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Introduction

Our examiners' reports are produced to offer constructive feedback on candidates' performance in the examinations. They provide useful guidance for future candidates. The reports will include a general commentary on candidates' performance, identify technical aspects examined in the questions and highlight good performance and where performance could be improved. The reports will also explain aspects which caused difficulty and why the difficulties arose, whether through a lack of knowledge, poor examination technique, or any other identifiable and explainable reason.

Where overall performance on a question/question part was considered good, with no particular areas to highlight, these questions have not been included in the report. A full copy of the question paper can be downloaded from OCR.

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As a centre approved to offer our Cambridge Technicals qualifications, we wanted to let you know we have now published the results awarded for 2018/19 Level 2 and 3 Cambridge Technicals (2016 suite). This information is helpful in allowing you to compare your centre achievements alongside national outcomes.

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ExamBuilder

Remember to keep your eye on ExamBuilder as we continue to update the bank of questions post exam series in line with our past paper policy. Therefore, you can be assured that new assessment material will continually be fed into ExamBuilder on an annual basis.

Online post series external feedback

Keep an eye out for updates on our post series feedback on Exams for Cambridge Technicals Webinars available in the autumn term.

Paper Unit 1 series overview

In general, it was encouraging to see that many candidates were prepared for this examination. They had clearly revised many of the topics encountered and were relatively familiar with the rubric of the paper. However, although a specific trend could not be identified, it was noted that some candidates did not respond to one or two items in the paper. In contrast, the majority of candidates fully completed the question paper within the 1 hour allocated.

The cohort of candidates was more familiar with the approach to be followed when answering the free-response (level of response / LoR-type item) Question 5(d), than for candidates in previous series. This enabled them to, at least, obtain some marks at Levels 1 or 2. Furthermore, most candidates were able to follow the expected rubric when completing the objective-format items, such as the completion of sentences, using tick-boxes for optional statements and joining concept boxes with lines.

Candidates often utilised the space provided to show their calculations. This was with particular reference to Question 7. This is good practice since a number of candidates showed the mathematical steps involved, such as placing the correct values in an equation, and were given marks accordingly.

Relatively few candidates found the need to use the additional pages provided at the end of the paper. Appropriate links to such pages were often clearly presented within the answer space in the body of the paper. Some candidates chose to complete an additional page booklet and inserted it within their paper but did not use the pages provided at the end of the paper. In all such cases, this was unnecessary.

Question 1 (a)

1 The electron configuration of a carbon atom is 2,4.

(a) Draw the electron configuration of a carbon atom on **Fig. 1.1**.

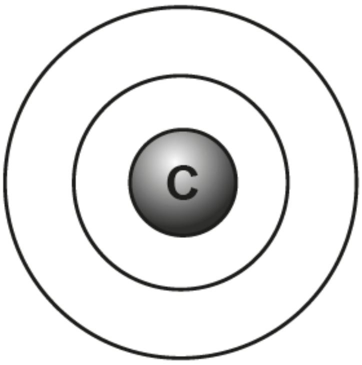


Fig. 1.1

[1]

The majority of candidates successfully identified the configuration of four electrons on the outer shell and two on the inner.

Question 1 (b)

(b) An isotope of carbon has 13 nucleons.

How many neutrons are there in an atom of carbon-13?

Put a (ring) around the correct answer.

6 **7** **12** **13**

[1]

Although almost all candidates were aware that seven neutrons are in an atom of carbon-13, some incorrectly circled options such as 13. This error may have been linked to the number of nucleons for this isotope.

Question 1 (c)

(c) Explain why carbon atoms are neutral.

....

....

....**[2]**

Not many candidates referred to the positive and negative charges involved. Most candidates did appreciate that there is an equal number of protons and electrons. Some candidates incorrectly referred to the numbers of neutrons when responding to this item.

Question 1 (d) (i)

(d) **(i)** Which element is in the same Group as carbon but one Period below?

....**[1]**

Most candidates correctly identified silicon as the element in the same Group as carbon. Very few gave alternative responses.

Question 1 (d) (ii)

(ii) Explain why the element identified in **(d)(i)** is in the same Group as carbon.

....

....**[1]**

The same number of electrons in the outer shell was a common, and correct response. Some candidates also obtained the mark due to a reference to the same chemical properties or the same number of valence electrons. Such alternative responses were rare.

Question 1 (d) (iii)

(iii) Explain why the number of electron shells increases down the Group.

....

....

....**[2]**

Many candidates successfully included an increase in the number of electrons within their response. This was often linked to a limit in the number of electrons per shell, hence the need for more electron shells down the Group. Few candidates struggled with this explanation.

Question 1 (e) (i)

(e) Methane has the molecular formula CH_4.

(i) Draw the 'dot and cross' diagram for methane.

You only need to show the outer electrons.

[2]

It was important for candidates to show the source of electrons at each bond. This was often demonstrated via a 'dot and cross' model (as indicated in the stem of the item). Many candidates were limited to 1 mark since, although they included one carbon and four hydrogen atoms, the electron source was absent or unclear.

	AfL	For those candidates who struggled with the drawing, it was good to see that they crossed through their first attempt and redrew a second, often successful, model. This is perhaps the best way to make this type of change, rather than attempting to modify the first attempt.

Question 1 (e) (ii)

(ii) State the type of bonding in methane.

....**[1]**

Almost all candidates successfully identified the bond as covalent. Some candidates did incorrectly consider that ionic bonding was involved.

Question 1 (f) (i)

(f) The relationship between atomic radius and proton number is shown in **Fig. 1.2**.

