



Write your name here

Surname

Other names

# 16+ Scholarship

**Subject: Biology**

**Time: 1 hour**

**You must have:**

Pen  
Pencil  
Calculator  
Ruler

**Total Marks**

56

## Instructions

- Use **black** ink or ball-point pen.
- **Fill in the boxes** at the top of this page with your name.
- Answer **all** questions.
- Answer the questions in the spaces provided
  - *there may be more space than you need.*
- Show all the steps in any calculations and state the units.

## Information

- The total mark for this paper is 56
- The marks for **each** question are shown in brackets
  - *use this as a guide as to how much time to spend on each question.*

## Advice

- Read each question carefully before you start to answer it.
- Keep an eye on the time.
- Write your answers neatly and in good English.
- Try to answer every question.
- Check your answers if you have time at the end.



**Q1.**

Amylase is an enzyme that breaks down starch.

- (a) Amylase is a polymer of smaller molecules.

Name the type of smaller molecule.

\_\_\_\_\_

(1)

- (b) Explain how amylase breaks down starch.

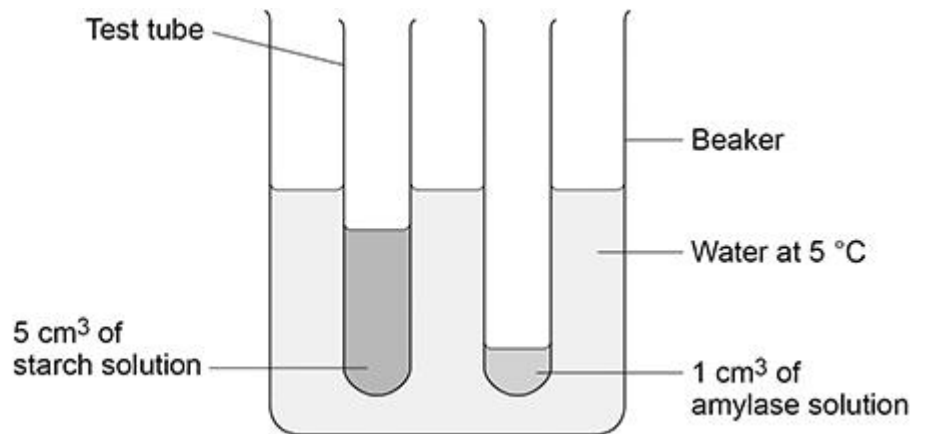
Answer in terms of the 'lock and key theory'.

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

(3)

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

The figure below shows the apparatus used.



This is the method used.

1. Set up the apparatus as shown in the figure above.
2. After 5 minutes, pour the starch solution into the amylase solution and mix.
3. Remove one drop of the starch-amylase mixture and place onto a spotting tile.
4. Immediately add two drops of iodine solution to the starch-amylase mixture on the spotting tile.
5. Record the colour of the iodine solution added to the starch-amylase mixture.
6. Repeat steps 3 to 5 every minute until the iodine solution stays yellow-brown.
7. Repeat steps 1 to 6 using water at different temperatures.

(c) Name **two** control variables the student used in the investigation.

1 \_\_\_\_\_

2 \_\_\_\_\_

(2)

(d) Why did the student leave the starch solution and amylase solution for 5 minutes before mixing them?

\_\_\_\_\_

\_\_\_\_\_

(1)

The table below shows the results of the investigation.

Temperature in °C	Time taken until iodine solution stays yellow-brown in minutes
5	did not become yellow-brown
20	5
35	2
50	7
65	14
80	did not become yellow-brown

(e) What conclusion can be made about the effect of temperature on amylase activity between 20 °C and 65 °C?

\_\_\_\_\_

\_\_\_\_\_

(1)





**Q3.**

White blood cells protect the body against pathogens such as bacteria and viruses.

- (a) (i) Pathogens make us feel ill.

Give **one** reason why.

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(1)

- (ii) White blood cells produce antibodies. This is one way white blood cells protect us against pathogens.

