CCEA GCSE SCIENCE: DOUBLE AWARD (NON-MODULAR)

SCIENCE



EXAM QUESTION PACK

PAPER 1 HIGHER TIER G8404 PAPERS

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Rewarding Learning

General Certificate of Secondary Education
2012

Science: Double Award (Non-Modular)

Paper 1
Higher Tier

[G8404]

WEDNESDAY 30 MAY, AFTERNOON

MARK SCHEME

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/ denotes alternative points
; denotes separate points
Comments on marking points are given in italics

		AVAILABLE MARKS
1	**(a)** 10; [1]	
	(b) **(i)** factor stops photosynthesis happening at maximum rate/factor that restricts the rate of photosynthesis/factor that stops reactions going faster/slows down P/S/slows down a process/factor that interferes with photosynthesis/prevents increase in photosynthesis; [1]	
	(ii) Line A – light; Line B – carbon dioxide; [2]	4
2	**(a)** **reflex arc** (need both words) [1]	
	(b) quick(er)/protection/automatic/without thought/quick/immediate/ fast/brain [1]	
	(c) must have both arrows going from stimulus to the sensory neurone to the spinal cord, and one from the spinal cord to motor neurone (need **both** correct for [1]); [1]	
	(d) relay/association/connector/intermediate; [1]	
	(e) contract/flex; [1]	5
3	**(a)** (**more**) blood to skin surface/blood capillaries widen/blood flow increase/ expand (**not** move)/blood flow directed to skin surface; heat lost by **radiation**; [2]	
	(b) sweat **evaporates**; using heat **from body**; [2]	4
4	increased heart rate; more oxygen into body/CO_2 out of body/more gas exchange/more air into lungs/body; liver; [3]	3

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			AVAILABLE MARKS
5	**(a)**	Any **four** from: 1. record distance moved; 2. over a set time; 3. do at different temperature or describe how you change temperature; 4. reset bubble/reset using syringe; 5. keep named controlled variable the same i.e. windspeed/humidity/ surface area of leaves, same plant; 6. repeat and average/repeat for **reliability** [4]	
	(b)	increase; more evaporation/faster evaporation/more water uptake/more transpiration/faster transpiration/more water through stomata; [2]	6
6	**(a)**	so that CO_2 is not present in the air in flask 2 before the locust produces it by respiration/so that they know any CO_2 is produced by insect/locust or during experiment/to see if produced by insect/in respiration; [1]	
	(b)	flask 2; clear/colourless; flask 3: milky white/cloudy; [2]	
	(c)	no insect/replace with dead insect/beads/empty jar; [1]	4
7	**(a)**	**(i)** Type of bacteria – nitrogen fixing; Source of nitrogen – nitrogen (in the air); **or** Type of bacteria – nitrifying bacteria; Source of nitrogen – ammonia; [2]	
		(ii) denitrifying (bacteria); [1]	
	(b)	spread slurry/brown manure/plough the plants back into the ground/ green manure/plant legumes/don't harvest crop/or leave plants/aeration/ ploughing but only with increasing nitrogen fixing/nitrifying bacteria; [1]	
	(c)	active transport/uptake; [1]	5
8	**(a)**	**(i)** Sun/sunlight ***not*** *light on its own* [1]	
		(ii) vegetation → beetle → centipede → toad → fox; [2] arrows in the correct direction from the plant	
		(iii) vegetation at bottom and largest; fox is the smallest and the top; shape symmetrical and in order; [3] *allow consequential marking from their food chain*	
		(iv) fox [1]	
	(b)	**(i)** 850 – (85 + 300 + 250) = 850 – 635 = 215 kJ; [2] [1] for working if final answer is wrong	
		(ii) 85 kJ [1]	10

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AVAILABLE MARKS

9 **(a)** **(i)** to destarch it/so that any starch present at the end was made during the experiment; [1]

(ii) to kill the leaf/stop chemical reactions;
(boil in) alcohol/ethanol; [2]

(iii) turn off Bunsen burner/use an electric water bath; [1]

(iv) blue/black; [1]

(b) **(i)** the shape doesn't match/it fits with it/enzyme is specific/lock and key/specificity/substrate is specific/enzyme specific; [1]

(ii) more than two glucose molecules;
joined together; [2]

(iii) shape of enzyme/active site is changed by heat/denatured/enzyme changed shape; [1]

(c) Any **two** (adaptation with corresponding explanation) from:
Adaptation – microvilli/large surface area;
Explanation – increased absorption area/for quicker/more absorption;
not *easier*
or
Adaptation – lots of them;
Explanation – more absorption/quicker absorption;
or
Adaptation – thin epithelium/one cell thick/thin walls;
Explanation – short diffusion distance;
or
Adaptation – permeable or semi-permeable;
Explanation – to allow molecules to pass across;
or
Adaptation – good blood supply/blood supply close to the wall;
Explanation – maintain diffusion/concentration gradient/quick distribution around body;
or
Adaptation – villi can move/muscle in villi;
Explanation – to allow more glucose/products of digestion to come in contact;
or
Adaptation – lacteal;
Explanation – to allow absorption of fats/fatty acids and glycerol; [4]

(d) **(i)** hepatic portal vein; [1]
insulin; [1]
glycogen; [1]
urea; [1]

(ii) removed because it is **toxic**/harmful/poisonous;
removed by kidney; [2]

19

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10 (a) (i) arrow lungs to LA;
LV to aorta past split towards head and arms; [2]

(ii) X on LV; [1]
must be inside the heart and below the level of the valve

(iii) A – renal **artery**;
B – vena cava; [2]

(b) (i) coronary (artery); [1]

(ii) no oxygen/sugar (**not** just blood); no respiration/no energy; [2]

(c) (i) engulfs/surround/absorb/takes in/ingest;
digest/break down/dissolve; [2]
if in wrong order then maximum [1]

(ii) Any **two** from:
- dead/weakened dose of microbe/disease
- presence of antigen
- antigen or microbe or disease recognised by WBC
- **lymphocyte** produces antibodies [2]

***not** a small dose*

(iii) don't have to get sick/less disease in population/don't catch dangerous disease/long lasting/permanent/get memory cells; [1]

(iv) in mother's milk/by injection (**of antibodies**)/across placenta; [1]
***not** booster on own (unless explained), **not** vaccination*

AVAILABLE MARKS

14

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				AVAILABLE MARKS
11	**(a)**	**(i)**	minerals run-off (via drainage ditch)/slurry run-off/run-off of fertiliser/ leaching/organic waste/septic tank contents/sewage; [1]	
		(ii)	Any **five** from: • increase in growth of algae/algae bloom • algae block out light from the other underwater plants • they can't photosynthesise • algae and plants **die** • bacteria start to **decay** algae and plants (decompose/break down) • **bacteria respire and use up oxygen**; • fish and other animal life die [5]	
	(b)	**(i)**	quadrat; [1]	
		(ii)	identify plant species; estimate percentage cover; calculate average/record; and repeat several times for reliability in one area; repeat in the other area; (Any **four**) [4] *if use co-ordinates/line transect/belt transect/belt transect/throw/ random numbers* Quality of written communication [2]	
		(iii)	temperature; thermometer; sun/light; light meter/LDR; pH; pH meter; rain/rainfall; rain gauge/measuring cylinder; wind; anemometer; soil moisture; moisture meter or oven – described; humidity; hygrometer; (Any **two** pairs) [4]	17

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					AVAILABLE MARKS
12	**(a)**	**(i)**	GG; Gg;	[2]	
		(ii)	Gg and Gg parents; Punnett; cross correct; circle around gg;	[4]	
		(iii)	two Punnett squares; both cross with gg (for second mark);	[2]	
		(iv)	if any offspring are white (then tawny parent was heterozygous)/ if no white offspring it is not heterozygous (Gg);	[1]	
	(b)	**(i)**	camouflaged/hiding/blending; easier to hunt/easier to escape predator (when young)/to reproduce;	[2]	
		(ii)	(survival to) breed/reproduce; pass on allele for gold colour/pass on genes; **or** converse for white lions	[2]	
	(c)	**(i)**	isolate human gene/DNA that codes for insulin; remove the plasmid (from bacterium)/from ring of DNA; cut plasmid (open); join plasmid and human gene; put (it) back into the bacterium;	[5]	
		(ii)	place in fermenter/bioreactor/tank; bacteria multiply/reproduce/divide/mitosis; **or** bacteria multiply; separation/purification/extracted/harvested;	[2]	
	(d)	**(i)**	T; *on left* A; *on right* *if A and T in wrong order then* [1]	[2]	
		(ii)	double; helix;	[2]	
		(iii)	protein/polypeptide/dipeptide;	[1]	
		(iv)	X-ray (diffraction/crystallography); Wilkins/Franklin; 3D structure/**model**; Watson/Crick; complementary base pairing; Chargaff; (Any **two**)	[4]	29
				Total	**120**

Rewarding Learning

Centre Number	
71	

Candidate Number

General Certificate of Secondary Education
2011

Science: Double Award (Non-Modular)

Paper 1
Higher Tier

[G8404]

G8404

THURSDAY 19 MAY, AFTERNOON

TIME

1 hour 45 minutes.

INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.
Write your answers in the spaces provided in this question paper.
Answer **all twelve** questions.

INFORMATION FOR CANDIDATES

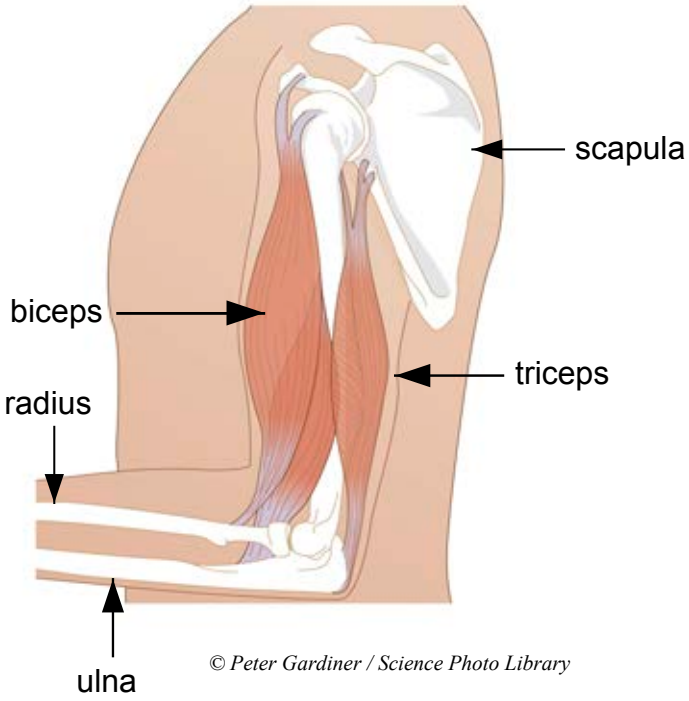
The total mark for this paper is 120.
Quality of written communication will be assessed in question **6(b)**.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.
Details of calculations should be shown.
Units must be stated in numerical answers where appropriate.

For Examiner's use only	
Question Number	Marks
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
Total Marks	

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Examiner Only	
Marks	Remark

1 The diagram shows the bones and the biceps and triceps muscles of the arm.



© Peter Gardiner / Science Photo Library

Use the diagram and your knowledge to answer the following questions.

(a) Name the **two** bones that the biceps muscle is attached to.

_____ and _____ [2]

(b) Which muscle must be contracted in order to raise the lower arm?

_____ [1]

(c) What type of cell carries the electrical impulse to the muscle to make it contract?

_____ [1]

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2 A student carried out food tests on three solutions A, B and C.

The results are shown in the table.

Solution	Iodine test	Benedict's test	Biuret test	DCPIP
A	✓	✗	✗	✗
B	✗	✗	✓	✗
C	✗	✓	✗	✓

A tick ✓ indicates a positive result and an ✗ indicates a negative result for the test.

(a) Using the information in the table state what types of food were present in the different solutions.

Solution A _____

Solution B _____

Solution C _____ and _____ [3]

(b) Which of these food tests requires heating?

_____ [1]

(c) What colour change is seen with a positive result for the Biuret test?

From _____ to _____ [1]

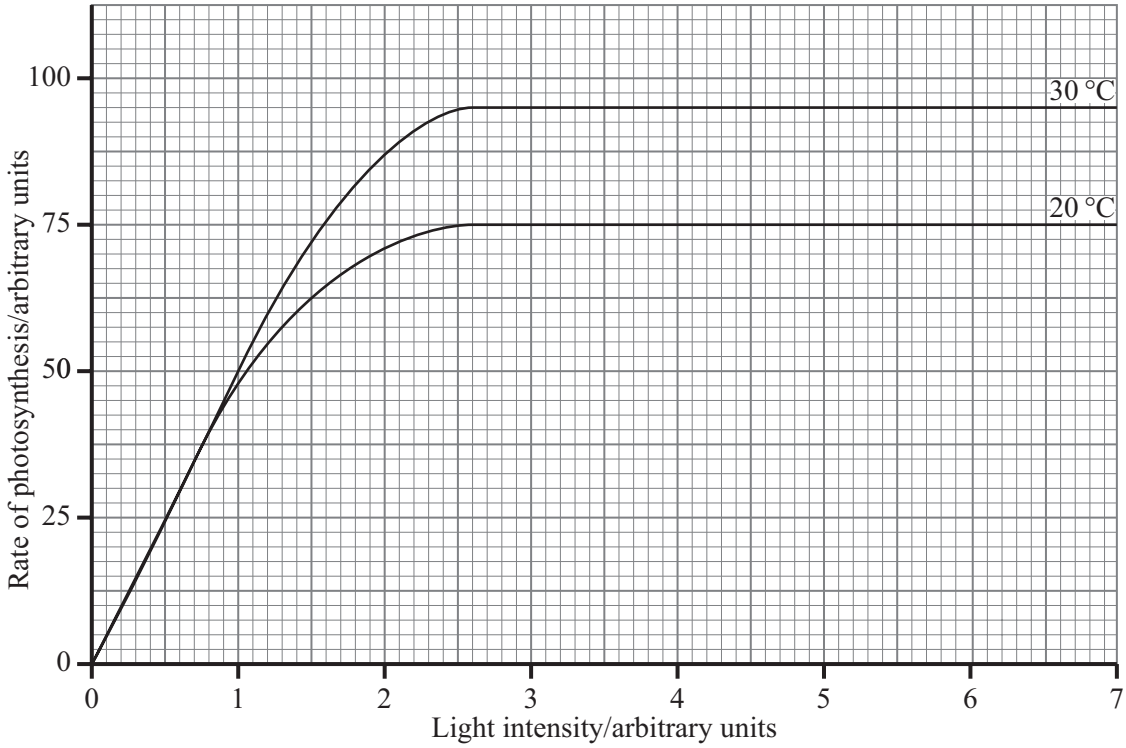
Examiner Only

Marks	Remark

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Examiner Only	
Marks	Remark

3 The graph shows the effect of light intensity on the rate of photosynthesis at two different temperatures. The carbon dioxide concentration is 0.03% at both temperatures.



