AQA

SPECIMEN MATERIAL

GCSE BIOLOGY

H

Higher Tier Paper 1H

Specimen 2018 Time allowed: 1 hour 45 minutes

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

Instructions
- Answer **all** questions in the spaces provided.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information
- There are 100 marks available on this paper.
- 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.
- When answering questions 02.4, 03.2, and 10 you need to make sure that your answer:
  - is clear, logical, sensibly structured
  - fully meets the requirements of the question
  - shows that each separate point or step supports the overall answer.

Advice
In all calculations, show clearly how you work out your answer.

Please write clearly, in block capitals.

Centre number ☐☐☐☐☐ Candidate number ☐☐☐☐

Surname ☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐

Forename(s) ☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐☐

Candidate signature _____

There are no questions printed on this page

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]

by the transpiration stream ✓, in the xylem ✓

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, 0, 3, 5

$\frac{n+1}{2}$

$\frac{5+1}{2} = 3^{rd}$

44 + 41 + 40 + 42 + 39 = 206

$\frac{206}{5} = 41.2$

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

[3 marks]

Mount epidermis on slide. Count stomata in one area. Repeat in 4 more areas. Calculate mean.

+ repeat method on other side of leaf

0 1 . 4 What is the median number of stomata on the upper surface of the leaf?

[1 mark]

1

0 1 . 5 Calculate the value of **X** in **Table 1**.

Give your answer to 2 significant figures.

[2 marks]

206 ÷ 5 = 41.2 ✓

Mean number of stomata on lower surface of leaf = 41 ✓

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]

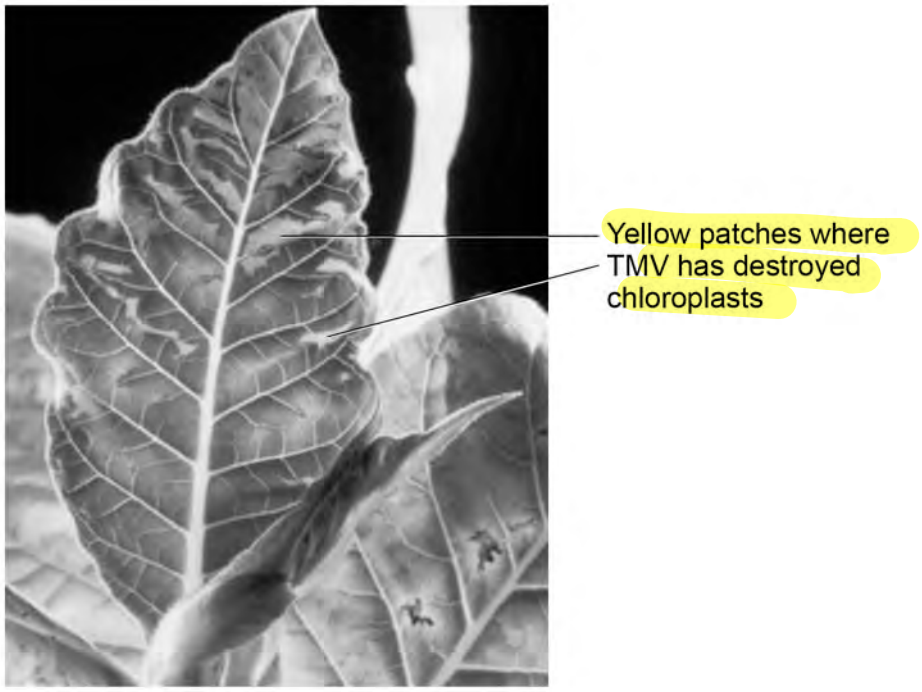
Less water lost ✓, So it does not wilt. ✓

Turn over for the next question

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

Figure 1 shows a leaf infected with TMV.

Figure 1



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

Suggest why.

[1 mark]

To kill virus

OR To prevent virus spreading

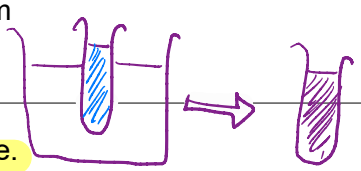
0 2 . 2 Scientists produced a single plant that contained a TMV-resistant gene.

