Pearson Edexcel

Additional Assessment Materials Summer 2021

Pearson Edexcel GCSE in Biology (1BI0) Foundation

Resource Set Topic 1: Key Concepts in Biology

Questions

(Public release version)

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Additional Assessment Materials, Summer 2021

General guidance to Additional Assessment Materials for use in 2021

Context

- Additional Assessment Materials are being produced for GCSE, AS and A levels (with the exception of Art and Design).
- The Additional Assessment Materials presented in this booklet are an **optional** part of the range of evidence teachers may use when deciding on a candidate's grade.
- 2021 Additional Assessment Materials have been drawn from previous examination materials, namely past papers.
- Additional Assessment Materials have come from past papers both published (those materials available publicly) and unpublished (those currently under padlock to our centres) presented in a different format to allow teachers to adapt them for use with candidate.

Purpose

- The purpose of this resource to provide qualification-specific sets/groups of questions covering the knowledge, skills and understanding relevant to this Pearson qualification.
- This document should be used in conjunction with the mapping guidance which will map content and/or skills covered within each set of questions.
- These materials are only intended to support the summer 2021 series.

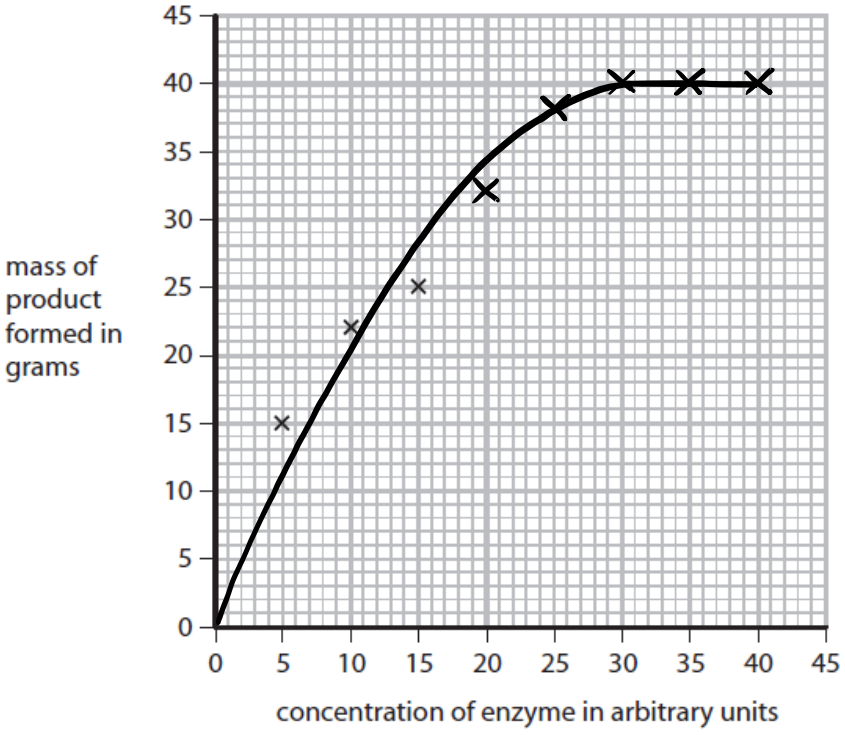
5 A student investigated the effect of enzyme concentration on the mass of product formed in one hour.
Figure 6 shows the results of this investigation.

concentration of enzyme in arbitrary units	mass of product formed in grams
5	15
10	22
15	25
20	32
25	38
30	40
35	40
40	40

Figure 6

(a) Complete the graph by plotting the points and drawing a line to show the trend in the data.
The first three points have been plotted for you.

(2)



(b) Describe the effect that enzyme concentration has on the mass of product formed.

(2)

increase in enzyme concentration increases the mass of product formed as it is a limiting factor until a point where not limiting anymore so mass of product levels off (30 au / 40g)

(c) The ratio of enzyme concentration to the mass of product formed, using an enzyme concentration of 40 arbitrary units, is 1:1.

Calculate the ratio of enzyme concentration to product formed when the enzyme concentration is 5 arbitrary units.

(2)

5 : 15

1 : 3

ratio 1 : 3

(d) The investigation used the enzyme pepsin from the stomach, at a temperature of 37°C and at a pH of 7.

(i) Which statement gives one way to increase the mass of product formed in this investigation?

(1)

☐ **A** increase the pH

☐ **B** decrease the temperature

☐ **C** decrease the enzyme concentration

☒ **D** increase the substrate concentration

(ii) Explain why a temperature of 80°C was not used in this investigation.