(a) Use the information in the graph and your knowledge to suggest the light intensity and temperature that a market gardener should have in his greenhouse to maximise his profit. Explain your answer.

Light intensity _____ arbitrary units

Temperature _____ °C

Explanation _____

_____

_____

_____ [3]

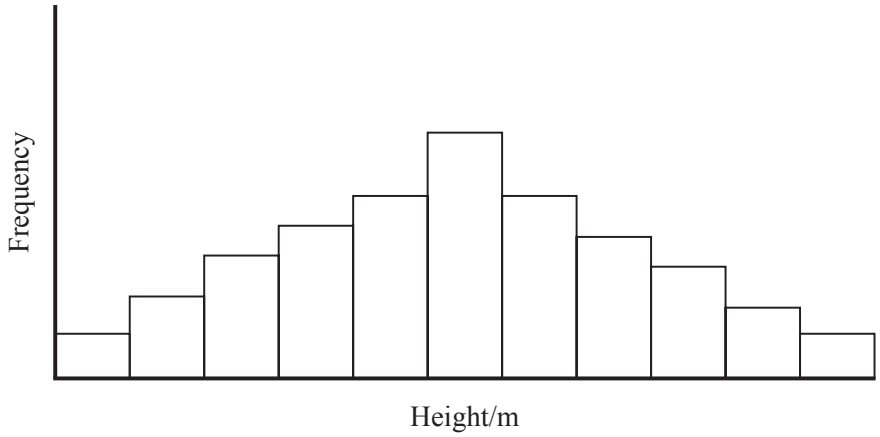
(b) Explain why temperatures above 50 °C would be a problem when growing plants in a greenhouse. Suggest how a grower might regulate temperatures in a greenhouse.

_____

_____ [2]

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4 The graph shows how height in a population of animals varies. Height is an example of continuous variation.



(a) State the two causes of height variation in this population.

_____ and _____ [2]

(b) Suggest the effect on the average height of future populations if the smallest animals couldn't compete for food.

_____ [1]

Examiner Only

Marks	Remark

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5 Organisms of the same species show variation and this allows natural selection.

(a) Suggest **one** adaptation a plant might possess that would enable it to survive better in low light intensity than other plants of the same species.

_____ [1]

(b) How would this adaptation be passed on?

_____ [1]

(c) Explain why an adaptation that does **not** give a plant an advantage may not be passed on.

_____

_____ [2]

Examiner Only	
Marks	Remark

6 The table shows the mineral level (nitrates and phosphates) and depth of light penetration in an unpolluted lake, a polluted lake and Lough Neagh.

Lake	Mineral level/arbitrary units per litre	Depth of light penetration/m
Unpolluted	10–34	6
Polluted (eutrophic)	35–100	3
Lough Neagh	165	1.1

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Use the data in the table and your knowledge to answer the following questions.

(a) Compare the mineral level in Lough Neagh with the other lakes.

_____

_____ [1]

(b) The minerals are used by the water plants for growth. Why is light only able to penetrate 1.1 m in Lough Neagh?
Explain how this can result in death of fish in the lough.

The quality of written communication will be assessed in this question.

_____

_____

_____

_____

_____

_____

_____

_____

_____ [5]

Quality of written communication [2]

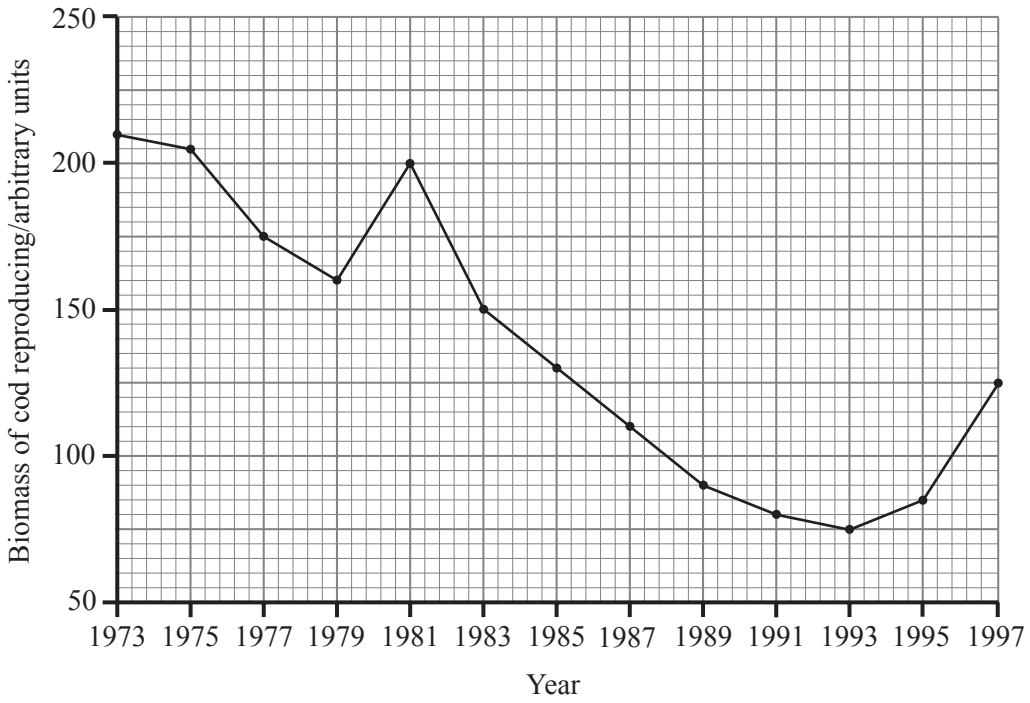
Examiner Only

Marks	Remark

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Examiner Only	
Marks	Remark

7 The graph shows the biomass of cod reproducing in the North Sea over a 24 year period.



Use the graph and your knowledge to answer the following questions.

(a) How many times greater was the biomass of cod reproducing in 1983 compared to 1993?

_____ times [2]

The biomass of cod reproducing in the North Sea started to rise in 1993 after the introduction of new regulations by the European Commission. One regulation made the fishing industry use increased mesh size in fishing nets.

(b) Explain how this regulation helped to increase the biomass of cod reproducing.

_____

_____ [2]

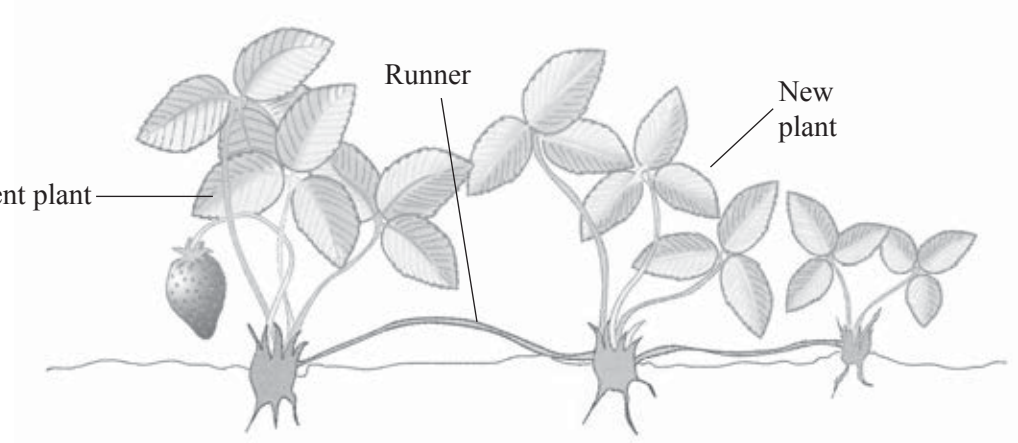
(c) Suggest **two** other regulations that could have been imposed by the European Commission to help increase cod stocks.

1. _____

2. _____ [2]

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8 The diagram shows a strawberry plant with runners.



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(a) Name this type of reproduction.

_____ [1]

(b) Give **one** disadvantage of this type of reproduction.

_____ [1]

(c) If a grower had a strawberry plant that produced tasty fruit, what **two other** methods could she use to increase her stock of this plant?

_____

_____ [2]

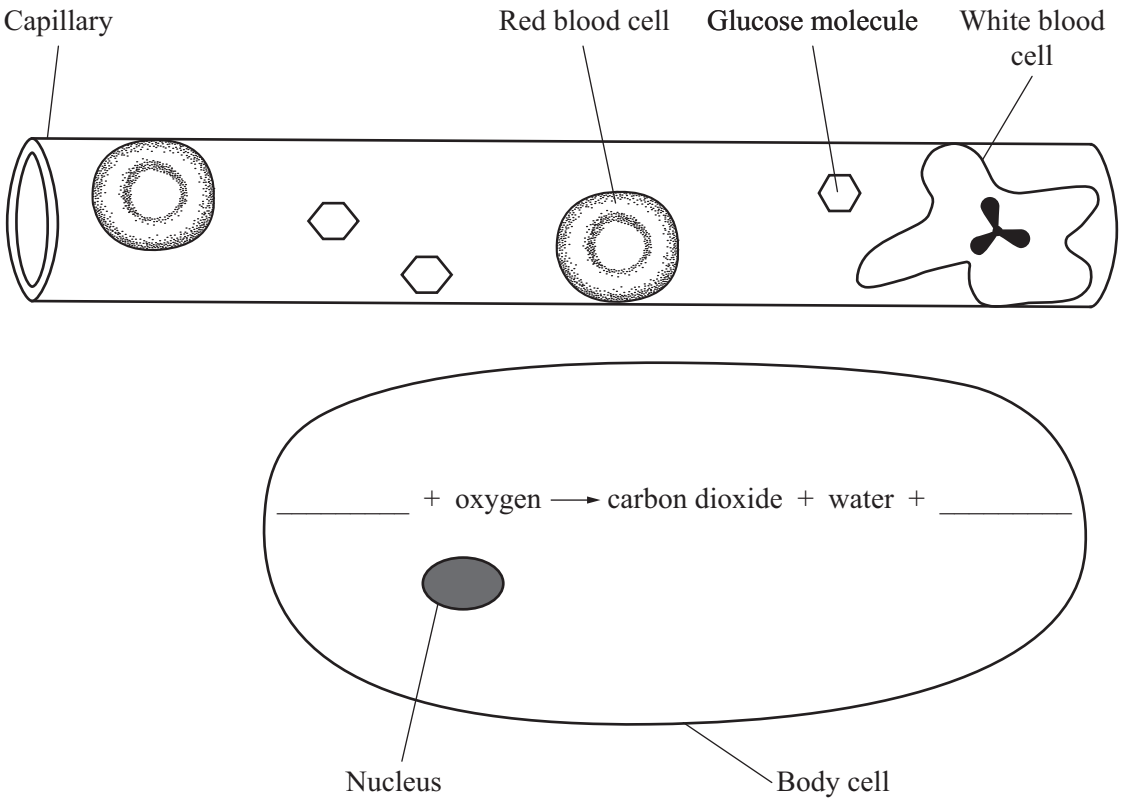
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Marks	Remark

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Examiner Only	
Marks	Remark

9 **(a)** The diagram shows a blood capillary and a body cell.



(i) Complete the word equation for respiration in the body cell. [2]

(ii) How is oxygen carried in the blood capillary?

_____ [1]

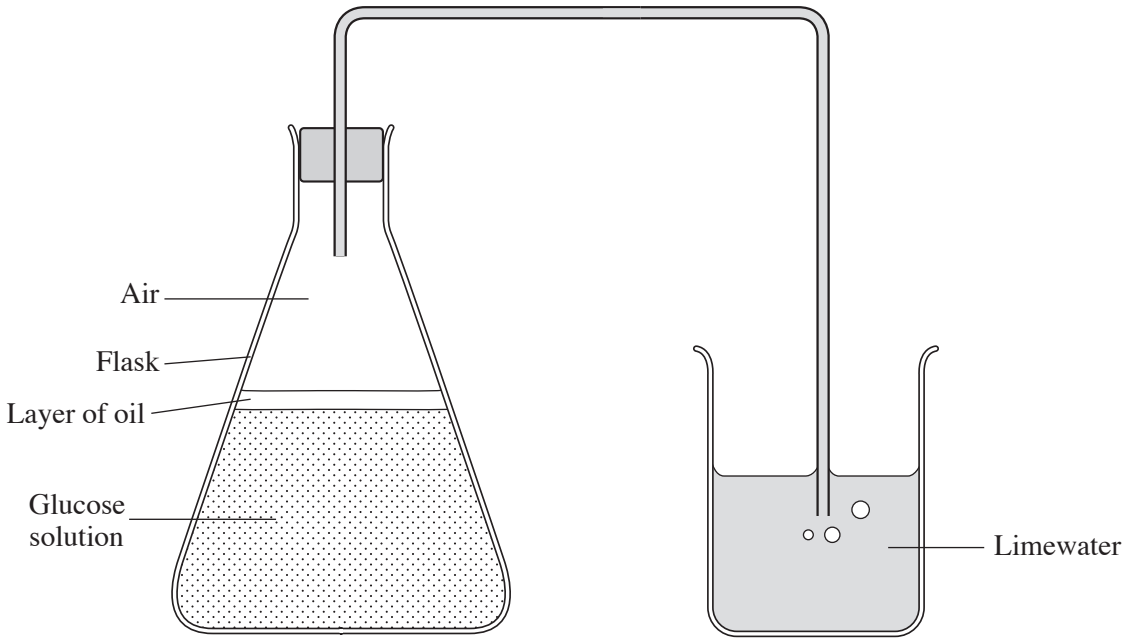
(iii) What happens to the carbon dioxide immediately after it has been produced in the body cell?

