AQA

Please write clearly in block capitals.

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

Surname _____

Forename(s) _____

Candidate signature _____
I declare this is my own work.

GCSE
COMBINED SCIENCE: TRILOGY

H

Higher Tier
Biology Paper 1H

Time allowed: 1 hour 15 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 70.
- 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.

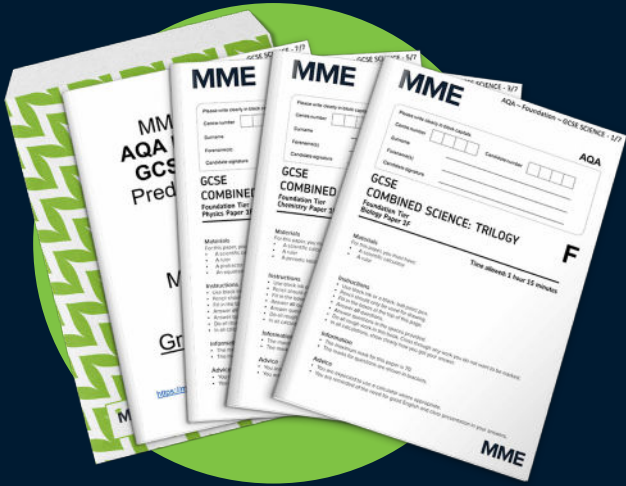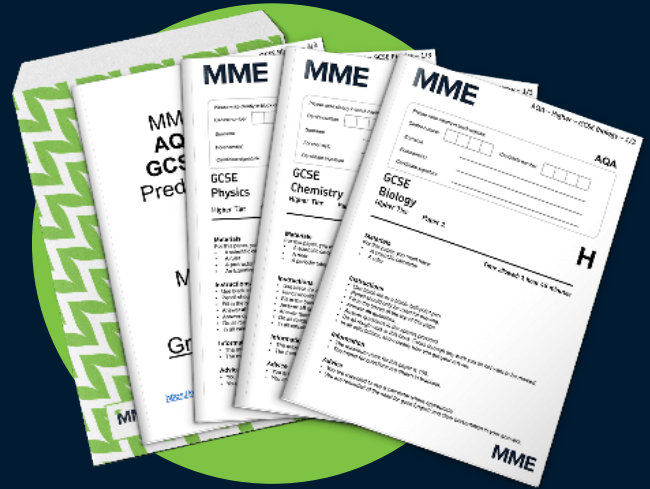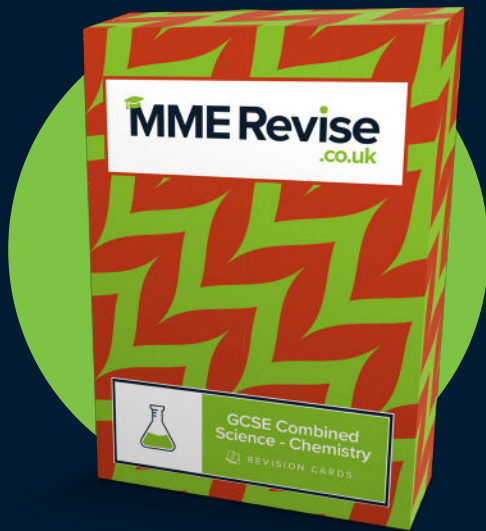| For Examiner's Use	
Question	Mark
1	
2	
3	
4	
5	
6	
TOTAL	

MME.

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0 1 Bacteria can cause a variety of diseases in humans.

0 1 . 1 What are **two** similarities between a bacterial cell and an animal cell?

[2 marks]

Tick (✓) **two** boxes.

Both have a cell membrane.	✓
Both have a cell wall.	
Both have a nucleus.	
Both have cytoplasm.	✓
Both have plasmids.	

0 1 . 2 Salmonella food poisoning is caused by bacteria in food.

Give **one** symptom of salmonella food poisoning.

Do **not** refer to vomiting or diarrhoea in your answer.

[1 mark]

fever and high temperatures

Question 1 continues on the next page

Turn over ▶

**0 1 . 3** What is the name of the first antibiotic developed? [1 mark]

penicillin

A child with a severe bacterial infection was given a course of antibiotics.

Figure 1 shows how the concentration of live bacteria in the child's body changed when taking the course of antibiotics.