(3)

80°C is a very high temperature which denatures the enzymes. The shape of active site will change and will no longer be there will be no complementary to the substrate. So no enzyme-substrate complexes, collisions per unit time so no reaction will occur. 37°C is optimum for enzyme.

9 (a) Figure 11 shows two potato chips.

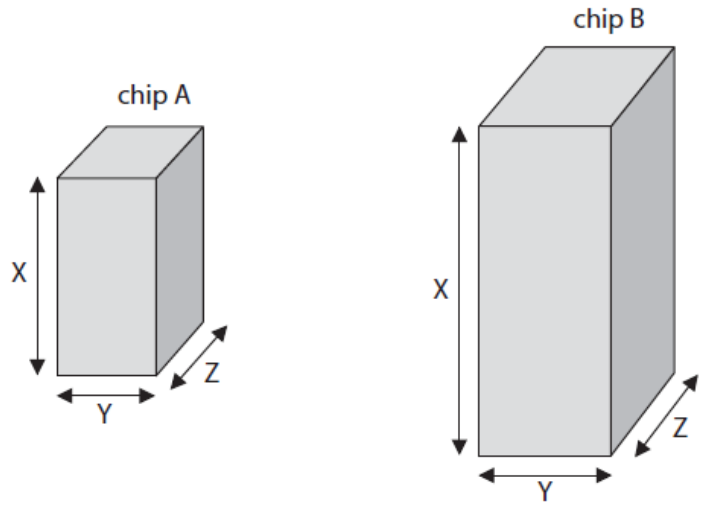


Figure 11

Figure 12 shows some information about each potato chip.

potato chip	length of X in cm	length of Y in cm	length of Z in cm	total surface area of four sides in cm²	total surface area of top and bottom in cm²	total surface area of chip in cm²
A	3.0	1.5	1.5	18.0	4.5	22.5
B	5.0	2.0	2.0	?	?	?

Figure 12

(i) Calculate the total surface area of potato chip B using the formula,

Total surface area = 2XY + 2XZ + 2YZ

(2)

$2(5.0 \times 2.0) + 2(5.0 \times 2.0) + 2(2.0 \times 2.0)$

$= 20 + 20 + 8 = 48$

total surface area = 48 cm²

(ii) The potato chips were placed in distilled water for 20 minutes.

Figure 13 shows the increase in mass of each potato chip.

potato chip	increase in mass in grams
A	0.1
B	0.3

Figure 13

Explain why potato chip B has a greater increase in mass than potato chip A.

(2)

potato chip B has a greater surface area than A, thus, more water molecules can enter chip through more of cell membrane via osmosis, hence greater mass recorded

(iii) Potato chip A is transferred from the distilled water into a concentrated salt solution.

Explain what will happen to the cells in potato chip A.

(3)

- cells will plasmolyse
- greater water potential / more water molecules in A compared with concentrated salt solution
- so water molecules will move through partially permeable cell membrane from cell to solution down the water potential gradient via osmosis
- lots of water loss as concentrated salt solution so become plasmolysed (vacuole shrink, cytoplasm shrink, cell membrane pulls away from cell wall)

10b.

(b) Crop plants provide a source of energy in the form of carbohydrates such as starch and sugars.

(i) Describe the test to identify starch.

(2)

- crush plant crops & add water to make a solution and filter off insoluble solids
- add a few drops of iodine solution to solution
- colour changes from orange/brown to blue-black if starch present

(ii) The amount of energy in the sugars extracted from crop plants can be measured using the calorimeter shown in Figure 16.

