Langholm Academy

National 5 Biology

Unit 1: Cell Biology

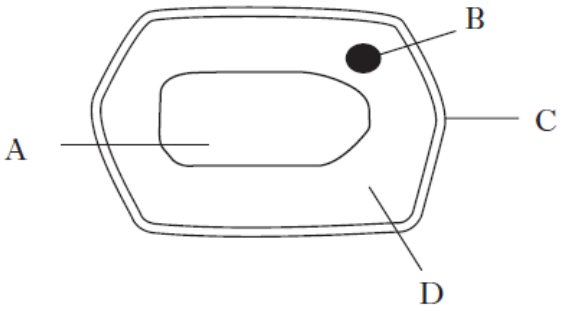
Homework Booklet

Name: _____ Class: _____

Homework title	*Due date*	*On time/Complete?*	*Mark*
Cell Structure			/25
Transport Across Cell Membranes			/37
DNA			/11
Proteins and Enzymes			/48
Genetic Engineering			/10
Respiration			/17

Cell Structure

Questions 1 and 2 refer to the plant cell diagram below.



1. Which of the plant cell components shown above is made from a structural carbohydrate?

2. Which labelled part controls cell activities?

3. Which structural feature is found in a plant cell and not in an animal cell?

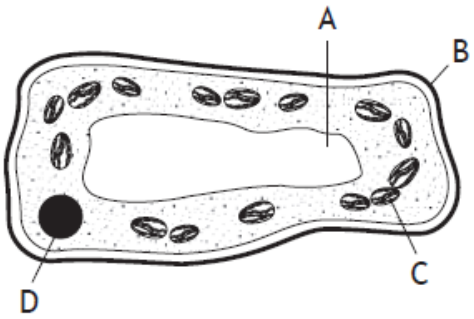
   A Nucleus

   B Cell wall

   C Cell membrane

   D Cytoplasm

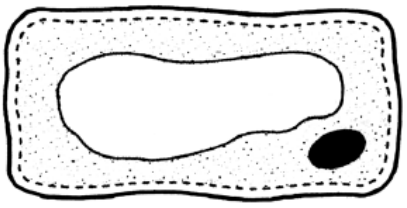
4. The diagram below shows parts of a plant cell.



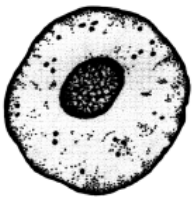
Which part of this cell is composed of cellulose?

5. (*a*) (i) The diagrams below represent two cells.

Onion root cell



Human cheek cell



Name **three** structures, or parts, shown to be present in **both** cells.

_____

_____

_____ **2**

(ii) Name a structure which would be found in a green leaf cell of a plant, but **not** in a root cell.

_____ **1**

(iii) What name is given to a substance added to make cell structures more visible when viewing them with a microscope?

_____ **1**

6. A group of students carried out an investigation into the variety of cell types.

The types of cell they examined are shown in the box below.

Animal	Plant	Bacterial	Fungal

(a) (i) Identify the type(s) of cell which have a cell wall. **1**

_____

(ii) Identify the type(s) of cell which have a plasmid. **1**

_____

(iii) Some organelles are found in all cells.

Choose one of the following organelles and tick (✓) the appropriate box.

Describe the function of the chosen organelle. **1**

Ribosome ☐ Mitochondria ☐

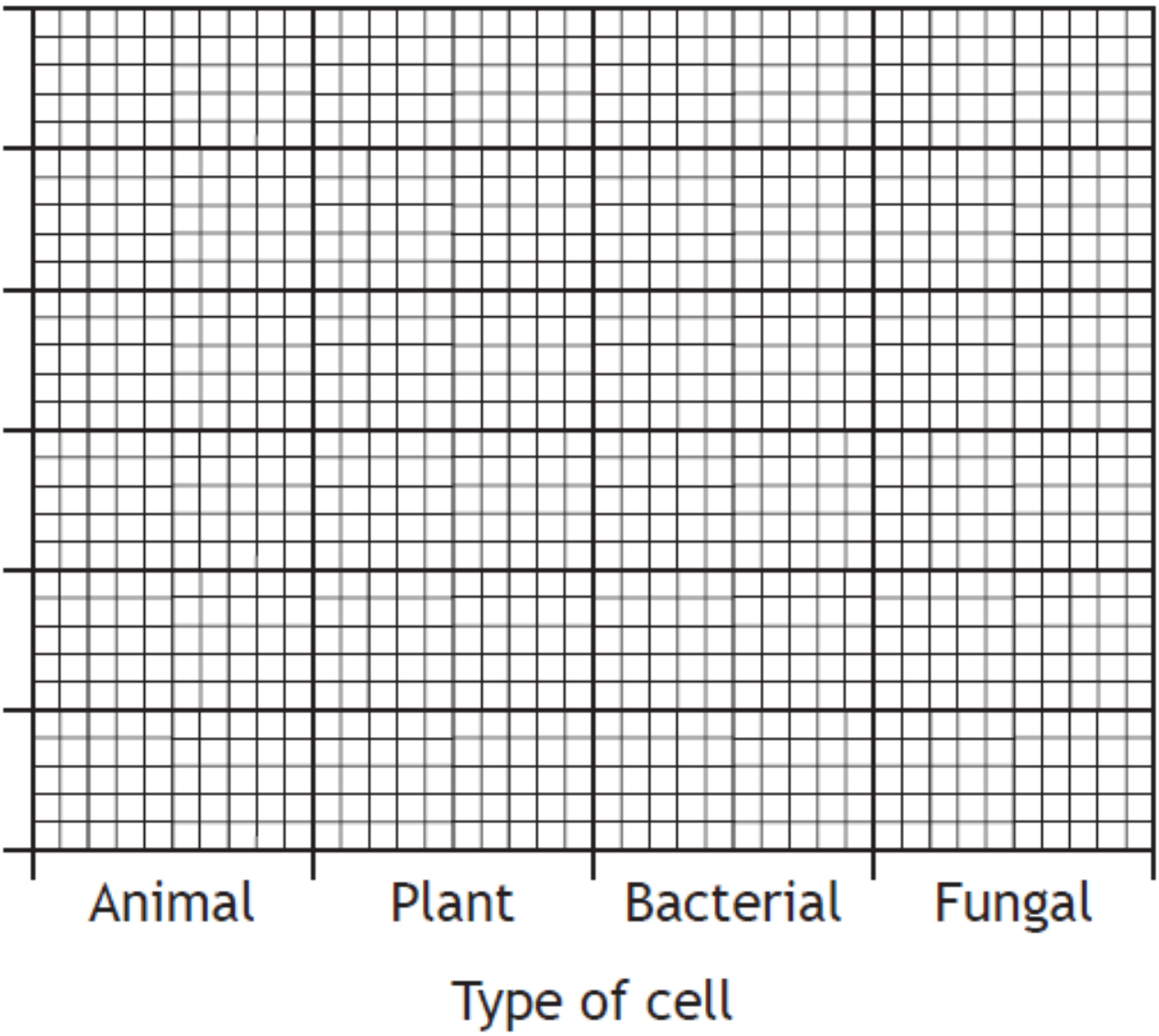
Function _____

_____

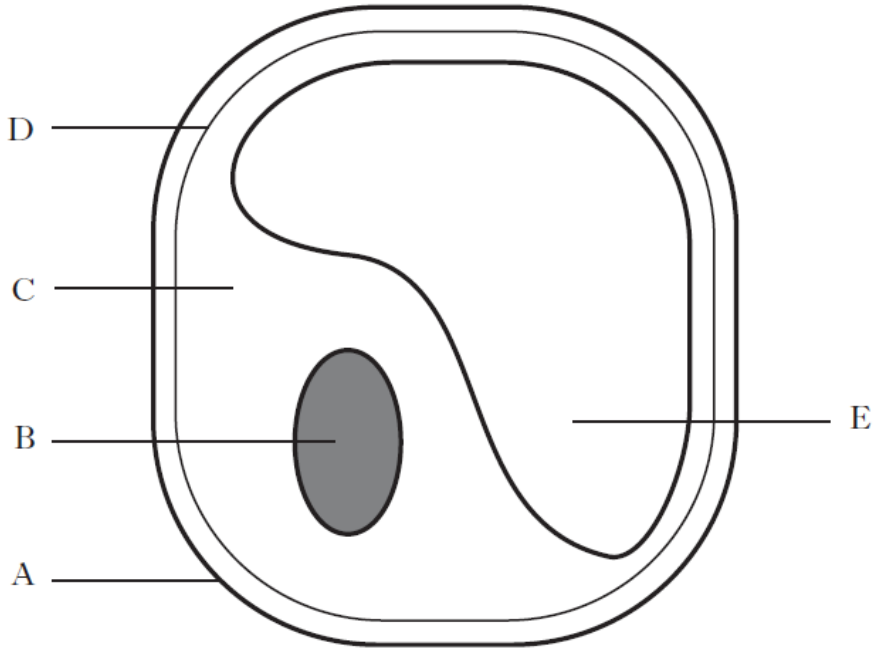
(b) The students then measured a number of cells and calculated the average cell sizes. The results are shown in the table below.

Type of cell	*Average size of cell* (μm)
Animal	24
Plant	48
Bacterial	3
Fungal	7

On the graph paper below, complete the vertical axis and draw a bar chart to show the average size of the cells shown in the table. **2**



7. The diagram below represents a plant cell.



(*a*) Complete the table below to identify the part, the cell structures and the function.

Part	*Cell structure*	*Function*
	cell membrane	controls entry and exit of materials
E		stores cell sap
B		

2

(*b*) Using evidence from the diagram, explain why this cell is more likely to be a root cell than a leaf mesophyll cell.

