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

Tuesday 16 May 2023 Morning 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.

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.

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

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ANSWER IN THE SPACES PROVIDED

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

0 1 A root is a plant organ.

Plant roots contain many different types of tissue.

0 1 . 1 What is a tissue?

[1 mark]

a group of the same / similar cells performing similar / specific function

0 1 . 2 Tissue in the tip of a plant root contains stem cells.

Stem cells can differentiate into any type of cell.

Name the type of tissue in plants that contains stem cells.

[1 mark]

meristem

In the past many drugs were extracted from plants.

0 1 . 3 Aspirin is a painkiller.

Which plant does aspirin originate from?

[1 mark]

willow

Question 1 continues on the next page

Scientists have extracted chemical **A** from the deadly nightshade plant.

Chemical **A** can be used as a painkiller.

Table 1 shows information about where chemical **A** is found.

Table 1

Part of deadly nightshade plant	Mass of chemical A in 100 g of plant tissue in grams
Roots	1.3
Leaves	1.2
Berries	0.7

0 1 . 4 The scientists usually extract chemical **A** from the berries of the deadly nightshade plant.

Suggest **one** reason why berries are used instead of leaves or roots.

[1 mark]

Berries are easy to access / pick or easier to extract chemical

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A deadly nightshade plant has chlorosis (yellow leaves).

The mass of chemical **A** found in the **leaves** of the plant is 60% of the mass shown in **Table 1**.

0 1 . 5 Calculate the mass of chemical **A** in 200 g of the **leaves** with chlorosis.

Give your answer in mg.

[4 marks]

(0.6 × 1.2 =) 0.72

(0.72 × 2 =) 1.44

1.44 × 1000

1440 (mg)

Mass of chemical **A** = 1440 mg

0 1 . 6 Suggest **one** reason why the leaves of the deadly nightshade plant have chlorosis.

[1 mark]

lack of chlorophyll OR lack of magnesium (ions)

Question 1 continues on the next page

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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 to check toxicity

2 • to check dosage

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]

(writers / companies may get) financial gain or (competitor may suffer) financial loss

Do not write outside the box

0 1 . 9 How can scientists be sure that claims about new drugs are valid?

[1 mark]

Tick (✓) **one** box.

Advertise the claims on social media. ☐

Ask an international company to produce the drug. ☐

Have the claims peer reviewed. ☑

Publish the claims in a newspaper. ☐

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Turn over for the next question

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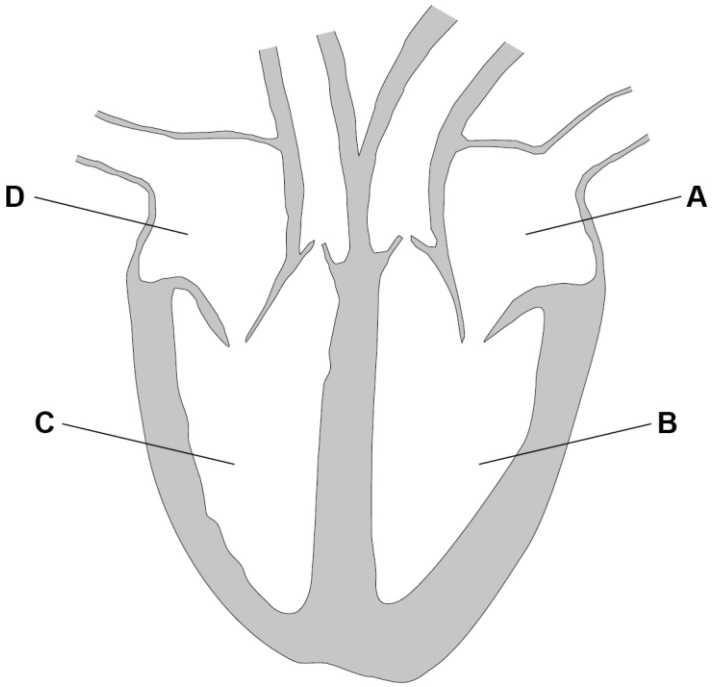
0 2 This question is about the circulatory system.