Figure 1

Concentration of live bacteria in the body in arbitrary units

Time in days

↑
Course of antibiotics started

IB/M/Jun22/8464/B/1H
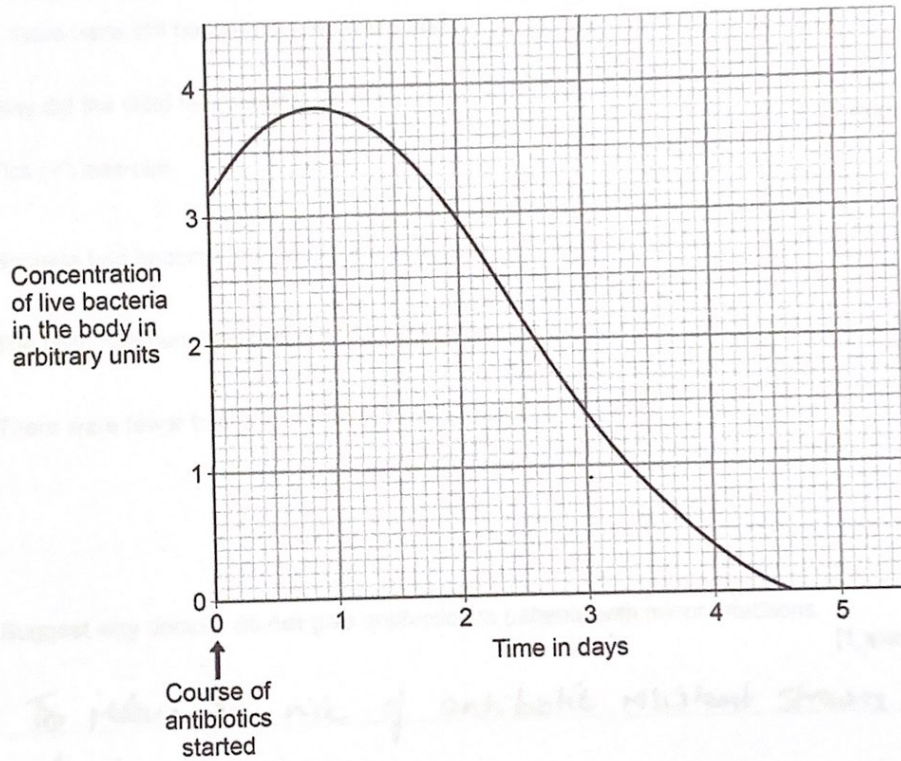
0 1 . 4 The concentration of live bacteria in the body continued to increase after starting the course of antibiotics.

Suggest **one** reason why.

[1 mark]

There is a delay between the taking of the antibiotics and the antibiotics reaching the bacteria.

0 1 . 5 After 3 days of taking the antibiotic:

- the child felt better
- there were still bacteria in the child's body.

Why did the child feel better?

[1 mark]

Tick (✓) **one** box.

Bacteria had become immune to the antibiotic. ☐

The child had become resistant to the bacteria. ☐

There were fewer toxins in the body than at day 0 ✓

0 1 . 6 Suggest why doctors do **not** give antibiotics to patients with minor infections.

[1 mark]

To reduce the risk of antibiotic resistant strains developing.
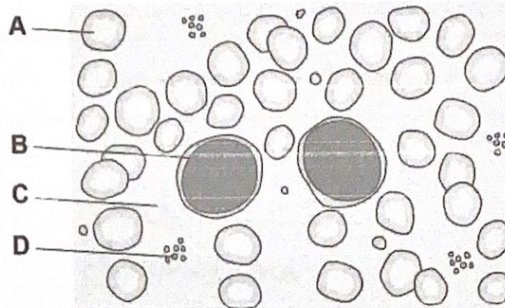
Question 1 continues on the next page

Turn over ▶

Figure 2 shows blood viewed using a microscope.

Figure 2

0 1 . 7 A vaccine will stimulate the production of antibodies.

Which part of the blood in **Figure 2** produces antibodies?

[1 mark]

Tick (✓) **one** box.

A ☐   B ☑   C ☐   D ☐

0 1 . 8 Which part of the blood in **Figure 2** starts the clotting process?

[1 mark]

Tick (✓) **one** box.

A ☐   B ☐   C ☐   D ☑

9

| 0 | 2 | This question is about cell division.

| 0 | 2 | . | 1 | Write the biological structures from the box in the correct order of size.

[1 mark]

| cell | chromosome | gene | nucleus |

Smallest

↓

Largest

gene

chromosome

nucleus

cell

Question 2 continues on the next page

Turn over ▶

Figure 3 shows how a fertilised egg cell can produce specialised cells.

Figure 3

Fertilised egg cell

Embryo

Process A

Red blood cells

Muscle cells

Nerve cells

0 2 . 2   Name **Process A**.