_____

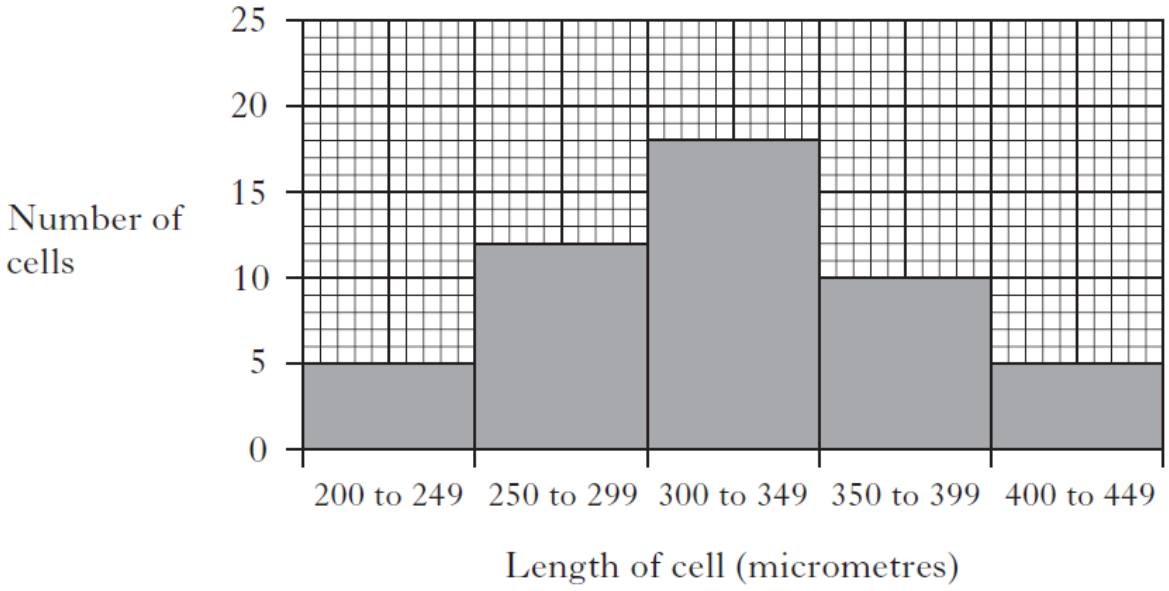
_____ **1**

(*c*) Name the structural carbohydrate that is found in cell walls.

_____ **1**

8. A piece of onion skin was examined using a microscope and the lengths of 50 cells were measured.

The bar chart below shows the number of cells of different lengths which were found.



(*a*) Which range of cell lengths contained the most cells?

From _____ to _____ micrometres **1**

(*b*) What percentage of cells had a length of 350 micrometres or more?

Space for calculation

_____ % **1**

9. Read the following passage and answer the questions based on it.

Robert Hooke (born 1635 – died 1703)

Robert Hooke was a scientific genius. His interests included physics, astronomy, chemistry and biology.

Hooke's special contribution to biology was the invention of the many-lensed compound microscope (Figure 1). With it, Hooke observed a huge variety of organisms in great detail. He used his artistic skills to draw what he saw in his book *Micrographia*, which was published in 1665.

Figure 1

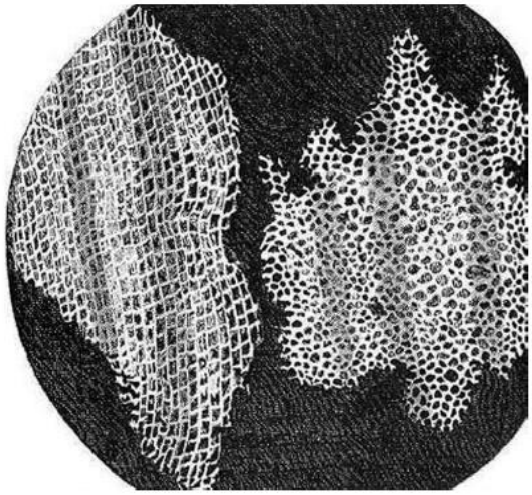


Figure 2

Probably Hooke's most famous microscopic observation was his study of thin slices of cork (Figure 2). He wrote "I could plainly see it to be all perforated and porous, much like a honeycomb, but that the pores were not regular. These microscopic pores or cells were indeed the first I ever saw, and perhaps, that were ever seen." Hooke had discovered plant cells. In fact it was Hooke who decided to call them "cells". He also reported seeing similar structures in other plants.

Hooke's microscope was a great improvement on Antony van Leeuwenhoek's single-lensed microscope. In 1678, van Leeuwenhoek wrote to the Royal Society to report his discovery of "little animals". He said "They were so small that I judged that even if 100 of these were laid end to end they would not reach the length of a millimetre." Hooke was asked by the Society to confirm van Leeuwenhoek's findings and did so successfully. As a result, Hooke became the founder of the study of cell biology and microbiology.

(*a*) What age was Robert Hooke when he published *Micrographia*?

Space for calculation

_____ years **1**

(*b*) What was the main difference between Robert Hooke's compound microscope and the microscope invented by Antony van Leeuwenhoek?

_____

_____ **1**

(*c*) Give **one** similarity and **one** difference which Hooke noted between a honeycomb and cork cells.

Similarity _____ **1**

Difference _____ **1**

(*d*) What part of plant cells make up the structure of cork as seen by Robert Hooke?

_____ **1**

(*e*) We now know that the "little animals" mentioned in the passage vary from 0·002 millimetres to 0·008 millimetres.

Explain how this information proves that Leeuwenhoek's estimate of their size was correct.

Space for calculation

Explanation _____

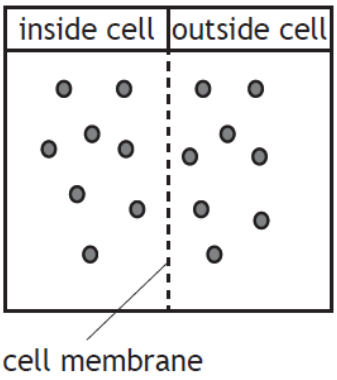
_____

_____ **1**

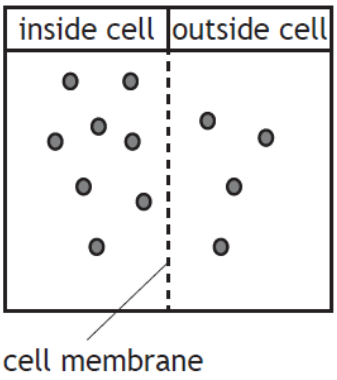
Transport Across Cell Membranes

1. In the diagrams below, the circles represent molecules on either side of a cell membrane. In which of these diagrams would the molecules move into a cell by diffusion?

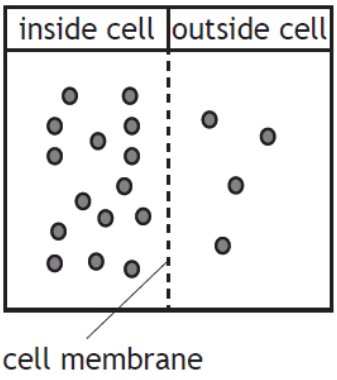
A



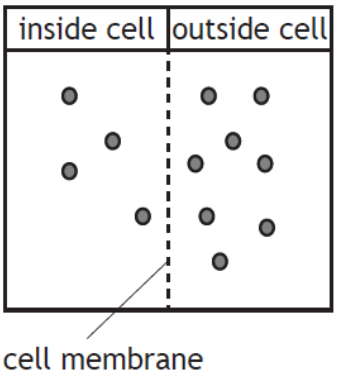
B



C



D

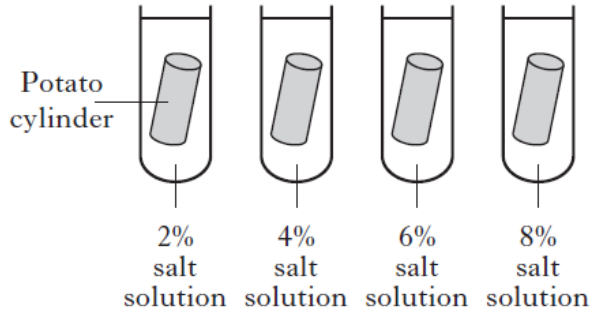


2. Which line in the table below identifies the direction of diffusion of the three substances during muscle contraction?

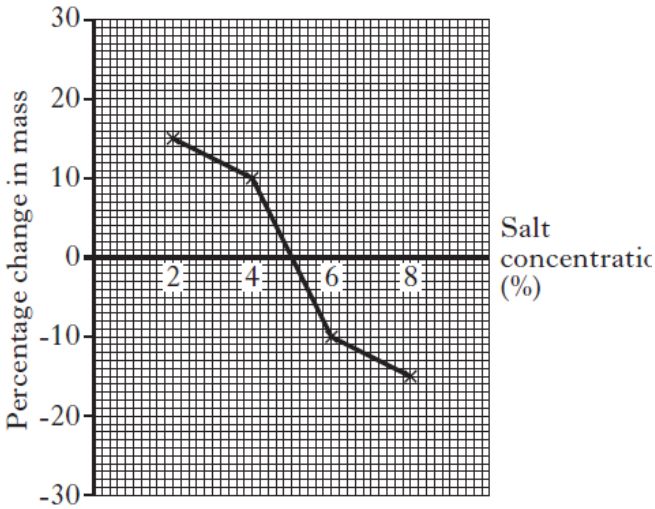
	Substance		
	Glucose	*Oxygen*	*Carbon dioxide*
A	out	out	in
B	in	out	in
C	out	in	out
D	in	in	out

Questions 3 and 4 refer to the investigation described below.

3. Four potato cylinders of equal mass were placed in four separate test tubes as shown below.



After two hours, the percentage change in mass of each cylinder was calculated and the results plotted on the graph below.



In which concentration of salt would the potato cylinders be most flaccid?

A 8%

B 5%

C 2%

D 0%

4. When the experiment was repeated with 10% salt the initial mass was 20 g and the final mass was 16·8 g.

What was the percentage decrease in mass?

A 3·2%

B 16%

C 20%

D 84%

5. Four cylinders of potato tissue were weighed and each was placed into a salt solution of a different concentration.

The cylinders were reweighed after one hour and the results are shown below.

Salt Solution	*Initial mass of potato cylinder* (g)	*Final mass of potato cylinder* (g)
A	10·0	7·0
B	10·0	9·4
C	10·0	11·2
D	10·0	12·6

In which salt solution would most potato cells be plasmolysed?

