OCR
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GCSE (9–1) Biology B (Twenty First Century Science) F

J257/02 Depth in biology (Foundation Tier)

Sample Question Paper

Date – Morning/Afternoon

Version 2

Time allowed: 1 hour 45 minutes

You may use:
- a scientific or graphical calculator

First name

Last name

Centre number | Candidate number

INSTRUCTIONS
- Use black ink. HB pencil may be used for graphs and diagrams only.
- Complete the boxes above with your name, centre number and candidate number.
- Answer **all** the questions.
- Write your answer to each question in the space provided.
- Additional paper may be used if required but you must clearly show your candidate number, centre number and question number(s).
- Do **not** write in the bar codes.

INFORMATION
- The total mark for this paper is **90**.
- The marks for each question are shown in brackets **[ ]**.
- Quality of extended responses will be assessed in questions marked with an asterisk (*).
- This document consists of **28** pages.

Answer **all** the questions.

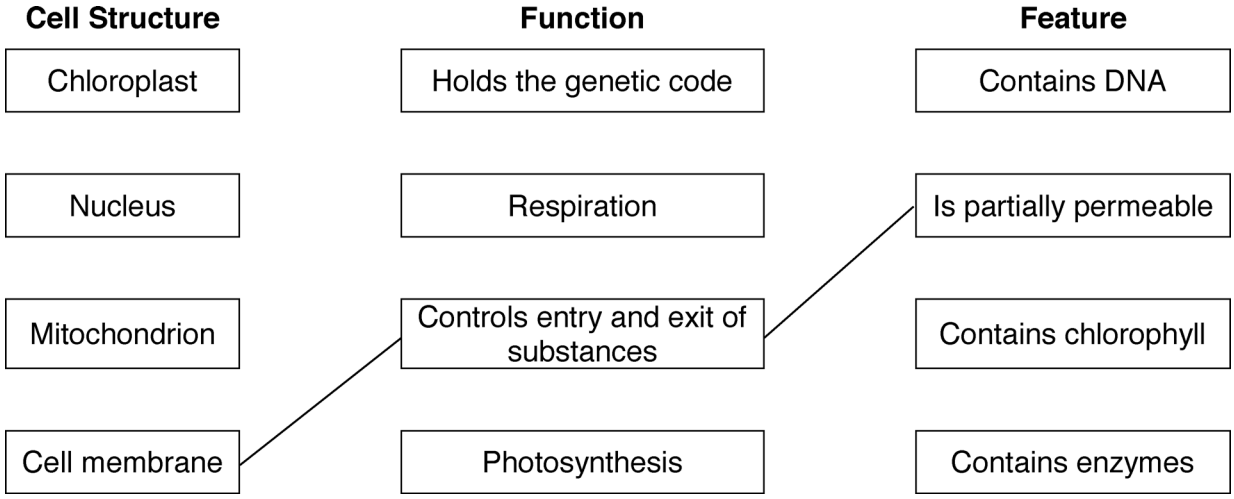
1 Cells are the basic building blocks of life. They need to do many things to stay alive.

(a) Structures within cells perform a variety of functions and have features that allow them to do these jobs.

The diagram below shows different cell structures, functions and features.

Draw **lines** to link the **cell structure** to its **function** and the **feature** that allows the structure to do its job.

Two lines have been drawn for you.



[3]

(b) Amaya and Jane are identical twins.

Their parents can easily tell the difference between them.

Explain why Amaya and Jane are described as genetically identical and suggest why their parents can tell the difference between them.

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

2 It is important to keep fit and healthy.

(a) Read these descriptions about three different people.

- Jamal runs twice a week to keep fit. He has normal blood pressure and is not overweight.
- Mia has the flu. She feels unwell and goes to bed with a high temperature.
- Ben has inherited a condition called Huntington's disease from his father.

(i) Using the three people described above as examples, explain the difference between health and disease.

.....

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.....

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

(ii) Explain the difference between a communicable disease and non-communicable disease.

Use the three people above as examples to help you.

.....

.....

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

(iii) Sexually transmitted infections are a type of communicable disease.

Contraception prevents pregnancy and the pictures below shows four forms of contraception.

Which one also prevents the spread of sexually transmitted infections?

Explain why.

