AQA A-LEVEL BIOLOGY

BIOLOGY



EXAM QUESTION PACK

UNIT 1 OLD SPECIFICATION PAPERS

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Centre number | | | | | | Candidate number | | | | |

Surname _____

Forename(s) _____

Candidate signature _____

AS BIOLOGY

Unit 1 Biology and disease

Thursday 26 May 2016 Afternoon Time allowed: 1 hour 15 minutes

Materials

For this paper you must have:
- a ruler with millimetre measurements
- a calculator.

Instructions
- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- You may ask for extra paper. Extra paper must be secured to this booklet.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information
- The maximum mark for this paper is 60.
- The marks for questions are shown in brackets.
- You are expected to use a calculator, where appropriate.
- Quality of Written Communication will be assessed in all answers.
- You will be marked on your ability to:
  – use good English
  – organise information clearly
  – use scientific terminology accurately.

Do not write outside the box

Answer **all** questions in the spaces provided.

1 (a) **Table 1** shows some parts of cells and two different types of cell.
Complete **Table 1** by putting a tick in a box if the structure is present in the type of cell.

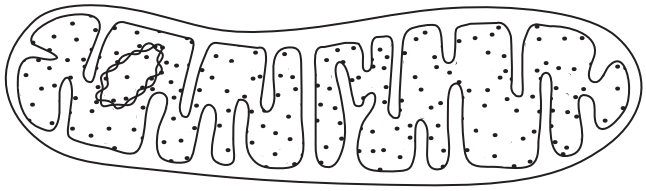
[2 marks]

Table 1

	Cell wall	**Cell-surface membrane**	**Nucleus**
White blood cell			
Bacterial cell			

1 (b) **Figure 1** is a diagram of a mitochondrion at a magnification of × 30 000.

Figure 1



Calculate the actual length of this mitochondrion in micrometres (µm). Show your working.

[2 marks]

Answer = _____ µm

Do not write outside the box

1 (c) Some scientists support the theory that mitochondria are organelles that evolved from prokaryotic cells.

1 (c) (i) Give **one** piece of evidence that supports the theory that mitochondria evolved from prokaryotic cells.

[1 mark]

1 (c) (ii) What is the advantage to cells of having mitochondria?

[2 marks]

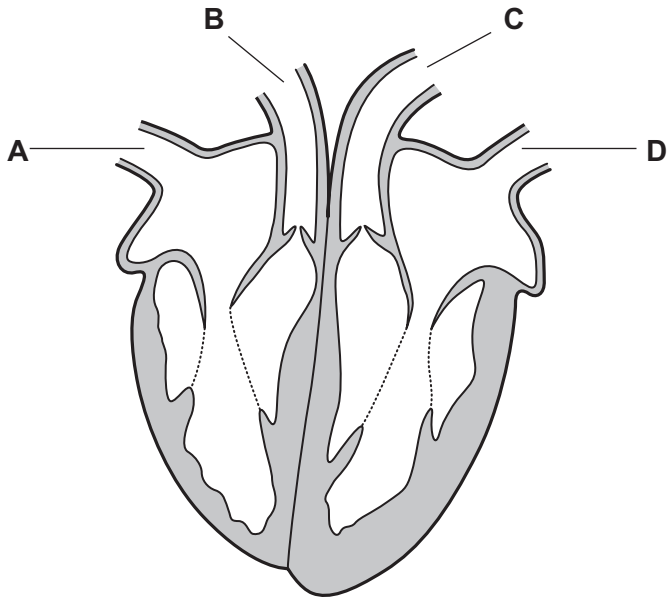
7

Turn over for the next question

Do not write outside the box

2 **Figure 2** shows a section through the heart. The main blood vessels are labelled **A**, **B**, **C** and **D**.

Figure 2



2 (a) In parts **(a) (i)** and **(a) (ii)**, write a letter, **A**, **B**, **C** or **D**, in the box to represent the correct blood vessel.

2 (a) (i) Which blood vessel carries oxygenated blood away from the heart?

[1 mark]

2 (a) (ii) Which blood vessel carries deoxygenated blood to the heart?

[1 mark]

Do not write outside the box

2 (b) Explain how the highest blood pressure is produced in the left ventricle.

[1 mark]

2 (c) Some babies are born with a hole between the right and the left ventricles.

These babies are unable to get enough oxygen to their tissues.
Suggest why.

[2 marks]

5

Turn over for the next question

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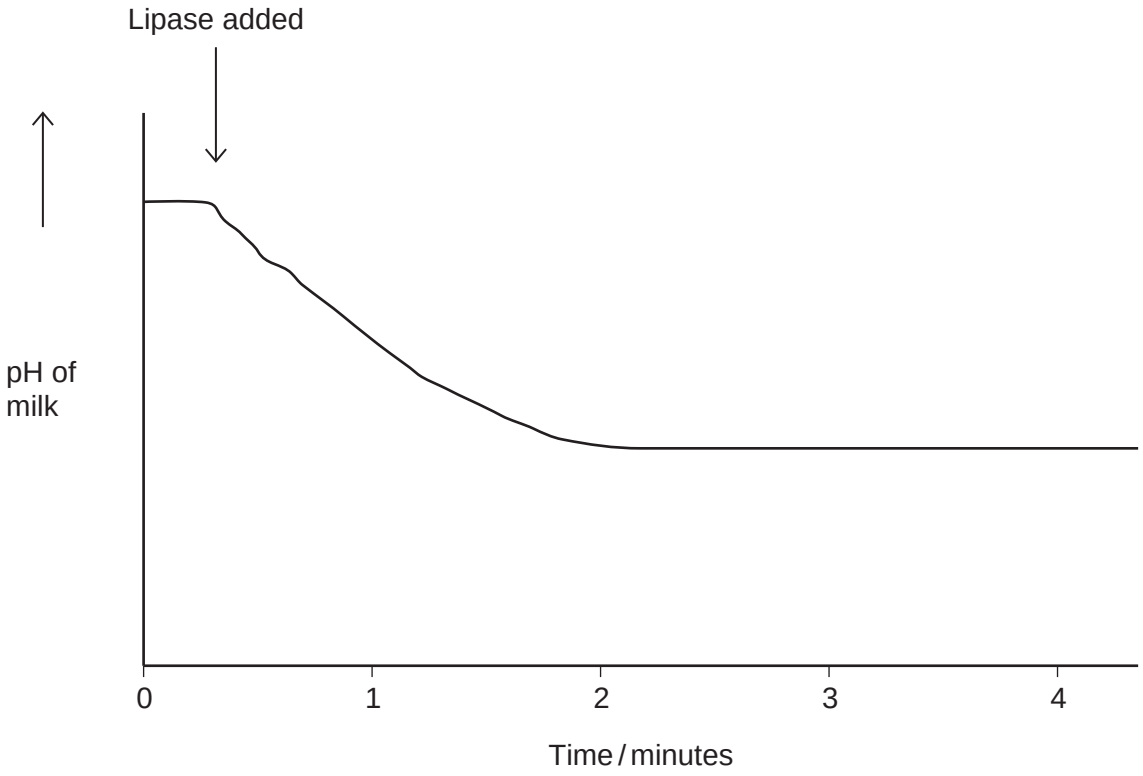
3 Lipase is an enzyme that hydrolyses triglycerides.

A student investigated the hydrolysis of triglycerides in milk by human lipase at 20 ºC.

He recorded the pH of a sample of milk before and after adding lipase. He used a pH meter to record pH.

Figure 3 shows a graph of his results.

Figure 3



3 (a) Suggest **one** advantage of using a pH meter rather than a pH indicator in this experiment.

[1 mark]

Do not write outside the box

3 (b) Explain why the pH decreases when the lipase is added to the milk.

[1 mark]

_____

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_____

3 (c) Suggest why the pH remained constant after 2 minutes.

[2 marks]

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3 (d) The student carried out his experiment at 20 ºC. He then repeated the experiment at 15 ºC.
Draw a line on the graph in **Figure 3** to show the results you would expect at 15 ºC.

[2 marks]

6

Turn over for the next question

Do not write outside the box

4 Trypsin is a protease. It is produced in an inactive form inside some of the cells of the pancreas.

4 (a) Name the part of a pancreatic cell that produces the inactive form of trypsin.

[1 mark]

_____

4 (b) Suggest the advantage of producing trypsin in an inactive form inside cells in the pancreas.

[2 marks]

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4 (c) After the inactive form of trypsin enters the small intestine, another enzyme removes a short chain of amino acids from the end of the inactive trypsin molecules. This leads to the formation of the active form of trypsin.

4 (c) (i) Name the type of bond hydrolysed when the short chain of amino acids is removed.

[1 mark]

_____

Do not write outside the box

4 (c) (ii) Sometimes trypsin can become activated inside a pancreatic cell. A competitive inhibitor in the cell then binds to the trypsin and stops it working.
Explain how the competitive inhibitor stops trypsin working.

[3 marks]

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7

Turn over for the next question

Do not write outside the box

5 (a) Explain the role of the diaphragm in breathing out.

[3 marks]

Scientists investigated the effect of stopping smoking on the forced expiratory volume of people. The forced expiratory volume (FEV_1) is the greatest volume of air that a person can breathe out in 1 second.

The scientists recruited a large number of people who smoked. Some of these smokers stopped smoking at the start of the investigation whilst others continued to smoke.

The scientists:

- measured the FEV_1 of each person and calculated the mean FEV_1
- re-measured the FEV_1 of each person after one year and calculated the mean FEV_1 of the smokers and the mean FEV_1 of the people who had stopped smoking
- repeated this at the end of five years.

Figure 4 shows the scientists' results.

Figure 4



Do not write outside the box

5 (b) Use the data shown in **Figure 4** to compare the change in FEV_1 of people who continued to smoke with those who stopped smoking.

[2 marks]

5 (c) Smoking causes changes in the lungs and airways of smokers.
Suggest **two** changes in the lungs of people who continue to smoke that could explain the change in their FEV_1.

[2 marks]

1

2

7

Turn over for the next question

Do not write outside the box

6 Scientists investigated whether people who are lactose intolerant can drink small volumes of milk without developing symptoms.

The scientists recruited a large number of volunteers who were lactose intolerant. They asked each person to drink 240 cm^3 milk every morning and to record their symptoms each day. The scientists told them to record their symptoms using a scale from 0 to 5.

The scientists split the volunteers into two groups, **A** and **B**.
For the first week, they gave:

- untreated milk containing lactose to group **A**
- lactose-free milk to group **B**.

After 1 week, the scientists changed the type of milk given to the volunteers.

Table 2 summarises the treatment.

Table 2

Group	Week 1	Week 2
A	Untreated milk	Lactose-free milk
B	Lactose-free milk	Untreated milk

6 (a) Suggest how the scientists may have treated the milk to remove lactose.

[1 mark]

6 (b) The scientists told the volunteers to drink the milk first thing in the morning rather than at bedtime.

Suggest why.

[1 mark]

Do not write outside the box

6 (c) Suggest **one** instruction that the scientists would have given the volunteers about what they should **not** eat or drink each day, during this investigation.

[1 mark]

_____

_____

_____

6 (d) Suggest why the scientists changed the type of milk they gave each group after one week.

[1 mark]

_____

_____

_____

Question 6 continues on the next page

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6 (e) The volunteers were asked to record three symptoms. They used a scoring scale from 0 to 5, where 0 indicates no symptoms and 5 indicates severe symptoms.

Table 3 shows the scientists' results.

Table 3

	Mean symptom score	
Symptom	**Drinking untreated milk**	**Drinking lactose-free milk**
Bloating	1.6	0.5
Stomach pain	0.4	0.3
Diarrhoea	0.1	0.3

6 (e) (i) What can you conclude from the scientists' results in **Table 3**?

[3 marks]

6 (e) (ii) Suggest why the scientists' results might be unreliable.

[1 mark]

8

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Turn over for the next question

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ANSWER IN THE SPACES PROVIDED

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7 Ebola is a disease caused by a virus. The Ebola virus has a glycoprotein on its surface which binds to a specific receptor protein in the cell-surface membranes of human cells. When it binds to this receptor protein, the virus can enter the cell. Some people do not produce this receptor protein. These people may become infected with the Ebola virus but do not develop the disease.

A blood test can be used to determine whether a person has Ebola. People with Ebola have large numbers of specific plasma cells and a specific antibody in their blood. Some scientists have suggested treating people suffering from Ebola by using transfusions of blood plasma from people who have recently recovered from the disease.

The Ebola virus has a high mutation rate. This makes it difficult to develop a vaccine.

7 (a) People who do not have the specific receptor protein in their cell-surface membranes may be infected with the Ebola virus but do not develop the disease (lines 1–5).

Explain why they do **not** develop the disease.

[2 marks]

7 (b) Explain the increase in specific plasma cells and antibody in people infected with the Ebola virus.

[2 marks]

Do not write outside the box

7 (c) Explain how a blood transfusion from a patient recently recovered from Ebola may be an effective treatment (lines 8–10).

[3 marks]

7 (d) A high mutation rate makes it difficult to develop a vaccine (line 11).
Explain why.

[3 marks]

Turn over for the next question

10

Do not write outside the box

8 (a) Glucose is absorbed from the lumen of the small intestine into epithelial cells.
Explain how the transport of sodium ions is involved in the absorption of glucose by epithelial cells.

[5 marks]

Do not write outside the box

8 (b) Oxygen and chloride ions can diffuse across cell-surface membranes. The diffusion of chloride ions involves a membrane protein. The diffusion of oxygen does not involve a membrane protein.

Explain why the diffusion of chloride ions involves a membrane protein and the diffusion of oxygen does not.

[5 marks]

10

END OF QUESTIONS

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A-LEVEL
BIOLOGY

BIOL1 – Biology and disease

Mark scheme
June 2016

Version: 1.0 Final

Mark schemes are prepared by the Lead Assessment Writer and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation events which all associates participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the students' responses to questions and that every associate understands and applies it in the same correct way. As preparation for standardisation each associate analyses a number of students' scripts. Alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, associates encounter unusual answers which have not been raised they are required to refer these to the Lead Assessment Writer.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of students' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

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Question	Marking Guidance	Mark	Comments
1(a)	<table><tr><td>White blood cell</td><td></td><td>✓</td><td>✓</td></tr><tr><td>Bacterial cell</td><td>✓</td><td>✓</td><td></td></tr></table>	2	
1(b)	2.80 (μm);;	2	Answer in range 2.76–2.83 scores 2 marks If length incorrect but divided by 30 000, allow 1 mark
1(c)(i)	Circular DNA / smaller/70S ribosomes / no introns / no histones/proteins associated with DNA;	1	Ignore reference to plasmids
1(c)(ii)	1. Able to respire aerobically; 2. So make (more) ATP/ release (more) energy;	2	2.Reject ‘producing energy’ unqualified

Question	Marking Guidance	Mark	Comments
2(a)(i)	C;	1	Ignore name of vessel
2(a)(ii)	A;	1	Ignore name of vessel
2(b)	Strongest/stronger contractions;	1	Accept most muscle in wall / thickest/thicker muscular wall. A comparative statement is needed Answer must be in context of producing force and not resisting it
2(c)	1. Blood flows from left ventricle to right ventricle/ mixing of oxygenated and deoxygenated blood; 2. Lower volume of (oxygenated) blood leaves left ventricle/flows into aorta/C OR Lower pressure in blood leaving left ventricle/flowing into aorta/C OR Less oxygen in blood leaving left ventricle/aorta/C;	2	

Question	Marking Guidance	Mark	Comments
3(a)	Any **one** from: 1. Numerical readings / not subjective / colour change subjective / gives quantitative data / not qualitative / gives continuous data; 2. Greater accuracy;	1 max	2. Accept greater precision
3(b)	Fatty acids produced;	1	
3(c)	1. No more (fatty) acids produced; 2. All triglycerides/fat//lipids/substrate used up / enzyme denatured;	2	
3(d)	1. Line starting at same point and falling above original line; 2. Levels off at same pH, but later;	2	2. Accept the line still falling at 4 minutes Do not credit if levels off at higher pH

Question	Marking Guidance	Mark	Comments
4(a)	Ribosome/rough endoplasmic reticulum;	1	Ignore RER or endoplasmic reticulum unqualified
4(b)	1. Does not digest protein inside cells; 2. So (pancreatic) cell/tissue/function not destroyed/damaged;	2	1.Accept named examples
4(c)(i)	Peptide (bond);	1	
4(c)(ii)	1. Inhibitor is a similar shape to the substrate; 2. (Inhibitor) blocks active site/is complementary to the active site/binds to the active site (of trypsin); 3. Substrate can't bind to active site / no/fewer ES complexes formed;	3	

Question	Marking Guidance	Mark	Comments
5(a)	1. Diaphragm moves up /becomes dome shaped; 2. Reduces volume of thorax / increase pressure in thorax; 3. Pressure in thorax **higher** than outside (air);	3	2.Accept 'space' for volume, chest/lungs for thorax 3.Accept chest/lungs
5(b)	1. FEV_1 of those who have stopped smoking increased after 1 year whereas the FEV_1 of smokers decreased; 2. (Between years 1 and 5, FEV_1 of both decreases but) the rate of decrease in FEV_1 of smokers is faster than those who stopped smoking;	2	Comparison required Idea of a faster rate of decrease in smokers, not just quoting final FEV values
5(c)	1. Airways are narrowed/blocked; 2. Excess mucus (in airway); 3. Inflammation (of airways); 4. Elasticity is lost/scar tissue builds up;	2 max	Ignore answers in the context of reduced surface area of alveoli or increased diffusion distance.

Question	Marking Guidance	Mark	Comments
6(a)	Add lactase;	1	
6(b)	Would be aware of/able to record (mild) symptoms (during the day/while awake);	1	
6(c)	Eat no other foods containing lactose/untreated dairy foods/untreated milk/any more milk;	1	Accept ref to correctly named dairy foods eg cheese, yoghurt
6(d)	Eliminates variation in the volunteers' response (to lactose) / each group/person acts as its own control / to compare effect of lactose on both groups;	1	Ignore – see the effect of lactose clearly For comparison is insufficient
6(e)(i)	1. Drinking (untreated) milk causes (a little) bloating; 2. Drinking (small amount)of untreated milk has little/no effect on pain/diarrhoea; 3. Difference is small so may not be significant/no standard deviation so cannot judge significance;	3	
6(e)(ii)	(Scale of 0–5) is subjective;	1	Ignore 'lying'

Question	Marking Guidance	Mark	Comments
7(a)	1. Virus can't bind (to receptor)/ can't enter cells; 2. So can't be replicated/ multiply; 3. So, doesn't damage cell(s)/tissues (and cause symptoms);	2 max	2. Accept can't reproduce 3. Accept no toxins released
7(b)	1. Antigen/glycoprotein on Ebola binds to/stimulates (a specific) B cell; 2. (Binding causes) replication/cloning of B cell; 3. Plasma cells/B cells release/produce antibodies;	2 max	1. Accept correct reference to stimulation of B cells by T cells 2. Accept replication/cloning of plasma cell;
7(c)	1. Lots of antibodies (against Ebola) in recovered patient; 2. Transfusion/plasma contains antibodies; 3. Antibodies (specific so) will bind with (Ebola) antigen; 4. (In recipient) virus destroyed/cannot enter cell;	3 max	2. Ignore reference to cells 4. Antigen destroyed is insufficient
7(d)	1. (High mutation rate leads to) antigens change/antigenic variability; 2. Vaccine contains specific antigen; 3. Antibodies not complementary to (changed) antigen / won't bind to (changed) antigens;	3	1. Accept (high mutation rate leads to) changes in base sequence coding for antigen;

Question	Marking Guidance	Mark	Comments
8(a)	1. Na^+ ions leave epithelial cell and enter blood; 2. (Transport out is by) active transport / pump / via carrier protein using ATP; 3. So, Na^+ conc. in cell is lower than in lumen (of gut); 4. Sodium/Na^+ ions enter by facilitated diffusion; 5. Glucose absorbed with Na^+ ions against their concentration/diffusion gradient / glucose absorbed down an electrochemical gradient;	5	Penalise for Na without ions once. 2. Reject channel protein 3. Maintains diffusion gradient for Na^+ from lumen/into cells; 4. Accept diffusion/from high to low concentration through a symport/cotransport protein 5. Accept glucose absorbed with sodium ions by indirect active transport
8(b)	1. Chloride ions water soluble/charged/polar; 2. Cannot cross (lipid) bilayer (of membrane); 3. Chloride ions transported by facilitated diffusion OR diffusion involving channel/carrier protein; 4. Oxygen not charged/non-polar; 5. (Oxygen) soluble in/can diffuse across (lipid) bilayer;	5	Penalise chloride molecules only once Ignore ref to size 1.Accept not lipid soluble 4. Accept oxygen lipid soluble

Centre Number						Candidate Number				
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Other Names										
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Question	Mark
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TOTAL	

General Certificate of Education
Advanced Subsidiary Examination
June 2015

Biology BIOL1

Unit 1 Biology and disease

Thursday 21 May 2015 1.30 pm to 2.45 pm

For this paper you must have:
- a ruler with millimetre measurements
- a calculator.

Time allowed
- 1 hour 15 minutes

Instructions
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- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
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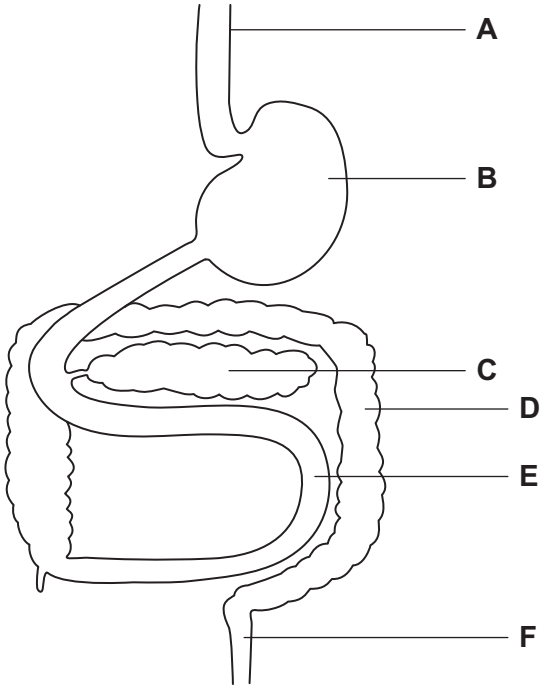
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- You will be marked on your ability to:
  – use good English
  – organise information clearly
  – use scientific vocabulary accurately.

Do not write outside the box

Answer **all** questions in the spaces provided.

1 **Figure 1** represents part of the human digestive system. The organs are labelled **A**–**F**.

Figure 1



1 (a) Give the letter of the organ that produces amylase.

[1 mark]

1 (b) Give the letter of the organ that produces maltase.

[1 mark]

Do not write outside the box

1 (c) Maltose is hydrolysed by the enzyme maltase.

Explain why maltase catalyses only this reaction.

[3 marks]

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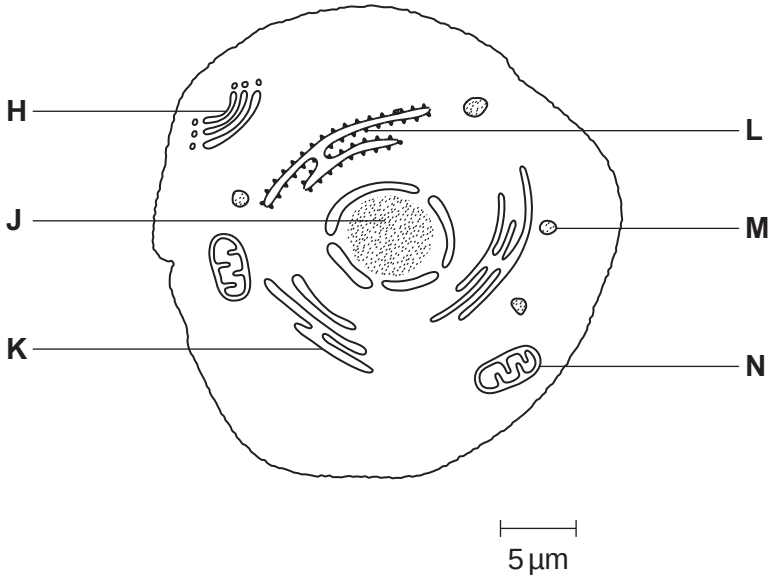
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Turn over for the next question

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2 **Figure 2** shows a eukaryotic cell.

Figure 2



2 (a) Complete **Table 1** by giving the letter labelling the organelle that matches the function.

[3 marks]

Table 1

Function of organelle	Letter
Protein synthesis	
Modifies protein (for example, adds carbohydrate to protein)	
Aerobic respiration	

2 (b) Use the scale bar in **Figure 2** to calculate the magnification of the drawing.
Show your working.

[2 marks]

Answer = ...

5

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3 (a) Give **two** ways in which pathogens can cause disease.

[2 marks]

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3 (b) Putting bee honey on a cut kills bacteria. Honey contains a high concentration of sugar.

Use your knowledge of water potential to suggest how putting honey on a cut kills bacteria.

[3 marks]

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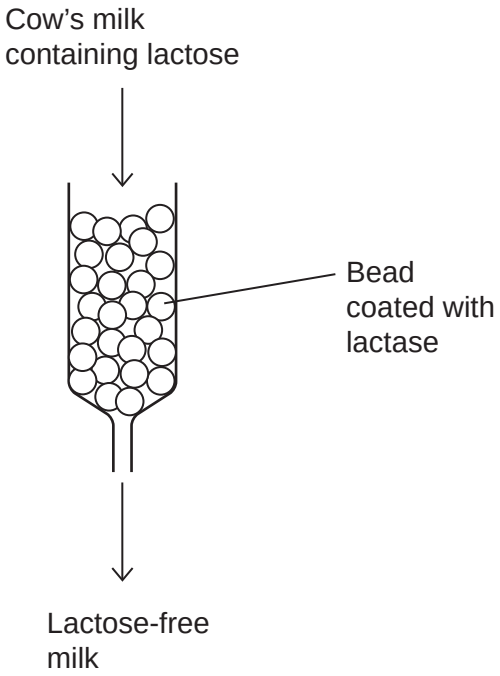
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4 Cow's milk contains the sugar lactose. Many cats are unable to digest cow's milk because they are lactose intolerant.

Cow's milk can be made suitable for these cats by treating it with the enzyme lactase to hydrolyse lactose. This makes the cow's milk lactose-free. Beads are coated with lactase and placed in a tube, as shown in **Figure 3**. Cow's milk flows over the beads and the lactose is hydrolysed.

Figure 3



4 (a) Attaching lactase to the beads is a more efficient use of lactase than adding the lactase directly to cow's milk.

Suggest **three** reasons why it is more efficient to attach lactase to the beads.

[3 marks]

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Do not write outside the box

4 (b) Monosaccharides and disaccharides taste sweet.
The lactose-free milk made after hydrolysis with lactase tastes sweeter than the cow's milk containing lactose.
Suggest why.

[2 marks]

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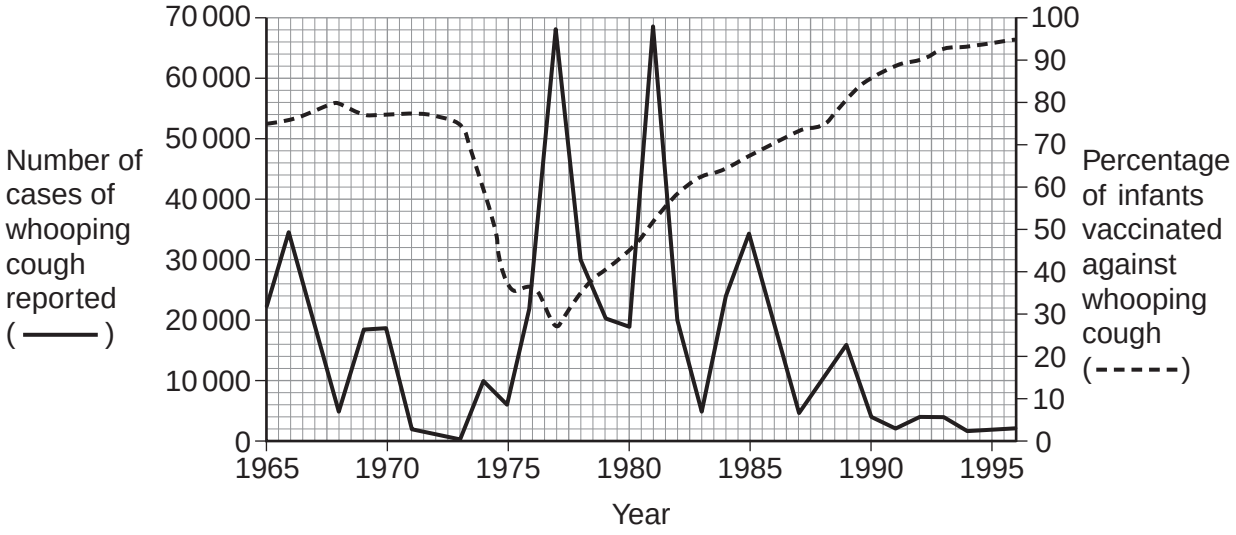
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5 Whooping cough is a disease that affects some infants. Doctors collected data relating to whooping cough between 1965 and 1996.

They collected data for:
- the number of cases of whooping cough reported
- the percentage of infants vaccinated against whooping cough.

Figure 4 shows the data collected by the doctors.

Figure 4



5 (a) Suggest **two** reasons why the percentage of infants vaccinated decreased between 1973 and 1975.

[2 marks]

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Do not write outside the box

5 (b) Between 1980 and 1990, there were three peaks in the number of reported cases of whooping cough. After 1981, the number of cases of whooping cough in each peak decreased.

Use the information from **Figure 4** to suggest why.

[2 marks]

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[Extra space] .....

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5 (c) The percentage of the population vaccinated does **not** need to be 100% to be effective in preventing the spread of whooping cough.

Suggest why.

[2 marks]

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[Extra space] .....

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6

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6 (a) When a person has an asthma attack, the airways in the lungs become narrower.
Give **one** reason why the airways become narrower.

[1 mark]

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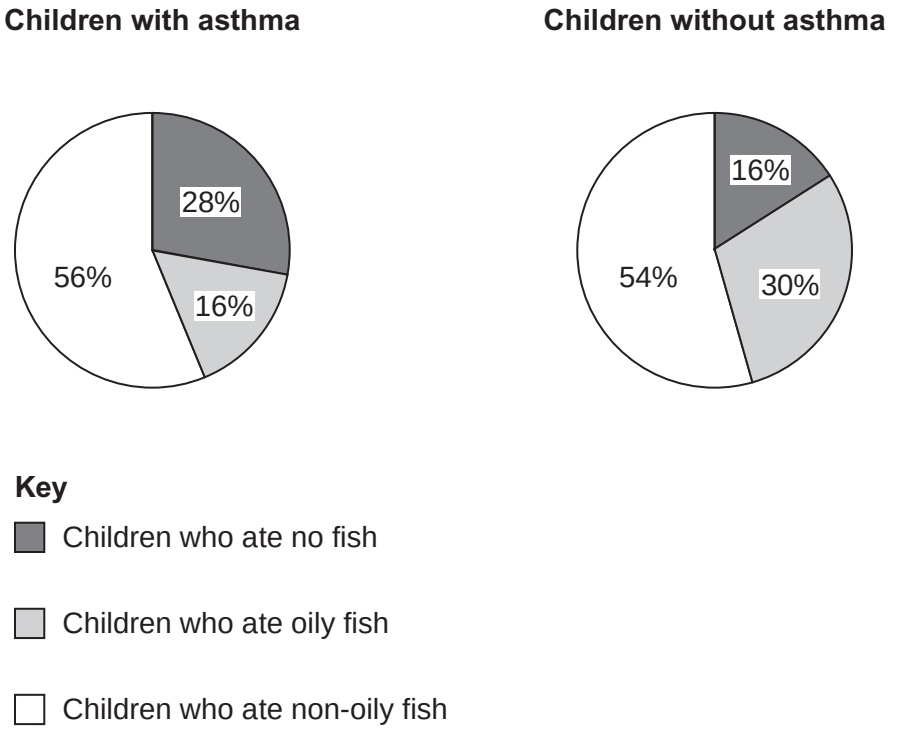
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Nutritionists investigated the relationship between eating oily and non-oily fish and the incidence of asthma. They analysed the diets of children with asthma and the diets of children without asthma.

