CAMBRIDGE TECHNICALS

Oxford Cambridge and RSA

CAMBRIDGE TECHNICALS LEVEL 3 (2016)

Examiners' report

APPLIED SCIENCE

05847–05849, 05879, 05874

Unit 1 January 2022 series

Version 1

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Contents

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 and the mark scheme can be downloaded from OCR.

Unit 1 series overview

It appears that almost all candidates had revised sufficiently well for this examination and that most of the specification content had been encountered. The instructions of questions in the examination were understood by the majority of candidates. Most candidates attempted all questions and completed the paper within the time allocated. Some candidates did not respond to one or two items in the examination, but no pattern of 'nil response' could be identified for specific questions.

As for the last series (January 2021), candidates were increasingly confident with the approach to be followed when answering the Level of Response question (LoR) [Question 7]. As a result, the majority of candidates were given marks for this LoR question at Levels 1 and 2.

The objective-format questions, such as completing tick-boxes for optional statements, the addition of missing words in sentences, joining concept boxes with lines and completing tables, were familiar to candidates. However, some candidates did not use the calculation space provided for Question 8, thereby preventing the allocation of mid-stage calculation marks (even if the final answer was incorrect).

Few candidates used the additional pages provided at the end of the paper. When they did use such pages, appropriate links were shown within the answer spaces in the paper. Some candidates used asterisks to make the link, while others referred to the additional page numbers.

Many candidates coped well with this examination.

Candidates who did well on this paper generally did the following:	***Candidates who did less well on this paper generally did the following:***
• Had clearly prepared well for the examination, with a focus on the details often provided via the 'exemplification' section of the specification. • Had acquired a range of skills and knowledge as outlined in the Unit 1 specification. • Were generally confident about inorganic and organic chemistry, using correct symbols and terminology. • Were more confident with the biology-related topics encountered. • Interpreted the rubric of the question paper to help them to respond well to the wide range of formats presented. • Were able to interpret graphs and images to identify a realistic description or explanation. • Used the context/outline in the stem of each question to demonstrate the knowledge and skills required. Had a sound understanding of the penultimate question on the breaking of different materials in relation to temperature.	• Did not appear to prepare sufficiently well for the examination and had not used the information available via the 'exemplification' section of the specification to good effect. • Struggled to demonstrate a range of skills and knowledge as outlined in the Unit 1 specification. • Were less confident about inorganic and organic chemistry, included an understanding of the Periodic Table. • Did not respond to some items, but with no pattern linked to individual questions. • Were challenged by instructions within questions, including the correct completion of tables. • Were not able to successfully interpret data provided via a graph. • Did not have the knowledge and skills required to respond effectively to the penultimate question on the breaking of different materials in relation to temperature.

Question 1 (a) (i)

1 Part of the Periodic Table is shown in **Fig. 1.1**.

The letters are not the correct chemical symbols of the elements.

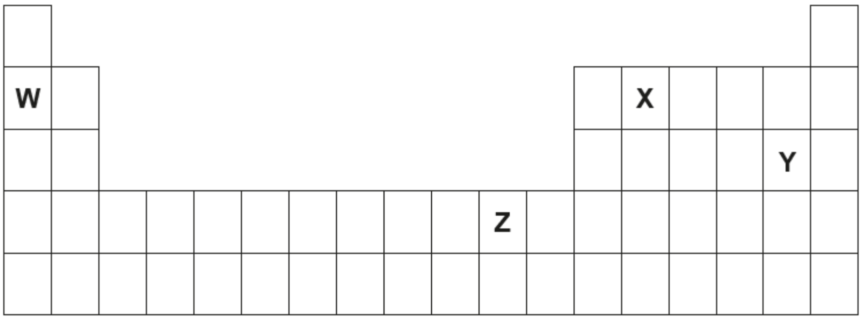


Fig. 1.1

(a) **(i)** Element **Y** has two isotopes.

Define the term isotope.

....

.... **[2]**

Many candidates were able to define isotope in relation to the same number of protons and different number of neutrons.

Question 1 (a) (ii)

(ii) Explain why the relative atomic mass of element **Y** is **not** a whole number.

....

....

....

.... **[2]**

This question appeared to be more challenging for some candidates. A reference to isotopes was required and linked to an average/mean calculation and the impact on the relative atomic mass. No general pattern of alternative responses was identified.

Question 1 (a) (iii)

(iii) An isotope of **W** has four neutrons.

What is the nucleon number of this isotope?

.... **[1]**

Almost all candidates understood that the nucleon number must be 7. However, some candidates identified 4 (or another value) as the nucleon number.

	AfL	It is recommended that an appreciation of nucleon number is reinforced for future candidates (Unit 1 Specification Reference - Learning Outcome [LO] 1.1).

Question 1 (a) (iv)

(iv) Determine the number of outer shell electrons in elements **W** and **X**.

W..

X..

[1]

Although most candidates tended to correctly identify 1 and 4 as the numbers of outer shell electrons, others were unable to do this.

	AfL	It is suggested that the topic of electron shells is taught via models (Unit 1 Specification Reference LO 1.1).

Question 1 (a) (v)

(v) Identify the name of element **Z**, using the full Periodic Table.

.... **[1]**

Element Z was identified correctly by most candidates as copper. No pattern of alternative responses was observed, although some candidates did refer incorrectly to gold.

Question 1 (b)

(b) Complete the sentences. Use the letters from **Fig. 1.1**.

You can use each letter once, more than once or not at all.

Two elements which combine to form a covalent compound are .... and ....

Two elements which combine to form an ionic compound are .... and ....

[2]

A number of candidates struggled to complete the two sentences correctly.

	AfL	The distinction between covalent and ionic compounds can be demonstrated diagrammatically to achieve a greater understanding of this topic, including the use of 'dot and cross' models (Uni1 Specification Reference LO 1.3).

Question 1 (c) (i)

(c) **Fig. 1.2** shows the relationship between atomic radius and proton number for the first 20 elements in the Periodic Table.

