NOTICE TO CUSTOMER:

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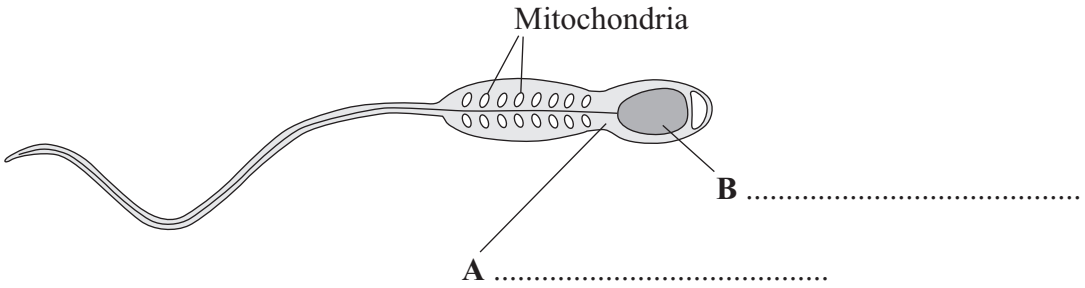
Answer **all** questions in the spaces provided.

1 This question is about cells.

1 (a) (i) The diagram shows a sperm cell.

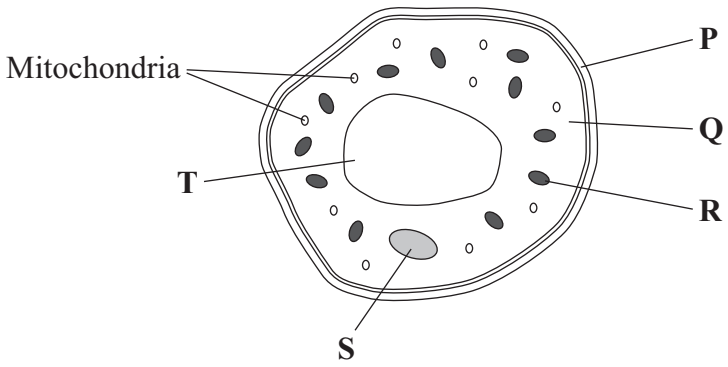


Use words from the box to label parts **A** and **B**.

cell membrane	**cytoplasm**	**nucleus**

(2 marks)

1 (a) (ii) The diagram shows a cell from a leaf.



Give the letters of **two** parts of the leaf cell which would **not** be found in a sperm cell. ☐ and ☐

(1 mark)

1 (b) Sperm cells have many mitochondria.

Why do sperm cells need many mitochondria?

Tick (✓) **one** box.

Sperm cells are involved in fertilisation. ☐

Sperm cells are produced in very large numbers. ☐

Sperm cells need a lot of energy to swim. ☐

(1 mark)

4

Turn over for the next question

2 Enzymes have many uses in the home and in industry.

2 (a) Which type of organism is used to produce these enzymes?

Tick (✓) **one** box.

Mammals ☐

Microorganisms ☐

Plants ☐

(1 mark)

2 (b) Babies may have difficulty digesting proteins in their food. Baby food manufacturers use enzymes to 'pre-digest' the protein in baby food to overcome this difficulty.

Use words from the box to complete the sentences.

amino acids	**amylases**	**proteases**	**sugars**

2 (b) (i) Proteins are 'pre-digested' using enzymes called .....

(1 mark)

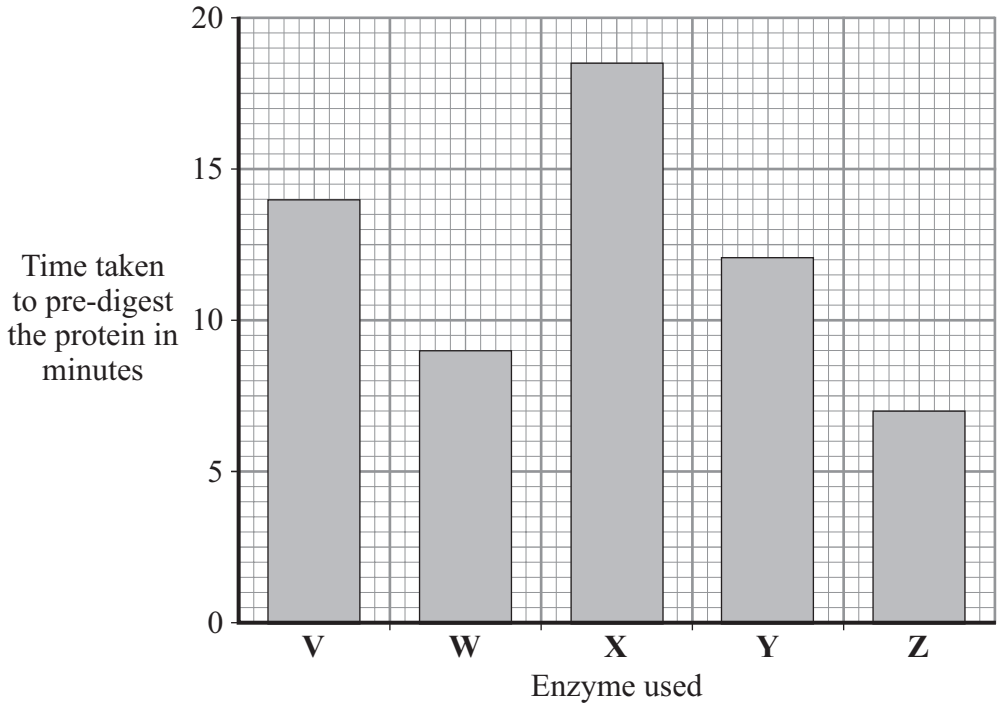
2 (b) (ii) This pre-digestion produces .....

(1 mark)

2 (c) A baby food manufacturer uses enzyme **V** to pre-digest protein.
He tries four new enzymes, **W**, **X**, **Y** and **Z**, to see if he can reduce the time taken to pre-digest the protein.

The graph shows the time taken for the enzymes to completely pre-digest the protein.

The manufacturer uses the same concentration of enzyme and the same mass of protein in each experiment.



2 (c) (i) How long did it take enzyme **V** to pre-digest the protein? ☐ minutes

(1 mark)

2 (c) (ii) Which enzyme would you advise the baby food manufacturer to use?

Draw a ring around your answer.

enzyme V **enzyme W** **enzyme X** **enzyme Y** **enzyme Z**

Give a reason for your answer.

.....

.....

(2 marks)

2 (c) (iii) Give **two** factors which should be controlled in the baby food manufacturer's investigations.

Tick (✓) **two** boxes.

Oxygen concentration ☐

Temperature ☐

Light intensity ☐

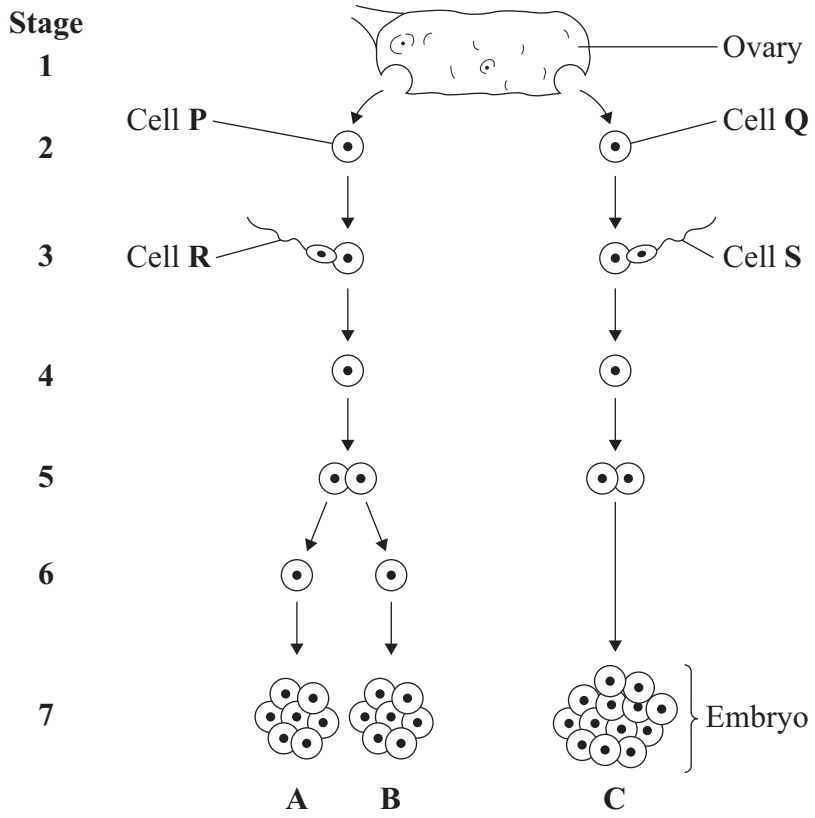
pH ☐

(2 marks)

8

3 A woman gives birth to triplets.
Two of the triplets are boys and the third is a girl.
The triplets developed from two egg cells released from the ovary at the same time.

The diagram shows how triplets **A**, **B** and **C** developed.



3 (a) Which stages on the diagram show gametes?

Draw a ring around your answer.

1 and 2 **2 and 3** **3 and 7** **1 and 7**

(1 mark)

3 (b) Embryo **B** is male.

Which of the following explains why embryo **B** is male?

Tick (✓) **one** box.

Cell **P** has an X chromosome; cell **R** has an X chromosome. ☐

Cell **P** has a Y chromosome; cell **R** has an X chromosome. ☐

Cell **P** has an X chromosome; cell **R** has a Y chromosome. ☐

(1 mark)

3 (c) The children that develop from embryos **A** and **C** will **not** be identical.

Explain why.

You may use words from the box in your answer.

egg	**genes**	**sperm**

.....

.....

.....

.....

.....

(2 marks)

Question 3 continues on the next page

3 (d) Single cells from an embryo at **Stage 7** can be separated and grown in a special solution.

3 (d) (i) What term describes cells that are grown in this way?

Draw a ring around your answer.

alleles **screened cells** **stem cells**

(1 mark)

3 (d) (ii) What happens when the cells are placed in the special solution?

Tick (✓) **two** boxes.

The cells divide ☐

The cells fertilise ☐

The cells differentiate ☐

The cells separate ☐

(2 marks)

3 (d) (iii) Give **one** use of cells grown in this way.

.....

.....

(1 mark)

3 (d) (iv) Some people might object to using cells from embryos in this way.

Give **one** reason why.

.....

.....

.....

(1 mark)

9

4 Waste products, such as carbon dioxide and urea, have to be removed from the body.

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

4 (a) Carbon dioxide is produced by [breathing / diffusion / respiration] .

(1 mark)

4 (b) Most carbon dioxide leaves the body through the [kidneys / lungs / skin] .

(1 mark)

4 (c) Urea is produced in the [kidneys / liver / lungs] .

