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

Do not write outside the box

0 1 This question is about cells and transport.

0 1 . 1 Complete **Table 1**.

[3 marks]

Table 1

Name of cell part	Function of cell part
	Contains genetic information
Mitochondria	
	Controls the movement of substances into and out of the cell

Cells in potatoes are plant cells.

Cells in potatoes do **not** contain chloroplasts.

0 1 . 2 What is the function of chloroplasts?

[1 mark]

0 1 . 3 Name **one** type of cell in a potato plant that does **not** contain chloroplasts.

[1 mark]

Question 1 continues on the next page

Do not write outside the box

The student calculated the percentage change in mass of each potato piece.

0 1 . 6 For one potato piece:

- the starting mass was 2.5 g
- the end mass was 2.7 g.

Calculate the percentage increase in mass of the potato piece.

[2 marks]

Use the equation:

$$\text{percentage increase in mass} = \frac{\text{increase in mass}}{\text{starting mass}} \times 100$$

Percentage increase in mass = _____ %

Question 1 continues on the next page

Do not write outside the box

0 1 . 9 Explain why the potato pieces in the 0.4 mol/dm^3 salt solution decreased in mass.

[3 marks]

17

Do not write outside the box

0 2 . 3 A fungal cell divides once every 90 minutes.

How many times would this fungal cell divide in 24 hours?

[2 marks]

Number of times cell divides in 24 hours = _____

Do not write outside the box

0 3 A student prepared some onion cells.

The student viewed the onion cells using a light microscope.

This is the method used.

1. Cut an onion into pieces using a sharp knife.
2. Peel off a thin layer of onion epidermis from one piece of onion.
3. Place the onion epidermis onto a microscope slide in a single flat layer.
4. Add three drops of iodine solution.
5. Slowly lower a cover slip at an angle onto the onion epidermis.
6. Place the slide on the stage of the microscope.

0 3 . 1 **Table 4** shows a risk assessment for this experiment.

Complete **Table 4**.

[2 marks]

Table 4

Hazard	Risk	Plan to minimise risk
Iodine solution is an irritant	May cause allergic reaction or skin rash	
Sharp knife		

Do not write outside the box

0 3 . 2 Give a reason for each of the following steps in the method.

[3 marks]

A **thin layer** of onion epidermis is used.

Iodine solution is added to the onion epidermis.

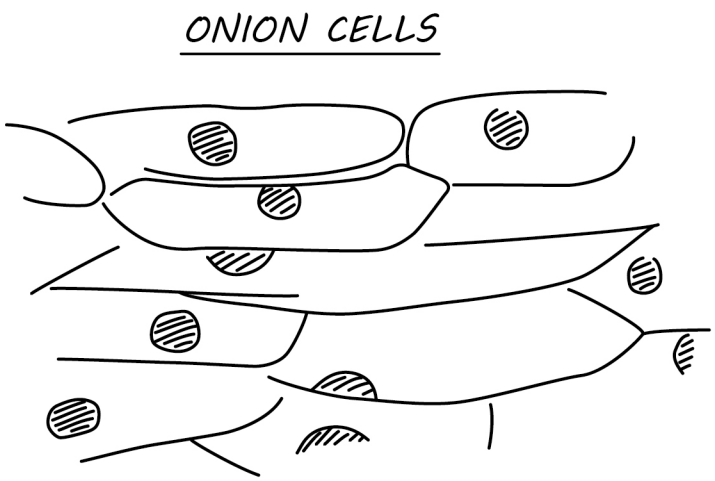
The cover slip is lowered onto the onion epidermis **at an angle**.

Question 3 continues on the next page

Do not write outside the box

Figure 4 shows the student's drawing of **Figure 3**.

Figure 4



0 3 . 4 Give **two** ways the student could improve the drawing in **Figure 4**.

[2 marks]

1 _____

_____

2 _____

_____

0 3 . 5 Onion cells can be seen using an electron microscope.

Give **two** ways onion cells would look different when seen using an electron microscope.

[2 marks]

1 _____

_____

2 _____

_____

14

Turn over for the next question

Do not write outside the box

0 4 Plants and animals have many defence responses.

0 4 . 1 **Table 5** shows some plant defences.

Identify whether each defence is a chemical response or a physical response.

[2 marks]

Tick (✓) **one** box in each row.

Table 5

	Type of response	
Plant defence	**Chemical**	**Physical**
Thick, waxy layer on leaf surface		
Berries that are poisonous		
Bark on trees that falls off		

Do not write outside the box

0 5 Water and carbon dioxide are exchanged between leaves and the atmosphere through pores called stomata.

0 5 . 1 Name the cells that control the opening and closing of the stomata.

[1 mark]

Water moves through a plant in the transpiration stream.

0 5 . 2 Describe **two** differences between the transpiration stream and translocation.

[2 marks]

1

2

0 5 . 3 Which environmental conditions would cause the rate of transpiration to be greatest in a plant?

[1 mark]

Tick (✓) **one** box.

- Cold with low humidity ☐
- Cold with high humidity ☐
- Warm with low humidity ☐
- Warm with high humidity ☐

Do not write outside the box

0 5 . 5 The changes in the mean width of the stomata in low atmospheric carbon dioxide are different from the changes in normal conditions.

Explain how the difference helps the plant to survive in low atmospheric carbon dioxide.

[2 marks]

10

Turn over for the next question

Do not write outside the box

0 6 **Table 6** shows information about five different organisms.

Table 6

Organism	Surface area in m^2	Volume in m^3	Surface area to volume ratio
A	6.04×10^{-8}	1.65×10^{-12}	36606:1
B	3.21×10^{-3}	1.25×10^{-6}	2568:1
C	9.96×10^{-3}	1.35×10^{-4}	**X**:1
D	4.61×10^{-1}	1.57×10^{-2}	29:1
E	1.99×10^{1}	6.12×10^{0}	3:1

0 6 . 1 Calculate value **X** in **Table 6**.

Give your answer to the nearest whole number.

[3 marks]

X (nearest whole number) = _____

0 6 . 2 What is the relationship between the size of an organism and its surface area to volume ratio?

Use **Table 6**.

[1 mark]

Do not write outside the box

0 6 . 3 Organism **B** exchanges gases with the environment directly through its skin.

Organism **D** exchanges gases with the environment using its respiratory system.

Explain why organism **D** requires a respiratory system, but organism **B** does **not** require a respiratory system.

[2 marks]

Question 6 continues on the next page

Do not write outside the box

0 7 Human immunodeficiency virus (HIV) is a pathogen.

0 7 . 1 Give **one** way HIV can spread from one person to another person.

[1 mark]

Table 8 shows information about new cases of HIV diagnosed in the UK.

Table 8

Year	Number of new HIV cases in women	Number of new HIV cases in men
2010	376	2266
2012	361	2310
2014	397	2370
2016	298	1886
2018	242	1288

0 7 . 2 Describe the trends shown in **Table 8** between 2010 and 2018.

[2 marks]

0 7 . 3 Suggest **one** reason for the change in the number of new HIV cases between 2014 and 2018.

[1 mark]

Do not write outside the box

0 7 . 4 Calculate the ratio of new cases of HIV in women to new cases of HIV in men in 2018.

Give your answer to 3 significant figures.

