Carbohydrates and Lipids

Question Paper 3

Level	International A Level
Subject	Biology
Exam Board	CIE
Topic	Biological Molecules
Sub Topic	Carbohydrates and Lipids
Booklet	Theory
Paper Type	Question Paper 3

Time Allowed : **78 minutes**

Score : **/ 65**

Percentage : **/100**

Grade Boundaries:

A*	A	B	C	D	E	U
>85%	'77.5%	70%	62.5%	57.5%	45%	<45%

1 Polysaccharides, such as glycogen, amylopectin and amylose, are formed by polymerisation of glucose. Fig. 2.1 shows part of a glycogen molecule.

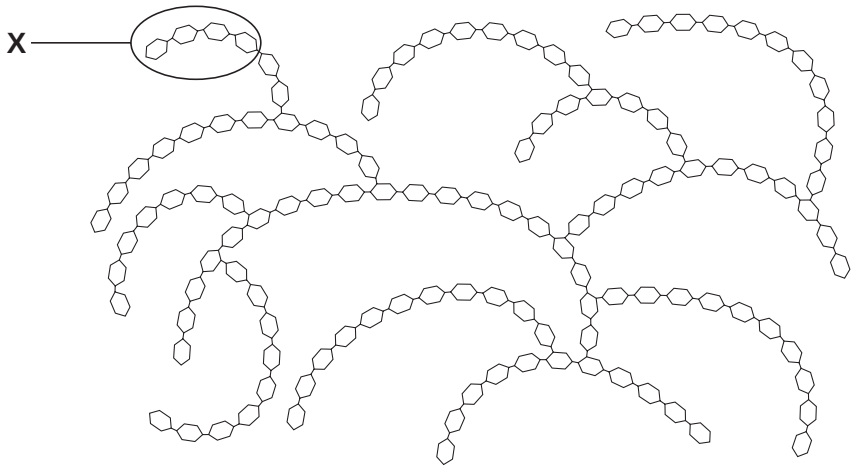

Fig. 2.1

(a) With reference to Fig. 2.1,

(i) describe how the **structure** of glycogen differs from the structure of amylose;

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..... [2]

(ii) describe the advantages for organisms in storing polysaccharides, such as glycogen, rather than storing glucose.

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..... [3]

(b) Glycogen may be broken down to form glucose.

Fig. 2.2 shows region **X** from the glycogen molecule in Fig. 2.1 in more detail.

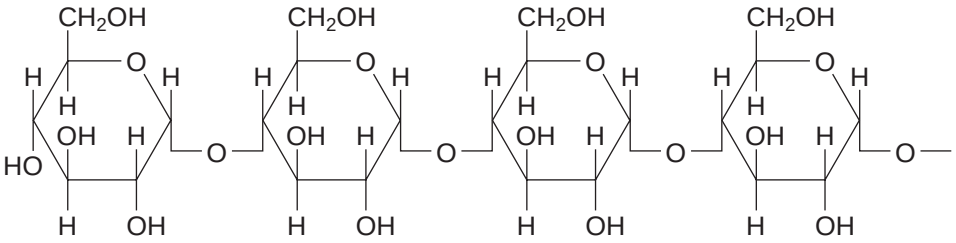


Fig. 2.2

Draw an annotated diagram in the space provided to explain how a glucose molecule is formed from the free end of the glycogen molecule shown in Fig. 2.2.

[3]

[Total: 8]

2 Fig. 2.1 shows a β glucose molecule.

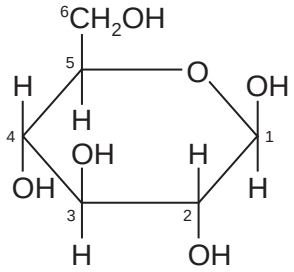


Fig. 2.1

(a) State how **α glucose** differs from β glucose as shown in Fig. 2.1.

.....[1]

(b) Fig. 2.2 shows a molecule of β glucose that is about to be added to the end of a growing chain of a polysaccharide.

