OCR A-LEVEL BIOLOGY A

BIOLOGY



EXAM QUESTION PACK

UNIT F211 OLD SPECIFICATION PAPERS

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OCR
Oxford Cambridge and RSA

Thursday 26 May 2016 – Afternoon

AS GCE BIOLOGY

F211/01 Cells, Exchange and Transport

Candidates answer on the Question Paper.

OCR supplied materials:
Insert (inserted)

Other materials required:
- Electronic calculator
- Ruler (cm/mm)

Duration: 1 hour

F 2 1 1 0 1

5 8 7 7 4 0 7 1 9 3

Candidate forename		Candidate surname	

Centre number						Candidate number				

INSTRUCTIONS TO CANDIDATES

- Write your name, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
- Use black ink. HB pencil may be used for graphs and diagrams only.
- Answer **all** the questions.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Write your answer to each question in the space provided. If additional space is required, you should use the lined page(s) at the end of this booklet. The question number(s) must be clearly shown.
- Do **not** write in the bar codes.

INFORMATION FOR CANDIDATES

- The number of marks is given in brackets **[ ]** at the end of each question or part question.
- The total number of marks for this paper is **60**.
-  Where you see this icon you will be awarded marks for the quality of written communication in your answer.
- You may use an electronic calculator.
- You are advised to show all the steps in any calculations.
- This document consists of **20** pages. Any blank pages are indicated.

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Answer **all** the questions.

1 *Amoeba proteus* is a single-celled organism that lives in freshwater habitats. Fig. 1.1 is a drawing of *A. proteus*.

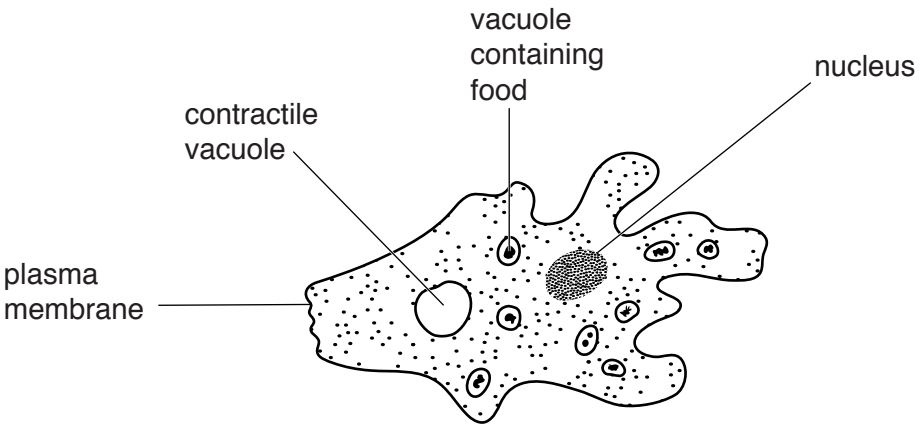


Fig. 1.1

(a) Explain why an *Amoeba* does **not** need a specialised surface for gaseous exchange.

.....

.....

.....

.....

..... **[2]**

(b) State **one** feature shown in Fig. 1.1 that would **not** be present in a prokaryotic cell.

..... **[1]**

(c) One role of the plasma membrane is to act as a barrier between the cell and its surroundings.

(i) Which component of the plasma membrane acts as a barrier to mineral ions entering the cell?

..... **[1]**

(ii) Describe **two other** roles of membranes in an *Amoeba*.

.....

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..... **[2]**

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(d) Water continually enters an *Amoeba* from its surroundings. The contractile vacuole is an organelle that collects water from inside the cell and expels it from the cell. The contractile vacuole expands as it collects water and then fuses with the plasma membrane to release the water from the cell.

(i) Name the process by which water is expelled from the *Amoeba*.

..... **[1]**

(ii) What would happen to an *Amoeba* if it had no contractile vacuole?

..... **[1]**

(e) A student investigated the activity of the contractile vacuole when an *Amoeba* was placed in solutions of different water potential.

The student placed the *Amoeba* in each solution and counted the number of times the contractile vacuole filled and emptied in the first minute. The results are shown in Table 1.1.

Water potential surrounding *Amoeba* (kPa)	**Number of times the contractile vacuole filled and emptied in the first minute**
0	19
–100	14
–200	9
–300	5
–400	2
–500	0

Table 1.1

Explain why the contractile vacuole emptied more frequently when the water potential surrounding the *Amoeba* was –100 kPa compared to when the water potential was –400 kPa.

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.....

.....

..... **[2]**

[Total: 10]

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2 **(a)** Stem cells can specialise to form a variety of cell types.

What other feature is shown by stem cells but not by specialised cells?

.....

..... **[1]**

(b) Table 2.1 lists a number of specialised cells found in the gaseous exchange system of a mammal.

Complete the table to describe the function of each type of specialised cell.

Specialised cells	Function of cells in the gaseous exchange system
Ciliated cells	....
Goblet cells	....
Smooth muscle cells	....
Squamous epithelial cells	....

Table 2.1

[4]

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(c) Plants also contain specialised cells.

Cells in the phloem are specialised so that translocation can occur.

What is meant by translocation?

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..... **[2]**

[Total: 7]

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3 Table 3.1 lists the **maximum** magnification and resolution of three different types of microscope.

Microscope	Magnification	Resolution (nm)
X	×1500	200
Y	×100 000	20
Z	×500 000	1

Table 3.1

(a) Which microscope, **X**, **Y** or **Z**, is a **transmission** electron microscope?

..... **[1]**

(b) Fig. 3.1(a) and Fig. 3.1(b) below show root hairs on the surface of roots. The two images were taken using different types of microscope.

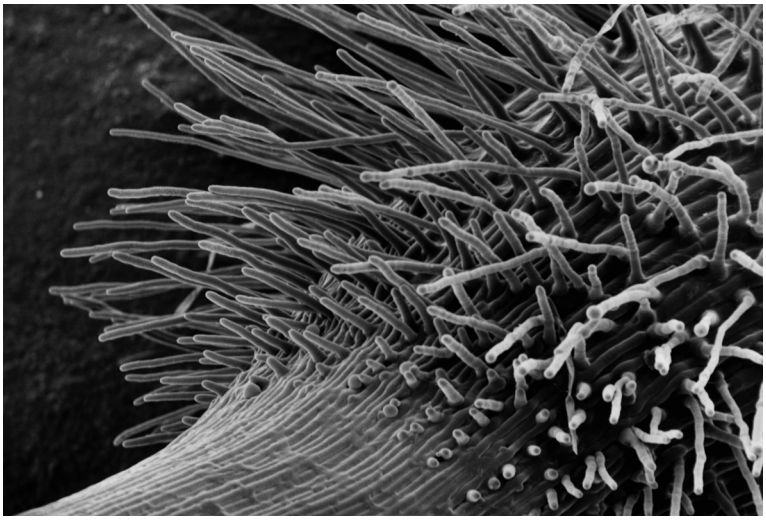


Fig. 3.1(a)



Fig. 3.1(b)

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One of the images was taken using a scanning electron microscope.

Identify which image, **Fig. 3.1(a)** or **Fig. 3.1(b)**, was taken using a scanning electron microscope.

.....

Justify your choice.

.....

.....

.....

.....

..... **[2]**

(c) Complete the following paragraph about the transport of water across the root cortex.

Water can follow different pathways from the epidermis to the xylem in the root.

In the apoplast pathway, water passes between the cells and through the ..... .

In the symplast pathway, water enters the cell cytoplasm by osmosis and passes from cell to cell via specialised cell junctions called ..... .
At the ..... layer, water passing between the cells must enter the symplast pathway because passage between the cells is blocked by the ..... . **[4]**

Question 3(d) begins on page 8

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(d) The uptake of water from the soil is dependent upon its availability. Some plants living in habitats where water is not easily available are adapted to conserve water.

As part of an investigation, a student measured the surface area of a sample of leaves. The student selected leaves from a variety of habitats, placed each leaf on graph paper and drew the outlines. The outlines are shown in Fig. 3.2.

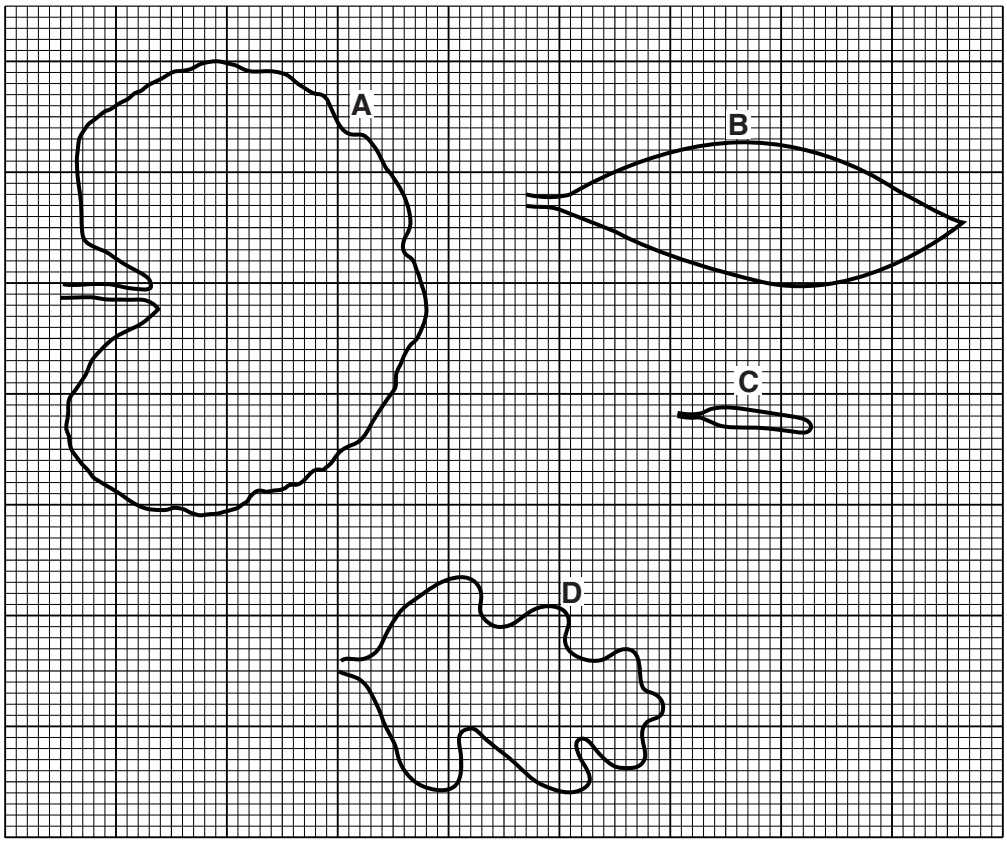


Fig. 3.2

(i) Which leaf, **A**, **B**, **C** or **D**, is most likely to have come from a plant adapted to living in a habitat with low water availability?

..... **[1]**

(ii) Explain the reason for your choice in **(i)**.

.....

.....

..... **[1]**

(iii) State **one other** adaptation that leaves might have to conserve water.

.....

.....

..... **[1]**

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(e) One environmental factor that affects the loss of water **vapour** from the leaves is air movement.

Explain how increased air movement increases the loss of water vapour from the leaves.

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..... **[2]**

[Total: 12]

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4 **(a)** Cells are usually stained before viewing under a light microscope.

Explain why cells need to be stained.

.....

.....

..... **[2]**

(b) Fig. 4.1, **on the insert**, shows a cell during mitosis.

(i) Name the stage of mitosis shown.

..... **[1]**

(ii) From the start of mitosis, describe the events that have taken place in this cell to enable it to reach the stage shown in Fig. 4.1.

In your answer you should use appropriate technical terms, spelled correctly.

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..... **[5]**

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(c) Mitosis occupies only a small part of the cell cycle.

Outline the events that take place in the rest of the cell cycle.

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..... **[3]**

[Total: 11]

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5 Mosses are small plants with no true roots. Each plant is anchored by simple root-like structures which do not contain vascular tissue.

The leaves of moss plants are usually one cell thick and are attached to a thin stem. Neither the leaves nor stem contain vascular tissue.

Fig. 5.1 shows a leaf from a typical moss plant.

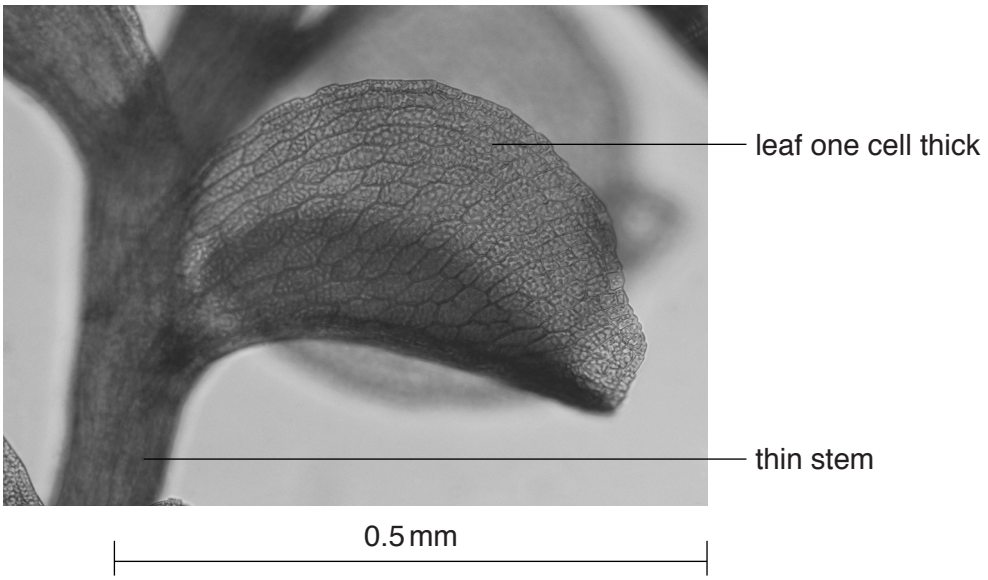


Fig. 5.1

(a) Suggest **and** explain how the absence of vascular tissue might affect the size to which moss plants can grow.

.....

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..... **[2]**

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(b) Although a moss plant has no vascular tissue, water still moves through the plant from the root-like structures to the leaves.

Use your knowledge of the mechanisms of water transport to explain the movement of water through the moss plant.

In your answer you should use appropriate technical terms, spelled correctly.

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..... **[4]**

(c) **(i)** What is meant by the term *tissue*?

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..... **[2]**

(ii) Leaves of dicotyledonous plants contain types of cells that are not found in the leaves of mosses, such as that shown in Fig. 5.1.

Other than the cells found in vascular tissues, name **two** types of cell found in the leaves of dicotyledonous plants that are not found in the leaves of mosses.

.....

..... **[2]**

[Total: 10]

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6 Fig. 6.1, **on the insert**, shows a small artery. These small arteries are found linking the larger arteries with the arterioles that carry blood into the capillary beds of an organ or tissue.

(a) Calculate the thickness of the wall of the artery between the points marked **A** and **B** on Fig. 6.1.

Show your working and express your answer to the nearest **micrometre**.

Answer = ... μm **[2]**

(b) Table 6.1 contains a number of statements that can be used to explain some features of the mammalian heart and blood vessels.

A	Both atria pump blood into the ventricles.
B	The pressure is very high.
C	The left ventricle wall creates higher pressure than the right ventricle wall.
D	The pressure fluctuates a lot.
E	Mammals have a double circulatory system.
F	The muscle contracts to maintain blood pressure.
G	The ventricles are larger than the atria.

Table 6.1

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Table 6.2 lists some structural features of the heart or blood vessels.

Select the most appropriate statement, **A** to **G**, from Table 6.1 (on page 14) to explain each feature.

The first one has been completed for you.

Structural features of the heart or blood vessels	Statement (A to G)
The wall of the left ventricle is two to three times thicker than the wall of the right ventricle.	**C**
Small arteries have muscular walls.	
The wall of the left atrium is the same thickness as the wall of the right atrium.	
Arteries close to the heart have a lot of elastic tissue in their walls.	
There is a septum that divides the left side of the heart from the right.	

Table 6.2

[4]

Question 6(c) begins on page 16

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(c) Fig. 6.2 shows a **transverse** section through the heart.

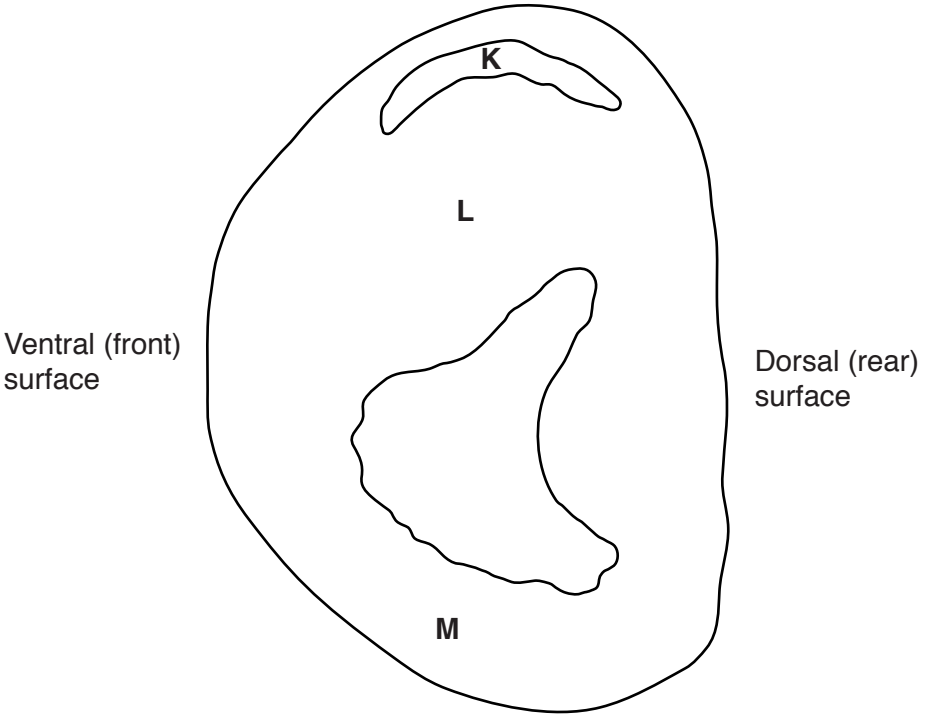
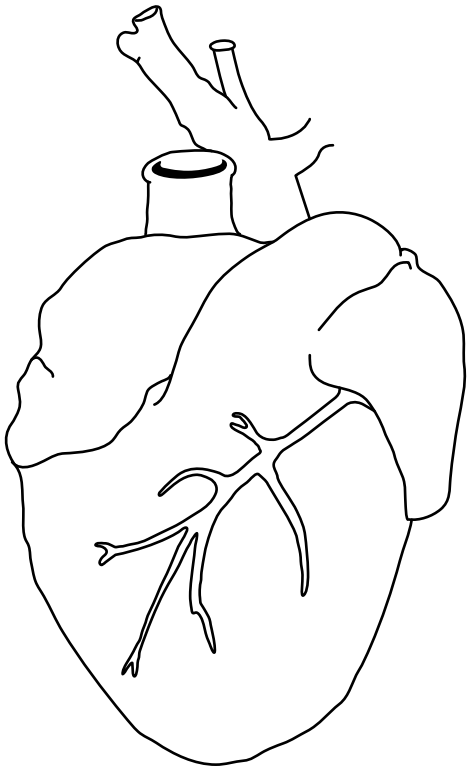


Fig. 6.2

(i) **On the diagram below** draw a line to show where the section in Fig. 6.2 has been taken.



[1]

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(ii) Identify the features represented by **K**, **L** and **M** on Fig. 6.2.

K .....

L .....

M .....

[3]

[Total: 10]

END OF QUESTION PAPER

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ADDITIONAL ANSWER SPACE

If additional answer space is required, you should use the following lined page(s). The question number(s) must be clearly shown in the margin(s).

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ADDITIONAL ANSWER SPACE

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ADDITIONAL ANSWER SPACE

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GCE

Biology

Unit **F211:** Cells, Exchange and Transport

Advanced Subsidiary GCE

Mark Scheme for June 2016

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Annotations

Annotation	***Description***
GM	Point already given (i.e. Given max)
	Underline (for ambiguous / contradictory wording)
I	Ignore
	Correct response
^	Omission
	Marking point partially met
NBOD	Benefit of doubt not given
	Irrelevant response
ECF	Error carried forward
CON	Contradiction
	Incorrect response

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Abbreviations, annotations and conventions used in the detailed Mark Scheme (to include abbreviations and subject-specific conventions).

Annotation	Meaning
/	alternative and acceptable answers for the same marking point
(1)	Separates marking points
reject	Answers which are not worthy of credit
not	Answers which are not worthy of credit
IGNORE	Statements which are irrelevant
ALLOW	Answers that can be accepted
( )	Words which are not essential to gain credit
__	Underlined words must be present in answer to score a mark
ECF	Error carried forward
AW	Alternative wording
ORA	Or reverse argument

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Question			Expected Answers	Marks	Additional Guidance
1	(a)		(cell) very small **OR** large surface area to volume ratio **;** short diffusion pathway **;** *idea that* diffusion sufficient / fast enough, to supply (all) needs **;**	max 2	**IGNORE** low, activity / metabolic rate **IGNORE** not very big / small (unless qualified) **ACCEPT** microscopic **ACCEPT** larger SA:Vol (ratio)
	(b)		nucleus **;** (contractile / food) vacuole **;**	max 1	**Mark the first answer.** If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = **0 marks**
	(c)	(i)	phospholipids / phospholipid bilayer **;**	1	**Mark the first answer.** **IGNORE** cholesterol **DO NOT CREDIT** phosphate / heads **ACCEPT** phospholipid tails / lipid tails / fatty acids

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Question			Expected Answers	Marks	Additional Guidance
		(ii)	control what, enters / leaves, the organelles ; (contains receptors to) detect changes in environment ; compartmentalisation ; site for, enzymes / electron carriers / components of metabolic pathways ; create concentration gradients ; form pseudopodia ;	max 2	**Mark the first two answers.** If two correct responses are given followed by one or two incorrect responses or which contradict the correct answers then = **1 or 0 marks** **IGNORE** ref to control of materials entering / leaving <u>cell</u> / ref. to barrier with outside **ACCEPT** cell, communication / signalling / recognition **ACCEPT** separate, organelles/ DNA / food / enzymes, (from cytoplasm) separate organelles from each other formation of , vesicles / vacuoles hold water separate metabolic pathways **IGNORE** ref to increases surface area
	(d)	(i)	<u>exocytosis</u> ;	1	**Mark the first answer.** If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = **0 marks** **DO NOT CREDIT pinocytosis / pino(exocytosis)**

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Question			Expected Answers	Marks	Additional Guidance
		(ii)	burst / lysis / plasma membrane would rupture **;**	1	**Mark the first answer.** If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = **0 marks** **ACCEPT** haemolysis **DO NOT CREDIT** plasmolysis
	(e)		WP of -100 solution higher than -400 / ORA **;** (at -100kPa) water potential gradient steeper **/** described / ORA **;** (at -100kPa) water enters Amoeba more quickly / ORA **;**	max 2	**IGNORE** refs to hyper / hypo tonic solutions **ACCEPT -**100 less negative than -400 Note: response must contain clear ref to both -100 solution and -400 solution **ACCEPT** more water enters Note: ref to osmosis being more rapid **only** valid if direction of water movement is clear
			Total	**10**	

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Question			Expected Answers	Marks	Additional Guidance
2	(a)		(ability to continue) dividing **;**	1	**Mark the first answer.** If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = **0 marks**
	(b)		move / waft / sweep, mucus **;** produce / release / secrete , mucus **;** constrict the (named) airways **;** provide, thin barrier / short diffusion distance **;**	4	**Mark the first answer.** If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = **0 marks** **DO NOT CREDIT** excrete **CREDIT** narrows lumen / reduces diameter of airway **IGNORE** controls, diameter / air flow **IGNORE** smooth lining / *reduces* diffusion distance **IGNORE** thin, surface / cells, for diffusion
	(c)		transport / movement / mass flow, of, assimilates / sucrose / amino acids **;** from source to sink / description **;**	2	**IGNORE** ref to (organic) solutes / food / glucose / sugars e.g. from cells / tissues / site where produced to cells / tissues / site where used **ACCEPT** named source AND sink
			Total	**7**	

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Question			Expected Answers	Marks	Additional Guidance
3	(a)		Z ;	1	**Mark the first answer.** If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = **0 marks**
	(b)		Fig. 3.1(a) (no mark) shows surface view ; 3D / three dimensional ; better <u>resolution</u> (than b) ;	max 2	Please place a green blob on paper Do not allow mp 2 if fig 3.1 b selected Do not allow mp 3 if fig 3.1 b selected Must be comparative comment
	(c)		cell walls ; plasmodesma(ta) ; endodermis / endodermal ; Casparian strip ;	4	**DO NOT CREDIT** Caspian / Caspiran
	(d)	(i)	C ;	1	**Mark the first answer.** If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = **0 marks**
		(ii)	small(er) <u>surface area</u> means less, evaporation / transpiration ;	1	**Mark independent of (d)(i)** **Mark the first answer.** If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = **0 marks** **IGNORE** less water loss / fewer stomata **DO NOT CREDIT** small surface area to volume ratio **DO NOT CREDIT** no, transpiration / evaporation

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Question			Expected Answers	Marks	Additional Guidance
		(iii)	thick (waxy) cuticle ; few stomata ; stomata, sunken / in pits ; hairs / hairy ; leaf, curled / rolled ; dense spongy mesophyll ; closure of stomata, during day / when water availability low ;	max 1	**Mark the first answer.** If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = **0 marks**
	(e)		water vapour around the, stomata / leaf surface, is blown away; reduces water (vapour) potential around, stomata ; *idea of*: increases / maintains, water (vapour) potential gradient (between air space in leaf and outside) ;	max 2	**IGNORE** moisture (for all mark points) **ACCEPT** boundary layer reduced **ACCEPT** evaporated water as water vapour **ACCEPT** relative humidity for water potential **IGNORE** diffusion gradient / concentration gradient
			Total	**12**	

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Question			Expected Answers	Marks	Additional Guidance
4	(a)		create / provide / increase contrast **;** make, cells / (named) component(s), visible OR cells / (named) components, can be, identified / distinguished / differentiated **;**	2	**IGNORE** clearer **ACCEPT** (named) organelle(s) stand out from surroundings **ACCEPT** regions / parts / AW, of cell
	(b)	(i)	anaphase **;**	**1**	**Mark the first answer.** If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = **0 marks**

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Question			Expected Answers	Marks	Additional Guidance
		(ii)	1. **chromosomes** coil / **supercoil** / **condense** ; 2. **nuclear envelope** disintegrates ; 3. **nucleolus,** no longer visible / disappears ; 4. **centrioles** move to opposite, ends of cell / **poles** ; 5. chromosomes attached to **spindle** fibres at **centromere** ; 6. chromosomes align at **equator** ; 7. chromosomes move towards opposite, poles / ends of cell ; 8. spindle fibres change length / shorten ; **max 4** QWC ; **max 1**	max 5	**ACCEPT** chromatid for chromosome throughout Note: There is no mark for naming phases, but if phase is mentioned and description is incorrect for named phase then **DO NOT CREDIT** Accept mp 1-5 in prophase, mp 6 metaphase, mp 7 anaphase mp 8 in any phase **IGNORE** ref to events in telophase and cytokinesis, as they occur *after* anaphase **ACCEPT** chromatin **ACCEPT** nuclear membrane **IGNORE** dissolves **DO NOT CREDIT** pairs of chromosomes line up **ACCEPT** pairs of chromatids line up **IGNORE** spindle fibres contract Place a green blob next to each word and a tick next to the pencil. Award if any two terms spelt correctly and used in correct context from: **chromosomes / chromatids / chromatin** **supercoil** **nucleolus** **condense** **centromere** **nuclear envelope** (but not membrane) **centriole** **pole** **spindle** **equator**

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Question			Expected Answers	Marks	Additional Guidance
	(c)				**For mp 1 & 2 where candidates link events to S & G phases then description must be correct for phase.** **S phase is DNA synthesis only** **G phases contain protein synthesis, increasing numbers of organelles, growth, increased respiration and checking of DNA.**
			DNA / genetic material, replicated / synthesised / checked ;		**IGNORE** chromosomes replicate / DNA copied / DNA doubles
			cell growth / increased respiration / protein synthesis / increase in number of organelles ;		**ACCEPT** more ATP
			cytokinesis / cell surface membrane constricts / cytoplasm splits in two / cell plate forms (plants) ;		
			ref to G and S phases ;		**ACCEPT** Gap or 'growth' for G and Synthesis for S throughout **ACCEPT** in context of diagram
				max 3	
			Total	**11**	

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Question			Expected Answers	Marks	Additional Guidance
5	(a)		must remain small OR cannot grow tall / large / big ; no support from vascular tissues / vascular bundles / xylem ; use only diffusion / no mass flow / no rapid transport ; diffusion too slow (to enable substances to move large distances) ; idea of: short diffusion pathway / large surface area to volume ratio ;	Max 2	

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Question	Expected Answers	Marks	Additional Guidance
(b)	*1. idea of* water lost by **evaporation / transpiration / evapotranspiration ;**		
	2. (water moves by) **symplast** and **apoplast** pathways **;**		**DO NOT CREDIT** mp 2 – 7 in context of water uptake **DO NOT CREDIT mp 3-7 in context of movement in xylem either stated or implied**
	3. through / along cell walls by, **capillary action / adhesion** (apoplast pathway) **;**		AWARD **only** where it is clear that the movement is in context of apoplast.
	1. (water loss) reduces the **water potential** of (leaf) cells **;**		**ACCEPT** ψ
	2. water moves from higher water potential to lower water potential / <u>down</u> **water potential gradient** (symplast pathway) **;**		
	3. by **<u>osmosis</u>** (symplast pathway) **;**		**IGNORE** osmosis if used in context of apoplast pathway
	4. through **plasmodesmata** (symplast pathway) **; max 3**		
	QWC ; max 1		Place a green blob next to each word and a tick next to the pencil. Award if any two terms spelt correctly and used in correct context from: **apoplast** **osmosis** **symplast** **adhesion** **capillary action** **plasmodesmata** **evaporation** (allow correct derivatives) **transpiration** **evapotranspiration** **water potential** **water potential gradient**
		max 4	

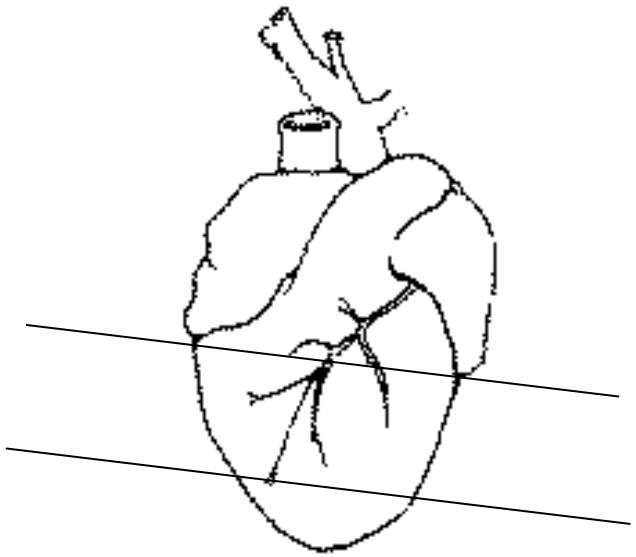
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Question			Expected Answers	Marks	Additional Guidance
	(c)	(i)	group of cells ; working together / performing a function ;	 2	**ACCEPT** cells derived from same stem cell source
		(ii)	palisade (mesophyll) ; spongy mesophyll ; guard cells ; (upper / lower) epidermal cells ; AVP ;	 2 max	**Mark the first two answers.** If two correct responses are given followed by one or two incorrect responses or which contradict the correct answers then = **1 or 0 marks** e.g. parenchyma, collenchyma, sclerenchyma
			Total	**10**	

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Question			Expected Answers	Marks	Additional Guidance
6	(a)		14 000 / 120 = 117 µm **;;**	2	length of line A-B = 14mm / 14000 µm Correct answer = 2 marks. Allow one mark if correct working shown including units for cm & mm e.g. 1.4 cm / 120 14 mm / 120 14000 / 120 If answer = 125 µm allow one mark for correct working but incorrect measurement (15mm instead of 14) Allow one mark if not rounded to nearest micrometre
	(b)		**F ;** **A ;** **B** or **D ;** **E ;**	4	

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Question			Expected Answers	Marks	Additional Guidance
	(c)	(i)	a line drawn across the ventricles ;	1	**ACCEPT** any line between those shown below 
		(ii)	K = right ventricle ; L = (interventricular) septum ; M = (left) ventricle wall / cardiac muscle / myocardium ;	3	 **ACCEPT** septem **IGNORE** ventricle
			Total	**10**	

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OCR
Oxford Cambridge and RSA

Thursday 21 May 2015 – Afternoon

AS GCE BIOLOGY

F211/01 Cells, Exchange and Transport

Candidates answer on the Question Paper.

OCR supplied materials:
None

Other materials required:
- Electronic calculator
- Ruler (cm/mm)

Duration: 1 hour

F 2 1 1 0 1

4 8 3 7 1 6 8 9 3 3

Candidate forename		Candidate surname	

Centre number						Candidate number				

INSTRUCTIONS TO CANDIDATES

- Write your name, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
- Use black ink. HB pencil may be used for graphs and diagrams only.
- Answer **all** the questions.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Write your answer to each question in the space provided. If additional space is required, you should use the lined page(s) at the end of this booklet. The question number(s) must be clearly shown.
- Do **not** write in the bar codes.

INFORMATION FOR CANDIDATES

- The number of marks is given in brackets **[ ]** at the end of each question or part question.
- The total number of marks for this paper is **60**.
- Where you see this icon you will be awarded marks for the quality of written communication in your answer.
- You may use an electronic calculator.
- You are advised to show all the steps in any calculations.
- This document consists of **16** pages. Any blank pages are indicated.

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Answer **all** the questions.

1 **(a)** Transpiration is the loss of water vapour from the aerial parts of a plant.

(i) Name the pores through which most water vapour is lost from a leaf.

..... **[1]**

(ii) Describe how the guard cells surrounding the leaf pores are adapted to their role.

.....

.....

.....

.....

.....

..... **[2]**

(iii) Name **one** other part of the leaf from which water may be lost.

.....

..... **[1]**

(b) Water lost from the leaf must be replaced with water from the xylem.

Complete the following passage about movement of water from the xylem to the cells of the leaf using the most appropriate terms.

When water is lost from the cells of the leaf it reduces the .....

in those cells. As a result, water enters the cells by ..... .

This process occurs across the plasma membrane which is ..... .

If all the water lost from the leaf cells is not replaced, they lose .....

and the leaf may wilt. **[4]**

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(c) The cohesion-tension theory is often used to explain the mechanism by which water moves up the xylem from the roots to the leaves.

Use this theory to explain how water moves from the roots to the leaves.

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... **[3]**

[Total: 11]

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2 **(a)** Table 2.1 compares some features of animal cells, plant cells, yeast cells and bacterial cells.

Complete the table.

Feature	Animal	Plant	Yeast	Bacterium
Means of cell division	cytokinesis	cytokinesis		binary fission
Presence of nucleus				
Material in cell wall	none		chitin	
Presence of ribosomes				

[4]

Table 2.1

(b) Fig. 2.1 shows some undifferentiated plant cells, such as those found at the tips of roots and shoots.

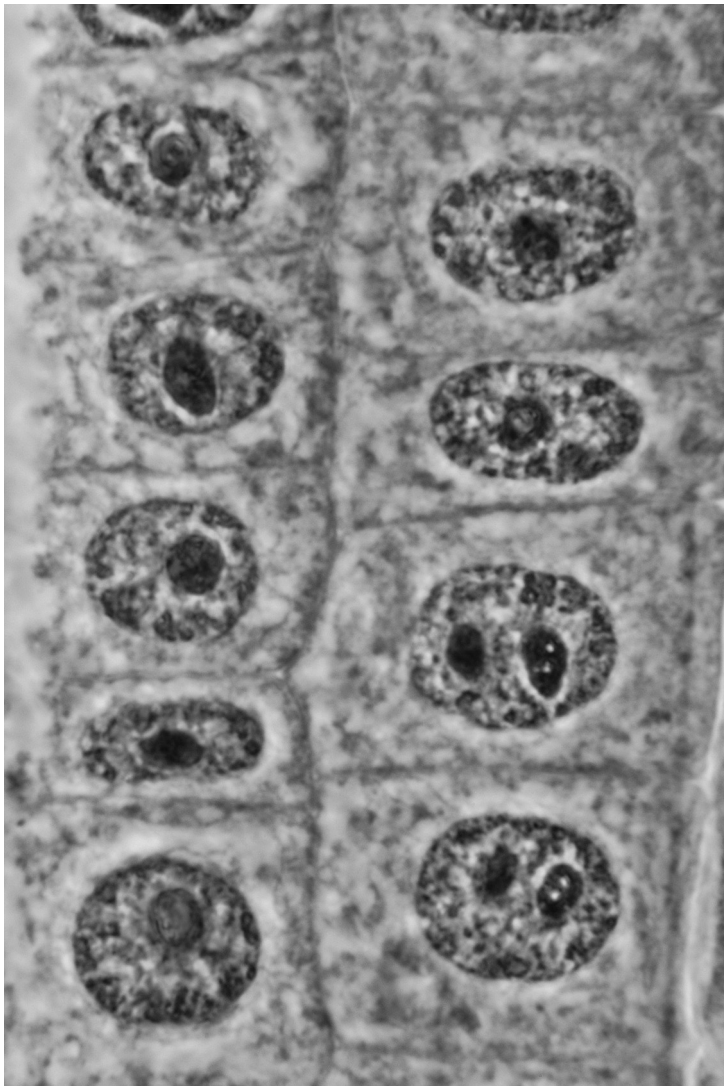


Fig. 2.1

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(i) Name the type of tissue that undergoes cell division to form these undifferentiated plant cells.

..... **[1]**

(ii) State the features shown in Fig. 2.1 that would **not** be found in mature xylem vessels.

.....

.....

..... **[2]**

(iii) Describe how the structure of the cell walls in xylem vessels would differ from the cell walls shown in Fig. 2.1.

.....

.....

.....

..... **[2]**

(c) Name **two** types of cell that can be found in **phloem** tissue.

.....

..... **[2]**

[Total: 11]

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3 **(a)** **(i)** Name the **two** types of epithelial tissue found in the lungs and airways.

.....

..... **[2]**

(ii) The epithelial cells in the lungs are arranged into structures called alveoli.

Explain how the alveoli create a surface for efficient gaseous exchange.



In your answer you should use appropriate technical terms, spelled correctly.

.....

.....

.....

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.....

.....

..... **[5]**

(b) To improve gaseous exchange, the air in the alveoli is refreshed by ventilation. The air movement created by ventilation can be recorded using suitable apparatus.

(i) Name the apparatus used to record these air movements.

..... **[1]**

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Fig. 3.1 shows a trace recorded from this apparatus.

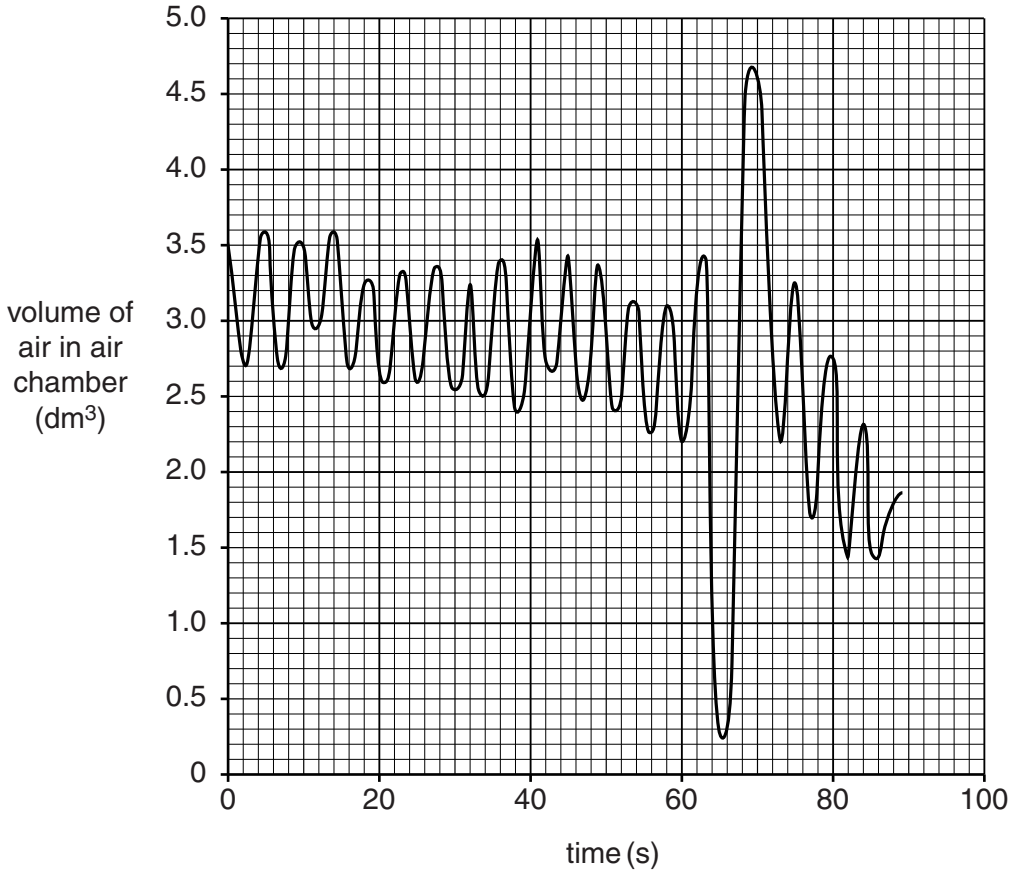


Fig. 3.1

(ii) Calculate the rate of breathing over the first minute from the trace.

answer = ... breaths per minute **[1]**

(iii) Using the trace, calculate the rate of oxygen consumption over the first minute.

Show your working.

answer = ... $dm^3\ min^{-1}$ **[2]**

[Total: 11]

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4 **(a)** Describe the structure of a plasma (cell surface) membrane.

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... **[3]**

(b) A student investigated the movement of substances through the cell surface membrane of yeast cells using an indicator.

- The student was supplied with a suspension of yeast cells in a slightly alkaline solution.
- The indicator used is yellow in alkaline conditions but turns red in acidic conditions.

The student mixed the indicator with the yeast suspension and labelled the tube containing this suspension **A**. The suspension was red/pink in colour.

(i) The student took a small sample from tube **A** and centrifuged this sample.

After centrifuging, the student observed that the liquid portion was colourless but the cells at the bottom were red/pink.

Suggest the mechanism by which the indicator enters the cells and suggest the component of the membrane involved.

mechanism .....

component ..... **[2]**

(ii) The student took a small sample from suspension **A** and added alkaline ammonia solution. There was no colour change.

What could the student conclude about the permeability of the yeast plasma membrane?

.....

..... **[1]**

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(iii) The student then took another sample from suspension **A** and boiled it. When this boiled suspension was centrifuged the liquid portion was yellow and the cells at the bottom were red/pink.

The student suggested that the liquid in the suspension was yellow because boiling the yeast had damaged the plasma membrane, allowing the indicator out of the cells.

Describe the effect of high temperature on the structure of the yeast cell membranes.



In your answer you should use appropriate technical terms, spelled correctly.

.....

.....

.....

.....

.....

.....

.....

.....

..... **[4]**

[Total: 10]

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PLEASE DO NOT WRITE ON THIS PAGE

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5 **(a)** Table 5.1 and Table 5.2 list events that occur during the cardiac cycle.

Each event in Table 5.1 is immediately followed by one of the events listed in Table 5.2.

Complete Table 5.1 by inserting the appropriate letters of the events from Table 5.2.

The first row has been completed for you.

Event in the order in which they occur	**Letter describing the event that follows**
atrial walls start to relax	D
sinoatrial (SA) node generates electrical signals	
atrioventricular (AV) node receives electrical signals from SA node	
ventricle walls start to contract	
ventricle walls relax	

Table 5.1

Event	**Letter**
atrioventricular valves close	A
semilunar valves close	B
walls of atria contract	C
ventricle walls start to contract	D
electrical signals transmitted down septum	E

Table 5.2

[4]

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(b) Fig. 5.1 shows a normal ECG trace. The electrical activity of the heart is measured in millivolts (mV).

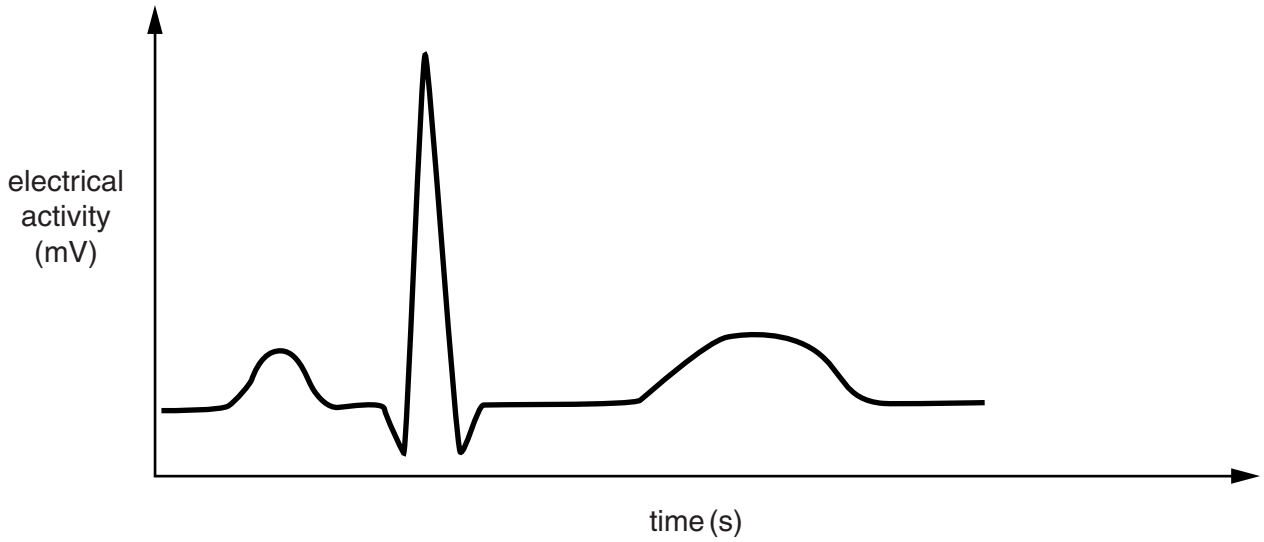
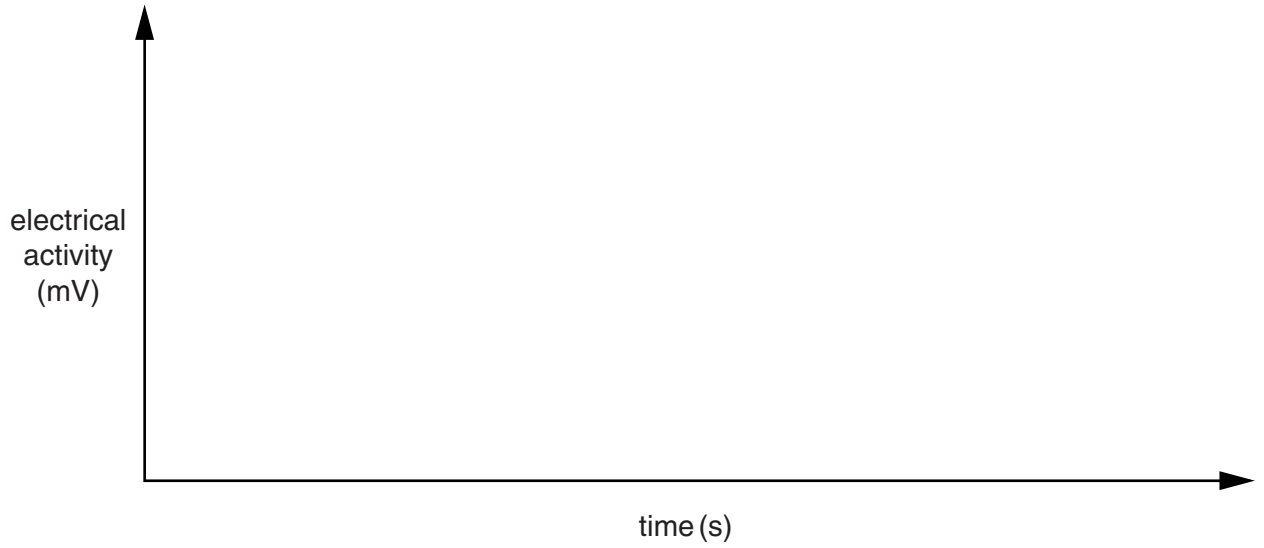


Fig. 5.1

In a condition known as supraventricular tachycardia, electrical signals leak from the atrial walls directly to the top of the ventricles. This causes the ventricle walls to contract twice for every atrial contraction.