Figure 1 shows the human heart.

Figure 1



0 2 . 1 Which part of the heart receives oxygenated blood from the lungs?

[1 mark]

Tick (✓) **one** box.

A ☑ **B** ☐ **C** ☐ **D** ☐

0 2 . 2 Which part of the heart pumps deoxygenated blood to the lungs?

[1 mark]

Tick (✓) **one** box.

A ☐ **B** ☐ **C** ☑ **D** ☐

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

Where in the heart is the pacemaker found?

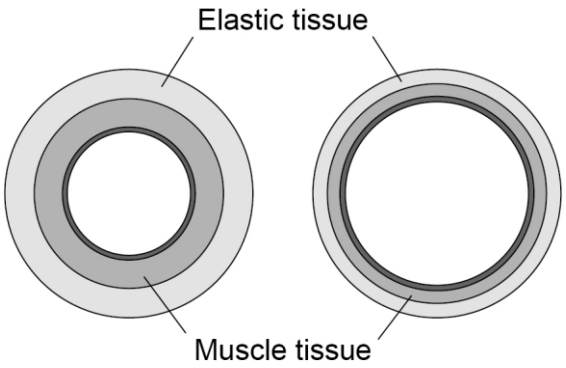
[1 mark]

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 (artery) has a thicker elastic (tissue) or (artery) has a narrower lumen

2 (artery) does not contain valves

Question 2 continues on the next page

Turn over ►

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0 2 . 5 In coronary heart disease, the coronary arteries become narrower.

A build-up of fatty material can cause a blockage in a coronary artery.

Table 2 shows how a blockage in a coronary artery affects blood flow.

Table 2

Percentage (%) of coronary artery that is blocked	Blood flow in cm^3/minute
0	100
10	64
20	42
50	8
80	2

Describe the trend shown in **Table 2**.

[1 mark]

As the percentage of the (coronary) artery that is blocked increases, blood flow decreases

Do not write outside the box

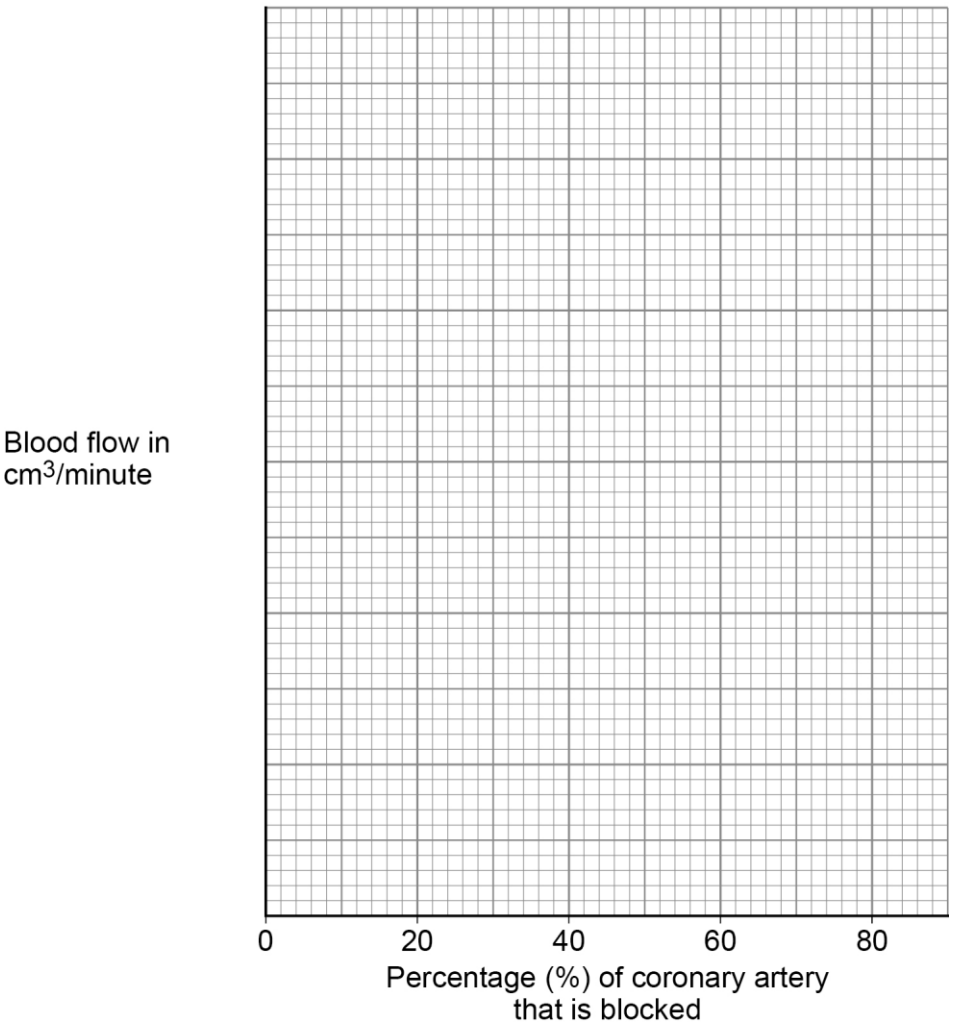
0 2 . 6 Complete **Figure 3**.