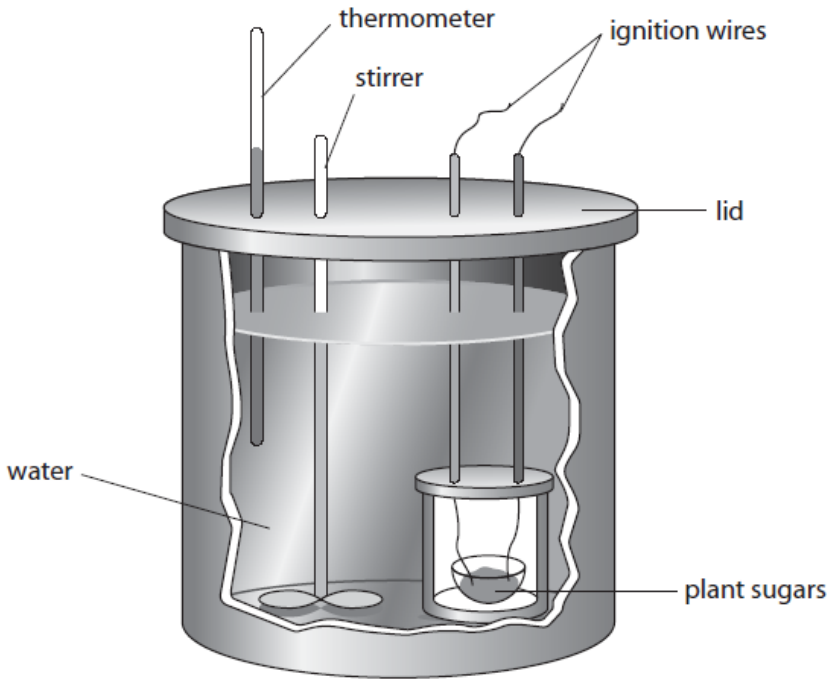


Figure 16

Explain why the calorimeter has a lid.

(2)

to prevent heat loss so all heat energy is transferred to water, accurate temperature increase can be measured and so the amount of energy calculated is the closest to the true value

(iii) State why it is important to stir the water in the calorimeter.

(1)

ensures heat is distributed evenly throughout water

5 (a) Figure 7 shows the activity of the enzymes pepsin and trypsin at different pH levels.

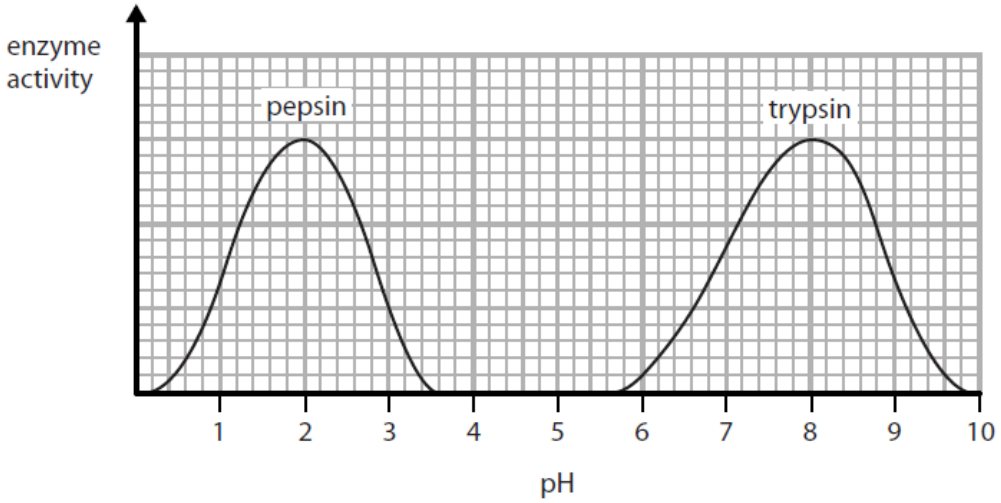


Figure 7

(i) Describe the trend in the graph for the enzyme **trypsin**.

Use data from the graph to support your answer.

(4)

- same graph / curve showing trend as pepsin: enzyme activity increases at an increasing rate up to a peak as pH increases then decreases at a decreasing rate;
- peak of enzyme activity at pH 8.
- different range of pH : 3.6 for pepsin; 4.2 for trypsin
- different range of pH where enzyme functions: 0~3.6 for pepsin, 5.7~10 for trypsin

(ii) State the optimum pH for the enzyme **pepsin**.

(1)

pH 8

(iii) Pepsin only works effectively in the stomach.

Describe the conditions in the stomach that allow pepsin to work effectively.

(2)

- pH 2 : acidic condition
- 37°C : optimal warm temperature

(b) At high pH values the active site of the enzyme pepsin changes shape.

When the active site of the enzyme changes shape, the enzyme is

(1)

- ☒ **A** specific
- ☒ **B** denatured
- ☒ **C** digested
- ☒ **D** dead

(c) State what is produced when proteins are digested.

(1)

amino acids

6b.

(b) Figure 9 shows two sperm cells.

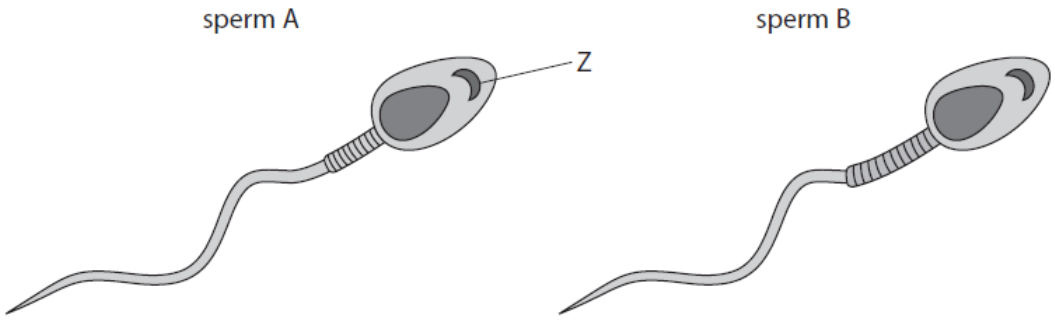


Figure 9

(i) Name structure Z.