(i) Using the axes below, sketch an ECG trace that might be expected in a patient with this condition.



[1]

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(ii) Suggest and explain what effect supraventricular tachycardia might have on blood flow from the heart.

.....

.....

.....

.....

..... **[2]**

(c) The blood circulatory system of a mammal undergoes changes at, or soon after, birth.

(i) One of these changes is that the foramen ovale, a hole in the septum between the right and left atria, closes. In the fetus, the foramen ovale allows blood to flow directly from the right atrium to the left atrium.

Suggest why the foramen ovale is open in the fetus before birth.

.....

.....

.....

.....

..... **[2]**

(ii) Another change occurring after birth is that fetal haemoglobin is replaced with adult haemoglobin.

State one difference between fetal haemoglobin and adult haemoglobin **and** give one reason why this difference is essential to the fetus.

difference .....

.....

reason .....

.....

..... **[2]**

[Total: 11]

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6 **(a)** Table 6.1 gives the functions of certain organelles in a eukaryotic cell.

Complete the table by stating the function associated with each organelle.

The first row has been completed for you.

Organelle	Function
nucleus	contains the genetic material
smooth endoplasmic reticulum	....
lysosome	....
ribosome	....

[3]

Table 6.1

(b) One theory about the evolution of organelles is the endosymbiotic theory. This theory suggests that the mitochondria and chloroplasts found in eukaryotic cells represent formerly free-living bacteria that were absorbed into a larger cell.

The following list describes a number of features of mitochondria and chloroplasts.

Place a tick (✓) next to the **three** statements that could be used as evidence for the endosymbiotic theory.

- mitochondria contain ribosomes that are smaller than those found in the cell cytoplasm ☐
- chloroplasts contain chlorophyll and other photosynthetic pigments ☐
- mitochondria are a similar size to bacteria ☐
- the inner membrane of a mitochondrion is folded to form cristae ☐
- chloroplasts contain many disc-shaped membranes called thylakoids ☐
- chloroplasts have their own circular DNA ☐

[3]

[Total: 6]

END OF QUESTION PAPER

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ADDITIONAL ANSWER SPACE

If additional answer space is required, you should use the following lined page(s). The question number(s) must be clearly shown in the margins.

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ADDITIONAL ANSWER SPACE

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GCE

Biology

Unit **F211:** Cells, Exchange and Transport

Advanced Subsidiary GCE

Mark Scheme for June 2015

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This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by examiners. It does not indicate the details of the discussions which took place at an examiners' meeting before marking commenced.

All examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the report on the examination.

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Abbreviations, annotations and conventions used in the detailed Mark Scheme.

/ = alternative and acceptable answers for the same marking point
(1) = separates marking points
DO NOT CREDIT = answers which are not worthy of credit
IGNORE = statements which are irrelevant
CREDIT = answers that can be accepted
ACCEPT = answers that can be accepted but which are not the ideal response
( ) = words which are not essential to gain credit
__ = underlined words must be present in answer to score a mark (correct spelling not essential)
ecf = error carried forward
AW = alternative wording
ora = or reverse argument
, = indicates need to select from alternatives to complete the marking point

Annotations: the following annotations are available on SCORIS.

✓ = correct response
× = incorrect response
bod = benefit of the doubt
nbod = benefit of the doubt **not** given
ECF = error carried forward
^ = information omitted
I = ignore
BP = blank page
● = QWC
GM = given mark
CON = response that contradicts previous correct response
Highlighting is also available to highlight any particular points on the script.

The following questions should be annotated with ticks to show where marks have been awarded in the body of the text: **ALL QUESTIONS**

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Question			Expected Answers	Marks	Additional Guidance
1	(a)	(i)	Stoma(ta) ;	1	
	(a)	(ii)	*idea of:* unevenly thickened (cell) wall ;		Statement should be comparative **CREDIT** wall beside pore thicker / wall is thicker on one side **ACCEPT** refs to: thick inner **and** thin outer walls / inner wall thicker / outer wall thinner **ACCEPT** thickened for thicker
			able to, change shape / bend ;		**CREDIT** so can bend **DO NOT CREDIT** 'contract' 'recoil' 'move' **IGNORE** functions such as 'open / close stoma' 'flexible' 'expand' 'stretch' 'bulge'
			transport proteins / ion pumps, in plasma membrane ;		
			(presence of) chloroplasts (to provide, ATP / energy) ;	2 max	**ACCEPT** mitochondria **IGNORE** chlorophyll **DO NOT CREDIT** 'produce / make energy'
	(a)	(iii)	epidermis / cuticle ;	1	**Mark the first answer.** If the answer is correct and a further answer is given that is incorrect or contradicts the correct answer then **= 0 marks** **ACCEPT** guard cell **IGNORE** 'surface'

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Question			Expected Answers	Marks	Additional Guidance
	(b)				**Mark the first answer on each prompt line.** If the answer is correct and a further answer is given that is incorrect or contradicts the correct answer then **= 0 marks**
			water potential ;		**DO NOT CREDIT** water potential gradient **IGNORE** Ψ
			osmosis ;		**IGNORE diffusion**
			selectively / partially / differentially, permeable ;		**DO NOT CREDIT** semi permeable
			turgidity / turgor (pressure) ;	4	**ACCEPT** 'turgidness' **IGNORE** shape / rigidity / stability

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Question	Expected Answers	Marks	Additional Guidance
(c)			**IGNORE** refs to adhesion / capillarity
	<u>evaporation</u> at top of, plant / xylem **;**		**ACCEPT** leaf or named part of leaf **IGNORE** ref to transpiration / loss of water vapour
	(creates) tension in <u>xylem</u> **;**		**IGNORE** xylem (vessels) under tension
	water <u>molecules</u>, stick together / are cohesive **/** form a chain or column **;**		**CREDIT** water molecules, attracted together / (hydrogen) bonded together / form a continuous stream
	(column / chain) pulled up (by tension);		**IGNORE** column, moves up / sucked up **ACCEPT** column drawn up **ACCEPT** description if linked to tension at top e.g. tension at top forces water up
		3 max	**DO NOT CREDIT** chain 'pushed' up xylem
	Total	**11**	

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<table>
<tr><th colspan="3">Question</th><th>Expected Answers</th><th>Marks</th><th>Additional Guidance</th></tr>
<tr><td>2</td><td>(a)</td><td></td><td>
<table>
<tr><th>Animal</th><th>Plant</th><th>Yeast</th><th>Bacterium</th></tr>
<tr><td></td><td></td><td>budding</td><td></td><td>;</td></tr>
<tr><td>yes</td><td>yes</td><td>yes</td><td>no</td><td>;</td></tr>
<tr><td></td><td>cellulose</td><td></td><td>peptidoglycan</td><td>;</td></tr>
<tr><td>yes</td><td>yes</td><td>yes</td><td>yes</td><td>;</td></tr>
</table>
</td><td>4</td><td>Mark the first answer in each box. If the answer is correct and a further answer is given that is incorrect or contradicts the correct answer then = 0 marks

Award 1 mark for each correct row

ACCEPT tick / present & cross / not present / absent / none

IGNORE ref to nucleoid

CREDIT murein as alternative to peptidoglycan
ACCEPT peptidoglycin
DO NOT ACCEPT peptoglycan

ACCEPT ‘on RER’ or ‘in cytoplasm’ for yes
ACCEPT ref to size of ribosomes (large / 80S / 22nm in Eukaryotes, small / 70S / 18nm in bacteria)</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td>(b)</td><td>(i)</td><td><u>meristem</u>(atic) ;</td><td>1</td><td>IGNORE position in plant such as ‘root tip’, cambium</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td>(b)</td><td>(ii)</td><td>nucleus / nucleolus / chromatin ;

cytoplasm ;

cross / end, (cell) walls ;</td><td>2 max</td><td>Read through and award marks for correct features
IGNORE ref to other individual organelles / vacuole
IGNORE nucleous
DO NOT CREDIT ‘two nuclei in one cell’

CREDIT end plates
ACCEPT no end walls / no nucleus / no cytoplasm
IGNORE walls between cells</td></tr>
</table>

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Question			Expected Answers	Marks	Additional Guidance
	(b)	(iii)	thicker ; lignified ; contain (bordered) pits ;	 2 max	**IGNORE** stronger **CREDIT** have lignin **/**contain lignin / reinforced with lignin / impregnated with lignin **DO NOT CREDIT** have lignin on the walls / lined by lignin / surrounded by lignin **IGNORE** ref to pattern of thickening **IGNORE** 'pore'
	(c)		sieve (tube) element ; companion (cell) ; parenchyma ;	 2 max	**IGNORE** 'sieve tube' 'sieve cell' **ACCEPT** fibres / sclereids / sclerenchyma
			Total	**11**	

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Question			Expected Answers	Marks	Additional Guidance
3	(a)	(i)	columnar / ciliated **;** squamous / pavement **;**	2	**Mark the first two answers.** **IGNORE** 'cilia cells'
	(a)	(ii)	1. wall is <u>one</u> <u>cell</u> thick for short(er) **diffusion,** distance / pathway **;** **2. squamous,** cells / epithelium , provide short diffusion distance / pathway **;** 3. **elastic** so, **recoil /** expel air **/** helps **ventilation ;** 4. create / maintain, **concentration gradient /** described **;** **5.** large number (of alveoli) provide large(r) **surface area ;** **6.** small size (of alveoli) provide large(r) **surface area to volume ratio ;** **7.** (cells secrete) surfactant to maintain surface area **;** **max 4**		Mp 1 & 2 the phrase 'for short(er) diffusion distance' only needs to be stated once to gain both marks **IGNORE** ref to rate of diffusion **ACCEPT** 'alveolus / epithelium one cell thick' **DO NOT CREDIT** 'membrane / cell wall, one cell thick' **ACCEPT** pavement / thin / flat for squamous **IGNORE** thin wall **ACCEPT** gas for air **IGNORE** CO_2 / O_2 **IGNORE** diffusion gradient Take care not to confuse mp 5 & 6 **DO NOT CREDIT** large in number so large SA:Vol **DO NOT CREDIT** small so provide large surface area **CREDIT** SA:Vol **ACCEPT** surfactant to prevent collapse

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Question			Expected Answers	Marks	Additional Guidance
			QWC ; **max 1**	5 max	Any **two** technical terms from the list below used appropriately and spelled correctly : **concentration gradient** **squamous** **surface area to volume ratio** **ventilation** **elastic recoil** **surface area** (note: do not allow as part of 'surface area to volume ratio') **diffusion** (note: do not allow as part of 'diffusion gradient')
	(b)	**(i)**	spirometer ;	1	**DO NOT CREDIT** respirometer **IGNORE** trace
		(ii)	13.5 ;	1	**ACCEPT** 13 or 14
		(iii)	0.5 ; ;	2	Correct answer = 2 marks If answer incorrect allow one mark for: either 3.6 – 3.1 (measured from peaks) OR 2.7 – 2.2 (measured from troughs) **ECF** one mark for final answer if candidate has used 3.5 as the initial reading (3.5 – 3.1 = 0.4 for 1 mark) **For candidates who have measured over less than a minute and divided by number of seconds:** **ACCEPT for two marks** 0.56 if measured peaks 0.52 if measured troughs **ACCEPT** working (3.6 – 3.1) x 60 / 54 for peaks OR (2.7 – 2.2) x 60 /58 for troughs
			Total	**11**	

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Question			Expected Answers	Marks	Additional Guidance
4	(a)		phospholipid bilayer containing proteins **;** head / hydrophilic region, facing outwards **OR** tail / hydrophobic region, facing inwards **;** ref to intrinsic **and** extrinsic (glyco)proteins / described **;** *idea of*: glycoproteins **/** glycolipids, sticking out (of bilayer / membrane)**;** cholesterol, inside bilayer / between phospholipids **;**	3 max	**Marks can be awarded for an annotated diagram** **IGNORE** ref to 'fluid mosaic model' **ACCEPT** glycoprotein / channel protein / carrier protein / etc. for protein **DO NOT CREDIT** ref to hyrophobic heads or hydrophillic tails **ACCEPT** transmembrane for intrinsic **and** on surface for extrinsic **IGNORE** ref to functions such as 'carrier / channel' etc. **IGNORE** glycoproteins / glycolipids are, extrinsic / on the outside / on surface **CREDIT** between fatty acid tails
	(b)	(i)	<u>active</u> transport / uptake **;** (transport / carrier) protein **;**	2	**Mark the first answer on each prompt line.** If the answer is correct and a further answer is given that is incorrect or contradicts the correct answer then **= 0 marks** **ACCEPT** intrinsic protein / transmembrane protein **DO NOT CREDIT** channel protein / extrinsic protein
	(b)	(ii)	not permeable to, ammonia / NH_3 / ammonium / NH_4^+ **;**	1	Response must be specific to permeability to ammonia **CREDIT** ammonia cannot pass through membrane **ACCEPT** selectively permeable so does not allow passage of ammonia (into the cells) **IGNORE** 'selectively / partially, permeable' unqualified **IGNORE '**not permeable to alkalis'

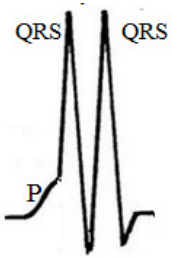
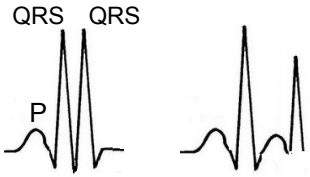
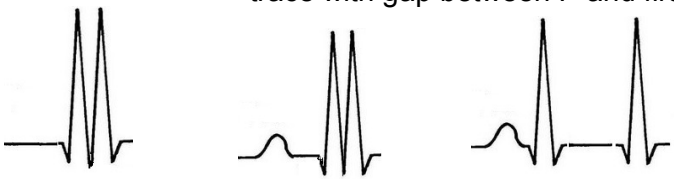
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Question			Expected Answers	Marks	Additional Guidance
	(b)	(iii)	**phospholipids** / (named) molecules**,** vibrate more / move around more / have more **kinetic energy ;** increases, size / number, of gaps, in membrane / between phospholipids **;** **bilayer**, becomes more fluid / melts **;** proteins / glycoproteins, **denatured ;** **max 3**		**IGNORE** refs to increase in permeability / leaky as the question asks about structure not properties **CREDIT** creates gaps in membrane **ACCEPT** holes for gaps **IGNORE** ref to pores, ref to gaps created by proteins denaturing **IGNORE** membrane / phospholipids become more fluid **ACCEPT** description of denaturing e.g. 3D shape / tertiary structure, changes **IGNORE** enzymes denature , ref to active site
			QWC ; **max 1**	4 max	Any **two** technical terms from the list below used appropriately and spelled correctly : **phospholipid(s)** **bilayer** **kinetic energy** (ref to molecules - do not credit in ref to membrane or cell) **denature(d)** (must refer to proteins or glycoproteins)
			Total	**10**	

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Question			Expected Answers	Marks	Additional Guidance
5	(a)		**C ;** **E ;** **A ;** **B ;**	4	

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Question			Expected Answers	Marks	Additional Guidance
	(b)	(i)	P wave combined with larger peak before QRS complex ;  	1	**Note:** - **look for additional QRS peak between P and original QRS peak** - **new peak may be merged with P but there must still be evidence of P** **IGNORE** relative size and width of two QRS peaks **IGNORE** anything drawn after second QRS **IGNORE** small gap / 'bump' between two QRS peaks **ACCEPT** two QRS peaks drawn immediately after P peak if no delay between P and first QRS **IGNORE** relative size and width of two QRS peaks **IGNORE** anything drawn after second QRS **IGNORE** small gap / bump between two QRS peaks  **DO NOT CREDIT** two QRS with no sign of a P peak trace with gap between P and first QRS 

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Question			Expected Answers	Marks	Additional Guidance
	(b)	(ii)	lower output / less blood leaves heart (for each ventricular contraction) **;** *idea of:* ventricles do not have time to fill (before contracting) **;** OR ventricle contraction inefficient because first contraction is downwards	2	**ACCEPT** less goes around body **CREDIT** 'heart pumps less blood' 'blood flow reduced' e.g. ventricle(s) not full before contracting e.g. atria unable to, contract / empty, before ventricles contract **IGNORE** ref to change in pressure & rate of flow (question asks about blood flow)
	(c)	(i)	lungs not, functioning / filled with air **;** blood / haemoglobin, is, not oxygenated in the lungs / oxygenated in placenta **;** (therefore) pulmonary circuit / lungs, bypassed **;**	2 max	**ACCEPT** fetus not breathing **ACCEPT** ref to 'single circulation' **ACCEPT** little blood goes to, lungs / pulmonary circuit **DO NOT ACCEPT** no blood goes to lungs

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Question			Expected Answers	Marks	Additional Guidance
	(c)	(ii)	**EITHER** *Difference:* (fetal haemoglobin) higher affinity for oxygen / described / **ORA ;** *Reason:* (fetal haemoglobin) must be able to bind to oxygen, in low(er) partial pressure / in placenta / when adult oxyhaemoglobin dissociates / when adult haemoglobin dissociates from oxygen**;** **OR** *Difference:* (fetal haemoglobin) contains gamma sub-units **;** *Reason:* creates high(er) affinity for oxygen **;**	2	**ACCEPT** able to become more saturated than adult haemoglobin at low pO_2 **IGNORE** gets more saturated at low pO_2 (ie no comparison to adult haemoglobin) **IGNORE** ref to saturation curve **CREDIT** 'associate with / combine with / loads' for bind **IGNORE** pick up / take up / gains / absorbs / attracts / attaches / saturates **DO NOT CREDIT** oxygen dissociates or haemoglobin dissociates
			Total	**11**	

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Question			Expected Answers	Marks	Additional Guidance
6	(a)		transport / synthesis / metabolism, of, fats / lipids / steroid (hormones) / carbohydrates **;** contain (hydrolysing) enzymes **OR** break down / digest, (named) organelles / cells / (named) pathogens **;** protein synthesis **;**	3	**Mark the first answer in each box.** If the answer is correct and a further answer is given that is incorrect or contradicts the correct answer then **= 0 marks** **CREDIT** 'processes' 'packages' **ACCEPT** 'processes toxins' **DO NOT CREDIT** 'are, hydrolysing / digestive enzymes' 'produce enzymes' **IGNORE** ref to 'harmful substances' 'waste materials' 'phagocytosis' 'secretes enzymes' **CREDIT** ref to translation
	(b)		✓ ; ✓ ; ✓ ;	3	If four ticks given reduce mark by 1 If five ticks given reduce mark by 2 If six ticks given reduce mark by 3 For each mark reduction annotate with 'CON'
			Total	**6**	

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Wednesday 21 May 2014 – Morning

AS GCE BIOLOGY

F211/01 Cells, Exchange and Transport

Candidates answer on the Question Paper.

OCR supplied materials:
None

Other materials required:
- Electronic calculator
- Ruler (cm/mm)

Duration: 1 hour

Candidate forename		Candidate surname	

Centre number						Candidate number				

INSTRUCTIONS TO CANDIDATES

- Write your name, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
- Use black ink. HB pencil may be used for graphs and diagrams only.
- Answer **all** the questions.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Write your answer to each question in the space provided. If additional space is required, you should use the lined page at the end of this booklet. The question number(s) must be clearly shown.
- Do **not** write in the bar codes.

INFORMATION FOR CANDIDATES

- The number of marks is given in brackets **[ ]** at the end of each question or part question.
- The total number of marks for this paper is **60**.
- Where you see this icon you will be awarded marks for the quality of written communication in your answer.
- You may use an electronic calculator.
- You are advised to show all the steps in any calculations.
- This document consists of **16** pages. Any blank pages are indicated.

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Answer **all** the questions.

1 Plant and animal cells have different structural features.

(a) (i) Name **two** features of plant cells that are not features of animal cells.

1 .....

2 .....

[2]

(ii) Name **one** structure present in animal cells that is not present in plant cells.

..... **[1]**

(iii) The cytoskeleton in cells consists of microtubules and microfilaments.

Describe the roles of the cytoskeleton.

.....

.....

.....

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.....

..... **[3]**

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(b) The pancreas is an organ that secretes protease enzymes.

Outline how the organelles in pancreatic cells work together to produce and release these protein molecules from the cells.



In your answer you should use appropriate technical terms, spelled correctly.

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..... **[5]**

[Total: 11]

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2 Many teachers use models to demonstrate and explain breathing and lung function in mammals.

Fig. 2.1 is a model of the mammalian chest.

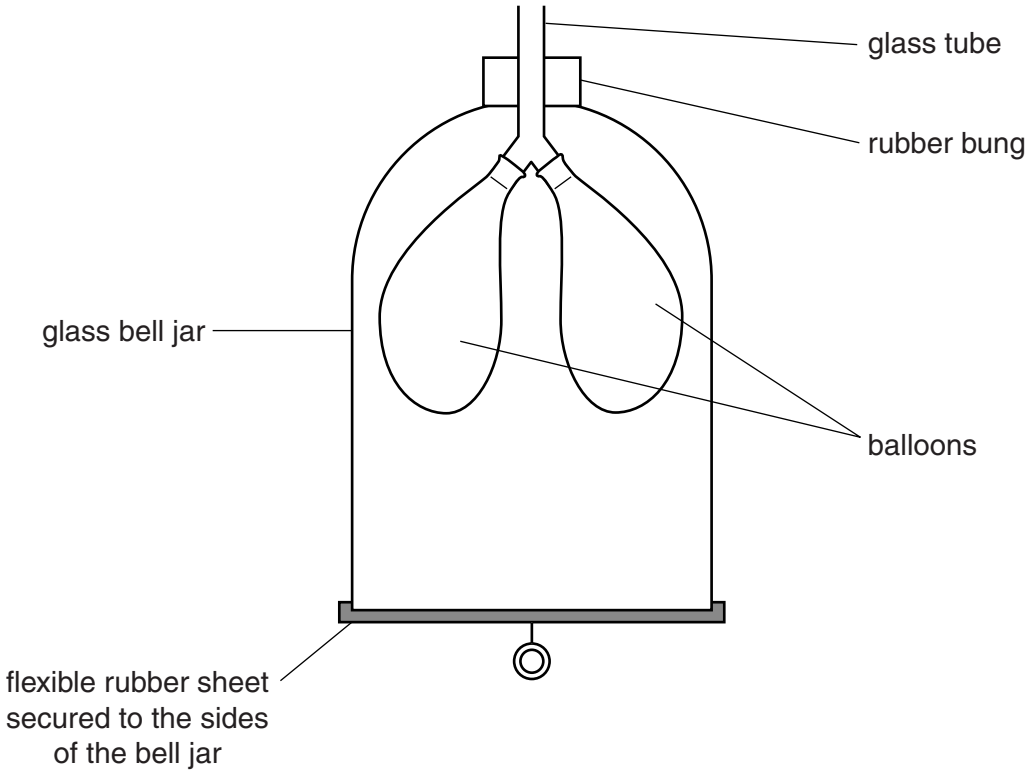


Fig. 2.1

(a) When the rubber sheet is pulled down the balloons expand.

Explain why the balloons expand.

.....

.....

.....

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.....

.....

..... **[3]**

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(b) A teacher used the model in Fig. 2.1 to demonstrate the difference between tidal volume and vital capacity.

(i) Explain the meaning of the term *tidal volume*.

.....

.....

.....

..... **[2]**

(ii) Suggest how the teacher may have used the model to demonstrate tidal volume.

.....

.....

.....

..... **[2]**

(iii) Explain the meaning of the term *vital capacity*.

.....

.....

.....

..... **[2]**

(iv) Suggest how the teacher may have used the model to demonstrate vital capacity.

.....

.....

..... **[1]**

[Total: 10]

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3 **(a)** Blood contains erythrocytes and neutrophils.

Tissue fluid may contain neutrophils but does not contain erythrocytes.

Tissue fluid is formed from plasma by pressure filtration through the capillary walls.

All materials exchanged between the blood and cells pass through the capillary wall.

Explain why tissue fluid does not contain erythrocytes.

.....

.....

.....

..... **[2]**

(b) Erythrocytes are full of haemoglobin.

Describe the role of haemoglobin in transporting oxygen around the body.

.....

.....

.....

.....

.....

.....

.....

..... **[3]**

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(c) Most carbon dioxide is transported as hydrogencarbonate ions in the plasma.

Hydrogencarbonate ions are produced in the erythrocytes and diffuse into the plasma.

(i) Describe how the hydrogencarbonate ions are **produced** in the erythrocytes.

In your answer you should use appropriate technical terms, spelled correctly.

.....

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..... **[4]**

(ii) High concentrations of carbon dioxide in the blood reduce the amount of oxygen transported by haemoglobin.

Name this effect and explain why it occurs.

name .....

explanation .....

.....

.....

.....

.....

.....

.....

[3]

[Total: 12]

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4 Plants transport water and assimilates through specialised tissues.

(a) Fig. 4.1 shows a tissue plan of a vertical section through part of a leaf.

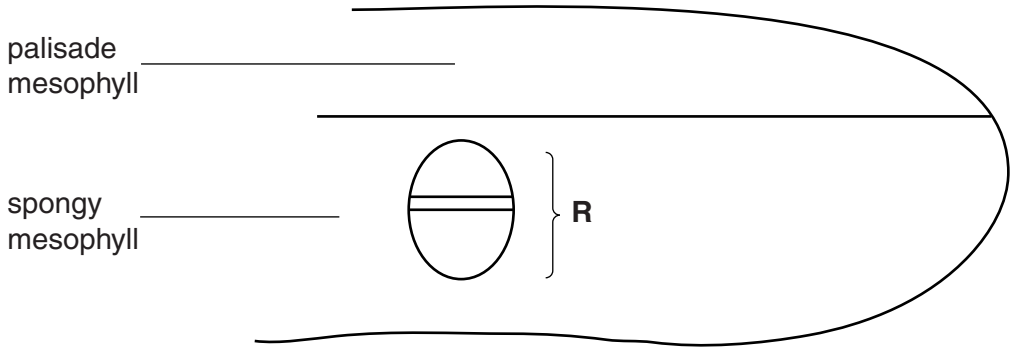


Fig. 4.1

(i) **On Fig. 4.1**, identify with a letter **X** the position of the xylem **and** identify with a letter **P** the position of the phloem.

The answer to this question should be drawn on Fig. 4.1. **[1]**

(ii) Name structure **R**.

..... **[1]**

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(b) The majority of cells in phloem tissue are either companion cells or sieve tube elements.

A scientist isolated companion cells and conducted some experiments to investigate the mechanism involved in loading sucrose into the sieve tubes.

He recorded the following observations:

observation 1 isolated companion cells became slightly negatively charged compared with their surroundings

observation 2 companion cells could decrease the pH of the surrounding solution from 7.0 to 5.6

observation 3 the pH inside the companion cells rose from 7.0 to 8.2

observation 4 treatment with cyanide (which stops aerobic respiration) prevents the change in pH occurring

From **observation 1**, the scientist concluded that the mechanism involved a transfer of charged particles (ions) between the companion cells and their surroundings.

(i) What conclusions can be drawn from **observations 2 and 3** about the mechanism?

.....

.....

.....

.....

..... **[2]**

(ii) What conclusions can be drawn from **observation 4** about the mechanism?

.....

.....

..... **[1]**

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(c) The scientist drew a diagram to explain the mechanism used to load sucrose into the sieve tube elements.

His diagram is shown in Fig. 4.2.

A
charged particles are removed from the companion cells

B
co-transport of charged particles and sucrose into the companion cells

C
sucrose moves into the sieve tube elements

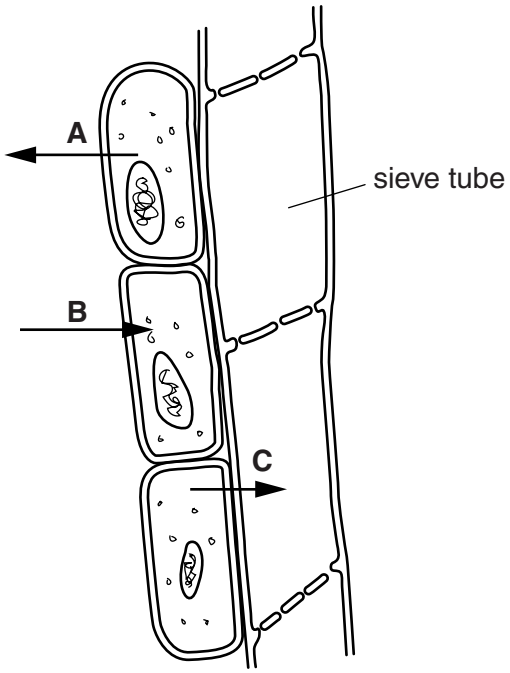


Fig. 4.2

(i) The following paragraph is an extract from the scientist's work.

Complete the paragraph.

At step **A**, charged particles are moved out of the companion cells by the process of ..... . This creates a ..... gradient between the companion cell and its surroundings. At step **B**, the charged particles and assimilates are co-transported by ..... diffusion into the companion cells. The assimilates build up in the companion cells and move by ..... into the sieve tube elements at step **C**. Assimilates, such as sucrose and ..... , can be loaded in this way. **[5]**

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(ii) The structure of cells is usually adapted to carry out their functions.

The scientist used an electron microscope to look for further evidence to support the mechanism involved in loading sucrose into the sieve tubes.

Suggest what evidence the scientist might expect to see in companion cells, using an electron microscope.

.....

.....

.....

..... **[2]**

[Total: 12]

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5 A group of microorganisms called slime moulds includes the species *Dictyostelium discoideum*.

The life cycle of *D. discoideum* is shown in Fig. 5.1.

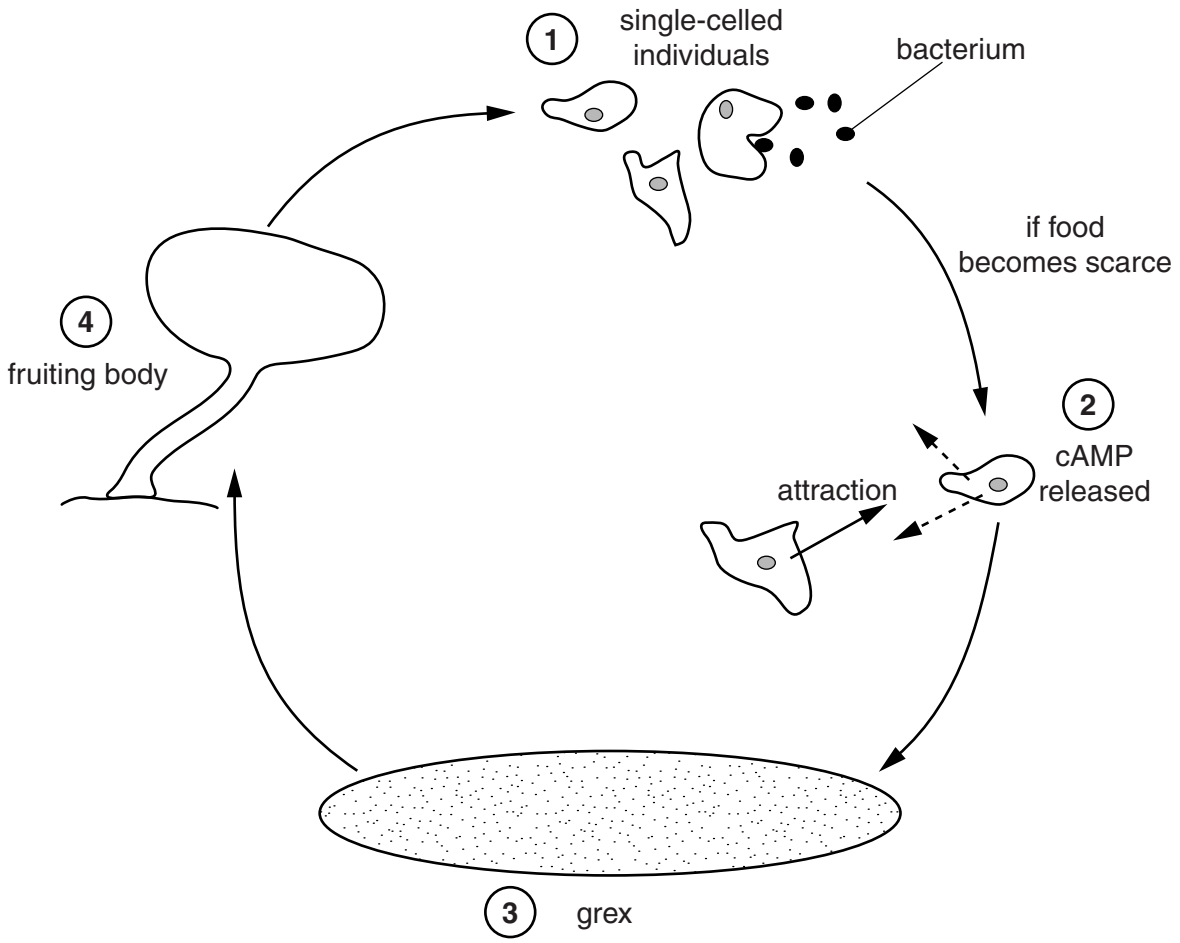


Fig. 5.1

(1) When plenty of food is available this slime mould exists as single-celled individuals which feed and reproduce asexually.
The slime mould cells feed on bacteria.
The slime mould cells are attracted to folic acid which has been released by the bacteria.

(2) When food becomes scarce the slime mould cells release a chemical (cAMP) which attracts other slime mould cells.

(3) The slime mould cells then group and stick together to form a multicellular mass called a grex.
The grex moves in a coordinated way in search of a more suitable environment.
As the grex moves, the cells release the chemical DIF. DIF causes some cells to become stalk cells and others to become spore cells.

(4) When the grex reaches suitable conditions, it forms a fruiting body consisting of a stalk and spores.
These spores are released and develop into new, individual, slime mould cells.

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(a) **(i)** Suggest the type of cell division used by *D. discoideum* for reproduction during stage (1) of its life cycle.

..... **[1]**

(ii) At what stage of the life cycle does differentiation begin?

..... **[1]**

(b) Communication and cooperation between cells is essential for the survival of *D. discoideum*.

(i) State the correct term for communication between cells.

..... **[1]**

(ii) Describe **two** examples of communication between cells that occur during the life cycle of *D. discoideum*.

.....

.....

.....

.....

..... **[2]**

(iii) The plasma membranes of the slime mould cells are specially adapted for communication.

Using the information on page 12, and your biological knowledge, suggest how the plasma membrane of *D. discoideum* is adapted for cell communication.

.....

.....

.....

..... **[2]**

(c) Individual cells of *D. discoideum* can divide once every hour. A grex may consist of 100 000 individual cells.

Calculate how many hours it would take for one cell to produce enough cells to form a grex.

Answer = ... hours **[1]**

[Total: 8]

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6 State the correct term for each of the following definitions.

(a) A pair of chromosomes that contain genes for the same characteristics.

..... **[1]**

(b) A group of organs working together to perform an essential function.

..... **[1]**

(c) A type of circulatory system that does not keep the blood within blood vessels.

..... **[1]**

(d) A type of cell division that produces genetic variation.

..... **[1]**

(e) The detailed structure of cells visible only with an electron microscope.

..... **[1]**

(f) The pathway that transports water along cell walls and between cells in plants.

..... **[1]**

(g) The bulk transport of materials out of a cell.

..... **[1]**

[Total: 7]

END OF QUESTION PAPER

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ADDITIONAL ANSWER SPACE

If additional answer space is required, you should use the following lined page. The question number(s) must be clearly shown in the margin.

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Biology

Unit **F211:** Cells, Exchange and Transport

Advanced Subsidiary GCE

Mark Scheme for June 2014

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These are the annotations, (including abbreviations), including those used in scoris, which are used when marking

Annotation	Meaning of annotation
	Tick
	Cross
	Blank Page – this annotation **must** be used on all blank pages within an answer booklet (structured or unstructured) and on each page of an additional object where there is no candidate response.
	Benefit of doubt use sparingly
	Noted but no credit given
	Omission
Green blob	To denote term for QWC
NBOD	Not benefit of doubt
Red squiggly underline	Incorrect statement / word

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Question			Answer	Mark	Guidance
1	(a)	(i)	cellulose / cell, wall ; chloroplast(s) ; starch grain(s) / amyloplast(s) ; large / permanent, vacuole ; tonoplast ; plasmodesma(ta) ;	2 max	**Mark the first answer on each prompt line.** If the answer is correct and a further answer is given that is incorrect or contradicts the correct answer then **= 0 marks** **DO NOT CREDIT** wall unqualified, **DO NOT CREDIT** if incorrect compound e.g peptidoglycan / chitin **IGNORE** plastid **IGNORE** vacuole alone – must be qualified as large or permanent
		(ii)	centriole **/** glycogen granule ;	1	**Mark the first answer.** If the answer is correct and a further answer is given that is incorrect or contradicts the correct answer then **= 0 marks** **ACCEPT** lysosomes, cilia, flagella
		(iii)	1 (whole) cell, support / stability / scaffolding / maintain shape ; 2 movement of, cilia / flagella / undulipodia OR use of cilia / flagellum / undulipodium to move cell ; 3 changing shape of cell / cytokinesis / pseudopodia / phagocytosis / endocytosis / exocytosis / muscle contraction ; 4 (named) organelles, moved / held in place ; 5 movement of, chromosomes / chromatids / (m)RNA ;	3 max	**IGNORE** 'movement of, cell / membrane' unqualified **IGNORE** strength / structure / rigid **IGNORE** make up cilia / flagella **ACCEPT** descriptions **ACCEPT** movement of vesicle **IGNORE** movement of substances / materials **ACCEPT** formation of spindle / centrioles

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Question	Answer	Mark	Guidance
(b)		4 max	Max 4 marks for content Look for name of organelle and its function / role **ACCEPT** enzyme / protease for protein **MAX 3** if answer refers to insulin or incorrect protein
	1 nucleus **,** contains gene (for protein) / site of **transcription** / produces mRNA **;**		**ACCEPT** DNA / genetic material / genetic information for 'gene' **IGNORE** 'mRNA leaves nucleus'
	2 **ribosomes** / **rough endoplasmic reticulum** / RER**,** site of, protein synthesis **/ translation ;**		**ACCEPT** description of assembling a *chain* of amino acids
	3 **vesicles** for transport (of protein) **;**		mp3 can be awarded either for transport between ER and Golgi or between Golgi and Plasma membrane
	4 **Golgi** (apparatus / body), processes / modifies / (re)packages, proteins **;**		E.G. tertiary folding / quaternary structure / carbohydrate added / converted to glycoprotein / placed in vesicles **IGNORE** ref to RER
	5 (vesicles) fuse to, **cell surface** / **plasma, membrane ;**		**IGNORE** binds / attach / joins **IGNORE** exocytosis **IGNORE** ref to vesicles leaving cell **ACCEPT** merges with / becomes part of
	QWC **;**	1	Any **two** technical terms from the list below used appropriately and spelled correctly : **ribosomes** **rough endoplasmic reticulum (NOT** RER for QWC**)** **transcription (and derivatives)** **translation (and derivatives)** **golgi** **vesicles** **plasma membrane / cell surface membrane**
	Total	**11**	

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Question			Answer	Mark	Guidance
					DO NOT ALLOW marks for use of just 'oxygen' in place of 'air' throughout question 2
2	**(a)**		1 volume, inside / of, jar increases **;** 2 pressure inside, jar / balloons, decreases **;** 3 to below pressure in atmosphere **;** 4 (therefore) air, moves / pushed / forced, into, balloons **/** glass tube **;**	3 max	**IGNORE** references to chest / lungs **CREDIT** idea of creating a pressure gradient (between balloon and exterior) **IGNORE** hydrostatic **Note:** 'makes pressure in jar lower than atmosphere' = 2 marks **ACCEPT** flows / enter / fills **DO NOT CREDIT** suction / drawn / pulled in / diffuse in / taken in **IGNORE** *just* into bell jar
	(b)	**(i)**	volume of air, inhaled / exhaled **;** in, one / each, breath **;** during, steady / regular, breathing **;**	2 max	**ACCEPT** breathed / moved, in (and / or out of lungs) **IGNORE** amount **ACCEPT** at rest / during steady exercise / normal / quiet breathing
		(ii)	up / down, movements (of rubber sheet / band) **;** *idea of:* small / steady / regular, movements (of rubber sheet) **;**	2	**ACCEPT** pull / push on rubber sheet / band **ACCEPT** pull / push and let go **ACCEPT** rhythmically / in time with breathing / repetitively **IGNORE** gently **Note:** pulled down slightly = 2 marks

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Question			Answer	Mark	Guidance
		(iii)	the maximum <u>volume</u> of air **;** inhaled / exhaled, in one breath **;**	2	**ACCEPT** tidal volume + inspiratory reserve + expiratory reserve = 2 **ACCEPT** total lung capacity – residual volume = 1 mark **IGNORE** total volume **ACCEPT** breathed, in / out, in one breath **DO NOT CREDIT** held in lungs or max vol in lungs **DO NOT CREDIT** breathed in **and** out in one breath
		(iv)	***idea that*** pulled down on rubber, sheet / band, as far as possible **and** pushed up as far as possible **;**	1	**ACCEPT** pull / push in either order **ACCEPT** pull **and** push as hard as possible
			Total	**10**	

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Question			Answer	Mark	Guidance
3	(a)		gap(s) between endothelium cells (too) small ; (erythrocytes) too large / cannot change shape (much) ; to, fit / move / pass, between (endothelium) cells **OR** through, gaps / pores / fenestrations;	2 max	**IGNORE** holes in wall **ACCEPT** pores / fenestrations too small Look for idea that they are **too** big not just big **ACCEPT** not small enough **ACCEPT** squeeze **DO NOT CREDIT** diffusion of cells **IGNORE** to pass through capillary wall (it is in question and we want to know how they get through) **Note:** too big to pass through gaps = 2 marks (mp2 & 3)
	(b)		1 (haemoglobin has) high affinity for oxygen ; 2 oxygen binds to haemoglobin in, lungs / alveoli / high pO_2 ; 3 oxyhaemoglobin ; 4 oxygen released, in tissues / where needed / where pO_2 is low / where respiration is occurring ;	3 max	**ACCEPT** haem group / iron ions for haemoglobin **ACCEPT** high, oxygen tension / concentration **ACCEPT** attaches / combines / loads / associates / becomes more saturated **IGNORE** picks up / oxygenated **DO NOT CREDIT** reacts with **ACCEPT** unloads **/** dissociates from Hb **Note:** do not give a mark for '***oxygen*** dissociates' as this implies oxygen is forming ions / atoms **ACCEPT** low, oxygen tension / concentration **IGNORE** gives up / drops off **IGNORE** ref to high carbon dioxide concentration

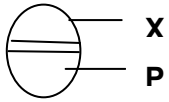
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Question			Answer	Mark	Guidance
	(c)	(i)		3 max	**CREDIT** mark points taken from equations or flow charts e.g. $CO_2 + H_2O \rightarrow H_2CO_3 \rightarrow H^+ + HCO_3^-$ this = mp 2 & 4 to award mp 3 & 5 correctly located annotations needed **ACCEPT** correct symbols and formulae throughout (but **NOT** for QWC mark) **CON** If name and formula contradict e.g. hydrogencarbonate ions = H_2CO_3
			1 carbon dioxide, enters / diffuses into, erythrocytes **;**		**ACCEPT** red blood cells
			2 (carbon dioxide) combines / reacts, with water **;**		
			3 correct ref to **carbonic anhydrase;**		**Note:** correct context is it catalyses, combination of carbon dioxide and water / formation of carbonic acid **IGNORE** if linked to dissociation of carbonic acid
			4 forms **carbonic acid ;**		**IGNORE** carbolic/carboxylic
			5 (carbonic acid) **dissociates** to form hydrogencarbonate ions *and,* **hydrogen ions** / **protons ;**		**ACCEPT** splits / broken down **ACCEPT** bicarbonate ions **Note:** both products must be ions produced from dissociation of a compound (not dissociation of hydrogencarbonate ions)
			QWC **;**	1	Any two technical terms from the list below used appropriately and spelled correctly : **carbonic acid** **carbonic anhydrase,** **dissociates** (or derivatives of this word) **hydrogen ions / protons**

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Question			Answer	Mark	Guidance
		(ii)	*Name* 1 Bohr (effect / shift) **;** *Explanation (**any 2** of the following marks)* 2 reduces <u>affinity</u> (of Hb) for oxygen **;** 3 formation of haemoglobinic acid / hydrogen ions interact with haemoglobin **;** 4 prevents, fall in pH / build-up of H^+, in cells **OR** provides buffering effect **;** 5 alter, structure / shape, of haemoglobin **;** 6 ***more*** oxygen released where, needed / more respiration / carbon dioxide concentration high **;** 7 CO_2 binds to haemoglobin forming carb<u>amino</u>haemoglobin **;**	3 max	**Maximum 2 marks if effect not named correctly** **ACCEPT** phonetic spelling **IGNORE** ref to 'curve shifting' **ACCEPT** hydrogen ions, combine / bind, with Hb **ACCEPT** HHb for haemoglobinic acid **ACCEPT** $H^+ + Hb \rightarrow HHb$ **ACCEPT** causes **more** oxygen to leave (oxy)haemoglobin / high**er** levels of oxygen released **IGNORE** ref to oxygen released more quickly or more easily **Note:** do not give a mark for 'more ***oxygen*** dissociates' as this implies oxygen is forming ions / atoms (as this explains reduced oxygen transport)
			Total	**12**	

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Question			Answer	Mark	Guidance
4	(a)	(i)	letter **X** marking upper part of vascular bundle **and** letter **P** marking lower part of vascular bundle **;**	1	 **X** **P** **ACCEPT** Xylem & Phloem **DO NOT CREDIT Y**
		(ii)	vascular bundle / vein **;**	1	**IGNORE** tissue / midrib
	(b)	(i)	(the charged particles are) hydrogen ions / H^+ / protons **;** (ions are) moved out of the cells / move into surrounding (solution) **;**	2	**IGNORE** descriptions of observations 2 and / or 3 **IGNORE** ref to OH^- / alkaline substances **Note** do not need to refer to hydrogen ions for mp 2 **Note** that 'hydrogen ions move out of the cell' **= 2 marks**
		(ii)	active transport involved / cyanide prevents active transport / (mechanism) is active / (mechanism) needs energy / (mechanism) needs ATP **;**	1	**IGNORE** descriptions of observation 4 e.g. no ATP is made **IGNORE '**mechanism / active loading, does not work in presence of cyanide' as too vague
	(c)	(i)	active transport **;** concentration / pH / H^+ / proton / electrochemical **;** facilitated **;** diffusion **;** amino acids **;**	5	**Mark the first answer.** If the answer is correct and a further answer is given that is incorrect or contradicts the correct answer then **= 0 marks** **IGNORE** active loading **IGNORE** high **DO NOT ACCEPT** diffusion **ACCEPT** facilitated diffusion **ACCEPT** plasmodesmata **DO NOT CREDIT** facilitated diffusion **DO NOT CREDIT** glucose / fructose / ions

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Question			Answer	Mark	Guidance
		(ii)	many / large, <u>mitochondria</u> ; plasmodesmata (between companion cell and sieve tube) / described ; many ribosomes / extensive RER ; many proteins in the, plasma / cell surface, membrane ;	2	**IGNORE** qualification of type of protein
			Total	**12**	

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Question			Answer	Mark	Guidance
5	(a)	(i)	mitosis ;	1	**CREDIT** correct spelling only **ACCEPT** binary fission
		(ii)	in the grex / 3 ;	1	
	(b)	(i)	cell signalling ;	1	
		(ii)	1 attraction of cell(s) to folic acid from bacteria ; 2 attraction of cells to each other by cAMP ; 3 coordinated movement in grex ; 4 differentiation / described, of (grex / slime mould) cells in response to DIF ;	2 max	**NOTE** must name the chemical involved for description (except mp 3 coordinated movement) **ACCEPT** attraction of cells to bacteria by folic acid **IGNORE** makes cells stick together
		(iii)	contains , receptors / glycoproteins / glycolipids / glycocalyx ; for , folic acid / cAMP / DIF ;	2	**DO NOT CREDIT** *consists* of receptors
	(c)		17 (hours) ;	1	
			Total	**8**	

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Question			Answer	Mark	Guidance
6					**Mark the first answer for each question part.** If the answer is correct and a further answer is given that is incorrect or contradicts the correct answer then **= 0 marks**
	(a)		homologous (chromosomes) **OR** homologue(s) **;**	1	**IGNORE** bivalent
	(b)		(organ) system **;**	1	**DO NOT CREDIT** specific named system unless given as example
	(c)		open (circulatory system) **;**	1	
	(d)		meiosis **;**	1	**CREDIT** correct spelling only
	(e)		ultrastructure **;**	1	
	(f)		apoplast / apoplastic **;**	1	
	(g)		exocytosis **;**	1	**DO NOT CREDIT** endocytosis / mass flow **IGNORE** bulk flow
			Total	**7**	

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RECOGNISING ACHIEVEMENT

Tuesday 21 May 2013 – Afternoon

AS GCE BIOLOGY

F211/01 Cells, Exchange and Transport

F211O06013

Candidates answer on the Question Paper.