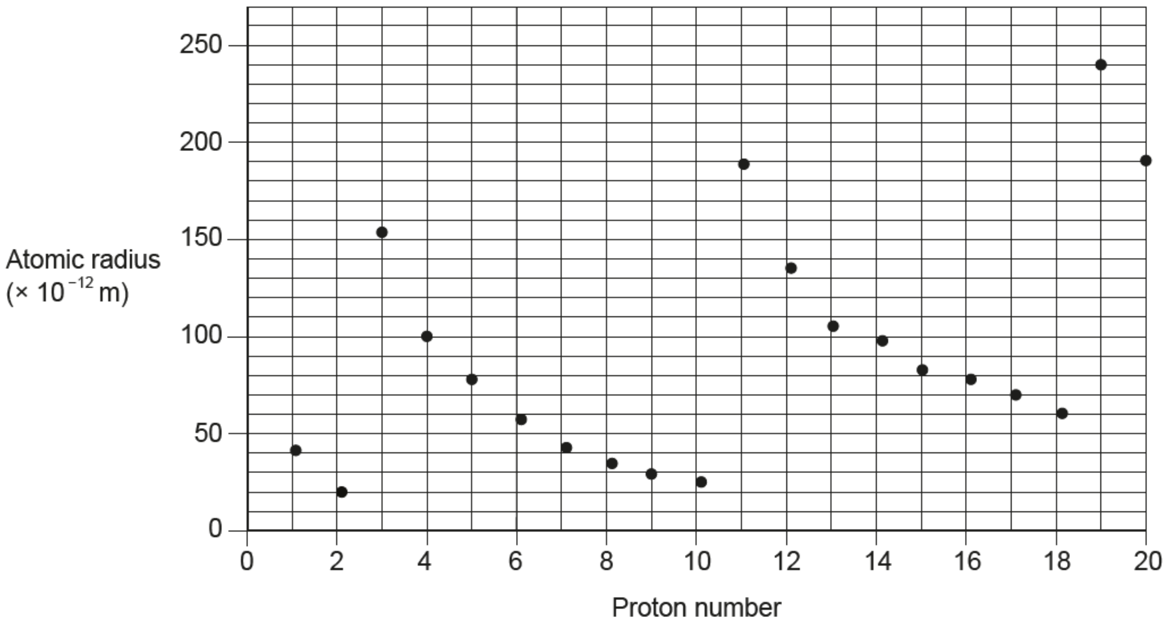


Fig. 1.2

(i) Put a ring around the **three** Group 1 alkali metals on **Fig. 1.2**. **[1]**

A number of candidates added a ring around proton number 1, instead of starting the series with proton number 3. This prevented them from obtaining the mark, even if they continued to ring proton numbers 11 and 19.

Question 1 (c) (ii)

(ii) Give the names of **two** elements with an approximate radius of 80 × 10^{-12} m.

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

This question did not present a challenge for the majority of candidates. Almost all correctly identified boron as one of the two elements.

Question 1 (c) (iii)

(iii) Explain why the atomic radius decreases from element 11 to element 18.

....

....

....

.... **[2]**

Although many candidates attempted to provide an explanation based on the attraction between the nucleus/protons and the electrons, few correctly noted that there was an increase in proton numbers from element 11 to element 18.

	AfL	It is suggested that the Periodic Table is considered on a frequent basis while delivering the content of this unit to help candidates to feel much more confident about the details (Unit 1 Specification Reference LO 1.2).

Question 1 (c) (iv)

(iv) Explain why there is a large increase in atomic radius from element 18 to element 19.

....

.... **[1]**

Many candidates successfully noted that an extra electron shell is added between elements 18 and 19. No clear pattern of alternative responses was noted.

Question 2 (a) (i)

2 Sulfur is an essential element in living cells.

- A common source of sulfur is the sulfate ion.
- Plants absorb sulfate ions which are used to form the essential amino acids, cysteine and methionine.
- When the plant dies the amino acids decompose and release sulfur and sulfate ions back into the soil.

One model of this cycle is summarised in **Fig. 2.1**.

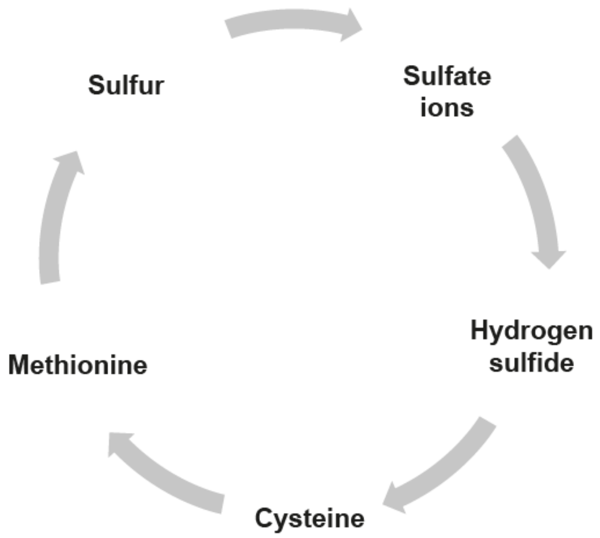


Fig. 2.1

(a) **(i)** Identify the other element present with sulfur in the sulfate ion.

Tick (✓) **one** box.

Carbon ☐

Nitrogen ☐

Oxygen ☐

Phosphorus ☐

[1]

Many candidates correctly identified oxygen as the element present. However, a number selected carbon.

?	**Misconception**	This misunderstanding could be overcome with more focus on the composition of the essential elements listed in LO5.1 of the Unit 1 specification.

Question 2 (a) (ii)

(ii) Explain why the conversion of sulfate ions (SO_4^{2-}) into hydrogen sulfide (H_2S) in **Fig. 2.1** is an example of reduction.

....

....

....

.... **[2]**

The features of a reduction reaction were expressed well by many candidates with reference to the fundamental features of oxygen loss and hydrogen gain. However, those candidates who referred to electrons tended not to articulate a full response. It is important for candidates to appreciate the 'source' of electron gain and loss.

Question 2 (b) (i)

(b) The skeletal formula of methionine is shown in **Fig. 2.2**.

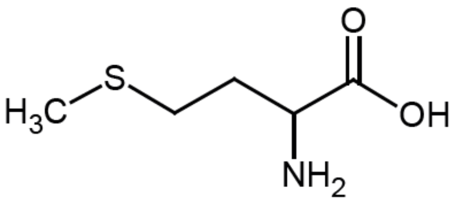


Fig. 2.2

(i) Methionine is classified as an amino acid.