[1 mark]

Differentiation

0 2 . 3   How many cell divisions are needed to form a 16-cell embryo from the original fertilised egg cell?
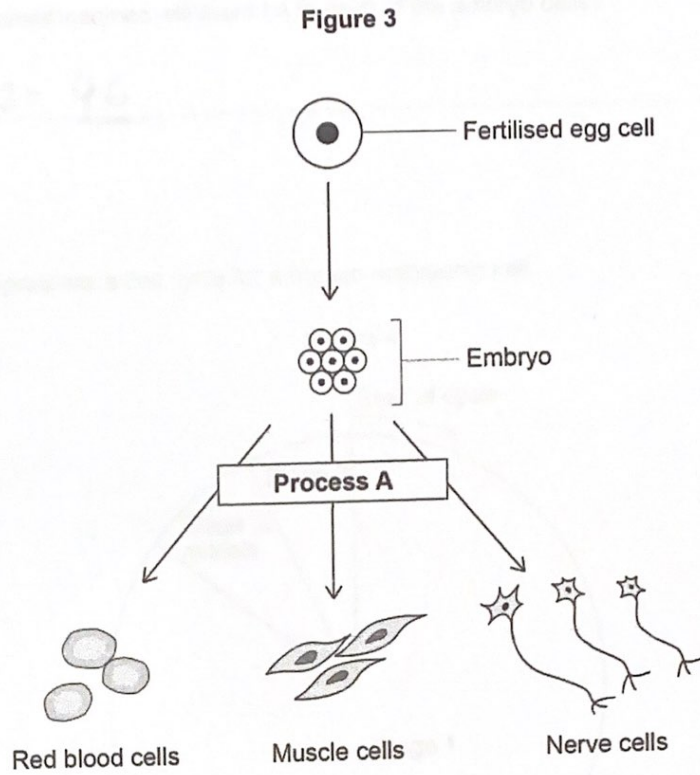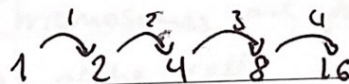
[1 mark]

1   2   4   8   16
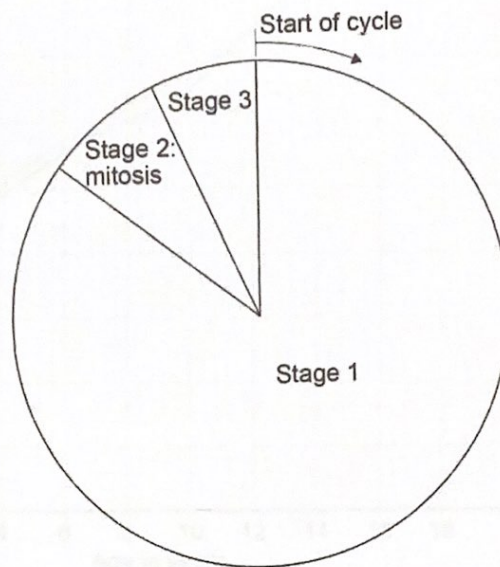
Number of cell divisions = _____ 4

0 2 . 4 In humans a fertilised egg cell contains 23 pairs of chromosomes.

How many chromosomes will there be in each of the embryo cells?

[1 mark]

$23 \times 2 = \underline{46}$

0 2 . 5 **Figure 4** represents a cell cycle for a human embryonic cell.

Figure 4

Describe **one** change in the cell that occurs during **each** of the stages of the cell cycle.

[3 marks]

Stage 1 _Chromosomes are replicated._

Stage 2 _Chromosomes are pulled to opposite poles of the cell._

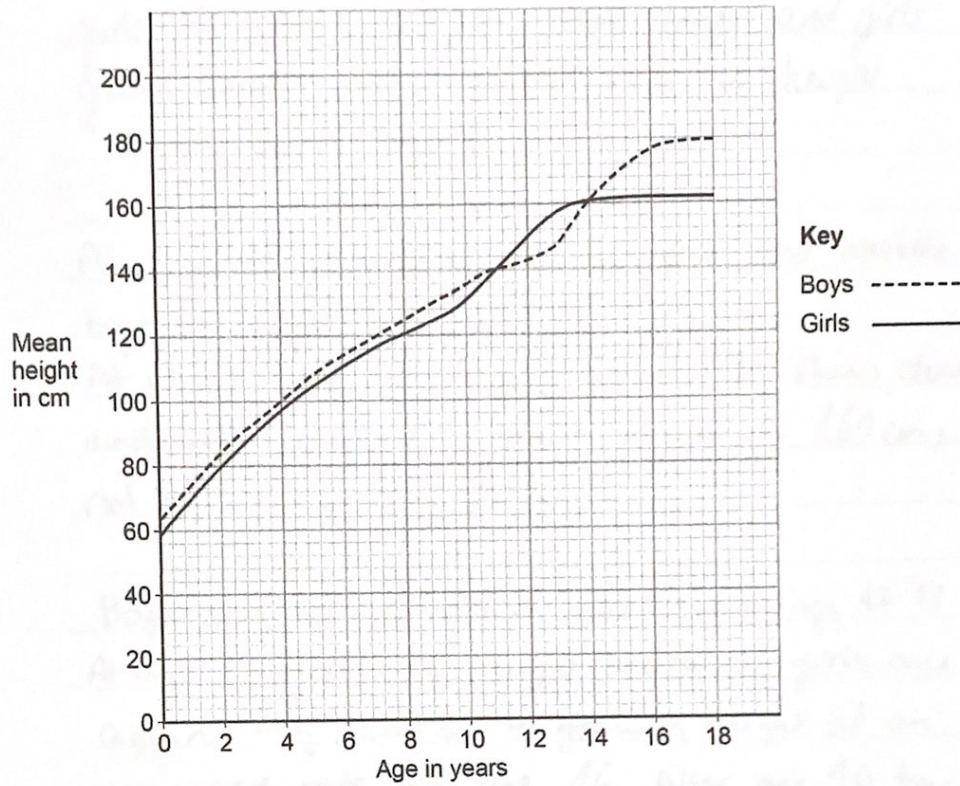Stage 3 _The cytoplasm of the cell divides into 2._

Turn over ▶

Cell division is important in the growth of multicellular organisms.