Figure 5 shows their results.

Figure 5



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6 (b) What conclusions can you make from the data in **Figure 5**?

[3 marks]

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[Extra space] .....

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6 (c) Describe how you could use the emulsion test to show the presence of oil in a sample of fish.

[3 marks]

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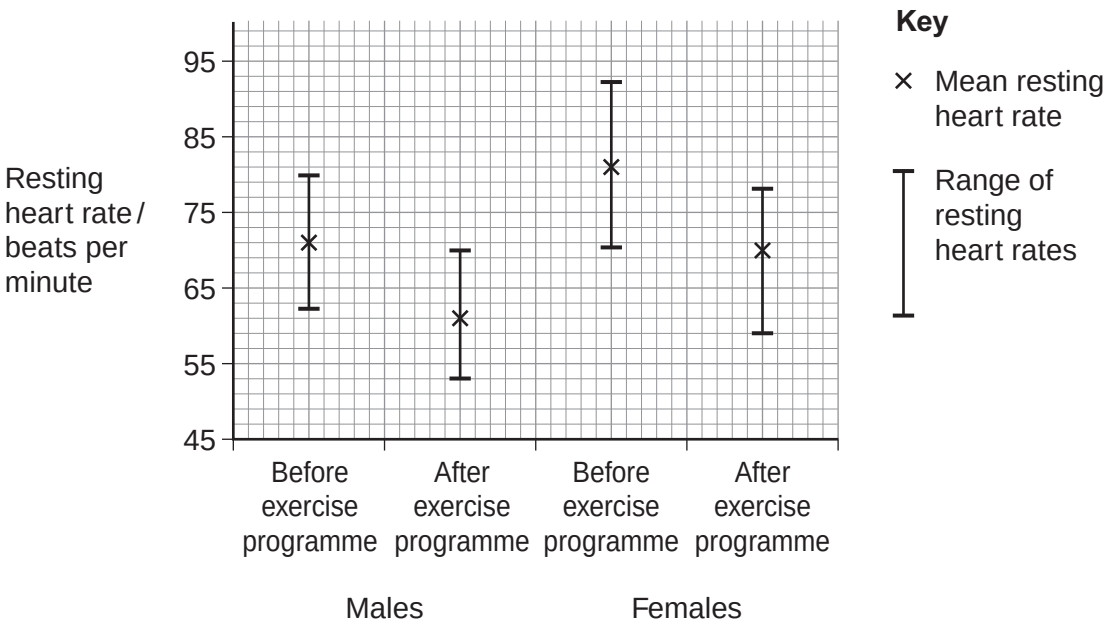
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7 Scientists investigated the effect of a 6-week exercise programme on the resting heart rate of males and females.

The scientists recruited a large group of male volunteers and a large group of female volunteers. They measured the resting heart rate of each volunteer before the exercise programme. Both groups took part in the same exercise programme. The scientists measured the resting heart rate of each volunteer after the exercise programme.

The scientists determined the mean resting heart rate and the range of resting heart rates for each group before and after the exercise programme. **Figure 6** shows their results.

Figure 6



7 (a) What was the range of the resting heart rates in males after the exercise programme?

[1 mark]

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7 (b) Calculate the percentage decrease in the mean resting heart rate of females after the exercise programme. Show your working.

[2 marks]

Answer = ... %

7 (c) The scientists used the percentage change in the mean resting heart rate after the exercise programme to compare the results for males and females.

Explain why they used percentage change in the resting heart rate.

[2 marks]

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7 (d) The scientists calculated the cardiac output of the volunteers before and after the exercise programme. In some volunteers, their cardiac output stayed the same, even though their resting heart rate decreased.

Explain how their cardiac output could stay the same even when their resting heart rate had decreased.

[2 marks]

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8 Read the following passage.

Low-density lipoprotein (LDL) is a substance found in blood. A high concentration of LDL in a person's blood can increase the risk of atheroma formation. Liver cells have a receptor on their cell-surface membranes that LDL binds to. This leads to LDL entering the cell. A regulator protein, also found in blood, can bind to the same receptor as LDL. This prevents LDL entering the liver cell. People who have a high concentration of this regulator protein in their blood will have a high concentration of LDL in their blood. Scientists have made a monoclonal antibody that prevents this regulator protein working. They have suggested that these antibodies could be used to reduce the risk of coronary heart disease.

A trial was carried out on a small number of healthy volunteers, divided into two groups. The scientists injected one group with the monoclonal antibody in salt solution. The other group was a control group. They measured the concentration of LDL in the blood of each volunteer at the start and after 3 months. They found that the mean LDL concentration in the volunteers injected with the antibody was 64% lower than in the control group.

Use the information in the passage and your own knowledge to answer the following questions.

8 (a) The scientists gave an injection to a mouse to make it produce the monoclonal antibody used in this investigation (line 7).

What should this injection have contained?

[1 mark]

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8 (b) LDL enters the liver cells (lines 3–4).

Using your knowledge of the structure of the cell-surface membrane, suggest how LDL enters the cell.

[2 marks]

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8 (c) Explain how the monoclonal antibody would prevent the regulator protein from working (lines 7–8).

[2 marks]

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8 (d) Explain how this treatment could reduce the risk of coronary heart disease (lines 8–9).

[3 marks]

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8 (e) Describe how the control group should have been treated.

[2 marks]

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9 (a) Describe and explain how cell fractionation and ultracentrifugation can be used to isolate mitochondria from a suspension of animal cells.

[5 marks]

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9 (b) Describe the principles and the limitations of using a transmission electron microscope to investigate cell structure.

[5 marks]

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END OF QUESTIONS

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A-LEVEL

Biology

BIOL1 – Biology and disease

Mark scheme

2410
June 2015

Version: 1 Final Mark Scheme

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Question	Marking Guidance	Mark	Comments
1(a)	C;	1	Ignore name of organ.
1(b)	E;	1	Ignore name of organ.
1(c)	1. Active site (of enzyme) has (specific) shape/tertiary structure / active site complementary to substrate/maltose; 2. (Only) maltose can bind/fit; 3. To form enzyme substrate complex;	3	1. Reject active site on substrate. Must have idea of shape 1. Assume "it" = maltase 1. Accept (specific) 3D active site 1. Reject has same shape. 2. Accept "substrate" for "maltose" 3. Accept E-S complex

<table>
<tr><th>Question</th><th>Marking Guidance</th><th>Mark</th><th>Comments</th></tr>
<tr><td>2(a)</td><td><table><tr><td>Protein synthesis</td><td>L;</td></tr><tr><td>Modifies protein</td><td>H;</td></tr><tr><td>Aerobic respiration</td><td>N;</td></tr></table></td><td>3</td><td></td></tr>
<tr><td>2(b)</td><td>1800–2200;;
1 mark for an incorrect answer in which student clearly divides measured length by actual length (of scale);</td><td>2</td><td>1.8, 2.0 or 2.2 in working or answer = 1 mark.
Ignore units in answer.
Accept I/A or I/O for 1 mark but ignore triangle.
Accept approx 60mm divided by 30μm for 1 mark</td></tr>
</table>

Question	Marking Guidance	Mark	Comments
3(a)	1. (Releases) toxins; 2. Kills cells/tissues;	2	2. Accept any reference to cell/tissue damage. Ignore infecting/invading cells
3(b)	1. Water potential in (bacterial) cells higher (than in honey) / water potential in honey lower (than in bacterial cells); 2. Water leaves bacteria/cells by osmosis; 3. (Loss of water) stops (metabolic) reactions;	3	Q candidates must express themselves clearly 1. Must be comparative Eg high WP in cell and low WP in honey 3. Needs a reason why lack of water kills the cell

Question	Marking Guidance	Mark	Comments
4(a)	Accept **three** suitable suggestions: 1. (Lactase/beads) can be reused/not washed away; 2. No need to remove from milk; 3. Allows continuous process; 4. The enzyme is more stable; 5. Avoid end-product inhibition;	3 max	1. Accept lactase/beads not wasted. 1. Less lactase used is insufficient 2. Accept lactase not present in milk. Ignore ref to SA
4(b)	1. (Lactose hydrolysed to) galactose and glucose; 2. (So) more sugar molecules; 3. (So) more/different receptors stimulated / sugars produced are sweeter (than lactose);	2 max	2. Idea of **more** sugars essential

Question	Marking Guidance	Mark	Comments
5(a)	Any **two** from: 1. (Decrease linked to) few(er) cases of whooping cough; 2. (Decrease linked to) risk of/fear of side effects; 3. Insufficient vaccine available / too expensive to produce/distribute;	2 max	3. Too expensive unqualified is insufficient for mark
5(b)	1. Vaccination rate increases; 2. Fewer people to spread the disease/ whooping cough / more people immune / fewer susceptible;	2	2. Neutral - greater herd effect. 2. Allow description of immune **Q** Reject 'resistant'.
5(c)	1. More people are immune / fewer people carry the pathogen; 2. So susceptible/unvaccinated people less likely to contact infected people;	2	If neither point 1 or 2 awarded Herd immunity = 1 mark. Unvaccinated does not mean infected 1. **Q** Do not accept disease for pathogen

Question	Marking Guidance	Mark	Comments
6(a)	Lining inflamed/swollen /muscle (around the airways) contracts/ more mucus produced;	1	Accept reference to histamine. Inflammation alone insufficient for mark
6(b)	1. Fewer children/less likely that children with asthma eat fish; 2. Fewer children/less likely that children with asthma eat oily fish; 3. Little/only 2%/no difference in (children with or without asthma who eat) non-oily fish;	3	Accept converse. MP1 and 2 - Allow use of numbers. Do not accept arguments related to amount of fish eaten
6(c)	1. (Shake with) ethanol/alcohol; 2. Then add (to) water; 3. White/milky/cloudy (layer indicates oil);	3	1. Accept named alcohol 2. Order must be correct 3. Ignore forms emulsion as in stem 3. Ignore precipitate

Question	Marking Guidance	Mark	Comments
7(a)	53–70 / 70-53 / 17 (beats per minute);	1	
7(b)	13.6/13.58/14;;	2	If answer is incorrect, 1 mark for the principle of difference (11) divided by initial heart rate (81). $\frac{70-81}{81}$ or $\frac{81-70}{81}$ for 1 mark Ignore + or - signs
7(c)	1. Allows comparison; 2. (Initial/resting) heart rates different (between males and females);	2	
7(d)	1. Cardiac output = stroke volume × heart rate; 2. (So) stroke volume increases / increased size or volume of ventricles;	2 max	1. Accept CO = SV x HR 2. Neutral: more blood leaves heart. 2. If the term stroke volume is not used, it must be defined.

Question	Marking Guidance	Mark	Comments
8(a)	Regulator protein;	1	Accept regulator protein antigen. Reject regulator protein receptor. Ignore regular protein
8(b)	1. Lipid soluble / hydrophobic; 2. Enters through (phospholipid) bilayer; ***OR*** 3. (Protein part of) LDL attaches to <u>receptor</u>; 4. Goes through carrier/channel protein;	2	4. Accept by facilitated diffusion or active transport. 4. Reject active transport through channel protein
8(c)	Any **two** from: 1. (Monoclonal antibody) has a specific tertiary structure/variable region / is complementary to regulator protein; 2. Binds to / forms complex with (regulator protein); 3. (So regulator protein) would not fit/bind to the receptor / is not complementary to receptor;	2 max	Do not award MP1 if reference to active site. "It" refers to monoclonal antibody in MP1 and MP2 3. Reject receptor on LDL
8(d)	1. Less LDL in blood / more LDL taken up (by liver cells); 2. So less atheroma/less chance of blood clot in <u>coronary</u> artery; 3. (So) less chance of reduced/no blood flow/oxygen to heart muscle/cells/tissues;	3	
8(e)	1. Injection with salt solution; 2. Otherwise treated the same;	2	1. Accept inject placebo in salt solution

Question	Marking Guidance	Mark	Comments
9(a)	Any **five** from: 1. Cell homogenisation to break open cells; 2. Filter to remove (large) debris/whole cells; 3. Use isotonic solution to prevent damage to mitochondria/organelles; 4. Keep cold to prevent/reduce damage by enzymes / use buffer to prevent protein/enzyme denaturation; 5. Centrifuge (at lower speed/1000 g) to separate nuclei/cell fragments/ heavy organelles; 6. Re-spin (supernatant / after nuclei/pellet removed) at higher speed to get mitochondria in pellet/at bottom;	5 max	1. Accept suitable method of breaking open cells. 2. Reject removes cell walls. 3. Ignore to prevent damage to cells. 5. Ignore incorrect numerical values. 6. Must have location Reject ref to plant cell organelles only once
9(b)	<u>Principles:</u> 1. Electrons pass through/enter (thin) specimen; 2. Denser parts absorb more electrons; 3. (So) denser parts appear darker; 4. Electrons have short wavelength so give high resolution; <u>Limitations:</u> 5. Cannot look at living material / Must be in a vacuum; 6. Specimen must be (very) thin; 7. Artefacts present; 8. Complex staining method / complex/long preparation time; 9. Image not in 3D / only 2D images produced;	5 max	Principles: Allow maximum of 3 marks <u>Limitations:</u> Context of limitation must be clear, not simply explaining how TEM works Eg “allows you to see organelles as a thin section is used” is not a limitation Allow maximum of 3 marks Ignore ref to colour

Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

For Examiner's Use	
Examiner's Initials	
Question	Mark
1	
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TOTAL	

AQA

General Certificate of Education
Advanced Subsidiary Examination
June 2014

Biology BIOL1

Unit 1 Biology and disease

Wednesday 21 May 2014 9.00 am to 10.15 am

For this paper you must have:
- a ruler with millimetre measurements
- a calculator.

Time allowed
- 1 hour 15 minutes

Instructions
- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided.
- Do not write outside the box around each page in margins or on blank pages.
- You may ask for extra paper. Extra paper must be secured to this booklet.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information
- The maximum mark for this paper is 60.
- The marks for questions are shown in brackets.
- You are expected to use a calculator, where appropriate.
- Quality of Written Communication will be assessed in all answers.
- You will be marked on your ability to:
  – use good English
  – organise information clearly
  – use scientific vocabulary accurately.

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Answer **all** questions in the spaces provided.

1 (a) Describe how phospholipids are arranged in a plasma membrane.

[2 marks]

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1 (b) Cells that secrete enzymes contain a lot of rough endoplasmic reticulum (RER) and a large Golgi apparatus.

1 (b) (i) Describe how the RER is involved in the production of enzymes.

[2 marks]

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1 (b) (ii) Describe how the Golgi apparatus is involved in the secretion of enzymes.

[1 mark]

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2 (a) Give **two** risk factors associated with coronary heart disease.

[2 marks]

1 .....

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2 .....

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2 (b) During a myocardial infarction, areas of heart muscle begin to die.
Explain why.

[3 marks]

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Turn over for the next question

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3 (a) Describe how bacteria are destroyed by phagocytes.

[3 marks]

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3 (b) Give **two** structures a bacterial cell may have that a white blood cell does not have.

[2 marks]

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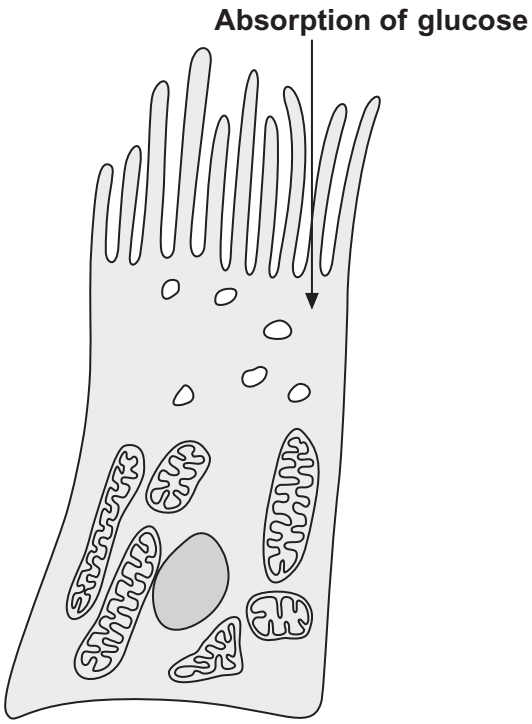
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4 **Figure 1** shows a cell from the kidney. This cell rapidly absorbs glucose.

Figure 1



4 (a) (i) Give **two** structures shown in **Figure 1** that are adaptations of this cell that make possible the rapid absorption of glucose.

[1 mark]

Structure 1 .....

Structure 2 .....

4 (a) (ii) For each structure you identified in part **4(a)(i)**, explain how it is an adaptation to make possible the rapid absorption of glucose.

[2 marks]

Structure 1 .....

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Structure 2 .....

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4 (b) The absorption of glucose into the cell leads to the movement of water into the cell.

Explain how.

[2 marks]

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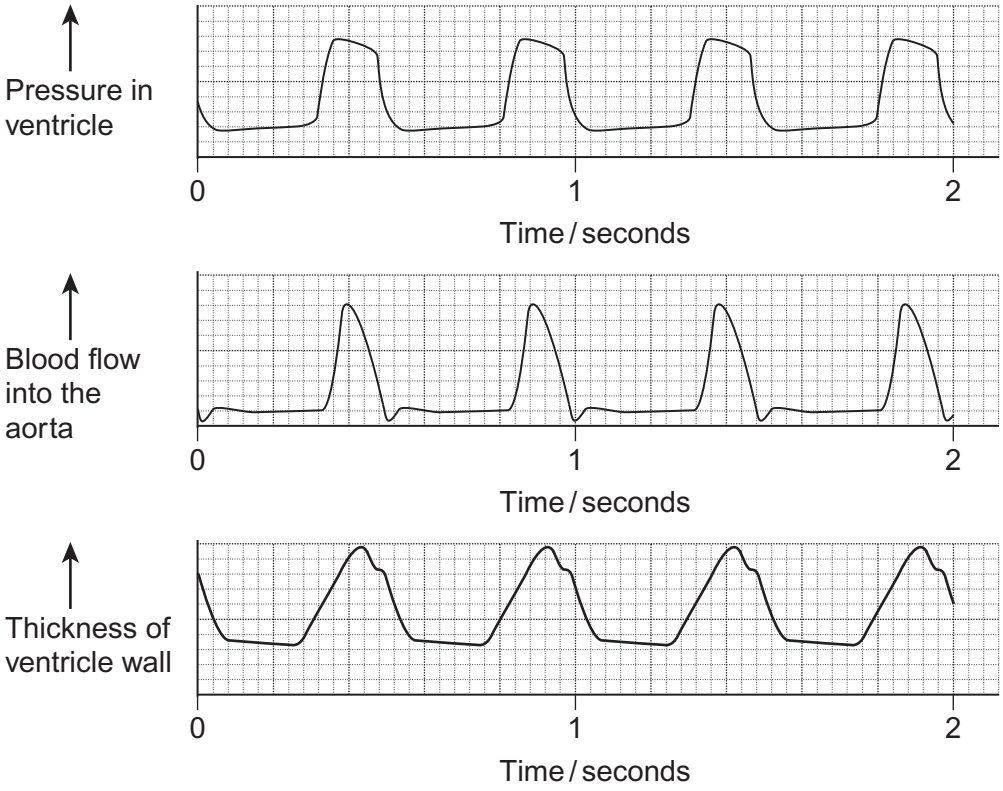
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Turn over for the next question

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5 **Figure 2** shows recordings made from the heart of a dog.

Figure 2



5 (a) Use information from **Figure 2** to explain how the pressure in the dog's ventricle is related to blood flow into the aorta.

[2 marks]

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5 (b) Use information from **Figure 2** to explain how the pressure in the dog's ventricle is related to the thickness of the ventricle wall.

[2 marks]

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5 (c) Use **Figure 2** to calculate the heart rate of the dog in beats per minute.
Show your working.

[2 marks]

Heart rate ..... beats per minute

6

Turn over for the next question

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6 Some mice have diabetes. The diabetes causes the blood glucose concentration to become very high after a meal. Scientists investigated the use of an inhibitor of amylase to treat diabetes.

The scientists took 30 mice with diabetes and divided them into two groups, **A** and **B**.

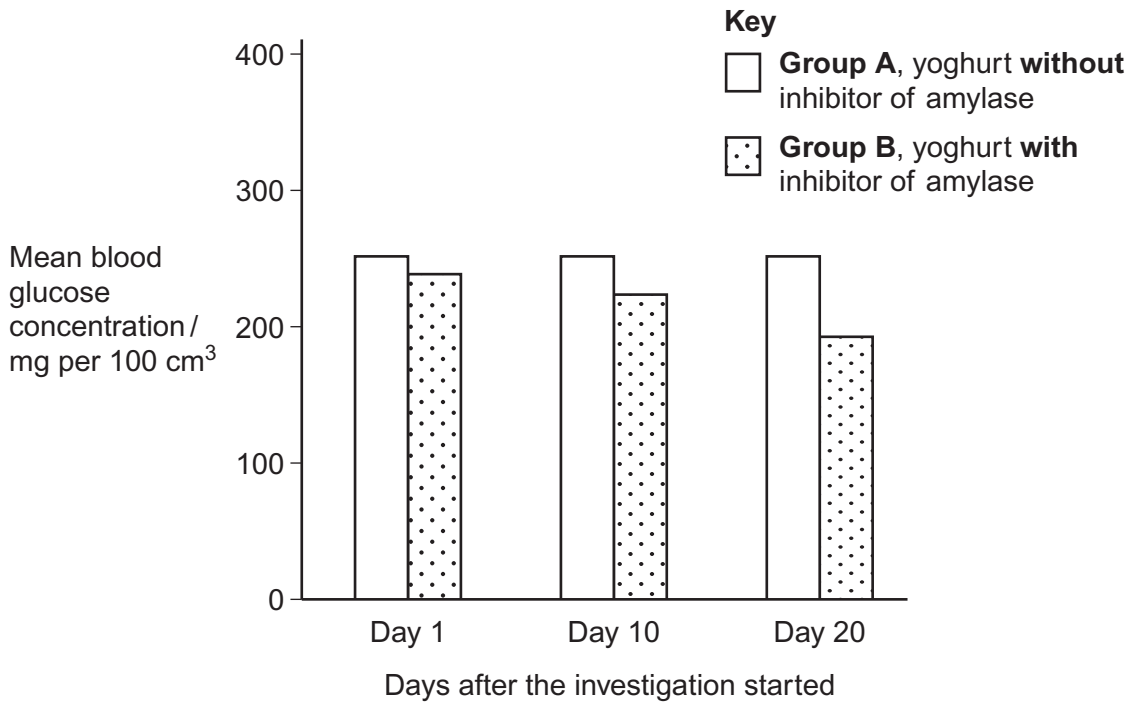
- **Group A** was given yoghurt **without** the inhibitor of amylase each day.
- **Group B** was given yoghurt **with** the inhibitor of amylase each day.

Apart from the yoghurt, all of the mice were given the same food each day.

The scientists measured the blood glucose concentration of each mouse, 1 hour after it had eaten. This was done on days 1, 10 and 20 after the investigation started.

Figure 3 shows the scientists' results.

Figure 3



6 (a) **Group A** acted as a control in this investigation.

Explain the purpose of this group.

[2 marks]

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6 (b) Apart from the yoghurt, it was important that all of the mice were given the same food each day.

Give **two** reasons why it was important that all of the mice were given the same food each day.

[2 marks]

1 .....

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2 .....

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6 (c) The scientists' hypothesis was that adding the inhibitor of amylase to the food would lead to a lower blood glucose concentration.

Use your knowledge of digestion to suggest how the addition of the inhibitor could lead to a lower blood glucose concentration.

[2 marks]

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6 (d) Give **one** reason why these results may **not** support the use of the inhibitor of amylase to treat diabetes in mice.

[2 marks]

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7 Scientists investigated the effect of tuberculosis (TB) on breathing. They obtained data from African miners aged 20 to 65 years.

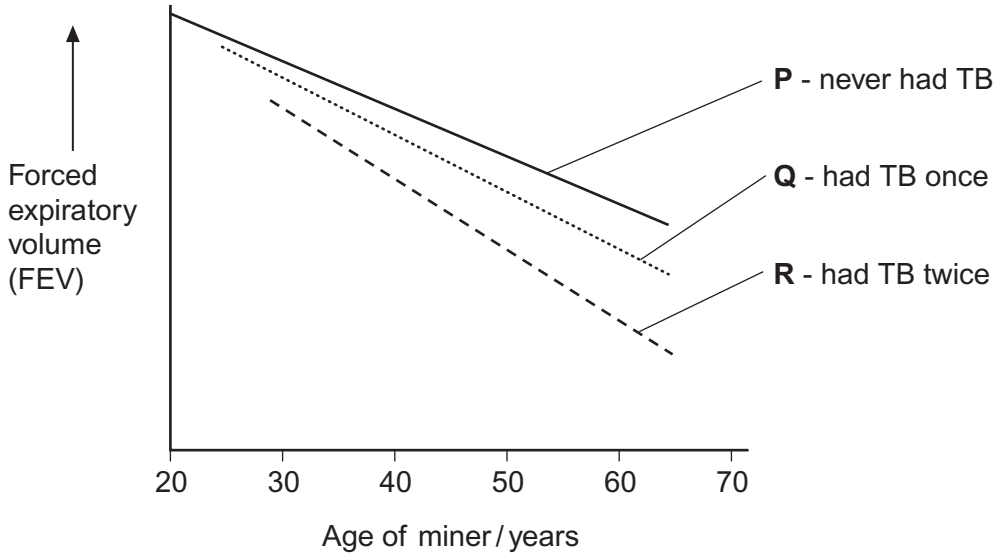
They divided the miners into groups based on how many times they had had TB.

- **Group P**, never had TB
- **Group Q**, had TB once
- **Group R**, had TB twice

The data were for forced expiratory volume (FEV). FEV is the maximum volume a person can breathe out in 1 second.

Their results are shown in **Figure 4**.

Figure 4



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7 (a) Describe the results.

[3 marks]

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7 (b) Tuberculosis leads to permanent changes in the gas exchange system.
These changes include fibrosis.

Explain how fibrosis caused by tuberculosis could have produced the changes in FEV of the miners.

[3 marks]

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8 Read the following passage.

Whooping cough is caused by the bacterium *Bordetella pertussis*. The first vaccines for whooping cough contained whole bacterial cells that had been heated for several minutes. Today, most vaccines only contain between one and three parts of the bacterial cells. People given whole-cell vaccines were more likely to develop harmful side effects than the people given the vaccines containing parts of the bacterial cells. Those given whole-cell vaccines produced a greater range of antibodies against the bacterium.

There have been suggestions that whooping cough vaccines may not work very well. These suggestions are due to recent reports of large rises in the number of cases of whooping cough. Doctors who examined a group of patients with coughs diagnosed about 17% of them as having whooping cough. Scientists tested the blood of the same group of patients for antibody against a toxin produced by *Bordetella pertussis*. They concluded that 4% of this group actually had whooping cough.

Use the information in the passage and your own knowledge to answer the following questions.

8 (a) (i) People given whole-cell vaccines were more likely to develop harmful side effects than the people given the vaccines containing parts of the bacterial cells (lines 4–6).

Suggest reasons why.

[3 marks]

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8 (a) (ii) People given whole-cell vaccines produced a greater range of antibodies against the bacterium than the people given the vaccines containing parts of the bacterial cells (lines 7–8).

Explain why.

[2 marks]

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8 (b) The scientists concluded from their test that 4% of patients with long-term coughs actually had whooping cough (line 15).

Explain how they used the results of their test to reach this conclusion.

[3 marks]

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Question 8 continues on the next page

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8 (c) What does the scientists' work suggest about reports of large rises in the number of cases of whooping cough (lines 10–11)?

Explain your answer.

[2 marks]

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9 (a) In humans, the enzyme maltase breaks down maltose to glucose.
This takes place at normal body temperature.

Explain why maltase:
- only breaks down maltose
- allows this reaction to take place at normal body temperature.

[5 marks]

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Question 9 continues on the next page

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9 (b) Scientists have investigated the effects of competitive and non-competitive inhibitors of the enzyme maltase.

Describe competitive and non-competitive inhibition of an enzyme.