Put a ring around the **two** functional groups in **Fig. 2.2** that are common to all amino acids. **[1]**

Some candidates appreciated that the two functional groups are amine and carboxylic. The rubric of the item was generally followed correctly.

Question 2 (b) (ii)

(ii) Each amino acid has a different R group.

Methionine has an R group of $–CH_2CH_2SCH_3$, as shown in **Fig. 2.2**.

The R group in cysteine is $–CH_2SH$.

Draw the skeletal formula of cysteine.

[1]

The presentation of a skeletal formula was appreciated (as provided in Fig. 2.2) but the details were not understood. The location of the R group was not demonstrated via the models constructed. This question was challenging for almost all candidates.

Question 2 (c)

(c) Amino acids are joined together to form polypeptide chains. This process takes place in living cells.

- The order of amino acids found in each type of polypeptide chain is determined by the sequence of bases in DNA.
- The bases are held together in pairs along the DNA double helix.

Fig. 2.3 shows pairings for the four DNA bases adenine, thymine, guanine and cytosine.

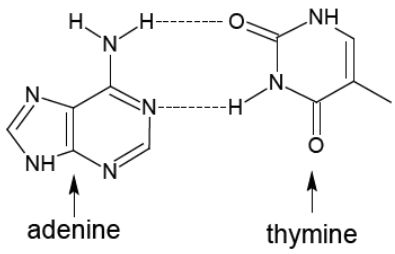
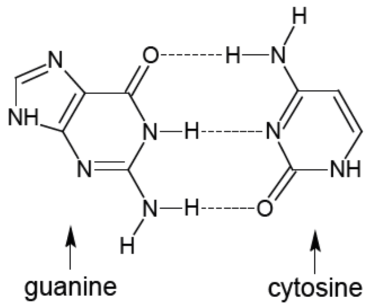
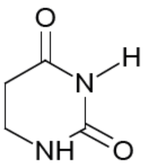
Base pairing	Structure
Adenine and thymine	
Guanine and cytosine	

Fig. 2.3

Uracil is a different base found in RNA.

Uracil is able to replace one of the four bases in **Fig. 2.3**.



Uracil

Which base in **Fig. 2.3** can be replaced by uracil?

Explain your answer.

....

....

....

....

....

.... **[3]**

Many candidates were able to name thymine as the organic base replaced by uracil. The similarity between the two bases was also noted by a number of candidates but the shared ability to bond with adenine was less well understood.

	AfL	It is recommended that the details of organic base structures and the complementary bonding between pairs is reinforced for DNA/RNA via simple models (Unit 1 Specification Reference LO 4.4).

Question 3 (a) (i)

3 Many organic compounds have functional groups that contain oxygen.

Esters are organic compounds that have the functional group shown in **Fig. 3.1**.

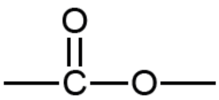


Fig. 3.1

(a) Polylactate is a polyester.

The repeating unit of polylactate is shown in **Fig. 3.2**.

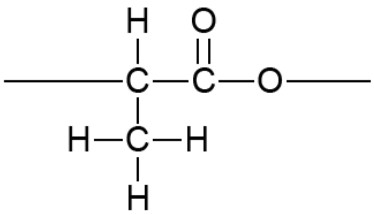


Fig. 3.2

(i) What is the empirical formula of polylactate?

Tick (✓) **one** box.

CH_2O ☐

$C_3H_4O_2$ ☐

$C_3H_6O_3$ ☐

$C_6H_8O_4$ ☐

[1]

The empirical formula was interpreted correctly by many candidates. Such candidates identified $C_3H_4O_2$ for polylactate. No clear pattern of alternative responses was noted.

Question 3 (a) (ii)

(ii) Draw the monomer that is used to make polylactate.

[1]

Few candidates were able to draw the monomer used to make polylactate.

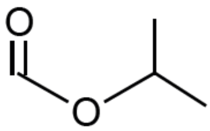
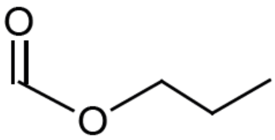
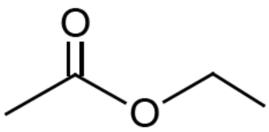
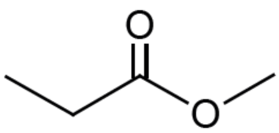
	AfL	It is suggested that the structural and empirical formulae of polymers is demonstrated via diagrams, as for those listed in the Unit 1 Specification Reference LO4.2.

Question 3 (b) (i)

(b) **(i)** Ethyl ethanoate is also an ester.

What is the skeletal formula of ethyl ethanoate?

Tick (✓) **one** box.

[1]

The interpretation of skeletal formulae is clearly challenging for many candidates. Although the third option in the tick table was correctly identified by some, a pattern of alternative responses was not observed.

Question 3 (b) (ii)

(ii) Esters are produced when a carboxylic acid reacts with an alcohol.

A structural isomer of ethyl ethanoate is methyl propanoate.

Put a ring around the formulae of the carboxylic acid and the alcohol that form methyl propanoate.

Carboxylic acid

$HCOOH$ CH_3COOH CH_3CH_2COOH

Alcohol

CH_3OH CH_3CH_2OH $CH_3CH_2CH_2OH$

[2]

Candidates were often able to identify the carboxylic acid via the formula provided but a number struggled to note the alcohol. Some candidates were unable to select both formulae.

	AfL	It may be useful to rehearse the differences between alcohols and carboxylic acids via the Unit 1 Specification Reference LO4.1 in conjunction with an understanding of polymers at LO4.2. Again, the construction of simple diagrammatic models may be an appropriate teaching tool for this purpose.

Question 3 (b) (iii)

(iii) Another structural isomer of ethyl ethanoate is shown in **Fig. 3.3**.

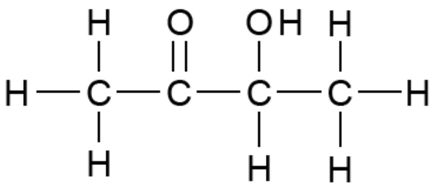


Fig. 3.3

The molecule in **Fig. 3.3** shows a different type of isomerism.

