AQA

Please write clearly in block capitals.

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

Surname _____

Forename(s) _____

Candidate signature _____

I declare this is my own work.

GCSE
BIOLOGY

H

Higher Tier Paper 1H

Time allowed: 1 hour 45 minutes

Materials

For this paper you must have:
- a ruler
- a scientific calculator.

Instructions
- Use black ink or black ball-point pen.
- Pencil should only be used for drawing.
- Fill in the boxes at the top of this page.
- Answer **all** questions in the spaces provided.
- 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.
- In all calculations, show clearly how you work out your answer.

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

Information
- The maximum mark for this paper is 100.
- The marks for questions are shown in brackets.
- You are expected to use a calculator where appropriate.
- You are reminded of the need for good English and clear presentation in your answers.

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ANSWER IN THE SPACES PROVIDED

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

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
nucleus	Contains genetic information
Mitochondria	Site of aerobic respiration
cell membrane	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]

photosynthesis

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

[1 mark]

Root hair

Question 1 continues on the next page

Turn over ►

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A student investigated the effect of salt concentration on pieces of potato.

This is the method used.

1. Cut three pieces of potato of the same size.

2. Record the mass of each potato piece.

3. Add 150 cm^3 of 0.4 mol/dm^3 salt solution to a beaker.

4. Place each potato piece into the beaker.

5. After 30 minutes, remove each potato piece and dry the surface with a paper towel.

6. Record the mass of each potato piece.

7. Repeat steps 1 to 6 using different concentrations of salt solution.

0 1 . 4 What is the independent variable in the investigation?

[1 mark]

Tick (✓) **one** box.

- Concentration of salt solution ☑
- Mass of potato piece ☐
- Time potato is left in salt solution ☐
- Volume of salt solution ☐

0 1 . 5 Why did the student dry the surface of each potato piece with a paper towel in step **5**?

[1 mark]

To make sure only the potato mass was measured OR if water / solution / liquid was left on (the potato), the mass would be higher / affected

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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:

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

0.2/2.5×100 =8(%)

Percentage increase in mass = 8 %

Question 1 continues on the next page

The student used the results from each potato piece to calculate the mean percentage change in mass at each concentration.

Table 2 shows the results.

Table 2

Concentration of salt solution in mol/dm^3	**Mean percentage (%) change in mass**
0.0	9.8
0.1	9.5
0.2	7.0
0.3	0.4
0.4	–1.4

0 1 . 7 Complete **Figure 1**.

You should:

- label the x-axis
- use a suitable scale for the x-axis
- plot the data from **Table 2**
- draw a line of best fit.

[4 marks]

