Qualification Accredited

Oxford Cambridge and RSA

GCSE (9-1)

Examiners' report

GATEWAY SCIENCE COMBINED SCIENCE A

J250
For first teaching in 2017

J250/09 Summer 2018 series

Version 1

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 can be downloaded from OCR.

3-3 grade

Like all exam boards, we have awarded a 'safety net' grade of 3-3 for higher tier GCSE Combined Science candidates in 2018 where appropriate so that they are not disadvantaged by being the first to sit a new GCSE. To help teachers making difficult decisions about higher versus foundation tiers in 2019, OCR will be providing further guidance and extra webinars during the Autumn term.

Paper 9 series overview

Candidates seemed to engage well with the paper, completing the all questions in the time allowed. Very few blank spaces were seen.

Question 1

1 Which statement is correct about a **chemical** change?

A A solid changes to a liquid.

B No new substances are formed.

C The change is irreversible.

D The change is reversible.

Your answer [ ] **[1]**

Candidates could generally recall this information with a large percentage identifying a chemical change as an irreversible reaction. Lower ability candidates tended to choose D as their incorrect response.

Question 2

2 Which statement about phosphorus is **correct**?

Use the Periodic Table to help you answer this question.

A A phosphorus atom has 15 protons and 16 electrons.

B The phosphorus-31 isotope has 16 neutrons.

C Phosphorus is a metal.

D The symbol for phosphorus is Po.

Your answer [ ] **[1]**

Approximately half of the candidates could use the periodic table as directed in the question to identify the isotope of phosphorous 31 as having 16 neutrons. The most commonly seen incorrect response was the imbalance of protons and electrons for an isotope, showing a misconception in the understanding of atomic mass and atomic number.

Question 3

3 The element astatine, At, is below iodine in Group 7.

Which prediction about astatine is correct?

A Astatine is a gas.

B Astatine is more reactive than iodine.

C Astatine is white.

D Astatine reacts with sodium to form NaAt.

Your answer [1]

This question required recall of the patterns of reactivity of group 7. Less than a third of candidates were credited this mark. There was no common choice in those candidates who were not credited this mark.

Question 4

4 Atoms can form ions.

Which statement is **correct**?

A All metal ions are negatively charged.

B Ions are always smaller than the atom they are made from.

C Negative ions are formed when an atom gains electrons.

D Positive ions are formed when an atom gains electrons.

Your answer [1]

This was the highest scoring multiple choice answer and has clearly been well taught in centres.

Question 5

5 What is meant by an **alloy**?

A A compound substance

B A metal used in car wheels

C A mixture of metals

D An element

Your answer [1]

A large proportion of candidates could recall that an alloy is a mixture of metals. The most common error was selecting B, suggesting an everyday misconception of the use of the word 'alloy'.

Question 6

6 Look at the equation.

$H_2SO_4 + \mathbf{x}NH_4OH \rightarrow (NH_4)_2SO_4 + \mathbf{y}H_2O$

Which values of **x** and **y** balance the equation?

A **x** = 1 and **y** = 1

B **x** = 1 and **y** = 2

C **x** = 2 and **y** = 1

D **x** = 2 and **y** = 2

Your answer **[1]**

Approximately half the candidates could balance the equation using the correct selection of numbers. There were no common selections in the remaining answers perhaps showing an area centres can work on for future examination series. Candidates who were credited this mark often used the space at the side of the question to count the number of atoms of each element present in the formula to help them correctly balance the equation.

Question 7

7 Which statement best describes the **stationary phase** in thin layer chromatography (TLC)?

A A glass plate with chromatography paper

B Alumina powder in ethanol

C A plastic plate coated in glue

D Silica spread on a glass plate

Your answer **[1]**

Only higher ability candidates were successful at identifying the stationary phase in TLC. The most common incorrect responses identified 'A'. Perhaps a lack exposure to the practical equipment in some centres may have reduced the number of candidates' ability to access this mark.

Question 8

8 Which of the following happens at a **cathode**?

A Gain of electrons by anions

B Gain of electrons by cations

C Loss of electrons by anions

D Loss of electrons by cations

Your answer ☐ **[1]**

Less than half of candidates could identify the correct statement explaining the process that takes place at the cathode. The most common incorrect response was 'D' showing a lack of understanding of the charges on cations. There is often a misconception regarding the charge on the ions and whether there has been an initial loss or gain of electrons to create the ion.

