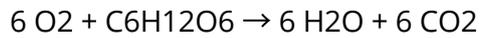
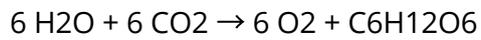
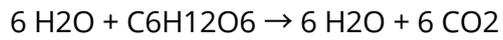
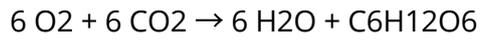


Q1.

All living organisms respire.

(a) What is the chemical equation for aerobic respiration?

Tick (✓) one box.



(1)

(b) Name the sub-cellular structures where aerobic respiration takes place.

(1)

(c) Energy is released in respiration.

Give two uses of the energy released in respiration.

1 _____

2 _____

(2)

(d) Describe two differences between aerobic and anaerobic respiration in humans.

Do not refer to oxygen in your answer.

1 _____

2 _____

(2)

(e) What are the two products of anaerobic respiration in plant cells?

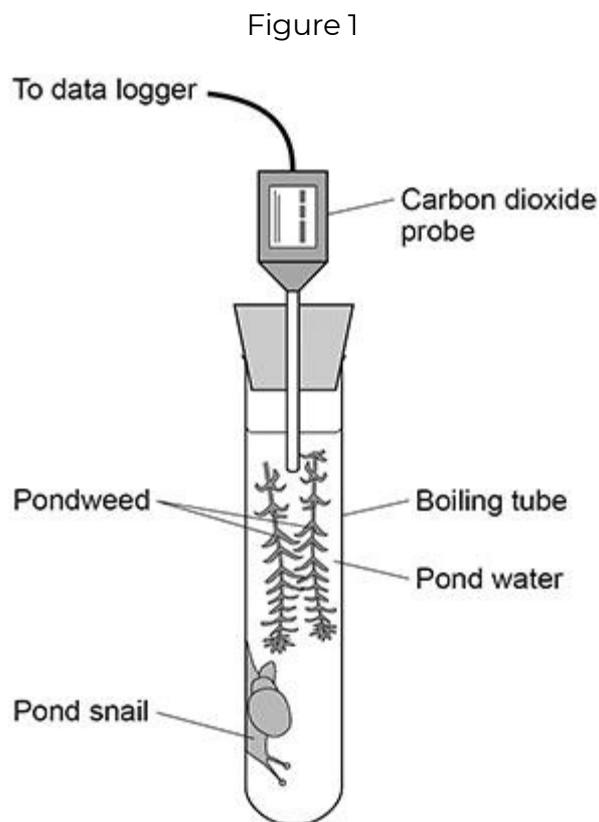
Tick (✓) two boxes.

- | | |
|----------------|--------------------------|
| Carbon dioxide | <input type="checkbox"/> |
| Ethanol | <input type="checkbox"/> |
| Glucose | <input type="checkbox"/> |
| Lactic acid | <input type="checkbox"/> |
| Water | <input type="checkbox"/> |

(2)

A scientist investigated respiration and photosynthesis using some pondweed and a pond snail.

Figure 1 shows the apparatus used.



The apparatus was left in a well-lit room for 5 days.

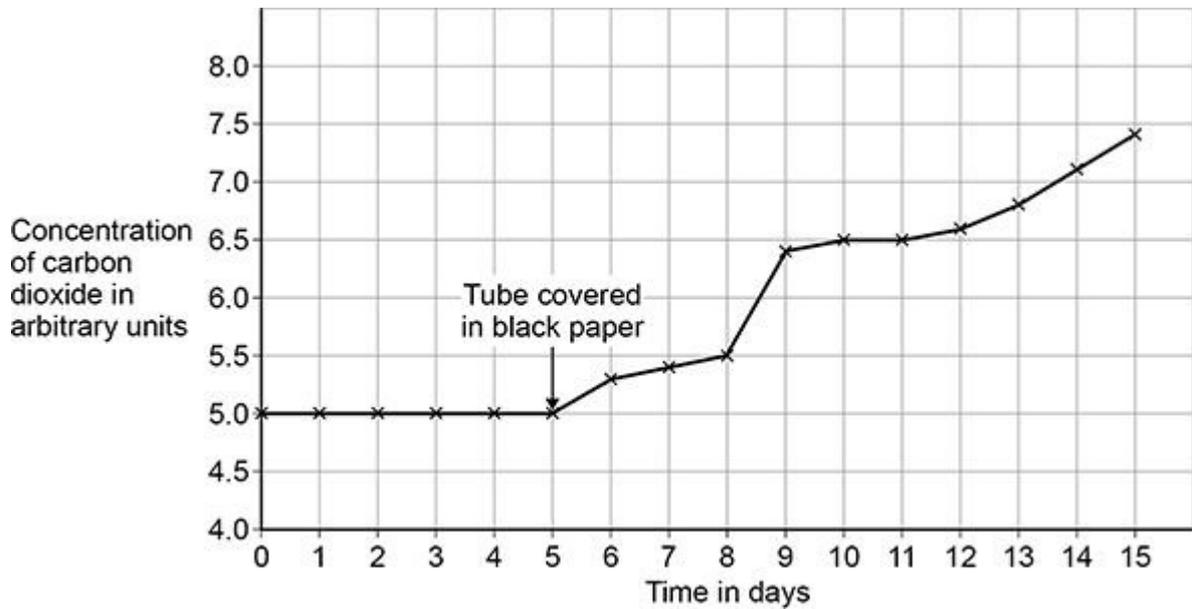
The data logger recorded the concentration of carbon dioxide continuously.

After 5 days, the scientist completely covered the boiling tube with black paper.

The data logger continued to record the concentration of carbon dioxide.

Figure 2 shows the concentration of carbon dioxide inside the boiling tube over 15 days.

Figure 2



- (f) Explain why the concentration of carbon dioxide in the tube stayed the same between day 0 and day 5.

(2)

- (g) Suggest why the concentration of carbon dioxide increased between day 5 and day 10.

(1)

- (h) On day 10, the pond snail died.

Explain why the death of the pond snail caused the concentration of

carbon dioxide to increase after day 10.

(3)
(Total 14 marks)

Q2.

The growth of daisy plants on a lawn is affected by biotic factors and by abiotic factors.

