Carbohydrates and Lipids

Question Paper 1

Level	International A Level
Subject	Biology
Exam Board	CIE
Topic	Biological Molecules
Sub Topic	Carbohydrates and Lipids
Booklet	Theory
Paper Type	Question Paper 1

Time Allowed : **42 minutes**

Score : **/ 35**

Percentage : **/100**

Grade Boundaries:

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

1 Fig. 5.1 shows a diagram of the molecular structures of tristearin (a triglyceride) and phosphatidylcholine (a phospholipid).

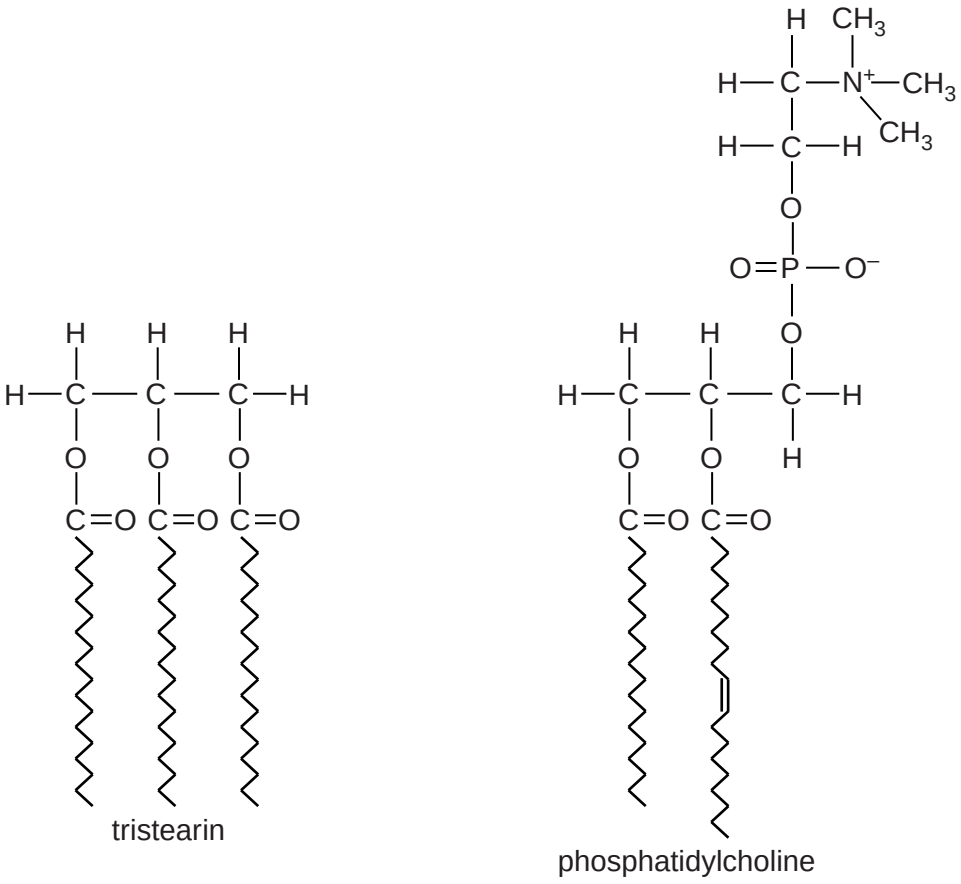

Fig. 5.1

(a) Table 5.1 shows a structural difference between the two molecules shown in Fig. 5.1.

Complete Table 5.1 with two further structural differences **other than** in numbers of different types of atoms.

Table 5.1

structural feature	tristearin	phosphatidylcholine
length of fatty acid chains	all the same length	different lengths

[2]

(b) Cells in the pancreas secrete enzymes, such as amylase and trypsin, into a duct.

The enzymes are packaged in vesicles so that they can be exported from these cells as shown in Fig. 5.2.

