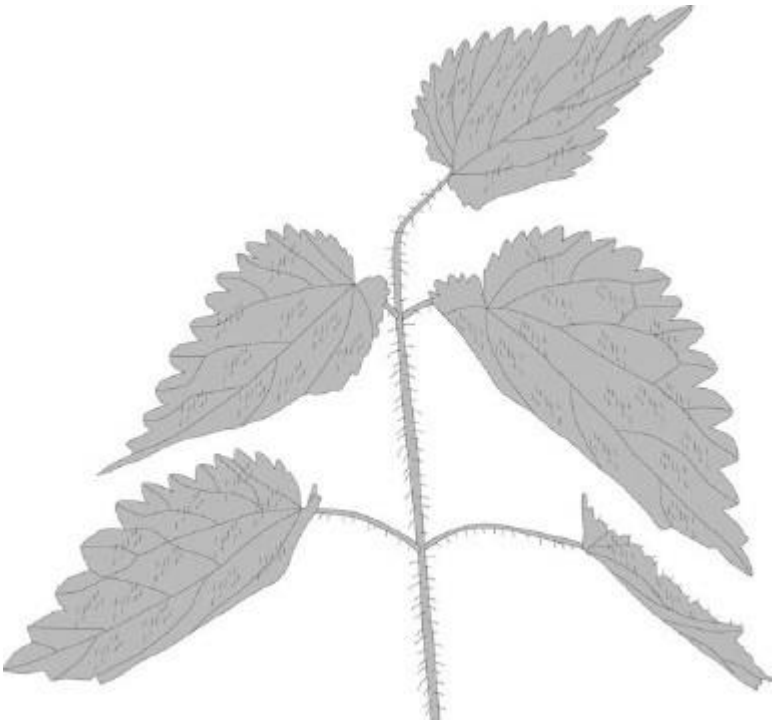
1 Plants have adaptations to help defend themselves and to help them survive.

Figure 1 shows a nettle plant.

Figure 1



(a) Explain how the nettle is adapted for defence and protection.

(3)

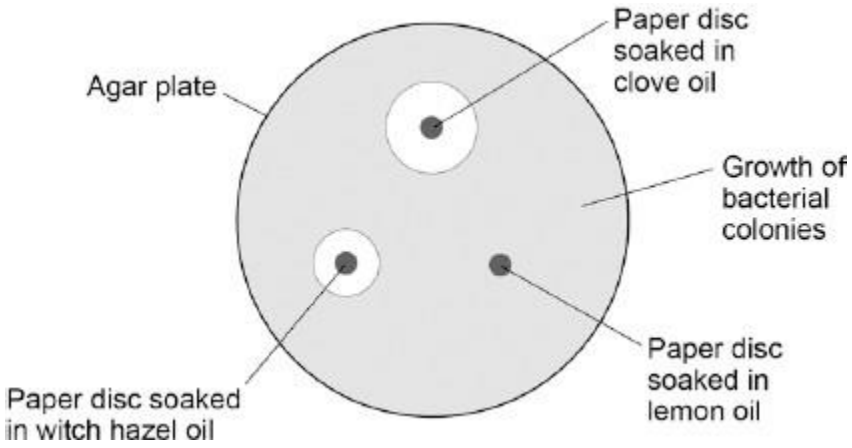
(b) Witch hazel is another plant adapted for defence.

Witch hazel produces oil with antiseptic properties. The oil prevents bacteria from attacking the plant.

A student investigated how effective three different plant oils were at preventing the growth of bacteria.

Figure 2 shows the results.

Figure 2



Which plant oil is the most effective at preventing the growth of bacteria?

Give a reason for your answer.

Oil _____

Reason _____

_____

(2)

(c) The student tested tea tree oil using the same method.

The results showed tea tree oil was the most effective at preventing bacterial growth.

The student concluded that tea tree oil could be used to treat bacterial infections instead of antibiotics.

Give **one** reason why this is **not** a valid conclusion.

_____

_____

(1)

(Total 6 marks)

2 Plants need mineral ions for healthy growth.

(a) Which part of a plant takes in mineral ions?

Tick (✓) **one** box.

Flower ☐

Leaf ☐

Root ☐

(1)

(b) Leaves are usually green.