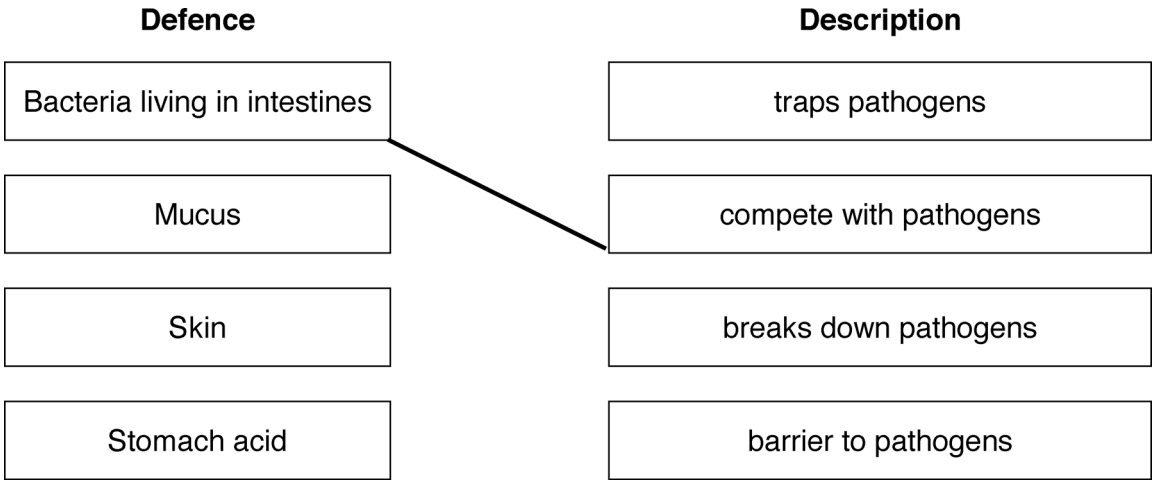
.....

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

(b) Humans have defences that make it difficult for pathogens to enter.

Draw **lines** to link each **defence** to its correct **description**.

One line has been drawn for you.



[2]

(c) Plants also need to protect themselves from disease.

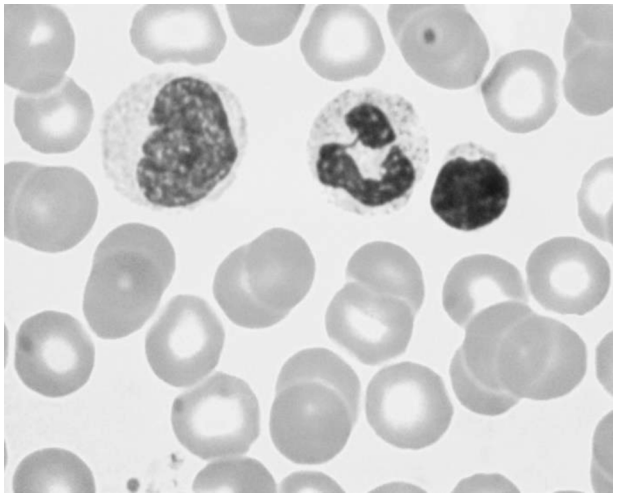
Give two **physical** defences used by plants against disease.

1 .....

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

3 **(a)** Blood is made up of cells, plasma and platelets.

The picture below shows blood cells as seen down a microscope.



Draw a labelled scientific drawing of a white blood cell in the space below.

Label the nucleus and the cell membrane.

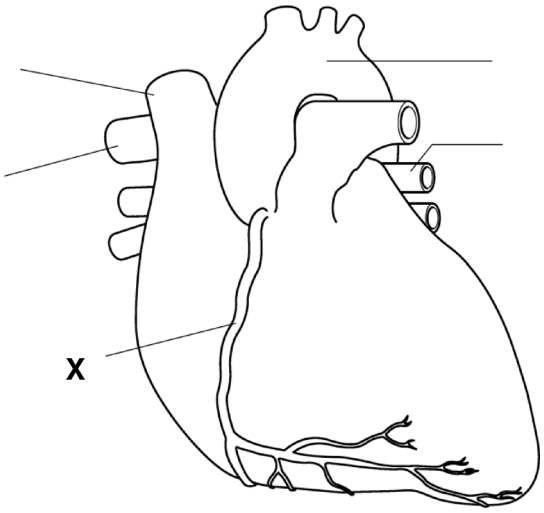
[4]

(b) There are more red blood cells than white blood cells in the blood sample above.

Estimate the ratio of red blood cells to white blood cells.

Ratio = ... **[1]**

(c) The diagram below shows a mammalian heart.