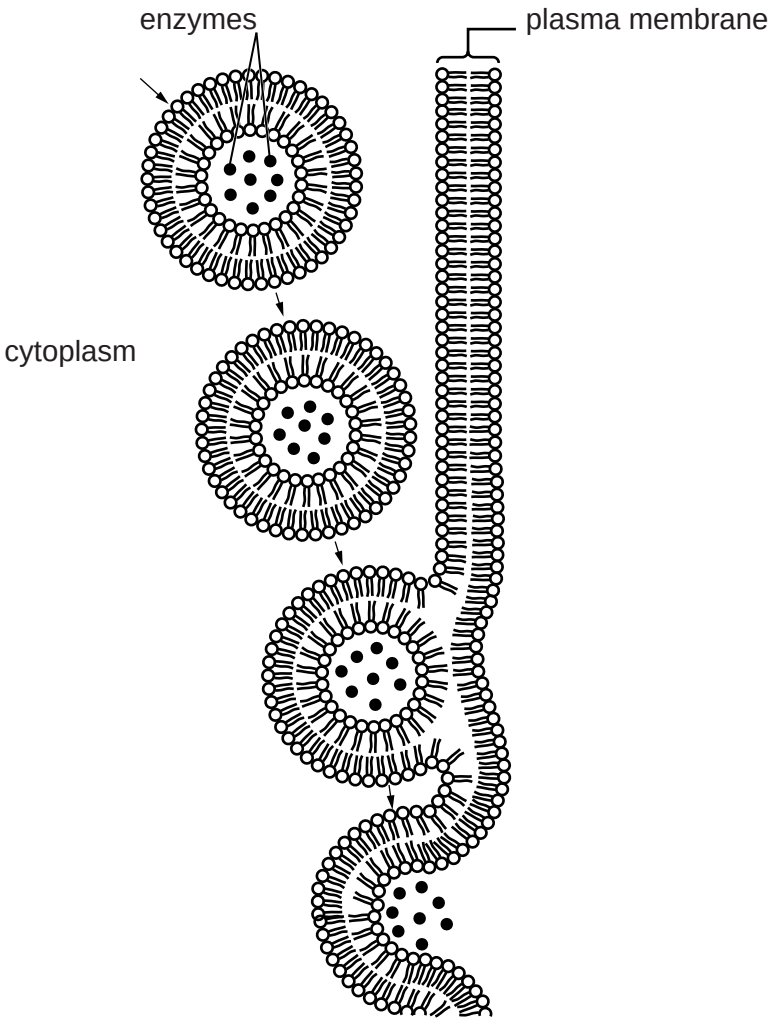

Fig. 5.2

With reference to Fig. 5.2, explain how enzymes that are secreted by cells in the pancreas are packaged into vesicles and exported.

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.....[4]

(c) Water has many significant roles to play in cells and living organisms.

Complete Table 5.2 below by stating the property of water that allows each of the following to take place.

Table 5.2

role of water	property of water
solvent for glucose and ions	
movement in xylem	
helps to decrease body temperature in mammals	

[3]

[Total: 9]

2 Starch is composed of two polysaccharides, amylose and amylopectin.

Fig. 3.1 shows a molecule of α-glucose before being added to the end of a molecule of amylose.

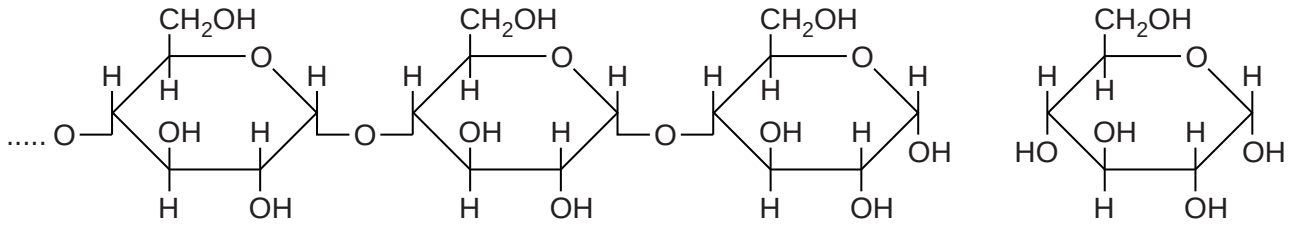

Fig. 3.1

(a) **(i)** Complete Fig. 3.1 to show how a molecule of α-glucose is added to the amylose. [3]

(ii) Name the bond that forms between glucose molecules in polysaccharides, such as amylose.