[5 marks]

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A-LEVEL
BIOLOGY

BIOL1 –Biology and disease
Mark scheme

2410
June 2014

Version: 1.0 Final

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Question	Marking Guidance	Mark	Comments
1(a)	1. Bilayer; 2. Hydrophobic / fatty acid / lipid (tails) to inside; 3. Polar / phosphate group / hydrophilic (head) to outside;	2 max	1. Accept double layer 1. Accept drawing which shows bilayer 2. & 3. need labels 2. & 3. accept water loving or hating
1(b)(i)	1. (Rough endoplasmic reticulum has) <u>ribosomes</u>; 2. To make protein (which an enzyme is);	2	1. accept "contains / stores" 2. Accept amino acids joined together / (poly)peptide 2. Reject makes amino acids 2. Ignore glycoprotein
1(b)(ii)	(Golgi apparatus) modifies (protein) **OR** packages / put into (Golgi) vesicles **OR** transport to cell surface / vacuole;	1	Accept protein has sugar added Reject protein synthesis Accept lysosome formation

Question	Marking Guidance	Mark	Comments
2(a)	**Two** suitable risk factors;; Examples, 1. Smoking; 2. High salt intake; 3. High (blood) cholesterol; 4. High blood pressure / stress; 5. Lack of exercise / obesity; 6. Heredity / genes / familial; 7. Gender; 8. Age;	2 max	Accept 2 reasonable factors 3. Accept high cholesterol in diet / intake 3. Accept high LDL 3. Diet high in saturated fat (Neutral lipid / diet)
2(b)	1. Reduced blood flow in coronary artery / coronary artery blocked; 2. Less / not enough / no oxygen; 3. Respiration drops / stops (so cells start to die);	3	QWC 1. accept clot in coronary artery 2. Accept less glucose 3. Ignore reference to energy production "less oxygen for respiration" = 2 marks

Question	Marking Guidance	Mark	Comments
3(a)	1. (Phagocyte engulfs) to form vacuole / vesicle / phagosome; 2. Lysosome empties contents into vacuole / vesicle / phagosome; 3. (Releasing) enzymes that digest / hydrolyse bacteria;	3	QWC 1. Accept surrounds bacteria with membrane 2. Accept joins / fuses 3. Ignore breakdown / destroy / lytic enzymes
3(b)	Two suitable structures;; Examples, 1. Cell wall; 2. Capsule / slime layer; 3. Circular DNA; 4. Naked DNA / DNA without histones; 5. Flagellum; 6. Plasmid; 7. Pilus; 8. 70s / smaller ribosomes; 9. Mesosome;	2 max	3. Reject "circular chromosome"

Question	Marking Guidance	Mark	Comments
4(a)(i)	Two of the following for 1 mark in any order 1. Microvilli; 2. Mitochondria; 3. Vesicles;	1 max	Must be structures so ignore "short diffusion pathways" 1. Reject villus / (micro)villus
4(a)(ii)	1. (Microvilli) increased / large / bigger (surface) area (for transport proteins / for diffusion); 2. (Mitochondria) to supply ATP/energy, for active transport / cotransport; 3. (Vesicles) to bring carrier proteins to membrane;	2 max	No double penalty for "Villus" from 4(a)(i) Must be clear links from structure to adaptation If link to 4)(a)(i) wrong but correct structure named in 4)(a)(ii) and then linked to correct adaptation then allow 2. Ignore references to "produce energy" 3. Accept vesicles allow endocytosis
4(b)	1. Lowers the water potential (of the cell); 2. Water moves (in) by osmosis;	2	1. Accept Ψ/WP 2. DQ "out"

Question	Marking Guidance	Mark	Comments
5(a)	1. Ventricle pressure rises **then** blood starts to flow into aorta; 2. (Because) pressure above that in aorta causes (aortic / semilunar) valve to open / pressure below that in aorta causes (aortic / semilunar) valve to be shut; 3. Ventricle pressure starts to fall **so** blood flow falls;	2 max	1. Accept times, eg ventricle pressure rises at 0.3 (25) seconds, followed by blood flow into aorta at 0.35 / 0.4 seconds 1. **Idea of sequence is essential** Accept times 3. **Idea of sequence is essential**
5(b)	1. Thickness of wall increases **because** ventricle (wall) contracts; 2. Contraction **causes** the increase in pressure;	2	1. must be idea that increase in thickness is linked to contraction 1. accept muscle for ventricle and systole for muscle contraction 2. Accept <u>thickening</u> of wall
5(c)	1. Between 120 ± 5;; 2. Length of cardiac cycle correct but final answer wrong;	2	2 marks for correct answer 1. length of cycles varies slightly 2. Length of cardiac cycle = 0.45 - 0.52

Question	Marking Guidance	Mark	Comments
6(a)	1. To show the effect of the inhibitor / drug; 2. To show the effect of yoghurt (on its own does not affect blood glucose);	2	
6(b)	1. Food is a factor affecting blood glucose / different foods contain different amounts of starch / glucose / sugar / carbohydrate; 2. To keep starch / fibre intake the same / similar;	2	1. accept converse 2. accept something in food which affects the inhibitor
6(c)	1. Fewer E-S complexes formed; 2. (With inhibitor) less / no starch digested to maltose ; 3. (So) less / no glucose from maltose; 4. (So) less absorption of glucose (from gut);	2 max	2. require knowledge that maltose comes from starch 3. require knowledge that glucose comes from maltose 3. accept no glucose

6(d)	**Suitable reason; with explanation;** Paired responses – do not mix and match <u>Examples</u>, 1. Need larger sample / only 30 mice / only 15 mice in each group; 2. Might not be representative / anomalies might have a bigger or smaller effect; ***OR*** 3. Investigation only lasted 20 days; 4. Can't see what longer term effects are; ***OR*** 5. Fall in blood glucose is small / numbers from graph; 6. Mice with inhibitor still have a large rise in blood glucose / so don't know if differences significant; ***OR*** 7. No stats / SDs / SEs; 8. So don't know if differences significant; ***OR*** 9. Blood glucose could continue to fall; 10. which could be harmful; ***OR*** 11. No group without yoghurt; 12. So cannot compare to other groups;	2 max	Ignore references to correlation does not prove causation, it could be due to other factors 1. accept small sample size 2. accept mean not reliable 3. experiment was not long enough 6. accept differences are due to chance

Question	Marking Guidance	Mark	Comments
7(a)	1. FEV falls / drops with age (even without TB); 2. FEV falls faster / drops further / is lower (with age) with TB / greater drop in FEV with TB; 3. FEV falls fastest / drops furthest / is lowest in those who had TB twice (R); 4. Results for TB once (Q) start in early twenties and for TB twice (R) in late twenties / from 30;	3 max	2."Fall in FEV" insufficient 3. worth 2 marks as subsumes point 2 3. the more times they have had TB = twice **"The more times they have had TB, the lower their FEV" = <u>2 marks</u>**
7(b)	(Fibrosis causes / due to), 1. Development of scar tissue / scarring / connective tissue; 2. Loss of elasticity / elastic tissue / elastin in lungs; 3. Restricts inhalation; 4. Breathe out less / reduced FEV due to reduced lung elasticity / scar tissue does not recoil / is not elastic / lung tissue does not recoil;	3 max	FEV depends on how much can be inhaled – as well as ability to exhale 3. Accept resists expansion / lung capacity drops

Question	Marking Guidance	Mark	Comments
8(a)(i)	(**Whole-cell vaccine**), 1. Heat(ing) supposed to kill bacteria; 2. Some might be alive / active/ viable; 3. (If so) bacteria could reproduce; 4. Bacterium makes or contains toxin; 5. Toxin might not be affected / all destroyed by heat; 6. Bacteria or toxins attacking / killing person's cells;	3 max	Accept converse statements for other vaccine Reject references to the vaccine being alive or the disease reproducing etc 2. Accept active pathogens present
8(a)(ii)	(**Whole-cell vaccine**), 1. (Contains) many different / greater range of antigens; 2. Each antigen causes its own immune response / production of / has a specific (type of) antibody;	2	Ignore references to more / greater antigens unqualified. It is the <u>variety</u> of antigens that matters
8(b)	1. Only patients who had whooping cough have toxin / antibody / immune response; 2. Toxin is an antigen; 3. Toxin (only) produced by this bacterium; 4. Leading to presence of specific antibody; 5. Only 4% had this antibody / 13% did not have antibody;	3 max	1. Accept converse e.g. those without antibody had another disease 4. accept complementary antibody 5. must use numbers
8(c)	1. There may not be large rises; 2. Might be the result of wrong diagnosis / reference to difference in figures / 13% diagnosed with whooping cough didn't have it;	2	2. Ignore reference to new strains or antigenic variability

Question	Marking Guidance	Mark	Comments
9(a)	1. Tertiary structure / 3D shape of enzyme (means); 2. Active site complementary to maltose / substrate / maltose fits into active site / active site and substrate fit like a lock and key; 3. Description of induced fit; 4. Enzyme is a catalyst; 5. Lowers activation energy / energy required for reaction; 6. By forming enzyme-substrate complex;	5 max	1. Accept references to active site 2. Idea of shapes fitting together 5. Accept "provides alternative pathway for the reaction at a lower energy level" 6 Accept idea that binding stresses the bonds so more easily broken **Do not award point 6 simply for any reference to E-S complex**

9(b)	1. Inhibitors reduce binding of enzyme to substrate / prevent formation of ES complex; **(Competitive inhibition),** 2. Inhibitor similar shape (idea) to substrate; 3. (binds) in to active site (of enzyme); 4. (Inhibition) can be overcome by more substrate; **(Non-competitive inhibition),** 5. Inhibitor binds to site on enzyme other than active site; 6. Prevents formation of active site / changes (shape of) active site; 7. Cannot be overcome by adding more substrate;	5 max	Max 3 if only one type of inhibition dealt with Accept maltase and maltose as examples of enzyme and substrate (and others) 1. only once, for either inhibitor 3. Accept allows max rate of reaction to be reached / max product will eventually be formed 3. Accept complementary to active site 6. Accept does not allow max rate of reaction to be reached / max product will not be formed

Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

For Examiner's Use	
Examiner's Initials	
Question	Mark
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TOTAL	

General Certificate of Education
Advanced Subsidiary Examination
January 2013

Biology BIOL1

Unit 1 Biology and disease

Wednesday 9 January 2013 9.00 am to 10.15 am

For this paper you must have:
- a ruler with millimetre measurements
- a calculator.

Time allowed
- 1 hour 15 minutes

Instructions
- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- You may ask for extra paper. Extra paper must be secured to this booklet.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information
- The maximum mark for this paper is 60.
- You are expected to use a calculator, where appropriate.
- The marks for questions are shown in brackets.
- Quality of Written Communication will be assessed in all answers.
- You will be marked on your ability to:
  – use good English
  – organise information clearly
  – use scientific terminology accurately.

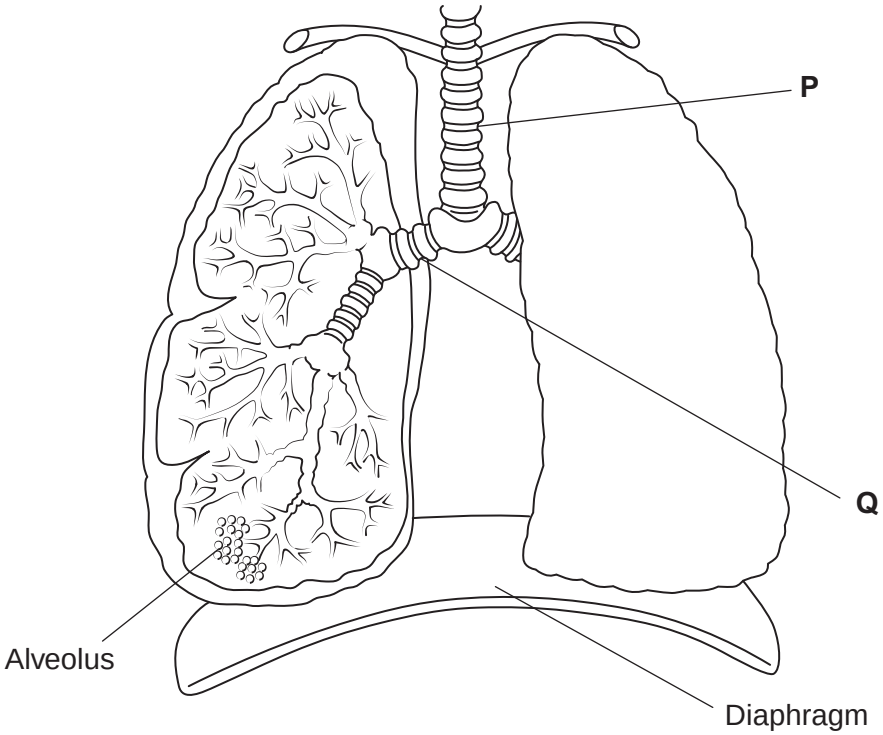
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ANSWER IN THE SPACES PROVIDED

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Answer **all** questions in the spaces provided.

1 (a) The diagram shows the structure of the human gas exchange system.



Name organs

P .....

Q .....

(1 mark)

1 (b) Explain how downward movement of the diaphragm leads to air entering the lungs.

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(2 marks)

1 (c) Complete the equation.

Pulmonary ventilation = ... × .....

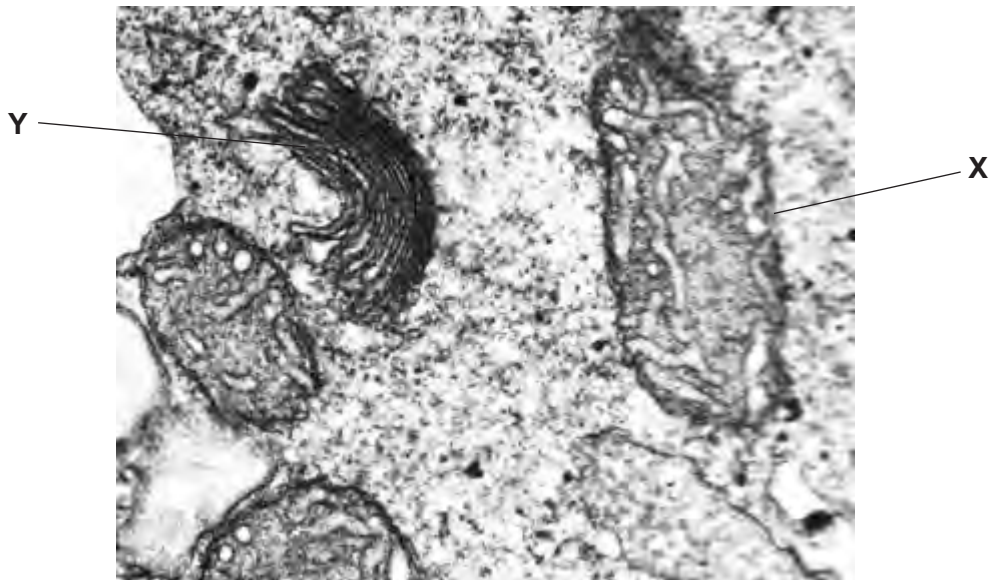
(1 mark)

4

Turn over ▶

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2 The photograph shows part of the cytoplasm of a cell.



2 (a) (i) Organelle **X** is a mitochondrion.

What is the function of this organelle?

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(1 mark)

2 (a) (ii) Name organelle **Y**.

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(1 mark)

2 (b) This photograph was taken using a transmission electron microscope. The structure of the organelles visible in the photograph could not have been seen using an optical (light) microscope. Explain why.

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(2 marks)

4

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3 (a) Name the monosaccharides of which the following disaccharides are composed.

3 (a) (i) Sucrose

monosaccharides ..... and .....

(1 mark)

3 (a) (ii) Lactose

monosaccharides ..... and .....

(1 mark)

3 (b) Amylase and maltase are involved in the digestion of starch in the small intestine.

Complete the table by identifying where these enzymes are produced and the product of the reaction they catalyse.

Name of enzyme	Where the enzyme is produced	Product of the reaction catalysed by the enzyme
Amylase		
Maltase		

(2 marks)

4

Turn over for the next question

Do not write outside the box

4 (a) Cholera bacteria produce toxins which increase secretion of chloride ions into the lumen of the intestine.

Explain why this results in severe diarrhoea (watery faeces).

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(3 marks)

(Extra space) .....

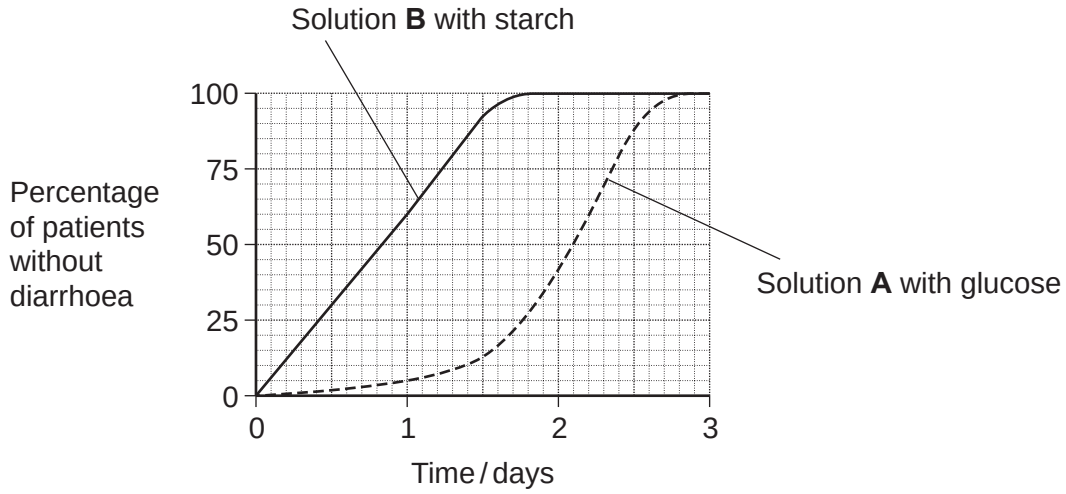
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4 (b) Scientists investigated how effective two oral rehydration solutions, **A** and **B**, were in treating patients with diarrhoea caused by cholera.

- Solution **A** contained glucose.
- Solution **B** was identical to **A**, except that glucose was replaced by starch.

The graph shows their results.



Do not write outside the box

4 (b) (i) The water potential of solution **B** was higher (less negative) than the water potential of solution **A**.

Explain why.

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(1 mark)

4 (b) (ii) 100 patients were treated with solution **A** and 100 patients were treated with solution **B**.

Calculate the difference in the number of patients without diarrhoea after 1 day's treatment with solution **A** and those without diarrhoea after 1 day's treatment with solution **B**.

Show your working.

Difference in number of patients .....

(2 marks)

6

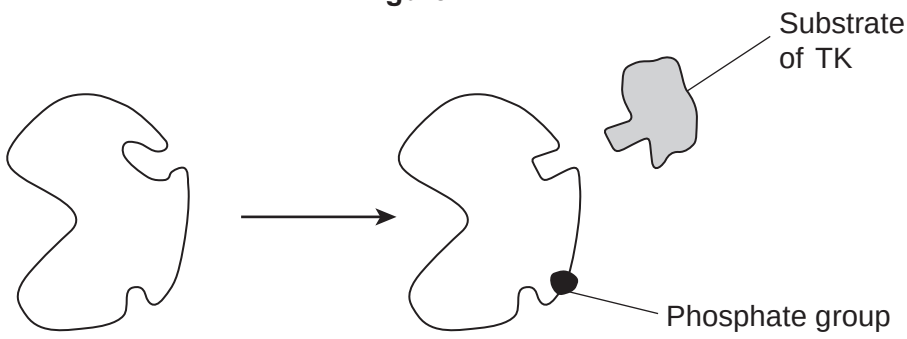
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5 The enzyme tyrosine kinase (TK) is found in human cells. TK can exist in a non-functional and a functional form. The functional form of TK is only produced when a phosphate group is added to TK.

This is shown in **Figure 1**.

Figure 1



Non-functional form of TK Functional form of TK

5 (a) Addition of a phosphate group to the non-functional form of TK leads to production of the functional form of TK.

Explain how.

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(2 marks)

5 (b) The binding of the functional form of TK to its substrate leads to cell division. Chronic myeloid leukaemia is a cancer caused by a faulty form of TK. Cancer involves uncontrolled cell division.

Figure 2 shows the faulty form of TK.

Figure 2



Faulty form of TK

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Suggest how faulty TK leads to chronic myeloid leukaemia.

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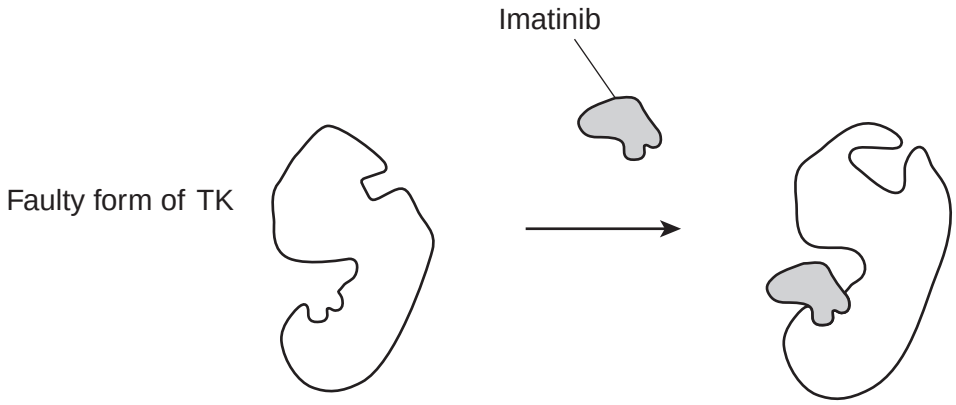
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(2 marks)

5 (c) Imatinib is a drug used to treat chronic myeloid leukaemia.
Figure 3 shows how imatinib inhibits faulty TK.

Figure 3



Using all of the information, describe how imatinib stops the development of chronic myeloid leukaemia.

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(2 marks)

6

Turn over ▶

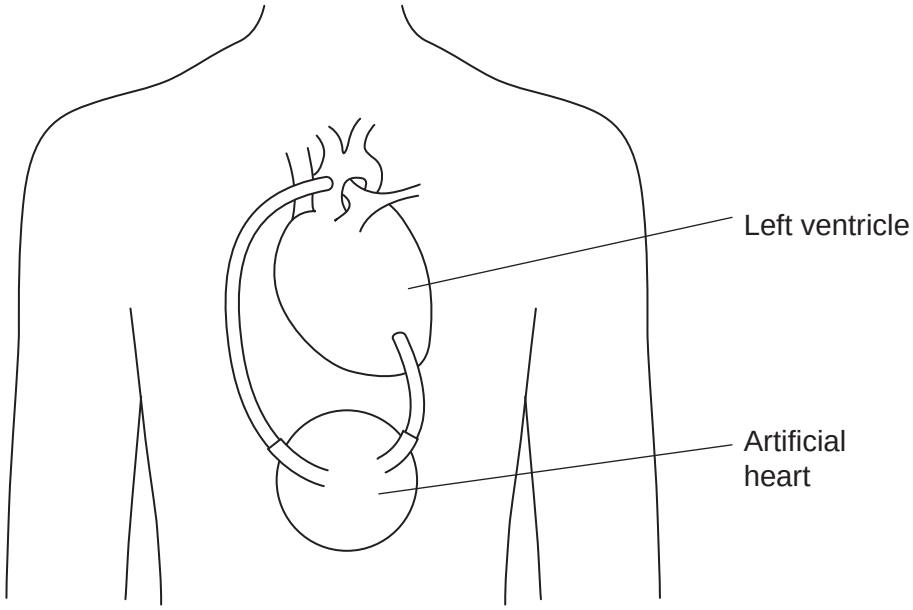
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6 Some people have a form of *heart failure* where their heart is not pumping blood as well as it used to. Some people with heart failure are given an artificial heart to improve circulation of blood from the left ventricle.
Figure 4 shows where this type of artificial heart is connected.

Figure 4



6 (a) Name the blood vessel to which the artificial heart is connected.

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(1 mark)

6 (b) In these patients, the right ventricle still produces sufficient blood flow to keep the patient alive.

Suggest why the left ventricle requires the help of the artificial heart but the right ventricle does not.

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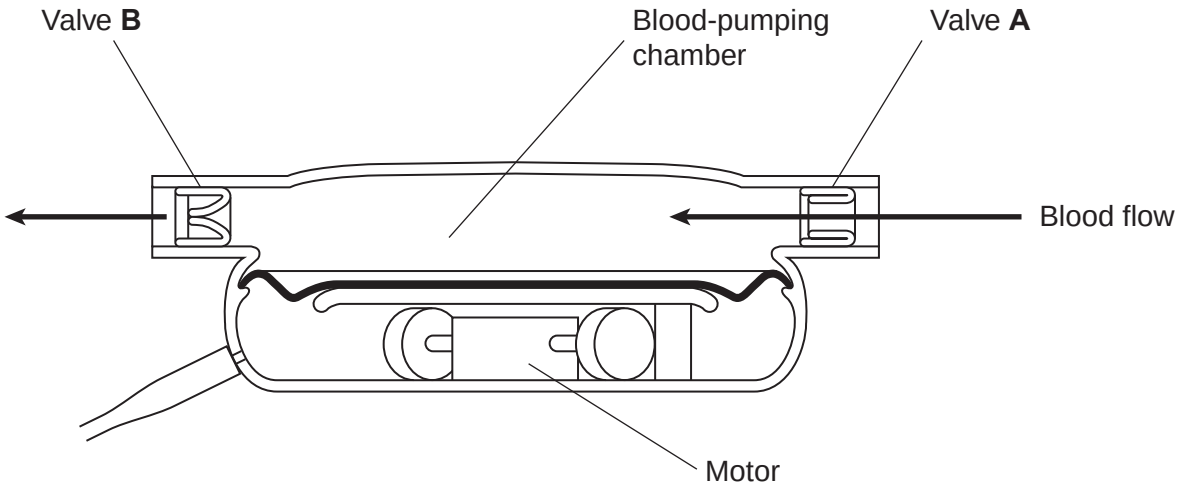
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Question 6 continues on the next page

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6 (c) **Figure 5** shows the internal structure of this type of artificial heart.

Figure 5



Valves **A** and **B** have the same functions as heart valves involved in the cardiac cycle. Name the heart valve that has the same function as:

valve **A** .....

valve **B** .....

(2 marks)

Do not write outside the box

6 (d) There are different designs of artificial heart. Doctors compared results for patients who received two different types of artificial heart, **X** and **Y**.

They recorded information 2 years after the artificial hearts were implanted. Their results are shown in **Figure 6**.

Figure 6

	Information recorded 2 years after artificial heart implanted		
Type of artificial heart	**Number of patients surviving without replacement of artificial heart**	**Number of patients surviving but who required repair or replacement of artificial heart**	**Number of patients who died**
X (119 patients)	62	13	44
Y (58 patients)	7	24	27

Which type of artificial heart was the more successful? Use calculations to support your answer.

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(3 marks)

(Extra space) .....

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8

Turn over ▶

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7 Some people have a condition called *white-coat hypertension*. People with this condition develop a higher than normal heart rate and blood pressure when they are in a doctor's surgery. High heart rate is correlated with high blood pressure.

Doctors investigated differences in heart rate between men with *white-coat hypertension* and those without the condition. They measured the men's mean heart rates:

- in the doctor's surgery, by recording the pulse in the wrist for 1 minute, when the men were lying down
- at home, using a portable heart rate monitor when the men were walking around
- at home, using a portable heart rate monitor when the men were sleeping.

7 (a) The groups of men selected for this investigation were matched.
Other than being men, suggest **one** factor for which they should have been matched.

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(1 mark)

7 (b) Explain why the pulse recordings in the doctor's surgery were taken when the men were lying down.

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(1 mark)

7 (c) The pulse felt in the artery in the wrist can be recorded and used to measure heart rate.

Suggest why the pulse felt can be used to measure heart rate.

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(2 marks)

Do not write outside the box

7 (d) The portable heart rate monitor recorded the men's heart rates continuously. This gave more reliable mean heart rates than those obtained by recording the pulse in the wrist for 1 minute.

Suggest why it is more reliable.

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(2 marks)

7 (e) The table shows the doctors' results.

Where and how heart rate was measured	Mean heart rate / beats per minute	
	Men with white-coat hypertension	Men without white-coat hypertension
Doctor's surgery, recording pulse when lying down	67	63
At home, walking around, using heart monitor	76	73
At home, sleeping, using heart monitor	63	60

A journalist, who saw these results, stated that they showed there is no such thing as *white-coat hypertension*.

Do these data support this statement? Give reasons for your answer.

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(2 marks)

8

Do not write outside the box

8 The human immunodeficiency virus (HIV) leads to the development of acquired immunodeficiency syndrome (AIDS). Eventually, people with AIDS die because they are unable to produce an immune response to pathogens.

Scientists are trying to develop an effective vaccine to protect people against HIV. There are three main problems. HIV rapidly enters host cells. HIV causes the death of T cells that activate B cells. HIV shows a lot of antigenic variability.

Scientists have experimented with different types of vaccine for HIV. One type contains HIV in an inactivated form. A second type contains attenuated HIV which replicates in the body but does not kill host cells. A third type uses a different, non-pathogenic virus to carry genetic information from HIV into the person's cells. This makes the person's cells produce HIV proteins. So far, these types of vaccine have not been considered safe to use in a mass vaccination programme.

Use the information in the passage and your own knowledge to answer the following questions.

8 (a) People with AIDS die because they are unable to produce an immune response to pathogens (lines 2–4).

Explain why this leads to death.

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(3 marks)

(Extra space) .....

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Do not write outside the box

8 (b) Explain why each of the following means that a vaccine might **not** be effective against HIV.

8 (b) (i) HIV rapidly enters host cells (lines 6 – 7).

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(2 marks)

8 (b) (ii) HIV shows a lot of antigenic variability (lines 7 – 8).

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(2 marks)

8 (c) So far, these types of vaccine have not been considered safe to use in a mass vaccination programme (lines 14 – 15).

Suggest why they have **not** been considered safe.

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(3 marks)

(Extra space) .....

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10

Do not write outside the box

9 (a) Some substances can cross the cell-surface membrane of a cell by simple diffusion through the phospholipid bilayer.
Describe other ways by which substances cross this membrane.

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(5 marks)

(Extra space) .....

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Do not write outside the box

9 (b) Atheroma formation increases a person's risk of dying.

Explain how.

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(5 marks)

(Extra space) .....