OCR supplied materials:
- Insert (inserted)

Other materials required:
- Electronic calculator
- Ruler (cm/mm)

Duration: 1 hour

F211101

Candidate forename		Candidate surname	

Centre number						Candidate number				

INSTRUCTIONS TO CANDIDATES

- The Insert will be found in the centre of this document.
- Write your name, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
- Use black ink. HB pencil may be used for graphs and diagrams only.
- Answer **all** the questions.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Write your answer to each question in the space provided. If additional space is required, you should use the lined page at the end of this booklet. The question number(s) must be clearly shown.
- Do **not** write in the bar codes.

INFORMATION FOR CANDIDATES

- The number of marks is given in brackets **[ ]** at the end of each question or part question.
- The total number of marks for this paper is **60**.
- Where you see this icon you will be awarded marks for the quality of written communication in your answer.
- You may use an electronic calculator.
- You are advised to show all the steps in any calculations.
- This document consists of **16** pages. Any blank pages are indicated.

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Answer **all** the questions.

1 Fig. 1.1 is a diagram of a plant cell.

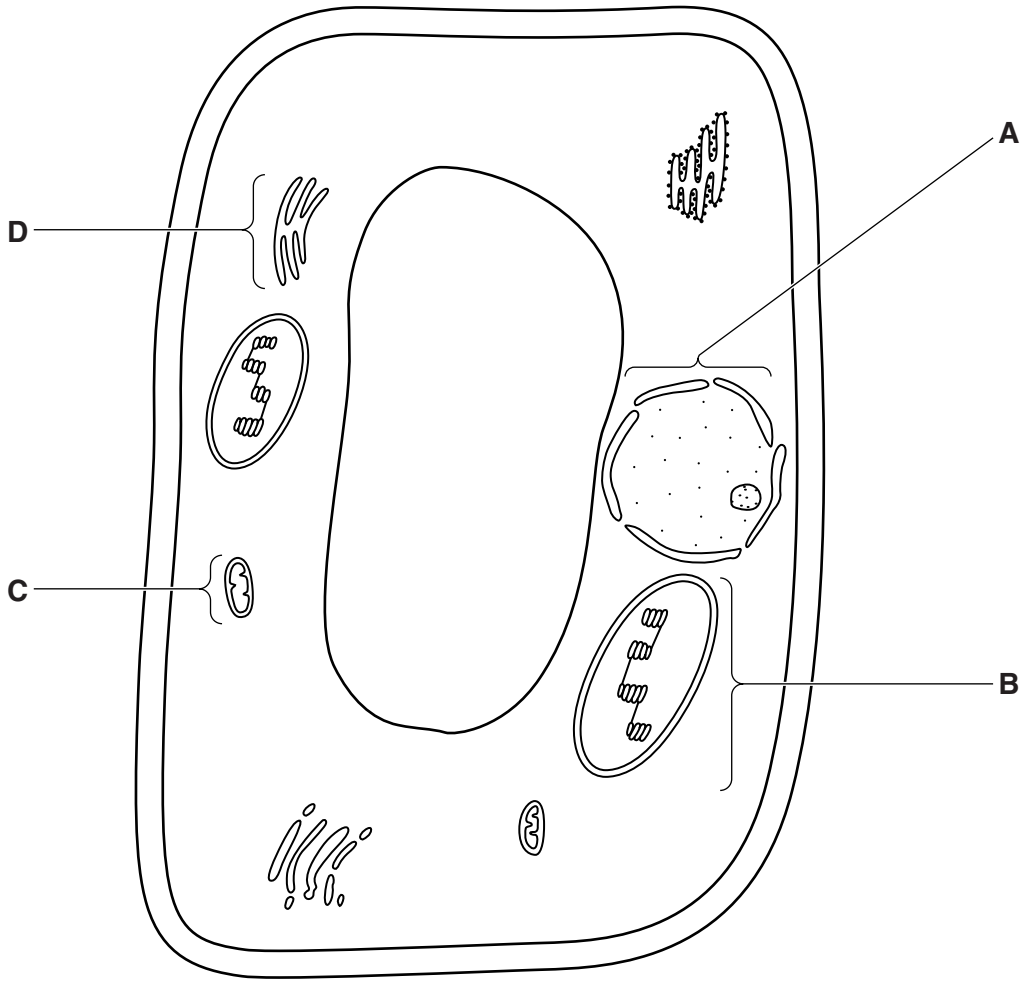


Fig. 1.1

(a) (i) Name the cell components labelled **A** and **B**.

A .....

B .....

[2]

(ii) State the **functions** of the components labelled **C** and **D**.

C .....

.....

.....

D .....

.....

.....

[2]

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(b) A student suggested that the details of component **C** could be seen clearly with a very good light microscope.

Explain why the student is **not** correct.

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..... **[2]**

(c) Staining is a process often used in microscopy.

Describe the **advantages** of staining specimens to be viewed under a microscope.

.....

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..... **[2]**

[Total: 8]

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2 In an experiment to measure the rate of diffusion, a student placed cubes of agar jelly containing an indicator into dilute hydrochloric acid. The indicator changes from pink to colourless in acidic conditions.

The student used cubes of different sizes and recorded the time taken for the pink colour of each cube to disappear completely.

The student's results are recorded in Table 2.1.

Length of side of cube (mm)	Surface area of cube (mm^2)	Volume of cube (mm^3)	Surface area to volume ratio	Time taken for pink colour to disappear (s)	Rate of diffusion ($mm\,s^{-1}$)
2	24	8	3.0:1	50	0.020
5	150	125	1.2:1	120	0.021
10	600	1 000		300	0.017
20	2 400	8 000	0.3:1	700	0.014
30	5 400	27 000	0.2:1	1 200	0.013

Table 2.1

(a) (i) Calculate the surface area to volume ratio of the cube with 10 mm sides.

Show your working.

Answer = ... **[2]**

(ii) **Using the data in Table 2.1**, describe the relationship between the rate of diffusion and the surface area to volume ratio.

.....

.....

.....

..... **[2]**

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(iii) Explain the significance of the relationship between rate of diffusion and the surface area to volume ratio for large plants.

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..... **[2]**

(b) Another student used the same raw data obtained in the experiment but calculated a different rate of diffusion for each cube. This student's results are shown in Table 2.2.

Length of side of cube (mm)	Time taken for pink colour to disappear (s)	Rate of diffusion ($mm\,s^{-1}$)
2	50	0.040
5	120	0.042
10	300	0.033
20	700	0.029
30	1200	0.025

Table 2.2

In this student's table, the calculation of the rate of diffusion is incorrect.

(i) Suggest the method used to calculate the rate of diffusion in Table 2.2.

.....

..... **[1]**

(ii) State why the method in **(b)(i)** is **not** correct.

.....

.....

.....

..... **[1]**

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(c) In mammals, the lungs are adapted to enable efficient gaseous exchange.

The table below lists some of the adaptations of the lungs.

Complete the table explaining how each adaptation improves efficiency of gaseous exchange.

Adaptation	How this adaptation improves efficiency of gaseous exchange
squamous epithelium	....
large number of alveoli	....
good blood supply	....
good ventilation	....

[4]

[Total: 12]

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Question 3 begins on page 8

PLEASE DO NOT WRITE ON THIS PAGE

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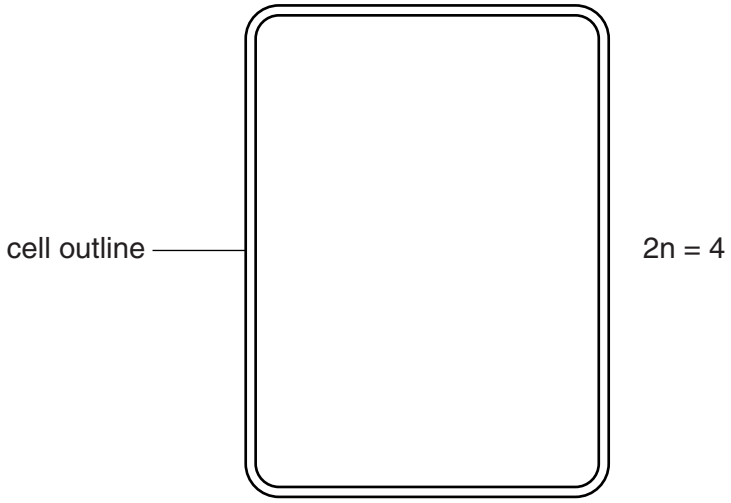
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3 (a) (i) Name the type of nuclear division that occurs in plant growth.

..... **[1]**

(ii) Draw the **chromosomes** within the cell outline below as they would appear during **metaphase** of nuclear division.

Assume the diploid number of chromosomes is **four**.

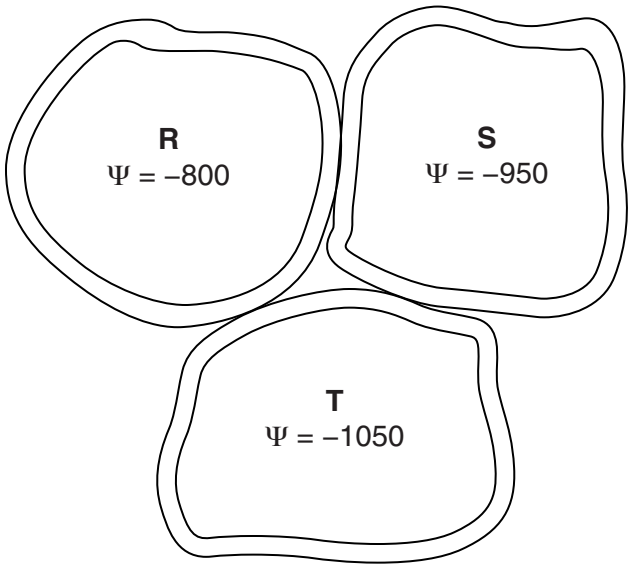


[2]

(iii) Cytokinesis follows nuclear division. After cytokinesis, the cells elongate due to water uptake by osmosis.

Fig. 3.1 shows three plant cells. The value shown in each cell refers to the water potential, Ψ, in kPa.

Draw arrows on Fig. 3.1 below to show the movement of water between cells **R**, **S** and **T**.



[2]

Fig. 3.1

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(b) Fig. 3.2, **on the insert**, shows the stump of a tree with new branches growing from the stump.

New growth in a stem or trunk comes from the **cambium**, which is situated between the xylem and phloem tissues.

Explain why the new branches in Fig. 3.2 are seen growing from a position just under the bark of the cut surface.

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..... **[2]**

(c) Name **one** other location where growth occurs in a plant.

..... **[1]**

(d) Look at the areas labelled **L** on Fig. 3.2. These are areas of loosely packed cells in the bark called lenticels. Lenticels allow gases to diffuse into the living tissues of the trunk.

Suggest why lenticels are essential to the survival of large multicellular plants **and** explain why similar structures are not found in large multicellular animals.

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..... **[2]**

[Total: 10]

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4 Fig. 4.1 shows the oxygen dissociation curves for fetal haemoglobin (**A**) and adult haemoglobin (**B**).

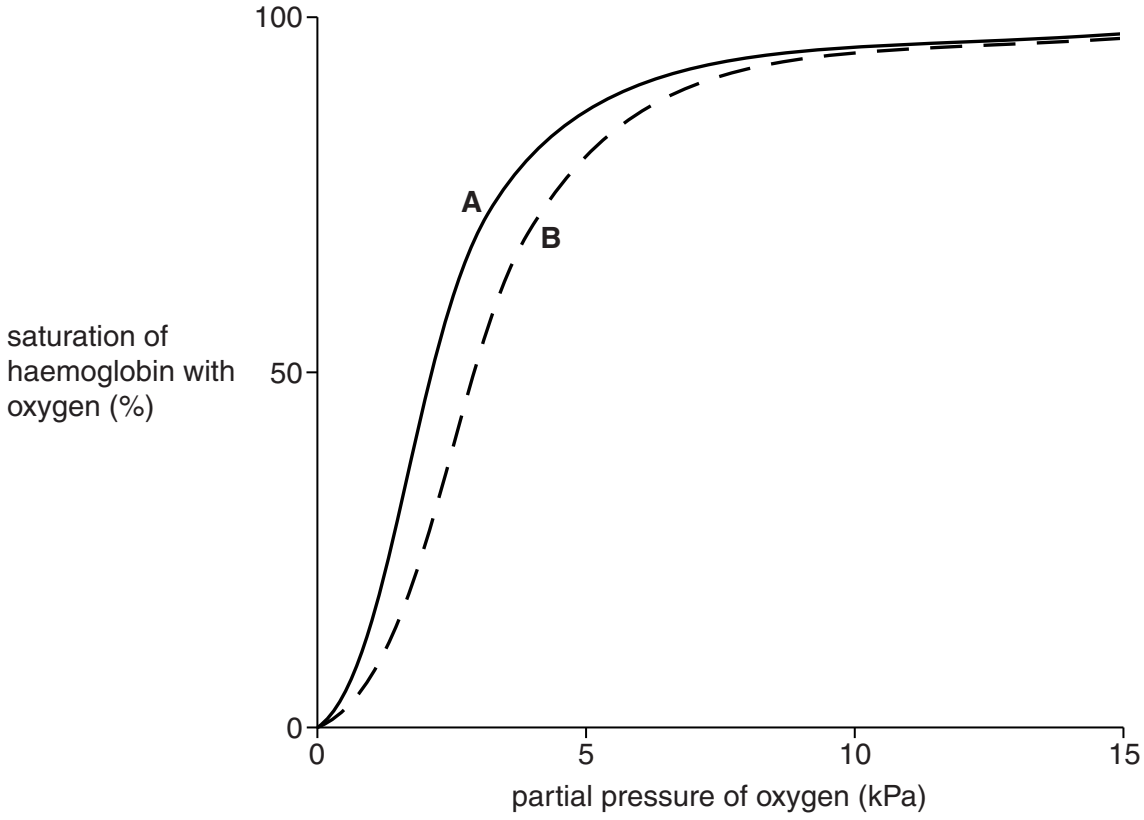


Fig. 4.1

(a) (i) Curve **A** represents fetal haemoglobin.

Explain why the fetal haemoglobin curve is to the left of the adult haemoglobin curve.

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..... **[3]**

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(ii) Sickle cell anaemia is an inherited disorder in which haemoglobin crystallises when the partial pressure of oxygen (pO_2) is low. The red blood cells change shape and oxygen transport is disrupted.

Treatment with drugs, such as hydroxyurea, can stimulate adults to produce fetal haemoglobin rather than adult haemoglobin.

Suggest why this treatment might be of benefit to adults with sickle cell anaemia.

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..... **[2]**

(b) Describe **and** explain how substances that are dissolved in the blood plasma, such as oxygen or glucose, **enter the tissue fluid** from the capillaries.

In your answer you should use appropriate technical terms, spelled correctly.

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..... **[4]**

[Total: 9]

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5 Membranes are found both at the surface of cells and within cells.

(a) State **two** functions of membranes **within** cells.

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.....

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..... **[2]**

(b) Describe the arrangement and functions of **two** named components of a cell surface membrane.



In your answer you should use appropriate technical terms, spelled correctly.

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..... **[5]**

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(c) (i) Which component of a cell membrane becomes more fluid as temperature increases?

..... **[1]**

(ii) Which component of a cell membrane denatures as temperature increases?

..... **[1]**

(iii) Liver cells contain membrane-bound organelles called peroxisomes. These organelles contain catalase, an enzyme that breaks down hydrogen peroxide to release oxygen gas.

A student carried out an investigation on catalase using the following procedure:

- two identical sized cubes were cut from a piece of fresh liver
- one cube was frozen overnight and then defrosted
- the other cube was stored in the refrigerator
- both cubes were returned to room temperature and were placed in separate test tubes containing equal volumes of 2% hydrogen peroxide solution.

The student observed that the cube of liver that had been frozen and defrosted, bubbled significantly more than the cube that had been refrigerated.

Suggest an explanation for this result.

.....

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.....

..... **[2]**

[Total: 11]

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6 **(a)** Distinguish between the term *transpiration* and the *transpiration stream*.

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..... **[3]**

(b) Xerophytes are plants that are adapted to living in dry conditions.

The lists below describe four general features of leaves. From each list, select the leaf that belongs to a xerophyte.

Place a tick (✓) in the correct box. The first one has been done for you.

Presence of hairs on leaves

Leaf **A**	no	
Leaf **B**	yes	✓
Leaf **C**	no	

Mean number of stomata (cm^{-2})

Leaf **D**	30 000	
Leaf **E**	23 000	
Leaf **F**	13 000	

Mean surface area of one leaf (cm^2)

Leaf **G**	0.2	
Leaf **H**	10.0	
Leaf **I**	23.0	

Thickness of cuticle (μm)

Leaf **J**	4.25	
Leaf **K**	8.50	
Leaf **L**	2.00	

[3]

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(c) The transport system of multicellular plants consists of xylem and phloem tissue.

The table below contrasts the structure and roles of xylem and phloem.

Complete the table using the most appropriate word or words.

Xylem	Phloem
xylem transports water and	phloem transports assimilates such as .....
 	sieve tubes contain perforated cross walls
xylem vessel walls are impregnated with	sieve tube walls have no additional support
xylem vessel walls contain ..... that allow water to pass into adjacent vessels	there are many gaps in the cell walls between companion cells and sieve tube elements called .....

[4]

[Total: 10]

END OF QUESTION PAPER

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ADDITIONAL ANSWER SPACE

If additional answer space is required, you should use the following lined page. The question number(s) must be clearly shown in the margin.

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GCE

Biology

Advanced Subsidiary GCE

Unit **F211:** Cells, Exchange and Transport

Mark Scheme for June 2013

Oxford Cambridge and RSA Examinations

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Annotations

Available in SCORIS

Annotation	Meaning
	Benefit of Doubt
	Contradiction
	Cross
	Error Carried Forward
	Given mark
	Extendable horizontal wavy line
	Ignore
	QWC
	Benefit of the doubt not given
	additional QWC credit given
	Tick
	Tick 1
	Tick 2
	Omission Mark

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Question			Answer	Marks	Guidance
1	(a)	(i)	**A** nucleus ; **B** chloroplast ;	2	**Mark the first answer on each prompt line.** If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = **0 marks** **DO NOT CREDIT** nuclear envelope / nucleolus **IGNORE** chlorophyll
		(ii)	**C** *mitochondrion* (aerobic) respiration / producing ATP / release energy ; **D** *SER / smooth endoplasmic reticulum* transport / production / processing, of, fats / lipids / steroids / carbohydrates ;	2	**Mark the first answer on each prompt line.** If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = **0 marks** **DO NOT CREDIT** Function of organelle if organelle identified / named incorrectly (as this would be an incorrect biological statement. **DO NOT CREDIT** makes / produces, energy **ACCEPT** produces ATP for respiration **IGNORE** ref to transport / modification of proteins **DO NOT CREDIT** ref production of proteins
	(b)		C / mitochondrion / cristae, too small ; resolution (of light microscope), not high (enough) OR *idea of* only, 0.2μm / 200nm ; wavelength of light too long ;	max 2	*idea of* too small / not big enough important **IGNORE** very small **ACCEPT** resolution low **IGNORE** ref to magnification for resolution accept any value in range 0.05 - 0.2 μm **IGNORE** ref to electron microscope

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	(c)		makes visible / easier to see / see more detail **;** (staining) provides / increases, <u>contrast</u> **;** identify / recognise, cell types / organelles / parts of cell **;** identify / recognise, different (named), compounds / molecules **;**	**max 2**	**ACCEPT** distinguish, cells / organelles, (from background) **IGNORE** ref to clarity **IGNORE** substances
			Total	**8**	

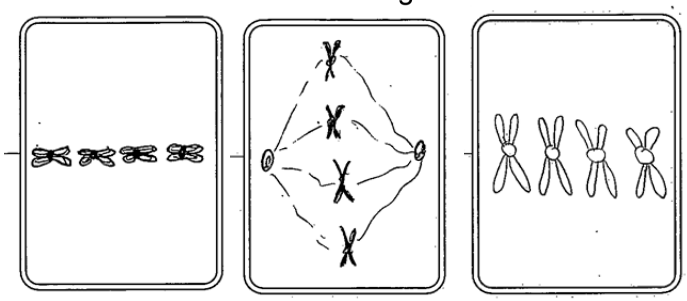
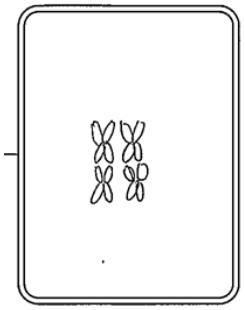
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Question			Answer	Marks	Guidance
2	(a)	(i)	0.6 : 1 ; ;	2	Correct answer = 2 marks **Ratio must be correct way round** 1: 0.6 is not correct but can still allow mark for correct working if shown If answer incorrect **ALLOW** 1 mark for working e.g. 600 ÷ 1000 600 : 1000 = 1 mark
		(ii)	as SA:VOL ratio decreases rate of diffusion decreases **OR** as SA:VOL ratio increases rate of diffusion increases ; use of two pairs of figures with correct units (mms^{-1}) for rate to illustrate trend ; ref to rate of diffusion in either of the first two cubes not fitting trend ;	max 2	**ACCEPT** positive correlation **DO NOT CREDIT** as rate of *diffusion* decreases *SA:VOL ratio* decreases use of figs requires ratio quote and rate quote at two points e.g. at SA:VOL of 3:1 rate is 0.02 mms^{-1}, at SA:VOL ratio of 0.2:1 rate is 0.013 (correct units only need to be used once) **DO NOT CREDIT** if unit for SA:Vol given **ACCEPT** correct calculation of rate change e.g. when the SA:VOL ratio was 3:1 the rate of diffusion was 0.020mms^{-1} which is 0.007mms^{-1} faster than the cube with 0.2:1 SA:VOL ratio
		(iii)	(large plants) have a, small / low, SA : VOL ratio ; *idea of* diffusion too slow (to supply requirements) ; *idea of* need transport system (for water / minerals / assimilates) ; *idea of* need (special) surface area for, gaseous exchange / uptake of minerals ;	max 2	**DO NOT CREDIT** smaller unless we know smaller than what **ACCEPT** e.g. larger plants have a smaller SA : Vol ratio must have idea of ***too*** slow **ACCEPT** diffusion takes ***too*** long **DO NOT CREDIT** transport of gases

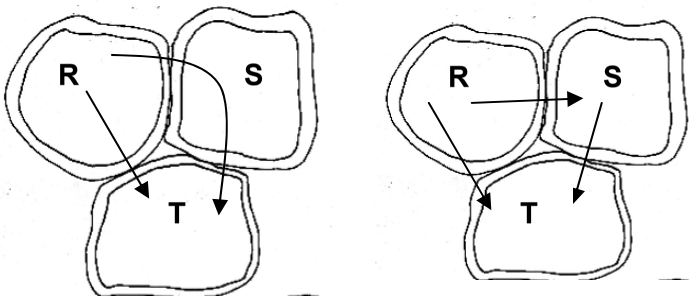
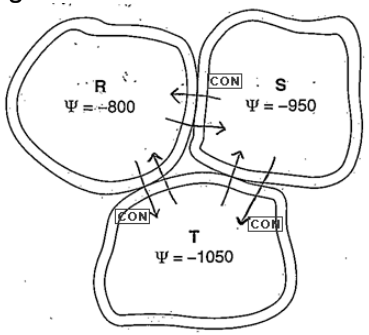
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Question			Answer	Marks	Guidance
	(b)	(i)	divided length of side by time taken ;	1	**IGNORE** divide mm by s (units alone too vague)
		(ii)	*idea that* student used whole length of side, rather than half length ;	1	**ACCEPT** needs to divide answer by 2 / distance has to be to centre of cube rather than whole length of side / assumed diffusion occurs (across whole cube) from one side
	(c)		*squamous epithelium* short(er) diffusion, distance / path ; *large number of alveoli* large(r) surface area ; *good blood supply* high / large / steep, concentration gradient OR removes oxygen (from lung surface) / brings carbon dioxide (to lung surface); *good ventilation* high / large / steep, concentration gradient OR supplies oxygen (to alveoli) / removes carbon dioxide (from alveoli) ;	4	**ACCEPT** reduced / shorter diffusion distance **ACCEPT** thin diffusion barrier **IGNORE** thin diffusion pathway **ACCEPT** increases surface area **IGNORE** SA : Vol ratio **ACCEPT** maintains / creates concentration gradient **IGNORE** ref diffusion gradient **ACCEPT** maintains / creates concentration gradient **IGNORE** ref diffusion gradient **IGNORE** ref to air
			Total	12	

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3	(a)	(i)	mitosis / mitotic ;	1	Correct spelling only
		(ii)	four chromosomes on equator ; (each chromosome as) two sister chromatids ;	2	If the image is unclear then pencil or a different colour may have been used - RAISE AN EXCEPTION Award 2 marks for the following  **DO NOT CREDIT** mp 1 if nuclear membrane shown **DO NOT CREDIT** mp 1 if homologous chromosomes paired e.g.  **DO NOT CREDIT** mp 2 if sister chromatids are not joined (at centromere)

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		(iii)	arrow from R to T ; arrow from R to S **AND** arrow from S to T OR arrow from R to S to T ;	2	e.g.  If contradictory arrows to the above are drawn, apply CON for each arrow going from low Ψ to high Ψ. e.g.  gets 0
	(b)		this is where cambium / meristem / xylem / phloem / vascular bundle, is found ; mitosis/cell division, occurs in cambium (to produce new cells for growth) ; new cells, differentiate / specialise, (into xylem and phloem) ; xylem supplies water for, (cell) elongation / (cell) growth ; phloem supplies, sugars / assimilates, for, energy / growth /respiration ;	max 2	**CREDIT** from a labelled diagram **CREDIT** description of position being close to the edge of trunk **DO NOT CREDIT** responses that suggest that cambium etc. are in or outside bark OR under cut surface **ACCEPT** cambium differentiates **IGNORE** nutrients

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	(c)		tip / apex, of, shoot / root ; meristem ; bud ; **max 1**		**Mark the first answer on each prompt line.** If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = **0 marks** **IGNORE** root or shoot unqualified **ACCEPT** behind root tip
	(d)		allow <u>oxygen</u> to reach, cells / tissues (under bark) ; for (aerobic) respiration ; animals transport oxygen in, blood / circulation / transport system ; plants do not transport (much) oxygen in transport system ; *idea that* (oxygen not supplied from leaves as) stomata only open in day / no leaves in winter ; **max 2**		**IGNORE** refs to need for CO_2 / photosynthesis throughout **ACCEPT** correct formula O_2 **DO NOT CREDIT** oxygen for photosynthesis **ACCEPT** gas(es) for oxygen **ACCEPT** gas(es) for oxygen
			Total	**10**	

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Question			Answer	Marks	Guidance
4	(a)	(i)	1 placenta has low pO_2 ;		**ACCEPT** oxygen tension for pO_2 throughout **IGNORE** lower
			2 adult (oxy)haemoglobin will, release O_2 / dissociate, (in, low pO_2 / placenta) ;		
			3 fetal haemoglobin has higher affinity for oxygen / described ;		This must be a comparative statement **CREDIT** *Idea that* fetal haemoglobin picks up more oxygen than the adult haemoglobin at a given pO_2 / fetal haemoglobin picks up oxygen at lower pO_2 **IGNORE** ref to easier / quicker, uptake of O_2
			4 fetal haemoglobin, is (still) able to take up (some) oxygen, in placenta / at low(er) pO_2 ;	max 3	This is not a comparative point, the emphasis is on the ability of fetal haemoglobin to take up some oxygen even when little is available **DO NOT CREDIT** if response suggests that % saturation increases as pO_2 decreases **ACCEPT** fetal oxyhaemoglobin
		(ii)	(fetal) haemoglobin may not crystallise (much) (at low pO_2) ;		assume candidate refers to fetal haemoglobin unless adult / maternal stated
			red blood cells do not change shape ;		
			(fetal) haemoglobin can pick up more oxygen at low pO_2 (than sickle haemoglobin);		Emphasis for this mp is the fetal haemoglobin being able to pick up more oxygen than sickle haemoglobin **CREDIT** (fetal) haemoglobin becomes more saturated at low pO_2 (than sickle haemoglobin) Allow ref to lower pO_2 unless it is implied that fetal haemoglobin picks up more oxygen at lower pO_2 than higher pO_2
			idea that more oxygen, transported / delivered (around body) ;	max 2	Emphasis for this mp is the distribution of oxygen **IGNORE** more oxygen obtained by person (as this implies breathing)

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	(b)		**diffusion ;** from high concentration to low concentration / down **concentration gradient;** (**hydrostatic**) **pressure** in capillary high(er than in tissue fluid) ; capillary (walls) leaky / described ; fluid / plasma, forced out (of capillary) OR fluid / plasma, moves, from higher pressure to lower pressure / down pressure gradient ; (as the fluid / plasma moves out) glucose / oxygen / small molecules, leave with, fluid / plasma ; **max 3**	**IGNORE** diffusion of glucose throughout answer 'down diffusion gradient' = 1 for 'diffusion' (mp 1 **not** mp 2) **DO NOT CREDIT** diffusion linked to pressure **ACCEPT** pO_2 for concentration **ACCEPT** permeable **IGNORE** pores / fenestrations / holes **ACCEP**T *idea of* small gaps between cells Emphasis here is on pressure forcing fluid out **DO NOT CREDIT** tissue fluid forced out Emphasis here is on glucose/ oxygen being carried out as a result of mass flow of fluid (not diffusion)
			QWC; **1**	**award** if any two terms spelt correctly and used in correct context from: **diffusion / diffuse**, **pressure**, **hydrostatic, concentration gradient**
			Total	**9**	

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Question			Answer	Marks	Guidance
5	(a)		forms, vesicles / (named) organelle(s) ;		**ACCEPT** transport in vesicles
			separate (contents of) organelles from cytoplasm / compartmentalisation ;		e.g. isolates DNA from cytoplasm / separate different environments / separate organelles e.g. lysosomes isolate enzymes (and prevent damage to cells) e.g. separates (metabolic) reactions **IGNORE** any ref to nuclear pores
			site of (named), processes / reactions ;		
			provides surface for attachment (of enzymes / ribosomes) ;		
			control what substances, enter / leave, organelles ;		**DO NOT CREDIT** substances, enter / leave, cells
			AVP ;		e.g. allow creation of concentration gradients e.g. ref to intracellular communication e.g. hold binding sites for movement of organelles
				max 2	

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	(b)				**Mark the first <u>two</u> components listed only** **Award marks for suitably labelled diagram(s)** **Mark points are linked – ensure the function matches the component** e.g. DO NOT CREDIT an enzyme arranged as a channel protein
			A1 **phospholipid**s form **bilayer /**described OR phospholipid **hydrophobic** tails pointing inwards and **hydrophilic** heads pointing out **;**		ACCEPT phospholipid bilayer
			F1 provide barrier to, large / polar / (named) molecules OR ions OR described **;**		**ACCEPT** ORA – only allow small / non-polar molecules to pass through e.g. prevents movement of glucose across membrane
			A2 **proteins** form, **pore**s / **channel** / **carrier**s OR **extrinsic / intrinsic / transmembrane /** described**,** proteins **;**		**ACCEPT** pore / channel / carrier, protein **ACCEPT** protein embedded in bilayer
			F2 for (active) transport / **cotranspor**t / **facilitated diffusion** OR **enzyme**s **;**		**ACCEPT** correct ref to movement of (appropriate) substance(s) across membrane
			A3 **cholesterol** molecules fit, within bilayer / between **phospholipid** / between **fatty acid**s / between (phospholipid OR hydrophobic) tails **;** **F3** stabilise membrane (structure) / regulates fluidity **;**	**max 4**	**ACCEPT** between bilayer **IGNORE** increases fluidity / reduces rigidity / strengthens / keeps it fluid

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			A4 glycoproteins / **glycolipid**s , on surface / sticking out from surface, (of cell surface membrane) **;** **F4 cell signalling** / **receptor** sites / **adhesion / antigens /** recognition OR stabilising (cell shape) **;**		Ensure candidate is referring to the *surface* of a membrane rather than the cell surface membrane unqualified **CREDIT** *Idea of* glycoproteins / glycolipids on inner surface or outer surface of (cell surface) membrane **IGNORE** glycoprotein / glycolipids embedded in membrane
			QWC **;**	**1**	**Note: only award this mark for terms used in description of first two components – and only award if given in correct description as shown below.** **award** if any two terms spelt correctly and used **in correct context** from: *for phospholipids accept*: **phospholipid, bilayer, hydrophilic, hydrophobic** *for proteins accept*: **protein, pore, channel, carrier, enzyme, intrinsic, extrinsic, transmembrane, cotransport, facilitated diffusion** *for cholesterol accept*: **cholesterol, fatty acid, phospholipid** *for glycoprotein / glycolipid accept*: **glycoprotein, glycolipid, cell signal(l)ing, receptor, adhesion, antigen**

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	(c)	**(i)**	(phospholipid) bilayer **;**	**1**	
		(ii)	(named) proteins **;**	**1**	**ACCEPT** glycoproteins **DO NOT CREDIT** coenzymes
		(iii)	*idea that:* freezing / defrosting, damages the, peroxisome / (plasma) membrane **;** increases permeability of membrane to, enzyme / hydrogen peroxide **;** more hydrogen peroxide broken down (so more oxygen released) **;**	**max 2**	eg formation of ice crystals causes membrane damage / peroxisomes burst **IGNORE** denatured for damaged **IGNORE** membranes become more leaky unqualified **ACCEPT** release enzyme **ACCEPT** hydrogen peroxide / substrate, broken down at a higher rate **IGNORE** higher rate of reaction unqualified / higher rate of oxygen production
			Total	**11**	

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<table>
<tr><td>6</td><td>(a)</td><td></td><td>transpiration
loss of water <u>vapour</u> / evaporation of water ;
from, aerial parts of plant / leaves / stomata ;

transpiration stream
movement of water (up xylem vessels) ;
from roots to, leaves / air surrounding leaves ;</td><td>max 3</td><td>IGNORE evaporation of water vapour</td></tr>
<tr><td></td><td>(b)</td><td></td><td>F ;
G ;
K ;</td><td>3</td><td>Only one tick per set – if more than one tick then apply CON
IGNORE crosses and hybrid crosses</td></tr>
<tr><td></td><td>(c)</td><td></td><td><table><tr><th>Xylem</th><th>Phloem</th></tr><tr><td>(named) mineral(s) / salts</td><td>sucrose / amino acids</td></tr><tr><td>no, end / cross, walls</td><td></td></tr><tr><td>lignin</td><td></td></tr><tr><td>(bordered) pits</td><td>Plasmodesmata</td></tr></table></td><td>4</td><td>Award 1 mark for a correct row.

IGNORE ions unqualified / nutrients
IGNORE proteins / sugars / minerals / salts for phloem
DO NOT CREDIT glucose

IGNORE continuous tube

DO NOT CREDIT holes / pores</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>10</td><td></td></tr>
</table>

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Wednesday 9 January 2013 – Morning

AS GCE BIOLOGY

F211/01 Cells, Exchange and Transport

Candidates answer on the Question Paper.

OCR supplied materials:
- Insert (inserted)

Other materials required:
- Electronic calculator
- Ruler (cm/mm)

Duration: 1 hour

Candidate forename		Candidate surname	

Centre number						Candidate number				

INSTRUCTIONS TO CANDIDATES

- The Insert will be found in the centre of this document.
- Write your name, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
- Use black ink. HB pencil may be used for graphs and diagrams only.
- Answer **all** the questions.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Write your answer to each question in the space provided. If additional space is required, you should use the lined page at the end of this booklet. The question number(s) must be clearly shown.
- Do **not** write in the bar codes.

INFORMATION FOR CANDIDATES

- The number of marks is given in brackets **[ ]** at the end of each question or part question.
- The total number of marks for this paper is **60**.
- Where you see this icon you will be awarded marks for the quality of written communication in your answer.
- You may use an electronic calculator.
- You are advised to show all the steps in any calculations.
- This document consists of **16** pages. Any blank pages are indicated.

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Answer **all** the questions.

1 **(a)** List **three** reasons why a large, multicellular animal, such as a mammal, needs a transport system.

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..... **[3]**

Fig. 1.1, **on the insert**, shows the nervous pathways that coordinate heart action.

Above the diagram is a trace showing the electrical activity associated with one heart beat.

(b) **(i)** State the full name given to a trace showing the electrical activity of the heart.

..... **[1]**

(ii) Identify the components of the heart labelled **A** and **B** on Fig. 1.1.

A .....

B .....
[2]

(c) **(i)** During the electrical stimulation of the heart, there is a short delay between the excitation of the atria and excitation of the ventricles.

Explain why this delay is essential.

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..... **[2]**

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(ii) The Purkyne tissue carries the excitation wave down the septum to the apex of the heart.

Explain why the excitation wave is carried to the apex.

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..... **[2]**

[Total: 10]

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2 **(a)** Fig. 2.1, **on the insert**, shows a yeast cell with scars resulting from its reproductive process.

(i) Name the process of asexual reproduction in yeast.

..... **[1]**

(ii) Outline the process of asexual reproduction in yeast.

.....

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..... **[2]**

(b) **(i)** A yeast cell can continue producing new cells until its surface is covered by scars.

The surface area of a sphere is given by the formula $4\pi r^2$, where $\pi = 3.14$.

The area of a circle is given by the formula πr^2.

Assuming that the cell in Fig. 2.1 contained no scars, calculate how many potential new cells could be produced by this cell.

Show your working.

Answer = ... **[2]**

(ii) Even when the environmental conditions are perfect, one yeast cell rarely produces the calculated number of potential new cells.

Suggest why the reproductive potential of the yeast cell is not reached.

.....

.....

..... **[1]**

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(c) Yeast cells separate after cell division. In a multicellular organism, the cells do not separate but become organised to form the body structure.

Describe how the cells in a multicellular organism are organised.



In your answer you should use appropriate technical terms, spelled correctly.

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..... **[5]**

[Total: 11]

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3 **(a)** The structure of cell membranes can be described as 'proteins floating in a sea of lipids'. This membrane structure allows certain substances to pass through freely whereas other substances cannot.

State the term used to describe a membrane through which some substances can pass freely but others cannot.

..... **[1]**

(b) Complete the following paragraph about cell membranes, using the most appropriate terms.

The model of cell membrane structure is called the .... model. Phospholipid bilayers with specific membrane proteins account for the ability of the membrane to allow both passive and ..... transport mechanisms. Ions and most polar molecules are insoluble in the phospholipid bilayer. However, the bilayer allows diffusion of most non-polar molecules such as .....Protein channels, which may be gated, and ..... proteins enable the cell to control the movement of most polar substances. **[4]**

(c) One function of membranes that is not mentioned in **(b)** is cell signalling.

(i) State what is meant by *cell signalling*.

.....

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..... **[1]**

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(ii) Explain how cell surface membranes contribute to the process of cell signalling.



In your answer you should use appropriate technical terms, spelled correctly.

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..... **[4]**

[Total: 10]

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4 **(a)** A student used a potometer to investigate the effect of leaf area on the rate of transpiration.

This apparatus is shown in Fig. 4.1.

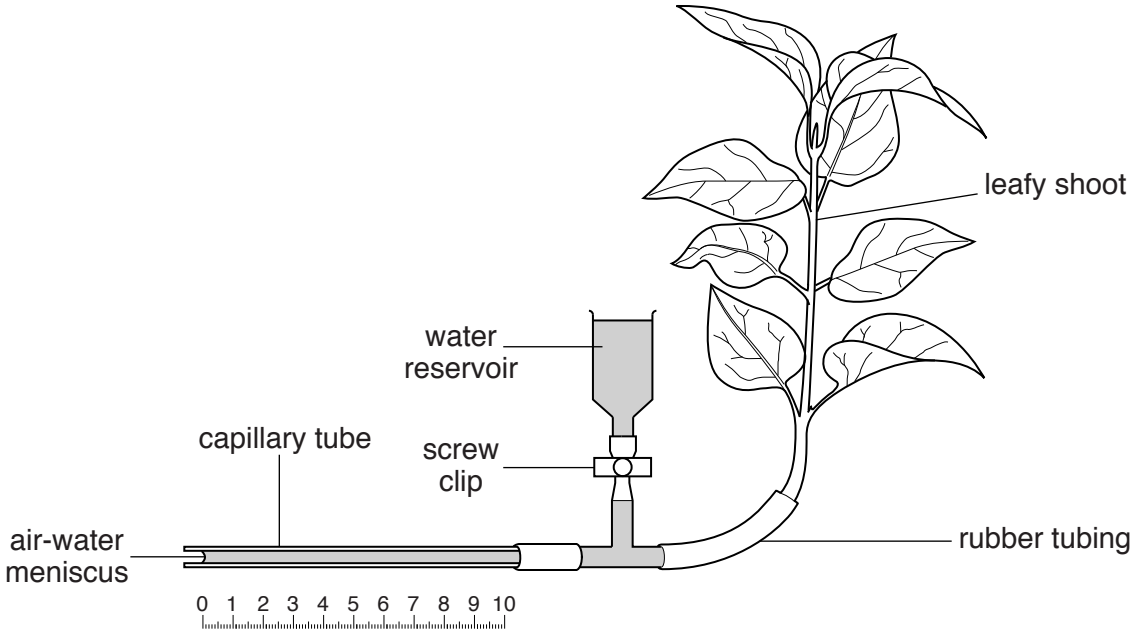


Fig. 4.1

The student presented the results of their investigation in a table, as shown below.

Number of leaves present on shoot attached to potometer	Mean rate of bubble movement
0	7
2	28
4	49
6	73
8	92

Table 4.1

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(i) State what information the student has **not** included in their table of results.

.....

.....

..... **[2]**

(ii) Describe **and** explain the data shown by the student's results.

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..... **[3]**

QUESTION 4(b) STARTS ON PAGE 10

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(b) As part of the evaluation of the investigation, the student wrote the following statements:

1 One limitation is that the leaves were not all the same size.

2 I assembled the potometer under water and the leaves got wet.

3 During my investigation the sun came out and the lab warmed up very quickly.

For each statement, explain why this may affect the results **and** suggest how the student could improve the investigation.

Statement 1

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Statement 2

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Statement 3

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[6]

[Total: 11]

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Question 5 starts on page 12

PLEASE DO NOT WRITE ON THIS PAGE

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5 **(a)** Complete Table 5.1 below which compares different types of cell.

Place a tick (✓) or a cross (✗) in each box to indicate whether the feature is present or absent. The first row has been completed for you.

	Cell type		
Feature	**Plant cell**	**Animal cell**	**Bacterial cell**
mitochondria	✓	✓	✗
chloroplasts			
cellulose cell wall			
centrioles			
ribosomes			

Table 5.1

[4]

(b) In an investigation, cells were broken up (homogenised) and the component organelles were separated into tubes.

Each tube was then tested to determine the identity of the component organelle(s).

The observations are shown in Table 5.2.

Test for the…	**Tube**			
	1	**2**	**3**	**4**
ability to make ATP	no ATP produced	ATP produced	no ATP produced	no ATP produced
presence of DNA	DNA present	trace amount	no DNA present	no DNA present
ability to produce proteins	no proteins made	no proteins made	no proteins made	proteins made
ability to digest bacteria	none	some ability	none	none

Table 5.2

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(i) Identify the tube that contains the following organelles:

nuclei .....

ribosomes .....

mitochondria .....

lysosomes ..... **[4]**

(ii) Which of the organelles listed in **(i)** is the smallest in size?

..... **[1]**

[Total: 9]

Question 6 starts on page 14

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6 **(a)** The lignin in the xylem vessel walls of plants and the C-rings of cartilage in the mammalian trachea perform an important role.

(i) Explain why lignin is essential in the wall of a xylem vessel.

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..... **[3]**

(ii) Explain why cartilage is essential in the trachea.

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..... **[3]**

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(b) All living organisms exchange substances with their external environment.

The following data apply to an average person:

- the surface area of the body is approximately 1.8 m^2
- the volume of the body is approximately 0.07 m^3
- the surface area of the lungs is approximately 70 m^2.

Comment on the significance of this information for gas exchange.

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..... **[3]**

[Total: 9]

END OF QUESTION PAPER

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ADDITIONAL ANSWER SPACE

If additional answer space is required, you should use the following lined page. The question number(s) must be clearly shown in the margin.