6. An animal cell placed in a liquid swells up and bursts. What will happen to a plant cell placed in the same liquid?

A It will become turgid.

B It will become flaccid.

C It will become plasmolysed.

D It will not change.

7. Which line in the table below shows what happens to cells when placed in a hypertonic solution?

	Animal Cell	*Plant Cell*
A	swells and bursts	becomes turgid
B	becomes turgid	swells and bursts
C	shrinks	becomes plasmolysed
D	becomes plasmolysed	becomes plasmolysed

8. (a) State a feature of the cell membrane which allows the movement of only some substances into the cell. **1**

_____

(b) Osmosis is a process which can occur across the cell membrane.

(i) Choose either the leaf cell or red blood cell by ticking (✓) one of the boxes below.

Describe the effect of osmosis on this type of cell if it was placed in pure water. **1**

Leaf cell ☐ Red blood cell ☐

Effect on the cell _____

_____

(ii) 1 Name a process, other than osmosis, which allows molecules to pass through the cell membrane. **1**

_____

2 Give a definition of the process chosen. **1**

_____

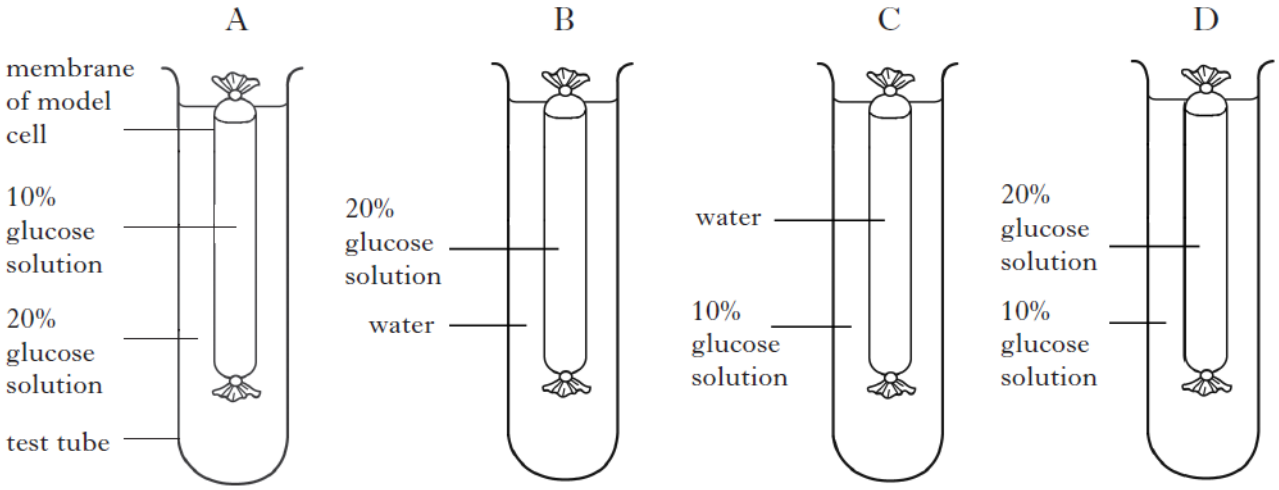
_____

_____

9. The following diagrams show an investigation into osmosis using four model cells.

The model cells were weighed before placing them in the test tubes.

After one hour the model cells were taken out of the test tubes and reweighed.



(*a*) What feature of the membrane of the model cell makes it suitable for this investigation?

_____ **1**

(*b*) State the letters of the model cells which would have increased in mass after one hour.

_____ **1**

(*c*) What should be done to the model cells before each weighing to obtain valid results?

_____ **1**

(*d*) Predict which model cell would have the greatest change in mass after one hour.

Give a reason for your choice.

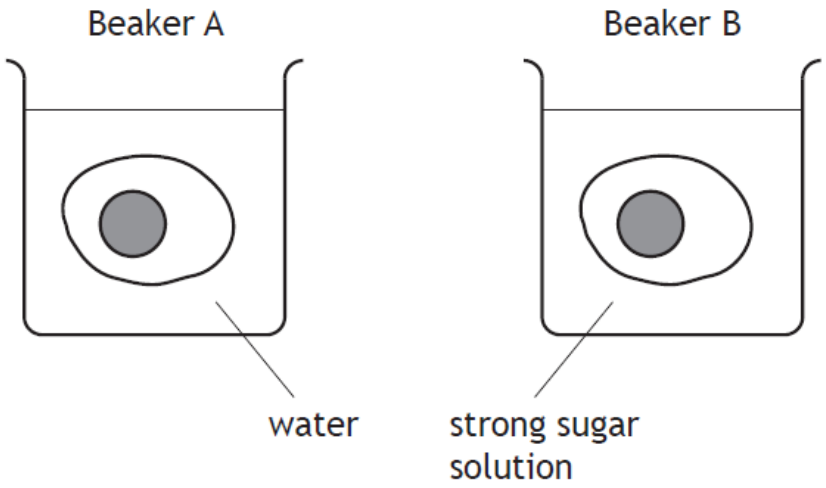
Model cell _____ **1**

Reason _____

_____ **1**

10. (a) Shells can be removed from eggs by dissolving them in vinegar for 2–3 days. The egg contents remain inside a thin membrane.

In an investigation the shells from two eggs were removed. The eggs were then weighed and placed in beakers as shown below.



After 2 hours the eggs were removed from the beakers, blotted dry and reweighed. The results are shown in the following table.

Beaker	*Mass at start* (g)	*Mass after 2 hours* (g)	*Percentage change in mass*
A	54·0	67·5	
B	52·1	47·8	−8·2

(i) Complete the table by calculating the percentage change in mass for beaker A. **1**

Space for calculation

(ii) Suggest why the eggs were blotted dry before being reweighed. **1**

_____

_____

(iii) Choose either beaker A or B and explain how osmosis caused the change in mass of the eggs in that beaker. **2**

Beaker _____

Explanation _____

_____

_____

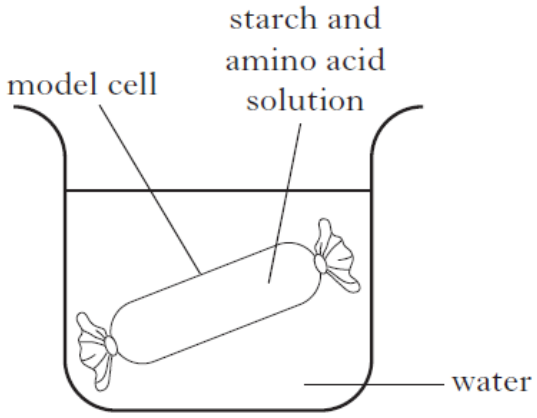
(b) The movement of molecules in or out of cells can be by passive or active transport.

Describe **one** difference between passive and active transport. **1**

_____

_____

11. (*a*) A model cell was made using a visking tubing bag filled with a starch and amino acid solution. It was placed into a beaker of water and left for two hours.



(i) Amino acids were detected in the water outside the model cell.

What process is responsible for this movement?

_____ **1**

(ii) Why would no starch be detected in the water outside the model cell?

_____

_____ **1**

(iii) What would happen to the mass of the model cell during the two hour period? Explain your answer.

Mass of model cell _____

Explanation _____

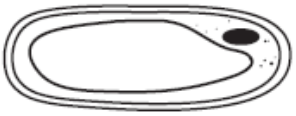
_____ **2**

12. (*a*) The diagram below shows the appearance of a cell from an onion.

Pieces of onion were placed in three different solutions:

a 10% salt solution; a 2% salt solution and pure water.

The following diagrams show the appearance of the cells after 10 minutes.

solution X	solution Y	solution Z
		
cells swell	cells are unchanged	cell contents shrink

(i) Use the letters from the diagrams to identify the solutions.

One has been identified already.

10% salt solution _____

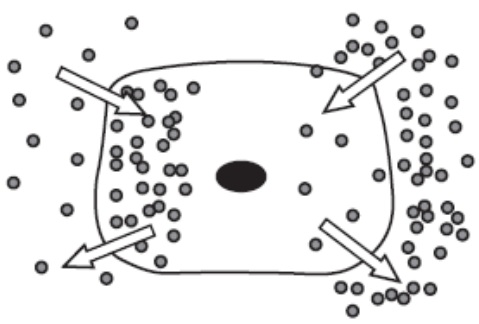
2% salt solution Y

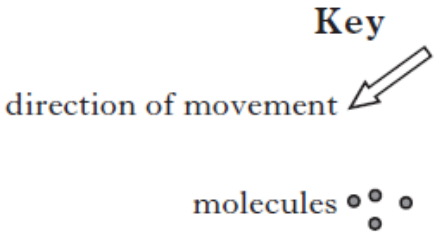
pure water _____ **1**

(ii) Name the process by which water diffuses through a selectively permeable membrane.

_____ **1**

(*b*) The diagram below represents differences in the concentration of molecules inside and outside an animal cell, together with the direction of movement of the molecules.

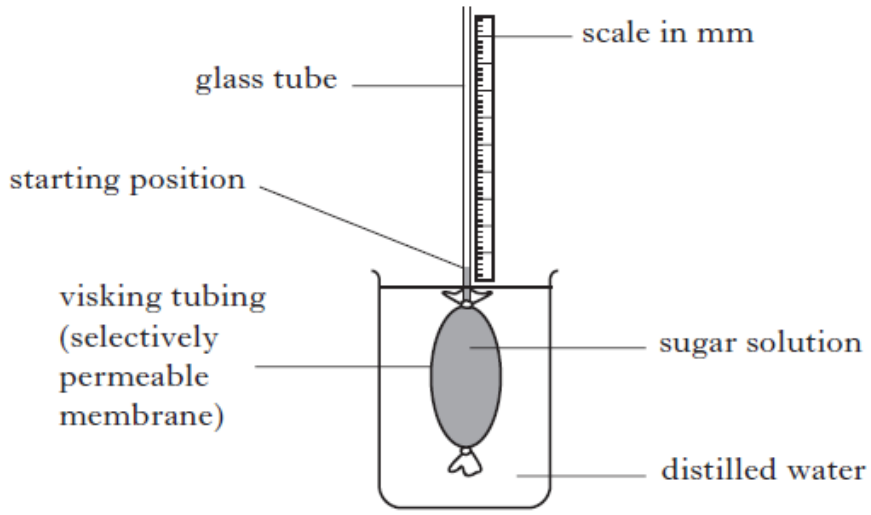




Circle the arrow on the diagram that would represent the diffusion of oxygen during respiration. **1**

13. An investigation was carried out into the movement of water through a selectively permeable membrane.

The apparatus used is shown in the diagram below.