.....[1]

(b) Glycogen and cellulose are two other polysaccharides.

Complete Table 3.1 to compare glycogen and cellulose with amylose.

Table 3.1

feature	amylose	glycogen	cellulose
monomer	α-glucose		
branched or unbranched molecule	unbranched		
role in organisms	energy storage		

[3]

(c) Type 2 diabetes (insulin-independent diabetes) is a non-infectious disease.

If not treated, this disease is characterised by large fluctuations in the concentration of glucose in the blood.

Maltase is an enzyme that completes the digestion of starch in humans. Molecules of maltase are bound to the microvilli of epithelial cells in the small intestine.

Ascorbase is a drug used in the treatment of type 2 diabetes. Molecules of ascorbase have a very similar shape to that of the substrate for maltase.

(i) Explain how ascorbase acts to inhibit these membrane-bound enzymes.

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..... [3]

(ii) Suggest why ascorbase can be used to treat people who have type 2 diabetes.

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..... [2]

[Total: 12]

3 Polysaccharides are synthesised by condensation reactions between monosaccharide or disaccharide subunits (monomers).

(a) Name the type of bond formed when polysaccharides are synthesised.

..... [1]

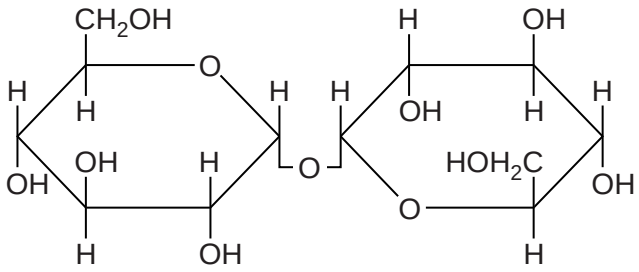
(b) Disaccharides are formed following synthesis from monosaccharides or as a result of polysaccharide hydrolysis.

Cellobiose, maltose, sucrose and trehalose are four different disaccharides found in nature. Fig. 4.1 shows the molecular structure of these disaccharides.

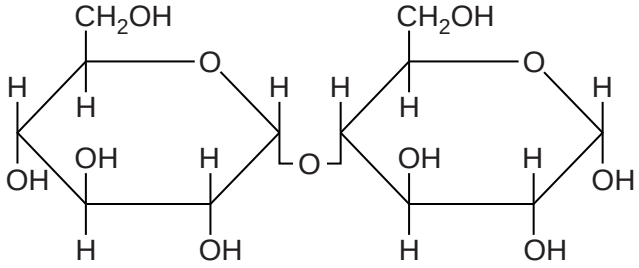
Identify the disaccharides, labelled **A** to **D**, using the information below.

- The disaccharide cellobiose is formed from the hydrolysis of the polysaccharide cellulose.
- When cellobiose is hydrolysed, two **β-glucose** molecules are produced.
- One of the disaccharides is sucrose.
- Trehalose is a disaccharide that is synthesised from two **α-glucose** molecules.
- The disaccharide maltose is formed from the hydrolysis of amylose, a component of starch.

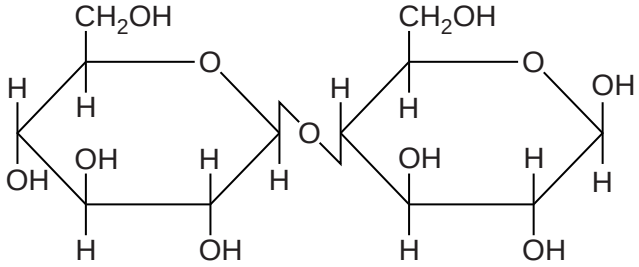
Write the name of the disaccharides in the spaces provided on Fig. 4.1.