You should:

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

[4 marks]

Figure 3



0 2 . 7 Predict the blood flow in a coronary artery with a 35% blockage.

Use **Figure 3**.

[1 mark]

Blood flow = _____ cm^3/minute

Question 2 continues on the next page

Turn over ►

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

[6 marks]

There is educed blood flow to heart muscle / tissue / cells (so) less oxygen to heart muscle / tissue / cells resulting in less glucose to heart (muscle / tissue / cells)

Less aerobic respiration (in heart / body cells) and more anaerobic respiration so less energy released (so) less muscle contraction (so) less blood / oxygen / glucose around the body (from heart)or slower flow of blood / oxygen / glucose to body (from heart)

Less carbon dioxide removed from body muscle / tissue / cells resulting in breathlessness and tiredness.

Anaerobic respiration causes production of lactic acid(build-up of lactic acid) causes muscle fatigue / pain or chest pain

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]

insert stent to open (coronary) artery

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0 3 *Salmonella* bacteria cause outbreaks of food poisoning in humans.

To prevent food poisoning in humans, farmers vaccinate their animals against *Salmonella* bacteria.

0 3 . 1 How do *Salmonella* bacteria in food cause the symptoms of vomiting and diarrhoea?

[1 mark]

Bacteria release / produce toxins

During a food poisoning outbreak, scientists identified the farm where the food came from.

The farmer had **not** vaccinated the farm animals against *Salmonella* bacteria.

0 3 . 2 The food poisoning outbreak could have been prevented if the farm animals had been vaccinated.

Explain how:

- the immune systems of animals respond to a vaccination
- the immune response in farm animals prevents an outbreak of food poisoning in humans.

[4 marks]

Vaccination of animal
• (animal's) white blood cells / lymphocytes produce antibodies (against Salmonella / vaccine / antigens)
• antibodies are specific / complementary / correct to Salmonella / antigens
• (specific) antibodies bind to Salmonella / antigens

Secondary response in animal
• if infected (specific) antibodies are produced quickly or in large numbers
• (so) white blood cells or antibodies would kill (live) Salmonella
• (so) fewer / no bacteria / pathogens / Salmonella in animals or in animal products (meat / milk / eggs)

Prevention of food poisoning in humans
• (so) fewer / no bacteria / pathogens / Salmonella eaten or in (named) food
• (so) number of bacteria never reaches a high enough level for infection to develop
• (so) fewer toxins produced (in humans).

