

All questions are for separate science students only

**Q1.**

Viruses cause disease.

(a) What name is given to microorganisms that cause disease?

Tick (✓) **one** box.

- |             |                          |
|-------------|--------------------------|
| Pathogens   | <input type="checkbox"/> |
| Predators   | <input type="checkbox"/> |
| Prokaryotes | <input type="checkbox"/> |

(1)

(b) How do viruses cause the symptoms of disease?

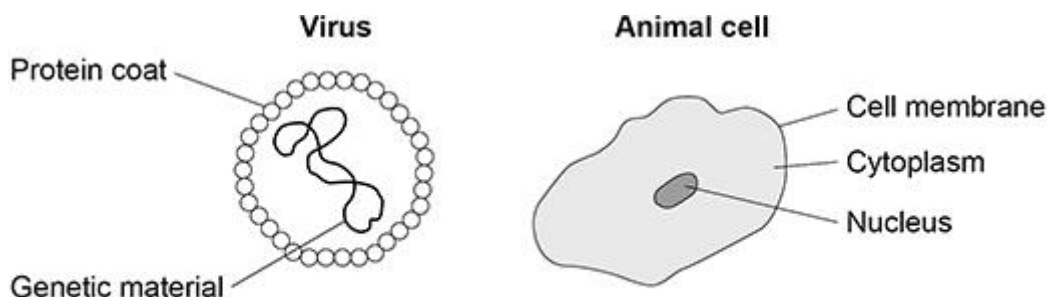
Tick (✓) **one** box.

- |  |                          |
|--|--------------------------|
| Viruses engulf white blood cells, destroying them. | <input type="checkbox"/> |
| Viruses produce antibodies that damage tissues.    | <input type="checkbox"/> |
| Viruses reproduce inside cells, damaging them.     | <input type="checkbox"/> |

(1)

**Figure 1** shows a virus and an animal cell.

**Figure 1**



Not to scale

(c) Suggest **one** reason why viruses are **not** classed as cells.

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(1)

A vaccine can protect humans from a viral disease.

(d) What does the vaccine contain?

Tick (✓) **one** box.

A toxic form of a virus

A weakened form of a virus

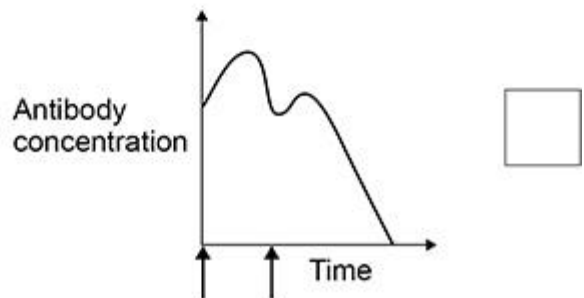
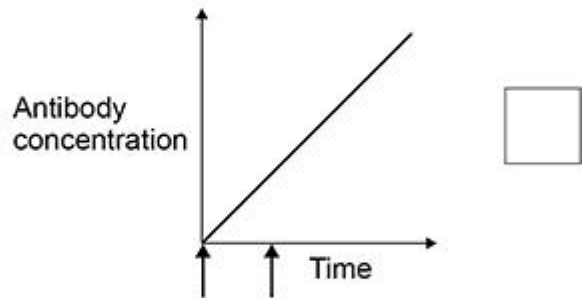
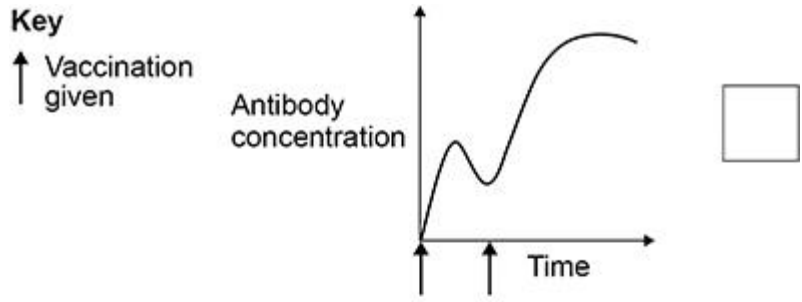
An active form of a virus

(1)

In some cases, a first vaccination needs to be followed by a second vaccination sometime later.