(1 mark)

4 (d) Urea is produced from the breakdown of [amino acids / glucose / urine] .

(1 mark)

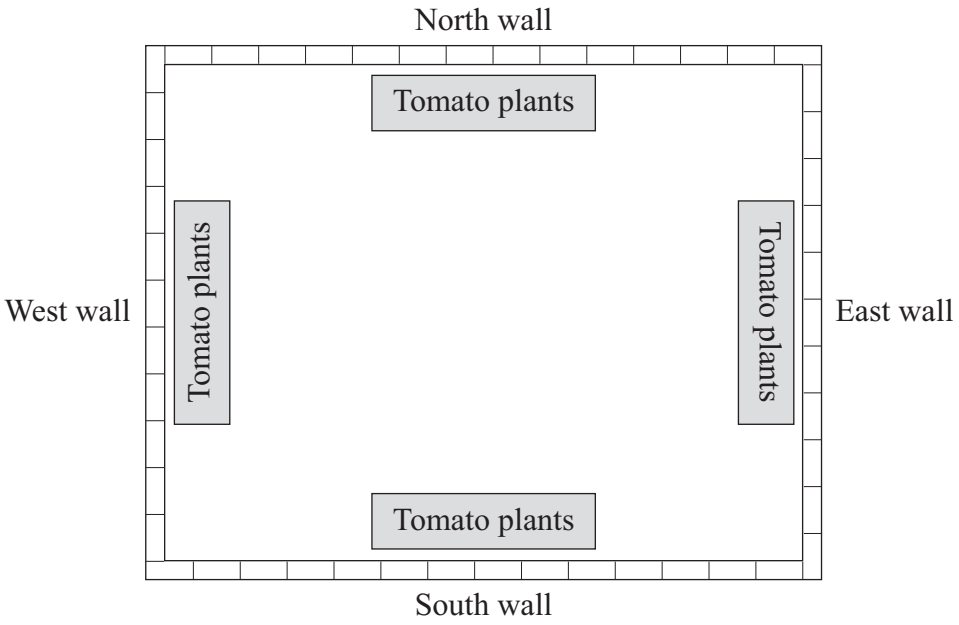
4

Turn over for the next question

5 A gardener grows tomatoes.

He wants to find out how to get the biggest mass of tomatoes.

He plants different varieties of tomato against different walls in his garden.



5 (a) The gardener wants his test to be fair.

Name **one** condition which he should keep the same for all his tomato plants.

.....

.....

(1 mark)

5 (b) The table shows the gardener's results.

Variety of tomato plant	**Sungold**	**Sungold**	**Sungold**	**Sungold**	**Nugget**	**Champion**
Wall they were planted against	North	West	South	East	East	East
Mean mass of tomatoes produced in kilograms per plant	3.5	3.0	1.2	2.5	3.2	2.7

Use these results to answer the questions.

5 (b) (i) To obtain the biggest mass of tomatoes, against which wall is it best to grow the tomato plants?

Tick (✓) **one** box.

North wall ☐

South wall ☐

East wall ☐

West wall ☐

(1 mark)

5 (b) (ii) To obtain the biggest mass of tomatoes, which variety of tomato plant would it be best to grow?

.....

(1 mark)

5 (c) From the information in the table, the gardener's test was **not** fair.

Give **one** way in which the test was **not** fair.

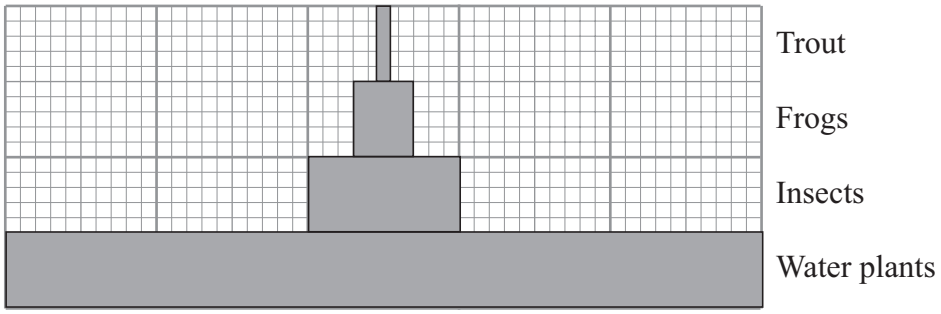
.....

.....

(1 mark)

4

6 The diagram shows a pyramid of biomass drawn to scale.



6 (a) What is the source of energy for the water plants?

.....

(1 mark)

6 (b) The ratio of the biomass of water plants to the biomass of insects is 5 : 1.

Calculate the ratio of the biomass of insects to the biomass of frogs.

Show clearly how you work out your answer.

.....

.....

ratio = ... : 1

(2 marks)

6 (c) Give **two** reasons why the biomass of the frog population is smaller than the biomass of the insect population.

1 .....

.....

2 .....

.....

(2 marks)

6 (d) Some insects die.

Describe how the carbon in the dead insect bodies may be recycled.

.....

.....

.....

.....

.....

.....

.....

.....

.....

.....

(4 marks)

9

Turn over for the next question

7 Diabetes is a disease in which a person's blood glucose concentration rises to higher levels than normal.
Diabetes is caused by insufficient insulin being produced.

7 (a) (i) Which organ monitors blood glucose concentration?

.....

(1 mark)

7 (a) (ii) Insulin reduces the concentration of glucose in the blood.

Describe how insulin does this.

.....

.....

(1 mark)

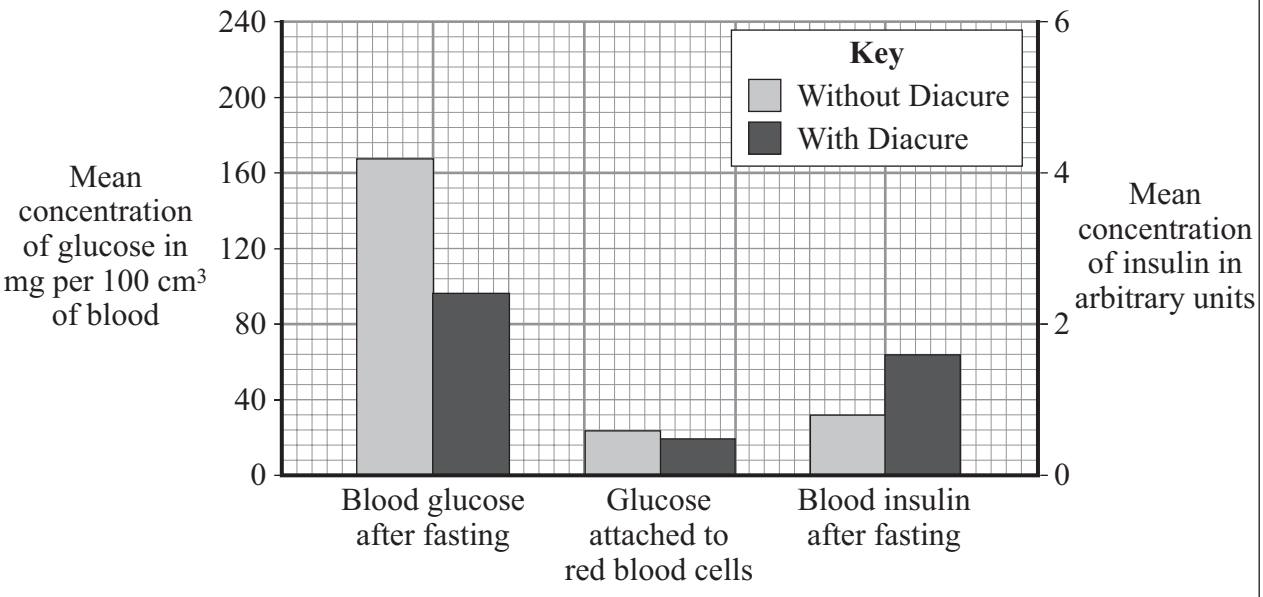
7 (b) A person with diabetes can be monitored in three ways:

- measuring the blood glucose concentration after fasting (going without food for 12 hours)
- measuring the amount of glucose attached to red blood cells: this is a measure of the average blood glucose concentration over the previous three months
- measuring the concentration of insulin in the blood after fasting

The manufacturer of a new treatment for diabetes, called Diacure, publishes the following two claims.

1. 98.6% of all people who used Diacure reported an improvement in their condition.

2. An independent study of 30 diabetic patients showed a significant reduction in blood glucose concentrations and a significant increase in insulin production, as shown by the graph.



7 (b) (i) Which of the manufacturer's claims is **not** based on scientific evidence?

.....

.....

(1 mark)

7 (b) (ii) Why might the data in this study be unreliable?

.....

.....

.....

(1 mark)

7 (b) (iii) The manufacturer did **not** draw attention to the data for the amount of glucose attached to red blood cells.

Suggest an explanation for this.

.....

.....

.....

.....

.....

(2 marks)

7 (b) (iv) The study of diabetic patients was carried out by an independent company.

Why is it important that the study should be independent?

.....

.....

.....

(1 mark)

7

END OF QUESTIONS

Answer **all** questions in the spaces provided.

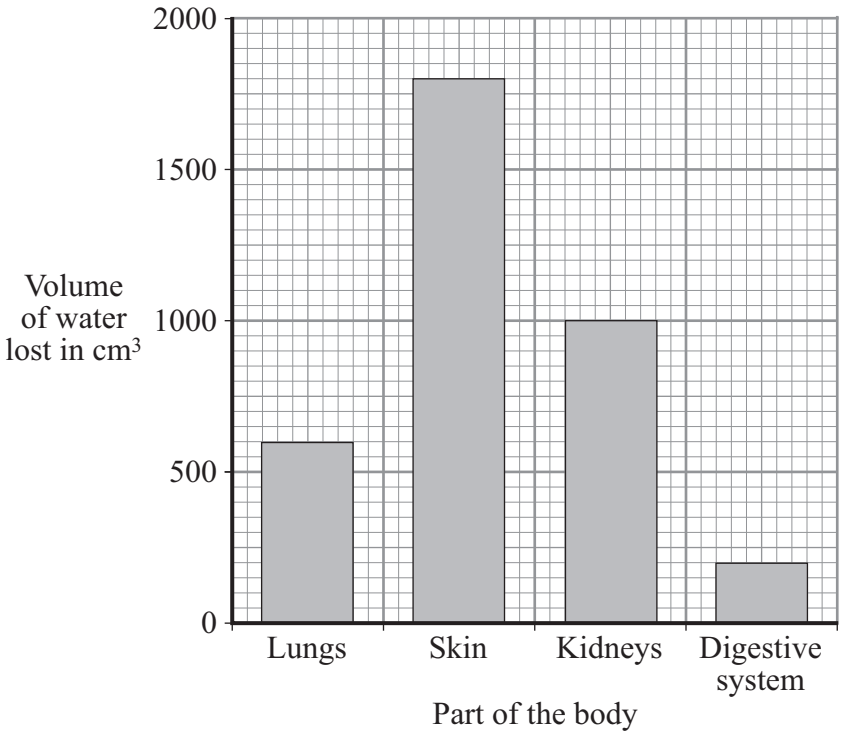
1 Water is lost from several parts of the body.