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GCE

Biology

Advanced Subsidiary GCE

Unit **F211:** Cells, Exchange and Transport

Mark Scheme for January 2013

Oxford Cambridge and RSA Examinations

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Annotations

Annotation	Meaning
	Benefit of Doubt
	Contradiction
	Cross
	Error carried forward
	Given Mark
	Extendable horizontal wavy line
	Ignore
	QWC Point
	Benefit of Doubt not given
	additional QWC credit given
	Tick
	Tick 1
	Tick 2
	Omission Mark

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Question			Answer	Marks	Guidance
1	(a)		low / small, surface area to volume ratio ; diffusion, too slow / distance too great ; to supply enough, oxygen / (named) nutrients ; to prevent, CO_2 / (named) waste product, building up ; active ;	3 max	**Mark the first 3 suggestions** **CREDIT** SA/Vol, SA:Vol **ACCEPT** surface area to volume (ie if 'ratio' missed) **IGNORE** lower SA / Vol **ACCEPT** diffusion pathway too long **ACCEPT** diffusion insufficient because, body too large / tissues too deep **ACCEPT** 'transport enough' for 'supply enough' idea of 'enough' is important **ACCEPT** to remove waste products **ACCEPT** to prevent waste reaching toxic levels **ACCEPT** high demand for oxygen / energy **OR** high metabolic rate **OR** endotherm / maintaining temperature / exercising
	(b)	(i)	electrocardiogram ;	1	**Mark the first answer.** If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = **0 marks** **IGNORE** ECG **DO NOT CREDIT** electrocardiograph
		(ii)	**A** sinoatrial node / SAN ; **B** atrioventricular node / AVN ;	2	**Mark the first answer on each prompt line.** If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = **0 marks** sinalatrial node / sanatrial node = NBOD atroventricular / atrialventricular, node= BOD artrialventricular / avioventricular node = NBOD

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Question			Answer	Marks	Guidance
	(c)	(i)	(to allow time) for the atria to (fully) contract ; to allow (time for), atria to empty / blood to move / ventricles to fill ; so that ventricle(s) do not contract, too early ;	2 max	**ACCEPT** systole for contraction **IGNORE** pumping **ACCEPT** so atria and ventricles do not contract at the same time **ACCEPT** (atria contract) before ventricular systole occurs **Note:** so ventricles do not contract before they are full = 2 so ventricles do not contract before atria are empty = 2 so atria have time to empty before the ventricles start to contract = 2
		(ii)	so that (ventricular) contraction starts at, apex / base / bottom ; to push blood upwards OR into/ towards, (named) arteries ; complete / efficient, emptying of ventricles ;	2 max	**IGNORE** ref to gravity / ref to blood pressure **ACCEPT** systole for contraction **ACCEPT** contract from the apex **IGNORE** pumping **ACCEPT** force all blood out of heart
			Total	**10**	

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Question			Answer	Marks	Guidance
2	(a)	(i)	budding ;	1	**Mark the first answer.** If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = **0 marks** **IGNORE** mitosis / asexual
		(ii)	mitosis ; swelling / bulge, in (surface of) the cell ; nucleus moves into, swelling / bulge / bud ; idea that, bulge / bud, nips / pinches / breaks off / cleaves ; ref to uneven distribution of cytoplasm ;	2 max	Ensure this is in context of before nucleus moves into bud **IGNORE** bud / growth **IGNORE** DNA / genetic material **IGNORE** 'separates' / 'detaches'
	(b)	(i)	35 / 36 ; ;	2	Correct answer = 2 marks If not whole number e.g. 35.79 or 35.8 = 1 mark If answer incorrect allow one mark for seeing: $4 \times 3.14 \times 1.5^2 \div 3.14 \times 0.5^2$ **OR** $4 \times 1.5^2 \div 0.5^2$ **OR** $4 \times 2.25 \div 0.25$ **OR** $\frac{4 \times 3.14 \times 2.25}{3.14 \times 0.25}$

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Question			Answer	Marks	Guidance
		(ii)	new bud cannot occur, on / close to, old scar **;** not enough space between scars for another bud **;** yeast cell not a true sphere **;** (gene) mutation / DNA damage **;**	1 max	**CREDIT** idea that some of surface between scars is not used / ref to unable to tessellate / scars not closely packed **IGNORE** 'covered in scars' OR ref to scar size **IGNORE** ref to chromosome numbers
	(c)		(cells) **differentiate(d)** / **specialise(d)** **;** (groups of) cells form **tissue**(s) **;** (groups of) tissues form **organ**(s) **;** (groups of organs) form **organ system**(s) **;** (group of) cells / tissues / organs / organ systems, work together / interact **;** named example of a tissue / an organ /an organ system **;** QWC **;**	4 max 1	**IGNORE** 'system' alone **ACCEPT** same job / same task / same function It should be clear whether they are naming a tissue, an organ or a system **NOTE e.g.** cells work together to form tissues = 2 marks (mp2 and 5) **two** terms used appropriately and spelled correctly **ACCEPT** correct derivations of these terms: **differentiate**, **specialise / specialize**, **tissue**, **organ**, **organ system**
			Total	**11**	

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Question			Answer	Marks	Guidance
3	(a)		partially permeable **;**	1	**ACCEPT** selectively permeable / differentially permeable **DO NOT CREDIT** semi permeable **IGNORE** fluid mosaic
	(b)		fluid mosaic **;** active **;** fats / lipids / oils / cholesterol / oxygen / carbon dioxide / (named) steroid hormones / fat soluble vitamins **;** carrier / (co)transport(er) **;**	4	**ACCEPT** phonetic spelling **IGNORE** 'mosaic structure' **ACCEPT** O_2 and CO_2 **ACCEPT** Vitamin A / D / E / K **DO NOT CREDIT** water **DO NOT CREDIT** channel
	(c)	(i)	communication between cells **;** *idea that:* molecule released by one cell, attaches to / causes change in, another cell **;**	1 max	**ACCEPT** cell communication **IGNORE** ref to cell recognition and cell binding

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Question			Answer	Marks	Guidance
		(ii)	release of signal molecule by, **exocytosis** / **secretion** **OR** described **;**	3 max	**ACCEPT** hormone / messenger (molecule) / named hormone for signal throughout **IGNORE** 'molecule' / 'proteins' alone unless qualified
			idea that: proteins / **glycoprotein**s / **glycolipid**s, act as / have, **receptor**s **OR** described **;**		**ACCEPT** eg 'place for signal molecules to bind' or 'binding site' for 'receptor'
			idea that: receptor / signal, is **specific ;**		**IGNORE** ref to recognition as meaning specific specific can be described
			idea that: shape of receptor **and** signal are **complementary ;**		this can be described
			idea that: attachment of signal molecule causes change (inside cell / on cell surface) **;**		e.g. cause release of cAMP e.g. hormones trigger a reaction in the cell
			cell surface membrane allows entry of some signal molecules **;**		**ACCEPT** diffusion (in context of steroid hormones)
			QWC **;**	1	Award for **two** terms used appropriately and spelled correctly **exocytosis**, **secretion / secretes / secreted**, **glycoprotein**, **glycolipid**, **receptor**, **specific**, **complementary**
			Total	**10**	

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Question			Answer	Marks	Guidance
4	(a)	(i)	<u>units</u> ; mm s^{-1} ; raw data ; leaf area ;	2 max	 **ACCEPT** mm min^{-1} / cm min^{-1} / cm s^{-1} / written in words **ACCEPT** mm^3 min^{-1} / cm^3 min^{-1} / cm^3 s^{-1} / written in words e.g. individual trial results / the repeat readings / data used to calculate the mean **IGNORE** only the mean is shown **IGNORE** 'how many repeats were done'

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Question			Answer	Marks	Guidance
		(ii)		3 max	**ACCEPT** ORA throughout **IGNORE** refs to more bubbles / photosynthesis
			description as number of leaves increases the (rate of) bubble movement increases **;** (pair of) figs to illustrate the change **;**		must be pair of figures illustrating change eg 7 bubble movement with 0 leaves and 92 bubble movement with 8 leaves **ACCEPT** calculated difference e.g. increase of 21 between 2 & 4
			explanation larger (surface) area **;** more stomata **;** more / fast(er), evaporation / transpiration / loss of water vapour **;** more / fast(er), uptake of water (by shoot) **;** *idea that:* (some) bubble movement with no leaves as not all uptake due to transpiration from leaves **;**		**ACCEPT** 'surface area increases' **IGNORE** 'many stomata' OR 'more stomata open' **NOTE** e.g. more, stomata / surface area for transpiration = 2 marks (as more transpiration implied) e.g some loss from other parts of stem / uptake into cells

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Question			Answer	Marks	Guidance
	(b)		*statement 1* surface area / SA, of leaves is different **OR** different number of stomata **;** (choose shoot(s) with), similar sized leaves / similar surface area **OR** repeats to calculate mean **;** *statement 2* reduces water (vapour) potential gradient (between inside and outside of leaf) **;** assemble without wetting leaves / dry the leaves / wait until leaves dry **;** *statement 3* (increased temperature) will increase, evaporation / transpiration / loss of water vapour **;** control the temperature / carry out in room with controlled temperature **;**	6	**IGNORE** 'surface area to volume ratio' (as a phrase) **ACCEPT** measure surface area of each leaf **and** calculate rate of movement per unit area **ACCEPT** measure leaves to check they are same size **DO NOT CREDIT** cut or trim leaves to size **ACCEPT** water potential outside leaf is too high **OR** WP outside higher than inside **IGNORE** ref to light **ACCEPT** do it in constant temperature **CREDIT** suitable practical method of achieving this **IGNORE** 'pull blinds down' / 'open the window' / 'general ref to environment or conditions', without mentioning temperature or heat
			Total	**11**	

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<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>5</td><td>(a)</td><td></td><td>
<table>
<tr><th></th><th colspan="3">cell type</th></tr>
<tr><th>feature</th><th>plant cell</th><th>animal cell</th><th>bacterial cell</th></tr>
<tr><td>mitochondria</td><td>✓</td><td>✓</td><td>×</td></tr>
<tr><td>chloroplasts</td><td>✓</td><td>×</td><td>×</td></tr>
<tr><td>cellulose cell wall</td><td>✓</td><td>×</td><td>×</td></tr>
<tr><td>centrioles</td><td>×</td><td>✓</td><td>×</td></tr>
<tr><td>ribosomes</td><td>✓</td><td>✓</td><td>✓</td></tr>
</table>
</td><td>4</td><td>Allow one mark for each correct row.
DO NOT CREDIT ‘hybrid’ ticks or crosses

NB each row must have 3 correctly completed boxes</td></tr>
<tr><td></td><td>(b)</td><td>(i)</td><td>1 ;
4 ;
2 ;
2 ;</td><td>4</td><td>Mark the first answer on each prompt line. If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = 0 marks</td></tr>
<tr><td></td><td></td><td>(ii)</td><td>ribosome(s) ;</td><td>1</td><td>IGNORE ‘tube number’</td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>9</td><td></td></tr>
</table>

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Question			Answer	Marks	Guidance
6	(a)	(i)	provides, strength / support **;** to keep, it / the vessel / the tube, open **OR** prevent collapse of, vessel / tube **;** (because) transpiration produces, tension / negative pressure **;** to waterproof the, cell / vessel / tube / wall **;** (so) cell**,** dies / content decays **;** to create a hollow, tube / vessel **OR** to create a continuous column / allow unimpeded flow **;** to limit lateral flow of water **;** ref to adhesion (between water molecules and wall) **;**	3 max	**IGNORE** ref to flexibility **IGNORE** xylem unqualified **IGNORE** 'collapse of wall' **IGNORE** 'xylem' **IGNORE** xylem vessels die **CREDIT** reduce / prevent lateral movement **ACCEPT** lignin helps water move by adhesion
		(ii)	(provides) strength / support, to keep, it / trachea / airway, open **OR** (provides) strength / support, to prevent collapse **;** during, inspiration / inhaling / breathing in **;** volume of, chest cavity / thorax / lungs, increases **;** low(er) / negative, pressure in, trachea / thorax / lungs **;**	3 max	**IGNORE** ref to alveoli / C-shape of cartilage **ACCEPT** in context of bending the neck

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Question			Answer	Marks	Guidance
	(b)			3 max	ensure that 'surface area to volume ratio' is used correctly
			body has small <u>surface area to volume ratio</u> **OR** lungs, provide / have, large <u>surface area to volume ratio</u> **;**		**CREDIT** SA/Vol, SA:Vol **ACCEPT** person for body
			correct calculation of (one) surface area to volume ratio **;**		25.7 /26 (:1) for body OR 1000(:1) for lungs DO NOT CREDIT 1 : 1000 OR 1 : 26
			idea of: body SA / SA:Vol is not big enough to meet body's needs **OR** lung SA / SA:Vol is big enough to meet body's needs **;**		**e.g.** allows gaseous exchange at a high enough rate **IGNORE** ref to efficiency
			oxygen into (blood / body) **and** carbon dioxide out (of blood / body) **;**		**CREDIT** O_2 and CO_2
			Total	**9**	

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Monday 14 May 2012 – Morning

AS GCE BIOLOGY

F211 Cells, Exchange and Transport

Candidates answer on the Question Paper.

OCR supplied materials:
None

Other materials required:
- Electronic calculator
- Ruler (cm/mm)

Duration: 1 hour

F211060611

F 2 1 1

Candidate forename		Candidate surname	

Centre number						Candidate number				

INSTRUCTIONS TO CANDIDATES

- Write your name, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
- Use black ink. HB pencil may be used for graphs and diagrams only.
- Answer **all** the questions.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Write your answer to each question in the space provided. If additional space is required, you should use the lined page at the end of this booklet. The question number(s) must be clearly shown.
- Do **not** write in the bar codes.

INFORMATION FOR CANDIDATES

- The number of marks is given in brackets **[ ]** at the end of each question or part question.
- The total number of marks for this paper is **60**.
- Where you see this icon you will be awarded marks for the quality of written communication in your answer.
- You may use an electronic calculator.
- You are advised to show all the steps in any calculations.
- This document consists of **16** pages. Any blank pages are indicated.

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Answer **all** the questions.

1 **(a)** Yeast reproduces asexually by a process called budding. During this process, cell division occurs.

(i) Name the type of cell division that occurs in asexual reproduction.

..... **[1]**

(ii) Before the division of the nucleus of a cell, the genetic material must replicate.

Explain why this is essential.

.....

.....

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.....

.....

..... **[2]**

(b) Unlike yeast, the nuclei of most eukaryotic organisms contain homologous pairs of chromosomes.

Explain what is meant by a *homologous pair of chromosomes*.

.....

.....

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..... **[3]**

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(c) In most multicellular organisms, the cells produced by cell division are organised into tissues.

(i) State what is meant by the term *tissue*.

.....

.....

.....

..... **[2]**

(ii) Complete Table 1.1 below comparing two types of epithelium, squamous epithelium and ciliated epithelium.

For each type of epithelium, state **one** function of the tissue and **one** specific location in the human body where it is found.

Table 1.1

type of epithelium	function of tissue	specific location in the human body
squamous		
ciliated		

[4]

[Total: 12]

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2 Fig. 2.1 is a diagram of a cell showing the organelles involved in the production and secretion of an extracellular protein. The rough endoplasmic reticulum (RER) is shown enlarged at the side of the diagram.

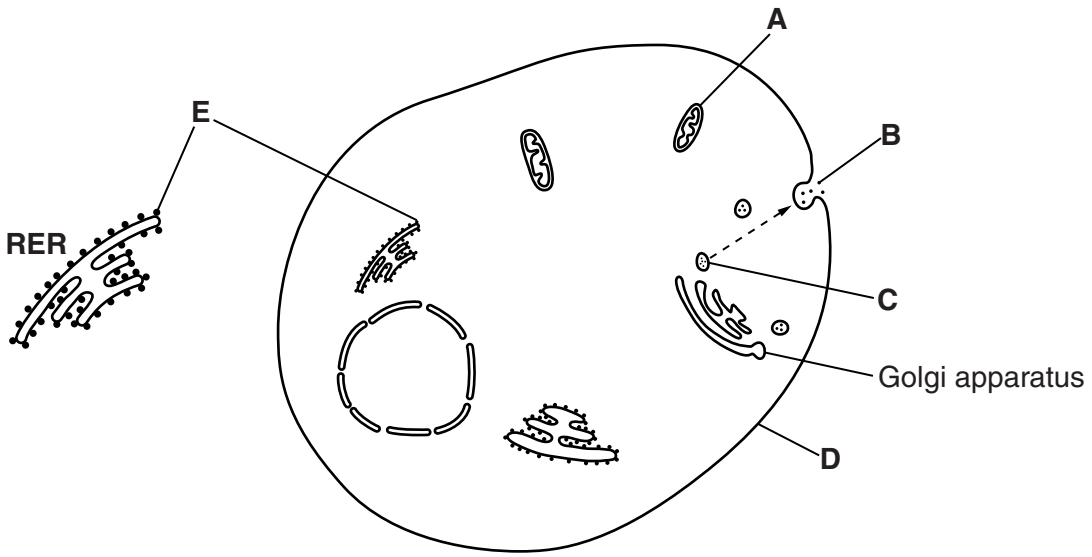


Fig. 2.1

(a) (i) Name the structures labelled **C**, **D** and **E**.

C .....

D .....

E ..... **[3]**

(ii) Suggest **one** type of extracellular protein secreted at **B**.

..... **[1]**

(iii) Organelle **A** provides ATP which is a source of energy.

Suggest **one** stage during the secretion of a protein that requires energy.

.....

..... **[1]**

(iv) Outline the role of the Golgi apparatus.

.....

.....

.....

.....

.....

..... **[2]**

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(b) The cell shown in Fig. 2.1 is a eukaryotic cell.

(i) Identify **two** features, **visible in Fig. 2.1**, which would **not** be present in a prokaryotic cell.

.....

.....

.....

..... **[2]**

(ii) Name **one** feature that would be present in the cytoplasm of a prokaryotic cell that is **not** found in a eukaryotic cell.

..... **[1]**

[Total: 10]

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3 Fig. 3.1 provides information about the blood pressure in different parts of the mammalian blood circulatory system.

Fig. 3.1 also shows the **total** cross-sectional area of the vessels, relative to one another, in parts of the blood circulatory system.

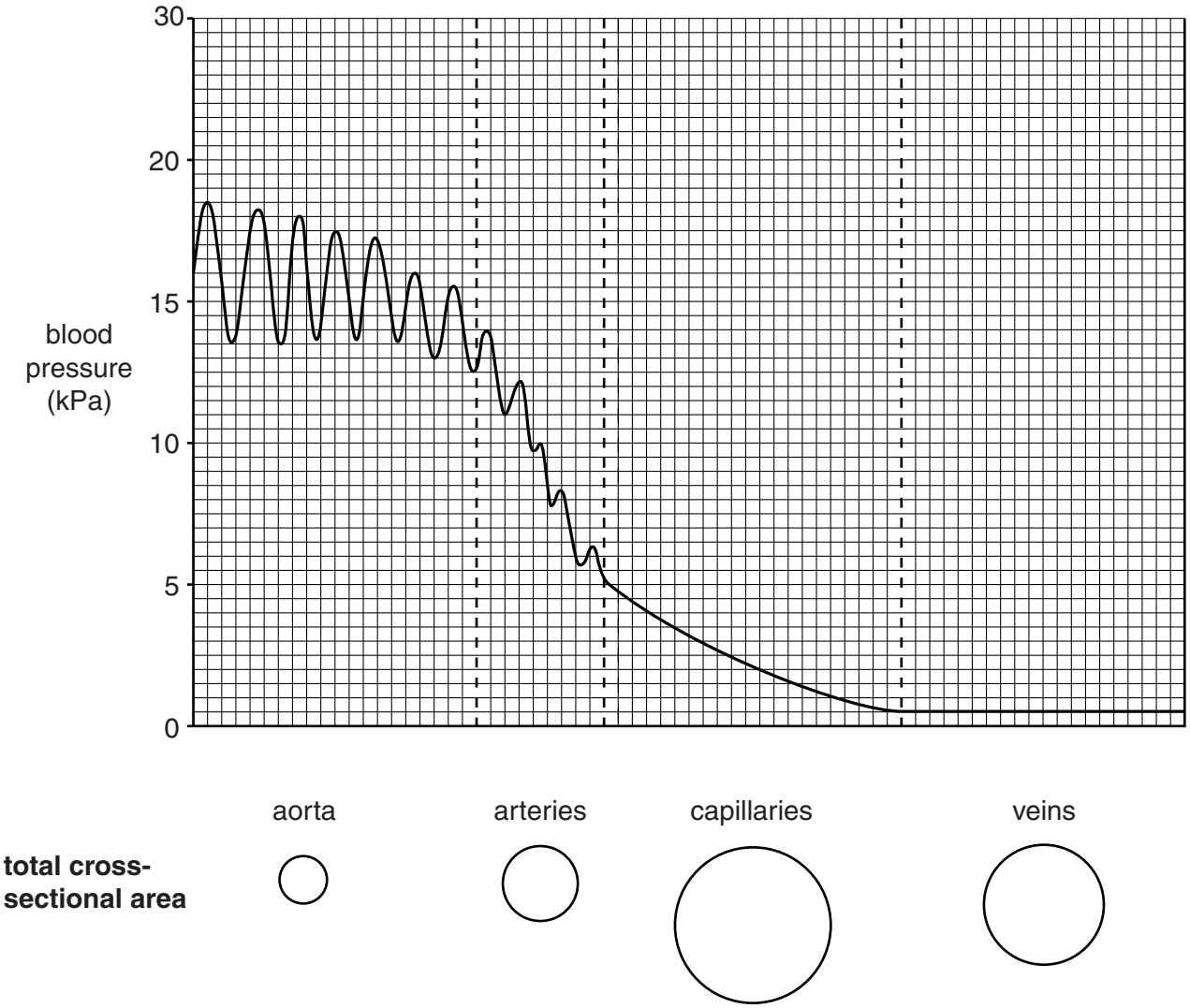


Fig. 3.1

(a) Place a tick (✓) in the box below that most closely describes the mammalian blood circulatory system.

	open circulatory system	closed circulatory system
single circulatory system		
double circulatory system		

[1]

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(b) The pressure fluctuates as the blood flows along the aorta, as shown in Fig. 3.1.

(i) Explain what causes this fluctuation.

.....

.....

.....

.....

.....

..... **[2]**

(ii) State the term used to describe the number of fluctuations per minute.

.....

..... **[1]**

(c) Using the information in Fig. 3.1, describe the pressure changes in the blood as it flows through the circulatory system from the aorta to the veins.

.....

.....

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..... **[3]**

(d) **(i)** Using the information in Fig. 3.1, explain what causes the overall change in pressure as blood flows from the aorta to the arteries and from the arteries to the capillaries.

.....

.....

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.....

..... **[2]**

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(ii) Explain why it is important that the pressure changes as blood flows from the aorta to the capillaries.

.....

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.....

.....

..... **[2]**

[Total: 11]

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4 **(a)** A student wanted to observe some red blood cells under the microscope. The student placed a small sample of blood onto a microscope slide and added a drop of distilled water. When viewed at high power, the student observed that the red blood cells had burst.

In a similar procedure using plant epidermis, the student observed that the plant cells did not burst.

(i) Explain these observations.

In your answer you should use appropriate technical terms, spelt correctly.

[5]

(ii) Suggest how the student could modify the procedure to observe red blood cells without them bursting.

[1]

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(b) Oxygen enters red blood cells as they pass through the capillaries in the lungs.

Name the mechanism by which oxygen enters the red blood cells.

..... **[1]**

(c) The cells in the epidermis of a plant root are specialised to absorb minerals from the surrounding soil.

State the process by which root epidermal cells absorb minerals from the soil **and** describe how these cells are specialised to achieve absorption.

.....

.....

.....

.....

.....

.....

.....

..... **[3]**

[Total: 10]

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PLEASE DO NOT WRITE ON THIS PAGE

QUESTION 5 STARTS ON PAGE 12

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5 Fig. 5.1 shows the changes in the volume of air in the lungs of a student at rest during one breath.

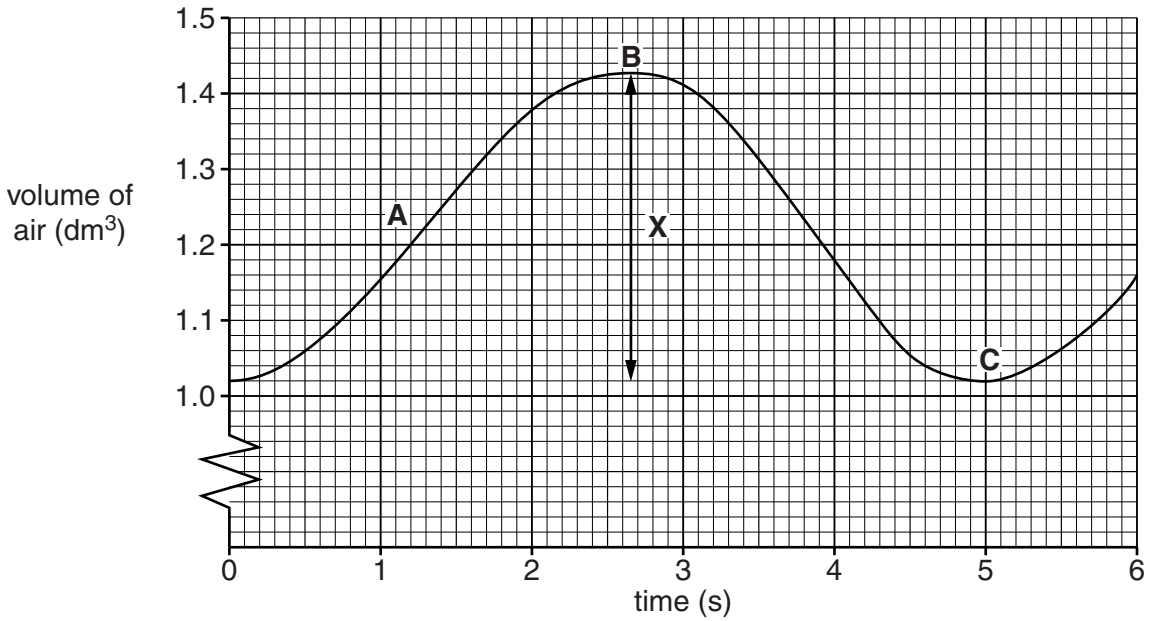


Fig. 5.1

(a) (i) Name the measurement represented by the line **X**.

..... **[1]**

(ii) What is happening to the elastic fibres in the walls of the alveoli at point **A**?

..... **[1]**

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(b) Explain what causes the change in the volume of air between points **B** and **C** on Fig. 5.1.

In your answer you should use appropriate technical terms, spelt correctly.

.....

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.....

..... **[4]**

(c) Using Fig. 5.1, calculate the breathing rate of this student in breaths per minute.

Answer = ... breaths per minute **[2]**

(d) About 1 dm^3 of air cannot be expelled from the lungs. This is known as the residual volume.

Suggest why it is **not** possible to expel all the air from the lungs.

.....

.....

.....

.....

..... **[2]**

[Total: 10]

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6 Fig. 6.1 shows an aphid feeding from a plant stem. The aphid feeds by inserting its tube-like mouthparts into the tissue that transports sugar solution. Some details of this transport tissue are shown in the vertical section.

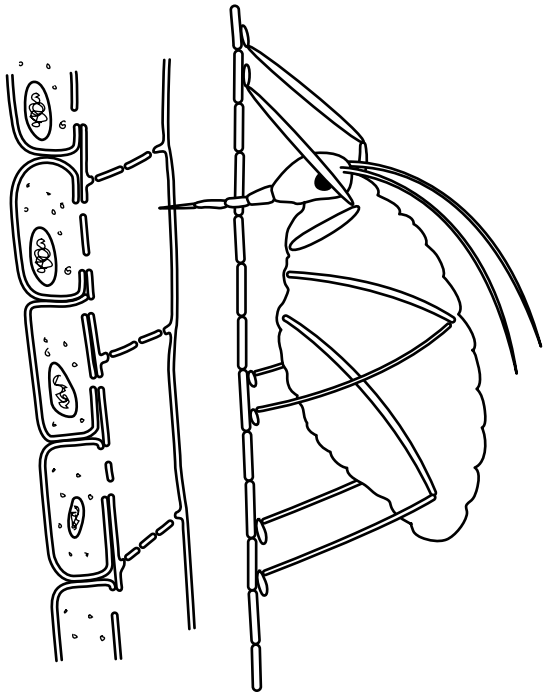


Fig. 6.1

(a) (i) Name the sugar most commonly transported through the stem of a plant **and** the tissue that transports this sugar.

sugar .....

tissue ..... **[1]**

(ii) Sugar molecules are actively loaded into the transport tissue.

Describe how active loading takes place.

.....

.....

.....

.....

.....

.....

.....

..... **[3]**

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(b) A classic experiment investigated the effect of temperature on the rate of sugar transport in a potted plant.

Aphid mouthparts were used to take samples of sugar solution from the transport tissue in the stem. The sugary solution dripped from the mouthparts. The number of drips per minute was counted.

The procedure was repeated at different temperatures.

Table 6.1 shows the results obtained.

Table 6.1

temperature (°C)	number of drips per minute
5	3
10	6
20	14
30	26
40	19
50	0

Suggest brief explanations for these results.

.....

.....

.....

.....

.....

.....

.....

.....

..... **[3]**

[Total: 7]

END OF QUESTION PAPER

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ADDITIONAL PAGE

If additional space is required, you should use the lined page below. The question number(s) must be clearly shown.

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GCE

Biology

Advanced Subsidiary GCE

Unit **F211:** Cells, Exchange and Transport

Mark Scheme for June 2012

Oxford Cambridge and RSA Examinations

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Annotations

Annotations available in SCORIS.

Annotation	Meaning
	Benefit of Doubt
	Contradiction
	Cross
	Error Carried Forward
	Odd or incorrect Grammar
	Extendable horizontal wavy line
	Ignore
	Large dot (Key point attempted)
	Benefit of the doubt not given
	additional QWC credit given
	Tick
	Tick 1
	Tick 2
	Omission Mark

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Question			Answer	Marks	Guidance
1	(a)	(i)	mitosis ;	1	**Mark the first answer.** If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = **0 marks**
		(ii)	*idea that:* cells, genetically identical / have same DNA ; so both (daughter) cells receive a full, copy / complement ;	2	**ACCEPT** in context of identical to each other or identical to parent **ACCEPT** 'same genetic information/material' **ACCEPT** same / correct amount of DNA **ACCEPT** same / correct number of chromosomes **IGNORE** ref to clones unqualified **IGNORE** 'new cells need genetic material' without ref to full amount daughter cells have all the identical genetic material = 2 marks (mp 1 and 2)
	(b)		**1** one maternal and one paternal / AW ; **2** carry same genes ; **3** carry, same / different, alleles ; **4** (usually) same / similar, length ; **5** centromere in same position ; **6** same banding pattern ; **7** pair up in meiosis / form bivalent ;	3 max	**CREDIT** 'same loci' **IGNORE** 'genetic material', 'genetically identical' 'genetic information' **ACCEPT** 'same shape' 'same size' **IGNORE** 'same pattern'
	(c)	(i)	a, group / collection, of cells ; (cells) specialised / AW ; to perform a function(s) / working together ;	2 max	**IGNORE** 'same' or 'different' cells **ACCEPT** same job

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<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td></td><td></td><td>(ii)</td><td>
<table>
<tr><th>function</th><th>location</th></tr>
<tr><td>acts as a surface

or

short (diffusion) pathway ;</td><td>alveoli

or

cheek lining

or

in blood vessels ;</td></tr>
<tr><td>move, mucus / AW

or

secrete mucus ;</td><td>bronchioles

or

bronchi

or

trachea

or

airways ;</td></tr>
</table>
</td><td>4</td><td>Mark the first answer in each box. If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = 0 marks
Mark each box independently.

IGNORE description e.g. ‘one cell thick’
ACCEPT glomerulus as blood vessel

ACCEPT move fluid / liquid for mucus
IGNORE removal of germs / dirt / substances / particles

ACCEPT ‘move ovum’ and ‘in fallopian tubes’

ACCEPT removal of bacteria / fungal spores / dust if in mucus</td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>12</td><td></td></tr>
</table>

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Question			Answer	Marks	Guidance
2	(a)	(i)	**C** (secretory / Golgi) vesicle **;** **D** plasma membrane **or** cell <u>surface</u> membrane **;** **E** ribosome **;**	3	**Mark the first answer on each prompt line.** If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = **0 marks** **DO NOT CREDIT** lysosome **ACCEPT** cell plasma membrane **IGNORE** rough endoplasmic reticulum
		(ii)	enzyme / (peptide) hormone / glycoprotein **;**	1	**Mark the first answer.** If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = **0 marks** **ACCEPT** named example e.g. insulin, mucus, cytokine, antibodies, collagen **IGNORE** haemoglobin, histamine, steroid hormones e.g. testosterone
		(iii)	transport vesicles to, plasma / cell surface, membrane **;** fusing vesicle to membrane / <u>exo</u>cytosis **;**	1 max	**Mark the first answer.** If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = **0 marks** **CREDIT** greater detail of cytoskeleton activity e.g. role of protein motors / changing length of microtubules - 'transport' alone not enough **IGNORE** ref to membrane unqualified **ACCEPT** binding / merging **IGNORE** bonding
		(iv)	**1** receives proteins from the, (R)ER / ribosomes **;** **2** modify / process, proteins **or** make glycoproteins / add named molecule(s) / described **;** **3** (re)package / AW**,** into vesicles **;** **4** make lysosomes **;** **5** replenishes, plasma / cell surface, membrane **;** **6** lipid synthesis **;**	2 max	**IGNORE** SER eg add carbohydrate groups / sugars or fold protein modifies and packages proteins into vesicles = 2 marks **ACCEPT** make glycolipids

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Question			Answer	Marks	Guidance
	(b)	(i)	nucleus **or** nuclear, envelope / pore / membrane **;** mitochondrion / mitochondria **;** (rough / smooth) endoplasmic reticulum / ER OR ribosomes attached to membrane **;** Golgi (body / apparatus) **;** (secretory) vesicle(s) **;**	2 max	**Mark the first two answers only.** **IGNORE** membrane bound organelles, lysosomes, free ribosomes, ref to ribosome size
		(ii)	(free / circular / naked) DNA / genetic material / nucleoid **;** <u>plasmid</u> **;** 18nm / 70S / smaller, ribosomes **;**		**Mark the first answer.** If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = **0 marks** **IGNORE** 'chromosomes', 'chromatin' **IGNORE** mesosome (as this is an infolding of plasma membrane and not <u>in</u> the cytoplasm)
			Total	**10**	

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<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>Guidance</th></tr>
<tr><td>3</td><td>(a)</td><td></td><td>
<table>
<tr><th></th><th>open circulatory system</th><th>closed circulatory system</th></tr>
<tr><td>single circulatory system</td><td></td><td></td></tr>
<tr><td>double circulatory system</td><td></td><td>✓ ;</td></tr>
</table>
</td><td>1</td><td>ACCEPT cross / other mark
DO NOT CREDIT if a tick is placed in more than one box</td></tr>
<tr><td></td><td>(b)</td><td>(i)</td><td>systole / contraction, increases pressure ;

diastole / relaxation/ blood flowing onwards, decreases pressure ;

(contraction of) ventricle, muscle / wall ;

left (ventricle) ;</td><td>2 max</td><td>IGNORE ‘the heart’ or ‘the heart beating’ or ‘the heart pumping’ without further qualification
IGNORE ref to right (side) for mp 1 - 3

ACCEPT ref to peak on graph for increasing pressure

ACCEPT ref to trough on graph for decrease in pressure

ACCEPT ventricular systole

‘contraction of left ventricle’ = 1 mark
‘contraction of muscle in left ventricle’ = 2 marks
‘ventricular systole increases pressure’ = 2 marks</td></tr>
<tr><td></td><td></td><td>(ii)</td><td>pulse / heart, <u>rate</u> ;</td><td>1</td><td>IGNORE heart beat / beats per minute</td></tr>
</table>

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Question	Answer	Marks	Guidance
(c)	*marks for pressure change:* pressure drops, as distance from heart increases **;** greatest / rapid / significant, pressure drop while blood is in the arteries **;** pressure, constant / does not drop, in veins **;** *marks for amplitude of fluctuations:* fluctuation / AW, decreases from aorta to arteries **;** no fluctuation in, capillaries / veins **;** use of comparative figures with unit **;**	3 max	**ACCEPT** from aorta to arteries / correctly named blood vessels – look for decrease in pressure trend **ACCEPT** plateaus / level **IGNORE** ref to frequency of fluctuations **ACCEPT** 'smaller fluctuations in artery' correct figures must be quoted from the graph to back up <u>one</u> point – correct unit used at least once. eg 'peak to peak', between aorta and arteries, falls 18.5 to 14 kPa pressure in aorta between 18.5 and 12.5 kPa pressure in arteries drops from 12.5 to 5 kPa pressure in capillary drops from 5 to 0.5 kPa overall drop from 18.5 to 0.5 kPa *Any other figures must be checked against graph* **ACCEPT** correct calculated figure eg pressure drops 6kPa in aorta

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Question			Answer	Marks	Guidance
	(d)	(i)	blood flows into larger number of vessels ; (total) cross-sectional area of the arteries is greater than the aorta ; (total) cross-sectional area of the capillaries is greater than the, aorta / arteries ;		**IGNORE** ref to pressure fluctuations and structure of vessel walls as not relevant to overall pressure change **ACCEPT** idea of vessels branching to many/more (smaller) vessels **IGNORE** ref to lumen size
			capillary (wall) is, thin / only one cell thick ; (high pressure would) burst / damage, capillary (wall) ; reduce chance of, tissue fluid build up / oedema ;	2 max	**IGNORE** ref to rate of flow **IGNORE** ref to capillary walls small / made of squamous cells **ACCEPT** cannot withstand (high) pressure
			Total	**11**	

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Question			Answer	Marks	Guidance
4	(a)	(i)			**CREDIT** mps 1-3 in context of either blood cell or plant cell Comparative statement must be made.
			1 cell (cytoplasm) has a lower **water potential** than (distilled) water / ORA **;**		**1 ACCEPT** Ψ **ACCEPT** more negative water potential
			2 water moves (into cells) **,** down water potential **gradient** / from high Ψ to low Ψ **;**		**2 IGNORE** 'along' or 'across' **IGNORE** definition of osmosis in isolation, must be in context of explaining observations
			3 (water) enters the cell by **osmosis ;**		**3 ACCEPT** 'water osmoses into cell' **IGNORE** ref to diffusion
			4 *idea of:* **cell surface / plasma, membrane** (of blood cell) weak so**,** bursts / cannot withstand pressure / **haemolyses ;**		
			5 *idea of:* (plant) cell wall **,** strong / provides support**,** so**,** does not burst / can withstand pressure **;**		**5 IGNORE** ref to rigid wall, wall acts as barrier
			6 (plant) cell becomes **turgid** / **turgidity** increases**,** which reduces water uptake **;** **4 max**		**6 IGNORE** ref to plasmolysis anywhere in response
			QWC – **two** technical terms used in context and spelt correctly **;** **1**		any **two** from: **gradient, water potential**, **osmosis**, **cell surface membrane / plasma membrane, turgid / turgidity, (derivatives of) haemolysed** (note: only allow turgid for plant cells)
				5 max	

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Question			Answer	Marks	Guidance
		(ii)	use a, salt / sugar, solution **OR** add solute to water **;** use a solution with the, same / similar / lower, water potential as blood cells **;**	1 max	**ACCEPT** saline solution **ACCEPT** isotonic / hypertonic **ACCEPT** same solute concentration / potential **IGNORE** same water concentration **IGNORE** use less water / solution with low water potential
	(b)		diffusion **;**	1	**DO NOT CREDIT** facilitated diffusion
	(c)		**1** active, transport / uptake **;** ***plus any two from:*** **2** cells have, extensions / hairs **;** **3** thin cell wall **;** **4** large / increased, surface area **;** **5** many / more, mitochondria **;** **6** (many) carrier proteins in cell (surface) membrane **;**	3 max	**1 ACCEPT** facilitated diffusion **IGNORE** transport using ATP **DO NOT CREDIT** osmosis **Allow max two marks for specialised features** **2 ACCEPT** cells have root hairs **IGNORE** roots have root hair cells **4 ACCEPT** high, surface area to volume ratio / SA:vol credit in context on root hair cell or root having large surface area **6 ACCEPT** transport proteins / protein pumps **ACCEPT** channel protein in context of facilitated diffusion
			Total	**10**	

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Question			Answer	Marks	Guidance
5	(a)	(i)	tidal volume ;	1	
		(ii)	being stretched / stretching ;	1	**ACCEPT** lengthening **DO NOT CREDIT** relaxing **IGNORE** expanding 'stretching and contracting' = **CON**
	(b)		*between **B** & **C** expiration:* **1** (external) **intercostal** muscles / **diaphragm**, relax ; **2** rib cage / ribs**,** move down OR diaphragm, moves / pushed, up ; **3 volume** of, **thorax** / chest cavity / lungs, drops / decreases ; **4 pressure** inside, thorax / chest cavity / lungs, increases ; **5** above, external / atmospheric, pressure ; **6** air leaves down pressure **gradient** ; **7** (elastic) **recoil** of alveoli ; **3 max** QWC – **two** technical terms used in context and spelt correctly ; **1**	4 max	**1 ACCEPT** ref to internal intercostal muscles contracting **1 DO NOT CREDIT** ref to diaphragm relaxing and intercostal muscles (unqualified) contracting **2 IGNORE** 'diaphragm becomes domed / curved' **3 ACCEPT** 'space inside' or 'air in' for volume **5 ACCEPT** (pressure) higher than outside **Answers given in context of 'at B' or 'at C' – QWC not awarded.** Any **two** from **intercostal**, **diaphragm**, **recoil**, **volume** **thorax**, **pressure**, **gradient**
	(c)		12 ;;	2	Allow two marks for correct answer. If answer wrong allow one mark for working $\frac{60}{5}$

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Question			Answer	Marks	Guidance
	(d)		*idea that:* thorax / rib cage / lungs, cannot be completely , compressed / flattened **;** trachea / bronchi, held open by cartilage **;** bronchioles / alveoli, held open by elastic fibres **;** AVP **;**	2 max	**IGNORE** bronchioles or alveoli **IGNORE** bronchi or trachea eg absence of pressure gradient / atmospheric and thoracic pressures equal presence of surfactant in alveoli upward movement of diaphragm limited by collagen fibres
			Total	**10**	

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Question			Answer	Marks	Guidance
6	(a)	(i)	sucrose **and** phloem ;	1	Both needed for one mark **Mark the first answer on each line.** If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = **0 marks** **DO NOT CREDIT** sucrase **DO NOT CREDIT** phloem sieve tubes / companion cells
		(ii)	**1** hydrogen ions / H^+ / protons, pumped out of companion cells ; **2** increases, hydrogen ion / H^+ / proton, concentration (gradient) (outside companion cell) ; **3** hydrogen ions, re-enter / flow back into, companion cells ; **4** sucrose / sugar, moves with hydrogen ions / AW ; **5** down concentration gradient ; **6** ref. cotransporter proteins / cotransport(ation) ; **7** by facilitated diffusion ; **8** sucrose / sugar, diffuses into sieve tube (element) ; **9** through plasmodesmata ; 3 max		**1 ACCEPT** hydrogen ions leave companion cells using ATP **2 ACCEPT** creates gradient **2 DO NOT CREDIT** increase, hydrogen ion / H^+ / proton concentration, in sieve tube element **3 ACCEPT** diffuse / move **4 DO NOT CREDIT** glucose (penalise once) **4 DO NOT CREDIT** sucrose follows H^+ **8 IGNORE** sucrose diffuses into *phloem*

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Question	Answer	Marks	Guidance
(b)	**1** active transport requires ATP **;** *at low temperatures:* **2** (molecules have) little kinetic energy **;** **3** (therefore) less, respiration / ATP made **;** **4** less active transport **or** less, movement / loading, of sugars into sieve tube (element) **;** **5** less, osmosis / movement of water, into sieve tube (element) **;** **6** low (hydrostatic) pressure created **;** *as temperature increases:* **7** (molecules have) more kinetic energy **;** **8** (therefore) more, respiration / ATP made **;** **9** more active transport **or** more, movement / loading, of sugars into sieve tube (element) **;** **10** more , osmosis / movement of water, into sieve tube (element) **;** **11** higher / more (hydrostatic) pressure created **;** **12** at high temperature (plant), enzymes / proteins, denatured **;**	3 max	**1 ACCEPT** loading / uptake for transport **3 IGNORE** no respiration / no ATP made / no loading of sucrose **4 ACCEPT** slow active transport / slow loading **9 ACCEPT** faster active transport / faster loading **12 DO NOT CREDIT** cells denatured **12 CREDIT** change to tertiary structure, damage to proteins
	Total	**7**	

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Wednesday 11 January 2012 – Morning

AS GCE BIOLOGY

F211 Cells, Exchange and Transport

Candidates answer on the Question Paper.

OCR supplied materials:
- Insert (inserted)

Other materials required:
- Electronic calculator
- Ruler (cm/mm)

Duration: 1 hour

Candidate forename		Candidate surname	

Centre number						Candidate number				

INSTRUCTIONS TO CANDIDATES

- The Insert will be found in the centre of this document.
- Write your name, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
- Use black ink. HB pencil may be used for graphs and diagrams only.
- Answer **all** the questions.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Write your answer to each question in the space provided. If additional space is required, you should use the lined pages at the end of this booklet. The question number(s) must be clearly shown.
- Do **not** write in the bar codes.

INFORMATION FOR CANDIDATES

- The number of marks is given in brackets **[ ]** at the end of each question or part question.
- The total number of marks for this paper is **60**.
- Where you see this icon you will be awarded marks for the quality of written communication in your answer.
- You may use an electronic calculator.
- You are advised to show all the steps in any calculations.
- This document consists of **16** pages. Any blank pages are indicated.

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Answer **all** the questions.

1 Fig. 1.1 shows an air sac and a capillary in the mammalian lung.

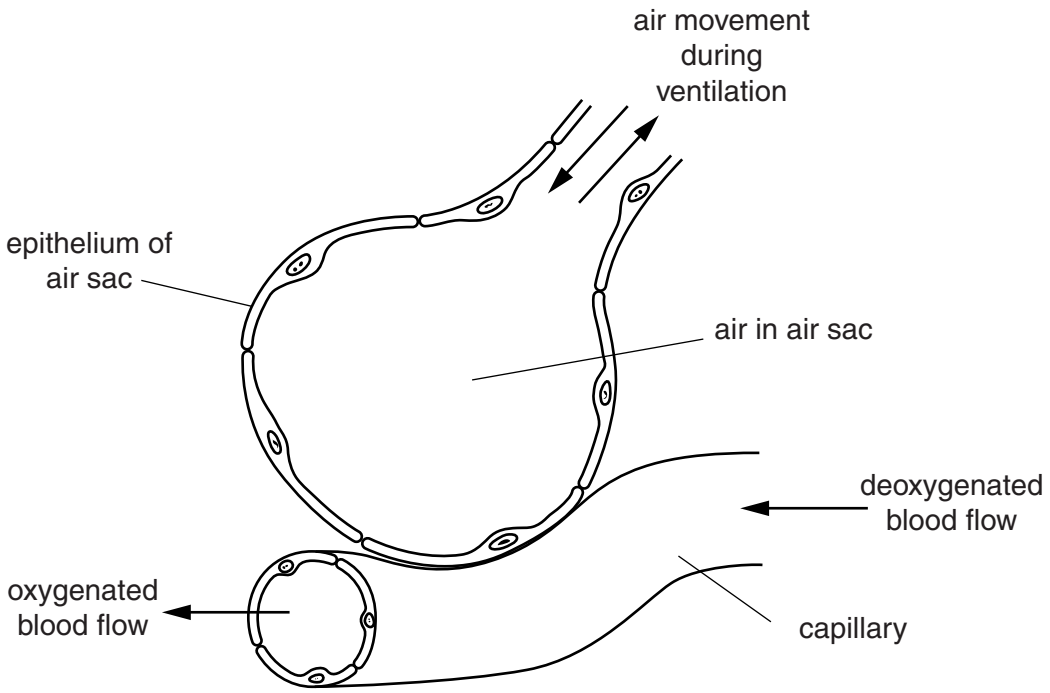


Fig. 1.1

(a) The mammalian lungs contain many air sacs.

(i) Name the air sacs **and** state why there are many air sacs in the lungs.

.....

.....

.....

..... **[2]**

(ii) Name the type of epithelium in the walls of the air sacs.

..... **[1]**

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(iii) The air sacs contain many elastic fibres.

Explain the role of these elastic fibres during ventilation.

.....

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..... **[2]**

(b) For efficient gaseous exchange to occur, a steep diffusion gradient must be maintained between the air in the air sacs and the blood.

A steep diffusion gradient can be maintained by ventilating the lungs. This refreshes the air in the air sacs.

(i) Explain how refreshing the air in the air sacs helps to maintain a steep diffusion gradient.

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..... **[2]**

(ii) Describe **and** explain **one other** way in which a steep diffusion gradient is maintained in the lungs.

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..... **[2]**

[Total: 9]

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2 **(a)** Complete the following paragraph about cells by using the most appropriate term(s).

Cells that are not specialised but still have the ability to divide are called

..... cells. Such cells can be found in the

..... of the long bones of mammals. These cells can

..... into other types of cell, such as erythrocytes that carry

oxygen in the blood. In plants, ... tissue also contains cells

that are not specialised. **[4]**

(b) Sponges are simple eukaryotic multicellular organisms that live underwater on the surface of rocks.

Sponges have a cellular level of organisation. This means that they have no tissues.

Each cell type is specialised to perform a particular function.

One type of cell found in a sponge is a collar cell. Collar cells are held in position on the inner surface of the body of the sponge.

Fig. 2.1 is a diagram showing a vertical section through the body of a sponge and an enlarged drawing of a collar cell.

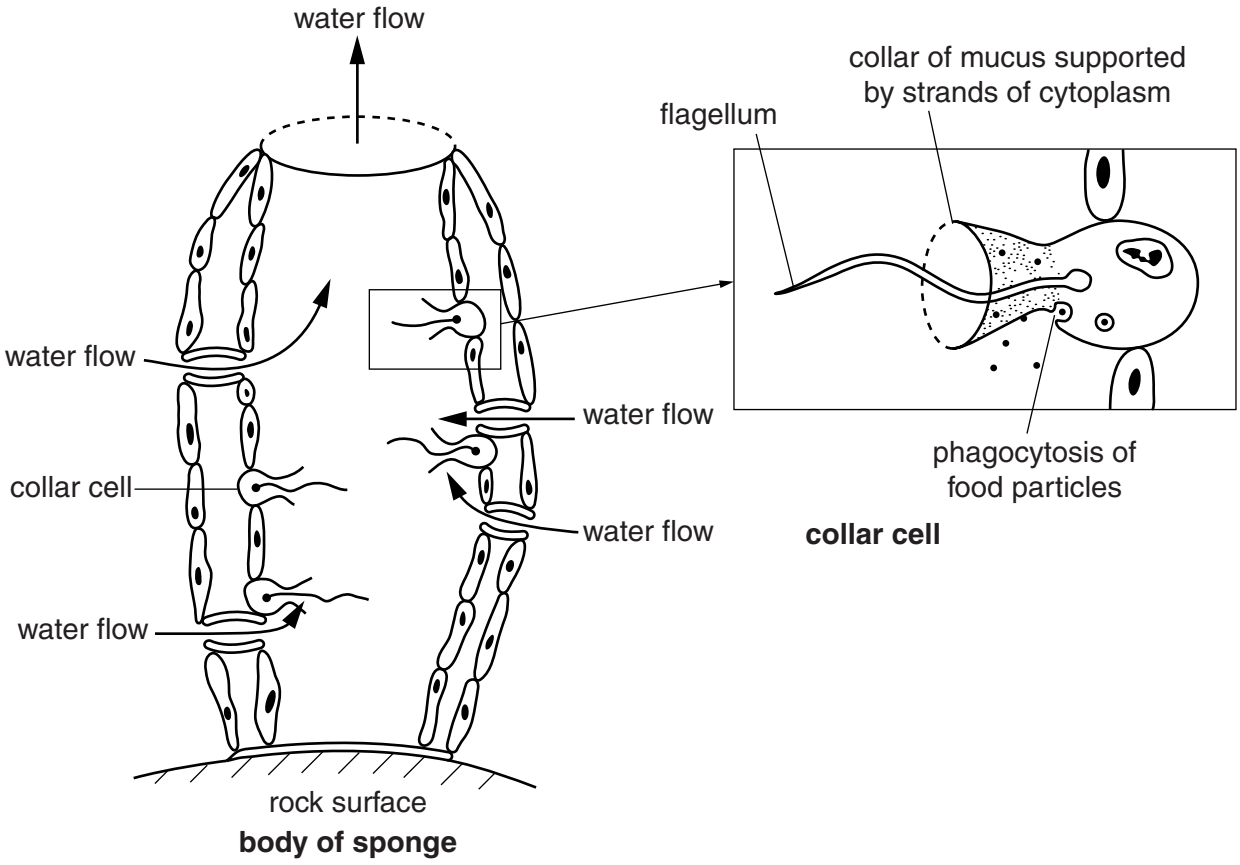


Fig. 2.1

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(i) Suggest **one** function of the flagellum in the collar cell.

.....

.....

..... **[1]**

(ii) Suggest **one** possible role for the collar of mucus in the cell.

.....

.....