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10

END OF QUESTIONS

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General Certificate of Education (A-level)
January 2013

Biology BIOL1

(Specification 2410)

Unit 1: Biology and Disease

Final

Mark Scheme

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It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of students' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

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Question	Marking Guidance	Mark	Comments
1(a)	(**P**) Trachea/windpipe <u>and</u> (**Q**) bronchus;	1	For **P** or **Q**, accept (ring of) cartilage (i.e. not for both) Accept bronchi Reject bronchioles Ignore reference to left or right lung
1(b)	1. Increases volume (in lungs/thorax); 2. Lowers pressure (in lungs/thorax); 3. Air (pushed) in by higher outside pressure / down pressure gradient;	2 max	Context must be lungs/thorax Ignore space increases Accept lungs/chest expand Ignore reference to 'change in pressure' Ignore reference to 'sucked in'
1(c)	Tidal volume <u>and</u> ventilation rate;	1	Accept volume each breath and breathing rate Accept either way around Tidal volume must have context of 'in one breath' not 'volume' alone Ignore units Accept TV × VR/BR

Question	Marking Guidance	Mark	Comments
2(a)(i)	(Aerobic) respiration;	1	Accept ATP production/energy release Reject <u>anaerobic</u> respiration Reject energy production
2(a)(ii)	Golgi (apparatus/body);	1	Ignore smooth ER
2(b)	('It' = Optical microscope) 1. Has low resolution/not high enough resolution; 2. (Because) wavelength of light not short enough/too long;	2	Ignore reference to magnification Accept converse relating to EM Accept larger wavelength Accept statements that microscopes have a wavelength

Question	Marking Guidance	Mark	Comments
3(a)(i)	Glucose and fructose;	1	Ignore reference to alpha and beta Either way around
3(a)(ii)	Glucose and galactose;	1	Ignore reference to alpha and beta Either way around
3(b)	1. (Amylase) pancreas, produces maltose; 2. (Maltase) in/on epithelium (of small intestine), produces glucose;	2	Place and product = 1 mark (mark horizontally) Ignore references to salivary glands or saliva Accept wall/lining of small intestine Ignore reference to cells alone Ignore reference to ribosomes/rER

Question	Marking Guidance	Mark	Comments
4(a)	1. Water lost into gut/water moves into gut/ water leaves cells; 2. Low(er) water potential of intestine/gut (lumen); 3. Osmosis/movement down a WP gradient; 4. Less/not enough water (re)absorbed;	3 max	QWC ignore large/small WP QWC ignore reference to high/low concentrations of water or high/low concentrations of solution Ignore reference to stomach QWC ignore 'along' concentration gradients
4(b)(i)	Starch is not (very) soluble/does not dissolve well;	1	Accept converse for glucose in **A** Ignore 'starch is osmotically inactive' Ignore reference to solute potentials
4(b)(ii)	55;; Working : 5% for **A** and 60% for **B**;	2	2 marks for correct answer Max 1 if answer as a %

Question	Marking Guidance	Mark	Comments
5(a)	1. (Phosphate) changes shape of TK/changes shape of enzyme/changes the active site; 2. Active site forms/becomes the right shape/can bind to substrate/complementary to substrate/E-S complex can form;	2	It = phosphate Accept 'alters' for changes 1. Reject that phosphate is an inhibitor Accept adding energy/affecting charged/affects polar groups (on amino acids) 2. Reject similar/same shape as substrate
5(b)	1. Faulty TK has functional active site <u>without phosphate</u>; 2. (So, faulty) TK functional all the time/TK not controlled (by phosphate);	2	Accept 'works without phosphate'
5(c)	1. Non-competitive inhibitor/binds to site other than active site; 2. Causes TK to be in non-functional form/active site not formed/wrong shape/E-S complex not formed; 3. So, (uncontrolled) cell division stopped/slowed/controlled;	2 max	Accept allosteric site Do not accept 'changes shape' unqualified

Question	Marking Guidance	Mark	Comments
6(a)	Aorta;	1	
6(b)	1. Left ventricle pumps to whole body (except lungs)/pumps blood further; 2. Left ventricle does most work/produces a greater pressure/produces a greater force;	2	Accept converse for right ventricle Reject 'push'
6(c)	1. (Valve **A**) atrioventricular valve; 2. Semi-lunar valve;	2	1. Accept bicuspid/mitral 2. Accept aortic valve Ignore references to left and right
6(d)	**X** because (no mark) 1. 52.1% survived without replacement compared to 12.1% / difference of 40%; 2. 10.9% required repair or replacement of artificial heart compared to 41.4% / difference of 30.5%; 3. 37% died compared to 46.6% / difference of 9.6%; ***OR*** (X/Y = 119 divided by 58 = 2.05) 14.4; 49.2; 55.4;	3	Accept other valid calculations – probabilities If correct figures written in table, award marks Max 2 if incorrect rounding of values Note that this ratio could be reversed i.e. 58 divided by 119 multiplied by numbers in top row Accept rounded to 14; 49; and 55;

Question	Marking Guidance	Mark	Comments
7(a)	One suitable factor; E.g. Age/no heart condition/not on medication;	1 max	Not health or lifestyle Accept BMI/ smokers/ diet/ fitness/ race etc. – has to affect heart rate or blood pressure
7(b)	Patients were at rest/not moving/not using muscles/in standardised position/controlled conditions;	1	Accept same position as sleeping Ignore relaxed
7(c)	1. Caused by pressure/surge of blood; 2. From (one) contraction/beat of (left) ventricle/heart;	2	Ignore pulse rate equals heart rate Reject right ventricle Ignore pumps/pumping
7(d)	1. Monitor records heart rate over long period of time/all the time/more data collected; 2. Anomalies in recording have less effect; 3. Recording pulse rate for <u>one minute only</u> may give an anomalous/atypical result; 4. Errors when trying to count pulse for one minute/ human error; 5. Monitor records HR over a range of activities during the day/pulse rate only records for a single set of conditions;	2 max	Ignore reference to continuously as in stem Ignore anomalies can be discarded Ignore more accurate/reliable mean

7(e)	1. Men with condition always have higher heart rates; 2. But no direct measurements of blood pressure; 3. Only one investigation/test/need more studies; 4. Using different recording methods/conditions (in each case so cannot compare results); 5. Men without condition also have increased/higher heart rate in doctor's surgery;	2 max	Accept blood pressure references for heart rate Accept - no stats analysis to show significance Ignore references to 'yes' and 'no' throughout

Question	Marking Guidance	Mark	Comments
8(a)	1. Infected by/susceptible to (other) pathogen(s)/named disease caused by a pathogen (from environment); 2. Pathogen(s) reproduce/cause diease (in host); 3. Damage cells/tissues/organs; 4. Release toxins;	3 max	Context is where immune system cannot prevent or stop these events Allow attack/kill MPs not given in context of HIV
8(b)(i)	1. (HIV enters cells) before antibodies can bind to/destroy it; 2. Antibodies cannot enter cells (to destroy HIV)/stay in blood; ***OR*** 3. (Enters cells) before (secondary) immune response caused/before memory cells have time to respond; 4. So no antibodies present (to attack HIV); ***OR*** 5. Vaccine taken up too quickly to cause immune response; 6. So no antibodies/memory cells formed;	2 max	Ignore SAFETY comments 1. and 2. Relate to antibodies 3. and 4. Relate to virus 5. and 6. Relate to vaccine
8(b)(ii)	1. Antigen (on HIV) changes; 2. (Specific) antibody/receptor no longer binds to (new) antigen; ***OR*** 3. Many different strains of HIV/many antigens present on HIV; 4. Not possible to make a vaccine for all antigens/vaccine may not stimulate an antibody for a particular antigen;	2 max	Accept mutates Ignore SAFETY comments

8(c)	3 suitable suggestions;;; E.g. 1. Inactive virus may become active/viral transformation; 2. Attenuated virus might become harmful; 3. Non-pathogenic virus may mutate and harm cells; 4. Genetic information/protein (from HIV) may harm cells; 5. People (may) become/test HIV positive after vaccine used; 6. This may affect their work/life;	3 max	QWC ignore reference to HIV cells 5. Vaccinated people may develop disease from a different strain to that in the vaccine 6. May continue high risk activities and develop or pass on HIV

Question	Marking Guidance	Mark	Comments
9(a)	<u>By osmosis (no mark)</u> 1. From a high water potential to a low water potential/down a water potential gradient; 2. Through aquaporins/water channels; <u>By facilitated diffusion (no mark)</u> 3. Channel/carrier protein; 4. Down concentration gradient; <u>By active transport (no mark)</u> 5. Carrier protein/protein pumps; 6. Against concentration gradient; 7. Using ATP/energy (from respiration); <u>By phagocytosis/endocytosis (no mark)</u> 8. Engulfing by cell surface membrane to form vesicle/vacuole; <u>By exocytosis/role of Golgi vesicles (no mark)</u> 9. Fusion of vesicle with cell surface membrane;	5 max	No mark awarded for naming terms e.g. osmosis, facilitated diffusion, active transport, co-transport etc. QWC ignore large/small WP QWC ignore reference to high/low concentrations of water or high/low concentration of solution QWC ignore 'along' concentration gradients Co-transport subsumed into mark scheme for active transport and facilitated diffusion Can award MP2, 3, 5 for 3 marks with no context given Ignore lipid <u>diffusion</u> as in stem of question

9(b)	1. Atheroma is fatty material/cholesterol/foam cells/plaque/calcium deposits/LDL; 2. In wall of artery; 3. (Higher risk of) aneurysm/described; 4. (Higher risk of) thrombus formation/blood clot; 5. Blocks coronary artery; 6. Less oxygen/glucose to heart muscle/cells/tissue; 7. Reduces/prevents respiration; 8. Causing myocardial infarction/heart attack; 9. Blocks artery to brain; 10. Causes stroke/stroke described;	5 max	2. Reject 'on', 'in artery', 'vein' Thicker walls insufficient 4. Accept pulmonary embolism/described

Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

For Examiner's Use	
Examiner's Initials	
Question	Mark
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TOTAL	

General Certificate of Education
Advanced Subsidiary Examination
June 2013

Biology BIOL1

Unit 1 Biology and disease

Tuesday 21 May 2013 1.30 pm to 2.45 pm

For this paper you must have:
- a ruler with millimetre measurements
- a calculator.

Time allowed
- 1 hour 15 minutes

Instructions
- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- You may ask for extra paper. Extra paper must be secured to this booklet.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information
- The marks for questions are shown in brackets.
- You are expected to use a calculator, where appropriate.
- The maximum mark for this paper is 60.
- Quality of Written Communication will be assessed in all answers.
- You will be marked on your ability to:
  – use good English
  – organise information clearly
  – use scientific terminology accurately.

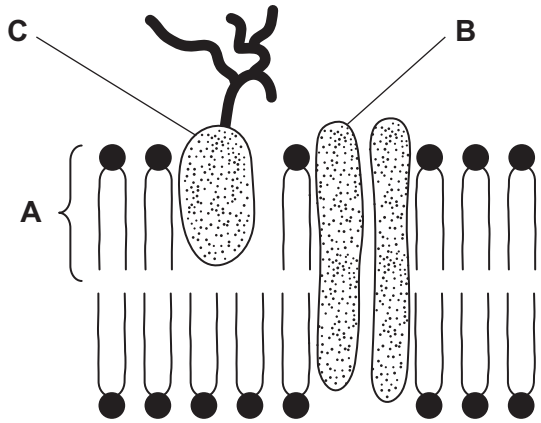
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Answer **all** questions in the spaces provided.

1 The diagram shows the structure of the cell-surface membrane of a cell.



1 (a) Name **A** and **B**.

A .....

B .....

(2 marks)

1 (b) (i) **C** is a protein with a carbohydrate attached to it. This carbohydrate is formed by joining monosaccharides together.

Name the type of reaction that joins monosaccharides together.

.....

(1 mark)

1 (b) (ii) Some cells lining the bronchi of the lungs secrete large amounts of mucus. Mucus contains protein.

Name **one** organelle that you would expect to find in large numbers in a mucus-secreting cell and describe its role in the production of mucus.

Organelle .....

Description of role .....

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(2 marks)

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2 (a) An enzyme catalyses only one reaction. Explain why.

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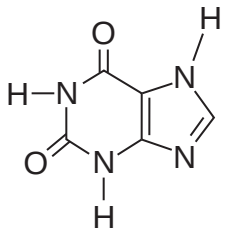
(2 marks)

2 (b) Gout is a disease caused by the build-up of uric acid crystals in joints. Uric acid is produced from xanthine in a reaction catalysed by the enzyme xanthine oxidase.

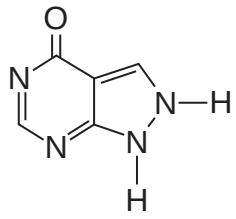
xanthine $\xrightarrow{\text{xanthine oxidase}}$ uric acid

Allopurinol is a drug used to treat gout. The diagram shows the structures of xanthine and allopurinol.

Xanthine



Allopurinol



Use this information to suggest how allopurinol can be used to treat gout.

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(3 marks)

(Extra space) .....

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3 (a) (i) Name the process by which oxygen passes from an alveolus in the lungs into the blood.

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(1 mark)

3 (a) (ii) Describe **two** adaptations of the structure of alveoli for efficient gas exchange.

1 .....

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2 .....

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(2 marks)

3 (b)



The photograph shows a fire-breather creating a ball of fire. Fire-breathers do this by blowing a fine mist of paraffin oil onto a flame. Some of this mist can be inhaled and may eventually lead to fibrosis.

People who have been fire-breathers for many years often find they cannot breathe out properly. Explain why.

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(2 marks)

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4 (a) Infection by the cholera bacterium can cause acute diarrhoea. Explain how.

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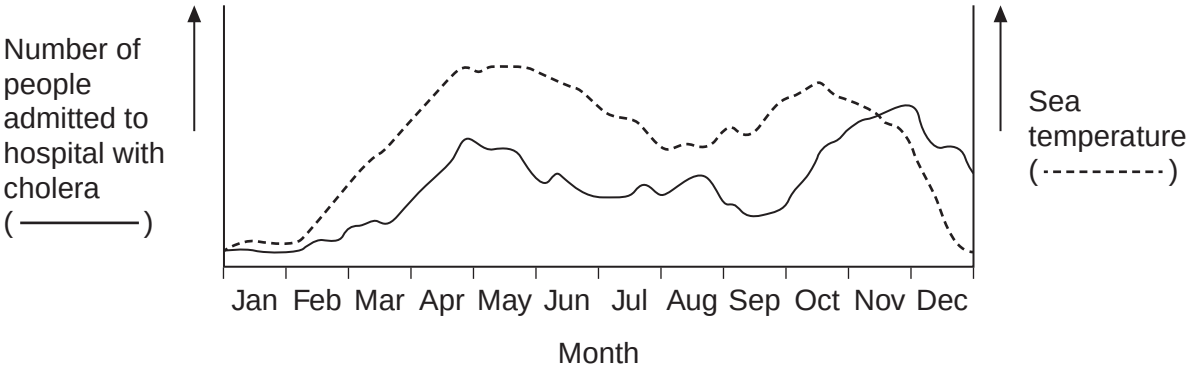
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(2 marks)

The bacteria that cause cholera can be found in seawater. Outbreaks of cholera often begin in populations living near the coast.

Scientists in Bangladesh investigated the relationship between outbreaks of cholera and the sea temperature. They used the number of people admitted to hospital with cholera as a measure of the number of cases of the disease. The graph shows their results.



4 (b) Describe the relationship between sea temperature and the number of people admitted to hospital with cholera between January and June.

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(2 marks)

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4 (c) Some scientists have suggested that a rise in sea temperatures could lead to an increase in outbreaks of cholera. Do these data support this suggestion? Give reasons for your answer.

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(2 marks)

4 (d) In areas where there are repeated outbreaks of cholera, most people who become infected by cholera bacteria do not become ill. Suggest and explain **one** reason why.

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(2 marks)

8

Turn over for the next question

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5 Imatinib is a drug used to treat a type of cancer that affects white blood cells. Scientists investigated the rate of uptake of imatinib by white blood cells. They measured the rate of uptake at 4 ºC and at 37 ºC.

Their results are shown in the table.

	Mean rate of uptake of imatinib into cells / µg per million cells per hour	
Concentration of imatinib outside cells / µmol dm^{-3}	**4 ºC**	**37 ºC**
0.5	4.0	10.5
1.0	10.7	32.5
5.0	40.4	420.5
10.0	51.9	794.6
50.0	249.9	3156.1
100.0	606.9	3173.0

5 (a) The scientists measured the rate of uptake of imatinib in µg per million cells per hour. Explain the advantage of using this unit of rate in this investigation.

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(2 marks)

5 (b) Calculate the percentage increase in the mean rate of uptake of imatinib when the temperature is increased from 4 ºC to 37 ºC at a concentration of imatinib outside the cells of 1.0 µmol dm^{-3}.

Give your answer to one decimal place.

Answer .....

(2 marks)

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5 (c) Imatinib is taken up by blood cells by active transport.

5 (c) (i) Explain how the data for the two different temperatures support this statement.

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(2 marks)

5 (c) (ii) Explain how the data for concentrations of imatinib outside the blood cells at 50 and 100 µmol dm^{-3} at 37 ºC support the statement that imatinib is taken up by active transport.

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(2 marks)

8

Turn over for the next question

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6 (a) Describe how you would test a sample of food for the presence of starch.

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(2 marks)

6 (b) The concentration of glucose in the blood rises after eating a meal containing carbohydrates.

The rise is slower if the carbohydrate is starch rather than sucrose. Explain why.

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(3 marks)

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Question 6 continues on the next page

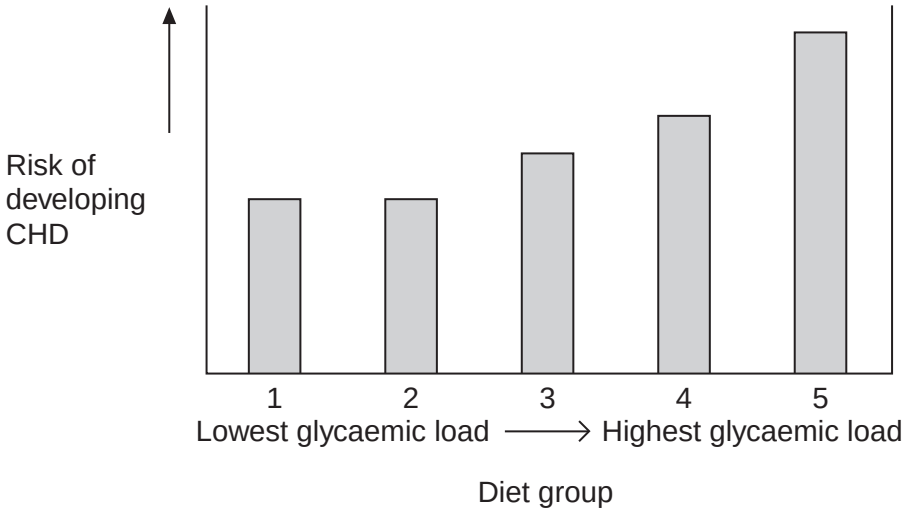
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The glycaemic load (GL) of a diet is a measure of how much digestible carbohydrate it contains. The higher the GL of a diet the more quickly it raises the blood glucose concentration after a meal. A diet with a high GL also increases the concentration of harmful lipids in the blood.

Scientists investigated the relationship between diets with different glycaemic loads and the risk of developing coronary heart disease (CHD) in women.

The scientists determined the glycaemic loads of the diets of a large number of women. They then divided the women into 5 groups. Group 1 had diets with the lowest glycaemic load and group 5 had diets with the highest glycaemic load. The scientists determined the risk of developing CHD in each group.

The graph shows their results.



6 (c) The scientists excluded women who smoked from the study. Explain why.

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(1 mark)

Do not write outside the box

6 (d) (i) What do these data show about the effect that glycaemic load of the diet has on the risk of developing CHD?

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(1 mark)

6 (d) (ii) Use the information provided to explain the effect that glycaemic load of the diet has on the risk of developing CHD.

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(2 marks)

9

Turn over for the next question

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7 Read the following passage.

Microfold cells are found in the epithelium of the small intestine. Unlike other epithelial cells in the small intestine, microfold cells do not have adaptations for the absorption of food.

Microfold cells help to protect against pathogens that enter the intestine. They have receptor proteins on their cell-surface membranes that bind to antigens on the surface of pathogens. The microfold cells take up the antigens and transport them to cells of the immune system. Antibodies are then produced which give protection against the pathogen.

Scientists believe that it may be possible to develop vaccines that make use of microfold cells. These vaccines could be swallowed in tablet form.

Use information from the passage and your own knowledge to answer the following questions.

7 (a) Microfold cells do not have adaptations for the absorption of food (lines 2 - 3). Give **two** adaptations that other epithelial cells have for the absorption of food.

1 .....

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2 .....

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(2 marks)

7 (b) (i) Microfold cells have receptor proteins on their cell-surface membranes that bind to antigens (line 5). What is an antigen?

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(1 mark)

7 (b) (ii) Microfold cells take up the antigens and transport them to cells of the immune system (lines 6 - 7). Antigens are not able to pass through the cell-surface membranes of other epithelial cells. Suggest **two** reasons why.

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(2 marks)

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7 (c) Scientists believe that it may be possible to develop vaccines that make use of microfold cells (lines 9 -10). Explain how this sort of vaccine would lead to a person developing immunity to a pathogen.

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(5 marks)

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Turn over for the next question

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8 (a) Describe how a heartbeat is initiated and coordinated.

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(5 marks)

(Extra space) .....

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8 (b) Explain how the heart muscle and the heart valves maintain a one-way flow of blood from the left atrium to the aorta.

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(5 marks)

(Extra space) .....

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END OF QUESTIONS

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General Certificate of Education (A-level)
June 2013

Biology BIOL1

(Specification 2410)

Unit 1: Biology and Disease

Final

Mark Scheme

Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation events which all examiners participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the students' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for standardisation each examiner analyses a number of students' scripts: alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, examiners encounter unusual answers which have not been raised they are required to refer these to the Principal Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of students' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

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Question	Marking Guidelines	Marks	Comments
1(a)	1. **A**: phospholipid (layer); 2. **B**: pore/channel/pump/carrier/ transmembrane/intrinsic/transport <u>protein</u>;	2	1. Reject hydrophobic / hydrophilic phospholipid 2. Ignore unqualified reference to protein
1(b)(i)	Condensation (reaction);	1	
1(b)(ii)	Organelle named; Function in protein production/secretion; eg 1. Golgi (apparatus); 2. Package/process proteins; ***OR*** 3. Rough endoplasmic reticulum/ribosomes; 4. Make polypeptide/protein/forming peptide bonds; ***OR*** 5. Mitochondria; 6. Release of energy/make ATP; ***OR*** 7. Vesicles; 8. Secretion/transport of protein;	2	Function must be for organelle named Incorrect organelle = 0 1. Accept smooth endoplasmic reticulum 3. Accept alternative correct functions of rough endoplasmic reticulum. ER/RER is insufficient 3. Accept folding polypeptide/protein 6. Reject produce/make energy 6. Accept produce energy in the form of ATP

Question	Marking Guidelines	Marks	Comments
2(a)	1. (Enzyme has) <u>active site</u>; 2. Only substrate fits (the active site);	2	1. Reject active site is same shape as substrate 1. Reject active site is on the substrate 1. Accept active site forms during induced fit 2. Accept converse statement
2(b)	1. (Allopurinol) is a similar shape to xanthine; 2. (Allopurinol) enters active site / is a competitive inhibitor; 3. Less xanthine binds/fewer e-s complexes/fewer uric acid crystals formed/less uric acid formed;	3	Assume "it" = allopurinol 1. Reject <u>same</u> shape. Accept similar structure 2. Ignore e-s complexes in relation to inhibitor 2. Reject non-competitive inhibitor in the context of binding to the active site 2. Ignore complementary/fits 3. Reject <u>no</u> e-s complexes/xanthine <u>cannot</u> enter active site, <u>no</u> uric acid 3. Can award in context of non-competitive inhibition

Question	Marking Guidelines	Marks	Comments
3(a)(i)	(Simple) diffusion;	1	Reject facilitated diffusion Accept lipid diffusion
3(a)(ii)	1. Thin walls/cells; 2. (Total) surface area is large;	2	1. 'Short diffusion pathway' alone is an explanation not a description 1. Accept squamous epithelia / one cell thick 2. Ignore references to 'volume ratio'
3(b)	1. Loss of elasticity/elastic tissue; 2. Scar tissue; 3. Less recoil;	2 max	1. Accept elastin

Question	Marking Guidelines	Marks	Comments
4(a)	1. Toxin (produced by bacterium) causes (chloride) ions to move into (lumen of) intestine; 2. Water potential (of intestine contents) falls / water moves by osmosis into intestine/out of cells;	2	1. Reject incorrect ion 1. Direction of ion movement must be clear 2. Ignore movement of water from blood (rather than cells)
4(b)	1. Both show little/no increase/remain constant in January/February; 2. (Up to May) sea temperature rises more quickly/before increase in cholera; 3. Both reach a peak in/decline after April/May;	2 max	Ignore references to correlation Accept May to June
4(c)	1. Positive correlation from January to September/October (between sea temperature and cholera cases); 2. Only records people in hospital with cholera / may be people with cholera not in hospital; 3. Negative correlation/cases rising as sea temperature falls in October/November;	2 max	1. Ignore as sea temperature rises, cholera cases rise, as in stem 1. Accept any two months within range 3. 'At end of year' insufficient

4(d)	Suitable suggestion with explanation;; 1. Have produced memory cells; 2. After previous infection/vaccination; ***OR*** 3. Different forms of cholera; 4. Some don't produce much/any toxins; ***OR*** 5. Few bacteria ingested; 6. Not enough toxin to produce symptoms; ***OR*** 7. Some people naturally resistant to bacterium; 8. Because of structure of cell membranes / amount of secretions eg bile/pancreatic juices;	2	1. 'Have become immune' is not enough 2. Accept 'produces secondary response' 3. Accept types /strains /variety

Question	Marking Guidelines	Marks	Comments
5(a)	1. To allow comparison; 2. Because different number of cells in samples / different times for incubation / numbers become easier to manipulate;	2	
5(b)	203.7(%);;	2	Allow 1 mark for 21.8/10.7 Allow 1 mark for correct answer (203.74) but not correctly to 1 dp 204= 1 mark
5(c)(i)	1. (At every concentration) uptake is faster at 37°C/at higher temperature; 2. Due to faster respiration/ATP production;	2	
5(c)(ii)	1. Uptake at 37°C only small increase /levelling off/almost constant; 2. As carrier proteins full; 3. Concentration of imatinib is not the limiting factor;	2 max	Accept 'no (significant) change' Ignore use of numbers

Question	Marking Guidelines	Marks	Comments
6(a)	1. Add iodine/potassium iodide solution to the food sample; 2. Blue/black/purple indicates starch is present;	2	1. Allow 'iodine' 2. Must be in the context of the correct reagent
6(b)	1. Starch digested to maltose/by amylase; 2. Maltose digested to glucose/by maltase; 3. Digestion of sucrose is a single step/only one enzyme/sucrase;	3	Ignore 'hard to digest/easily digested' 3. Accept converse for starch 3. Do not accept digestion of sucrose is faster
6(c)	1. Smoking increases risk of CHD; 2. Introduces another variable;	1 max	
6(d)(i)	1. No effect on risk with diet group 1 and 2/lowest glycaemic load; 2. Above diet group 2/in higher groups, risk increases as glycaemic load increases;	1 max	Simple statement of correlation is not enough for this mark
6(d)(ii)	1. For diet group 2 and above, increase in risk of CHD as GL increases; 2. (Higher GL diets lead to) more (harmful) lipids (in blood), so greater risk of atheroma; 3. Atheroma leads to blockage of <u>coronary artery</u> / increased risk of blood clot in <u>coronary artery</u>;	2 max	Ignore reference to lipids in diet Ignore references to myocardial infarction/heart attack

Question	Marking Guidelines	Marks	Comments
7(a)	1. Microvilli; 2. Carrier proteins/co-transport proteins/membrane-bound enzymes; 3. Many mitochondria;	2 max	1. Accept large surface area Accept lots of ATP produced
7(b)(i)	Substance that causes an immune response/production of antibodies;	1	Ignore foreign/non-self
7(b)(ii)	1. Not lipid soluble; 2. Too large (to diffuse through the membrane); 3. Antigens do not have the complementary shape/cannot bind to receptor/channel/carrier proteins (in membranes of other epithelial cells);	2 max	
7(c)	1. (Vaccine contains) antigen/attenuated/dead pathogen; 2. Microfold cells take up/bind and present/transport antigen (to immune system/lymphocytes/T-cells); 3. T-cells activate B-cells; 4. B-cells divide/form clone/undergo mitosis; 5. B-cells produce antibodies; 6. Memory cells produced; 7. More antibodies/antibodies produced faster in secondary response/on reinfection;	5 max	1. Reject if in context of injection of vaccine 3. Accept T-cells release cytokines 4. Accept plasma cells for B-cells 6. Ignore T/B in reference to memory cells 7. Must be comparative

Question	Marking Guidelines	Marks	Comments
8(a)	1. SAN sends wave of electrical activity / impulses (across atria) causing atrial contraction; 2. Non-conducting tissue prevents immediate contraction of ventricles/prevents impulses reaching the ventricles; 3. AVN delays (impulse) whilst blood leaves atria/ventricles fill; 4. (AVN) sends wave of electrical activity / impulses down Bundle of His; 5. Causing ventricles to contract from base up;	5	Accept excitation 4. Allow Purkyne fibres/tissue
8(b)	1. Atrium has higher pressure than ventricle (due to filling/contraction); 2. Atrioventricular valve opens; 3. Ventricle has higher pressure than atrium (due to filling/contraction); 4. Atrioventricular valve closes; 5. Ventricle has higher pressure than aorta; 6. Semilunar valve opens; 7. Higher pressure in aorta than ventricle (as heart relaxes); 8. Semilunar valve closes; 9. (Muscle/atrial/ventricular) <u>contraction</u> causes increase in pressure;	5 max	Start anywhere in sequence, but events must be in the correct order. 2. Accept bicuspid, reject tricuspid 2. Allow: blood passes through the valve = valve open / blood stopped from passing through the valve = valve closed 4. 'prevents backflow' is not enough Points 1, 3, 5, and 7 must be comparative: eg high<u>er</u> 6. Allow aortic valve Marks 2, 4, 6, 8 given in the correct sequence can gain 4 marks 8. Allow aortic valve 8. 'prevents backflow' is not enough

Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

For Examiner's Use	
Examiner's Initials	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
8	
TOTAL	

General Certificate of Education
Advanced Subsidiary Examination
January 2012

Biology BIOL1

Unit 1 Biology and disease

Wednesday 11 January 2012 9.00 am to 10.15 am

For this paper you must have:
- a ruler with millimetre measurements
- a calculator.

Time allowed
- 1 hour 15 minutes

Instructions
- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- You may ask for extra paper. Extra paper must be secured to this booklet.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information
- The marks for questions are shown in brackets.
- The maximum mark for this paper is 60.
- You will be marked on your ability to:
  – use good English
  – organise information clearly
  – use scientific terminology accurately.

Do not write outside the box

Answer **all** questions in the spaces provided.

1 (a) Some seeds contain lipids. Describe how you could use the emulsion test to show that a seed contains lipids.

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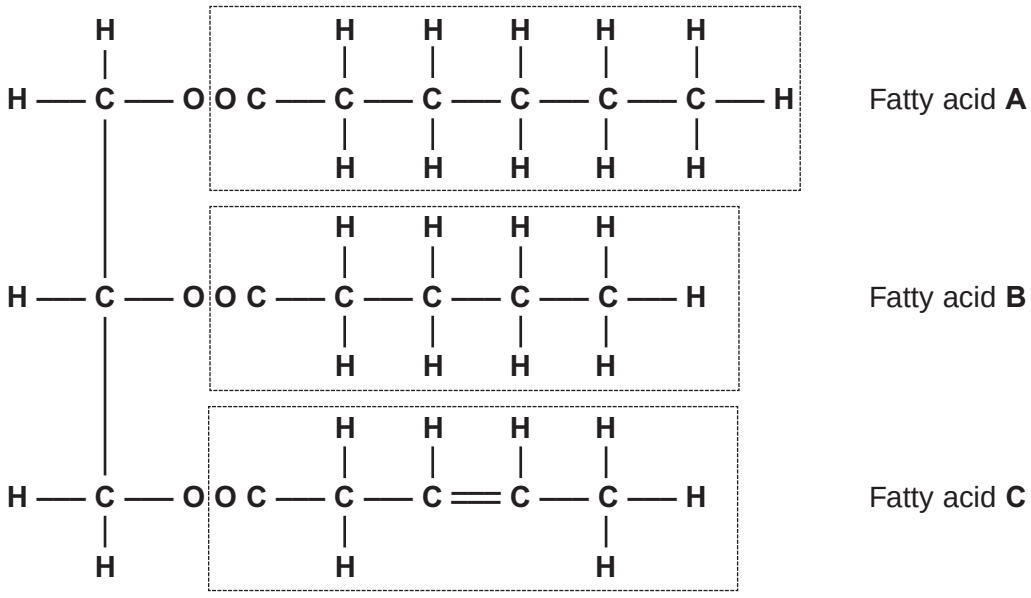
(3 marks)

(Extra space) .....

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1 (b) A triglyceride is one type of lipid. The diagram shows the structure of a triglyceride molecule.



Do not write outside the box

1 (b) (i) A triglyceride molecule is formed by condensation. From how many molecules is this triglyceride formed?

(1 mark)

1 (b) (ii) The structure of a phospholipid molecule is different from that of a triglyceride. Describe how a phospholipid is different.

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(2 marks)

1 (b) (iii) Use the diagram to explain what is meant by an unsaturated fatty acid.