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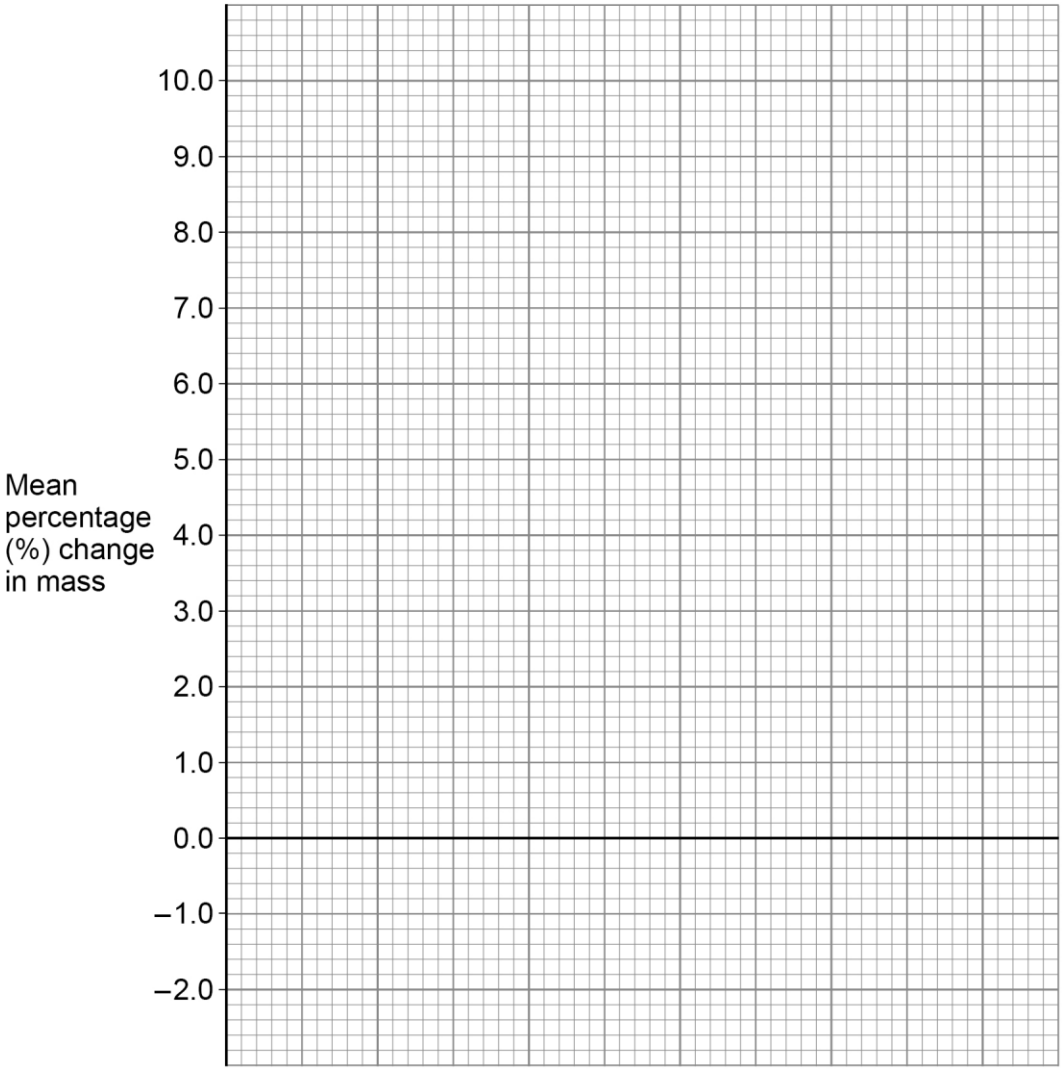
Figure 1



0 1 . 8 What concentration of salt solution was equal to the concentration of the solution inside the potato pieces?

Use **Figure 1**.

[1 mark]

Concentration = _____ mol/dm^3

Question 1 continues on the next page

Turn over ►

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

[3 marks]

Water moves out of cells / potato by osmosis because) the solution in the cells / potato is less concentrated than outside

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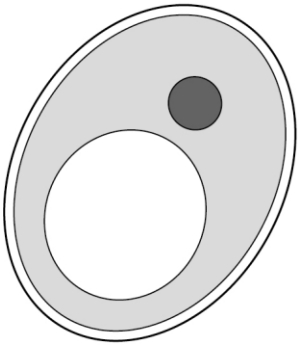
0 2 Plant cells and fungal cells are similar in structure.

Figure 2 shows a fungal cell.

Figure 2



0 2 . 1 Name **one** structure in **Figure 2** which is present in both plant cells and fungal cells but **not** in animal cells.

[1 mark]

Cell wall or large / permanent vacuole

0 2 . 2 Which disease is caused by a fungus?

[1 mark]

Tick (✓) **one** box.

Gonorrhoea ☐

Malaria ☐

Measles ☐

Rose black spot ☑

Question 2 continues on the next page

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

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

[2 marks]

24 × 60/90

16

Number of times cell divides in 24 hours = 16

Some types of fungal cell are grown to produce high-protein food.

The high-protein food can be used to make meat-free burgers.

0 2 . 4 Where is protein digested in the human digestive system?

[1 mark]

Tick (✓) **one** box.

- Large intestine ☐
- Liver ☐
- Salivary glands ☐
- Stomach ☑

0 2 . 5 Which chemical could be used to test if the burgers contain protein?