[3 marks]

Ratio (3 significant figures) = _____ : 1

0 7 . 5 In the UK population the total number of women is greater than the total number of men.

The data in **Table 8** is used to compare the proportions of new cases of HIV in the population for men and women.

Suggest how the data could be presented differently so that a more valid comparison can be made.

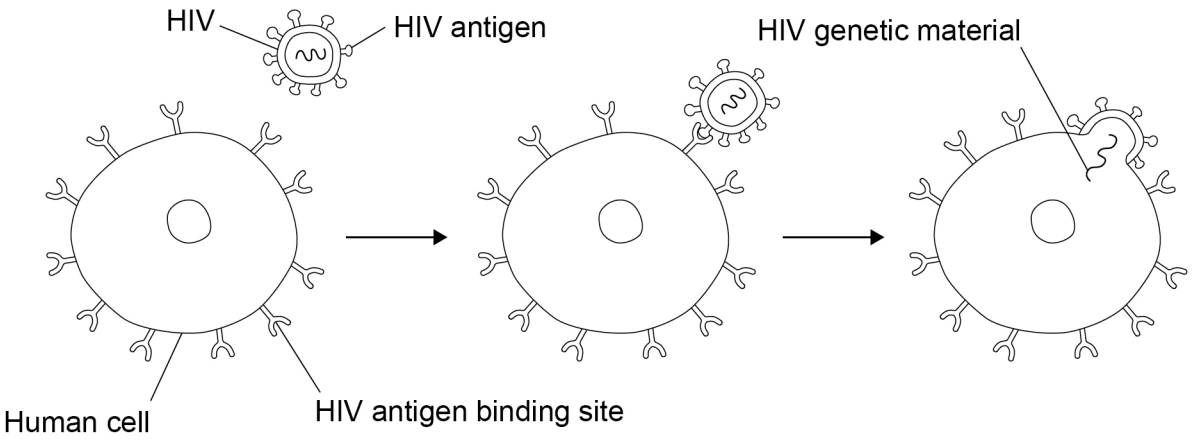
[1 mark]

Question 7 continues on the next page

Do not write outside the box

0 7 . 8 **Figure 9** shows how HIV enters a human cell.

Figure 9



Suggest how the monoclonal antibody for HIV helps to prevent a person infected with HIV developing AIDS.

Use information from **Figure 9**.

[3 marks]

19

END OF QUESTIONS

Do not write outside the box

Chemical **A** has **not** been tested in large-scale clinical trials in the UK.

0 1 . 7 It is important for drugs to be tested in clinical trials before the drugs are approved for use by the public.

Give **two** reasons why.

[2 marks]

1 _____

_____

2 _____

_____

There are many online reports making claims about the effects of chemical **A**.

Some of these reports are biased.

0 1 . 8 Suggest **one** reason why a report making claims about the effects of chemical **A** may be biased.

[1 mark]

_____

_____

Do not write outside the box

0 2 . 3 A group of cells called the pacemaker controls the resting heart rate.

Where in the heart is the pacemaker found?

[1 mark]

Tick (✓) **one** box.

Left atrium ☐

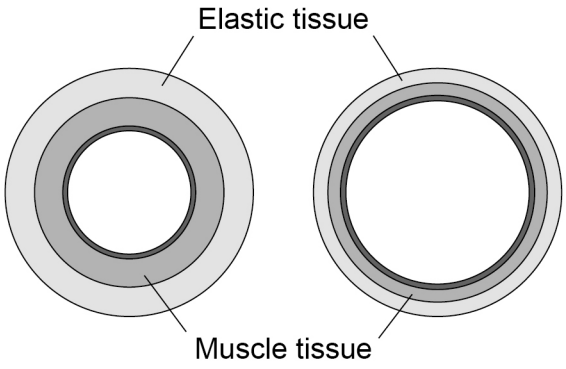
Left ventricle ☐

Right atrium ☐

Right ventricle ☐

0 2 . 4 **Figure 2** shows a cross section of an artery and of a vein.

Figure 2



Describe **two** ways that the structure of an artery is different from the structure of a vein.

[2 marks]

1 _____

_____

2 _____

_____

Question 2 continues on the next page

Do not write outside the box

0 2 . 8 Explain the effect of a partly blocked coronary artery on the human body.

[6 marks]

0 2 . 9 There are different treatments for a blockage in a coronary artery.

Explain how **one** treatment for a blockage in a coronary artery works.

[2 marks]

19

Do not write outside the box

Most cases of food poisoning do **not** need to be treated with antibiotics.

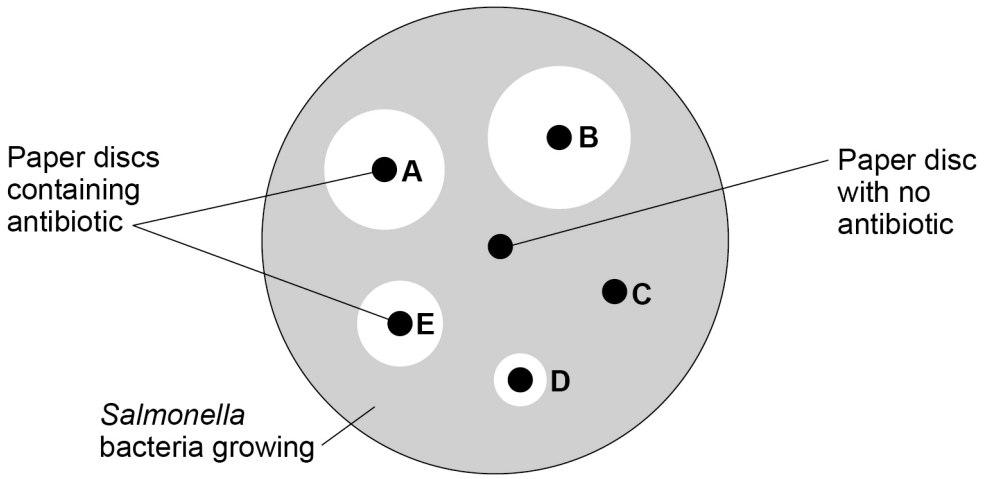
However, some patients may need to take antibiotics to recover.

Scientists investigated the effectiveness of five different antibiotics on the *Salmonella* bacteria in the outbreak.

Antibiotics **A**, **B**, **C**, **D** and **E** were used in the investigation.

Figure 4 shows the results.

Figure 4



0 3 . 3 Describe **two** aseptic techniques the scientists should have used in the investigation.

[2 marks]

1 _____

_____

2 _____

_____

Do not write outside the box

0 3 . 4 The scientists incubated the bacteria at 37 °C.
Students in school laboratories incubate bacteria at 25 °C.

Explain why scientists use 37 °C but students must use 25 °C to incubate bacteria.

[3 marks]

0 3 . 5 What is the purpose of the paper disc with no antibiotic in **Figure 4**?

[1 mark]

0 3 . 6 The scientists concluded that either antibiotic **A** or antibiotic **B** should be prescribed to patients with food poisoning.

Why should antibiotic **A** or antibiotic **B** be prescribed?

[1 mark]

0 3 . 7 The scientists wanted to be more certain about which antibiotic should be prescribed.

Describe how the results in **Figure 4** could be used to obtain a **quantitative** comparison of antibiotics **A** and **B**.