_____ [1]

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Marks	Remark

(b) An investigation was carried out to show anaerobic respiration of a microorganism. The microorganism was added to the glucose solution, which had been boiled, then cooled. The apparatus used is shown in the diagram.



(i) Name the microorganism normally used in this investigation.

_____ [1]

(ii) Why was the glucose solution

boiled _____

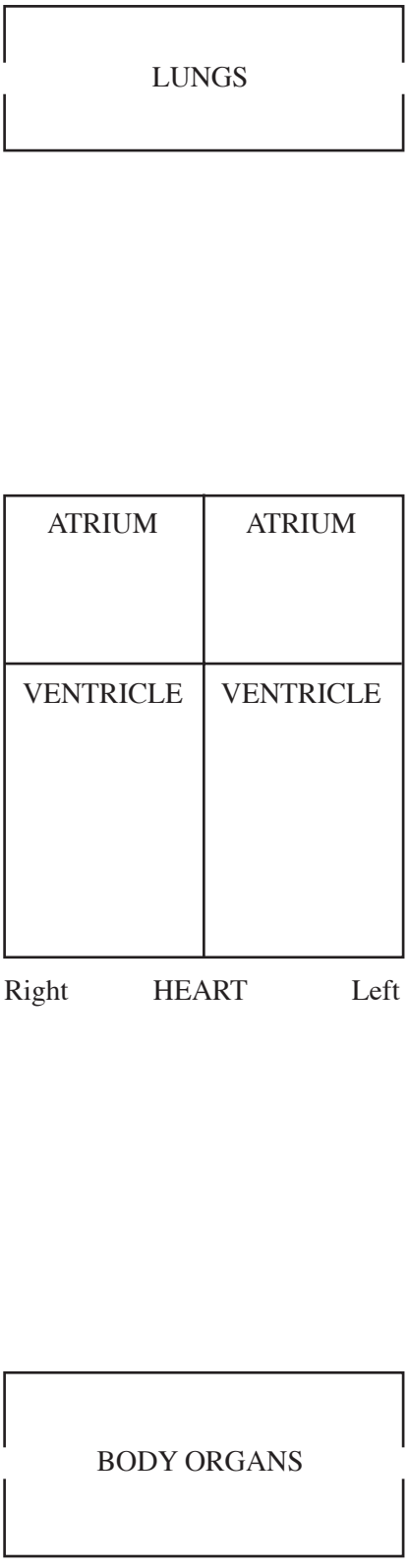
then cooled? _____ [2]

(iii) What would you expect to happen to the limewater?

_____ [1]

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(c) The diagram shows the lungs, heart and body organs of a mammal.



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Marks	Remark

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(i) Complete the diagram by drawing four blood vessels to show the circulation of blood from:

- the body organs to the heart – label as A
- the heart to the lungs and back – label both as B
- heart to the body organs – label as C. [4]

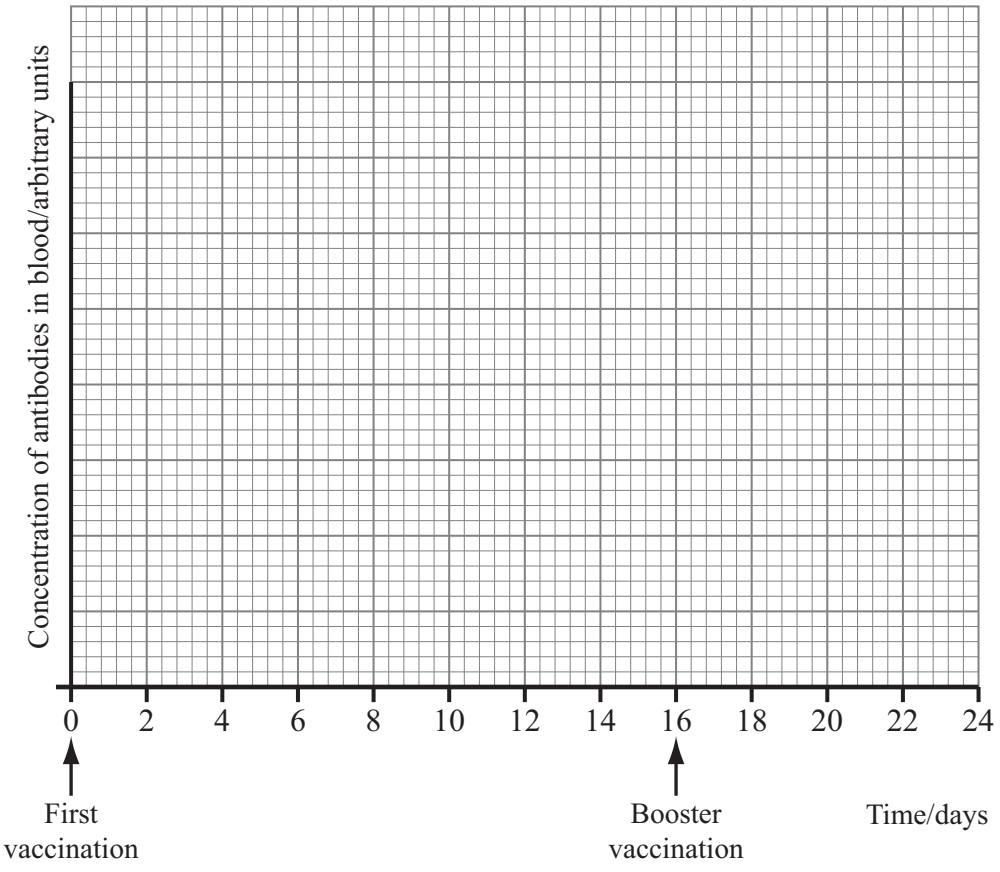
(ii) Name the largest artery in the body. _____ [1]

(iii) Explain why the left ventricle has the thickest muscular wall in the heart.

_____ [1]

(d) Some white blood cells in the body provide immunity by producing antibodies. Most vaccinations introduce a modified disease-causing organism into the body.

Draw a line to show what happens to the concentration of antibodies following a vaccination and a subsequent booster vaccination.



[5]

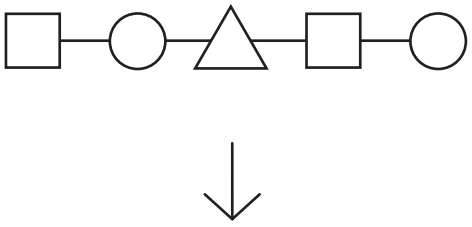
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Marks	Remark

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Examiner Only	
Marks	Remark

10 **(a)** The diagram shows how amino acids link together to form a protein molecule.



(i) Complete the diagram above to show what happens to this protein molecule during digestion in the stomach and small intestine. [2]

(ii) The amino acids will then be absorbed into the blood. Name the process involved.

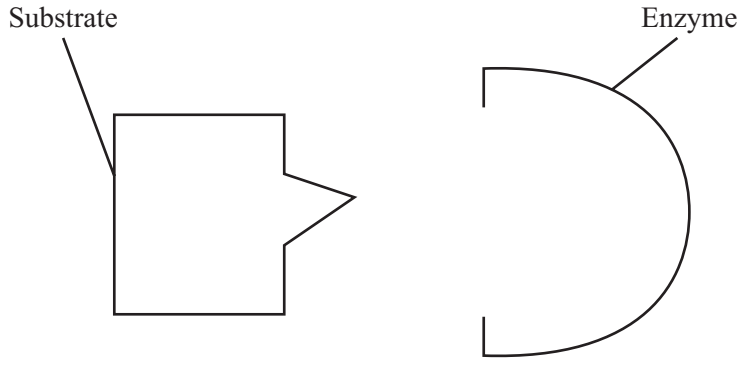
_____ [1]

(iii) Give **two** ways the small intestine is adapted for the process of absorption.

1. _____

2. _____ [2]

(b) The diagram shows the shape of a substrate molecule and part of an enzyme molecule.



(i) Complete the diagram of the enzyme molecule that would break down this substrate molecule. [1]

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(ii) Explain why this enzyme molecule would not break down a different substrate molecule.

_____ [1]

(iii) Why does increasing temperature from 20 °C to 30 °C increase the rate of an enzyme-catalysed reaction?

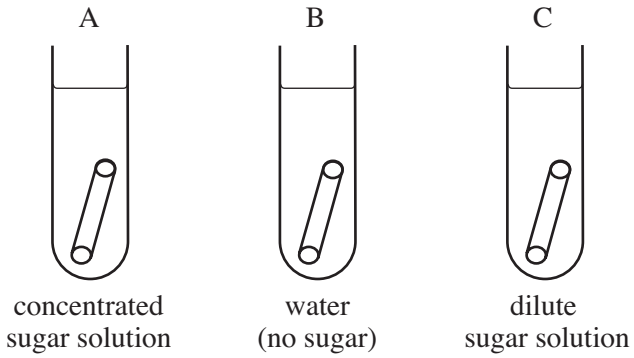
_____ [1]

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Marks	Remark

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Examiner Only	
Marks	Remark

(c) An investigation into osmosis was carried out with potato cylinders. Three test tubes A, B and C were set up, each with a potato cylinder of 50 mm length and a different concentration of sugar solution. The potato cylinders were left for several hours, removed and their final length recorded. The results are given in the table.



Test tube	Solution	Length of potato cylinder at the start/mm	Length of potato cylinder at the end/mm
A	Concentrated sugar solution	50	48
B	Water (no sugar)	50	53
C	Dilute sugar solution	50	50

(i) Why was it **not** necessary to work out the percentage change in length in this experiment?

_____

_____ [1]

(ii) Give **one** factor that should have been kept constant in this experiment.

_____ [1]

(iii) Explain the results for the potato cylinder in test tube A.

_____

_____ [2]

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(iv) Draw a diagram of one potato **cell** from the potato cylinder in test tube A as it would appear at the end of the investigation.

Label the cell membrane, cell wall and vacuole in your diagram.

[4]

(v) Suggest what would happen if red blood cells are placed in water. Explain your answer.

_____

_____ [2]

(d) (i) Name the process in plant root hair cells that involves the transport of minerals from the soil.

_____ [1]

(ii) Explain why energy is needed for this process.

_____ [1]

(iii) Waterlogged soil contains little oxygen. Explain how the uptake of minerals is affected if the plant is grown in waterlogged soil.

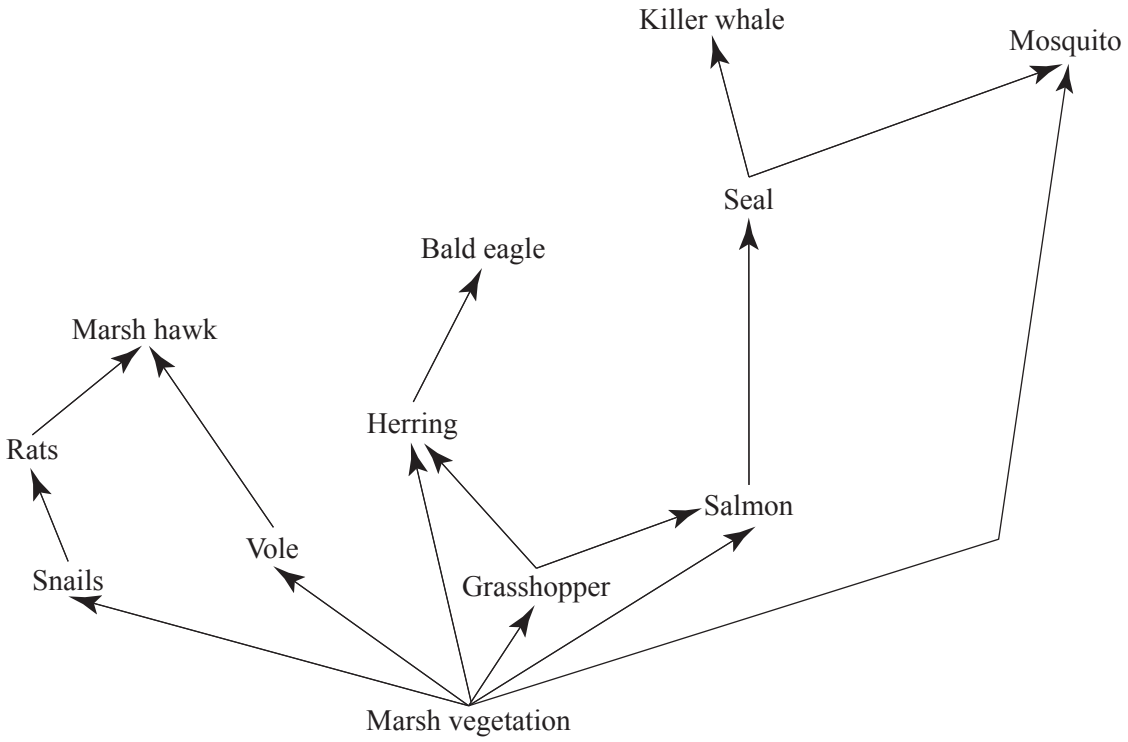
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_____ [2]

Examiner Only	
Marks	Remark

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11 (a) The diagram shows a food web.



http://www.acklamgrange.org.uk/science/topics/food_web3.jpg

(i) At what two trophic levels is the herring feeding?