(1)

acrosome

(ii) Sperm B has a larger middle section than sperm A.

Explain why sperm B will be more likely to fertilise an egg than sperm A if they were both released at the same time.

(3)

- sperm B has a longer middle part compared to sperm A
- middle part has mitochondria
- mitochondria is the site of aerobic respiration where energy is released
- for B, more energy released so swim faster to reach & fertilise egg

7 Starch is a nutrient in food.

Starch is a source of energy.

(a) Name the enzyme that breaks down starch.

(1)

amylase

(b) Enzymes from different parts of the digestive system were used to investigate the breakdown of starch.

Figure 10 shows the apparatus used in this investigation.

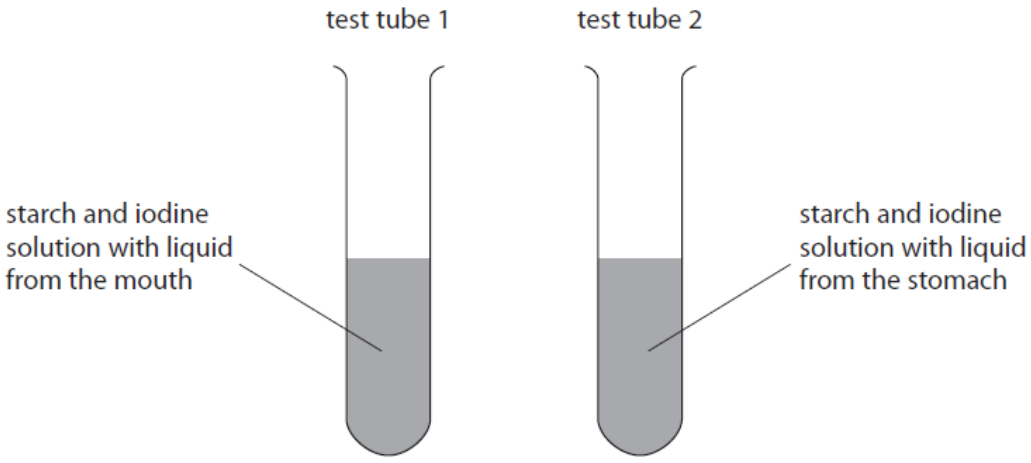


Figure 10

The colour of the contents of each test tube was recorded every two minutes for a total of ten minutes.

The results are shown in Figure 11.

time in minutes	colour of the contents of each test tube	
	test tube 1 starch and iodine solution with liquid from the mouth	**test tube 2** starch and iodine solution with liquid from the stomach
0	blue-black	blue-black
2	blue-black	blue-black
4	brown	blue-black
6	orange	blue-black
8	orange	blue-black
10	orange	blue-black

Figure 11

(i) Give **one** reason why the contents of both test tubes were blue-black at the beginning of the investigation.

(1)

at t=0, starch always present

(ii) Explain the results of this investigation after ten minutes.

(3)

- in mouth, amylase enzyme present
- amylase enzyme breaks down starch into maltose
- after 10 mins, all starch broken down in mouth so no more starch present so colour is orange
- in stomach, no amylase enzyme, only protease enzyme
- not complementary to starch so starch not broken down
- starch still remains present after 10 mins so no colour change

*(c) The diagram shows equipment that can be used to measure the energy content of different foods.

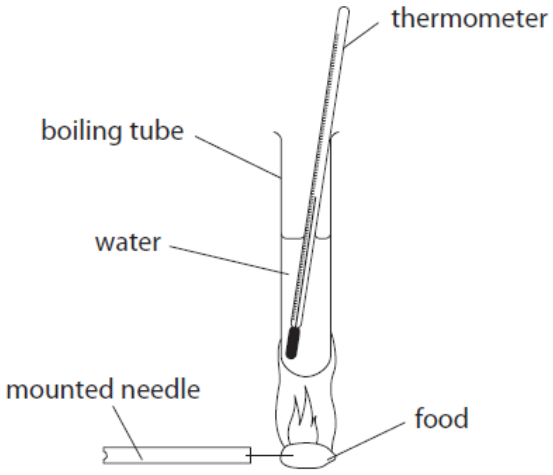


Figure 12

Devise a method to compare the energy content of two foods using this equipment.