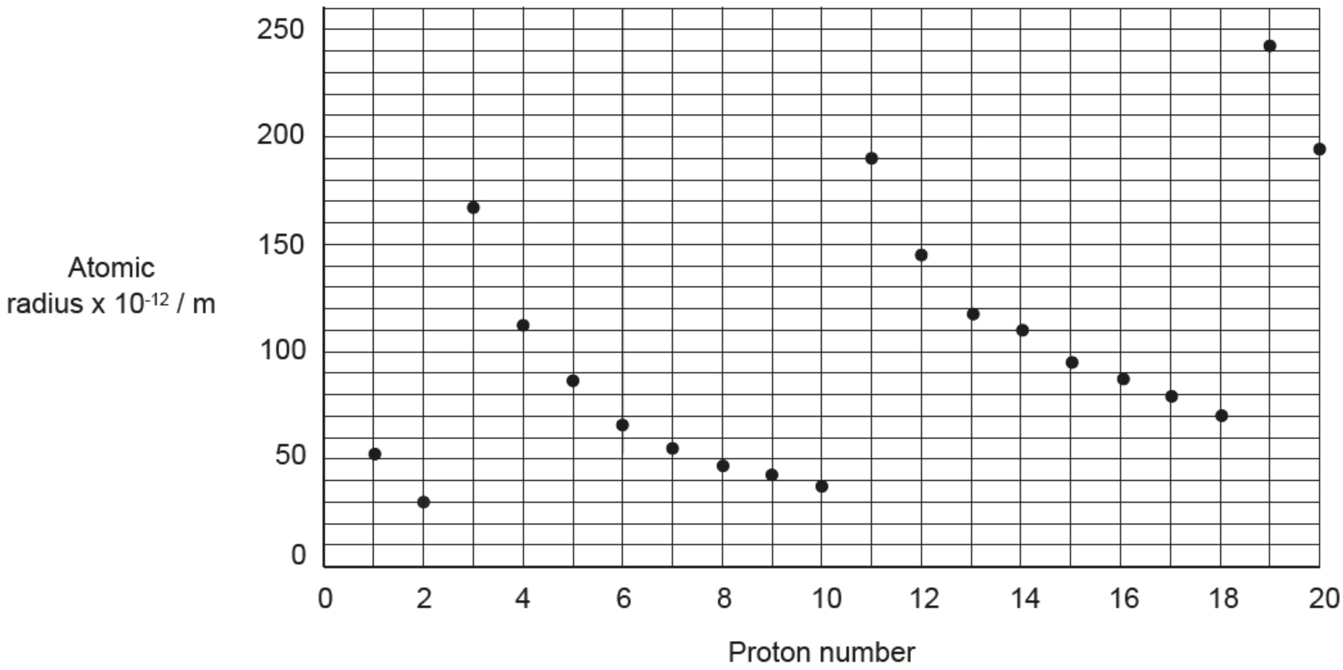


Fig. 1.2

(i) On **Fig. 1.2** draw circles around the Group 0 elements (noble gases).

[1]

Most responses were correct. Candidates drew circles around the three Group 0 elements shown (at proton numbers 2, 10 and 18). Some candidates did not get the mark because they either included a fourth circle at another point on **Fig. 1.2** or did not respond (perhaps because they overlooked the item).

Question 1 (f) (ii)

(ii) Describe the trends shown in **Fig. 1.2**.

....

....

....

....**[2]**

Many candidates struggled with the description of trends. It was expected that descriptions would outline an atomic radius decrease across each period and a corresponding increase down each group. This level of explanation was rarely seen. Some candidates gained 1 or 2 marks due to making clear references to the data sets, using the values presented on the x and y axes.

Question 1 (f) (iii)

(iii) Explain **one** of the trends you described in **(f)(ii)**.

....

....

....**[1]**

An appropriate explanation was often lacking for this item. Some candidates correctly mentioned the attractive force of the nucleus but only a few candidates gave an explanation based on the greater attraction of electrons. This is clearly a challenging topic for many candidates.

i	**OCR support**	The Unit 1 specification provides an outline of the key features to be covered for this topic, see learning outcome (LO) **1.2** for atomic radius. https://www.ocr.org.uk/Images/260245-science-fundamentals.pdf

Question 2 (a) (i)

2 **(a)** Nitrates are important inorganic compounds in plant biology.

Fig. 2.1 shows a plant crop. The crop has been supplied with sufficient levels of nitrate.

Fig. 2.1

(i) Nitrates are needed in plants to form a type of polymer.

Complete the sentences using words from the list.

amino acids **ammonium** **calcium** **cellulose** **fatty acids**

glycerol **lipid** **protein** **sodium** **starch** **sucrose**

When nitrates enter plant cells they are first converted into .... ions.

These ions are then used to form ....

Finally, the molecules formed are used to make the polymer,

....

[3]

Very few candidates successfully completed all three sentences. There appeared to be a tendency to randomly select words from the list provided, without an apparent link between ions and the molecules formed. One common error was the choice of sodium instead of ammonium for the ion. Some candidates did correctly realise that the ions were used to form amino acids and, hence, the polymer, protein.

Question 2 (a) (ii)

(ii) Nitrates must be given to plants to avoid symptoms of deficiency.

One way that farmers increase the amount of nitrate available to their crops is to add inorganic fertiliser to their fields. However, the excessive use of inorganic fertiliser can lead to nitrate run-off into nearby streams and rivers.

Fig. 2.2 shows a graph of a study of a river that runs past a field treated with nitrate fertiliser.

The study involved measuring the fish population and the accumulation of algae bloom in the river. Algae are green aquatic plants which can grow rapidly, blocking sunlight from aquatic organisms and depleting oxygen levels.

