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0 1

Plants transport water and mineral ions from the roots to the leaves.

0 1 . **1**

Plants move mineral ions:

- from a low concentration in the soil
- to a high concentration in the root cells.

What process do plants use to move these minerals ions into root cells?

[1 mark]

Tick **one** box.

Active transport

Diffusion

Evaporation

Osmosis

0 1 . **2**

Describe how water moves from roots to the leaves.

[2 marks]

Question 1 continues on the next page

Plants lose water through the stomata in the leaves.

The epidermis can be peeled from a leaf.

The stomata can be seen using a light microscope.

Table 1 shows the data a student collected from five areas on one leaf.

Table 1

Leaf area	Number of stomata	
	Upper surface	Lower surface
1	3	44
2	0	41
3	1	40
4	5	42
5	1	39
Mean	2	X

0 1 . 3 Describe how the student might have collected the data in **Table 1**.

[3 marks]

0 1 . 4

What is the median number of stomata on the upper surface of the leaf?

[1 mark]

0 1 . 5

Calculate the value of **X** in **Table 1**.

Give your answer to 2 significant figures.

[2 marks]

Mean number of stomata on lower surface of leaf = _____

0 1 . 6

The plant used in this investigation has very few stomata on the upper surface of the leaf.

Explain why this is an **advantage** to the plant.

[2 marks]

Turn over for the next question

0	2
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Tobacco mosaic virus (TMV) is a disease affecting plants.

Figure 1 shows a leaf infected with TMV.

Figure 1

Image of a leaf infected with TMV not reproduced here due to third party copyright restrictions

0	2	.	1
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All tools should be washed in disinfectant after using them on plants infected with TMV.

Suggest why.

[1 mark]

0	2	.	2
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Scientists produced a single plant that contained a TMV-resistant gene.

Suggest how scientists can use this plant to produce **many** plants with the TMV-resistant gene.

[1 mark]

0 2 . **3** Some plants produce fruits which contain glucose.

Describe how you would test for the presence of glucose in fruit.

[2 marks]

0 2 . **4** TMV can cause plants to produce less chlorophyll.

This causes leaf discoloration.

Explain why plants with TMV have stunted growth.

[4 marks]

Turn over for the next question

0	3
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Microorganisms cause infections.

The human body has many ways of defending itself against microorganisms.

0	3
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.	1
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Describe **two** ways the body prevents the entry of microorganisms.

[2 marks]

1

2

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0	4
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All living cells respire.

0	4	.	1
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Respiration transfers energy from glucose for muscle contraction.

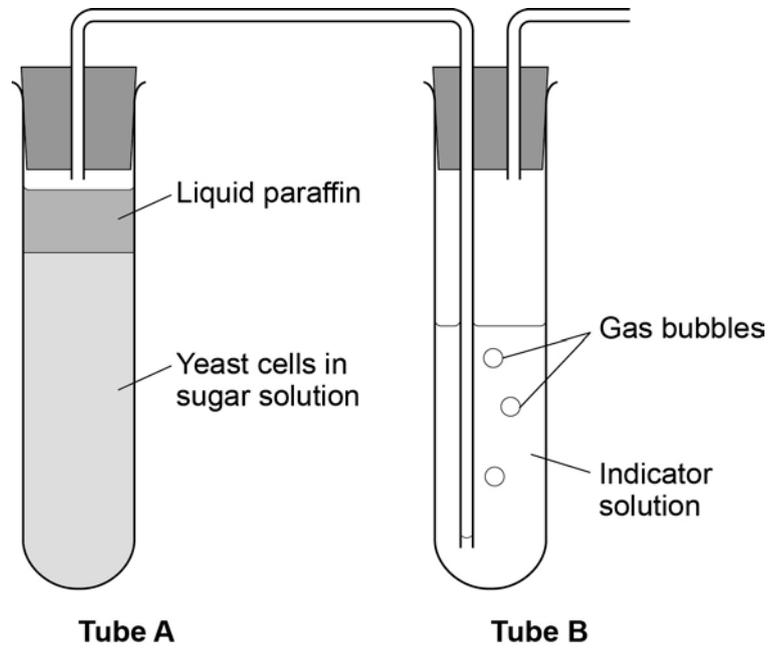
Describe how glucose from the small intestine is moved to a muscle cell.