[1 mark]

Turn over ►

Do not write outside the box

0 3 . 8 One year later, there was another outbreak at the farm involving *Salmonella* bacteria.

Antibiotic **B** did **not** have an effect.

Suggest why antibiotic **B** no longer had an effect.

[1 mark]

0 3 . 9 Antibiotics treat food poisoning because they kill *Salmonella* bacteria inside the human body.

Some antibiotics work because they damage the bacterial cell wall.

The bacteria die because the cells burst.

Explain why the cells burst.

[3 marks]

17

Do not write outside the box

Anabolic steroids are drugs.

Anabolic steroids:

- increase muscle mass in humans
- are banned in most competitive sports.

Some athletes take anabolic steroids to improve their performance in sport.

0 4 . 3 Explain how taking anabolic steroids could improve an athlete's performance.

[2 marks]

Scientists use monoclonal antibodies to test for the presence of anabolic steroids in an athlete's urine.

To produce monoclonal antibodies, a mouse lymphocyte is combined with a tumour cell.

0 4 . 4 What type of cell is created when a mouse lymphocyte and a tumour cell combine?

[1 mark]

Tick (✓) **one** box.

Embryo ☐

Hybridoma ☐

Phagocyte ☐

Stem cell ☐

Do not write outside the box

0 4 . 5 Describe how scientists make monoclonal antibodies using the cell created when a mouse lymphocyte and a tumour cell combine.

[3 marks]

0 4 . 6 What property makes a monoclonal antibody useful in detecting the presence of an anabolic steroid in urine?

[1 mark]

Tick (✓) **one** box.

A monoclonal antibody is quick and easy to produce. ☐

A monoclonal antibody is specific to only one person's urine. ☐

A monoclonal antibody only binds to the anabolic steroid. ☐

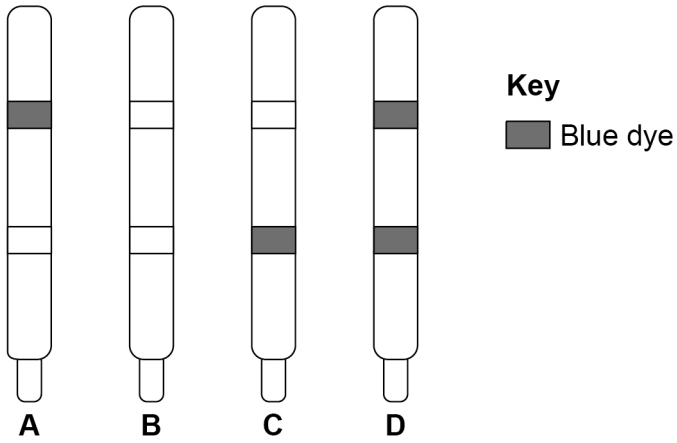
A monoclonal antibody can identify many different drugs at the same time. ☐

Question 4 continues on the next page

Do not write outside the box

Figure 6 shows the urine test results of four athletes.

Figure 6



0 4 . 8 Describe the evidence in **Figure 6** that shows the test for athlete **B** has **not** worked.

Suggest **one** reason why the test did **not** work.

[2 marks]

Evidence _____

_____

Reason _____

_____

0 4 . 9 Which athlete has tested positive for anabolic steroids in their urine?

[1 mark]

Tick (✓) **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐

21

Turn over ►

Do not write outside the box

The malarial protist is a eukaryotic cell.

Describe **three** ways the structure of the malarial protist is different from the structure of a prokaryotic cell.

Do **not** refer to size in your answer.

[3 marks]

1 _____

_____

2 _____

_____

3 _____

_____

0 5 . 3 During one stage of malaria infection, the malarial protists enter red blood cells and cause them to burst.

Explain why the bursting of red blood cells causes tiredness.

[2 marks]

_____

_____

_____

_____

Question 5 continues on the next page

Do not write outside the box

0 5 . 4 The malarial protist reproduces sexually and asexually during a life cycle.

Complete **Table 3** to give **three** differences between sexual reproduction and asexual reproduction.

[3 marks]

One difference has been completed for you.

Table 3

	Sexual reproduction	**Asexual reproduction**
	Involves two parents	Involves one parent
1		
2		
3		

0 5 . 5 One drug for treating malaria prevents mitosis occurring in the malarial protist.

The drug stops the synthesis of new DNA bases in the cell.

Suggest how the drug prevents mitosis occurring.

[1 mark]

Do not write outside the box

0 5 . 6 Describe the process of cell division by mitosis.

[3 marks]

Question 5 continues on the next page

Do not write outside the box

0 5 . 7 Different types of disease may interact.

Scientists studied the incidence of malaria infections in children:

- with disorder **S**
- without disorder **S**.

The incidence of malaria in children with disorder **S** was calculated as a percentage of the incidence in children without disorder **S**.

Table 4 shows the results.

Table 4

Age in years	Calculated percentage (%) incidence of malaria in children with disorder S
2 to < 4	69
4 to < 6	63
6 to < 8	50
8 to 10	45
> 10	73

Describe what the results in **Table 4** show about the interaction between disorder **S** and malaria.

[2 marks]

15

Do not write outside the box

0 6 . 4 Give the independent variable and the dependent variable in this investigation.

[2 marks]

Independent variable _____

Dependent variable _____

0 6 . 5 All of the air had to be removed from the leaf discs before placing them in the beaker.

Suggest **one** reason why.

[1 mark]

0 6 . 6 The leaf discs were placed in a beaker of sodium hydrogencarbonate ($NaHCO_3$) solution.

Explain why sodium hydrogencarbonate solution was used instead of water.

[2 marks]

0 6 . 7 Explain why the leaf discs moved to the surface of the solution during the investigation.

[2 marks]

Turn over ►

Do not write outside the box

0 1 . 3 Draw a simple diagram of the cell in **Figure 1**.

Label **two** parts of the cell.

[2 marks]

0 1 . 4 Name **one** structure found in a plant cell but **not** found in an animal cell.

[1 mark]

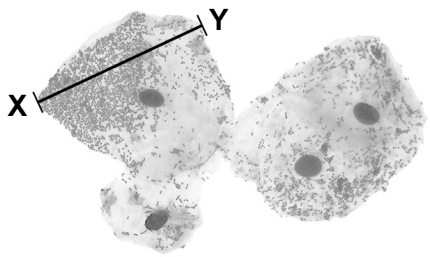
_____

Question 1 continues on the next page

Do not write outside the box

Figure 2 shows some different cells.

Figure 2



0 1 . 5 The real length from point **X** to point **Y** is 0.06 mm

Calculate the magnification.

Use the equation:

$$\text{magnification} = \frac{\text{size of image}}{\text{real size of object}}$$

[3 marks]

Magnification = × _____

Do not write outside the box

0 1 . 6 The cells shown in **Figure 2** were viewed using a light microscope.

Give **two** advantages of using an electron microscope instead of a light microscope.
[2 marks]

1 _____

_____

2 _____

_____

10

Turn over for the next question

Do not write outside the box

0 3 This question is about photosynthesis.