[1 mark]

Tick (✓) **one** box.

- Benedict's reagent ☐
- Biuret reagent ☑
- Ethanol ☐
- Iodine solution ☐

Question 2 continues on the next page

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0 2 . 6 **Table 3** shows some information about burgers made from meat and meat-free burgers.

Table 3

	Mass per 100 g of burger	
	Burgers made from meat	**Meat-free burgers**
Protein in g	14.0	9.0
Fibre in g	0.9	5.5
Fat in g	16.0	5.2
Carbohydrate in g	15.5	15.1
Cholesterol in mg	120.0	0.0

Evaluate the use of burgers made from meat compared with meat-free burgers in providing humans with a healthy, balanced diet.

Use information from **Table 3** and your own knowledge.

[6 marks]

• meat-free burgers contain more fibre; aids digestion or prevents constipation meat burgers contain more protein
• for growth

• meat burgers contain more fat ,it can cause CHD or heart attack or narrowing of arteries
• may lead to needing a stent, may lead to obesity.Obesity is a risk factor for (type 2) diabetes

• meat burgers contain more cholesterol,It can cause narrowing of arteries or CHD or heart attack may lead to needing a stent ,may need to take statins

• both burgers have similar amounts of carbohydrate,good for providing energy

• no information on vitamins / minerals provided for either burger

• meat burgers require animals to be farmed
• increase in methane in atmosphere
• (methane) contributes to global warming

• meat burgers require animals to be slaughtered ;ethical issues

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Turn over for next question

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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	wash skin immediately (after contact) or wear gloves or clean up spills
Sharp knife	may cut you	cut away from the body or cut on a chopping board

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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.

help see individual cells

Iodine solution is added to the onion epidermis.

stain / see the parts of the cell

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

prevent / reduce air bubbles

Question 3 continues on the next page

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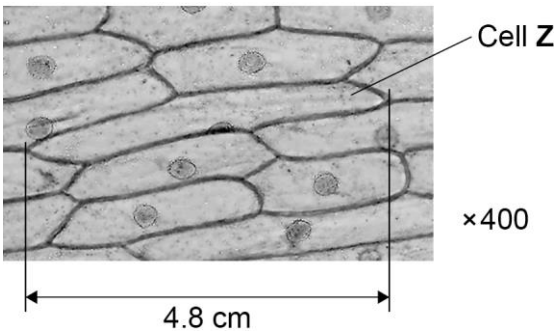
Figure 3 shows what the student saw under the microscope at a magnification of ×400.

Figure 3



0 3

. 3 The length of cell **Z** in **Figure 3** is 4.8 cm.

Calculate the real length of cell **Z**.

Give your answer in micrometres (µm).

[5 marks]

recall of equation
magnification = size of image/ size of real object

rearrangement of equation
~~size of real object = size of image/ magnification~~

substitution
4.8/400

0.012 (cm)

conversion
~~120 (µm)~~

Real length of cell **Z** = _____ µm

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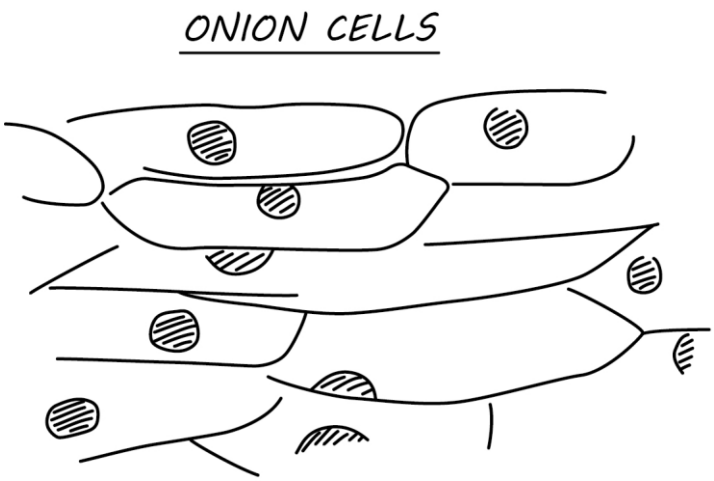
Figure 4 shows the student's drawing of **Figure 3**.