0 2 . 6   **Figure 5** shows the mean height of boys and of girls from birth to age 18 years.

Figure 5

Compare the growth of boys with the growth of girls.

Use data from **Figure 5** in your answer.

[6 marks]

Up until the age of 11 boys tend to be taller than girls, by about 4-5 cm. Both boys and girls grow roughly at a similar rate in height untill until age 11.

At age 11 girls hit a growth spur and overtake boys in height till age 14.
At about age 13-14 girls growth rate slows down and settles around a mean height of 160 cm, not increasing any further.

Boys only hit their growth spur around age 12-13. At age 14 their mean height overtakes girls once again. They carry on to grow in height at an increased rate till age 16. After age 16 their mean height settles around 180cm,

0 2 . 7 Give **one** way that cell division by mitosis is important in **fully grown** animals.

[1 mark]

To repair tissues that get damaged.

14

Turn over ▶

0 3 Amylase is an enzyme that digests starch.

0 3 . 1 Which organs in the human digestive system produce amylase? [1 mark]

Tick (✓) one box.

Liver, small intestine and large intestine ☐

Salivary glands, stomach and liver ☐

Salivary glands, pancreas and small intestine ✓

Stomach, pancreas and large intestine ☐

A student investigated the effect of pH on the activity of amylase.

This is the method used.

1. Prepare amylase solution at pH 5

2. Mix the amylase solution with starch in a boiling tube.

3. Remove a drop of the amylase-starch mixture every 30 seconds and test it for the presence of starch.

4. Record the time when all the starch has been digested.

5. Repeat steps 1 to 4 using amylase solution prepared at pH 6, then at pH 7 and then at pH 8

0 3 . 2 What was the independent variable in this investigation? [1 mark]
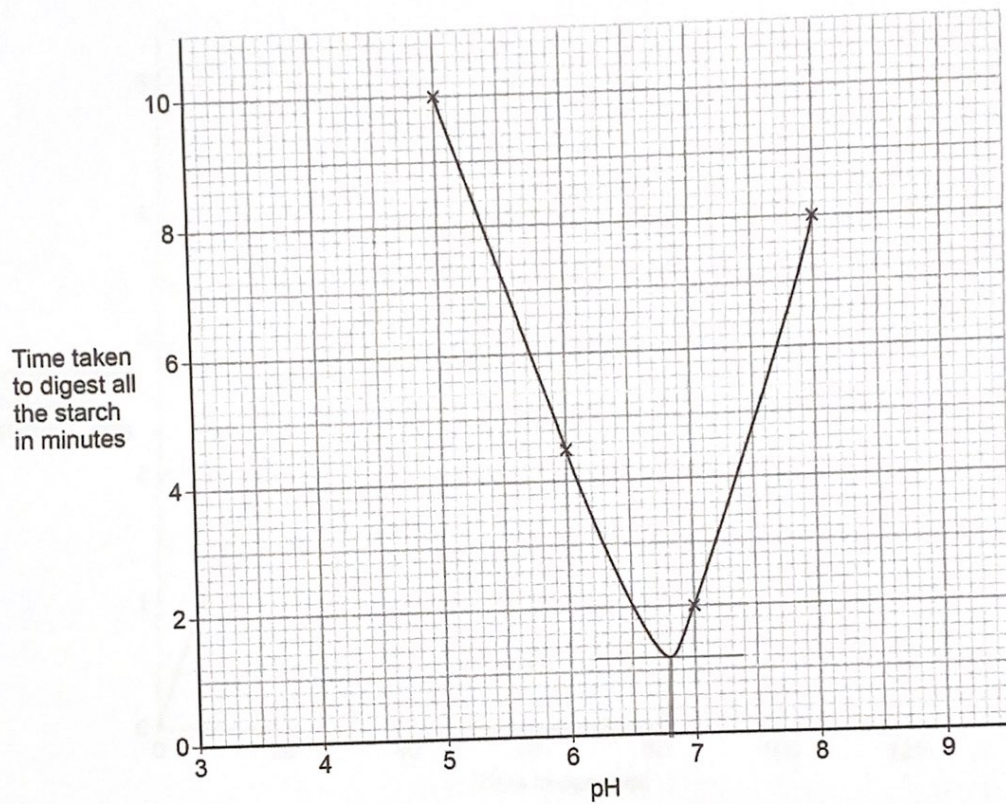
pH of the amylase solution

0 3 . 3 Describe how the student would know when all the starch had been digested.

