

**A Level Biology A**  
**H420/02 Biological Diversity**

**Question Set 5**

1 (a) (i) Fig. 20 shows the disaccharide lactose, which is found in milk.

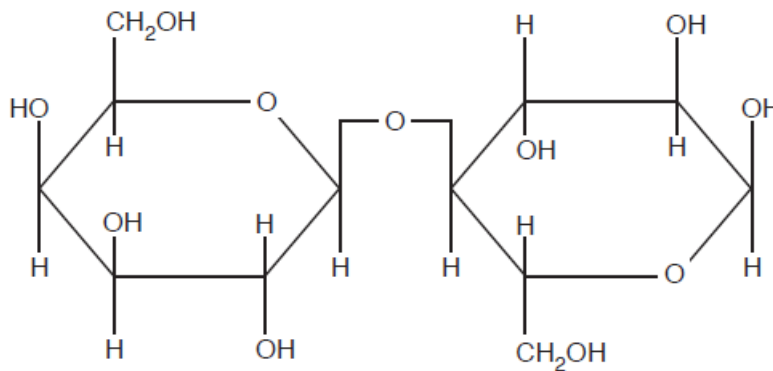


Fig. 20

Another disaccharide is maltose. Maltose and lactose both contain the same number of atoms of each element, C, H and O.

State two **other** structural similarities between lactose and maltose.

Both are hexoses  
Both have CH<sub>2</sub>OH group

[2]

(ii) Complete the table below to identify differences between the structures of lactose and maltose. The first one has been completed for you.

Lactose	Maltose
one glucose monomer and one galactose monomer	both monomers are glucose
contains $\beta$ -glucose	contains $\alpha$ -glucose
$\beta$ -glycosidic bond	$\alpha$ -glycosidic bond
sugars are in opposing orientation (flipped)	both monomers are in same direction

[3]

(b) (i) One of the monomers of lactose is galactose.

The bacterium *E. coli* usually uses glucose as a respiratory substrate.

Under certain circumstances, *E. coli* is able to use galactose as a respiratory substrate by breaking down lactose into glucose and galactose and then using both glucose and galactose as respiratory substrates.

Explain how the structure of galactose allows it to be used as a respiratory substrate.

[3]

The bonds contain energy thus when the bond is broken down by respiratory enzymes via glycolysis, it releases energy in forms of ATP. ATP molecules are soluble so they can move within cell.

- (ii) *E. coli* usually grows in conditions where the extracellular concentration of lactose is low. In such conditions lactose does not easily cross the bacterial cell surface membrane.

Suggest and explain why lactose is unable to cross membranes.

**It may be too big to pass between phospholipids.**

[2]

- (iii) In order for lactose to enter the cytoplasm of *E. coli* a protein is required.

The *E. coli* living in the digestive system of young mammals are more likely to contain this protein than *E. coli* living in the digestive system of old mammals.

Suggest an explanation for this observation.

**mammal diet is high in milk so lactose concentration is high. Thus lac Y is switched on / expressed. Lactose permease are formed.**

[2]

- (c) Lactose is a reducing sugar.

Benedict's reagent can be used to detect the presence of lactose in a solution. A colorimeter can be used to measure the concentration of lactose.

The colorimeter first needs to be calibrated.

Describe how a method that uses Benedict's reagent and a colorimeter could be calibrated to measure the concentration of lactose in an unknown sample.

[4]

**calibrate to zero on the colorimeter using a cuvette with distilled water. Use a red filter and set of known concentrations of lactose. These are formed by doing serial dilutions. Record the % of transmission. Plot concentration against % transmission. Test the unknown sample the same way. Read from the calibration curve to determine the unknown concentration.**

**Total Marks for Question Set 5: 13**

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