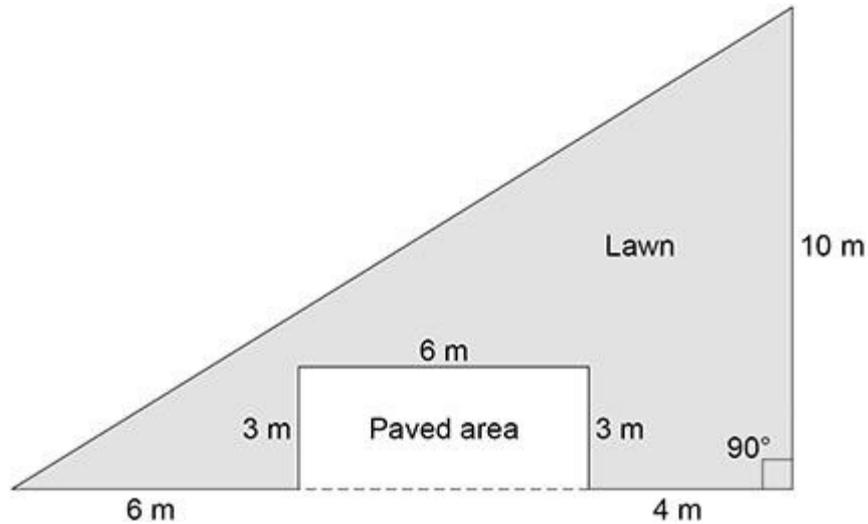
(a) The table below shows six factors.

Tick (✓) one box in each row to show whether the factor is biotic or abiotic.

Factor	Biotic	Abiotic
Nitrates in the soil		
Rabbits eating the plants		
Shading by a building		
Soil pH		
Temperature		
Trampling by people		

(3)

The figure below shows a plan of a garden.



A student estimates the number of daisy plants growing on the lawn.
The student places a quadrat at 10 different positions on the lawn.
The quadrat measures 50 cm × 50 cm.
The student counts the number of daisy plants in each quadrat.

(b) How should the student decide where to place the quadrat?

Give the reason for your answer.

(2)

(c) The mean number of daisy plants in each quadrat is 6.

Calculate the number of daisy plants on the lawn. Give your answer to 3 significant figures.

Number of daisy plants on the lawn = _____

(6)

- (d) Using the mean from this investigation to calculate the number of daisy plants on the lawn may not be accurate.

Give two reasons why.

1 _____

2 _____

(2)

(Total 13 marks)

Q3.

This question is about photosynthesis.

- (a) Complete the word equation for photosynthesis.

_____ + _____ → _____ +
oxygen

(2)

- (b) Describe how energy for the photosynthesis reaction is gained by plants.

(2)

Students investigated the effect of temperature on the rate of photosynthesis.

The students shone light from a lamp onto pondweed and measured the volume of oxygen produced per hour.

The table below shows the results.

Temperature in °C	Rate of photosynthesis in cm ³ /hour			
	Test 1	Test 2	Test 3	Mean
20	18.5	19.3	19.5	X
25	32.6	34.1	32.9	33.2
30	41.9	45.2	44.9	44.0
35	38.6	39.8	44.0	40.8
40	23.1	20.5	22.4	22.0
45	1.9	14.2	2.2	2.1

(c) Calculate mean value X.

X = _____ cm³/hour

(2)

The students identified one anomalous result in the table above.

(d) Draw a ring around the anomalous result in the table above.

(1)

(e) Suggest one possible cause of the anomalous result.

(1)

(f) How did the students deal with the anomalous result?

(1)

(g) Give one factor the students should have kept constant in this investigation.

(1)

The table above is repeated below.

Temperature in °C	Rate of photosynthesis in cm ³ /hour			
	Test 1	Test 2	Test 3	Mean
20	18.5	19.3	19.5	X
25	32.6	34.1	32.9	33.2
30	41.9	45.2	44.9	44.0
35	38.6	39.8	44.0	40.8
40	23.1	20.5	22.4	22.0
45	1.9	14.2	2.2	2.1

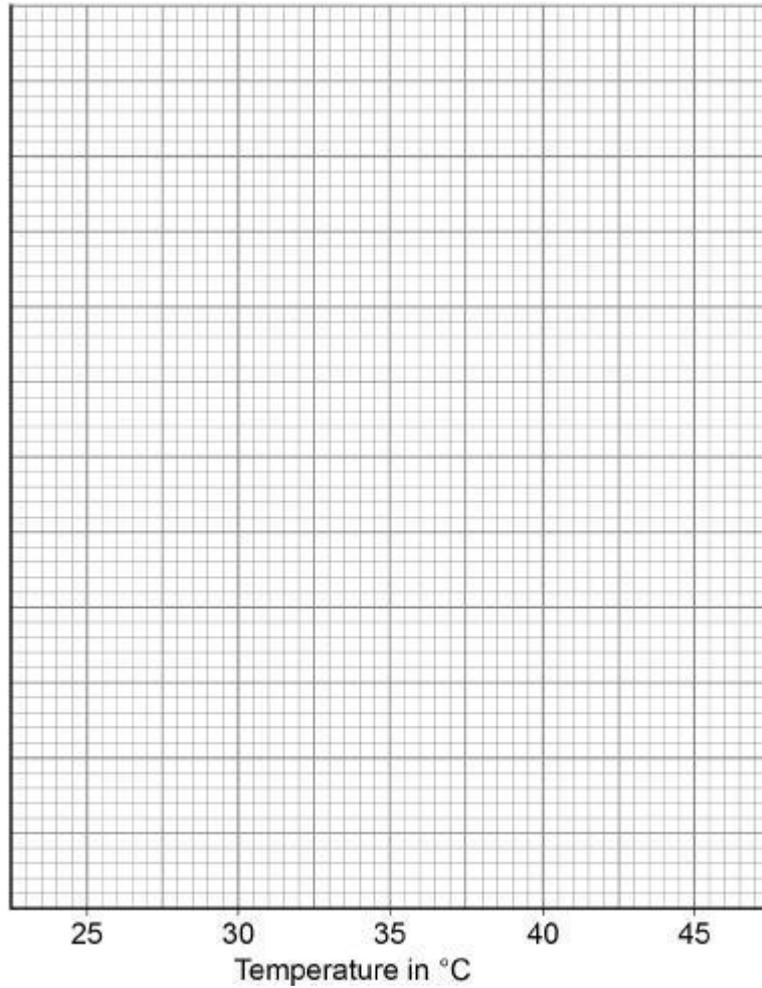
(h) Why did the rate of photosynthesis decrease from 35 °C to 45 °C?