..... **[1]**

(c) In more advanced organisms, cells are organised into tissues consisting of one or more types of specialised cells.

Describe how cells are organised into tissues, using **xylem** and **phloem** as examples.

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..... **[4]**

[Total: 10]

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3 Three examples of fluids in the mammalian body are blood, tissue fluid and lymph.

(a) Complete Table 3.1 below comparing different features of arterial blood, tissue fluid and lymph.

Table 3.1

feature	arterial blood	tissue fluid	lymph
hydrostatic pressure		low	
presence of large proteins	yes		
presence of neutrophils	yes		
presence of erythrocytes			no

[4]

(b) In a closed circulatory system, blood is kept inside blood vessels.

(i) Suggest **two** advantages of keeping the blood inside vessels.

1 .....

.....

2 .....

..... **[2]**

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(ii) Describe **and** explain how the wall of an artery is adapted both to withstand and maintain high hydrostatic pressure.



In your answer you should use appropriate technical terms, spelt correctly.

to withstand pressure .....

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to maintain pressure .....

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..... **[5]**

[Total: 11]

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4 The use of microscopy has greatly enhanced our knowledge of cell structure.

(a) Explain the difference between *magnification* and *resolution*.

.....

.....

.....

.....

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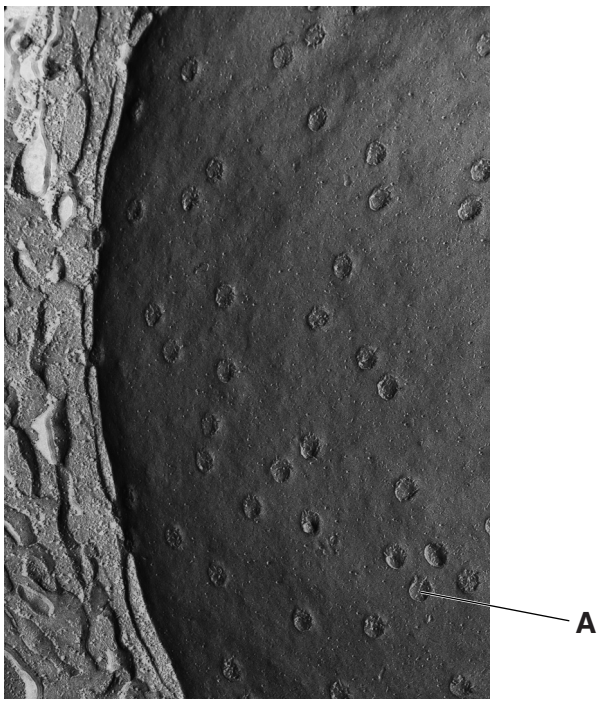
..... **[2]**

(b) State the resolution that can be achieved by each of the following types of microscope.

light microscope .....

transmission electron microscope ..... **[2]**

(c) Fig. 4.1 is an electron micrograph showing part of a nucleus.



x 25000

Fig. 4.1

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(i) A student stated that Fig. 4.1 was taken using a scanning electron microscope.

What evidence supports the student's statement?

.....

.....

.....

..... **[1]**

(ii) On Fig. 4.1, the nuclear pore complex, labelled **A**, is 3 mm wide.

Calculate the actual diameter of the pore, in nanometres.

Answer = ... nm **[2]**

(iii) State the function of the nuclear pores.

.....

.....

..... **[1]**

(d) State **two** features of a eukaryotic cell, other than nuclear pores, that would **not** be visible using medium power of a light microscope.

.....

..... **[2]**

[Total: 10]

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5 **(a)** A student used a potometer to investigate the effect of light intensity on the rate of transpiration in a healthy leafy shoot.

The results obtained are shown in Table 5.1.

Table 5.1

light intensity in arbitrary units (a.u.)	rate of transpiration (mm min^{-1})			
	trial 1	trial 2	trial 3	mean
10	5.0	7.0	5.0	5.7
20	5.0	7.0	5.0	5.7
30	12.0	12.0	11.0	11.7
40	24.0	23.0	26.0	24.3
50	32.0	33.0	32.0	32.3

(i) Describe the trend shown in the mean rate of transpiration as light intensity increases from 20 to 50 a.u.

.....

.....

..... **[2]**

(ii) Suggest why the rate of transpiration did not change between light intensities 10 a.u. and 20 a.u.

.....

..... **[1]**

(b) **(i)** Explain why transpiration is unavoidable during the day.

.....

.....

.....

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.....

.....

..... **[3]**

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(ii) Fig. 5.1, **on the insert**, is a photograph of a transverse section of a leaf taken from a xerophyte.

Describe the xerophytic features of this leaf **and** explain how each feature reduces loss of water vapour.

In your answer you should use appropriate technical terms, spelt correctly.

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..... **[5]**

[Total: 11]

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6 Membranes are a fundamental part of the cell. They are found both at the surface of a cell and inside a cell.

(a) State **three** roles of membranes **inside** cells.

.....

.....

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..... **[3]**

(b) Cells contain a large number of membrane-bound vesicles. Many of these vesicles transport substances between organelles.

(i) Outline how the vesicles are moved from one organelle to another.

.....

.....

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..... **[2]**

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(ii) The proteins embedded in the membranes of vesicles have different functions.

- COPI and COPII proteins are known as 'address proteins'.
- Vesicles that transport materials from the Golgi to the rough endoplasmic reticulum (RER) are coated in COPI proteins.
- Vesicles that transport materials to the Golgi from the RER are coated in COPII proteins.

Suggest how these proteins ensure that a vesicle is transported to the correct target organelle.

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..... **[2]**

(c) Cells in the pancreas secrete proteins such as the enzymes pancreatic amylase and protease.

Describe how these extracellular enzymes are secreted from the cells.

.....

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..... **[2]**

[Total: 9]

END OF QUESTION PAPER

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ADDITIONAL PAGE

If additional space is required, you should use the lined pages below. The question number(s) must be clearly shown.

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ADDITIONAL PAGE

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ADDITIONAL PAGE

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GCE

Biology

Advanced Subsidiary GCE

Unit **F211:** Cells, Exchange and Transport

Mark Scheme for January 2012

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Annotations

Annotations available in SCORIS

Annotation	Meaning
	Benefit of Doubt
	Contradiction
	Cross
	Error Carried Forward
	Given Mark
	Extendable horizontal wavy line
	Ignore
	QWC point
	Benefit of the doubt not given
	additional QWC credit given
	Tick
	Tick 1
	Tick 2
	Omission Mark

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Annotations and conventions used in the detailed Mark Scheme

Annotation	Meaning
/	alternative and acceptable answers for the same marking point
;	separates marking points
not	answers which are not worthy of credit
DO NOT CREDIT	answers which are not worthy of credit
ignore	statements which are irrelevant
ACCEPT	answers that can be accepted
( )	words which are not essential to gain credit
__	underlined words must be present in answer to score a mark
ecf	error carried forward
AW	alternative wording
ora	or reverse argument

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Question			Answer	Mark	Guidance
1	(a)	(i)	alveoli ; to provide large(r), surface area / SA ;	2	**ACCEPT** alveolus / alvioli, alviolis **ACCEPT** large(r) surface area to volume ratio **OR** SA:VOL
		(ii)	squamous / pavement ;	1	Look for the name **ACCEPT** squamas, squamos, squarmous **DO NOT CREDIT** ref to ciliated
		(iii)	to prevent bursting ; recoil ; to return air sac to original, size / shape ; to help expel air ;	2 max	**IGNORE** stretch / contract **DO NOT CREDIT** in context of inhaling **IGNORE** ref to role returning airways back to size **IGNORE** ref to fibres returning to original size **DO NOT CREDIT** carbon dioxide / waste gas, expelled
	(b)	(i)	**1** increases, partial pressure / concentration, of oxygen (in the air sac) ; **2** so concentration of oxygen (in the air sac) is higher than that in the blood ; **3** decreases, partial pressure / concentration, of carbon dioxide (in air sac) ; **4** so concentration of CO_2 (in the air sac) is lower than that in the blood ;	2	**ACCEPT** (provides) high concentration of oxygen (in air sac) **IGNORE** 'maintains' throughout
		(ii)	**EITHER** **D1** (continuous) blood flow (in the capillaries) ; **E1** to, bring in (more) carbon dioxide / take away (more) oxygen ; **OR** **D2** oxygen combines with haemoglobin ; **E2** to keep concentration in, blood / plasma, low ;	2	idea of blood flow **ACCEPT** good / copious / continuous, blood supply **IGNORE** highly vascular / many capillaries present **IGNORE** short diffusion path / capillaries very close to alveoli
			Total	**9**	

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Question			Answer	Marks	Guidance
2	(a)		stem / undifferentiated ; (bone) marrow ; differentiate ; meristem(atic) / cambium ;	4	**Mark the first answer for each prompt line.** If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = 0 marks **ACCEPT** totipotent / pluripotent **IGNORE** unspecialised (as specialised in the passage) **IGNORE** specialise as given in the passage **ACCEPT** callus
	(b)	(i)	*idea of:* create flow of water / move water ;	1	**Mark the first answer only.** If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = 0 marks **DO NOT CREDIT** ref to movement of, organism / cell **IGNORE** ref to liquid / food particles
		(ii)	strain / filter (the water) **OR** trap particles ; to catch food (particles) ;	1 max	**Mark the first answer only.** If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = 0 marks **IGNORE** trap substances unqualified **ACCEPT** named suitable food particles eg bacteria **IGNORE** ref to preventing infection / catching pathogens **IGNORE** ref to nutrients unqualified as these are dissolved **IGNORE** ref to catching dust

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Question			Answer	Marks	Guidance
	(c)		*xylem* consists of vessels **;** one cell specialisation described **;** transpiration stream **OR** movement of, water / minerals **;** *phloem* sieve tube element(s) and companion cell(s) **;** one cell specialisation described **;** translocation **OR** transports, sucrose / assimilates / products of photosynthesis / amino acids **;** AVP **;**	4 max	**ACCEPT** cells joined end to end **ACCEPT** continuous column / tube eg wall water proof / wall lignified / no end walls / (bordered) pits / hollow / no organelles / no cell contents **IGNORE** dead **IGNORE** transpiration unqualified **ACCEPT** sieve element / sieve tube, and companion cell eg sieve plates (between phloem elements) no nucleus / few organelles, in sieve tube (elements) little cytoplasm in sieve tube (elements) many plasmodesmata many mitochondria / dense cytoplasm, in companion cells **ACCEPT** sugar **IGNORE** load / unload sugars alone *in either xylem or phloem* ref to fibres ref to, packing cells / parenchyma cells
			Total	**10**	

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Question	Answer	Marks	Guidance
3 (a)		4	**Mark the first answer for each box.** If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = **0 marks** **Award 1 mark per correct row.**

feature	arterial blood	tissue fluid	lymph	
hydrostatic pressure	high	low	low	;
presence of large proteins	yes	no no **OR** yes yes		;
presence of neutrophils	yes	yes	(yes / no)	;
presence of erythrocytes	yes	no	no	;

IGNORE yes and no in first row

ACCEPT some / few / low / usually, for yes in rows 2 and 3
DO NOT CREDIT not usually for yes

In row two mark is awarded for idea that tissue fluid and lymph are the same (proteins in tissue fluid will enter lymph) - both responses must be the same to achieve a mark.

Mark is awarded for tissue fluid response only.

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Question			Answer	Marks	Guidance
	(b)	(i)	maintain / high(er), (blood) pressure ; increase rate of, flow / delivery ; flow can be, diverted / directed / AW ;	2 max	**Mark the first suggestion on each prompt line.** **IGNORE** separates oxygenated from deoxygenated blood **IGNORE** generate / create, pressure **IGNORE** ref to pressure gradient **ACCEPT** blood moves faster / quicker **IGNORE** ref to going to, all cells / where needed

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Question	Answer	Marks	Guidance
(ii)			**Ensure that there is at least one D mark and one E mark for four marks** **AND** **Ensure that there is at least one withstand mark and one maintain mark for four marks**
	to withstand pressure		
	D1 wall is thick **;**		**ACCEPT** tunica media, tunica adventitia, tunica externa for wall
	D2 (thick layer of) **collagen ;**		
	E3 (wall / collagen) provides strength **;**		**ACCEPT** (wall / collagen) is strong
	D4 **endothelium,** corrugated / folded **;**		**ACCEPT** tunica intima for endothelium
	E5 *idea of:* no damage to, endothelium / artery (wall) (as it stretches) **;**		**IGNORE** lining **IGNORE** prevents artery bursting / breaking **ACCEPT** wall will not tear
	max 3		
	to maintain pressure		
	D6 (thick layer of) **elastic** tissue / elastic fibres / **elastin ;**		**IGNORE** elastic unqualified
	E7 to cause **recoil** / return to original size **;**		
	D8 (thick layer of) **<u>smooth</u> muscle ;**		
	E9 narrows / constricts, **lumen** / artery **;**		Ref to lumen must be in context of explaining how pressure is maintained eg makes lumen small(er) = 1 mark **DO NOT CREDIT** in context of constriction to push or pump the blood along the artery **IGNORE** 'lumen is narrow' or 'has small lumen' as these are a description of the lumen not referring to the wall
	E10 AVP **;**		*eg:* *idea of:* blood is forced (through narrow, channel / lumen) *idea of:* restriction of blood flow to one area allows pressure to be maintained elsewhere
	max 3		
		4 max	**QWC rubric continued on next page……**

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Question	Answer	Marks	Guidance
3 (b)(ii)	**Q** QWC - two technical terms used and spelt correctly **;**	1	Words must be used in correct context and section. any **2** from: *withstanding pressure:* **collagen** **endothelium / endothelial** *maintaining pressure:* **elastic / elastin** **recoil** **smooth muscle** **lumen** **constrict(ion)**
	Total	**11**	

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Question			Answer	Marks	Guidance
4	(a)		*magnification is* the number of times larger the image is compared to the object **;**		**ACCEPT** alternative wording that implies quantitative comparison of image size with object size **DO NOT CREDIT** comparison of object to image (wrong way round)
					ACCEPT $\frac{\text{size of image}}{\text{size of object}}$ **or** $\frac{\text{size of image}}{\text{actual size}}$
					IGNORE makes image bigger unqualified
			resolution is ability to, distinguish / differentiate between, two separate points **OR** the, level / degree, of detail that can be seen **;**	2	**IGNORE** ref to clarity **ACCEPT** 'how detailed the image is'
	(b)				**Mark the first answer for each prompt line.** If the answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = **0 marks**
					ACCEPT a single figure within the range
			light *50* - 200 nm / 0.05 - 0.2 μm **;**		Units are required for both light & TEM
			TEM 0.05 - 1.0 nm **;**	2	**ACCEPT** 0.00005 - 0.001μm or 5 x 10^{-5} - 1x10^{-3}μm
	(c)	(i)	3 dimensional / 3D, (image) **;** can see the surface (detail) **;**	1 max	**ACCEPT** has depth of field / contours

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Question			Answer	Marks	Guidance

		(ii)	120 **;;**	2	**Award two marks for correct answer**
					if answer incorrect allow one mark for working:
					
					$\frac{3\,000\,000}{25\,000}$ or $\frac{3}{25\,000}$ or evidence that candidate is dividing 3mm or 3000000 nm by 25 000
					
					OR
					
					if 3mm incorrectly converted but still divided by 25000 then allow ecf for one mark eg:
					$\frac{3\,00000}{25\,000}$ = 12
					
					Note: If candidate has measured the pore as 4mm and carried out the calculation using this figure allow one mark ecf

		(iii)	allow communication between nucleus and cytoplasm **or** allow, molecules / named substances, to, enter / leave (the nucleus) **;**	1	**IGNORE** ref control **Note: the term 'substances' is not sufficient on its own** **DO NOT CREDIT** if named example is moving in wrong direction eg. RNA / mRNA / ribosomes, entering nucleus or DNA leaving nucleus

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Question			Answer	Marks	Guidance
	(d)		(named) membranes / phospholipid bilayer ; ribosomes ; Golgi ; endoplasmic reticulum / ER / RER / SER ; cytoskeleton / microtubules / microfilaments / spindle fibres ; centrioles ; vesicles / lysosomes ; mitochondria ;	2 max	**Mark the first <u>two</u> suggestions** eg plasma / cell surface / nuclear / thylakoid / cristae / tonoplast, chloroplast membrane **DO NOT CREDIT** flagellum / chromosomes / chromatin / nucleolus **IGNORE** ref to molecules
			Total	**10**	

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Question			Answer	Marks	Guidance
5	(a)	(i)	increases / rises / goes up ; use of figures to illustrate ;	2	figures must include **mean values** for two comparative points within the range either stated or calculated. eg (between 20 and 50) it rises from 5.7 to 32.3 eg (between 20 and 50) rate rises by 26.6 eg between 30 and 40 rate rises from 11.7 to 24.3 eg between 20 and 50 rate rises by 467% **IGNORE** units **Note:** as light intensity goes from 20 to 50, the rate increases from 5.7 to 32.3 = **2 marks** **DO NOT ACCEPT** figures that include 10 a.u. (as not asked for in the question)
		(ii)	stomata are (nearly) closed ; *idea that*: light <u>intensity</u> not high enough ;	1 max	**ACCEPT** no extra stomata are opened / stomata are not opened wider
	(b)	(i)	**1** stomata are open ; **2** allow, gaseous exchange / entry of carbon dioxide / exit of oxygen ; **3** for photosynthesis ; **4** water <u>vapour</u> leaves (the leaf) ; **5** down a water (vapour) potential gradient ; **6** high(er) temperatures (during the day) ; **7** causes greater <u>evaporation</u> / some water vapour loss through leaf surface all the time ;	3 max	**DO NOT CREDIT** if gases are described moving in wrong direction **IGNORE** ref to respiration **ACCEPT** description of light independent stage **ACCEPT** Ψ for water potential

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Question			Answer	Marks	Guidance
		(ii)			**IGNORE** ref to moisture / moist air **IGNORE** ref to sunken / small / closed / few stomata
			1 thick , **cuticle** / waxy or layer **;**		**ACCEPT** waterproof for waxy
			2 leaf is, folded / rolled / curled / curved / AW **;**		
			3 reduces (exposed) **surface area** (for evaporation) **;**		**DO NOT CREDIT** ref to surface area to vol ratio / SA:Vol
			4 hairs **;**		**DO NOT CREDIT** if hairs described in wrong place eg on palisade **DO NOT CREDIT** cilia
			5 reduces, **evaporation / diffusion** through leaf, surface / **epidermis**) **;**		**DO NOT CREDIT** evaporation of water vapour
			for points 6, 7 & 8 credit only in context of folded leaf or hairs:		
			6 trap **water vapour ;**		**ACCEPT** water vapour builds up in enclosed area **ACCEPT** stop wind blowing, water vapour / diffusion shells, away **ACCEPT** humid air collects in enclosed space
			7 creates high **water (vapour) potential** outside (stomata) **;**		**ACCEPT** Ψ for water potential **DO NOT CREDIT** high water potential gradient outside stoma
			8 reduces **water (vapour) potential gradient ;** **max 4**		
			Q QWC – two technical terms used and spelt correctly **;** **1**		any **2** from: **cuticle** (derivatives of) **evaporation** **water vapour** **potential gradient** **epidermis** **surface area** **diffusion**
				5 max	
			Total	**11**	

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Question			Answer	Marks	Guidance
6	(a)				**Mark first three suggestions only** **DO NOT CREDIT** ref to cell signalling / cell recognition
			1 form / produce / make, compartments / organelles / named organelles (within a cell) / AW **;**		**ACCEPT** vesicles as compartments eg mitochondria, ER, nucleus, lysosomes, Golgi, chloroplast **ACCEPT** compartmentalisation **DO NOT CREDIT** 'to contain an organelle'
			2 isolation / AW, of, contents (of organelle) / substance / named substance / reactions / metabolic pathways **;**		eg of AW include hold / contain / store / separates eg of named substance: (hydrolytic) enzymes, hormones / chemical messengers **DO NOT CREDIT** separates cell contents
			3 site for attachment of, enzymes / other named molecules / ribosomes **;**		**IGNORE** ref to increasing surface area / ref to site for reactions to occur eg of other named molecules : receptors / electron carriers / photosystems / pigments
			4 provide selective permeability / described **;**		eg controls what can enter and leave an organelle **DO NOT CREDIT** in context of materials entering and leaving the cell
			5 creation of, concentration gradients / specific environments / described **;**	3 max	eg of specific environment = pH **IGNORE** moves substances in vesicles
	(b)	(i)	cytoskeleton / microtubule / microfilament **;** provide, pathways / tracks, (for movement) **;**		**ACCEPT** guide the vesicles
			(vesicle) moves along, <u>microfilaments</u> / <u>microtubule</u> **;**		Mp 3 or 4 scores 2 marks as they include mp 1 **IGNORE** moved by microtubules / microfilaments
			<u>microtubules</u>, extended / broken down **;**		
			uses, ATP / (metabolic) energy **;** AVP **;**	2 max	eg ref to (protein) motor / dynein / kinesin

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Question			Answer	Marks	Guidance
		(ii)	receptor found only on, correct / target, (named) organelle **;** *idea that:* address protein provides a way of, labelling / identifying / recognising, the vesicle **;** protein / COPI / COPII, has a specific shape **;** (shape of) receptor and (address) protein are complementary **;**	2 max	**DO NOT CREDIT** statements that relate to events outside a cell (eg protein is a complementary shape to the receptor on the surface of a target cell) as the question is in the context of vesicles moving *within* cells. **ACCEPT** correct target organelle is identified for each vesicle **ACCEPT** receptor fits the shape of the, protein / COPI / COPII
	(c)		<u>exocytosis</u> **;** vesicle fuses / merges **;** (with), cell surface / plasma, membrane **;** discharging / releasing, enzyme / contents (to exterior) **;**	2 max	**IGNORE** bind / attach / join **IGNORE** ref to, cell membrane / phospholipid bilayer, unqualified **IGNORE** secretion alone as stated in question
			Total	**9**	

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ADVANCED SUBSIDIARY GCE

BIOLOGY

Cells, Exchange and Transport

F211

Candidates answer on the question paper.

OCR supplied materials:
- Insert (inserted)

Other materials required:
- Electronic calculator
- Ruler (cm/mm)

Monday 16 May 2011
Morning

Duration: 1 hour

F 2 1 1

F2157106111

Candidate forename		Candidate surname	

Centre number						Candidate number				

INSTRUCTIONS TO CANDIDATES

- The insert will be found in the centre of this document.
- Write your name, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
- Use black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Write your answer to each question in the space provided. If additional space is required, you should use the lined pages at the end of this booklet. The question number(s) must be clearly shown.
- Answer **all** the questions.
- Do **not** write in the bar codes.

INFORMATION FOR CANDIDATES

- The number of marks is given in brackets **[ ]** at the end of each question or part question.
- The total number of marks for this paper is **60**.
- Where you see this icon you will be awarded marks for the quality of written communication in your answer.
- You may use an electronic calculator.
- You are advised to show all the steps in any calculations.
- This document consists of **16** pages. Any blank pages are indicated.

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Answer **all** the questions.

1 **(a)** Fig. 1.1, **on the insert**, shows an electron micrograph of cells from the liver.

(i) Some cells, such as liver cells, contain a lot of Golgi apparatus.

State **one** function of the Golgi apparatus.

.....

.....

..... **[1]**

(ii) Suggest why the nuclear envelope contains pores.

.....

.....

.....

.....

..... **[2]**

(iii) State the function of the lysosomes.

.....

.....

..... **[1]**

(b) The liver is an organ.

Explain what is meant by the term *organ*.

.....

.....

.....

.....

..... **[2]**

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(c) Using the mammalian **gaseous exchange system** as an example, explain how the different cells and tissues enable the effective exchange of gases.



In your answer, you should use appropriate technical terms, spelt correctly.

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..... **[5]**

[Total: 11]

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2 The cell surface membrane allows different substances to enter and leave the cell.

(a) List **three** components of a cell surface membrane.

.....

.....

..... **[3]**

(b) **(i)** Explain what is meant by the term *active transport*.

.....

.....

.....

.....

..... **[2]**

(ii) State **two** examples of active transport in cells.

For each example, you should name the substance that is transported **and** the cell involved.

.....

.....

.....

..... **[2]**

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(c) In addition to active transport, substances can pass through cell surface membranes by:

- diffusion
- facilitated diffusion
- osmosis
- bulk transport (endocytosis / exocytosis)

For each example described in Table 2.1 below, state how the substance crosses the cell surface membrane. The first one has been done for you.

Table 2.1

example	mechanism of movement across cell surface membrane
release of enzymes into the gut	bulk transport
a plant cell taking up water	
calcium ions entering a nerve cell down a concentration gradient	
oxygen entering a red blood cell	

[3]

[Total: 10]

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3 Large animals, such as mammals, need efficient transport systems.

(a) Fig. 3.1 shows a section through the mammalian heart.

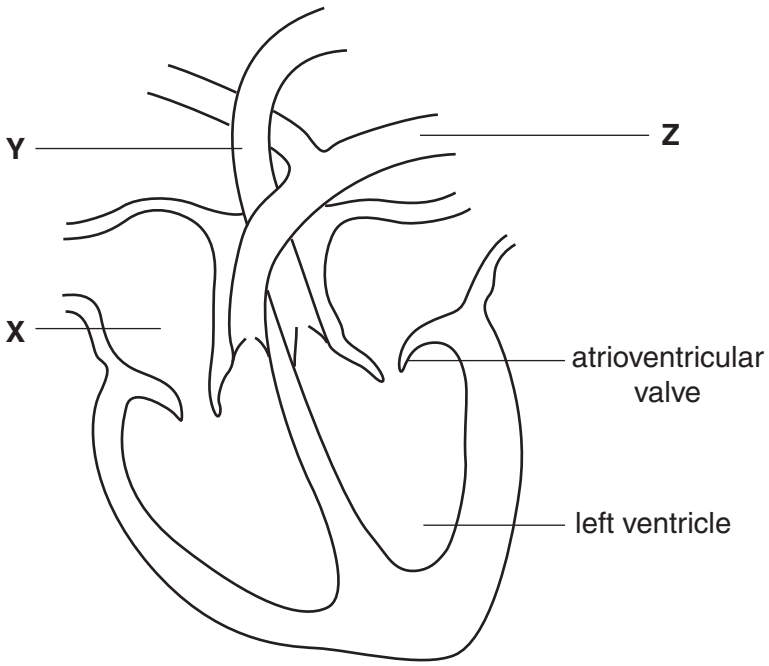


Fig. 3.1

(i) Name the parts labelled **X**, **Y** and **Z**.

X .....

Y .....

Z ..... **[3]**

(ii) Explain why the wall of the left ventricle is thicker than the wall of the left atrium.

.....

.....

.....

.....

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.....

.....

..... **[3]**

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(iii) Explain how pressure changes in the heart bring about the closure of the atrioventricular (bicuspid) valve.

.....

.....

.....

.....

.....

..... **[2]**

(b) The mammalian transport system is a double circulatory system.

An efficient circulatory system consists of a pump, a means of maintaining pressure, a transport medium and exchange surfaces.

State the component of the **mammalian circulatory system** that fulfils each of these roles.

The first one has been done for you.

pump ..... heart .....

means of maintaining pressure .....

transport medium .....

exchange surface .....

[3]

[Total: 11]

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4 In plants, dividing cells can be found in meristematic tissue.

(a) Name **two** parts of a plant where meristematic tissue can be found.

.....

..... **[2]**

(b) In an investigation, a student observed the cells in a stained section of meristematic tissue. The student counted how many cells could be seen in each stage of the cell cycle.

Table 4.1 shows the results.

Table 4.1

stage of cell cycle	percentage cells in stage (%)
interphase	82.00
prophase	4.34
metaphase	3.23
anaphase	3.23
telophase	7.20

(i) Explain why the meristematic tissue needed to be stained for this investigation.

.....

.....

.....

.....

.....

..... **[2]**

(ii) Name the type of nuclear division that occurs in a plant meristem.

..... **[1]**

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(c) Using the results shown in Table 4.1, calculate the percentage of the cell cycle taken up by nuclear division.

Show your working.

Answer = ... % **[2]**

(d) State **one** way in which the products of **meiosis** are different from the products of nuclear division in meristematic tissue.

.....

.....

..... **[1]**

[Total: 8]

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5 Fig. 5.1 shows a spirometer, which is used to investigate lung function.

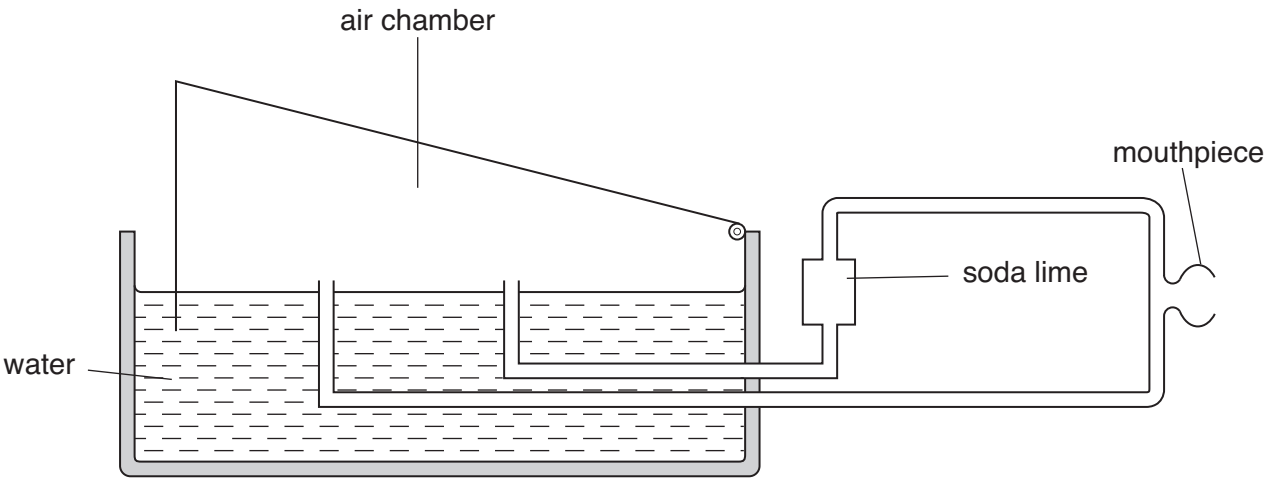


Fig. 5.1

(a) (i) Describe how the spirometer would be used to measure tidal volume.

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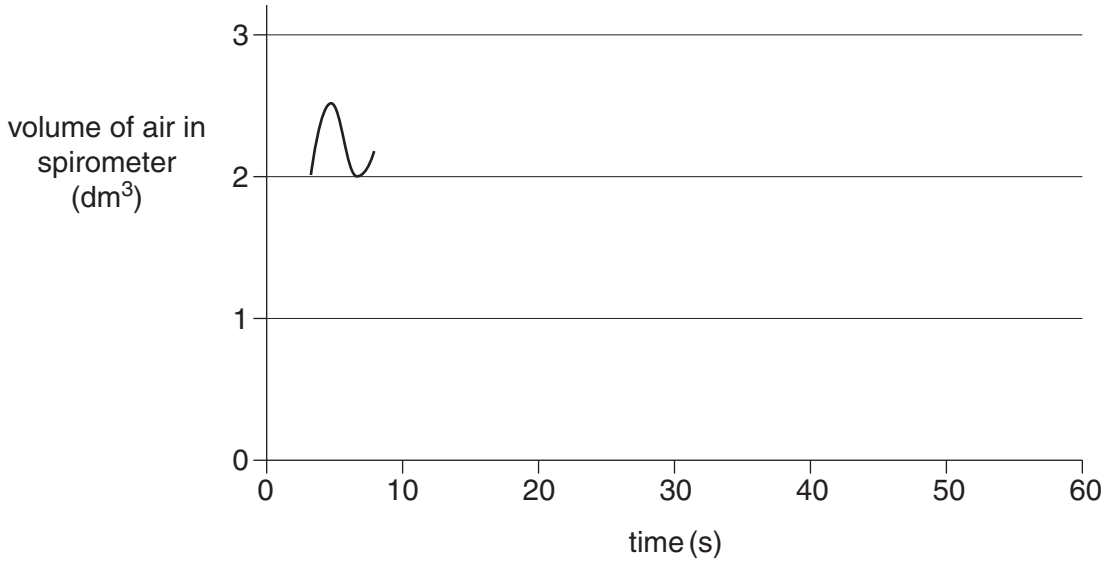
.....

..... **[3]**

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(ii) Using the axes below, complete the spirometer trace that you expect to see recorded from a healthy sixteen year old over **ten further breaths**, while at rest.



[2]

(iii) Describe how you could use a spirometer trace to measure the rate of oxygen uptake.

.....

.....

.....

.....

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.....

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.....

..... **[3]**

(b) Suggest **two** factors that should be considered when carrying out a risk assessment for an experiment using a spirometer.

.....

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.....

.....

..... **[2]**

[Total: 10]

QUESTION 6 STARTS ON PAGE 12

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6 **(a)** Translocation is the movement of assimilates along the phloem from one part of a plant to another.

(i) Name the sugar molecule most commonly translocated.

..... **[1]**

(ii) A tissue may act as a source or a sink at different times.

For each tissue listed below, state whether it is acting as a source, a sink or neither. The first one has been done for you.

tissue	source, sink or neither
a leaf in summer	source
a developing bud	
xylem	
an actively growing root tip	

[3]

(b) The sap in the phloem sieve tubes is moved by mass flow.

State **two** adaptations of sieve tubes that enable mass flow to occur.

.....

.....

.....

..... **[2]**

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(c) Describe how assimilates are loaded into the phloem.



In your answer, you should use appropriate technical terms, spelt correctly.

.....

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..... **[4]**

[Total: 10]

END OF QUESTION PAPER

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ADDITIONAL PAGE

If additional space is required, you should use the lined pages below. The question number(s) must be clearly shown.

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ADDITIONAL PAGE

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Biology

Advanced Subsidiary GCE

Unit **F211:** Cells, Exchange and Transport

Mark Scheme for June 2011

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Question			Expected Answer	Mark	Additional Guidance
1	(a)	(i)	production of vesicles / packaging proteins ; modification of / processing of / adding carbohydrate to , proteins ; production of lysosomes ;	max 1	**Mark the first answer.** If the first answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = **0 marks** **ACCEPT** lipids **IGNORE** ref to transport / secretion / exocytosis / substances / materials **DO NOT CREDIT** stores proteins **ACCEPT** makes glycoproteins
1	(a)	(ii)	allow movement (of substances) in or out of nucleus ; correctly named substance (entering or leaving nucleus) ; ref to correct destination of substance ;	max 2	**IGNORE** messages / information / communication **IGNORE** name of substance for MP 1 **IGNORE** ref to mechanism of movement e.g. RNA / (m)RNA / (r)RNA (t)RNA / polymerase / nucleotides / ribosomes / helicase / proteins / (steroid) hormones **IGNORE** ref nutrients **DO NOT CREDIT** if incorrect direction of movement described (e.g. RNA into nucleus **or** RNA in and out of nucleus) **DO NOT CREDIT** DNA as named substance ***Note*** 'allows mRNA out of nucleus' = **two marks** e.g. RNA to ribosomes or RER helicase to DNA polymerase to , DNA / gene nucleotides to DNA (steroid) hormones to , DNA / gene / chromosome

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Question			Expected Answer	Mark	Additional Guidance
1	(a)	(iii)	contain / release **,** lysins / lytic enzymes / hydrolytic enzymes / digestive enzymes **;**		**DO NOT CREDIT** 'engulf' **DO NOT CREDIT** 'lysosomes are digestive enzymes'
			digest / break down **,** organelles / foreign objects / toxins / cells / pathogens **;**		**ACCEPT** destroy **ACCEPT** ref to digestion of contents of phagocytic vesicle **IGNORE** ref to (unwanted) substances / materials / food **IGNORE** ref to acrosomes
			apoptosis / autolysis / described **;**	**max 1**	
1	(b)		*idea of* more than one (type of) tissue **;**		**ACCEPT** named examples of tissues
			working together / performing a function(s) **;**	**2**	**ACCEPT** job or task

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Question	Expected Answer	Mark	Additional Guidance
1 (c)			allow **F** marks even if **C** mark not quite accurate
	C1 thin / **squamous**, **<u>epithelium</u>** ; **C2** thin **<u>endothelium</u>** (of capillary) ;		**C1/C2** **IGNORE** ref to alveolus / alveolar wall / capillary wall **,** without ref to epithelium / endothelium
	F1 (provides) short **diffusion** distance / described ;		**F1** **ACCEPT** diffusion barrier **,** thin / one cell thick **IGNORE** refs to speed or rate of diffusion **IGNORE** ref to reduces diffusion distance alone – must be in context of short distance **DO NOT CREDIT** ref to thin **,** cell walls / membranes
	F2 ref to **surfactant** (from epithelial cells) **,** reducing surface tension / preventing alveoli collapsing ;		**F2** **IGNORE** ref to moisture
	C3 blood / red blood cells / **erythrocytes** ;		**C3** **IGNORE** (named) blood vessel **ACCEPT** blood supply / supply of blood
	F3 transports (named) gas(es) **,** to / from **,** exchange surface / alveoli ; **C4** diaphragm / intercostals **, muscles** ;		**F3** **IGNORE** ref to lungs **IGNORE** description of gas exchange
	F4 (maintains / creates) **diffusion** / **concentration , gradient** ;		**F4** This can be awarded in context of **F3** or **C4**
	C5 **ciliated** epithelium / **goblet** cells / ciliated cells ; **F5** *idea of:* protection from / removal of **,** dust / bacteria / pollen / spores ;		**F5** **ACCEPT** trap **,** dust / bacteria / pollen / spores **IGNORE** dirt / germs
	C6 **cartilage** ; **F6** hold airway open ;		
	C7 smooth **muscle** ;		***continued***

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Question	Expected Answer	Mark	Additional Guidance
continued			
	F7 constrict / control diameter of **,** airway / blood vessel **;**		**F7** **ACCEPT** narrows lumen
	C8 elastic , fibres / tissue **;** **F8** for recoil / aiding ventilation **;**		**C8** **IGNORE** elastin / elasticated **F8** **ACCEPT** prevent alveoli bursting
	C9 **macrophage** / **neutrophil** **;** **F9** engulf / destroy pathogens **or** protect from infection **;**	**max 4**	**C9** **IGNORE** ref to white blood cell unqualified
	QWC **;**	**1**	Any **three** with correct spelling and a suitable context from: **epithelium / epithelial**, **endothelium,** **cartilage,** **diffuse / diffusion,** **gradient,** **goblet,** **ciliated,** **concentration,** **squamous,** **macrophage,** **neutrophil,** **surfactant,** **muscle,** **erythrocyte**
	Total	**[11]**	

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Question			Expected Answer	Mark	Additional Guidance
2	(a)		phospholipids ; proteins ; glycoproteins ; cholesterol ; glycolipids ;	max 3	**Mark the first <u>three</u> components in continuous prose or first suggestion in bullet point / (numbered) list.** **IGNORE** lipids, bilayer, hydrophilic head, hydrophobic tail, ref to intrinsic / extrinsic Count all refs to different types of protein as one e.g. intrinsic protein ✓ extrinsic protein Ignore pore protein Ignore glycoprotein ✓ phospholipids ✓ **= 3 marks**
2	(b)	(i)	(movement of substances) against / up , concentration gradient **or** from low to high concentration ; using , ATP / (metabolic) energy ; using a , transport / carrier , protein ;	2	**CREDIT** diffusion gradient for concentration gradient **DO NOT CREDIT** along / across , concentration gradient **DO NOT CREDIT** 'diffusion against concentration gradient' **DO NOT CREDIT** pore / channel protein

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<table>
<tr><th colspan="3">Question</th><th>Expected Answer</th><th>Mark</th><th>Additional Guidance</th></tr>
<tr><td>2</td><td>(b)</td><td>(ii)</td><td>(mineral) ions / salts / named e.g, (into) root hair (cell) ;

hydrogen ions (out of) companion cells ;

(mineral) ions / salts / named e.g, (across) endodermis ;
sucrose out of sieve tube at sink ;

AVP ; ;</td><td>max 2</td><td>Mark the first <u>two</u> examples.
Ensure candidate refers to ions e.g. nitrates, phosphates, calcium ions, magnesium ions etc.
ACCEPT correct symbols with charge
DO NOT CREDIT ref to water
ACCEPT ref to loading of sucrose into , phloem cell / companion cell
ACCEPT ref to uptake of glucose by cells lining , (small) intestine / nephron / PCT
IGNORE references to endocytosis / exocytosis / phagocytosis / secretion
DO NOT CREDIT incorrect direction of movement if stated
e.g.
<table>
<tr><th>substance</th><th>cell</th><th>(direction)</th></tr>
<tr><td>sodium/potassium ion(s)</td><td>neurone</td><td>K^+ in
Na^+out</td></tr>
<tr><td>sodium/potassium ion(s)</td><td>named cell</td><td>Ion pump to drive cotransport</td></tr>
<tr><td>potassium ion(s)</td><td>guard cell (to open stomata)</td><td>in</td></tr>
<tr><td>sodium ion(s)</td><td>cell of loop of Henle</td><td>out</td></tr>
<tr><td>calcium <u>ion</u>(s)</td><td>muscle cell</td><td>(into sarcoplasmic reticulum)</td></tr>
<tr><td>calcium ions</td><td>presynaptic knob</td><td>out</td></tr>
<tr><td>hydrogen ions</td><td>in cell , respiring (aerobically) / photosynthesising</td><td>for chemiosmosis</td></tr>
<tr><td>named ion(s)</td><td>cells lining distal convoluted tubule</td><td>in / out</td></tr>
</table></td></tr>
<tr><td>2</td><td>(c)</td><td></td><td>osmosis ;
<u>facilitated</u> <u>diffusion</u> ;
diffusion ;</td><td>3</td><td>Mark the first answer for each example. If the first answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = 0 marks</td></tr>
<tr><td></td><td></td><td></td><td>Total</td><td>[10]</td><td></td></tr>
</table>

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Question			Expected Answer	Mark	Additional Guidance
3	(a)	(i)	**X** = <u>right</u> atrium **;** **Y** = aorta **;** **Z** = (left) pulmonary artery **;**	**3**	**Mark the first answer for each letter.** If the first answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = **0 marks** **ACCEPT** <u>right</u> atria **IGNORE** RA **IGNORE** PA
3	(a)	(ii)	*left ventricle* **1** (more muscle to create) more force **;** **2** (needs to create) high<u>er</u> pressure **;** **3** push blood against greater **,** resistance / friction **;** **4** (left ventricle) pumps blood further / pumps blood to all parts of body / supplies systemic circulation **;**	**3 max**	Assume answer refers to left ventricle unless otherwise stated. **ACCEPT ORA** for left atrium throughout **1** **IGNORE** more powerful contraction **ACCEPT** stronger contraction **2** **IGNORE** withstanding or maintaining pressure **4** **ACCEPT** pumps blood **,** all round body / greater distance **IGNORE** pumps blood to the body **DO NOT CREDIT** references to **,** right ventricle / lungs

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Question			Expected Answer	Mark	Additional Guidance
3	(a)	(iii)			**DO NOT CREDIT** statements that refer to right atrium or right ventricle
			1 ventricular systole **or** ventricle **,** wall / muscle **,** contracts **;**		**1** **IGNORE** ref to atrial contraction
			2 (ventricular contraction) raises ventricular pressure **;**		
			3 (ventricular pressure) higher than atrial pressure **;**		
			4 *idea of* (pressure / movement of blood, generated by ventricular contraction) pushes valve shut **;**		**4** **DO NOT CREDIT** 'valve shuts' alone **DO NOT CREDIT** in context of blood flowing from atrium to ventricle resulting in pressure increase to close valve
			5 chordae tendinae prevent inversion **;**	**max 2**	**5** **ACCEPT** valve tendons / tendinous cords
	(b)				**Mark the first answer for each role.** If the first answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then **= 0 marks**
			aorta / (named) artery / arteries / arteriole(s) **;**		**ACCEPT** smooth muscle / elastic tissue / collagen / narrow lumen **DO NOT CREDIT** valves
			blood / plasma **;**		
			capillary / capillaries / capillary wall / (capillary) endothelium **;**	**3**	
			Total	**[11]**	

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Question			Expected Answer	Mark	Additional Guidance
4	(a)		(just behind) tip / apex , of root ; (just behind) tip / apex , of shoot ; cambium / pericycle / vascular bundle ; bud ;	max 2	**Mark the first <u>two</u> suggestions.** **ACCEPT** behind root cap **IGNORE** root unqualified **IGNORE** stem / root unqualified / shoot unqualified **ACCEPT** between xylem and phloem
4	(b)	(i)	**1** chromosomes / chromatin / nucleus , can be seen / are visible ; **2** determine / distinguish between , different stages (of mitosis / division / cell cycle) ; **3** (staining) provide contrast (between cell structures) / AW ; **4** (because) different , structures / chemicals , take up different amounts of stain ;	max 2	**IGNORE** ref to organelles throughout **1** **ACCEPT** DNA for chromosomes / chromatin **ACCEPT** chromosomes / chromatin / DNA / nucleus , not normally visible **3** **IGNORE** different structures can be seen (this is visibility not contrast) **4** **IGNORE** different tissues or cells , take up different amounts of stain
4	(b)	(ii)	mitosis / mitotic ;	1	spelling must be correct

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Question			Expected Answer	Mark	Additional Guidance
4	(c)		***Two*** *marks for correct answer, even if no working shown* 18.00 **; ;**	**2**	**CREDIT** 18 / 18.0 If answer is incorrect or missing allow one mark for working 100 – 82 **or** 4.34.+ 3.23 + 3.23 + 7.20 **or** 18 somewhere in working
4	(d)		*in meiosis* (cells produced are) not <u>genetically</u> identical **;** one set of chromosomes / haploid **;** (they are) gametes **;** four cells produced **;**	**max 1**	**Mark the first answer.** If the first answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = **0 marks** **IGNORE** ref to cells produced by mitosis (as qu asks about meiosis) **ACCEPT** not clones **Award** in context of genetically different from parent or from each other **ACCEPT** half number of chromosomes / half genetic material
			Total	**[8]**	

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Question			Expected Answer	Mark	Additional Guidance
5	(a)	(i)	**1** *idea of* not breathing through nose **;** **2** subject breathes **,** evenly / normally / regularly **;** **3** *idea of* (measure) height / amplitude **,** of waves (from trace) **;** **4** measure at least three waves and calculate mean **;** **5** detail of how spirometer works **;**	**max 3**	**1** e.g. subject wears nose clip / plug or holds nose **2** **IGNORE** at rest **3** **ACCEPT** (measure) difference between peak and trough **ACCEPT** annotated diagram / annotations on graph **5** e.g. as breathe <u>in</u> lid goes <u>down</u> / as breathe <u>out</u> lid goes <u>up</u> e.g. movement of lid recorded **,** on trace / by data logger e.g. pen attached to lid moves up/down as breathe **DO NOT CREDIT** description of water level changing **IGNORE** ref to using mouthpiece, soda lime, oxygen
5	(a)	(ii)	10 further waves drawn with similar heights **;** trace falls **;**	**2**	Look for 10 extra peaks and 10 extra troughs ***Note*** 'similar' means no wave drawn for vital capacity – all waves should be approximately same height

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Question			Expected Answer	Mark	Additional Guidance
5	(a)	(iii)	**1** measure **,** volume of oxygen used / decrease in volume in chamber **;** **2** one detail of how to measure volume change **;** **3** measure time taken (to use this oxygen) **;** **4** divide (volume) by time taken **;**	**3**	**1** **ACCEPT** annotations on graph **ACCEPT** **'**measure how much the trace has gone down' **or** 'measure decrease in trace' **2** e.g. draw line along tips of **,** peaks / troughs e.g. find difference in height from one **,** peak / trough **,** to another **3** **ACCEPT** (measure volume of oxygen used) in a given time **4** **ACCEPT** unit stated to indicate rate has been calculated e.g. dm^3s^{-1} / dm^3min^{-1} ***NOTE*** **'**draw line along tips of, peaks / troughs **and** calculate gradient of line' = **3 marks (mark points 1, 3 & 4)**
5	(b)		**1** check health of volunteer **;** **2** oxygen used **;** **3** new / sterilised / disinfected **,** mouthpiece (for each volunteer)**;** **4** *idea of:* soda lime working **;** **5** sufficient oxygen in chamber **;** **6** water level not too high / water must not enter tubes **;** **7** ensure valves working correctly **;**	**max 2**	**Mark the first *two* factors.** **1** e.g. check medical history of volunteer ask about asthma / TB / pneumonia / flu / bronchitis / emphysema **3** **IGNORE** clean mouthpiece **4** **CREDIT** need to remove CO_2 / CO_2 accumulates **5** **IGNORE** enough air in chamber **6** **IGNORE** general ref to leaks
			Total	**[10]**	

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Question			Expected Answer	Mark	Additional Guidance
6	(a)	(i)	sucrose ;	1	**Mark the first answer.** If the first answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = **0 marks**
6	(a)	(ii)	sink ; neither ; sink ;	3	**Mark the first answer for each tissue.** If the first answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = **0 marks**
6	(b)		**1** elongated elements ; **2** elements **,** joined end to end / form column ; **3** sieve plates / pores in end walls / perforated end plates / sieve pores ; **4** little cytoplasm / cytoplasm pushed to cell edges / thin (layer of) cytoplasm ; **5** no nucleus / few organelles ;	**max 2**	**Mark the first <u>two</u> adaptations.** **1** **ACCEPT** cells **2** **ACCEPT** cells **3** response must refer to pores at ends of sieve elements **4** **IGNORE** hollow **5** **IGNORE** no organelles / few cell contents

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Question			Expected Answer	Mark	Additional Guidance
6	(c)		**1** active transport of, **hydrogen ions** / **protons** / H^+ , out of **companion** cells ; **2** creates , hydrogen ion / **concentration** / diffusion , **gradient** ; **3** **(facilitated) diffusion** (of H^+) back into companion cells ; **4** sucrose / assimilates , move in with hydrogen ions ; **5** by **cotransport** / through cotransport protein ; **6** sucrose / assimilates , (diffuse) through **plasmodesmata** (from companion cell to sieve element) ; **7** into **sieve, tube / element** ;	**max 3**	**1** **ACCEPT** description of active transport **DO NOT CREDIT** hydrogen, H, H_2, hydrogen molecules **2** **ACCEPT** description of gradient created **5** **IGNORE** carrier protein **For mark points 4 and 6** **IGNORE** sugar If wrong assimilate is named e.g. glucose penalise once and then apply ECF
			QWC ;	**1**	Any **three** with correct spelling and a suitable context from: **companion, diffuse / diffusion, gradient, concentration, facilitated, cotransport, plasmodesmata, sieve tube, sieve element, hydrogen ions / protons**
			Total	**[10]**	

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RECOGNISING ACHIEVEMENT

ADVANCED SUBSIDIARY GCE

BIOLOGY

F211

Cells, Exchange and Transport

OCE/25767

Candidates answer on the question paper.

