**Answer ALL questions. Write your answers in the spaces provided.**

**Some questions must be answered with a cross in a box ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.**

**1** The cell membrane controls which substances can enter and leave a cell.

The cell membrane is a phospholipid bilayer with proteins embedded in it.

(a) (i) The shapes show the components of a phospholipid.

| phosphate group | glycerol | fatty acid | covalent bond |
|---|---|---|---|
|  |  |  |  |

Draw a diagram to show the structure of a phospholipid, using these shapes.

**(2)**

(ii) Which type of bond is found in this molecule?

(1)

- ☒ **A** ester
- ☒ **B** glycosidic
- ☒ **C** hydrogen
- ☒ **D** peptide

(b) (i) How does a nonpolar molecule move through a cell membrane, down a concentration gradient into a cell?

(1)

- ☒ **A** by active transport
- ☒ **B** by diffusion
- ☒ **C** by exocytosis
- ☒ **D** by osmosis

(ii) How many of the following statements are correct for the transport of a substance by endocytosis?

- transports substances out of the cell
- the cell membrane surrounds the substance
- can only transport substances down a concentration gradient

(1)

- ☒ **A** none
- ☒ **B** one
- ☒ **C** two
- ☒ **D** three

**(Total for Question 1 = 5 marks)**

**4** Water is an important molecule in living organisms.

(a) Water is a dipolar molecule that forms hydrogen bonds with other water molecules.

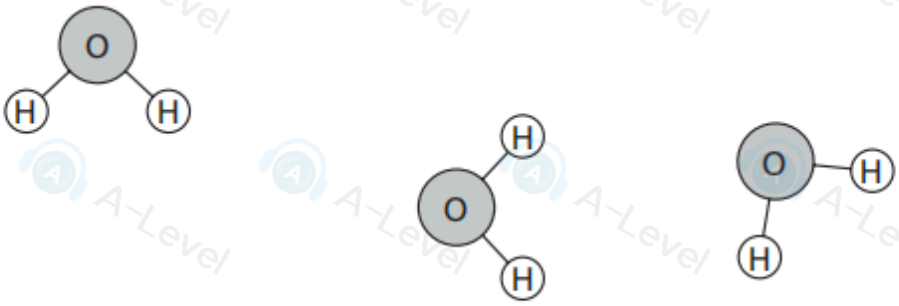
(i) Explain the dipole nature of water.

**(2)**

(ii) The diagram shows three water molecules.

Complete the diagram to show a hydrogen bond between two water molecules.

**(1)**




(b) Water plays a role as a solvent.

Sodium chloride dissolves in water.

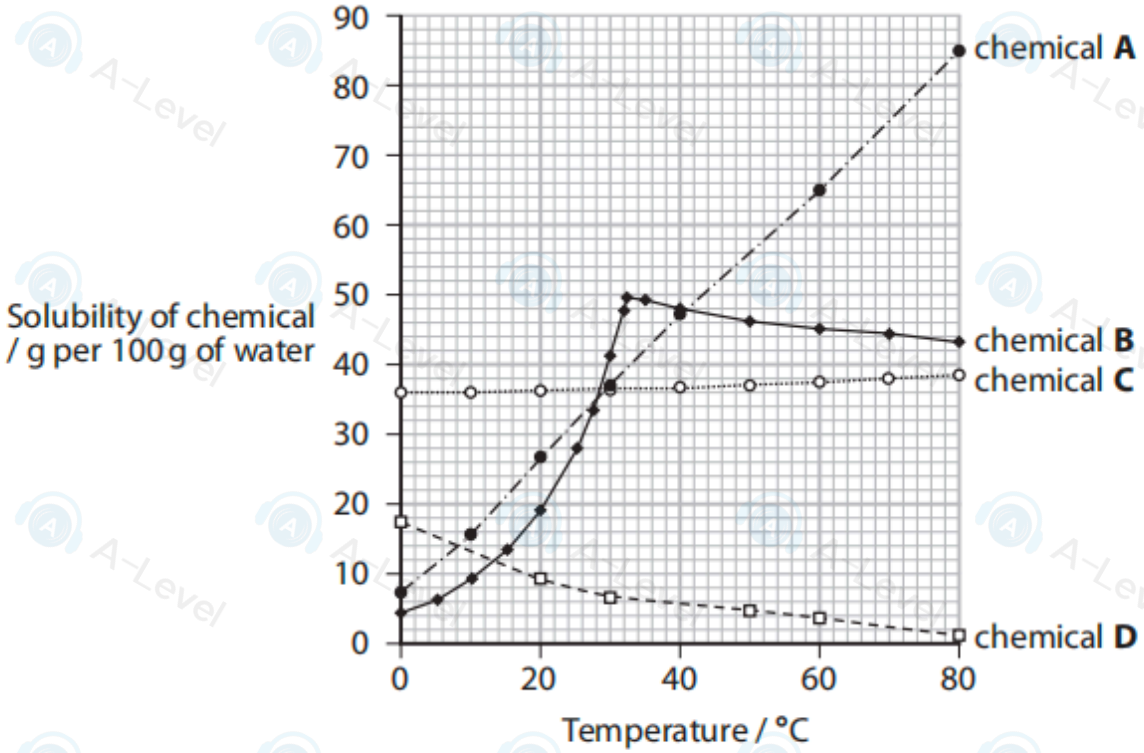
The diagram shows a sodium ion ($Na^+$).