1 (a) Draw **one** line from each body part to the substance in which water is lost.

Body Part	Substance
Kidneys	Urine
Lungs	Faeces
Skin	Sweat
	Breath

(3 marks)

1 (b) The bar chart shows the volume of water a person lost from different parts of the body during a warm day.



1 (b) (i) What volume of water was lost through the skin on the warm day?

Tick (✓) **one** box.

600 cm^3 ☐

1600 cm^3 ☐

1800 cm^3 ☐

(1 mark)

1 (b) (ii) What effect would colder weather have on the amount of water lost through the skin?

Draw a ring around your answer.

decreases **increases** **stays the same**

(1 mark)

1 (b) (iii) Give a reason for your answer.

.....

.....

(1 mark)

1 (c) What effect does cold weather generally have on the amount of urine produced?

Draw a ring around your answer.

decreases **increases** **stays the same**

(1 mark)

7

Turn over for the next question

2 Humans reproduce sexually.

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

2 (a) (i) At fertilisation [chromosomes / genes / sex cells] join together.

(1 mark)

2 (a) (ii) At fertilisation a single cell forms, which has new pairs of [chromosomes. / nuclei. / sex cells.]

(1 mark)

2 (b) Cystic fibrosis can be inherited by children whose parents do not have it.

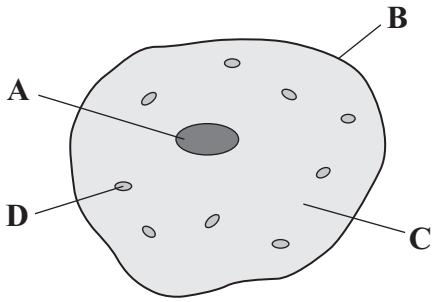
2 (b) (i) A person who has cystic fibrosis has [two / three / four] copies of the cystic fibrosis allele.

(1 mark)

2 (b) (ii) The cystic fibrosis allele is [large. / recessive. / strong.]

(1 mark)

2 (c) The diagram shows a human body cell.



Choose the correct answer from the box to complete each sentence.

cell membrane	**cell wall**	**cytoplasm**	**nucleus**

2 (c) (i) The part of the cell labelled **B** is the ..... .

(1 mark)

2 (c) (ii) The part of the cell labelled **C** is the ..... .

(1 mark)

2 (d) Which part of the cell, **A**, **B**, **C** or **D**:

2 (d) (i) contains the allele for cystic fibrosis ☐

(1 mark)

2 (d) (ii) is affected by cystic fibrosis? ☐

(1 mark)

8

Turn over for the next question

3 Diabetes is a disease in which blood glucose (sugar) concentration may rise more than normal.

3 (a) Which organ in the body monitors this rise in blood sugar?

Draw a ring around your answer.

liver **pancreas** **stomach**

(1 mark)

3 (b) One way of treating diabetes is by careful attention to diet.

Chart 1 shows the recommended diet for a person with diabetes.
Chart 2 shows a diet for a person without diabetes.

Chart 1 Person with diabetes

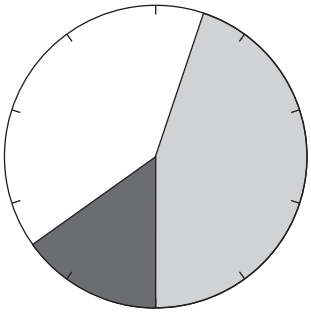
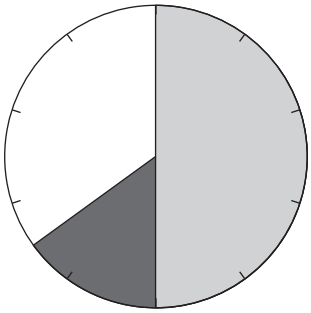


Chart 2 Person without diabetes



Key

Energy from: Carbohydrate Protein Fat

How is the recommended diet of a person with diabetes different from the diet of a person without diabetes?

Use information from the charts.

Tick (✓) **two** boxes.

The diabetic should get more energy from fat. ☐

The diabetic should get more energy from protein. ☐

The diabetic should get less energy from carbohydrate. ☐

The diabetic should get less energy from protein. ☐

(2 marks)

3 (c) Other than diet, give **one** way in which diabetes may be treated.

.....

.....

(1 mark)

4

Turn over for the next question

4 Plants need mineral ions for healthy growth.

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

Tick (✓) **one** box.

Flower ☐

Leaf ☐

Root ☐

(1 mark)

4 (b) Leaves are usually green.

4 (b) (i) What is the green substance in leaves?

Draw a ring around your answer.

chlorophyll **glucose** **starch**

(1 mark)

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

Explain why.

.....

.....

.....

.....

(2 marks)

4 (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 marks)

6

Turn over for the next question

5 A group of pupils investigated the digestion of fat by the enzyme lipase.

5 (a) What **two** substances are produced when fats are digested?

Tick (✓) **two** boxes.

Glucose ☐

Fatty acids ☐

Glycerol ☐

Amino acids ☐

(2 marks)

In the investigation:

- the pupils set up five test tubes
- each tube contained 1 cm^3 of fat and 10 cm^3 of lipase solution
- each tube was kept at a different temperature for 24 hours.

5 (b) (i) Give **one** control variable in this investigation.

.....

(1 mark)

5 (b) (ii) What was the independent variable being investigated?

.....

(1 mark)

5 (c) The pH of the solution in each tube was tested at the beginning of the investigation and after 24 hours.

The results of the pupils' investigation are shown in the table.

Tube	Temperature in °C	pH at the beginning	pH after 24 hours
1	0	Neutral	Neutral
2	20	Neutral	'Weak' acid
3	40	Neutral	'Strong' acid
4	60	Neutral	'Weak' acid
5	80	Neutral	Neutral

One pupil said, "We might **not** have found the best temperature for the lipase to work".

What more could they do to find the best temperature?

.....

.....

.....

.....

.....

(2 marks)

5 (d) The pupils then placed **Tube 1** into a water-bath kept at 40 °C.
The tube was left in the water-bath for 24 hours.

5 (d) (i) What pH would you expect the contents of the tube to be after the extra 24 hours?

Tick (✓) **one** box.

Neutral ☐

'Strong' acid ☐

'Weak' acid ☐

(1 mark)

5 (d) (ii) Give the reason for your answer.

.....

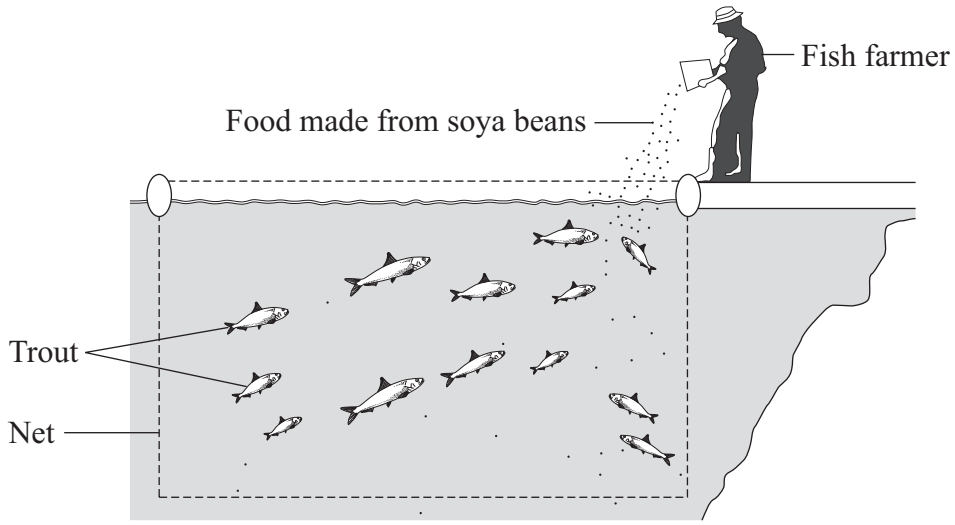
.....

(1 mark)

8

Turn over for the next question

6 A fish farmer keeps trout in a large net in a lake.



The fish farmer feeds the trout on food made from soya beans.

When the trout are large enough the farmer sells them for food for people.

6 (a) Draw a pyramid of biomass for the three organisms in this food chain.

Label the pyramid.

(2 marks)

6 (b) It would be more energy efficient if people ate the soya beans rather than eating the trout.

Which **two** of the following are reasons for this?

Tick (✓) **two** boxes.

Some people do not like eating animals such as trout. ☐

The trout release energy when they respire. ☐

Soya bean plants release energy when they respire. ☐

Some energy will be lost in waste from the trout. ☐

Soya bean plants absorb energy during photosynthesis. ☐

(2 marks)

6 (c) Suggest **one** advantage to the fish farmer of keeping the trout in a large net instead of letting them swim freely in the lake.

.....

.....

(1 mark)

6 (d) Some trout die before they are large enough to be sold.
The dead trout contain carbon.

Use your knowledge of the carbon cycle to describe how this carbon is returned to the atmosphere after the trout die.

.....

.....

.....

.....

.....

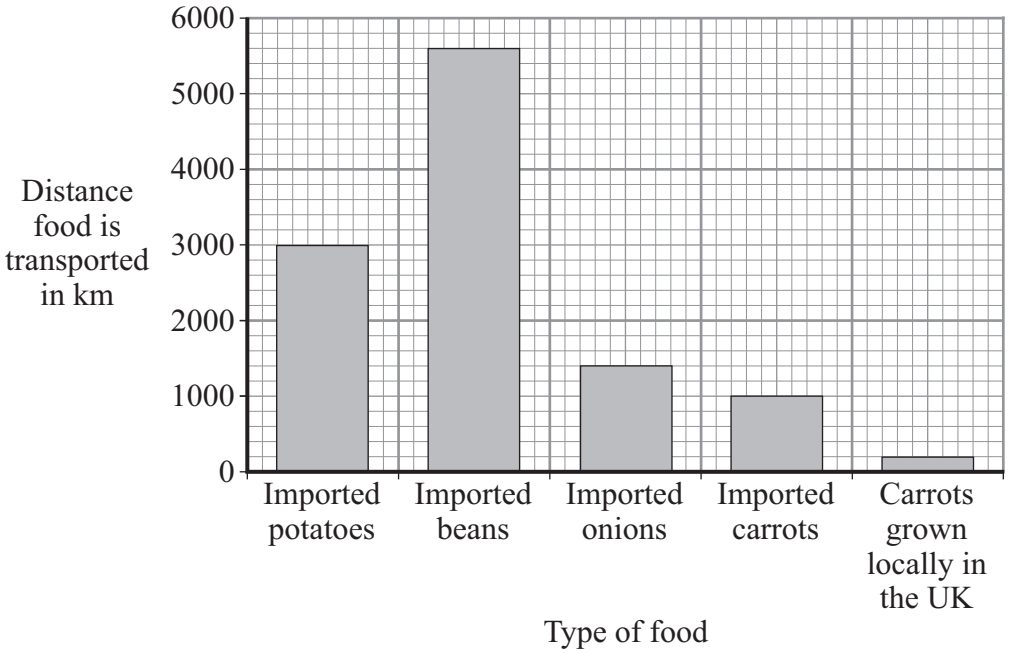
(2 marks)

7

Turn over for the next question

7 Some people are concerned about the distance that food is transported between the grower and the supermarket.

The bar chart shows the distances for some foods.