Explain the other type of isomerism shown by the structural isomer of ethyl ethanoate in **Fig. 3.3**.

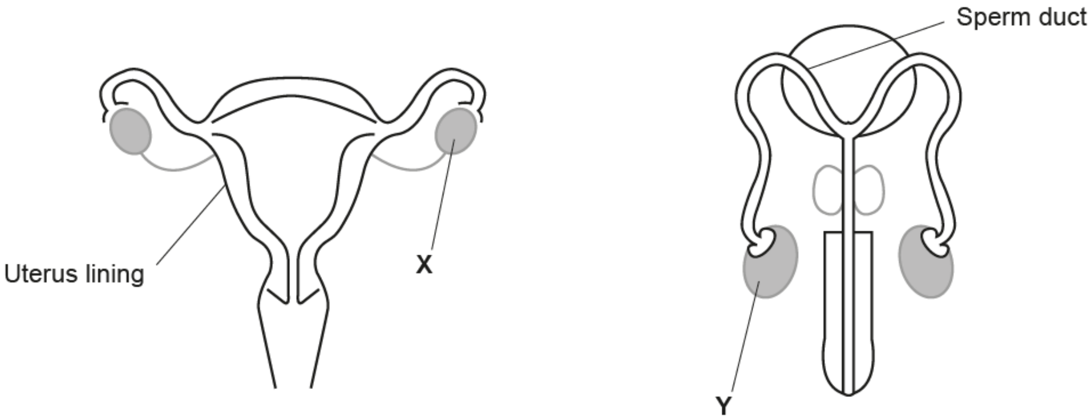
.... **[3]**

	Misconception	A number of candidates demonstrated a misconception with regards to the other type of isomerism shown by the structural isomer in Fig. 3.3. Some referred to 'functional' isomers. This classification is misplaced and not in use. The differences between structural, geometric and optical isomers are outlined in Unit 1 Specification Reference LO4.3.

Question 4 (a)

4 Simplified diagrams of the female and male reproductive systems are shown in **Fig. 4.1**.

The gonads in each reproductive system are labelled **X** and **Y**.



Female reproductive system **Male reproductive system**

Fig. 4.1

(a) Name **X** and **Y** in **Fig. 4.1**.

X ....

Y ....

[2]

This item was supported by additional scaffolding in the form of the labelling shown for the two reproductive systems. Almost all candidates were successful with this item.

?	**Misconception**	Some incorrectly identified the ovary as the egg or ovum. This misconception can be readily overcome with the use of readily-available diagrammatic models of the two systems.

Question 4 (b)

(b) Gonad **X** is the sexual organ responsible for producing egg cells. Egg cells contain a large amount of cytoplasm.

State **two** functions of cytoplasm in a cell.

1 ....

....

2 ....

....

[2]

Most candidates were aware that the cytoplasm is the site of cellular reactions and provides some form of support for the organelles. A few candidates confused the features with those of the cell surface membrane or nucleus. Some attempted to link the functions of cell cytoplasm with the overall function of the egg cell. Such responses tended not to be creditworthy.

Question 4 (c)

(c) Gonad **Y** produces sperm cells.

Fig. 4.2 shows an image of a sperm cell.

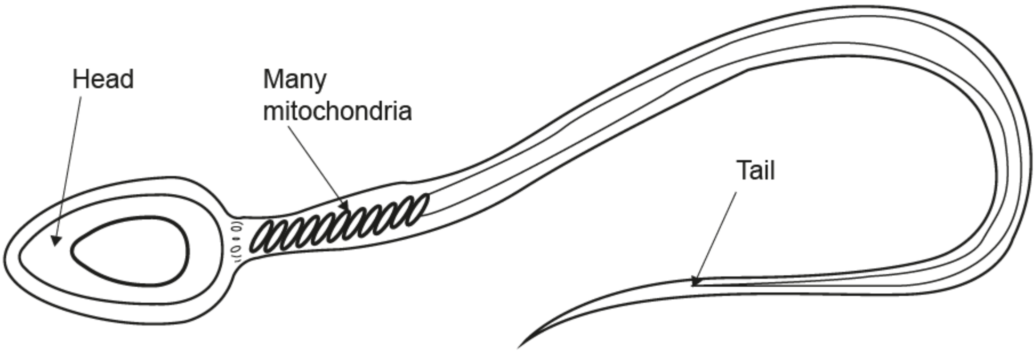


Fig. 4.2

The sperm cell has many more mitochondria than a typical human cell.

Suggest why the sperm cell needs to have a lot of mitochondria.

....

....

....

....

....

.... **[3]**

In general, almost all candidates were able to link the overall function of the mitochondrion (ATP production, release of energy and/or site of [aerobic] respiration) with the numbers of this organelle seen in the sperm cell. An incorrect reference to 'making energy' was ignored in the context of this question. Some candidates were well-informed about the energy needed to achieve fertilisation/penetration of the egg cell.

Question 4 (d) (i)

(d) **(i)** The head of the sperm cell shown in **Fig. 4.2** contains the nucleus. The nucleus is surrounded by a nuclear envelope.

What is the characteristic feature of the nuclear envelope?

Put a ring around the correct answer.

Double membrane **Single membrane** **Triple membrane**

[1]

Most candidates correctly put a ring around 'double membrane'. Very few selected the other options for this question.

Question 4 (d) (ii)

(ii) The sperm nucleus contains DNA in the form of chromosomes. The nucleus is a characteristic feature of all eukaryotic cells.

Complete the table to compare eukaryotic and prokaryotic cells.

Tick (✓) at least **one** box in each row.

The first feature has been completed for you.

Feature	**Eukaryotic cells (e.g. sperm cells)**	**Prokaryotic cells (e.g. bacteria)**
DNA in a nucleus	✓	
Membrane-bound organelles		
Cell surface membrane		
Mesosome		

[2]

A mixture of responses was observed for this question. Although many candidates realised that the mesosome is characteristic of prokaryotic cells they did not recall that the cell surface membrane is common to both types of cell. Others considered that membrane-bound organelles were found in prokaryotic cells.