Complete the diagram to show the arrangement of two water molecules around a sodium ion when it is dissolved.

**(1)**

(c) Temperature affects the solubility of chemicals in water.

The graph shows the effect of temperature on the solubility of four chemicals, **A**, **B**, **C** and **D**.



Describe the effects of temperature on the solubility of these chemicals.

**(4)**

**(Total for Question 4 = 8 marks)**

**3** Sucrose is a disaccharide made from glucose and fructose.

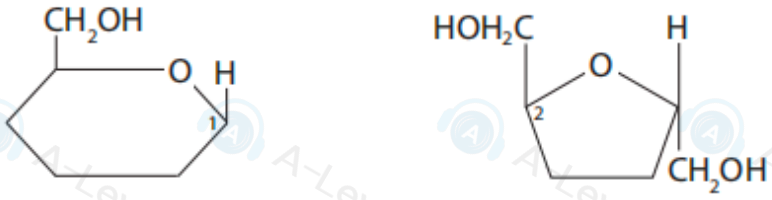
Glucose is joined to fructose by a 1–2 glycosidic bond.

(a) (i) The diagram shows a molecule of glucose and a molecule of fructose.

Carbon 1 on the glucose and carbon 2 on the fructose are numbered.

Complete the diagram to show a glycosidic bond between the glucose molecule and the fructose molecule.

**(1)**



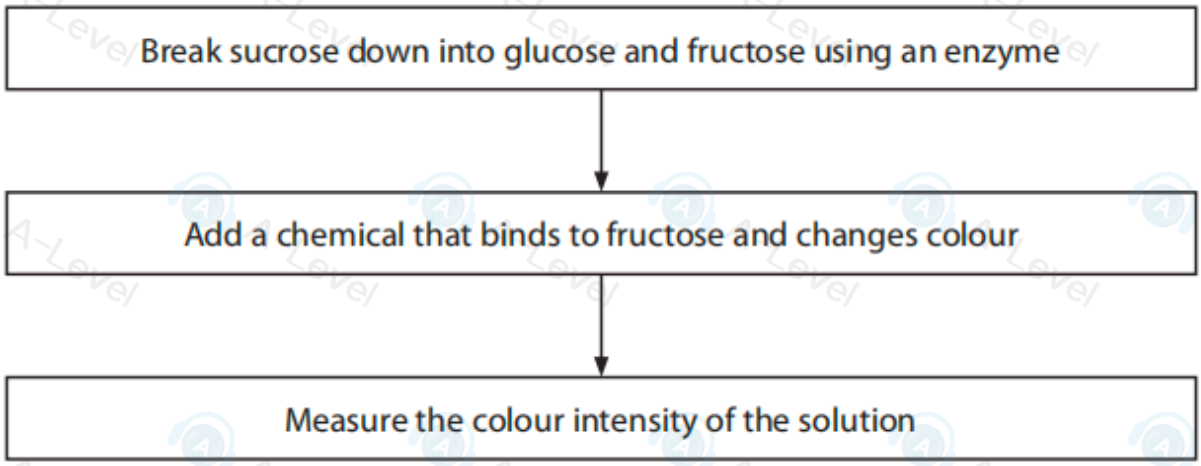

(ii) Complete the formula equation for the reaction that makes sucrose from glucose and fructose.

