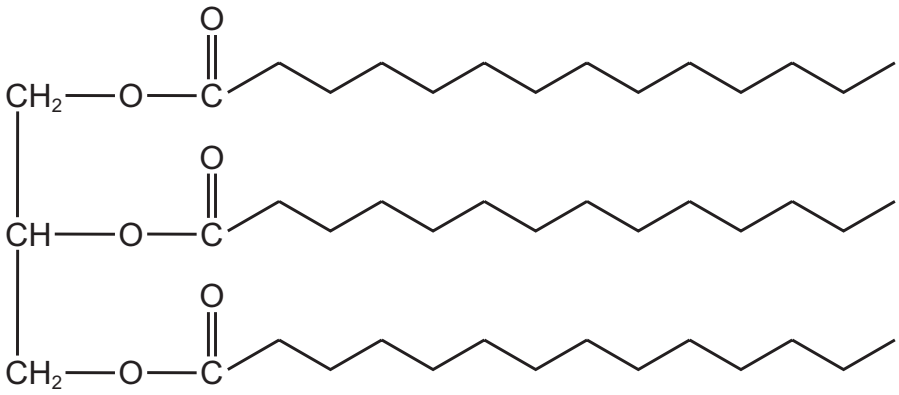
**8** The diagram shows a triglyceride molecule.



Which statement is correct for the structure and function of this triglyceride?

**A** The glycerol head forms hydrogen bonds with water in cytoplasm to produce oil droplets.

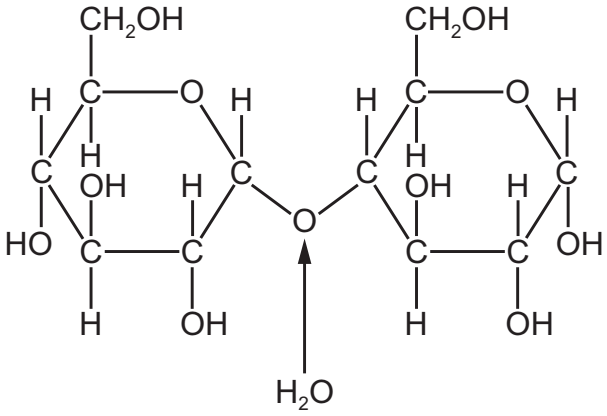
**B** The hydrophobic fatty acids allow only small molecules to pass through the cell surface membrane.