0 3 . 1 Complete the word equation for photosynthesis:

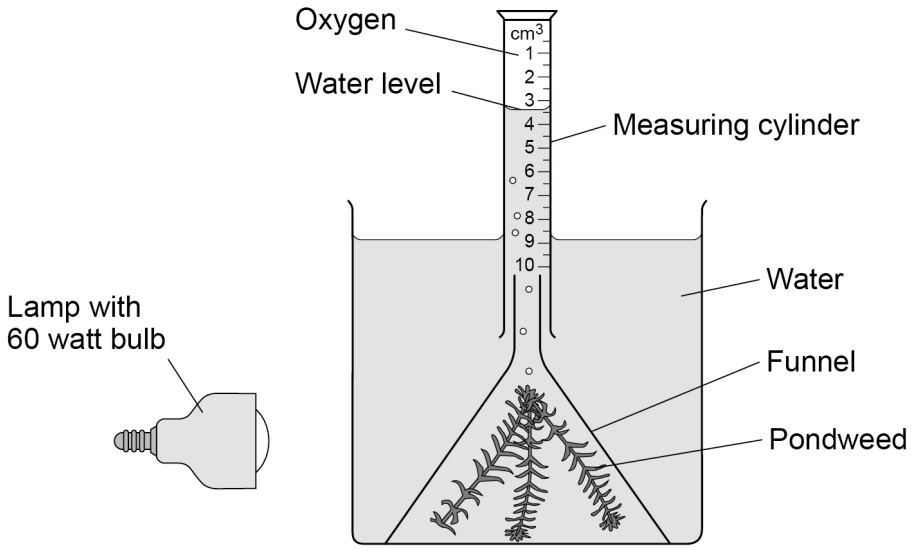
[2 marks]

_____ + _____ ⟶ _____ + oxygen

A student investigated photosynthesis using pondweed.

Figure 3 shows the apparatus the student used.

Figure 3



This is the method used.

1. Set up the apparatus as shown in **Figure 3**.
2. Switch on the lamp.
3. After 20 minutes, record the volume of oxygen collected in the measuring cylinder.
4. Repeat steps 1–3 using bulbs of different power output.

Do not write outside the box

0 3 . 2 What was the independent variable in the investigation?

[1 mark]

Tick (✓) **one** box.

Power output of bulb ☐

Rate of photosynthesis ☐

Time to collect oxygen ☐

Volume of oxygen collected ☐

0 3 . 3 Suggest **two** ways the method could be improved so the results would be more valid.

[2 marks]

1 _____

_____

2 _____

_____

Question 3 continues on the next page

Do not write outside the box

0 4 Water moves from a plant to the atmosphere through the leaves.

0 4 . 1 How is the volume of water lost from the leaves controlled?

[1 mark]

0 4 . 2 Describe the transport of water through a plant from the roots to the atmosphere.

[3 marks]

Question 4 continues on the next page

Do not write outside the box

0 4 . 3 Suggest **one** reason for the difference in the rate of water loss from the two plants in the first 2.5 hours.

[1 mark]

Both plants were moved to a different place at 2.5 hours.

0 4 . 4 Calculate the rate of water loss per hour in plant **B** from 2.5 hours to 3 hours.

Give your answer to **2** significant figures.

[3 marks]

Rate of water loss = _____ cm^3/hour

0 4 . 5 Suggest **two** reasons why the rate of water loss in both plants changed after 2.5 hours.

[2 marks]

1 _____

2 _____

10

Do not write outside the box

A patient with a leaking heart valve may have the valve replaced.

A study compared two different types of replacement heart valve:

- mechanical valves
- biological valves from pigs.

The data used in the study was collected from female patients aged 50–69.

Table 4 shows the data.

Table 4

	Type of replacement heart valve	
	Mechanical	**Biological**
Number of patients given the valve	2852	1754
Number of patients who died from heart-related problems after valve replacement	180	178
Percentage of patients alive after 5 years	91	89
Percentage of patients needing a second valve replacement within 6 years	2.2	5.2
Percentage of patients who had a blood clot on the brain after surgery	5.8	0.1

0 5 . 2 Give **one** conclusion about the death of patients from heart-related problems after a valve replacement.

Include calculations to support your answer.

[3 marks]

Do not write outside the box

0 6 People with diabetes have difficulty controlling their blood glucose concentration.

0 6 . 1 Which part of the blood transports glucose?

[1 mark]

Tick (✓) **one** box.

- Lymphocytes ☐
- Plasma ☐
- Platelets ☐
- Red blood cells ☐

Glucose is often found in the urine of people with diabetes.

0 6 . 2 Name a chemical used to test for glucose.

[1 mark]

_____

0 6 . 3 Describe a test that could be used to show that a person's urine contains glucose.

[2 marks]

Test _____

_____

Positive result _____

_____

Do not write outside the box

0 6 . 4 The body cells of a person with untreated diabetes lose more water than the body cells of a person who does **not** have diabetes.

Explain how diabetes can cause the body cells to lose more water.

[3 marks]

0 6 . 5 Glucose is absorbed into the blood in the small intestine by both diffusion and active transport.

Describe how the small intestine is adapted for efficient absorption.

[5 marks]

12

Do not write outside the box

0 7 . 3 Explain why having only one ventricle makes the circulatory system less efficient than having two ventricles.

[2 marks]

Figure 8 shows an axolotl.

Figure 8

0 7 . 4 Explain why an axolotl may die in water with a low concentration of oxygen.

[4 marks]

Do not write outside the box

0 8 Pancreatic cancer develops when a malignant tumour grows inside the pancreas.

0 8 . 1 The pancreas produces digestive enzymes.

What is an enzyme?

[2 marks]

0 8 . 2 Carbohydrase is an enzyme produced by the pancreas.

Name **two** other organs in the digestive system that produce carbohydrase.

[2 marks]

1 _____

2 _____

0 8 . 3 One symptom of pancreatic cancer is weight loss.

Explain how pancreatic cancer may cause a person to lose weight.

Do **not** refer to hormones in your answer.

[4 marks]

Do not write outside the box

Scientists have developed a drug that inhibits enzyme **A**.

The drug is given to pancreatic cancer patients who have the gene mutation that stops cancer cells producing enzyme **B**.

The drug only targets cancer cells.

0 8 . 4 Explain why the drug can be used to treat pancreatic cancer in patients with the gene mutation.

Use information from **Figure 9**.

[3 marks]

0 8 . 5 Explain why the drug could **not** be used to treat pancreatic cancer in a patient that produces both enzyme **A** and enzyme **B**.

[2 marks]

Question 8 continues on the next page

Do not write outside the box

0 8 . 6 The drug was trialled before it was licensed for use.

To improve validity of the results in the trial:

- some patients were given a placebo
- a double-blind trial was used.

Give reasons why a placebo and a double-blind trial were used.

[2 marks]

A placebo _____

_____

_____

A double-blind trial _____

_____

_____

0 8 . 7 One stage in a drug trial is to test the drug on healthy volunteers.

What is the next stage in the drug trial?

[1 mark]

Tick (✓) **one** box.

Testing on all patients with the disease ☐

Testing on human tissue ☐

Testing on live animals ☐

Testing on volunteers with the disease ☐

Do not write outside the box

0 8 . 8 A monoclonal antibody has been produced to treat pancreatic cancer.

Explain how the monoclonal antibody works to treat pancreatic cancer.

[3 marks]

19

END OF QUESTIONS

Do not write outside the box

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

0 1 This question is about photosynthesis.