Figure 4



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

[2 marks]

1 include magnification / scale

2 use continuous lines

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 (would) look more magnified / bigger and cell would have more detail

2 be at a higher resolution or we can see more sub-cellular structures

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Turn over for the next question

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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

Mimicry is a mechanical adaptation seen in both plants and animals.

Figure 5 shows two insects.

Figure 5

Hornet **Hornet Moth**

0 4 . 2 Hornets are insects that sting other animals and cause pain.

Hornet moths do **not** sting other animals.

Suggest how mimicry helps the **hornet moth** survive.

[1 mark]

It looks like the hornet so predators / animals are tricked / deceived by the colourin and avoid eating it

Question 4 continues on the next page

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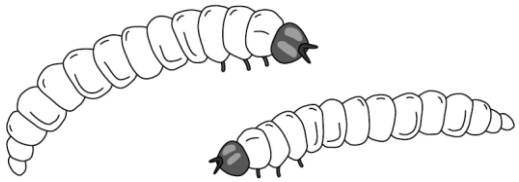
Adult hornet moths lay eggs that hatch into larvae.

Figure 6 shows the larvae of a hornet moth.

Figure 6



0 4 . 3 The larvae of the hornet moth:

- live inside the roots of trees
- use the tree roots as a source of food
- cause damage to the tree roots.

Explain why a tree might die if the roots of the tree are damaged.

[6 marks]

less absorption of water
less water so lower rate of photosynthesis so less glucose produced
o for respiration / energy release so less cellulose produced so fewer cells walls / cells made so fewer amino acids produced to make new proteins AND cells lose turgidity

• less absorption of (named) ions / minerals
o fewer nitrates so fewer proteins made for growth, fewer magnesium ions so less chlorophyll produced so lower rate of photosynthesis

• damage to phloem
o less transport of sugars to root cells for respiration / energy release

• damage to xylem
o less water transported (to cells; fewer nitrates reach cells so fewer proteins made for growth
o fewer magnesium ions reach cells so less chlorophyll produced
o less magnesium / chlorophyll so lower rate of photosynthesis

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0 4 . 4 The larvae of the hornet moth form when fertilised eggs divide by mitosis.

Describe how mitosis produces two genetically identical cells.

[4 marks]

genetic material / DNA / chromosomes is doubled / replicated / copied / duplicated.

The (replicated) chromosomes are pulled / moved apart.

Cytoplasm divides into two (cells) or cell membrane divides to form two cells.

0 4 . 5 The cells which are first formed from the fertilised eggs of the hornet moth are stem cells.

Name the process by which these stem cells then form specialised cells.

[1 mark]

Differentiation

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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]

Guard cells

Water moves through a plant in the transpiration stream.

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

[2 marks]