[1 mark]

Use iodine to test for the presence of starch.
If starch is present solution will turn blue/black.
If starch has been digested and so no longer present the
solution will remain orange.

0 3 . 4 **Figure 6** shows the student's results.

Figure 6

What was the optimum pH for the amylase?

Use **Figure 6**.

[1 mark]

Optimum pH = ___6.8___

Turn over ▶

A scientist did a different investigation.

This is the method used.

1. Prepare amylase solution at the optimum pH.

2. Mix the amylase solution with starch in a boiling tube.

3. Measure the concentration of sugar every 10 seconds for 2 minutes.

Figure 7 shows the scientist's results.

Figure 7

Concentration of sugar in arbitrary units (y-axis)

Time in seconds (x-axis)
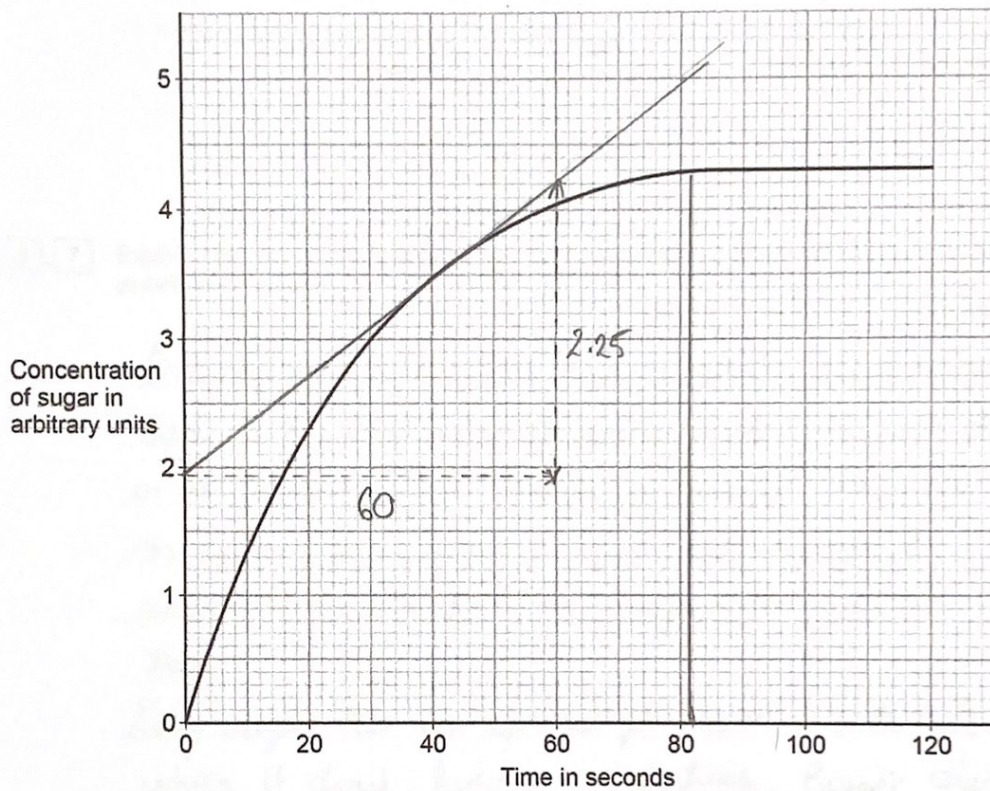
| 0 | 3 | . | 5 | How much time did it take for the amylase to digest all the starch?

Use **Figure 7**.

[1 mark]

Time to digest all the starch = _____82_____ seconds

0 3 . 6 Determine the rate of sugar production per minute at 40 seconds.

[4 marks]

Tangent drawn of Figure 37.

Change in x = 0 → 60 ⇒ 60 - 0 = 60

change in y = 1.95 → 4.20 ⇒ 4.20 - 1.95 = 2.25

rate = 2.25 / 60 = 0.0375 (per sec)

0.0375 × 60 = 2.25 (per min)

Rate = _____ 2.25 _____ arbitrary units per minute

0 3 . 7 Explain how the structure of enzyme molecules is related to the effect of pH on the activity of amylase.

[6 marks]

Enzymes are proteins that have a specific 3D structure due to the association of amino acids with each other in its structure. This creates a specific shape for its active site, where only a certain type of substrate would fit. For amylase this substrate is starch.

Every enzyme has an optimal pH above or below which it doesn't function as effectively. Bigger changes to the pH may even denature the enzymes, making them unable to bind any substrate. This is due to their active sites shape changing, so that the substrate no longer fits it.

15

Turn over ▶

0 4 Photosynthesis is an important chemical reaction in plants.
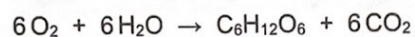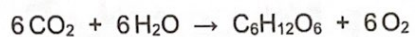
0 4 . 1 Why is light needed for photosynthesis?