**(2)**

$C_6H_{12}O_6 + C_6H_{12}O_6 \longrightarrow$

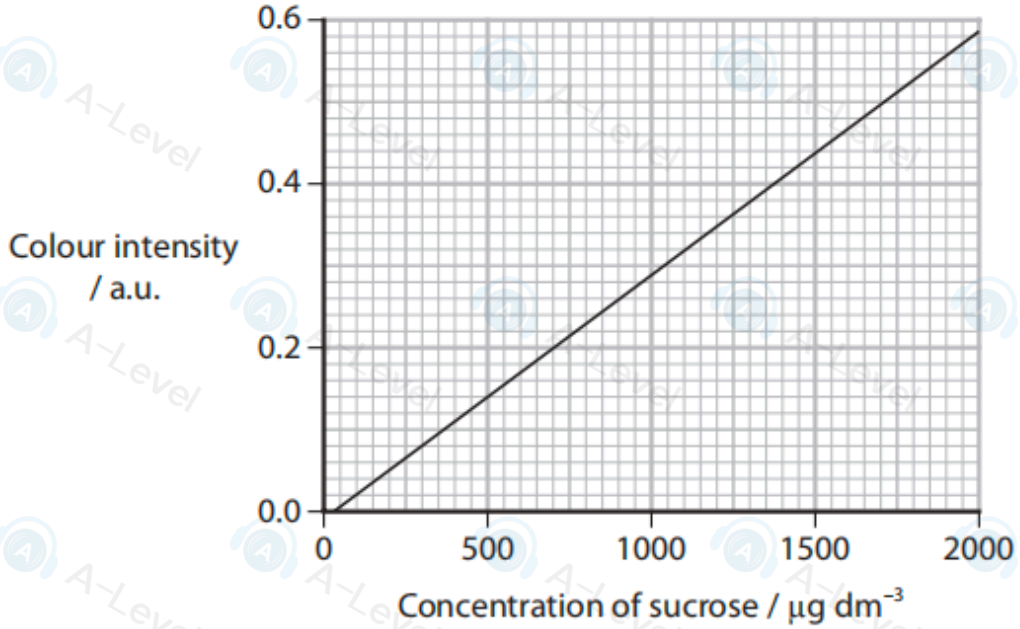
(b) The concentration of sucrose in a solution can be determined by a test.

The chart shows the steps involved in this test.



The colour intensity is directly proportional to the concentration of sucrose.

The graph shows this relationship.




(i) Give a reason why the colour intensity is directly proportional to the concentration of sucrose.

**(1)**

(ii) Suggest why the line does not start at the origin of the graph.

**(1)**

(iii) State why the concentration of maltose and lactose cannot be measured using this test.

**(1)**

**(Total for Question 3 = 6 marks)**

**Answer ALL questions. Write your answers in the spaces provided.**

**Some questions must be answered with a cross in a box ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.**

**1** Water is an important biological molecule.

Read through the following description of water.

Complete the description by writing the most appropriate word on the dotted lines.

Water has an uneven charge distribution so it is described as a

..... molecule. The hydrogen ends of the molecule

have a very slightly ..... charge.

Water is involved in the transport of substances so it is an important

..... in living organisms.

Water is needed in chemical reactions called .....

reactions that break down disaccharides such as

..... into glucose and galactose.