7 (a) Both imported carrots and carrots grown locally in the UK can be bought in supermarkets all year round.

How many times further are imported carrots transported than carrots grown locally in the UK?

Show clearly how you work out your answer.

.....

.....

..... times

(1 mark)

7 (b) Many of the beans sold in supermarkets in the UK are grown in Kenya, a tropical country in Africa.

Beans grow faster in Kenya than they do in the UK.

Suggest and explain **one** reason why.

Reason .....

.....

Explanation .....

.....

(2 marks)

7 (c) Many people believe that we should buy locally produced food instead of food imported from abroad.

Explain how this would help the environment.

.....

.....

.....

.....

.....

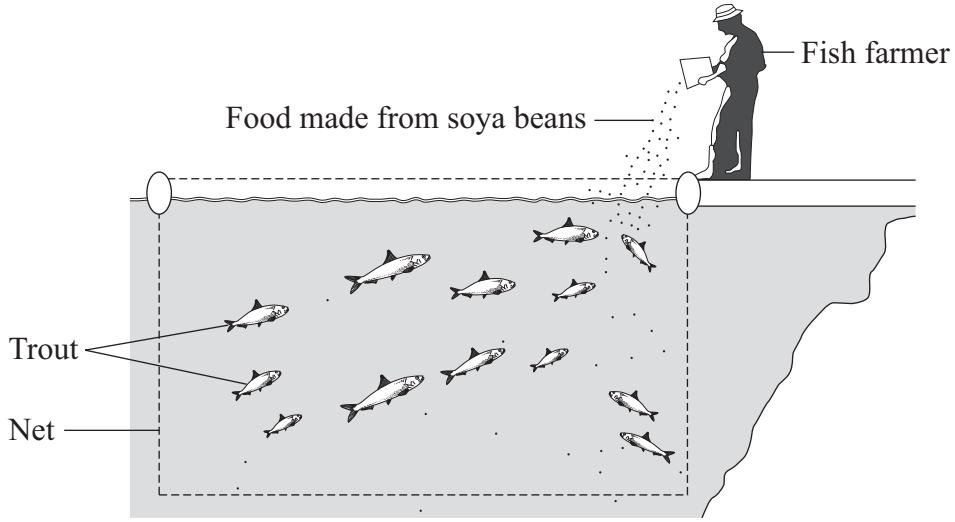
(2 marks)

5

END OF QUESTIONS

Answer **all** questions in the spaces provided.

1 A fish farmer keeps trout in a large net in a lake.



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When the trout are large enough the farmer sells them for food for people.

1 (a) Draw a pyramid of biomass for the three organisms in this food chain.

Label the pyramid.

(2 marks)

1 (b) It would be more energy efficient if people ate the soya beans rather than eating the trout.

Which **two** of the following are reasons for this?

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(2 marks)

1 (c) Suggest **one** advantage to the fish farmer of keeping the trout in a large net instead of letting them swim freely in the lake.

.....

.....

(1 mark)

1 (d) Some trout die before they are large enough to be sold.
The dead trout contain carbon.

Use your knowledge of the carbon cycle to describe how this carbon is returned to the atmosphere after the trout die.

.....

.....

.....

.....

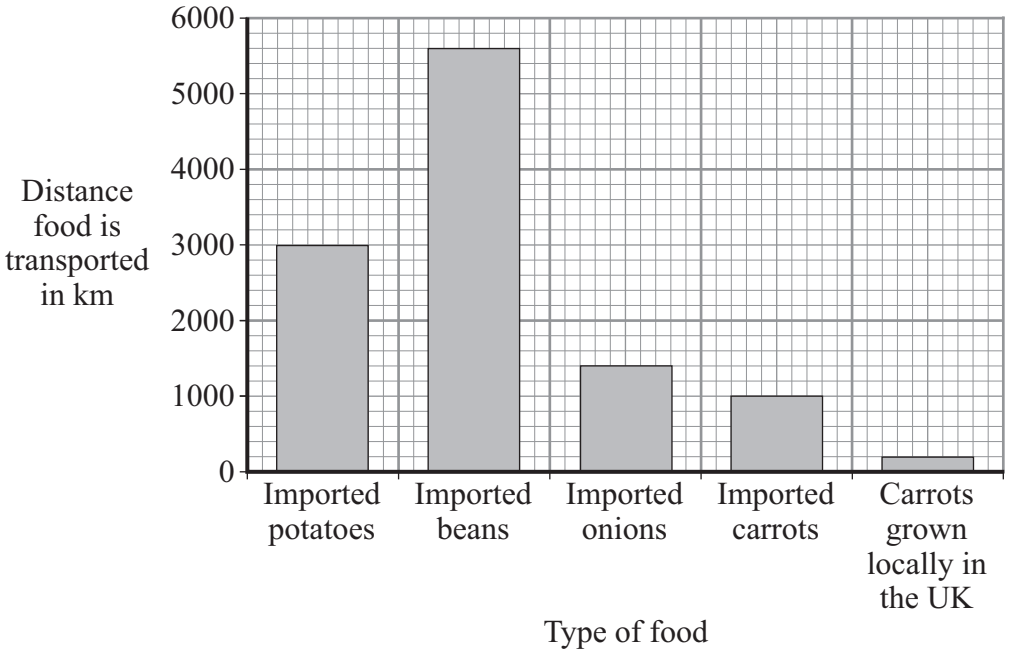
.....

(2 marks)

7

2 Some people are concerned about the distance that food is transported between the grower and the supermarket.

The bar chart shows the distances for some foods.



2 (a) Both imported carrots and carrots grown locally in the UK can be bought in supermarkets all year round.

How many times further are imported carrots transported than carrots grown locally in the UK?

Show clearly how you work out your answer.

.....

.....

..... times

(1 mark)

2 (b) Many of the beans sold in supermarkets in the UK are grown in Kenya, a tropical country in Africa.

Beans grow faster in Kenya than they do in the UK.

Suggest and explain **one** reason why.

Reason .....

.....

Explanation .....

.....

(2 marks)

2 (c) Many people believe that we should buy locally produced food instead of food imported from abroad.

Explain how this would help the environment.

.....

.....

.....

.....

.....

(2 marks)

5

Turn over for the next question

3 (a) (i) Which organ in the body monitors the concentration of glucose (sugar) in the blood?

.....

(1 mark)

3 (a) (ii) In a healthy person, insulin prevents high levels of glucose in the blood.

How does it do this?

.....

.....

(1 mark)

3 (b) There are two forms of diabetes.

In type 1 diabetes, the body produces little or no insulin.
In type 2 diabetes, the body cells do not respond to insulin.

There are two ways in which diabetes can be treated.

Draw lines to join the type of diabetes to the way or ways in which it can be treated.

Type of diabetes	**Treatment**
Type 1	Careful attention to diet only
	Careful attention to diet **and** injection of insulin
Type 2	Injection of insulin only

(2 marks)

3 (c) To make insulin, cells in the pancreas need amino acids.
A *small section of DNA* in the pancreas cells is involved in making insulin from the amino acids.

3 (c) (i) Insulin is a hormone.

What type of substance is insulin?

Draw a ring around **one** answer.

carbohydrate **lipid** **protein**

(1 mark)

3 (c) (ii) What term is used to describe the *small section of DNA* which controls the production of insulin?

.....

(1 mark)

3 (c) (iii) Amino acids cannot be stored in the body.

Describe, as fully as you can, what happens to the excess amino acids.

You may wish to use the following words in your explanation:

liver **kidneys** **bladder**

.....

.....

.....

.....

.....

.....

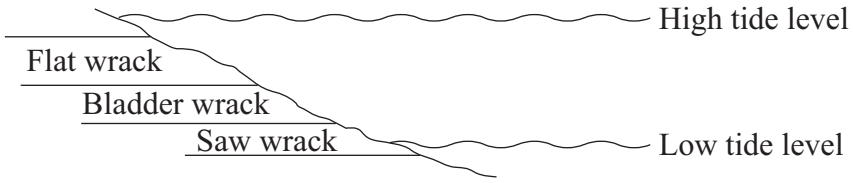
.....

.....

(3 marks)

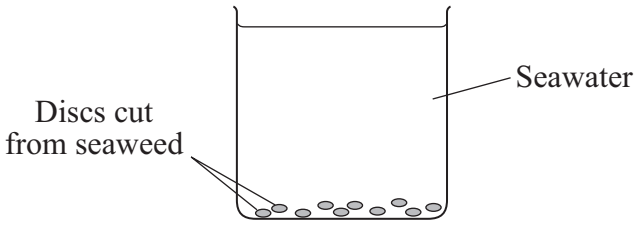
9

4 The diagram shows where three seaweeds live on a seashore.
As the tide moves in and out, these seaweeds are covered with seawater for different lengths of time.



Some students investigated the rate of photosynthesis in these seaweeds.

- They cut ten small discs from one seaweed.
- They dropped the discs into seawater in a beaker.
- They recorded the time taken for the fifth disc to float to the surface.
- They repeated this experiment with the other two seaweeds.



4 (a) (i) Suggest why the discs floated to the surface.

.....

.....