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

[1 mark]

Take stem cells from meristem

OR Tissue Culture



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

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

[2 marks]

Grind fruit in pestle and mortar to create a liquid
Add Benedicts reagent and heat in a water bath ✓
If glucose is present it will turn from blue to purple ✓

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]

Less photosynthesis occurs since chlorophyll required for it. So, less glucose is produced. Glucose is used in respiration so less energy is released for growth.

OR Glucose is required to make proteins. Since less glucose, less proteins produced which are essential for growth.

Turn over for the next question

0 3 Microorganisms cause infections.

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

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

[2 marks]

1 Acid in stomach kills pathogens in food

2 skin forms a protective barrier (or produces antimicrobial secretions)

+ Trachea has mucus which traps pathogens / bronchi have cilia which waft mucus to mouth to be swallowed

+ hairs in nostrils trap pathogens

0 3 . 2 In 2014 the Ebola virus killed almost 8 000 people in Africa.

Drug companies have developed a new drug to treat Ebola.

↑ assume dangerous

Explain what testing must be done before this new drug can be used to treat people.

[6 marks]

Include:
- what we are testing for
- how to carry out the tests
- justification of this method.

Carry out pre clinical trials to test for efficacy, dose and toxicity. Then do clinical trials on healthy volunteers at low doses to monitor safety. Following this test for optimum dosage, and efficacy. Do this in the form of a double blind trial, using a placebo that contains no active drug. There should be random allocation of patients to each group, and neither patients nor doctors should know who is in which. Once completed, data should be peer reviewed to help prevent false claims.

Turn over for the next question

There are no questions printed on this page

0 4 All living cells respire.

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

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

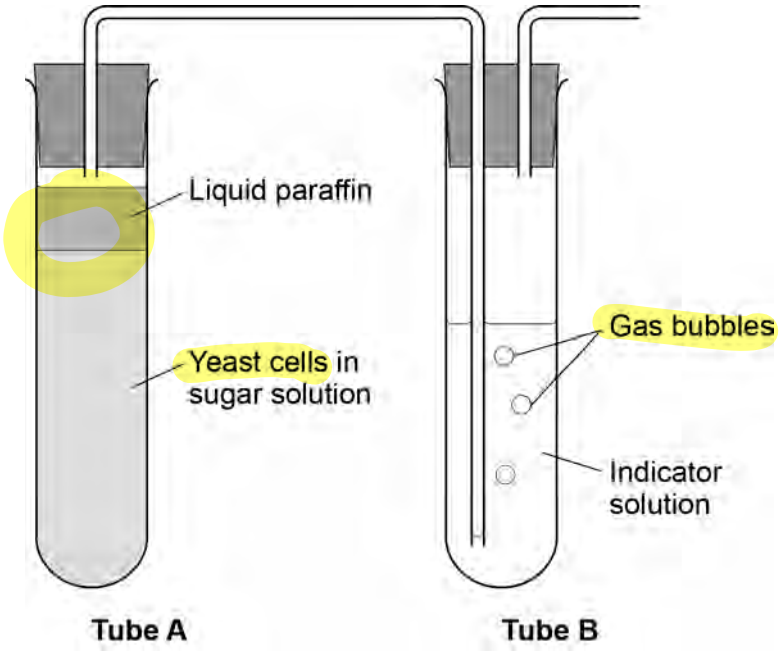
[2 marks]

Glucose moves into bloodstream by diffusion ✓ The blood then delivers glucose to muscles in capillaries ✓

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

no oxygen

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 (CO_2).

The indicator is:

- **blue** when the concentration of CO_2 is very low
- **green** when the concentration of CO_2 is low
- **yellow** when the concentration of CO_2 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.

glucose → CO_2 + ethanol

- [ ] Blue
- [ ] Green
- [x] 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]

Collect the CO_2 with a gas syringe ✓ Measure the volume collected in a stated time with a stopwatch ✓

OR use measuring cylinder

0 4 . 5 Compare anaerobic respiration in a yeast cell with anaerobic respiration in a muscle cell.

[3 marks]

Both release small amounts of energy. ✓

Yeast produces CO_2 which muscle cells do not. ✓

Yeast produces ethanol but muscle cells produce lactic acid ✓

comparative statements.