Include details of how to control the variables.

(6)

- controlled variables:
  mass of 2 foods, distance between test tube and burning food, position of thermometer in test tube, number/strength of stirring
- break down food into smaller pieces and measure its mass using top pan balance and ensure the other food is used of approximately the same mass
- measure 50 cm^3/ 50g of water using measuring cylinder and pour it in a test tube
- put food piece at the end of mounted needle and burn the food, which would be directly be transported under the test tube
- stir water using thermometer and record highest temperature rise when food is all burnt
- repeat investigation using the other food
- energy in food = mass of water (g) × 4.2 $J\,g^{-1}\,°C^{-1}$ × temperature rise
- compare energy released for each food

1 (a) Some foods contain starch.

Which chemical is used to test for starch?

(1)

- ☐ **A** amylase
- ☐ **B** ethanol
- ☒ **C** iodine solution
- ☐ **D** hydrochloric acid

(b) Benedict's solution is used to test for reducing sugars in food.

Figure 1 shows part of the method for this test.

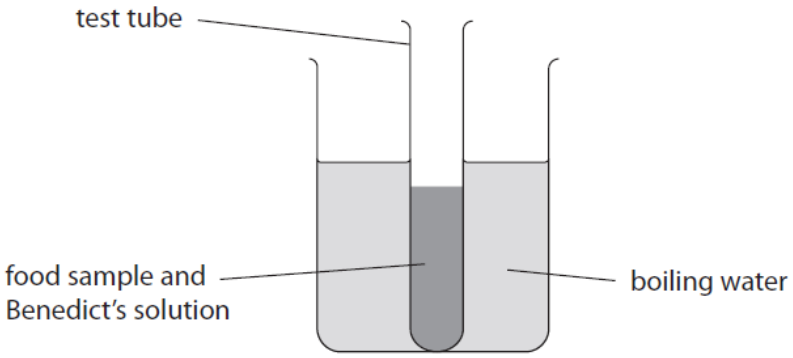


Figure 1

(i) Give **two** safety precautions needed when doing this test.

(2)

1 be careful when using boiling water due to high temperature so risk of spilling

2 be careful when handling Benedict's solution as irritant on skin & eyes, wear gloves

(ii) Give **one** reason for placing the test tube in boiling water.

(1)

to allow reduction reaction to occur to copper to form copper(II) oxide precipitate

(c) Figure 2 shows some information about the results of the test for reducing sugar.

colour of Benedict's solution after testing food sample	concentration of reducing sugar
blue	zero
green	low
yellow	↓
orange	
brick red	high

Figure 2

A student wanted to compare the amount of reducing sugar in three types of biscuit.

(i) Give **one** variable the student should control.

(1)

same mass/amount of biscuit

Figure 3 shows the student's results.

type of biscuit	colour with Benedict's solution
A	green
B	brick red
C	orange

Figure 3

(ii) State **two** conclusions that can be made from the data in Figure 3.

(2)

1 A has the lowest concentration of reducing sugar

2 B has the highest concentration of reducing sugar

2 (a) Figure 4 shows three cells.

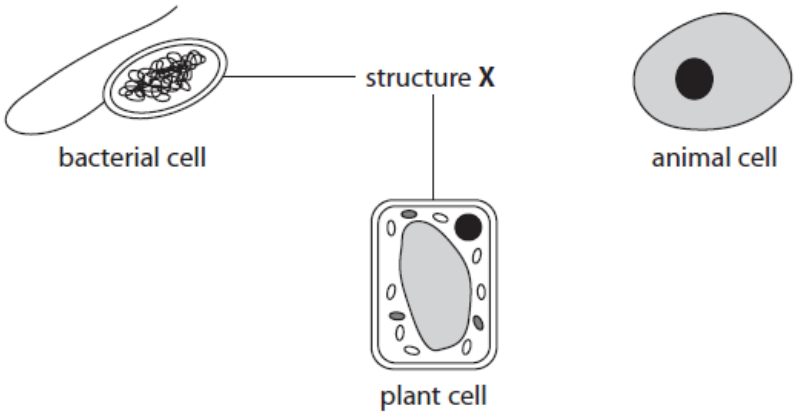


Figure 4

(i) What is structure **X**?

(1)

- ☐ **A** cell membrane
- ☒ **B** cell wall
- ☐ **C** cytoplasm
- ☐ **D** nucleus

(ii) The bacterial cell in Figure 4 has a flagellum.

State the function of a flagellum.