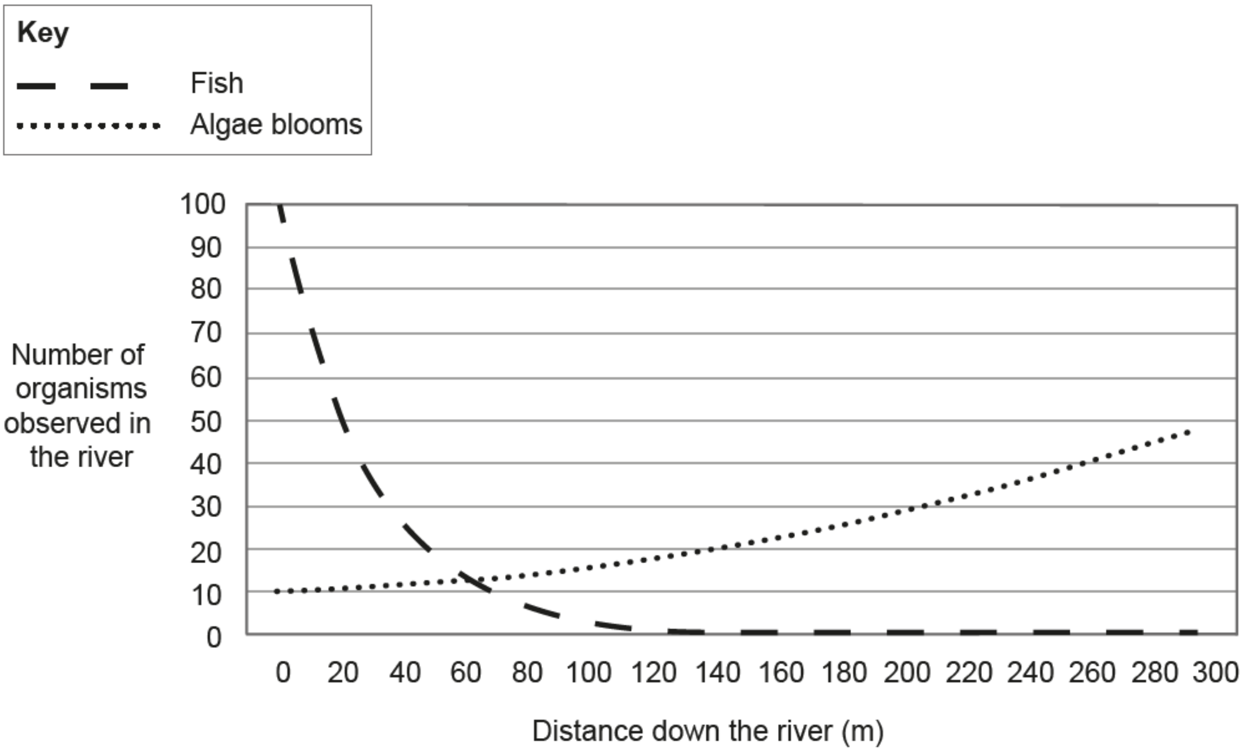


Fig. 2.2

Use the graph in **Fig. 2.2** to describe the trends in the populations of the organisms in the river.

....

....

....

....**[4]**

Many candidates did well with this item. They correctly noted the increasing algal blooms and corresponding decreasing number of fish down the river. Some were tempted to provide an explanation at this point. This was unnecessary since the item referred only to descriptions of trends. Further marks were given to those candidates who referred to the data points provided via the two axes. A number of options were available for such data, ranging from the zero or very limited fish numbers from 120 m down the river to the gradual increase in algal blooms from 10 m to approximately 38 m.

	AfL	Candidates should use data values in these types of questions. The data enhance the validity of the observations or descriptions.

Question 2 (a) (iii)

(iii) The study also found that the rate of algae bloom formation decreased in the winter compared to the summer.

Which factor caused the rate of algae bloom formation to decrease?

Tick (✓) **one** box.

Decreased air pressure	☐
Decreased light intensity	☐
Increased surface area	☐
Increased water temperature	☐

[1]

The vast majority of candidates appreciated that a decrease in light intensity was the factor causing the rate of algal bloom formation to decrease during the winter. The remaining distractors did not relate to winter conditions, hence the success of candidate responses.

Question 2 (b) (i)

(b) A high intake of nitrates in infants can lead to a condition called blue baby syndrome.

This is because the red colour of blood becomes darker and the infant's skin develops a blue tinge.

(i) Suggest **one** way in which an infant could take in high levels of nitrates.

....

....**[1]**

Although most candidates correctly realised that nitrates would be readily available in food eaten or via drinks, there was some confusion for a few candidates. Such candidates incorrectly referred to nitrates in the atmosphere or simply due to people/infants living near to 'contaminated' water.

Question 2 (b) (ii)

(ii) The change in the colour of blood is a result of nitrate(III) ions reacting with the iron(II) ions that are in haemoglobin.

$$Fe^{2+} + NO_2^{-} + 2H^{+} \longrightarrow Fe^{3+} + NO + H_2O$$

The reaction is a redox reaction. It involves both reduction and oxidation.

Use the equation to explain how this reaction involves **both** reduction and oxidation.

....

....

....

....

....

....

....

....**[4]**

A number of candidates got full marks. They were not only able to correctly describe reduction and oxidation as electron gain or loss, respectively, but were capable of linking this to iron and nitrate ions. A few candidates were distracted by the formation of water and incorrectly used this to explain the processes involved.

i	**OCR support**	The Unit 1 specification provides an outline of the key features to be covered for this topic, see LO **2.2** for oxidation and reduction. https://www.ocr.org.uk/Images/260245-science-fundamentals.pdf

Question 2 (b) (iii)

(iii) The reaction shown in **(b)(ii)** prevents Fe^{2+} in haemoglobin from performing its function in the infant's body.

Describe the function of Fe^{2+} within haemoglobin.

....

....

....**[2]**

It was anticipated that candidates would refer to the binding of Fe^{2+} ions with oxygen molecules and that this leads to the transport of oxygen around the body. Relatively few candidates appreciated both features. Many candidates at least referred to oxygen transport. Some of the responses showed an overall lack of understanding.

	AfL	It is suggested that teachers may wish to use simple 2D models of haemoglobin to show the haem groups containing the Fe^{2+} ions and to reveal the binding with oxygen molecules (as four oxygen molecules per haemoglobin molecule). A brief outline is also provided via the Unit 1 specification at LO **5.1** for oxygen transport, etc.

Question 3 (a)

3 The human body contains many different types of tissue.

Fig. 3.1a and **Fig. 3.1b** show the same tissue type.

The tissue shown in **Fig. 3.1a** forms the lining of blood vessels and the walls of alveoli in the lungs.

The tissue shown in **Fig. 3.1b** forms the outer layer of skin covering the human body.

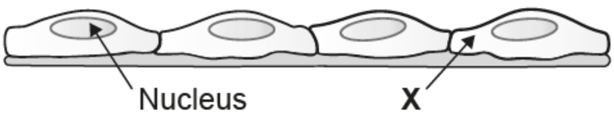


Fig 3.1a

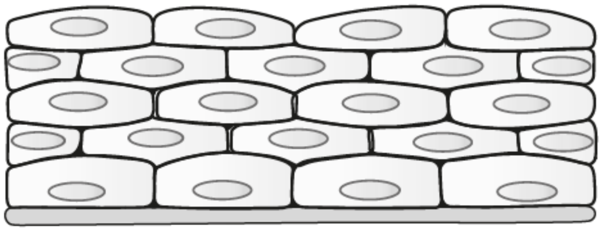


Fig 3.1b

(a) What type of tissue is shown in both **Fig. 3.1a** and **Fig. 3.1b**?