0 1 . 1 Complete the word equation for photosynthesis.

[2 marks]

_____ + _____ → _____ + oxygen

0 1 . 2 Describe how energy for the photosynthesis reaction is gained by plants.

[2 marks]

Students investigated the effect of temperature on the rate of photosynthesis.

The students shone light from a lamp onto pondweed and measured the volume of oxygen produced per hour.

Table 1 shows the results.

Table 1

Temperature in °C	Rate of photosynthesis in cm^3/hour			
	Test 1	**Test 2**	**Test 3**	**Mean**
20	18.5	19.3	19.5	**X**
25	32.6	34.1	32.9	33.2
30	41.9	45.2	44.9	44.0
35	38.6	39.8	44.0	40.8
40	23.1	20.5	22.4	22.0
45	1.9	14.2	2.2	2.1

Do not write outside the box

0 1 . 3 Calculate mean value **X**.

[2 marks]

X = _____ cm^3/hour

The students identified one anomalous result in **Table 1**.

0 1 . 4 Draw a ring around the anomalous result in **Table 1**.

[1 mark]

0 1 . 5 Suggest **one** possible cause of the anomalous result.

[1 mark]

0 1 . 6 How did the students deal with the anomalous result?

[1 mark]

0 1 . 7 Give **one** factor the students should have kept constant in this investigation.

[1 mark]

Do not write outside the box

0 2 Diffusion is an important process in animals and plants.

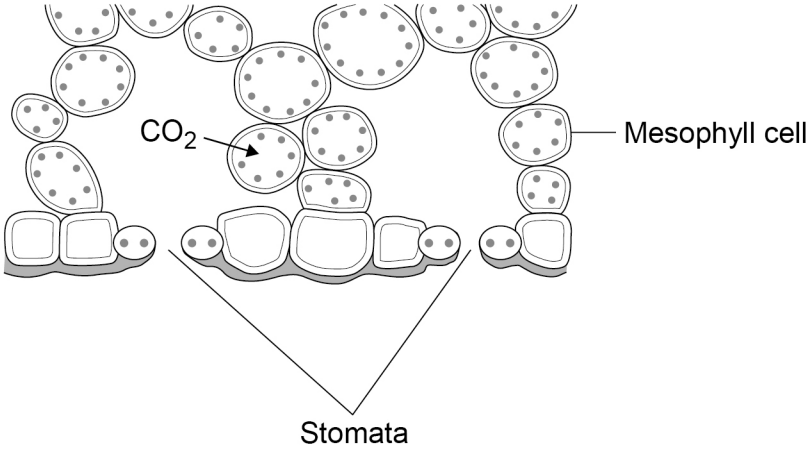
0 2 . 1 What is meant by the term diffusion?

[2 marks]

Do not write outside the box

0 2 . 2 **Figure 2** shows part of a leaf.

Figure 2



Molecules of carbon dioxide diffuse from the air into the mesophyll cells.

Which **two** changes will increase the rate at which carbon dioxide diffuses into the mesophyll cells?

[2 marks]

Tick (✓) **two** boxes.

Decreased number of chloroplasts in the cells ☐

Decreased surface area of cells in contact with the air ☐

Increased carbon dioxide concentration in the air ☐

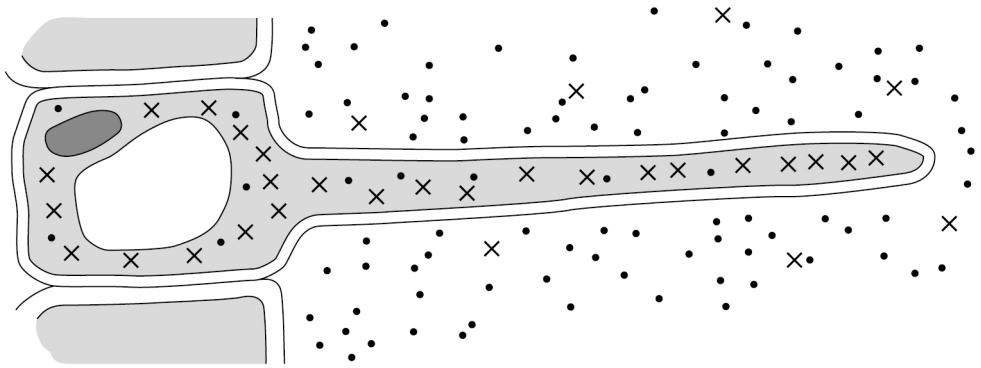
Increased number of stomata that are open ☐

Increased oxygen concentration in the air ☐

Do not write outside the box

Figure 4 shows a root hair cell.

Figure 4



Key

Water molecules

Nitrate ions

0 2 . 4 Name the process by which water molecules enter the root hair cell.

[1 mark]

0 2 . 5 Nitrate ions need a different method of transport into the root hair cell.

Explain how the nitrate ions in **Figure 4** are transported into the root hair cell.

Use information from **Figure 4** in your answer.

[3 marks]

Name of process

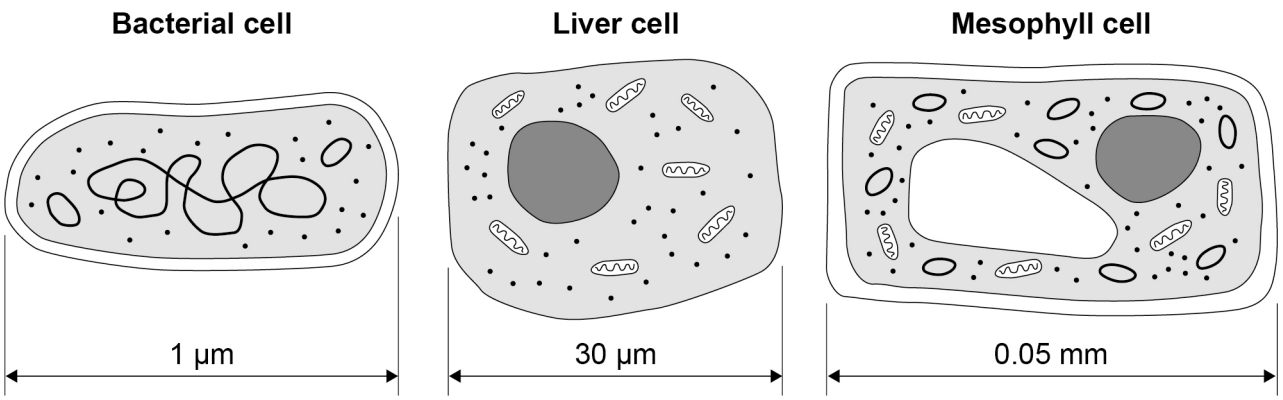
Explanation

14

Do not write outside the box

0 3 **Figure 5** shows three types of cell.

Figure 5



0 3 . 1 Give **two** similarities between the prokaryotic cell and the eukaryotic cells in **Figure 5**.

[2 marks]

1 _____

2 _____

0 3 . 2 Give **three** differences between the prokaryotic cell and the eukaryotic cells in **Figure 5**.

[3 marks]

1 _____

_____

2 _____

_____

3 _____

_____

Do not write outside the box

0 3 . 3 Calculate the ratio of the size of the bacterial cell to the size of the mesophyll cell.