Give **two** other ways that white blood cells protect us against pathogens.

1. \_\_\_\_\_

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2. \_\_\_\_\_

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(2)

- (b) Vaccination can protect us from the diseases pathogens cause.

- (i) One type of virus causes measles.

A doctor vaccinates a child against measles.

What does the doctor inject into the child to make the child immune to measles?

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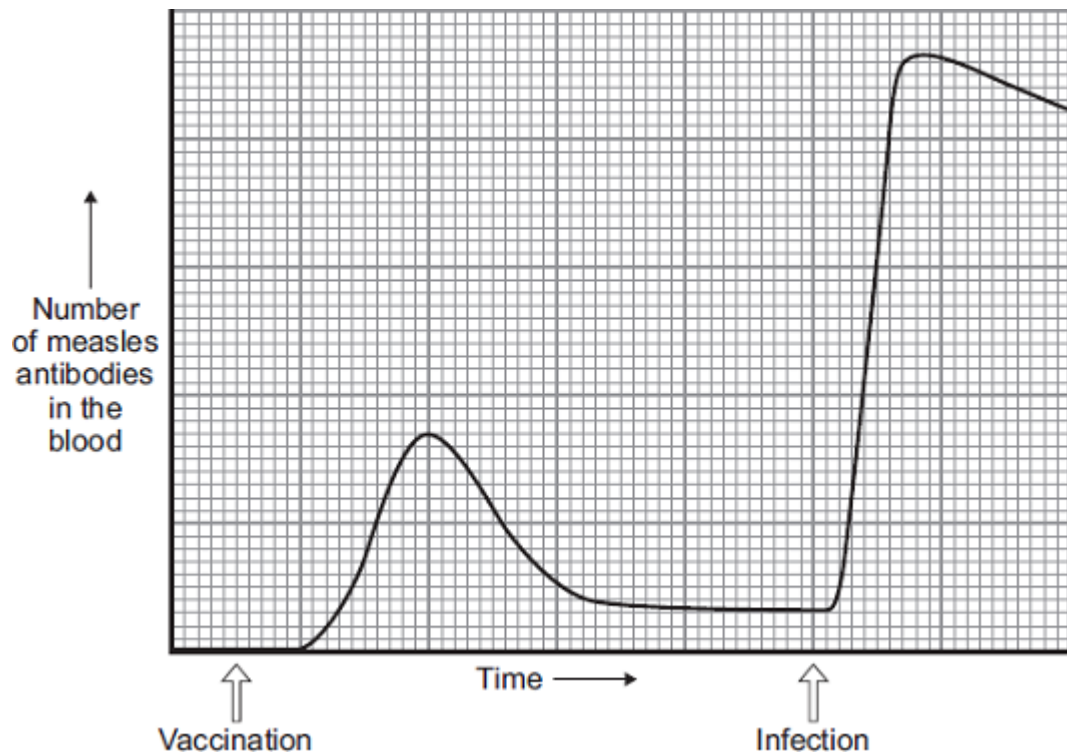
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(2)

(ii) A few weeks after the vaccination, the child becomes infected with measles viruses from another person.

The graph shows the number of measles antibodies in the child's blood from before the vaccination until after the infection.



More measles antibodies are produced after the infection than after the vaccination.

Describe other differences in antibody production after infection compared with after vaccination.

