AQA GCSE Biology | 8461

SPECIFICATION POINT 4.1.1.6

Culturing microorganisms (biology only)

Past-paper questions

Tier	**Foundation**
Question groups	**20**
Available paper years	**2008–2025**

Using this booklet

1. Answer the questions in order and show your working.
2. Original question numbers and marks are retained.
3. Print at actual size (100%) for measuring questions.
4. Use the companion answer booklet to check your work.

Name: _____ **Date:** _____

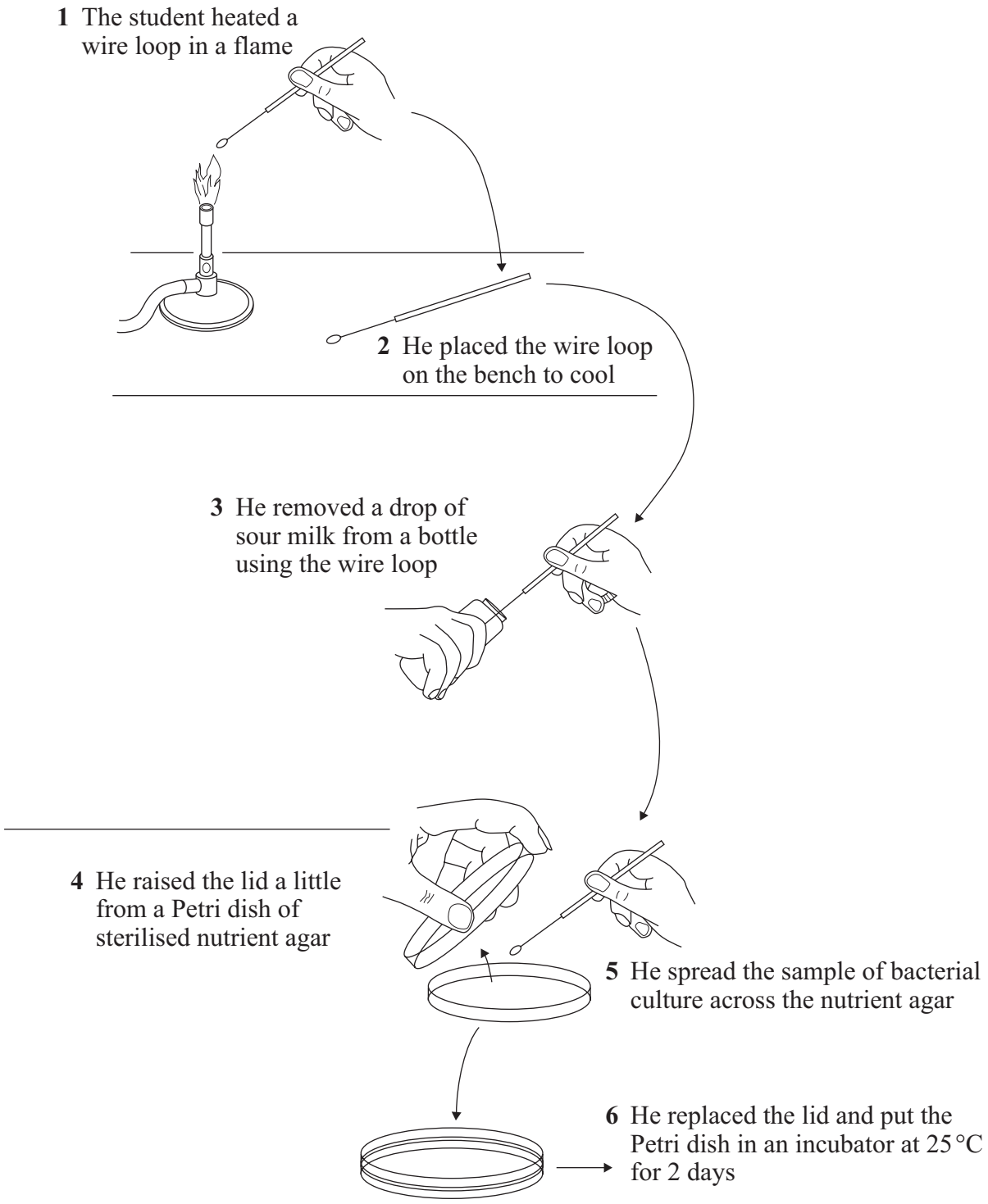
Whole questions are retained for context, so some parts assess other specification points. Current and legacy sources are labelled. Continue on extra paper if needed.

4.1.1.6 Culturing microorganisms (biology only)

Question 01

January 2008 | BLY3F | Original Q3 | Legacy

3 The diagram shows how a student transferred some sour milk from a bottle to a Petri dish of nutrient agar.



4.1.1.6 Culturing microorganisms (biology only)

Question 01 · continued

BLANK

List **A** gives four actions carried out by the student.
List **B** gives five possible effects of these actions.

Draw a straight line from each action in List **A** to its effect in List **B**.
Draw only **one** line from each action.

List A – Action	List B – Effect
	Risk of contamination with bacteria increased
Heating loop in flame	
	Risk of bacteria entering decreased
Placing loop on bench to cool	
	Kills bacteria
Only lifting lid of Petri dish a little	
	Prevents air entering
Placing Petri dish in incubator at 25 °C rather than 35 °C	
	Risk of growth of pathogens decreased

(4 marks)

4

4.1.1.6 Culturing microorganisms (biology only)

Question 02

June 2008 | BLY3F | Original Q5 | Legacy

5 (a) Microorganisms can be grown in Petri dishes containing nutrient agar.
The Petri dish and nutrient agar must be sterilised before use.

Which method is used to sterilise the Petri dish and nutrient agar?

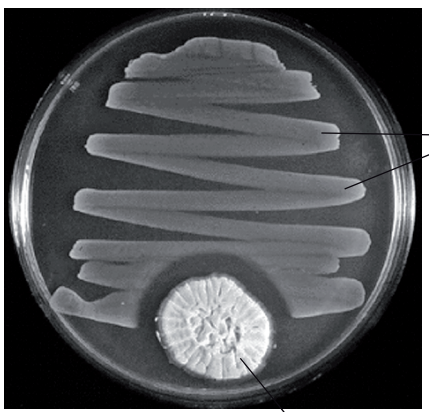
Tick (✓) **one** box.

- Heat at 120 °C for 30 minutes ☐
- Pass through a Bunsen burner flame ☐
- Place in an incubator at 25 °C for one day ☐

(1 mark)

Question 5 continues on the next page

5 (b) The photograph shows *Penicillium* mould and one species of bacterium growing together on nutrient agar in a Petri dish.



The *Penicillium* mould produces an antibiotic.

How can you tell this from the photograph?

.....

.....

(1 mark)

5 (c) A student investigated the effect of pH on the growth of *Penicillium*.

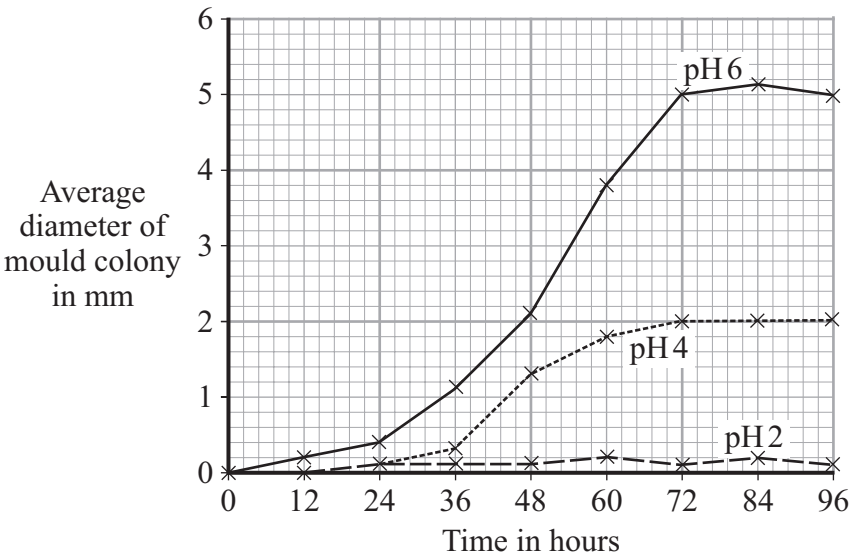
- He used three Petri dishes containing nutrient agar.
- The pH of the nutrient agar in the three Petri dishes was 2, 4 and 6 respectively.
- He inoculated each Petri dish with the same amount of *Penicillium* mould.
- Every 12 hours, he measured the diameter of five *Penicillium* colonies in each dish.
- From these measurements, he calculated the average diameter of the five colonies in each dish.

The graph on the opposite page shows the results.

4.1.1.6 Culturing microorganisms (biology only)

Question 02 · continued

for mark



5 (c) (i) Complete the sentence.

Calculating the average diameter of five colonies from each dish made the results more ..... .

(1 mark)

5 (c) (ii) At which pH did the mould grow best? .....

(1 mark)

5 (c) (iii) What was the maximum average diameter of the mould colony at pH 4?

..... mm

(1 mark)

5 (c) (iv) During which 12-hour period was growth fastest at pH 6?

From ..... to ..... hours.

(1 mark)

5 (d) pH is only one factor which affects the growth of *Penicillium* mould.

When *Penicillium* is grown in an industrial fermenter, other factors also need to be controlled.

Give **two** of these other factors.

1 .....

2 .....

(2 marks)

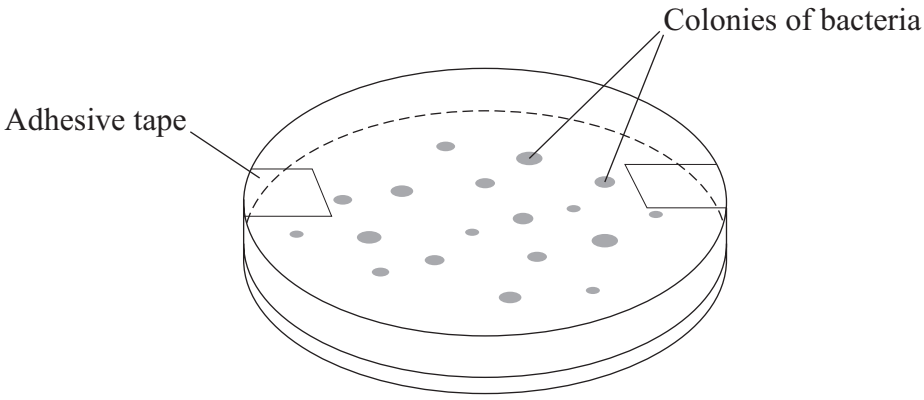
8

4.1.1.6 Culturing microorganisms (biology only)

Question 03

January 2009 | BLY3F | Original Q2 | Legacy

2 The diagram shows a Petri dish containing nutrient agar. Colonies of bacteria are growing on the nutrient agar.



Draw a ring around the correct answer to complete each sentence.

2 (a) (i) Agar jelly contains carbohydrates.

These carbohydrates are a source of [energy / minerals / protein] for the bacteria.

(1 mark)

2 (a) (ii) The dish is sealed with adhesive tape to prevent the entry of

[carbon dioxide / microorganisms / oxygen] from the air.

(1 mark)

2 (b) (i) The dish is placed in an incubator at a temperature of [10 °C / 25 °C / 75 °C] .

