1 The table gives information about what happens to energy in food eaten by a mammal and in food eaten by a fish.

	Percentage of energy in the food that is absorbed	Percentage of absorbed energy released by respiration	Percentage of absorbed energy assimilated into biomass
Mammal (cow)	37.5	89.1	10.9
Fish (trout)	86.0	65.0	35.0

(a) Suggest why the cow absorbs a lower percentage of energy from the food it eats than the fish.

(2)

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(b) Suggest why the cow releases more of the absorbed energy by respiration than the fish.

(1)

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(c) The data suggests that fish farming is more productive than farming cows.

Using your knowledge of energy transfer, suggest two ways in which the productivity of cows could be improved.

(4)

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2 .....

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(Total for Question = 7 marks)

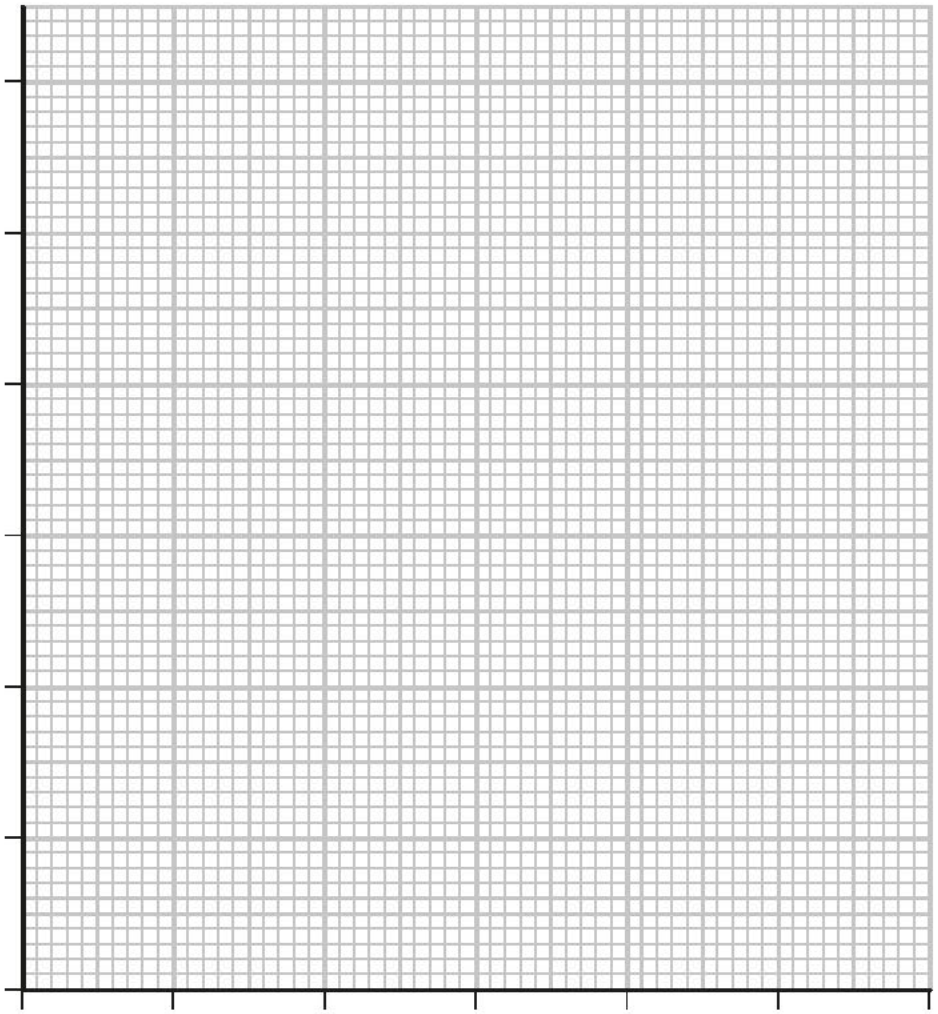
2 The table shows the energy requirements (in kilojoules) for females at different ages and different levels of activity.

Age in years	Energy requirement in kilojoules	
	Level of activity	
	Sitting	Active
3	4 200	5 600
6	5 000	7 600
11	6 700	8 400
16	7 600	10 100
25	8 400	10 100
41	7 600	9 200
55	6 700	9 200

(a) Plot a line graph on the grid below to show how age affects the energy requirements at each level of activity.

Use a ruler to join the points with straight lines.

(5)



(b) Describe how increasing age changes the energy requirements of females.

(2)

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(c) Explain the effect that the level of activity has on the energy requirements of females.