Question 3 continues on the next page

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

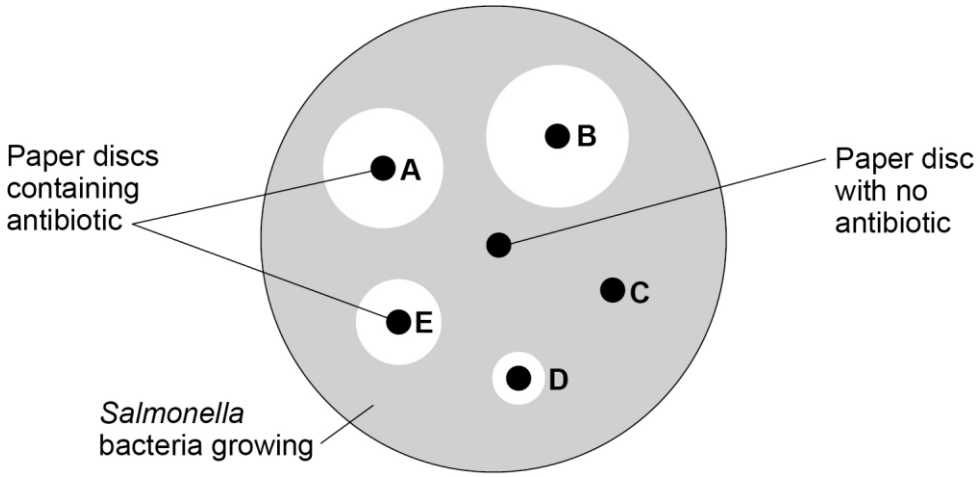
However, some patients may need to take antibiotics to recover.

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 • disinfect hands / work surface OR sterilise Petri dish or culture medium (before use)

2 work near a flame

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]

37 °C is human / body temperature and Salmonella / bacteria grows best / better at 37 °C and 25 °C reduces / prevents the growth of bacteria that are harmful to humans / students

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

[1 mark]

(acts as a) control

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]

They killed the most bacteria

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]

Measure the diameter / radius of each clear area or calculate / measure the area of each clear area

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]

Bacteria must be resistant to antibiotic B

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]

Water enters the bacterial cell by osmosis damaged / incomplete / no

cell wall cannot withstand pressure (of water)

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0 4 This question is about exercise.

0 4 . 1 During vigorous exercise, anaerobic respiration occurs in a person's body.

Explain **two** effects of anaerobic respiration on the person's body.

[4 marks]

1 (effect) muscle fatigue or oxygen debt occurs (1)

(reason) caused by (build-up of) lactic acid (1)

• (effect) (continued) heavy / deep / fast breathing (1)

2 (reason) to provide the oxygen needed to break down (built-up) lactic acid (1)

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0 4 . 2 Design an investigation to show the effect of different types of exercise on the heart rate of athletes.

[6 marks]

Question 4 continues on the next page

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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]

Athlete is faster / stronger because more muscle mass so more / stronger muscle contractions

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]

cell is cloned and many identical cells are produced. All the cells make the same antibody. The antibody is collected and purified