Tick (✓) **one** box.

Bone ☐

Connective ☐

Epithelial ☐

Nerve ☐

[1]

The majority of candidates correctly identified the tissue in **Fig. 3.1a** and **3.1b** as epithelial.

Question 3 (b)

(b) Two of the main functions of this tissue type are:

- Protection of organs
- Absorption of various substances.

Using the diagrams, describe and explain how each tissue in **Fig. 3.1a** and **Fig. 3.1b** is suited to a specific function.

Fig. 3.1a ....

....

....

Fig. 3.1b ....

....

....
[4]

It was essential for candidates to use the features of the two tissues as shown in the diagrams, **Fig.3.1a** and **3.1b**. The thin or one-cell thick tissue (also credited as squamous by some candidates) related to enhanced absorption/exchange of molecules. The thick or multi-layered tissue (also credited as striated by some candidates) related to protection against physical damage or pathogens. It was anticipated that candidates would provide more details/examples for the main functions stated in the stem of this item. Many candidates were challenged by this topic.

Question 3 (c) (i)

(c) **(i)** Name the region of the cell labelled **X** in **Fig. 3.1a**.

....**[1]**

Most candidates understood that the cytoplasm was labelled as X in the figure. There was a tendency for some candidates to consider that X was the plasma membrane.

Question 3 (c) (ii)

(ii) Give **two** functions of region **X** in the cell in **Fig. 3.1a**.

1 ....

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

Many candidates understood that cytoplasm is the site of reactions in the cell, forms the bulk of the cell and provides support or a location for the various organelles. Some candidates did particularly well and referred to the cytoskeleton provided by the cytoplasm.

i	**OCR support**	The Unit 1 specification provides an outline of the key features to be covered for this topic, see LO **3.2** for cytoplasm. https://www.ocr.org.uk/Images/260245-science-fundamentals.pdf

Question 3 (c) (iii)

(iii) Region **X** is a colloidal mixture of a fluid called cytosol and various organelles.

It is sometimes considered to behave like a sol and at other times to behave like a gel.

Colloids are classified according to the phase of the dispersed substance and the medium of dispersion.

Draw a line to link each type of **colloidal mixture** to its correct **description**.

Colloidal mixture	**Description**
	Gas dispersed in a liquid
Sol	
	Liquid dispersed in a solid
Gel	
	Solid dispersed in a liquid

[2]

A number of candidates correctly linked gel to 'liquid dispersed in a solid' and sol to 'solid dispersed in a liquid'. Many candidates struggled with this item.

	AfL	It is suggested that teachers use simple models to demonstrate the features of different colloidal mixtures and to refer to the basic outline provided in the Unit 1 specification at LO **2.1** for mixtures and alloys, as a guide.

Question 3 (d) (i)

(d) **(i)** DNA (deoxyribonucleic acid) is a macromolecule which contains the genetic code for a living organism.

DNA is stored in different ways in eukaryotic and prokaryotic cells.

Identify the feature of DNA storage in each of these two types of cell.

Complete **Table 3.1**.

Type of cell	Feature of DNA storage
Eukaryotic	....
Prokaryotic	....

Table 3.1

[2]

The majority of candidates recognised the features of DNA storage for Eukaryotic and Prokaryotic cells. There was a common understanding that Eukaryotic cells contain a nucleus, holding the DNA. In addition, the free location of DNA within the cytoplasm of Prokaryotic cells was appreciated.

Question 3 (d) (ii)

(ii) RNA (ribonucleic acid) is also found in a eukaryotic cell. It is similar to DNA but there are differences.

Table 3.2 shows the components of DNA.

RNA has some of the same components as DNA but not all.

Complete **Table 3.2** with either a tick (✓) or a cross (x) to show the components found in RNA.

Component	DNA	RNA
Adenine	✓	
Deoxyribose	✓	
Cytosine	✓	
Guanine	✓	
Phosphate	✓	
Thymine	✓	

Table 3.2

[2]

Some candidates were aware of the differences between DNA and RNA. Many other candidates were unsure about the full set of components listed. Others did not follow the instruction provided within the stem of this item and did not place a cross (X) to indicate that some of the features were absent in RNA. This limited the marks given and, as a result, some candidates obtained only 1 of the 2 marks available.

Question 3 (d) (iii)

(iii) RNA is able to travel out of the nucleus in the cells in **Fig. 3.1a** and into region **X**.

Explain why RNA can move out of the nucleus of a cell but DNA cannot.

....

....

....

....**[2]**

Some candidates provided details of RNA activity outside of the nucleus in relation to protein synthesis. This was not necessary for this item. The item focused solely on the movement of RNA out of the nucleus in comparison to the restriction of DNA within the nucleus. Many candidates correctly referred to the smaller size of RNA and to the single stranded nature of this polynucleotide (as opposed to the large size of DNA and its double-helix). This enabled such candidates to gain both marks. It was anticipated that some of the more able candidates might also refer to the relevance of histones/proteins in preventing the movement of DNA across the nuclear envelope. Very few candidates included this feature in their response.

Question 4 (a) (i)

4 **(a)** Sugar molecules are simple carbohydrates.

D-fructose and D-glucose are two naturally occurring sugars.

Fig. 4.1 shows the straight chain forms of D-fructose and D-glucose molecules.

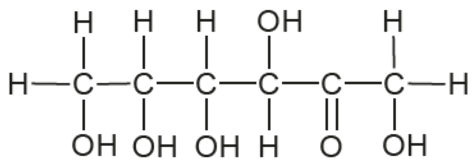
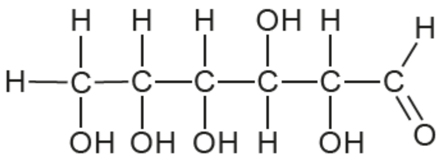
D-fructose	
D-glucose	

Fig. 4.1

(i) D-fructose and D-glucose are isomers of each other.

Use **Fig.4.1** to explain how the two sugar molecules are isomers.