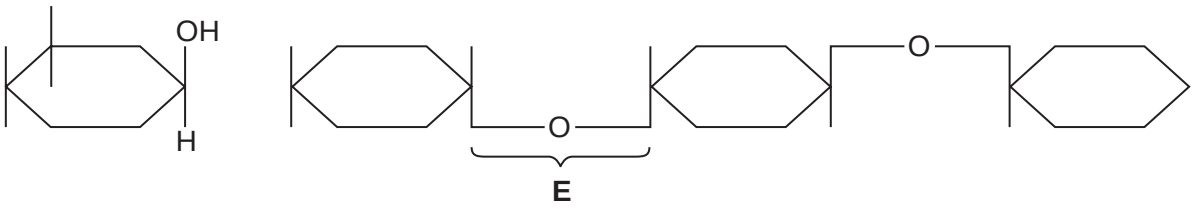
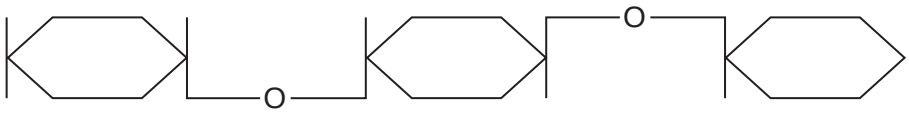


Fig. 2.2

(i) Name the bond **E**.

.....[1]

(ii) Use the diagram below to show how the β glucose molecule will attach to the end of the growing chain of the polysaccharide. You may annotate the diagram if you wish.



(iii) Name a polysaccharide that is formed entirely from β glucose molecules in the way shown in Fig. 2.2.

.....[1]

(c) A solution of starch was poured into six separate test-tubes, labelled **F** to **K**. The test-tubes were kept at 35 °C for 5 minutes and then treated as shown in Table 2.1. After a further 30 minutes the contents of the test-tubes were tested for the presence of reducing sugar.

Table 2.1

test-tubes	substances added after 5 minutes	presence or absence of reducing sugar after 30 minutes
F	distilled water	absent
G	amylase + boiled maltase	present
H	amylase + distilled water	present
I	boiled amylase + maltase	absent
J	amylase + maltase	present
K	maltase + distilled water	absent

Explain the results shown in Table 2.1.

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.....[4]

[Total : 10]

3 Starch, glycogen and cellulose are all polysaccharides. They are made from monomers that are joined by covalent bonds.

(a) Complete the table below to show which of the statements apply to each of the polysaccharides.

Fill in each box using a tick (✓) to show that the statement applies and a cross (✗) if it does not.

statement	starch	glycogen	cellulose
glycosidic bonds between monomers			
monomer is β glucose			
stored within chloroplasts			
stored in muscle cells			
exists in two forms – branched and unbranched chains			

[5]

A solution of the enzyme amylase was added to a solution of starch and kept at 25 °C. The starch was broken down by hydrolysis.

(b) Explain how you would determine the rate of hydrolysis.

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.....[4]

[Total: 9]

4 Fig. 2.1 shows the reaction to form triglycerides.

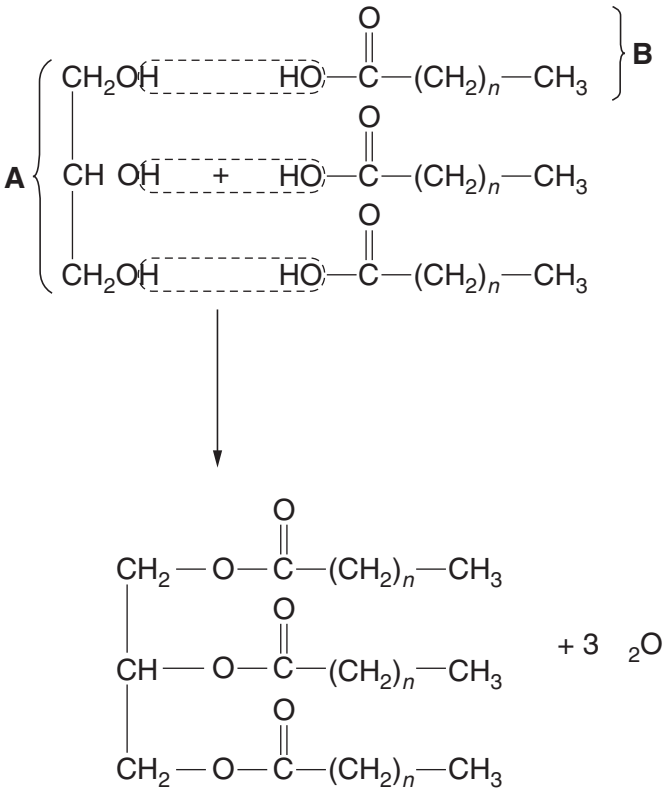

Fig. 2.1

(a) With reference to Fig. 2.1,

(i) name the molecules **A** and **B**;

A .....

B .....[2]

(ii) state the name of the reaction shown.

