**1** Triglycerides, amylose and glycogen are used to store energy in many living organisms.

(a) Triglycerides contain fatty acids. Fatty acids are classified as saturated or unsaturated.

The formula for a saturated fatty acid is $C_nH_{2n}O_2$

The formula for an unsaturated fatty acid, with one double bond, is $C_nH_{(2n-2)}O_2$

The table below shows the melting points of some common fatty acids.

| Fatty acid | Formula of fatty acid | Melting point / °C |
|---|---|---|
| **P** | $C_{16}H_{30}O_2$ | –11.0 |
| **Q** | $C_{18}H_{34}O_2$ | 13.4 |
| **R** | $C_{20}H_{40}O_2$ | 76.5 |
| **S** | $C_{24}H_{48}O_2$ | 86.0 |

For each of the statements below, put a cross ☒ in the box that corresponds to the correct statement.

(i) The saturated fatty acid(s) in the table

**(1)**

☒ **A** are P and Q

☒ **B** are R and S

☒ **C** is P only

☒ **D** is Q only

(ii) The fatty acid(s) liquid at 5 °C

**(1)**

☒ **A** are P and R

☒ **B** are Q and S

☒ **C** is P only

☒ **D** is Q only

(b) Use a labelled diagram to show how a triglyceride is formed.

**(3)**

(c) Amylose and glycogen are polysaccharides.

(i) Name the type of chemical reaction that joins monosaccharides together to form an amylose molecule.

**(1)**

(ii) Name the chemical bond that is formed between the monosaccharides in an amylose molecule.

**(1)**

(iii) Describe **one** structural difference between amylose and glycogen.

**(1)**

(iv) Explain **two** ways in which the structures of amylose and glycogen make them suitable for energy storage.

**(2)**

1 .....

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2 .....

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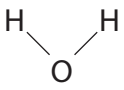
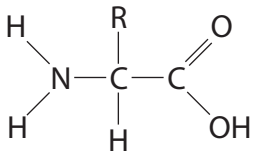
**(Total for Question 1 = 10 marks)**

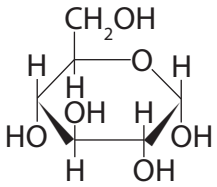
**2** The diagram below shows four molecules, P, Q, R and S, found in living organisms.



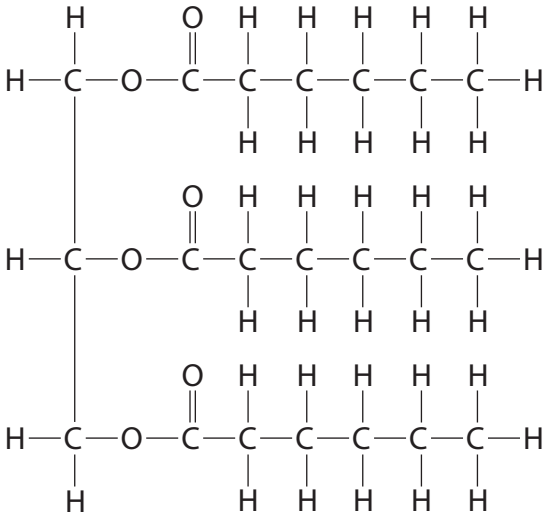
**P**



**Q**



**R**



**S**

(a) Place a cross ☒ in the box to complete each of the following statements.

(i) Two molecules of **P** can be joined together by

**(1)**

☒ **A** a hydrogen bond

☒ **B** a hydrophobic interaction

☒ **C** an ionic bond

☒ **D** a peptide bond

(ii) A condensation reaction between two molecules of **Q** forms

**(1)**

☒ **A** an ester bond

☒ **B** a glycosidic bond

☒ **C** a hydrogen bond

☒ **D** a peptide bond

(iii) Molecule **R** is

**(1)**

- ☒ **A** a fatty acid
- ☒ **B** an amino acid
- ☒ **C** deoxyribose
- ☒ **D** glucose

(iv) One of the products of the hydrolysis of molecule **S** is

**(1)**

- ☒ **A** a triglyceride
- ☒ **B** an amino acid
- ☒ **C** glycerol
- ☒ **D** water

(b) Name **one** element found in all molecules of **Q** that would not be found in carbohydrates.

**(1)**

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(c) Draw a diagram to show the molecules produced when **two** molecules of **R** join together during a condensation reaction.

**(3)**

(d) Explain how the dipolar nature of water is essential for living organisms.

**(2)**

**(Total for Question 2 = 10 marks)**

**3** Enzymes act as biological catalysts.

Amylase is an enzyme present in saliva that catalyses the hydrolysis of starch into maltose.

*(a) Describe the structure of starch.

**(5)**

(b) Explain the meaning of the following terms.

(i) Catalyst

**(2)**

(ii) Hydrolysis

**(2)**

(c) Bread contains a high proportion of starch. If bread is chewed for a long period of time it begins to taste sweet.

Suggest why bread tastes sweet after chewing for a long period of time.

**(1)**

**(Total for Question 3 = 10 marks)**

**4** Organisms can be classified into three domains: Archaea, Bacteria and Eukaryota. Fungi belong to the domain Eukaryota.

(a) (i) State **two** differences between the structure of cells of organisms belonging to the Eukaryota domain and those belonging to the Bacteria domain.

**(2)**

1 .....

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2 .....

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(ii) Name an organelle found in the cells of both eukaryotic and prokaryotic organisms.

**(1)**

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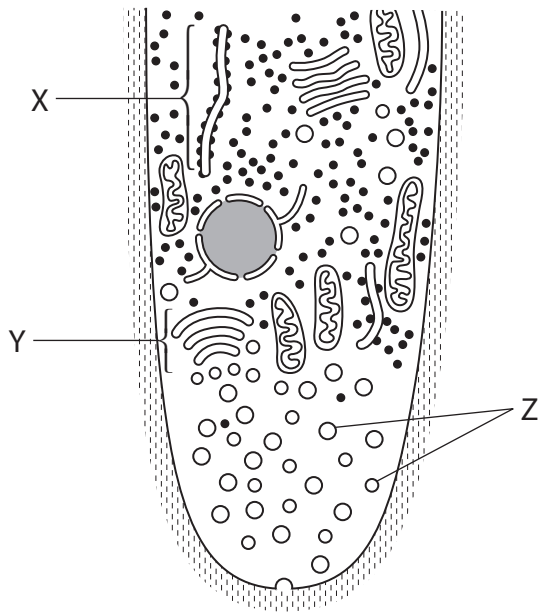
(b) Fungi have structures called hyphae that secrete enzymes used for the extracellular digestion of food.

The diagram below shows a growing tip of one fungal hypha containing vesicles, labelled Z. These vesicles contain digestive enzymes.



(i) Name the organelle labelled X on the diagram.

**(1)**

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(ii) Place a cross (☒) in the box next to the correct name of the organelle labelled Y on the diagram.

**(1)**

☒ **A** Golgi apparatus

☒ **B** mitochondrion

☒ **C** rough endoplasmic reticulum

☒ **D** smooth endoplasmic reticulum

*(iii) The organelles labelled X, Y and Z on the diagram are involved in the synthesis and secretion of digestive enzymes.

Describe the roles of these organelles in the synthesis and secretion of digestive enzymes.

**(4)**

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(c) Fungi produce different enzymes that can digest starch or cellulose.

Using your knowledge of the structure of starch and cellulose, suggest why it is necessary for fungi to produce different enzymes to digest these two substances.

**(4)**

**(Total for Question 4 = 13 marks)**