_____ and _____ [1]

(ii) Draw the food chain from the food web where the bald eagle is acting as a tertiary consumer.

[2]

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Marks	Remark

(iii) Suggest why the population of salmon might increase if the herring population was wiped out by overfishing.

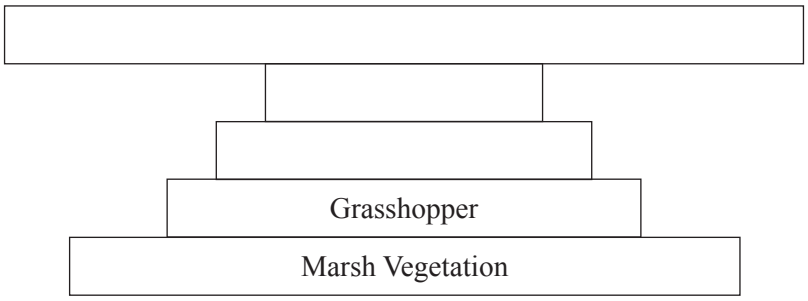
_____ [1]

(iv) Explain why the marsh hawk would gain more energy from eating voles than from eating rats.

_____

_____ [2]

A pyramid of numbers for one of the food chains in the food web is shown below.



(v) Complete the labels on the pyramid with the correct name of the organisms in the food chain. [2]

(vi) On the grid draw a pyramid of biomass from the pyramid of numbers above.

Beside each level write the name of the organism.

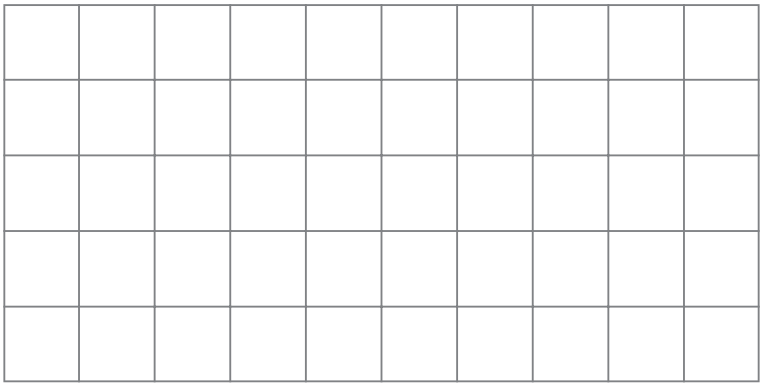
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_____

_____



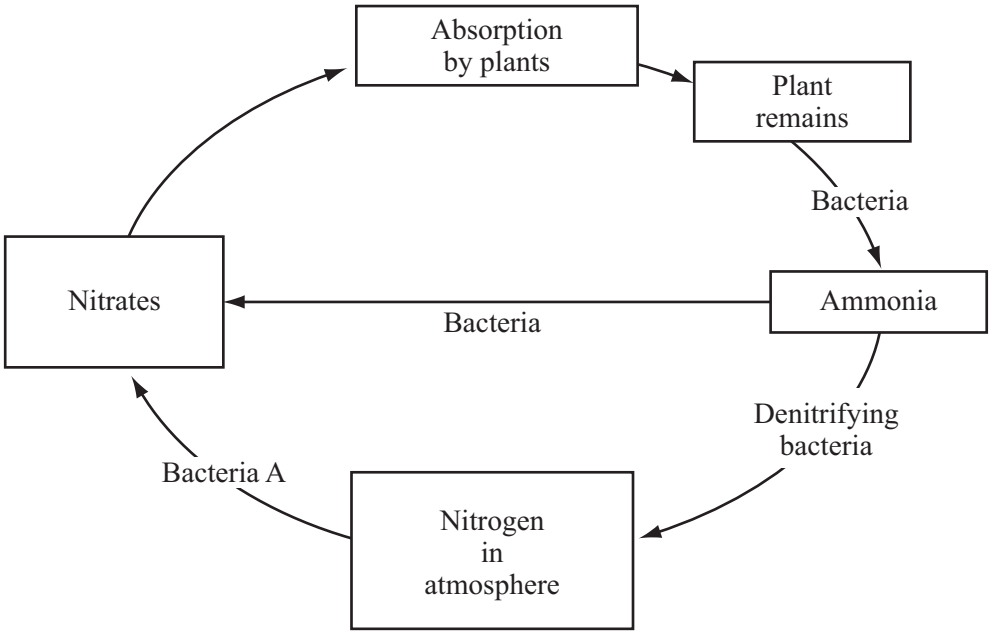
[4]

Examiner Only

Marks	Remark

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(b) The diagram shows part of the nitrogen cycle.



© *Visalia USD*

Use the diagram and your knowledge to answer the following questions.

(i) Name bacteria A.

_____ [1]

(ii) Explain why harvesting a crop causes a decrease in the nitrate content of the soil.

_____ [1]

(iii) Suggest and explain **two** methods, other than applying fertiliser, by which a farmer could increase the nitrate content of the soil.

Method 1 _____

Explanation _____

_____

Method 2 _____

Explanation _____

_____ [4]

Examiner Only

Marks	Remark

Examiner Only	
Marks	Remark

12 (a) The colour of the spots in Dalmatian dogs is determined by a gene. The allele (gene) for black spots is dominant to the allele (gene) for brown spots.



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Let B represent the allele (gene) for black spots.
Let b represent the allele (gene) for brown spots.

A Dalmatian which is heterozygous for black spots is crossed with a Dalmatian with brown spots.

(i) Give the genotypes for this cross.

Heterozygous Black spotted Dalmatian	×	Brown spotted Dalmatian
_____		_____ [2]

(ii) Use a Punnett square to show the possible genotypes of the offspring.

[2]

(iii) Give the phenotypes of the offspring and the ratio of the phenotypes.

Phenotypes _____ and _____

Ratio _____ [2]

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(b) A breeder purchases another black spotted Dalmatian. She carries out a back cross (test cross) to check the genotype of this Dalmatian.

All of the puppies in the litter had black spots.

Draw **one** Punnett square to show how **this** litter was produced.

[3]

(c) The hormone insulin regulates blood sugar levels in the body.

(i) Susan is not able to produce enough insulin. What condition does she suffer from?

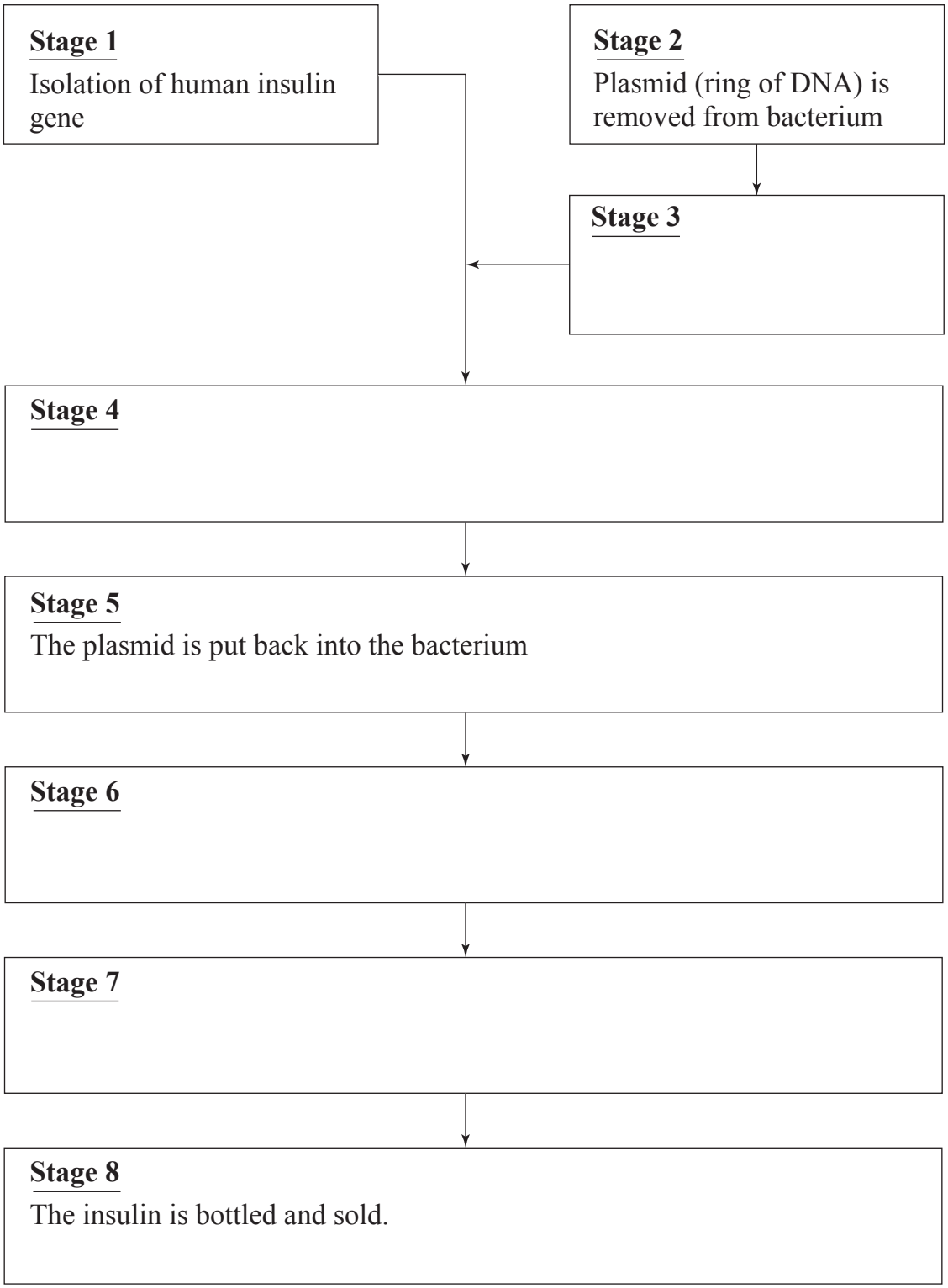
_____ [1]

(ii) How does insulin regulate blood sugar levels?

_____ [1]

Examiner Only	
Marks	Remark

The flow diagram shows some stages in the production of human insulin by genetic engineering.



(iii) Complete the boxes for stages **3**, **4**, **6** and **7**. [4]

Examiner Only

Marks	Remark

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Examiner Only	
Marks	Remark

(iv) State **one** advantage of making human insulin using genetic engineering.

_____ [1]

(d) (i) Name **one** of the two scientists who initially used **x-ray diffraction** to work out the shape of DNA.

_____ [1]

(ii) This knowledge was then used by other scientists to build a 3D model of DNA. Circle the shape below which best shows the structure of DNA.



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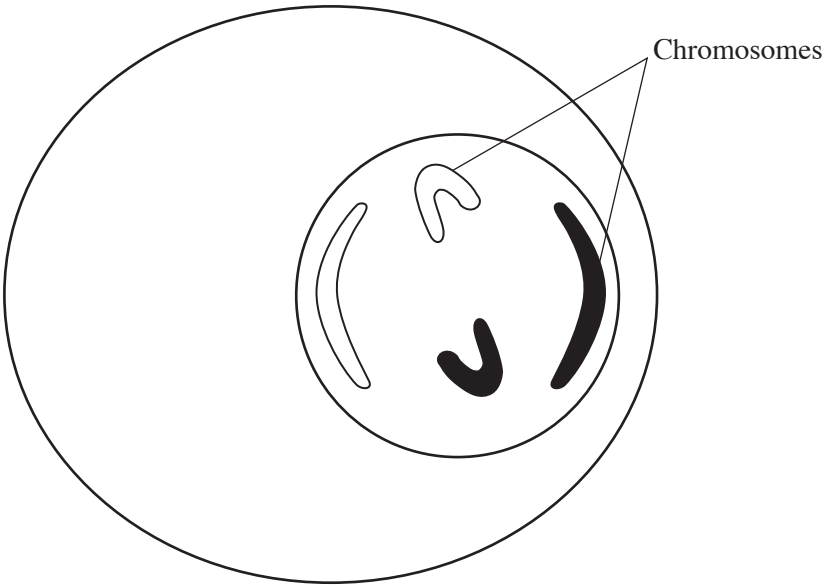
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© Hemera / Thinkstock

[1]

(e) Chromosomes are made up of genes which are made of DNA. The diagram shows four chromosomes in a cell before it divides.



(i) Name **one** type of cell that is produced as a result of:

mitosis _____

meiosis _____ [2]

(ii) Give **two** ways by which mitosis differs from meiosis.