(1)

to allow bacterial cell to move/swim

(iii) Give **one** other difference between the bacterial cell and the animal cell shown in Figure 4.

(1)

cell wall present in bacterial cell but not in animal cell

(b) Substances move into and out of cells.

How does oxygen move into and out of cells?

(1)

- ☐ **A** transpiration
- ☐ **B** active transport
- ☒ **C** diffusion
- ☐ **D** osmosis

(c) A plant leaf cell is 0.04 mm long.

Calculate the length of the image after this cell has been magnified 500 times.

(2)

$$M = \frac{I}{A} \qquad 500 = \frac{I}{0.04\,mm}$$

$$I = 20\,mm$$

length of image = 20 mm

4 (a) A student placed three different sized cubes of agar jelly into separate beakers containing the same concentration of hydrochloric acid.

The cubes contained a pink indicator.

This indicator becomes clear when in contact with an acid.

Figure 7 shows the results of the investigation after the cubes had been in the acid for 120 seconds.

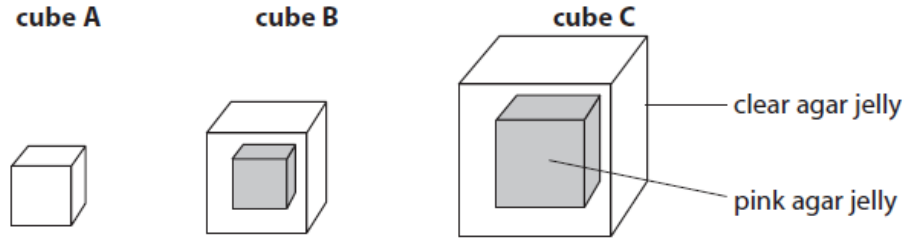


Figure 7

(i) The distance from the outside of cube B to the pink area was 3mm.

Calculate the distance diffused by hydrochloric acid in **one** second.

(2)

÷120 ↘ 3mm in 120s
0.025mm is ↙ ÷120

0.025 mm

(ii) The student wanted to confirm their results.

Give **one** improvement the student should make to this investigation to confirm their results.

(1)

add a control where water used instead of hydrochloric acid for each cubes

(b) Devise a method, using cubes of agar jelly, to investigate how temperature affects the rate of diffusion.

(3)

- use same size, shape, surface-area of cubes with indicator inside and hydrochloric acid of same volume & concentration for 5 test tubes
- use various increasing temperatures for each test tubes with intervals of 5°C
- measure time taken for colour to change from pink to colourless to measure & assess varying rates

(c) Some substances move into and out of cells by active transport.

Which is the correct description of the movement of a substance by active transport?

(1)

- ☒ **A** against a concentration gradient using energy
- ☐ **B** down a concentration gradient using energy
- ☐ **C** against a concentration gradient without using energy
- ☐ **D** down a concentration gradient without using energy

6 (a) A student investigated the activity of a human enzyme at different temperatures.

The student measured the mass of product formed after 10 minutes at different temperatures.

Figure 10 shows the results of this investigation.

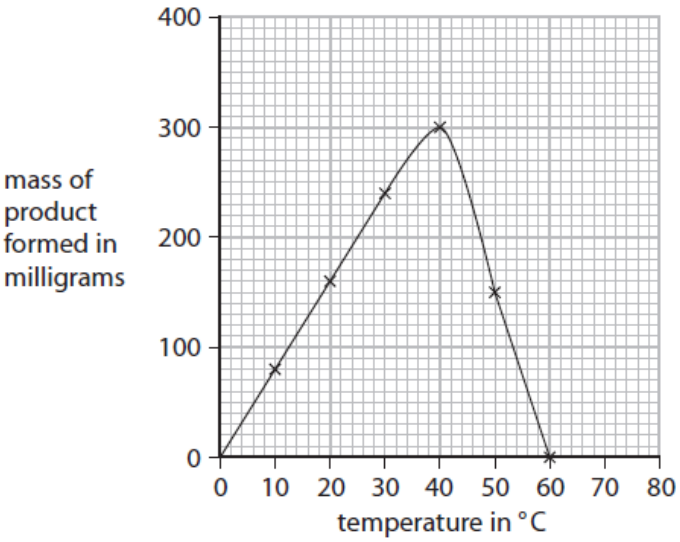


Figure 10

(i) Describe the trends shown in Figure 10.

(2)

- mass of product formed increases directly proportionally from 0 to 40°C up to 300g
- peaks at 300g at 40°C
- mass of product formed decreases back to 0 at 60°C

(ii) Explain the results obtained for temperatures from 40 °C to 60 °C.