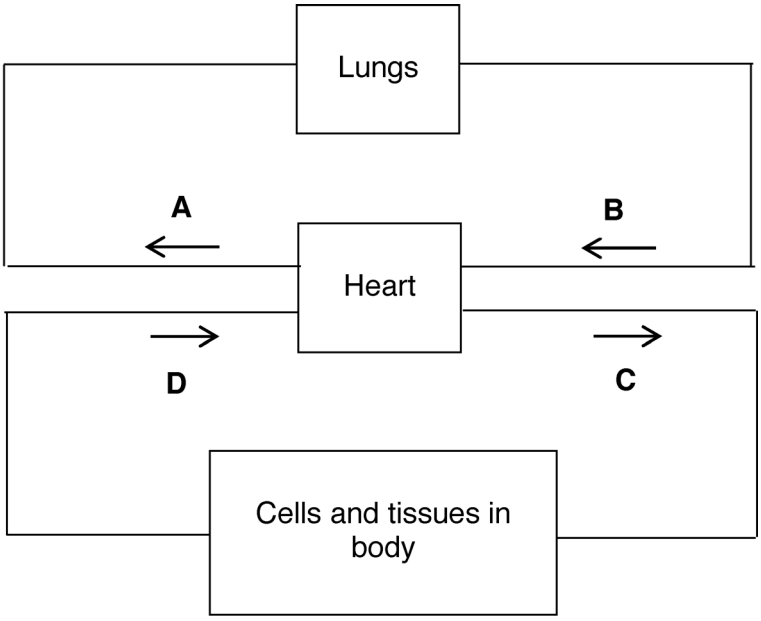
(i) Label **one** vessel that carries deoxygenated blood on the heart diagram. **[1]**

(ii) A heart attack is caused by a blockage in the blood vessel labelled **X**.

Name blood vessel **X**.

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

(d) The diagram shows some of the blood vessels, **A**, **B**, **C** and **D**, going into and out of the heart and to other parts of the body.



⟶ direction of blood flow

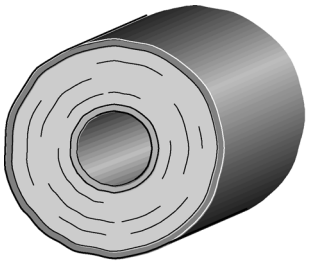
(i) Write the letter of a blood vessel that is an artery..... **[1]**

(ii) Write the letter of a blood vessel that is a vein. ..... **[1]**

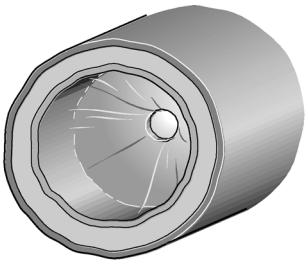
(e)* The table below shows information about the elasticity of arteries and veins when masses are attached to rings of the tissue.

The diagram below the table shows an artery, a vein and a capillary.

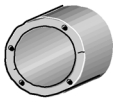
Mass (g)	Length of artery (mm)		Length of vein (mm)	
	With mass attached	After mass removed	With mass attached	After mass removed
0	20	20	21	21
10	45	25	36	36
20	53	27	38	37
30	58	28	40	39
40	63	33	41	39
50	65	33	41	41



Artery



Vein



Capillary

Explain how arteries, veins and capillaries are adapted to their functions.

Use the diagrams, draw conclusions from the data and use your own knowledge in your explanation.

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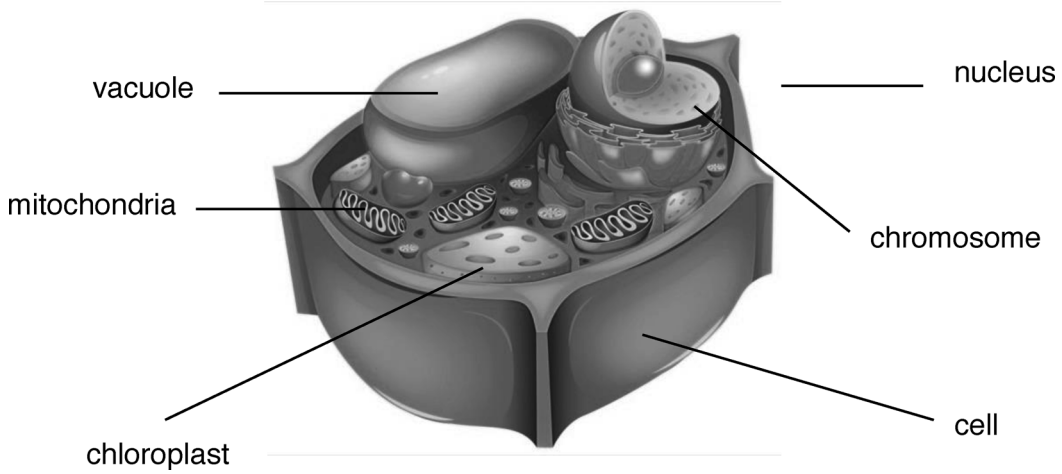
..... **[6]**

4 The use of microscopes has greatly increased our understanding of the structure and function of cells.

(a) The diagram shows a typical plant cell and some of the structures found inside it.