(e) Which graph shows how the concentration of antibodies in a person's blood changes after the first and second vaccinations?

Tick (✓) **one** box.



(1)

Tobacco mosaic virus (TMV) causes disease in plants.

TMV affects the rate of photosynthesis in plants.

(f) Which part of a plant shows discolouration caused by TMV?

Tick (✓) **one** box.

- Flower
- Leaf
- Root

(1)

The table below shows the rate of photosynthesis in four different tobacco plants.

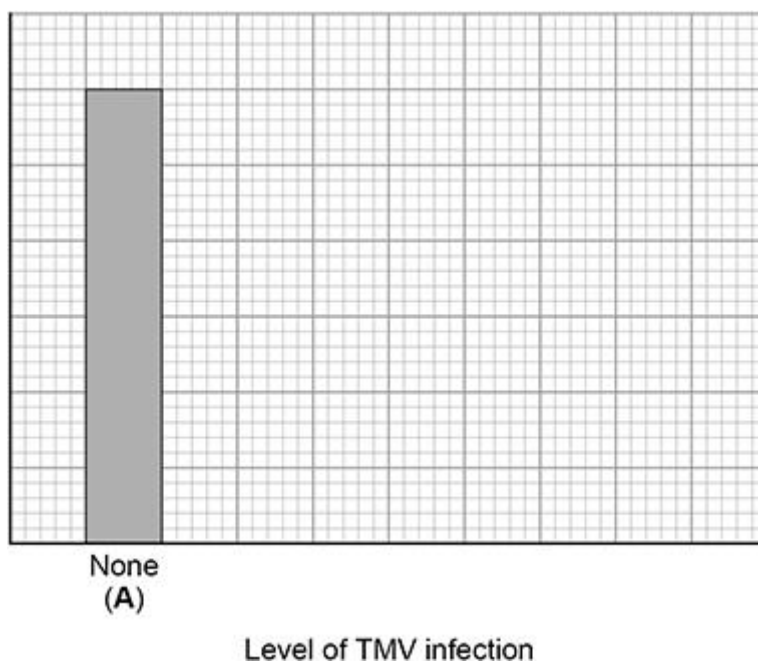
Tobacco plant	Level of TMV infection in plant	Rate of photosynthesis in arbitrary units
A	None	15
B	Mild	13
C	Medium	7
D	High	3

(g) Complete **Figure 2**.

You should:

- label the y-axis
- add the correct scale to the y-axis
- plot the data from the table above
- label each bar.

**Figure 2**



(5)

(h) What conclusion can be made from the data in the table above?

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(1)

- (i) Explain why a high level of TMV infection reduces growth in a plant.

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(2)

(Total 14 marks)

**Q2.**

A cactus is a plant that lives in a dry environment.

The image below shows part of a cactus plant.



- (a) Give **one** adaptation shown in the image above that helps to prevent the cactus from being eaten by animals.

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(1)

- (b) A plant may produce poisons that make animals unwell.

What is this type of defence mechanism?

Tick (✓) **one** box.

Chemical

Mechanical

Physical

(1)

- (c) Some desert plants only grow leaves after it has rained.

As soon as the soil dries out, the leaves fall off.

How could the leaves falling off the plant be an advantage to a plant that lives in a dry environment?

Tick (✓) **one** box.

The plant is less likely to reproduce.

The plant will not lose as much water.

The plant will photosynthesise faster.

(1)

The stem of a cactus is green.

- (d) What causes the green colour in the stem?

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(1)

- (e) What is the advantage to the cactus of having a green stem?

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(1)

The stem of a cactus contains many different tissues.

- (f) What name is given to a group of tissues working together?

Tick (✓) **one** box.

Organ

Organism

Organ system

(1)

- (g) Name **one** substance transported through the xylem in the stem of the

cactus.