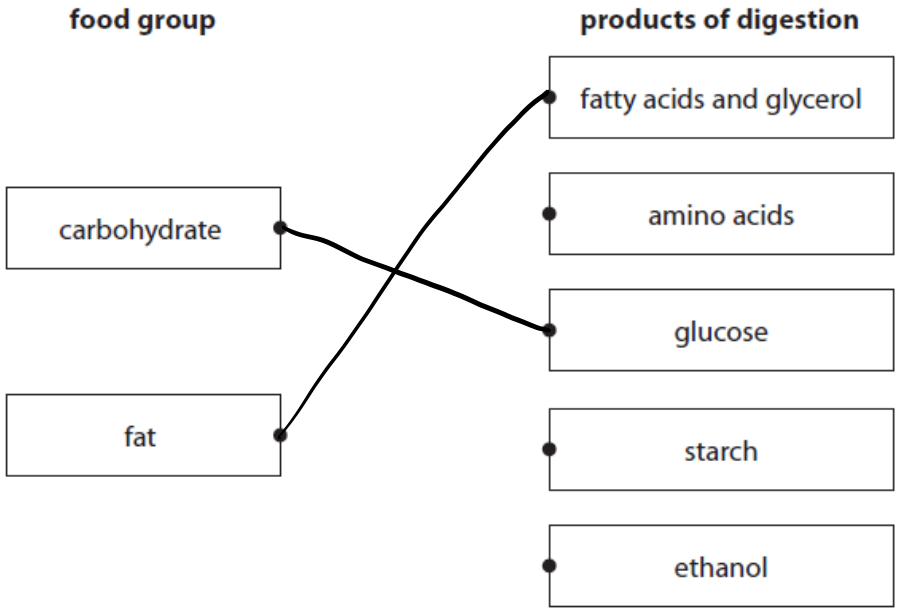
(2)

- too high temperature denatures enzyme
- change in shape of active site so no longer complementary to substrate
- no enzyme-substrate complex form so no collisions so less and less mass of product formed as temperature increases

(b) Some enzymes are involved in the breakdown of food substances.

(i) Draw **one** straight line from each food group to the products of digestion for that food group.

(2)



(ii) Which enzyme breaks down fat?

(1)

- ☐ **A** carbohydrase
- ☐ **B** amylase
- ☐ **C** protease
- ☒ **D** lipase

(c) Figure 11 shows an enzyme and two substrates, P and Q.

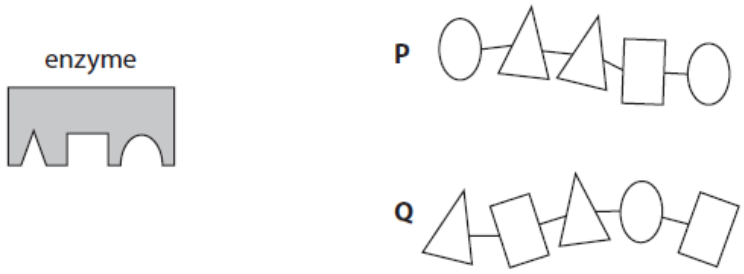


Figure 11

Explain the reason why no product will be formed if the enzyme is mixed with substrate **Q**.

(3)

- shape of active site of enzyme is not complementary to shape of substrate Q
- no enzyme-substrate complexes form, no collisions per unit time
- no substrate broken down into products

9bi-ii.

(b) Figure 15 is a drawing of a eukaryotic cell.

Structure **Z** is found in plant leaf cells.

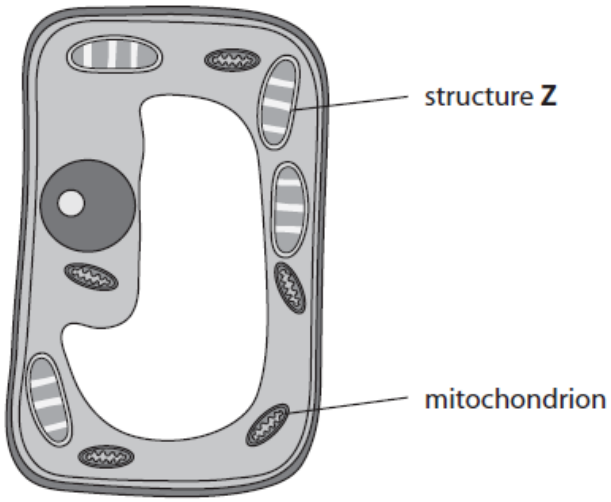


Figure 15

(i) Name structure **Z**.