On the dotted lines below, name each structure in order, starting with the largest and ending with the smallest.

The first one has been done for you.

Cell ....

.... **[3]**

(b) A cell is observed to divide once every hour, doubling the total number of cells.

A student estimates the number of cells after ten hours to be 1024.

Explain why this number is an estimate and is not an exact number of cells after ten hours.

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.....

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

(c) Cells divide by mitosis or meiosis.

Fig 4.1 shows a parent cell containing chromosomes.

Cells **A**, **B**, **C**, **D** and **E** are possible daughter cells that **could** result from either mitosis or meiosis.

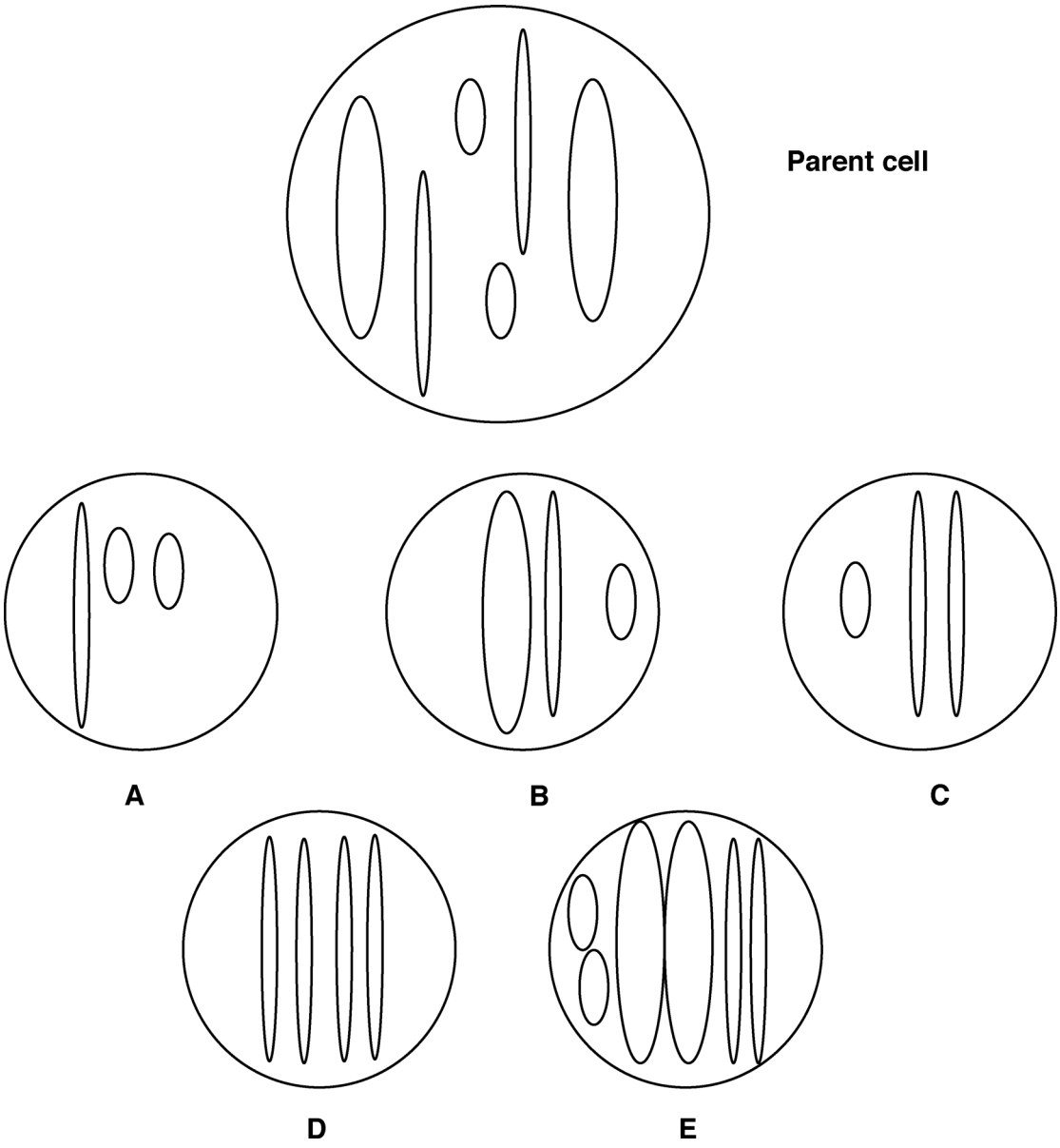


Fig 4.1

In Fig 4.1, identify the daughter cells, **A**, **B**, **C**, **D** or **E**, that correctly show the result of mitosis and meiosis.

In the table below:

- Write the letter of the correct daughter cell.
- Give reasons for your choice.

Type of cell division	Correct daughter cell	Reasons for choice
Mitosis	.....	**1**.
Meiosis	.....	**1**.
		2.

[5]

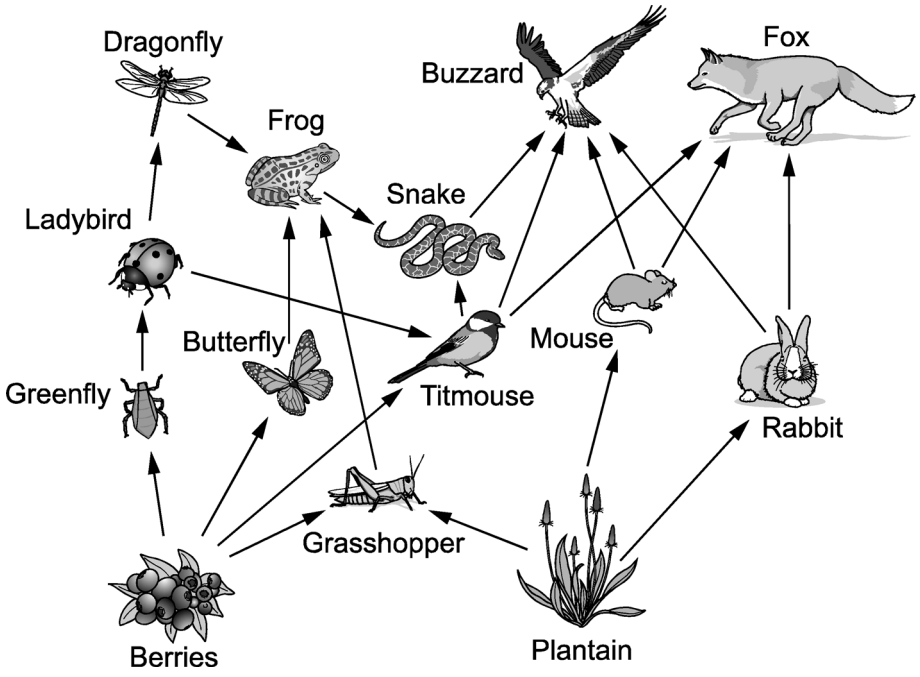
(d) A newt is a type of amphibian.

A newt can grow a new leg if one is damaged or bitten off by a predator.

What type of cell division does the newt use to grow a new leg?

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

5 This is a food web from woodland with a pond nearby.



(a) **(i)** Name a producer in this food web.

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

(ii) How many trophic levels are in the longest food chain in this food web?

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

(iii) What do the arrows in the food web mean?

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

(b) One food chain from this food web is:

Berries → Titmouse → Fox

Draw a pyramid of biomass for this food chain in the space below.

Label your pyramid.

[2]

(c) A group of students decide to investigate the populations of animals and plants in this food web.

Suggest the piece of apparatus they would use for sampling the following.

(i) Small plants in the woodland.

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

(ii) Invertebrates, such as woodlice, on the ground in the woodland.

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

(d) A species of toad is introduced into this community.

- The toad eats butterflies and dragonflies.
- The toad has skin that tasted bitter and so nothing wanted to eat it.

Explain the effect on the food web of introducing this toad.

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

6 Albinism is an inherited condition. The people affected are unable to make a pigment called melanin. Skin, hair and eyes may all be affected and the person will be very pale skinned with white-blonde hair and possibly red eyes.

Ling and Ben have a daughter called Mia who has albinism.

Ling and Ben are both heterozygous (carriers).

(a) Complete the Punnett square below to show how Ling and Ben passed the alleles for albinism to Mia.

Use **A** to represent the allele for normal melanin production and **a** to represent the allele for albinism.

Mia's genotype is aa.