1. _____

_____

2. _____

_____ [2]

Examiner Only

Marks	Remark

THIS IS THE END OF THE QUESTION PAPER

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111231

Rewarding Learning

General Certificate of Secondary Education
2011

Science: Double Award (Non-Modular)

Paper 1
Higher Tier

[G8404]

THURSDAY 19 MAY, AFTERNOON

MARK SCHEME

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				AVAILABLE MARKS
1	**(a)**	radius and scapula	[2]	
	(b)	biceps	[1]	
	(c)	nerve/motor neuron/neuron	[1]	4
2	**(a)**	A – starch; B – protein; C – sugar and vitamin *C* (need both); glucose/fructose not allow sucrose must be vitamin C not named food	[3]	
	(b)	Benedicts	[1]	
	(c)	blue to purple (need both)/lilac/mauve	[1]	5
3	**(a)**	2.5 light intensity [1]; 30 °C [1]; Highest light for least cost/any higher money is wasted;	[3]	
	(b)	plants die/wilt/enzymes denature/*too* much water evaporates; blinds/shading/open door, windows/use a thermostat/ air conditioning	[2]	5
4	**(a)**	DNA/genetics; Genes; environment	[2]	
	(b)	The animals in the population in the future would be *taller*/average height would be taller.	[1]	3
5	**(a)**	more leaves/more chlorophyll/different chlorophyll/taller – /grow earlier/bigger leaves/more chloroplasts/larger surface area	[1]	
	(b)	in the genes/genetically	[1]	
	(c)	death/would not survive; before reproduction	[2]	4

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			AVAILABLE MARKS
6	**(a)**	Higher/very polluted/nearly twice as much P as polluted lake/nearly 5 times P as unpolluted lake; [1]	
	(b)	Algal bloom (prevents light penetration); plants under surface can't P/S; so die; bacteria decompose/these plants; bacterial/decomposers use up O_2; less O_2 for fish [5] QWC two biological statements [2]	8
7	**(a)**	150/75 (1 mark) two (answer on own = 2 marks) [2]	
	(b)	younger fish escape/not caught/smaller fish escape; survive to reproduce/breed [2]	
	(c)	quotas; closed seasons, ban fishing; decommissioning of boats; sanctuaries/exclusion zones/nursery areas/breeding areas; [2]	6
8	**(a)**	asexual/vegetative propagation [1]	
	(b)	no variation/all susceptible to disease [1]	
	(c)	take cuttings; cloning/grafting/tissue culture/micro propagation; [2]	4
9	**(a)**	**(i)** sugar/glucose; energy; [2]	
		(ii) red blood cell/haemoglobin [1]	
		(iii) diffuses into blood/plasma/tissue fluid [1]	
	(b)	**(i)** yeast [1]	
		(ii) get rid of oxygen/sterilise/kill bacteria/kill microbes [1] otherwise heat might kill the yeast [1]	
		(iii) cloudy/milky white/milky [1]	

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AVAILABLE MARKS

(c) **(i)** blood vessel from body organs to right atrium of heart
blood vessel from right ventricle of heart to lungs
blood vessel from lungs to left atrium of heart
blood vessel from left *ventricle* to body organs [4]

(ii) aorta [1]

(iii) needs to pump blood all around the body [1]

(d) rises;
drops; *doesn't* decrease to same level as starting level;
quickly rises just after Booster (day 16)/steeper gradient than 1st rises;
rises to higher level; [5] 19

10 **(a)** **(i)** **[**1] for separated molecules; [1] for 5 shapes as in diagram correct shapes [2]

(ii) diffusion; [1]

(iii) large surface area; villi; one cell thick; capillary network/good blood supply; [2]

(b) **(i)** shape indented to match [1]

(ii) shape doesn't fit or described/substrate specific/lock and key [1]

(iii) more kinetic energy/collisions quicker/more collisions [1]

(c) **(i)** all the same length *at the start* [1]

(ii) temp/amount of drying/volume of solution/same diameter of cylinder/same age type of potato [1]

(iii) water moved out/left cell
more water inside than outside the potato [2]

(iv) plasmolysed cell; cell wall = double line;
[1] each correct label [4]

(v) explode/burst; no cell wall; water move in; conc. gradient explained [1] – what happens
[1] – why [2]

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				AVAILABLE MARKS
(d)	**(i)**	active uptake/transport	[1]	
	(ii)	against a concentration gradient/from low to high conc.	[1]	
	(iii)	less/reduced uptake/slower less *respiration*	[2]	22
11	**(a)**	**(i)** 2 and 3 (need both) or 2nd and 3rd	[1]	
		(ii) marsh vegetation → grasshopper → herring → bald eagle (1 correct food chain, 1 arrows) – must have marsh veg. at start	[2]	
		(iii) more grasshoppers to eat/more marsh vegetation/ more food/less competition for food	[1]	
		(iv) shorter food chain described; less energy lost between trophic levels/less trophic levels	[2]	
		(v) mosquito as top bar; salmon and seal	[2]	
		(vi) mosquito at top; mosquito smallest; symmetry + pyramid + steps; rest all labels correct in correct order – and correctly labelled;	[4]	
	(b)	**(i)** Nitrogen fixing	[1]	
		(ii) nitrates have been used to make plant grow/make protein/plants not available for decomposition	[1]	
		(iii) plough; aerates to reduce denitrifying/increase nitrifying/ N fixing bacteria; Drain; aerates to reduce denitrifying/increase nitrifying/N fixing bacteria; Plant legumes; increase N fixing bacteria; Slurry/Manure = 1 mark Explanation needs to link to method	[4]	18

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12 (a) (i) Bb; × bb – in this order [2]

(ii) Punnett square;
Correct cross; [2]

(iii) Phenotypes: Black (spots) brown (spots); CM for their Punnett
Ratios: 1 : 1 ; [2]

(b) correct gametes BB; bb
All offspring are heterozygous/Bb [3]

(c) (i) Diabetes [1]

(ii) Converts glucose to glycogen/increases the rate of respiration/
increases the uptake of glucose [1]

(iv) Stage 3: The plasmid is cut open
Stage 4: The gene for insulin is inserted into the plasmid
Stage 6: The genetically engineered bacterium multiplies rapidly/
reproduces
Stage 7: The hormone has to be extracted/bacteria filtered out/the
hormone has to be purified/insulin removed [4]

(v) no side effects/cheaper/large scale production/quicker [1]

(d) (i) Franklin or Wilkins [1]

(ii) Double helix (centre diagram); [1]

(e) (i) Mitosis – e.g. muscle cell [1]
Meiosis – e.g. sperm cell, egg cell [1]

(ii) Mitosis – produces cells that are: (*any two*) or converse
identical to parent cell;
same as each other;
diploid (parent cell = diploid);
produces 2 cells (rather than 4 in meiosis);
1 cell division. [2]

Total

AVAILABLE MARKS

22

120

Rewarding Learning

Centre Number	
71	

Candidate Number

General Certificate of Secondary Education
2010

Science: Double Award (Non-Modular)

Paper 1
Higher Tier

[G8404]

G8404

FRIDAY 21 MAY, MORNING

TIME

1 hour 45 minutes.

INSTRUCTIONS TO CANDIDATES

Write your Centre Number and Candidate Number in the spaces provided at the top of this page.
Write your answers in the spaces provided in this question paper.
Answer **all twelve** questions.

INFORMATION FOR CANDIDATES

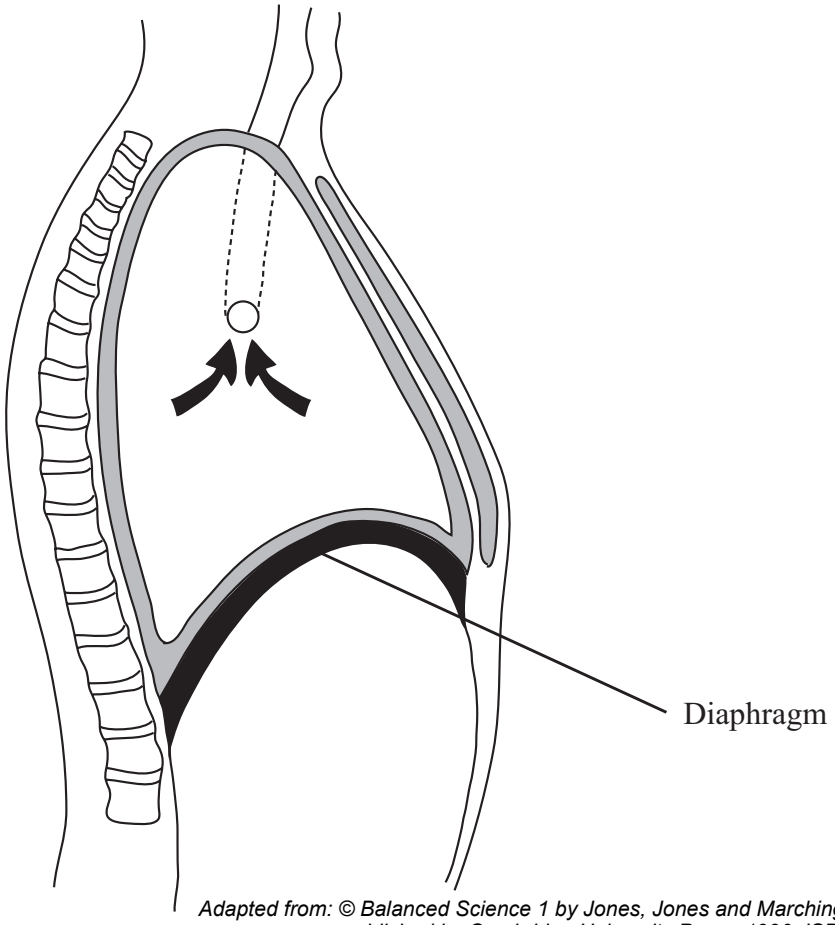
The total mark for this paper is 120.
Quality of written communication will be assessed in question **1(a)**.
Figures in brackets printed down the right-hand side of pages indicate the marks awarded to each question or part question.
Details of calculations should be shown.
Units must be stated in numerical answers where appropriate.

For Examiner's use only	
Question Number	Marks
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
12	
Total Marks	

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Examiner Only	
Marks	Remark

1 The diagram shows the lungs during expiration (breathing out).



Adapted from: © Balanced Science 1 by Jones, Jones and Marchington, page 219, published by Cambridge University Press, 1990. ISBN 0521356893

(a) Describe and explain the mechanism of expiration.

You will be assessed on the quality of written communication in this question.

_____

_____

_____

_____

_____ [4]

Quality of written communication. [2]

(b) Gas exchange takes place in the lungs.

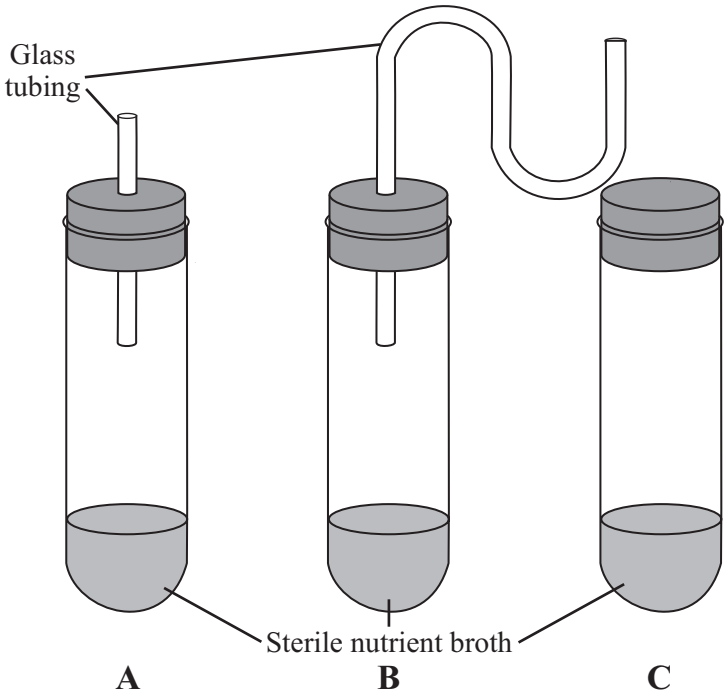
Give **one** way in which the lungs are adapted to carry out this process.

_____ [1]

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Examiner Only	
Marks	Remark

2. An investigation into bacterial growth was set up as shown in the diagram. The broth had been boiled for several minutes to make it sterile.



(a) Why was the broth sterilised? _____ [1]

The broth remains clear if there is no bacterial growth but turns cloudy if bacteria grow.

(b) Complete the table to show the appearance of the broth (cloudy or clear) after two days.

Tube	A	B	C
Appearance			

[3]

(c) Explain the result for tube B.

_____ [1]

(d) Name the scientist who first carried out a similar investigation.

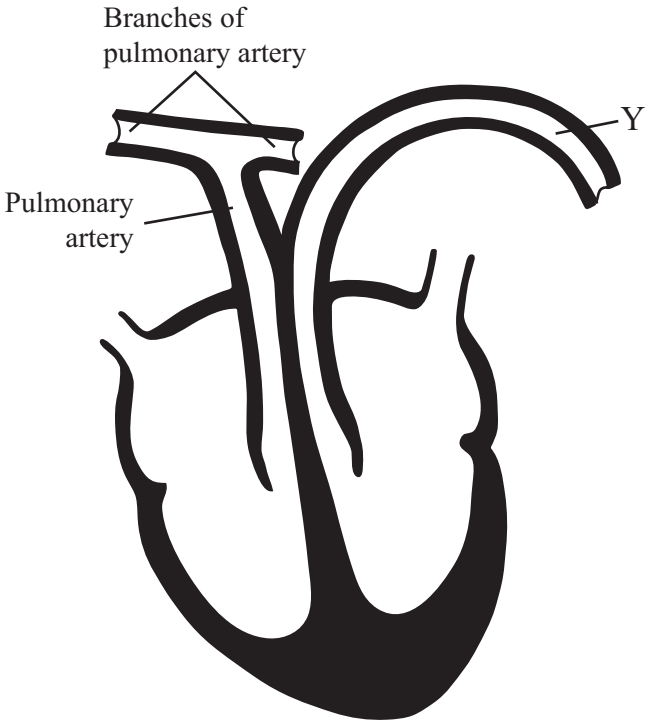
_____ [1]

(e) What theory did this investigation disprove?

_____ [1]

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3 The diagram shows a section through the heart.



(a) On the diagram mark with an X where deoxygenated blood enters the heart. [1]

(b) Name blood vessel Y _____ [1]

(c) Suggest why the pulmonary artery has two branches.

_____ [1]

(d) Which chamber of the heart has the thickest muscle wall.