**C** It packs closely with identical triglyceride molecules to form energy reserves in lysosomes.

**D** It has long hydrocarbon chains that release high energy output per unit mass when oxidised.



**10** Which statement correctly explains the result when the two molecules shown in the diagram react together?



**A** A hydrolysis reaction is forming the disaccharide maltose.

**B** A reducing sugar is split into two monosaccharides by hydrolysis.

**C** Condensation of two $\alpha$-glucose molecules is taking place.

**D** A condensation reaction is forming two reducing sugars.

**12** What is a feature of triglyceride molecules?

**A** They are hydrophobic molecules.

**B** They are molecules with a single ester bond.

**C** They are polar molecules.

**D** They are water-soluble molecules.



**8** Which statement about monosaccharides and disaccharides is correct?

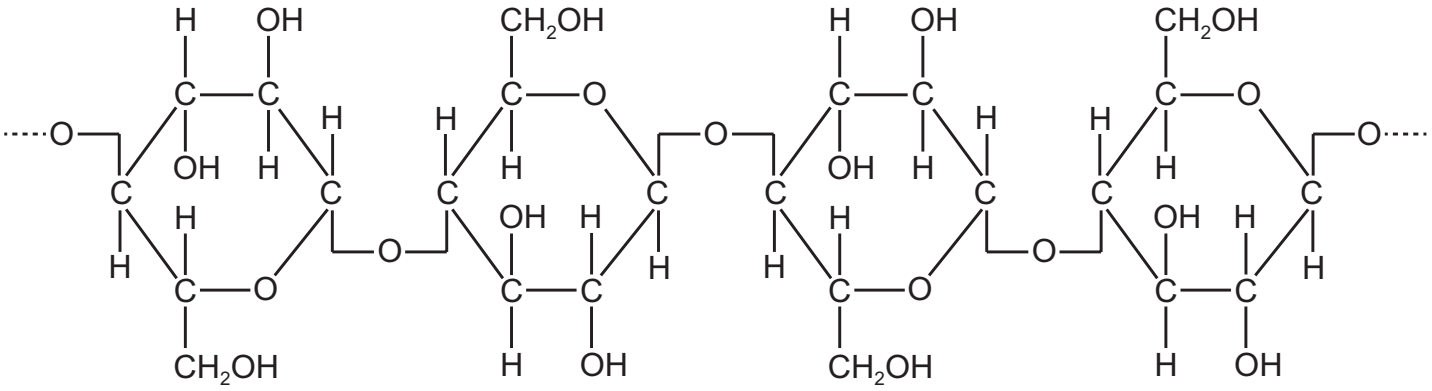
**A** Sucrose is a non-reducing disaccharide produced from two identical monosaccharides joined together by a condensation reaction.

**B** The hydrolysis of the reducing disaccharide maltose produces a reducing monosaccharide, and a non-reducing monosaccharide.

**C** Maltose is a non-reducing disaccharide that contains two identical reducing monosaccharides connected by a glycosidic bond.

**D** The addition of a water molecule to the glycosidic bond in a sucrose disaccharide produces two different reducing monosaccharides.

**10** The diagram shows a section of a polysaccharide.



Which statement about this polysaccharide is correct?

**A** It coils into a tight helix that provides a compact shape for energy storage in cells.

**B** It has high tensile strength when arranged into fibrils in plant cell walls.

**C** It folds into a globular shape that is soluble in water and easily transported.

**D** It combines with protein molecules to act as cell markers on the cell surface membrane.

**4** Fig. 4.1 is a photomicrograph of a copepod. These animals are found living in sea water and in fresh water environments.

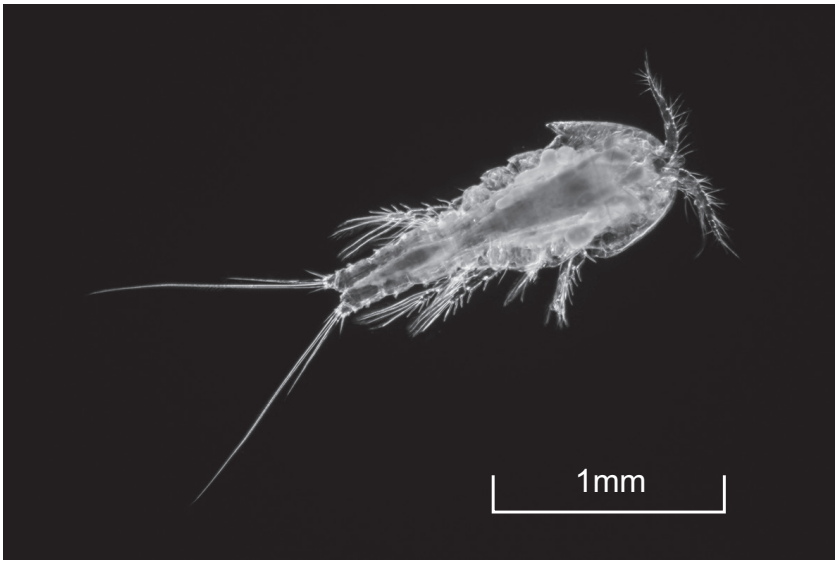



**Fig. 4.1**

**(a)** The outer surface of a copepod is covered in a layer of the polysaccharide chitin.

Fig. 4.2 shows part of a chitin molecule.