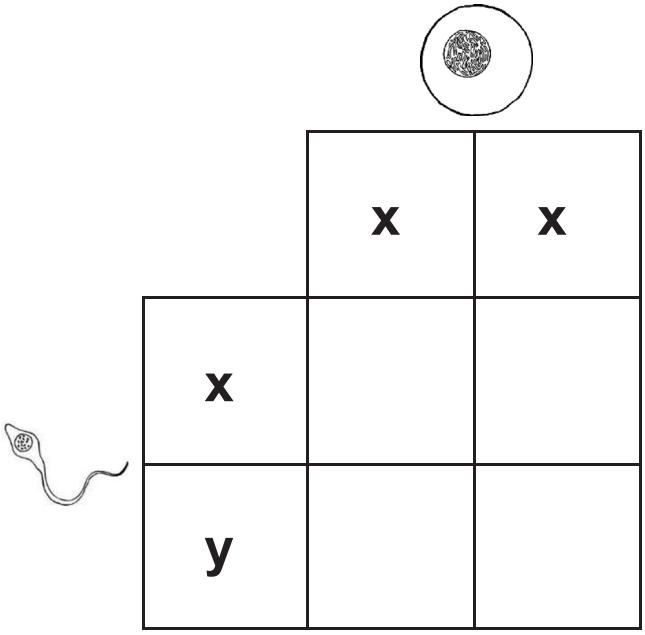
	A	**a**

[2]

(b) In humans, sex chromosomes determine gender.

Ling and Ben are having another child.

Use the diagram below to show the probability of Ling and Ben's second child being a boy.



Probability = ... **[2]**

(c) Use the example of the inheritance of albinism to describe the difference between **homozygous** and **heterozygous**.

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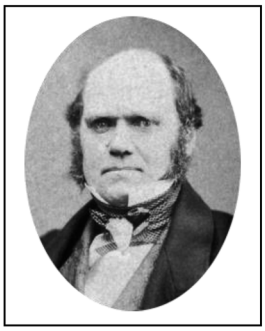
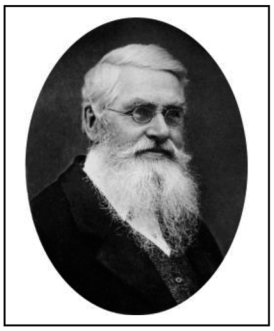
..... **[2]**

7 Lamarck, Darwin and Wallace were three scientists responsible for our understanding of evolution.

Jean Baptiste Lamarck



Charles Darwin



Alfred Russel Wallace

In the early 1800s, most scientists such as Lamarck thought that, when organisms acquired a characteristic during their lifetime, they could pass this characteristic on to their offspring. He thought that a giraffe had a long neck because it stretched to reach leaves from the branches of trees. He thought that the giraffes that stretched their necks the most would then pass on this characteristic to their offspring.

Darwin and Wallace did not believe this theory. They spent many years collecting different species of animals and plants from all over the world and they both came to the same conclusion.

Darwin and Wallace thought that life evolved due to a process of natural selection. Both Darwin and Wallace realised that, if natural selection was repeated over many generations, it could lead to the wide variety of different species that we see around us today.

(a) Today most scientists around the world believe Darwin's and Wallace's theory to be correct.

(i) Evaluate Lamarck's theory and suggest why most scientists now believe Darwin and Wallace's theory of evolution.

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

(ii) Wallace sent Darwin his ideas to check that he had not made any mistakes.

Put a tick (✓) in the box next to the statement that best describes this process.

Controlling variables ☐

Extrapolation ☐

Peer review ☐

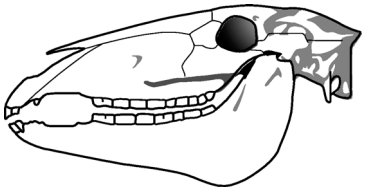
Repeatability ☐ **[1]**

(b) Scientists use fossils to provide evidence for evolution.

The five drawings below are of fossil skulls of horses.

The drawings, **A, B, C, D** and **E** can be used to show how horses have evolved.

The drawings are in the wrong order.

A	B	C	D	E
				

Complete the boxes to show how the horses have evolved.

The first and last have been done for you.

C	.....	.....	.....	B
First				**Last**

[2]

(c) Describe how the fossils can be used to provide evidence for the evolution of horses.

Use ideas of similarities and differences between the drawings and your own knowledge in your answer.

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

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TURN OVER FOR THE NEXT QUESTION

8 A student did an experiment to find out more about the process of osmosis.

(a) The student was provided with ten pieces of potato, each about 5 cm long.