(1)

(i) Complete the graph below using data from the table above.

You should:

- label the y-axis
- use a suitable scale for the y-axis
- plot the mean data from the table above for temperatures from 25 °C to 45 °C
- draw a line of best fit.



(5)
(Total 16 marks)

Q4.

Lipases break down lipids.

(a) Which two products are formed when lipids are broken down?

Tick (✓) two boxes.

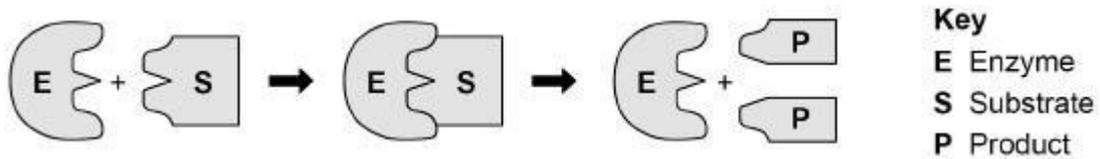
- Amino acids
- Fatty acids
- Glucose
- Glycerol

Glycogen

(2)

One model used to explain enzyme action is the 'lock and key theory'.

The diagram below shows a model of the theory.



(b) Explain the 'lock and key theory' of enzyme action.

Use information from the diagram above in your answer.

(3)

(c) There are many different types of lipase in the human body.

Why does each different type of lipase act on only one specific type of lipid molecule?

Students investigated the presence of starch and glucose in the leaves of geranium plants.

This is the method used.

- 1 Place two identical geranium plants on a bench near a sunny window for two days.
- 2 After two days:
 - leave one plant near the window for two more days.
 - place one plant in a cupboard with no light for two more days.

- 3 Remove one leaf from each plant.
- 4 Crush each leaf to extract the liquid from the cells.
- 5 Test the liquid from each leaf for glucose and for starch.

(1)

(d) Describe how the students would find out if the liquid from the leaf contained glucose.

(3)

(e) Describe how the students would find out if the liquid from the leaf contained starch.

(2)

The table below shows the students' results.

Test	Leaf from plant kept in light for four days	Leaf from plant kept in light for two days and then no light for two days
Glucose	Strong positive	Weak positive
Starch	Positive	Negative

(f) Explain why the leaf in the light for four days contained both glucose and starch.

(2)

- (g) Explain why the leaf left in a cupboard with no light for two days did contain glucose but did not contain starch.

(3)

- (h) Suggest one way the students could develop the investigation to find out more about glucose and starch production in plants.

(1)

(Total 17 marks)

Q5.

This question is about photosynthesis.

- (a) Complete the word equation for photosynthesis:

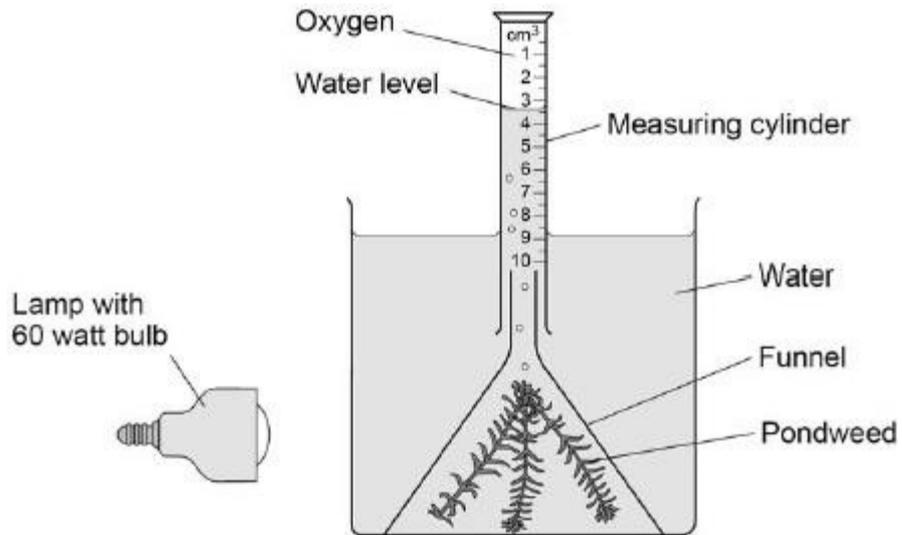
_____ + _____ → _____
+ oxygen

(2)

A student investigated photosynthesis using pondweed.

Figure 1 shows the apparatus the student used.

Figure 1



This is the method used.

1. Set up the apparatus as shown in Figure 1.
2. Switch on the lamp.
3. After 20 minutes, record the volume of oxygen collected in the measuring cylinder.
4. Repeat steps 1–3 using bulbs of different power output.

(b) What was the independent variable in the investigation?

Tick (✓) one box.

- | | |
|----------------------------|--------------------------|
| Power output of bulb | <input type="checkbox"/> |
| Rate of photosynthesis | <input type="checkbox"/> |
| Time to collect oxygen | <input type="checkbox"/> |
| Volume of oxygen collected | <input type="checkbox"/> |

(1)

(c) Suggest two ways the method could be improved so the results would be more valid.

1 _____

2 _____

(2)

The table below shows the student's results.

Power output of bulb in watts	Volume of oxygen collected in 20 minutes in cm ³	Rate of photosynthesis in cm ³ /hour
60	0.5	1.5
100	0.8	2.4
150	1.1	X
200	1.2	3.6
250	1.2	3.6

(d) Calculate value X in the table above.