(1 mark)

2 (b) (ii) This temperature is used rather than 35 °C so that it is

less likely that [fungi / pathogens / yeasts] will grow in the dish.

(1 mark)

4

4.1.1.6 Culturing microorganisms (biology only)

Question 04

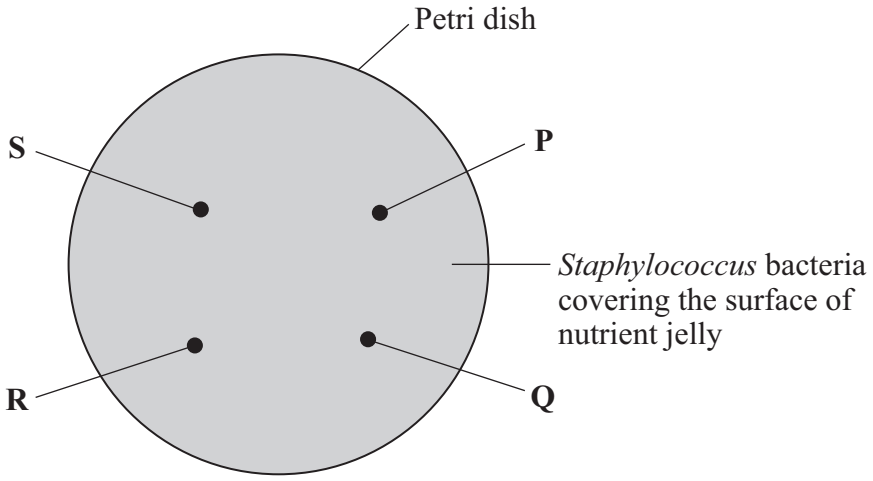
March 2009 | BLY1AP | Original Q6 | Legacy

QUESTION SIX

Students investigated the effectiveness of four different antibacterial mouthwashes, **P**, **Q**, **R** and **S**. Identical filter paper discs were soaked in mouthwashes **P**, **Q**, **R** and **S** respectively.

The discs were then placed on *Staphylococcus* bacteria growing in a Petri dish, as shown in **Diagram 1**.

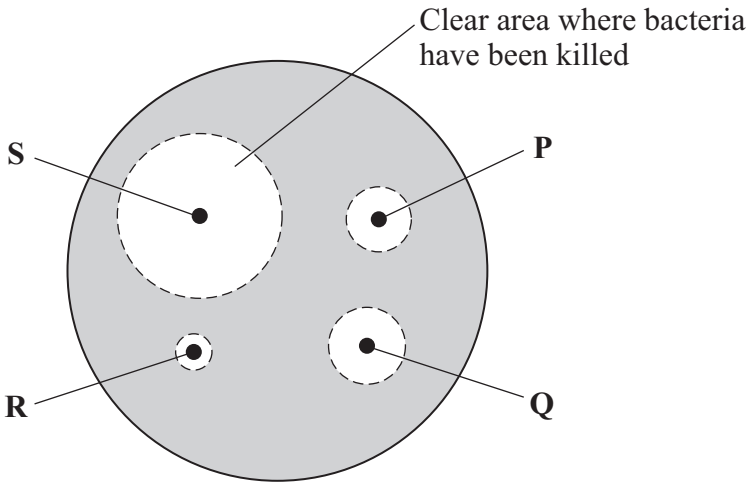
Diagram 1



The dish was covered and left for 48 hours.

Diagram 2 shows the appearance of the Petri dish after 48 hours.

Diagram 2



4.1.1.6 Culturing microorganisms (biology only)

Question 04 · continued

6A Which was the independent variable in this investigation?

1 the temperature of the room

2 the type of mouthwash

3 the time the dish was left for

4 the size of the clear area

6B Which was a control variable in this investigation?

1 the diameter of each bacterium

2 the diameter of the Petri dish

3 the diameter of the clear area

4 the diameter of each filter paper disc

6C Which mouthwash killed most *Staphylococcus* bacteria?

1 **P**

2 **Q**

3 **R**

4 **S**

6D The investigation would have been more reliable if the students had . . .

1 left the dish for 72 hours.

2 left the dish uncovered.

3 used larger discs of filter paper.

4 compared their results with other groups.

4.1.1.6 Culturing microorganisms (biology only)

Question 05

June 2009 | BLY3F | Original Q3 | Legacy

3 (a) Microorganisms can be grown on agar jelly in a Petri dish.

List A gives three actions used when growing microorganisms.
List B gives four possible effects of these actions.

Draw a straight line from each action in **List A** to its effect in **List B**.

List A – Action	**List B – Effect**
	To reduce the growth of pathogens
The agar jelly is heated at 120°C for 30 minutes	
	To kill unwanted microorganisms
Make sure the temperature for growing the microorganisms is no higher than 25 °C	
	To prevent microorganisms from the air getting into the Petri dish
The lid of the Petri dish is held on with tape	
	To prevent oxygen entering the Petri dish

(3 marks)

3 (b) UHT milk is milk that has been heated to 135 °C, then cooled.

In an investigation, three sterile Petri dishes containing sterile agar jelly were set up as follows.

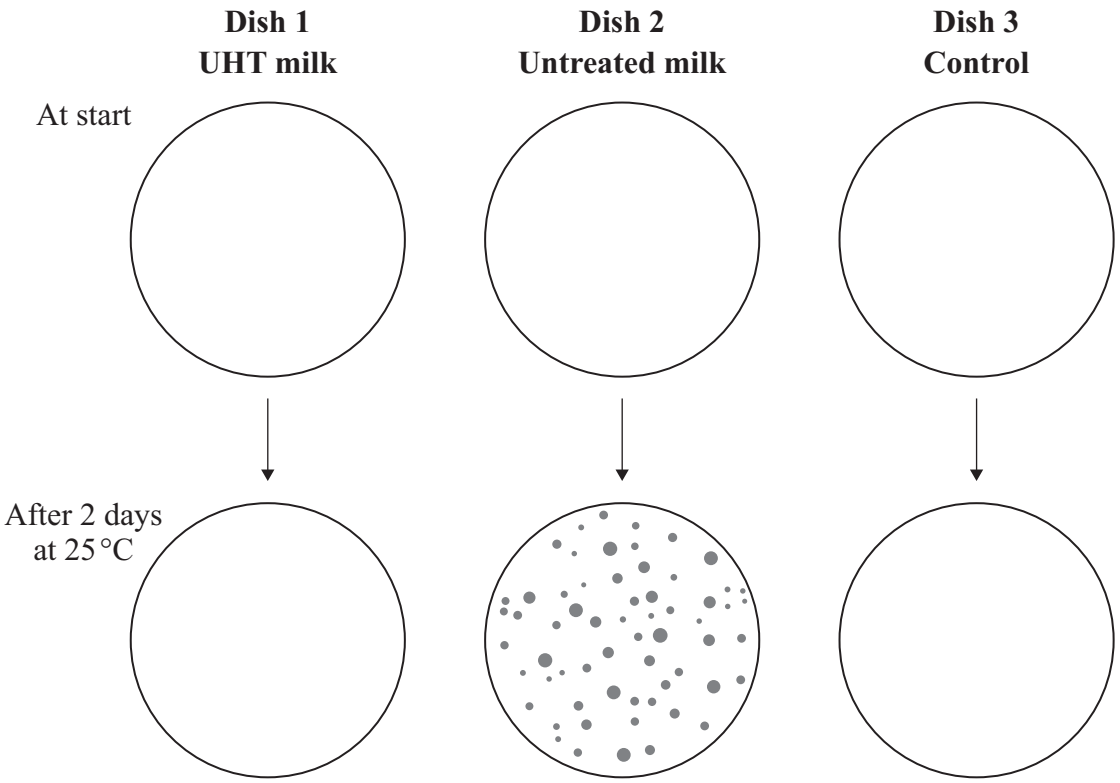
- UHT milk was added to dish **1**.
- Untreated milk was added to dish **2**.
- Dish **3** was left unopened as a control.
- The dishes were kept at 25 °C for two days.

The results are shown in the diagram on the opposite page.

4.1.1.6 Culturing microorganisms (biology only)

Question 05 · continued

for mark



3 (b) (i) Describe the difference in appearance between dishes **1** and **2** after two days.

.....

.....

(1 mark)

3 (b) (ii) Give **one** reason for this difference.

.....

.....

(1 mark)

3 (b) (iii) There was no change in the appearance of dish **3** after two days.

Give **one** reason why.

.....

.....

(1 mark)

6

4.1.1.6 Culturing microorganisms (biology only)

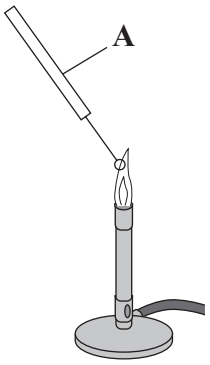
Question 06

2 (a) It is important to prevent contamination when growing microorganisms.

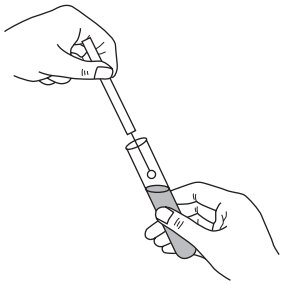
The diagram shows the transfer and culturing of microorganisms.

Stage V  A Petri dish with agar is heated to 120 °C for 20 minutes, then cooled

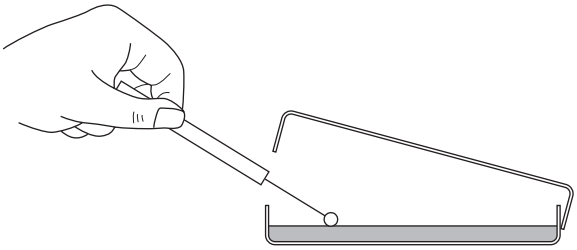
Stage W



Stage X



Stage Y



Stage Z  Petri dish kept at 25 °C for 48 hours

2 (a) (i) Name the apparatus labelled **A** in stage **W**.

Draw a ring around **one** answer.

inoculating loop **pipette** **thermometer**

(1 mark)

4.1.1.6 Culturing microorganisms (biology only)

Question 06 · continued

for mark

2 (a) (ii) Give the letters of the **two** stages from **V**, **W**, **X**, **Y** and **Z**, which are carried out to kill microorganisms.

Stages ☐ and ☐

(2 marks)

2 (a) (iii) Give the letter of the stage, **V**, **W**, **X**, **Y** or **Z**, where incubation takes place.

Stage ☐

(1 mark)

2 (b) A culture medium used for growing microorganisms contains various nutrients.

Which nutrient is the main source of energy for the microorganisms?