.....[1]

(b) Animals and plants store triglycerides as energy reserves.

Explain the advantages of storing triglycerides as energy reserves rather than carbohydrates, such as starch.

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.....[2]

Overconsumption of fat in the diet may lead to obesity.

(c) State how it is determined whether a person is sufficiently overweight to be classed as obese.

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.....[1]

(d) Outline two risks to health of being obese.

1. ....

2. ....[2]

[Total : 8]

5 Many microorganisms can digest cellulose by using a group of enzymes collectively known as cellulases. Cellobiose is the disaccharide produced during cellulose digestion.

The cellulase known as β-glucosidase completes the digestion of cellulose by hydrolysing the cellobiose molecule to produce two β-glucose molecules.

(a) Draw the ring structure of one β-glucose molecule in the space provided.

[2]

(b) β-glucosidase was extracted from two different bacteria, *Agrobacterium tumefaciens* and *Thermotoga maritima*.

Fig. 4.1 shows the results of an investigation into the effect of temperature between 0 °C and 100 °C, on the activity of each enzyme.

- **L** represents the lowest temperature at which activity of each enzyme was detected.
- **H** represents the highest temperature at which activity of each enzyme was detected.

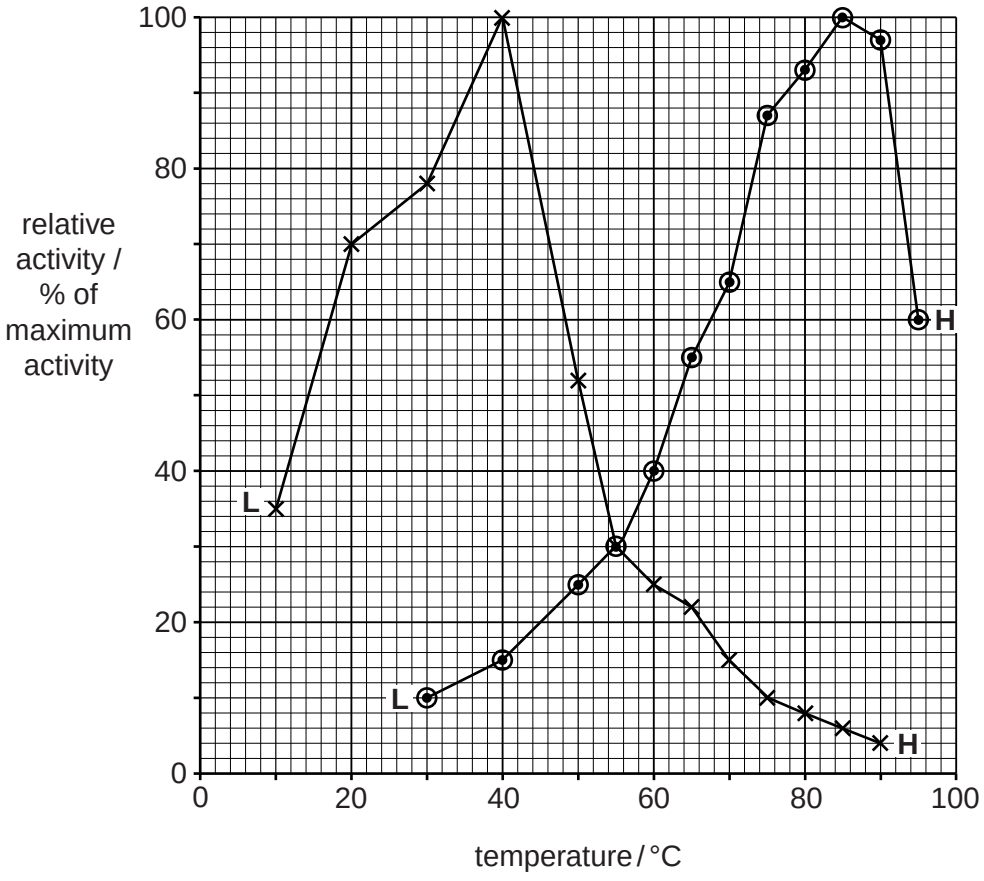

Fig. 4.1

(i) With reference to Fig. 4.1, describe the **differences** in the results for the two enzymes, **A** and **T**.

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.....[4]

(ii) Both enzyme **A** and enzyme **T** act on cellobiose. They have a similar, but not identical, primary structure.

Suggest how similarities **and** differences in the primary structure of the two enzymes could help to explain the results obtained in the investigation.