(1 mark)

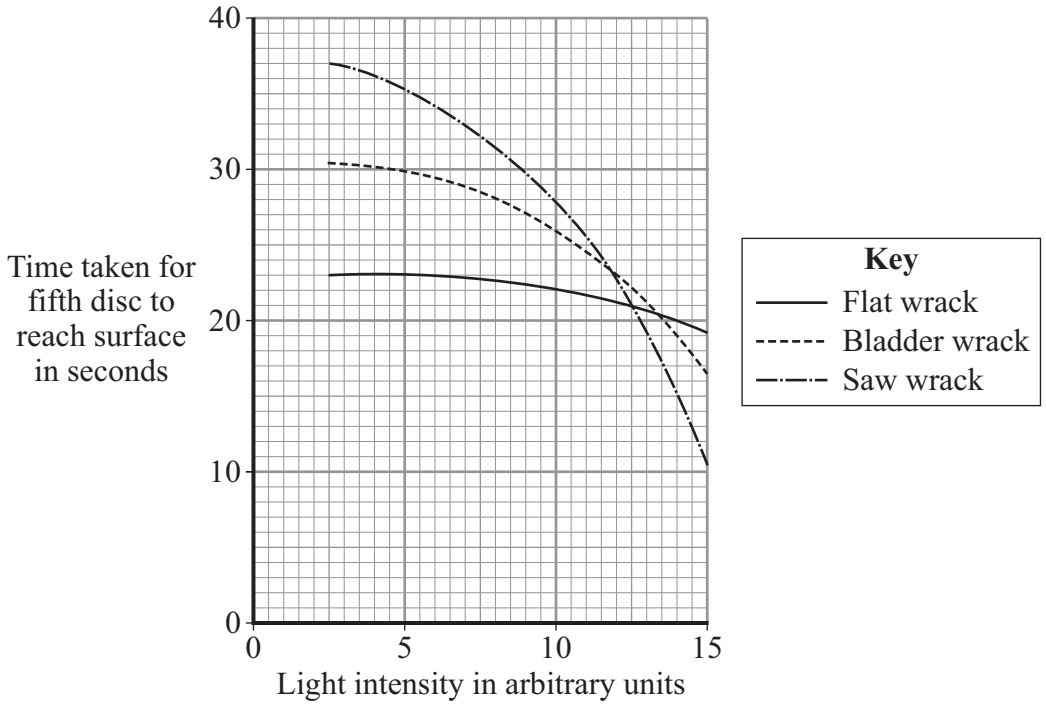
4 (a) (ii) Suggest the advantage of recording the time taken for the fifth disc to reach the surface, rather than for the tenth disc.

.....

.....

(1 mark)

4 (b) The students carried out their experiments at different light intensities.
The graph shows the results they collected.



4 (b) (i) Compare the rate of photosynthesis for flat wrack with the rate for saw wrack at different light intensities.

.....

.....

.....

.....

(2 marks)

4 (b) (ii) Seawater absorbs light.

The growth rate of saw wrack is less than the growth rate of bladder wrack.

Suggest why.

.....

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.....

.....

(2 marks)

6

5 (a) Mr and Mrs Smith both have a history of cystic fibrosis in their families.
Neither of them has cystic fibrosis.
Mr and Mrs Smith are concerned that they may have a child with cystic fibrosis.

Use a genetic diagram to show how they could have a child with cystic fibrosis.

Use the symbol **A** for the dominant allele and the symbol **a** for the recessive allele.

(3 marks)

5 (b) Mr and Mrs Smith decided to visit a genetic counsellor who discusses embryo screening.

Read the information which they received from the counsellor.

- Under an anaesthetic five eggs will be removed from Mrs Smith's ovary.
- The eggs will be fertilised in a dish using Mr Smith's sperm cells.
- The embryos will be grown in the dish until each embryo has about thirty cells.
- One cell will be removed from each embryo and tested for cystic fibrosis.
- A suitable embryo will be placed into Mrs. Smith's uterus and she may become pregnant.
- Any unsuitable embryos will be killed.

5 (b) (i) Suggest why it is helpful to take five eggs from the ovary, rather than just one.

.....

.....

(1 mark)

5 (b) (ii) Evaluate the use of embryo screening in this case.

Remember to give a conclusion as part of your evaluation.

.....

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(4 marks)

8

6 Starch is broken down into sugar by amylase. Amylase is produced in the salivary glands.

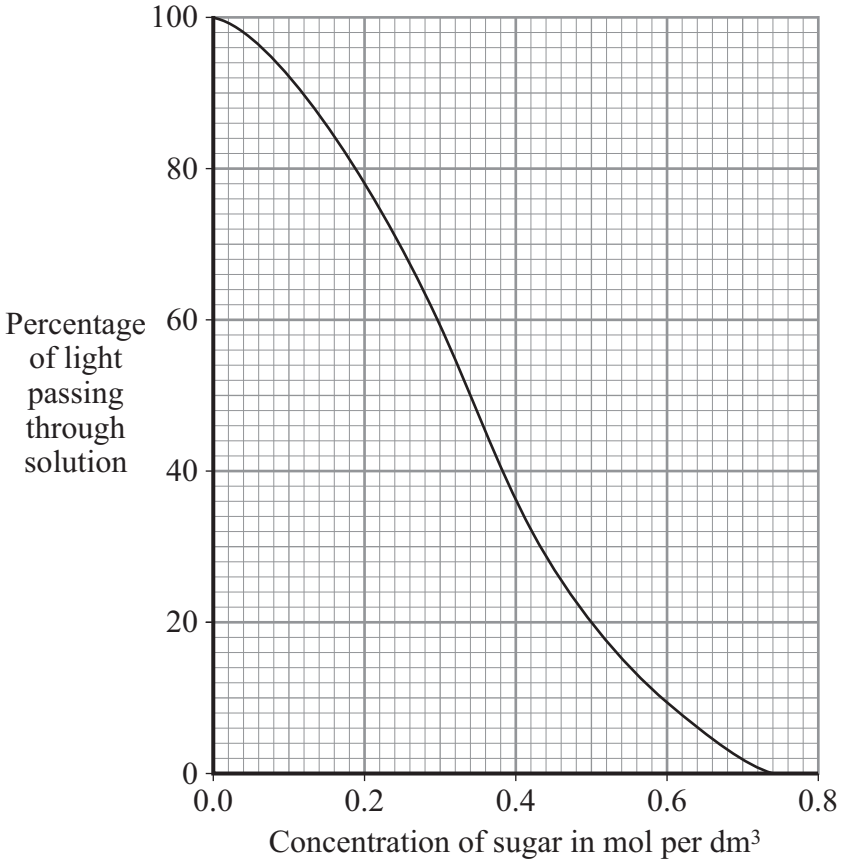
6 (a) Name **two** other organs in the digestive system which produce amylase.

.....and .....

(2 marks)

6 (b) A colorimeter measures colour intensity by measuring the percentage of light that passes through a solution.
Graph 1 shows the percentage of light passing through sugar solutions of different concentrations to which a test reagent has been added.

Graph 1



Students used a colorimeter to compare the starch-digesting ability of amylase enzymes obtained from two organs, **P** and **Q**.

- The students collected 5 cm^3 samples of amylase from **P** and **Q** and placed them into a water-bath at 40 ºC.
- Two test tubes containing 10 cm^3 samples of starch solution were also placed into the water-bath.
- All the tubes were left in the water-bath for 10 minutes.
- Each amylase sample was added to one of the tubes containing the starch solution.
- The test tubes were placed back into the water-bath.
- Every minute, a few drops were taken from each tube, the test reagent was added and the percentage of light passing through this solution was measured in the colorimeter.

The tubes containing amylase samples and starch solution were left in the water-bath for ten minutes before the amylase was added to the starch.

Explain why.

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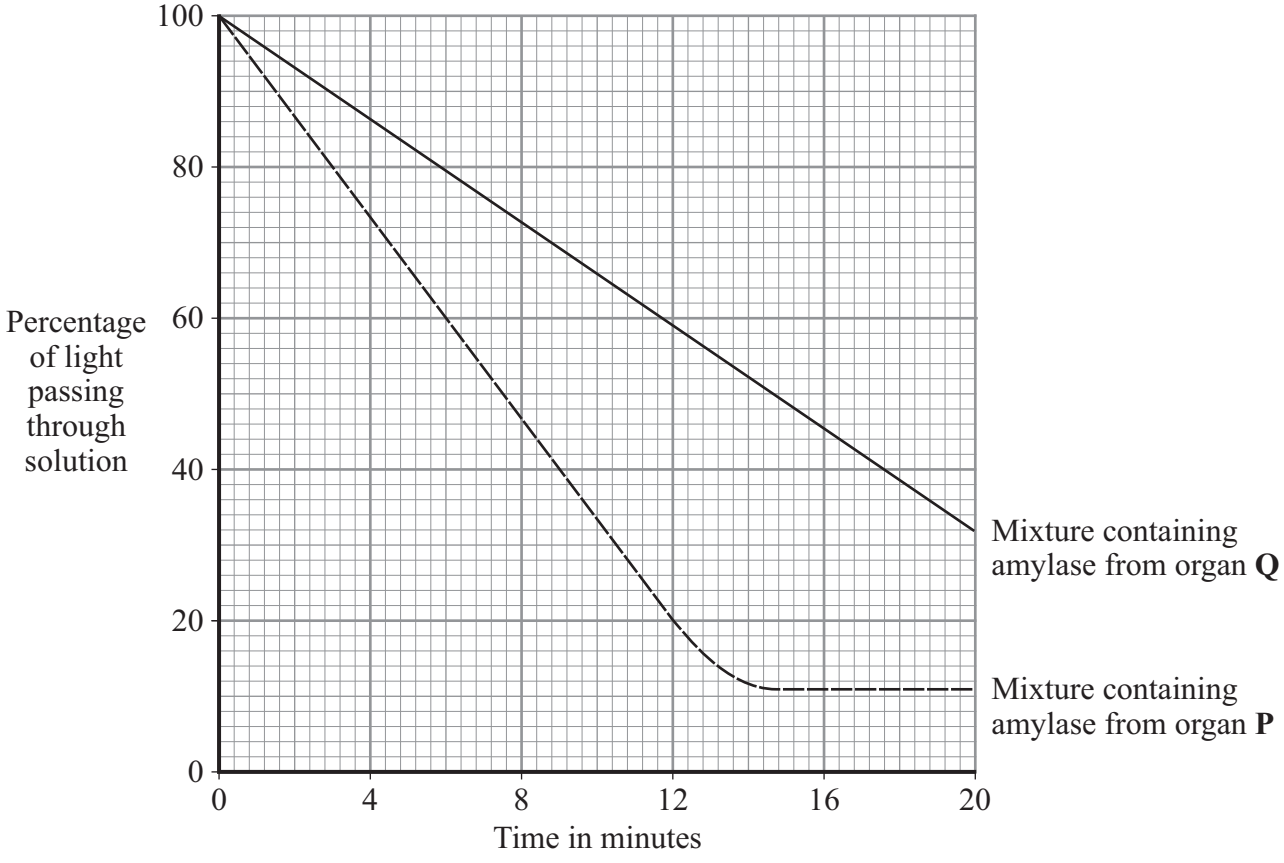
(2 marks)

6 (c) **Graph 2** shows how the readings from the colorimeter changed over the next 20 minutes.

Graph 2



6 (c) (i) Use **Graph 1** and **Graph 2** to determine the concentration of sugar in the mixture from organ **Q** after 20 minutes.

.....

Answer ..... mol per dm^3

(1 mark)

Question 6 continues on the next page

6 (c) (ii) Use your answer to 6(c)(i) to calculate the rate at which sugar was produced in the mixture containing amylase from organ **Q**.

Show clearly how you work out your answer.

.....

.....

.....

Answer.....mol per dm^3 per minute

(2 marks)

6 (c) (iii) Suggest why the amount of light passing through the mixture from organ **P** did not change after 16 minutes.