	AfL	It is suggested that candidates are encouraged to construct drawings of both eukaryotic and prokaryotic cells to reinforce the similarities as well as the differences, as noted in Unit 1 Specification Reference LO3.1.

Question 4 (e)

(e) Gonad **X** (**Fig. 4.1**) produces two hormones called oestrogen and progesterone.

These hormones are responsible for:

- the release of the egg cell (ovulation) from gonad **X**
- the thickness of the uterus lining (shown in **Fig. 4.3**).

Fig. 4.3 shows graphs of the changing amounts of the two hormones and the changing thickness of the uterus lining over 28 days.

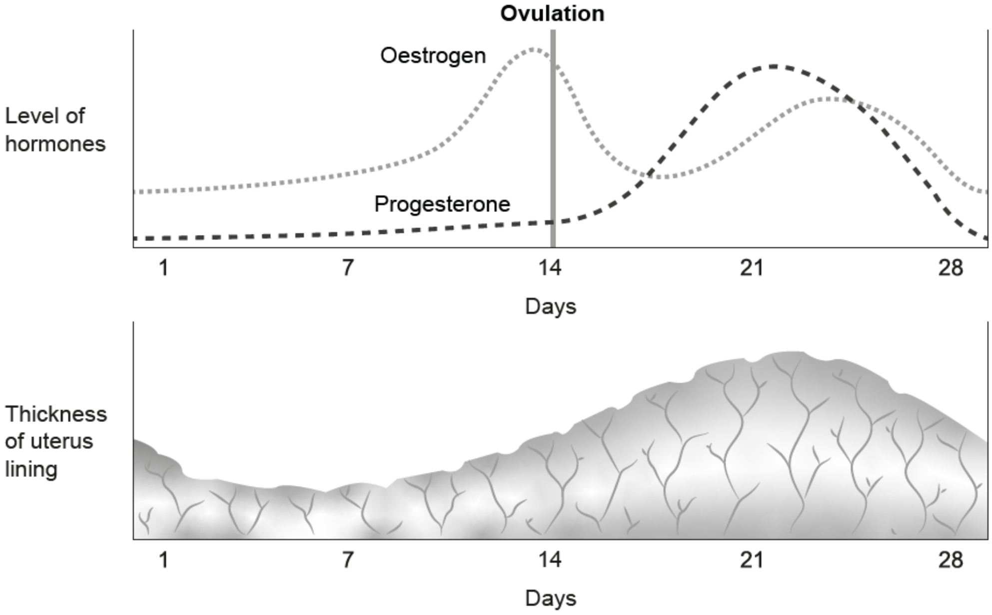


Fig. 4.3

Describe how the levels of the two hormones affect the release of the egg cell and the thickness of the uterus lining during the 28-day period.

Release of the egg cell

....

....

....

....

Thickness of the uterus lining

....

....

....

....

[4]

Some excellent responses were seen for this question. The most successful candidates were able to provide a good description with reference to named hormone levels (oestrogen and/or progesterone) linked to release of the egg cell (ovulation) and thickness of the uterus lining. The key feature of this question was based on the ability to identify these features in relation to the time scale provided in the graphs.

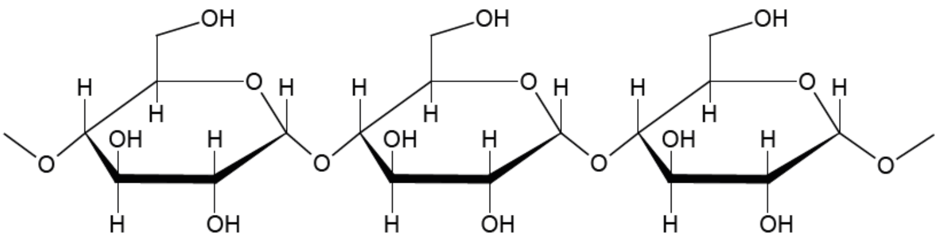
	AfL	Candidates should be encouraged to include a reference to both graph axes in addition to the labels provided when responding to this type of question.

Question 5 (a) (i)

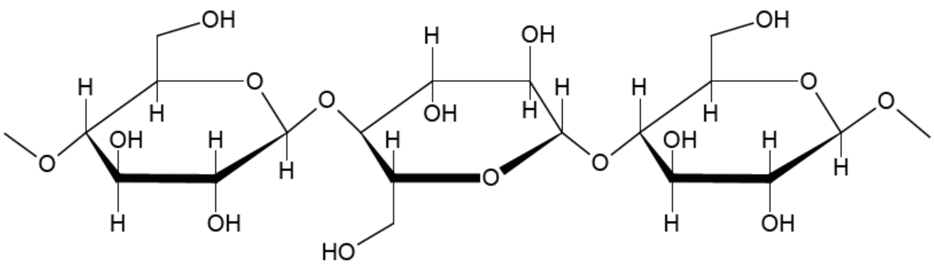
5 **(a)** Starch and cellulose are carbohydrates that are found naturally in plants.

Their structures are shown in **Fig. 5.1**.

Both contain sugar monomers linked by C–O–C bonds, but the monomers are linked in a different way.



Starch



Cellulose

Fig. 5.1

(i) What is the classification of the carbohydrates in **Fig. 5.1**?

Tick (✓) **one** box.

Polysaccharide ☐

Polypeptide ☐

Triglyceride ☐

Phospholipid ☐

[1]

	Misconception	Although most candidates correctly identified the classification as polysaccharide, it was clear that some candidates had a misconception and referred to polypeptide. Very few candidates incorrectly selected triglyceride or phospholipid.

Question 5 (a) (ii)

(ii) What is the C–O–C link in starch and cellulose?

Put a (ring) around the correct answer.

Ester **Glycosidic** **Hydrogen** **Peptide**

[1]

Many candidates correctly chose glycosidic but some selected peptide [even though they may have correctly identified the carbohydrate as a polysaccharide in Question 5 (a) (i)].

Question 5 (a) (iii)

(iii) What is the type of reaction that forms the carbohydrates in **Fig. 5.1**?

Put a (ring) around the **two** correct answers.

Addition **Condensation** **Hydrolysis**

Substitution **Polymerisation**

[2]

Many candidates obtained both marking points for this question. Some were distracted by addition or hydrolysis.