X = _____ cm³/hour

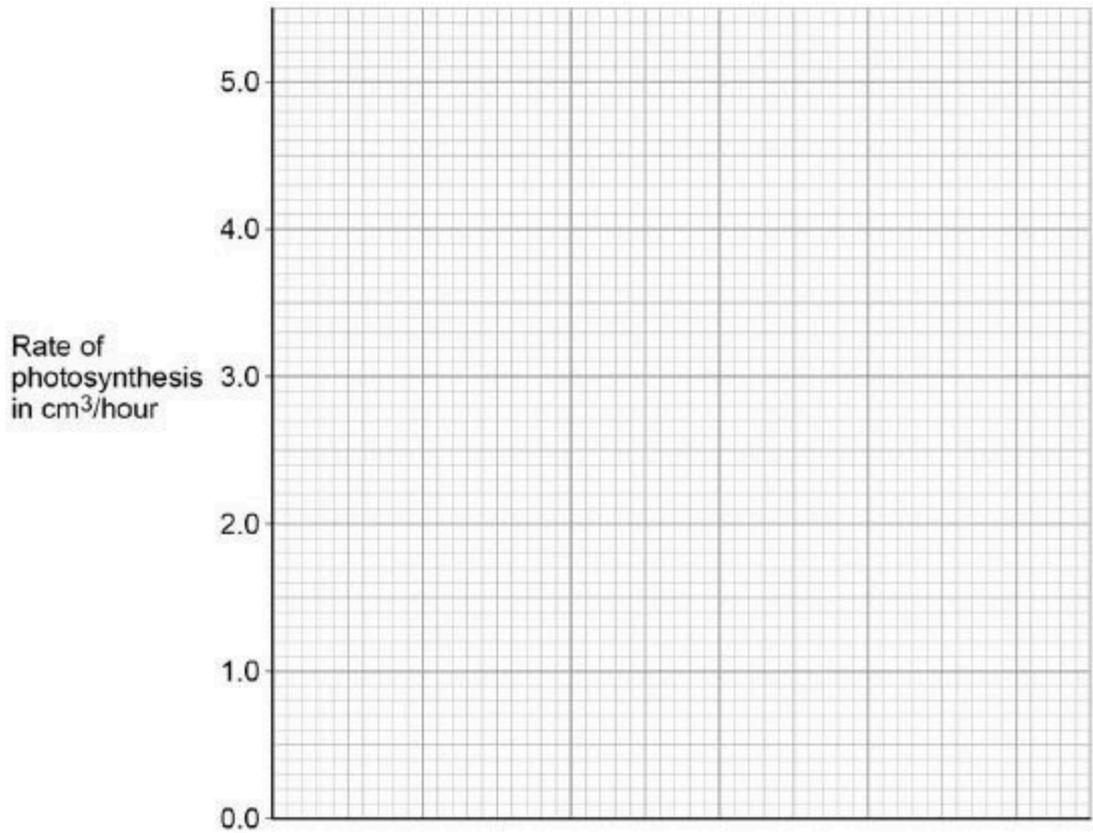
(1)

(e) Complete Figure 2.

You should:

- label the x-axis
- use a suitable scale
- plot the data from the table above and your answer to part (d)
- draw a line of best fit.

Figure 2



(4)

- (f) Determine the expected rate of photosynthesis with a bulb of power output 75 watts.

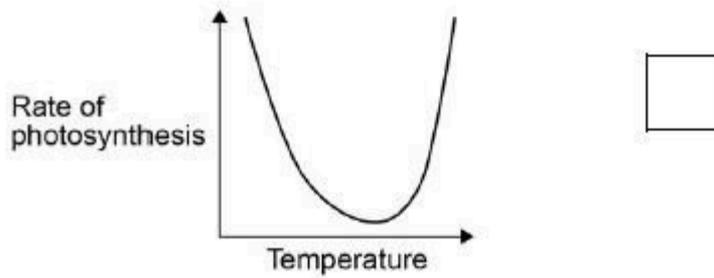
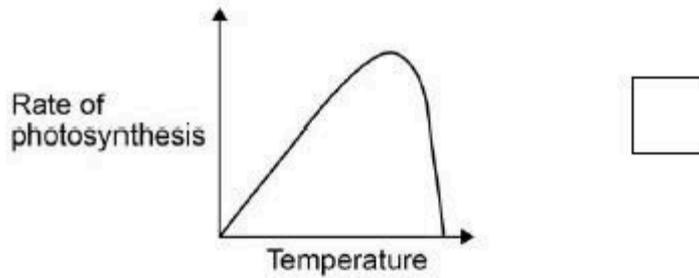
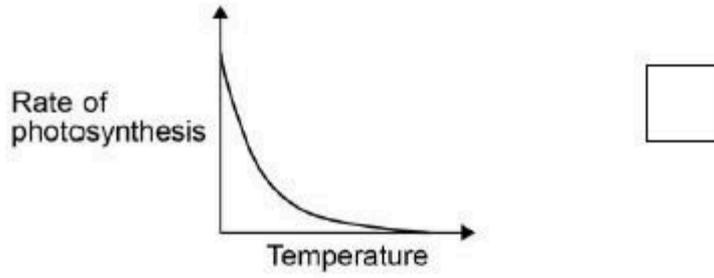
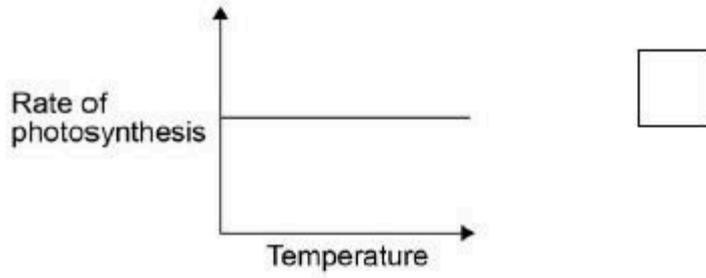
Use Figure 2.

Rate of photosynthesis at 75 watts = _____ cm³/hour

(1)

- (g) Which graph shows the effect of temperature on the rate of photosynthesis?

Tick (✓) one box.

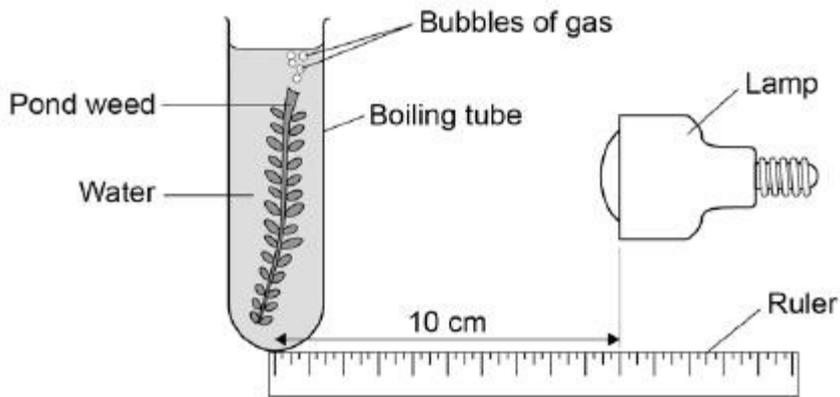


(1)
(Total 12 marks)

Q6.

