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BIOLOGY

FOUNDATIONS IN BIOLOGY

Level & Board	OCR (A-LEVEL)
TOPIC:	BIOLOGICAL MOLECULES - CARBOHYDRATES
PAPER TYPE:	QUESTION PAPER - 2
TOTAL QUESTIONS	8
TOTAL MARKS	/33

Biological Molecules – Carbohydrates - 2

1.

The ability to convert monosaccharides into polysaccharides and back again is necessary for many multicellular organisms. Glycogen is a highly branched polymer that mammals produce from the monosaccharide glucose. Liver cells store glycogen.

(a) Why do mammals store glycogen rather than glucose? **(3)**

2.

The disaccharide lactose, present in milk, is seen in Figure 20.

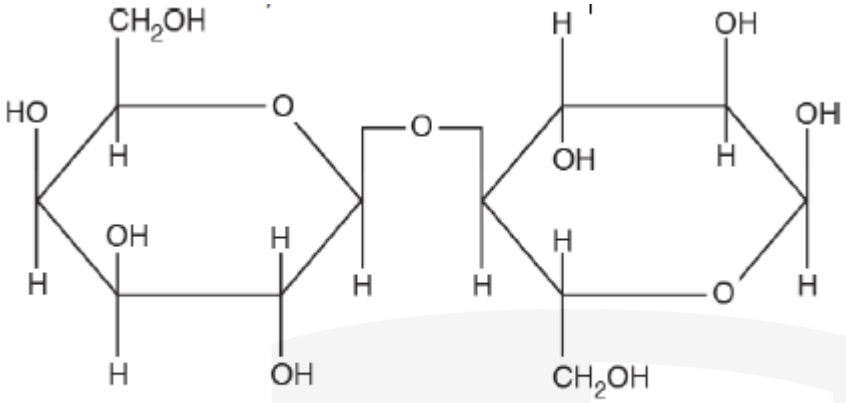


Fig. 20

Maltose is an additional disaccharide. The number of atoms of the elements C, H, and O is the same in maltose and lactose.

(a) Name two further structural parallels between maltose and lactose. **(2)**

(b) Fill in the following table to find out how the structures of lactose and maltose differ from one another. For you, the first one is finished. **(3)**

Lactose	Maltose
one glucose monomer and one galactose monomer	both monomers are glucose

3.

Galactose is one of the lactose monomers. Glucose is typically used by the bacteria E. coli as a respiratory substrate. By converting lactose to glucose and galactose and then using both of these substrates as respiratory substrates, E. coli can, in some situations, use galactose as a respiratory substrate.

(a) Describe how galactose's structure makes it suitable for use as a respiratory substrate. **(3)**

(b) E. Coli often develops in environments with low extracellular lactose concentrations. Under these circumstances, lactose finds it difficult to get through the bacterial cell membrane. Explain and provide evidence for the reason lactose cannot cross membranes. **(2)**

(c) A protein is necessary for lactose to enter E. coli's cytoplasm. Compared to E. coli found in the digestive systems of elderly mammals, this protein is more likely to be present in the digestive systems of young mammals. Provide a rationale for this observation. **(2)**

4.

Cellulose makes up the walls of plant cells. β-glucose polymerizes to form cellulose.

(a) Name three characteristics of cellulose that make it a good choice for the building blocks of plant cell walls. **(3)**

5.

Insects have a polymer called chitin. Their bodies' hard outer layer is formed by it.

The chemical structure of chitin is seen in Fig. 19.2.