Draw a ring around **one** answer.

carbohydrates **mineral ions** **vitamins**

(1 mark)

5

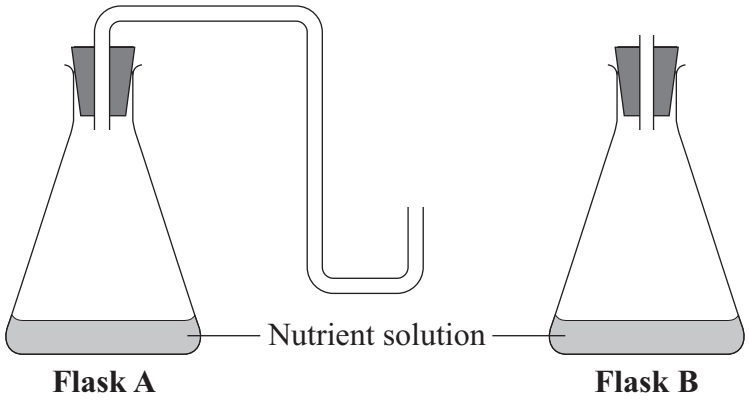
4.1.1.6 Culturing microorganisms (biology only)

Question 06 · continued

for mark

3 Some students investigated biogenesis.

They set up three flasks like **Flask A** and three flasks like **Flask B**, as shown in the diagram.



- The students boiled the nutrient solution in each flask for 40 minutes.
- They left the flasks to cool to room temperature.
- They then kept all six flasks at room temperature for one week.

4.1.1.6 Culturing microorganisms (biology only)

Question 07

January 2019 | BLY3F | Original Q4 | Legacy

4 (a) Give **two** advantages of having the biogas generator underground.

Tick (✓) **two** boxes.

It allows the digested slurry to soak into the soil. ☐

The biogas produced will be at a lower pressure. ☐

Very little of the biogas generator will be seen. ☐

It prevents unpleasant smells escaping. ☐

The temperature inside will not change much. ☐

(2 marks)

4.1.1.6 Culturing microorganisms (biology only)

Question 07 · continued

for mark

4 (b) The table shows the percentages of the different gases found in this biogas.

Gas	Percentage
Carbon dioxide	35.0
Hydrogen sulfide	1.5
Ammonia	1.5
Water vapour	2.0
Gas **X**	

Gas **X** is the main fuel gas found in biogas.

4 (b) (i) What is the name of gas **X**?

Draw a ring around **one** answer.

hydrogen **methane** **oxygen**

(1 mark)

4 (b) (ii) What is the percentage of gas **X** in the biogas?

Show clearly how you work out your answer.

.....

.....

.....

Percentage of gas **X** = ...

(2 marks)

5

4.1.1.6 Culturing microorganisms (biology only)

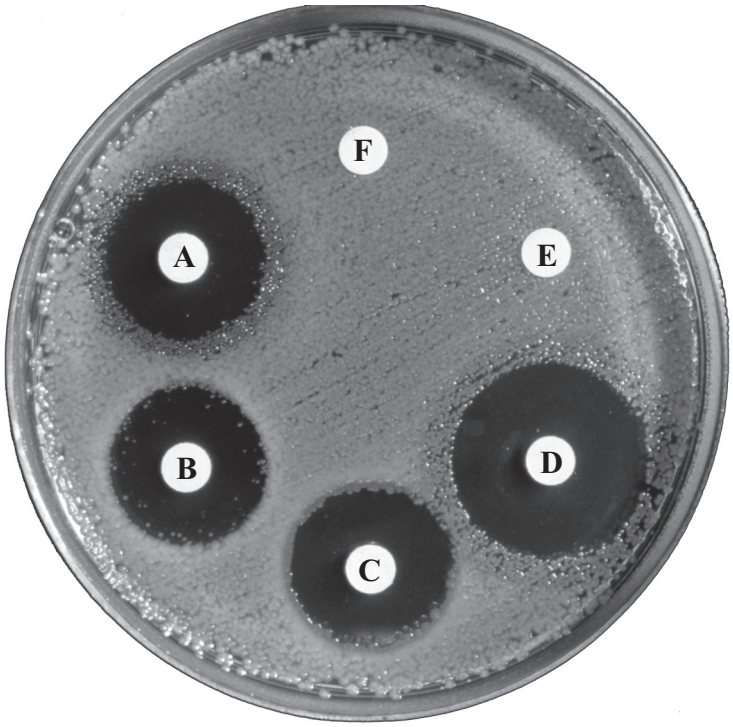
Question 07 · continued

for mark

5 Some scientists tested the effectiveness of six new antibiotics, **A**, **B**, **C**, **D**, **E** and **F**.

- They mixed a culture of one species of bacterium with nutrient agar in a Petri dish.
- They then prepared separate discs of filter paper, each soaked in a different antibiotic.
- They placed the filter paper discs on the surface of the agar.
- The Petri dish was kept at 35 °C for 2 days.

The results are shown in the photograph.



4.1.1.6 Culturing microorganisms (biology only)

Question 08

March 2010 | BLY1AP | Original Q7 | Legacy

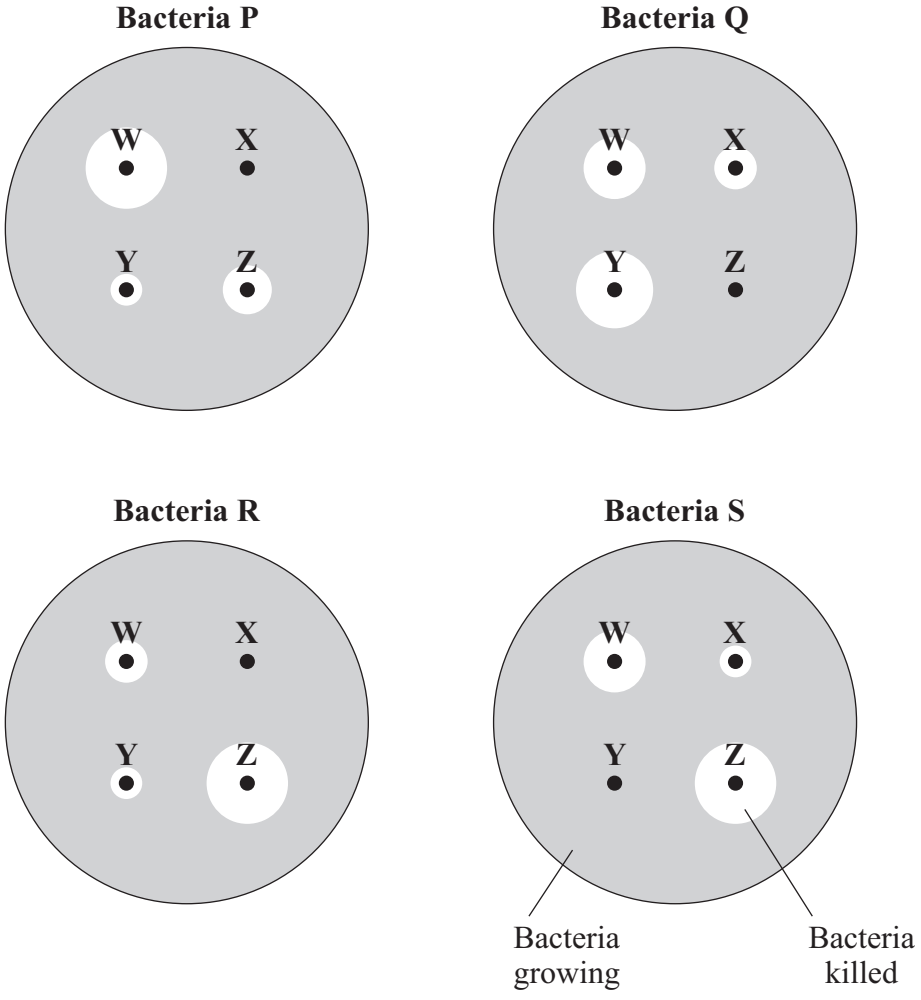
QUESTION SEVEN

A group of students investigated how effective four different antibiotics were at killing four different bacteria.

In this investigation:

- the four bacteria, **P**, **Q**, **R** and **S**, were spread on separate dishes containing nutrient agar
- paper discs were dipped into the four different antibiotics, **W**, **X**, **Y** and **Z**
- one of each disc was placed onto the agar in each of the four dishes.

The diagram shows the appearance of the dishes after three days. If the antibiotic kills the bacteria there is a clear space around the disc. The larger the clear space, the more effective the antibiotic is.



7A Which of the following is **not** an important control variable in this investigation?

1 the diameter of the dishes

2 the temperature at which the dishes were kept

3 the concentration of the antibiotics

4 the volume of antibiotic on each disc

4.1.1.6 Culturing microorganisms (biology only)

Question 08 · continued

7B How could the students improve the reliability of their investigation?

1 calculating the mean clear area for all the antibiotics in one dish

2 repeating the investigation using different antibiotics and different bacteria

3 repeating the investigation and calculating the mean clear area for each antibiotic

4 ignoring all the results where bacteria were **not** killed

7C Using the information in the diagrams, which antibiotic could be used to kill any of the bacteria?

1 antibiotic **W**

2 antibiotic **X**

3 antibiotic **Y**

4 antibiotic **Z**

7D Using the information in the diagrams, which antibiotic worked equally well in killing bacteria **R** and **S**?

1 antibiotic **W**

2 antibiotic **X**

3 antibiotic **Y**

4 antibiotic **Z**

4.1.1.6 Culturing microorganisms (biology only)

Question 09

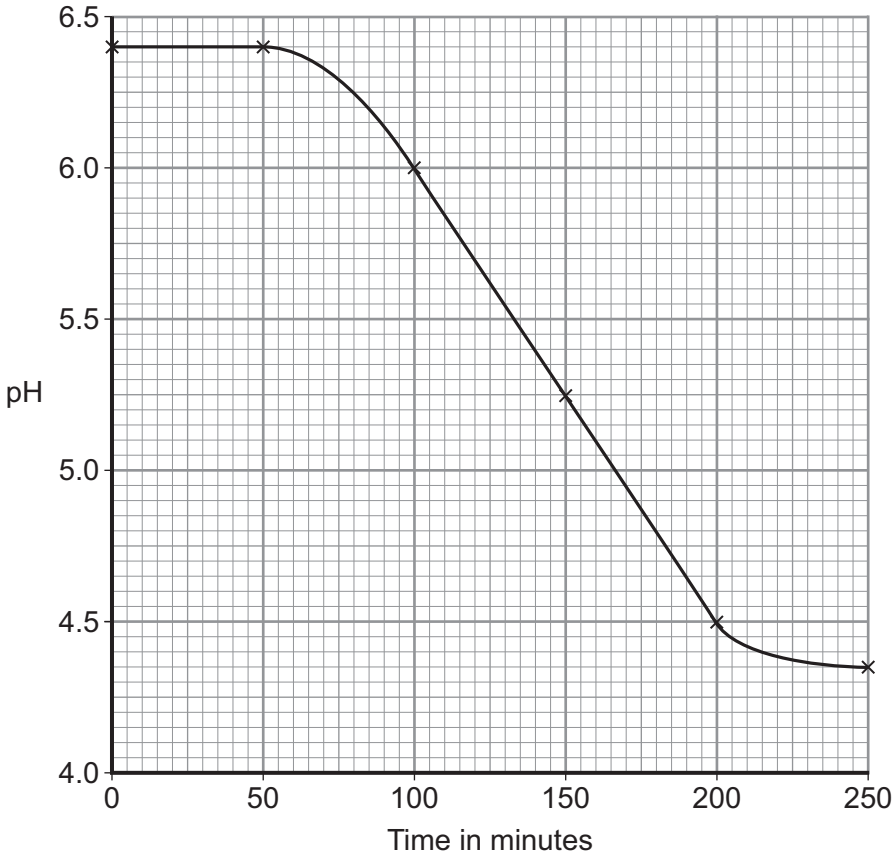
January 2011 | BLY3F | Original Q8 | Legacy

8 A student investigated the production of yoghurt.

The student:

- boiled 200 cm^3 of milk in a flask for 10 minutes
- let the milk cool to room temperature
- then added 20 cm^3 of 'yoghurt starter culture' (plain yoghurt which contains living bacteria)
- put the flask in a water bath at room temperature
- measured the pH of the yoghurt every 50 minutes.