The method used in the investigation is outlined below.

- A visking tubing bag containing 50 cm^3 of 0·5% sugar solution was attached to the glass tube.
- The bag was lowered into the beaker of water.
- The starting position of the sugar solution was recorded on the scale.
- After one hour, the distance moved by the solution was recorded.
- The procedure was repeated with the same apparatus, using different concentrations of sugar solution.

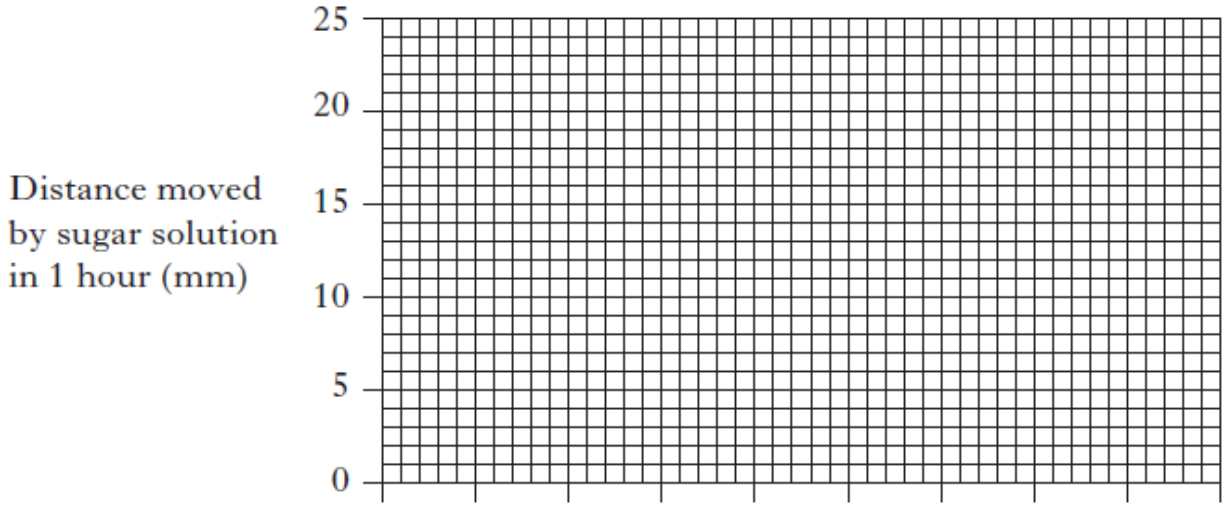
The results are shown in the following table.

Concentration of sugar solution (%)	*Distance moved by sugar solution in 1 hour* (mm)
0·5	3
1·0	6
2·0	12
3·0	18
3·5	21

(*a*) Identify **one** variable, not already mentioned, that should be kept constant when carrying out the investigation.

_____ **1**

(*b*) Use the results to plot a line graph on the grid below of distance moved by the sugar solution in one hour against the concentration of the sugar solution.



2

(*c*) From the results, predict the distance moved by a 4% sugar solution in one hour and justify your prediction.

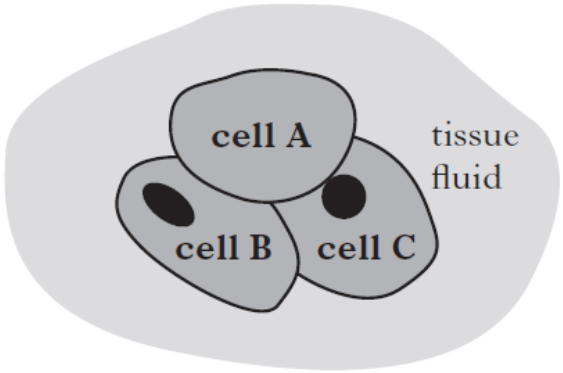
Prediction _____ mm

Justification _____

_____ **1**

14. Dissolved substances move from areas of high concentration to areas of lower concentration by the process of diffusion.

The following diagram represents three cells surrounded by tissue fluid.



The table below shows the relative concentrations of glucose, oxygen and carbon dioxide in the cells and tissue fluid.

	Relative concentrations of substance		
	glucose	*oxygen*	*carbon dioxide*
Cell A	medium	medium	medium
Cell B	high	high	low
Cell C	low	low	high
Tissue fluid	high	high	low

(i) Which substance would diffuse from cell A to the tissue fluid? **1**

_____

(ii) From which of the following would cell A gain oxygen by diffusion?

Tick (✓) the correct boxes.

Cell B ☐ Cell C ☐ tissue fluid ☐ **1**

(iii) Into which of the following would glucose diffuse from cell B?

Tick (✓) the correct boxes.

Cell A ☐ Cell C ☐ tissue fluid ☐ **1**

(*c*) Which cell structure controls the movement of substances into and out of cells?

_____ **1**

(*d*) What name is given to the special case of diffusion of water into or out of cells?

_____ **1**

Key Area 3 – DNA

1. Which of the following shows the correct DNA base pairing?

A
A – C
C – G
G – C
T – A

B
A – T
C – G
G – T
T – A

C
A – G
C – G
G – A
T – A

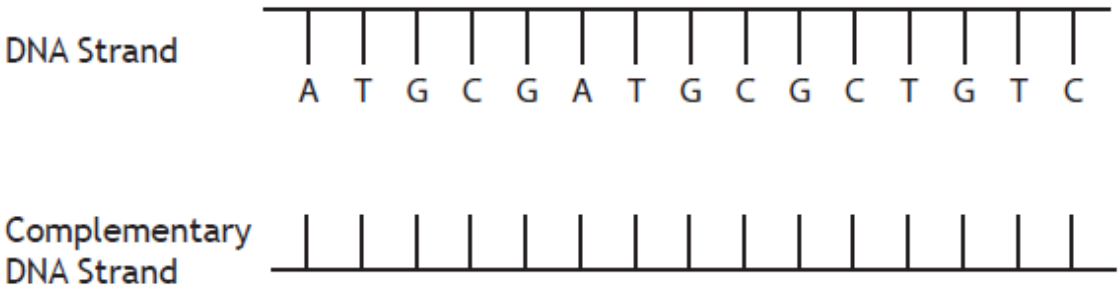
D
A – T
C – G
G – C
T – A

2. (*a*) Underline **one** option in each set of brackets to make the following sentences correct.

Chromosomes are made of DNA. The chain of {acids / bases} in DNA code for {amino acids / fatty acids} in {fats / proteins}. 2

3.

(a) DNA is a double stranded molecule. The following diagram shows part of one strand. Complete the diagram to show the complementary strand.



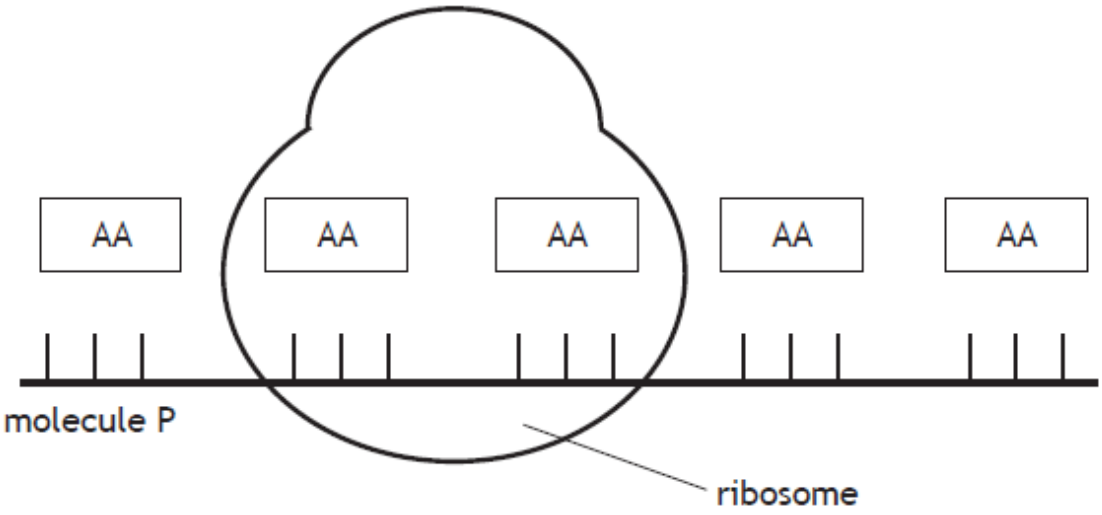
1

(b) (i) DNA contains genetic material which controls the synthesis of chemicals made from amino acids.

Name the type of chemicals synthesised. 1

_____

(ii) The diagram below shows an example of one of these chemicals being synthesised.



Name molecule P and describe how it determines the sequence of amino acids, represented by AA, as shown in the diagram. 2

Molecule P _____

Description _____

_____

(iii) Name the part of the cell where molecule P was made. 1

_____

4. (*a*) DNA contains the genetic information which is used to make proteins in a cell.

The diagram below represents part of a DNA double helix.

(i) Describe how the sequence of amino acids in a protein is coded for by DNA.

_____

_____ **1**

(ii) Describe **two** effects that a change in the sequence of amino acids would have on a protein.