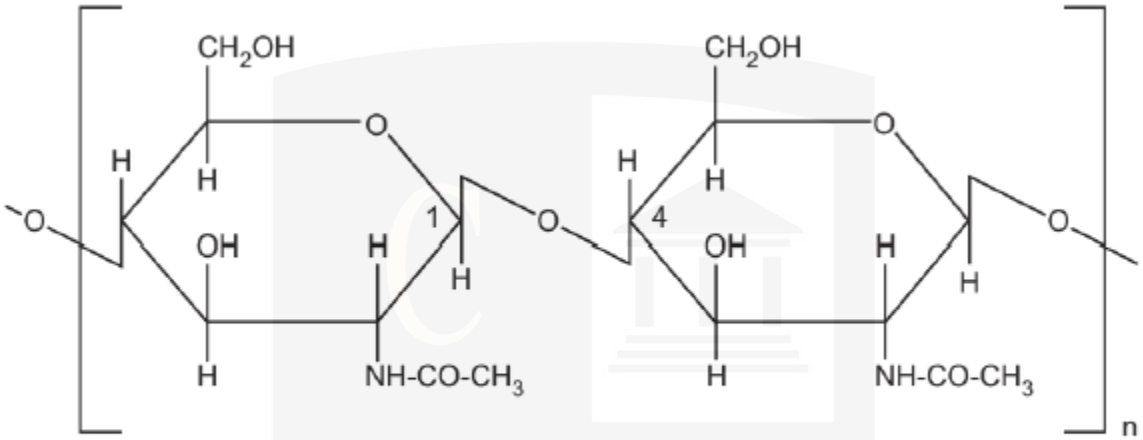


Fig. 19.2

(a) Using information from Fig. 19.2, state two similarities and two differences between the structures of chitin and glycogen. **(4)**

6.

This section contains information regarding carbs.

• Glycogen and starch are polysaccharides, and glucose is one of their monomers.

• The circulatory system in animals carries glucose, which is a vital source of energy.

> Many animals contain the energy-storing chemical glycogen.

• Many plants contain the energy-storing chemical known as starch.

One of the two polysaccharides that make up the molecular structure of starch is amylopectin.

(a) Name one characteristic of glucose that makes it simple for animals to carry. **(2)**

(b) Describe how the differences in structure between glycogen and amylopectin enable glycogen to function better in animals as an energy storage. **(3)**

Fig. 1.1 depicts the beta glucose molecule's structural structure.

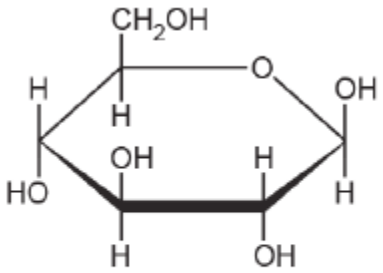


Fig. 1.1

(c) Explain how alpha glucose's structure differs from the molecule depicted in Figure 1.1. (2)

7.

The beginning of the ribose ring structure is depicted in Fig. 1.2.

(a) Fill in the diagram to indicate where the carbon atoms are located. The −H and −OH groups do not need to be included. **(2)**

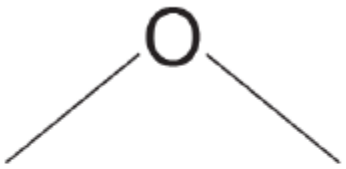
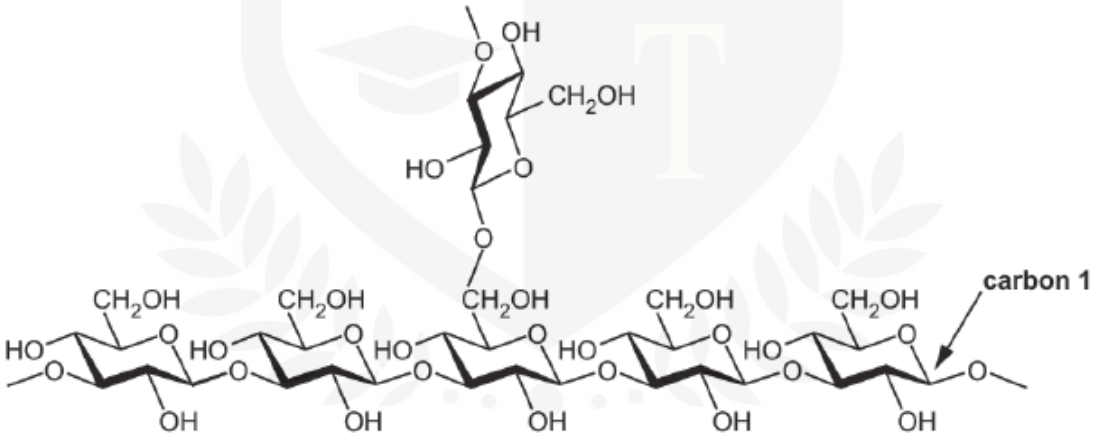


Fig. 1.2

8.

Plants create a carbohydrate called cellulose. β-glucose monomers are converted into cellulose. A slice of cellulose is depicted in the figure below.



(a) What structural variations exist between cellulose and callose? **(2)**

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