The results are shown in the graph.



8 (a) The milk was boiled for 10 minutes before it was used.

Explain why this was necessary.

.....

.....

(1 mark)

4.1.1.6 Culturing microorganisms (biology only)

Question 09 · continued

8 (b) (i) Use information from the graph to calculate the rate of fall in pH between 100 and 200 minutes.

Show clearly how you work out your answer.

.....

.....

.....

Answer = ... pH units per minute
(2 marks)

8 (b) (ii) Suggest **one** reason why the rate of fall in pH slowed down after 200 minutes.

.....

.....
(1 mark)

8 (c) What substance causes the yoghurt to thicken after 200 minutes?

.....

.....
(2 marks)

8 (d) The yoghurt would have been produced more quickly at 35 °C.

8 (d) (i) What is the maximum temperature at which bacteria should be grown in a school laboratory?

..... °C
(1 mark)

8 (d) (ii) It is **not** safe to grow bacteria at 35 °C in a school laboratory.

Explain why.

.....

.....
(1 mark)

8

4.1.1.6 Culturing microorganisms (biology only)

Question 10

June 2011 | BLY3F | Original Q3 | Legacy

3 Mycoprotein is produced from the fungus *Fusarium*. Mycoprotein is sometimes used instead of meat in foods for vegetarians.

3 (a) The table shows the amounts of some substances in mycoprotein and in chicken.

Substance	Mass in grams per 100 grams	
	Mycoprotein	Chicken
Protein	11.8	22.0
Dietary fibre	4.8	0.0
Fat	3.5	6.2
Carbohydrate	2.0	0.0
Cholesterol	0.0	0.1

3 (a) (i) Draw a ring around the correct answers to complete the sentence.

Eating mycoprotein instead of chicken helps to lower the risk of heart disease because

mycoprotein contains no [fat / carbohydrate / cholesterol] and

mycoprotein contains less [dietary fibre. / fat. / carbohydrate.]

(2 marks)

3 (a) (ii) A body-builder ate 4 kilograms of chicken each week to help him build up his muscles.

If he ate mycoprotein instead of chicken, he would need to eat about twice as much to have the same effect.

Use information from the table to give **one** reason why.

.....

.....

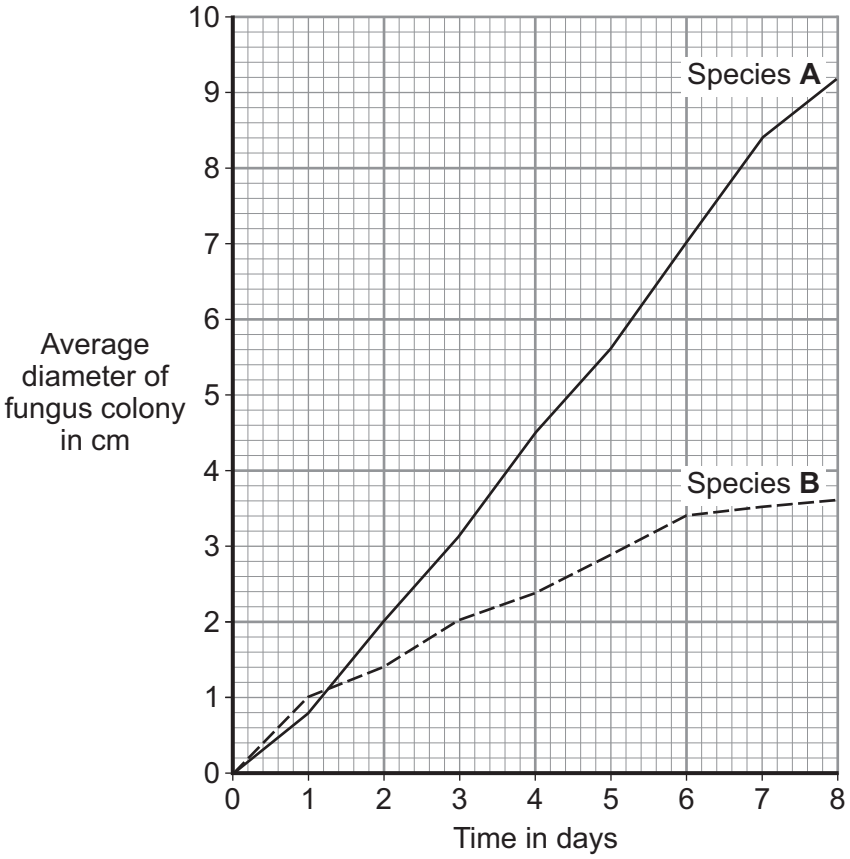
(1 mark)

4.1.1.6 Culturing microorganisms (biology only)

Question 10 · continued

3 (b) Scientists investigated the growth of two species, **A** and **B**, of the fungus *Fusarium.*
The scientists grew the fungus on agar jelly in Petri dishes.
They measured the diameter of a colony of each fungus every day for 8 days.

The graph shows the results.



3 (b) (i) Describe how the diameter of the colony of species **A** changed between day 0 and day 8.

.....

.....

.....

.....

(2 marks)

3 (b) (ii) Give **one** difference between the results for species **A** and the results for species **B**.

.....

.....

(1 mark)

Question 3 continues on the next page

4.1.1.6 Culturing microorganisms (biology only)

Question 10 · continued

3 (c) Both Petri dishes contained the same nutrients.
Both Petri dishes were kept at 25 °C.

When *Fusarium* is grown in an industrial fermenter, other factors also need to be controlled.

Give **two** of these other factors.

1 .....

2 .....

(2 marks)

8

4.1.1.6 Culturing microorganisms (biology only)

Question 11

January 2013 | BL1FP | Original Q9 | Legacy

9 A student is given a tube containing a liquid nutrient medium. The medium contains one type of bacterium.

9 (a) *In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate.*

The student is told to grow some of the bacteria on agar jelly in a Petri dish.

Describe how the student should prepare an uncontaminated culture of the bacterium in the Petri dish.

You should explain the reasons for each of the steps you describe.

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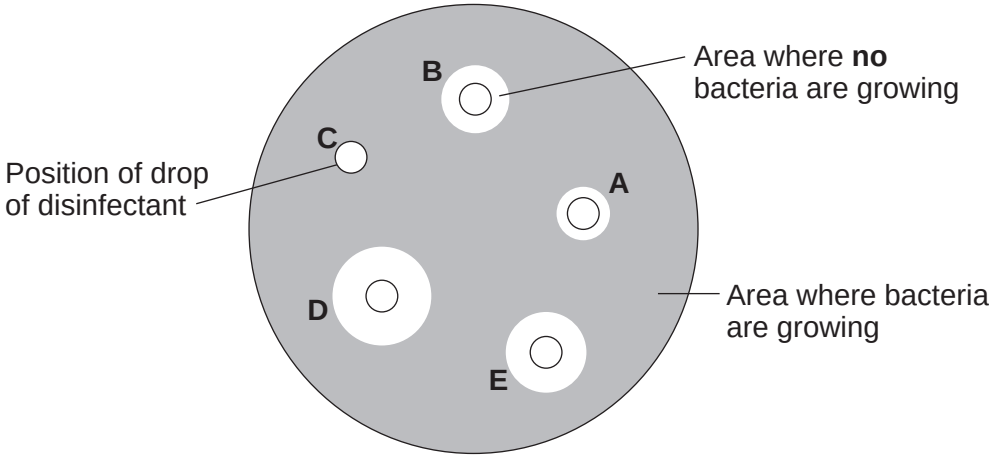
(6 marks)

4.1.1.6 Culturing microorganisms (biology only)

Question 11 · continued

9 (b) After the culture had been prepared, the student added one drop of each of five disinfectants, **A**, **B**, **C**, **D** and **E**, onto the culture.

The diagram shows the appearance of the Petri dish 3 days later.



9 (b) (i) There are areas on the agar jelly where **no** bacteria are growing.

Why?

.....

.....

(1 mark)

9 (b) (ii) The student concluded that disinfectant **D** would be the best for using around the home.

Give **one** reason why the student might be correct.

.....

.....

.....

Give **one** reason why the student might **not** be correct.

.....

.....

.....

(2 marks)

9

4.1.1.6 Culturing microorganisms (biology only)

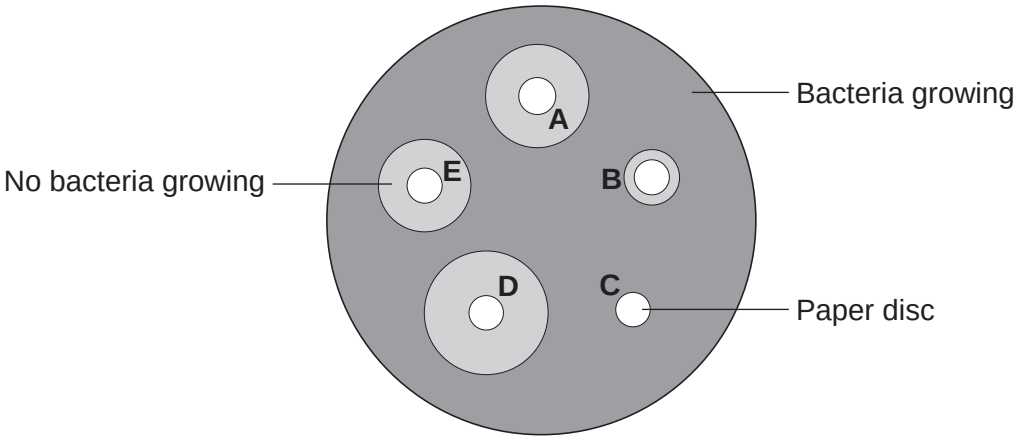
Question 12

June 2013 | BL1FP | Original Q3 | Legacy

3 Students in a school investigated the effect of five different antibiotics, **A**, **B**, **C**, **D** and **E**, on one type of bacterium.

The students:
- grew the bacteria on agar jelly in a Petri dish
- soaked separate paper discs in each of the antibiotics
- put the paper discs onto the bacteria in the Petri dish
- put the Petri dish into an incubator.

The diagram shows what the Petri dish looked like after 3 days.



3 (a) (i) What is the maximum temperature the incubator should be set at in the school?

Draw a ring around your answer.

10°C **25°C** **50°C**

(1 mark)

3 (a) (ii) Draw a ring around the correct answer to complete the sentence.

The incubator should **not** be set at a higher temperature because the higher

temperature might help the growth of

pathogens.
toxins.
viruses.

(1 mark)

4.1.1.6 Culturing microorganisms (biology only)

Question 12 · continued

3 (b) Which antibiotic, **A**, **B**, **C**, **D** or **E**, would be best to treat a disease caused by this type of bacterium?

Write your answer in the box. ☐

Give the reason for your answer.

.....

.....

(2 marks)

3 (c) Antibiotics **cannot** be used to treat diseases caused by viruses.