[2 marks]

Ratio = 1 : _____

0 3 . 4 Name the type of cell division that produces genetically identical body cells for growth and repair.

[1 mark]

_____

Question 3 continues on the next page

Do not write outside the box

0 4 . 1 Lipases break down lipids.

Which **two** products are formed when lipids are broken down?

[2 marks]

Tick (✓) **two** boxes.

Amino acids ☐

Fatty acids ☐

Glucose ☐

Glycerol ☐

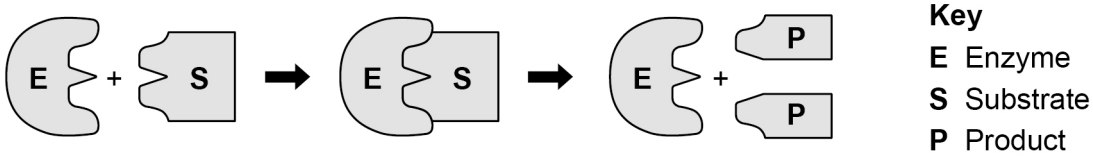
Glycogen ☐

Do not write outside the box

One model used to explain enzyme action is the 'lock and key theory'.

Figure 7 shows a model of the theory.

Figure 7



0 4 . 2 Explain the 'lock and key theory' of enzyme action.

Use information from **Figure 7** in your answer.

[3 marks]

0 4 . 3 There are many different types of lipase in the human body.

Why does each different type of lipase act on only **one** specific type of lipid molecule?

[1 mark]

Do not write outside the box

Students investigated the presence of starch and glucose in the leaves of geranium plants.

This is the method used.

1. Place two identical geranium plants on a bench near a sunny window for two days.

2. After two days:
   - leave one plant near the window for two more days.
   - place one plant in a cupboard with no light for two more days.

3. Remove one leaf from each plant.

4. Crush each leaf to extract the liquid from the cells.

5. Test the liquid from each leaf for glucose and for starch.

0 4 . 4 Describe how the students would find out if the liquid from the leaf contained glucose.

[3 marks]

0 4 . 5 Describe how the students would find out if the liquid from the leaf contained starch.

[2 marks]

Do not write outside the box

Table 2 shows the students' results.

Table 2

Test	Leaf from plant kept in light for four days	Leaf from plant kept in light for two days and then no light for two days
Glucose	Strong positive	Weak positive
Starch	Positive	Negative

0 4 . 6 Explain why the leaf in the light for four days contained both glucose and starch.

[2 marks]

0 4 . 7 Explain why the leaf left in a cupboard with no light for two days did contain glucose but did **not** contain starch.

[3 marks]

0 4 . 8 Suggest **one** way the students could develop the investigation to find out more about glucose and starch production in plants.

[1 mark]

17

Do not write outside the box

The gorse plant has nodules on its roots.

The nodules are part of the living root tissue.

Bacteria which convert nitrogen gas into soluble nitrate ions live in the nodule tissue.

Figure 9 shows the nodules on the roots.

Figure 9

0 5 . 5 Suggest how the nodules benefit the bacteria.

[2 marks]

0 5 . 6 Explain how the nodules benefit the gorse plant.

[2 marks]

Do not write outside the box

0 6 Data from 'The Million Women' survey in the UK was collected for over 15 years.

Scientists analysed the data to study the effect of consuming alcohol on liver disease.

The scientists:

- included 400 000 women who regularly consumed alcohol
- included 400 000 women who did **not** consume alcohol
- excluded women who already had a liver disease.

0 6 . 1 Age and gender were two factors controlled in this analysis.

Many other factors were also controlled.

Suggest **two** other factors which the scientists would have controlled.

[2 marks]

1 _____

_____

2 _____

_____

Question 6 continues on the next page

Do not write outside the box

0 6 . 2 A woman drinks 150 g of alcohol per week **not** with meals.

The woman decides to change to drinking 150 g of alcohol per week with meals.

Calculate the percentage decrease in relative risk of developing cirrhosis of the liver for this woman.

[2 marks]

Percentage decrease = _____ %

0 6 . 3 One glass of wine contains 12 g of alcohol.

A different woman drinks two glasses of wine each day with her meals.

Calculate the relative risk of developing cirrhosis of the liver for this woman.

[2 marks]

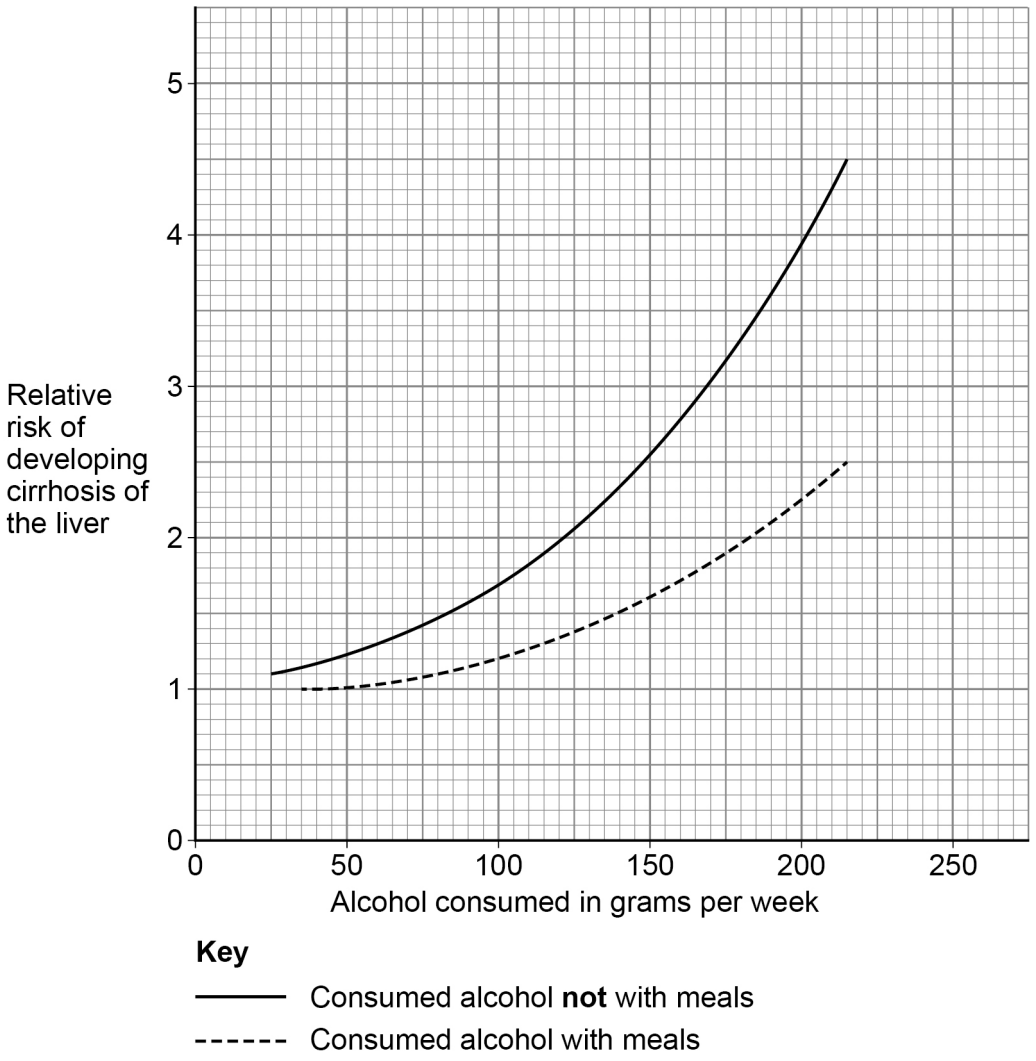
Relative risk = _____

Question 6 continues on the next page

Do not write outside the box

Figure 10 is repeated below.