_____

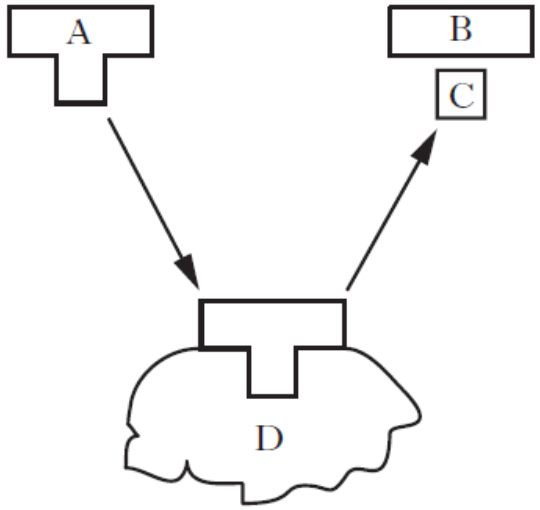
_____ **2**

Key Area 4 – Proteins

1. Which line in the table below correctly shows the functions of an enzyme?

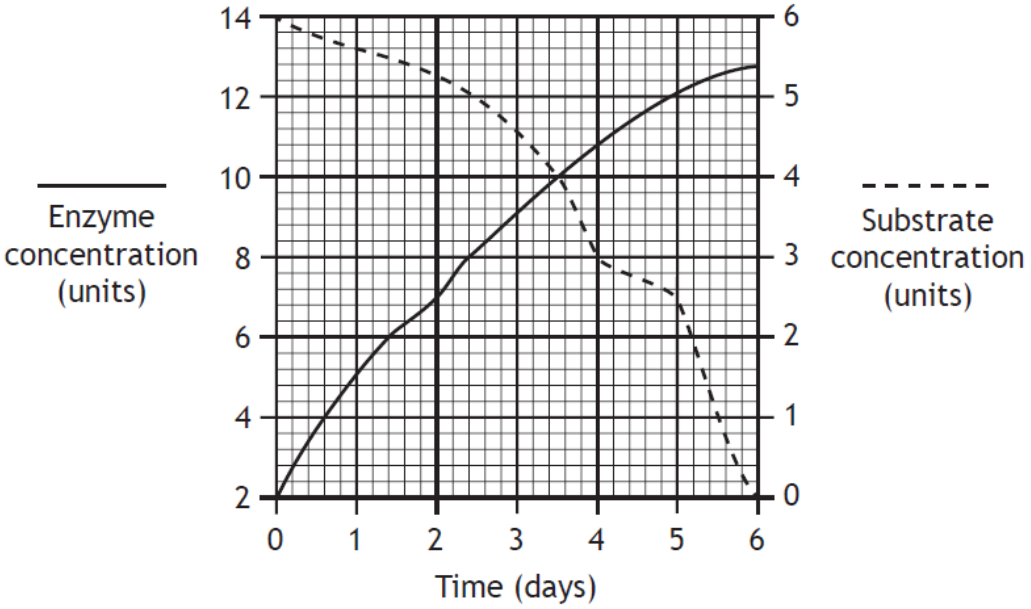
	Energy input of the chemical reaction	*Rate of the chemical reaction*
A	lowers	speeds up
B	raises	slows down
C	raises	speeds up
D	lowers	slows down

2. The diagram below represents a degradation reaction involving an enzyme.



Which letter identifies the substrate?

3. The graph below shows changes in the enzyme and substrate concentrations in a seed over a period of time.



How many days does it take for the substrate concentration to decrease by 50%?

A 2

B 3

C 4

D 5

4. The enzyme phosphorylase was added to a 4% glucose-1-phosphate solution. After one hour, the concentration of glucose-1-phosphate had fallen to 0·1%.

How many times lower was the concentration after one hour than at the start?

A 97·5

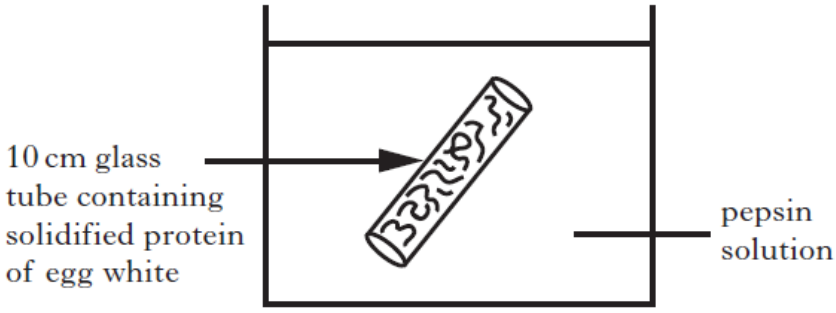
B 40·0

C 3·9

D 0·1

5. An investigation was carried out into the effect of pH on pepsin activity.

Four experiments were set up as shown in the diagram below at pH2, 5, 7 and 10.



The table below shows the lengths of the protein after one hour at each pH.

pH	*length* (cm)
2	6
5	8
7	9
10	10

What is the optimum pH for pepsin?

A pH2

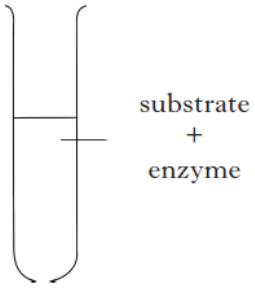
B pH5

C pH7

D pH10

6. An investigation was carried out to find the effect of pH on the activity of an enzyme.

Substrate at different pH values was added to the enzyme in different test tubes.

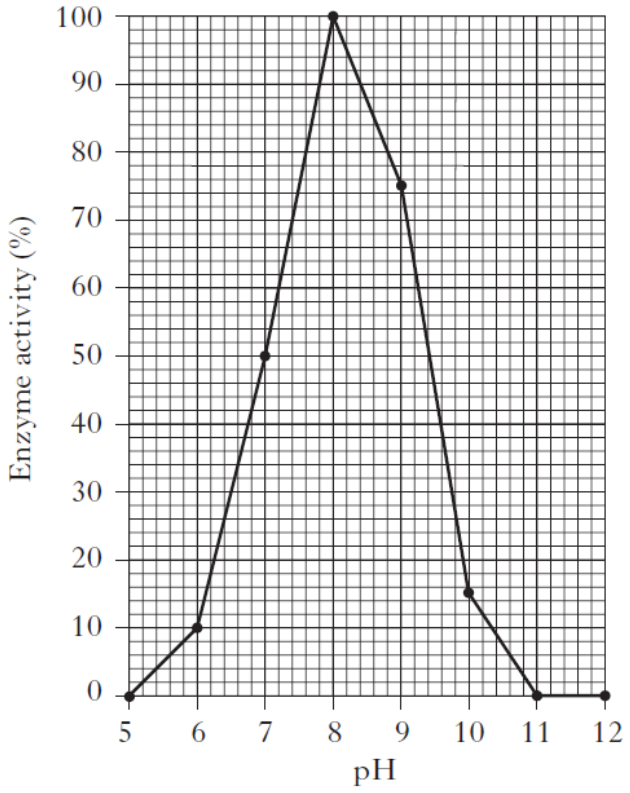


(*a*) State **two** variables that must be kept constant for a valid conclusion to be made from this investigation.

1 _____

2 _____ **2**

(*b*) The results of this investigation are shown in the graph below.



(i) What is the optimum pH for this enzyme?

_____ **1**

(ii) How many times more active is the enzyme at pH 9 than at pH 10?

Space for calculation

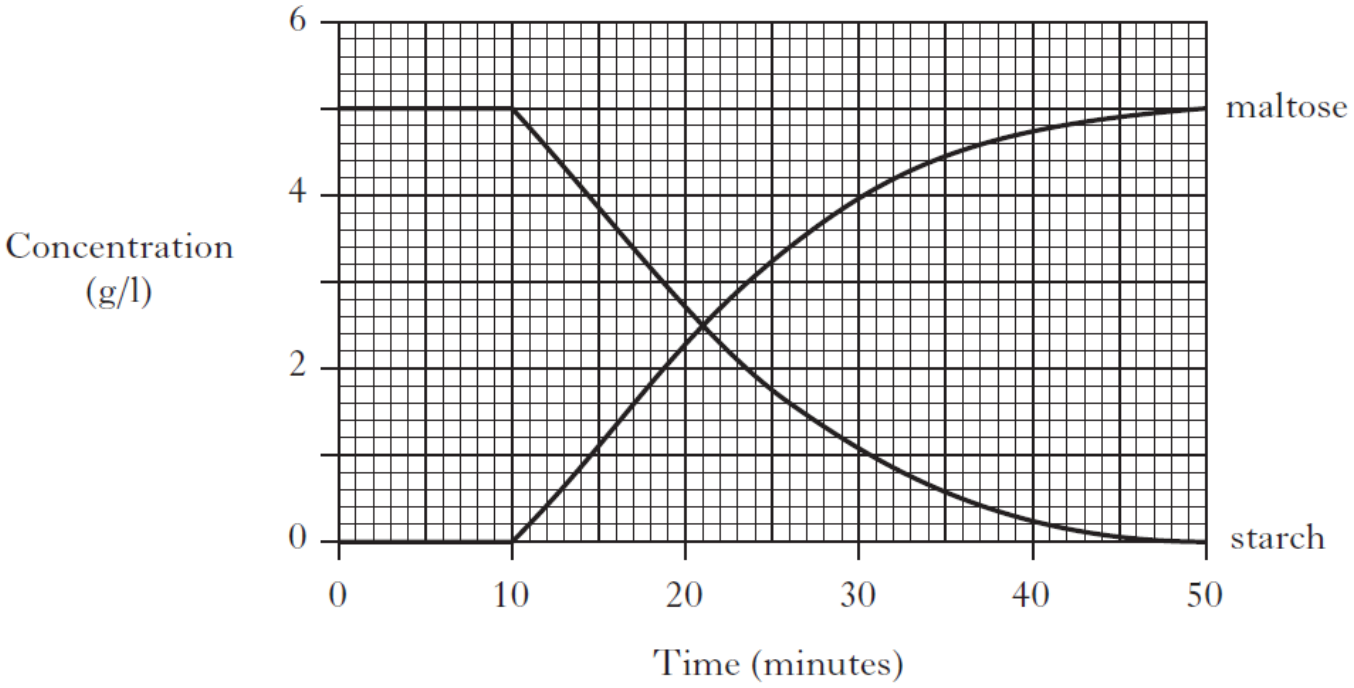
_____ times **1**

7. (*a*) In an investigation into the digestion of starch, a beaker containing a solution of starch was placed in a water bath at 30 °C. A test tube containing enzyme solution was also placed in the water bath.