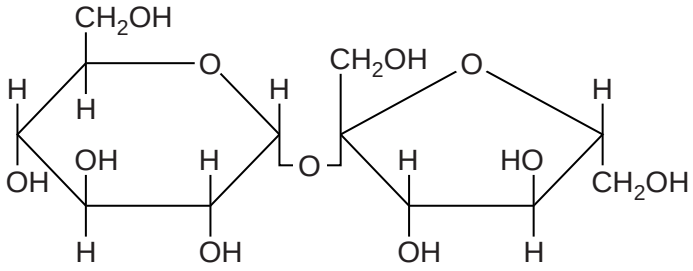
A .....



B .....



C .....



D .....

[3]

Fig. 4.1

In some organisms, trehalose is used as an energy store and gives protection against the harmful effects of very low temperatures. Trehalose is sometimes referred to as a cryoprotectant, allowing organisms to survive in freezing conditions.

Freezing temperatures can damage the cell surface membrane and membranes within the cell.

(c) Explain the importance of the cell surface membrane to cells.

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..... [3]

(d) Freezing temperatures can also completely stop enzyme activity by causing the molecules to undergo 'cold denaturation'. Enzyme activity is not recovered when temperatures are increased to a normal working temperature range.

(i) Explain the mode of action of enzymes.

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..... [3]

(ii) Suggest how the molecular structure of the enzyme changes during 'cold denaturation'.

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..... [2]

(e) Cryoprotectants, such as trehalose, are of particular interest in their application to preserving cells, tissues or organisms for future use.

An investigation was carried out to find the protective effect given by different concentrations of two cryoprotectants, trehalose and glycerol, on a respiratory enzyme.

The enzyme was subjected to a freezing temperature and then returned to its optimum temperature. The activity of the enzyme was measured at its optimum temperature.

Fig. 4.2 is a graph showing the results of the investigation.

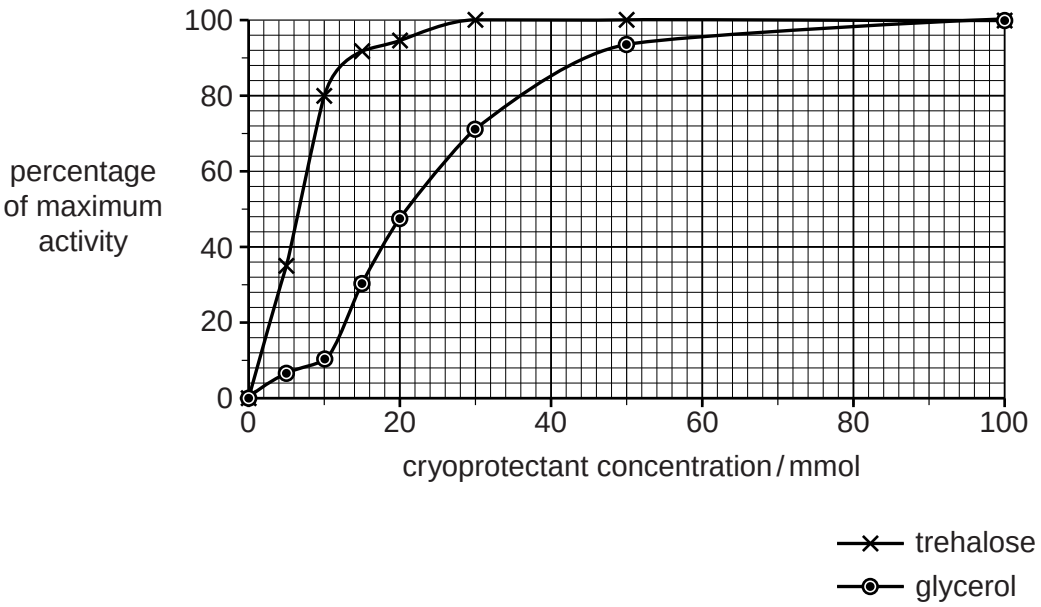

Fig. 4.2

With reference to Fig. 4.2, **describe** the results of the investigation.