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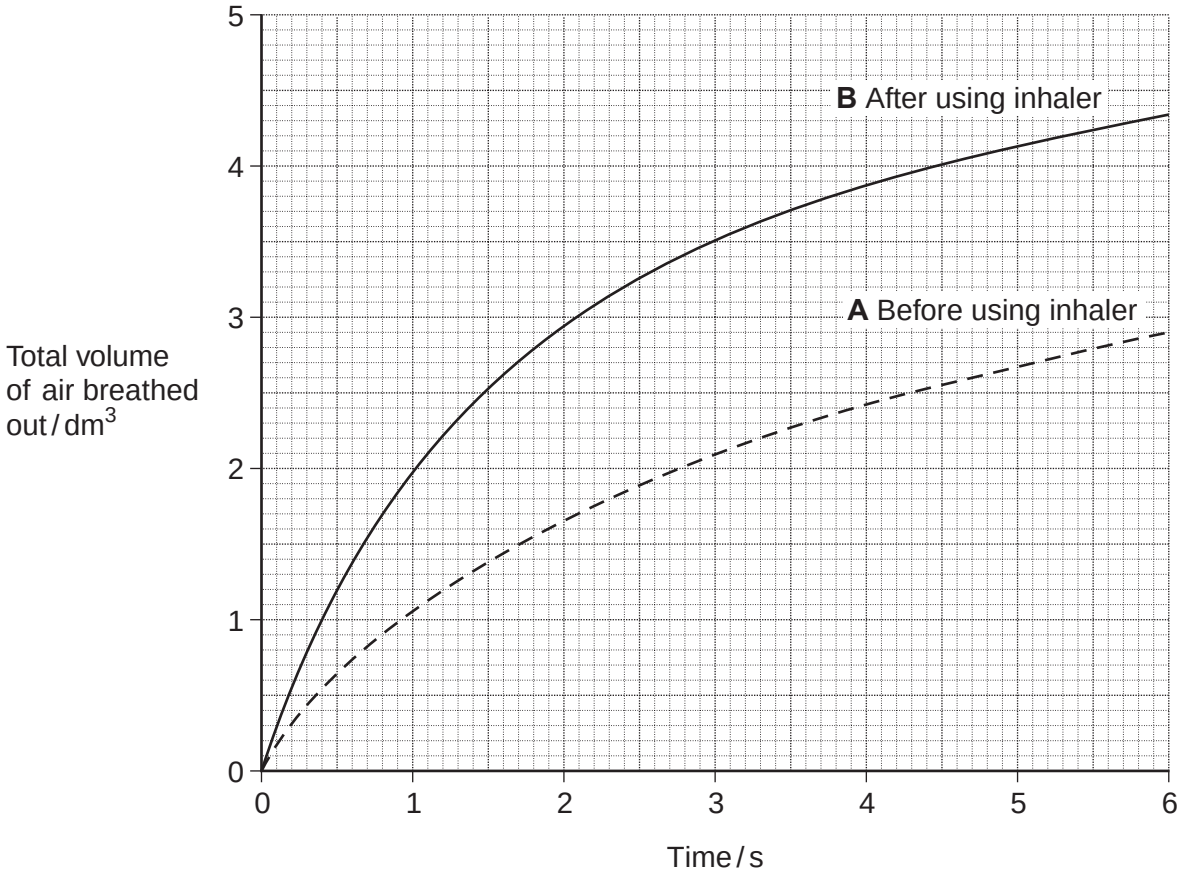
(2 marks)

8

Turn over for the next question

Do not write outside the box

2 A person with asthma breathed out as hard as he could. The graph shows the volume of air he breathed out in the first 6 seconds of a breath. Curve **A** shows the volume before he used an inhaler. Curve **B** shows the volume after he used an inhaler.



2 (a) The diaphragm helps to bring about the changes shown by the curve **A**. Explain how.

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(3 marks)

(Extra space) .....

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Do not write outside the box

2 (b) You could use curve **A** to find the total volume of air that this person could breathe out in one complete breath. Describe how.

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(2 marks)

2 (c) The inhaler which the person used contained a substance that dilates bronchioles. Use this information to explain why curve **A** is different from curve **B**.

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(2 marks)

7

Turn over for the next question

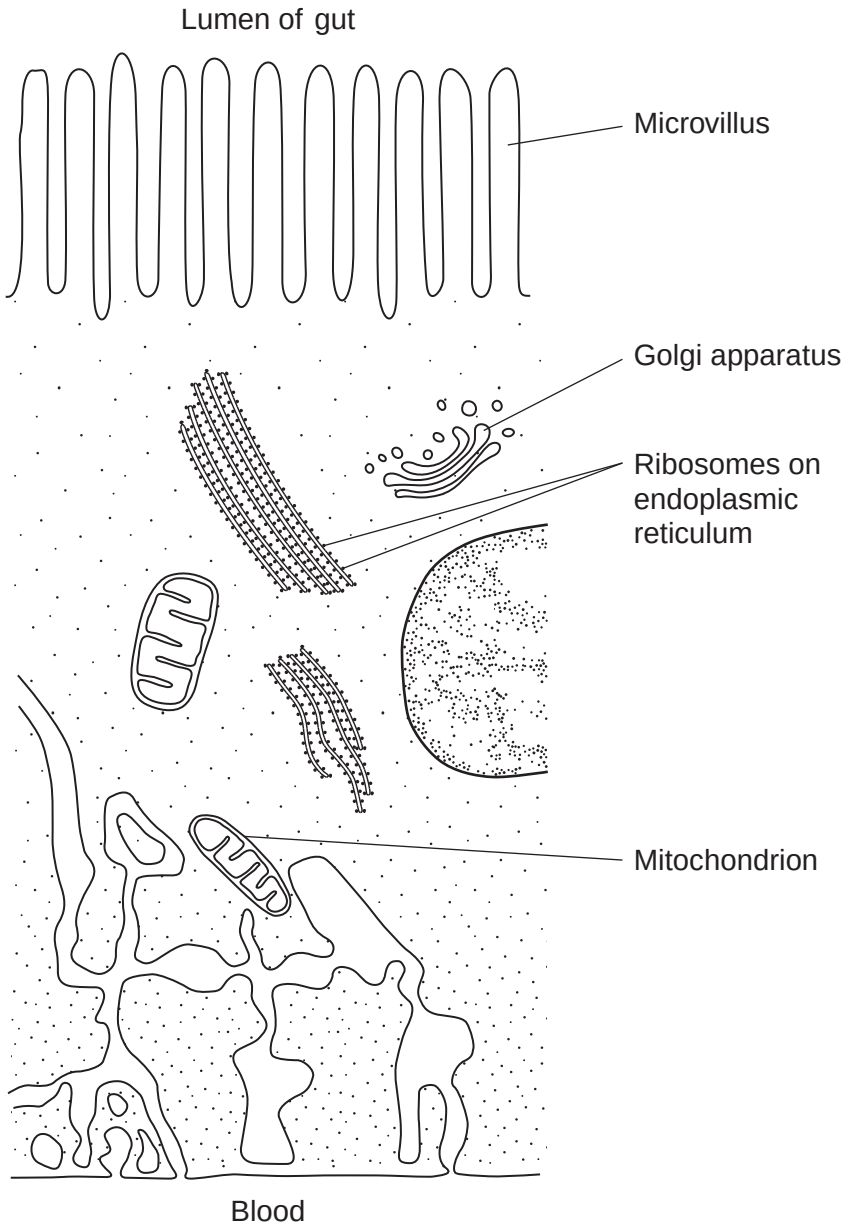
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3 (a) The table shows some features of cells. Complete the table by putting a tick in the box if the feature is present in the cell.

Feature	Cell		
	Cholera bacterium	Epithelial cell from intestine	Epithelial cell from alveolus of lung
Cell-surface membrane			
Flagellum			
Nucleus			

(3 marks)

3 (b) The diagram shows part of an epithelial cell from an insect's gut.



Do not write outside the box

This cell is adapted for the three functions listed below. Use the diagram to explain how this cell is adapted for each of these functions.

Use a **different** feature in the diagram for each of your answers.

3 (b) (i) the active transport of substances from the cell into the blood

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(2 marks)

3 (b) (ii) the synthesis of enzymes

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(2 marks)

3 (b) (iii) rapid diffusion of substances from the lumen of the gut into the cytoplasm

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(1 mark)

8

Do not write outside the box

4 (a) Scientists who investigate disease may look at risk factors. What is a risk factor?

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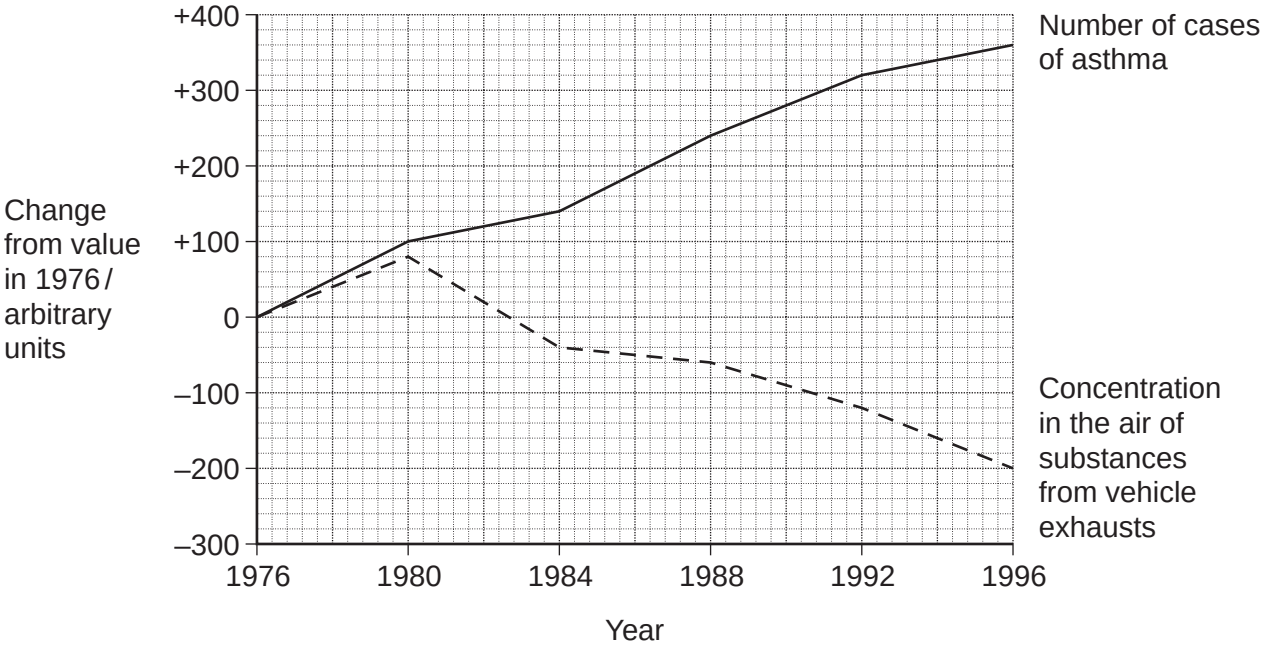
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(1 mark)

Scientists investigated the link between pollution from vehicle exhausts and the number of cases of asthma. Between 1976 and 1996, the scientists recorded changes in the following

- the concentration in the air of substances from vehicle exhausts
- the number of cases of asthma.

The graph shows their results



Do not write outside the box

4 (b) Between which years on the graph was there

4 (b) (i) a positive correlation between the number of cases of asthma and the concentration in the air of substances from vehicle exhausts

.....

(1 mark)

4 (b) (ii) a negative correlation between the number of cases of asthma and the concentration in the air of substances from vehicle exhausts?

.....

(1 mark)

4 (c) The scientists concluded that substances in the air from vehicle exhausts did **not** cause the increase in asthma between 1976 and 1980. Explain why.

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(3 marks)

(Extra space) .....

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6

Do not write outside the box

5 (a) (i) The human heart has four chambers.
In which **one** of the four chambers of the human heart does pressure reach the highest value?

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(1 mark)

5 (a) (ii) Explain how the structure of this chamber causes this high pressure.

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(1 mark)

Figure 1 shows the volume of blood in a man's right ventricle at different times during one cardiac cycle.

Figure 1

Time / s	Volume of blood / cm^3
0.0	125
0.1	148
0.2	103
0.3	70
0.4	56
0.5	55
0.6	98
0.7	125

Do not write outside the box

5 (b) (i) Use the data in the **Figure 1** to calculate the man's heart rate.

Heart rate = ... beats per minute

5 (b) (ii) Use the data in **Figure 1** and your answer to part **5 (b) (i)** to calculate the man's cardiac output. Show your working.

Cardiac output = ... cm^3 per minute

(3 marks)

5 (c) Use information from **Figure 1** to complete the table below to show whether the valves are **open** or **closed** at each of the times shown. Write open or closed in the appropriate boxes.

Time / s	Valve between right atrium and right ventricle	Valve between right ventricle and pulmonary artery
0.2		
0.6		

(2 marks)

7

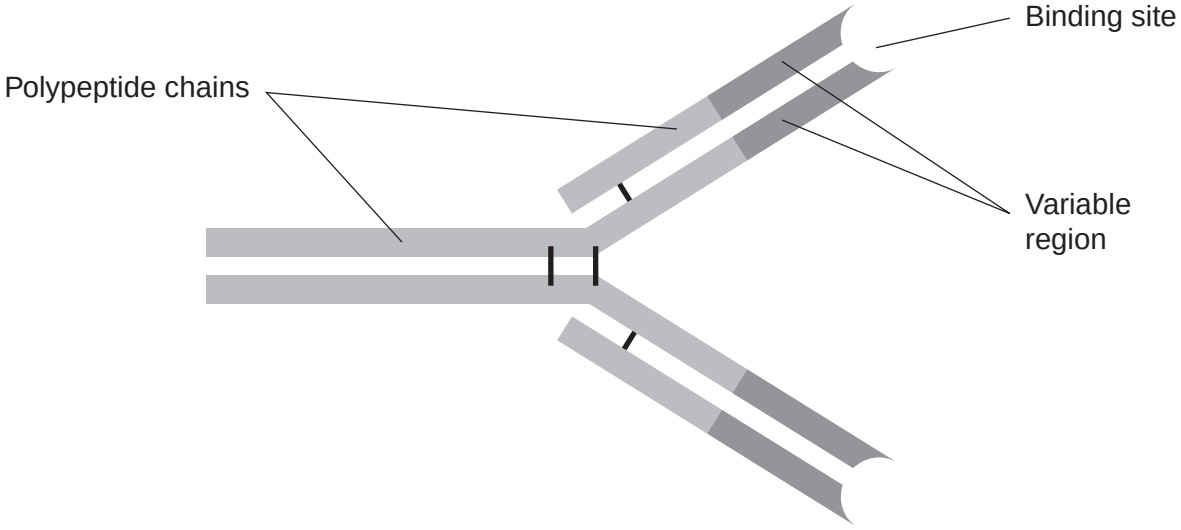
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ANSWER IN THE SPACES PROVIDED

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6 The diagram shows an antibody molecule.



6 (a) What is the evidence from the diagram that this antibody has a quaternary structure?

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(1 mark)

6 (b) Scientists use this antibody to detect an antigen on the bacterium that causes stomach ulcers. Explain why the antibody will only detect this antigen.

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(3 marks)

(Extra space) .....

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4

Do not write outside the box

7 Read the following passage.

Aspirin is a very useful drug. One of its uses is to reduce fever and inflammation. Aspirin does this by preventing cells from producing substances called prostaglandins. Prostaglandins are produced by an enzyme-controlled pathway. Aspirin works by inhibiting one of the enzymes in this pathway. Aspirin attaches permanently to a chemical group on one of the monomers that make up the active site of this enzyme.

The enzyme that is involved in the pathway leading to the production of prostaglandins is also involved in the pathway leading to the production of thromboxane. This is a substance that promotes blood clotting. A small daily dose of aspirin may reduce the risk of myocardial infarction (heart attack).

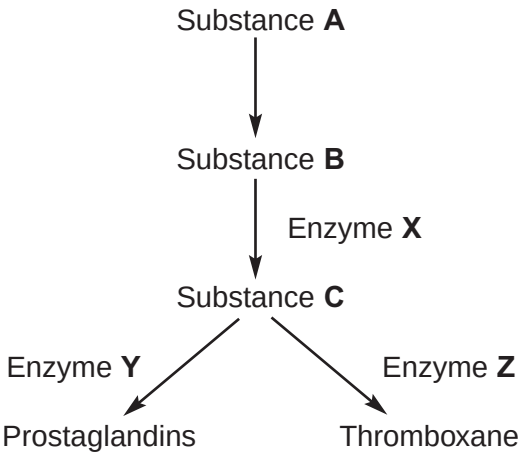
Use information from the passage and your own knowledge to answer the following questions.

7 (a) Name the monomers that make up the active site of the enzyme (lines 6 – 7).

.....

(1 mark)

7 (b) The diagram shows the pathways by which prostaglandins and thromboxane are formed.



7 (b) (i) Aspirin only affects one of the enzymes in this pathway. Use information in lines 5 – 7 to explain why aspirin does **not** affect the other enzymes.

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(2 marks)

Do not write outside the box

7 (b) (ii) Which enzyme, **X**, **Y** or **Z**, is inhibited by aspirin? Explain the evidence from the passage that supports your answer.

Enzyme .....

Explanation .....

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(2 marks)

7 (c) Aspirin is an enzyme inhibitor. Explain how aspirin prevents substrate molecules being converted to product molecules.

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(2 marks)

7 (d) Aspirin may reduce the risk of myocardial infarction (lines 8 – 12). Explain how.

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(3 marks)

(Extra space) .....

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10

Do not write outside the box

8 (a) Vaccines protect people against disease. Explain how.

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(5 marks)

(Extra space) .....

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Do not write outside the box

8 (b) Oral rehydration solutions (ORS) are used to treat diarrhoeal disease. What does an ORS consist of and how does it work?

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(5 marks)

(Extra space) .....

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10

END OF QUESTIONS

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Version 2



General Certificate of Education (A-level)
January 2012

Biology BIOL1

(Specification 2410)

Unit 1: Biology and Disease

Final

Mark Scheme

Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation events which all examiners participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the candidates' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for standardisation each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, examiners encounter unusual answers which have not been raised they are required to refer these to the Principal Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of candidates' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

Further copies of this Mark Scheme are available from: aqa.org.uk

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Although specific marks are not awarded, marks will take in to account the quality of written communication. Credit will only be awarded where candidates have presented information clearly and coherently and have used the specialist vocabulary indicated in the mark scheme for this unit. Specific references to quality of written communication appear in the comments column of this mark scheme.

Question	Marking Guidelines	Mark	Comments
1(a)	1. Crush/grind; 2. With ethanol/ alcohol; 3. Then add water/then add to water; 4. Forms emulsion / goes white/cloudy;	3	2 Water must be added <u>after</u> ethanol for third mark. 4 Do not accept carry out emulsion test.
1(b)(i)	4/four;	1	
1(b)(ii)	1. Phosphate/ PO_4; 2. Instead of one of the fatty acids / and two fatty acids;	2	"It" refers to phospholipid. 1 Accept minor errors in formula. Do not accept phosphorus/phosphorus group.
1(b)(iii)	1. Double bonds (present); 2. Some/two carbons with only one hydrogen / (double bonds) between carbon atoms / not saturated with hydrogen; 3. In (fatty acid) **C**/3;	2 max	Answer refers to unsaturated unless otherwise clearly indicated. 1 and 2. May be shown in appropriate diagram.

Question	Marking Guidelines	Mark	Comments
2(a)	1. (Diaphragm/diaphragm muscle) relaxes/relaxed; 2. Domed shape / (diaphragm) moves up; 3. Increases pressure; 4. Decreases volume;	3 max	Ignore references to inhalation, intercostal muscles or ribs if given as additional information.
2(b)	1. Extend/extrapolate curve/graph; 2. (Read off where) it flattens/ reaches maximum / peaks;	2	
2(c)	1. (Without inhaler) narrower bronchioles / bronchioles not dilated; 2. Muscle (surrounding bronchioles) contracted; 3. Less air able to pass through / more difficult for air to pass through;	2 max	Assume answer relates to Curve **A**, unless otherwise stated. Accept converse for **B.** 1 Do not allow contracted in this conext.

<table>
<tr><th>Question</th><th>Marking Guidelines</th><th>Mark</th><th>Comments</th></tr>
<tr><td>3(a)</td><td><table><tr><td>✓</td><td>✓</td><td>✓</td></tr><tr><td>✓</td><td></td><td></td></tr><tr><td></td><td>✓</td><td>✓</td></tr></table></td><td>3</td><td>Mark across, one mark for each correct row.
If crosses are used and no ticks, accept cross as equivalent to tick.
If crosses are used as well as ticks, mark tick only.</td></tr>
<tr><td>3(b)(i)</td><td>1. Mitochondria respire;
2. Release energy/ produce ATP;
3. Transport against gradient;
OR
4. Infolding of membrane;
5. Increases area;
6. More proteins for active transport;</td><td>2 max</td><td>2. Do not credit make energy
3. Do not credit active transport as this is given in question.
3. Do not accept diffusion against.
4. Reject microvilli but if mentioned can still accept points 5 and 6.</td></tr>
<tr><td>3(b)(ii)</td><td>1. Ribosomes make proteins/ enzymes;
2. Enzymes are proteins;
OR
3. Mitochrondria respire;
4. Release energy/produce ATP;
5. (Energy/ATP) for protein / enzyme synthesis;</td><td>2</td><td>Ignore references to Golgi or rough ER.</td></tr>
<tr><td>3(b)(iii)</td><td>Microvilli increase area / have large area;</td><td>1</td><td>Ignore references to other properties of microvilli.</td></tr>
</table>

Question	Marking Guidelines	Mark	Comments
4(a)	Something that increases chance / increases probability / makes it more likely;	1	
4(b)(i)	1976 –/to/and 1980;	1	
4(b)(ii)	1980 –/to/and 1996;	1	
4(c)	1. Correlation does not mean that there is a causal relationship; 2. May be some other factor/named factor; 3. Associated with vehicles and asthma / producing rise in both; 4. (After 1980) asthma continues to rise but exhaust concentration falls / negative correlation (after 1980);	3 max	1. Do not accept casual

Question	Marking Guidelines	Mark	Comments
5(a)(i)	Left ventricle;	1	
5(a)(ii)	Thick muscle/thick walls;	1	Accept more muscle/more muscular. Ignore stronger muscle.
5(b)(i)	85.7/86;	1	Accept 85 Ignore additional decimal places.
5(b)(ii)	Two marks for correct answer of 7905 – 7998;; One mark for incorrect answer in which candidate provides evidence of multiplying heart rate by stroke volume;	2	Accept either formula or illustration with figures from table.
5(c)	1. Closed open; 2. Open closed;	2	

Question	Marking Guidelines	Mark	Comments
6(a)	Has more than one/four polypeptide chains / made up of polypeptide chains;	1	
6(b)	1. Antibody/variable region has specific amino acid sequence/primary structure; 2. The shape/tertiary structure of the binding site; 3. Complementary to/fits/binds with these antigens; 4. Forms complex between antigen and antibody;	3 max	2 Do not accept active site for this point. 3 Accept active site for this point.

Question	Marking Guidelines	Mark	Comments
7(a)	Amino acid / amino acids ;	1	If anything else is given as well do not award mark.
7(b)(i)	1. Affects one monomer/amino acid; 2. Not found in all <u>active</u> <u>sites</u>;	2	i.e. What is affected i.e. Where it is found. 2. Must relate to active site. Enzyme is insufficient.
7(b)(ii)	1. **X**; 2. Enzyme in both pathways;	2	 2 Award independently
7(c)	1. Occupies/blocks/binds to active site; 2. Substrate will not fit / does not bind / no longer complementary to / enzyme-substrate complex not formed;	2	i.e. What it does in terms of the active site. 1. Ignore references to change in shape and shape of aspirin molecule. Ignore reference to competitive inhibitor i.e. Consequence required
7(d)	1. Prevents/reduces formation of thromboxane; 2. Blood clots do not form / less likely to form; 3. (Do not block) <u>coronary</u> arteries / vessels; 4. Heart muscle/wall gets oxygen;	3 max	1. Must prevent/reduce production. 2. Accept converse from this point onwards 4. Reference to heart must be qualified.

Question	Marking Guidelines	Mark	Comments
8(a)	1. Vaccines contain antigens / antigens are injected; 2. Dead pathogens / weakened pathogens; 3. Memory cells made; 4. On second exposure memory cells produce antibodies / become active / recognise pathogens; 5. Rapidly produce antibodies / produces more antibodies; 6. Antibodies destroy pathogens; 7. Herd effect / fewer people to pass on disease;	5 max	Ignore references to T or B cells. 2. Accept bacteria/viruses etc but not disease 4. Idea of memory cells responding. 5. Production of antibodies must be qualified for mark. Underlined ideas essential. 6. Accept bacteria/viruses etc but not disease
8(b)	1. Contains glucose/starch/ carbohydrate / sugar; 2. Sodium/salt; 3. Co-transport / symport; 4. Sodium and glucose taken up (from lumen); 5. Lowers water potential in cells/ increases water potential gradient; 6. Water taken up by osmosis;	5 max	1. Candidates may be aware of food based ORS. Accept appropriate carbohydrate sources such as rice/maize flour. 5. Accept Ψ 5 Do not accept converse argument. Water + correct direction + osmosis essential for this mark point.

Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

For Examiner's Use	
Examiner's Initials	
Question	Mark
1	
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8	
TOTAL	

General Certificate of Education
Advanced Subsidiary Examination
June 2012

Biology BIOL1

Unit 1 Biology and disease

Monday 14 May 2012 9.00 am to 10.15 am

For this paper you must have:
- a ruler with millimetre measurements.
- a calculator.

Time allowed
- 1 hour 15 minutes

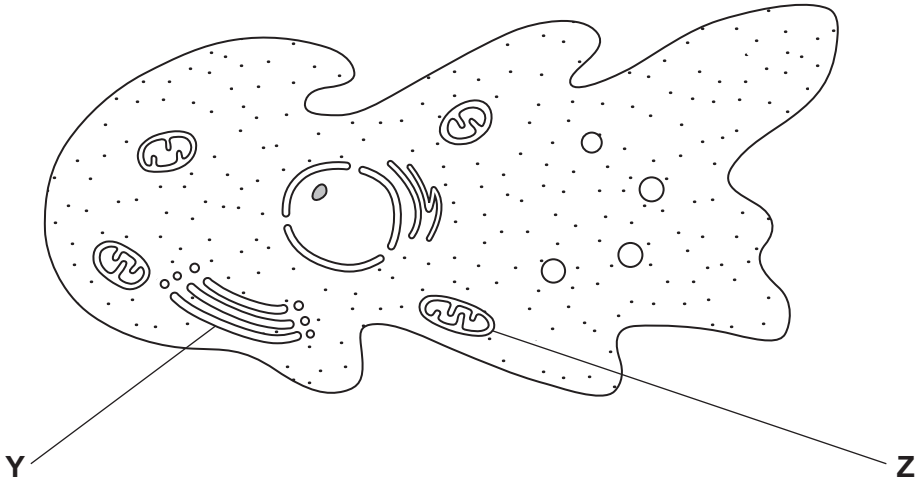
Instructions
- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided.
- Do not write outside the box around each page in margins or on blank pages.
- You may ask for extra paper. Extra paper must be secured to this booklet.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information
- The maximum mark for this paper is 60.
- You are expected to use a calculator, where appropriate.
- The marks for questions are shown in brackets.
- Quality of Written Communication will be assessed in all answers.
- You will be marked on your ability to:
  - use good English
  - organise information clearly
  - use scientific vocabulary accurately.

Do not write outside the box

Answer **all** questions in the spaces provided.

1 An amoeba is a single-celled, eukaryotic organism. Scientists used a transmission electron microscope to study an amoeba. The diagram shows its structure.



1 (a) (i) Name organelle **Y**.

.....

(1 mark)

1 (a) (ii) Name **two** other structures in the diagram which show that the amoeba is a eukaryotic cell.

1 .....

2 .....

(2 marks)

1 (b) What is the function of organelle **Z**?

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(1 mark)

Do not write outside the box

1 (c) The scientists used a transmission electron microscope to study the structure of the amoeba. Explain why.

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(2 marks)

6

Turn over for the next question

Do not write outside the box

2 Scientists compared the results of three investigations, **A**, **B** and **C**. These investigations were into the effect of drinking different amounts of alcohol on the risk of developing heart disease.

The graph shows the results of these investigations.



2 (a) Describe the relationship between increasing the number of alcoholic drinks per day and the risk of heart disease in investigation **A**.

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(2 marks)

Do not write outside the box

2 (b) All the volunteers who took part in investigation **C** were aged between 40 and 50 years old. Explain how choosing volunteers of a similar age improved this investigation.

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(1 mark)

2 (c) A newspaper headline used the information in the graph to claim 'Alcohol is good for you.' Evaluate this claim.

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(3 marks)

(Extra space) .....

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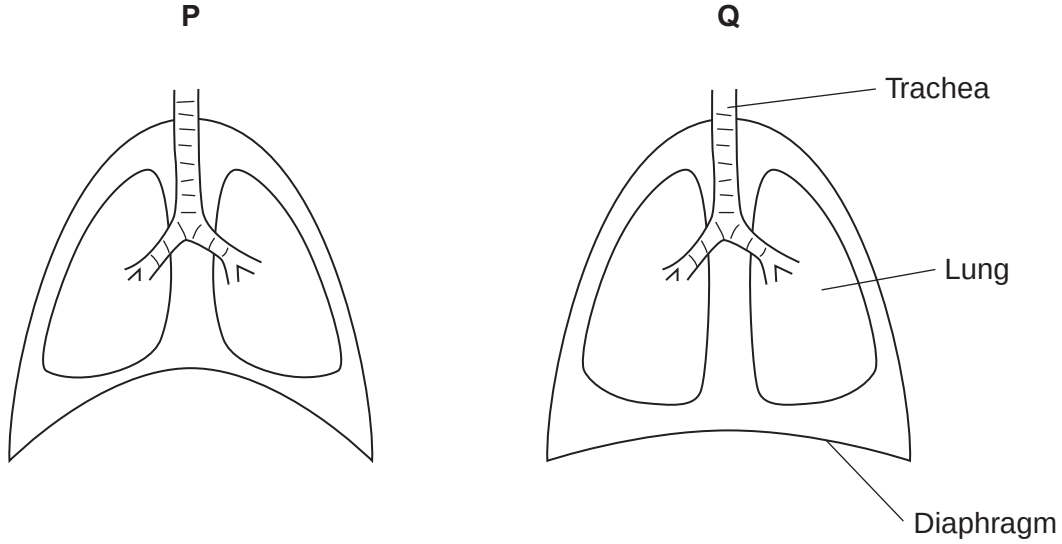
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6

Turn over for the next question

Do not write outside the box

3 The diagram shows the position of the diaphragm at times **P** and **Q**.



3 (a) Describe what happens to the diaphragm between times **P** and **Q** to bring about the change in its shape.

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(2 marks)

Do not write outside the box

3 (b) Air moves into the lungs between times **P** and **Q**. Explain how the diaphragm causes this.

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(3 marks)

(Extra space) .....

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3 (c) Describe how oxygen in air in the alveoli enters the blood in capillaries.

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(2 marks)

7

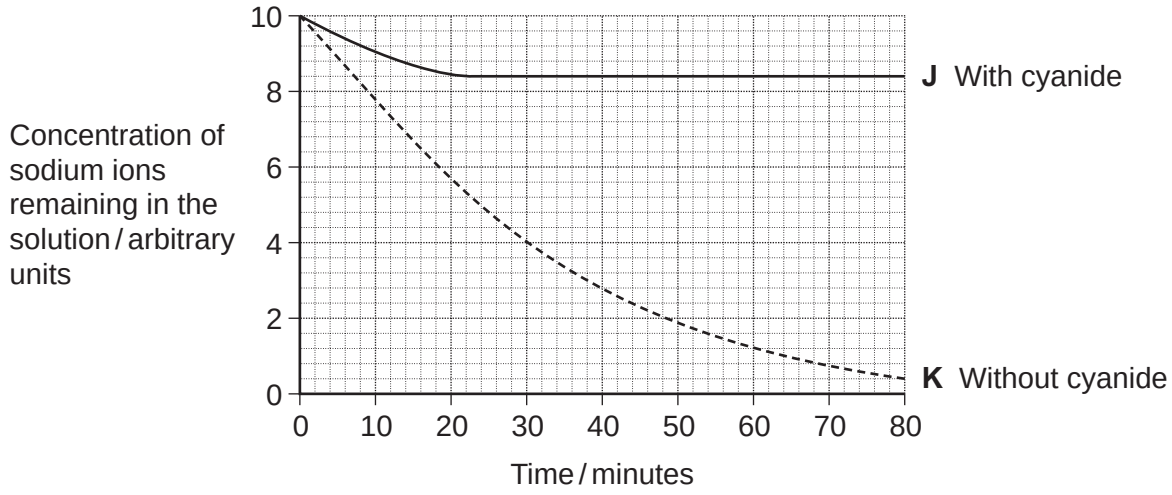
Turn over for the next question

Do not write outside the box

4 A scientist investigated the effect of cyanide on the uptake of sodium ions by animal tissue. He set up two beakers, **J** and **K**.
He put equal volumes of a solution containing sodium ions and equal masses of an animal tissue in each beaker.