(3)

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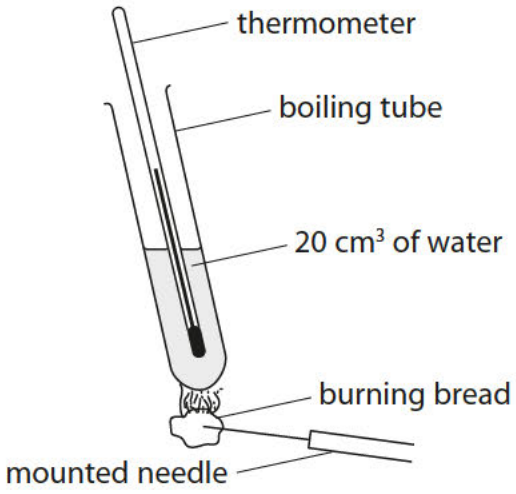
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(Total for Question = 10 marks)

3 This apparatus can be used to determine the energy value of food such as dried bread.



(a) John suggested that a more accurate value could be obtained if a larger volume of water was used.

Explain why John's suggestion might be correct.

(2)

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(b) Suggest **one** other modification and explain how it would improve the accuracy of the result.

(2)

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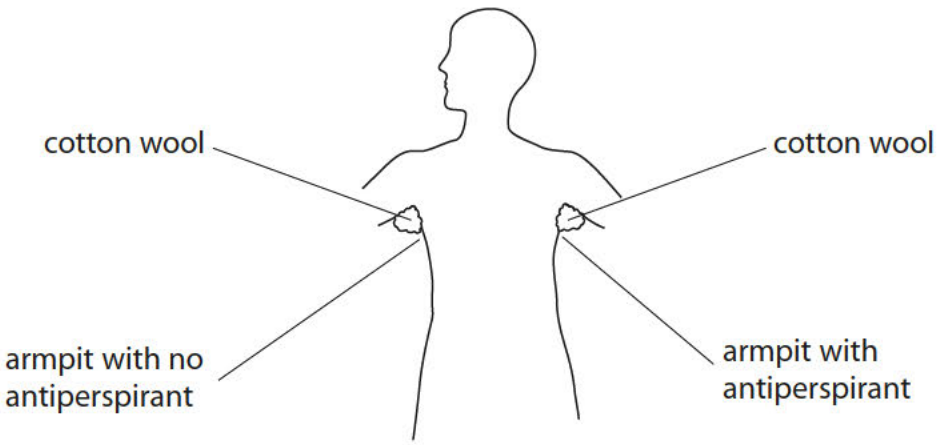
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(Total for Question = 4 marks)

4 Antiperspirants are used to reduce sweating under the arms.

An investigation was carried out to find out the effectiveness of an antiperspirant. Ten students put antiperspirant on the skin of their left armpit. No antiperspirant was put on the skin of their right armpit. Each student then weighed two pieces of cotton wool and placed one piece under each armpit. The cotton wool was used to absorb any sweat that was produced.



The ten students exercised at the same intensity for five minutes and then reweighed each piece of cotton wool.
They calculated the percentage increase in the mass of the cotton wool. Their results are shown in the table.

Student	Percentage increase in mass of cotton wool (%)	
	Without antiperspirant	With antiperspirant
1	2.4	1.9
2	2.7	1.6
3	2.9	2.0
4	2.6	1.8
5	2.6	1.7
6	2.5	1.6
7	2.6	2.0
8	2.7	1.7
9	2.5	0.0
10	2.5	1.7
Average	**2.6**	**?**

(a) The results for the left armpits with antiperspirant contain one anomalous result.

Calculate the **correct** average for the percentage increase in mass of the cotton wool with antiperspirant. Show your working.

(2)

Answer .....

(b) The results for the right armpits without antiperspirant are not all the same.

Suggest **two** reasons to explain this.

(2)

1 .....

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2 .....

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(c) Which of the following formulae, A, B, C or D, should be used to calculate the percentage increase in the mass of each piece of cotton wool.

Put a cross ☒ in the correct box.

(1)

☐ **A** $\%\ \text{increase} = \dfrac{\text{mass after exercise} - \text{initial mass}}{\text{initial mass}} \times 100$

☐ **B** $\%\ \text{increase} = \dfrac{\text{mass after exercise} - \text{initial mass}}{\text{mass after exercise}} \times 100$

☐ **C** $\%\ \text{increase} = \dfrac{\text{mass after exercise}}{\text{initial mass}} \times 100$

☐ **D** $\%\ \text{increase} = \dfrac{\text{initial mass}}{\text{mass after exercise}} \times 100$

(d) Exercise increases the rate of sweating, but people also sweat at rest.

(i) Explain how the rate of sweating of a person at rest is affected if that person is in hot air.