[1 mark]

to transfer energy

0 4 . 2 What is the equation for photosynthesis?

[1 mark]

Tick (✓) **one** box.

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

$CO_2 + H_2O \rightarrow CH_2O + O_2$ ☐

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

$6O_2 + 6H_2O \rightarrow C_6H_{12}O_6 + 6CO_2$ ☐
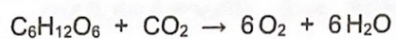
0 4 . 3 A student investigated the effect of different colours of light on the rate of photosynthesis at room temperature.

The student used pondweed in water.

A piece of pondweed was placed in red light, then in blue light and then in green light.

Each colour of light was the same intensity.

Describe how the student should make accurate measurements to obtain valid results for the rate of photosynthesis.

[4 marks]

Between each transition from each coloured light the pondweed should be left to equilibrate in the new condition, before measurements are taken.
In the experiment the volume of gas produced should be accurately measured with a gas syringe.
The time in which gas produced should be recorded and be the same length for all coloured light. In addition, for each treatments repeats should be made and means calculated and used.

Question 4 continues on the next page
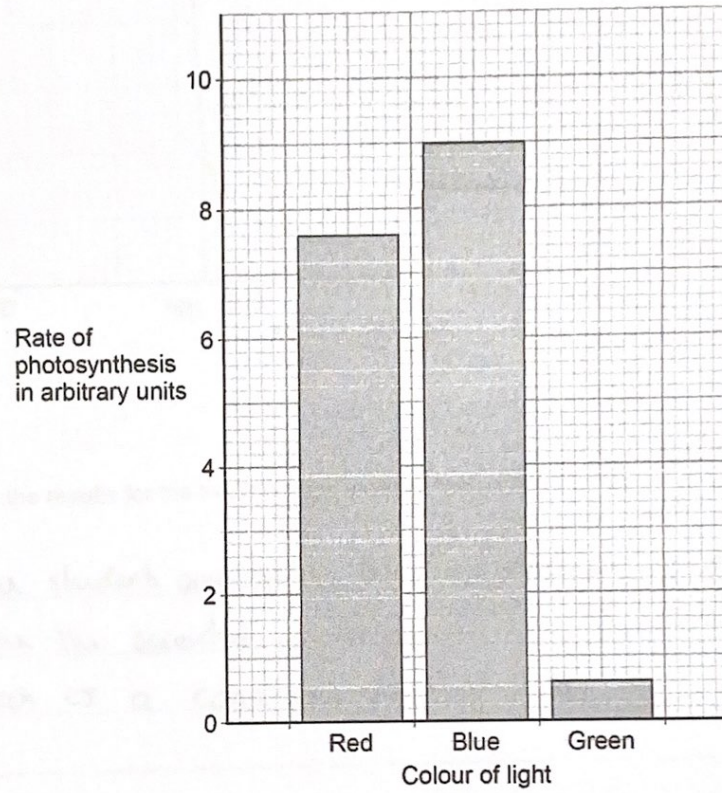
Turn over ▶

A scientist investigated the effect of different wavelengths of light on the rate of photosynthesis.

The wavelength of light determines the colour of the light.

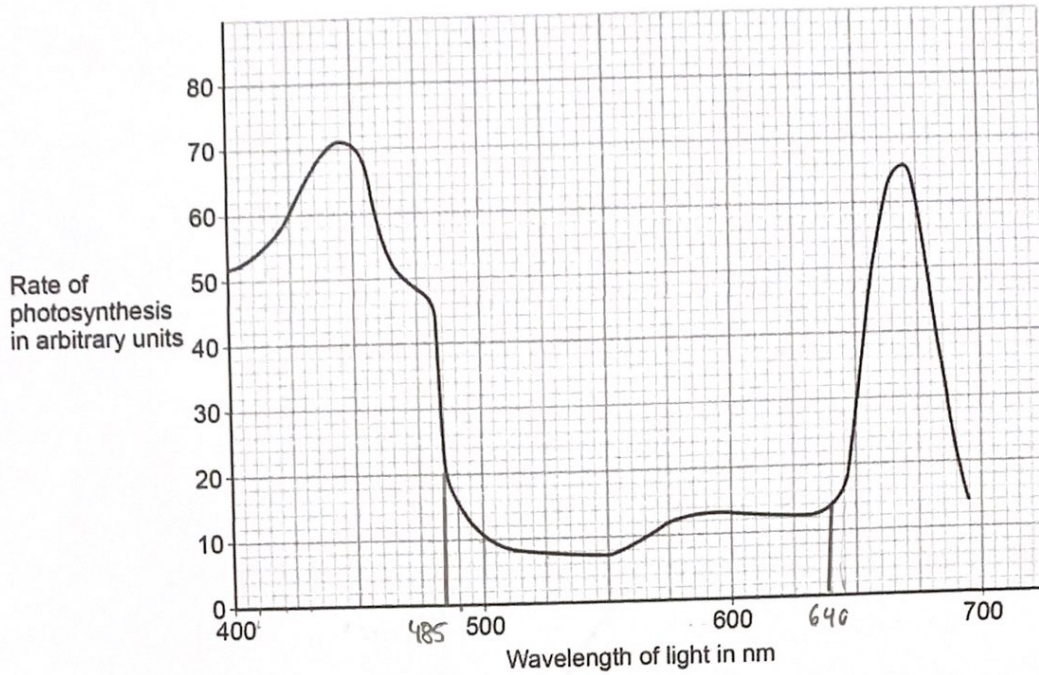**Figure 8** shows the student's results.