.....

.....

.....

(1 mark)

6 (c) (iv) One of the students suggested that they could have completed their experiment more quickly if the temperature of the water-bath had been set at 80 ºC.

This would **not** have been the case.

Explain why.

.....

.....

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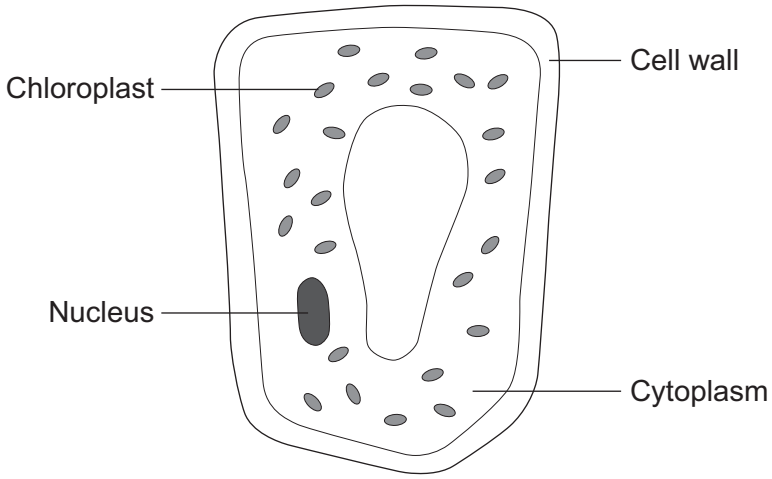
(2 marks)

10

END OF QUESTIONS

Answer **all** questions in the spaces provided.

1 The diagram shows a plant cell from a leaf.



1 (a) **List A** gives the names of three parts of the cell.
List B gives the functions of parts of the cell.

Draw a line from each part of the cell in **List A** to its function in **List B**.

List A **Parts of the cell**	**List B** **Functions**
	Where most of the chemical reactions take place
Nucleus	
	Absorbs light energy to make food
Cytoplasm	
	Strengthens the cell
Chloroplast	
	Controls the activities of the cell

(3 marks)

1 (b) Respiration takes place in the cell.

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

All cells use respiration to release

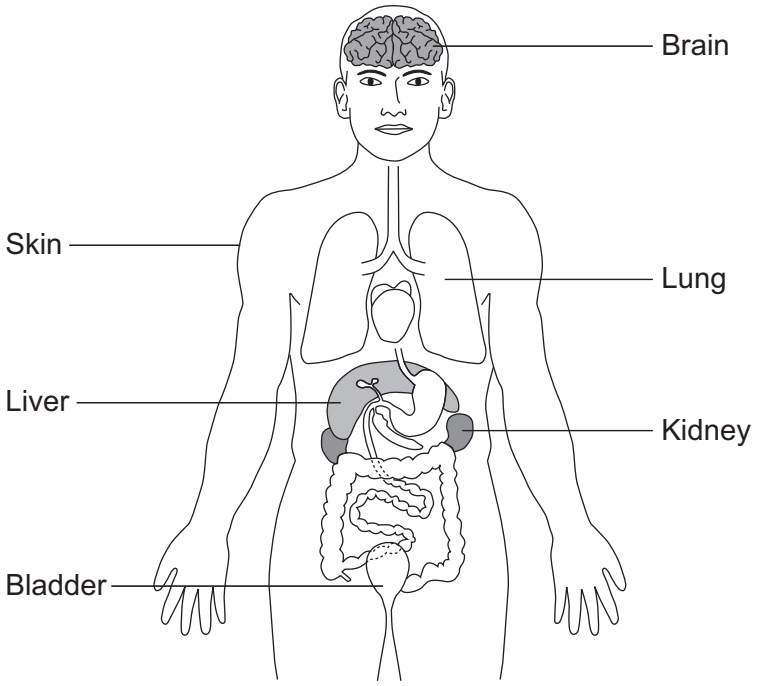
- energy.
- oxygen.
- sugar.

(1 mark)

4

Turn over for the next question

2 (a) The diagram shows organs which help to control conditions inside the body.



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

2 (a) (i) Carbon dioxide is removed from the body by the

kidney.
lung.
skin.

(1 mark)

2 (a) (ii) Urine is made in the

kidney.
lung.
skin.

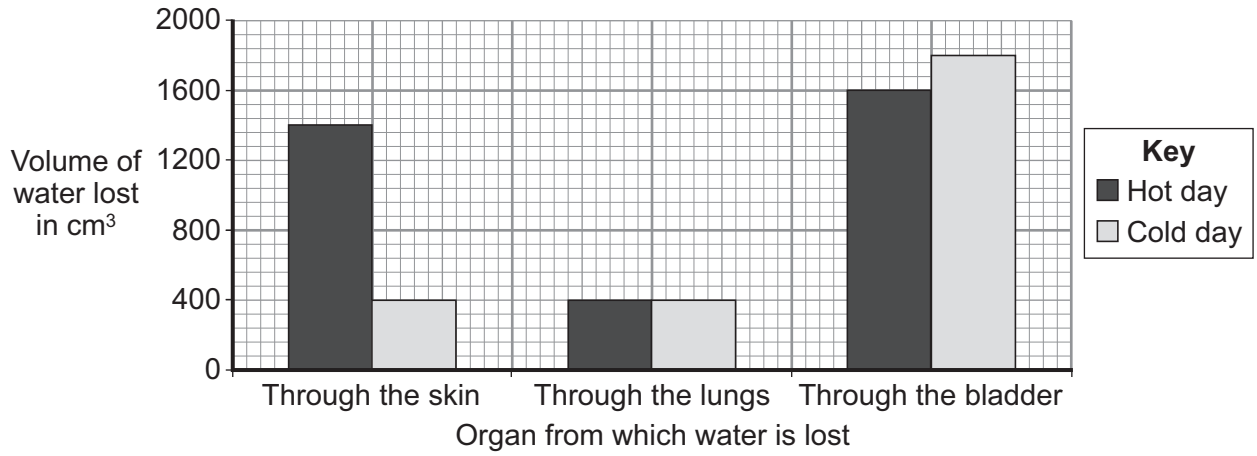
(1 mark)

2 (a) (iii) Urine is stored in the

bladder.
liver.
skin.

(1 mark)

2 (b) The bar chart shows the volume of water lost from different organs of the body. The information is shown for a hot day and for a cold day.



2 (b) (i) Look at the bar chart.

How does the volume of water lost on the hot day compare with the volume of water lost on the cold day for each organ?

Complete the table using words from the box.

the same	**less**	**more**

Organ	**Volume of water lost on a hot day compared with volume of water lost on a cold day**
Skin	
Lungs	
Bladder	

(3 marks)

2 (b) (ii) In total, more water is lost on the hot day than on the cold day.

How does the increase in the volume of water lost on the hot day help to control the body temperature?

.....

.....

(1 mark)

7

3 The amount of carbon dioxide in the atmosphere is increasing.

The table shows the estimated mass of carbon dioxide exchanged with the atmosphere in one year.

	Mass of carbon dioxide exchanged with the atmosphere in millions of tonnes	
	Passed out into the atmosphere	**Taken in from the atmosphere**
Plants	30	64
Animals	10	0
Microorganisms	24	0
Combustion	6	0

3 (a) (i) Calculate the total mass of carbon dioxide passed out into the atmosphere in one year.

Show clearly how you work out your answer.

.....

.....

Answer ..... million tonnes
(2 marks)

3 (a) (ii) Calculate the increase in the mass of carbon dioxide in the atmosphere in one year.

You should use your answer to part (a)(i) in your calculation.

Show clearly how you work out your answer.

.....

.....

Answer ..... million tonnes
(2 marks)

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

Plants use carbon dioxide in the process of

- decomposition.
- photosynthesis.
- respiration.

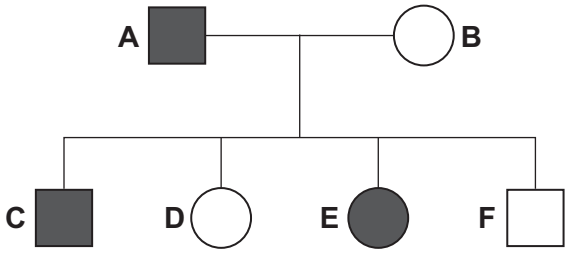
(1 mark)

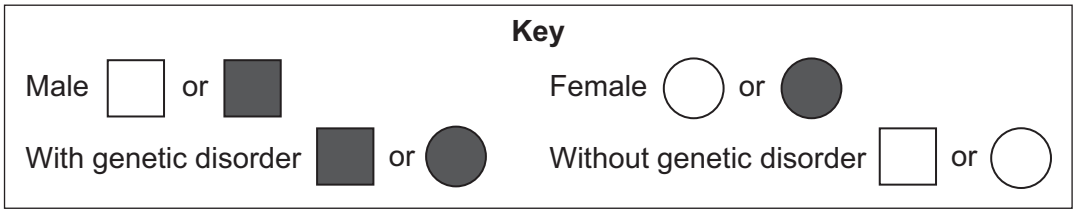
5

Turn over for the next question

4 The diagram shows the family tree of a pair of pigs, **A** and **B**.
Pigs **A** and **B** have four offspring, **C**, **D**, **E** and **F**.

Some of the pigs have a genetic disorder.





4 (a) Which pig, **A**, **B**, **C**, **D**, **E** or **F**, is:

4 (a) (i) a male pig with the genetic disorder ☐

(1 mark)

4 (a) (ii) a female pig without the genetic disorder? ☐

(1 mark)

4 (b) Draw a ring around the correct answer to complete the sentences.

Pig **C** has the genetic disorder.

4 (b) (i) Pig **C** inherited the genetic disorder from

pig **A**.
pig **B**.
pig **E**.

(1 mark)

4 (b) (ii) The gene for the genetic disorder was passed on in

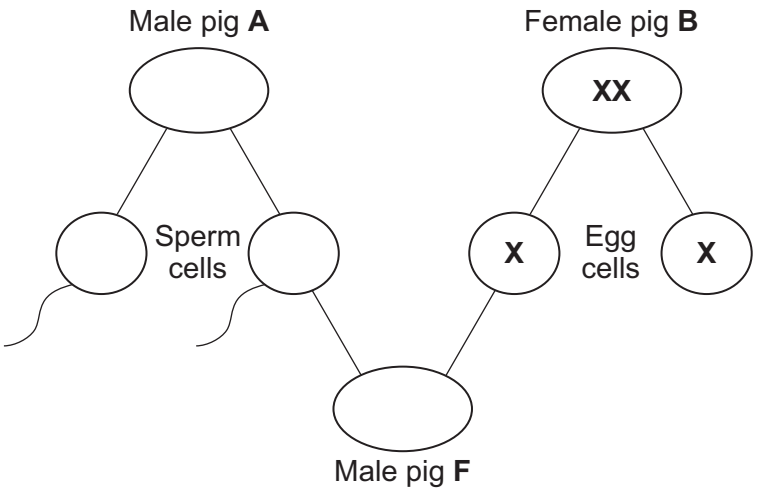
an embryo.
an enzyme.
a gamete.