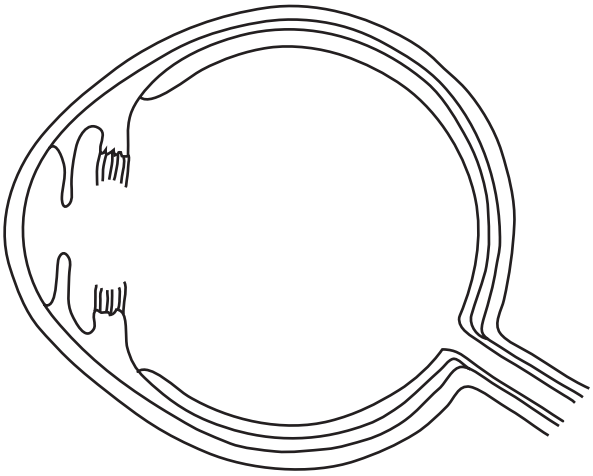
_____ [1]

Examiner Only

Marks	Remark

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4 The diagram shows a section through the eye.



(a) On the diagram, draw the lens in its correct position. [1]

(b) What is the function of the lens?

_____ [1]

(c) Where are the light receptors in the eye? _____ [1]

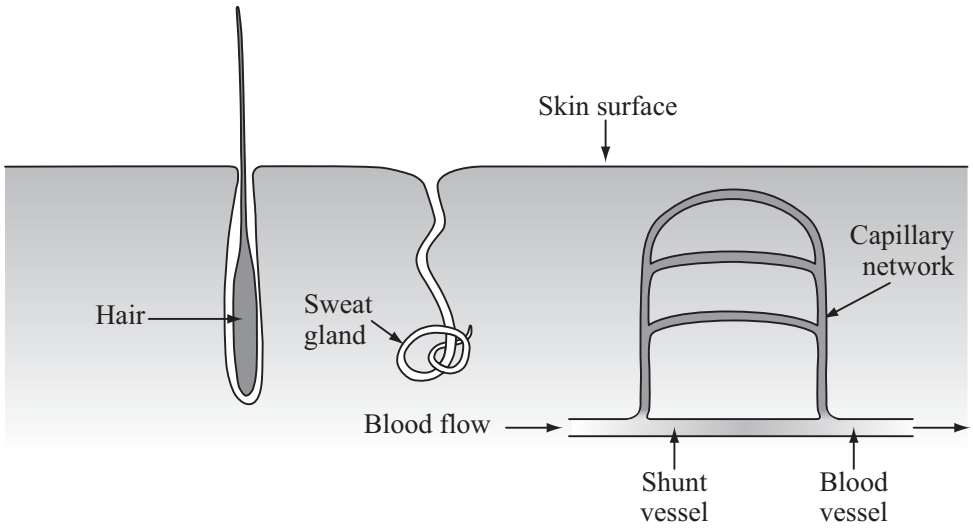
(d) On the diagram, draw an arrow to show where electrical impulses leave the eye. [1]

Examiner Only

Marks	Remark

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5 The diagram shows the skin in cool conditions.



Complete the table to describe and explain the response of the labelled parts of the skin in **hot** conditions.

Part of the skin	Response in hot conditions
Hair	Description
	Explanation
Capillary network	Description
	Explanation
Sweat gland	Description Sweat produced
	Explanation

[2]

[2]

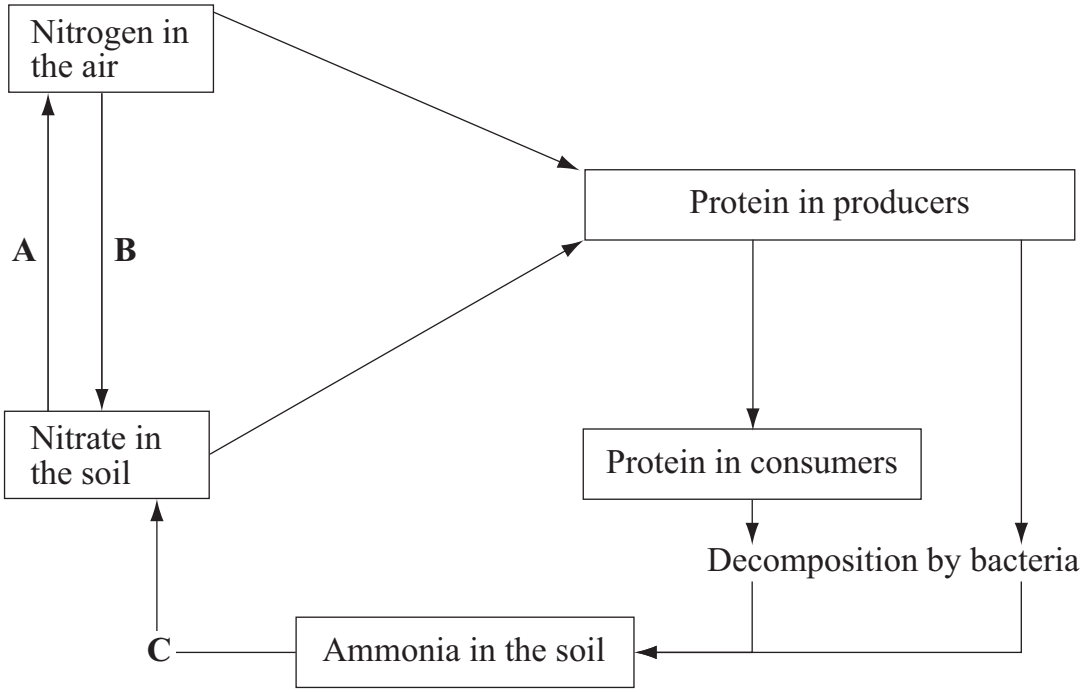
[2]

Examiner Only

Marks	Remark

Examiner Only	
Marks	Remark

6 The diagram shows the nitrogen cycle.
A, B and C are processes carried out by bacteria.



Use the diagram and your knowledge to answer the following questions.

(a) Bacteria are decomposers. Name another type of decomposer.

_____ [1]

(b) Name the types of bacteria that carry out the following processes.

A _____

B _____

C _____ [3]

(c) If a farmer is growing a crop, which of these types of bacteria is not helpful?

_____ [1]

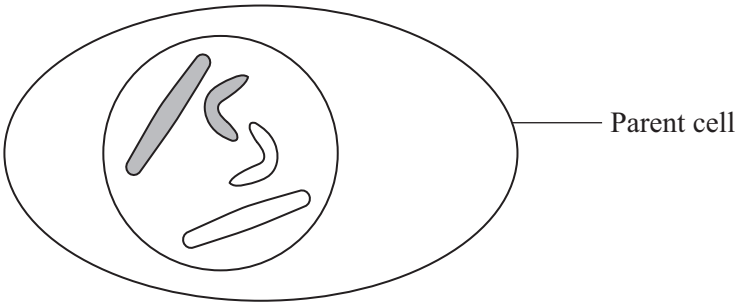
(d) Planting clover increases the number of type B bacteria as these bacteria are found in swellings in clover roots. Suggest the benefit to the soil of planting clover.

_____ [1]

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Examiner Only	
Marks	Remark

7 **(a)** The diagram shows an example of a cell. This cell divides to produce gametes. Complete the diagram to show the result of such cell division.



[3]

(b) Name the type of cell division that produces gametes.

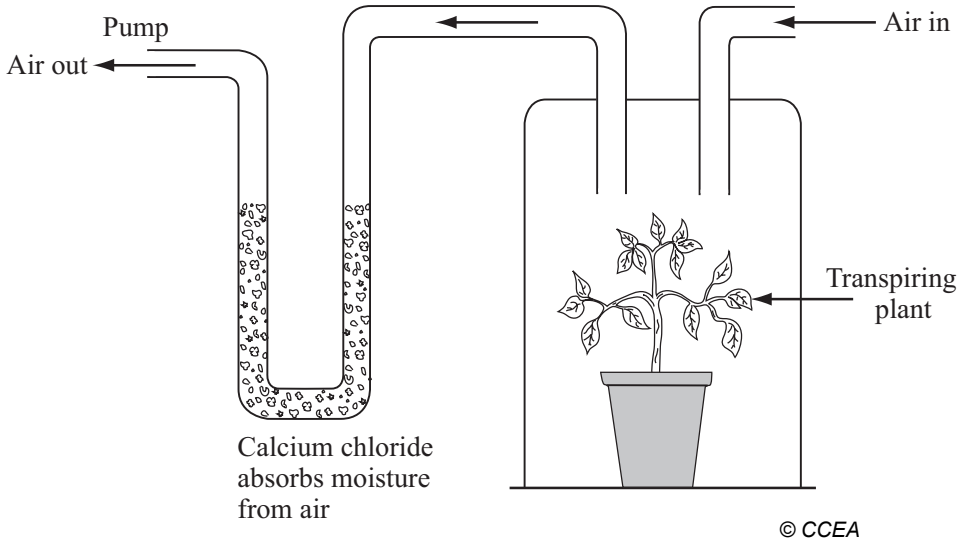
_____ [1]

(c) The parent cell has a diploid number of chromosomes. What term describes the number of chromosomes in the gamete?

_____ [1]

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8 The diagram shows apparatus that can be used to investigate the amount of water transpired by a plant.



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Calcium chloride increases in mass when it absorbs moisture.

(a) Describe how **you** would use this apparatus to compare the rate of transpiration in two plants, one as shown in the diagram and the other with fewer leaves.

_____

_____

_____

_____

_____

_____ [5]

(b) How would you expect the rate of transpiration to differ in the plant with fewer leaves?

_____ [1]

Examiner Only

Marks	Remark

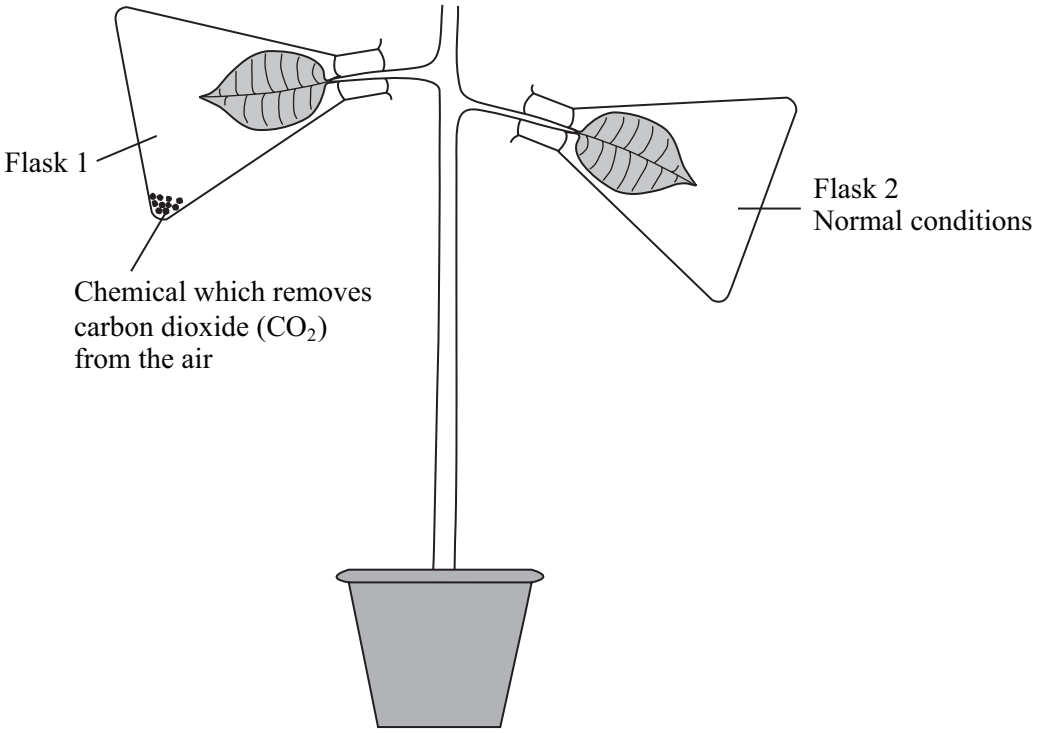
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Marks	Remark

9 **(a)** The diagram shows the apparatus used to investigate if carbon dioxide is needed for photosynthesis.

The plant was destarched and then the leaves were sealed in glass flasks.

The plant was then left in sunlight for 12 hours.



(i) How is the plant destarched?

_____ [1]

(ii) A starch test was carried out on each leaf.

Describe the colour you would expect to obtain at the end of the starch test in the

leaf from flask 1 _____

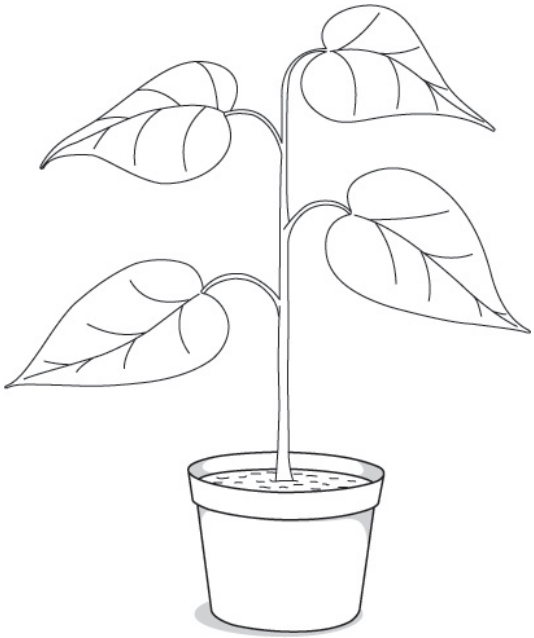
leaf from flask 2 _____ [2]

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(b) Another experiment was carried out on a tomato plant to investigate where sugar was transported to after it was made in the plant leaves. The results are shown below.