She was also given five dishes each containing a different **unknown** concentration of sugar solution.

The student put two pieces of potato in each dish and left them for 30 minutes. She then removed the potato pieces and re-measured their length.

The student recorded the results in Table 8.1.

Dish of sugar solution	Length of potato (cm)				Change in mean length (cm)	Percentage change (%)
	Original	After 30 minutes in sugar solution				
		Piece 1	Piece 2	Mean		
1	4.9	5.0	5.4	5.2	+0.3	.....
2	5.1	4.3	4.1	4.2	–0.9	–18.4
3	5.0	4.8	4.4	4.6	–0.4	–8.0
4	5.2	5.7	5.9	5.8	+0.6	+11.5
5	4.9	4.8	4.8	4.8	–0.1	–2.0

Table 8.1

(i) The student has not finished working out the results.

Calculate the missing value and write it in the table. **[2]**

(ii) The table below shows the concentration of sugar solution in each of the five dishes.

Use the results from the student's experiment to show which solution was in each dish.

Write down the correct dish numbers from Table 8.1 in the column headed **'Dish'**.

Sugar solution concentration (mol/dm^3)	Dish
0.2	
0.4	
0.6	
0.8	
1.0	

[1]

(iii) The student measured the length of the pieces of potato as a quick way to obtain results.

Why does this method not measure the total change to the pieces of potato?

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

(iv) How could the student modify the experiment to show the rate of water movement by osmosis in pieces of potato?

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

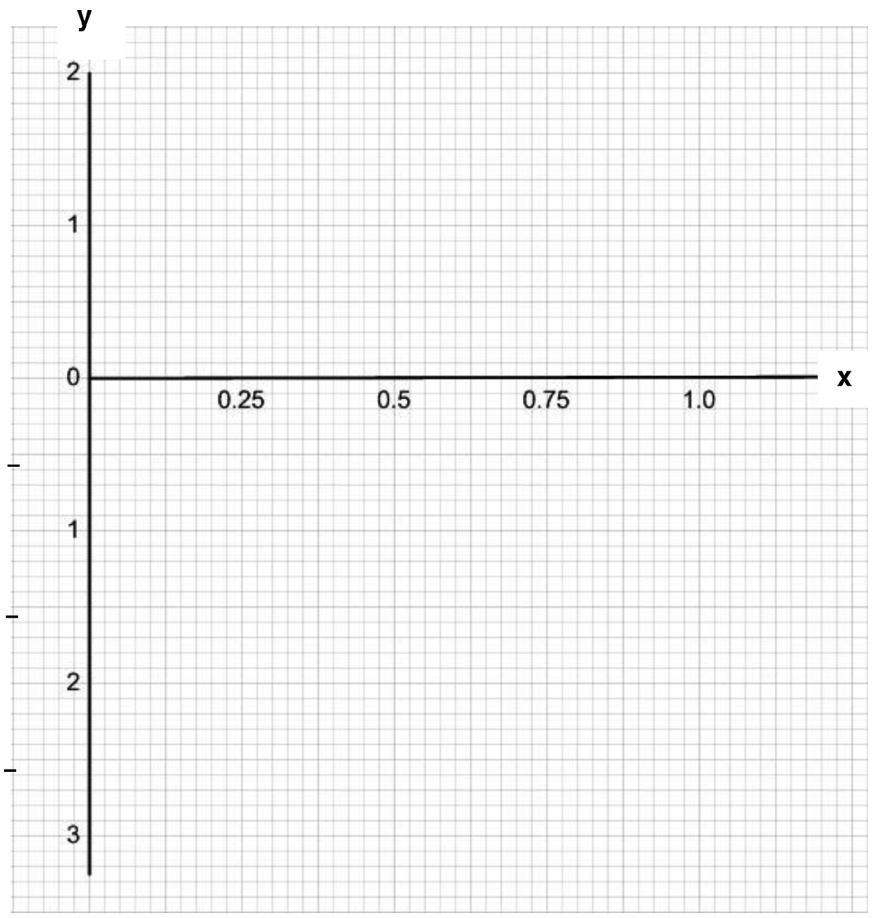
(b) Another student did a similar experiment.

These are his results in Table 8.2.