....

....

....

....

....**[3]**

Many candidates correctly referred to the same molecular formula and also to the different structural arrangement of the two isomers. The more able candidates also provided further details such as the $C_6H_{12}O_6$ feature or described the differences with regards to the position of C=O. This enabled such candidates to gain full marks for this item.

Question 4 (a) (ii)

(ii) Optical isomerism occurs in a molecule which contains at least one asymmetric carbon atom (or chiral centre).

Complete **Table 4.1** with the number of asymmetric carbon atoms present in each sugar molecule shown in **Fig. 4.1**.

Sugar molecule	Number of asymmetric carbon atoms
D-fructose	
D-glucose	

Table 4.1

[2]

Very few candidates appeared to understand the principle of asymmetric carbon atoms. They did not record that D-fructose has three of these atoms and D-glucose has four.

i	**OCR support**	The feature of the chiral centre (or asymmetric carbon atom) is outlined in the specification for Unit 1 at LO **4.3** for optical isomers. https://www.ocr.org.uk/Images/260245-science-fundamentals.pdf

Question 4 (a) (iii)

(iii) Both sugar molecules in **Fig. 4.1** have –OH functional groups.

They also have a C=O bond, but the functional group containing this type of bond is different in the two sugar molecules.

Draw a line to link each **sugar molecule** to the type of **functional group** present.

Sugar molecule	Functional group
	Aldehyde
D-fructose	Alkyne
	Carboxylic acid
D-glucose	Ester
	Ketone

[2]

Some candidates obtained full marks for this item and correctly used **Fig. 4.1** to confirm that D-fructose has a ketone functional group, whereas D-glucose has aldehyde as the functional group. Many candidates did not make this conclusion.

Question 4 (b)

(b) Sugars can be fully converted into alcohols by reacting them with hydrogen.

The equation in **Fig. 4.2** shows the reaction of D-fructose with hydrogen.

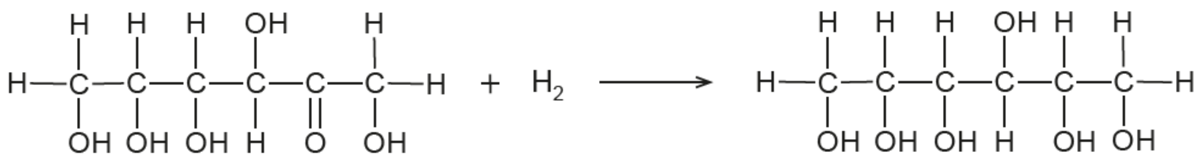


Fig. 4.2

What type of reaction is shown in **Fig. 4.2**?

Tick (✓) **one** box.

Addition ☐

Displacement ☐

Oxidation ☐

Substitution ☐

[1]

Relatively few candidates did not identify the type of reaction as addition. Some incorrectly selected oxidation. This item appeared to be accessible to a wide range of candidate ability.

Question 4 (c) (i)

(c) The D-glucose sugar molecule also occurs in a cyclic or ring form as shown in **Fig. 4.3**.

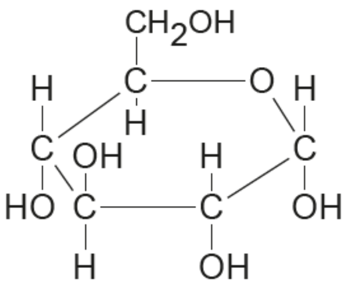
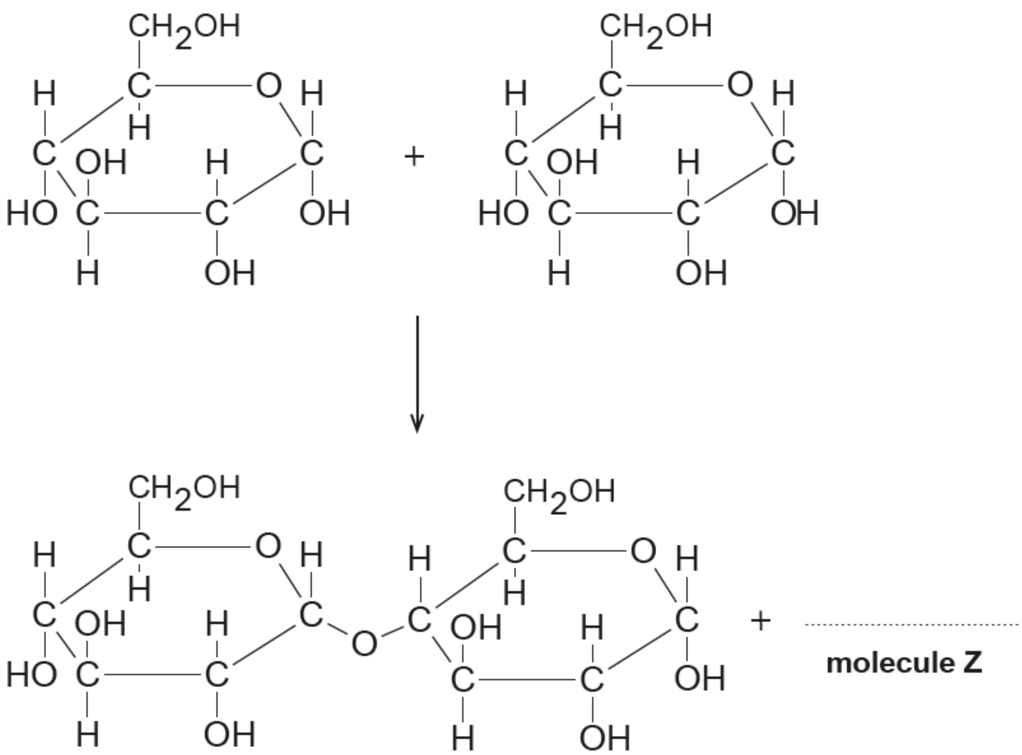


Fig. 4.3

Two cyclic or ring form D-glucose molecules can react together to form a larger carbohydrate molecule and another product.

The equation is shown in **Fig. 4.4**.



molecule Y

Fig. 4.4

(i) A single sugar molecule unit, such as D-glucose, is also known as a monosaccharide.

Give the name for the combination of two sugar molecule units as shown in **molecule Y** in **Fig. 4.4**.