Question 9

9 How many atoms of an element does **one mole** contain?

A $6.02214086 \times 10^{23}$

B $6.02214086 \times 10^{-23}$

C $9.02214086 \times 10^{23}$

D $9.02214086 \times 10^{26}$

Your answer ☐ **[1]**

Simple recall of Avogadro's constant proved difficult for lower ability candidates with the 'minus sign' before the '23' causing some candidates to select 'B'. Others selected the correct standard form number of 23 but chose 'C' with the incorrect value.

Question 10

10 The relative formula mass of NaOH is 40.

What mass of sodium hydroxide, NaOH, is found in $100\,cm^3$ of a $0.5\,mol/dm^3$ solution of NaOH?

A 0.2g

B 0.4g

C 2.0g

D 4.0g

Your answer ☐ **[1]**

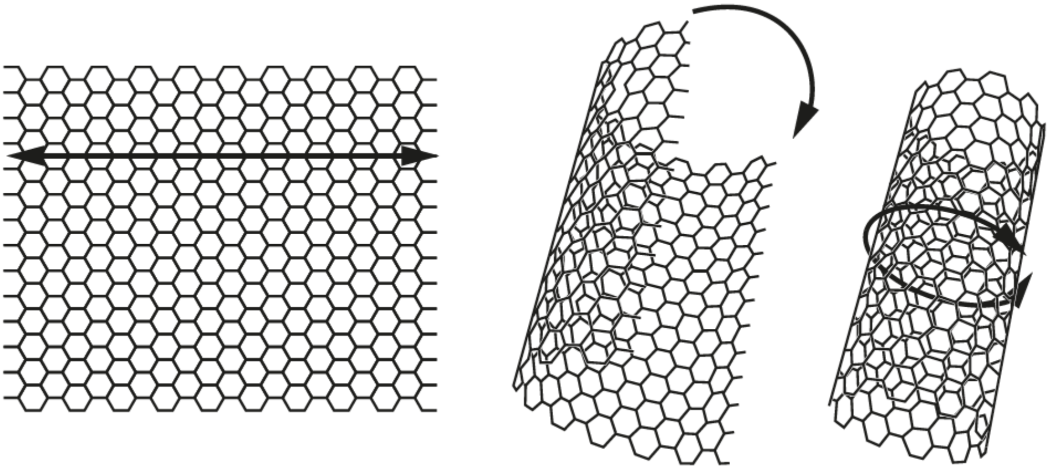
Only higher ability candidates correctly identified 2.0 grams as the correct response. Those who did gain credit here often used the space at the side of the question for calculations.

Section B

Question 11

11 Carbon nanotubes are a new material.

The diagrams show how a graphene sheet can form a nanotube.



(a) Nanotubes are more than 100 times stronger than iron.

Explain why nanotubes are so strong. Use ideas about bonding.

....

....

....

....

.... **[2]**

Higher ability candidates could give a clear explanation using the correct terminology of 'covalent bonds' and described how strong these bonds were in the carbon nanotube. Medium and lower ability candidates mixed intermolecular forces with covalent bonds and often spoke about the strength of the forces in the molecule or between molecules. They also described covalent bonds but called them intermolecular or electrostatic forces. Whilst these are common misconceptions they need to be addressed by centres wherever possible.

Exemplar 1

Explain why nanotubes are so strong. Use ideas about bonding.

CON

As graphene has strong intermolecular forces of attraction as is a ~~covalent~~ covalent bond. It is made of carbon atoms in a lattice. It has a high melting point because of its structure and is folded in a tube can provide a higher resistance to a force. **[2]**

This candidate has identified covalent bond but appears confused and is also talking about intermolecular forces which contradicts the good science. The addition of the extra information about intermolecular forces means the mark cannot be credited.

Question 11(b)

(b) Carbon is a non-metal.

Carbon nanotubes conduct electricity.

Explain why carbon nanotubes conduct electricity.

....

....

.... **[2]**

Candidates could generally identify that something was moving but often referred to 'carrying a current' rather than the actual movement of delocalised electrons. The descriptions candidates gave often showed misconceptions rather than a clear understanding of the concept being assessed.

Question 11(c)(i)

(c) Carbon nanotubes and iron have very similar electrical conductivities.

Look at some other properties of carbon nanotubes and iron.

Material	**Density (g/cm^3)**	**Melting point (°C)**
Carbon nanotubes	1.6	3500
Iron	7.9	1538

(i) Calculate how many times more dense iron is than carbon nanotubes.