[2 marks]

Question 4 continues on the next page

Figure 2 shows an experiment to investigate **anaerobic** respiration in yeast cells.

Figure 2



0 4 . **2** What is the purpose of the liquid paraffin in Tube A?

[1 mark]

Tick **one** box.

- To prevent evaporation
- To stop air getting in
- To stop the temperature going up
- To stop water getting in

The indicator solution in Tube **B** shows changes in the concentration of carbon dioxide (CO₂).

The indicator is:

- **blue** when the concentration of CO₂ is very low
- **green** when the concentration of CO₂ is low
- **yellow** when the concentration of CO₂ is high.

0 4 . **3** What colour would you expect the indicator to be in Tube **B** during maximum rate of anaerobic respiration?

[1 mark]

Tick **one** box.

Blue

Green

Yellow

0 4 . **4** Suggest how the experiment could be changed to give a reproducible way to measure the rate of the reaction.

Include any apparatus you would use.

[2 marks]

Question 4 continues on the next page

0 4 . **5**

Compare anaerobic respiration in a yeast cell with anaerobic respiration in a muscle cell.

[3 marks]

Turn over for the next question

0 5

A student investigated the effect of different sugar solutions on potato tissue.

This is the method used.

1. Add 30 cm³ of 0.8 mol dm⁻³ sugar solution to a boiling tube.
2. Repeat step 1 with equal volumes of 0.6, 0.4 and 0.2 mol dm⁻³ sugar solutions.
3. Use water to give a concentration of 0.0 mol dm⁻³.
4. Cut five cylinders of potato of equal size using a cork borer.
5. Weigh each potato cylinder and place one in each tube.
6. Remove the potato cylinders from the solutions after 24 hours.
7. Dry each potato cylinder with a paper towel.
8. Reweigh the potato cylinders.

Table 2 shows the results.

Table 2

Concentration of sugar solution in mol dm ⁻³	Starting mass in g	Final mass in g	Change of mass in g	Percentage (%) change
0.0	1.30	1.51	0.21	16.2
0.2	1.35	1.50	0.15	X
0.4	1.30	1.35	0.05	3.8
0.6	1.34	1.28	-0.06	-4.5
0.8	1.22	1.11	-0.11	-9.0

0 5**. 1**

Calculate the value of **X** in **Table 2**.

[2 marks]