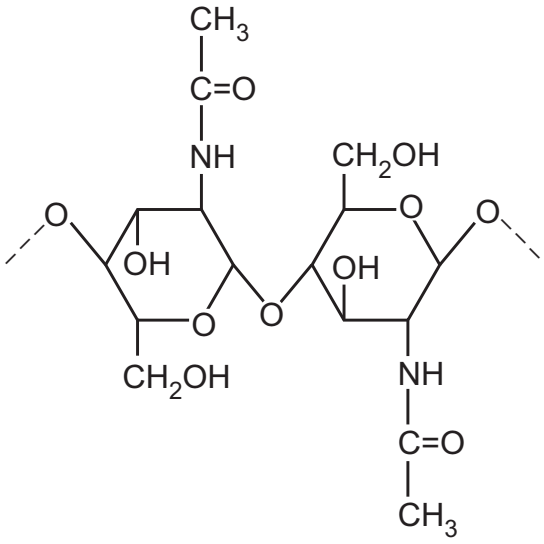



**Fig. 4.2**

**(i)** Draw a circle around a glycosidic bond in Fig. 4.2. [1]

**(ii)** In aquatic environments, *Vibrio cholerae* can live on the surface of copepods. *V. cholerae* secretes enzymes to hydrolyse chitin to its N-acetylglucosamine monomers. These can be broken down to provide carbon, nitrogen and a source of energy.

Draw the monomer that is formed when chitin is hydrolysed by *V. cholerae*.

[2]

**(b)** *V. cholerae* is a pathogen that causes cholera.

Scientists studied the transmission of *V. cholerae* in groups of people living in an area where there is a high number of cases of cholera.

Some families living in this area filtered their water through several layers of folded fabric from old clothing. The folded fabric traps particles and organisms larger than 20 μm.

The scientists recorded the number of cases of cholera in families that filtered their water through folded fabric and compared this to the number of cases of cholera recorded in families that did **not** filter their water through the folded fabric.

The results are shown in Fig. 4.3.

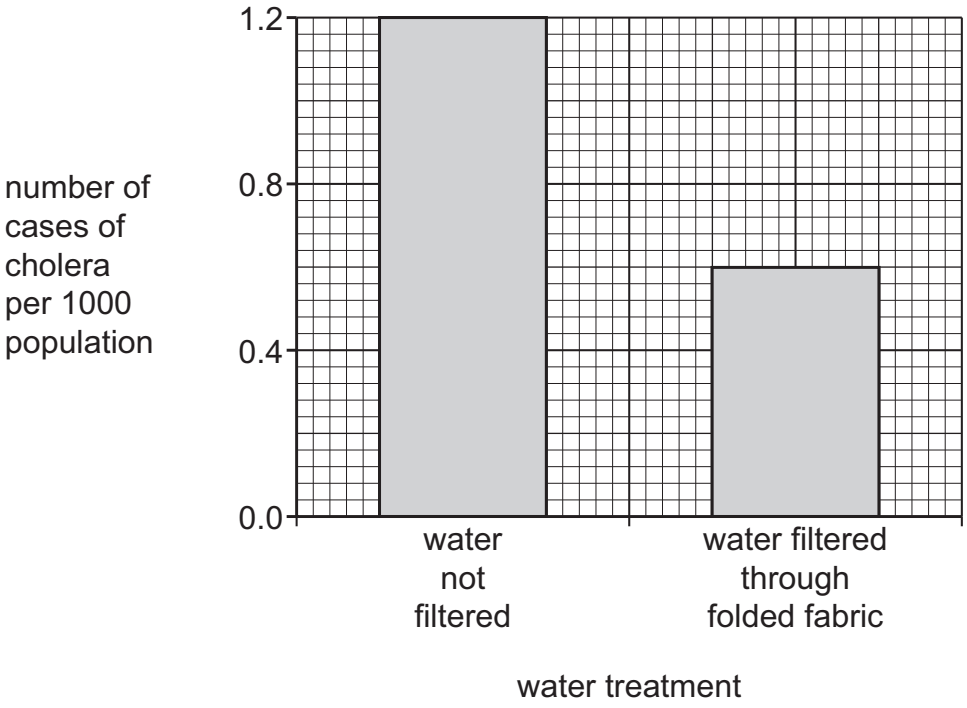



**Fig. 4.3**

Suggest possible explanations for the results shown in Fig. 4.3.

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[4]

**(c)** The World Health Organization (WHO) recommends the use of an oral cholera vaccine (OCV) to protect people living in an area where a cholera outbreak has occurred.

People who receive an OCV and make changes in their behaviour are less likely to have a serious case of cholera.