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 cm^3 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]

$(0.15 \div 1.35) \times 100 = 11.1$

Percentage change in mass = 11.1 %

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

[1 mark]

Allows results to be compared

OR because starting masses were different

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]

Figure 3

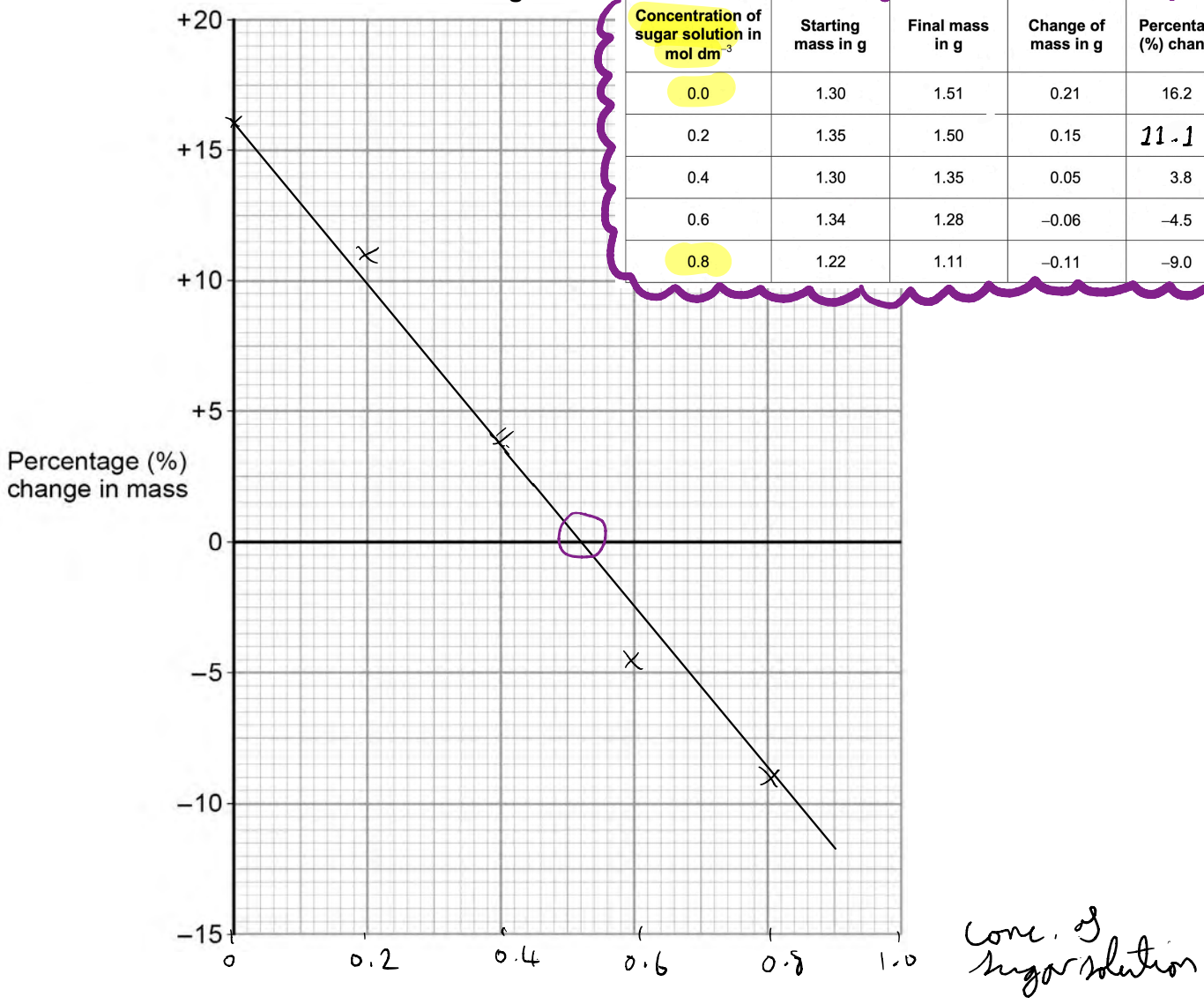


Table 2

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	11.1
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

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]

(no change in mass)

Concentration = 0.52 mol dm^{-3}

(0.45 – 0.55)

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]

Between a concentration of 0 – 0.52 mol/dm^3, water moves into cells. Between 0.52 – 0.8 mol/dm^3, water moves out of cells. In both cases, water moves by osmosis.