After some time, the enzyme solution was added to the starch solution and stirred.

The concentrations of starch and maltose sugar were then measured regularly.

The results are shown on the graph below.



(i) For how long were the solutions left in the water bath before being mixed?

_____ minutes **1**

(ii) Give a reason why the solutions were left for some time before being mixed.

_____

_____ **1**

(iii) At what time into the investigation was exactly half of the starch digested?

_____ minutes **1**

(iv) What evidence from the results shows that the maltose was produced from the starch?

_____

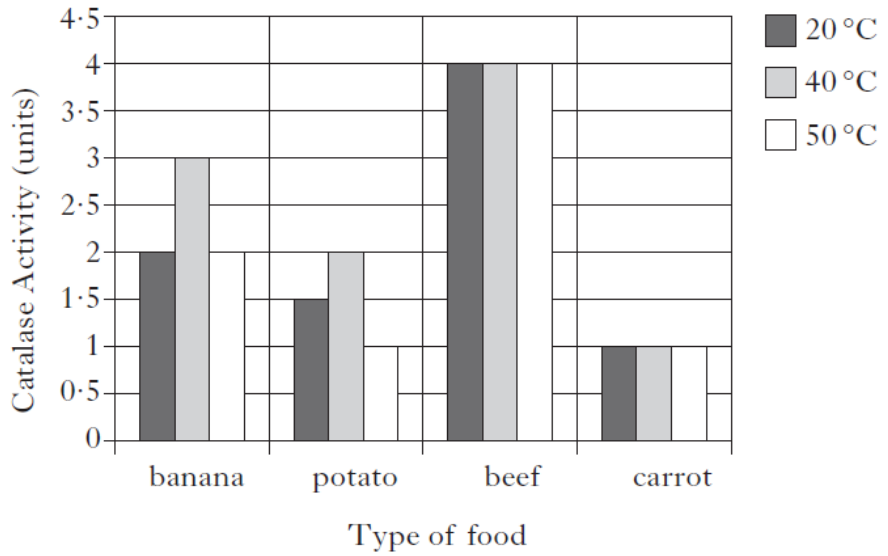
_____ **1**

(v) Name the enzyme used in the investigation.

_____ **1**

8. A student set up an investigation to measure the activity of catalase in a variety of foods at three different temperatures. *Ma*

The bar graph below shows the results recorded by the student.



(*a*) Describe the changes in catalase activity in banana when the temperature increased from 20 °C to 50 °C.

_____

_____ **1**

(*b*) Calculate the percentage decrease in catalase activity in potato when the temperature increased from 40 °C to 50 °C.

Space for calculation

_____ % **1**

(*c*) Using the results for **banana and potato** only, state the temperature that gave the highest catalase activity.

_____ °C **1**

(*d*) What conclusion can be drawn about catalase activity using the results for **carrots** only?

_____

_____ **1**

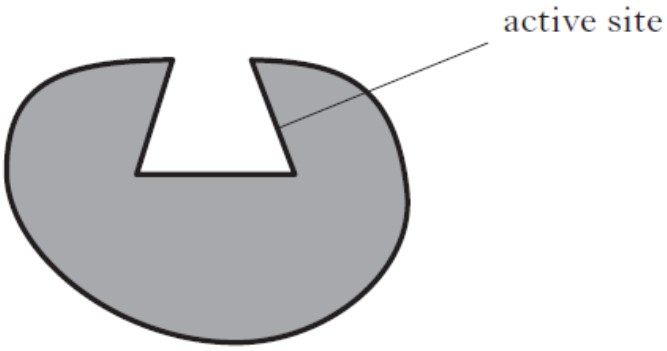
(*e*) Predict the catalase activity in beef at 100 °C. Give a reason for your answer.

Prediction _____ units

Reason _____

_____ **1**

9. The diagram below represents an enzyme which carries out a synthesis reaction.



(*a*) The sentences below describe some of the properties of enzymes.

Underline **one** option in each set of brackets to make the sentences correct.

Enzymes {lower / raise} the energy input required and

{slow down / speed up} the rate of chemical reactions.

The shape of an enzyme molecule is {complementary to / the same as} its substrate. **2**

(*b*) Describe what is meant by the term "synthesis reaction".

_____

_____ **1**

(*c*) Explain why a denatured enzyme no longer works.

_____

_____

_____ **2**

10. (a) Hydrogen peroxide can damage cells and lead to cell death. Catalase is an enzyme which breaks down hydrogen peroxide into oxygen and water.

Scientists in New Zealand investigated the link between the level of catalase in sheep livers and the fat in their meat. The hypothesis was that the higher the level of liver catalase, the greater the fat content of the meat.

In the investigation, they examined 9 sheep with a high percentage of fat and 15 sheep with a low percentage of fat. The sheep with the high percentage of fat had an average catalase level of 4800 K/g and those with the lower percentage of fat had an average catalase level of 3600 K/g.

The scientists concluded that their hypothesis was correct.

(i) Name the substrate of catalase. **1**

_____

(ii) Identify an aspect in the planning of the investigation that would suggest that the hypothesis might not be proven correct. **1**

_____

_____

(iii) A further investigation proved that the hypothesis was correct.

Describe how this investigation could help farmers to select only sheep with a low percentage of fat, to provide meat for consumers following a low fat diet. **1**

_____

_____

(b) The optimum temperature for the activity of catalase is 37°C.

Predict what would happen to the activity of catalase if the temperature was lowered to 34°C. **1**

_____

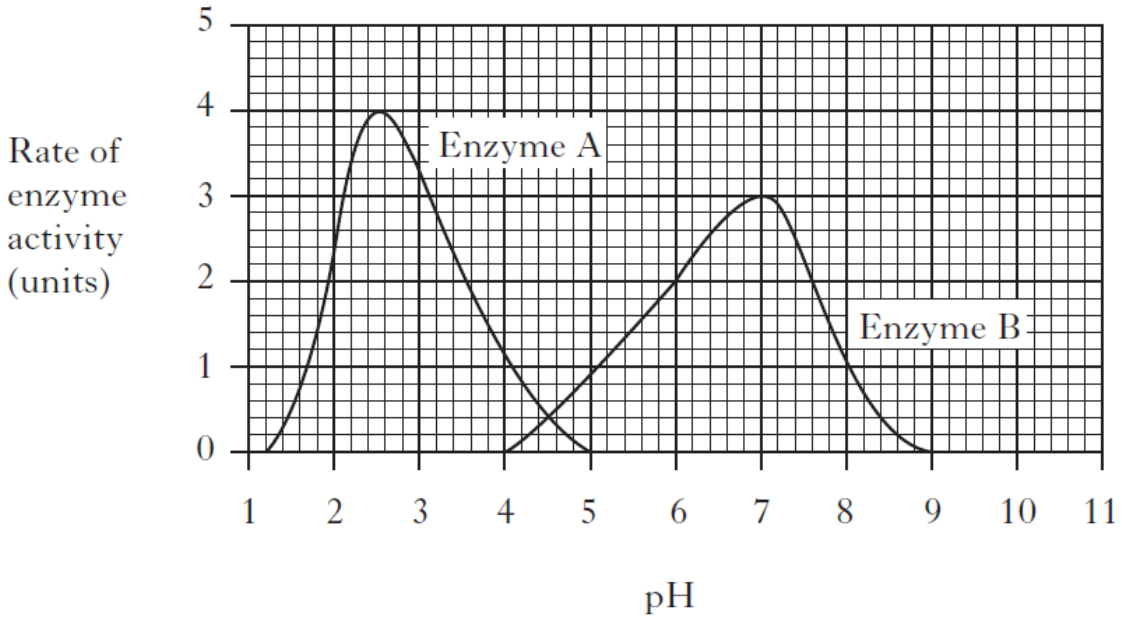
(*c*) Decide whether each of the following statements is **TRUE** or **FALSE**.

If the statement is **TRUE**, tick (✓) the **True** box. If the statement is **FALSE**, tick the **False** box and write the correct word or phrase in the **Correction** box to replace the word or phrase underlined in the statement.

Statement	*True*	*False*	*Correction*
Repeating an investigation several times improves the reliability of the results.			
To calculate a percentage, add up all the values and divide the total by the number of values.			
A control experiment is set up to prove that the result is caused by changing two of the possible variables.			

3

11. (*a*) The following graph shows the relationship between pH and the rate of activity of two different enzymes.



(i) Identify the enzyme which is likely to be pepsin and give a reason for your answer.

Enzyme _____

Reason _____

_____ **1**

(ii) Use information from the graph to answer the following questions.

1 Between which pH values are both enzymes active?

Between _____ and _____ **1**

2 How many times greater is the rate of activity of enzyme B at pH 7 than at pH 8?

Space for calculation

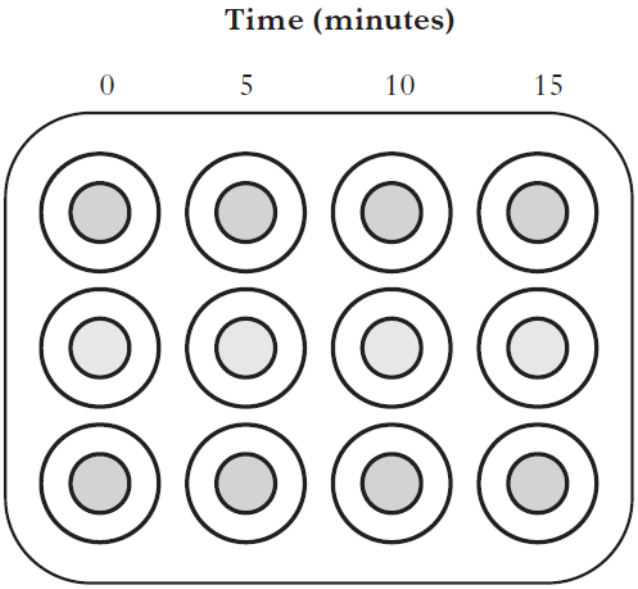
_____ times **1**

(*b*) Name **one** enzyme, other than pepsin, which is involved in the chemical breakdown of a substance.