**(i)** Describe **one** change in behaviour that a person can make, **other** than purifying water, to help prevent a serious case of cholera.

.....

..... [1]

**(ii)** The antibiotic tetracycline is used to treat cholera. However, some bacteria that cause cholera have evolved resistance to this antibiotic.

Scientists have reported that resistant bacteria have an extra protein in their cell surface membrane. This protein has been found to use ATP.

Suggest how the presence of this protein in the cell surface membrane gives *V. cholerae* resistance to tetracycline.

.....

.....

..... [2]

**(iii)** For some vaccines, there may not be an effective secondary immune response when a person is infected by the specific pathogen. The antibodies that are produced do **not** act on the pathogen. This is known as immune evasion.

Evolution of resistance of bacteria to antibiotics occurs more frequently than immune evasion.

Suggest why bacteria evolve resistance to antibiotics more frequently than vaccines that lose their effectiveness in protecting against bacterial pathogens.

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..... [2]

[Total: 12]

**1** **(a)** A plant produces sugars in its leaves. The sugars produced are needed by other parts of the plant and are transported through the phloem as sucrose.

Sucrose is transported to the roots where it is stored as starch. Some of the sucrose is transported to the fruit of the plant where it is stored as fructose and glucose. Sucrose is also transported to the seeds of the plant.

Water and mineral ions are taken up through the roots where they are transported through the xylem to the rest of the plant.

Solutions were made to represent extracts of different tissues and fluids found in a plant:

- fluid in the phloem
- root tissue
- seed tissue
- fruit tissue
- fluid in the xylem

You are provided with **4** solutions, **S1**, **S2**, **S3** and **S4**.

You will:

- identify the biological molecules present in each of the 4 solutions
- suggest which solution, **S1**, **S2**, **S3** or **S4**, could represent each of the plant extracts.

You are provided with the materials shown in Table 1.1.

**Table 1.1**

| labelled | contents | hazard | volume / $cm^3$ |
|---|---|---|---|
| **A** | dilute hydrochloric acid | irritant | 20 |
| **H** | sodium hydrogencarbonate powder | low | - |
| **Benedict's** | Benedict's solution | harmful irritant | 40 |
| **Iodine** | iodine solution | irritant | 20 |
| **S1** | solution 1 | low | 60 |
| **S2** | solution 2 | low | 60 |
| **S3** | solution 3 | low | 60 |
| **S4** | solution 4 | low | 60 |

If any solution comes into contact with your skin, wash off immediately with cold water.

It is recommended that you wear suitable eye protection.

You will need to:

- carry out the test for reducing sugars
- carry out the test for non-reducing sugars
- carry out the test for starch
- identify the biological molecules in **S1**, **S2**, **S3** and **S4**.

**(i)** State the reagent or reagents that are used to test for reducing sugars **and** the colour or colours produced if reducing sugars are present.

reagent or reagents .....

colour or colours .....

Describe how you will carry out the test for reducing sugars.

.....

.....

.....

[1]

step 1 Label 4 test-tubes **S1**, **S2**, **S3** and **S4**.

step 2 Put 1 $cm^3$ of each solution into the appropriately labelled test-tube.

step 3 Carry out the test for reducing sugars on **S1**, **S2**, **S3** and **S4** described in **(a)(i)**.

step 4 Record the colours observed in **(a)(iii).**

**(ii)** State the reagent or reagents that are used to test for non-reducing sugars **and** the colour or colours produced if non-reducing sugars are present.

reagent or reagents .....

colour or colours .....

Describe how you will carry out the test for non-reducing sugars.

.....

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.....

.....



[2]

step 5 Label 4 clean test-tubes **S1**, **S2**, **S3** and **S4**.

step 6 Put 1 $cm^3$ of each solution into the appropriately labelled test-tube.

step 7 Carry out the test for non-reducing sugars on **S1**, **S2**, **S3** and **S4** described in **(a)(ii)**.

step 8 Record the colours observed in **(a)(iii)**.

step 9 Label 4 clean test-tubes **S1**, **S2**, **S3** and **S4**.

step 10 Put 1 $cm^3$ of each solution into the appropriately labelled test-tube.

step 11 Carry out the test for starch on **S1**, **S2**, **S3** and **S4**.

step 12 Record the colours observed in **(a)(iii)**.