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

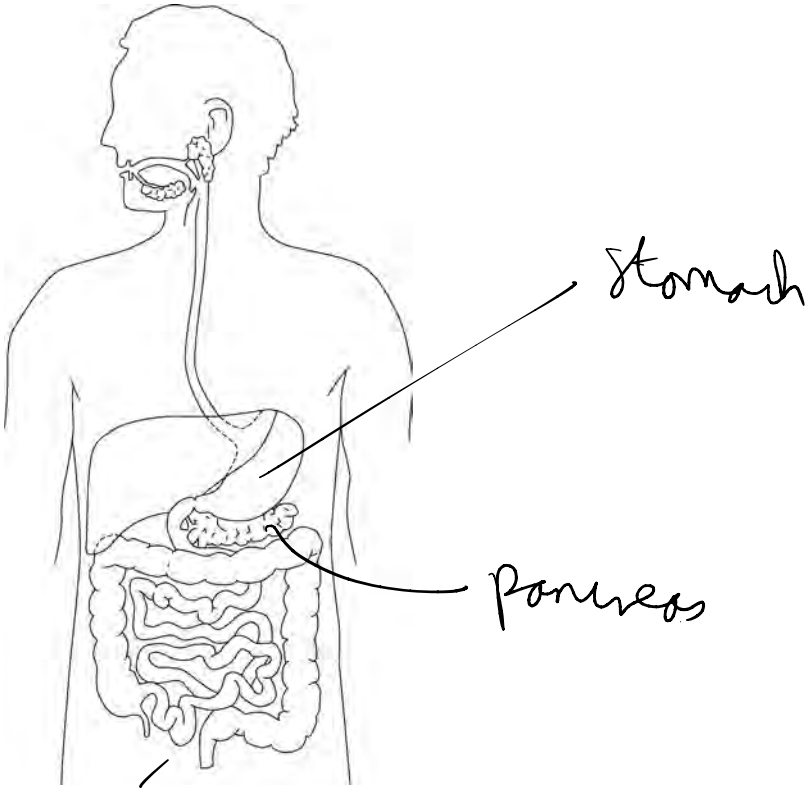
[2 marks]

1 Concentrations of solutions

2 Accuracy of balance.

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]

Bacteria not killed by HCl and so they damage the mucus lining. Therefore HCl causes an ulcer.

(or HCl damages stomach tissue)

0 6 . 3 *Helicobacter pylori* can also cause stomach cancer.

Malignant

Benign

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

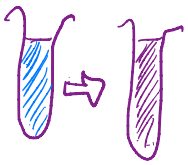
[3 marks]

If the cancer is malignant, cancer cells can spread to other organs. They move via the blood, forming a secondary tumour.

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]



Add Biuret solution to food sample ✓
Purple colour shows protein present ✓

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.

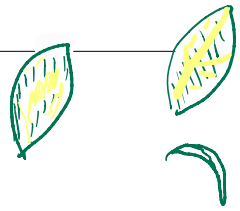
Symptoms of coeliac disease include poor growth.

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

[4 marks]

Damaged villi reduce surface area for absorption. Therefore, fewer amino acids and glucose absorbed. With less glucose, transfer of energy is reduced. With fewer amino acids, less are available to build new proteins.

0 7 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 Compare to pictures on a gardening website ✓ (or magazine / book)

2 Send to a lab for analysis ✓

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 Stunted growth ✓

Magnesium deficiency Yellowing of leaves ✓

Magnesium → chlorophyll

nitrate → amino acid → protein

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			
	Nitrate ions	**Phosphate ions**	**Potassium ions**	**Cost in £/kg**
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]

S has the higher nitrate ion concentration so promotes the best growth. S also has the highest potassium ion content so will produce the stronger roots. It is cheaper than fertiliser T. However, it does not have the highest phosphate ion content but perhaps the gardener is not interested in growing flowers.