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(1)

- (h) Name the tissue that transports dissolved sugars through the stem of the cactus.

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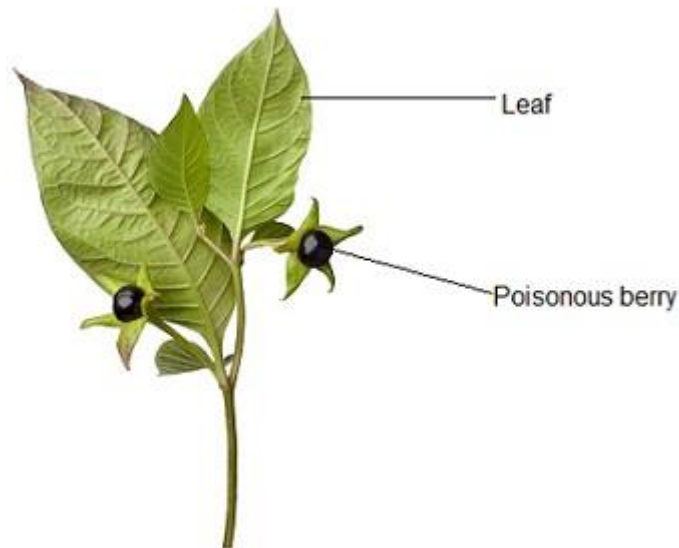
(1)

(Total 8 marks)

**Q3.**

**Figure 1** shows part of a deadly nightshade plant.

**Figure 1**



- (a) How will the poisonous berries help the deadly nightshade plant to survive?

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(1)

- (b) Which type of defence mechanism are the berries?

Tick (✓) **one** box.

Chemical

Mechanical

Physical

(1)

Figure 2 shows part of a gorse plant.

Figure 2



(c) Suggest how the gorse plant is adapted to defend itself.

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(1)

(d) The green leaves of the gorse plant make glucose for the plant to use.

What are **two** uses of glucose in the gorse plant?

Tick (✓) **two** boxes.

For defence

For respiration

To absorb water

To release minerals

To store as starch

(2)

(e) A student wanted to show that the leaves of a gorse plant contain glucose.

The student crushed the leaves to extract the liquid from the cells.

Describe the method the student could use to test the liquid from the cells for glucose.



Include the result if glucose is present.

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(3)

- (f) The roots of the gorse plant have bacteria that turn nitrogen gas into nitrate ions.

Explain why nitrate ions are needed by the gorse plant.

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(2)

- (g) The roots of gorse plants can be infected by honey fungus.

The honey fungus produces tiny spores underground.

Suggest how the honey fungus spores travel from the roots of an infected gorse plant to the roots of a healthy gorse plant.

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(1)

A drug can be extracted from gorse seeds.

Doctors want to trial the drug from gorse seeds to see if it can treat diarrhoea.

- (h) Which **two** factors must the doctors test the drug for in the trial?

Tick (✓) **two** boxes.

Appearance

Dosage

Solubility	<input type="checkbox"/>
Taste	<input type="checkbox"/>
Toxicity	<input type="checkbox"/>

(2)

- (i) In the trial some patients will take tablets made from gorse seeds and some patients will take tablets made from sugar.

What are the tablets made from sugar called?

Tick (✓) **one** box.

Antibiotics	<input type="checkbox"/>
Antibodies	<input type="checkbox"/>
Painkillers	<input type="checkbox"/>
Placebos	<input type="checkbox"/>

(1)

(Total 14 marks)

**Q4.**

Many plants have evolved defence mechanisms.

**Figure 1** shows part of a gorse plant and part of a deadly nightshade plant.

**Figure 1**



Gorse plant



Deadly nightshade plant

- (a) The gorse plant has evolved to have sharp thorns.

What type of defence response are thorns?

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(1)

- (b) How do thorns defend the gorse plant?

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(1)

- (c) The deadly nightshade plant has poisonous berries.

What type of defence response are poisonous berries?

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(1)

- (d) A scientist noticed that in one area the gorse plants had yellow leaves and had stunted growth.