Answer = ...**[2]**

This questioned highlighted areas for improvement in rounding numbers and the need to quote a correct number of significant figures appropriate to the question. This was evident for those candidates that gave 4.93 as a final response. The numbers being processed were 1.6 and 7.9 so the answer should have been quoted to 2 significant figures, although this is not expected but just good practice. Responses were allowed from 1 to 5 significant figures as quoted from the calculated values. Often a subtraction was carried out rather than division for lower ability candidates.

Question 11(c)(ii)

(ii) Explain why iron is more dense than carbon nanotubes.

....

....

.... **[1]**

Few candidates used comparative words in their responses so struggled to gain credit for their responses. Expected words included 'closer' with reference to the packing of atoms in metals or 'bigger' when describing the relative atomic mass of iron.

Question 11(c)(iii)

(iii) Suggest a reason why carbon nanotubes have a higher melting point than iron.

....

.... **[1]**

Candidates struggled to suggest a comparative argument involving the strength of covalent versus metallic bonds. Where candidates did discuss covalent bonds they displayed misconceptions of 'more' bonds rather than comparing the amount of energy needed to break the bonds. The misconception of intermolecular forces was also in evidence here with some candidates describing intermolecular forces being weaker or stronger rather than identifying the types of bonds present.

Question 12(a)

12 The table shows some common ions.

Negative ions		**Positive ions**	
Nitrate	NO_3^-	Aluminium	Al^{3+}
Oxide	O^{2-}	Magnesium	Mg^{2+}

(a) Write the formula for **aluminium oxide**.

.... **[1]**

Only higher ability candidates were credited credit here. There were a variety of answers that were not awarded credit including Al_3O_2, $2AlO_3$ and AlO. Candidates also quoted ions rather than formula without the charges.

Exemplar 2

~~$(2)Al^{3+} + (3)O^{2-}$~~ $\rightarrow 2AlO_3$ .... **[1]**

This was a common incorrect response. The candidate perhaps knows the number of each atom present in the formula but has incorrectly expressed the formula so cannot be given credit.

Question 12(b)

(b) A teacher wrote the formula for magnesium nitrate as:

$MgNO_3$

A student says that the formula is incorrect.

Who is right? Explain your answer.

....

.... **[1]**

A large number of candidates realised that the candidate was correct and not the teacher. This was not creditworthy. The reason for their decision was where the mark was credited. Candidates could either say why the teacher was wrong or give the correct formula. There was a variety of incorrect responses mainly around the candidate's inability to communicate the lack of balance of the charges of the ions in the formula as well as the incorrect idea of transfer of electrons.

Question 12(c)(i)

(c) Aluminium sulfide reacts with dilute hydrochloric acid.

(i) Balance the equation for this reaction.

Al_2S_3 + ... HCl → .... $AlCl_3$ + ... H_2S **[1]**

Over half of the candidates could balance the equation. Where incorrect responses were given it was often an incorrect number for HCl.

Question 12(c)(ii)

(ii) The table shows the melting point and boiling point of H_2S.