....**[1]**

It was anticipated that most candidates would recall that the molecule formed (as Y) from a condensation reaction between two D-glucose molecules was a disaccharide. The stem provided some guidance with reference to the term monosaccharide. Some candidates successfully obtained the mark due to the recognition that maltose was formed as molecule Y.

?	**Misconception**	Many candidates concluded that a polysaccharide had been formed. This misconception could be avoided with reference to the Unit 1 specification at LO **4.4**.

Question 4 (c) (ii)

(ii) Complete the equation shown in **Fig. 4.4** with the formula of **molecule Z**.

[1]

The stem of this item referred to 'formula'. Although many candidates adhered to this guidance, some did not identify H_2O as the bi-product of this condensation reaction. Other candidates misinterpreted the stem and wrote the word 'water'. This prevented them from gaining the mark.

Question 4 (d)

(d) D-glucose sugar molecules can also combine to form a long chain carbohydrate polymer called glycogen.

Fig. 4.5 shows part of a glycogen molecule.

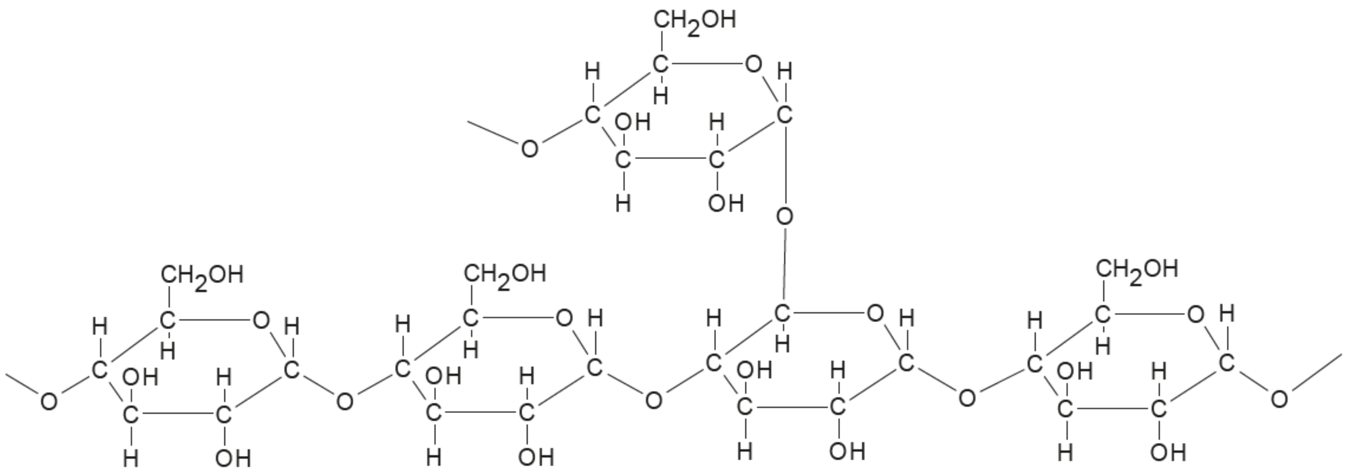


Fig. 4.5

Polypeptides are also natural polymers.

Complete **Table 4.2** to identify some of the differences between glycogen and a polypeptide.

Feature	Glycogen	Polypeptide
Type of monomer		
Type of bond between the monomers		
Atoms present		
Function in the body		

Table 4.2

[4]

Very few candidates obtained full marks for this item. Some were able to recognise the types of monomer (glucose versus amino acid) while others recalled that glycogen acts as an energy/sugar store in the body and that polypeptides form the proteins/enzymes in cells. A few candidates were not given the mark for the final row because they referred incorrectly to the 'production of energy'.

?	**Misconception**	Some candidates shared a common misconception for the completion of this table. They chose to place ticks in some of the boxes. This type of response was not indicated in the stem of this item and so did not gain any marks.

Question 4 (e) (i)

(e) One synthetic polymer is polyethene.
Polyethene is made from monomers of ethene, C_2H_4.

(i) Draw a section of a polyethene chain that contains 6 carbon atoms.

[2]

A number of candidates successfully drew a section of a polyethene chain, showing six carbon atoms with 12 hydrogen atoms to form a chain of hydrocarbons. Some candidates incorrectly added C=C bonds, while others added extra H atoms at the two ends of the molecule.

Question 4 (e) (ii)

(ii) Suggest why glycogen is classified as a carbohydrate but polyethene is not.

....

....**[1]**

Some candidates correctly noted that oxygen or OH was missing in polyethene (or the reverse for carbohydrate). Other candidates were unable to use the information provided about polyethene in the stem of this item (with reference to C_2H_4) and the model of glycogen at Fig. **4.5**.

Question 5 (a) (i)

5 Hydrogen peroxide is produced as a waste product in the human body.

(a) (i) What is the formula of hydrogen peroxide?

Tick (✓) **one** box.

HO ☐

HO_2 ☐

H_2O ☐

H_2O_2 ☐

[1]

The majority of candidates correctly identified H_2O_2 as the formula of hydrogen peroxide. Some were distracted by the other options available for this item.

i	**OCR support**	Hydrogen peroxide is listed within the inorganic compounds section of the Unit 1 specification at LO **5.1**. https://www.ocr.org.uk/Images/260245-science-fundamentals.pdf

Question 5 (a) (ii)

(ii) What process produces hydrogen peroxide in the human body?

Tick (✓) **one** box.

Metabolism of amino acids ☐

Replication of DNA ☐

Transmission of a nerve impulse ☐

Treatment of hypertension ☐

[1]

Almost all candidates appreciated that hydrogen peroxide is produced during the metabolism of amino acids. Some incorrectly selected the treatment of hypertension as their response. The metabolism of amino acids is often used as the example for hydrogen peroxide generation (via their degradation within the liver). This example is also referred to within the Unit 1 specification at LO **5.1**.

Question 5 (b)

(b) Hydrogen peroxide slowly decomposes into oxygen and one other product.

Complete the word equation for the decomposition of hydrogen peroxide.

Hydrogen peroxide → Oxygen + ...

[1]

The guidance provided in the stem, with reference to 'word equation', appeared to be understood by most candidates. However, not all candidates realised that water is generated.