(i) What is the green substance in leaves?

Draw a ring around your answer.

chlorophyll **glucose** **starch**

(1)

(ii) The green substance in leaves is important to plants.

Explain why.

_____

_____

_____

_____

(2)

(c) A shortage of mineral ions can affect a plant.

Draw **one** line from each mineral ion to the effect of its shortage.

Mineral ion	**Effect of its shortage**
Magnesium	Yellow leaves
Nitrate	Stunted growth
	White flowers

(2)

(Total 6 marks)

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

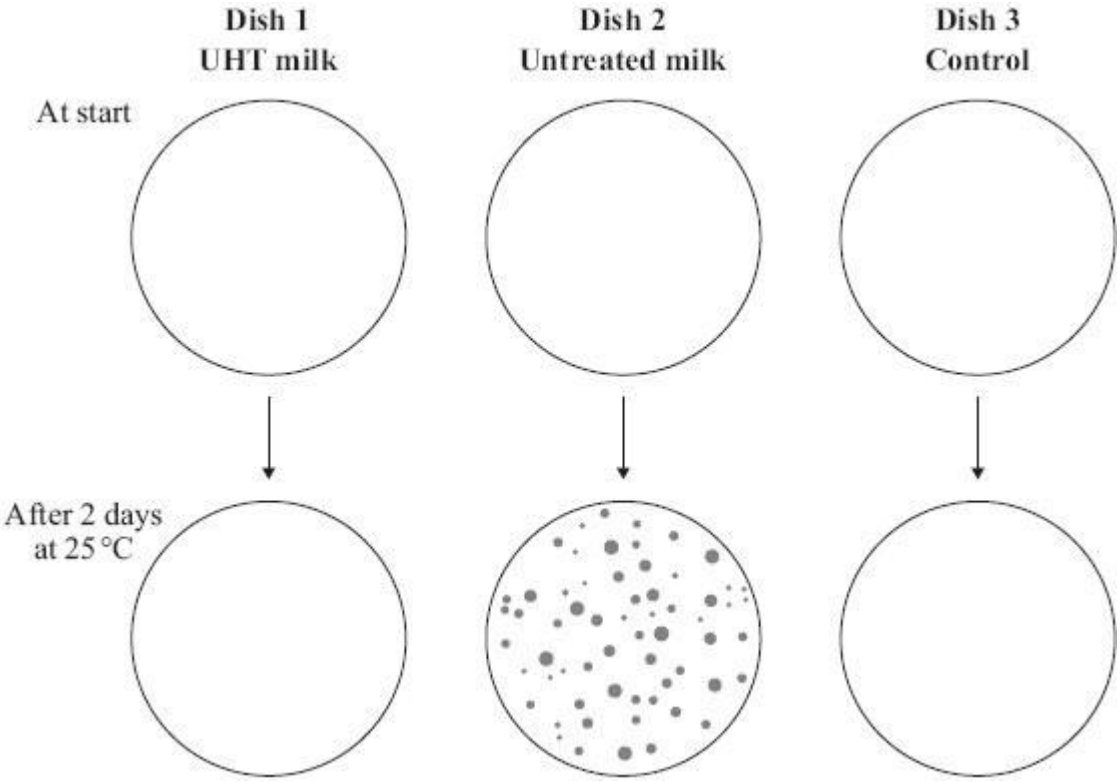
(3)

(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 below.



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

_____

_____

(1)

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

_____

_____

(1)

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

Give **one** reason why.