Melting point	–85.5 °C
Boiling point	–60.7 °C

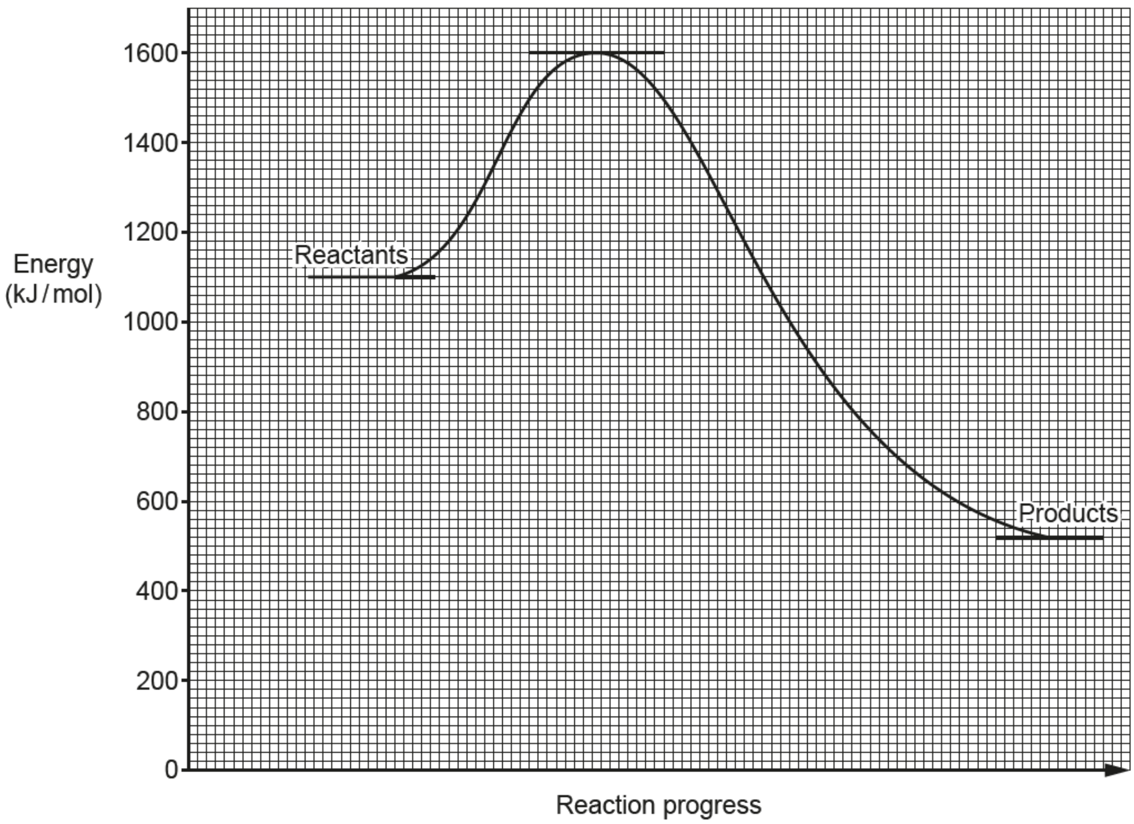
What state does H_2S exist in at room temperature?

.... **[1]**

Generally well answered with all ability of candidates accessing this mark.

Question 13(a)(i)

13 The graph below shows the energy changes during a chemical reaction.



(a) (i) Draw an arrow on the graph to show the **activation energy**.

Label your arrow **A**. **[1]**

Candidates struggled to accurately draw an arrow to describe the activation energy. Arrows were often drawn diagonally, pointing to the peak of the graph or if they were drawn vertically, they were inaccurately drawn. The lines were often too short either at the top or bottom of the range. Centres should encourage candidates to carefully draw such lines in future examinations. The direction of the arrow was often incorrect with arrow heads in both directions or pointing down rather than up. For the purposes of this examination the direction of the arrow was ignored but must be correct in future examinations.