OCR supplied materials:
- Insert (inserted)

Other materials required:
- Electronic calculator
- Ruler (cm/mm)

Tuesday 11 January 2011
Morning

Duration: 1 hour

F211

Candidate forename		Candidate surname	

Centre number						Candidate number				

INSTRUCTIONS TO CANDIDATES

- The insert will be found in the centre of this document.
- Write your name, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
- Use black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Write your answer to each question in the space provided. If additional space is required, you should use the lined pages at the end of this booklet. The question number(s) must be clearly shown.
- Answer **all** the questions.
- Do **not** write in the bar codes.

INFORMATION FOR CANDIDATES

- The number of marks is given in brackets **[ ]** at the end of each question or part question.
- The total number of marks for this paper is **60**.
- Where you see this icon you will be awarded marks for the quality of written communication in your answer.
- You may use an electronic calculator.
- You are advised to show all the steps in any calculations.
- This document consists of **16** pages. Any blank pages are indicated.

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Answer **all** the questions.

1 **(a)** Name the type of nuclear division that produces two genetically identical nuclei.

..... **[1]**

(b) There are a number of stages during cell division.

The list, **J** to **N**, describes some processes that occur during the division of an animal cell.

J	the cell surface membrane is constricted
K	the nuclear envelope reforms
L	sister chromatids are pulled apart
M	the chromosomes condense
N	the chromosomes move to the equator

Match each letter, **J** to **N**, with a stage of cell division in the list below.

The first one has been completed for you.

prophase .....M.....

metaphase .....

anaphase .....

telophase .....

cytokinesis ..... **[4]**

(c) During interphase the genetic material is copied.

State **two** other processes that occur during interphase.

.....

.....

.....

..... **[2]**

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(d) Suggest **two** ways that cell division in plants differs from cell division in animals.

.....

.....

.....

.....

.....

..... **[2]**

[Total: 9]

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2 Fig. 2.1 shows a drawing of a part of the lung.

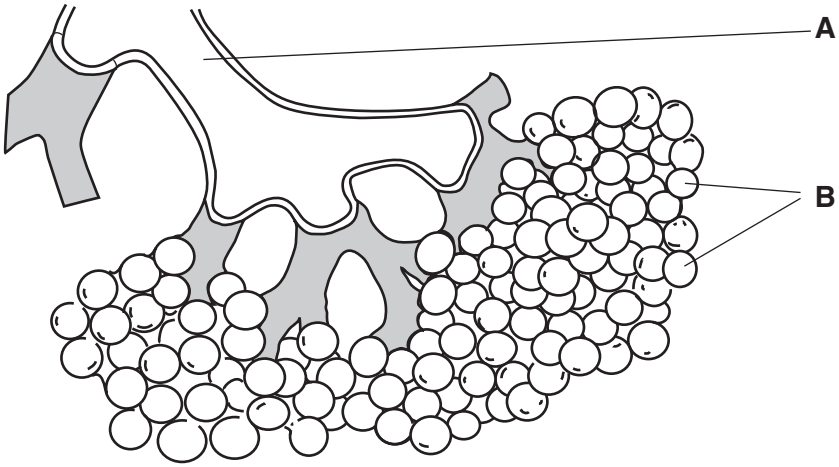


Fig. 2.1

(a) Name the structures labelled **A** and **B**.

A .....

B ..... **[2]**

(b) State **two** features of the structures labelled **B** that enable efficient gaseous exchange.

.....

.....

.....

..... **[2]**

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(c) As part of an allergic response, certain cells in the lungs release histamine.

Histamine is a cell signalling molecule that stimulates smooth muscle in the wall of structure **A** to contract.

Suggest how histamine stimulates smooth muscle contraction.

.....

.....

.....

.....

.....

.....

..... **[2]**

(d) Another action of histamine is to make capillary walls more permeable.

Suggest **two** effects this increased permeability may have on the surrounding tissues.

.....

.....

.....

.....

.....

..... **[2]**

[Total: 8]

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3 Read the following passage and complete each sentence by writing the most appropriate **term or phrase** in the spaces provided.

Large, active organisms need a circulatory system because they have a small

..... .

Haemoglobin is a pigment found in red blood cells. These cells are also known as

..... . Haemoglobin has a high ..... for oxygen. In the lungs, the haemoglobin associates with oxygen to form ..... . In respiring tissues, the oxygen is released by dissociation. In very active tissues, the amount of oxygen released can be increased by the presence of more ..... . This is called the ..... effect. **[6]**

[Total: 6]

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4 **(a)** Fig. 4.1 is a diagram showing the position of the vascular bundles in a transverse section of the stem of a young dicotyledonous plant.

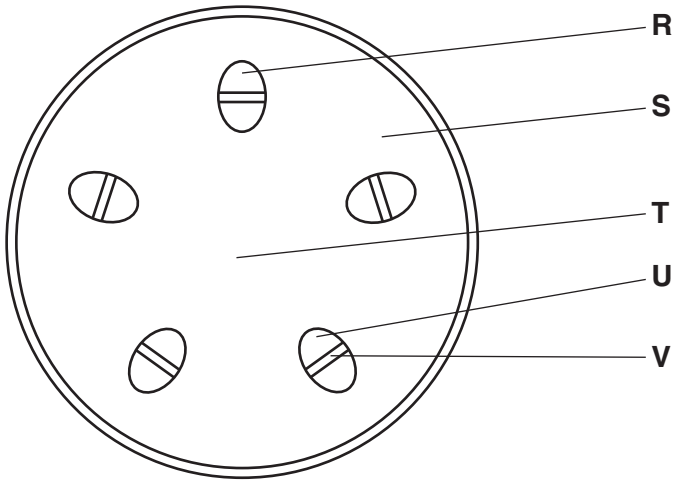


Fig. 4.1

Select the correct letter from Fig. 4.1 to identify each of the following tissues in the stem.

xylem .....

phloem .....

cambium ..... **[3]**

(b) Fig. 4.2, **on the insert**, shows the cut end of a stem from a woody plant. The other end of the stem is being heated in a fire. Steam can be seen coming from the vascular tissue at the cut end of the stem.

Describe the features of the xylem that enable the steam to pass from the heated end of the stem to the cut end.

.....

.....

.....

.....

..... **[2]**

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(c) (i) Define the term *transpiration*.

.....

.....

.....

..... **[2]**

(ii) Describe **and** explain how transpiration contributes to the mechanism of water transport up the stem.



In your answer, you should use appropriate technical terms, spelt correctly.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... **[5]**

(iii) Suggest why a bunch of flowers may survive longer if the ends of the stems are removed immediately before the flowers are placed in water.

.....

.....

.....

.....

..... **[2]**

[Total: 14]

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5 **(a)** Fig. 5.1 is provided for you **on the insert**.

(i) State **two** features of the cell shown in Fig. 5.1 that indicate it is eukaryotic.

.....

.....

.....

..... **[2]**

(ii) The line **A**–**B** on Fig. 5.1 represents 20 μm.

Calculate the magnification of the cell shown in Fig. 5.1.

Show your working.

Answer = ... x **[2]**

(iii) Microtubules and microfilaments are part of the cytoskeleton.

Suggest **two** roles of the cytoskeleton in the type of cell shown in Fig. 5.1.

.....

.....

.....

.....

..... **[2]**

(b) The cells of a multicellular organism are usually specialised to perform a particular function.

(i) Name the process in which a cell becomes specialised.

..... **[1]**

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(ii) Neutrophils are phagocytic blood cells that can engulf and digest foreign cells found in the blood.

Describe how the **ultrastructure** of a neutrophil is specialised to enable it to perform this function.



In your answer, you should use appropriate technical terms, spelt correctly.

.....

.....

.....

.....

.....

.....

.....

.....

..... **[4]**

[Total: 11]

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6 **(a)** **(i)** Name the process by which water leaves a cell.

..... **[1]**

(ii) Describe the routes that water molecules take through the **cell surface membrane**.

.....

.....

.....

.....

.....

..... **[2]**

A student carried out an investigation to determine the effects of different sucrose concentrations on cells from pieces of onion epidermis.

- Strips of epidermis were taken from an onion.
- Separate pieces of epidermis were placed into water and a range of sucrose solutions.
- The pieces of epidermis were left for 30 minutes before being removed.
- The pieces of epidermis were then viewed at high power under the microscope.

The student counted 100 cells from each piece of epidermis. The student noted how many cells had become plasmolysed.

The results are shown in Table 6.1.

Table 6.1

concentration of sucrose solution (mol dm^{-3})	water potential of sucrose solution (kPa)	percentage of cells plasmolysed (%)
0.0	0	0
0.1	–260	0
0.3	–860	3
0.4	–1120	7
0.5	–1450	39
0.6	–1800	57
0.7	–2180	83
0.8	–2580	94
1.0	–3500	100

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(b) None of the onion epidermis cells this student observed had burst when left in pure water.

Explain why plant cells do not burst when they are left in pure water.

.....

.....

..... **[2]**

(c) **(i)** The water potential of the onion epidermis cells can be assumed to be the same as the water potential of a solution that causes 50% plasmolysis.

Use the information in Table 6.1 to **estimate the water potential** inside these onion epidermis cells.

..... **[1]**

(ii) Suggest how the student could construct and use a graph to obtain a better estimate of the water potential.

.....

.....

.....

.....

..... **[2]**

(d) Suggest how the student could modify the procedure to make the results more reliable and accurate.

reliable .....

.....

.....

.....

accurate .....

.....

.....

.....

..... **[4]**

[Total: 12]

END OF QUESTION PAPER

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ADDITIONAL PAGE

If additional space is required, you should use the lined pages below. The question number(s) must be clearly shown.

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ADDITIONAL PAGE

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OCR
RECOGNISING ACHIEVEMENT

GCE

Biology

Advanced Subsidiary GCE

Unit **F211:** Cells, Exchange and Transport

Mark Scheme for January 2011

Oxford Cambridge and RSA Examinations

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Question			Expected Answers	Marks	Additional Guidance
1	(a)		mitosis / mitotic division **;**	**1**	**DO NOT CREDIT** meitosis, miosis **ACCEPT** mytosis
	(b)		**N ;** **L ;** **K ;** **J ;**	**4**	**Mark the first answer for each stage**. If the first answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = **0 marks**.
	(c)		**1** checking, genetic material / DNA / chromatin / chromosome(s) / genes, (for errors) **;** **2** protein synthesis **;** **3** synthesis / replication / increase in number of, organelles / named organelle **;** **4** ATP production / respiration **;** **5** <u>cell</u> growth / increase in <u>cell</u>, volume / size **;**	**2 max**	**Mark the first two suggestions only.** **IGNORE** DNA , replication / synthesis **ACCEPT** checking for mutations **DO NOT CREDIT** check for *cell* mutations **ACCEPT** named step e.g. transcription / translation / described **CREDIT** one named organelle only **ACCEPT** centriole as organelle **IGNORE** organelle growth **IGNORE** release energy **DO NOT CREDIT** produce / create, energy (in form of ATP) **IGNORE** cytoplasm replicates

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Question	Expected Answers	Marks	Additional Guidance
(d)			**Mark the first <u>two</u> suggestions only. Read as prose unless candidate has indicated two points by bullets or numbers – in this case mark the first comment in each bullet.**
	in plant (cell), plate / wall, forms (between new cells) **;** *idea of :* cytokinesis starts from middle of cell **;** (only) occurs in meristem **;** no centrioles **;** AVP **;**	**2 max**	Assume response refers to plants unless stated otherwise. Accept reverse argument for animals. **CREDIT** in animal no cell plate **IGNORE** plants have cell walls unqualified **ACCEPT** cytokinesis starts at outer edge in animals **ACCEPT** cambium / specialised tissues / cells **IGNORE** ref (root) cap, root tip / shoot tip **CREDIT** in animals most, cells / tissues, can divide **ACCEPT** centrioles not used to pull chromatids apart **DO NOT CREDIT** no spindle fibres in plants e.g. nuclear envelope does not reform in most plant cells in telophase I (it does form in most animal cells)
	Total	**9**	

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Question			Expected Answers	Marks	Additional Guidance
2	(a)		A = bronchiole ; B = alveolus / alveoli ;	2	**Mark the first answer for each letter.** If the first answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = **0 marks**. **DO NOT CREDIT** bronchus **ACCEPT** phonetic spelling of alveolus and bronchiole e.g. aveoli
	(b)		**1** large, surface area / SA :VOL ; **2** (alveolar) wall / epithelium, one cell thick ; **3** (made of) squamous, cells / epithelium ; **4** ref to surfactant ; *idea of:* **5** (very) close to, capillaries / blood supply **OR** rich blood supply / many capillaries ;	**2 max**	**Mark the first <u>two</u> suggestions only. Read as prose unless candidate has indicated two points by bullets or numbers – in this case mark the first comment in each bullet.** **ACCEPT** large SA / VOL, (alveoli) are small **and** in large number **DO NOT CREDIT** large amounts of tiny alveoli **ACCEPT** thin wall / thin barrier **DO NOT CREDIT** ref to cell wall / lining **IGNORE** alveolus one cell thick **ACCEPT** correct description of squamous cells (e.g. thin flat cell layer) **ACCEPT** pavement epithelium **IGNORE** reference to moist **DO NOT CREDIT** endothelium **IGNORE** ref to elastic fibres

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Question	Expected Answers	Marks	Additional Guidance
(c)	**1** (histamine), binds / attaches, to, receptor / glycoprotein **;** *idea of :* **2** in / on, plasma / cell surface, membrane (of muscle cell) **;** **3** <u>complementary</u> (shape) **;** **4** triggers response / causes effect, inside cells **;**	**2 max**	**binds to complementary receptor = 2 marks** **ACCEPT** glycolipids **IGNORE** binding site, ref antigens **ACCEPT** in / on, cell surface / cell membrane (of muscle cells) **ACCEPT** membrane bound receptors (on muscle cells) **CREDIT** correct examples of effects / details inside cells e.g. ref to opening sodium channes in cell surface membrane ref to second messenger ref to cyclic AMP ref to activation of enzymes / kinases ref to phosphorylation
(d)	*idea of :* **1** more tissue fluid formed / increase in volume of tissue fluid **;** **2** increase pressure in tissue **;** **3** swelling / inflammation / oedema**;** **4** (more) white blood cells pass into tissues **;** **5** larger molecules / (named) proteins , pass into tissue fluid **;**	**2 max**	**Mark the first <u>two</u> suggestions only. Read as prose unless candidate has indicated two points by bullets or numbers – in this case mark the first comment in each bullet.** **IGNORE** refs to the capillaries becoming more leaky **IGNORE** more water passes out **DO NOT CREDIT** *cells* swell **ACCEPT** (more) white blood cells leave the capillary **IGNORE** ref to more, glucose / nutrients / gases, leave blood capillary **IGNORE** ref to increased rate of diffusion
	Total	**8**	

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Question			Expected Answers	Marks	Additional Guidance
3			surface area to volume ratio ;		**ACCEPT** SA / VOL **or** SA:Vol
			<u>erythrocytes</u> ;		**ACCEPT** minor spelling errors if phonetically correct e.g. erythocyte **DO NOT CREDIT** erthocytes, erephosite, erthrocyte **IGNORE** red blood cells
			affinity ;		**ACCEPT** attraction
			oxyhaemoglobin ;		**ACCEPT** HbO / HbO_8 **DO NOT CREDIT** HbO_2 etc
			carbon dioxide / CO_2 / hydrogen ions / H^+ ;		**ACCEPT** carbonic acid **DO NOT CREDIT** CO^2 **DO NOT CREDIT** hydrogen, H, H_2
			Bohr / bohr (shift) ;	6	**ACCEPT** phonetic spellings e.g. borr, bore, borh
			Total	6	

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Question			Expected Answers	Marks	Additional Guidance
4	(a)		U ; R ; V ;	3	**Mark the first answer for each tissue.** If the first answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = **0 marks**.
	(b)		no cross walls / cells joined end to end / continuous ; hollow / no contents / no organelles / no cytoplasm ; (walls / vessels) lignified ; (bordered) pits in walls ;	2 max	**IGNORE** ref to dead cells / tubes **DO NOT CREDIT** lined / covered with lignin **DO NOT CREDIT** (walls) made of lignin **ACCEPT** xylem has lignin
	(c)	(i)	 evaporation / loss of water vapour ; from, aerial parts of plant / leaf / leaves ; via stomata ;	2 max	**movement of water vapour out of leaf = 2 marks** **DO NOT CREDIT** loss of water alone **CREDIT** loss through cuticle / epidermis

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Question	Expected Answers	Marks	Additional Guidance
(c) (ii)	*In the leaf:* *idea of :* **1** water loss (from leaf) is replaced **;** **2** via, **apoplast** / **symplast** / **vacuolar**, pathways **;** **3** down **water potential** gradient / AW **;** **4** (lost water replaced) by water from the **xylem ;** *In the xylem:* **5** (loss of water) causes, low / negative, (**hydrostatic**) pressure (at top / in leaf) **OR** creates pressure gradient **;** *idea of :* **6** water moves, from higher pressure to lower pressure / down pressure **gradient ;** **7** under **tension** / pulled up / drawn up **;** **8** by **<u>mass flow</u> ;** **9 cohesion** / attraction, between water molecules **;** *idea of :* **10** column / stream / chain, of water (molecules) **;** **QWC ;**	**4 max** **1**	**DO NOT CREDIT** ref to water potential in context of xylem **IGNORE** ref to root pressure or capillarity **ACCEPT** Ψ / WP for water potential For mp 2 & 3 **DO NOT CREDIT** in context of root **CREDIT** pathways described in correct context Idea of : water leaving xylem to enter leaf cells (that have lost water) **IGNORE** 'water moves by the cohesion-tension theory' without further explanation **ACCEPT** along pressure gradient Idea of: pulling force and not just water movement created by transpiration **DO NOT CREDIT** mp 7 or 8 in context of adhesion / capillarity or water potentials **IGNORE** suction, transpiration pull unqualified **CREDIT** hydrogen bonding between water molecules **IGNORE** long unqualified <u>TWO</u> terms used appropriately and spelt correctly: **xylem , apoplast/symplast/vacuolar , hydrostatic , gradient , cohesion / cohesive , tension , mass flow , water potential**

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Question			Expected Answers	Marks	Additional Guidance
		(iii)	*Ref to :* bubbles / air (present / being removed) **;** (blockage) in xylem **;** restore (continuous) column of water (in xylem) **;**	**2 max**	**air in the xylem = 2 marks**
			Total	**14**	

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Question			Expected Answers	Marks	Additional Guidance
5	(a)	(i)	nucleus / nuclear envelope / nuclear membrane / nucleolus ; membrane bound organelles / named organelle ; ribosomes larger ; (large) cell size / 20µm wide ;	2 max	**Mark the first <u>two</u> suggestions. Read as prose unless candidate has indicated two points by bullets or numbers – in this case mark the first comment in each bullet.** **ACCEPT** SER / RER / vesicle / cilia **DO NOT CREDIT** presence of ribosome / vacuole / flagellum / undulipodium
		(ii)	*Two marks for correct answer* 4500 ; ;	2	**No tolerance in initial measurement = exactly 90mm** If answer is incorrect, allow one mark for correct working i.e. any measurement divided by 20 e.g. 8.9 / 20
		(iii)	**1** provides, strength / stability / support (cell) ; **2** determines shape / changes shape / moves membrane (for endo / exocytosis) ; **3** movement of, organelles / named organelle / RNA / protein / chromosomes / chromatids ; **4** attachment to / hold, organelles / named organelle, in place; **5** make up, centrioles / spindle fibres ;	2 max	**Mark the first <u>two</u> suggestions. Read as prose unless candidate has indicated two points by bullets or numbers – in this case mark the first comment in each bullet.** **IGNORE** structure **IGNORE** movement of (whole) cell e.g. vesicles, cilia, mitochondria, ribosome

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Question			Expected Answers	Marks	Additional Guidance
	(b)	(i)	differentiation ;	1	**Mark the first answer.** If the first answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = **0 marks**. **DO NOT CREDIT** specialisation
		(ii)			**Max 2 marks for content if no reference is made at least once to large numbers of named organelles / receptors** **IGNORE** reasons or explanations **IGNORE** lobed nucleus **IGNORE** many enzymes
			1 (many) **lysosomes** / vesicles containing enzymes ;		**IGNORE** lysomes **ACCEPT** lyosomes **DO NOT CREDIT** lysosomes are enzymes
			2 (many) microfilaments / microtubules **OR** ref to, extensive / well developed, cytoskeleton ;		
			3 (many) **ribosome**s / (a lot of) **rough endoplasmic reticulum** / (a lot of) RER ;		
			4 (many) **mitochondria** ;		
			5 (lots of) **Golgi** ;		
			6 (many) receptor (sites) on, **cell surface / plasma , membrane** ;	3 max	**IGNORE** ref glycoproteins / glycolipids unqualified
			QWC ;	1	TWO terms used appropriately and spelt correctly: **lysosome(s), ribosome(s), rough endoplasmic reticulum, mitochondria / mitochondrion, Golgi/golgi, microfilaments/microtubules / cytoskeleton, cell surface membrane / plasma membrane.**
			Total	**11**	

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Question			Expected Answers	Marks	Additional Guidance
6	(a)	(i)	osmosis ;	1	**Mark the first answer.** If the first answer is correct and an additional answer is given that is incorrect or contradicts the correct answer then = **0 marks**. **DO NOT CREDIT** diffusion
		(ii)	fit between (phospho)lipids / through (phospho)lipid (bi)layer ; via, protein <u>channels</u> / protein <u>pores</u> / aquaporins ;	2	**DO NOT CREDIT** fit through phospholipids (molecules) **DO NOT CREDIT** carrier proteins – if this is used do not award mp 2 **IGNORE** transport proteins
	(b)		cell wall ; provides strength / withstands (internal) pressure / prevents cell membrane over expanding / exerts pressure potential ; limits uptake of water ;	2 max	**'has a strong cell wall' = 2 marks** **IGNORE** rigidity (of wall), cytoplasm pushes against cell wall **ACCEPT** stops uptake of water (when turgid)
	(c)	(i)	between –1451 and –1799 ;	1	**Ensure figure is a negative number** **CREDIT** a range or single value within this range

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Question			Expected Answers	Marks	Additional Guidance
		(ii)	*idea of:* **1** plot, percentage plasmolysed against water potential (of solution) / water potential on X axis and % plasmolysed on Y axis **;** *idea of:* **2** read down from 50% plasmolysed to water potential **;** **OR** *idea of:* **1** plot, % plasmolysed against sucrose concentration / sucrose concentration on X axis and % plasmolysed on Y axis **;** *idea of :* **2** read down from 50% plasmolysed to sucrose concentration **AND** look up equivalent water potential **;**	**2**	**IGNORE** ref to bars / bar graph **ACCEPT** axes wrong way round **ACCEPT** marking points shown correctly on annotated sketch line graph

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Question	Expected Answers	Marks	Additional Guidance
(d)	*reliable* **R1** observe more pieces of onion (epidermis from each solution) **;** **R2** count more cells (in each piece of epidermis) **;** **R3** calculate a mean **;** **R4** identify / ignore anomalous results **;** **max 3** *accurate* *idea of:* **A1** use, more / intermediate, concentrations within existing range / smaller gap between concentrations / closer (concentration) values **;** **A2** narrower range around 50% plasmolysis / 0.4 - 0.7 mol dm^{-3} / -1120 to -2180 kPa **;** **A3** take photographs and mark cells as counting **;**	**4 max**	**DO NOT CREDIT** 'repeats' unless qualified **ALLOW** 'repeat the results / experiment' to indicate more pieces of epidermis **IGNORE** average **ACCEPT** outliers for anomalies **IGNORE** removes / avoids, anomalies **IGNORE** lack of units **ACCEPT** examples of values quoted in between original values e.g. 0.25, 0.35, etc. **ACCEPT** 0.2 **and** 0.9 **ACCEPT** examples of values if clearly showing application of correct narrower range e.g. 0.45, 0.55 , 0.65 For A2 **DO NOT CREDIT** quoted values extend beyond correct narrower range e.g. 0.35, 0.55, 0.75
	Total	**12**	

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ADVANCED SUBSIDIARY GCE

BIOLOGY

Cells, Exchange and Transport

F211

Candidates answer on the Question Paper

OCR Supplied Materials:
- Insert (inserted)

Other Materials Required:
- Electronic calculator
- Ruler (cm/mm)

Tuesday 25 May 2010
Morning

Duration: 1 hour

OCE/13395

Candidate Forename		Candidate Surname	

Centre Number						Candidate Number				

INSTRUCTIONS TO CANDIDATES

- Write your name clearly in capital letters, your Centre Number and Candidate Number in the boxes above.
- Use black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure that you know what you have to do before starting your answer.
- Answer **all** the questions.
- Do **not** write in the bar codes.
- Write your answer to each question in the space provided. Additional paper may be used if necessary but you must clearly show your Candidate Number, Centre Number and question number(s).

INFORMATION FOR CANDIDATES

- The number of marks is given in brackets **[ ]** at the end of each question or part question.
- The total number of marks for this paper is **60**.
- You may use an electronic calculator.
- You are advised to show all the steps in any calculations.
- Where you see this icon you will be awarded marks for the quality of written communication in your answer.
- This document consists of **16** pages. Any blank pages are indicated.

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Answer **all** the questions.

1 **(a)** Fig. 1.1 is a diagram of a bacterium as seen under an electron microscope.

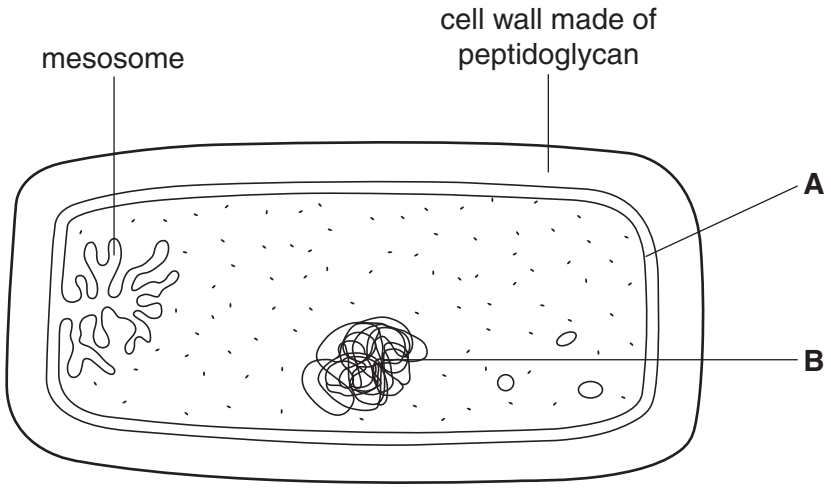


Fig. 1.1

(i) Name the structures labelled **A** and **B**.

A .....

B ..... **[2]**

(ii) It has been suggested that the mesosome has the same role as mitochondria in eukaryotic cells.

Suggest the role of the mesosome in prokaryotic cells, such as bacteria.

..... **[1]**

(iii) Eukaryotic cells, such as *Euglena*, contain membrane-bound organelles. Each organelle has a specific function in the cell.

State the **process** that is carried out in each of the organelles listed below.

ribosome .....

chloroplast ..... **[2]**

(b) Explain why a single-celled organism, such as *Euglena*, does **not** need a specialised area to carry out gaseous exchange.

.....

.....

.....

.....

..... **[2]**

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(c) The mammalian gas exchange system contains a variety of types of cells and tissues.

Complete Table 1.1, stating the function of each of the cells and tissues. The first row has been completed for you.

Table 1.1

cell / tissue	function
squamous epithelium	to provide a thin surface for a short diffusion distance
elastic tissue	....
ciliated epithelium	....
goblet cells	....
smooth muscle	....

[4]

[Total: 11]

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2 Fig. 2.1, **on the insert**, is a photomicrograph of a blood smear. The smear has been stained.

(a) State **two** reasons why the blood smear has been stained.

.....

.....

.....

.....

.....

..... **[2]**

(b) Suggest **one** detail that would be made visible if the micrograph were taken using:

(i) a scanning electron microscope

.....

(ii) a transmission electron microscope.

..... **[2]**

(c) The red colouration of the red blood cells is caused by the pigment haemoglobin. The main function of haemoglobin is to transport oxygen in the form of oxyhaemoglobin.

Fig. 2.2 shows the dissociation curves of adult oxyhaemoglobin (curve **A**) and fetal oxyhaemoglobin (curve **F**).

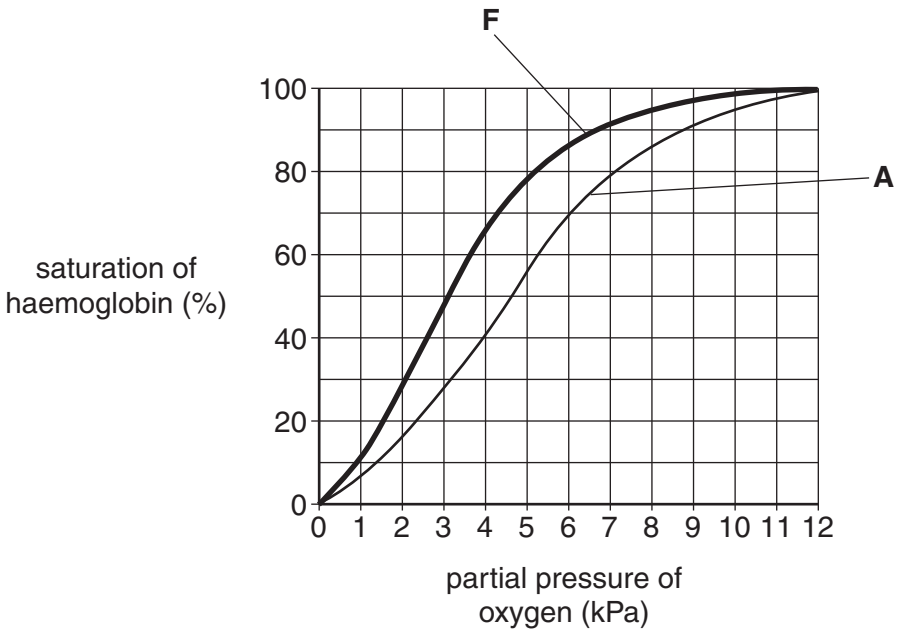


Fig. 2.2

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Explain why the curve for fetal oxyhaemoglobin is to the left of the curve for adult oxyhaemoglobin.



In your answer you should use appropriate technical terms, spelt correctly.

.....

.....

.....

.....

.....

.....

.....

.....

..... **[4]**

(d) In high partial pressures of carbon dioxide, the oxyhaemoglobin dissociation curve undergoes a change known as the Bohr shift.

(i) **Draw a curve on Fig. 2.2** to show the effect of the Bohr shift. **[2]**

(ii) Outline the benefits of the Bohr shift to actively respiring tissue.

.....

.....

.....

.....

..... **[2]**

[Total: 12]

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3 A student carried out an investigation involving uptake of the stain methylene blue by yeast cells.

The investigation involved adding methylene blue to a suspension of yeast cells. Samples of the stained yeast cells were heated to different temperatures.

The student then observed the cells at high power under a light microscope.

The results are shown in Table 3.1.

Table 3.1

temperature (°C)	cells observed stained blue (%)	colour of solution surrounding cells
10	98	colourless
20	96	colourless
30	97	colourless
40	96	colourless
50	73	colourless
60	12	light blue
70	2	blue
80	0	blue

(a) (i) Yeast cells take up methylene blue by active transport.

Using **only** the information provided in Table 3.1, outline the evidence that supports this statement.

.....

.....

.....

.....

..... **[2]**

(ii) Suggest why some cells did **not** stain blue at 20 °C.

.....

..... **[1]**

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(b) **(i)** Suggest **one** change that occurred to the plasma (cell surface) membranes of the yeast cells at temperatures above 60 °C.

.....

.....

..... **[1]**

(ii) Explain why the stained yeast cells lost their colour at higher temperatures.

.....

.....

.....

.....

..... **[2]**

(c) The student concluded that yeast cells are killed between 50 °C and 70 °C.

Suggest **one** way in which the student could have improved the **accuracy** of this experiment and **one** way in which he could have improved the **reliability**.

accuracy .....

.....

.....

reliability .....

.....

..... **[2]**

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(d) The student placed a small sample of the yeast suspension on a microscope slide and observed it under high power.

Fig. 3.1 shows what the student observed.

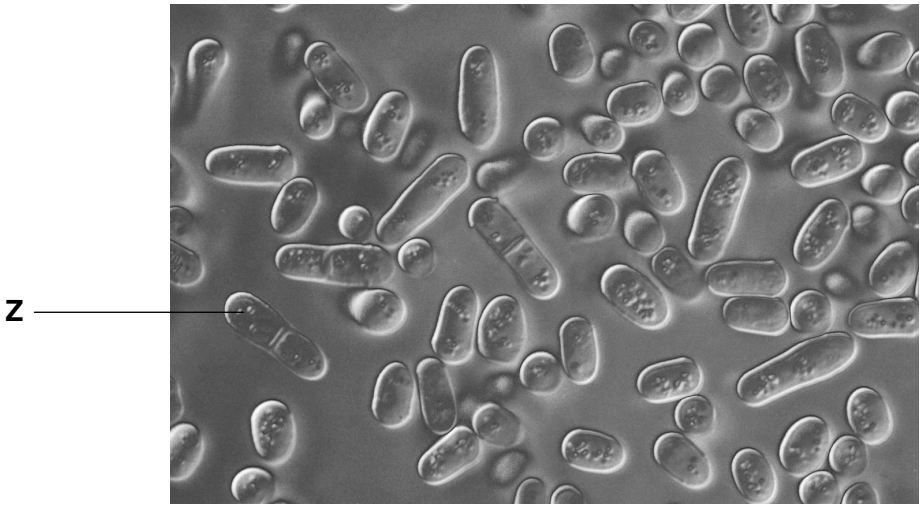


Fig. 3.1

Cell **Z** is undergoing a process called *budding*.

Outline the process of budding in yeast.

.....

.....

.....

.....

..... **[2]**

[Total: 10]

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4 Fig. 4.1 shows diagrams of two different types of cells, **X** and **Y**.

The cells are **not** drawn to scale.

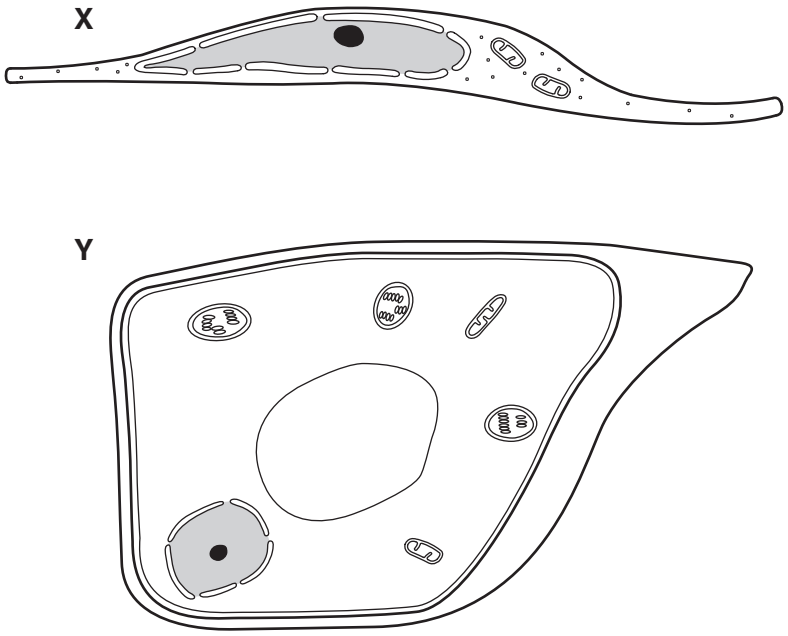


Fig. 4.1

(a) (i) State, using **only the information in Fig. 4.1**, two **differences** between plant cells and animal cells.

1 .....

.....

2 .....

..... **[2]**

(ii) Cell **Y** is a guard cell.

State, using **only the information in Fig. 4.1**, one adaptation of this cell and explain how the adaptation allows the cell to carry out its function.

adaptation .....

explanation .....

.....

..... **[2]**

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(b) Fig. 4.2 shows drawings of the six chromosomes inside an animal cell viewed during late prophase of mitosis.

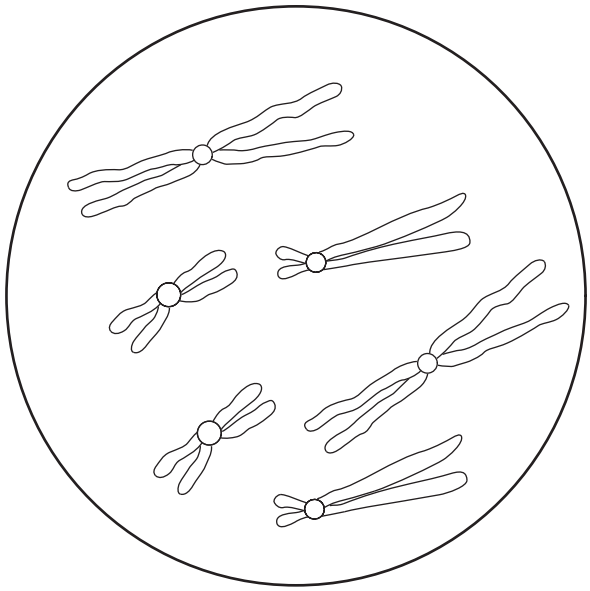
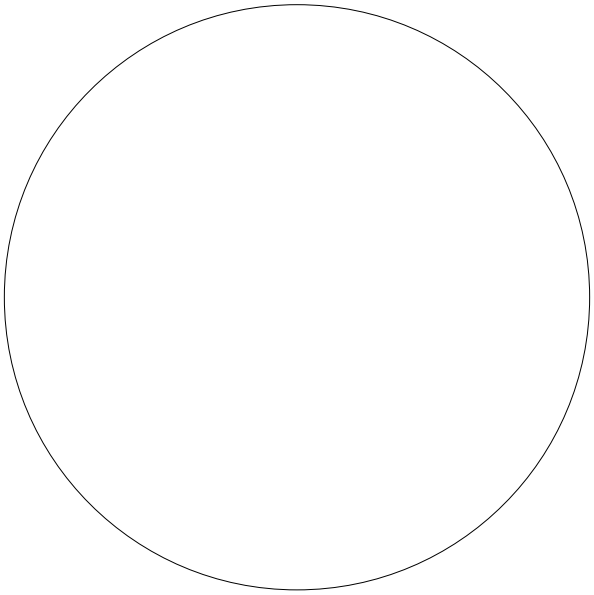


Fig. 4.2

(i) Identify **one pair** of *homologous chromosomes* in Fig. 4.2 by drawing around each chromosome in the pair **on the diagram**. **[1]**

(ii) The nucleus of a sperm cell is produced by **meiosis**.

Draw a diagram in the space below to represent the chromosomes that are present in the nucleus of a sperm cell from **the same animal**.



[2]

[Total: 7]

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QUESTION 5 STARTS ON PAGE 12

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5 Fig. 5.1 shows the possible pathways taken by water across the root of a plant.

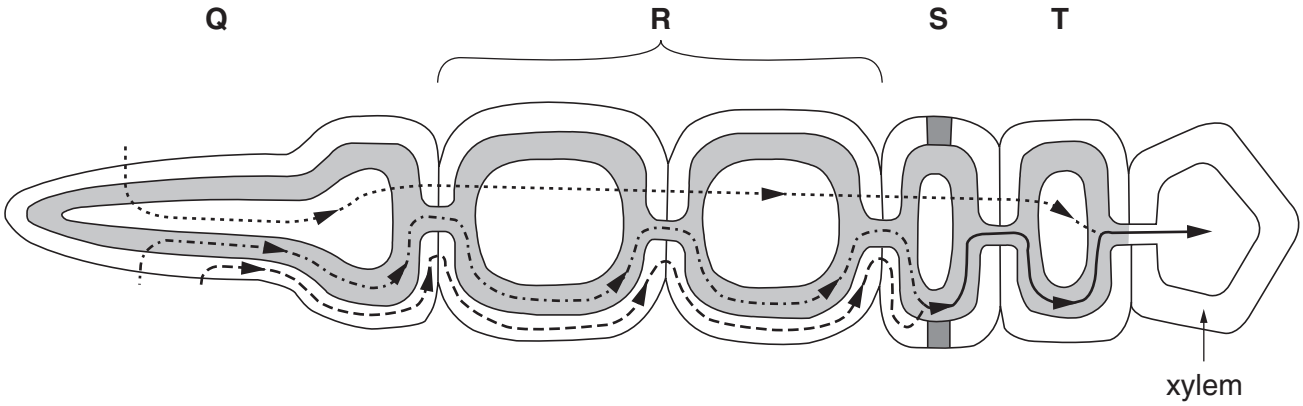


Fig. 5.1

(a) (i) Name the process by which water enters cell **Q** from the soil.

..... **[1]**

(ii) Pathway 1 is known as the vacuolar pathway, as the water passes into and through the cell vacuoles.

Name pathway 2 and pathway 3.

pathway 2 .....

pathway 3 ..... **[2]**

(iii) State which letter, **Q**, **R**, **S** or **T**, on Fig. 5.1, represents the endodermis.

..... **[1]**

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(b) Describe **and** explain how water is moved up the xylem from the roots to the leaves.



In your answer you should use appropriate technical terms, spelt correctly.

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..... **[5]**

(c) Table 5.1 shows a comparison of xylem vessels and phloem sieve tube elements.

Complete the table. The first row has been done for you.

Table 5.1

feature	xylem vessel	phloem sieve tube element
cells living or dead	dead	living
bordered pits present or absent		
lignin present or absent		
substances transported		
direction of transport		

[4]

[Total: 13]

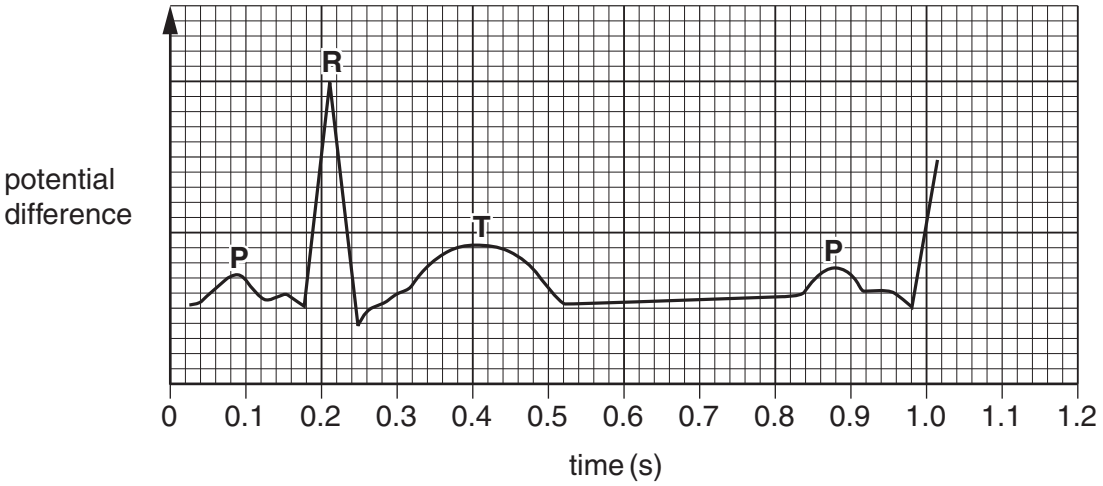
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6 Fig. 6.1 shows two electrocardiogram (ECG) traces.

- Trace **A** is a normal trace.
- Trace **B** is a trace from a heart after treatment with the drug digitalis.

Trace **A** – an electrocardiogram from a normal heart



Trace **B** – an electrocardiogram from a heart after treatment with digitalis

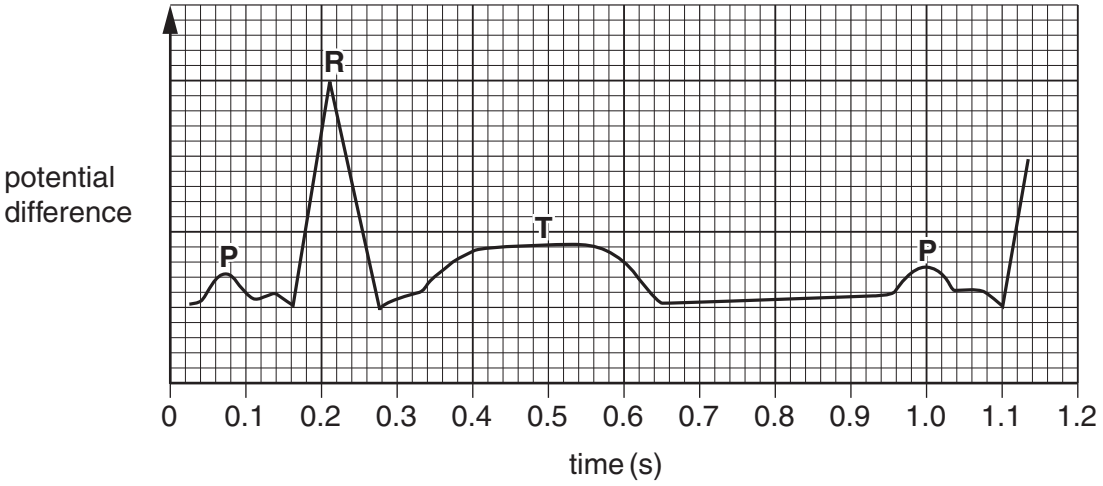


Fig. 6.1

(a) Calculate the heart rate using the information in Trace **A**.

Show your working.

Answer = ... beats per minute **[2]**

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(b) Using the information in Fig. 6.1, state **two** effects of digitalis on the activity of the heart.

1 .....

.....

2 .....

..... **[2]**

(c) Describe the roles of the sinoatrial node (SAN) **and** the atrioventricular node (AVN) in coordinating the cardiac cycle.

.....