One reason for yellow leaves and stunted growth is a deficiency of nitrate ions in the soil.

Explain **two** other possible reasons for the yellow leaves and stunted growth.

Do **not** refer to nitrate ions in your answer.

Reason 1

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Explanation

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Reason 2

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Explanation

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(5)

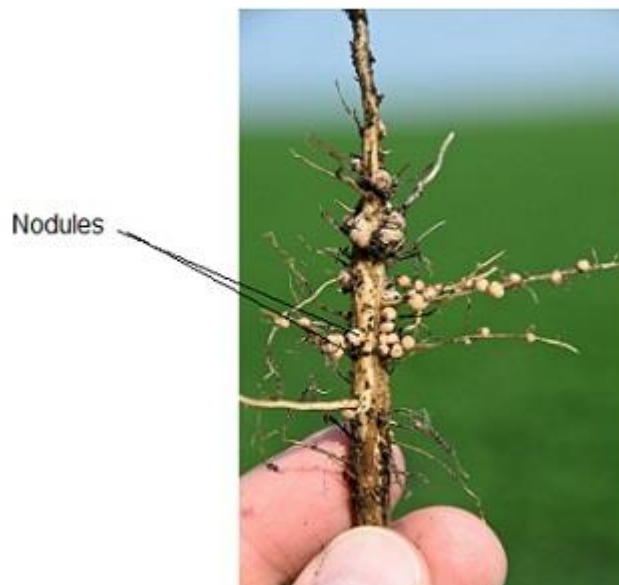
The gorse plant has nodules on its roots.

The nodules are part of the living root tissue.

Bacteria which convert nitrogen gas into soluble nitrate ions live in the nodule tissue.

**Figure 2** shows the nodules on the roots.

**Figure 2**



(e) Suggest how the nodules benefit the bacteria.

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(2)

(f) Explain how the nodules benefit the gorse plant.

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(2)

(g) For many years drugs have been extracted from plants.

Which plant material was chewed as a painkiller?

Tick (✓) **one** box.

Blackcurrant berries

Foxglove leaves

Rose petals

Willow bark

(1)

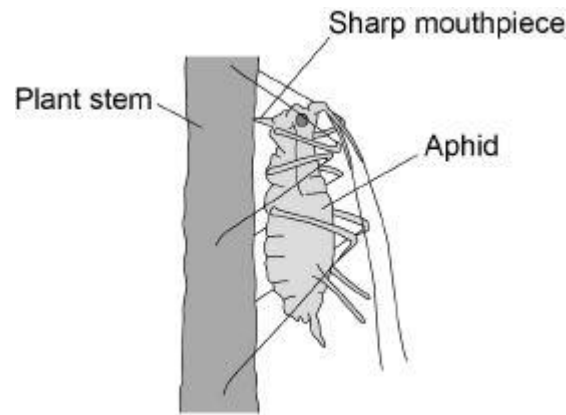
(Total 13 marks)

**Q5.**

Aphids are small insects that carry pathogens.

**Figure 1** shows an aphid feeding from a plant stem.

**Figure 1**



- (a) An aphid feeds by inserting its sharp mouthpiece into the stem of a plant.

After feeding, the mouthpiece of an aphid contains a high concentration of dissolved sugars.

Which part of the plant was the aphid feeding from?

Tick **one** box.

- |                |                          |
|----------------|--------------------------|
| Palisade layer | <input type="checkbox"/> |
| Phloem         | <input type="checkbox"/> |
| Stomata        | <input type="checkbox"/> |
| Xylem          | <input type="checkbox"/> |

(1)

- (b) What is the process that transports dissolved sugars around a plant?

Tick **one** box.

- |               |                          |
|---------------|--------------------------|
| Filtration    | <input type="checkbox"/> |
| Respiration   | <input type="checkbox"/> |
| Translocation | <input type="checkbox"/> |
| Transpiration | <input type="checkbox"/> |

(1)

- (c) Plants infected with aphids have stunted growth.