Sugar solution concentration (mol/dm^3)	Change in mean length (mm)
1.00	–1.9
0.75	–1.2
0.50	–0.5
0.25	+0.3
0.00	+1.0

Table 8.2

(i) Using the information in Table 8.2, label the x and y axis on the grid below. **[1]**



(i) Plot the student's results on the grid. **[2]**

(ii) Draw a line of best fit on the grid. **[1]**

(iv) Use your graph to find the concentration of sugar solution where the potato pieces do not change in length.

sugar solution concentration ..... mol/dm^3 **[1]**

(v) What can you conclude, in terms of osmosis, at this concentration?

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

9 A group of students carry out an enzyme investigation.

The word equation below shows the reaction.

$$\text{Hydrogen peroxide} \xrightarrow{\text{catalase}} \text{oxygen and water}$$

(a) Name the substrate and the enzyme in this reaction.

Substrate: .....

Enzyme: ..... **[1]**

(b)* The students investigated the effect of temperature on the rate of this enzyme-controlled reaction.

Fig 9.1 shows a graph of their results.

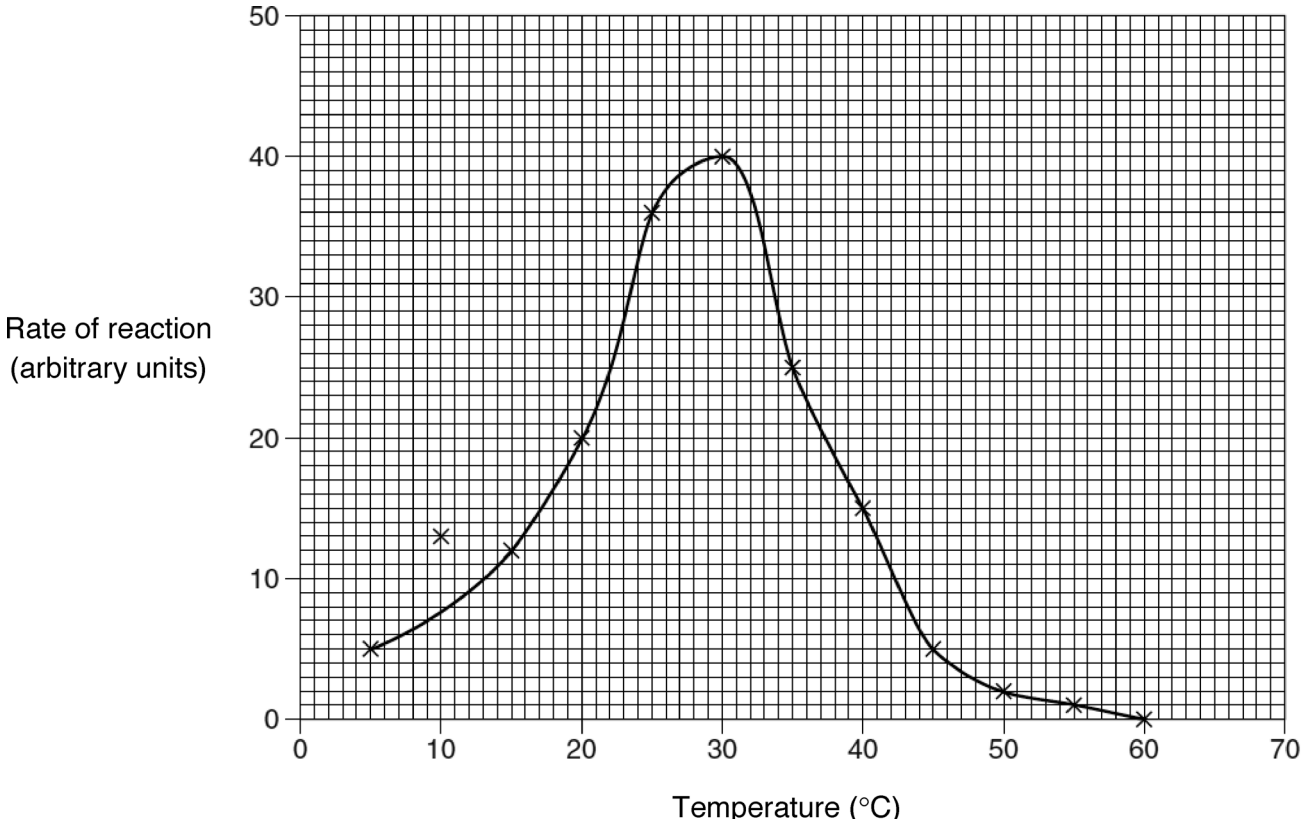

Fig 9.1

Using the graph in Fig 9.1, describe and explain the effect of temperature on this enzyme.

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..... **[6]**

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