(2)

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(ii) Explain how the rate of sweating of a person at rest is affected if that person is in air with a high humidity.

(2)

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(Total for Question = 9 marks)

5 The table shows the concentration of sodium ions and chloride ions inside a plant root hair cell and in the water in the soil.

Place	Ion concentration in mg per dm^3	
	sodium	chloride
in the root hair cell	1988	3745
in the water in the soil	28	35

(a) The ratio for the concentration of sodium ions in the root hair cell compared to the water in the soil is 71:1

(i) Calculate the ratio for the concentration of chloride ions in the root hair cell compared to the water in the soil.

(1)

ratio = ...

(ii) Adding too much water to soil will fill all the air spaces in the soil with water.

Suggest why this will prevent root hair cells from absorbing sodium or chloride ions.

(3)

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(b) The table lists two other mineral ions.

Complete the table by naming a molecule that is made in plants using the mineral ion.

(2)

Mineral ion	Molecule made using the mineral ion
magnesium	
nitrate	

(Total for Question = 6 marks)

6 The passage describes some of the roles of components found in human blood.

Complete the passage by writing a suitable word or words in each blank space.

(6)

The body uses white blood cells to combat infection. One type of blood cell ingests invading bacteria and are called ..... . After ingesting bacteria they produce ..... that digest the bacteria breaking them down.

Other white blood cells are called ..... and they release specific molecules that bind to antigens on the surface of the pathogen.

Other components of the blood are also involved in helping wounds to heal.

Small cell fragments called platelets help the blood to ..... .

This seals the wound to prevent further ..... and prevent entry of ..... .

(Total for Question = 6 marks)

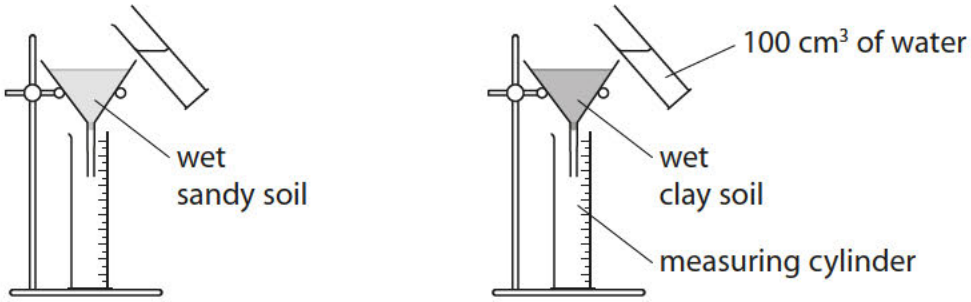
7 Some types of algae are microscopic organisms that can carry out photosynthesis. They produce most of their biomass as fats and oils. If these algae could be grown in large numbers it might help to solve the world's energy crisis because the fats and oils could be turned into biofuel.

Describe and explain the conditions needed to successfully grow large numbers of algae.

(5)

(Total for Question = 5 marks)

8 The diagram shows the apparatus used to investigate how quickly water passes through two different types of soil.



Each funnel contained 200 g of dry soil. Water was poured into each funnel to make the soil completely wet.

Then 100 cm^3 of water was poured on to the wet soil in each funnel and allowed to drain into the measuring cylinders. The volume of water collected in the cylinders was measured every two minutes until all 100 cm^3 had been collected. The table shows the results.

Time in minutes	Volume of water collected in cm^3	
	sandy soil	clay soil
2	70	20
4	100	36
6	100	52
8	100	68
10	100	84
12	100	97
14	100	100

(a) (i) Soil type is an independent variable in this investigation.

What is meant by the term **independent variable**?

(1)

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(ii) What is the **dependent variable** in this investigation?

(1)

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(iii) Tick the box to show the correct controlled variable in this investigation.

(1)

Variable	Tick
mass of dry soil	
size of measuring cylinder	
volume of water collected	

(iv) Calculate the average rate in cm^3 per minute at which water drained through the clay soil. Show your working.

(2)

Answer ..... cm^3 per minute

(v) The photographs show two stop clocks, A and B, that could be used to measure the time taken for water to drain through the soil in this investigation.

stop clock A



stop clock B



Which of these two stop clocks would give a more precise reading?
Explain your answer.

(1)

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(b) Sandy soil contains large soil particles with big air spaces between them.

Clay soil contains very small soil particles with small air spaces between them and most of these air spaces are filled with water.

(i) Suggest why many plants may find it difficult to grow in sandy soil.

(2)

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(ii) Use your knowledge of how plant roots absorb mineral ions to suggest why some plants may find it difficult to grow in clay soil.

(2)

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(Total for Question = 10 marks)