Percentage change in mass = _____ %

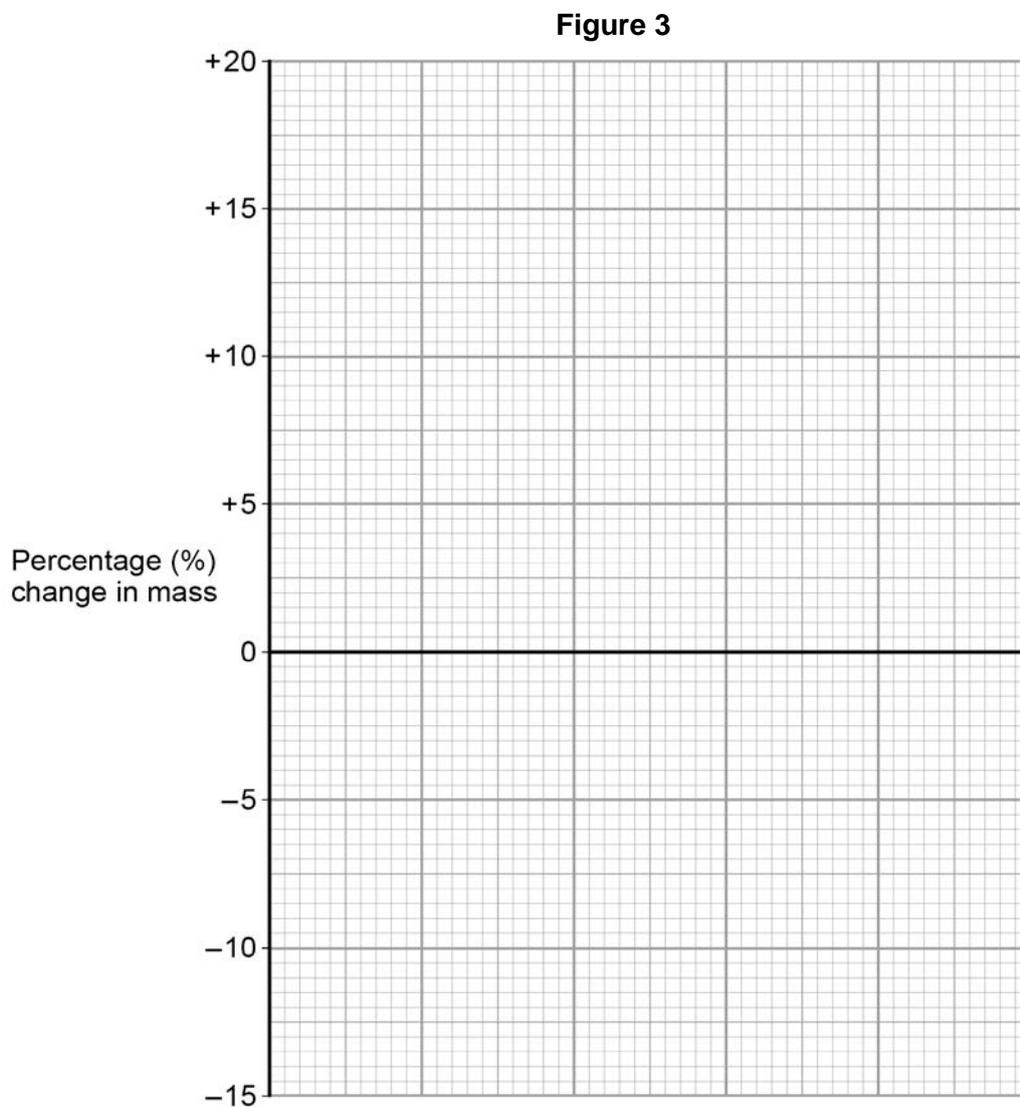
- 0 5** . **2** Why did the student calculate the percentage change in mass as well as the change in grams?

[1 mark]

- 0 5** . **3** Complete **Figure 3** using data from **Table 2**.

- Choose a suitable scale and label for the *x*-axis.
- Plot the percentage (%) change in mass.
- Draw a line of best fit.

[4 marks]



Question 5 continues on the next page

-
- 0 5** . **4** Use your graph in **Figure 3** to estimate the concentration of the solution inside the potato cells.

[1 mark]

Concentration = _____ mol dm⁻³

- 0 5** . **5** The results in **Table 2** show the percentage change in mass of the potato cylinders.

Explain why the percentage change results are positive **and** negative.

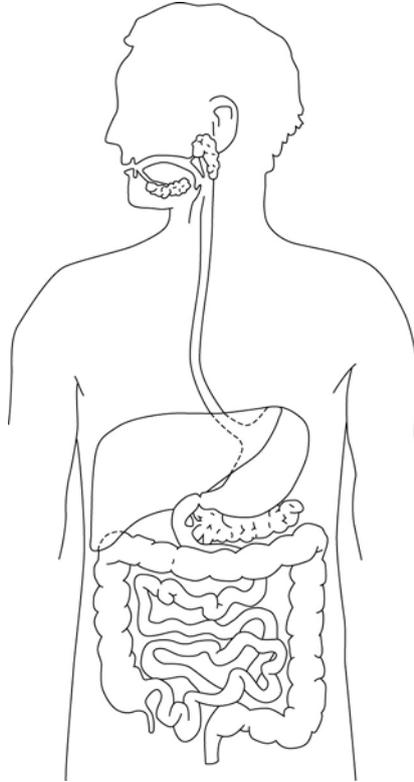
[3 marks]

- 0 5** . **6** Suggest **two** possible sources of error in the method given on **page 16**.

[2 marks]

1 _____

2 _____

0 6**Figure 4** shows the human digestive system.**Figure 4****0 6****1**Label the stomach and pancreas on **Figure 4**.**[1 mark]****Question 6 continues on the next page**

Many people suffer from stomach ulcers caused by a species of bacteria called *Helicobacter pylori*.