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..... **[3]**

[Total: 7]

END OF QUESTION PAPER

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GCE

Biology

Advanced GCE **F211**

Cells, Exchange and Transport

Mark Scheme for June 2010

Oxford Cambridge and RSA Examinations

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Question			Expected Answers	Marks	Additional Guidance
1	(a)	(i)	**A** = plasma / cell surface**,** membrane **;** **B** = DNA / chromosome / chromatin / genetic material **;**	2	**DO NOT CREDIT** membrane, cell membrane **DO NOT CREDIT** chromosome**s** (do not accept plural) **CREDIT** loop of / circle of, DNA **DO NOT CREDIT** plasmid, RNA **ACCEPT** nucleoid
1	(a)	(ii)	production of ATP **;** aerobic respiration **;**	max 1	**ACCEPT** named stages of aerobic respiration e.g. Krebs cycle, oxidative phosphorylation, ETC, chemiosmosis, link reaction, substrate level phosphorylation **DO NOT CREDIT** glycolysis, ATP *for* respiration **DO NOT CREDIT** *produce* energy (in form of ATP) **IGNORE** provide / release energy unqualified
1	(a)	(iii)	protein synthesis / translation **;** photosynthesis / described **;**	2	**ACCEPT** production / creation, of proteins / polypeptides, assembly of proteins from amino acids **IGNORE** autotrophic nutrition **DO NOT CREDIT** absorption of light unqualified
1	(b)		large surface area to volume ratio **;** small so demand for**,** O_2 / CO_2**,** is low **;** *idea of:* diffusion (alone) is adequate to meet needs **;**	2	**ACCEPT** large SA**:**Vol or large SA/Vol **ACCEPT** small Vol**:**SA ratio or small Vol/SA **DO NOT CREDIT** large surface area alone **IGNORE** gases alone, nutrients **ACCEPT** *idea of* : body SA large enough to meet needs by diffusion **ACCEPT** idea of : diffusion distance short

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Question			Expected Answers	Marks	Additional Guidance
1	(c)		<table><tr><td>cell / tissue</td><td>function in the lungs</td><td></td></tr><tr><td></td><td></td><td></td></tr><tr><td></td><td>recoil **OR** return to original**,** size / shape **OR** to help expel air **OR** prevents alveoli bursting</td><td>;</td></tr><tr><td></td><td>waft / wave / move / AW**,** mucus</td><td>;</td></tr><tr><td></td><td>secrete / release / produce, mucus</td><td>;</td></tr><tr><td></td><td>constrict the airway / AW</td><td>;</td></tr></table>	4	**IGNORE** stretch / expand **ACCEPT** ref to lungs, alveoli, airways recoiling etc **DO NOT CREDIT** ref trachea / bronchi recoiling **ACCEPT** transport / remove**,** mucus **DO NOT CREDIT** dirt particles without ref to mucus **DO NOT CREDIT** excrete mucus **ACCEPT** narrows lumen OR controls, airflow / diameter, of airways **DO NOT CREDIT** ref to alveoli OR greater airflow
			Total	**11**	

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Question			Expected Answers	Marks	Additional Guidance
2	(a)		visible / can be seen / increase contrast ; named example of what is now visible (after staining) ;	2	*First mark is for 'seeing' and the second mark is for 'recognising' what can now be seen.* **ACCEPT** see detail **IGNORE** ref to resolution **ACCEPT** recognise different *types* of white blood cell **ACCEPT** can (now) see**,** nucleus / organelles / named organelles **IGNORE** recognise parts inside red blood cell **IGNORE** can now see red blood cells (already visible) 'can now see red and white blood cells' = 2 marks
2	(b)	(i)	3D shape can be seen / greater depth of field ; can see**,** surface features / detail ;	max 1	**DO NOT CREDIT** shape alone **ACCEPT** 'you can see what is on the surface' **IGNORE** 'you see the surface better' because this needs further clarification i.e. features, shape, named structure
		(ii)	smaller / named, organelle (becomes visible) ; shapes / details of organelles ;	max 1	**ACCEPT** named structure(s) such as lysosome, RER, mitochondrion, ribosome, Golgi , vesicle, nucleolus **DO NOT CREDIT** nucleus or chloroplast (already visible)

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Question			Expected Answers	Marks	Additional Guidance
2	(c)		*This is a QWC question* **1** fetal <u>haemoglobin</u> has a high<u>er</u> **<u>affinity</u>** (for oxygen) (than adult haemoglobin) **;** **2** (fetal Hb) takes up oxygen in low(er) **partial pressure** of oxygen **;** **3 placenta** has low partial pressure of oxygen **;** **4** at low partial pressure of oxygen / in placenta**,** adult (oxy)haemoglobin will **dissociate** / AW **;**	max 3	**IGNORE** oxyhaemoglobin for haemoglobin **ACCEPT** Hb for <u>haemoglobin</u> (but not HbO) **ACCEPT** fetal Hb becomes *more* saturated at a *low(er)* partial pressure of oxygen **ACCEPT** ppO_2 / pO_2 / oxygen tension / O_2 concentration, for partial pressure of oxygen **ACCEPT** in placenta mother's haemoglobin, releases its oxygen / saturation drops
			QWC (two terms used in correct context and spelt correctly)**;**	max 1	Any **two** terms from the following**:** affinity, dissociate / dissociation, placenta, partial pressure / oxygen tension, saturation / saturated

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Question			Expected Answers	Marks	Additional Guidance
2	(d)	(i)	curve to right of curve A ; appropriate sigmoid shape ;	2	Curve should start at 0% on y axis and reach at least 80% on y axis
2	(d)	(ii)	**1** (actively respiring tissue) needs / requires, *more* oxygen ; **2** for aerobic respiration / to release *more* energy ; **3** (actively respiring tissue produces) *more* CO_2 ; **4** haemoglobin involved in transport of CO_2 ; **5** less haemoglobin available to combine with O_2 ; **6** (Bohr shift) causes *more* oxygen to be released ;	max 2	*idea* of '*more*' should be clear as shown (MP 1,2,3,6) **ACCEPT** make *more* ATP **ACCEPT** produces *a lot* of CO_2 / as CO_2 levels rise **CREDIT** detail to include carbonic acid dissociation / formation of haemoglobinic acid / HHb etc **DO NOT CREDIT** oxygen released *more* quickly / quicker **ACCEPT** oxygen released *more*, readily / easily 'More CO_2 produced so more O_2 released' = 2 marks
			Total	**12**	

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Question			Expected Answers	Marks	Additional Guidance
3	(a)	(i)			*MP 1 awarded for observation that the stain was no longer in the surrounding solution and not for the % of cells containing the stain.*
			1 at low temperatures, all stain is in cells **OR** no stain in surrounding solution **;**		**ACCEPT** the stain is not evenly distributed between cells and solution **ACCEPT** stain doesn't move out of cells
			2 (taken up / held) against**,** diffusion / concentration**,** gradient **;**		**ACCEPT** *up* the diffusion gradient
			3 at high temperature stain not held in cells **;**		**ACCEPT** solution now contains stain **ACCEPT** 0% = none / no cells (stained) *MP **1** and **3** - must be stated rather than inferred from quoted figs*
			4 at high temperature enzymes denatured so no ATP for active transport (of stain) **;**		**IGNORE** 'enzymes denatured' alone **CREDIT** active transport / carrier, proteins denatured **ACCEPT** mitochondria stopped working so no ATP produced
			5 use of correct comparative figs to illustrate a point **;**		e.g. 97% at 30°C but 0% at 80°C **IGNORE** figs without units
			AVP **; ;**	max 2	

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Question			Expected Answers	Marks	Additional Guidance
3	(a)	(ii)	cells, dead / not respiring ; no, (metabolic) energy / ATP, to take up stain ; AVP ;	max1	**DO NOT CREDIT** 'burst' as these cannot be seen **ACCEPT** inhibitor present / membrane impermeable **ACCEPT** no functioning mitochondria
3	(b)	(i)	(membrane) structure disrupted ; (phospho)lipid bilayer, melts / more fluid ; (membrane) proteins / carrier molecules, denatured / unable to function ; (membrane) becomes more permeable ;	max 1	*Mark first suggestion and if correct award mark – if further answers contradict first answer do not award mark.* **ACCEPT** damaged, destroyed, break down **IGNORE** *membrane,* denatured / more fluid **IGNORE** lipid *molecules* melt **ACCEPT** lose shape for denatured **ACCEPT** leaky **IGNORE** refs to bonds breaking

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Question			Expected Answers	Marks	Additional Guidance
3	(b)	(ii)	membrane <u>permeable</u> (to stain) **;** methylene blue, leaked out of cells / released to solution **;** by diffusion / down concentration gradient **;**	max 2	**IGNORE** leaky **ACCEPT** stain / blue / pigment, moved out **IGNORE** lost *colour* / *colour* moved out (it is in stem of question) **ACCEPT** by active transport (assuming thermostable enzymes) blue / stain, diffuses out = 2 marks
3	(c)		*accuracy* take readings at intermediate temperatures (between 50 °C – 70 °C) **;** *reliability* take more, readings at each temperature / repetitions **;**	2	*Mark first suggestion only* **DO NOT CREDIT** wider temperature range OR more temperatures unqualified OR more regular intervals **ACCEPT** take readings every 5 degrees / °C **ACCEPT** ref. to haemocytometer **ACCEPT** colorimeter used to measure colour intensity of blue solution **DO NOT CREDIT** ref to use of c<u>a</u>lorimeter **ACCEPT** repeat experiment (ideally 3 readings for each temperature) , increase the number of cells observed **ACCEPT** replica / replicate for repeat

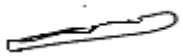
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Question			Expected Answers	Marks	Additional Guidance
3	(d)		nucleus divides / mitosis **;** *idea of* : cell**,** swells on one side / bulges **;** nucleus / cytoplasm / organelles**,** move into**,** bud / bulge **;** pinches off / cell wall forms**,** (so bud becomes a separate cell) **;**	max 2	**ACCEPT** asexual reproduction / cloning **IGNORE** cell splits, ref to genetically identical cells **IGNORE** *bud* forms on side **IGNORE** replicated DNA enters bud **ACCEPT** cytokinesis **IGNORE** two cells are formed / bud separates unqualified
			Total	**10**	

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Question			Expected Answers	Marks	Additional Guidance
4	(a)	(i)	*plant cell / Y, has*: a wall ; chloroplasts ; vacuole ;	max 2	Credit reverse argument **ACCEPT** thylakoid, discs / membranes OR granum(a) **IGNORE** chlorophyll
4	(a)	(ii)	**A1** a vacuole ; **E1** to take up water / to become turgid ; **A2** cell wall thicker on one side ; **E2** causes, cell to bend / open stoma(ta) ; **A3** mitochondria ; **E3** generates ATP (for active transport) ;	max 2	*Mark adaptation (A) as stand-alone* *Ensure explanation (E) stated is appropriately linked to adaptation* **DO NOT CREDIT** curved cell wall / thick cell wall unqualified **ACCEPT** close stoma(ta) if adaptation correct **IGNORE** ref to chloroplasts
4	(b)	(i)	two homologous chromosomes circled ;	1	**ACCEPT** one circle around both chromosomes or two circles The two chromosomes must be of same length 

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4	**(b)**	**(ii)**	*three* chromosomes, one from each pair **;** chromosomes drawn as one bar **;**	2	*Chromosomes should be of different lengths however if two are of similar length, look for different centromere position to award mark* **ACCEPT**  **DO NOT CREDIT** two joined together at centromere 
			Total	**7**	

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Question			Expected Answers	Marks	Additional Guidance
5	(a)	(i)	osmosis ;	1	
		(ii)	**2** = symplast (pathway) ; **3** = apoplast (pathway) ;	2	**ACCEPT** symplastic **ACCEPT** apoplastic
		(iii)	S ;	1	

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Question			Expected Answers	Marks	Additional Guidance
5	(b)		*This is a QWC question* **1** water moves into xylem down **water potential** gradient **;** **2 root pressure** / high (**hydrostatic**) **pressure** at bottom of xylem **;** **3** water vapour loss / **transpiration** / **evaporation**, at leaves / top of plant **;** **4** (creating) low (hydrostatic) pressure at top of xylem **;** **5** water**,** under **tension** / pulled up (in a continuous column) **;** **6 cohesion** between water molecules / described **;** **7 adhesion** of water molecules to xylem / described **;** **8 capillary action** / described **;** **9** water moves up (xylem / stem) by **mass flow ;** **10** from high(er) (hydrostatic) pressure to low(er) (hydrostatic) pressure / down (hydrostatic) pressure gradient **;**	max 4	**ACCEPT** ψ for water potential **ACCEPT** water moves from high ψ to low ψ **IGNORE** drawn for pulled up **ACCEPT** ref to xylem being very narrow so water rises
			QWC (three terms used in correct context and spelt correctly) **;**	1	Any **three** terms from the following **:** water potential, hydrostatic pressure, transpiration / evaporation, cohesion / cohesive, adhesion / adhesive, tension, root pressure, capillary action / capillarity, mass flow

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Question	Expected Answers	Marks	Additional Guidance
5 (c)			

xylem vessel	phloem sieve tube element	
present	absent	;
present	absent	;
(water and), minerals / ions / salts	products of photosynthesis / sucrose / assimilates / amino acids / minerals / ions / salts / plant 'hormones'	;
(only) up stem / towards leaves	both directions / up and down / from source to sink	;

One mark per row
Both statements must be correct to achieve mark

DO NOT CREDIT ticks and crosses

Read whole list – if any suggestion is wrong then do not award mark
XYLEM
DO NOT CREDIT 'nutrients' OR 'water' alone
PHLOEM
ACCEPT 'sugar' in place of sucrose
IGNORE unspecified 'solutes'
DO NOT CREDIT glucose

ACCEPT arrows ↑ (xylem) ↓↑ (phloem)
DO NOT CREDIT 'all directions'
IGNORE ref to pits / lateral movement

			Total	**13**	

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Question			Expected Answers	Marks	Additional Guidance
6	(a)		a single value between 67 and 80 ; ;	max 2	two marks for correct answer If answer incorrect, allow one mark for appropriate working i.e. 60 divided by time from trace selected by candidate
6	(b)		heart rate, slower / lower / reduced / 60 – 63 beats per minute ; rest period / diastole longer ; ventricle takes longer to contract / ventricular systole longer ;	max 2	*Mark first point on each numbered line* **ACCEPT** length of one beat is longer **DO NOT CREDIT** 'slows heart's activity' **ACCEPT** T wave elongated / increases from 0.24s to 0.32s / increases by 0.1 s **IGNORE** name of chamber **ACCEPT** R wave slightly elongated / increases from 0.07s to 0.12s / increases by 0.05 s
6	(c)		SAN, is pacemaker / initiates heart beat ; (SAN sends) impulse / wave of excitation, over atria (walls) ; AVN delays impulse ; (AVN) sends impulse down, septum / bundle of His / Purkyne fibres ;	max 3	**ACCEPT** *starts*, wave of excitation / action potential / electrical impulse **IGNORE** 'sends out' (wave) **IGNORE** *through* / *to,* the atrium **DO NOT CREDIT** signal / message for impulse, **allow ecf** **DO NOT CREDIT** pulse **IGNORE** delays contraction **ACCEPT** Purkinje
			Total	**7**	

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ADVANCED SUBSIDIARY GCE
BIOLOGY
Cells, Exchange and Transport

F211

Candidates answer on the Question Paper

OCR Supplied Materials:
None

Other Materials Required:
- Electronic calculator
- Ruler (cm/mm)

Tuesday 12 January 2010
Morning

Duration: 1 hour

OCE/10476

Candidate Forename		Candidate Surname	

Centre Number						Candidate Number				

INSTRUCTIONS TO CANDIDATES

- Write your name clearly in capital letters, your Centre Number and Candidate Number in the boxes above.
- Use black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure that you know what you have to do before starting your answer.
- Answer **all** the questions.
- Do **not** write in the bar codes.
- Write your answer to each question in the space provided, however additional paper may be used if necessary.

INFORMATION FOR CANDIDATES

- The number of marks is given in brackets **[ ]** at the end of each question or part question.
- The total number of marks for this paper is **60**.
- You may use an electronic calculator.
- You are advised to show all the steps in any calculations.
- Where you see this icon you will be awarded marks for the quality of written communication in your answer.
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Answer **all** the questions.

1 **(a)** State the maximum magnification that can be achieved by a light microscope and a transmission electron microscope.

Select your answers from the list below.

10x 40x 100x 400x 1500x 25 000x 50 000x 500 000x

light microscope x

transmission electron microscope ..... x **[2]**

(b) Describe what is meant by the term *resolution*.

.....

.....

.....

..... **[2]**

(c) Fig. 1.1 is an electron micrograph of xylem tissue in the stem of a plant.

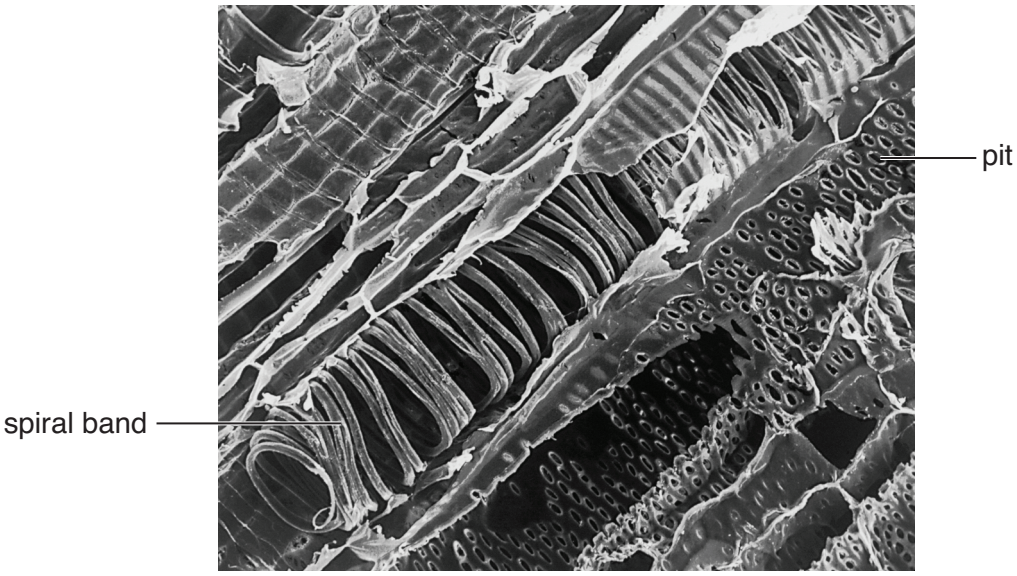


Fig. 1.1

(i) State **one** function of xylem tissue.

.....

..... **[1]**

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(ii) The spiral band in the xylem vessel shown in Fig. 1.1 contains a substance called lignin.

State the function of this spiral band of lignin **and** explain why it is important that the xylem vessel becomes lignified in this way.

.....

.....

.....

.....

.....

.....

..... **[3]**

(iii) Explain the function of the pits seen in Fig. 1.1.

.....

.....

.....

.....

..... **[2]**

[Total: 10]

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2 **(a)** **(i)** Explain what is meant by the term *tissue*.

.....

.....

.....

..... **[2]**

(ii) Name **one** type of epithelial tissue found in the lungs.

.....

..... **[1]**

(b) Explain why the lungs can be considered to be an organ.

.....

.....

.....

..... **[2]**

(c) In the lungs, goblet cells secrete mucus. The mucus is then moved by cilia.

Name **one** cellular structure from the list below that is associated with each of the following functions. You must select a structure once only.

mitochondria **ribosome** **Golgi vesicle** **centriole** **nucleus** **cytoskeleton**

(i) release of energy .....

(ii) movement of cilia .....

(iii) secrete mucus ..... **[3]**

[Total: 8]

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3 **(a)** Complete the passage below.

Membranes have a variety of functions in cells. All membranes are ..... permeable. This means that they allow the passage of certain substances by processes such as active transport or ..... through the membrane. The cell surface membrane, also known as the ..... membrane, surrounds the cytoplasm. The cell surface membrane consists of a bilayer of ..... . To stabilise the structure of the membrane and keep it fluid, molecules of ..... are also found in this bilayer. **[5]**

(b) Membranes contain a variety of proteins. Some of these proteins are combined with carbohydrates to form glycoproteins.

Describe the functions of glycoproteins in the cell surface membrane.

In your answer you should use appropriate technical terms, spelt correctly.

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..... **[5]**

[Total: 10]

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4 Fig. 4.1 shows a potometer, a piece of apparatus used for estimating the rate of transpiration.

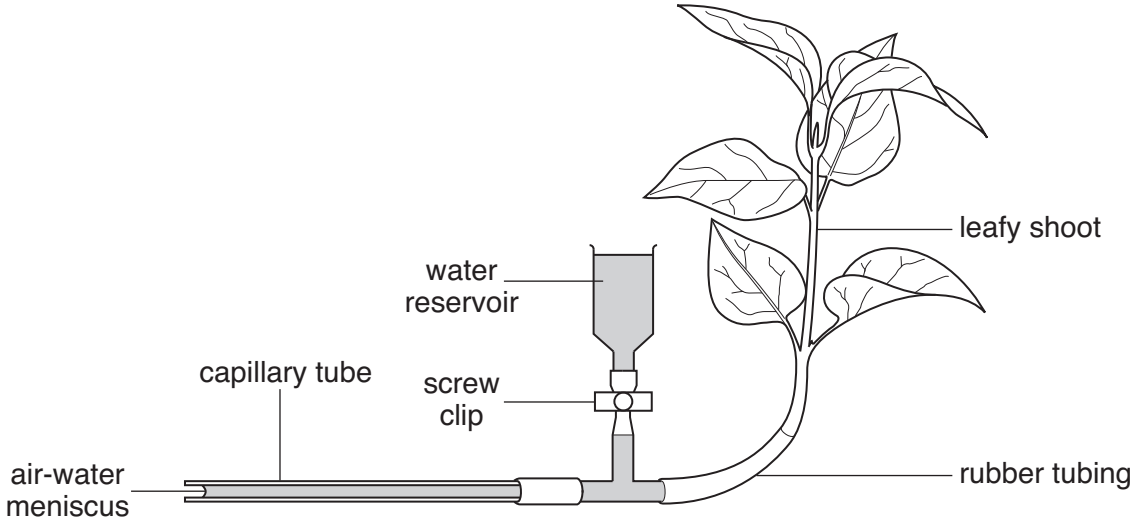


Fig. 4.1

(a) State **one** essential component of the apparatus, not shown in Fig. 4.1, that must be added before any results can be recorded.

..... **[1]**

(b) Describe **three** steps a student should take when **setting up** the potometer to ensure that the apparatus works correctly.

1 .....

.....

2 .....

.....

3 .....

..... **[3]**

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(c) A student used the apparatus shown in Fig. 4.1 to investigate how transpiration rates vary during the day. The student placed the potometer on a window ledge in the laboratory and estimated the rate of transpiration four times during the day.

The results are shown in Table 4.1.

Table 4.1

time of day	rate of transpiration (arbitrary units)			
	replicate 1	replicate 2	replicate 3	mean
10.00	32	29	31	30.7
12.00	37	35	38	36.7
14.00	23	26	25	24.7
16.00	25	27	24	

(i) Calculate the mean value for the rate of transpiration at 16.00 hours.

Give your answer to **one decimal place**.

Answer = ... **[1]**

(ii) Explain why, for each time of the day, the student carried out three replicates to calculate a mean.

.....

.....

.....

..... **[2]**

(iii) Suggest **two** possible reasons, other than light and temperature, why the rate of transpiration was **lower** in the afternoon than in the morning.

1 .....

.....

2 .....

..... **[2]**

(iv) Explain why the potometer only gives an **estimate** of the rate of transpiration.

.....

.....

.....

..... **[2]**

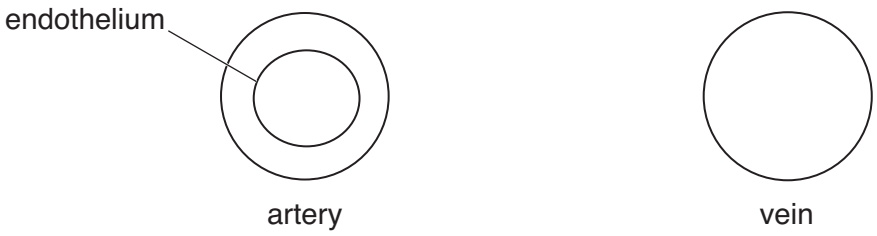
[Total: 11]

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5 (a) (i) Fig. 5.1 represents a transverse section of an artery and a vein.

Draw a line to show the relative position of the endothelium of the **vein**.



[1]

Fig. 5.1

(ii) State **two other** ways in which the wall of an artery is different from the wall of a vein.

1 .....

.....

2 .....

..... **[2]**

(b) (i) Blood in the arteries has a high hydrostatic pressure.

State how this hydrostatic pressure is generated in the heart.

.....

..... **[1]**

(ii) Explain why the hydrostatic pressure of the blood drops as blood moves away from the heart.

.....

.....

.....

..... **[2]**

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(iii) Capillaries have walls that are one cell thick.

Fig. 5.2 shows how the hydrostatic pressure of the blood changes as it moves through a capillary.

Fig. 5.2 also shows the water potential of the blood, due largely to the plasma proteins, which tends to move water into the blood.

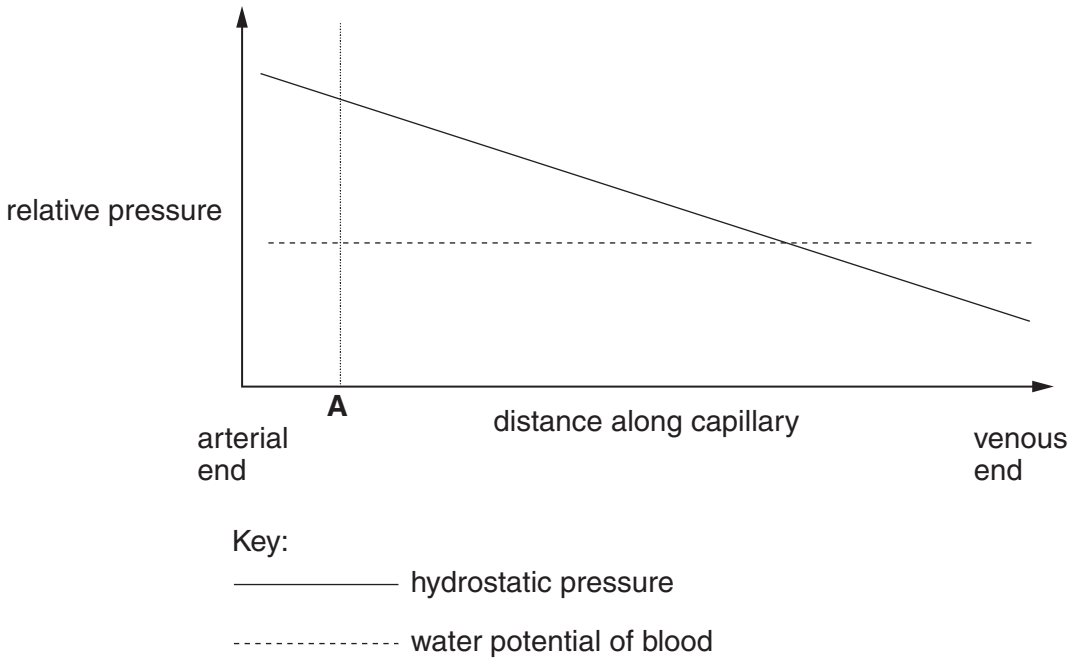


Fig. 5.2

Describe **and** explain what happens to the blood plasma at point **A** along the capillary in Fig. 5.2.

.....

.....

.....

.....

.....

.....

.....

..... **[3]**

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(c) Carbon dioxide is produced in tissues as a waste product of respiration.

The majority of carbon dioxide is carried as hydrogencarbonate ions (HCO_3^-) in the plasma.

Fig. 5.3 shows the chemical pathway in which carbon dioxide is converted into HCO_3^- in a red blood cell.

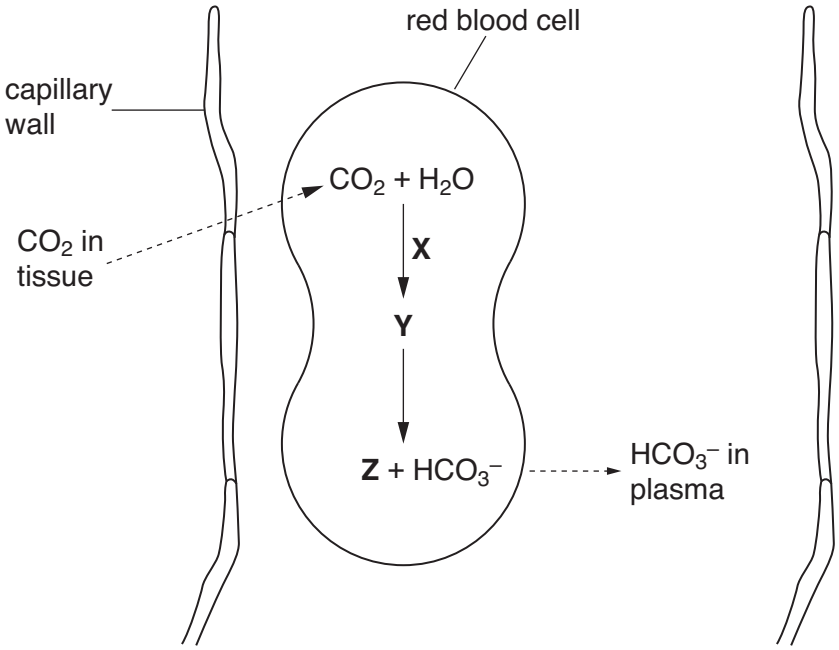


Fig. 5.3

Identify the following:

enzyme **X** .....

substance **Y** .....

ion **Z** ..... **[3]**

[Total: 12]

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6 Fig. 6.1 is a diagram of a spirometer, a piece of apparatus used to measure some aspects of breathing, such as breathing rate and vital capacity.

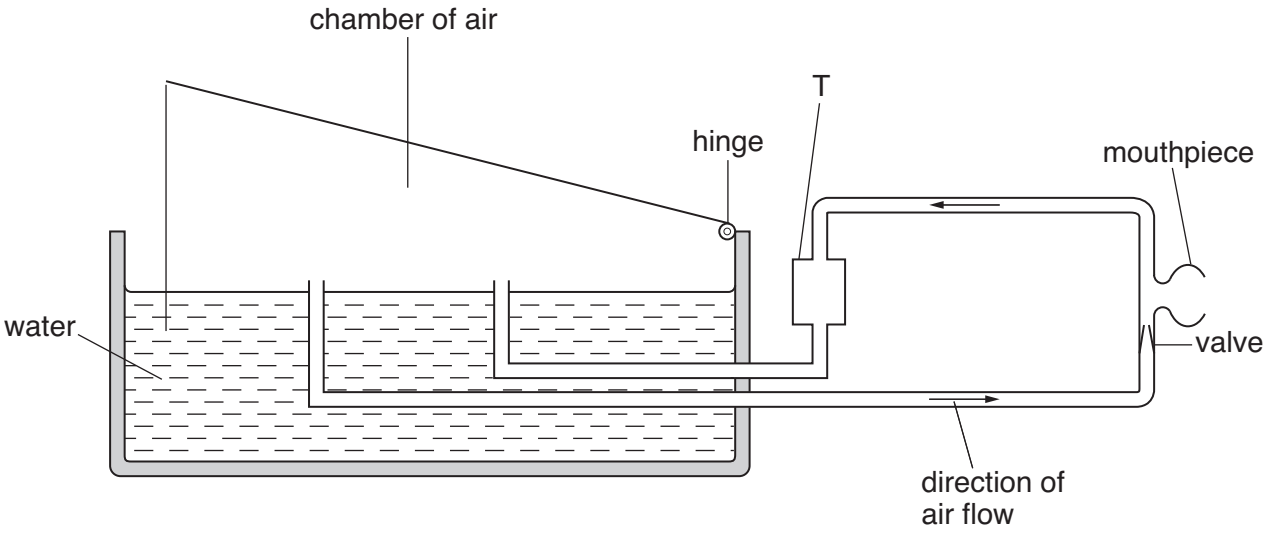


Fig. 6.1

(a) (i) Outline the mechanism of **inspiration**.

In your answer you should use appropriate technical terms, spelt correctly.

.....

.....

.....

.....

.....

..... **[3]**

(ii) A person breathes through the mouthpiece of a spirometer.

State what happens to the air chamber in Fig. 6.1 during **inspiration**.

..... **[1]**

(iii) Chamber **T** contains a chemical that absorbs carbon dioxide.

Suggest a chemical that could be used in chamber **T** to absorb carbon dioxide.

.....

..... **[1]**

QUESTION 6(b) STARTS ON PAGE 12

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(b) Explain why a person using the spirometer to measure their vital capacity should wear a nose clip.

.....

.....

.....

..... **[2]**

(c) State **two** other precautions that should be taken when using a spirometer to measure vital capacity.

1 .....

.....

2 .....

..... **[2]**

[Total: 9]

END OF QUESTION PAPER

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OCR
RECOGNISING ACHIEVEMENT

GCE

Biology

Advanced GCE **A2 H421**

Advanced Subsidiary GCE **AS H021**

Mark Scheme for the Units

January 2010

HX21/MS/R/10J

Oxford Cambridge and RSA Examinations

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CONTENTS

Advanced GCE Biology (H421)

Advanced Subsidiary GCE Biology (H021)

MARK SCHEMES FOR THE UNITS

Unit/Content	Page
F211 Cells, Exchange and Transport	1
F212 Molecules, Biodiversity, Food and Health	18
F214 Communication, Homeostasis & Energy	37
Grade Thresholds	54

Question			Expected Answers	Marks	Additional Guidance
1	(c)	(ii)	*Functions:* **F1** (lignin), strengthens / thickens**,** the (xylem) <u>wall</u> **;** **F2** waterproofing (wall) / AW **;** **F3** (improving) adhesion of water (molecules) **;** **F4** (spiral) pattern allows flexibility / stretching / movement**;** **2 max**		**ACCEPT** support only if in specific context of supporting the xylem <u>wall</u> **ACCEPT** waterproofs cell **DO NOT ACCEPT** adhesion **and** cohesion when used together Flexibility / stretching must ref, *pattern* of lignin laid down i.e. spirals
			Explanation: **E1** prevents collapse of xylem **;** **E2** (water) under tension / at low pressure / negative pressure**;** **E3** reduces (lateral) loss of water, through wall **;** **E4** increases capillarity / AW **;** **E5** prevents stem breaking / AW **;** **2 max**	**3 max**	*Award mark(s) for function and explanation independently* **DO NOT CREDIT** loss of water unqualified

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Question			Expected Answers	Marks	Additional Guidance
1	(c)	(iii)	(pits) allow water to move, in / out / between, vessel(s) ; to bypass blockage ; supply water to other, tissues / (other types) cells / parts of plant ;	2 max	**ACCEPT** lateral movement for 'out' **ACCEPT** bypass air lock **ACCEPT** any named, tissue / cells e.g. to allow water to other tissues 1 mark to allow water out to other tissues 1 mark to allow water out of vessel to other tissues 2 marks
			Total	**10**	

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Question			Expected Answers	Marks	Additional Guidance
2	(a)	(i)	collection / group, of cells (of one or more types) ;	2 max	**IGNORE** ref similar cells
			(cells), working together **OR** with, common / same, function ;		**ACCEPT** a group of cells with a function = 2 marks
			specialised (cells) ;		**DO NOT CREDIT** differentiated
2	(a)	(ii)	squamous / ciliated ;	1	**ACCEPT** endothelium / columnar **DO NOT ACCEPT** cilia, goblet cell, ciliated *cells*
2	(b)		(organ is) a collection of tissues / named tissues ;	2	Look for idea of more than one tissue **ACCEPT** two or more correctly named tissues from: epithelium, elastic, glandular, smooth muscle, blood, nervous, cartilage, connective
			(working together) to enable gas exchange / AW ;		**DO NOT ACCEPT** perform a function unqualified – we want to know *what* function (can be named or described) **DO NOT ACCEPT** respiration **IGNORE** breathing

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Question			Expected Answers	Marks	Additional Guidance
2	(c)	(i)	(*release of energy*) mitochondria **;**	1	
		(ii)	*(movement of cilia)* cytoskeleton **;**	1	**ACCEPT** mitochondria if not used in **(i)**
		(iii)	*(secretion of mucus)* Golgi (vesicle) **;**	1	**ACCEPT** cytoskeleton if not used in **(ii)** **ACCEPT** Golgi body / apparatus **DO NOT ACCEPT** Golgi vessel
			Total	8	

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Question			Expected Answers	Marks	Additional Guidance
3	(a)		partially / selectively ; (facilitated) diffusion **OR** osmosis ; plasma ; phospholipids ; cholesterol ;	5	**DO NOT ACCEPT** semi **ACCEPT** differentially **ACCEPT** plasma cell

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Question			Expected Answers	Marks	Additional Guidance
3	(b)				***Look for <u>description</u> not list of functions***
			1 (acting as) **antigens ;** **2** identification / **recognition**, (of cells) as**,** self / non-self / AW **;** **3** **cell signalling** / described **;** **4** **receptor** / binding site, for, **hormone** / (chemical) signal / (medicinal / named) drugs **;** **5** ref. to **receptor** / binding site / trigger, on transport proteins / AW **;** **6** cell **adhesion** / to hold cells together (in a tissue) **;** **7** attach to water molecules (to stabilise membrane / cell) **;** **4 max** for description		*Do not credit repetition of same point* **ACCEPT** foreign for non-self **ACCEPT** description e.g. communication *between* cells / cell responds to, chemical / signal, *from another cell* **ACCEPT** description of *attachment process* for receptor / binding site **DO NOT ACCEPT** molecule unqualified **ACCEPT** binding site for foreign antigen **ACCEPT** ref to receptors on ion channels **ACCEPT** bind to other cells for cell adhesion
			QWC: **three** technical terms used and spelt correctly **;**	**5 max**	Any **three** from: receptor, antigen, hormone, <u>cell</u> signal(ling), adhesion, recognition, <u>facilitated</u> diffusion, <u>active</u> transport
			Total	**10**	

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Question			Expected Answers	Mark	Additional Guidance
4	(a)		timer **OR** scale / ruler **;**	1	
4	(b)				***Mark the first three suggestions*** *irrespective of numbered points* *IGNORE reasons – just mark* ***steps*** *in the process*
			shoot is healthy **;**		**ACCEPT** shoot not wilted
			assemble apparatus / cut shoot**,** under water **;**		
			cut last 2-3 cm off cut end / cut at an angle **;**		**ACCEPT** cut end off shoot
			check there are no air bubbles in apparatus **;**		**ACCEPT** make sure cut end of shoot is in contact with water once apparatus assembled
			apparatus**,** water tight / air tight / has no leaks **;**		**ACCEPT** screw clip tight **DO NOT ACCEPT** use Vaseline unqualified
			leaves dry **;**		
				3 max	**DO NOT CREDIT** allow time for acclimatisation, equilibration

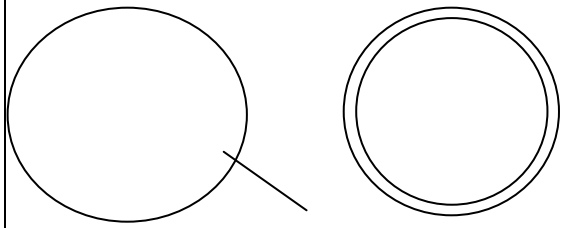
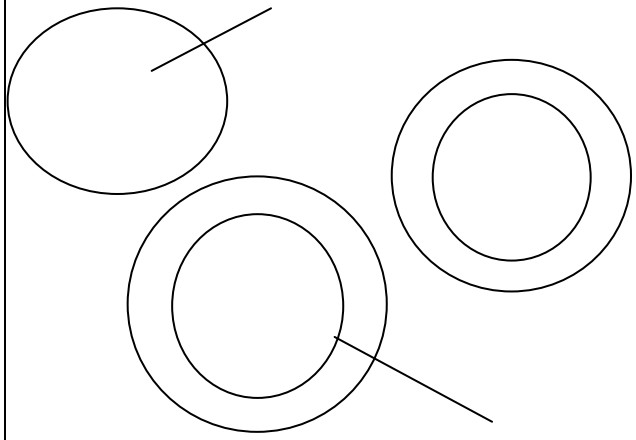
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Question			Expected Answers	Mark	Additional Guidance
4	(c)	(i)	25.3 ;	1	**IGNORE** any units
4	(c)	(ii)	to make results (more) reliable ;		**DO NOT ACCEPT** accurate **and** reliable (use of **both** terms) anywhere in the answer
			to help identify anomalies ;	2	Look for idea of spotting the anomaly e.g. spot, notice, recognise, show, detect. **DO NOT CREDIT** prevents / take out / remove / accounts for, anomalies **DO NOT CREDIT** 'ensure there is no anomaly' unless qualified **ACCEPT** outliers for anomalies **ACCEPT** to identify other factors / (uncontrolled) variables that may be having an effect
4	(c)	(iii)			*Mark first response in each numbered section (1-2). If not all sections are used, return to the first section and mark further suggestions*
			in afternoon: plant dying / less healthy / wilting ; ref to stomatal closure ; more humid / higher water (vapour) potential in air ; less air movement / wind / draughts ;	2 max	Assume answer is for different conditions in the afternoon **ACCEPT** ORA if stated 'in morning...' **IGNORE** ref to light / dark Look for **comparative** statements – higher, greater etc **DO NOT CREDIT** more **moisture** in air

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Question			Expected Answers	Mark	Additional Guidance
4	(c)	(iv)	(potometer) measures (water) uptake ;		
			not all water (taken up) is lost ;		**ACCEPT** ref to figs e.g. 99% water *taken up* is lost **ACCEPT** the assumption that water loss is equal to water uptake is incorrect
			some water used (in photosynthesis / making cells turgid) ;	**2 max**	
			Total	**11**	

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Question			Expected Answers	Marks	Additional Guidance
5	(a)	(i)	vein with thinner wall than artery **;**	1	**CREDIT:** Correct position of endothelium as indicated by circle or label line Must be clearly **thinner** than shown on artery  **DO NOT CREDIT**: 

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Question			Expected Answers	Mark	Additional Guidance
5	(a)	(ii)	*Arteries have:* no valves **;** endothelium / tunica intima, folded / AW **;** more / thicker, muscle / elastic tissue / tunica media **;** more / thicker, collagen / tunica externa **;**	**2 max**	*Assume answer refers to wall of artery.* **IGNORE** any ref to artery wall being thicker, unqualified, as this has already been stated in the question **IGNORE** *reasons for differences* **ACCEPT** ORA if stated - 'vein is…...' Look for **comparative** statements **ACCEPT** tunica adventitia for tunica externa
5	(b)	(i)	contraction of <u>ventricle</u>, wall / muscle **;**	**1**	**ACCEPT** ventricular systole **DO NOT CREDIT** heart muscle unqualified **DO NOT CREDIT** contraction of atria **and** ventricles **DO NOT CREDIT** pump / squeeze / push / beat without ref to contraction

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Marks			Expected Answers	Mark	Additional Guidance
5	(b)	(ii)	more, (smaller) vessels / named vessels ;		**ACCEPT** *divides* into smaller vessels (implies more of them)
			(vessels) have larger, total lumen / cross sectional area ;		**ACCEPT** larger total surface area
			reduced resistance to blood flow ;		**DO NOT CREDIT** further from the heart
			arteries, stretch / expand ;		
			loss of, fluid / plasma, from capillaries ;	**2 max**	**DO NOT CREDIT** loss of, blood / water **DO NOT CREDIT** loss of fluid / plasma, unqualified or from other vessels
5	(b)	(iii)			*Assume 'it' refers to plasma:*
			plasma / fluid, moves out of, capillary / blood ;		**DO NOT CREDIT** water / diffuses out **ACCEPT** filters out
			enters / forms, tissue fluid ;		
			(plasma) proteins, remain in capillary / too large to pass through capillary wall / AW ;		
			(fluid moves) down pressure gradient ;		
			hydrostatic pressure greater than, water potential / Ψ;	**3 max**	**DO NOT CREDIT** ref to osmosis

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Marks			Expected Answers	Marks	Additional Guidance
5	(c)		**X** = carbonic anhydrase **;**		**ACCEPT** correct phonetic spelling **DO NOT ACCEPT** anahydrase
			Y = carbonic acid / H_2CO_3 **;**		If formula only given, it must be correct. Incorrect formula can be ignored if correct name given.
			Z = hydrogen (ion) / H^+ **;**	**3**	**DO NOT CREDIT** H alone
			Total	**12**	

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ADVANCED SUBSIDIARY GCE

BIOLOGY

Cells, Exchange and Transport

F211

Candidates answer on the question paper

OCR Supplied Materials:
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Other Materials Required:
- Electronic calculator
- Ruler (cm/mm)

Monday 1 June 2009
Afternoon

Duration: 1 hour

OCE/10512

F211

Candidate Forename		Candidate Surname	

Centre Number						Candidate Number				

MODIFIED LANGUAGE

INSTRUCTIONS TO CANDIDATES

- Write your name clearly in capital letters, your Centre Number and Candidate Number in the boxes above.
- Use black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure that you know what you have to do before starting your answer.
- Answer **all** the questions.
- Do **not** write in the bar codes.
- Write your answer to each question in the space provided, however additional paper may be used if necessary.

INFORMATION FOR CANDIDATES

- The number of marks is given in brackets **[ ]** at the end of each question or part question.
- The total number of marks for this paper is **60**.
- You may use an electronic calculator.
- You are advised to show all the steps in any calculations.



Where you see this icon you will be awarded marks for the quality of written communication in your answer.

- This document consists of **16** pages. Any blank pages are indicated.

FOR EXAMINER'S USE		
Qu.	Max.	Mark
1	9	
2	15	
3	12	
4	7	
5	9	
6	8	
TOTAL	60	

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Answer **all** the questions.

1 Fig. 1.1 (a) is a diagram of a part of a mammalian lung.

Fig. 1.1 (b) is an enlargement of part of the lining of the bronchus.

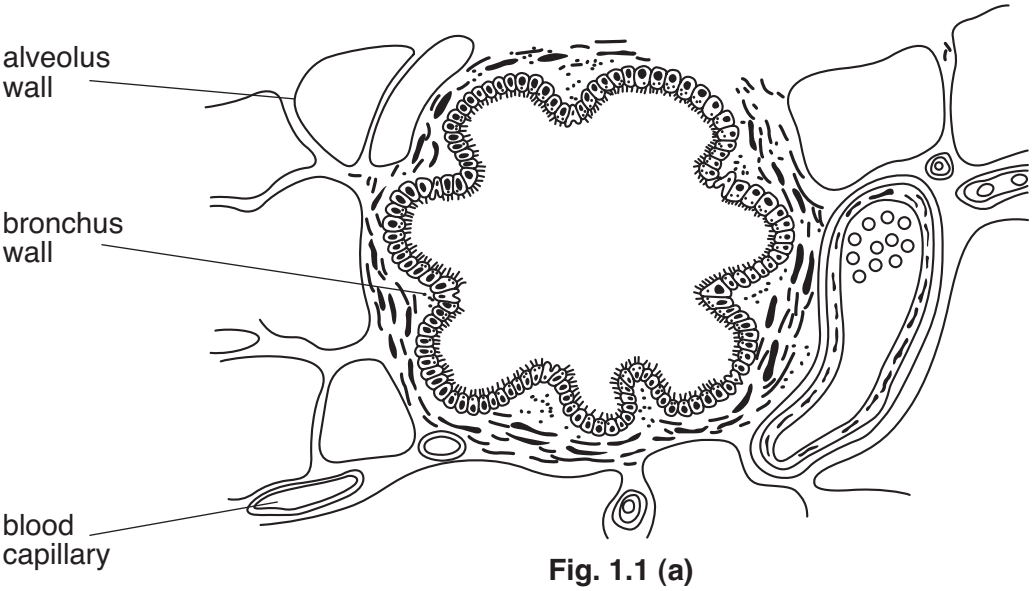


Fig. 1.1 (a)

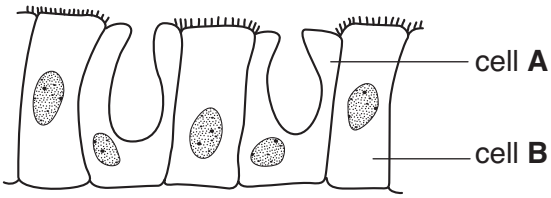


Fig. 1.1 (b)

(a) (i) Name the two types of cell, **A** and **B**, shown lining the **bronchus**.

A .....

B ..... **[2]**

(ii) Describe how cell types **A** and **B** work together to keep the lung surface clear of dust and other particles.

.....

.....

.....

.....

.....

..... **[3]**

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(iii) The bronchus wall also contains smooth muscle fibres.

State the function of the smooth muscle fibres.

.....

..... **[1]**

(b) (i) Explain why blood capillaries and alveoli are very close together.

.....

.....

.....

.....

..... **[2]**

(ii) The walls of the alveoli contain elastic fibres.

State the function of these elastic fibres.

.....

..... **[1]**

[Total: 9]

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2 Fig. 2.1 shows the structure of a plasma (cell surface) membrane.