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[Total: 10]

6 Fig. 1.1 is a drawing made from an electron micrograph of a mammalian liver cell.

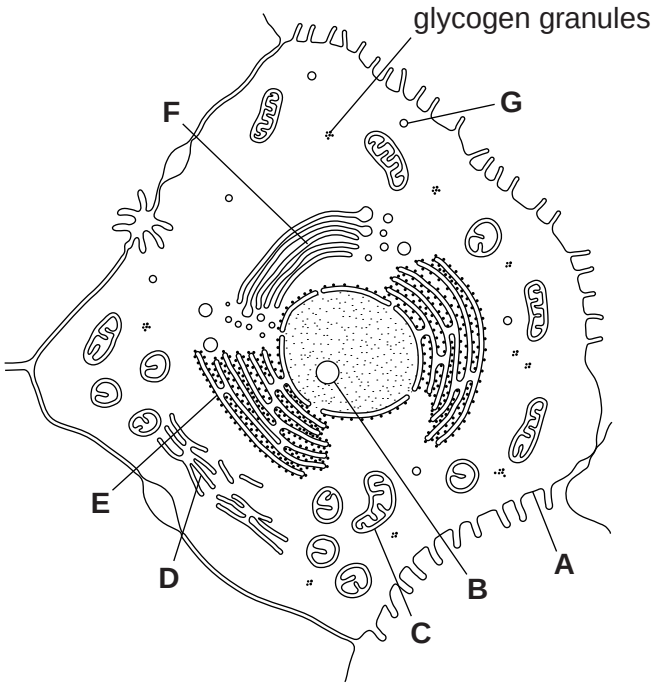

Fig. 1.1

(a) Complete the table by naming the structures **B** to **G** and stating **one** function of each. The first one (**A**) has been completed for you.

	name of organelle	**function**
A	cell surface membrane	controls movement of substances into and out of the cell
B		
C		
D		
E		
F		
G		

[6]

(b) As shown in Fig. 1.1, liver cells contain many storage granules of glycogen.

Describe the molecular structure of glycogen **and** explain how this structure makes it suitable for storage.

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.....[4]

[Total: 10]

7 Fig. 1.1 is a labelled diagram of a leaf palisade mesophyll cell, as seen with a high quality light microscope.

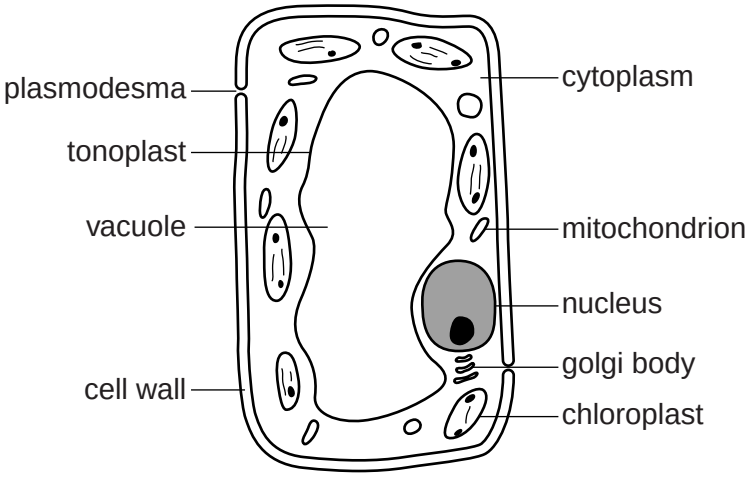

Fig. 1.1

An electron micrograph of the same leaf mesophyll cell at the **same magnification** would show more detail than is shown in Fig. 1.1.

(a) Explain why, at the **same magnification**, an electron micrograph is able to provide more detail than a light micrograph.

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..... [2]

(b) **Describe** three additional features that could be seen on an electron micrograph of the leaf mesophyll cell that are not seen in Fig. 1.1.

1. .....

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2. .....

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3. .....

..... [3]

(c) The length of the labelled chloroplast in Fig. 1.1 is 5.0 μm. Calculate the magnification of the cell shown in Fig. 1.1.

Show your working.

magnification × ..... [2]

(d) In Fig. 1.1, starch granules are visible within the chloroplasts. Starch is the most common storage compound of plants. It is composed of amylopectin and amylose.

(i) Describe the structural differences between amylopectin and amylose.

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..... [2]

(ii) State **one** role of magnesium ions within chloroplasts.

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..... [1]

[Total: 10]