(1 mark)

4 (c) Pig **F** is a male.

Complete the diagram to show how the sex of pig **F** depends on the inheritance of the sex chromosomes **X** and **Y**.

The sex chromosomes of pig **B** and the egg cells have been completed for you.



(3 marks)

7

Turn over for the next question

5 Denim jeans can be coloured with blue dye. The dye joins on to the fibres of the material. Some people like their denim jeans to look faded. This is called 'stonewashed'. There are two different ways to make denim material look faded.

Traditional stone washing

- Denim material is put in a slowly spinning container with large stones.
- Very hot water is added.
- Washing takes up to five hours.
- Washing breaks some of the denim fibres and lets the dye come out from the fibres.
- Washing will work with any dye.

Bio-stonewashing

- Denim material is washed with enzymes in warm water.
- Washing takes half an hour.
- The enzymes let the dye come out from the fibres.
- Different enzymes are needed for different dyes.
- The enzymes are expensive.
- After the treatment the enzymes have to be removed from the denim.

5 (a) Use **only** the information above to answer this question.

5 (a) (i) Suggest **two advantages** of using the bio-stonewashing method instead of the traditional stonewashing method.

1 .....

.....

2 .....

.....

(2 marks)

5 (a) (ii) Suggest **two disadvantages** of using the bio-stonewashing method instead of the traditional stonewashing method.

1 .....

.....

2 .....

.....

(2 marks)

5 (b) Some blue dyes are made of protein.

What type of enzyme would be used to remove these blue dyes from denim?

Draw a ring around **one** answer.

carbohydrase **lipase** **protease**

(1 mark)

5

Turn over for the next question

6 Substances can move into and out of cells.

6 (a) (i) How does oxygen move into and out of cells?

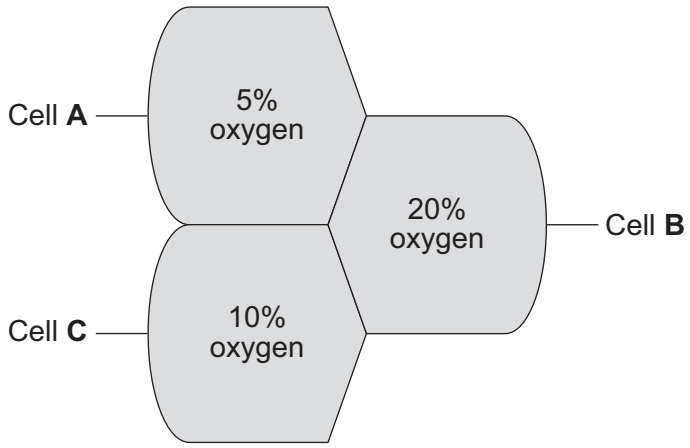
Draw a ring around **one** answer.

diffusion **digestion** **photosynthesis**

(1 mark)

6 (a) (ii) **Diagram 1** shows the percentage concentration of oxygen in three cells, **A**, **B** and **C**.

Diagram 1



Oxygen can move from cell to cell.

Into which cell, **A**, **B** or **C**, will oxygen move the fastest? ☐

(1 mark)

6 (b) (i) How does water move into and out of cells?

Draw a ring around **one** answer.

breathing **osmosis** **respiration**

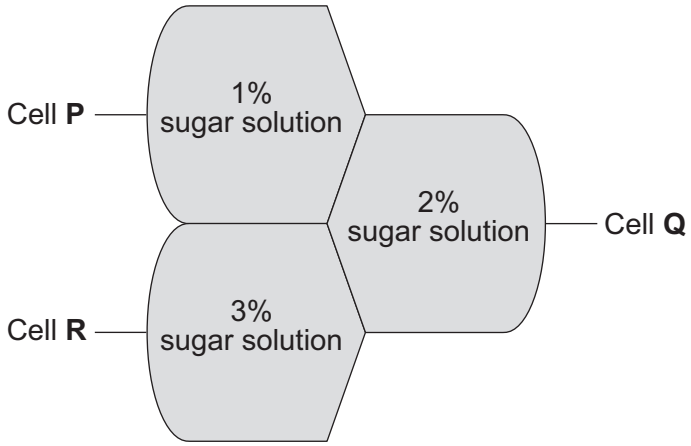
(1 mark)

6 (b) (ii) Differences in the concentration of sugars in cells cause water to move into or out of cells at different rates.

Diagram 2 shows three different cells, **P**, **Q** and **R**.

The information shows the percentage concentration of sugar solution in cells **P**, **Q** and **R**.

Diagram 2



Water can move from cell to cell.

Into which cell, **P**, **Q** or **R**, will water move the fastest? ☐

(1 mark)

4

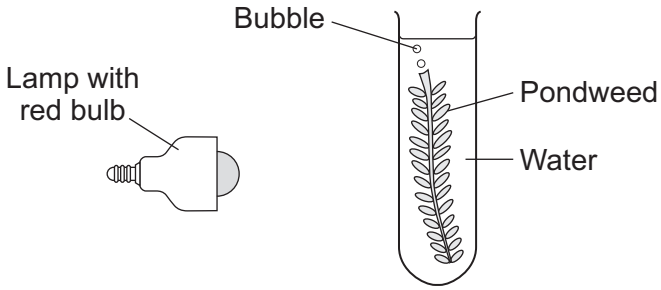
Turn over for the next question

7 A group of pupils investigated the way in which the colour of light affects photosynthesis.

The pupils:

- put a piece of pondweed into a test tube of water
- shone light from a lamp with a red light bulb onto the pondweed
- counted the bubbles of gas produced by the pondweed every minute for three minutes.

The diagram shows the experiment.



The pupils repeated their experiment using a yellow light bulb, a green light bulb and a blue light bulb.

7 (a) (i) What was the independent variable in the investigation?

.....

(1 mark)

7 (a) (ii) To make the investigation fair the pupils needed to control some variables.

Suggest **one** variable that the pupils should have controlled during their investigation.

.....

(1 mark)

7 (a) (iii) It is better to count the bubbles every minute for three minutes than to count all the bubbles in three minutes.

Why?

.....

.....

(1 mark)

7 (b) The table shows the pupils' results.

Colour of bulb	Number of bubbles produced in one minute			
	1st minute	2nd minute	3rd minute	Mean
Red	24	19	21	21
Yellow	18	14	15	16
Green	6	4	3	4
Blue	32	34	32	33

Algae are tiny organisms that photosynthesise.
In natural light algae grow very quickly on the sides of a fish tank.
The algae make it difficult to see the fish.

7 (b) (i) What would be the best colour of light bulb to illuminate the fish tank to reduce the growth of algae?

Use the results in the table to help you to decide.

Draw a ring around **one** answer.

red **yellow** **green** **blue**

(1 mark)

7 (b) (ii) Explain why the colour you have chosen is the best.

.....

.....

.....

.....

(2 marks)

6

Turn over for the next question

8 A group of students investigated a food chain in a garden.

The table shows the estimates of the population and biomass of some of the organisms the students found.

Organism	Number in the garden	Mean mass of each one in g	Biomass of population in g
Hedgehog	1	200	200
Slug	600	2	1200
Lettuce	20	300	

8 (a) (i) Calculate the biomass of the lettuce population.

Show clearly how you work out your answer.

.....

.....

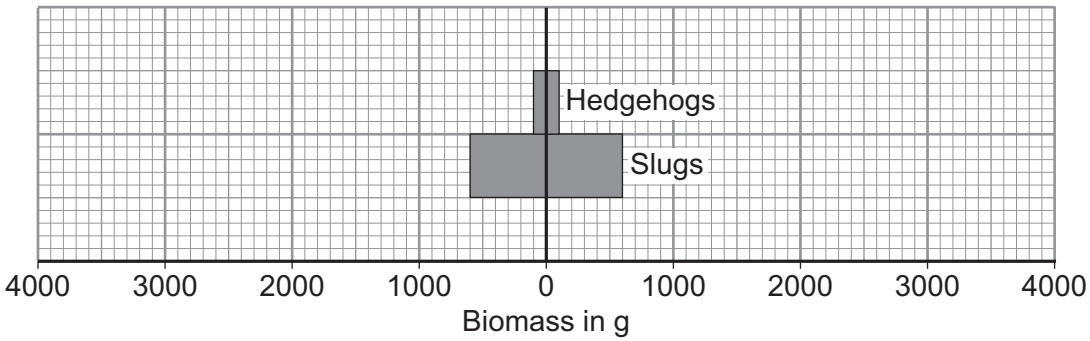
.....

Biomass = ... g

(2 marks)

8 (a) (ii) Use your answer to part (a)(i) to complete the pyramid of biomass.

Show the biomass of the lettuces in the garden.



(2 marks)

8 (b) Hedgehogs eat slugs.

The biomass of the hedgehog population is much less than the biomass of the slug population.

Explain why as fully as you can.

.....

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.....

(3 marks)

7

END OF QUESTIONS

Answer **all** questions in the spaces provided.

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The pupils:

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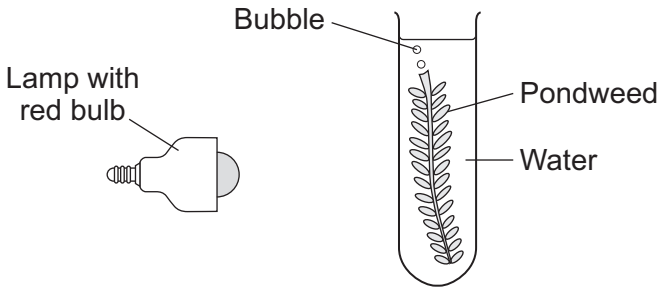
The diagram shows the experiment.



The pupils repeated their experiment using a yellow light bulb, a green light bulb and a blue light bulb.

1 (a) (i) What was the independent variable in the investigation?

.....

(1 mark)

1 (a) (ii) To make the investigation fair the pupils needed to control some variables.

Suggest **one** variable that the pupils should have controlled during their investigation.

.....

(1 mark)

1 (a) (iii) It is better to count the bubbles every minute for three minutes than to count all the bubbles in three minutes.

Why?

.....

.....

(1 mark)

1 (b) The table shows the pupils' results.

Colour of bulb	Number of bubbles produced in one minute			
	1st minute	2nd minute	3rd minute	Mean
Red	24	19	21	21
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Algae are tiny organisms that photosynthesise.
In natural light algae grow very quickly on the sides of a fish tank.
The algae make it difficult to see the fish.

1 (b) (i) What would be the best colour of light bulb to illuminate the fish tank to reduce the growth of algae?

Use the results in the table to help you to decide.

Draw a ring around **one** answer.

red **yellow** **green** **blue**

(1 mark)

1 (b) (ii) Explain why the colour you have chosen is the best.