A student investigated the effect of light intensity on the rate of photosynthesis.

The diagram shows the apparatus the student used.



This is the method used.

1. Set up the apparatus as shown in the diagram above.
2. Place the lamp 10 cm from the pondweed.
3. Turn the lamp on and count the number of bubbles produced in one minute.
4. Repeat with the lamp at different distances from the pondweed.

(a) Complete the hypothesis for the student's investigation.

'As light intensity increases, _____
_____.'

(1)

(b) What was the independent variable in this investigation?

Tick one box.

Light intensity

Number of bubbles
produced

Temperature

Time

(1)

(c) The teacher suggests putting the boiling tube into a beaker of water during the investigation.

Suggest why this would make the results more valid.

(1)

Table 1 shows the student's results.

Table 1

Distance of lamp from pondweed in cm	Number of bubbles produced per minute			
	Mean	Trial 2	Trial 3	
10	67	66	69	67
20	61	64	62	62.3
30	53	51	52	X
40	30	32	31	31
50	13	15	15	14

(d) Calculate value X in Table 1.

X = _____ bubbles per minute

(1)

(e) State one error the student has made when completing the results at 20 cm.

(1)

(f) What evidence in Table 1 shows that the data is repeatable?

Tick one box.

The number of bubbles decreases as distance decreases.

The numbers of bubbles at each distance are similar.

The student calculated a mean for each distance.

The student did the experiment three times.



(1)

Another student investigated the effect of the colour of light on the rate of photosynthesis.

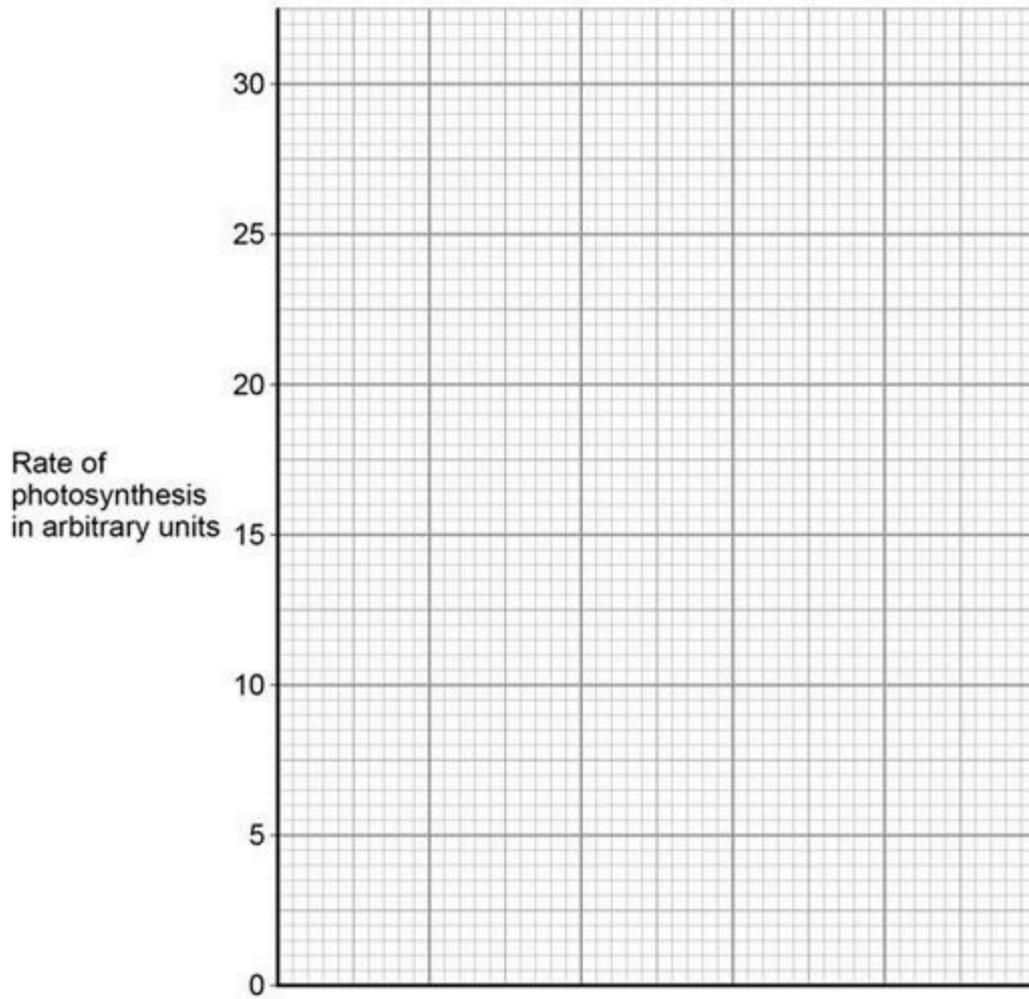
The results are shown in Table 2.

Table 2

Colour of light	Rate of photosynthesis in arbitrary units
Blue	24
Green	4
Red	17
Yellow	8

(g) Plot the data from Table 2 on the graph.

You should label the x-axis.



(3)

(h) Give two conclusions from the graph above.

1.

2.

(2)

(i) The glucose produced in photosynthesis can be converted into amino acids to make new proteins for the plant.

Complete the sentences.

The glucose produced in photosynthesis can also be used in other ways.

Glucose can be used in respiration to release _____ .

Glucose can be converted to cellulose to strengthen the _____ .