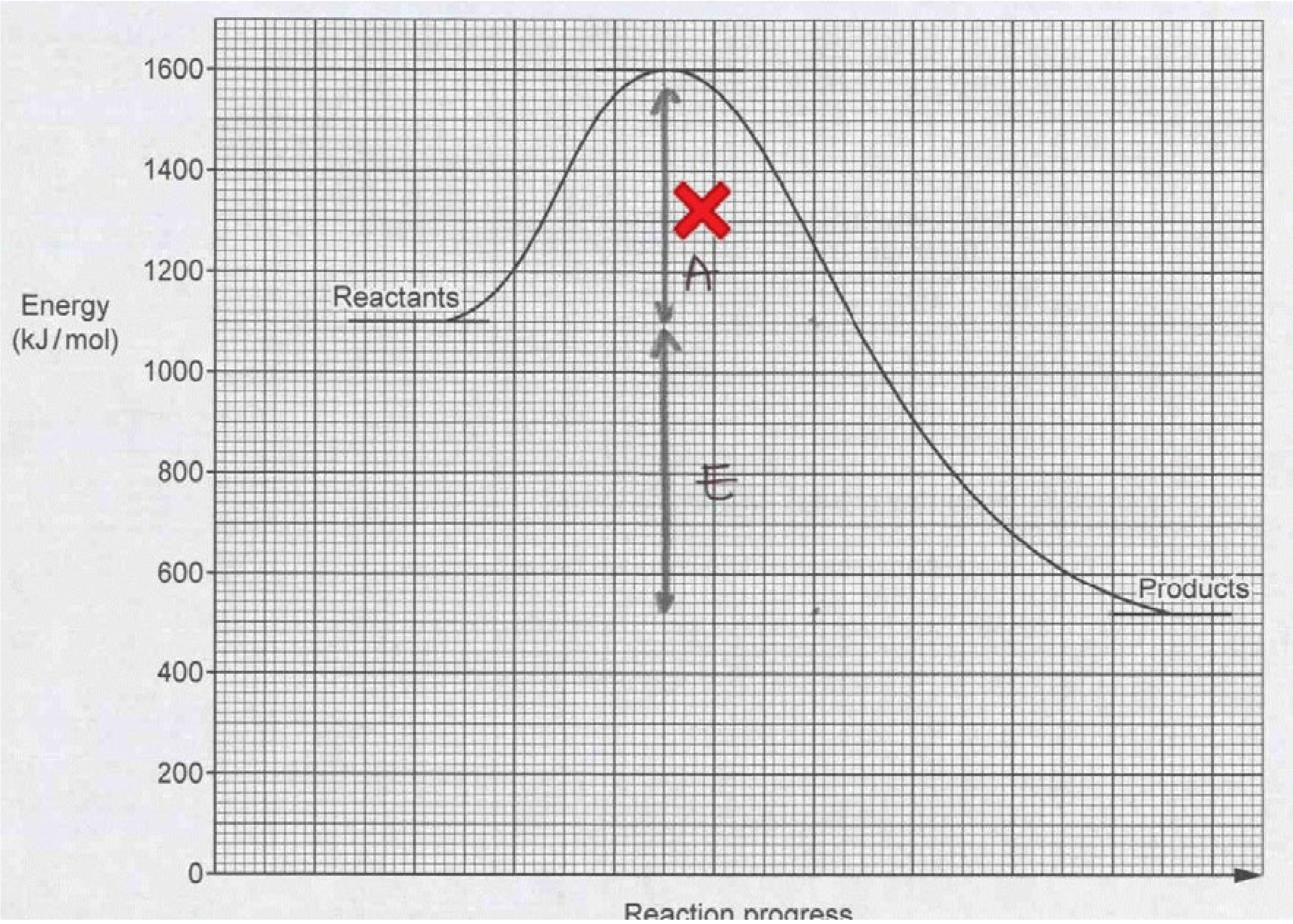
Question 13(a)(ii)

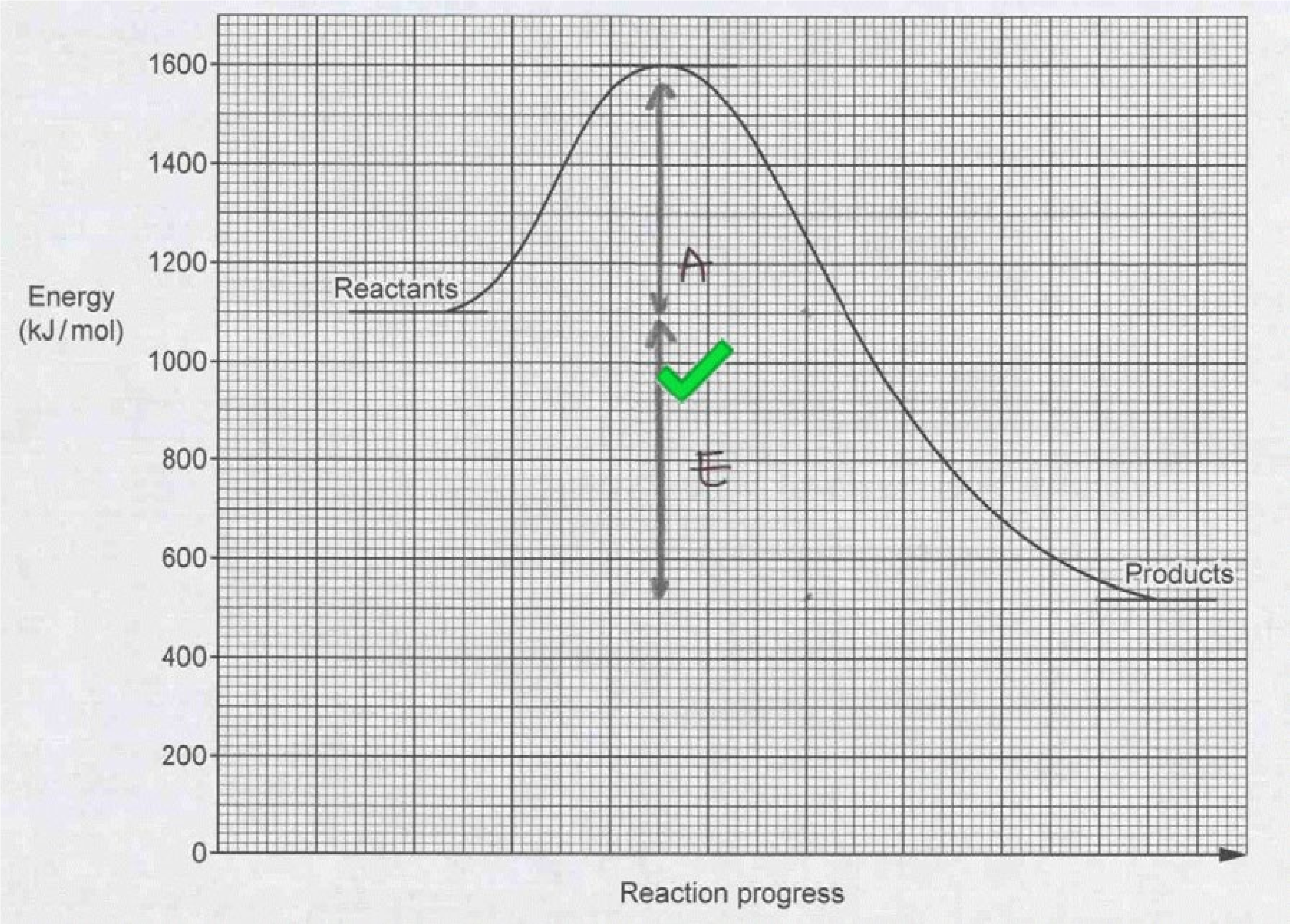
(ii) Draw another arrow on the graph to show the overall **energy change** in the reaction.