.....

.....

.....

.....

(2 marks)

6

Turn over for the next question

2 A group of students investigated a food chain in a garden.

The table shows the estimates of the population and biomass of some of the organisms the students found.

Organism	Number in the garden	Mean mass of each one in g	Biomass of population in g
Hedgehog	1	200	200
Slug	600	2	1200
Lettuce	20	300	

2 (a) (i) Calculate the biomass of the lettuce population.

Show clearly how you work out your answer.

.....

.....

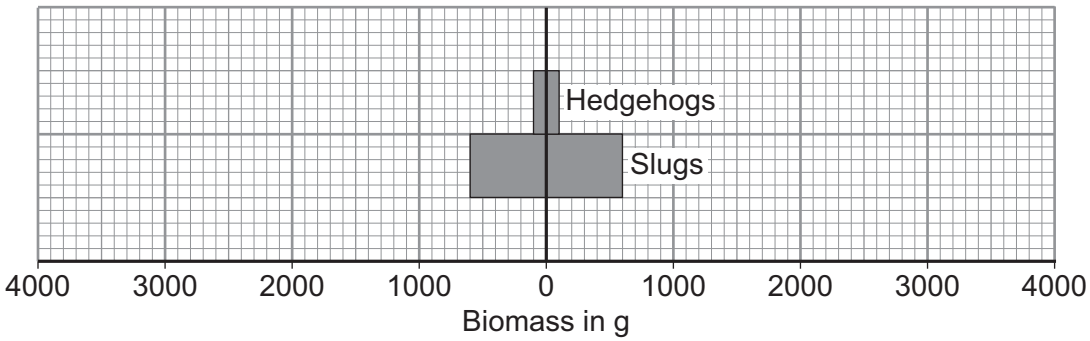
.....

Biomass = ... g

(2 marks)

2 (a) (ii) Use your answer to part (a)(i) to complete the pyramid of biomass.

Show the biomass of the lettuces in the garden.



(2 marks)

2 (b) Hedgehogs eat slugs.

The biomass of the hedgehog population is much less than the biomass of the slug population.

Explain why as fully as you can.

.....

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(3 marks)

7

Turn over for the next question

3 In diabetics blood glucose concentrations are sometimes abnormal.

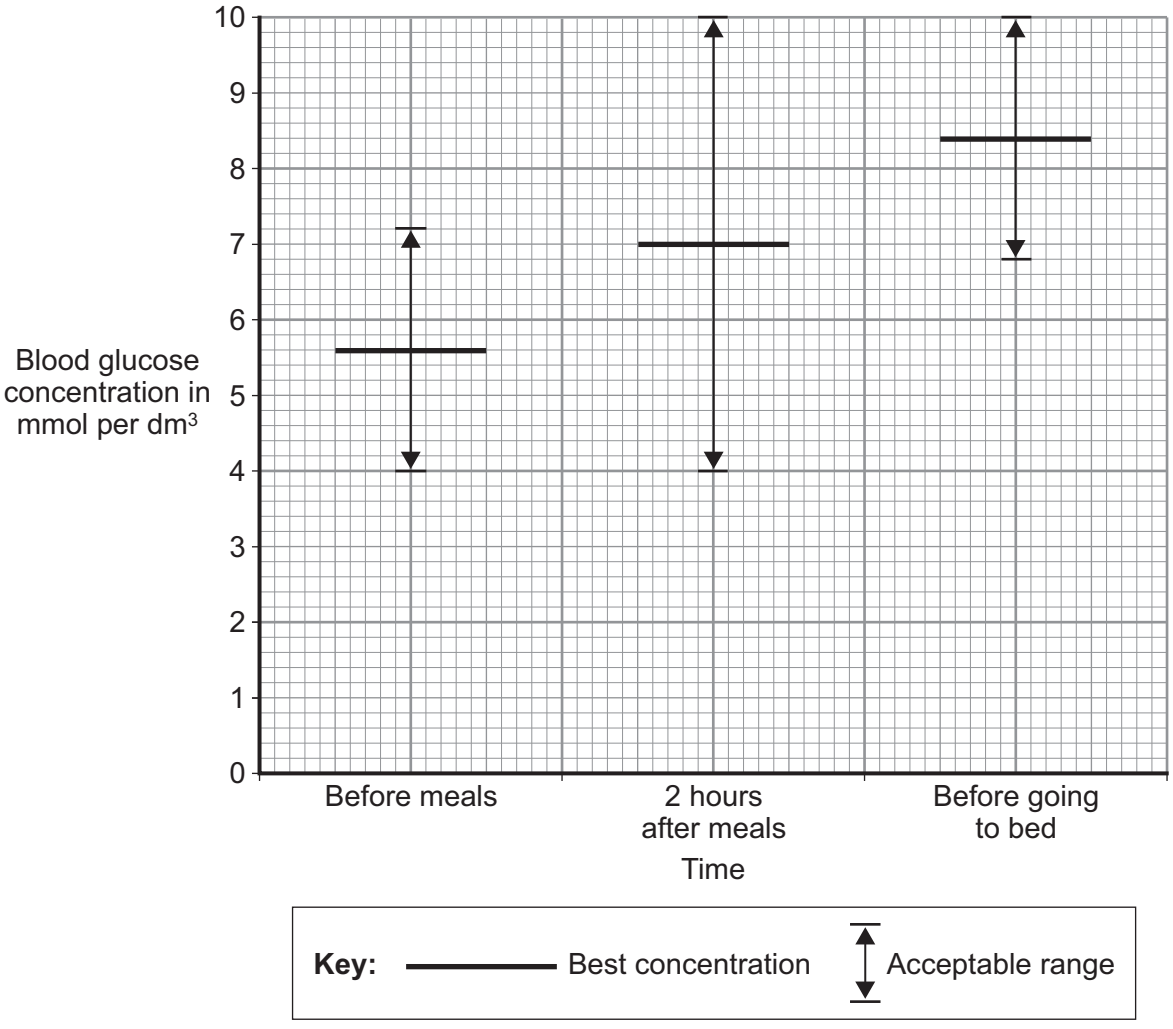
3 (a) Name the organ that monitors the concentration of glucose in the blood.

.....

(1 mark)

3 (b) Diabetics can measure their blood glucose concentration.

The graph shows the best blood glucose concentration and the acceptable range of blood glucose concentration at different times.



What is the acceptable range for the blood glucose concentration before meals?

From ..... to ..... mmol per dm^3

(1 mark)

3 (c) The amount of insulin a diabetic injects can be changed so that blood glucose concentration is kept near to the best level.

Two hours after eating breakfast a diabetic measures his blood glucose concentration. His blood glucose concentration is 13 mmol per dm^3.

He reads these instructions:

- for every 2 mmol per dm^3 of blood glucose *above* the best concentration, inject 1 unit *more* of insulin
- for every 2 mmol per dm^3 of blood glucose *below* the best concentration, inject 1 unit *less* of insulin.

How should he change his normal insulin injection to bring his blood glucose level to the best concentration?

Show clearly how you work out your answer.

.....

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.....

.....

Answer = ...

(3 marks)

5

Turn over for the next question

4 A certain allele increases the chance of women developing one type of breast cancer.

A woman has this allele. She wants to be sure that she will not have daughters who also have the allele.

Doctors:

- collect several eggs from her ovaries
- fertilise the eggs with sperm, in dishes.

4 (a) The doctors expect half the embryos produced to be female.

Explain why.

.....

.....

.....

.....

(2 marks)

4 (b) The embryos grow to around 100 cells.

Doctors:

- remove one cell from each embryo
- check the cell for the allele.

Complete the sentence.

This process is known as embryo ..... .

(1 mark)

4 (c) One of the female embryos did not have the allele.
This female embryo was implanted into the woman's uterus.

Evaluate the advantages and disadvantages of the whole procedure.

Use information from all parts of this question and your own knowledge.

Remember to give a conclusion to your evaluation.

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(4 marks)

7

Turn over for the next question

5 There are enzymes in biological washing powders. Biological washing powder has to be used at temperatures below 45 °C.

5 (a) The enzymes in biological washing powders do **not** work on the stains on clothes at temperatures above 45 °C.

Explain why.

.....

.....

.....

.....

(2 marks)

5 (b) Some bacteria, called thermophilic bacteria live in hot springs at temperatures of 80 °C.

Scientists have extracted enzymes from these thermophilic bacteria. These enzymes are being trialled in industrial laundries.
The laundries expect to increase the amount of clothes they can clean by using enzymes from thermophilic bacteria instead of using the biological washing powders the laundries use now.

5 (b) (i) The laundries expect to be able to increase the amount of clothes that they can clean each day.

Suggest why.

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(2 marks)

5 (b) (ii) Using washing powders with enzymes from thermophilic bacteria may be more harmful to the environment than using the biological washing powders that laundries use now.

Suggest why.

.....

.....

.....

.....

.....

(2 marks)

6

Turn over for the next question

6 Cystic fibrosis and Huntington's disease are inherited disorders.

6 (a) Someone can be a carrier of cystic fibrosis.

Explain how.

You may include a genetic diagram in your answer.

.....

.....

.....

.....

(2 marks)

6 (b) Why does only one parent need to have the Huntington's disease allele for a child to inherit Huntington's disease?

.....

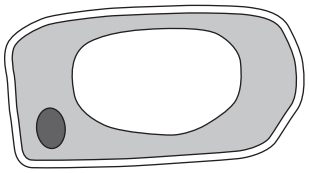
.....

(1 mark)

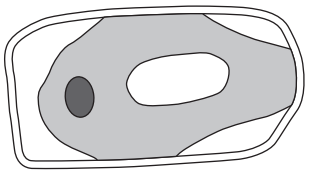
3

7 The diagram shows the same plant cell:

- after 1 hour in distilled water
- after 1 hour in strong sugar solution.



After 1 hour in distilled water



After 1 hour in strong sugar solution

7 (a) Describe **two** ways in which the cell in the strong sugar solution is different from the cell in distilled water.

1 .....

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2 .....

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(2 marks)

7 (b) Explain how the differences between the cell in the strong sugar solution and the cell in distilled water were caused.

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(2 marks)

4

8 The temperature in a sauna is much hotter than core body temperature.

A woman sits in a sauna.
The high temperature of the sauna causes the woman's core body temperature to rise.

8 (a) When the woman's core body temperature rises, the woman's rate of sweating increases.

Explain why.

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(2 marks)

8 (b) The woman comes out of the sauna.
The woman's skin looks redder than when she went into the sauna.

Describe what happened to the blood circulation in her skin to cause this change in colour.

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(2 marks)

8 (c) After coming out of the sauna the woman gets into a bath of icy water.
This makes the woman shiver.

8 (c) (i) What process brings about shivering?

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(1 mark)

8 (c) (ii) Shivering increases body temperature.

Explain how.

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(2 marks)

7

END OF QUESTIONS