?	**Misconception**	The most common misconception was that hydrogen was produced, perhaps stemming from some confusion linked to the name of the substrate, hydrogen peroxide.

Question 5 (c)

(c) Hydrogen peroxide is a liquid at room temperature and pressure.

The rate of decomposition would be slower if hydrogen peroxide was a solid.

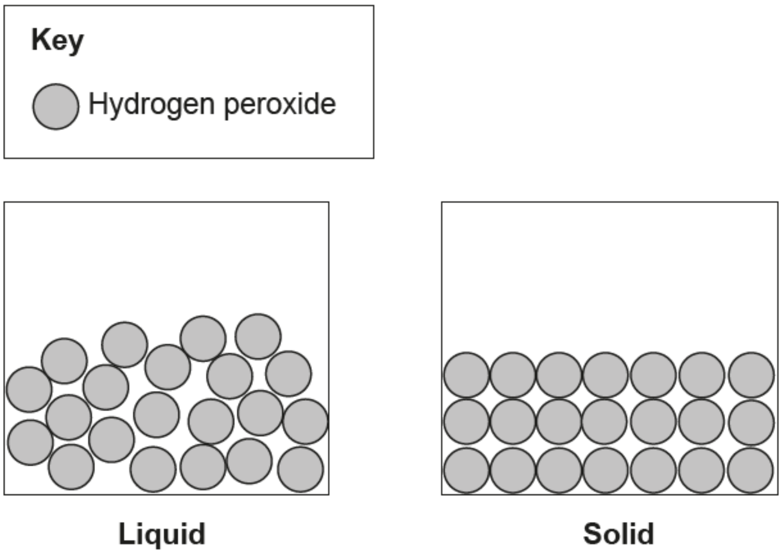


Fig. 5.1

Explain why the rate of decomposition is slower when hydrogen peroxide is in its solid state.

You may use the diagrams shown in **Fig. 5.1** in your answer.

....

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....

....

.... **[3]**

Many candidates performed well for this item. They often correctly provided explanations based on the differences of space between particles, the movement of particles and the collisions linked to the energy available to break bonds. The responses were usually clear but some candidates referred to atoms rather than molecules or particles. Candidates rarely used diagrams to support their explanations. This did not limit the marks given.

Question 5 (d)

(d) The decomposition of hydrogen peroxide happens quickly in the human body because it is catalysed by enzymes in the liver.

An experiment was conducted to see how much oxygen could be produced in 1 minute when liver was added to hydrogen peroxide at different temperatures.

Fig. 5.2 shows a graph of the experiment.

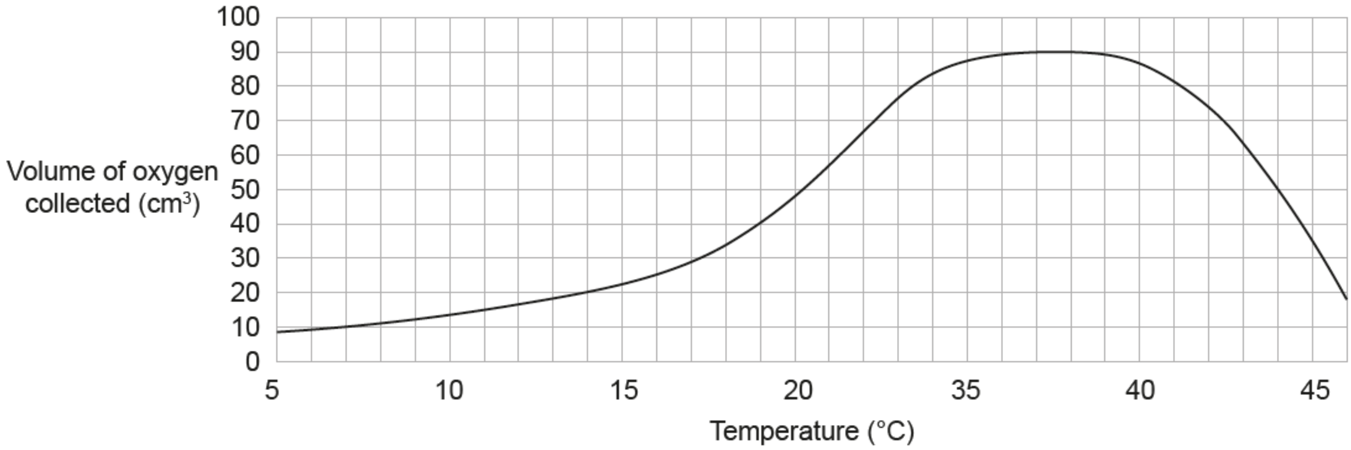

Fig. 5.2

Describe and explain the shape of the graph.

.... **[6]**

This free-response item (also known as a Level of Response [LoR] item) focused on two actions. Candidates were expected to describe the appearance of the graph shown in Fig. **5.2** but also to provide an explanation. This approach was reflected in the marks given against a range of valid points. Candidates who provided only a description were unable to move beyond Level 2, even though they may have provided many valid points. The inclusion of explanations, such as the denaturation of the enzyme at higher temperatures, the corresponding change in shape of the active site and the inability of substrate molecules to fit into this altered shape, enabled the most able candidates to progress onto Level 3 and obtain 5 or 6 marks.

Question 6 (a)

6 An infographic to show the ranges of some of the mechanical properties of different materials is shown in **Fig. 6.1**.