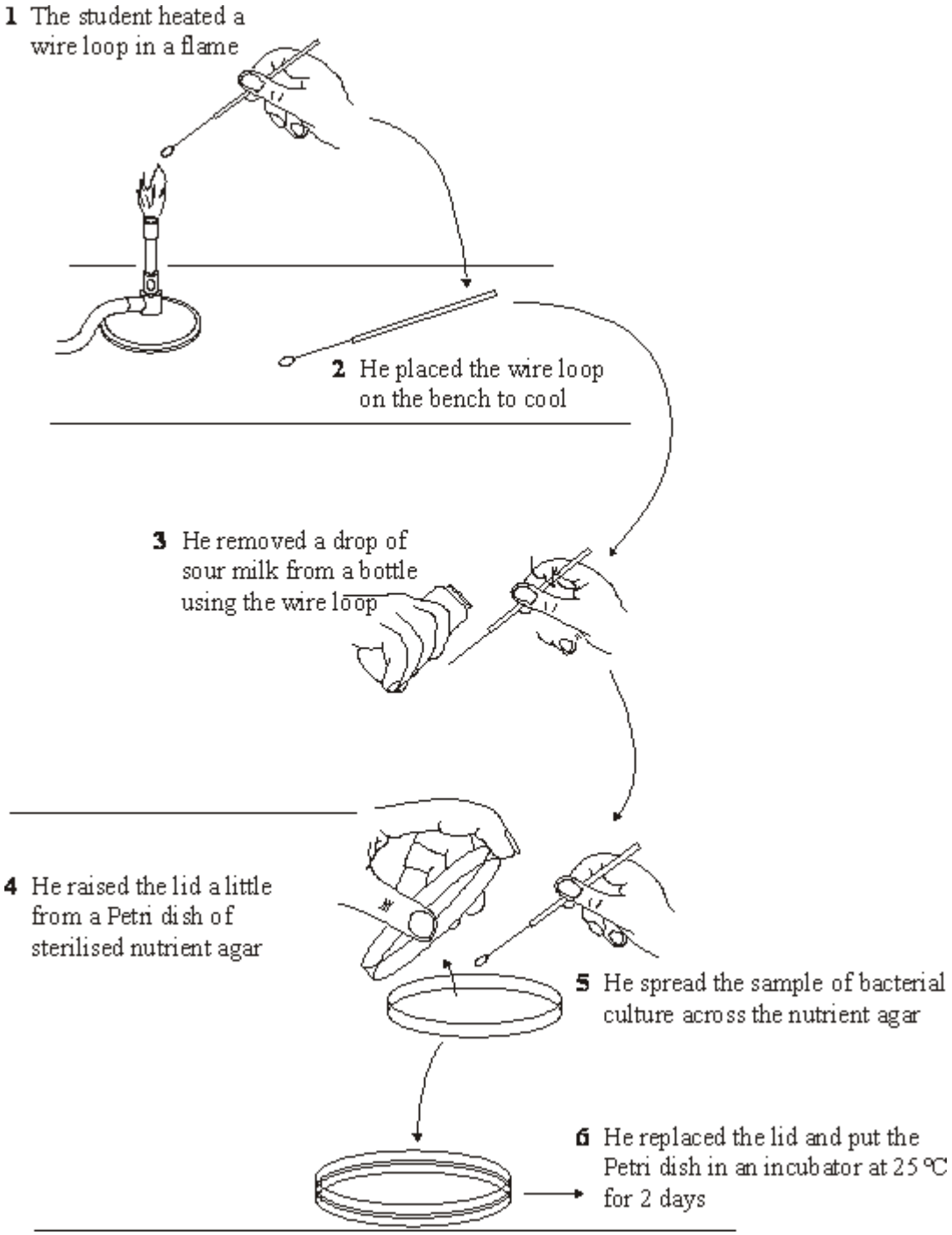
_____

_____

(1)

(Total 6 marks)

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



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

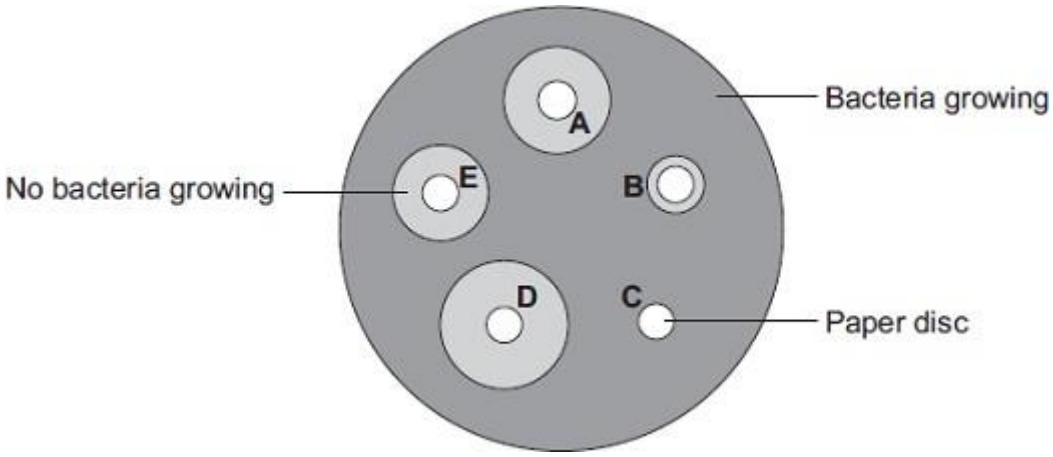
(Total 4 marks)

5 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.