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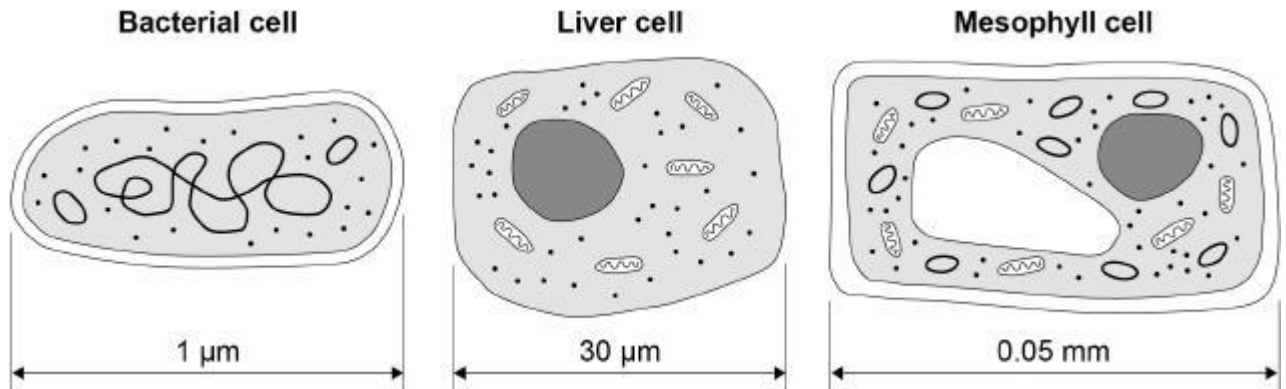
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(3)



**Q4.**

The diagram below shows three types of cell.



(a) Give **two** similarities between the prokaryotic cell and the eukaryotic cells in the diagram above.

- 1 \_\_\_\_\_
- 2 \_\_\_\_\_

(2)

(b) Give **three** differences between the prokaryotic cell and the eukaryotic cells in the diagram above.

- 1 \_\_\_\_\_
- \_\_\_\_\_
- 2 \_\_\_\_\_
- \_\_\_\_\_
- 3 \_\_\_\_\_
- \_\_\_\_\_

(3)

(c) Calculate the ratio of the size of the bacterial cell to the size of the mesophyll cell.

- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_
- \_\_\_\_\_

Ratio = 1 : \_\_\_\_\_

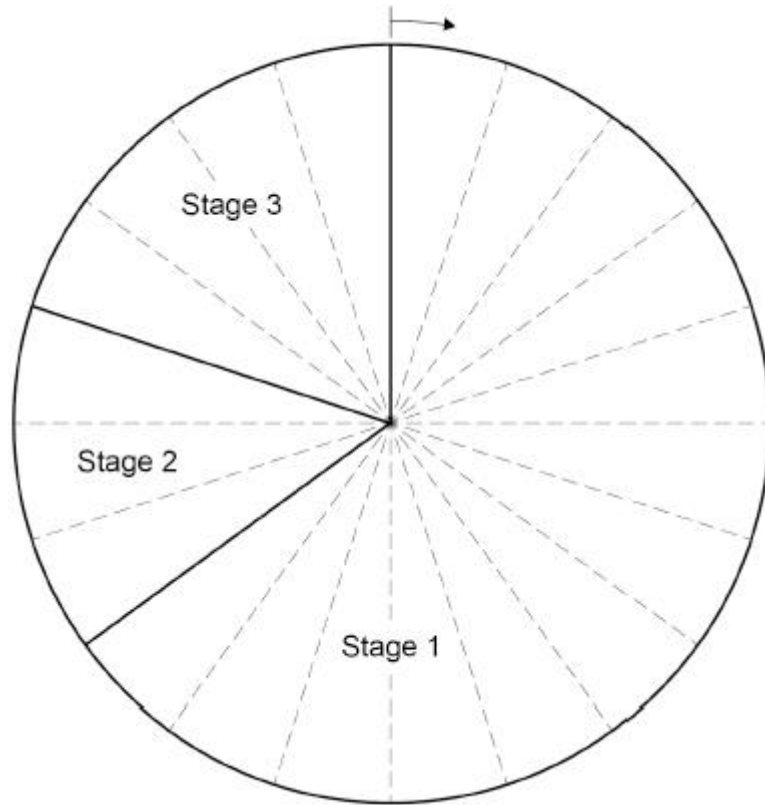
(2)

- (d) Name the type of cell division that produces genetically identical body cells for growth and repair.

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(1)

The chart below shows a cell cycle.