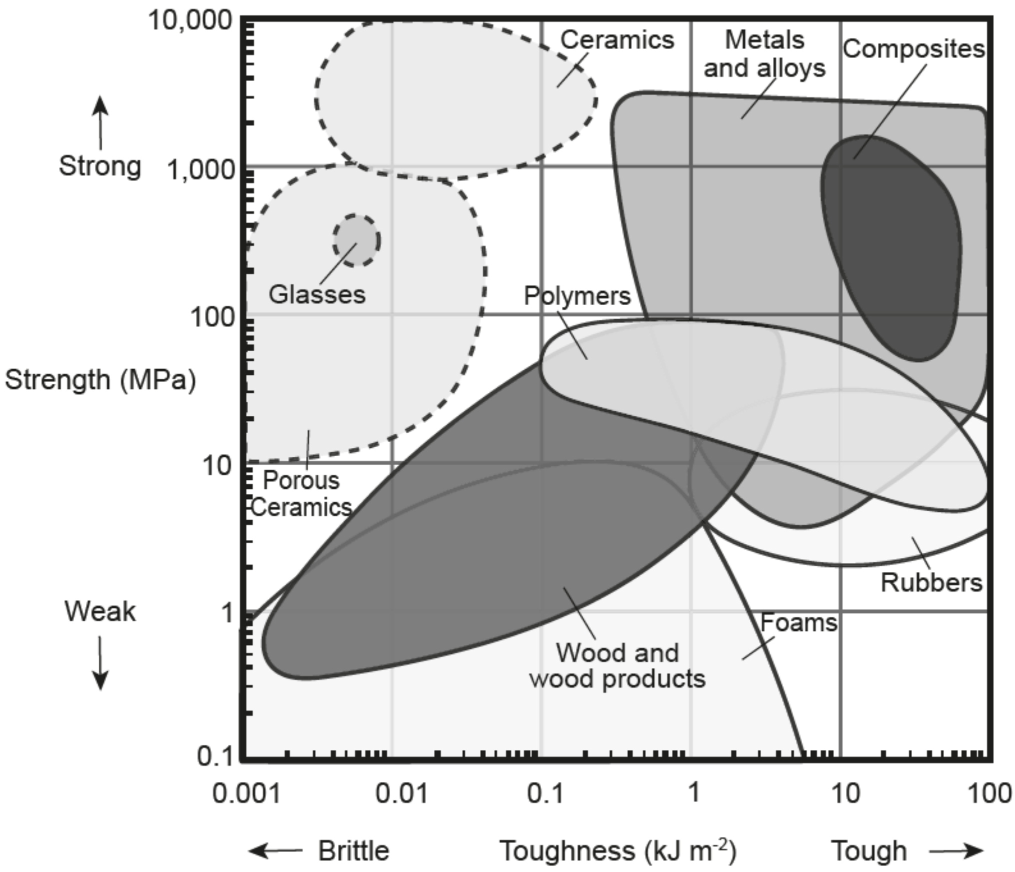

Fig. 6.1

(a) Compare the mechanical properties of the different materials shown in **Fig. 6.1**.

....

....

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....

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....

....

.... **[3]**

The interpretation of an infographic can be challenging. Many candidates were successful with this item and gained 2 out of the 3 marks available. Such candidates selected one of the materials and identified its strength and/or toughness, e.g. ceramics are strong but relatively brittle. A comparison was then often included with reference to a second material, e.g. composites are generally not quite as strong as ceramics but are much tougher. Some candidates provided explanations in the context of material properties. This was not necessary since the item focused on an observational account of differences presented within Fig. **6.1**. A number of candidates did particularly well and used the data sets presented on the two axes. Even though the values are logarithmic, these students were able to identify approximate ranges, e.g. porous ceramics have a strength between 10 and 1000 MPa.

Question 6 (b)

(b) Describe **three** properties of brittle materials.

1 ....

....

2 ....

....

3 ....

....

[3]

A number of candidates struggled with this item. Candidates did frequently appreciate that brittle materials break easily. This is a correct statement and gained 1 mark. Other features of brittle materials, such as their ability to snap suddenly or low ductility, were overlooked.

	AfL	It may be useful for teachers to clarify the differences between the material properties of malleability, ductility, brittleness and hardness. These terms are listed in the specification for Unit 1 in LO **6.1**.

Question 7 (a)

7 A small D.C. motor has a resistance of 0.6 Ω.

When connected to a power supply set to 5.0 V, a current of 0.2 A flows through the circuit.

The spindle of the motor turns rapidly.

(a) Calculate the power supplied to the motor.

Use the equation: power = potential difference x current

Power supplied = ... W **[2]**

Most candidates used the information provided in the stem of this question to successfully complete the calculation (5.0 V x 0.2 A = 1.0 W).

Question 7 (b) (i)

(b) **(i)** Calculate the potential difference across the motor.

Use the equation: potential difference = current x resistance

Potential difference = ... V **[2]**

It was anticipated that candidates would readily identify the two values (current = 0.2 A and resistance = 0.6 Ω) as provided in the stem. Some candidates struggled with this item and gave a range of incorrect calculations.

?	**Misconception**	Some candidates were distracted by the multiplication of two values with one decimal point each. This resulted in responses such as 1.2. They often obtained 1 of the 2 marks for the correct inclusion of the calculation, 0.2 x 0.6 within the space provided. This reinforced the guidance that appropriate use of this space to show calculations is good practice.

Question 7 (b) (ii)

(ii) Use your answer to **(b)(i)** to calculate the power dissipated in the motor.

Power dissipated = ... W **[1]**

Relatively few candidates completed this item successfully. The correct calculation (0.12 x 0.2) was not considered. If an incorrect response for the potential difference in (b)(i) had been included within the equation, the mark was given as an error carried forward.

Question 7 (b) (iii)

(iii) Determine the power available for the motor to do work.

Power available = ... W **[1]**

Some candidates realised that the power available should be calculated by deducting the power dissipated (0.024 W) from the power supplied (1.0 W). This gave a response of 0.976 W. This item was a good discriminator between candidates. The marking of this item also allowed for an error carried forward from (b)(ii).

Question 7 (c) (i)

(c) A load is attached to the spindle of the motor which now spins more slowly.

The power supply is still set to 5.0 V but the current flowing through the circuit is now 1.3 A.

(i) Calculate the power supplied to the motor when the load is attached.

Power supplied = ... W **[1]**

The majority of candidates completed this item successfully and calculated that the power supplied was 6.5 W. It was good to see that candidates were using the data sheet to good effect.

Question 7 (c) (ii)

(ii) Calculate the power dissipated in the motor when the load is attached.

Power dissipated = ... W **[2]**

The more able students obtained full marks for this item. The calculation involved two steps and this was challenging for many candidates. The potential difference was determined via current x resistance (as shown on the data sheet). In this case, potential difference = 1.3 A x 0.6 Ω = 0.78 V. The more difficult, second step involved the multiplication of potential difference (0.78 V) with the current (1.3A) to determine the power dissipated in the motor (1.014W).

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