1 Transpiration stream involves xylem and translocation involves phloem

2 Transpiration stream transports water (and minerals / ions) and translocation transports dissolved sugars

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 ☐

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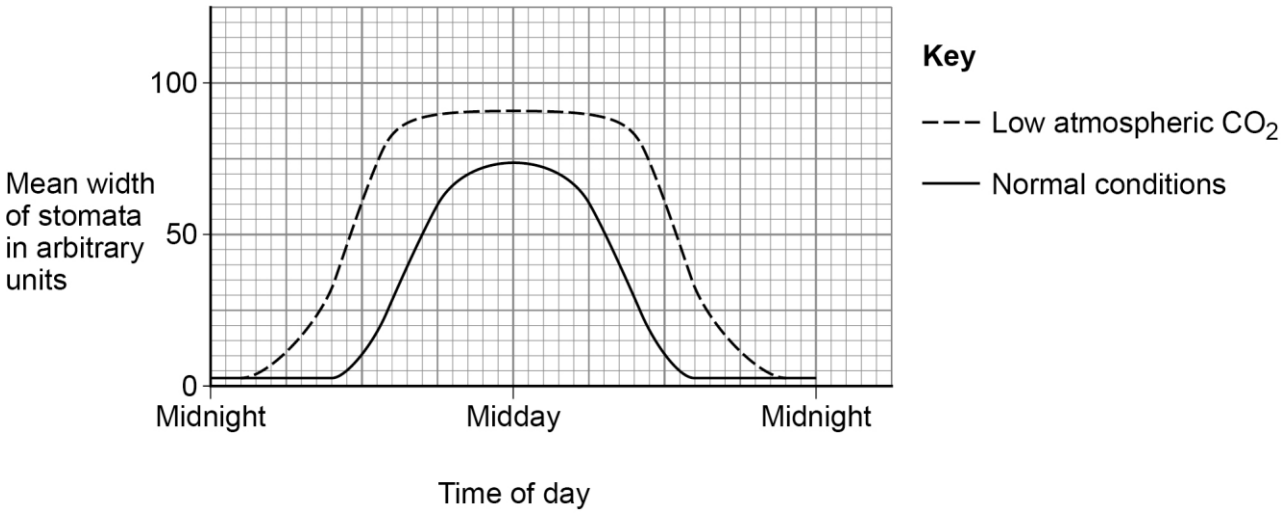
Figure 7 shows information about the mean width of the stomata in a plant.

Figure 7



0 5 . 4 The changes in the mean width of the stomata in **normal conditions** are an advantage to the plant.

Explain how.

[4 marks]

Stomata (almost) closed at (mid)night because there is no / less light for photosynthesis

closing stomata) reduces / prevents water loss. Stomata open wide at midday as maximum light

intensity for photosynthesis and stomata open wide to take in most / more carbon dioxide for

photosynthesis.

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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]

Stomata are open wider and for more time so allows plant) to take in more carbon dioxide for photosynthesis.

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Turn over for the next question

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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]

9.96 ×10-3/ 1.35 ×10-4

73.77…

74

X (nearest whole number) = 74

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]

As size increases,surface area to volume ratio decreases

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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]

D has a smaller surface area to volume ratio than B so diffusion distance is too large to meet demands of cells / organism.

Question 6 continues on the next page

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Table 6 is repeated below.

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

Table 7 shows information about organism **D** and organism **E**.

Table 7

Organism	Metabolic rate in arbitrary units
D	890
E	75

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0 6 . 4 Organisms **D** and **E** both keep a constant body temperature (warm-blooded).

Explain why the metabolic rate of organism **D** is greater than the metabolic rate of organism **E**.

Use information from **Table 6** and **Table 7**.

[4 marks]

D has a larger surface area to volume ratio and so will lose heat more quickly (per unit volume than E and (D) requires greater rate of respiration as respiration is a large part of metabolism so need to generate more heat to keep itself warm.

Question 6 continues on the next page

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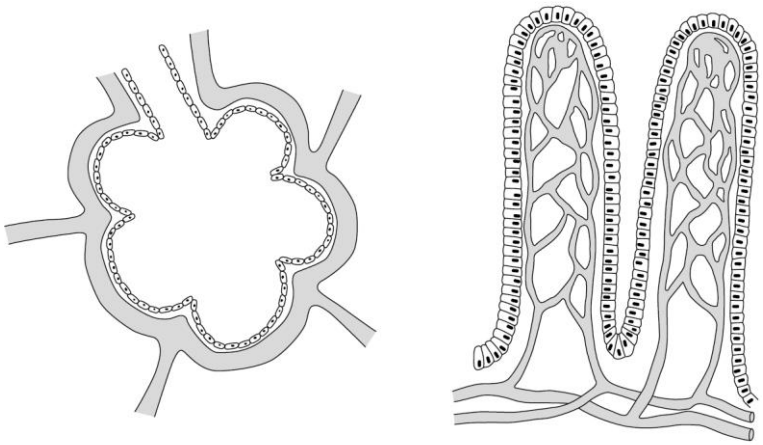
0 6 . 5 Organism **D** and organism **E** both have alveoli in the lungs and villi in the small intestine.