(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)

(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)

(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)

(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 ☐

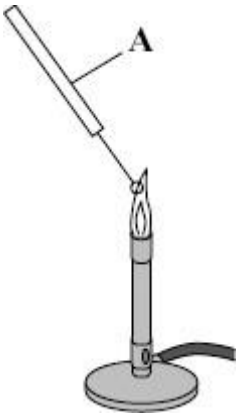
(1)

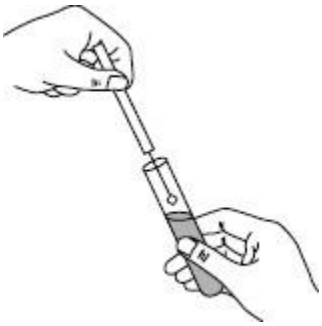
(Total 5 marks)

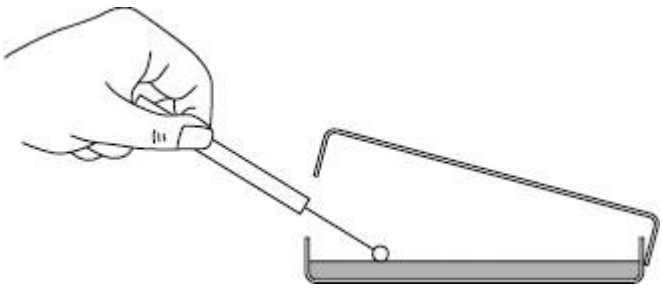
6 (a) It is important to prevent contamination when growing microorganisms.

The diagram shows the transfer and culturing of microorganisms.

Stage V  A Petri dish with agar is heated to 150 °C for 50 minutes, then cooled

Stage W 

Stage X 

Stage Y 

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

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

Draw a ring around **one** answer.

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

(1)

(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)

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

Stage ☐

(1)

(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.

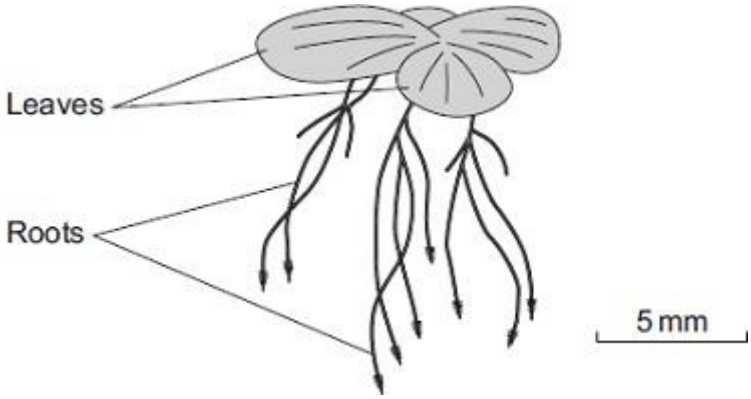
carbohydrates **mineral ions** **vitamins**

(1)

(Total 5 marks)

7 Duckweed is a plant. Duckweed grows in ponds. The leaves of duckweed float on the surface of the water and its roots hang down in the water.

The drawing shows a duckweed plant.



(a) Duckweed roots absorb nitrate ions from the water.
The nitrate ions help the duckweed to grow.

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

Duckweed needs nitrate ions to make

carbohydrate.
fat.
protein.

(1)

(b) Some students grew duckweed plants in three different solutions of mineral ions, **A**, **B** and **C**, and in distilled water (**D**).

Table 1 shows the concentrations of mineral ions in each of **A**, **B**, **C** and **D** at the start of the investigation.