	AfL	These reactions are noted via the exemplification section of Unit 1 Specification Reference LO4.4.

Question 5 (a) (iv)

(iv) Starch and cellulose have different functions within plant cells.

Draw lines to connect each **carbohydrate** with its correct **function in a plant cell**.

Carbohydrate	**Function in a plant cell**
	Source of energy
Cellulose	Structure of cell wall
	Synthesis of protein
Starch	Active uptake of mineral ions
	Absorption of light

[2]

Almost all candidates appreciated that starch is a source of energy for a plant cell. However, fewer candidates linked cellulose to the structure of the cell wall. The instructions of this question were followed correctly by most candidates. It is important for candidates to understand that one line was required from each carbohydrate.

Question 5 (b) (i)

(b) Starch can be broken down into sugar molecules by the enzyme amylase.

This enzyme is found in human saliva.

(i) Starch is water-insoluble but when it is mixed with water, it becomes evenly dispersed.

When starch is broken down, the sugar molecules formed are soluble in water.

Complete the table to identify the type of mixture starch forms with water, and sugar forms with water.

Tick (✓) **two** boxes.

Mixture	**Starch with water**	**Sugar with water**
Colloid		
Suspension		
Solution		

[2]

A variety of responses were observed for this tick-box table. Many candidates obtained both marking points and correctly noted that starch forms a colloid in water and sugar forms a solution with water. No clear pattern of alternative responses or misconceptions was recorded.

Question 5 (b) (ii)

(ii) The breakdown of starch by amylase depends on the pH in the mouth.

Fig. 5.2 shows a graph of the effect of pH on the breakdown of starch.

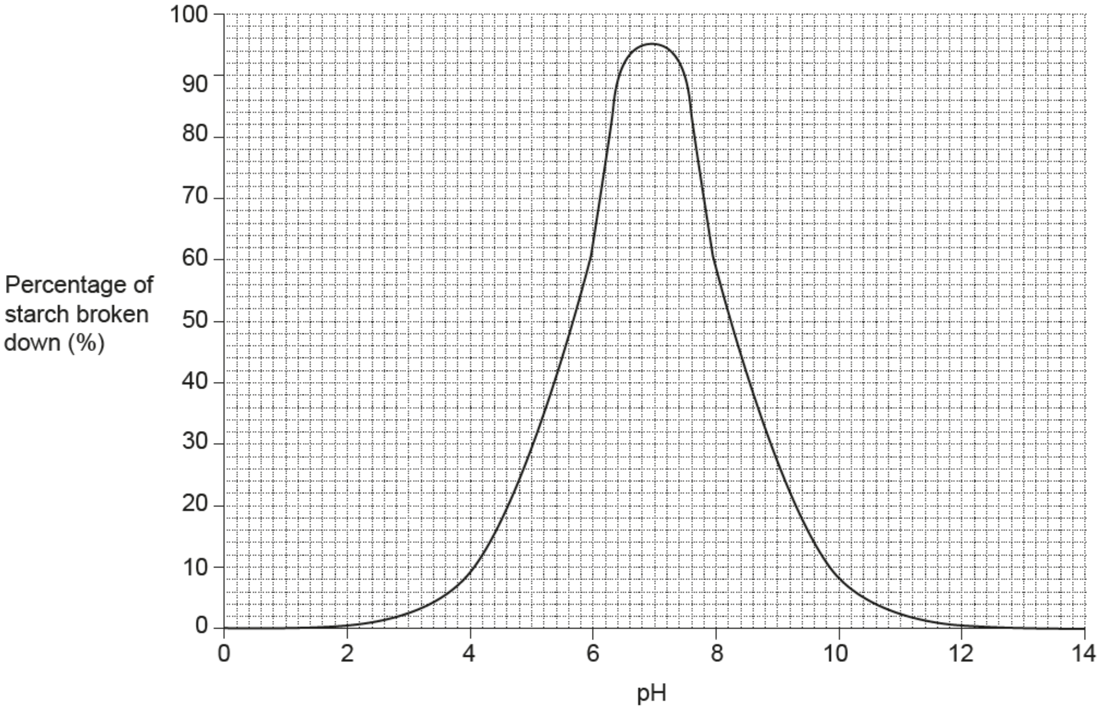


Fig. 5.2

Identify the optimum pH from **Fig. 5.2**.

pH = ... **[1]**

Almost all candidates provided the correct pH value of 7. This question was accessible to many because it was a straightforward interpretation of the graph.

Question 5 (b) (iii)

(iii) Explain why the percentage of starch broken down is **lower** on each side of the optimum value.

Use the lock and key hypothesis in your answer.

....

....

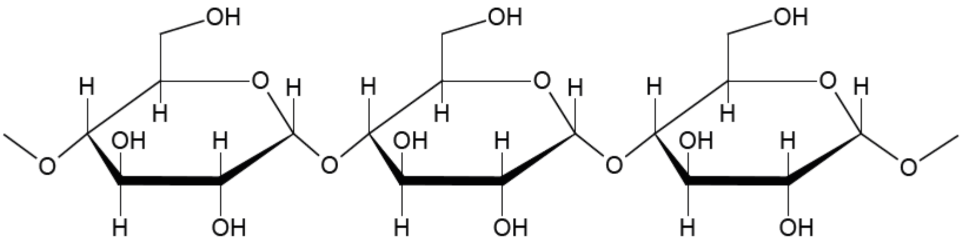
....

.... **[2]**

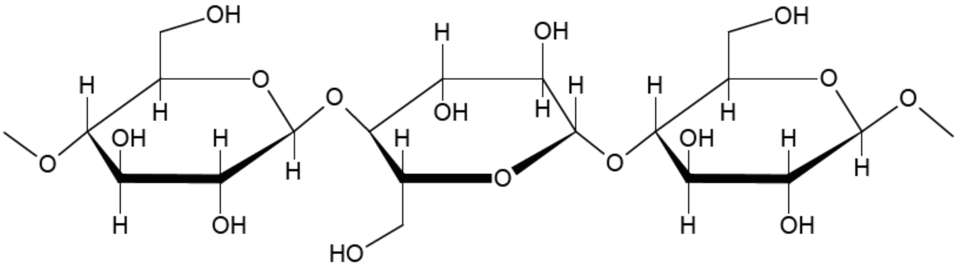
A number of candidates correctly referred to the denaturation of the enzyme (active site). Some continued to do well and provided a realistic explanation of events in the context of the denatured enzyme not fitting into the shape of the substrate/starch. Relatively few explored the lock and key hypothesis further within their response but still obtained full marks.