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

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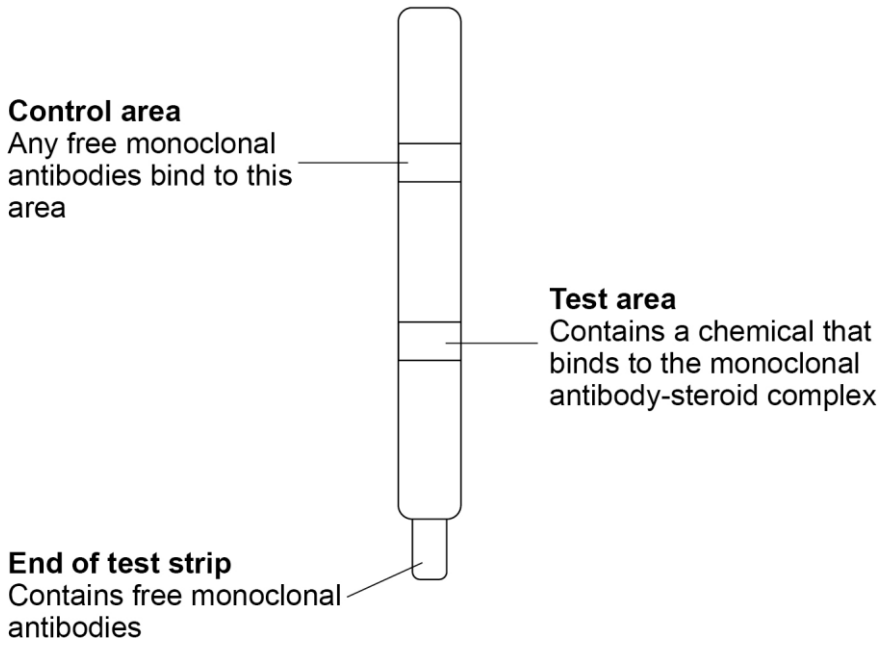
Figure 5 shows a test strip that can detect the presence of an anabolic steroid in an athlete's urine.

Figure 5



The end of the test strip is dipped in urine.

The urine moves up through the test strip.

The test area and the control area contain a dye.
The dye turns blue when monoclonal antibodies bind to it.

0 4 . 7 Suggest the purpose of the control area in the test strip.

[1 mark]

To show that the test is working

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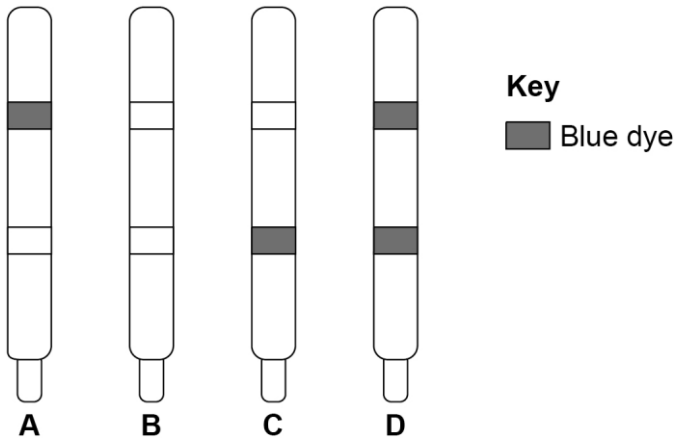
Figure 6 shows the urine test results of four athletes.

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 no blue / visible dye (in control area)

Reason Because no (free) monoclonal antibodies bound to control area

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

[1 mark]

Tick (✓) **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☑

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0 5 The protist that causes malaria is passed from one person to another person by mosquitos.

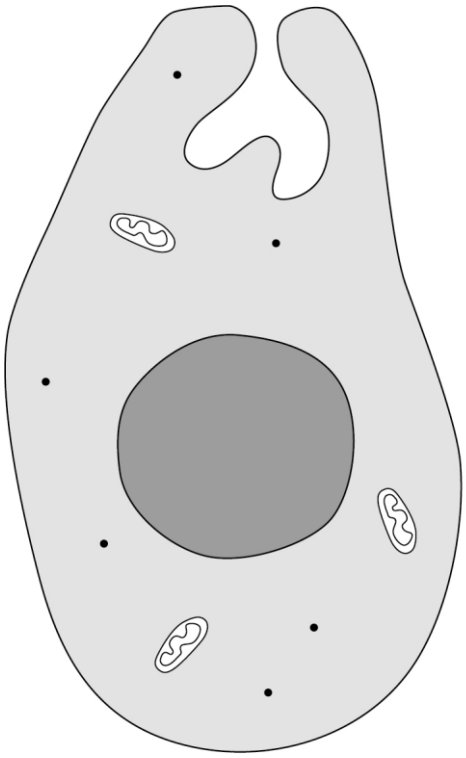
0 5 . 1 What term describes an organism that passes a pathogen from one person to another person?