Label your arrow **E**. **[1]**

As with (a)(i) Candidates struggled to draw accurate lines. The most common errors were lines drawn diagonally or from the top of the graph to the products line rather than vertically from the reactants to products. Centres should encourage candidates to carefully draw such lines in future examinations. Accuracy of the line is important. As with (a)(i) the direction of the arrows must be correct in future examinations.

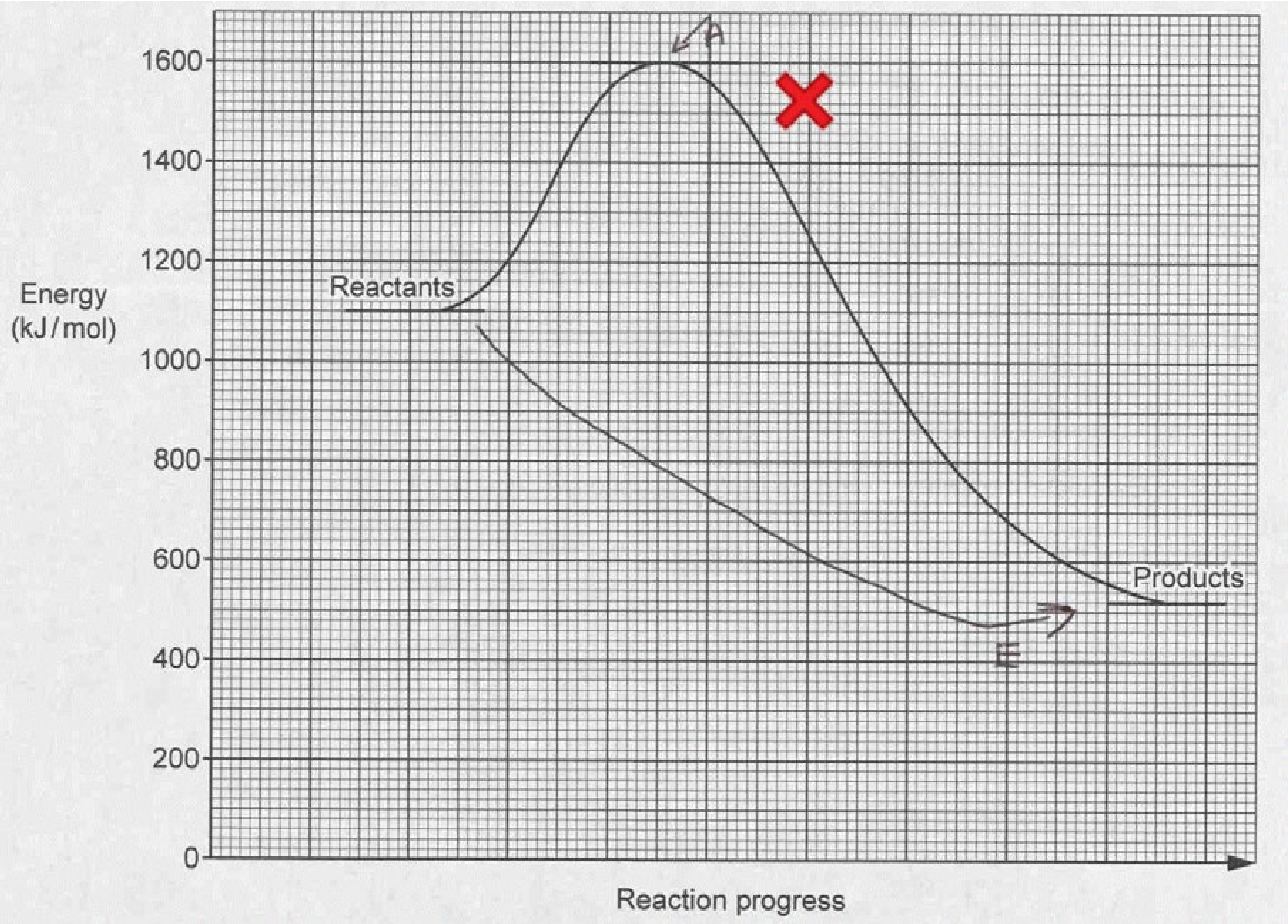
Exemplar 3

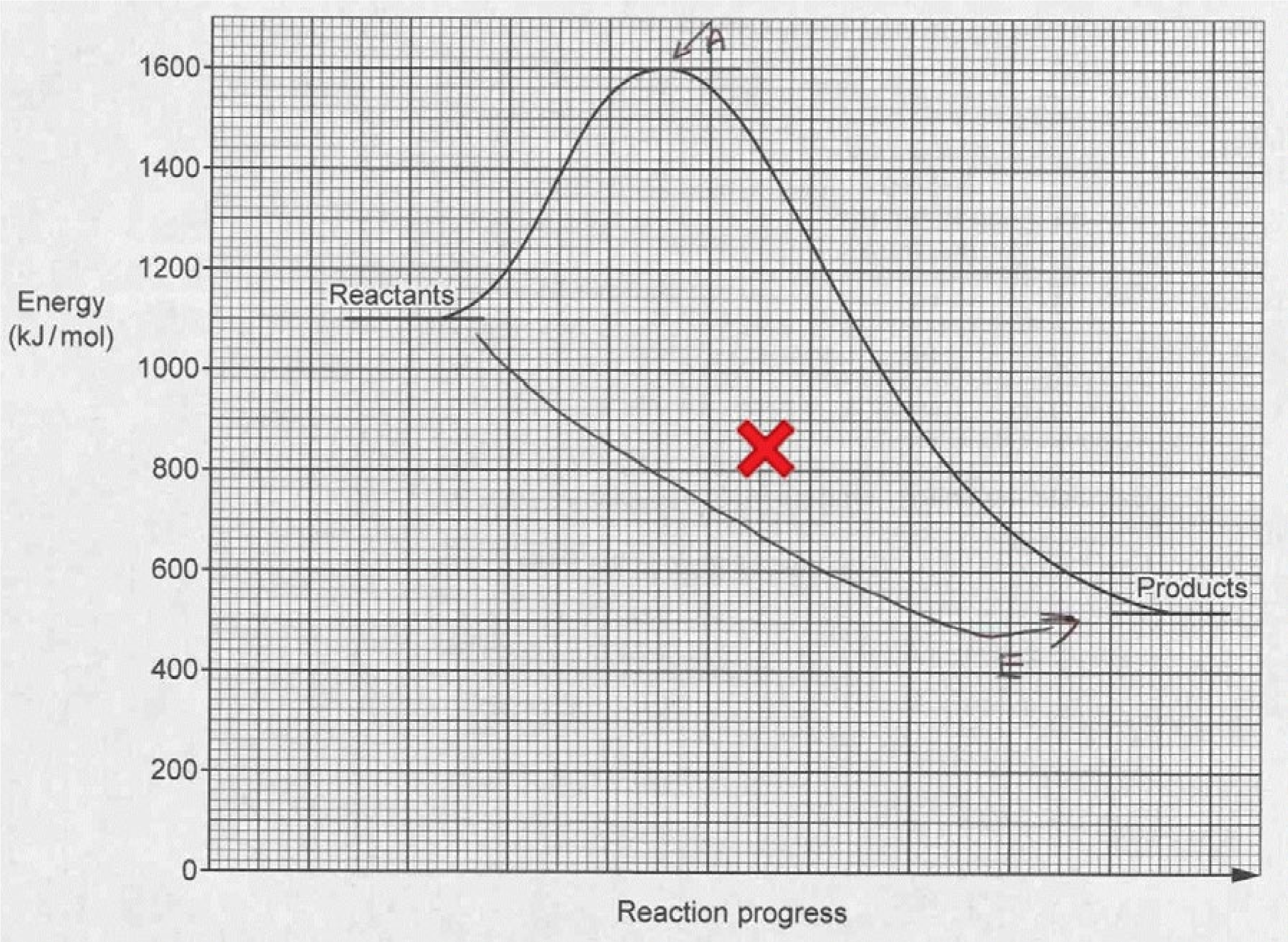

1600
1400
1200
1000
800
600
400
200
0
Energy (kJ/mol)
Reactants
Products
A
E
Reaction progress



The arrow for A is poorly drawn and does not reach the peak of the graph. Only one small square margin is allowed in graphs or constructions like this so please encourage candidates to take care with graph drawing and diagrams for future examinations. The arrow heads were allowed at both sided of the line to show the difference in the energy at the 2 points identified but ideally one arrow head at the peak of the graph should be shown. For 13ai in this example the arrow gains credit as it is accurately drawn.

Exemplar 4


Energy (kJ/mol)
1600
1400
1200
1000
800
600
400
200
0
Reactants
Products
A
E
Reaction progress



This was a frequently seen response, with arrows pointing at the peak and labels rather than using the graph to show the precise values.

Question 13(b)

(b) The reaction in the graph is **exothermic**.

Explain why. Use ideas about bonds.

....

....

.... **[2]**

Only very high ability candidates gained credit here. There was almost no description of endothermic and exothermic processes related to breaking and forming of bonds. If candidates did gain credit it was for the recognition that an exothermic reaction releases energy to the surroundings. This appears well taught as well over half the candidates gained this mark.

Question 13(c)

(c) Hydrogen burns in oxygen to form water.

Look at the equation for the reaction.

$2H_2 + O_2 \rightarrow 2H_2O$

Bond	**Average bond energy (kJ/mol)**
H – H	436
H – O	464
O = O	498