Part of tomato plant	Percentage of the sugar transported to each part of the plant
Roots	52
Stem	45
Youngest leaf	2
2nd youngest leaf	1

(i) Draw an arrow to show the direction in which **most** sugar was transported in the plant. [1]



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(ii) Name the type of cells through which sugars are transported.

_____ [1]

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Marks	Remark

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(iii) Give three ways sugars, made by photosynthesis, are used by plants.

1. _____

2. _____

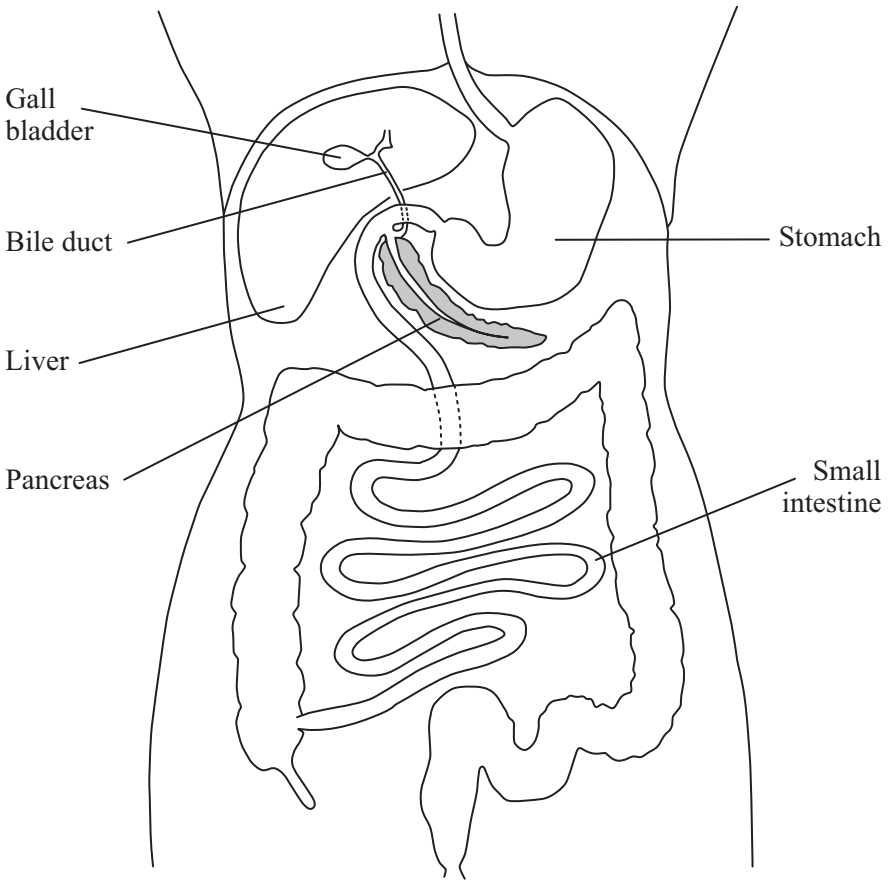
3. _____ [3]

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Marks	Remark

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Examiner Only	
Marks	Remark

10 (a) The diagram shows the liver and associated organs.



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(i) The gall bladder passes bile down the bile duct to the small intestine. Give **one** function of bile.

_____

_____ [1]

(ii) Name the enzyme that breaks down fats after bile has acted on them.

_____ [1]

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(b) Proteins are digested to amino acids in the small intestine.

Examiner Only	
Marks	Remark

(i) Name the process by which amino acids pass into the blood in the small intestine.

_____ [1]

(ii) Name the blood vessel that transports amino acids from the small intestine to the liver.

_____ [1]

(iii) Describe how amino acids are used by cells.

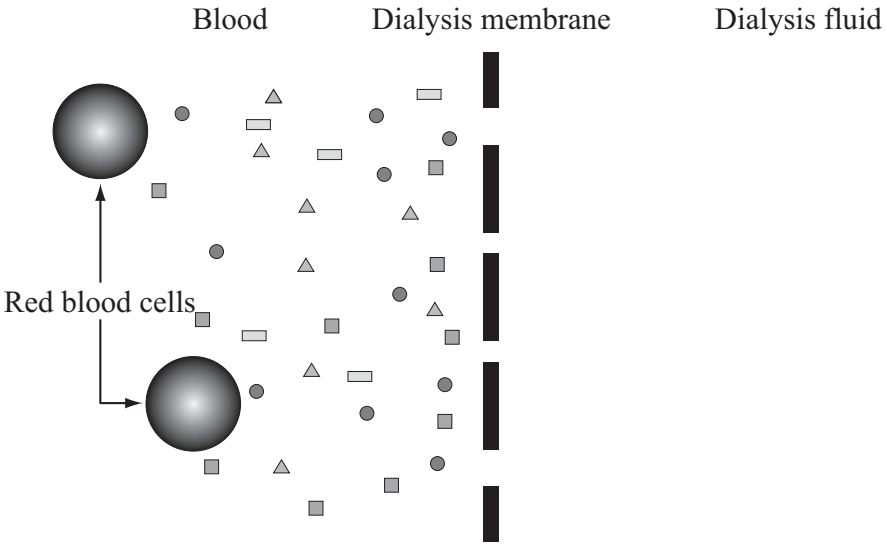
_____

_____ [2]

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(c) Excess amino acids are broken down to urea by the liver and then transported to the kidneys. Anne's kidneys failed and so she had to undergo dialysis.

The diagram shows the composition of Anne's blood as it enters the dialysis machine.



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(i) Complete the table to show whether each of the components listed is present in the **dialysis fluid at the start** of dialysis. Place a tick (✓) if the component is present or a cross (✗) if it is absent. The first one has been completed for you.

Component in Anne's blood	Present or absent in dialysis fluid at the start of dialysis
Salts	✓
Water	
Urea	
Glucose	
Red blood cells	

[4]

(ii) At the end of dialysis how would you expect the composition of the dialysis fluid to have changed?

_____ [1]

(iii) Why does the dialysis fluid need to be changed regularly?

_____

_____ [1]

Examiner Only

Marks	Remark

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(d) (i) The liver and insulin regulate blood glucose levels.

Describe how this regulation occurs after eating a meal with a high glucose content.

_____

_____

_____

_____ [3]

(ii) Name the condition people suffer from if they cannot regulate their blood glucose levels.

_____ [1]

Examiner Only	
Marks	Remark

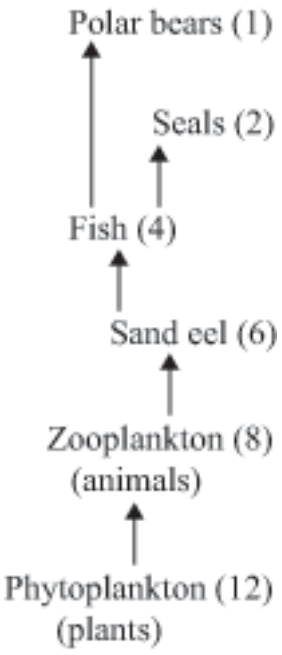
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(Questions continue overleaf)

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11 (a) The diagram shows a food web for an island in the Arctic.

Examiner Only	
Marks	Remark



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Examiner Only	
Marks	Remark

(i) Name the energy source for this food web. _____ [1]

(ii) Use the food web to name

a primary consumer _____

a secondary consumer _____ [2]

(iii) Use the food web to give a food chain with **only** five types of organisms. [3]

_____ → _____ → _____ → _____ _____

(iv) Explain why the phytoplankton (plants) are called producers.

_____

_____ [2]

(v) Suggest why the numbers of zooplankton may decrease during winter.

_____

_____ [2]

(vi) On the grid draw a pyramid of numbers for your food chain in (**iii**).
Use the numbers of organisms shown in the food web.
Beside each level write the name of the organism.

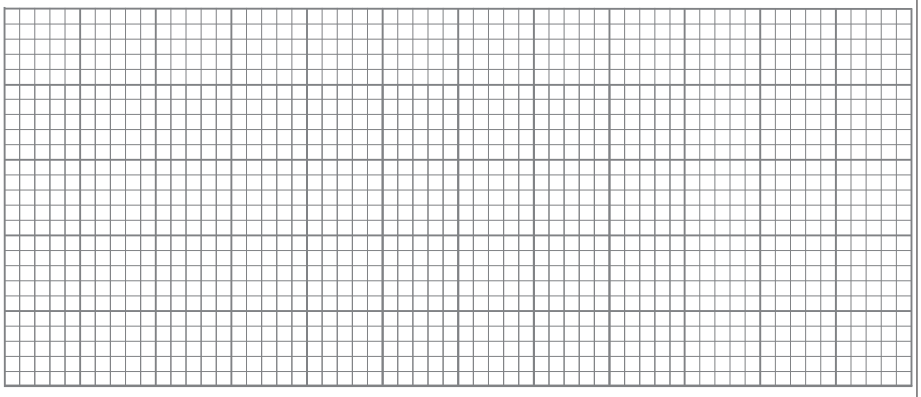
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_____

_____

_____

_____



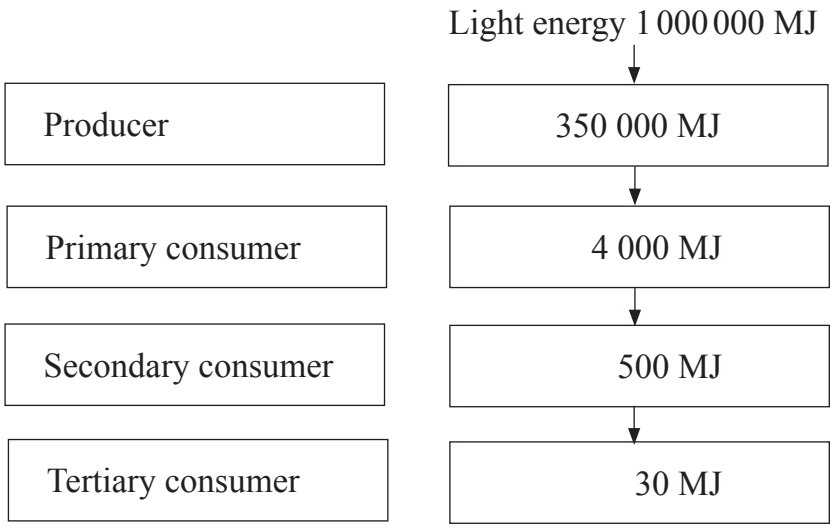
[5]

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(vii) Explain why it is an advantage to the polar bear to have more than one food source.

_____ [1]

(b) The diagram shows the transfer of energy from one trophic level to the next. Energy is lost between trophic levels.



(i) What percentage of the energy available to primary consumers is transferred to secondary consumers? Show your working.

_____ % [2]

(ii) Give **two** ways that energy is lost between trophic levels.

1. _____

2. _____ [2]

Examiner Only

Marks	Remark

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(c) A scientist wanted to estimate the size of population of fish in a lake. He captured a first sample containing 112 fish from the lake and put a mark on the fin of each one. He released these fish back into the lake. One week later he captured a second sample which contained 140 fish, 16 of which were marked and 124 unmarked.

The formula used to estimate the size of a population is given below.

$$\text{Population} = \frac{\text{Total number of fish in the first sample} \times \text{Total number of fish in the second sample}}{\text{Number of marked fish in the second sample}}$$

(i) Calculate the size of the fish population using the formula given. Show your working.

Answer _____ [2]

(ii) Suggest **two** reasons why the fish population in a lake may decrease.

1. _____

2. _____ [2]

(iii) Why is it more difficult to estimate fish populations in the sea rather than in a lake?

_____ [1]

(iv) Give **one** reason why it is important to monitor fish populations in the sea.

_____ [1]

Examiner Only

Marks	Remark

12 Pea plants can produce peas that are wrinkled or smooth.

The gene (allele) for wrinkled is dominant to the gene (allele) for smoothness.

Let R represent the gene (allele) for wrinkled peas.
Let r represent the gene (allele) for smooth peas.

(a) A plant breeder crossed two heterozygous pea plants.

(i) Use a Punnett square to show the possible genotypes of the offspring of this cross.

[3]

(ii) Give the phenotypes of the offspring and the ratio of the phenotypes.

Phenotypes _____ and _____

Ratio _____ [2]

(b) The breeder had a pea plant that produced wrinkled peas but he did not know its genotype.

(i) Use Punnett squares to show the backcrosses (test crosses) that he used to determine the genotype of this pea plant.

[3]

(ii) If any smooth offspring are produced what does this tell you about the genotype of the parent pea plant?