Table 1

Mineral ion	**Concentration of mineral ions in mg per dm^3 at the start of the investigation**			
	A	**B**	**C**	**D**
Nitrate	1000	4	4	0
Phosphate	300	0	0	0
Magnesium	200	84	24	0

The students counted the number of duckweed leaves in **A**, **B**, **C** and **D** at the start of the investigation and after 28 days.

Table 2 shows their results.

Table 2

	A	**B**	**C**	**D**
Number of leaves at start	4	4	4	4
Number of leaves after 28 days	50	27	14	6

(i) Using **Table 1** and **Table 2**, describe the effect of magnesium ions on the growth of duckweed.

_____

_____

(1)

(ii) Solution **A** contained the highest concentration of nitrate ions.

One student said, 'The results show that nitrate ions are needed for the growth of duckweed.'

What evidence in **Table 2** supports what the student said?

_____

_____

(1)

(c) The students measured the growth of the duckweed by counting the number of leaves.

(i) Suggest a better method of measuring the growth of the duckweed.

_____

_____

(1)

(ii) Suggest why your method is better than the students' method.

_____

_____

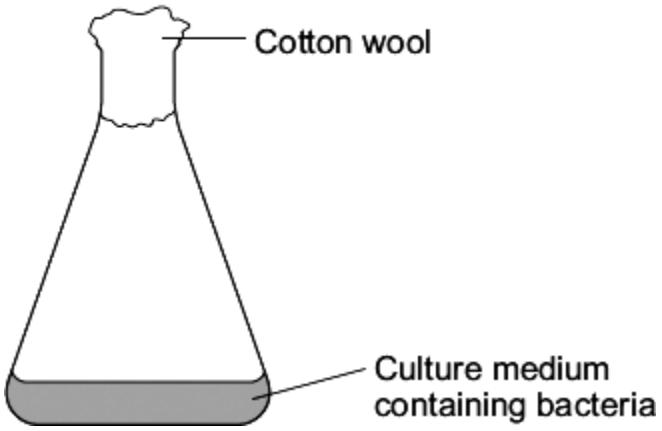
(1)

(Total 5 marks)

8 Some students grew one species of bacterium in a flask.

Diagram 1 shows the flask.

Diagram 1



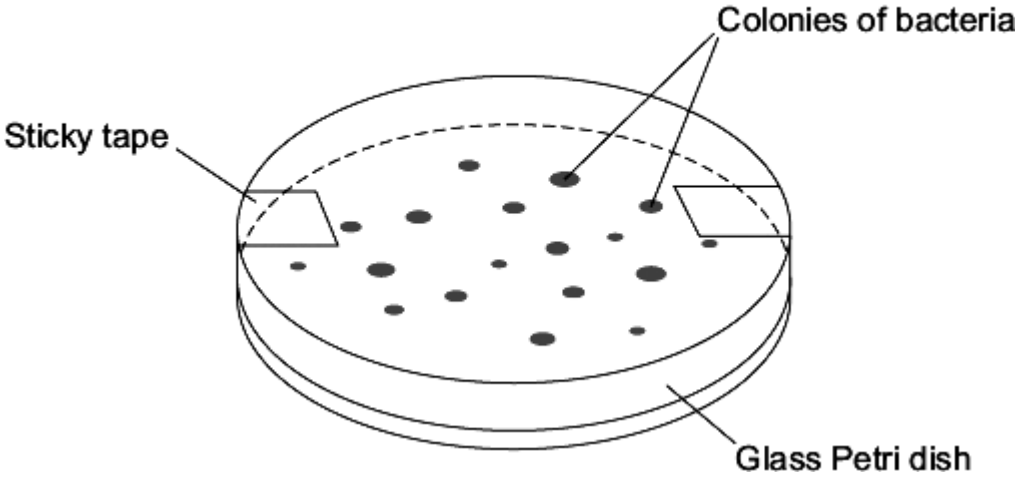
The students wanted to find the number of bacteria in 1 cm^3 of the culture medium.

The students:

- diluted 1 cm^3 of the culture medium from the flask with 999 cm^3 of water
- added 1 cm^3 of diluted culture to sterilised nutrient agar in a Petri dish
- placed the Petri dish in an incubator at 25 °C.

Diagram 2 shows the Petri dish after 3 days in the incubator.