Figure 10



0 6 . 4 Consuming alcohol with meals instead of not with meals decreases the relative risk of developing cirrhosis of the liver.

Give **two** other conclusions about the relative risk of developing cirrhosis of the liver related to alcohol consumption.

Use data from **Figure 10** in your answer.

[2 marks]

1 _____

_____

_____

2 _____

_____

_____

Do not write outside the box

0 6 . 5 Suggest **two** reasons why the data is considered to be valid.

[2 marks]

1 _____

_____

2 _____

_____

0 6 . 6 Suggest **one** aspect of the survey which might reduce validity.

[1 mark]

_____

_____

0 6 . 7 Cirrhosis of the liver leads to liver failure.

Describe the effects of liver failure on the human body.

[4 marks]

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

15

Turn over for the next question

Do not write outside the box

0 7 Monoclonal antibodies (mAbs) are usually made using mouse lymphocytes.

Candida albicans infection produces serious symptoms in patients with a poor immune system.

Recently scientists have produced mAbs to *Candida albicans* using human lymphocytes produced naturally after an infection.

0 7 . 1 *Candida albicans* lives in the throat of infected patients.

A sample is taken from the throat of a patient with a suspected *Candida albicans* infection.

The sample is transferred onto a microscope slide.

Describe how the mAbs and a fluorescent dye could be used to see any *Candida albicans* pathogens on the slide.

[3 marks]

Do not write outside the box

In a laboratory the human lymphocyte mAbs were injected into animals infected with *Candida albicans*.

The mAbs caused increased phagocytosis of the *Candida albicans* pathogens.

Doctors intend to start a trial to give the mAbs to patients severely ill with *Candida albicans.*

0 7 . 2 Explain how increased phagocytosis of the *Candida albicans* pathogen will help the patient.

[2 marks]

Question 7 continues on the next page

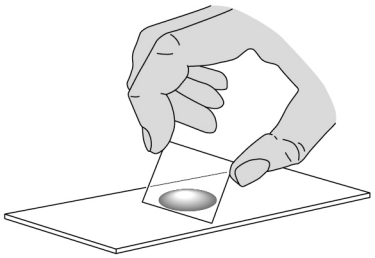
Answer **all** questions in the spaces provided.

Do not write outside the box

0 1 A student prepared some animal cells to view using a microscope.

Figure 1 shows the student preparing the cells.

Figure 1



0 1 . 1 Name **two** pieces of laboratory equipment the student could have used to **prepare** cells to view using a microscope.

[2 marks]

1 _____

2 _____

Do not write outside the box

0 1 . 5 Red blood cells are specialised animal cells.

Compare the structure of a red blood cell with the structure of a plant cell.

[6 marks]

0 1 . 6 When placed into a beaker of water:

- a red blood cell bursts
- a plant cell does **not** burst.

Explain why the red blood cell bursts but the plant cell does **not** burst.

[2 marks]

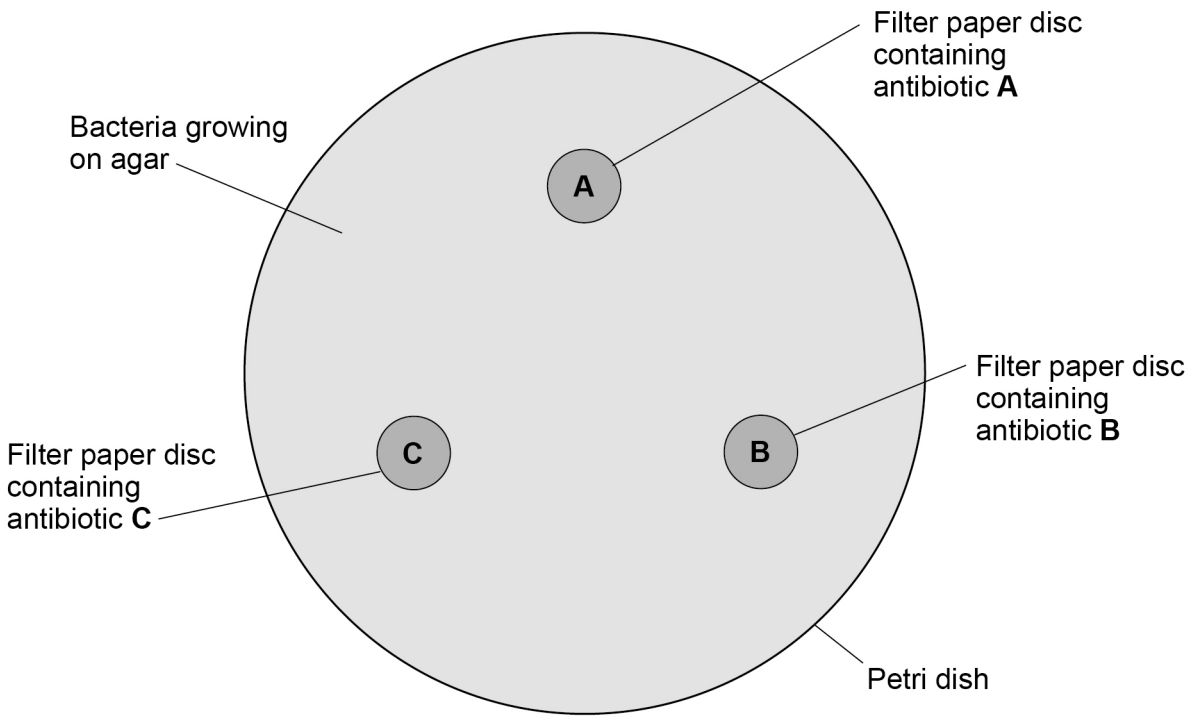
13

Do not write outside the box

0 2 A student investigated the effectiveness of three different antibiotics.

Figure 3 shows how the student set up an agar plate.

Figure 3



The student used aseptic techniques to make sure that only one type of bacterium was growing on the agar.

0 2 . 1 Describe **two** aseptic techniques the student should have used.

[2 marks]

1 _____

_____

_____

2 _____

_____

_____

Question 2 continues on the next page

Do not write outside the box

0 3 . 1 Which is the BMI category of person **A** in **Table 1**?

[1 mark]

Tick (✓) **one** box.

Clinically obese ☐

Normal ☐

Obese ☐

Overweight ☐

Underweight ☐

0 3 . 2 Calculate value **X** in **Table 1**.

Use the equation:

$$\text{BMI} = \frac{\text{body mass}}{\text{height}^2}$$

Give your answer to 3 significant figures.

[3 marks]

X = _____ kg/m^2

Question 3 continues on the next page

Do not write outside the box

Scientists think there is a link between BMI and life expectancy.

Table 2 shows information about predicted life expectancy of men after the age of 50.