Why?

Tick (✓) **one** box.

Viruses are not pathogens ☐

There are too many different types of virus ☐

Viruses live inside cells ☐

(1 mark)

5

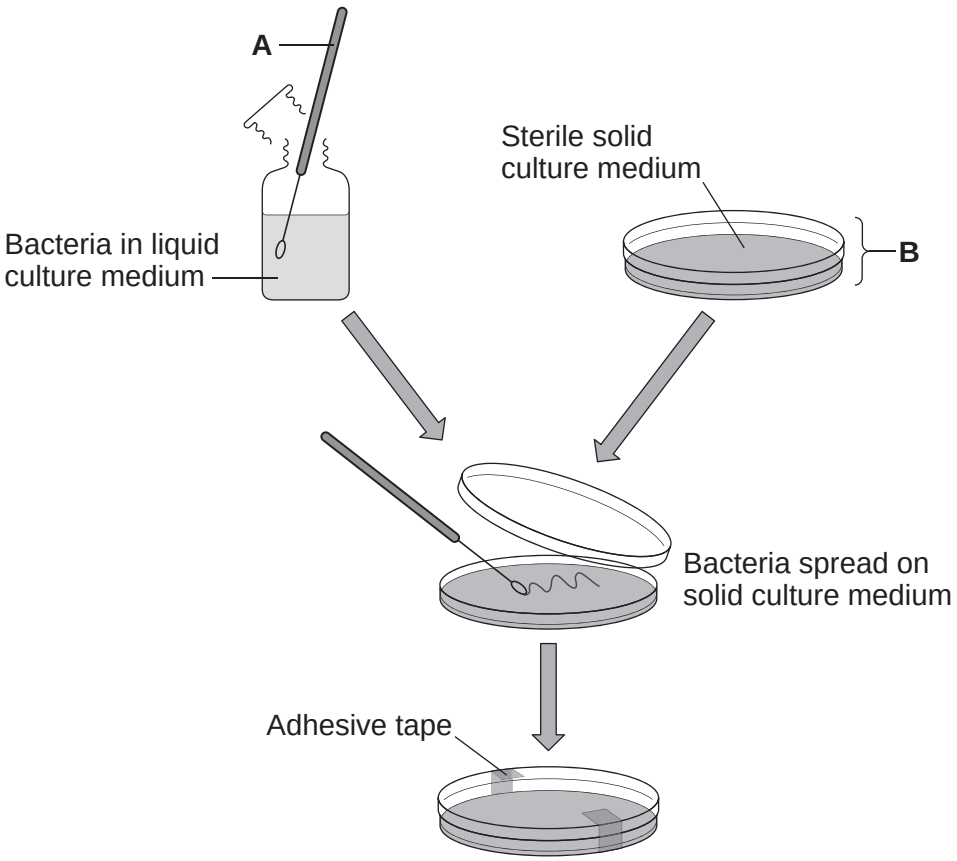
4.1.1.6 Culturing microorganisms (biology only)

Question 13

June 2015 | BL1FP | Original Q3 | Legacy

3 **Figure 4** shows a method used to grow pure cultures of a bacterium.

Figure 4



3 (a) Name apparatus **A** and apparatus **B**.

[2 marks]

Apparatus **A** .....

Apparatus **B** .....

3 (b) (i) Why should apparatus **A** and apparatus **B** be sterilised before they are used?

[1 mark]

.....

.....

4.1.1.6 Culturing microorganisms (biology only)

Question 13 · continued

3 (b) (ii) How should apparatus **A** be sterilised?

Tick (✓) **one** box.

[1 mark]

Using enzymes ☐

Using a flame ☐

In an incubator ☐

3 (b) (iii) Adhesive tape is used to secure the lid on apparatus **B**.

Give **one** reason why the lid of apparatus **B** should be securely taped in place.

[1 mark]

.....

.....

3 (c) What is the maximum temperature that should be used **in schools** to grow the bacteria in apparatus **B**?

Draw a ring around the correct answer.

[1 mark]

10 °C **25 °C** **50 °C**

6

4.1.1.6 Culturing microorganisms (biology only)

Question 14

June 2017 | BL1FP | Original Q5 | Legacy

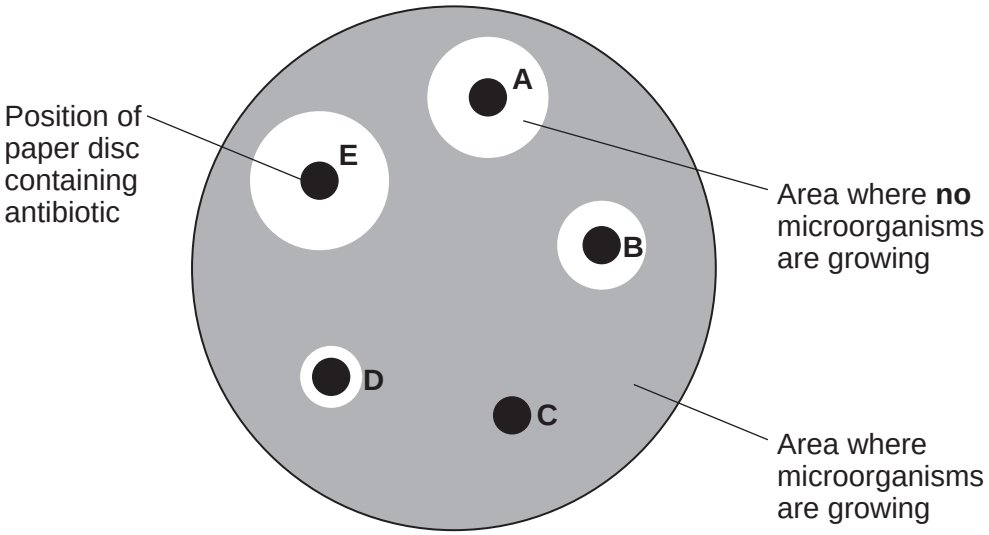
5 Some students investigated antibiotics.

The students:

- spread one type of microorganism on a sterile Petri dish containing an agar culture medium
- added five paper discs, each with one drop of a different antibiotic, **A**, **B**, **C**, **D** and **E**
- secured the lid on the dish with adhesive tape
- incubated the dish for 3 days at 25° C.

Figure 6 shows the Petri dish after the 3 days.

Figure 6



5 (a) Give **one** safety precaution that the students used in their investigation.

State why this safety precaution is needed.

[2 marks]

Safety precaution used _____

_____

Why the safety precaution is needed _____

_____

Question 14 · continued

5 (b) One student made a conclusion:

'Doctors should always give antibiotic **E** to get rid of any disease.'

5 (b) (i) Describe the evidence from **Figure 6** which supports the student's conclusion.

[1 mark]

_____

_____

5 (b) (ii) Suggest **one** reason why the student's conclusion may **not** be correct.

[1 mark]

_____

_____

5 (c) Antibiotics can be given to farm animals as well as to humans.

Table 2 shows the mass of different antibiotics that have been given to farm animals and to humans.

Table 2

Antibiotic	Mass of antibiotic in kilograms	
	Given to farm animals	Given to humans
A	121 600	314 500
B	323 000	47 500
C	37 000	5 400
D	71 200	47 700
E	42 000	49 000

5 (c) (i) Write down **all** of the antibiotics, **A**, **B**, **C**, **D** or **E**, which have been used **more** for farm animals than for humans.

[1 mark]

_____

Question 5 continues on the next page

4.1.1.6 Culturing microorganisms (biology only)

Question 14 · continued

5 (c) (ii) Farmers in some countries use antibiotics to prevent disease in farm animals. This prevents the animals becoming ill or dying.

Suggest **one** other advantage to the farmer of giving antibiotics to farm animals.

[1 mark]

Tick (✓) **one** box.

The antibiotics will be passed to people who consume the animals. ☐

Healthy animals will produce a higher yield. ☐

The antibiotics will build up in the animals. ☐

5 (c) (iii) What is the possible effect of using too much antibiotic?

[1 mark]

Tick (✓) **one** box.

Animals become resistant to the antibiotic. ☐

Microorganisms become resistant to the antibiotic. ☐

People become immune to the antibiotic. ☐

People become resistant to the antibiotic. ☐

5 (d) The human body defends itself against pathogens using one type of blood cell.

5 (d) (i) Complete the sentence.

[1 mark]

Pathogens in the body can be killed by _____ blood cells.

4.1.1.6 Culturing microorganisms (biology only)

Question 14 · continued

June 2017 | BL1FP | Original Q5 | Legacy

5 (d) (ii) Give **two** ways in which the blood cells you have named in part **(d)(i)** protect the body from disease.

[2 marks]

Tick (✓) **two** boxes.

These blood cells produce antibiotics. ☐

These blood cells produce antibodies. ☐

These blood cells ingest pathogens. ☐

These blood cells reproduce pathogens. ☐

These blood cells produce toxins. ☐

10

4.1.1.6 Culturing microorganisms (biology only)

Question 15

June 2018 | 8461/1F | Original Q7

0 7 Eating food containing *Salmonella* bacteria can cause illness.

0 7 . 1 Two symptoms of infection by *Salmonella* are vomiting and diarrhoea.

What causes these symptoms?

[1 mark]

0 7 . 2 Give **two** ways a person with a mild infection of *Salmonella* can help prevent the spread of the bacteria to other people.

[2 marks]

1

2

0 7 . 3 In very serious infections of *Salmonella*, a doctor can prescribe drugs to kill the bacteria.

What type of drug can the doctor prescribe to kill the bacteria?

[1 mark]

0 7 . 4 A person with AIDS may take longer than a healthy person to recover from a *Salmonella* infection.

Explain why.

[2 marks]

Question 15 · continued

0 7 . 5 *Salmonella* bacteria can be transmitted from chickens to humans. Chickens can be vaccinated to prevent the transmission of *Salmonella* bacteria to humans.

Suggest **one** other way farmers could prevent the transmission of *Salmonella* from chickens to humans.

[1 mark]

A restaurant owner employed a scientist to test the effectiveness of two kitchen cleaning liquids.