- He added cyanide to beaker **J**.
- He did not add cyanide to beaker **K**.

He measured the concentration of sodium ions remaining in the solution in each beaker, for 80 minutes. The graph shows his results.



4 (a) Calculate the rate of uptake of sodium ions by the tissue in beaker **K** for the first 30 minutes. Show your working.

Answer …… arbitrary units per minute
(2 marks)

Do not write outside the box

4 (b) Adding cyanide affects the uptake of sodium ions by the tissue. Use the graph to describe how.

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(2 marks)

4 (c) Cyanide is a substance which affects respiration.
Use information in the question to explain the effect of cyanide on the uptake of sodium ions by the tissue.

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(3 marks)

(Extra space) .....

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7

Turn over for the next question

Do not write outside the box

5 (a) What is a pathogen?

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(1 mark)

5 (b) When a pathogen enters the body it may be destroyed by phagocytosis. Describe how.

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(4 marks)

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5 (c) When a pathogen causes an infection, plasma cells secrete antibodies which destroy this pathogen.

Explain why these antibodies are only effective against a specific pathogen.

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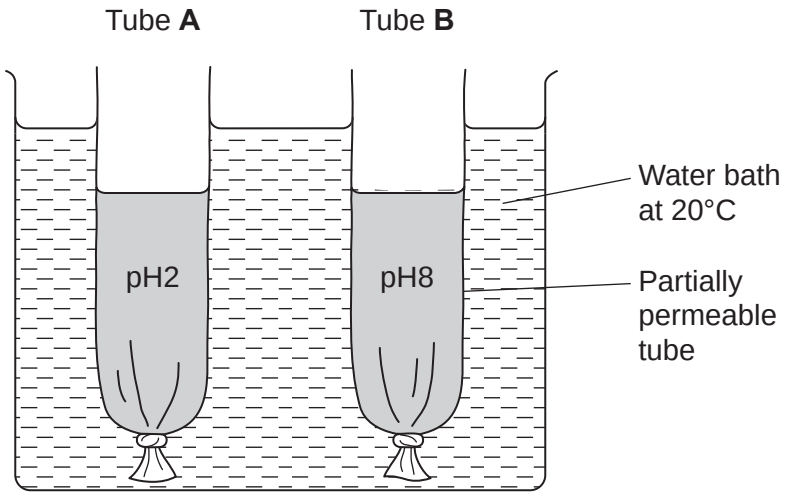
(2 marks)

7

Turn over for the next question

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6 A student investigated the effect of pH on the activity of the enzyme amylase. She set up the apparatus shown in the diagram.



The tubes were made from Visking tubing. Visking tubing is partially permeable. She added an equal volume of amylase solution and starch to each tube.

- She added a buffer solution at pH2 to tube **A**.
- She added an equal volume of buffer solution at pH8 to tube **B**.

After 30 minutes, she measured the height of the solutions in both tubes. She then tested the solutions in tubes **A** and **B** for the presence of reducing sugars.

6 (a) Describe how the student would show that reducing sugars were present in a solution.

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(3 marks)

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Do not write outside the box

6 (b) After 30 minutes, the solution in tube **B** was higher than the solution in tube **A**.

6 (b) (i) Explain why the solution in tube **B** was higher.

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(3 marks)

(Extra space) .....

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6 (b) (ii) The student concluded from her investigation that the optimum pH of amylase was pH8. Is this conclusion valid? Explain your answer

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(1 mark)

7

Turn over for the next question

Do not write outside the box

7 Read the following passage.

Gluten is a protein found in wheat. When gluten is digested in the small intestine, the products include peptides. Peptides are short chains of amino acids. These peptides cannot be absorbed by facilitated diffusion and leave the gut in faeces.

Some people have coeliac disease. The epithelial cells of people with coeliac disease do not absorb the products of digestion very well. In these people, some of the peptides from gluten can pass between the epithelial cells lining the small intestine and enter the intestine wall. Here, the peptides cause an immune response that leads to the destruction of microvilli on the epithelial cells.

Scientists have identified a drug which might help people with coeliac disease. It reduces the movement of peptides between epithelial cells. They have carried out trials of the drug with patients with coeliac disease.

Use the information in the passage and your own knowledge to answer the following questions.

7 (a) Name the type of chemical reaction which produces amino acids from proteins.

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(1 mark)

7 (b) The peptides released when gluten is digested cannot be absorbed by facilitated diffusion (lines 2 – 3). Suggest why.

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(3 marks)

(Extra space) .....

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Do not write outside the box

7 (c) The epithelial cells of people with coeliac disease do not absorb the products of digestion very well (lines 4 – 5). Explain why.

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(3 marks)

(Extra space) .....

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7 (d) Explain why the peptides cause an immune response (lines 7 – 8).

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(1 mark)

7 (e) Scientists have carried out trials of a drug to treat coeliac disease (lines 10 – 11). Suggest **two** factors that should be considered before the drug can be used on patients with the disease.

1 .....

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2 .....

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(2 marks)

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Turn over for the next question

Do not write outside the box

8 (a) The heart controls and coordinates the regular contraction of the atria and ventricles. Describe how.

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8 (b) The diet of a person can increase the risk of coronary heart disease. Explain how.

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END OF QUESTIONS

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General Certificate of Education (A-level)
June 2012

Biology BIOL1

(Specification 2410)

Unit 1: Biology and Disease

Final

Mark Scheme

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Question	Marking Guidelines	Mark	Comments
1(a)(i)	Golgi (apparatus/body);	1	
1(a)(ii)	1. Nucleus; 2. Mitochondrion; 3. Endoplasmic reticulum/ER; 4. Lysosome;	2 max	1. Accept: nucleolus/nuclear envelope/nuclear membranes 2. Accept cristae/mitochondrial membranes 3. Ignore reference to rough/ smooth 4. Reject lysozyme
1(b)	(Aerobic) respiration/ATP production/provide energy;	1	Accept Krebs cycle/ electron transport. Ignore 'produces energy' Reject anaerobic respiration Ignore what energy is used for
1(c)	1. High/ better resolution; 2. Shorter wavelength; 3. To see internal structures/ organelles/named organelles;	2 max	3. Accept ultrastructure

Question	Marking Guidelines	Mark	Comments
2(a)	1. (Risk) decreases, then increases; 2. (Risk) increases from 2 (drinks per day);	2	2. Accept increases risk above 3
2(b)	Age affects heart disease / age affects how alcohol affects the body;	1	Accept age affects results Accept 'removes confounding variable' Accept 'controlling a variable'
2(c)	1. (True because) studies show decreased risk up to 3 drinks per day; 2. (False because) eg all show an increased risk above 5 drinks / day, eg **A** and **B**, show increased risk (of heart disease) above 4 per day; 3. Data only about heart disease/alcohol causes other diseases/social problems; 4. Amount of alcohol per drink may vary; 5. May be due to other factor	1 2 max	To gain 3 marks candidates must have mp1 and 2 from mps 2-5 1. Accept any <u>evidence</u> from graph 2. Accept any <u>evidence</u> from graph

Question	Marking Guidelines	Mark	Comments
3(a)	1. Flatten/moves down; 2. (Diaphragm muscle) contracts;	2	1. Ignore: additional information about rib movements
3(b)	1. Diaphragm contracts/moves down/ flattens; 2. Increases volume (of thorax); 3. Decrease in pressure; 4. Air moves from high to lower pressure/down pressure gradient;	3 max	Ignore refs to rib movement 3. Accept pressure lower than atmospheric pressure 4. Reject: by diffusion
3(c)	1. Diffusion; 2. Across (alveoli)epithelium/ (capillary) endothelium;	2 max	Accept down diffusion gradient 2. Accept: capillary epithelium/squamous cell

Question	Marking Guidelines	Mark	Comments
4(a)	2 marks for correct answer 0.2;; 1 mark for 6/30;	2	Accept concentration ÷ time
4(b)	1. (Uptake) decreases/ slower, <u>then</u> no further uptake / uptake stops; 2. (Decreases) to 20 - 22/no uptake after 20/22 minutes;	2	2. Accept: (only) 1.6 (arbitrary units) absorbed / (only) drops to 8.4 Is for correct use of data from graph
4(c)	1. Stops/ reduces /inhibits respiration; 2. No/less energy released/ ATP produced; 3. (ATP/energy needed) for active transport;	3	1. Accept: inhibits respiratory enzymes 2. Ignore: less energy produced/ made 3. Accept ref to Na^+ pump/ description of active transport Ignore consequences of less Na^+ in cell

Question	Marking Guidelines	Mark	Comments
5(a)	(Micro)organism that causes disease / harm to body / an immune response;	1	Accept: named microorganism that causes disease Allow infection
5(b)	1. Phagocyte attracted by a substance/ recognises (foreign) antigen; 2. (Pathogen)engulfed/ ingested; 3. Enclosed in vacuole/ vesicle/ phagosome; 4. (Vacuole) fuses/joins with lysosome; 5. Lysosome contains enzymes; 6. Pathogen digested/ molecules hydrolysed;	4 max	1. accept named substance eg chemical / antigen 2. Accept: description 5. Accept named example of enzyme 6. Neutral: Destroyed
5(c)	1. Antigens (on pathogen) are a specific shape/ have specific tertiary / 3D structure; 2. Antibody fits/binds / is complementary to antigen/ antibody-antigen complex forms; ***OR*** 3. Antibodies are a specific shape / have specific tertiary/ 3D structure; 4. Antigens (on pathogen) fit/ bind/ are complementary to antibody / antibody-antigen complex forms;	2	1/3 Structure alone is insufficient Reject – active site

Question	Marking Guidelines	Mark	Comments
6(a)	1. Add Benedict's; 2. Heat; 3. Red/orange/yellow/green (shows reducing sugar present);	3	Hydrolyse with acid negates mp1 2. Accept warm, but not an unqualified reference to water bath 3. Accept brown
6(b)(i)	1. Starch hydrolysed / broken down / glucose/maltose produced; 2. Lower water potential; 3. Water enters by osmosis;	3	1. Neutral: Sugar produced
6(b)(ii)	Only 2 pHs studied/ more pHs need to be tested;	1	Accept: different amylase may have a different optimum pH

Question	Marking Guidelines	Mark	Comments
7(a)	Hydrolysis (reaction);	1	Accept phonetic spelling
7(b)	1. Too big/ wrong shape; 2. To fit/ bind/ pass through (membrane/ into cell/through carrier/ channel protein); 3. Carrier / channel protein;	3	1. Wrong charge – neutral Accept insoluble 3. Accept carrier/ channel protein not present
7(c)	1. Villi /microvilli damaged/ destroyed; 2. Reduced surface area ; 3. For (facilitated) diffusion/ active transport;	3	2. Accept fewer channel/ carrier proteins 3. Must be in correct context
7(d)	Foreign/(act as) antigen /non-self;	1	Reject foreign cells
7(e)	1. Dose to be given; 2. No (serious) side effects; 3. How effective; 4. Cost of drug;	2 max	Accept: interaction with other drugs

Question	Marking Guidelines	Mark	Comments
8(a)	1. SAN → AVN → bundle of His /Purkyne fibres; 2. Impulses / electrical activity (over atria); 3. Atria contract; 4. Non-conducting tissue (between atria and ventricles); 5. Delay (at AVN) ensures atria empty/ ventricles fill before ventricles contract; 6. Ventricles contract from apex upwards;	5 max	1. Mark for correct sequence
8(b)	1. Too much saturated fat/ cholesterol in diet; 2. Increase in LDL/ cholesterol in blood; 3. Atheroma/ fatty deposits/ plaques in artery walls; 4. Reduces diameter of / blocks <u>coronary</u> arteries; 5. Less oxygen/ glucose to heart muscle /tissue/ cells; 6. Increase in blood pressure; 7. (Increased risk of)clot / thrombosis / embolism/ aneurysm;	5 max	1. Accept: Too much salt / alcohol Marking points 6 and 7 can be awarded in the context of salt

Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

For Examiner's Use	
Examiner's Initials	
Question	Mark
1	
2	
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5	
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7	
TOTAL	

General Certificate of Education
Advanced Subsidiary Examination
January 2011

Biology BIOL1

Unit 1 Biology and disease

Tuesday 11 January 2011 9.00 am to 10.15 am

For this paper you must have:
- a ruler with millimetre measurements
- a calculator.

Time allowed
- 1 hour 15 minutes

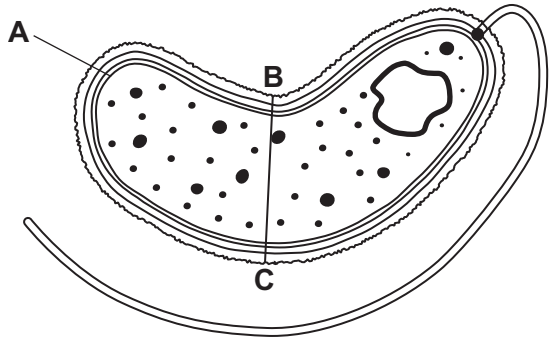
Instructions
- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- You may ask for extra paper. Extra paper must be secured to this booklet.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information
- The marks for questions are shown in brackets.
- The maximum mark for this paper is 60.
- You will be marked on your ability to:
  – use good English
  – organise information clearly
  – use scientific terminology accurately.

Do not write outside the box

Answer **all** questions in the spaces provided.

1 The diagram shows a cholera bacterium. It has been magnified 50 000 times.



1 (a) Name **A**.

.....

(1 mark)

1 (b) Name **two** structures present in an epithelial cell from the small intestine that are **not** present in a cholera bacterium.

1 .....

2 .....

(2 marks)

1 (c) Cholera bacteria can be viewed using a transmission electron microscope (TEM) or a scanning electron microscope (SEM).

1 (c) (i) Give **one** advantage of using a TEM rather than a SEM.

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(1 mark)

1 (c) (ii) Give **one** advantage of using a SEM rather than a TEM.

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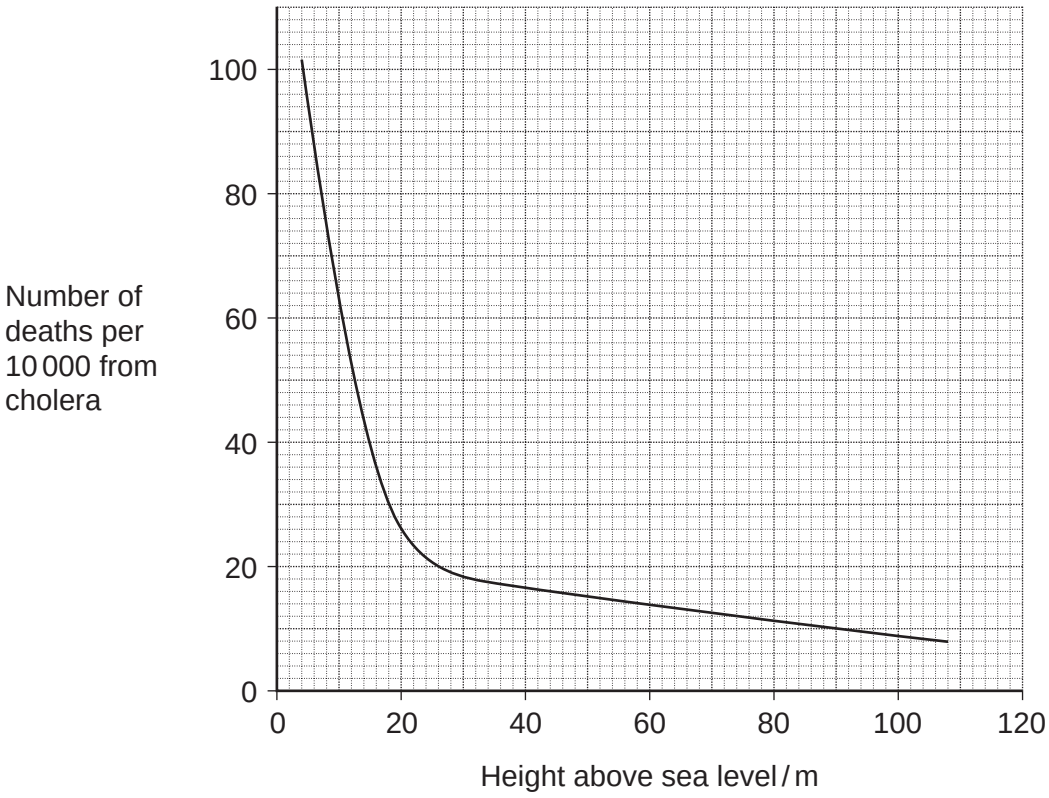
(1 mark)

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1 (d) Calculate the actual width of the cholera bacterium between points **B** and **C**. Give your answer in micrometres and show your working.

.....µm
(2 marks)

1 (e) An outbreak of cholera occurred in London in 1849. The graph shows the relationship between the number of deaths from cholera and the height at which people lived above sea level.



Describe the relationship between the number of deaths from cholera and the height at which people lived above sea level.

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(2 marks)

9

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2 (a) *Induced fit* and *lock and key* are two models used to explain the action of enzymes.

2 (a) (i) Describe the *induced fit* model of enzyme action.

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(2 marks)

2 (a) (ii) Describe **one** way that the *lock and key* model is different from the *induced fit* model.

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(1 mark)

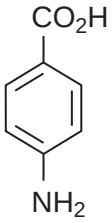
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2 (b) Folic acid is a substance required by bacteria for cell growth. Bacteria produce folic acid by the following reaction.

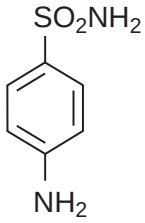
para-aminobenzoic acid (PABA) $\xrightarrow{\text{enzyme}}$ folic acid

The diagram shows the structure of a molecule of PABA. It also shows the structure of a molecule of a drug called sulfanilamide, which can be used to treat bacterial infections. Sulfanilamide prevents bacteria producing folic acid.

PABA



sulfanilamide



Use the diagram and your knowledge of enzymes to explain how sulfanilamide prevents bacteria producing folic acid.

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(3 marks)

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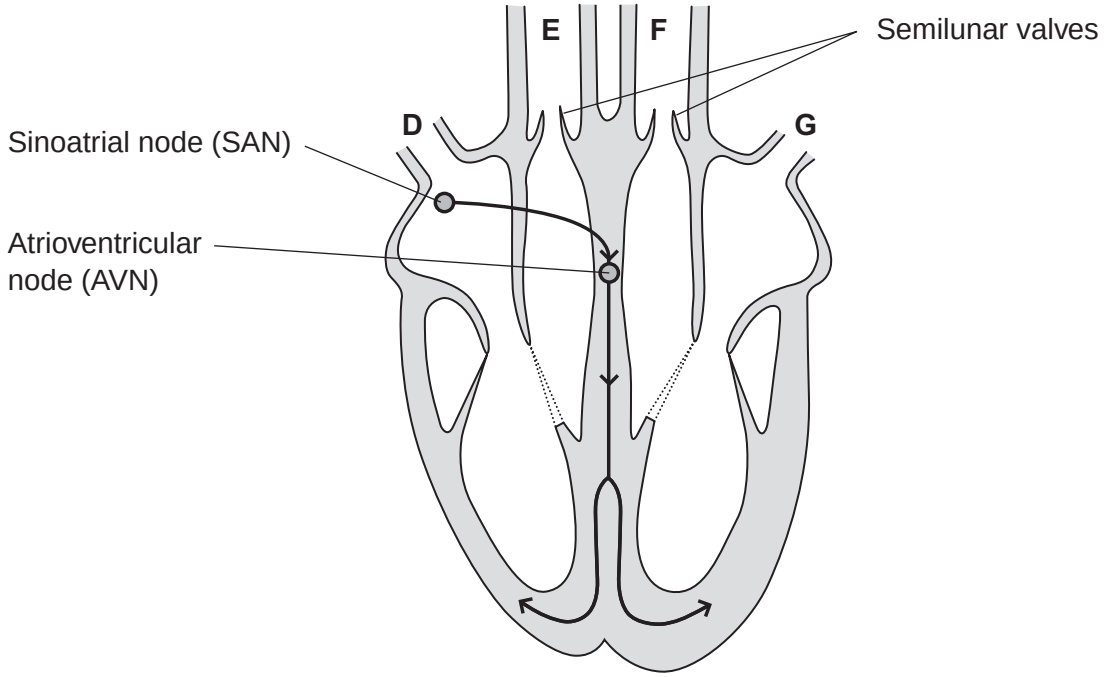
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3 The diagram shows a human heart as seen from the front. The main blood vessels are labelled **D** to **G**. The arrows show the pathways taken by the electrical activity involved in coordinating the heartbeat in the cardiac cycle.



3 (a) Which of the blood vessels, **D** to **G**

3 (a) (i) carries oxygenated blood to the heart

(1 mark)

3 (a) (ii) carries deoxygenated blood to the lungs?

(1 mark)

3 (b) Explain, in terms of pressure, why the semilunar valves open.

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(1 mark)

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3 (c) When a wave of electrical activity reaches the AVN, there is a short delay before a new wave leaves the AVN. Explain the importance of this short delay.

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(2 marks)

3 (d) The table shows the cardiac output and resting heart rate of an athlete before and after completing a training programme.

	Before training	**After training**
Cardiac output / cm^3	5000	5000
Resting heart rate / beats per minute	70	55

3 (d) (i) Calculate the athlete's stroke volume after training. Show your working.

.....cm^3

(2 marks)

3 (d) (ii) Use information from the table to explain how training has caused the resting heart rate of this athlete to be lower.

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(2 marks)

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4 (a) Omega-3 fatty acids are unsaturated. What is an *unsaturated* fatty acid?

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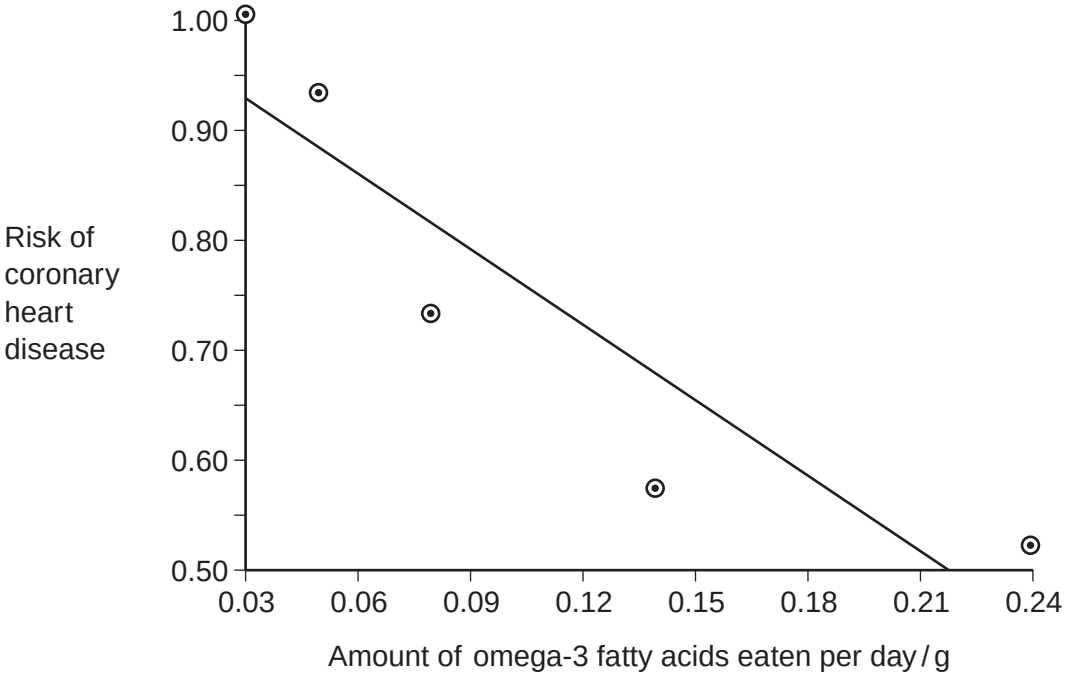
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(2 marks)

4 (b) Scientists investigated the relationship between the amount of omega-3 fatty acids eaten per day and the risk of coronary heart disease. The graph shows their results.



Do the data show that eating omega-3 fatty acids prevents coronary heart disease? Explain your answer.

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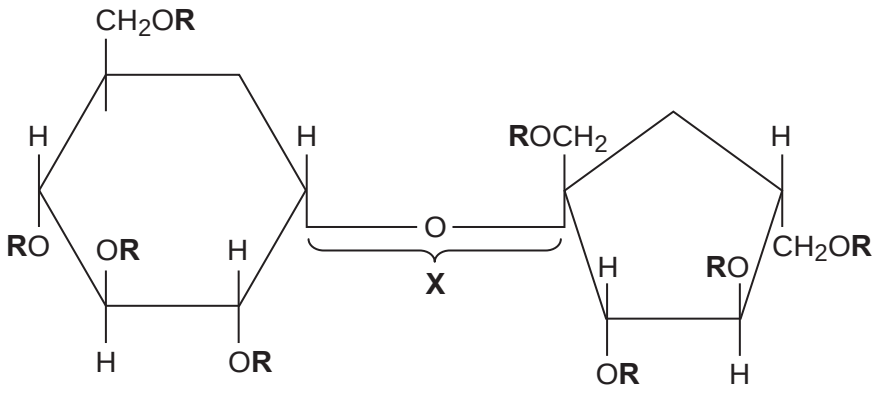
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(3 marks)

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4 (c) Olestra is an artificial lipid. It is made by attaching fatty acids, by condensation, to a sucrose molecule. The diagram shows the structure of olestra. The letter **R** shows where a fatty acid molecule has attached.



4 (c) (i) Name bond **X**.

.....

(1 mark)

4 (c) (ii) A triglyceride does **not** contain sucrose or bond **X**.
Give **one** other way in which the structure of a triglyceride is different to olestra.

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(1 mark)

4 (c) (iii) Starting with separate molecules of glucose, fructose and fatty acids, how many molecules of water would be produced when one molecule of olestra is formed?

(1 mark)

8

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5 A student investigated the effect of putting cylinders cut from a potato into sodium chloride solutions of different concentration. He cut cylinders from a potato and weighed each cylinder. He then placed each cylinder in a test tube. Each test tube contained a different concentration of sodium chloride solution. The tubes were left overnight. He then removed the cylinders from the solutions and reweighed them.

5 (a) Before reweighing, the student blotted dry the outside of each cylinder. Explain why.

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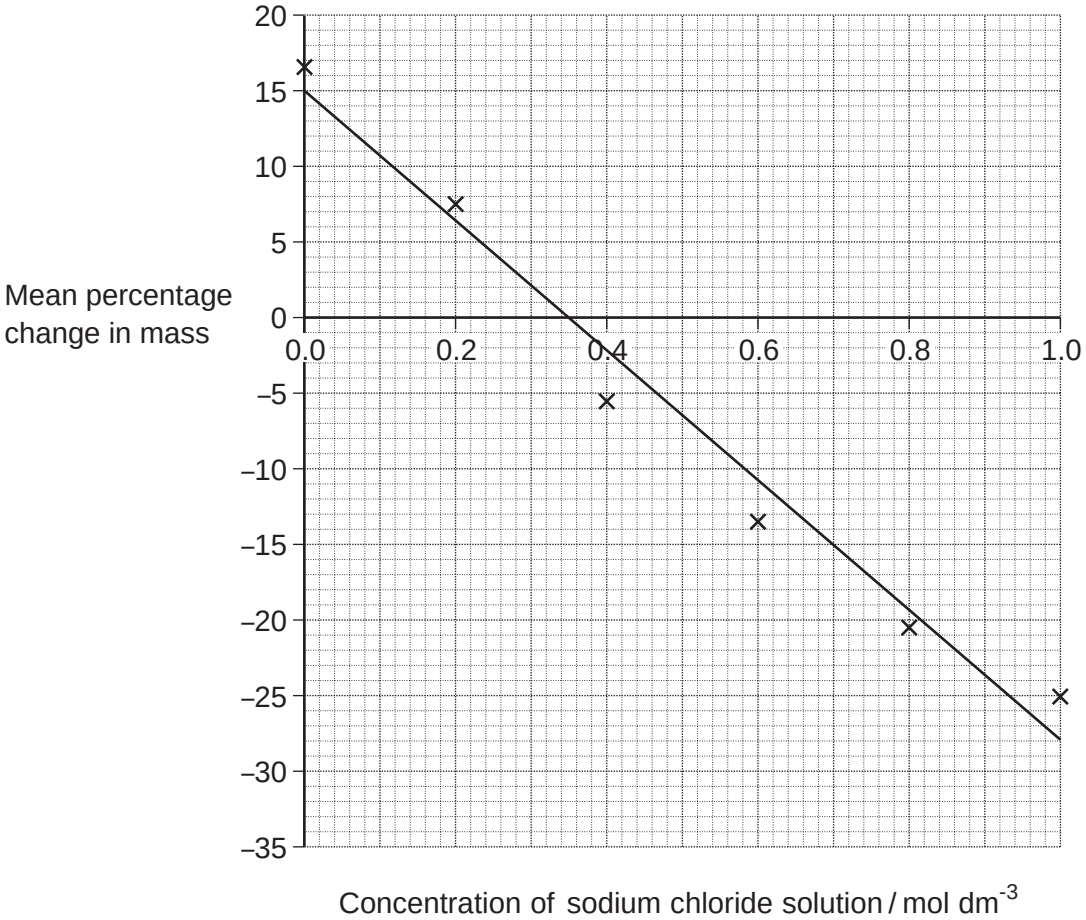
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(2 marks)

The student repeated the experiment several times at each concentration of sodium chloride solution. His results are shown in the graph.



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5 (b) The student made up all the sodium chloride solutions using a 1.0 mol dm^{-3} sodium chloride solution and distilled water.

Complete the table to show how he made 20 cm^3 of a 0.2 mol dm^{-3} sodium chloride solution.

Volume of 1.0 mol dm^{-3} sodium chloride solution	Volume of distilled water

(1 mark)

5 (c) The student calculated the *percentage* change in mass rather than the change in mass. Explain the advantage of this.

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(2 marks)

5 (d) The student carried out several repeats at each concentration of sodium chloride solution. Explain why the repeats were important.

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(2 marks)

5 (e) Use the graph to find the concentration of sodium chloride solution that has the same water potential as the potato cylinders.

.....mol dm^{-3}

(1 mark)

8

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6 Read the passage below.

Most cases of cervical cancer are caused by infection with Human Papilloma Virus (HPV). This virus can be spread by sexual contact. There are many types of HPV, each identified by a number. Most of these types are harmless but types 16 and 18 are most likely to cause cervical cancer.

