

**Biological Molecules – 2021/20 GCE AS Biology A****1. Nov/2021/Paper\_H020/2/No.1**

The information below is about carbohydrates.

- Glucose is a monomer of polysaccharides such as glycogen and starch.
- Glucose is an important source of energy in animals and is transported in the circulatory system.
- Glycogen is an energy storage molecule found in many animals.
- Starch is an energy storage molecule found in many plants.
- Amylopectin is one of the two polysaccharides that constitute the molecular structure of starch.

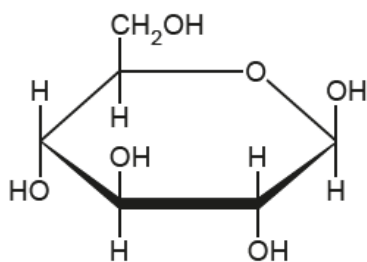
(a) (i) State **one** property of glucose that allows it to be easily transported in animals.

..... [1]

(ii) Explain how the structure of glycogen differs from that of amylopectin to make it better suited as an energy store in animals.

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 .....  
 .....  
 .....  
 .....  
 .....  
 .....  
 ..... [3]

(iii) Fig. 1.1 shows the molecular structure of beta glucose.



**Fig. 1.1**

Describe how the structure of alpha glucose would be different from the molecule shown in Fig. 1.1.

.....  
 ..... [1]

(b) Fig. 1.2 shows the start of the ring structure of ribose.

Complete the diagram to show the position of the carbon atoms. There is no need to include the  $\text{-H}$  and  $\text{-OH}$  groups. [1]

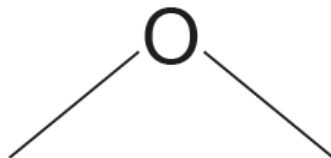


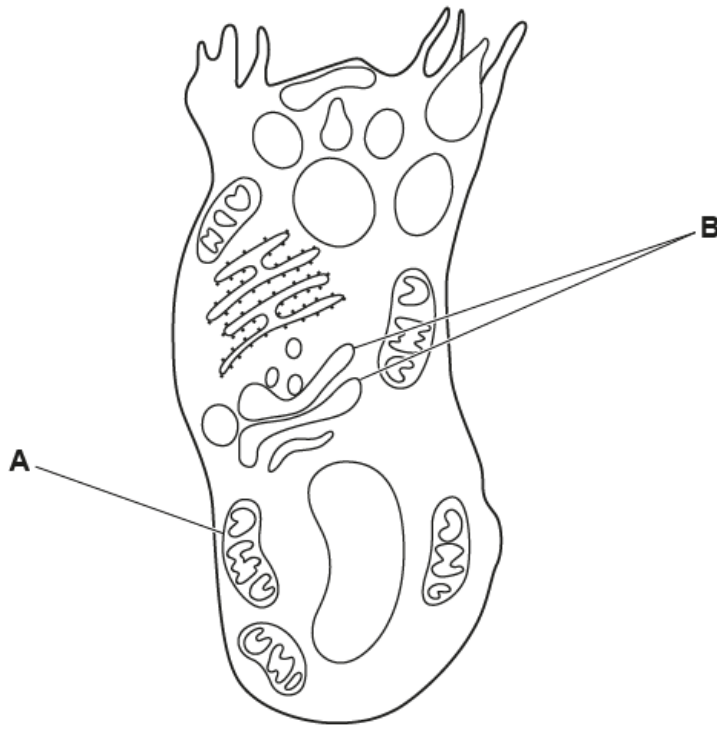
Fig. 1.2

2. Nov/2020/Paper\_H020/2/No.2

- (a) Mucus is composed of water, carbohydrates, proteins and triglycerides.

Mucus is secreted by goblet cells.

Below is a diagram of a goblet cell as seen under an electron microscope.



- (i) Suggest why goblet cells have large numbers of the cellular component labelled **A**.

.....  
 ..... [1]

- (ii) Suggest how the role of the cellular component labelled **B** is relevant to the function of the goblet cell.

.....  
 .....  
 .....  
 .....  
 ..... [2]

- (b) (i) Mucus is present in goblet cells as condensed granules.

Some studies reveal that when secreted, the mucus expands to 500 times its volume in 20 ms.

40 cm<sup>3</sup> of mucus is held in condensed granules.

Calculate the volume of mucus in these granules **one** second after secretion, assuming a constant rate of expansion.

volume of mucus = ..... cm<sup>3</sup> [2]

- (ii) Sjogren's syndrome is a rare condition that can reduce the production of mucus.

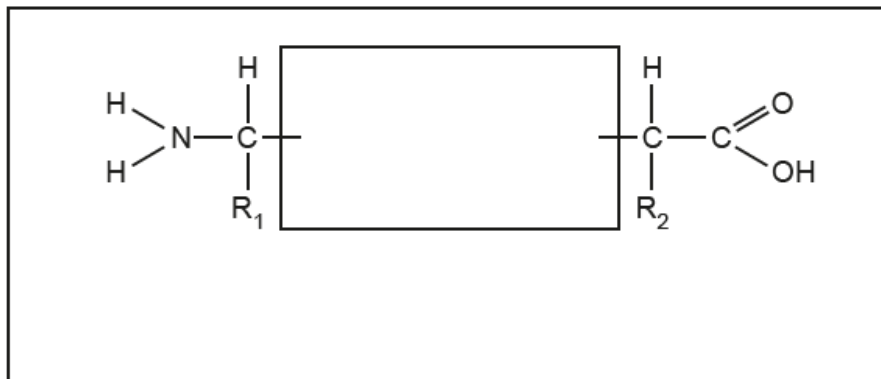
Suggest how the upper respiratory tract of a person with Sjogren's syndrome might be affected.

.....  
.....  
..... [1]

- (c) (i) A protein is made up of amino acids which are joined by chemical bonds.

Below is an incomplete diagram of one of these bonds.

Complete the diagram of the molecular structure of these two amino acids to show how they are joined together **and** name the bond you have drawn.



Name of bond .....

[2]

- (ii) The process of esterification leads to the formation of ester bonds during the production of triglycerides.

Describe what is meant by the term esterification.

.....  
 .....  
 .....  
 .....  
 ..... [2]

(d) Sjogren's syndrome is an autoimmune condition.

- Family members of Sjogren's syndrome sufferers can often have other autoimmune diseases such as Lupus
  - Lupus affects approximately 1 in 1350 of the world's population
  - In 2018 the world population was estimated at  $7.7 \times 10^9$
  - The world population is estimated to increase by 1.11% a year
  - Around 60% of Lupus sufferers are photosensitive, meaning their symptoms can be triggered by going out in direct sunlight.
- (i) Using the information provided, calculate how many of the world's Lupus sufferers by the end of 2019 would be photosensitive.

number of photosensitive Lupus sufferers = ..... [2]

- (ii) Lupus symptoms include pain in joints, inflammation, fatigue, fever and a skin rash.

Suggest what component of sunlight causes photosensitivity and which symptom is likely to be more common in photosensitive sufferers.

Component of sunlight .....

Symptom .....

[1]

- (iii) Explain what is meant by an autoimmune disease **and** suggest why members of the same family can be sufferers of autoimmune diseases.

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..... [2]