The stomach is lined with a protective lining of mucus.

Helicobacter pylori are acid-tolerant bacteria which can damage this mucus lining.

0 6 . **2**

Suggest how an infection with *Helicobacter pylori* might result in a stomach ulcer developing.

[2 marks]

0 6 . **3**

Helicobacter pylori can also cause stomach cancer.

Describe how a person infected with *Helicobacter pylori* could also develop liver cancer.

[3 marks]

0 6 . **4** Gluten is a form of protein found in some grains.

Describe the test you would use to find out if protein is present in food.

[2 marks]

0 6 . **5** Coeliac disease is a disease of the digestive system.

It damages the lining of the small intestine when foods that contain gluten are eaten.

When people with coeliac disease eat foods that contain gluten:

1. their immune system forms antibodies to gluten
2. these antibodies attack the lining of the small intestine
3. this causes inflammation in the intestines and damages the villi.

Symptoms of coeliac disease include poor growth.

Suggest why a person with coeliac disease might have this symptom.

[4 marks]

0	7
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A gardener is looking at the plants in his greenhouse.

0	7	.	1
---	---	---	---

Some of the plants have a disease.

Give **two** ways the gardener could identify the pathogen infecting the plants.

[2 marks]

1 _____

2 _____

0	7	.	2
---	---	---	---

Plants can become unhealthy if they do not have essential mineral ions.

Describe the appearance of plants with:

- **nitrate** deficiency
- **magnesium** deficiency.

[2 marks]

Nitrate deficiency _____

Magnesium deficiency _____

0 7 . 3 Plants need other mineral ions.

- Potassium ions are needed for healthy root growth.
- Phosphate ions are needed for healthy flowers and fruits.

The gardener makes his own garden compost.

The percentage (%) of minerals in his compost was compared with two fertilisers he could buy.

The data are shown in **Table 3**.

Table 3

	Percentage (%) mineral content			Cost in £/kg
	Nitrate ions	Phosphate ions	Potassium ions	
Garden compost	0.5	0.3	0.8	0.00
Fertiliser S	5.0	1.3	6.6	4.99
Fertiliser T	3.0	12.0	6.0	9.99

The gardener buys Fertiliser **S**.

Explain why he chose Fertiliser **S**.

[4 marks]

0 8

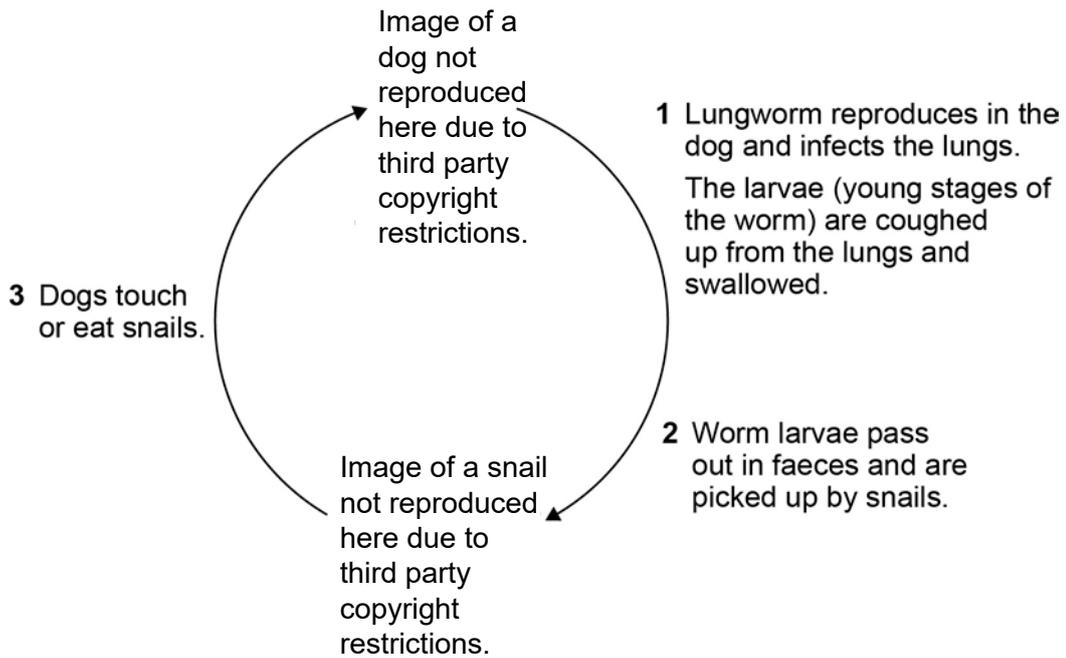
Lungworm is an infection.