_____ **1**

12. (*a*) The diagram below shows an investigation into the activity of the phosphorylase enzyme.

A spotting tile was set up as shown below. Each column was then tested at the times shown.



(i) Name the product formed in row A.

_____ **1**

(ii) Name the food test that could be used to identify this product.

_____ **1**

(iii) Row C acts as a control. Explain the purpose of this control.

_____

_____ **1**

(*b*) Decide if each of the following statements about enzymes is **True** or **False**, and tick (✓) the appropriate box.

If the statement is **False**, write the correct word(s) in the **Correction** box to replace the word underlined in the statement.

Statement	*True*	*False*	*Correction*
During denaturation, the <u>substrate</u> changes shape.			
Amylase is a <u>synthesis</u> enzyme.			
Enzymes <u>decrease</u> the energy input needed for a chemical reaction.			

3

(*c*) (i) Enzymes are biological catalysts. Describe what is meant by the term *catalyst*.

_____

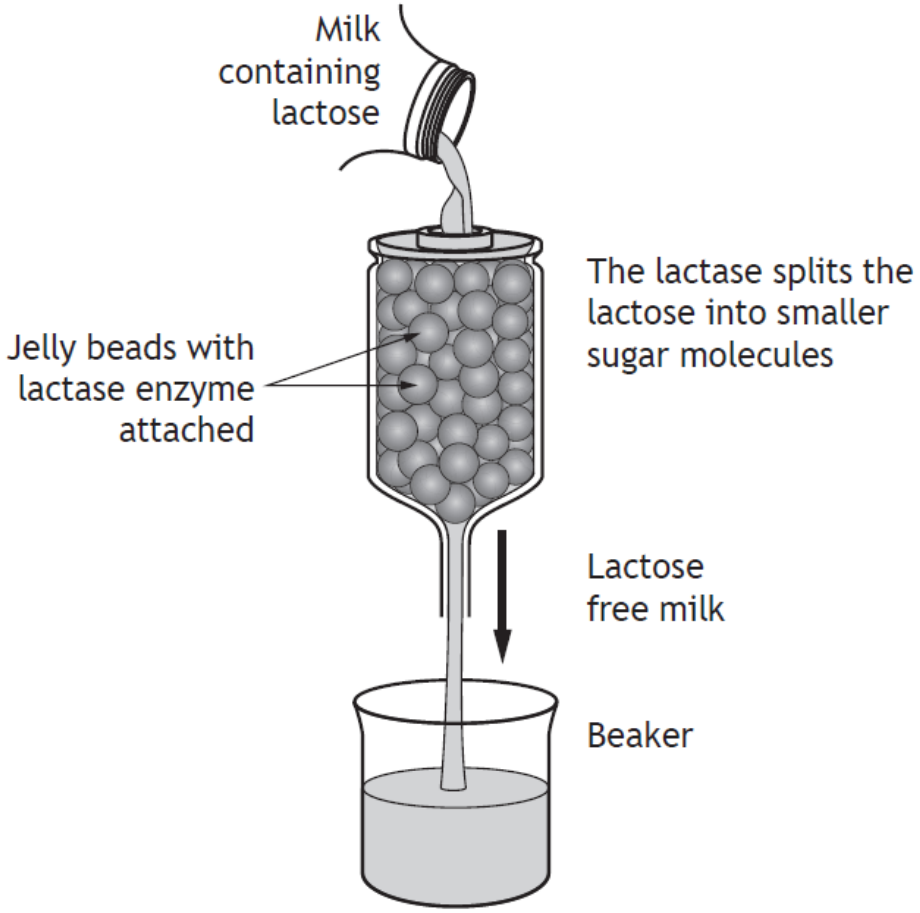
_____

_____ **1**

(ii) Name the type of chemical substance from which enzymes are made.

_____ **1**

13. The diagram below shows how the enzyme lactase is used in the production of lactose-free milk.



(a) (i) Underline **one** option in each of the brackets to make the following sentences correct. **2**

This process is an example of a {degradation / synthesis} reaction.

In this reaction, lactose is the {product / substrate} of lactase.

(ii) A fault in the production resulted in boiling water running over the lactase enzyme.

Using your knowledge of enzymes, predict how the milk produced would differ from the expected product.

Explain your answer. **2**

Prediction _____

_____

Explanation _____

_____

(b) Enzymes such as lactase are biological catalysts.

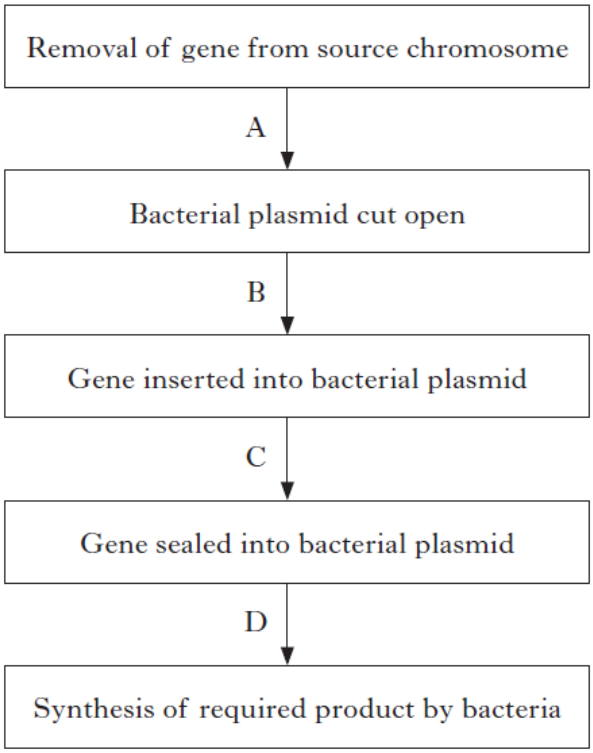
Explain the role of enzymes in living cells. **1**

_____

_____

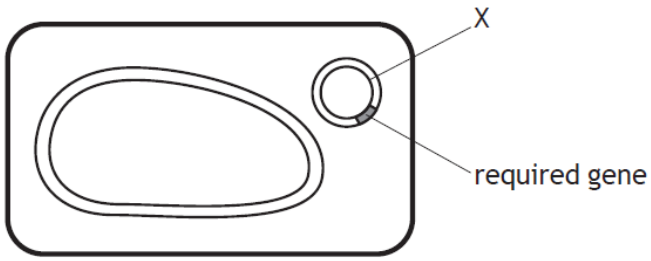
Key Area 5 – Genetic Engineering

1. Some stages of genetic engineering are shown below.



Which letter indicates the stage where the plasmid is inserted into a bacterial cell?

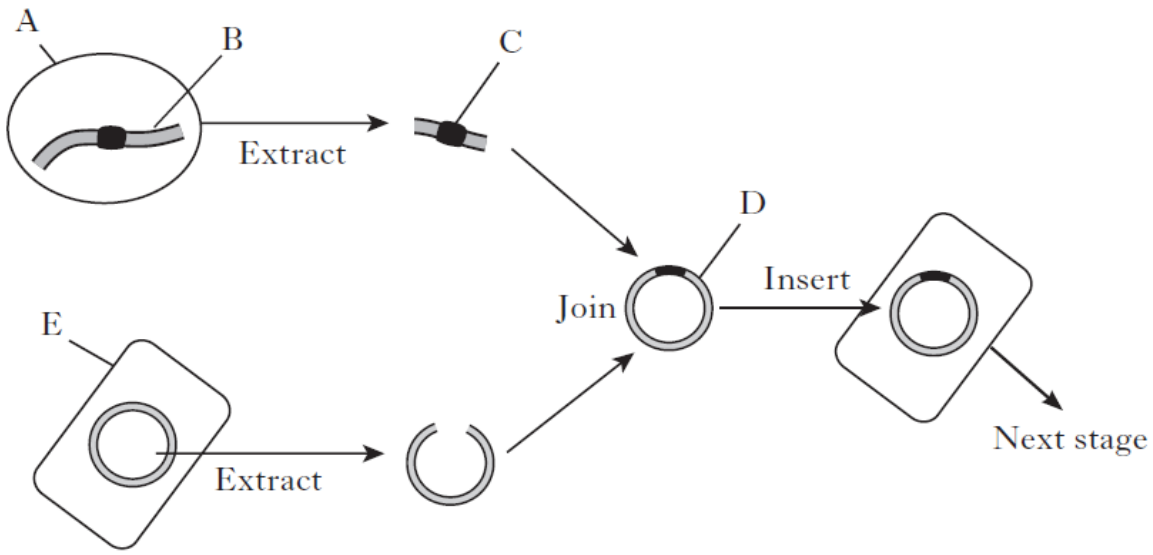
2. The diagram below represents a genetically engineered bacterial cell.



The structure labelled X is a

A chromosome
B plasmid
C ribosome
D nucleus.

3. The diagram below represents some of the stages of genetic engineering which are used to produce medicines such as insulin for human use.



(*a*) Complete the table below to identify the labelled parts of the diagram.

Name of structure	*Letter*
bacterial cell	
insulin gene	
plasmid	

2

(*b*) Describe the next stage needed to produce insulin for use as a medicine.

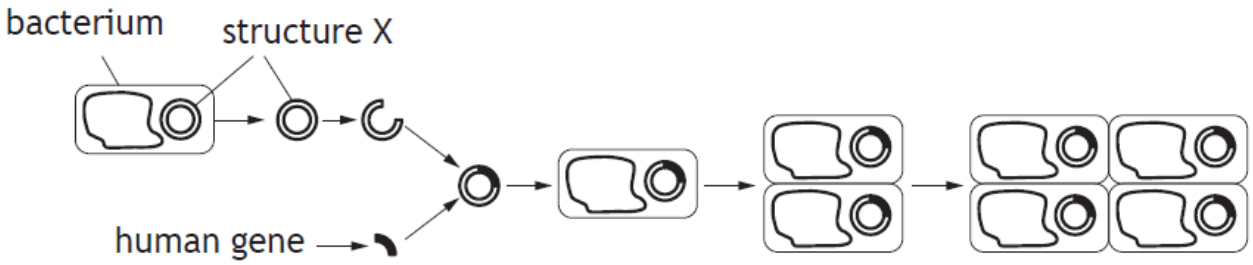
_____

_____ **1**

(*c*) Name another human hormone produced by genetic engineering.