Diagram 2



(a) Each colony of bacteria is formed where one bacterium landed on the agar jelly.

How is each colony formed?

_____

_____

(1)

(b) Complete the following calculation to find how many bacteria there were in 1 cm^3 of the undiluted culture.

Number of colonies of bacteria in the Petri dish = _____

These colonies were formed from 1 cm^3 of the culture diluted × 1000.

Therefore, number of bacteria in 1 cm^3 of undiluted culture = _____

(2)

(c) It is important to sterilise the culture medium and all the apparatus before use.

Explain why.

_____

_____

_____

_____

(2)

(d) The bacteria would grow faster at 35 °C. In a school laboratory, the Petri dish should **not** be incubated at a temperature higher than 25 °C.

Why?

_____

_____

(1)

(e) The students decided to repeat their investigation.

Why?

_____

_____

(1)

(Total 7 marks)

9 The following are precautions taken when preparing a streak of bacteria on an agar jelly plate.

Give a reason for each.

(i) The inoculating loop is heated in a hot bunsen flame.

REASON:

_____

_____

(1)

(ii) The loop is allowed to cool before putting it into the bacterial culture.

REASON:

_____

_____

(1)

(iii) The lid of the petri dish is only partly opened.

REASON:

_____

_____

(1)

(iv) The petri dish is sealed with sticky tape.

REASON:

_____

_____

(1)

(Total 4 marks)

1 (a) stinging hairs / can sting

1

(so) this harms herbivores / stops animals eating them

1

(so) less of the plant is removed / damaged

1

(b) clove (oil)

1

it has the largest areas with no bacteria growing

*allow largest inhibition zone **or** description of largest inhibition zone*

1

(c) antibiotics were not tested

1

[6]

2 (a) root

1

(b) (i) chlorophyll

1

(ii) absorbs / traps / takes in light

*do **not** accept attracts / solar energy /sunshine / sun*

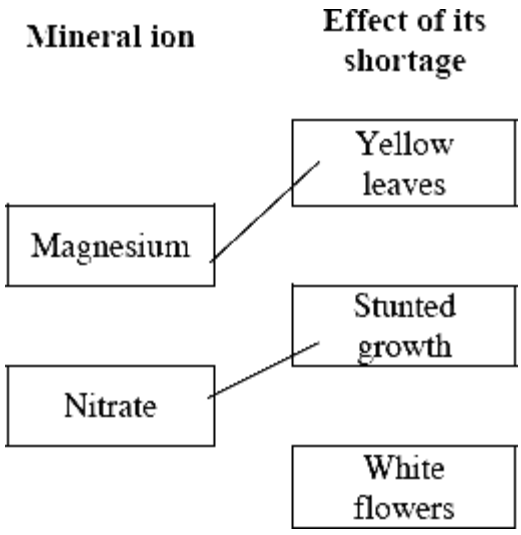
1

(for) photosynthesis

accept to make food / glucose / sugar/ biomass

1

(c)



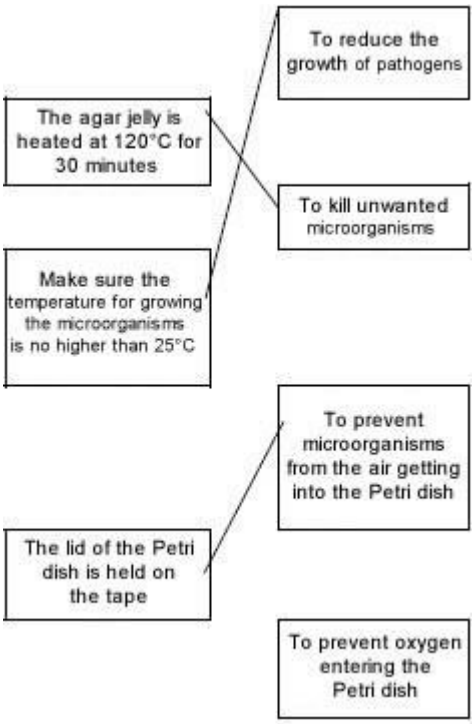
***1** mark per correct line*

extra line from a mineral ion cancels the mark

2

[6]