Lungworm can kill dogs.

It is caused by a small worm.

Figure 5 shows the lifecycle of the lungworm.

Figure 5



0 8

. 1

What type of organism is represented by the snail in the lifecycle of the lungworm?

[1 mark]

Tick **one** box.

Fungus

Parasite

Protist

Vector

0 8 . **2** Suggest how the spread of the lungworm disease can be prevented.

[3 marks]

0 8 . **3** Malaria is a disease spread by mosquitoes.

Describe **two** ways to control the spread of malaria.

[2 marks]

1 _____

2 _____

Turn over for the next question

0	9
---	---

Figure 6 shows photographs of some animal cells at different stages during the cell cycle.

Figure 6

A

Image of an animal cell not reproduced here due to third party copyright restrictions.

B

Image of an animal cell not reproduced here due to third party copyright restrictions.

C

Image of an animal cell not reproduced here due to third party copyright restrictions.

0 9 . **1** Which photograph in **Figure 6** shows a cell that is **not** going through mitosis? **[1 mark]**

Tick **one** box.

A		B		C	
----------	--	----------	--	----------	--

0 9 . **2** Describe what is happening in photograph **A**. **[2 marks]**

Question 9 continues on the next page

A student wanted to find out more about the cell cycle.

The student made a slide of an onion root tip.

She counted the number of cells in each stage of the cell cycle in one field of view.

Table 4 shows the results.

Table 4

		Stages in the cell cycle				
	Non-dividing cells	Stage 1	Stage 2	Stage 3	Stage 4	Total
Number of cells	20	9	4	2	1	36

0 9 . **3** Each stage of the cell cycle takes a different amount of time.

Which stage in **Table 4** is the fastest in the cell cycle?

Give a reason for your answer.

[2 marks]

Stage _____

Reason _____

0 9 . **4** The cell cycle in an onion root tip cell takes 16 hours.

Calculate the length of time **Stage 2** lasts in a typical cell.

Give your answer to 2 significant figures.

[3 marks]