_____ **1**

4. The diagram below represents part of the process of genetic engineering.



(a) (i) Structure X is removed from the bacterium and modified during this process.

Name structure X. **1**

_____

(ii) The bacteria have an initial concentration of 1000 cells/cm^3.

Each cell divides once every 30 minutes.

Calculate how long it will take for the concentration to become greater than 15 000 cells/cm^3. **1**

Space for calculation

_____ hours

5. (*a*) Genetic engineering is used to produce growth hormone.

The growth hormone gene is identified and removed from a human chromosome. This gene is then used in the genetic engineering process which involves a number of stages.

The table below shows the stages but they are not in the correct order.

Complete the table, entering a number (2 to 5) in each remaining box, to show the correct order for each stage.

Stages	*Number*
bacterial plasmid cut open	
bacteria multiply and synthesise growth hormone	
growth hormone gene inserted into bacterial plasmid	
bacterial plasmid removed from bacterium	1
bacterial plasmid inserted into bacterium	

1

6. (*a*) Insulin is used to treat people with diabetes. It can be manufactured by genetically-engineered bacteria using the steps described below.

A Bacteria are grown in a fermenter and produce insulin.

B The human insulin gene is isolated.

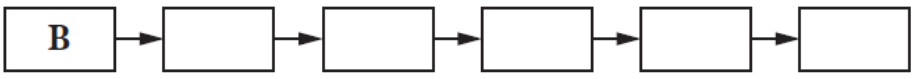
C Plasmids are removed from bacteria.

D Human insulin is purified and used to treat people with diabetes.

E The human insulin gene is inserted into a plasmid.

F Altered plasmids are put into bacteria.

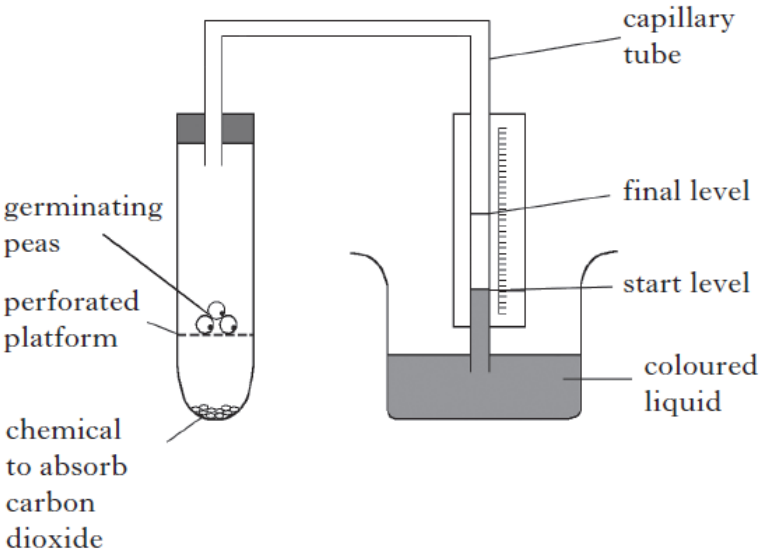
Arrange the steps into the correct order by putting the appropriate letter into each empty box.



1

Key Area 6 – Respiration

1. The apparatus below was used to investigate gas exchange in germinating peas.



The movement of the coloured liquid in the capillary tube can be used to measure the volume of

A oxygen produced by respiration

B carbon dioxide used up by respiration

C oxygen used up by respiration

D carbon dioxide produced by respiration.

2. The energy released from glucose is used to synthesise

A Pi

B ADP

C ATP

D pyruvic acid.

3. Four reactions in the respiration pathway are shown below.

1 Glucose → pyruvic acid

2 Pyruvic acid → carbon dioxide + water

3 Pyruvic acid → lactic acid

4 Pyruvic acid → carbon dioxide + ethanol

Which of the reactions can occur in yeast?

A 2 and 3 only

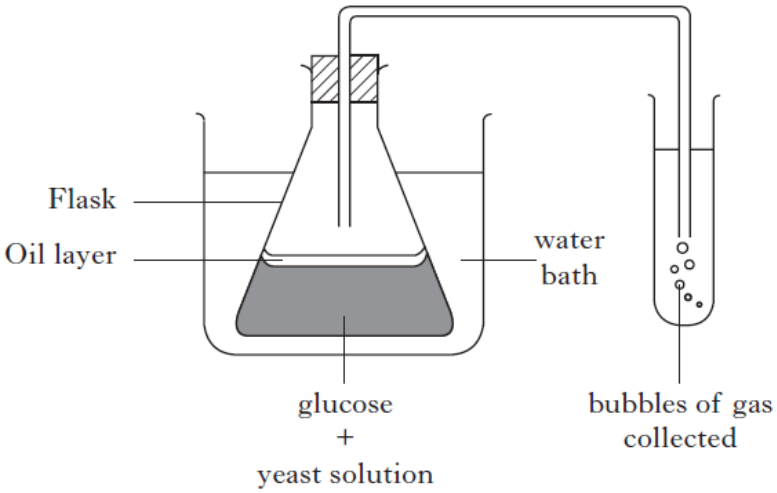
B 2 and 4 only

C 1, 2 and 3 only

D 1, 2 and 4 only

Questions 4 and 5 are based on the following information.

An investigation into anaerobic respiration in yeast was carried out.



4. The purpose of the oil layer in the flask is to ensure that

A oxygen from the solution is not released into the flask

B carbon dioxide from the flask does not enter the solution

C oxygen from the air does not enter the solution

D carbon dioxide from the solution is not released into the flask.

5. A control flask was set up to show that fermentation is due to the activity of yeast. The solution in the control flask was

A yeast and glucose

B dead yeast and glucose

C yeast and water

D dead yeast and water.

6. Muscle tissue can be dark or light in colour.

Dark tissue cells use oxygen to release energy.

Light tissue cells do not use oxygen to release energy.

(a) Name the process by which energy is released in the dark tissue cells. **1**

_____

(b) (i) Name the substance which muscle cells break down to produce pyruvate. **1**

_____

(c) The table below shows the average percentage of dark and light tissue cells. These cells were found in the muscles of athletes training for different events at the 2014 Commonwealth games in Scotland.

Type of Athlete	*Average percentage of dark tissue cells* (%)	*Average percentage of light tissue cells* (%)
cyclist	60	40
swimmer	75	25
shot putter	40	60
marathon runner	82	18
sprinter	38	62

(i) Using information in the table, identify which type of athlete would be likely to produce the most lactic acid in their muscle cells. Justify your answer. **2**

Type of athlete _____

Justification _____

_____

(ii) A sample of muscle tissue from an athlete was examined and found to contain a total of 360 cells.

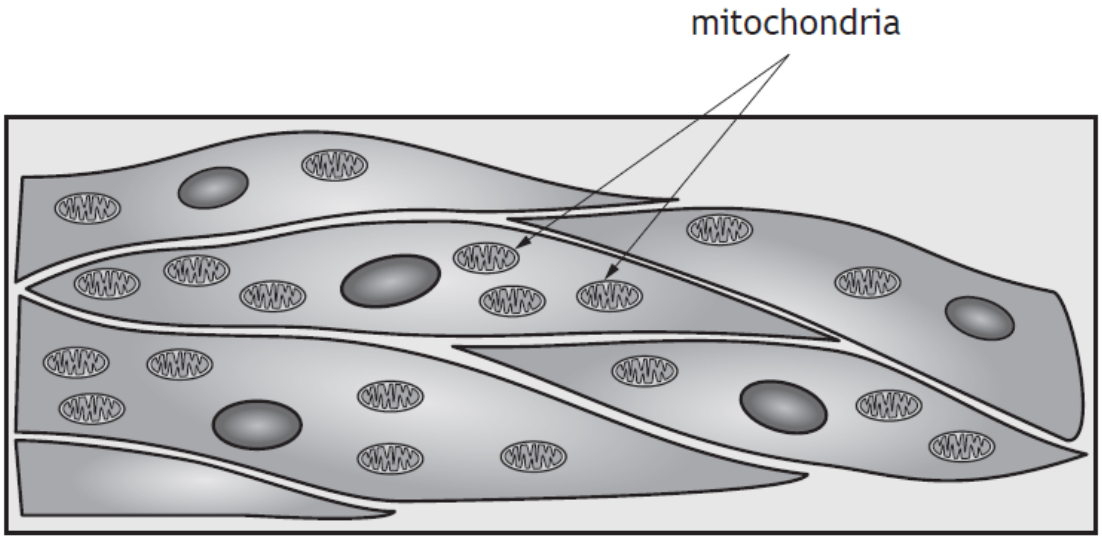
90 of these cells were light tissue cells.

Identify which type of athlete the sample was taken from. **1**

Space for calculation

Type of athlete _____

7. The diagram below shows muscle cells.



(a) (i) Explain why muscle cells require many mitochondria. **1**

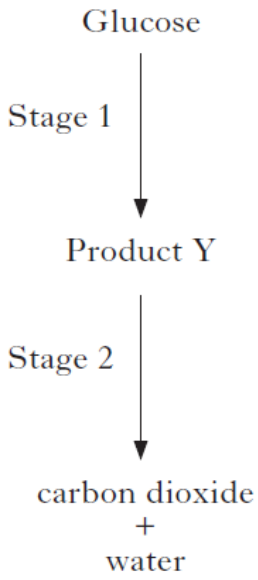
_____

_____

(ii) Name **one** substance produced by a cell carrying out aerobic respiration. **1**

_____

8. The process of aerobic respiration in a muscle cell is outlined below.



(*a*) (i) Name Stage 1.

_____ **1**

(ii) Name product Y from Stage 1.

_____ **1**

(iii) What other substance must be present for Stage 2 to occur?

_____ **1**

9. (a) Cellular processes occur in different parts of the cell.

Name the energy producing process which starts in the cytoplasm and is completed in the mitochondria. **1**

_____

(c) Explain why a sperm cell contains more mitochondria than a skin cell. **1**

_____

_____

_____