Explain **one** way the removal of dissolved sugars from the stem of the plant causes stunted growth.

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(2)

- (d) Most aphids do not have wings when they hatch. After several generations, some aphids hatch which have wings and can fly.

Explain the advantage to the aphid of being able to fly.

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(2)

- (e) The leaves of some plants release oils onto their surface.

Suggest how the production of oil on the surface of a leaf may protect the plant from aphids.

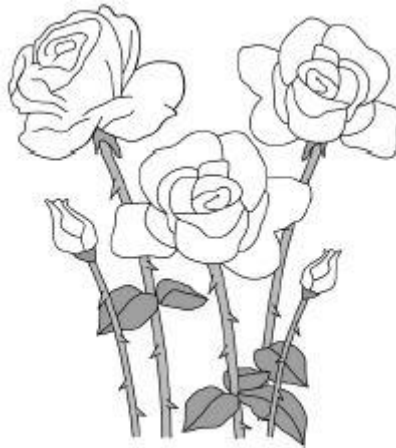
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(1)

**Figure 2** shows part of a rose plant.

**Figure 2**



- (f) Give **one** adaptation shown in **Figure 2** that helps the rose plant defend itself.

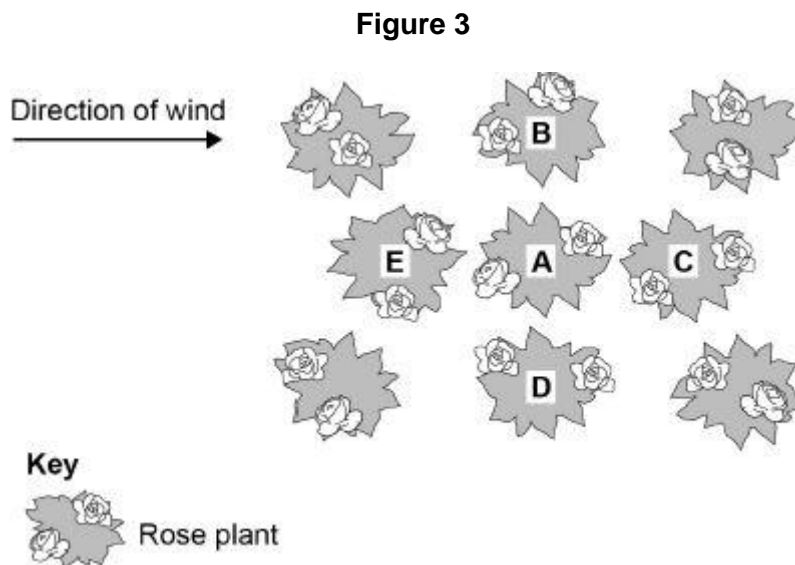
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(1)

**Figure 3** shows a plan of a garden containing rose plants.



- (g) Plant **A** has the fungal disease rose black spot.

Which plant in **Figure 3** is the fungus likely to spread to first?

Give a reason for your answer.

Plant \_\_\_\_\_

Reason

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(2)

- (h) Suggest **one** way the gardener could reduce the spread of rose black spot to the other plants in the garden.

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(1)

(Total 11 marks)

**Q6.**

Rose black spot is a disease of roses.

- (a) What type of microorganism causes rose black spot?

Tick **one** box.

A bacterium

A fungus

A protist

A virus

(1)

- (b) Explain how different **types of organism** defend themselves against microorganisms.

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(6)

(c) A student tried to grow some bacteria in the laboratory.

The diagram shows some of the apparatus used.



This is the method used.

1. Remove the lid of the Petri dish.
2. Remove the lid of the bottle containing the bacteria.
3. Use the inoculating loop to remove some of the bacteria from the bottle.
4. Spread the bacteria over the agar using the inoculating loop.
5. Put the lid back on the Petri dish.
6. Put the Petri dish into an incubator at 25 °C for 24 hours.

Steps 1–5 could cause the sample of the bacteria on the petri dish to be contaminated.

Give **three** improvements to the method to prevent contamination.