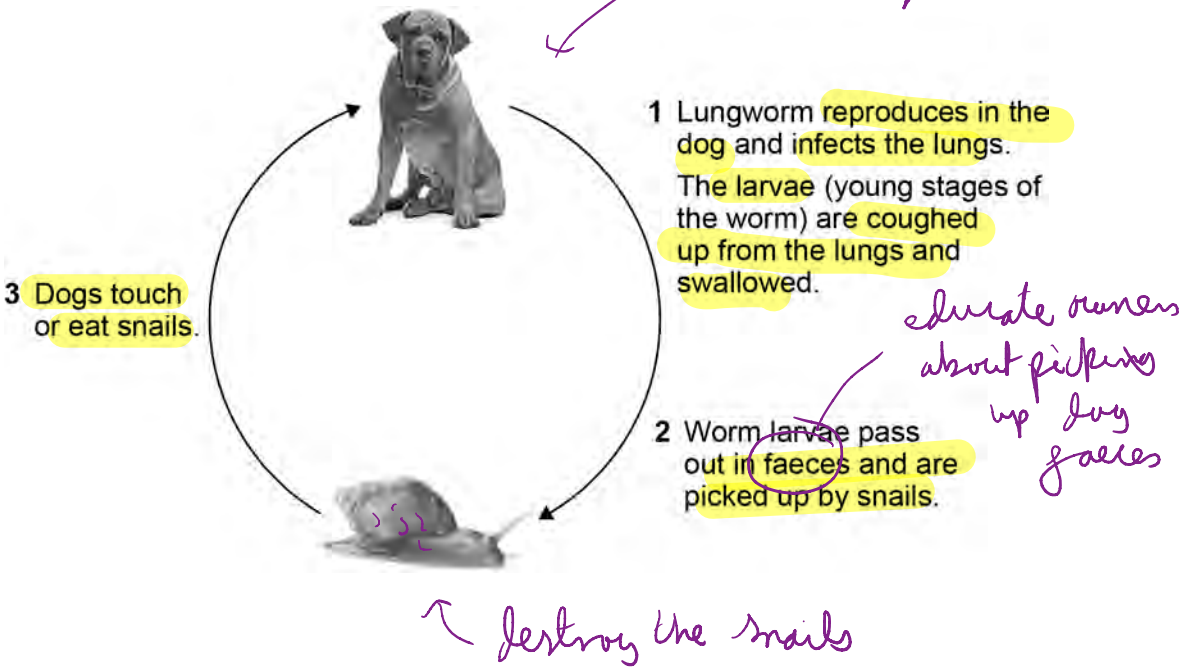
0 8 Lungworm is an infection.

Lungworm can kill dogs.

It is caused by a small worm.

Figure 5 shows the lifecycle of the lungworm.

Figure 5



isolate injected dogs + treat injected dogs

educate owners about picking up dog faeces

destroy the snails

0 8 . 1 What type of organism is represented by the snail in the lifecycle of the lungworm?

[1 mark]

Tick **one** box.

microorganism

- Fungus ☐
- Parasite ☐
- Protist ☐
- Vector ☑

the lungworm

a microorganism e.g. malaria

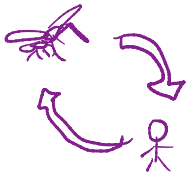
0 8 . 2 Suggest how the spread of the lungworm disease can be prevented.

[3 marks]

Destroy snails. Isolate infected dogs.
Educate dog owners about picking up dog faeces.