Question 5 (b) (iv)

(iv) Cellulose cannot be broken down by amylase, but starch can.



Starch



Cellulose

Fig. 5.3

Explain the difference in the reactions of starch and cellulose with amylase.

Use **Fig. 5.3** to support your answer.

[3]

Some candidates did successfully refer to starch binding with amylase, or cellulose not binding with this enzyme. Many candidates were challenged by this question. No common misconception was noted.

Question 6 (a)

6 Manganese, nickel and platinum are transition metals.

The transition metals have important chemical and biological functions.

(a) Manganese and nickel can be mixed with other metals to improve their properties.

What is the name given to a mixture of metals?

Tick (✓) **one** box.

Aerosol	☐
Alloy	☐
Emulsion	☐
Foam	☐

[1]

The majority of candidates recalled that the mixture of manganese and nickel with other metals forms an alloy. No clear pattern of alternative responses was noted, although some candidates were distracted by the incorrect term 'aerosol'.

Question 6 (b) (i)

(b) Nickel can act as a catalyst for the reaction shown:

$$CH_2{=}CH_2 + H_2 \longrightarrow CH_3{-}CH_3$$

(i) Give **two** features of this reaction that would prove that nickel is a catalyst.

1 ....

....

2 ....

....

[2]

The definition of a catalyst is outlined in Unit 1 Specification Reference LO2.3. Some candidates were challenged by this question but many did well and obtained 1 or 2 marks.

Question 6 (b) (ii)

(ii) The reactants in the reaction are gases.

Describe and explain the effect of reducing the pressure of the reactant gases on the rate of reaction.

Description ....

....

Explanation ....

....

....

.... **[3]**

This question proved to be very accessible for many candidates. They were able to describe the decreased rate of reaction and provide an explanation in relation to more space between the gas particles at lower pressures and thus less frequent collisions. References to an increased 'surface area' rather than space/volume were ignored.

Question 6 (c) (i)

(c) Manganese (II) ions (Mn^{2+}) and nickel (II) ions (Ni^{2+}) are important components of enzymes.

(i) Identify **three** biological functions of Mn^{2+} ions in the human body.

Tick (✓) **three** boxes.

The biosynthesis of choline for normal liver function	☐
The formation of bone matrix and cartilage structure	☐
The formation of myofibrils for muscle contraction	☐
The maintenance of a constant environment in cells	☐
The transport of carbon dioxide molecules	☐
The operation of some protein-based transport systems	☐

[3]

This question focused on factual recall. Many candidates obtained a mark for identifying the biosynthesis of choline and a further mark for the operation of some protein-based transport systems. Few candidates were given full marks.

i	**OCR support**	A list of biological functions of metal ions, ranging from iron and calcium to manganese and platinum, is available in LO5.1 of the Unit 1 specification. This list can appear challenging but it may be possible to teach this via the construction of visual concept maps. See the Unit 1 specification for more information.

Question 6 (c) (ii)

(ii) Mn^{2+} ions are present in enzymes responsible for photolysis in plants.

Where does photolysis occur in the plant cell?

Tick (✓) **one** box.

Cell wall	☐
Chloroplast	☐
Endoplasmic reticulum	☐
Golgi apparatus	☐

[1]

Many candidates correctly linked the process of photolysis in plants to the chloroplast. The topic of photolysis and photosynthesis at the chloroplast relates to LOs within the Unit 1 specification (LO3.2 and LO5.1).

	AfL	Although the details of photosynthesis are not required, it may be useful to link LO3.2 and LO5.1 via the use of a diagrammatic model shared with candidates. This could provide the connection between the chloroplast, photosynthesis (including photolysis) and the need for manganese.

Question 6 (c) (iii)

(iii) Nickel ions (Ni^{2+}) are an important component of some enzymes.

Complete the sentences about nickel-containing enzymes.

Use the words. You can use each word once, more than once or not at all.

amylase	**carbon**	**hydrogen**
hydrolase	**hydrolysis**	**oxidation**
oxygen	**polymerisation**	**reductase**

Nickel-containing enzymes include hydrogenase and ....

Hydrogenase catalyses the .... of

molecular ....

[3]

The sentences presented in this question also relate directly to the exemplification section of Unit 1 Specification Reference LO5.1. Relatively few candidates obtained full marks but a number correctly identified hydrolase as the other nickel-containing enzyme. They also recalled that hydrogenase catalyses the process of oxidation (in this case, of molecular hydrogen). The question was challenging and, although the topic was based on factual recall, some candidates did not obtain any marks.

Question 6 (d)

(d) Platinum (II) ions (Pt^{2+}) are used in medicine to treat illness.

Explain how Pt^{2+} is used in medicine.

....

....

....

....

....

.... **[3]**

Some candidates fully appreciated that platinum ions are used to treat cancers by interrupting the process of mitosis by interfering with DNA replication. Such ions are an active ingredient of the drug Cisplatin. This feature is outlined as the final item listed in LO5.1 of the Unit 1 Specification. It was noted that some candidates had found out that platinum ions can be used for other medical treatments. These alternative explanations were verified and marks given accordingly. Other candidates were less successful with this question and tended to repeat the wording provided in the stem within their response.

Question 7

7 The Charpy Impact Test measures the energy needed to break materials such as metals and polymers.

The results of a Charpy Impact Test comparing steel and nylon samples at different temperatures (−150 °C to 100 °C) are shown in the graph.

Steel is an alloy and nylon is a polymer.

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Compare the energy needed to break samples of steel and nylon at different temperatures.

Include references to strength, brittleness and ductility in your answer.

....

....

....

....

....