1.
 

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2.
 

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3.
 

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(3)

(d) Why did the student grow the bacteria at 25 °C rather than at 40 °C?

Tick **one** box.

- So the bacteria grew more quickly
- So the bacteria grew more slowly
- To prevent the growth of a harmful pathogen
- To save money

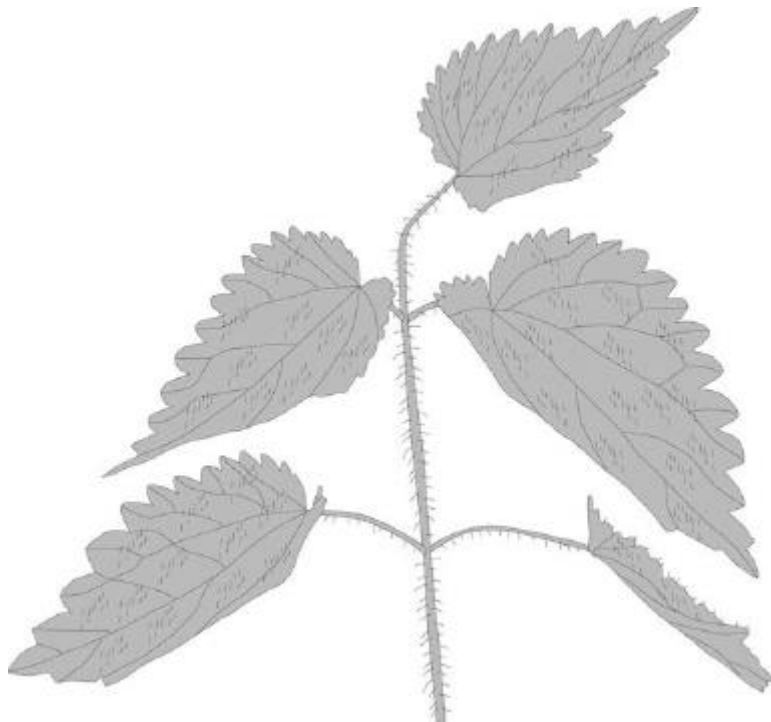
(1)  
(Total 11 marks)

**Q7.**

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.

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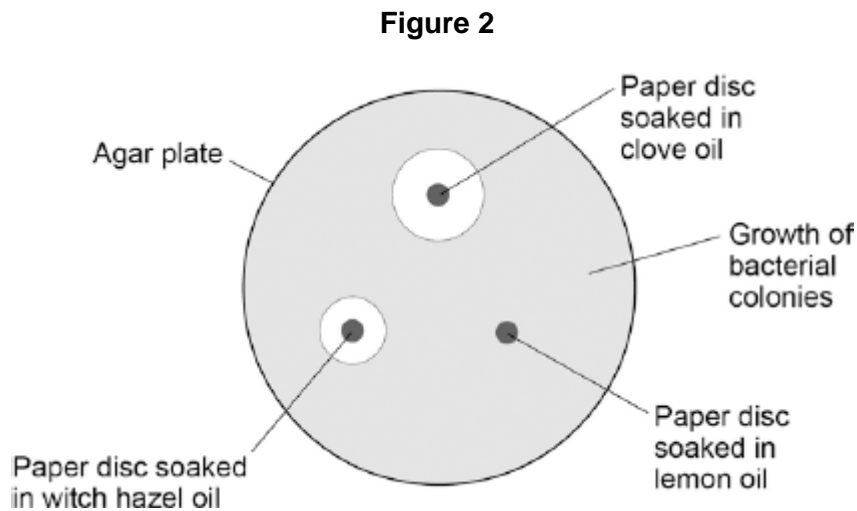
(3)

- (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.



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

Give a reason for your answer.

Oil \_\_\_\_\_

Reason

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(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.