Table 2

BMI Category	Predicted number of years living in good health after the age of 50	Predicted number of years living in bad health after the age of 50
Normal	19.06	4.98
Overweight	18.68	5.32
Obese	16.37	7.08
Clinically obese	13.07	10.10

0 3 . 3 Describe **two** patterns shown in **Table 2** about the effects of BMI category.

[2 marks]

1 _____

_____

_____

2 _____

_____

_____

Do not write outside the box

The number of people who are obese in the UK is increasing.

0 3 . 4 Explain the financial impact on the UK economy of an increasing number of people who are obese.

[2 marks]

0 3 . 5 A person who is obese is more at risk of arthritis.

Arthritis is a condition that damages joints.

Suggest how arthritis could affect a person's lifestyle.

[1 mark]

0 3 . 6 A person who eats a diet high in saturated fat might become obese.

Name **two** health conditions that might develop if a person eats a diet high in saturated fat.

Do **not** refer to arthritis in your answer.

[2 marks]

1 _____

2 _____

11

Turn over for the next question

Do not write outside the box

0 4 All living organisms respire.

0 4 . 1 What is the chemical equation for aerobic respiration?

[1 mark]

Tick (✓) **one** box.

$6\,O_2 + 6\,CO_2 \rightarrow 6\,H_2O + C_6H_{12}O_6$ ☐

$6\,H_2O + C_6H_{12}O_6 \rightarrow 6\,H_2O + 6\,CO_2$ ☐

$6\,H_2O + 6\,CO_2 \rightarrow 6\,O_2 + C_6H_{12}O_6$ ☐

$6\,O_2 + C_6H_{12}O_6 \rightarrow 6\,H_2O + 6\,CO_2$ ☐

0 4 . 2 Name the sub-cellular structures where aerobic respiration takes place.

[1 mark]

_____

0 4 . 3 Energy is released in respiration.

Give **two** uses of the energy released in respiration.

[2 marks]

1 _____

_____

2 _____

_____

Do not write outside the box

0 4 . 4 Describe **two** differences between aerobic and anaerobic respiration in humans.

Do **not** refer to oxygen in your answer.

[2 marks]

1 _____

_____

2 _____

_____

0 4 . 5 What are the **two** products of anaerobic respiration in plant cells?

[2 marks]

Tick (✓) **two** boxes.

Carbon dioxide ☐

Ethanol ☐

Glucose ☐

Lactic acid ☐

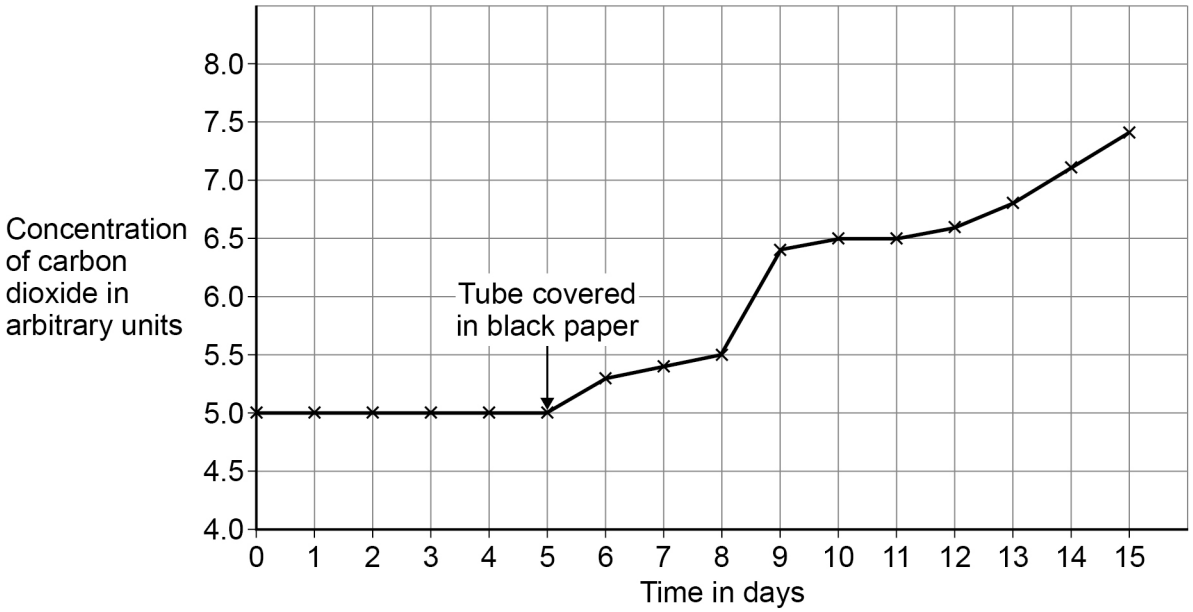
Water ☐

Question 4 continues on the next page

Do not write outside the box

Figure 7 shows the concentration of carbon dioxide inside the boiling tube over 15 days.

Figure 7



0 4 . 6 Explain why the concentration of carbon dioxide in the tube stayed the same between day 0 and day 5.

[2 marks]

0 4 . 7 Suggest why the concentration of carbon dioxide increased between day 5 and day 10.

[1 mark]

Question 4 continues on the next page

Do not write outside the box

0 4 . 8 On day 10, the pond snail died.

Explain why the death of the pond snail caused the concentration of carbon dioxide to increase after day 10.

[3 marks]

14

Do not write outside the box

0 5 Amylase is an enzyme that breaks down starch.

0 5 . 1 Amylase is a polymer of smaller molecules.

Name the type of smaller molecule.

[1 mark]

_____

0 5 . 2 Name the **three** parts of the human digestive system that produce amylase.

[2 marks]

1 _____

2 _____

3 _____

0 5 . 3 Explain how amylase breaks down starch.

Answer in terms of the 'lock and key theory'.

[3 marks]

_____

_____

_____

_____

_____

_____

Question 5 continues on the next page

Do not write outside the box

0 5 . 4 Name **two** control variables the student used in the investigation.

[2 marks]

1 _____

2 _____

0 5 . 5 Why did the student leave the starch solution and amylase solution for 5 minutes before mixing them?

[1 mark]

_____

_____

Question 5 continues on the next page

Do not write outside the box

0 5 . 7 Explain the results at 5 °C and at 80 °C.

Use **Table 3**.

[5 marks]

0 5 . 8 The student investigated the effect of temperature on amylase activity.

Describe how the student could extend the investigation to determine the effect of a different factor on amylase activity.

[2 marks]

17

Turn over for the next question

Do not write outside the box

0 6 . 7 Determine the rate of water loss at 12:00

Use the tangent on **Figure 10**.

Give your answer:

- in cm^3 per minute
- in standard form.

[4 marks]

Rate of water loss = _____ cm^3 per minute

0 6 . 8 The rate of water loss at midnight was much lower than at 12:00

Explain why.

[2 marks]

17

Turn over for the next question

Do not write outside the box

In one type of blood transfusion, **only** red blood cells from a donor are transferred to the patient.

0 7 . 4 It is dangerous for a patient with blood group **A** to receive red blood cells from a donor with blood group **B**.

Explain why.

[3 marks]

0 7 . 5 Explain why blood group **O** red blood cells can be given to patients with any blood group.

[2 marks]

Question 7 continues on the next page