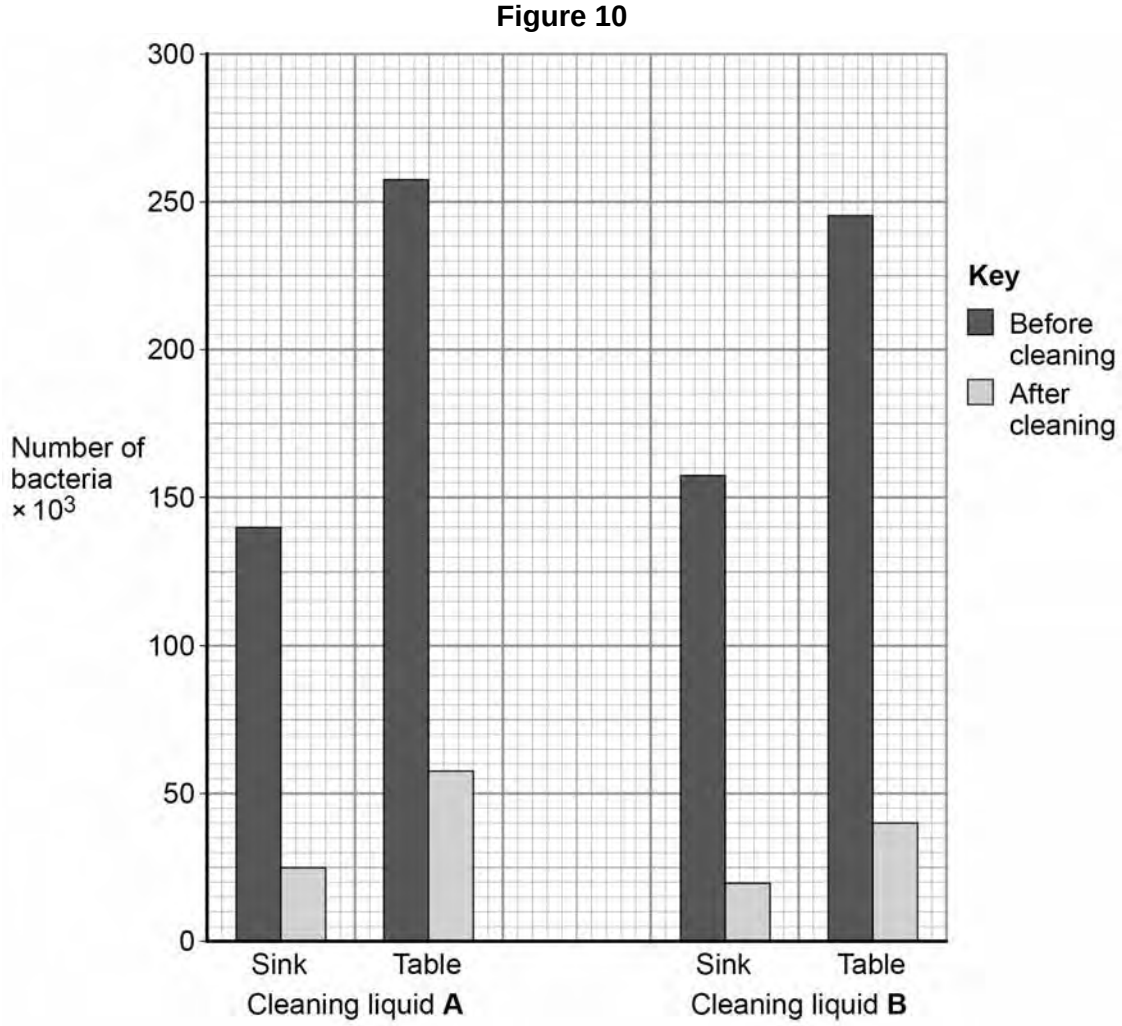
The scientist took samples from two work surfaces:

- before the surfaces had been cleaned with the cleaning liquids
- after the surfaces had been cleaned with the cleaning liquids.

The samples were then analysed for the number of bacteria they contained.

The results are shown in **Figure 10**.

Figure 10



4.1.1.6 Culturing microorganisms (biology only)

Question 15 · continued

0 7 . 6 Which cleaning liquid is the more effective?

Give a reason for your answer.

[1 mark]

Cleaning liquid _____

Reason _____

_____

_____

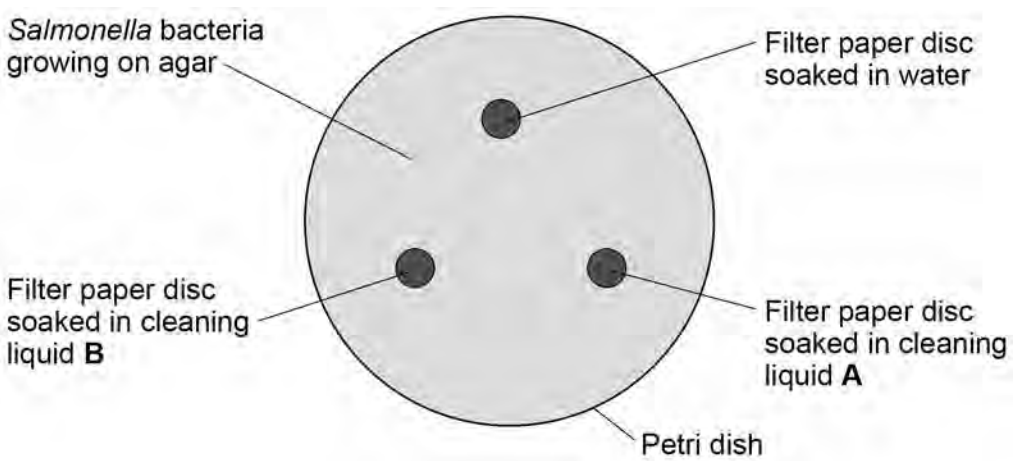
Question 7 continues on the next page

Question 15 · continued

The scientist investigated the effect of cleaning liquid **A** and cleaning liquid **B** on *Salmonella* bacteria grown in a laboratory.

Figure 11 shows the way the investigation was set up.

Figure 11



The Petri dish was placed in an incubator at 25 °C for 48 hours.

After 48 hours, the scientist calculated the area around each paper disc where no bacteria were growing.

The results are shown in **Table 4**.

Table 4

Filter paper disc	Area around disc with no bacteria growing in cm^2
Water	0
Cleaning liquid **A**	11
Cleaning liquid **B**	13

0 7 . 7 What measurement would the scientist need to take to calculate the area where no bacteria were growing?

[1 mark]

4.1.1.6 Culturing microorganisms (biology only)

Question 15 · continued

0 7 . 8 Give **one** change to the investigation that would allow the scientist to check if the results are repeatable.

[1 mark]

0 7 . 9 The scientist showed the results to the restaurant owner.

Both cleaning liquids cost the same per dm^3.

Suggest **one** other factor the restaurant owner should consider when choosing which cleaning liquid to use.

[1 mark]

11

4.1.1.6 Culturing microorganisms (biology only)

Question 16

June 2019 | 8461/1F | Original Q5

0 5 A man has the following symptoms:

- yellow discharge from his penis
- pain when urinating.

0 5 . 1 The man has a bacterial infection.

What is the most likely cause of the man's symptoms?

[1 mark]

Tick (✓) **one** box.

Gonorrhoea ☐

HIV ☐

Measles ☐

Salmonella poisoning ☐

0 5 . 2 The man took a full course of antibiotics.

The man's symptoms did **not** improve.

Why did the antibiotics **not** cure the symptoms?

[1 mark]

Tick (✓) **one** box.

The bacteria are immune to the antibiotics. ☐

The bacteria are resistant to the antibiotics. ☐

The man is immune to the antibiotics. ☐

The man is resistant to the antibiotics. ☐

4.1.1.6 Culturing microorganisms (biology only)

Question 16 · continued

0 5 . 3 Using a condom can stop the bacteria being passed to another person during sexual intercourse.

Suggest a different way the man could avoid passing the bacteria on to someone else.

[1 mark]

Question 5 continues on the next page

4.1.1.6 Culturing microorganisms (biology only)

Question 16 · continued

A scientist investigated the effect of three different antibiotics on three different types of bacteria, **A**, **B** and **C**.

This is the method used.

1. Grow bacteria **A** on an agar plate.

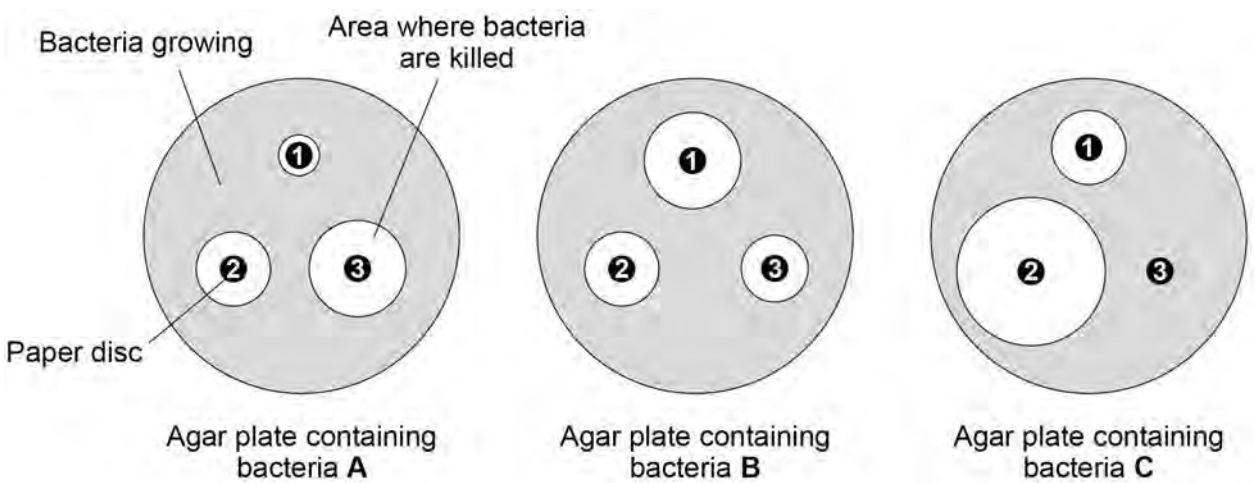
2. Put three separate paper discs each containing one of the antibiotics (**1**, **2** and **3**) onto the agar plate.

3. Put the agar plate into an incubator for 48 hours.

4. Repeat steps 1–3 for bacteria **B** and for bacteria **C**.

Figure 9 shows the scientist's results.

Figure 9



4.1.1.6 Culturing microorganisms (biology only)

Question 16 · continued

June 2019 | 8461/1F | Original Q5

0 5 . 4 Compare the effectiveness of the three antibiotics at killing the different types of bacteria.

[6 marks]

Question 5 continues on the next page

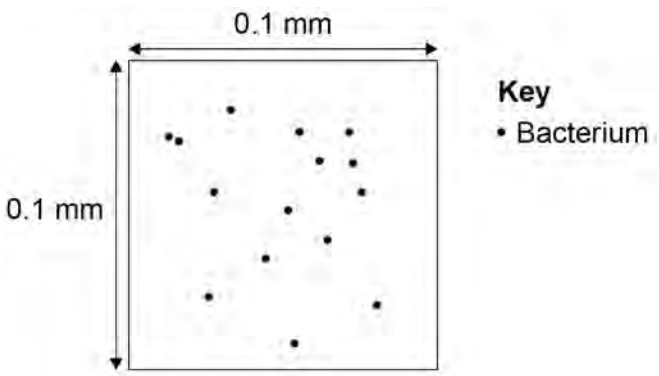
Question 16 · continued

Milk contains bacteria.

A small volume of raw milk was placed in a counting chamber in a special type of microscope slide.

Figure 10 shows what the counting chamber looked like when viewed using a microscope.

Figure 10



A scientist counted the number of bacteria in four samples of raw milk.

Table 4 shows the results.

Table 4

Milk sample	Number of bacteria in counting chamber
E	15
F	12
G	13
H	16

0 5 . 5 Which milk sample is shown in **Figure 10**?

[1 mark]

Tick (✓) **one** box.

Sample **E** ☐

Sample **F** ☐

Sample **G** ☐

Sample **H** ☐

Question 16 · continued

0 5 . 6 Calculate the mean number of bacteria in the four samples in **Table 4**.

[2 marks]

Mean number of bacteria = _____

0 5 . 7 Calculate the mean number of bacteria per mm^3 of milk in the samples.