Figure 9 shows the scientist's results.

Figure 8

Rate of photosynthesis in arbitrary units

Colour of light

Figure 9

04.4 Why are the results for the two investigations presented differently?

[2 marks]

In the students investigation they use categorical data, while the scientist investigation uses wavelength, which is a continous form of data.

04.5 Suggest the range in wavelength of green light.

Use **Figure 8** and **Figure 9**.

[1 mark]

Range in wavelength of green light = from ___485___ nm to ___640___ nm

9

Turn over ▶

0 5 This question is about tumours.

0 5 . 1 Describe the similarities and differences between benign tumours and malignant tumours.

[4 marks]

Both benign and malignant tumours are due to changes to the DNA in a cell. In both this genetic change causes uncontrolled division of a cell or group of cells.

However, malignant tumours tend to grow faster and be able to spread to other tissues. These can be neighbouring tissues to where the tumour developed, or cancer cells can travel in the blood to other parts of the body.

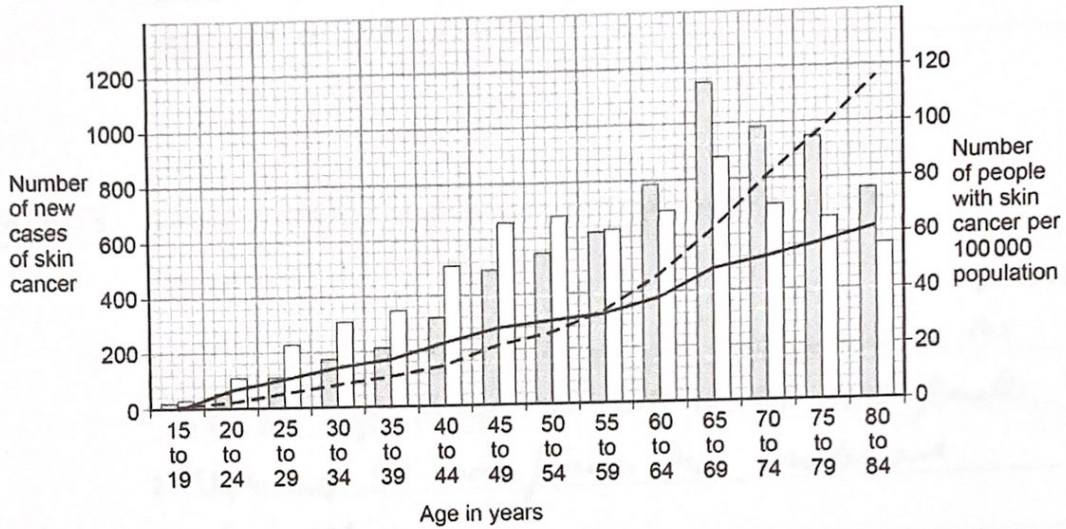**Question 5 continues on the next page**

Turn over ▶

Figure 10 shows data about skin cancer in males and females for different age groups in the UK.

It shows:

- the number of new cases of skin cancer in 1 year
- the number of people with skin cancer per 100 000 population in 1 year.

Figure 10

Key

- [ ] New male cases
- [ ] New female cases
- – – – Number of males with skin cancer per 100 000
- —— Number of females with skin cancer per 100 000

0 5 . 2 There are no new cases of skin cancer diagnosed in people younger than 15 years of age.

Explain why. **[2 marks]**

Younger people had less exposure to tt ionising radiation, such as UV. As ionising radiation can cause mutations, less exposure to it will result in less cell or DNA damage.

0 5 . 3 Give **two** conclusions about the number of **new cases** of skin cancer.

Use **Figure 10**. **[2 marks]**

1 Greatest number of cases are diagnosed in the 65-69 age range for both males and females.
2 Upto age 59 more females than males are diagnosed.

0 5 . 4 The data for the number of people with skin cancer is given per 100 000 population.