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

vector



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

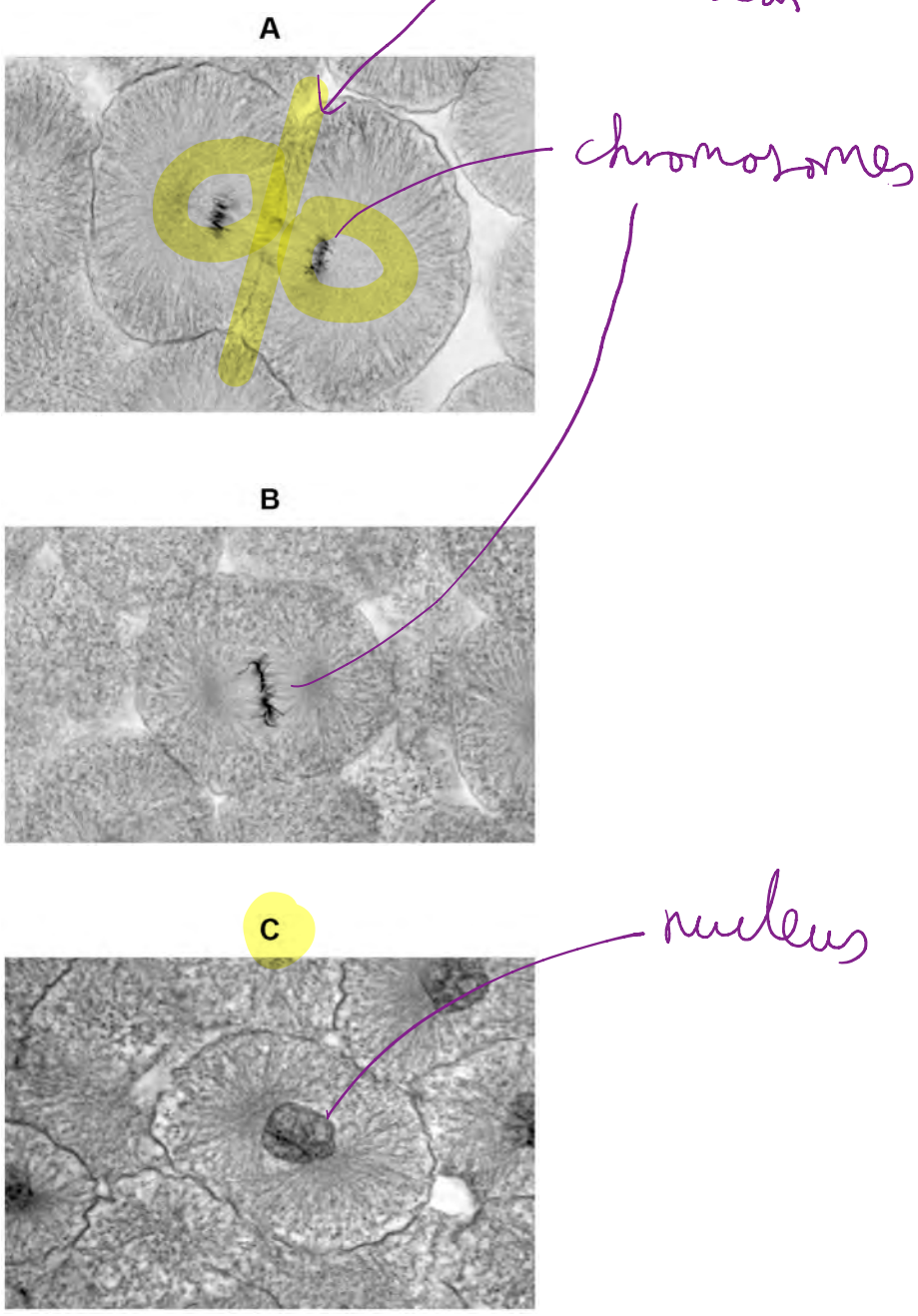
1 Use mosquito nets so mosquitos cannot bite humans

2 Prevent mosquitos breeding.

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



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	✓

Describe what is happening in photograph **A**.

[2 marks]

Division of cell membrane and cytoplasm ✓ (OR Cytokinesis) To form 2 identical daughter cells. ✓

Question 9 continues on the next page

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

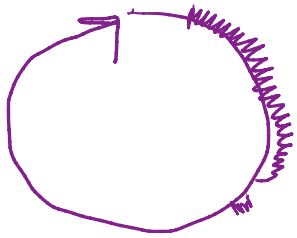
The student made a slide of an onion root tip.

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



takes longer so there will be more cells in this stage

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.

Stage 4

Reason Fewest number of cells in this stage

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]

4/36 × 16 × 60 = 106.66...

conversion from hours to minutes.