- (e) What percentage of the time for one cell cycle is represented by stage 2 and stage 3 together?

Tick (✓) **one** box.

7%     35%     40%     65%

(1)

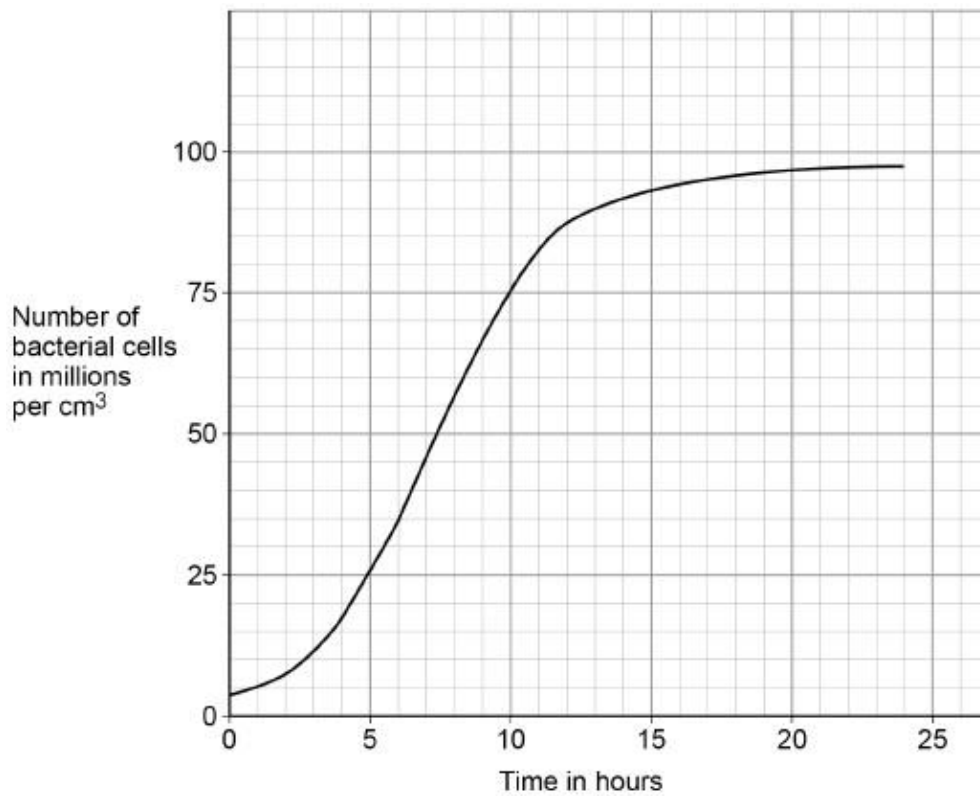


The herbicide glyphosate will kill ragwort and other weeds.

Scientists use bacteria for the genetic engineering of crop plants to make the crops resistant to glyphosate.

**Figure 1** shows the growth of a culture of the bacteria in a solution of nutrients at 25 °C

**Figure 1**



(b) Why did the rate of reproduction increase between 2 hours and 7 hours?

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(1)

(c) After 12 hours, the rate of reproduction decreased.

Suggest **three** ways the scientists could maintain a high rate of reproduction in the bacterial culture.

1 \_\_\_\_\_

\_\_\_\_\_

2 \_\_\_\_\_

\_\_\_\_\_

3 \_\_\_\_\_

\_\_\_\_\_

(3)

(d) The rate of reproduction of the bacteria is fastest at 7 hours.

How many times faster is the rate of reproduction at 7 hours than the rate at 12 hours?

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

Rate at 7 hours is \_\_\_\_\_ times faster.

(4)

- (e) Scientists transferred a gene for resistance to the herbicide glyphosate into the bacteria.

The genetically-modified (GM) bacteria can then transfer the glyphosate-resistance gene to a crop plant.

Explain the advantage of making crop plants resistant to glyphosate.

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(3)

**END OF EXAMINATION**