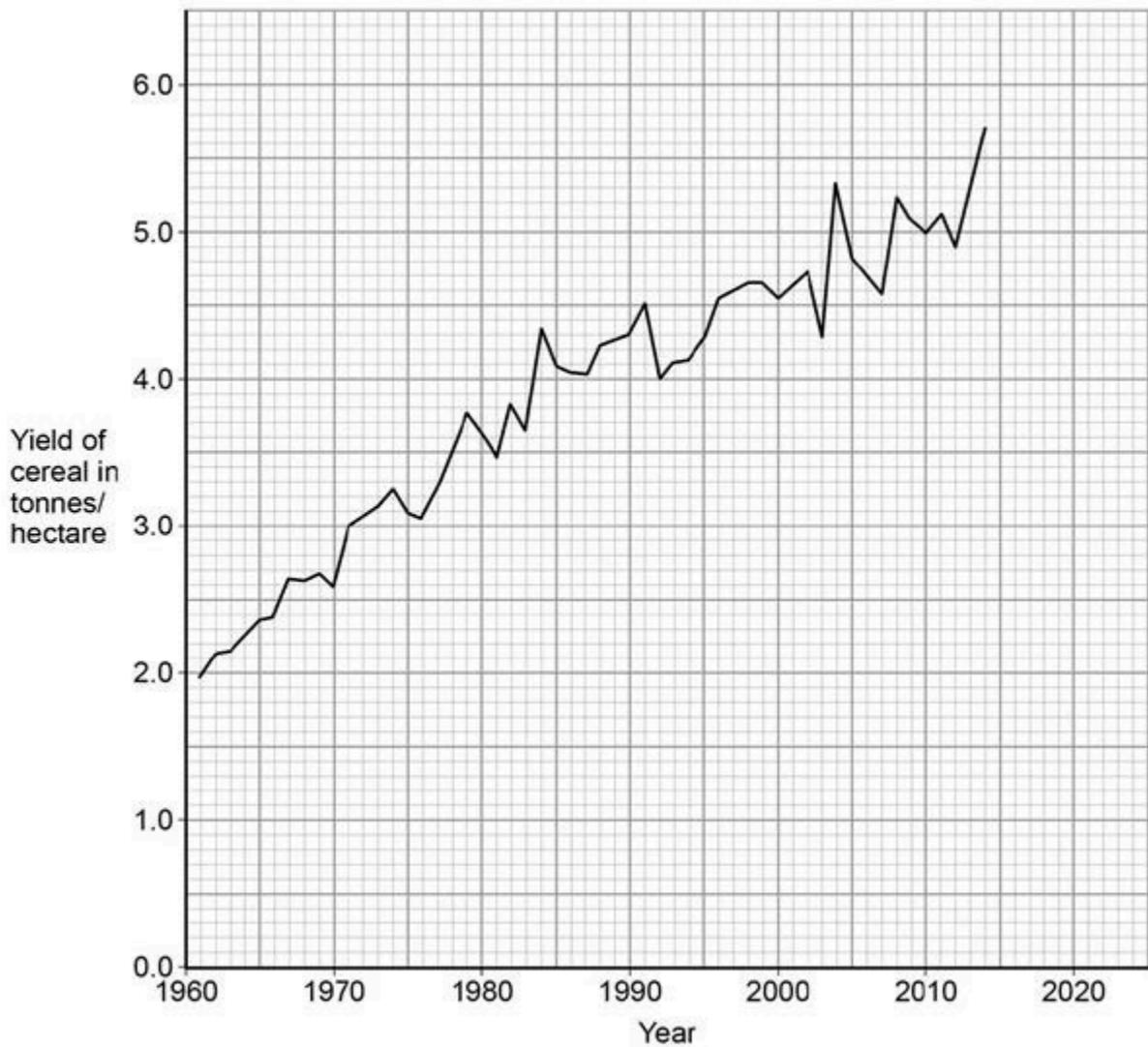
Glucose can be stored as _____ .

(3)

(Total 14 marks)

Q7.

The graph shows information about the yield of cereal crops grown in the European Union.



(a) Calculate the increase in the yield of cereal between 1970 and 2010.

Increase in yield = _____tonnes/hectare

(2)

- (b) Estimate by what fraction the yield of cereal increased between 1971 and 1992.

Tick one box.

$\frac{1}{10}$ $\frac{1}{3}$ $\frac{1}{2}$ $\frac{3}{4}$

(1)

- (c) The increase in yield is partly due to increased use of nitrate fertilisers.

Which substance do plants make using nitrate ions?

Tick one box.

Cellulose

Fat

Protein

Starch

(1)

- (d) The yield of cereal in 2004 was much greater than the yield in 2003.

Suggest three possible reasons for the increased yield in 2004.

Tick three boxes.

A genetically-modified variety of seed was sown in 2004.

A pathogenic fungus grew on the cereal in 2004.

Farmers added more nitrate to the soil in 2003.

More cereal seeds were sown in 2003.

More rain fell in spring and early summer in 2004.

The mean summer temperature was lower in 2003.



(3)

Humans eat cereals.

Humans also eat the animals that feed on cereals.

Figure 1 and Figure 2 show two food chains.