[1 mark]

Vector

0 5 . 2 **Figure 7** shows the malarial protist.

Figure 7



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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 • Protist / it has mitochondria OR protist / it has (a) nucleus or protist DNA / genetic material is not free in the cytoplasm

2 • Protist / it does not have plasmids

3 • Protist / it does not have a cell wall

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]

Less oxygen carried (in blood) AND less energy released from respiration

Question 5 continues on the next page

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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	Involves gametes joining / fusing or involves fertilisation	involves no (fusion of) gametes or does not involve fertilisation
2	There is genetic variation	There isno genetic variation
3	more energy required	less energy required

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]

No bases so DNA replication cannot occur

Do not write outside the box

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

[3 marks]

After DNA replication one set of chromosomes is pulled to each end of the cell AND nucleus divides

AND cytoplasm or cell membrane divides to form two cells

Question 5 continues on the next page

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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]

Having disorder S reduces incidence / percentage of malaria ,as age increases a lower percentage of children with disorder S get malaria until age 10, then the percentage increases

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0 6 This question is about photosynthesis.

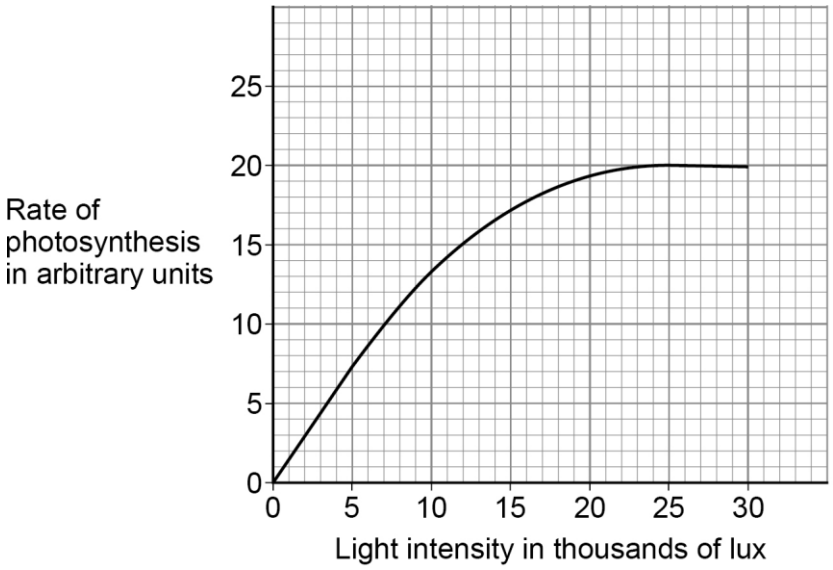
0 6 . 1 Complete the symbol equation for photosynthesis.

[1 mark]

6 H_2O + 6 CO_2 → $C_6H_{12}O_6$ + 6 O_2

Figure 8 shows how the rate of photosynthesis changes with light intensity.

Figure 8



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0 6 . 2 Which part of the graph could be represented by the equation $y = mx + c$?

[1 mark]

Tick (✓) **one** box.

From 0 to 5 000 lux ☑

From 10 000 to 15 000 lux ☐

From 15 000 to 20 000 lux ☐

From 20 000 to 25 000 lux ☐

Question 6 continues on the next page

A student investigated the effect of colour of light on the rate of photosynthesis in leaves.

Figure 9 shows how the investigation was set up.