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(1)

(Total 6 marks)

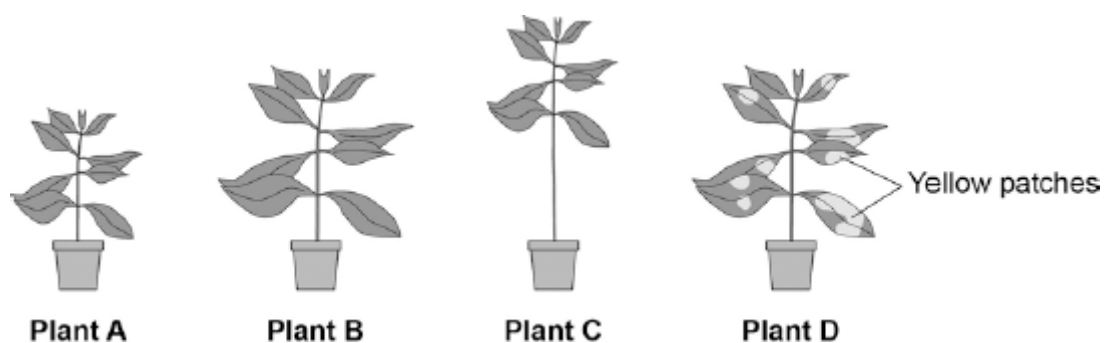
**Q8.**

To be healthy, plants need the right amount of mineral ions from the soil.

The diagram below shows four plants.

The plants were grown in four different growing conditions:

- sunny area, with nitrate and magnesium added to the soil
- sunny area, with magnesium but **no** nitrate added to the soil
- sunny area, with nitrate but **no** magnesium added to the soil
- dark area, with nitrate and magnesium added to the soil.



(a) Which plant was grown with no **nitrate**?

Tick **one** box.

A     B     C     D

(1)

(b) Which plant was grown with no **magnesium**?

Tick **one** box.

A     B     C     D

(1)

(c) Give **one** variable that was kept constant in this experiment.

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(1)

- (d) Plants need other minerals for healthy growth such as potassium ions and phosphate ions.

A farmer wanted to compare the percentage of minerals in two types of manure.

- Cow manure from her own farm.
- Chicken manure pellets she could buy.

The table below shows data for each type of manure.

	Phosphate ions in %	Potassium ions in %
Cow manure	0.4	0.5
Chicken manure pellets	2.5	2.3

Suggest **one** advantage and **one** disadvantage of using the chicken manure pellets compared to the cow manure.

Advantage

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Disadvantage

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(2)

(Total 5 marks)

**Q9.**

Tobacco mosaic virus (TMV) is a disease affecting plants.

The diagram below shows a leaf infected with TMV.



Yellow patches where TMV has destroyed chloroplasts

© Nigel Cattlin/Visuals Unlimited/Getty Images

- (a) All tools should be washed in disinfectant after using them on plants infected with TMV.

Suggest why.

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(1)

- (b) Scientists produced a single plant that contained a TMV-resistant gene.

Suggest how scientists can use this plant to produce **many** plants with the TMV-resistant gene.

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(1)

- (c) Some plants produce fruits which contain glucose.

Describe how you would test for the presence of glucose in fruit.

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(2)





Nitrate deficiency \_\_\_\_\_

\_\_\_\_\_

Magnesium deficiency \_\_\_\_\_

\_\_\_\_\_

(2)

(c) Plants need other mineral ions.

- Potassium ions are needed for healthy root growth.
- Phosphate ions are needed for healthy flowers and fruits.

The gardener makes his own garden compost.

The percentage (%) of minerals in his compost was compared with two fertilisers he could buy.

The data are shown in the table below.

	Percentage (%) mineral content			Cost in £ / kg
	Nitrate ions	Phosphate ions	Potassium ions	
<b>Garden compost</b>	0.5	0.3	0.8	0.00
<b>Fertiliser S</b>	5.0	1.3	6.6	4.99
<b>Fertiliser T</b>	3.0	12.0	6.0	9.99

The gardener buys Fertiliser **S**.

Explain why he chose Fertiliser **S**.

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\_\_\_\_\_

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\_\_\_\_\_

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**(4)**

**(Total 8 marks)**