Figure 1

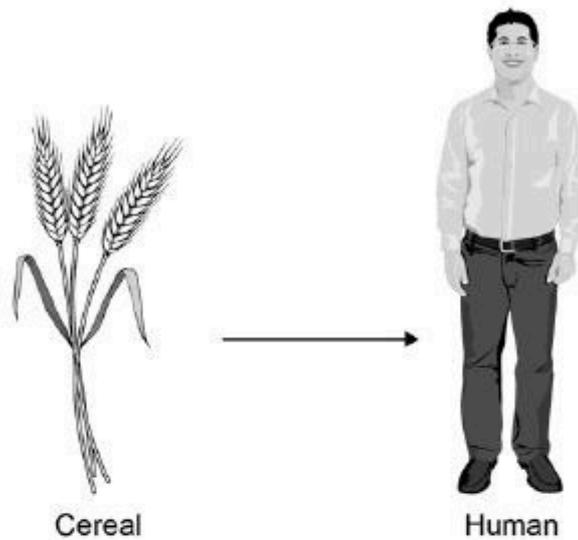
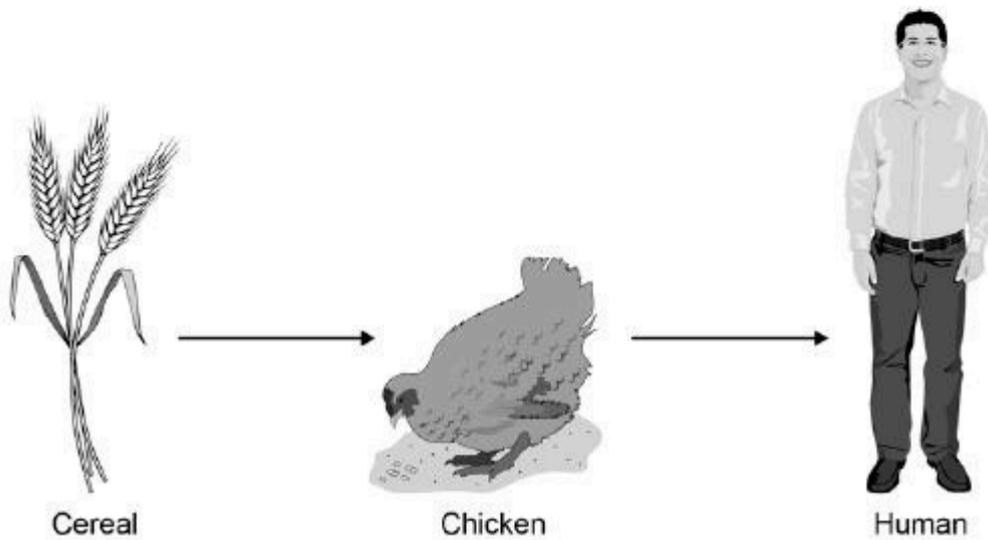
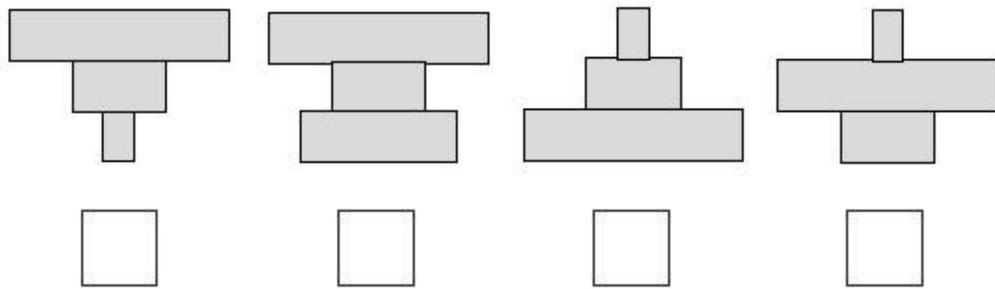


Figure 2



(e) Which pyramid of biomass is correct for the food chain shown in Figure 2?

Tick one box.



In Figure 1, 1 hectare of cereal crop would provide enough energy for 8 people for a year.

In Figure 2, 10 hectares of cereal crop would be needed to provide enough energy for only 1 person for a year.

- (f) It is much more efficient for humans to get energy by eating cereals than by eating chickens.

Calculate how many times more efficient.

Answer = _____ times

(1)

- (g) Why is it more efficient for humans to get energy by eating cereals than by eating chickens?

Tick two boxes.

Cereals gain extra energy from mineral ions in the soil.

Chickens contain more protein per gram than cereals.

Chickens use energy for movement and for keeping warm.

Much of the food eaten by chickens is wasted as faeces.

Not all parts of the cereal plants are edible.

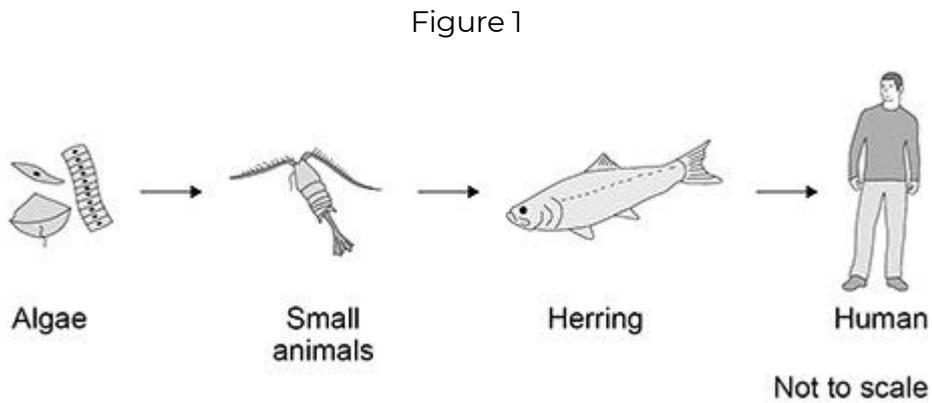
(2)

(Total 11 marks)

Q8.

People eat fish caught in the North Sea.

Figure 1 shows a food chain.



(a) The algae make glucose by photosynthesis.

Which two substances do the algae need for photosynthesis?

Tick (✓) two boxes.

- Carbon dioxide
- Nitrogen
- Oxygen
- Starch
- Water

(2)

(b) What is the source of energy for photosynthesis?

Tick (✓) one box.

- Light
- Mineral ions
- Protein

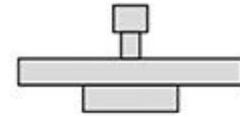
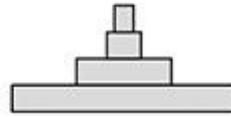
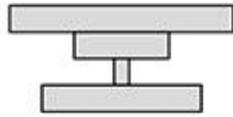
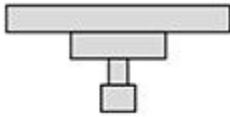
Water



(1)

(c) Which pyramid of biomass is correct for the food chain shown in Figure 2?