(1)

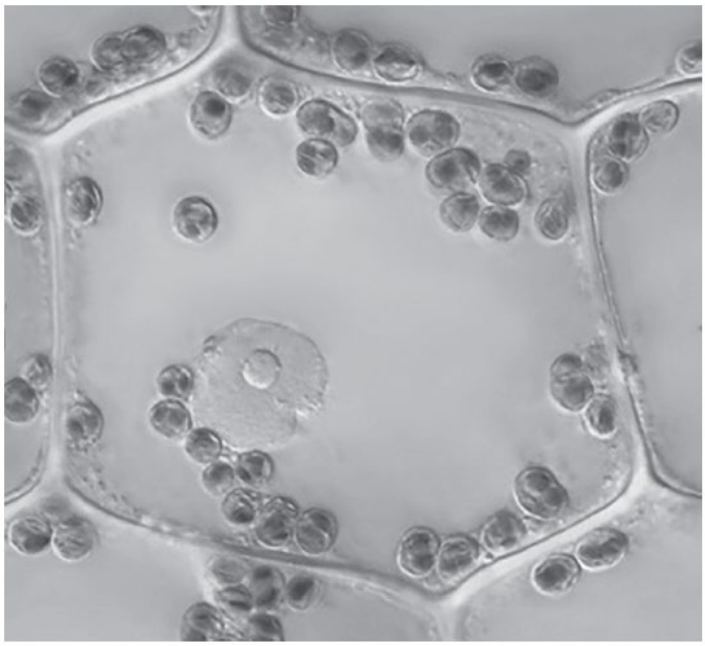
chloroplast

(ii) Give **one** function of the mitochondrion.

(1)

site of aerobic respiration where energy released

6 Figure 10 shows a plant cell as seen under a light microscope.



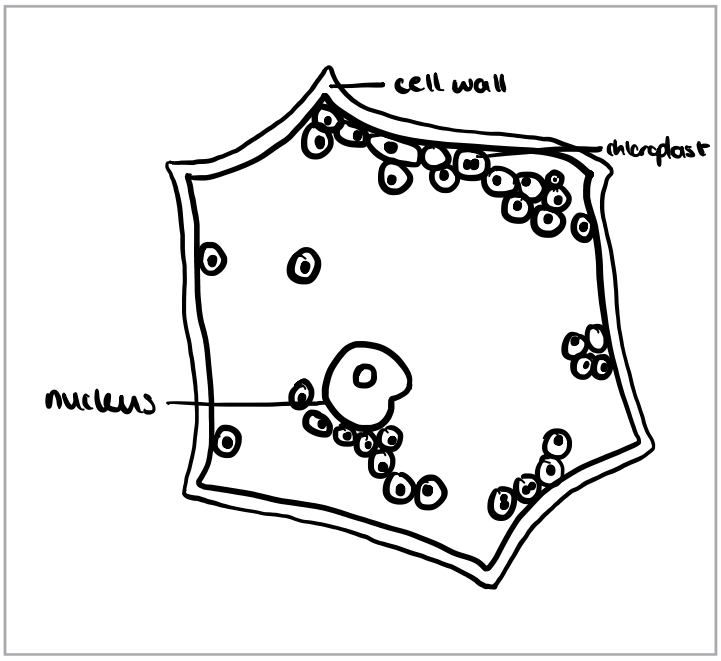
(Source: © HERVE CONGE, ISM/SCIENCE PHOTO LIBRARY)

Figure 10

(a) Draw this plant cell in the box below.

Label **three** parts of this cell.

(4)



(b) Mitochondria cannot be seen with a light microscope.

What is the function of mitochondria in a plant cell?

(1)

☒ **A** respiration

☐ **B** make proteins

☐ **C** photosynthesis

☐ **D** store water

(c) A student wanted to investigate the movement of water into and out of cells in potatoes.

The student had the equipment shown in Figure 11.

Figure 11

The test tubes in the rack contain different concentrations of sodium chloride solution.

The solutions were 0.1 M, 0.2 M, 0.3 M, 0.4 M and 0.5 M sodium chloride solution.

The test tube in the beaker contains distilled water.

There are three potato chips in each of the six test tubes.

(i) State why the test tube in the beaker only contains distilled water and three potato chips.

(1)

acts as a control for comparison

(ii) State **two** variables that need to be controlled in this investigation.

(2)

1 total surface area of potato chip

2 volume of sodium chloride solution

(iii) Explain why the chips in the 0.5 M sodium chloride solution lost mass.

(3)

- greater water potential in chip than in solution
- water molecules move down the water potential gradient from chip to solution via osmosis
- chip lost water and thus mass

TOTAL= 89 MARKS