_____ [1]

Examiner Only

Marks	Remark

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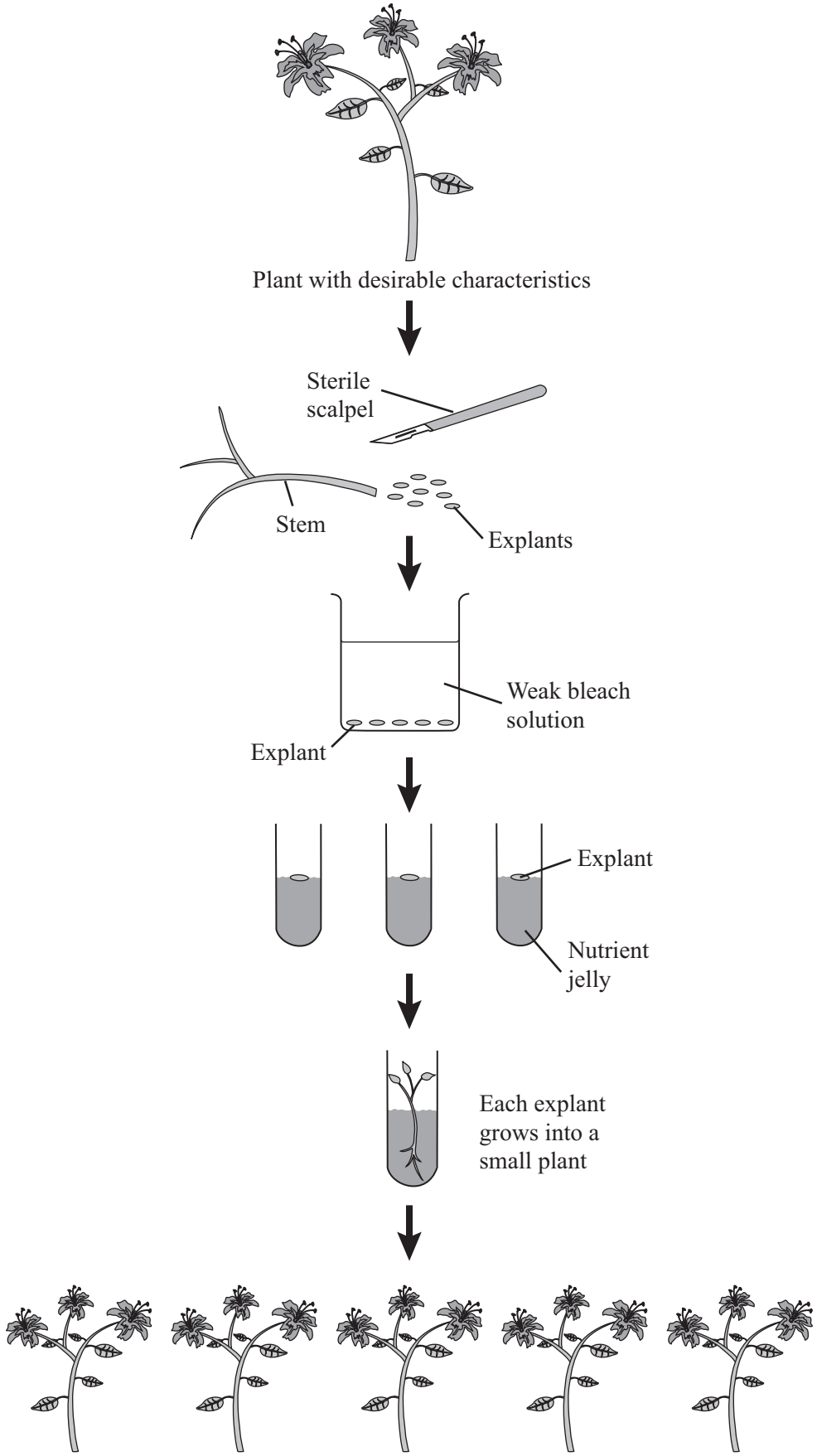
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Examiner Only	
Marks	Remark

(c) The diagram shows how plants can be produced by the process of tissue culture.



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(i) When choosing a plant for tissue culture suggest **two** desirable characteristics that the plant might have.

1. _____

2. _____ [2]

(ii) Why is tissue culture an example of artificial selection?

_____ [1]

(iii) Suggest an advantage of using tissue culture to produce plants commercially.

_____ [1]

(iv) Why do the following minerals need to be added to the nutrient jelly?

Magnesium _____

Calcium _____ [2]

(v) Suggest why the explants are placed in a weak bleach solution.

_____ [1]

(vi) Give **two** environmental conditions that would need to be controlled to produce plants by tissue culture.

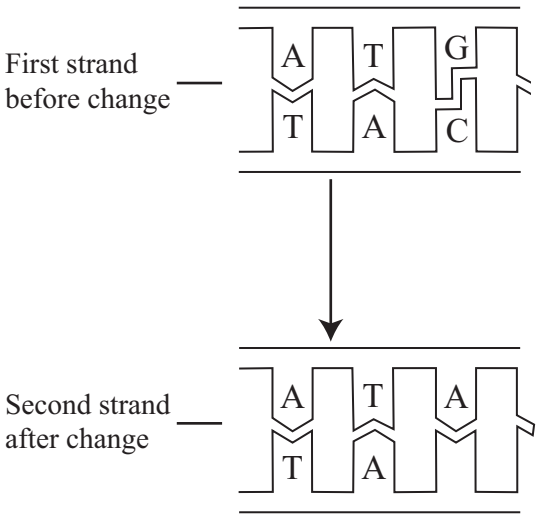
1. _____

2. _____ [2]

Examiner Only	
Marks	Remark

Examiner Only	
Marks	Remark

(d) The diagram shows a section of DNA before and after a change occurred in the DNA structure. The letters A, T, G and C represent the four bases.



(i) The G on the first strand changed to A. Complete the second strand by adding in the missing base. [1]

(ii) What is a change in DNA structure called?

_____ [1]

(iii) What type of molecule does DNA code for?

_____ [1]

(iv) What effect may the change in DNA structure, shown above, have on the molecule it codes for?

_____ [1]

(v) What approach did Watson and Crick take that led them to the discovery of the structure of DNA?

_____ [1]

(vi) What term is used to describe the structure of DNA?

_____ [2]

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THIS IS THE END OF THE QUESTION PAPER

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110004

GCSE

Science: Double Award (Non-Modular)

Summer2010

Mark Schemes

Issued: October 2010

Rewarding Learning

General Certificate of Secondary Education
2010

Science: Double Award (Non-Modular)

Paper 1
Higher Tier

[G8404]

FRIDAY 21 MAY, MORNING

MARK SCHEME

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				AVAILABLE MARKS
1	**(a)**	Diaphragm raised/relaxed/becomes dome-shaped/moves up; (**not** up & out/up & in); Ribs move down and in/down/in; reference to **intercostal** muscles (**not** muscles); Volume decrease/smaller chest/thorax dec.; (**not** lungs decrease) Pressure increases; Any four	[4]	
		QWC	[2]	
	(b)	Large surface area/**many** alveoli/moist/short diffusion distance/ permeable/good blood supply/thin walls/thin membranes; (**not** thin cell walls)	[1]	7
2	**(a)**	To kill any bacteria present in the broth/make sure no microbes present/ remove microbes	[1]	
	(b)	Cloudy – A; Clear – B; Clear – C;	[3]	
	(c)	Microbes can't enter both/caught in bend (**not** describing shape of swan-neck flask/ref to dust alone)	[1]	
	(d)	Pasteur	[1]	
	(e)	**Spontaneous** generation or described	[1]	7
3	**(a)**	X on right atrium or blood vessel	[1]	
	(b)	Aorta	[1]	
	(c)	One branch to each lung (**not** one to head, one to lungs) (**not** one to lungs) (**not** one back to heart)	[1]	
	(d)	Left ventricle	[1]	4
4	**(a)**	Lens between suspensory ligaments	[1]	
	(b)	Bend/refract light/focus the image/focus the light/focus rays (**not** concentrate light)	[1]	
	(c)	Retina/fovea (**not** at the back (on its own))	[1]	
	(d)	Arrow at or beside optic nerve	[1]	4

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			AVAILABLE MARKS
5	• Hair flat/down/bends; less air as insulation/less air trapped/less insulation/ allows more heat loss; [2] • Capillaries dilates/widens/vasodilation/shunt vessel constricts; **more** blood to skin/(**more**) heat to surface; (not capillaries move) [2] • Heat used; to evaporate sweat; [2]		6
6	**(a)** Fungi (**not** earthworms) [1]		
	(b) Denitrifying – A; Nitrogen fixing – B; Nitrifying bacteria – C; [3]		
	(c) Denitrifying/A [1]		
	(d) **More** nitrates (**not** nitrogen/protein/fertilises) [1]		6
7	**(a)** 4 cells; (**not** ball of cells); Each cell 1 large + 1 small chromosome; At least 2 different combinations; If 2 cells – haploid with diff. combinations = 1 mark [3]		
	(b) Meiosis; [1]		
	(c) Haploid (**not** n) [1]		5
8	**(a)** weigh **$CaCl_2$** at start; leave for certain time; (**not** weigh plant) Reweigh $CaCl_2$ at end/record the change in mass; reset up with plant with less leaves/reset with 2nd plant; Some mass of $CaCl_2$/keep light/wind speed/temp/named variable constant; calculate water loss per given time; (Any five) [5]		
	(b) Slower/lower/less transpiration [1]		6

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					AVAILABLE MARKS
9	(a)	(i)	Place in dark cupboard **for 1 day or more**	[1]	
		(ii)	Yellow/brown; orange-yellow; (**not** red/no colour change) Blue/black; black (**not** blue on own/brown-black)	[2]	
	(b)	(i)	Down – arrow	[1]	
		(ii)	Phloem	[1]	
		(iii)	Respiration/energy/active transport/germination; (**not** food/glycogen) fruit formation/seed formation/stored as fat; growth/new leaves/new flowers/proteins/reproduction - gametes; (**not** repair/nutrient storage) cellulose; (**not** cell walls on own) stored as starch/starch on own/tubers; (**not** storage/stores glycogen) chlorophyll; nectar; (**not** attracts insects) (Any three)	[3]	8
10	(a)	(i)	Emulsify fats/ Neutralise acids; (**not** breakdown fat droplets/food)	[1]	
		(ii)	Lipase	[1]	
	(b)	(i)	Diffusion/absorption	[1]	
		(ii)	Hepatic portal vein (**not** hpv/hepatic portal)	[1]	
		(iii)	To make protein/enzymes; for growth/repair;	[2]	
	(c)	(i)	Component — Present or Absent in dialysis fluid at start of dialysis Water ✓ Urea ✗ (**not** left blank) Glucose ✓ Red blood cells ✗ (**not** left blank)	[4]	
		(ii)	Urea/**more** salt/**more** water/more urea/equal amount of salt as in blood (**not** red blood cells/glucose/water/salt)	[1]	
		(iii)	Maintain concentration gradient/described/ prevent urea going back into blood/fills up with urea	[1]	

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				AVAILABLE MARKS
(d)	**(i)**	Stored as glycogen/stores glycogen; (**not** stores on own) insulin produced in the pancreas; stored as fat; (insulin causes) more uptake; (liver) more respiration; insulin reduces the blood glucose level; (**not** returns blood sugar level to normal) (Any three) [3]		
	(ii)	Diabetes [1]		16
11	**(a)**	**(i)** Sun/light/sunlight/light energy [1]		
		(ii) Zooplankton; [1] sand eel; [1]		
		(iii) Phytoplankton → zooplankton → sand eels → fish ➔; polar bears [1] mark phytoplankton at start & polar bears at end [1] mark arrow [1] mark organisms in between in correct order (zooplankton – sand eels – fish) [3]		
		(iv) Produce sugars/food/photosynthesise/starch; (**not** produce energy) Using sunlight; [2]		
		(v) Less phytoplankton/less food; due to less light/temp (**not** harsh conditions) (**not** more sand eels eat them) [2]		
		(vi) Pyramid Numbers 1 – polar bear 4 – fish 6 – sand eels 8 – zooplankton 12 – phytoplankton [1] symmetrical **and** pyramid shape [1] mark numbers correct [1] mark phytoplankton at base [1] mark polar bear top/or seals if cm from (iii) [1] mark all other labels correct [5]		
		(vii) If problem with one food source – still have other/more to eat 1 may die out [1]		

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AVAILABLE MARKS

(b) **(i)** $\frac{500}{4000}$; × 100 = 12.5%; or 2 marks for 12.5% [2]

(ii) Not all the animal is eaten;
Movement/hunting;
excretion/defaecation/urine/faeces/waste;
reproduction;
resipration/heat
(Any two) [2]

(c) **(i)** $\frac{112 \times 140}{16}$; = 980; [2]

(ii) Disease;
pollution/acid rain/eutrophication/thermal pollution;
overfishing; (**not** fishing)
predators;
lack of food/decrease number of prey;
(Any two) [2]

(iii) Larger area/not enclosed/fish can move [1]

(iv) Adjust or apply quotas/legislation/to prevent extinction/
to determine pollution levels/to prevent overfishing; [1]

26

12 **(a)** **(i)**

	R	r
R	RR	Rr
r	Rr	rr

Punnett;
both parents correct;
correct cross;
[3]

(ii) wrinkled and smooth
3 : 1
(Must have phenotype to get 2 marks) [2]

(b) **(i)**

	R	R
r	Rr	Rr
r	Rr	Rr

	R	r
r	Rr	rr
r	Rr	rr

[3]

Only two Punnetts;
each with rr;
one RR and one Rr;

(ii) Parents must have been heterozygous/carry the recessive gene/Rr [1]

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				AVAILABLE MARKS
(c)	**(i)**	drought resistant/frost resistant/wind/resistant; Disease free/disease resistant; long shelf life/long lasting flowers or fruit; colour/scent/attractiveness/taste/variegated/good shape; quick growing/large yield/**lots** of flowers/**lots** of fruit/big leaves/ tall plants/dwarf plant; (**not** size/height/strength)	[2]	
	(ii)	Characteristics selected by man; (**not** produced by man)	[1]	
	(iii)	Large numbers/faster/**all** same/get plants out of season (**not** cheaper/easily done/economically viable unqualified)	[1]	
	(iv)	Mg – Chlorophyll/chloroplasts; Ca – Cell walls/cellulose cell walls (**not** cellulose on own);	[2]	
	(v)	Sterilise/to kill bacteria/remove bacteria (**not** remove germs/impurities/clean them)	[1]	
	(vi)	Light (sun); temp (heat); pH; nutrient concentrates; nutrient cocktail; fertiliser; CO_2; O_2; humidity (water/moisture); (Any two)	[2]	
(e)	**(i)**	T	[1]	
	(ii)	Mutation	[1]	
	(iii)	Protein (**not** amino acids or protein **and** amino acids)	[1]	
	(iv)	Different protein made/A different amino acid in sequence/ causes a genetic disorder/different molecule/changes shape;	[1]	
	(v)	Model/3D Model (**not** x-rays/using microscopes)	[1]	
	(vi)	Double; Helix;	[2]	25
			Total	**120**

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