**(iii)** Record your results in an appropriate table.

[5]

**(iv)** Complete Table 1.2 to suggest which solution (**S1**, **S2**, **S3** or **S4**) could represent each of the plant extracts.

Use your results in **(a)(iii)** and the information on plant transport given in **(a)**.

A solution could represent more than one plant extract.

**Table 1.2**

| plant extract | solution |
|---|---|
| fluid in the phloem | **S**... |
| root tissue | **S**... |
| seed tissue | **S**... |
| fruit tissue | **S**... |
| fluid in the xylem | **S**... |

[2]

**(v)** Protein could be present in some of the solutions.

Describe how you would identify which solutions contain protein.

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.....

.....

..... [2]

**(b)** A scientist investigated the effect of light on the concentration of sugars in a plant for 24 hours. The plant was kept in the dark for the first 8 hours and then exposed to light for the remaining 16 hours.

Samples were taken from the leaves and from the phloem sieve tubes. The concentration of sugars in each sample was measured.

The results are shown in Table 1.3.

**Table 1.3**

| time / hours | concentration of sugars / μmol | |
|---|---|---|
| | leaves | phloem sieve tubes |
| 0 | 0.38 | 0.22 |
| 5 | 0.21 | 0.17 |
| 8 | 0.13 | 0.11 |
| 15 | 0.24 | 0.16 |
| 24 | 0.39 | 0.22 |

**(i)** Plot a line graph of the data in Table 1.3 on the grid in Fig. 1.1.

Use a sharp pencil.

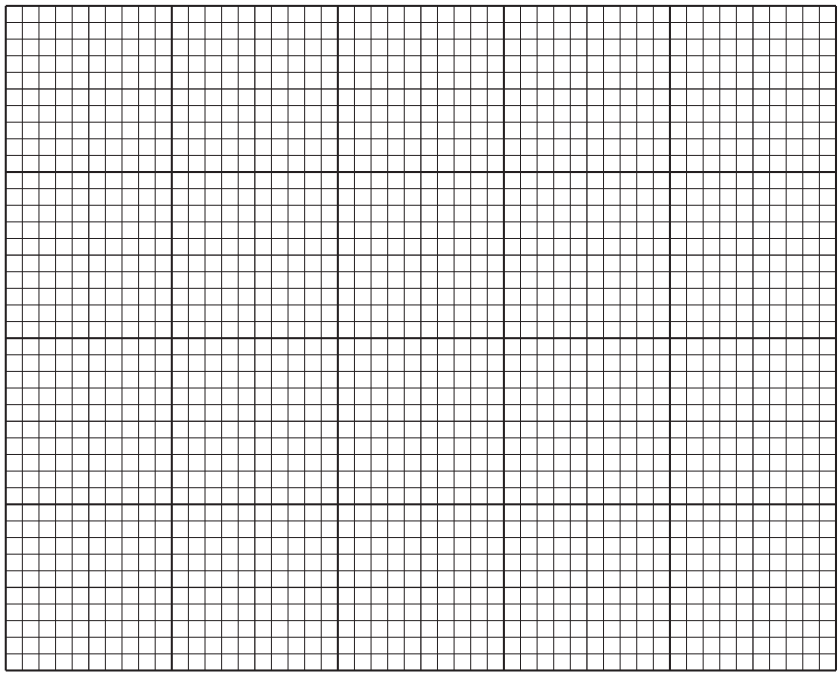

**Fig. 1.1**

[4]

**(ii)** Describe the trend for the concentration of sugars in the leaves and phloem sieve tubes shown in Fig. 1.1.

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.....

.....

..... [1]

**(iii)** Suggest an explanation for the trend in the data when the plant was in the dark and when the plant was in the light.

plant in the dark .....

.....

.....

plant in the light .....

.....

.....

[2]

**(iv)** Calculate the percentage increase in the concentration of sugars in the leaves between 15 and 20 hours.

Show your working.

percentage increase .....%

[2]

[Total: 21]