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..... [4]

[Total: 16]

4 Fig. 5.1 shows five different biological molecules.

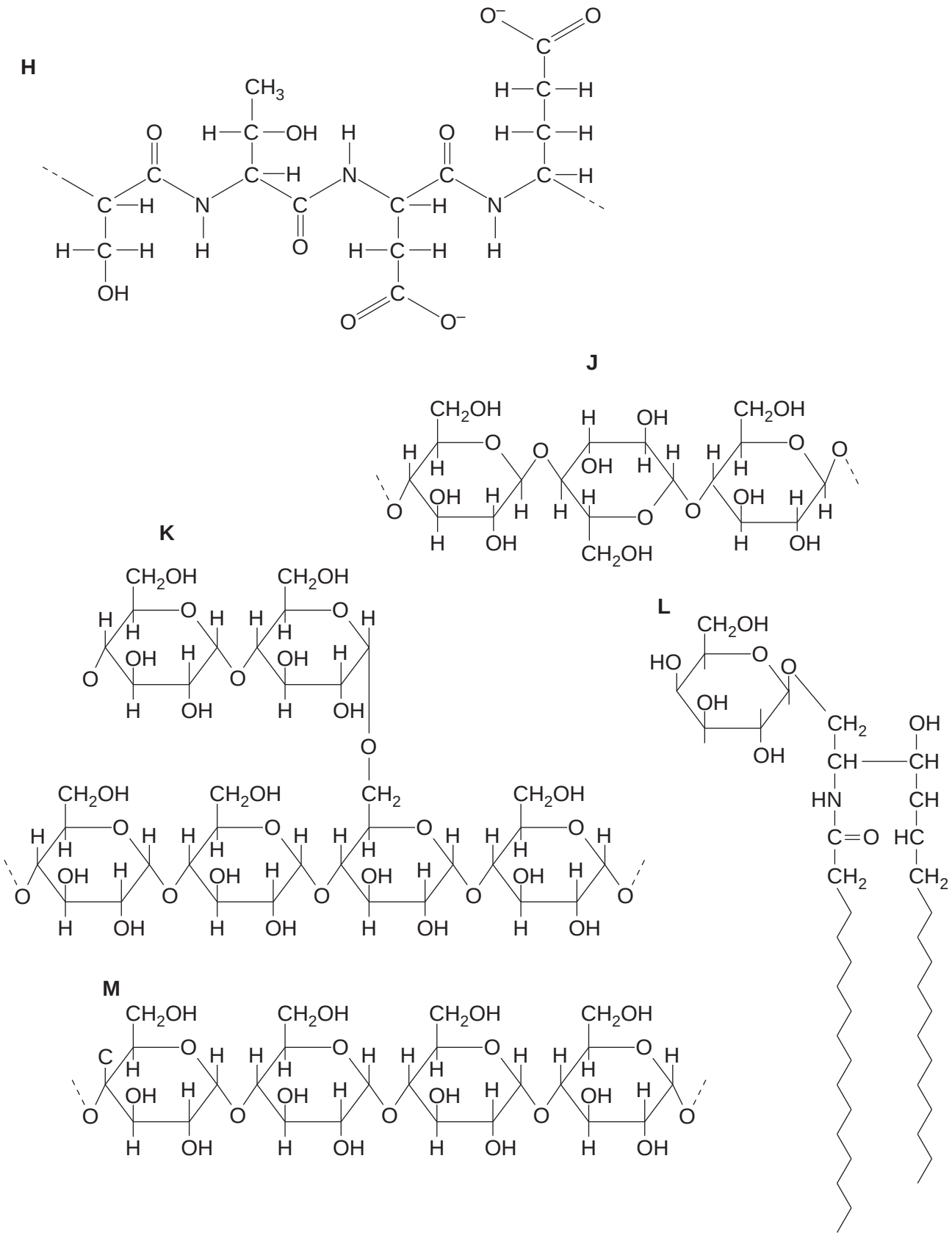

Fig. 5.1

Complete Table 5.1 by indicating which molecule matches each statement.

You may use each letter (**H** to **M**) once, more than once or not at all.

You should write only one letter in each box.

Table 5.1

statement	letter
contains peptide bonds	
part of the molecule forms the hydrophobic part of cell membranes	
contains 1-4 and 1-6 glycosidic bonds	
forms the primary structure of a protein	
used for energy storage in plants	
forms a helical structure	
the sub-unit molecule is β-glucose	

[Total: 7]