**(Total for Question 1 = 5 marks)**

**6** Glucose is an example of a monosaccharide.

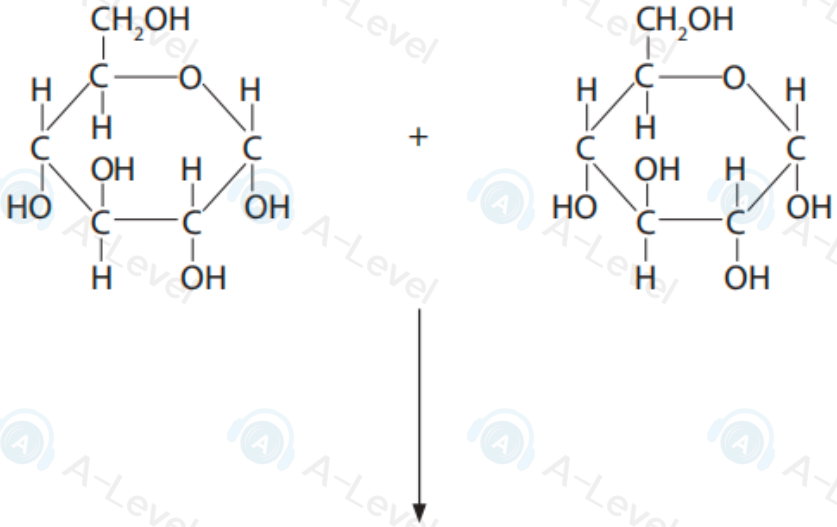
Monosaccharides join together to form disaccharides, oligosaccharides and polysaccharides.

Oligosaccharides contain from three to ten monosaccharides.

(a) The diagram shows two glucose molecules.

Complete the diagram to show how these two molecules join by a glycosidic bond to form **two** products.

**(3)**



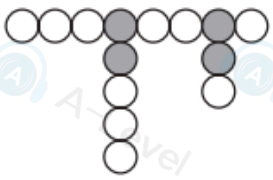
(b) Starch is a polysaccharide composed of amylose and amylopectin.

Digestion of starch begins in the mouth by an enzyme called amylase.

This amylase can break only 1–4 glycosidic bonds.

Only disaccharides and oligosaccharides are produced during this reaction.

(i) The diagram shows part of an amylopectin molecule.



**Key**

○ glucose molecule joined by 1–4 glycosidic bonds

● glucose molecule joined by 1–4 and 1–6 glycosidic bonds

Draw **one** disaccharide and **two** different oligosaccharides that could be produced following the digestion of this part of amylopectin by this amylase.

**(2)**

(ii) Explain why this amylase is able to break only 1–4 glycosidic bonds.

**(2)**

(c) The digestion of carbohydrates is completed in the small intestine.

Glucose is then absorbed into the bloodstream.

(i) Suggest how disaccharides and oligosaccharides are broken down in the small intestine.

Give reasons for your answer.

**(3)**

(ii) The absorption of glucose into the bloodstream requires membrane transport proteins.

Explain why glucose cannot diffuse into the bloodstream.

**(2)**

**(Total for Question 6 = 12 marks)**

**Answer ALL questions.**

**Write your answers in the spaces provided.**

**Some questions must be answered with a cross in a box ☒. If you change your mind about an answer, put a line through the box ☒ and then mark your new answer with a cross ☒.**

1 The primary structure of a protein determines its secondary structure and its three-dimensional structure.

(a) Read through the following account of the primary structure of a protein.

**(5)**

Complete the account by writing the most appropriate word or words on the dotted lines.

The primary structure of a protein is the specific sequence of amino acids joined together by ..... bonds.

These bonds are formed between the ..... group of one amino acid and the ..... group of an adjacent amino acid by a ..... reaction.

These bonds are formed during the stage of protein synthesis called .....

(b) The table describes the types of bond that hold the secondary and the three-dimensional structures together.

Which type of bonding is true for each structure?

**(2)**

| Structure | Hydrogen bonds only | Ionic bonds only | Both hydrogen and ionic bonds | Neither of these bonds |
|---|---|---|---|---|
| secondary structure | ☒ | ☒ | ☒ | ☒ |
| three-dimensional structure | ☒ | ☒ | ☒ | ☒ |

**(Total for Question 1 = 7 marks)**

**2** A person with diabetes has a blood glucose level that can be too high.

When the blood glucose level of a person without diabetes becomes too high, the liver stores glucose as a polysaccharide.

(a) Which polysaccharide does the liver store?

(1)

- ☒ **A** amylopectin
- ☒ **B** cellulose
- ☒ **C** glycogen
- ☒ **D** starch

(b) Blood glucose levels can become high following the digestion of carbohydrates.

Which of the following can be digested to release glucose?

(1)

- ☒ **A** both fructose and sucrose
- ☒ **B** both fructose and galactose
- ☒ **C** both galactose and lactose
- ☒ **D** both lactose and sucrose

(c) Diabetes is a risk factor for cardiovascular disease.