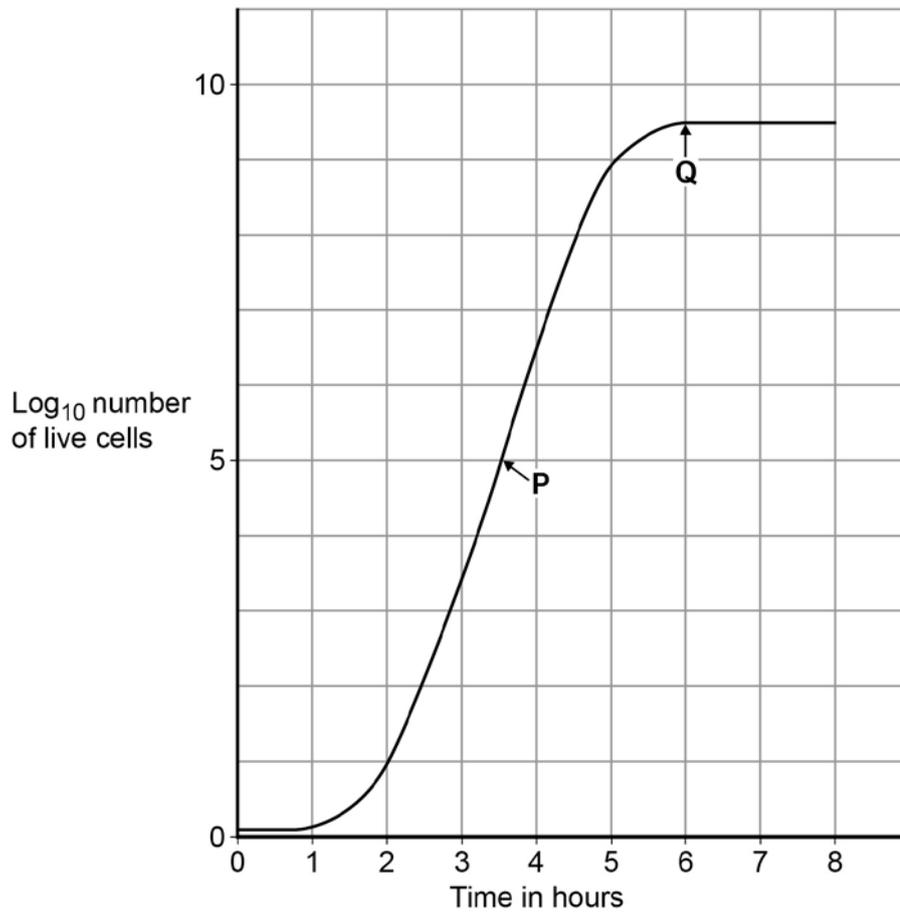
Time in **Stage 2** = _____ minutes

Question 9 continues on the next page

Bacteria such as *Escherichia coli* undergo cell division similar to mitosis.

Figure 7 shows a growth curve for *E. coli* grown in a nutrient broth.

Figure 7



0 9 . 5 What type of cell division causes the change in number of *E. coli* cells at **P**?

[1 mark]

0 9 . **6** Suggest why the number of cells levels out at **Q**.

[2 marks]

Turn over for the next question

Turn over for the next question

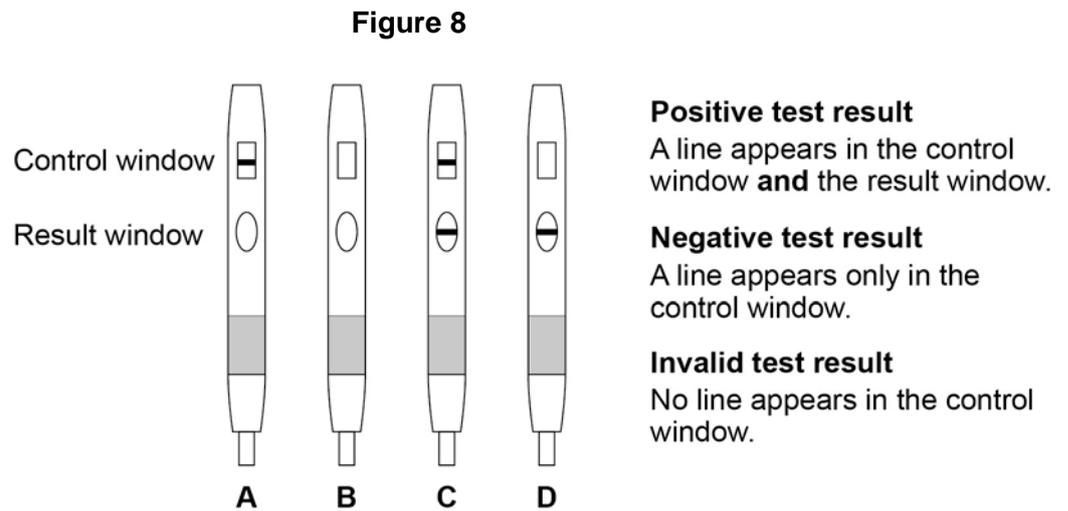
1 1

Monoclonal antibodies are used to measure the levels of hormones in the blood.

Pregnant women produce the hormone HCG.

HCG is excreted in urine.

Figure 8 shows four pregnancy test strips.



1 1

. 1

Which test strip shows a negative test result?

[1 mark]

Tick **one** box.

A	B	C	D
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1 1

. 2

Monoclonal antibodies are used for pregnancy testing.

Give **one other** use of monoclonal antibodies.

[1 mark]

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Figure 5: Snail © karandaev/Thinkstock
Figure 6: Cell A © Ed Reschke/Getty Images
Figure 6: Cell B © Ed Reschke/Getty Images
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