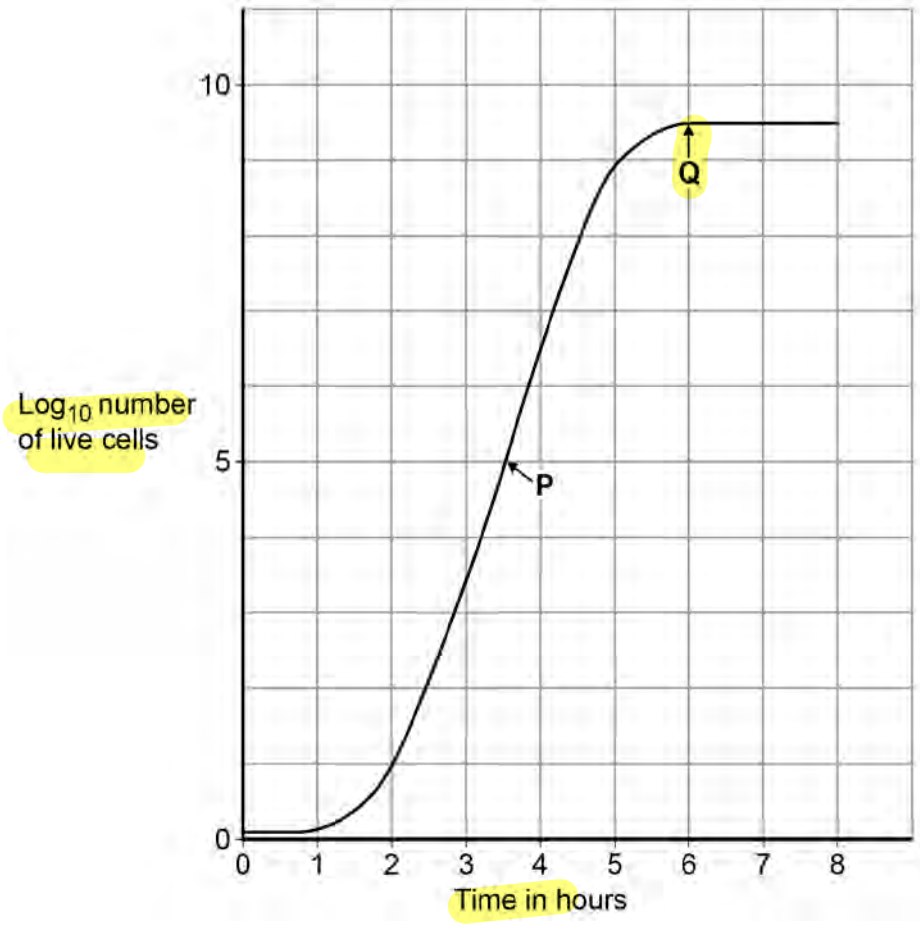
fraction of cells in stage 2

Time in **Stage 2** = 110 minutes

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]

Binary Fission. ✓

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

[2 marks]

There is a shortage of nutrients.
So, cells die.
OR rate of cell growth is the same as the rate of cell death

1 0 Explain how the human circulatory system is adapted to:

- supply oxygen to the tissues
- remove waste products from tissues.

Level 3: "detailed and coherent"

[6 marks]

LUNGS
HEART
TISSUE
low pressure
high pressure

gross structure.

It is a double circulatory system which allows higher blood pressure and greater flow of blood and so oxygen, to tissues. The pulmonary artery carries deoxygenated blood to the alveoli where it absorbs oxygen. This is carried back to the heart in the pulmonary vein before being pumped to tissues by the heart through the aorta. Oxygen is carried by red blood cells which contain no nucleus so contain more haemoglobin for oxygen transport. Capillaries carry blood into tissues. They have thin walls to allow optimum diffusion of oxygen out and waste products in.

+ high surface area of capillaries for optimum diffusion
blood goes back to heart in veins with valves to prevent backflow

Turn over for the next question

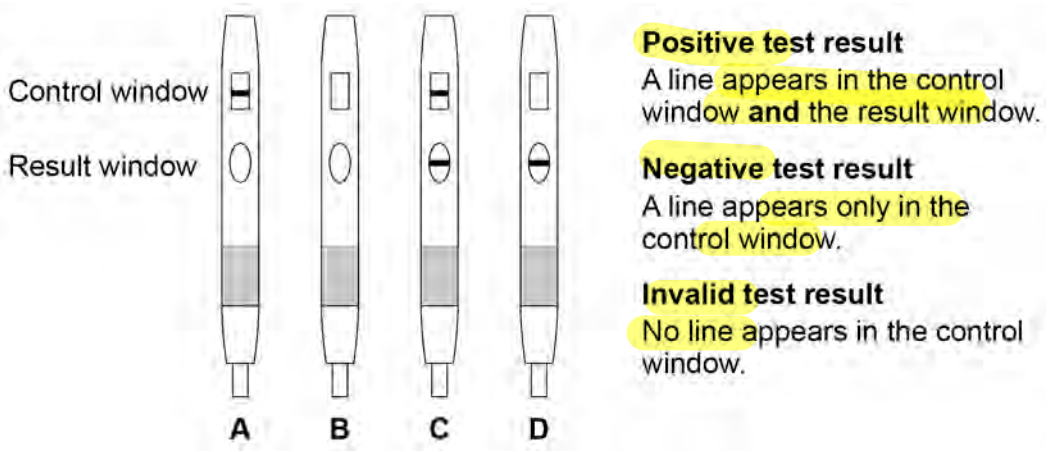
1 1 Monoclonal antibodies are used to measure the levels of hormones in the blood.