Figure 8 shows some alveoli and some villi.

Figure 8



Alveoli **Villi**

Describe how the alveoli and the villi are adapted to increase absorption.

[4 marks]

both have a large surface area to maximise diffusion

• both have thin walls or have walls that are one cell thick to reduce diffusion distance / time

• both are in close proximity to blood supply to reduce diffusion distance / time

• both have a good blood supply or both have a capillary network to maintain concentration gradient

• villi have microvilli to (further) increase surface area

• cells of villi contain many mitochondria for active transport

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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]

sexual contact / intercourse OR exchange of body fluids

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]

Number of cases in women decreases then increases, then decreases and number of cases in men increases then decreases.

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

[1 mark]

Better education into prevention of spread of HIV or condoms more widely available.

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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]

242/1288

= 0.1878…

=0.188

Ratio (3 significant figures) = 0.188 : 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]

Calculate as a percentage

Question 7 continues on the next page

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Scientists have been working to produce a vaccine for HIV for many years.

0 7 . 6 Explain how a vaccine for HIV could work to prevent a person developing HIV infection.

[4 marks]

Inactive HIV / virus is injected into bloodstream / muscle / body and white bloods cells produce antibodies, if infected with HIV specific antibodies are produced quickly antibodies destroy the active virus / HIV.

A person with late stage HIV infection has AIDS.

Scientists have produced monoclonal antibodies for HIV.
The monoclonal antibodies can prevent a person infected with HIV developing AIDS.

0 7 . 7 Describe how the monoclonal antibody for HIV can be produced.

[4 marks]

HIV / antigen / protein injected into mouse then extract / collect (mouse) lymphocytes that make a specific antibody to HIV / antigen / protein. Lymphocytes are combined with a tumour cell to create a hybridoma.Hybridoma cloned to create many cells that produce the antibody

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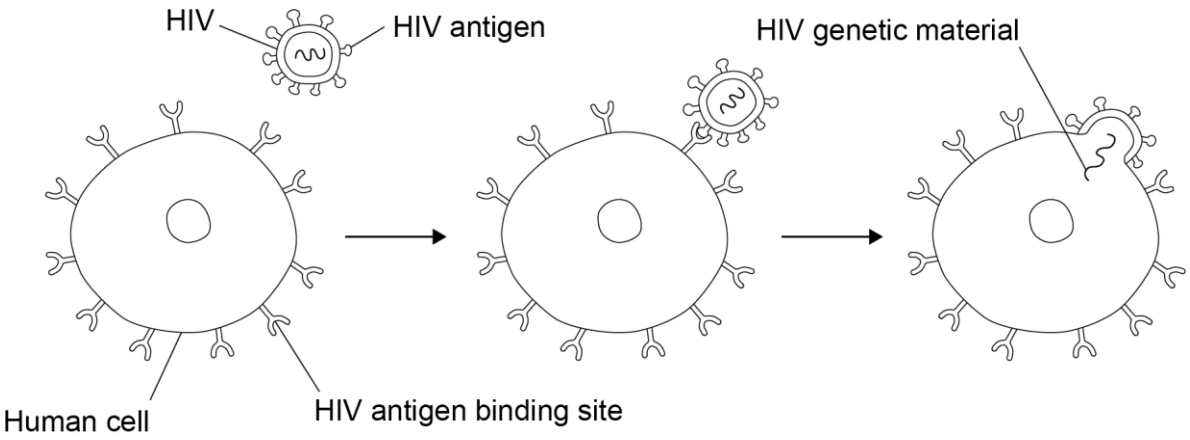
0 7 . 8 **Figure 9** shows how HIV enters a human cell.

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]

Monoclonal antibody is complementary / specific to HIV antigen. Monoclonal antibodies attach to (all the) HIV antigens so HIV cannot bind to human cell.

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END OF QUESTIONS

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