(i) One estimate is that there are 415 million people with diabetes in the world and that 46% of these people are undiagnosed.

Calculate the number of people who have undiagnosed diabetes.

(1)

Answer .....

(ii) There are two types of diabetes, Type I and Type II.

The treatment for Type I diabetes is different from the treatment for Type II diabetes, so it is important for a correct diagnosis to be made.

Diagnosis can be difficult, particularly in people aged between 20 and 40 years old.

A genetic screening method is now available for the diagnosis of diabetes.

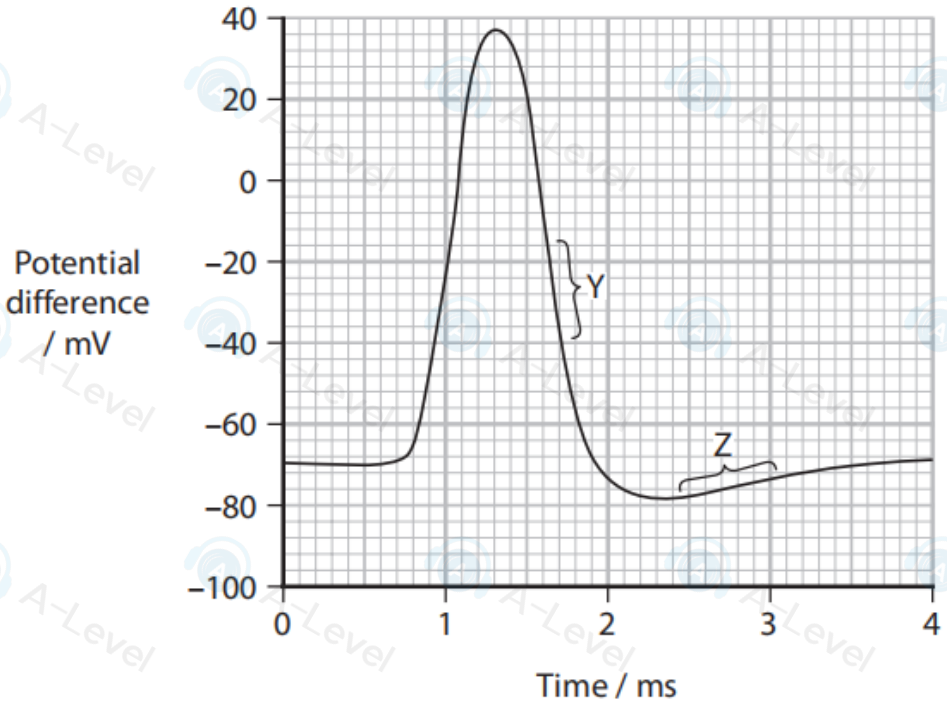
Explain why doctors are more likely to screen individuals once they develop diabetes than use methods such as prenatal testing.

**(3)**

**(Total for Question 2 = 6 marks)**

**1** Nerve impulses travel along axons as action potentials.

(a) The graph shows an oscilloscope trace for an action potential in an axon.




(i) Which is the resting potential for this axon?

(1)

☒ **A** −70 mV

☒ **B** −78 mV

☒ **C** 38 mV

☒ **D** 108 mV

(ii) Both voltage-gated sodium and voltage-gated potassium ion channels are involved in generating an action potential.

Which of these voltage-gated channels are open at Y?

**(1)**

- ☒ **A** no voltage-gated ion channels are open
- ☒ **B** voltage-gated sodium ion channels only
- ☒ **C** voltage-gated potassium ion channels only
- ☒ **D** both sodium and potassium voltage-gated ion channels

(iii) Which is the state of polarisation of the membrane at Z?

**(1)**

- ☒ **A** depolarised
- ☒ **B** hyperpolarised
- ☒ **C** hypopolarised
- ☒ **D** unpolarised

(iv) How many of the following statements are correct?

- the magnitude of the action potential is proportional to the strength of stimulus that generates the action potential
- action potentials spread out in both directions along the axon
- following an action potential, there is a refractory period during which it is not possible to generate a new action potential

**(1)**

- ☒ **A** none
- ☒ **B** one
- ☒ **C** two
- ☒ **D** three