.... **[6]**

Most candidates obtained marks for this question at Level 1 or Level 2. Within the structure of this Level of Response question (LoR), these two levels allowed the majority of candidates to obtain 1 or 2 marks, or 3 or 4 marks respectively. The expected response focused on a comparison of steel and nylon in relation to the energy needed to break samples at different temperatures. This means that candidates needed to consider each material and to refer to the data presented via both axes of the graph (i.e. energy needed and temperature). In addition, suggestions in the context of strength, brittleness and ductility were considered. Detailed explanations were not required for this question. The questions focused on comparisons. Those candidates who provided detailed explanations, such as bonds and melting points, tended not to progress onto the higher levels of marking points.

	AfL	It is recommended that candidates could be given the opportunity to reflect further on the interpretation of graphical data, making the most of both axes and the details provided via the lines or histograms of the graph. This approach could be followed via a variety of applied science contexts, including sources available through the teacher-assessed units.

Question 8 (a) (i)

8 A circuit to determine the average internal resistance of a solar cell is shown in **Fig. 8.1**.

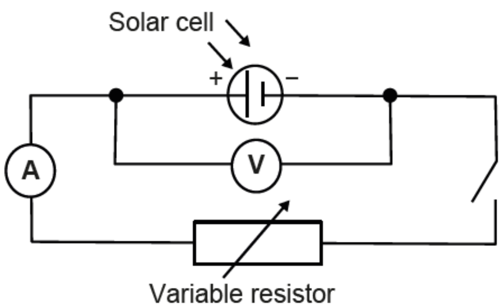

Fig. 8.1

The resistance of the variable resistor is changed and the potential difference across the solar cell and the current in the circuit are measured.

Fig. 8.2 shows a graph of the results.

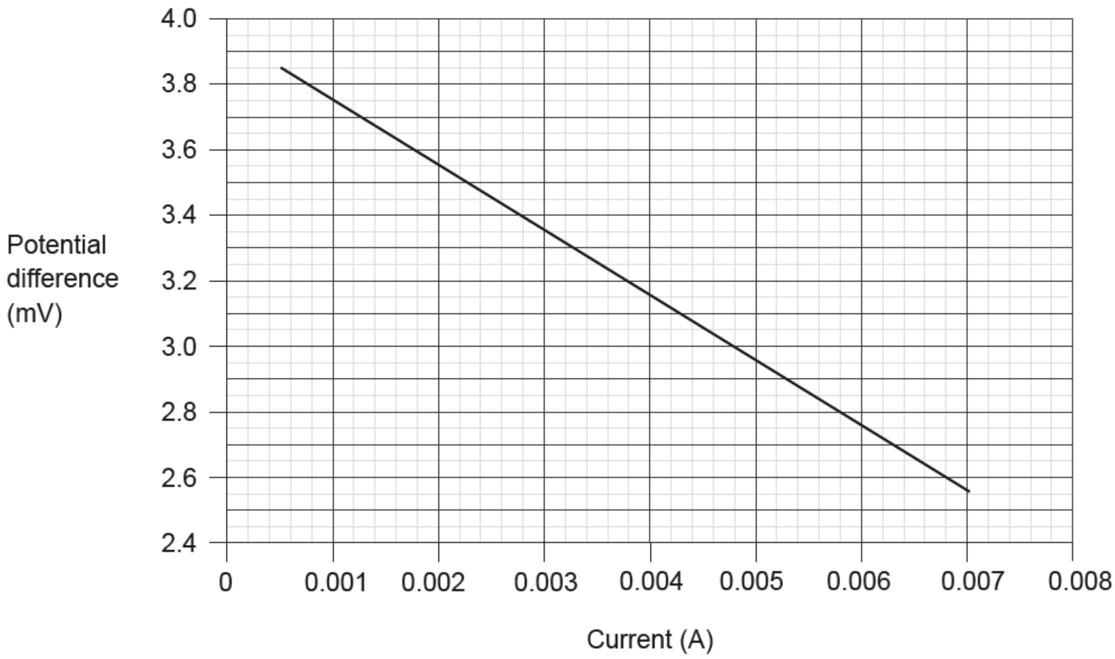

Fig. 8.2

(a) Use **Fig. 8.2** to help you answer part **(a)**.

(i) Estimate the potential difference across the solar cell at 0 A.

Potential difference = ... mV **[1]**

Almost all candidates provided the correct estimate (3.95mV). They were capable of extending the line drawn to the intercept at the y-axis. No clear pattern of alternative responses was observed.

Question 8 (a) (ii)

(ii) Calculate the change in potential difference across the solar cell between 0 and 0.007 A.

Change in potential difference = ... mV **[1]**

Almost all candidates completed this question successfully. The potential difference at 0.007A (2.55mV) was deducted from the potential difference at 0A (3.95mV). This did not present a problem for many. A mark was given as 'error carried forward' if candidates deducted 2.55mV from their estimate in (a) (i), even if their estimate was incorrect.

Question 8 (a) (iii)

(iii) Calculate the average internal resistance of the solar cell.

Use your answer to **(a)(ii)** and the equation:

$$\text{Average internal resistance} = \frac{\text{change in potential difference}}{\text{change in current}}$$

Average internal resistance = ... mΩ **[2]**

Again, almost all candidates obtained both marks and correctly calculated that the average internal resistance was 200 (mΩ). There was no pattern of alternative responses or common misconceptions. However, a mark was given for the correct calculation (using 'error carried forward' for the candidate's response to (a) (ii) divided by 0.007) but in the absence of the correct final answer.

Question 8 (b) (i)

(b) The solar cell in **Fig. 8.1** is illuminated by a lamp.

When there is no resistor in the circuit the cell produces an e.m.f. of 3.7 V and a current of 8×10^{-3} A.

(i) Calculate the power produced by the solar cell.

Use the equation: power = potential difference × current

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

It was relatively rare to see an incorrect answer. Candidates were able to insert the two values provided in the stem of the question within the equation presented.

Question 8 (b) (ii)

(ii) Determine the number of days it takes for the cell to transfer 1 kWh of energy.

Use your answer to **(b)(i)**.

Number of days to transfer 1 kWh of energy = ... **[3]**

Few candidates obtained full marks for this question. It appeared that the most challenging aspect was the conversion of 1 KWh to joules and then onto MJ. This was an essential feature of the calculation and, although some candidates appreciated that at some point in the process the value from (b)(i) should be divided into another value, many candidates did not achieve any marks. This was a challenging conclusion to the paper.

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