Figure 9

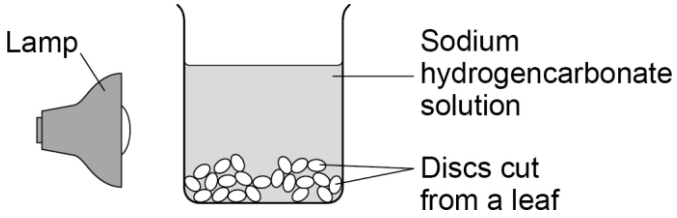

Table 5 shows the results.

Table 5

Colour of light	Time taken for 10 leaf discs to reach the surface of the solution in seconds
Blue	115
Green	831
Red	397

0 6 . 3 Give **one** way the student could change the colour of the light shining on the leaf discs.

[1 mark]

Use different coloured bulb/ LED

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

[2 marks]

Independent variable colour of light

Dependent variable time (taken for 10 leaf discs to reach the surface of the solution)

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]

So that discs would sink to the bottom of the beaker

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]

Sodium hydrogencarbonate provides / releases carbon dioxide and Carbon dioxide is used) for photosynthesis

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

[2 marks]

oxygen was produced in photosynthesis and oxygen / gas is trapped in / around disc / leaf

Turn over ►

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There are two types of chlorophyll in leaves.

Figure 10 shows the percentage of different wavelengths of light that the two types of chlorophyll absorb.

Figure 10

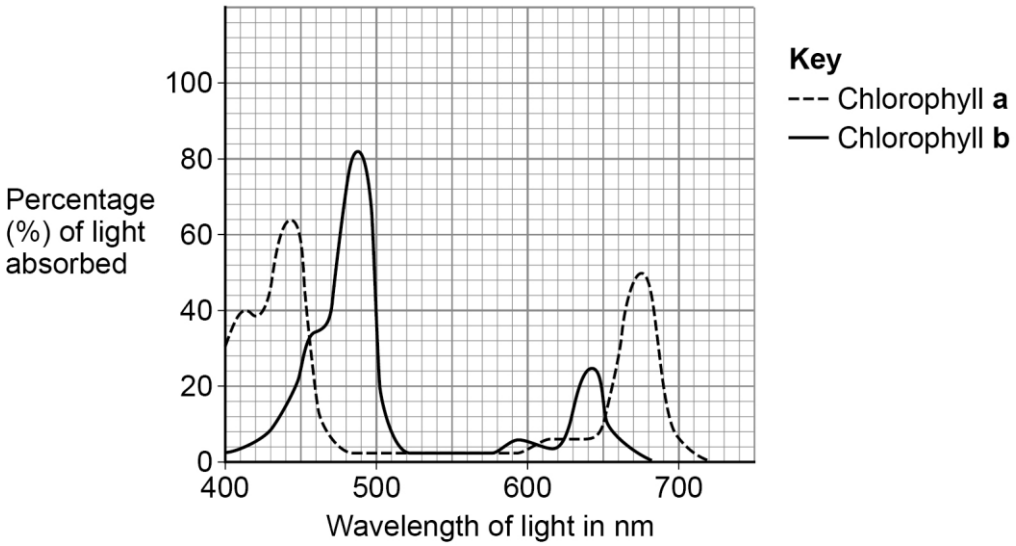

Table 6 shows the colour of different wavelengths of light.

Table 6

Range of wavelength of light in nm	380 − 435	450 − 499	500 − 570	571 − 590	620 − 720
Colour of light	violet	blue	green	yellow	red

0 6 . 8 Suggest the advantage to a plant of having two types of chlorophyll.

[1 mark]

To absorb / use many / more colours / wavelengths of ligh

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0 6 . 9 **Table 5** is repeated below.

Table 5

Colour of light	Time taken for 10 leaf discs to reach the surface of the solution in seconds
Blue	115
Green	831
Red	397

The leaf discs in the investigation are green.

Explain the results in **Table 5** for blue light and for green light.

Use data from **Figure 10** and **Table 6**.

[4 marks]

Chlorophyll absorbs least or very little or not much green light so discs in blue light took the least time to rise (to surface) because they photosynthesised faster

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