A vaccine made from HPV types 16 and 18 is offered to girls aged 12 to 13. Three injections of the vaccine are given over six months. In clinical trials, the vaccine has proved very effective in protecting against HPV types 16 and 18. However, it will be many years before it can be shown that this vaccination programme has reduced cases of cervical cancer. Until then, smear tests will continue to be offered to women, even if they have been vaccinated. A smear test allows abnormal cells in the cervix to be identified so that they can be removed before cervical cancer develops.

The Department of Health has estimated that 80% of girls aged 12 to 13 need to be vaccinated to achieve herd immunity to HPV types 16 and 18. Herd immunity is where enough people have been vaccinated to reduce significantly the spread of HPV through the population.

Use information from this passage and your own knowledge to answer the following questions.

6 (a) HPV vaccine is offered to girls aged 12 to 13 (line 5). Suggest why it is offered to this age group.

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(1 mark)

6 (b) The vaccine is made from HPV types 16 and 18 (line 5). Explain why this vaccine may **not** protect against other types of this virus.

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(2 marks)

Do not write outside the box

6 (c) Three injections of the vaccine are given (lines 5 to 6). Use your knowledge of immunity to suggest why.

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(2 marks)

6 (d) It will be many years before it can be shown that this vaccination programme has reduced cases of cervical cancer (lines 7 to 9). Suggest **two** reasons why.

1 .....

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(2 marks)

6 (e) Smear tests will continue to be offered to women, even if they have been vaccinated (lines 9 to 10). Suggest why women who have been vaccinated still need to be offered smear tests.

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(1 mark)

6 (f) Suggest **one** reason why vaccinating a large number of people would reduce significantly the spread of HPV through the population (lines 14 to 16).

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(2 marks)

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7 (a) Pulmonary tuberculosis is a disease of the lungs.
Describe the transmission and course of infection of pulmonary tuberculosis.

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(5 marks)

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7 (b) Emphysema is another disease of the lungs. People with emphysema may feel weak and tired. Explain why.

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(5 marks)

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END OF QUESTIONS

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Version 1



General Certificate of Education (A-level)
January 2011

Biology BIOL1

(Specification 2410)

Unit 1: Biology and Disease

Final

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Registered address: AQA, Devas Street, Manchester M15 6EX.

Question	Marking Guidance	Mark	Comments
1(a)	(Plasma / cell) membrane;	1	Reject: nuclear membrane
1(b)	Nucleus / nuclear envelope / nuclear membrane / nucleolus; Mitochondrion; (Smooth / rough) ER; Lysosome; Microvillus / brush border; Golgi; Linear / non-circular DNA / chromosome; 80S / denser / heavier / larger ribosomes;	2 max	Accept: membrane-bound organelles only if an example has not been given Neutral: villi Neutral: DNA strands Neutral: ribosomes
1(c)(i)	Higher resolution / higher (maximum) magnification / higher detail (of image); ***OR*** Allows internal details / structures within (cells) to be seen / cross section to be taken;	1	Accept: 'better' instead of 'higher' Neutral: shorter wavelength Reject: longer wavelength Reject: can be used on living specimens **Q** Do not accept 'clearer' image
1(c)(ii)	Thin sections do not need to be prepared / shows surface of specimen / can have 3-D images;	1	Accept: can be used on thick(er) specimens Reject: can be used on living specimens Neutral: refs. to staining / preparation / artefacts / colour

1(d)	Two marks for correct answer of 0.42 – 0.46;; One mark for incorrect answers in which candidate clearly divides measured width by magnification;	2	Correct answer = 2 marks outright Accept: 0.4 or 0.5 only if working is correct for 2 marks Do not award a mark for 0.4 or 0.5 if there is no working out Ignore rounding up
1(e)	As height increases, the number of deaths decrease / inversely proportional / negative correlation; Correct reference to increase / decrease at 14-30m;	2	Accept: converse statement Must give a trend and not simply give individual points Do not penalise for 'more likely to get cholera'

Question	Marking Guidance	Mark	Comments
2(a)(i)	Active site / enzyme not <u>complementary</u>; Active site changes (shape) / is flexible; (Change in enzyme allows) substrate to fit / E-S complex to form;	2 max	Active site becomes complementary / wraps around substrate = 2 marks For mark point 2. allow 'binding site' but not 'enzyme' For mark point 2. can only have enzyme changes (shape) if active site has been mentioned earlier Final mark point must have context Reject: active site on substrate for second marking point only Accept: diagrams only if suitably labelled or annotated
2(a)(ii)	<u>Active site</u> does not change (shape) / is fixed (shape) / is rigid / does not wrap around substrate / (already) fits the substrate / is complementary (before binding);	1	Assume that 'it' refers to lock and key

2(b)	Similar structure / shape (to PABA) / both complementary; Competes for / binds to active site / competitive inhibitor; Less PABA binds / less E-S complexes; ***OR*** Specific reference to different structure / shape (to PABA) using the diagram; Binds to position other than active site / binds to allosteric site / binds to inhibitor site / non-competitive inhibitor; Changes the active site so substrate cannot bind / less PABA binds / less E-S complexes;	3 max	**Q** Reject: same structure / shape Note: competitive inhibitor binds to active site = 1 mark (same mark point) Assume that 'it' refers to sulfanilamide Accept: PABA / substrate cannot bind Neutral: less product produced as in question stem Neutral: different structure / shape to PABA Reject: active site on substrate for second marking point only

Question	Marking Guidance	Mark	Comments
3(a)(i)	**G**;	1	Neutral: name of blood vessel
3(a)(ii)	**E**;	1	Neutral: name of blood vessel
3(b)	Pressure is greater below valve / in ventricle than (artery);	1	Must be comparative Reject: pressure is greater in ventricle than atrium Neutral: pressure in ventricle increases Accept: **E** / **F** / named artery Accept: converse argument
3(c)	Allow atria to empty / contract / ventricles to fill; Before ventricles contract; ***OR*** Delays contraction of ventricles; Until after atria have contracted / ventricles have filled;	2	Neutral: 'to pump blood'
3(d)(i)	Two marks for correct answer of 91 / 90.9;; One mark for incorrect answers which clearly show understanding of the relationship between SV = CO/HR;	2	Correct answer = 2 marks outright 5000 divided by 70, 55 or 15 = 1 mark for principle

3(d)(ii)	Increase in size or volume of heart / ventricles / increased heart muscle / increased strength of contraction / hypertrophy; Cardiac output is the same (before and after training); Increase in stroke volume / more blood leaves heart in each beat;	2 max	Accept: increased strength of heart muscle Neutral: heart muscle contracts more **Q** Do not allow 'heart is stronger' Neutral*:* more blood leaves the heart If the term 'stroke volume' is not used, it must be defined

Question	Marking Guidance	Mark	Comments
4(a)	Double bond(s); (Bonds) between carbon;	2	C=C bond(s) = 2 marks 'No' C=C bond(s) disqualifies 1 mark only Accept: does not contain maximum number of H for 1 mark Neutral: contains C=O bonds
4(b)	Graph shows negative correlation / description given; Correlation does not mean causation / prevention / shows lower risk not prevention; May be due to another factor / example given;	3	Neutral: refs. to methodology e.g. sample size / line of best fit **Q**: Do not allow 'casual' relationship
4(c)(i)	Glycosidic;	1	Accept: if phonetically correct Reject: ester bond
4(c)(ii)	Contains glycerol / three fatty acids / forms three ester bonds;	1	Neutral: contains less fatty acids Answers must refer to a triglyceride Ignore refs. to incorrect bond names Neutral: olestra has eight fatty acids / R groups Reject: contains three glycerols
4(c)(iii)	9;	1	

Question	Marking Guidance	Mark	Comments
5(a)	Water will affect the mass / only want to measure water taken up or lost; Amount of water on cylinders varies / ensures same amount of water on outside;	2	Neutral: removes water Accept: '(sodium chloride) solution' for water Do not accept 'sodium chloride' Neutral: refs. to fair testing
5(b)	$4cm^3$ (of 1.0 mol dm^{-3} sodium chloride solution) and $16cm^3$ (of distilled water);	1	Reject: factors and multiples of these figures e.g. $2cm^3$ and $8cm^3$, as final volume should be $20cm^3$
5(c)	Allows comparison / shows proportional change; Idea that cylinders have different starting masses / weights;	2	Reject: if comparison is in context of the start and final mass of the same cylinder Neutral: different masses Neutral: different starting sizes
5(d)	(Allows) anomalies to be identified / ignored / effect of anomalies to be reduced / effect of variation in data to be minimised; Makes the average / mean / line of best fit more reliable / allows concordant results;	2	Accept: 'outliers' instead of anomalies **Q** Reject: abnormalities Reject: idea of not recording anomalies / preventing anomalies from occurring Accept: 'cancels out anomalies' as bottom line response **Q** Reject: makes the average / mean more accurate Neutral: makes the average / mean more valid Neutral: makes 'it' / results / conclusion more reliable

5(e)	0.35 (mol dm^{-3})	1	

Question	Marking Guidance	Mark	Comments
6(a)	Girls are not sexually active / not likely to carry HPV / vaccine may not work if already infected / few girls sexually active (at this age);	1	Neutral: girls are not sexually mature Neutral: to provide better protection Accept: provides immunity before sexually active Neutral: girls are less likely to have '**it**' as could mean the vaccine from the question stem
6(b)	Other (HPV) types have different antigens; No memory cells for other types / memory cells not activated; Antibodies cannot attach to antigen / correct antibodies not produced / antibodies are not complementary;	2 max	Accept: refs. to antigenic variability Accept: B cells for memory cells Accept: memory cells cannot recognise antigen for 'not activated' Accept: examples of memory cell activation
6(c)	More antigen; More memory cells; So more antibodies produced / antibodies produced quicker (if infected);	2 max	Accept: 'many' / 'enough' instead of 'more' Neutral: primary / secondary response Accept: T cells / B cells / plasma cells instead of 'antibodies' Reject: the idea that vaccines contain antibodies **Q** Reject: antibodies 'fight' / 'antibiotics'

6(d)	Cancer takes years to develop / develops later in life; Takes time for females to become sexually active / females must become sexually active to obtain data; Few people / only teenagers vaccinated;	2 max	Neutral: will take time to vaccinate 80% of young girls Accept: do not develop cancer instantly
6(e)	(Cervical cancer) can be caused by other types of HPV / other factors / example given; ***OR*** (Some) women may have been infected (with HPV) before receiving the vaccine; ***OR*** (As a precaution) in case vaccine does not work / a way of monitoring if the vaccine has worked ;	1	Accept: 'caused by other types of HPV' in the context of mutation Neutral: to check for abnormal cells / that they are immune to the virus
6(f)	Virus cannot replicate / is destroyed / is not carried (in vaccinated people); Non-vaccinated people more likely to contact vaccinated people;	2	Neutral: 'do not spread virus' as in question stem Must be in context of the individual and not the population as in question stem **Q** Do not allow 'disease is destroyed' Neutral: 'herd effect' as given in the question stem

Question	Marking Guidance	Mark	Comments
7(a)	1 (Bacteria transmitted in) droplets / aerosol; 2 (Bacteria) engulfed / ingested by phagocytes / macrophages; 3 (Bacteria) encased in named structure e.g. wall / tubercle / granuloma / nodule; 4 (Bacteria) are dormant / not active / not replicating; 5 If immunosuppressed, bacteria activate / replicate / released; 6 Bacteria destroy alveoli / capillary / epithelial cells; 7 (Leads to) fibrosis / scar tissue / cavities /calcification; 8 (Damage) leads to less diffusion /less <u>surface area</u> / increases diffusion distance; 9 (Activation / damage allows bacteria) to enter blood / spreads (to other organs);	5 max	1 Accept: TB / 'it' / the disease / air droplets 1 Neutral: spread through the air / coughs / sneezes 1 Reject: virus 2 Neutral: 'destroyed by'; 2 Accept: white blood cells 3 Neutral: bacteria contained 5 Accept: reference to HIV / old age / stress 7 Accept: fibrous tissue 8 Neutral: reduced gas exchange 8 Accept: reduced SA:VOL

7(b)	1	Alveoli break down / collapse / rupture / <u>walls</u> thicken;	5 max	1	Neutral: alveoli damaged
	2	Less <u>surface area</u> / increases diffusion distance / less diffusion;		2	Accept: references to a lack of alpha-1-antitrypsin
	3	Loss of elastin / elastic tissue / elastase involved;		3	This mark is for a structure. Accept: elastin permanently stretched
	4	(Alveoli / lungs) cannot recoil / spring back / have reduced elasticity / more difficult to expel air;		4	This mark is for a mechanism. Do **not** award reduced elasticity for 3.
	5	Reduced diffusion gradient / air not replenished / less air leaves lungs;		4	Neutral: more difficult to inhale air
	6	Less oxygen enters blood / tissues;		5	This mark is for a consequence
	7	Less respiration / less energy released / less ATP produced;			Accept: reduced concentration gradient;
					Neutral: less air enters lungs
				7	**Q** Reject: 'less energy produced' / <u>anaerobic</u> respiration
				7	Accept: 'less energy produced in the form of ATP' / less oxygen for respiration

Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

For Examiner's Use	
Examiner's Initials	
Question	Mark
1	
2	
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4	
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6	
7	
TOTAL	

General Certificate of Education
Advanced Subsidiary Examination
January 2010

Biology BIOL1

Unit 1 Biology and disease

Tuesday 12 January 2010 9.00 am to 10.15 am

For this paper you must have:
- a ruler with millimetre measurements.
- a calculator.

Time allowed
- 1 hour 15 minutes

Instructions
- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. **Answers written in margins or on blank pages will not be marked.**
- You may ask for extra paper. Extra paper must be secured to this booklet.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information
- The maximum mark for this paper is 60.
- The marks for questions are shown in brackets.
- You are reminded of the need for good English and clear presentation in your answers.
- Use accurate scientific terminology in all answers.
- Quality of Written Communication will be assessed in all answers.

There are no questions printed on this page

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

Areas outside the box will not be scanned for marking

Answer **all** questions in the spaces provided.

1 (a) Some people cannot digest lactose when they are adult. They could digest lactose when they were children.

Use your knowledge of water potential to explain why these adults get diarrhoea when they drink milk.

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(2 marks)

1 (b) (i) The equation shows the reaction catalysed by the enzyme lactase. Complete this equation.

Lactose + ... ⟶ Glucose + ...

(2 marks)

1 (b) (ii) Name the type of chemical reaction shown in this equation.

.....

(1 mark)

1 (c) Lactase is an enzyme. Lactose is a reducing sugar.

1 (c) (i) Describe how you could use the biuret test to distinguish a solution of the enzyme, lactase from a solution of lactose.

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(1 mark)

1 (c) (ii) Explain the result you would expect with the enzyme.

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(1 mark)

7

Areas outside the box will not be scanned for marking

2 Miner's lung is a disease caused by breathing in dust in coal mines. The dust causes the alveolar epithelium to become thicker. People with miner's lung have a lower concentration of oxygen in their blood than healthy people.

2 (a) (i) Describe the path by which oxygen goes from an alveolus to the blood.

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(2 marks)

2 (a) (ii) Explain why people with miner's lung have a lower concentration of oxygen in their blood.

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(1 mark)

2 (b) In healthy lungs, a gradient is maintained between the concentration of oxygen in the alveoli and the concentration of oxygen in the lung capillaries.

2 (b) (i) Describe how ventilation helps to maintain this difference in oxygen concentration.

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(2 marks)

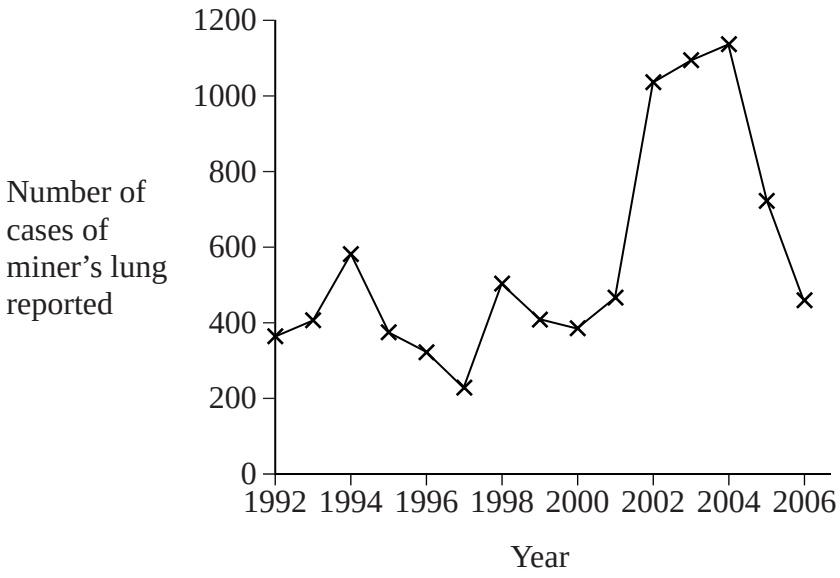
2 (b) (ii) Give **one** other way that helps to maintain the difference in oxygen concentration.

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(1 mark)

Areas outside the box will not be scanned for marking

2 (c) Scientists investigated the number of cases of miner's lung reported in Britain between 1992 and 2006.



Coal mining in Britain had been dramatically reduced by 1990.

Some scientists concluded that the rise in reported cases of miner's lung after 1992 shows that the disease takes a long time to develop.

Evaluate this conclusion.

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(2 marks)

(Extra space).....

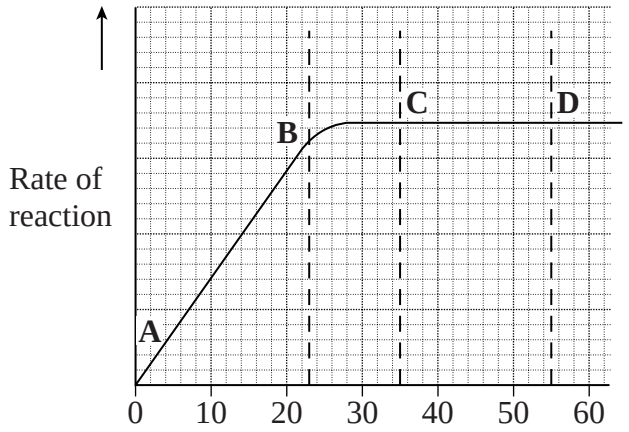
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Turn over ▶

Areas outside the box will not be scanned for marking

3 The graph shows the effect of substrate concentration on the rate of an enzyme-controlled reaction.



3 (a) (i) Describe what the graph shows about the effect of substrate concentration on the rate of this enzyme-controlled reaction.

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(2 marks)

(Extra space) .....

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3 (a) (ii) What limits the rate of this reaction between points **A** and **B**? Give the evidence from the graph for this.

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(2 marks)

(Extra space) .....

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Areas outside the box will not be scanned for marking

3 (a) (iii) Suggest a reason for the shape of the curve between points **C** and **D**.

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(1 mark)

3 (b) Sketch a curve on the graph to show the rate of this reaction in the presence of a competitive inhibitor.

(1 mark)

3 (c) Methotrexate is a drug used in the treatment of cancer. It is a competitive inhibitor and affects the enzyme folate reductase.

3 (c) (i) Explain how the drug lowers the rate of reaction controlled by folate reductase.

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(2 marks)

(Extra space) .....

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3 (c) (ii) Methotrexate only affects the rate of the reaction controlled by folate reductase. Explain why this drug does not affect other enzymes.

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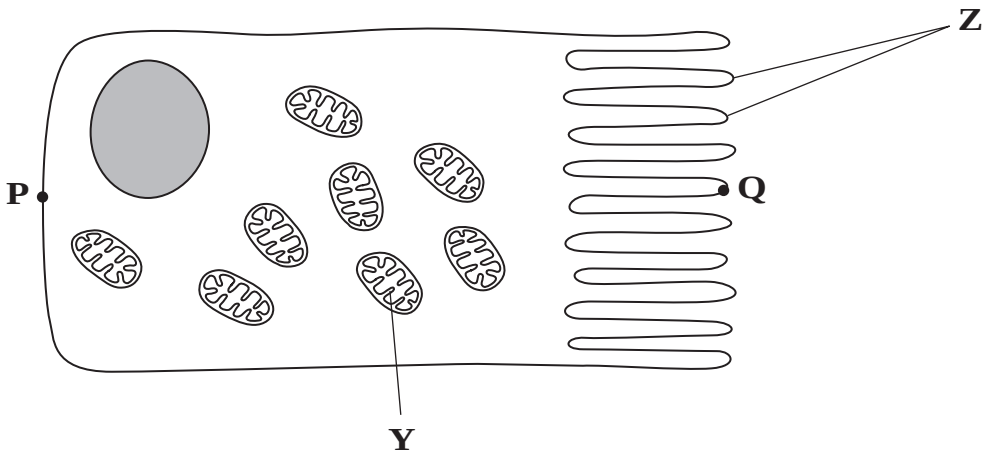
(1 mark)

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Turn over for the next question

Areas outside the box will not be scanned for marking

4 The diagram shows an epithelial cell from the small intestine.



4 (a) (i) Name organelle **Y**.

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(1 mark)

4 (a) (ii) There are large numbers of organelle **Y** in this cell. Explain how these organelles help the cell to absorb the products of digestion.

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(2 marks)

(Extra space) .....

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Areas outside the box will not be scanned for marking

4 (b) This diagram shows the cell magnified 1000 times. Calculate the actual length of the cell between points **P** and **Q**. Give your answer in µm. Show your working.

Answer ..... µm
(2 marks)

4 (c) Coeliac disease is a disease of the human digestive system. In coeliac disease, the structures labelled **Z** are damaged.

Although people with coeliac disease can digest proteins they have low concentrations of amino acids in their blood.

Explain why they have low concentrations of amino acids in their blood.

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(2 marks)

(Extra space).....

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Turn over for the next question

Areas outside the box will not be scanned for marking

5 Students investigated the effect of different concentrations of sodium chloride solution on discs cut from an apple. They weighed each disc and then put one disc into each of a range of sodium chloride solutions of different concentrations. They left the discs in the solutions for 24 hours and then weighed them again. Their results are shown in the table.

Concentration of sodium chloride solution / mol dm^{-3}	**Mass of disc at start / g**	**Mass of disc at end / g**	**Ratio of mass at start to mass at end**
0.00	16.1	17.2	0.94
0.15	19.1	20.2	0.95
0.30	24.3	23.2	1.05
0.45	20.2	18.7	1.08
0.60	23.7	21.9	
0.75	14.9	13.7	1.09

5 (a) (i) Calculate the ratio of the mass at the start to the mass at the end for the disc placed in the 0.60 mol dm^{-3} sodium chloride solution.

Answer .....

(1 mark)

5 (a) (ii) The students gave their results as a ratio. What is the advantage of giving the results as a ratio?

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(2 marks)

Areas outside the box will not be scanned for marking

5 (a) (iii) The students were advised that they could improve the reliability of their results by taking additional readings at the same concentrations of sodium chloride. Explain how.

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(2 marks)

5 (b) (i) The students used a graph of their results to find the sodium chloride solution with the same water potential as the apple tissue. Describe how they did this.

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(2 marks)

5 (b) (ii) The students were advised that they could improve their graph by taking additional readings. Explain how.

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(2 marks)

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Areas outside the box will not be scanned for marking

6 Read the following passage.

Pathogens affect humans. They also affect farm animals. Once pathogens have entered the body of an animal they can cause disease. Vets sometimes have difficulty identifying the disease from which a particular animal is suffering. Until recently, they have had to take blood samples and send them to a laboratory. The laboratory carries out tests on the sample.

New tests have been developed. Some of these new tests use monoclonal antibodies. Tests using monoclonal antibodies are fast, specific and allow vets to identify a disease while they are still on the farm.

Brucellosis is a disease of cattle. It is caused by bacteria. These bacteria can infect people who drink milk or eat dairy products from infected cattle. A test using monoclonal antibodies allows vets to identify cattle that are carriers. The carriers are cattle that carry the brucellosis bacteria but do not show any symptoms of the disease.

Use the information from the passage and your own knowledge to answer the following questions.

6 (a) Other than bacteria, name **one** type of pathogen (line 1).

.....

(1 mark)

6 (b) Give **two** ways in which a pathogen may cause disease when it has entered the body (lines 1–2).

1 .....

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2 .....

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(2 marks)

Areas outside the box will not be scanned for marking

6 (c) Some new tests use monoclonal antibodies (lines 6–7).

6 (c) (i) Explain why these antibodies are referred to as monoclonal.

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(1 mark)

6 (c) (ii) Tests using monoclonal antibodies are specific (line 7). Use your knowledge of protein structure to explain why.

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(3 marks)

(Extra space) .....

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6 (d) The tests using monoclonal antibodies allow vets to identify brucellosis while they are still on a farm. Explain the advantages of this.

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(3 marks)

(Extra space) .....

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Turn over ▶

Areas outside the box will not be scanned for marking

7 (a) The cardiac cycle is controlled by the sinoatrial node (SAN) and the atrioventricular node (AVN). Describe how.

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(5 marks)

(Extra space) .....

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Areas outside the box will not be scanned for marking

7 (b) What is atheroma and how may it cause myocardial infarction?

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(5 marks)

(Extra space) .....

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10

END OF QUESTIONS

There are no questions printed on this page

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Version 1.0: 02/2010

ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Education

Biology 1411

BIOL1 Biology and disease

Mark Scheme

2010 examination - January series

Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting ensures that the mark scheme covers the candidates' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for the standardisation meeting each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting they are required to refer these to the Principal Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of candidates' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

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Dr Michael Cresswell Director General

Although specific marks are not awarded in questions 1-7, marks will take into account the quality of written communication. Credit will only be awarded where candidates have presented information clearly and coherently and have used the specialist vocabulary indicated in the mark scheme for this unit. Specific references to the quality of written communications are marked **Q** in this mark scheme.

SECTION A

Question	Part	Sub Part	Marking Guidance	Mark	Comments
1	(a)		Low(er) water potential in lumen / intestine / gut; Water enters lumen / leaves (body) cells / by osmosis;	2	Accept: hypertonic instead of low(er) water potential Neutral: water does not leave lumen by osmosis **Q** Water potential must be in the correct context
1	(b)	(i)	(Lactose +) Water; → (Glucose +) Galactose;	2	Accept: H_2O for water
1	(b)	(ii)	Hydrolysis;	1	Accept: if phonetically correct
1	(c)	(i)	(Add Biuret reagent to both solutions) – no mark; Lactase / enzyme will give purple / lilac / mauve; ***OR*** Lactose / reducing sugar will not give purple / lilac / mauve / will remain blue;	1	Neutral: positive / negative result Neutral: incorrect reference to the method
1	(c)	(ii)	Lactase / enzyme is a protein;	1	Accept: lactase / enzyme contains peptide bonds

Question	Part	Sub Part	Marking Guidance	Mark	Comments
2	(a)	(i)	Through alveolar epithelium; Through capillary epithelium/endothelium;	2	Accept: Through lining / wall of alveolus and capillary for 1 mark Accept: squamous epithelial cells for 'epithelium' Neutral: alveolar endothelium Neutral: references to diffusion **Q** Correct use of terminology;
2	(a)	(ii)	(Thicker alveolar wall) – no mark (So) Longer diffusion pathway / slower diffusion;	1	Neutral: less diffusion Neutral: references to surface area
2	(b)	(i)	(In alveolus) Brings in air containing a high(er) oxygen concentration; Removes air with a low(er) oxygen concentration;	2	Need the idea of air moving and oxygen concentration Neutral: reference to carbon dioxide concentration
2	(b)	(ii)	Circulation of blood / moving blood;	1	Neutral: blood Neutral: short diffusion pathway

2	(c)		Long time between decrease in mining and increase in cases; Graph shows fluctuations; Correlation does not prove causation / there may be other causes of miner's lung; Improved diagnosis methods; Do not know number of cases / baseline before 1990; Not all cases reported / not all individuals with miner's lung visit a doctor;	2 max	*Accept*: correct use of figures from graph for the first marking point: e.g. cases do not increase until after 2000 / 2001-2004 / 10 years later.

Question	Part	Sub Part	Marking Guidance	Mark	Comments
3	(a)	(i)	Increases then plateaus / constant / steady / rate does not change; Correct reference. to 27/28 units; e.g. increases up to / plateaus at 27/28	2	Neutral: 'peaks' / 'reaches a maximum' / 'stops increasing' / 'no effect' instead of 'plateaus' Reject: rate decreases / reaction stops
3	(a)	(ii)	Substrate concentration / amount of substrate; As substrate concentration increases, rate increases / positive correlation (between rate and substrate concentration);	2	
3	(a)	(iii)	All <u>active sites</u> occupied / saturated / enzyme limiting (rate of reaction) / maximum number of E-S complexes;	1	Reject: enzymes used up Reject: substrate limits rate of reaction Neutral: substrate no longer limits the reaction Neutral: reference to temperature
3	(b)		Curve is lower and plateaus at a higher substrate concentration (it must also start at zero);	1	Accept: curve lower and joins existing curve at final point (with no plateau) Reject: if curve plateaus before original Reject: if curve plateaus lower than original
3	(c)	(i)	Methotrexate / drug is a similar shape / structure to substrate; Binds to / fits / is complementary to <u>active site</u>; Less substrate binds / less enzyme-substrate complexes formed;	2 max	**Q** Reject: same structure / shape **Q** Reject: reacts with active site Accept: substrate cannot bind / enzyme-substrate complex not formed

3	(c)	(ii)	Methotrexate / drug is only similar shape to specific substrate / only fits this active site; ***OR*** Methotrexate / drug is a different shape to other substrates / will not fit other active sites;	1	Assume that 'it' refers to the drug

Question	Part	Sub Part	Marking Guidance	Mark	Comments
4	(a)	(i)	Mitochondrion;	1	Neutral: cristae
4	(a)	(ii)	(Site of aerobic) respiration / ATP production / energy release; Active transport / transport against the concentration gradient;	2	**Q** Reject: anaerobic respiration **Q** Reject: energy produced Accept: energy produced in the form of ATP
4	(b)		89 – 91 gains 2 marks; Principle of: correct measured length gains 1 mark; magnification	2	Correct answer gains 2 marks outright 89-91 (mm) / 1000 or 8.9-9.1 (cm) / 1000 gains 1 mark
4	(c)		Suitable explanation given e.g. Reduced surface area; (So) less absorption; (Membrane-bound) enzymes less effective; (So) proteins / polypeptides not digested; Cell membranes damaged; (So) Fewer / less effective carrier / channel proteins; Carrier / channel proteins damaged; (So) less absorption;	2	Accept: converse arguments Neutral: structure **Z** incorrectly named Reduced surface area for absorption gains 2 marks Accept: references to diffusion and active transport for 'absorption' Reject: active transport if linked to channel proteins

Question	Part	Sub Part	Marking Guidance	Mark	Comments
5	(a)	(i)	1.08;	1	Must be to 3 significant figures, as in the table
5	(a)	(ii)	Allows comparison / shows proportional change; Idea that discs had different starting masses / weights;	2	*Neutral*: sizes / amounts *Neutral*: different masses
5	(a)	(iii)	(Allows) Anomalies to be identified / effect of anomalies to be reduced / effect of variation in data to be minimised; A <u>mean</u> to be calculated;	2	*Accept:* outliers instead of anomalies *Reject*: idea of not recording anomalies / preventing anomalies from occurring *Neutral:* average
5	(b)	(i)	Plot (sodium chloride) concentration against ratio / draw line of best fit; Find (sodium chloride concentration from the graph) where the ratio is 1 / there is no change in mass;	2	*Reject*: if wrong axes or type of graph
5	(b)	(ii)	Line / curve of best fit is more reliable / precise; Intercept / point where line crosses axis is more reliable / precise; ***OR*** Can plot SD values / error bars; (To show) variability about the mean / how spread out the results are;	2	*Neutral:* graph *Reject*: references to 'more accurate'

Question	Part	Sub Part	Marking Guidance	Mark	Comments
6	(a)		Virus / fungus / protozoan;	1	Neutral: named example
6	(b)		Produces toxins; Damages cells / tissues / example given e.g. cell lysis;	2	Neutral: infects / colonises / invades cells
6	(c)	(i)	(Antibodies) produced from a single clone of B cells / plasma cells; ***OR*** (Antibodies) produced from the same B cell / plasma cell;	1	Accept: hybridoma cell line instead of B cell / plasma cell Reject: idea that antibodies are cloned
6	(c)	(ii)	(Specific) primary structure / order of amino acids; (Specific) tertiary / 3D structure; (So) Only binds to / fits / complementary to one antigen;	3	Reject: 'active site' for either point 2. or 3. only once
6	(d)		(Rapid) treatment of carriers / infected cattle / disease; Can isolate / cull carriers / infected cattle; Infected (dairy) products not sold / consumed / tracked; Reduces spread of disease; No need to kill / prevents the death of non-infected animals;	3 max	Neutral: reference to rapid identification of infected cattle Neutral: ethical arguments

Question	Part	Sub Part	Marking Guidance	Mark	Comments
7	(a)		1. SAN initiates heartbeat / acts as a pacemaker / myogenic; 2. (SAN) sends wave of electrical activity / impulses (across atria) causing atrial contraction; 3. AVN delays (electrical activity / impulses); 4. (Allowing) atria to empty before ventricles contract / ventricles to fill before they contract; 5. (AVN) sends wave of electrical activity / impulses down Bundle of His / Purkyne fibres; 6. (Causing) ventricles to contract (from base up) / ventricular systole;	5 max	**Q** Must be in context Reject: signals / electronic / messages / nerve impulses once only Neutral: reference to non-conducting tissue delaying impulses instead of the AVN
7	(b)		1. Cholesterol / plaque / lipoprotein / LDL / fatty material / cells; 2. In artery wall / under lining / endothelium of artery / blood vessel; 3. Atheroma linked to blood clot / thrombosis; 4. (Blocks) coronary artery / artery supplying heart muscle / tissue / cells; 5. Reduces oxygen / glucose supply (to heart muscle / tissues / cells); 6. (Heart muscle / tissue / cells) unable to respire / dies;	5 max	Accept: LDL / triglyceride / cell debris; Reject: fatty acids / HDL; **Q** Do not accept references to veins or capillaries as equivalent to blood vessels **Q** Must be in the correct context If coronary artery is not mentioned or described, reference to heart muscle / tissue / cells is needed for 5.

Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

For Examiner's Use	
Examiner's Initials	
Question	Mark
1	
2	
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5	
6	
7	
TOTAL	

General Certificate of Education
Advanced Subsidiary Examination
June 2010

Biology BIOL1

Unit 1 Biology and disease

Tuesday 25 May 2010 9.00 am to 10.15 am

For this paper you must have:
- a ruler with millimetre measurements.
- a calculator.

Time allowed
- 1 hour 15 minutes

Instructions
- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- If you need extra space for your answer(s), use the lined pages at the end of this book. Write the question number against your answer(s).
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information
- The marks for questions are shown in brackets.
- The maximum mark for this paper is 60.
- You will be marked on your ability to:
  – use good English
  – organise information clearly
  – use scientific terminology accurately.

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There are no questions printed on this page

DO NOT WRITE ON THIS PAGE
ANSWER IN THE SPACES PROVIDED

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Answer **all** questions in the spaces provided.

1 (a) Cholera bacteria are prokaryotic cells. Give **three** structures found in prokaryotic cells but not in eukaryotic cells.

1 .....

2 .....

3 .....

(3 marks)

1 (b) Cholera bacteria cause an increase in the secretion of chloride ions into the small intestine. Use your knowledge of water potential to explain how the increased secretion of chloride ions causes diarrhoea.

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(2 marks)

1 (c) People with diarrhoea suffer fluid loss. They can use oral rehydration solutions (ORS) to replace the lost fluid. The mixture used to make an oral rehydration solution is stored as a powder. The powder can be made into a solution with boiled water.

1 (c) (i) Why must boiled water be used to make an ORS?

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(1 mark)

1 (c) (ii) The mixture used to make the ORS contains glucose. Give **one** other substance that must be present in the mixture.

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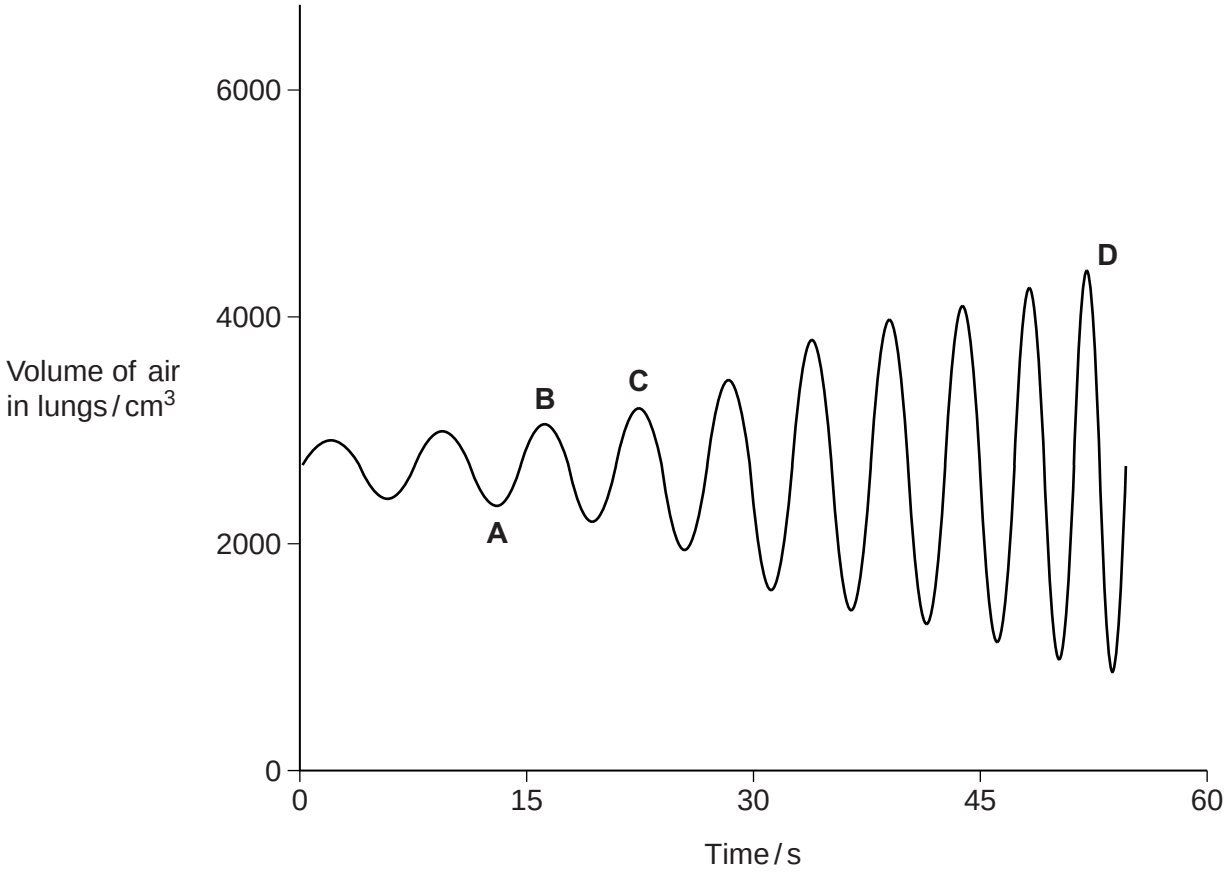
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(1 mark)

7

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2 The graph shows changes in the volume of air in a person's lungs during breathing.



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2 (a) The person was breathing in between times **A** and **B** on the graph.

2 (a) (i) Explain how the graph shows that the person was breathing in between times **A** and **B**.

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(1 mark)

2 (a) (ii) Describe and explain what happens to the shape of the diaphragm between times **A** and **B**.

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(2 marks)

2 (b) The person's pulmonary ventilation changed between times **C** and **D**.
Describe how the graph shows that the pulmonary ventilation changed.

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(3 marks)

(Extra space) .....

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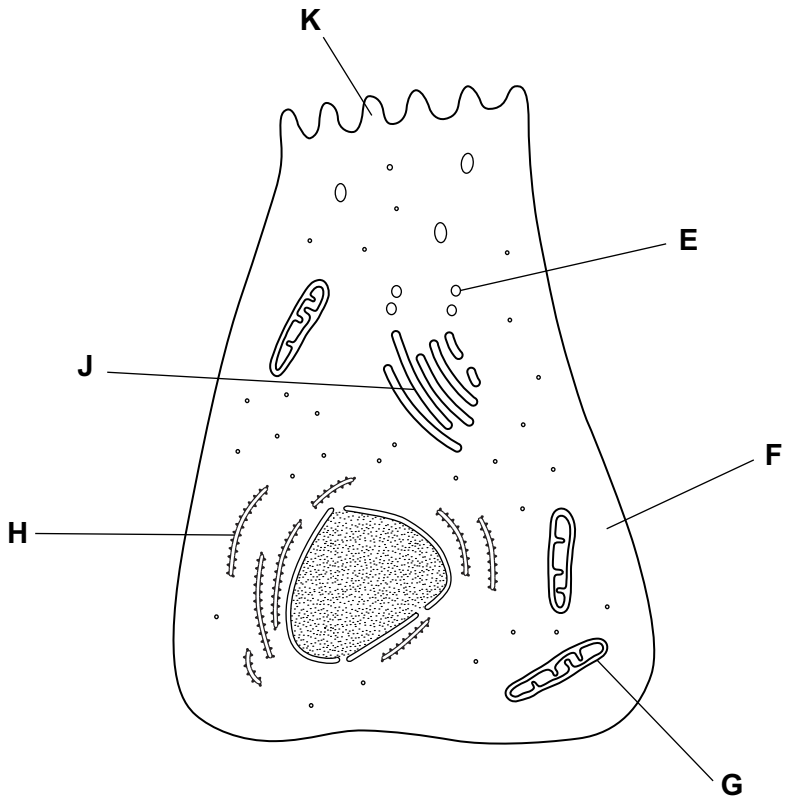
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3 (a) Name the type of bond that joins amino acids together in a polypeptide.

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(1 mark)

The diagram shows a cell from the pancreas.



3 (b) The cytoplasm at **F** contains amino acids. These amino acids are used to make proteins which are secreted from the cell.

Place the appropriate letters in the correct order to show the passage of an amino acid from the cytoplasm at **F** until it is secreted from the cell as a protein at **K**.

F				**K**

(2 marks)

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3 (c) There are lots of organelle **G** in this cell. Explain why.

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(2 marks)

3 (d) A group of scientists homogenised pancreatic tissue before carrying out cell fractionation to isolate organelle **G**.

Explain why the scientists

3 (d) (i) homogenised the tissue

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(1 mark)

3 (d) (ii) filtered the resulting suspension

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(1 mark)

3 (d) (iii) kept the suspension ice cold during the process

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(1 mark)

3 (d) (iv) used isotonic solution during the process.

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(2 marks)

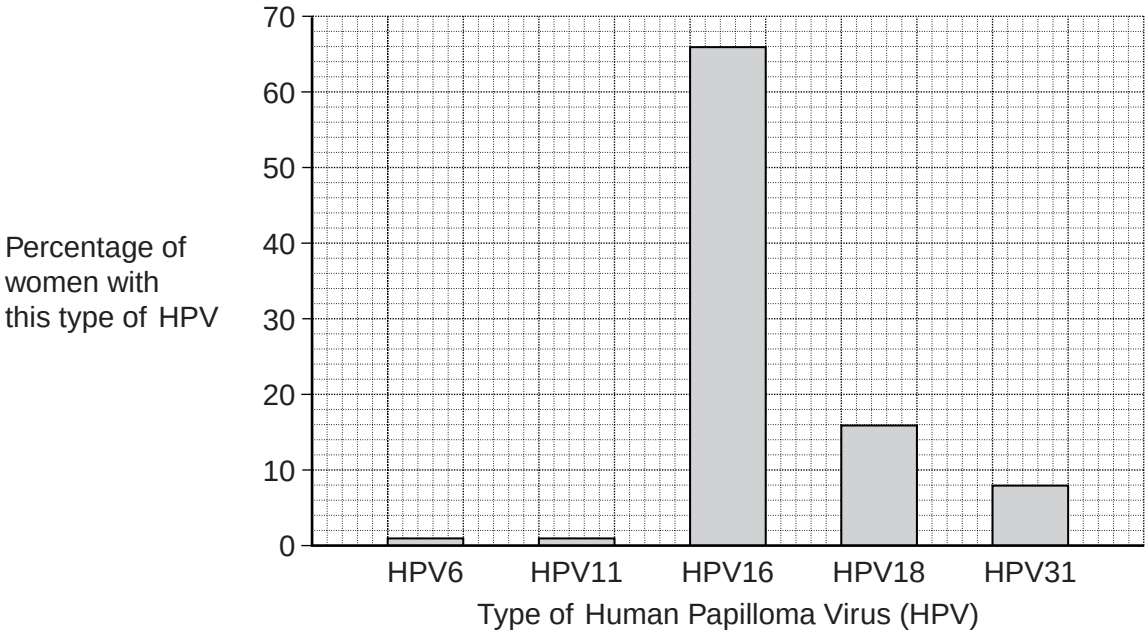
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4 Cervical cancer occurs in the neck of the uterus.

Scientists investigated the link between cervical cancer and infection with some types of Human Papilloma Virus (HPV).

The graph shows the frequency of five different types of HPV in women who had cervical cancer.



4 (a) A local newspaper published an article about cervical cancer with the headline 'HPV causes cervical cancer'.

Do the data shown in the graph support this claim? Explain your answer.

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(3 marks)

(Extra space) .....

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4 (b) Scientists have developed vaccines against HPV. One of the vaccines contains HPV antigens.

4 (b) (i) What is an HPV antigen?

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(2 marks)

4 (b) (ii) A vaccine can be used to produce immunity to HPV. Describe how memory cells are important in this process.

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(3 marks)

(Extra space) .....

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4 (c) Some doctors suggested offering the vaccine to young men. Explain the advantage of vaccinating young men as well as young women.

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(2 marks)

10

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5 Gangliosides are lipids found in the cell surface membranes of nerve cells. Hexosaminidase is an enzyme present in blood that breaks down gangliosides. If gangliosides are not broken down, they damage nerve cells.

5 (a) Hexosaminidase only breaks down gangliosides. It does not break down other lipids. Explain why this enzyme only breaks down gangliosides.

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(3 marks)

(Extra space) .....

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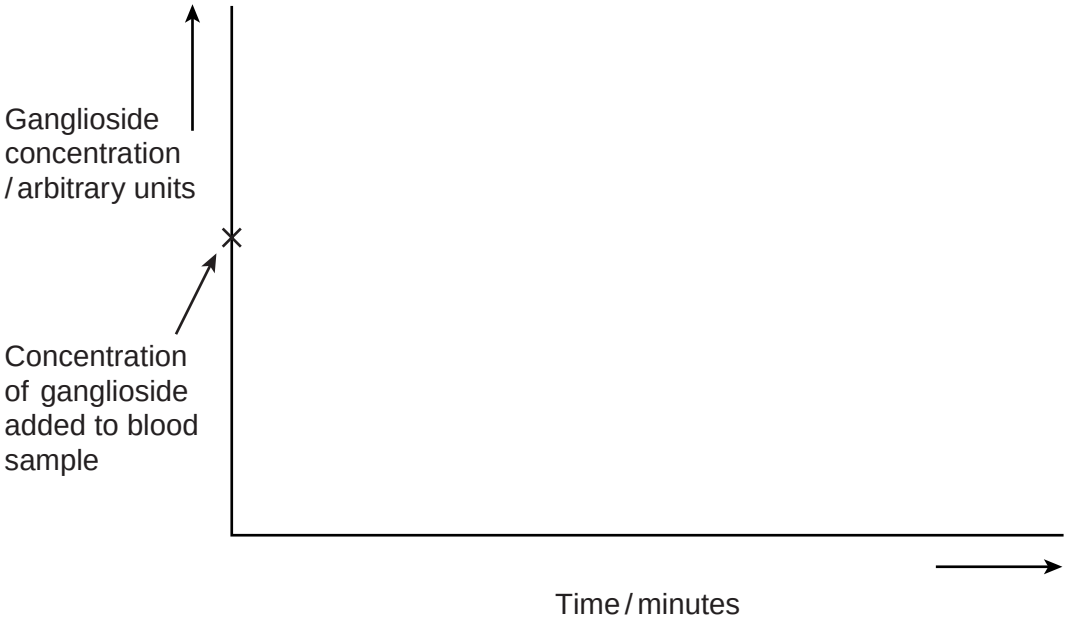
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5 (b) Hexosaminidase is found in the blood of healthy people. People with Tay Sachs disease do not have this enzyme in their blood.

Doctors confirm Tay Sachs disease by using a blood test. The technician carrying out the test adds a solution containing a high concentration of gangliosides to a sample of blood from the person being tested. The technician then measures the concentration of gangliosides in the person's blood at regular intervals.

5 (b) (i) Complete the graph below by sketching a curve to show the results you would expect for a person with Tay Sachs disease. Label this curve **T**.

(1 mark)



5 (b) (ii) Sketch a curve on the same graph to show the results you would expect for a healthy person who does **not** have Tay Sachs disease. Label this curve **H**.

(1 mark)

5 (c) Scientists are trying to find a way to give the missing enzyme to people with Tay Sachs disease. Suggest why they cannot give the enzyme as a tablet that is swallowed.

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(2 marks)

7

Turn over ▶

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6 Read the following passage.

Some foods contain substances called flavenoids. Flavenoids lower blood cholesterol concentration and reduce the risk of developing coronary heart disease.

Some types of dark chocolate have a high concentration of flavenoids. One group of scientists investigated the effect of eating dark chocolate on the risk of developing coronary heart disease.

The scientists randomly divided healthy volunteers into two groups. Every day one group was given dark chocolate containing flavenoids to eat. The other group acted as a control.

The scientists measured the diameter of the lumen of the main artery in the arms of the volunteers every week. At the end of a month, the diameter of the lumen of the main artery in the arm of the volunteers who had eaten dark chocolate containing flavenoids had increased.

Use information from the passage and your own knowledge to answer the questions.

6 (a) High blood cholesterol concentration is a risk factor associated with coronary heart disease.

Give **two** other risk factors associated with coronary heart disease.

1 .....

2 .....

(2 marks)

6 (b) (i) The scientists used healthy volunteers in this investigation (line 7). Why was it important that the volunteers were healthy?

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(1 mark)

6 (b) (ii) The scientists randomly divided the volunteers into two groups (line 7). Explain why they divided them randomly.

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(1 mark)

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6 (c) (i) Describe how the control group should have been treated.

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(2 marks)

6 (c) (ii) Why was it important to have a control group in this investigation?

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(1 mark)

6 (d) Suggest why an increase in the diameter of the lumen of the main artery in the arm (lines 11-12) is associated with a reduced risk of coronary heart disease.

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(3 marks)

(Extra space) .....

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7 (a) Many different substances enter and leave a cell by crossing its cell surface membrane. Describe how substances can cross a cell surface membrane.

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(5 marks)

(Extra space) .....

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7 (b) Describe and explain how the lungs are adapted to allow rapid exchange of oxygen between air in the alveoli and blood in the capillaries around them.

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(5 marks)

(Extra space) .....

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END OF QUESTIONS

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Version 1.0

General Certificate of Education
June 2010

Biology BIOL1

Biology and disease

Final

Mark Scheme

Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting ensures that the mark scheme covers the candidates' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for the standardisation meeting each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting they are required to refer these to the Principal Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of candidates' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

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Although specific marks are not awarded in question 1-7, marks will take into account the quality of written communication. Credit will only be awarded where candidates have presented information clearly and coherently and have used the specialist vocabulary indicated in the mark scheme for this unit. Specific references to the quality of written communication are marked **Q** in this mark scheme.

Question	Marking guidance	Mark	Comments
1(a)	Capsule / glycocalyx / slime layer; Circular / ring of / non-linear DNA / DNA without histones; Plasmid; Flagellum; Pilus; Small / less dense / 70s ribosomes;	3 max	**Q** *Reject:* capsid *Neutral:* slime *Neutral:* mesosome *Accept:* cell wall if qualified as murein / peptidoglyclan *Neutral:* structures *absent* from prokaryotes
1(b)	Lower / more negative water potential (in lumen / intestine / gut); Water enters (intestine) / leaves (body) cells by osmosis;	2	**Q** Use of correct terminology. Do not credit references to 'water concentration'. *Neutral*: hypertonic instead of lower water potential *Neutral*: water does not leave lumen by osmosis Must be in the correct context.
1(c)(i)	Kills / destroys bacteria; ***OR*** Does not contain bacteria / removes bacteria / sterile / prevents bacteria entering body;	1	**Q** Do not allow 'kills germs' *Accept:* microorganisms / pathogens / examples *Neutral:* denatures bacterial enzymes *Neutral:* to make it easier to dissolve the powder *Reject:* denatures bacteria / kills toxins

1(c)(ii)	Sodium (ions) / potassium (ions) / chloride (ions) / citrate (ions);	1	**Q** *Reject*: chlorine *Neutral:* salts *Accept*: chlorine ions *Accept*: sodium chloride / salt *Neutral:* water *Neutral:* amino acids

Question	Marking guidance	Mark	Comments
2(a)(i)	(Lung volume) increases / reaches a maximum (at **B**);	1	Do not negate mark for 'breathing out' if qualified e.g. when (lung volume) decreases
2(a)(ii)	Flattens / lowers / moves down; (Diaphragm / muscle) contracts;	2	 *Reject:* second mark only if intercostal muscles cause the diaphragm to flatten
2(b)	Pulmonary ventilation = tidal volume × breathing rate; Breathing rate increases / more breaths per min (between **C** and **D**) / peaks get closer; <u>Tidal volume</u> / volume of air (inhaled) <u>per breath</u> increases (between **C** and **D**) / deeper breaths; (<u>Tidal volume</u> increase) qualified by data from graph e.g. approximate three-fold increase / appropriate calculation;	3 max	*Accept:* ventilation rate instead of breathing rate *Neutral:* breathing increases *Accept:* breathe quicker *Neutral: v*olume in lungs increases *Accept:* distance from bottom to top of peak increases for 'tidal volume increases' *Neutral:* higher peaks for 'tidal volume increases'

Question	Marking guidance	Mark	Comments
3(a)	Peptide;	1	**Q** Do not accept polypeptide *Neutral:* covalent
3(b)	(F) H J E (K);	2	All three boxes correct = 2 marks Two boxes correct = 1 mark
3(c)	(Site of aerobic) respiration; Release ATP / energy; Active transport / transport against the concentration gradient / protein synthesis / exocytosis;	2 max	**Q** *Reject*: anaerobic respiration **Q** *Reject*: produces / makes energy *Accept:* produces ATP for energy *Reject:* produces ATP for respiration *Neutral:* protein secretion
3(d)(i)	Breaks open cells / disrupts cell membrane / releases cell contents / releases organelles / break up cells;	1	*Reject:* breaks down cell wall *Neutral:* separates the cells *Reject:* breaks up cells so they can be separated *Reject:* breaks up / separates organelles
3(d)(ii)	Removes (cell) debris / complete cells / tissue;	1	*Neutral:* to isolate organelle **G** / mitochondria *Neutral:* removes unwanted substances / impurities *Reject:* removes organelles / cell walls
3(d)(iii)	Reduces / prevents enzyme activity;	1	*Reject:* ref. to denaturation

3(d)(iv)	Prevents osmosis / no (net) movement of water / water does not enter organelle / water does not leave organelle; So organelle / named organelle is not damaged / does not burst / does not shrivel;	2	*Neutral:* ref. to water potential **Q** Ref. to cells rather than organelles negates the second mark only *Reject:* ref. to turgid / flaccid for second mark *Reject:* organelle 'explodes' for second mark

Question	Marking guidance	Mark	Comments
4(a)	(yes): Many women (with cervical cancer) have HPV 16 (18 &31); (no): Few women (with cervical cancer) have HPV 6 /11; (HPV infection does not mean causation because): Could be caused by another factor / example given / may be due to coincidence; No control group / did not study HPV in healthy women / did not study all HPV types / having cancer may increase susceptibility to HPV / does not add up to 100% / not all women with cancer have HPV / individual may have more than one HPV type;	3 max	*Neutral:* correlation between HPV (16) and cervical cancer *Reject:* many women with HPV 16 (18 &31) have cervical cancer / not all women have cancer *Accept:* figures from graph for 'many' and 'few' *Accept:* minor errors in reading HPV frequencies from graph *Reject:* does not mean HPV vaccine causes cancer; *Neutral:* refs. to sample size and factors that should have been kept constant
4(b)(i)	Protein / glycoprotein / glycolipid / polysaccharide; Causes immune response / antibody production;	2	 *Accept:* B / T cell production
4(b)(ii)	Memory cells produced / remain / stored (from previous infection); (When individual) comes into contact with virus / antigen (again); Rapid / secondary / greater response / many or more antibodies produced; Destroys virus / antigen before it can cause harm / symptoms / cancer;	3 max	*Neutral:* antibodies produced / remain *Neutral:* 'cell' instead of 'virus' *Reject:* 'bacteria' once only *Accept:* B cells / T cells *Reject:* if destroys the virus / antigen *in the vaccine* before it can cause harm **Q** Do not allow 'fights HPV' **Q** Do not allow 'memory cells remember'

4(c)	HPV destroyed in males / prevents males being carriers of HPV; Prevents males passing on HPV (to unvaccinated females) / HPV may cause (other) cancers in males;	2	*Neutral:* prevents males catching HPV *Accept*: reference to herd effect protecting the population

Question	Marking guidance	Mark	Comments
5(a)	Active site; (Complementary / specific) structure / shape; (Only) fits / binds to gangliosides; Forms enzyme-substrate complexes; ***OR*** Active site; (Complementary / specific) structure / shape; (Does not) fit / bind with other lipids; Does not form enzyme-substrate complexes;	3 max	Note: 'active site has a specific shape' = 2 marks; *Reject*: same shape Second mark for either route can refer to the enzyme or the substrate *Accept:* converse of second mark point and (different) structure / shape if referring to other lipids
5(b)(i)	No change / substrate remains high / horizontal line;	1	Curve should be labelled If curve **H** correctly labelled then assume other is curve **T** *Reject:* obvious rise or fall / rise then plateau
5(b)(ii)	Curve decreases rapidly at first then more slowly;	1	Curve should be labelled If curve **T** correctly labelled then assume other is curve **H** *Reject*: falling at a slower rate initially
5(c)	(Enzymes are) proteins; Digested / broken down / destroyed (by enzymes / acid); ***OR*** (Enzymes are) too large; To cross cell membranes / be absorbed / enter the bloodstream;	2	*Accept:* denatured (by acid) *Neutral:* digested by saliva *Reject:* digested by amylase *Neutral:* will not reach the bloodstream

Question	Marking guidance	Mark	Comments
6(a)	Two suitable factors, e.g: Named dietary factor(s) / (cigarette) smoking / high blood pressure / gender / age / alcohol / genes / lack of exercise / obesity / stress;	2 max	*Neutral:* cholesterol *Accept:* two different dietary factors for 2 marks e.g. LDL and salt *Accept:* LDL or fatty material *Accept:* ethnicity / race for 'genes' *Accept:* overweight for 'obesity'
6(b)(i)	Healthy volunteers have 'normally' functioning vessels; ***OR*** Blood vessel / lumen / diameter not affected by other factors / is of normal size;	1	*Accept:* a valid ethical argument e.g. treatment does not harm healthy volunteers *Reject:* ref. to change in artery thickness *Accept:* converse arguments for unhealthy volunteers Must be related to *this* investigation *Neutral:* to ensure that that the results are due to the independent variable
6(b)(ii)	Avoids bias / selection (by scientists);	1	*Neutral:* ref. to having the same number / gender / age of people in each group;
6(c)(i)	Same as experimental group; Chocolate with no flavenoids;	2	*Neutral:* no dark chocolate *Neutral:* placebo *Reject:* milk chocolate *Neutral:* ref. to fair testing

6(c)(ii)	(To ensure that results are) not due to some other substance in the chocolate / due to flavenoids (only);	1	Must be related to *this* investigation *Neutral:* to ensure that that the results are due to the independent variable *Neutral:* to show results are not due to other factors *Neutral:* to show results are only due to the chocolate *Neutral:* to compare results for people who did and did not have flavenoids
6(d)	Coronary artery also likely to have a wide lumen; (Less chance of) high blood pressure; (Less chance of) a blood clot / thrombosis; (Less chance of) atheroma / description given;	3 max	 *Accept:* reduces blood pressure *Neutral:* (less chance of) a blockage

Question	Marking guidance		Mark	Comments
7(a)	1	(Simple / facilitated) <u>diffusion</u> from high to low concentration / down <u>concentration gradient</u>;	5 max	**Q** Do not allow across / along / with concentration gradient
	2	Small / non-polar / lipid-soluble molecules pass via phospholipids / bilayer;		*Reject:* named molecule passing through membrane by an incorrect route for point 2
		OR		*Accept*: diagrams if annotated
		Large / polar / water-soluble molecules go through proteins;		
	3	<u>Water</u> moves by osmosis / from high water potential to low water potential / from less to more negative water potential;		
	4	<u>Active transport</u> is movement from low to high concentration / against <u>concentration gradient</u>;		Only penalise <u>once</u> if active transport is not named in point 4. e.g. 'movement against the concentration gradient involves proteins and requires ATP' = 2 marks
	5	Active transport / <u>facilitated diffusion</u> involves proteins / carriers;		*Accept:* facilitated diffusion involves channels for point 5
				Reject: active transport involves channels for point 5
	6	Active transport requires energy / ATP;		
	7	Ref. to Na^+ / glucose co-transport;		Credit ref. to endo/exocytosis as an alternative to point 7

7(b)	1	Many alveoli / alveoli <u>walls</u> folded provide a large surface area;	5 max	*Neutral:* alveoli provide a large surface area
	2	Many capillaries provide a large surface area;		*Neutral:* greater / better diffusion *Neutral:* fast gas exchange
	3	(So) fast <u>diffusion</u>;		Allow 'fast <u>diffusion</u>' only <u>once</u>
	4	Alveoli or capillary walls / epithelium / lining are thin / short distance between alveoli and blood;		*Reject*: thin membranes / cell walls *Accept:* one cell thick for 'thin'
	5	Flattened / squamous epithelium;		*Accept*: endothelial
	6	(So) short <u>diffusion</u> distance / pathway;		
	7	(So) fast <u>diffusion</u>;		
	8	Ventilation / circulation;		*Accept:* descriptions for ventilation / circulation
	9	Maintains a diffusion / concentration gradient;		Do not double penalise if description lacks detail e.g. thin membranes so a short diffusion distance = 1 mark
	10	(So) fast <u>diffusion</u>;		