Complete the following steps.

[3 marks]

Calculate the total area of the counting chamber in **Figure 10**.

Total area of counting chamber = _____ mm^2

The depth of the counting chamber is 0.01 mm

Calculate the volume of the counting chamber in **Figure 10**.

Use the equation:

volume = area × depth

Volume of counting chamber = _____ mm^3

Calculate the mean number of bacteria per mm^3 of milk in the samples.

Use the equation:

$$\text{mean number of bacteria per mm}^3\text{ of milk} = \frac{\text{mean number of bacteria from Question 05.6}}{\text{volume of counting chamber}}$$

Mean number of bacteria per mm^3 of milk = _____

Milk is heated to reduce the number of bacteria it contains before it is sold for humans to drink.

Milk with more than 20 000 bacteria per cm^3 cannot be sold for humans to drink.

Table 5 shows the number of bacteria per cm^3 in four different samples of milk.

Table 5

Milk sample	Number of bacteria per cm^3 of milk
P	1.8×10^4
Q	2.2×10^4
R	2.2×10^{-5}
S	1.8×10^3

0 5 . 8 Which of the milk samples could **not** be sold for humans to drink?

[1 mark]

Tick (✓) **one** box.

P ☐ **Q** ☐ **R** ☐ **S** ☐

0 5 . 9 Why should milk sold for humans to drink **not** contain large numbers of bacteria?

[1 mark]

_____

_____

17

4.1.1.6 Culturing microorganisms (biology only)

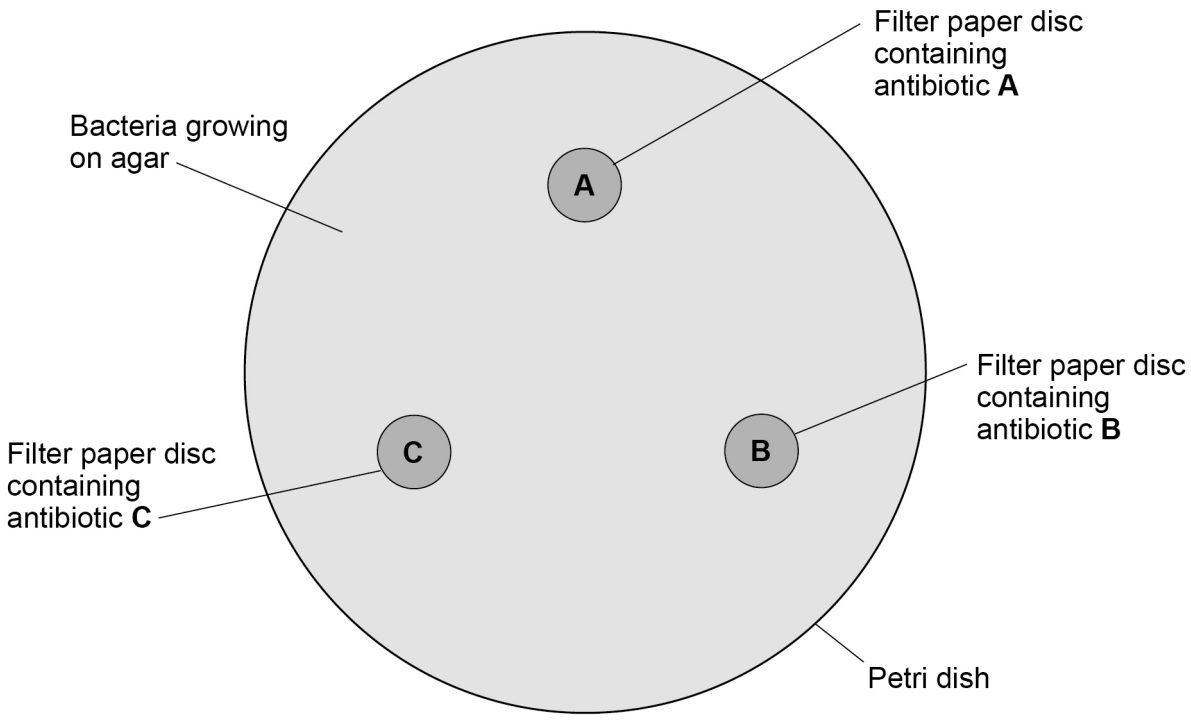
Question 17

November 2021 | 8461/1F | Original Q8

0 8 A student investigated the effectiveness of three different antibiotics.

Figure 16 shows how the student set up an agar plate.

Figure 16



The student used aseptic techniques to make sure that only one type of bacterium was growing on the agar.

0 8 . 1 Describe **two** aseptic techniques the student should have used.

[2 marks]

1 _____

_____

_____

2 _____

_____

_____

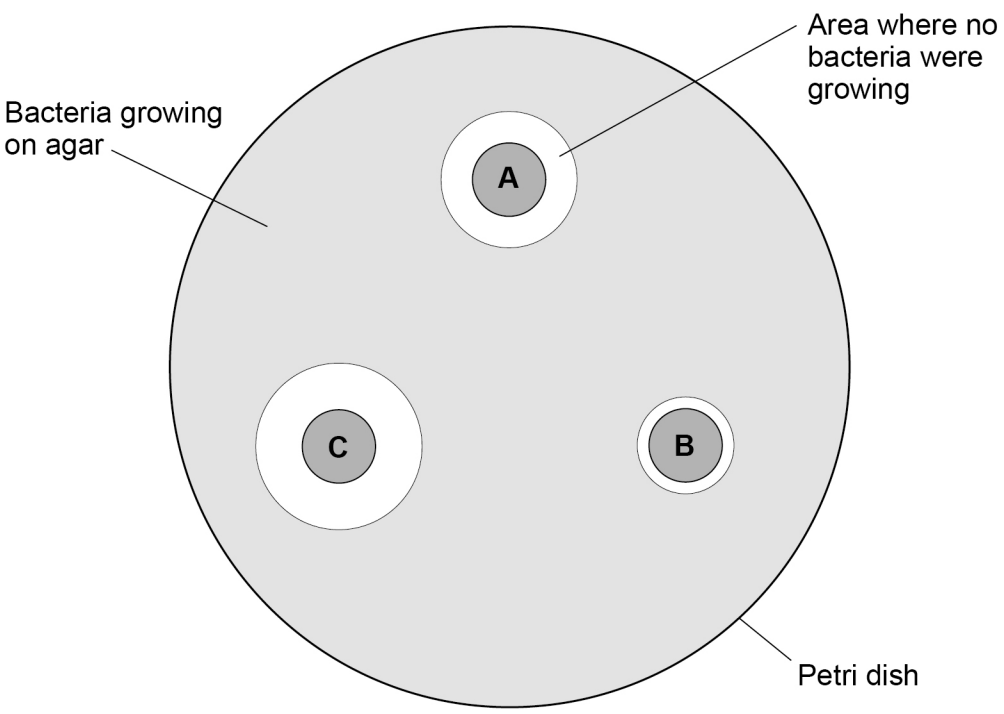
Question 8 continues on the next page

Question 17 · continued

The student placed the agar plate in an incubator at 25 °C for 48 hours.

Figure 17 shows the agar plate after 48 hours.

Figure 17



0 8 . 2 Which antibiotic is the **least** effective?

Give a reason for your answer.

[1 mark]

Least effective antibiotic _____

Reason _____

_____

_____

4.1.1.6 Culturing microorganisms (biology only)

Question 17 · continued

0 8 . 3 Calculate the area where no bacteria were growing for antibiotic **C**.

Use $\pi = 3.14$

Give the unit.

[5 marks]

Area = _____ Unit _____

0 8 . 4 Suggest **one** way the student could improve the investigation.

[1 mark]

_____

_____

9

4.1.1.6 Culturing microorganisms (biology only)

Question 18

June 2023 | 8461/2F | Original Q4

0 4 Some farmers keep cows indoors in large sheds.

Other farmers keep cows outdoors in fields of grass.

Figure 6 shows cows being kept indoors and outdoors.

Figure 6



Table 3 shows the energy inputs and energy outputs for keeping cows.

Table 3

	Energy in kJ/m^2/year	
	Indoors	**Outdoors**
Input as food	10 000	5 950
Input as fossil fuel	6 000	50
Output as meat and milk	40	2

0 4 . 1 Calculate the total energy input for keeping cows **outdoors**.

Use data from **Table 3**.

[1 mark]

Total energy input = _____ kJ/m^2/year

0 4 . 2 The total energy input for keeping cows **indoors** is 16 000 kJ/m^2/year.

Calculate the percentage efficiency of keeping cows **indoors**.

Use the equation:

$$\text{percentage efficiency} = \frac{\text{energy output}}{\text{total energy input}} \times 100$$

[2 marks]

Percentage efficiency = _____ %

0 4 . 3 The percentage efficiency of keeping cows outdoors is 0.03%.

Why is it more energy efficient to keep cows indoors than to keep cows outdoors?

[2 marks]

Tick (✓) **two** boxes.

- Cows are more stressed indoors. ☐
- Cows move less indoors. ☐
- It is noisier indoors. ☐
- It is warmer indoors. ☐
- There is less light indoors. ☐

Diseases in cows can cause problems for farmers.

0 4 . 4 Suggest why diseases spread more quickly when the cows are kept indoors.

[1 mark]

Question 18 · continued

One species of bacterium causes a disease in cows.

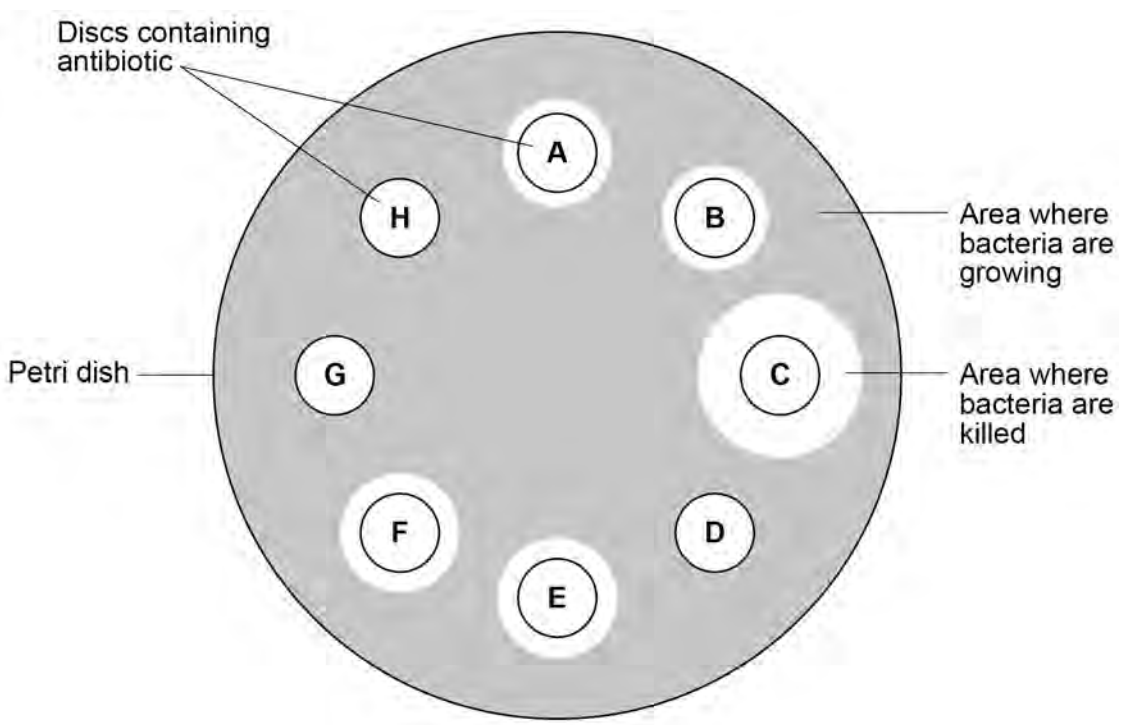
Scientists investigated the effect of eight different antibiotics on the growth of this species of bacterium.