Pregnant women produce the hormone HCG.

HCG is excreted in urine.

Figure 8 shows four pregnancy test strips.

Figure 8



Which test strip shows a negative test result?

[1 mark]

Tick **one** box.

A ✓ **B** ☐ **C** ☐ **D** ☐

1 1 . 2 Monoclonal antibodies are used for pregnancy testing.

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

[1 mark]

To treat cancer

normal

cancer

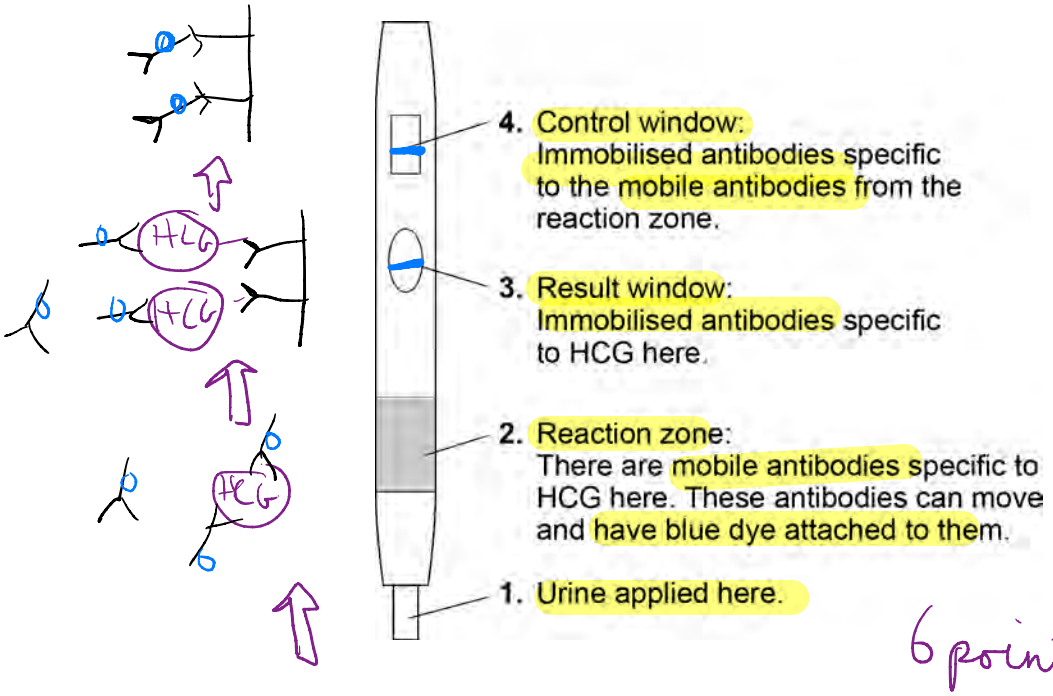
+ to diagnose cancer
to identify blood clots
to identify other hormones

antigen

monoclonal antibody

1 1 . 3 **Figure 9** shows the parts of a pregnancy test strip.

Figure 9



6 points

The pregnancy test strip will show a positive test result when a woman is pregnant.

Explain how the pregnancy test strip works to show a positive result.

[6 marks]

As urine passes through the reaction zone, mobile antibodies bind to HCG. Urine continues to move up the stick and HCG binds to the specific immobile antibodies in the results zone, creating a blue line. Any antibodies that have not bound to HCG move up to the control window and bind to the specific immobile antibodies here. Thus, a blue line is also seen in the control window.

END OF QUESTIONS

There are no questions printed on this page