3 (a) **Liast A – Action** **List B – Effect**



1 *mark per correct line*

each extra line cancels ***1*** *mark*

3

(b) (i) dish 2 has (colonies of) microorganisms / bacteria / (but there are none in dish 1)

allow fungi / pathogens / microbes / germs

allow more microorganisms in dish 2

1

(ii) untreated milk contains <u>living</u> microorganisms

or

microorganisms killed by UHT

or

no <u>living</u> microorganisms in UHT milk

ignore microorganisms enter from the air

1

(iii) dish 3 was not opened

*do **not** allow no growth of microorganisms because of lack of air / oxygen*

or

it was sterilised

ignore microorganisms cannot enter from the air

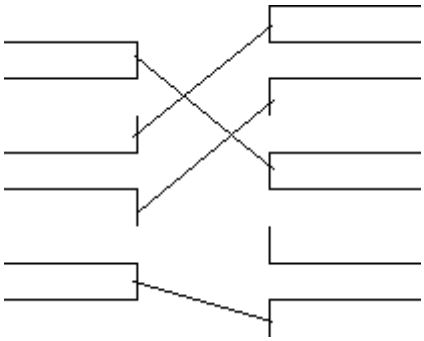
or

nothing / no milk was added

1

[6]

4



***1** mark for each line*

extra line from List A Action cancels the mark

[4]

5 (a) (i) 25°C

1

(ii) pathogens

1

(b) **D**

1

more / most bacteria killed

accept biggest area / ring where no bacteria are growing

1

(c) viruses live inside cells

1

[5]

6 (a) (i) inoculating loop

1

(ii) V

1

W

either order

1

(iii) Z

1

(b) carbohydrates

1

[5]

7 (a) protein

1

(b) (i) (more) magnesium gives more growth / more leaves / more duckweed

if converse must be clear that less magnesium gives less growth

1

(ii) **A** gave highest number of leaves / plants **or** more than others

*it equals **'A'***

*use of numbers must compare **A** with at least one other*

or

A gave most growth / most duckweed **or** more than others

allow faster / fastest / better / best growth

allow more growth with nitrate / less growth without nitrate

do not allow 'no' growth without nitrate

(c) (i) mark (c) as a whole

sensible method:

e.g. mass / weighing

ignore dry or fresh

allow other sensible method involving measuring eg length of roots – ignore 'size' of roots or measure roots unqualified

1

(ii) corresponding explanation:

ignore accuracy

e.g. includes roots / includes <u>whole</u> plant
or
leaves vary in size
or
(length / mass / surface area given in c(i)) is a continuous variable

1

[5]

8

(a) cell division / bacterium divides / multiplies / reproduces

allow asexual / mitosis

ignore growth

1

(b) 18

1

18 000 / 18×10^3 / 1.8×10^4

*do **not** accept 1.8 / 1.8 ^{04} / 1.8^4*

allow ecf from wrong count

1

(c) to kill / destroy other microorganisms / named type
or to prevent contamination

ignore germs / viruses

1

to prevent other microorganisms affecting the results
or other microorganisms would be counted

allow to give accurate / reliable results

1

(d) prevent growth of pathogens / disease-causing microorganisms / dangerous microorganisms

*do **not** accept microorganisms <u>become</u> pathogenic*

ignore germs / viruses

ignore general safety / biohazards / harmful products produced by bacteria

1

(e) to improve the reliability of the investigation / check for anomalies

*do **not** accept accuracy / precision / fairness / validity ignore averages / repeatability / reproducibility*

1

[7]

9

(i) the loop is sterilised

accept to <u>kill</u> anything on the loop

or
to kill any bacteria on it;

do not credit to clean the loop

1

(ii) if hot it would <u>kill bacteria picked up</u> (from culture);

accept 'microorganisms' or 'microbes'

accept entry of <u>contaminated</u> air but reject entry of air unqualified

1

(iii) to prevent entry (from the air) of unwanted bacteria or bacterial spores or fungal spores;

accept so can't breath on it
accept 'microorganisms' or 'microbes'

1

(iv) so that the (petri) dish is not opened (after bacteria are cultured)
or to reduce evaporation
or drying of the agar,

accept 'microorganisms' or 'microbes'
accept to prevent anything relevant getting in/out
reject references to spillage

1

[4]