The scientists put discs containing the different antibiotics onto a Petri dish containing the bacteria.

Antibiotics **A** to **H** were used in the investigation.

Figure 7 shows what the Petri dish looked like after 2 days.

Figure 7



0 4 . 5 This species of bacterium is resistant to some of the antibiotics.

Give the letter of **one** antibiotic the bacterium is resistant to.

[1 mark]

_____

4.1.1.6 Culturing microorganisms (biology only)

Question 18 · continued

0 4 . 6 Complete the sentence.

Choose the answer from the box.

[1 mark]

carbohydrate	DNA	lipid

Antibiotic resistance in a single bacterium is caused by a change in the bacterium's _____ .

0 4 . 7 Complete the sentence.

Choose the answer from the box.

[1 mark]

excretion	feeding	reproduction

A change in one bacterium can cause millions of bacteria to become resistant to the antibiotic.

This is because bacteria have a high rate of _____ .

0 4 . 8 Suggest why the production of millions of antibiotic-resistant bacteria is a problem for farmers.

[2 marks]

_____

_____

_____

_____

11

4.1.1.6 Culturing microorganisms (biology only)

Question 19

0 2 Pathogens cause disease.

0 2 . 1 How does the skin defend the human body against pathogens?

[1 mark]

The stomach contains acid to kill pathogens.

A scientist investigated the effect of acid on the survival of bacteria.

This is the method used.

1. Prepare four test tubes each with 10 cm^3 of culture solution.
2. Use acid to adjust the pH of the solutions to be pH1, pH2, pH3 and pH5
3. Add 1 cm^3 of bacteria mixture to each test tube.
4. Take a 0.1 cm^3 sample from each test tube and record the number of live bacteria.
5. Keep the test tubes at 37 °C for 24 hours.
6. Repeat step 4.

Table 1 shows some of the results.

Table 1

Time in hours	Number of live bacteria			
	pH1	pH2	pH3	pH5
0	210	210	210	216
24	23	**X**	63	185

4.1.1.6 Culturing microorganisms (biology only)

Question 19 · continued

0 2 . 2 What fraction of the bacteria present at 0 hours for **pH3** survived for 24 hours?

Give your answer in its simplest form.

[2 marks]

Fraction surviving = _____

0 2 . 3 How many more bacteria were killed at pH1 than at pH5 in 24 hours?

Complete the following steps.

[3 marks]

Calculate the number of bacteria killed at pH1 _____

Calculate the number of bacteria killed at pH5 _____

Calculate how many more bacteria were killed at pH1 than at pH5 _____

Number = _____

0 2 . 4 A student calculated value **X** in **Table 1** to be 43

Suggest how the student calculated this value.

[2 marks]

8

4.1.1.6 Culturing microorganisms (biology only)

Question 20

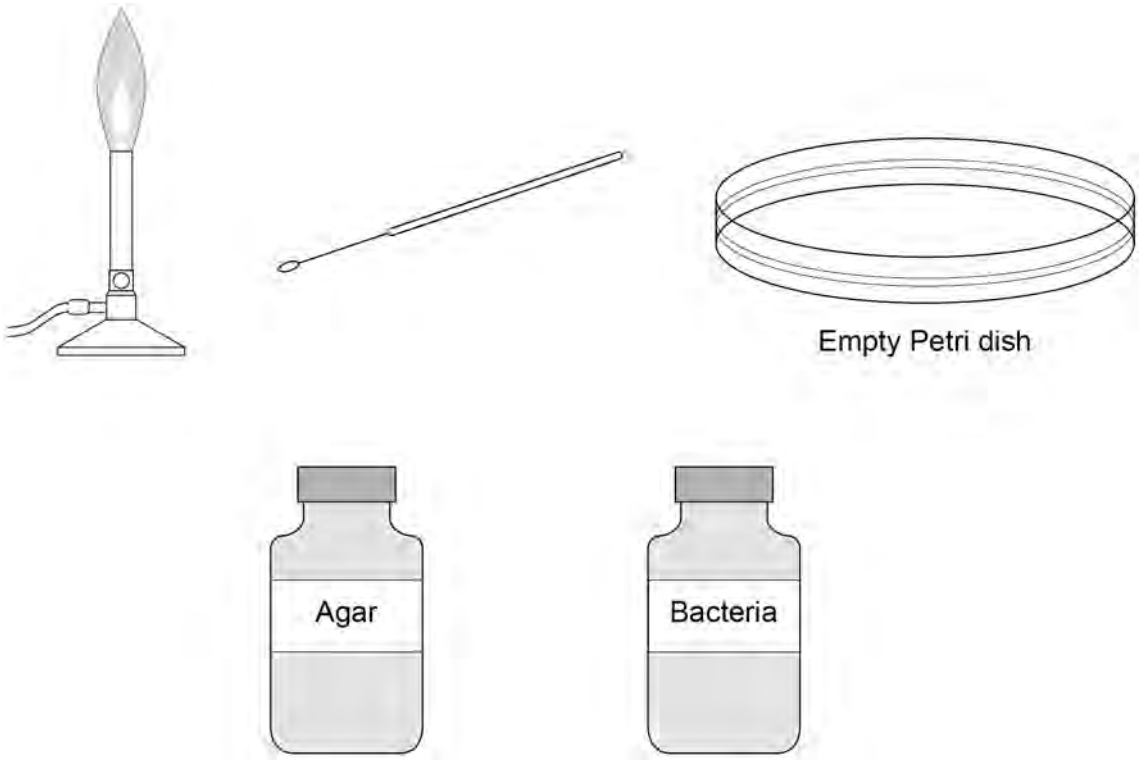
June 2025 | 8461/1F | Original Q4

0 4 A student investigated the effect of antibiotics on the growth of bacteria.

The student prepared an agar gel plate.

Figure 5 shows some of the equipment the student used.

Figure 5



0 4 . 1 Describe a method the student could use to:

- prepare a sterile agar gel plate
- grow an uncontaminated sample of bacteria on the agar gel plate.

Use the equipment in **Figure 5** in your answer.

[6 marks]

4.1.1.6 Culturing microorganisms (biology only)

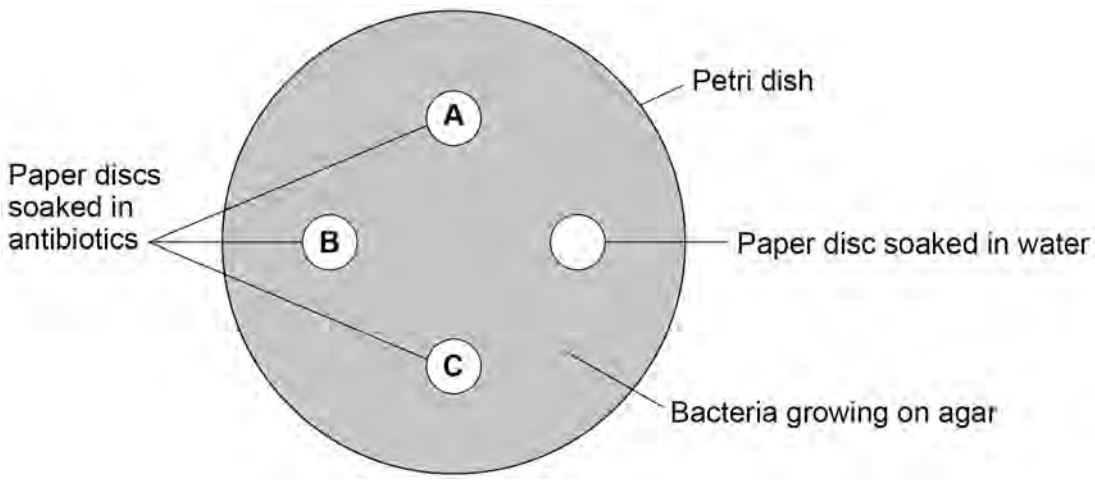
Question 20 · continued

Question 4 continues on the next page

The student used an agar gel plate to test three antibiotics, **A**, **B** and **C**.

Figure 6 shows how the agar gel plate was set up.

Figure 6



0 4 . 2 The student incubated the agar gel plate at 25 °C.

Why should the temperature **not** be higher than 25 °C?

[1 mark]

0 4 . 3 What was the purpose of the paper disc soaked in water?

[1 mark]

Tick (✓) **one** box.

To check the bacteria were uncontaminated. ☐

To make the investigation more accurate. ☐

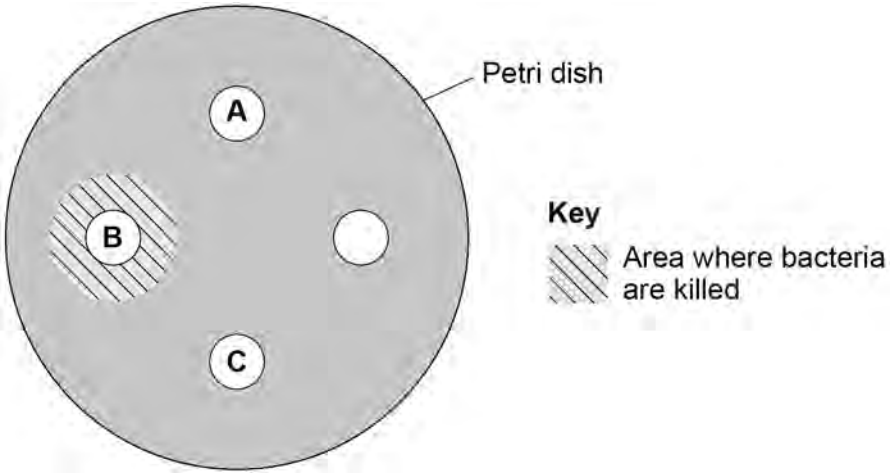
To show the effect of no antibiotics. ☐

0 4 . 4 The student removed the agar gel plate from the incubator after 48 hours.

Antibiotic **A** was the **most** effective at killing the bacteria.
Antibiotic **C** was the **least** effective at killing the bacteria.

Figure 7 shows the results for the disc soaked in antibiotic **B**.

Figure 7



Complete **Figure 7** to show the results you would expect.

You should:

- draw a ring around the disc soaked in antibiotic **A**
- draw a ring around the disc soaked in antibiotic **C**.

[2 marks]

0 4 . 5 The student repeated the investigation with antibiotic **D**.

The bacteria were resistant to antibiotic **D**.

What effect would antibiotic **D** have had on the bacteria?

[1 mark]

Tick (✓) **one** box.

All of the bacteria would have been killed. ☐

Some of the bacteria would have been killed. ☐

None of the bacteria would have been killed. ☐

11