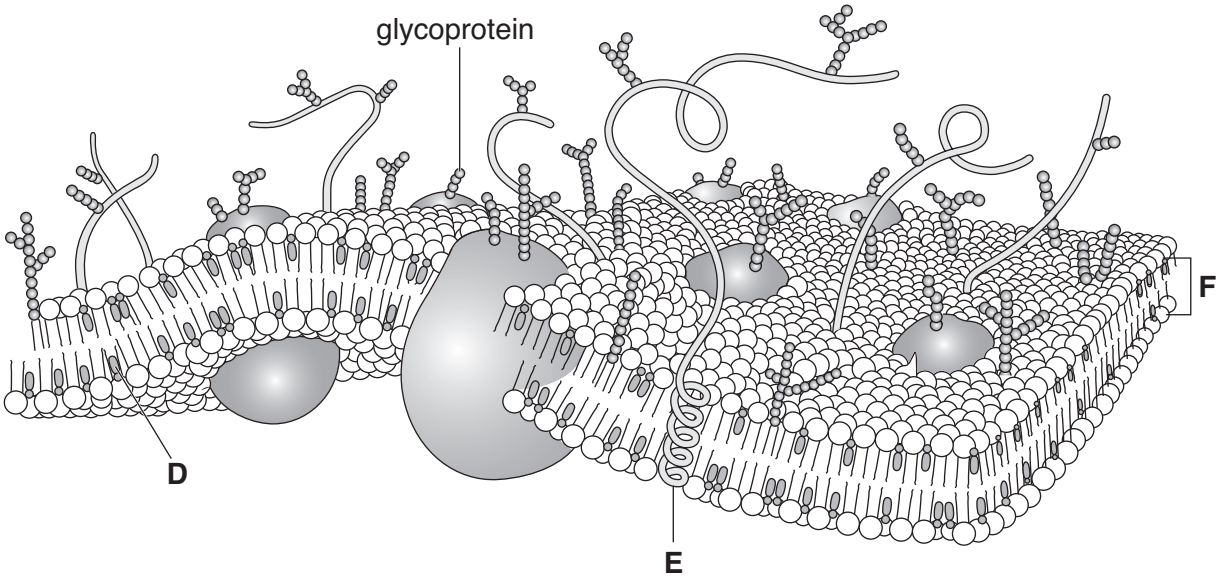


Fig. 2.1

(a) (i) Name the components of the plasma (cell surface) membrane labelled **D**, **E** and **F**.

D .....

E .....

F ..... **[3]**

(ii) State **one** function for each of the components **D**, **E** and **F**.

D .....

.....

E .....

.....

F .....

..... **[3]**

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(b) Glycoprotein molecules are positioned in the plasma (cell surface) membrane with the carbohydrate chain outside the cell.

This is to allow the glycoproteins to act as receptors in the process of cell signalling.

(i) Explain what is meant by the term *cell signalling*.

.....

.....

.....

..... **[2]**

(ii) Explain **how** a glycoprotein can act as a receptor.

.....

.....

.....

..... **[2]**

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(c) A student investigated the effect of temperature on the release of pigment from pieces of beetroot.

She cut a fresh beetroot into four pieces and placed each piece into water at a different temperature.

After 10 minutes she removed the beetroot and used a colorimeter to test how much pigment had entered the water.

She placed the coloured water into the colorimeter and measured the percentage transmission of light through the water. Her results are shown in Table 2.1.

Table 2.1

temperature of water (°C)	percentage transmission of light
10	85
30	87
50	78
100	0

(i) The results show that below 50 °C little pigment had entered the water.

Explain why there was no transmission of light after the beetroot had been placed in water at 100 °C.

.....

.....

.....

.....

..... **[2]**

(ii) Suggest **three** ways in which the student could have improved her investigation.

1 .....

.....

2 .....

.....

3 .....

..... **[3]**

[Total: 15]

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3 **(a)** Complete the following paragraph about the loss of water from plants.

The loss of water from the aerial parts of a plant is known as ..... .

The majority of water is lost from the leaves. Water is transported up the stem in the ..... and passes into the mesophyll cells of the leaf by ..... . Water evaporates from the surface of these cells. The water vapour diffuses out of the air spaces in the leaf through the ..... . **[4]**

(b) **(i)** Explain why water loss from the leaves of a plant is unavoidable.

.....

.....

.....

..... **[2]**

(ii) Name the **type** of plant adapted to reduce water loss from its leaves.

..... **[1]**

(iii) State **and** explain **two** adaptations of leaves that reduce evaporation.



In your answer, you should use appropriate technical terms, spelt correctly.

.....

.....

.....

.....

.....

.....

.....

.....

.....

..... **[5]**

[Total: 12]

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4 **(a)** Table 4.1 compares the structures of prokaryotic and eukaryotic cells.

Complete the table.

Table 4.1

prokaryotic	eukaryotic
no true nucleus	genetic material held in a nucleus
genetic material consists of 'naked' DNA	
average diameter of cell 0.5 – 5 µm	
	ribosomes about 22 nm in diameter
	cell wall sometimes present

[4]

(b) The cytoskeleton is an important component in the cytoplasm of all eukaryotic cells.

(i) Name **one** structure, **associated with the cytoskeleton**, which can bring about cell movement.

..... **[1]**

(ii) Suggest **two** processes **inside cells** that rely on the cytoskeleton for movement.

.....

.....

.....

..... **[2]**

[Total: 7]

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5 **(a)** Fig. 5.1, **on the insert**, shows some drawings of a cell during different stages of mitosis.

Place stages **P**, **Q**, **R**, **S** and **T** in the correct sequence.

The first stage has been identified for you.

S

..... **[4]**

(b) Mitosis is part of the cell cycle.

Fig. 5.2 shows a diagram of the cell cycle.

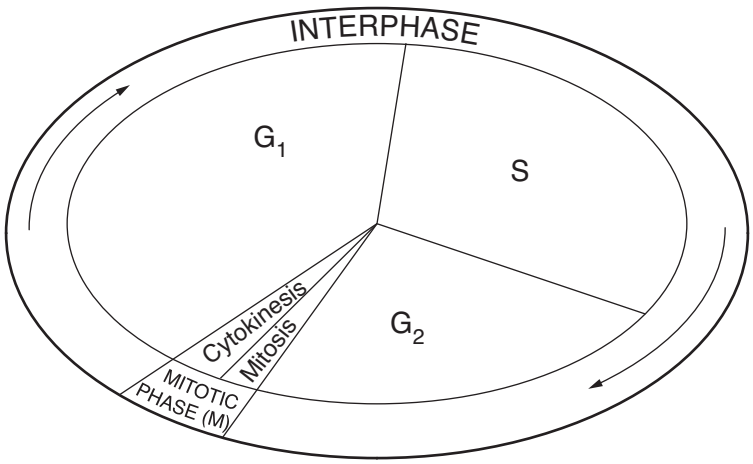


Fig. 5.2

(i) Name **one** process that occurs during stages G_1 and G_2.

..... **[1]**

(ii) The genetic information is copied and checked during stage **S**.

Suggest what might happen if the genetic information is not checked.

.....

.....

.....

..... **[2]**

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(c) A cell undergoes two divisions during **meiosis**.

Suggest how cells produced by meiosis may differ from those produced by mitosis.

.....

.....

.....

.....

.....

..... **[2]**

[Total: 9]

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QUESTION 6 STARTS ON PAGE 12

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6 **(a)** **(i)** Name the type of muscle found in the walls of the heart chambers.

..... **[1]**

(ii) Name the process that creates pressure inside the heart chambers.

..... **[1]**

(b) Fig. 6.1 shows the changes in pressure inside the heart chambers during one heart beat.

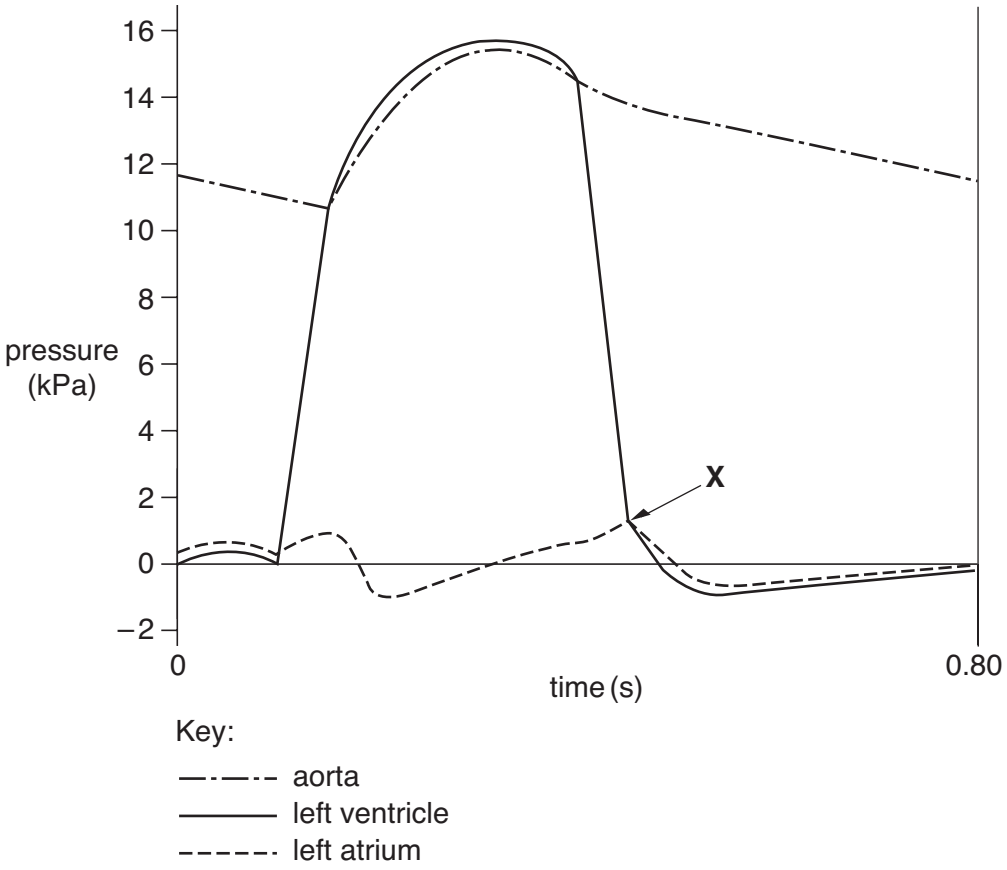


Fig. 6.1

(i) Calculate the heart rate from the information in Fig. 6.1.

Show your working and give your answer **to the nearest whole number**.

Answer = ... beats min^{-1} **[2]**

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(ii) Describe and explain what happens **immediately after X** on Fig. 6.1.

In your answer, you should use appropriate technical terms, spelt correctly.

.....

.....

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.....

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..... **[4]**

[Total: 8]

END OF QUESTION PAPER

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RECOGNISING ACHIEVEMENT

GCE

Biology

Advanced GCE **A2 H421**

Advanced Subsidiary GCE **AS H021**

Mark Scheme for the Units

June 2009

H021/H421/MS/R/09

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CONTENTS

Advanced GCE Biology (H421)

Advanced Subsidiary GCE Biology (H021)

MARK SCHEMES FOR THE UNITS

Unit/Content	Page
F211 Cells, Exchange and Transport	1
F212 Molecules, Biodiversity, Food and Health	11
Grade Thresholds	30

Question			Expected Answers	Marks	Additional Guidance
1	(b)	(i)	short, distance / path / AW ; (so that) diffusion / concentration, gradient is, high / steep ; high rate of, (gas) exchange / diffusion ;	2 max	**DO NOT ACCEPT** ref to number of cells / cell thickness or short space **DO NOT ACCEPT** short gradient **ACCEPT** high rate of movement of named gas in correct direction **ACCEPT** 'rapid' / fast / quick **ACCEPT** ref to efficient, gas exchange / diffusion **DO NOT ACCEPT** gas exchange occurs more 'easily'
	(b)	(ii)	recoil / expel air / prevent bursting ;	1	**ACCEPT** exhale more completely / force air out **DO NOT ACCEPT** 'exhale' (if used alone) **DO NOT ACCEPT** 'contract' **DO NOT ACCEPT** 'stretch' on its own **DO NOT ACCEPT** if response includes any ref to bronchus or smooth muscle
			Total	9	

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Question			Expected Answers	Marks	Additional Guidance
2	(a)	(i)	**D** cholesterol **;** **E** protein / glycoprotein / intrinsic protein / protein channel / protein pump / transport protein / carrier protein **;** **F** phospholipid (bilayer) / phospholipid head **;**	**3**	**ACCEPT** polypeptide chain **DO NOT ACCEPT** amino acid chain **DO NOT ACCEPT** extrinsic protein **DO NOT ACCEPT** lipids / bilayer
2	(a)	(ii)	**D** stabilise the membrane OR maintain / affect / control / AW, fluidity OR reduces permeability to, polar / charged, particles **;** **E** allow communication across membrane OR allow, polar / charged, particles to pass through membrane **;** **F** to act as a barrier (to, polar / charged, particles) / select what enters or leaves cell **;**	**3**	***mark independently of (a)(i) i.e. NO ecf*** **DO NOT ACCEPT** refs to rigidity / support / strength **ACCEPT** reduces / affects, lateral movement of phospholipids **ACCEPT** cell recognition / receptor site / cell signalling / cell attachment **ACCEPT** (acts as) selectively permeable or partially permeable membrane **ACCEPT** allows small / fat soluble molecules to pass through **DO NOT ACCEPT** separates inside from outside
2	(b)	(i)	communication between cells / AW **;** cell, recognition / identification **;** cells work together / coordination between action of different cells **;** to trigger, response / reaction (inside the cell) **;**	**2 max**	**ACCEPT** example to illustrate the point, e.g. action of hormone / cytokines
2	(b)	(ii)	(receptor) specific shape / described **;** complementary to (shape of), trigger / named trigger / communicating **;** molecule **;** (trigger / AW) binds / attaches to receptor **;**	**2 max**	**ACCEPT** tertiary structure **DO NOT ACCEPT** ref to active site **ACCEPT** fits / idea of lock & key in correct context **DO NOT ACCEPT** 'matches' **DO NOT ALLOW** joins / bonds / links / combines / fits

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Question			Expected Answers	Marks	Additional Guidance
2	(c)	(i)	cell surface / plasma, membrane damaged ; pigment, released / leaks out ; pigment, absorbs / takes up, the light ;	2 max	**ACCEPT** description of damage e.g. proteins denatured / phospholipids separate / bilayer melts **DO NOT ACCEPT** bilayer becomes 'more fluid' **DO NOT ACCEPT** 'cell membrane' unqualified **ACCEPT** 'cell contents' for pigment **DO NOT ACCEPT** 'no light transmitted' 'solution is opaque'
2	(c)	(ii)	*Mark first response on each numbered line. Only return to extra points on first or second line if no response in line two or three* more samples at each temperature ; same / fixed, volume of water ; all samples same, size / surface area ; ref to further cutting to increase surface area ; pieces, rinsed / blotted, after cutting ; more (intermediate) temperatures ; same beetroot used / same part of beetroot used ;	3 max	 **ACCEPT** repeats **ACCEPT** collect average / mean results **DO NOT ACCEPT** mass **ACCEPT** any method of cutting to provide larger surface area **ACCEPT** list of figures of additional temps between 0-100 **DO NOT ACCEPT** wider range of temperatures / more evenly spaced temperatures **DO NOT ACCEPT** leave for longer **DO NOT ACCEPT** idea of control
			Total	**15**	

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Question			Expected Answers	Marks	Additional Guidance
3	(a)		transpiration ; xylem ; osmosis ; stoma(ta) / stomatal pore ;	4	**DO NOT ACCEPT** 'diffusion' alone **ACCEPT** diffusion with osmosis used as qualification **DO NOT ACCEPT** 'pore' or 'guard cells'
3	(b)	(i)	stomata (open to) allow, gaseous exchange / carbon dioxide in / oxygen out / AW ; (gaseous exchange) for photosynthesis ; (photosynthesis) essential for plant to, gain energy / make sugars ; some water lost through cuticle ;	2 max	look for reverse argument **DO NOT ACCEPT** ref to air OR to get gases OR let gases in **ACCEPT** 'gases in and out'
	(b)	(ii)	xerophyte ;	1	**DO NOT ACCEPT** cactus

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Question			Expected Answers	Marks	Additional Guidance
	(b)	(iii)	*Allow the first point **once** as further explanation for A1 – A4 in addition to the linked explanation:* reduce water (vapour) **potential gradient** / **diffusion** gradient **;** **[A 1]** hairy leaves **;** trap **water vapour** / moisture **;** **[A 2] stomata,** in pits / sunken **;** pits trap, **water vapour** / moisture **;** **[A 3]** rolled leaves / presence of **hinge cells ;** reduce **surface area** OR (rolled leaves) trap **water vapour** / moisture **;** **[A 4]** high solute concentration in cells **;** reduces water potential inside leaf cells **;** **[A 5]** thick(er) **cuticle ;** (which is) waterproof / (relatively) **impermeable ;** **[A 6]** small leaves / **needles ;** smaller **surface area ;** **[A 7]** fewer **stomata ;** reduces **diffusion** (of water vapour) **;** **[A 8] stomata** close, during the day **;** reduces **diffusion** (of water vapour) **;** **[A 9]** most **stomata** on lower surface **;** less exposure to sun OR cooler OR reduces diffusion (of water vapour) **;**		***MARK FIRST <u>TWO</u> ADAPTATIONS <u>ONLY</u>*** **ALLOW** max 2 for adaptation [A] marks Explanation must be linked to an appropriate statement of adaptation. Allow an explanation mark even if adaptation mark not awarded. **DO NOT ACCEPT ‘**water’ for ‘water vapour’ throughout **DO NOT ACCEPT** ‘transpiration’ for diffusion of water vapour throughout **DO NOT ACCEPT** surface area to volume ratio **ACCEPT ‘**spines’ **DO NOT ACCEPT** surface area to volume ratio

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Question			Expected Answers	Marks	Additional Guidance
			[A 10] more densely packed spongy mesophyll **;** smaller surface area for evaporation (from mesophyll cell surface) **;** 4 max QWC - technical terms used appropriately and spelt correctly **;** 1	**5 max**	Use three terms from: cuticle, impermeable, water vapour, potential gradient, diffuse / diffusion, stoma(ta), needles, surface area, hinge cells, saturated
			Total	**12**	

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Question			Expected Answers		Marks	Additional Guidance
4	(a)		prokaryotic	eukaryotic	4	
				as chromosomes / chromatin OR (genetic material) associated with, proteins / histones ;		**DO NOT ACCEPT** chromatid
				(diameter of cell) 20 – 40 μm ;		Figures must have correct units **ACCEPT** any figure(s) in range 10 – 100 μm
			(ribosomes) 18**nm** ;			**ACCEPT** any figure(s) in range 10 – 20 nm **ACCEPT** 70 S
			cell wall (present) ;			**DO NOT ACCEPT** sometimes or usually present
	(b)	(i)	flagellum / cilium / microtubule / microfilament / undulipodium ;		1	**ACCEPT** plurals
4	(b)	(ii)	(*movement <u>inside cells</u> of*) chromosomes / chromatids (in cell division) ; (cytoplasm in) cytokinesis ; organelles / named organelle ; RNA (in protein synthesis) ; proteins ;		2 max	**DO NOT ACCEPT** mitosis / cell division e.g. centriole / vesicle / lysosome / mitochondrion / chloroplast / ribosome ensure that the proteins are being moved in cytoplasm by microtubules rather than by ER or in vesicles (mark given above)
			Total		7	

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Question			Expected Answers	Marks	Additional Guidance
5	(a)		Q, T, P, R **;** **;** **;** **;**	4	Allocate marks for the following pairs: S – Q Q – T T – P P - R
5	(b)	(i)	growth of cell / growth of organelles / increase number of organelles / synthesis of proteins **;**	1	**DO NOT ACCEPT** **'**growth' unqualified **DO NOT ACCEPT** refs to DNA replication **IGNORE** ref. to respiration **ACCEPT** named steps in protein synthesis
5	(b)	(ii)	mutation / faulty DNA produced / error in copying **;** daughter cells will not receive identical genetic information **;** proteins / (daughter) cells, not made / do not function **;**	2	**ACCEPT** **'**daughter cells will not be clones' **ACCEPT** **'**proteins / daughter cells function differently'
5	(c)		haploid / half genetic information / chromosome number is n **;** genetic information not identical / produces genetically different cells **;** 4 cells produced **;**	2 max	**ACCEPT** use of comparative chromosome numbers as example **DO NOT ACCEPT** identical / not identical without 'genetic' **DO NOT ACCEPT** smaller cells
			Total	9	

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Question			Expected Answers	Marks	Additional Guidance	
6	(a)	(i)	cardiac ;	1	**ACCEPT** myogenic	
6	(a)	(ii)	(muscle) contraction / systole ;	1	**ACCEPT** atrial or ventricular systole **DO NOT ACCEPT** atrial or systolic pressure	
6	(b)	(i)	*correct answer = two marks* 75 ; ; *if answer incorrect **ALLOW** one mark for correct working* 60 / 0.8	 2		
6	(b)	(ii)	pressure in **ventricle** is below (pressure in) **atrium** ; **bicuspid** / **atrioventricular** valve, open(s) ; blood flows into (atrium and) ventricle ; max 3 QWC - technical terms used appropriately and spelt correctly ; 1	 4	ORA **ACCEPT** mitral **DO NOT ACCEPT** pushed or pumped **DO NOT ACCEPT** arterioventricular Use three terms in correct biological context from: ventricle / ventricular, atrium / atrial, bicuspid, mitral, atrioventricular, diastole	
			Total	**8**		

			Paper Total	**60**	

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THIS IS A NEW SPECIFICATION

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ADVANCED SUBSIDIARY GCE
BIOLOGY
Cells, Exchange and Transport

F211

CUP/T77123

Candidates answer on the question paper

OCR Supplied Materials:
None

Other Materials Required:
- Electronic calculator
- Ruler (cm/mm)

Wednesday 14 January 2009
Afternoon

Duration: 1 hour

F211

Candidate Forename		Candidate Surname	

Centre Number						Candidate Number				

INSTRUCTIONS TO CANDIDATES

- Write your name clearly in capital letters, your Centre Number and Candidate Number in the boxes above.
- Use black ink. Pencil may be used for graphs and diagrams only.
- Read each question carefully and make sure that you know what you have to do before starting your answer.
- Answer **all** the questions.
- Do **not** write in the bar codes.
- Write your answer to each question in the space provided, however additional paper may be used if necessary.

INFORMATION FOR CANDIDATES

- The number of marks is given in brackets **[ ]** at the end of each question or part question.
- The total number of marks for this paper is **60**.
- You may use an electronic calculator.
- You are advised to show all the steps in any calculations.
- Where you see this icon you will be awarded marks for the quality of written communication in your answer.
- This document consists of **16** pages. Any blank pages are indicated.

FOR EXAMINER'S USE		
Qu.	**Max.**	**Mark**
1	11	
2	11	
3	10	
4	11	
5	10	
6	7	
TOTAL	60	

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Answer **all** the questions.

1 Fig. 1.1 is a diagram of an animal cell as seen using a transmission electron microscope.

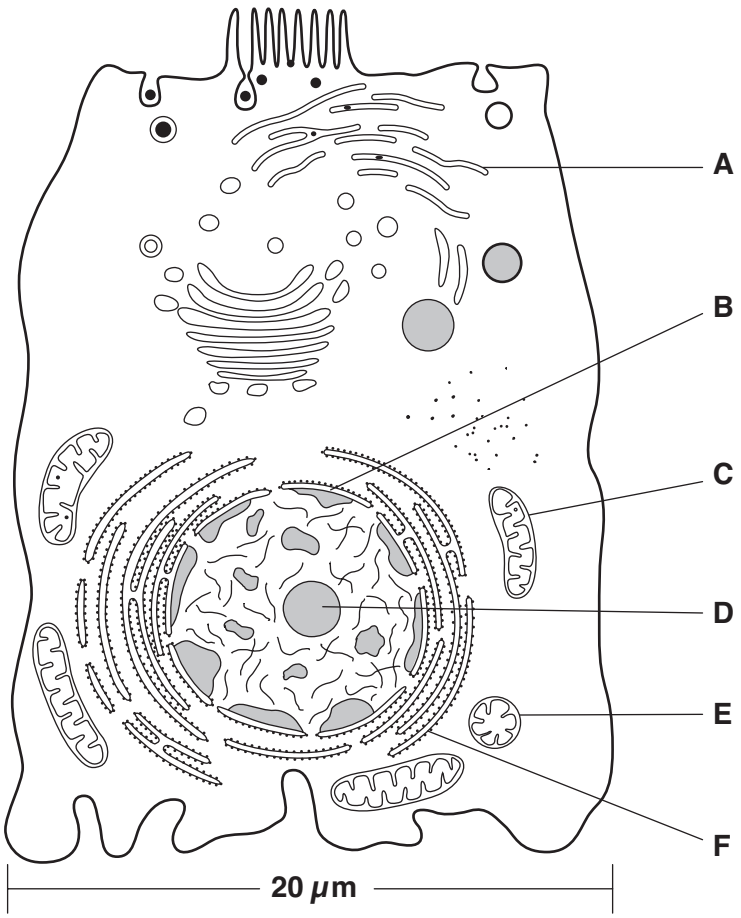


Fig. 1.1

(a) (i) Name the structures of the cell labelled **A**, **B**, **C** and **D**.

A .....

B .....

C .....

D ..... **[4]**

(ii) Structures **C** and **E** are examples of the same organelle.

Suggest why **E** looks so different to **C**.

.....

.....

.....

..... **[2]**

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(iii) Calculate the actual length of structure **C**.

Show your working and give your answer in micrometres (μm).

Answer = ... μm **[2]**

(b) Proteins are produced by the structure labelled **F**. Some of these proteins may be **extracellular** proteins that are released from the cell.

Outline the sequence of events following the production of extracellular proteins that leads to their release from the cell.

.....

.....

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..... **[3]**

[Total: 11]

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2 Fig. 2.1 shows diagrams of four cells that have been placed in different solutions.

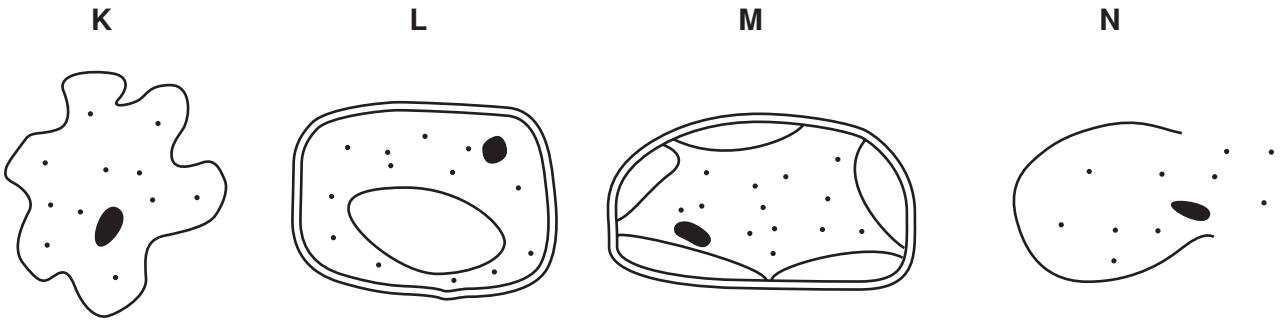


Fig. 2.1

(a) In the table below, write the letter **K**, **L**, **M** or **N** next to the description that best matches the diagram. One has been done for you.

description	letter
an animal cell that has been placed in distilled water	
an animal cell that has been placed in a concentrated sugar solution	
a plant cell that has been placed in distilled water	
a plant cell that has been placed in a concentrated sugar solution	M

[3]

(b) Explain, using the term **water potential**, what has happened to cell **M**.

.....

.....

.....

.....

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..... **[3]**

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(c) Small non-polar substances enter cells in different ways to large or polar substances.

Outline the ways in which substances, **other than water**, can enter a cell through the plasma (cell surface) membrane.



In your answer, you should use appropriate technical terms, spelt correctly.

small, non-polar substances .....

.....

.....

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large substances .....

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polar substances .....

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.....

.....

..... **[5]**

[Total: 11]

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3 The division of stem cells by mitosis produces cells that are genetically identical.

(a) **(i)** State what is meant by the term *stem cell*.

.....

.....

.....

..... **[2]**

(ii) Name **one** tissue in **plants** that contains stem cells.

..... **[1]**

(b) State **three** reasons why mitosis is important to organisms.

1 .....

2 .....

3 ..... **[3]**

(c) Traditionally, stem cells from bone marrow have been used to treat patients with leukaemia.

Recent studies have shown that stem cells taken from umbilical cord blood may be more effective in treating leukaemia than stem cells taken from bone marrow.

Table 3.1 shows the probability of a patient remaining leukaemia-free for five years after being treated with stem cells from different sources.

Table 3.1

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(i) Describe, using the information in Table 3.1, the evidence that **perfectly matched** umbilical cord blood stem cells are more effective than bone marrow stem cells in treating leukaemia.

.....

.....

.....

.....

..... **[2]**

(ii) Suggest **two** advantages, **other than an increased probability of survival**, of using umbilical cord blood stem cells instead of bone marrow stem cells in transplant procedures.

.....

.....

.....

.....

..... **[2]**

[Total: 10]

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4 **(a)** Explain, using the term **surface area to volume ratio**, why large, active organisms need a specialised surface for gaseous exchange.

.....

.....

.....

.....

.....

..... **[2]**

(b) Table 4.1 describes some of the features of the mammalian gas exchange system.

Complete the table by explaining how each feature improves the efficiency of gaseous exchange. The first one has been completed for you.

Table 4.1

feature of gas exchange system	how feature improves efficiency of gaseous exchange
many alveoli	this increases the surface across which oxygen and carbon dioxide can diffuse
the epithelium of the alveoli is very thin	
there are capillaries running over the surface of the alveoli	
the lungs are surrounded by the diaphragm and intercostal muscles	

[3]

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(c) Outline how the diaphragm **and** intercostal muscles cause **inspiration**.

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..... **[4]**

(d) Fig. 4.1 shows the trace from a spirometer recorded from a 16-year-old student.

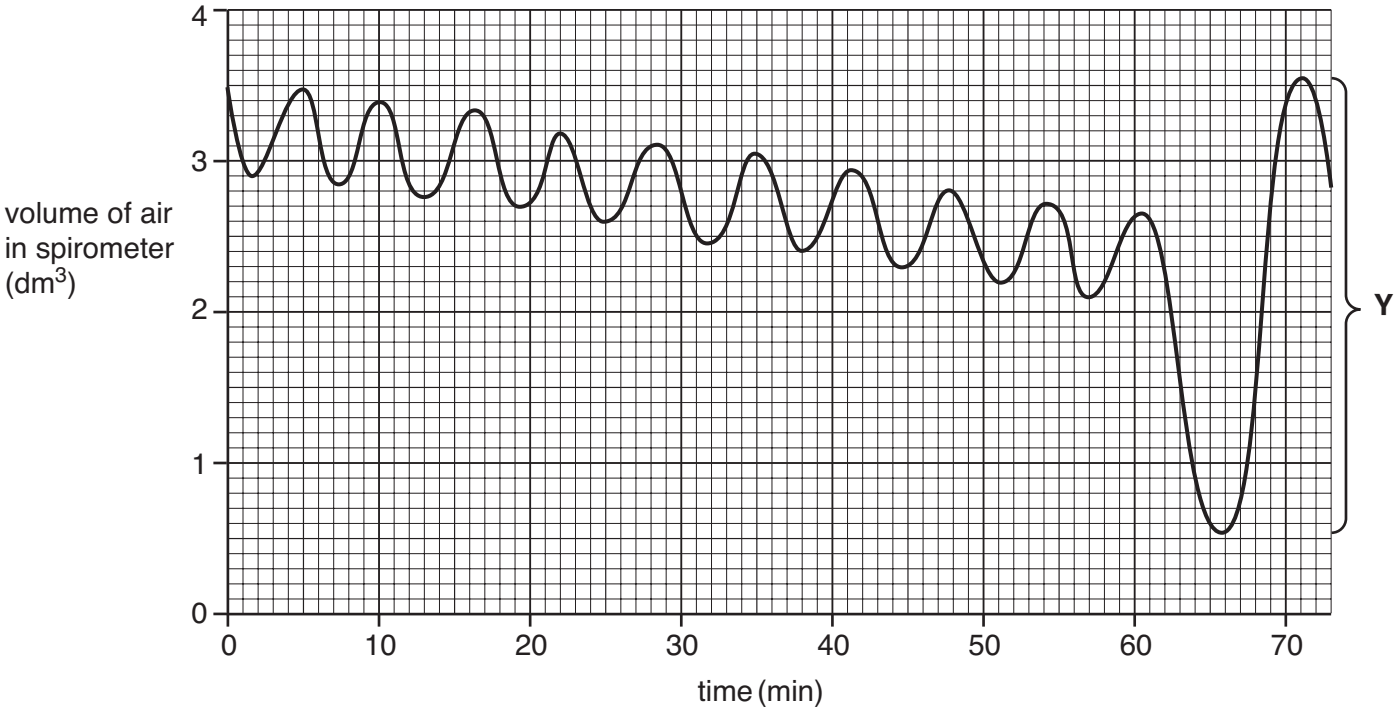


Fig. 4.1

(i) **Label on the trace**, using the letter **X**, a point that indicates when the student was inhaling. **[1]**

(ii) At the end of the trace the student measured his vital capacity. This is indicated by the letter **Y**.

State the vital capacity of the student.

..... **[1]**

[Total: 11]

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5 Fish have a single, closed circulatory system.

(a) State the meaning of the terms *single circulatory system* and *closed circulatory system.*

single circulatory system .....

.....

.....

closed circulatory system .....

.....

..... **[2]**

(b) The heart of a mammal contains four main chambers. The action of these chambers is coordinated by electrical activity in specialised tissues.

Fig. 5.1 shows where these tissues are found in the heart.

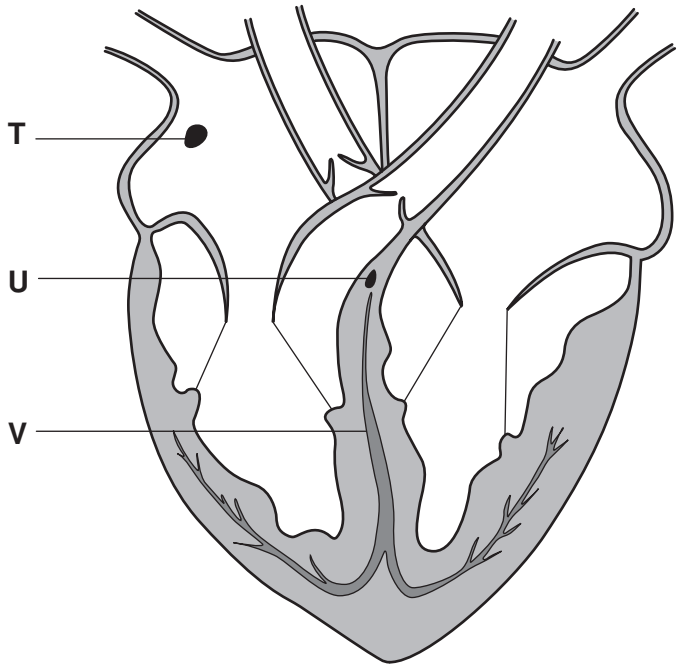


Fig. 5.1

(i) Name the tissues labelled **T**, **U** and **V**.

T .....

U .....

V ..... **[3]**

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(ii) Describe how the action of the heart is initiated **and** coordinated.



In your answer, you should use appropriate technical terms, spelt correctly.

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..... **[5]**

[Total: 10]

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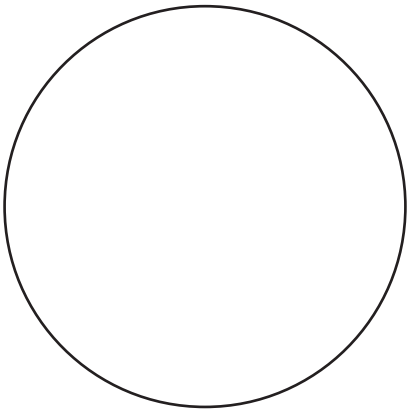
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6 Translocation is the movement of the products of photosynthesis within a plant.

Translocation occurs in the phloem and involves sources and sinks.

(a) Using the outline below, draw in the position of the phloem in the root of a dicotyledonous plant.

root



[1]

(b) Research using carbon dioxide containing a radioactive label, C^{14}, has revealed the following evidence about the mechanism of translocation:

A labelled carbon can be observed in the phloem soon after being supplied to a well-lit plant;

B the rate of movement of sugars in the phloem is many times faster than could be achieved by diffusion alone.

Different research has revealed that:

C an insect such as an aphid feeds by inserting its proboscis (mouth parts) into the phloem;

D the pH of the phloem companion cells is lower than surrounding cells;

E the phloem companion cells contain many mitochondria.

Using the letters **A**, **B**, **C**, **D** and **E**, select **two** pieces of evidence from the list above which support the theory that translocation occurs in the phloem.

……

…… **[2]**

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(c) State what is meant by the terms *source* and *sink*.

.....

.....

.....

.....

..... **[2]**

(d) When the bark is removed from a tree, the phloem is also removed. If a complete ring of bark is removed, the tree trunk can be seen to swell above the cut.

Suggest **two** reasons why the trunk swells above the cut.

.....

.....

.....

.....

.....

..... **[2]**

[Total: 7]

END OF QUESTION PAPER

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GCE

Biology

Advanced GCE **A2 H421**

Advanced Subsidiary GCE **AS H021**

Mark Scheme for the Units

January 2009

H021/H421/MS/R/09J

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CONTENTS

Advanced Subsidiary GCE Biology (H021)

MARK SCHEMES FOR THE UNITS

Unit/Content	Page
F211 Cells, Exchange and Transport	2
Grade Thresholds	14

Question			Expected Answers	Marks	Additional Guidance
1	(a)	(iii)	*correct answer = two marks* 3.75 / 3.8 **;;** *if answer incorrect **ALLOW** one mark for correct working*	 **2**	**ACCEPT** if 3.75 or 3.8 is seen anywhere in response (even if later rounded to 4) **Max 1** if response is 4 with no working *how to award one mark for working e.g.* candidate shows correct calculation but wrong answer actual length = $\frac{20 \times 15}{80}$ **OR** candidate uses magnification (x4000) in calculation: actual length = 15000 / 4000 **;** length of C should be 15mm / 15000μm **ACCEPT** ecf for working mark if length of C is not measured correctly but incorrect figure is used in calculation correctly
1	(b)	(ii)	proteins moved to Golgi (apparatus / body) **;** processed / modified / AW **;** into <u>vesicles</u> **;** (vesicle) moved to, plasma / cell surface, membrane **;** (vesicles) <u>fuse</u> with membrane **;** <u>exocytosis</u> **;**	 **3 max**	 e.g. carbohydrate group added **DO NOT ACCEPT** reprocessed idea that product of processing is placed into vesicles for transport **DO NOT ACCEPT** vacuole – but do not penalise more than once **DO NOT ACCEPT** 'cell membrane'
				[Total: 11]	

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<table>
<tr><th colspan="3">Question</th><th>Expected Answers</th><th>Marks</th><th>Additional Guidance</th></tr>
<tr><td>2</td><td>(a)</td><td></td><td>
<table>
<tr><th>description</th><th>letter</th></tr>
<tr><td>an animal cell that has been placed in water</td><td>N ;</td></tr>
<tr><td>an animal cell that has been placed in a strong sugar solution</td><td>K ;</td></tr>
<tr><td>a plant cell that has been placed in water</td><td>L ;</td></tr>
<tr><td>a plant cell that has been placed in a strong sugar solution</td><td></td></tr>
</table>
</td><td>3</td><td></td></tr>
<tr><td>2</td><td>(b)</td><td></td><td>water moves out of cell ;
by osmosis ;

cell has, high<u>er</u> / great<u>er</u> / <u>less</u> negative, <u>water potential</u> (than surrounding solution) / ORA ;

(water moves) <u>down</u> <u>water potential</u> gradient/from high to low <u>water potential</u> ;</td><td>3 max</td><td>note: this is explain not describe

ACCEPT Ψ for water potential
must be comparative – DO NOT ACCEPT high alone

DO NOT ACCEPT across or along water potential gradient
DO NOT ACCEPT ref to water concentration anywhere
IGNORE ref to solute potentials</td></tr>
</table>

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Question			Expected Answers	Marks	Additional Guidance
2	(c)		*small, non-polar substances* **diffuse** (through membrane / **phospholipid bilayer**) **;** *large substances* (using), **transport** / **carrier**, proteins **;** **endocytosis** / **phagocytosis** / described **;** *polar substances* through, pore / **channel**, proteins **;** (using), transport / carrier, proteins **;** *general – must be used in correct context, each **once only*** ref to **facilitated diffusion ;** ref to **active transport** / use of ATP **;** ***4 max*** QWC – technical terms spelled **AND** used in correct context **;** ***1***	**5 max**	**ACCEPT** diffusion / diffuses **ACCEPT** protein pump **DO NOT ACCEPT** channel proteins here **ACCEPT** pinocytosis apply only to large / polar substances apply only to large / polar substances **DO NOT ACCEPT** ref to active transport with channel proteins (three from: phospholipid / bilayer / diffusion / facilitated diffusion / active transport / transport protein / carrier protein / channel protein / pinocytosis / endocytosis / phagocytosis) if protein spelled incorrectly throughout, only penalise once
				[Total : 11]	

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Question			Expected Answers		Additional Guidance
3	(a)	(i)	a cell that is, unspecialised / not differentiated ; capable of, division / mitosis ; able to, differentiate / specialise / become other cell types ;	2 max	**DO NOT ACCEPT** replication **ACCEPT** totipotent / pluripotent / omnipotent
3	(a)	(ii)	cambium / meristem / early embryonic cells ;	1	**ACCEPT** plants have no stem cells
	(b)		growth (of tissue / organism) ; replace (cells) / repair (tissues) ; asexual reproduction/cloning / producing genetically identical cells ; maintain chromosome number in all cells ;	3	*initially mark first response on each line, if not all lines used, go back and credit further correct points* **DO NOT ACCEPT** growth of cells **DO NOT ACCEPT** repair of cells **ACCEPT** ref to maintain, haploid / diploid, number
	(c)	(i)	higher percentage remain leukaemia free (for five years) / AW ; **ORA** use of figs ;	2	*Need clear comparative statement* **DO NOT ACCEPT** 'more people' e.g. 60% cf. 38% approx. one and a half times more 22% more e.g. **ALLOW** one mark for: '60% given cord blood cells survive, 38% given marrow cells survive for five years' **ALLOW** two marks for: '60% given cord blood cells survive but only 38% given marrow cells survive for five years' as this is a comparative statement

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Question			Expected Answers		Additional Guidance
	(c)	(ii)	1 greater availability of cord cells / more likely to find donors; 2 easier to harvest / no pain for donor ; 3 cells at earlier stage of development ; 4 can be stored for future, use/repair / gene therapy, of donor ; 5 slightly mismatched cord cells work (almost) as well as marrow cells ;	**2**	**ACCEPT ORA** throughout **ACCEPT** easier to extract/obtain / less risky / less invasive **ACCEPT** can differentiate into wider range of cells **DO NOT ACCEPT** cells younger
				[Total : 10]	

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<table>
<tr><th colspan="3">Question</th><th>Expected Answers</th><th>Marks</th><th>Additional Guidance</th></tr>
<tr><td>4</td><td>(a)</td><td></td><td>large / active, organisms have high(er), demand for oxygen / need to remove CO_2 ;
small(er), <u>surface area to volume ratio / SA:V / surface area:volume</u> ;
surface area too small / distance too large / diffusion takes too long (to supply needs) ;</td><td>2 max</td><td>ACCEPT ORA throughout
IGNORE ref to nutrients

ACCEPT diffusion too slow
look for reason why diffusion not good enough</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td>(b)</td><td></td><td>create / maintain, (steep), diffusion / concentration, gradient ;
<table><tr><th></th><th></th></tr><tr><td>epithelium</td><td>short (diffusion) distance ;</td></tr><tr><td>capillaries</td><td>delivers carbon dioxide (to be removed from blood) / carries oxygen away (from alveoli) ;
short (diffusion) distance ;</td></tr><tr><td>diaphragm / intercostal muscles</td><td>ventilation / supply of oxygen (to alveoli) / removal of carbon dioxide (from alveoli) ;</td></tr></table></td><td>3 max</td><td>could give mark in any row as an additional mark – but only once

DO NOT ACCEPT any vague reference to ‘gases’ throughout

ACCEPT short diffusion distance here even if given above

ACCEPT breathing in and out / AW</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td>4</td><td>(c)</td><td></td><td>diaphragm (contracts / flattens and) moves downwards ;
intercostal muscles <u>contract</u> to move ribs, up / out ;
increase <u>volume</u> of thorax ;
reduce pressure inside thorax ;
to below atmospheric pressure/creates pressure gradient / AW ;</td><td>4 max</td><td>IGNORE ref to internal / external
ACCEPT increase volume of lungs / chest
ACCEPT decrease pressure in lungs / chest
must ensure the pressure gradient is in correct direction – lower in lungs</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>

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Question			Expected Answers	Marks	Additional Guidance
4	(d)	(i)	a clear **X** placed on any part of trace where line is sloping down **;**	1	**ACCEPT** label line with **X** **DO NOT ALLOW X** on tip of crest / trough
4	(d)	(ii)	3 dm^3 **;**	1	correct units **must** be given **ACCEPT** litres
				[Total: 11]	

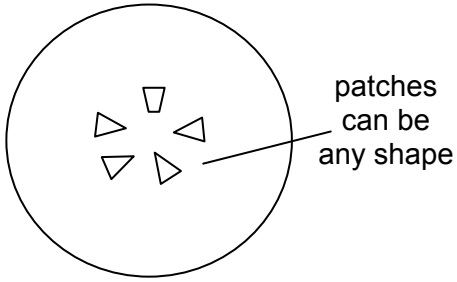
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Question			Expected Answers	Marks	Additional Guidance
5	(a)		*single circulatory system:* blood passes through the heart once for each, circulation / circuit / cycle, of the body **;** *closed circulatory system:* the blood is maintained inside vessels **;**	**2**	**DO NOT ACCEPT** ref to <u>cardiac</u> cycle **DO NOT ACCEPT** 'blood passes through heart once' - it must be clear there is a circuit / return to heart **ACCEPT** description e.g. heart to gills to body to heart **ACCEPT** ref to no separate pulmonary and systemic systems **ACCEPT** ref to lungs **ACCEPT** names of two types of vessel as alternative to 'vessels'
5	(b)	(i)	**T** SAN / sinoatrial node **;** **U** AVN / atrioventricular node **;** **V** bundle of His / Purkyne tissue **;**	**3**	**ACCEPT** pacemaker **DO NOT ACCEPT** sinoarterial / artrial node **DO NOT ACCEPT** arterioventricular node **ACCEPT** Purkinje

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Question			Expected Answers	Marks	Additional Guidance
5	(b)	(ii)	**T** / SAN, creates / initiates / starts / originates, **excitation ;** wave (of excitation) spreads over **atrial,** wall / muscle **;** ref to, AVN / **U ;** atria contract / atrial **systole ;** contraction is synchronised / AW **;** delay at AVN **;** (excitation spreads) down **septum ;** ref to, **bundle of His** / **Purkyne** fibres **;** ventricles contract / ventricular systole, from, **apex** / bottom **;** QWC – technical terms, spelled **AND** used in correct context	**4 max** **1**	**ACCEPT** acts as **pacemaker** **ACCEPT** impulse / action potential / depolarisation **DO NOT ACCEPT** electricity / signal / message **DO NOT ACCEPT** if response suggests that brain needed to trigger SAN **ACCEPT** EITHER in context of both atria OR both ventricles contracting together **ACCEPT** Purkinje any **three** from: pacemaker, sinoatrial node, atrioventricular node, excitation, atrial / atrium / atria, septum, Purkyne, bundle of His, ventricle(s) / ventricular, apex, systole.
				[Total: 10]	

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Question			Expected Answers	Marks	Additional Guidance
6	(a)		3 – 5 discrete patches in ring (near centre) ;	1	if xylem drawn then phloem must be labelled **DO NOT ACCEPT** vascular bundles around edge **DO NOT ACCEPT** if phloem occupies more than half total width 
6	(b)		**A** / labelled carbon can be observed in the phloem soon after being supplied to the plant ; **B** / the rate of flow of sugars in the phloem is higher than diffusion ; **C** / an insect such as an aphid feeds by inserting its proboscis (mouth parts) into the phloem ;	max 2	*mark first two letters only*

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Question			Expected Answers	Marks	Additional Guidance
	(c)		*source* site where, sucrose / sugars / assimilates, loaded (into phloem) / AW ; *sink* site where, sucrose / sugars / assimilates, unloaded / removed (from phloem) / AW ;	2	**DO NOT ACCEPT** glucose / substance throughout **ACCEPT** where, sucrose / sugars / assimilates, produced/created or converted from stored products **DO NOT ACCEPT** terms 'loading' and 'unloading' in wrong context **ACCEPT** where, sucrose / sugars / assimilates, stored or used (in metabolic processes) **DO NOT ACCEPT** 'required' or 'needed' instead of 'used'
6	(d)		(sugars) cannot pass the cut / AW ; decrease water potential ; water moves into cells ; (damage triggers) increased cell division ; to produce cells to store sugars ; cut causes, gall / infection ;	2 max	**ACCEPT** sugars, stuck above cut / stuck at top of tree / can't move down/build up above cut
				[Total: [7]	

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