Suggest why the data is **not** given as the total number of people. **[1 mark]**

There are a different number of people for each age group as well as of different sex.
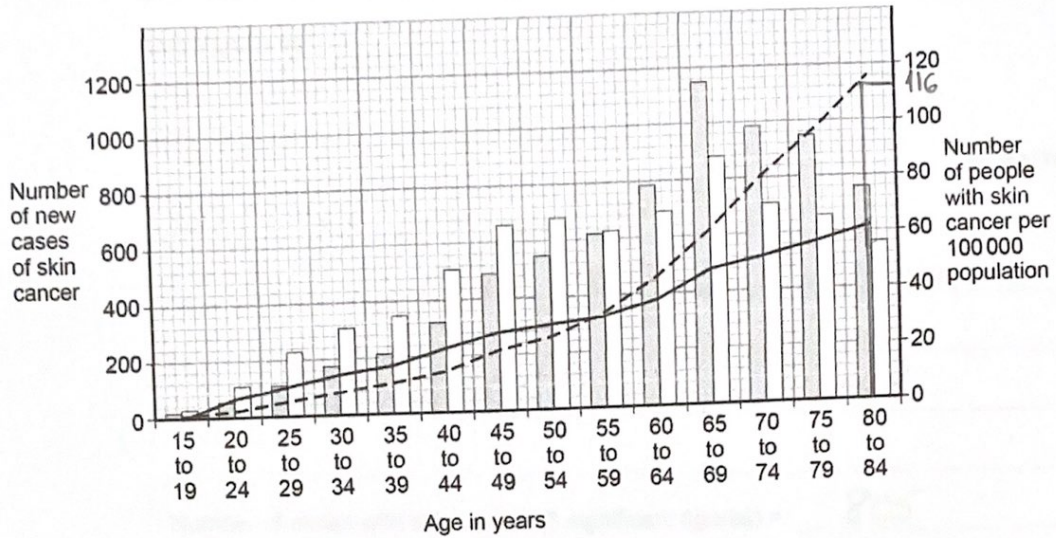
Question 5 continues on the next page

Turn over ▶

Figure 10 is repeated below.

Figure 10

Key

☒ New male cases

☐ New female cases

– – – Number of males with skin cancer per 100 000

—— Number of females with skin cancer per 100 000

| 0 | 5 | . | 5 | Describe **two** trends shown in **Figure 10**.

Use **only** the data for the number of people with skin cancer per 100 000 population.
[2 marks]

1 Number of people per 100 000 increases as age increases.

2 Number of people per 100 000 increases steadily for males until age 55, then increases more rapidly after

0 5 . 6 The estimated population of males aged 80 to 84 years was 694 000

Calculate the number of males aged 80 to 84 years with skin cancer in that year.

Use **Figure 10**.

Give your answer to 3 significant figures.

[3 marks]

80 - 84 had 116 people por 100 000

$$\Rightarrow \frac{116 \times 694\,000}{100\,000} = 805.04$$

3sf ⟹ 805

Number of males with skin cancer (3 significant figures) = ___805___

14

Turn over for the next question

0 6 This question is about the heart.

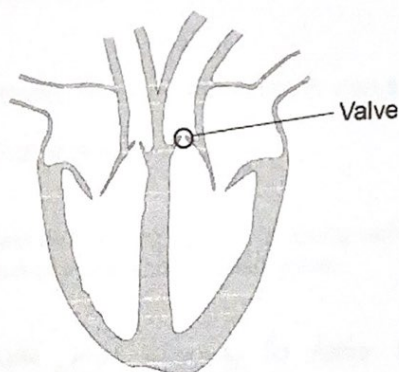**0 6 . 1** Why is the heart described as an organ? [1 mark]

It consist of different tissues and performs a specific function.

0 6 . 2 Valves in the heart keep the blood flowing through the heart in one direction.

Figure 11 shows the heart with one of the valves labelled.

Figure 11

— Valve

Explain the effects on a person if the valve labelled in **Figure 11** developed a leak.
[4 marks]

Some of the blood would flow back into the left ventricle. ~~there~~ Therefore less oxygenated blood would flow out of the heart to the cells. Cells require oxygen for respiration from the blood. If less oxygenated blood is pumped, less oxygen is supplied, so less respiration can take place. The person hence may feel out of breath and tiered.

0 6 . 3 Faulty heart valves can be replaced using biological or mechanical valves.

The faulty valve is replaced during an operation.

Biological valves:

- are from animals or human donors
- allow blood to flow through them normally
- wear out and stiffen over time, so may need to be replaced.

Mechanical valves:

- are made from synthetic materials
- may cause blood clots on the surface of the valve
- require anti-clotting drugs to be taken for the rest of the patient's life
- can last for a very long time in ideal conditions.

A young woman enjoys extreme sports and would like to start a family.

The woman needs a heart valve replacing.

Describe the advantages and disadvantages for this young woman of having a biological heart valve instead of a mechanical heart valve.

[4 marks]

Advantages include, not having to remember to take drugs for the rest of her life. Blood thinners could also interfere with the development of a child or cause complications with bleeding at birth. With a biological valve these issues can be avoided.

However, she may have to undergo a second operation if the biological valve needs replacing. Also for a valve from a donor they may have to wait for a while to find a suitable donor.

9

END OF QUESTIONS