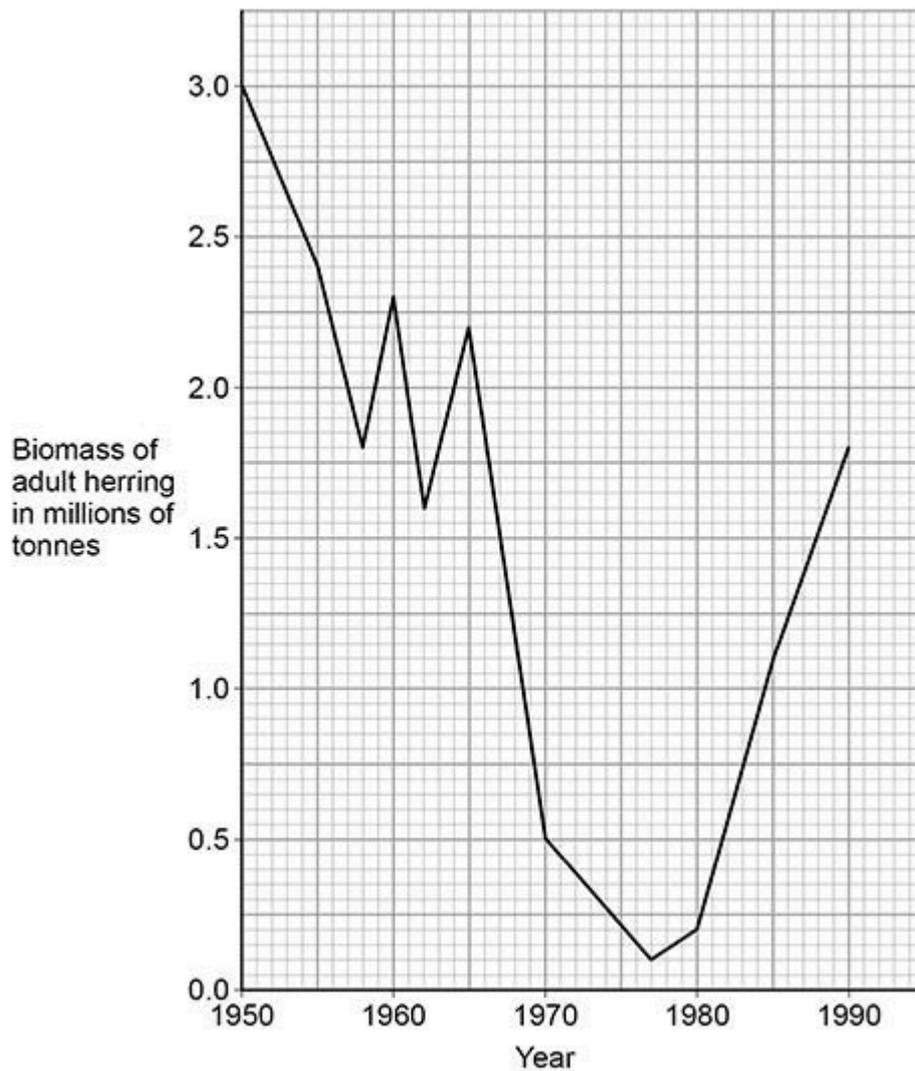
Tick (✓) one box.



(1)

Figure 2 shows the biomass of adult herring in the North Sea between 1950 and 1990.

Figure 2



- (d) Too many herring were caught in the 1960s.

Calculate the percentage decrease in the biomass of adult herring between 1960 and 1970.

Use the equation:

$$\text{percentage decrease} = \frac{(\text{biomass in 1960} - \text{biomass in 1970})}{\text{biomass in 1960}} \times 100$$

Give your answer to the nearest whole number.

Percentage decrease = _____ %

(4)

From 1977, laws were introduced to help conserve herring.

- (e) Describe the change in biomass of adult herring from 1977 to 1990.

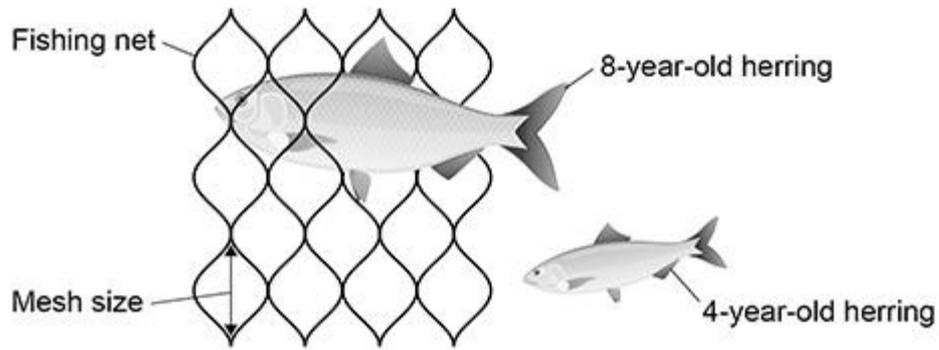
Use data from Figure 2 in your answer.

(2)

- (f) One of the laws was to control mesh size of fishing nets.

Figure 3 shows a fishing net with a legal mesh size.

Figure 3



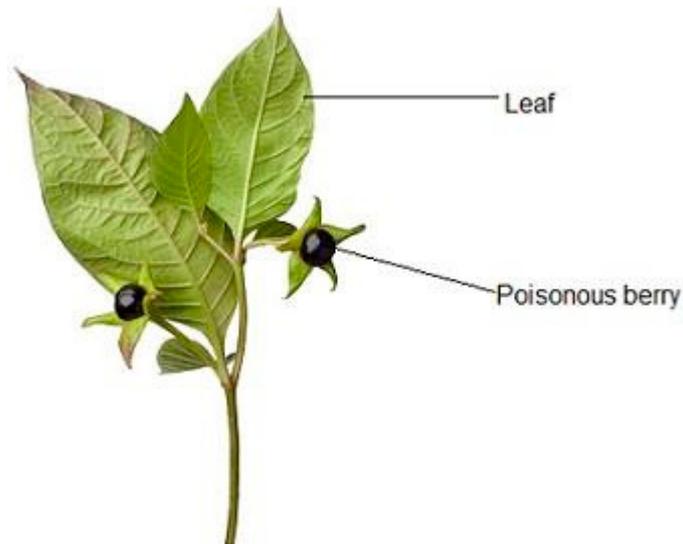
Herring can live for up to 12 years. Herring start to reproduce when they are 3 to 4 years old. Explain how the control of mesh size of fishing nets has helped to conserve stocks of herring.

(2)
(Total 12 marks)

Q9.

Figure 1 shows part of a deadly nightshade plant.

Figure 1



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

(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.

(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.

(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.

(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.

(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 | <input type="checkbox"/> |
| Dosage | <input type="checkbox"/> |
| 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)

Q10.

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

(Total 6 marks)