Calculate the **energy change** for this reaction.

Use the average bond energies shown in the table.

Answer = ... kJ/mol **[3]**

Candidates were generally able to calculate the energy needed to break the bonds as 1370. Fewer candidates could correctly calculate the energy released when new bonds form as 1856. The most common incorrect value was 1868. Candidates who correctly calculated these values struggled to subtract the bigger value from the smaller value to give a negative number. These compounded errors meant only the very high ability candidates 3 marks.

Exemplar 5

H – H x 2 = 872 + 498 = 1370

~~H = O~~ x H – H x 2 = 872 + H – O x 2 = 1800

1800 – 1370 = 430

Answer = 430 kJ/mol **[3]**

The organisation of answers was generally poor. This candidate has correctly calculated the energy needed to break the bonds in H_2 and O_2 but has not correctly identified the bonds present in H_2O. The final subtraction also is incorrect and would give a positive number rather than subtracting the energy released when new bonds form from the energy needed to break the bonds.

Exemplar 6

H_2 -> H–H O_2 = O=O $2H_2O$: H–O–H H–O–H

2 x 436 + 498 -> ~~2~~ 4 x 464

= ~~1370 + 498~~ 1370 -> 1856

energy change = 1370 - 1856

= -486

Answer = -486 kJ/mol **[3]**

This is an excellent example of where the candidate has laid out their workings carefully, even drawing the structures to ensure the correct binds were identified. The calculation is easy to follow. They have also included the essential negative sign.

Question 14(a)

14 A student reacts an acid with a metal carbonate.

(a) Complete the **word equation** for the reaction.

Acid + Metal Carbonate → .... + ... + ... **[1]**

This question had one of the higher number of blank spaces on the examination. The general equation for a reaction of an acid plus a metal carbonate should be recall. Common errors included 'carbon' rather than 'carbon dioxide', 'hydrogen' instead of 'carbon dioxide' and 'metal' instead of 'salt'. Centres need to be aware that candidates may be asked to recall general equations such as this.

Question 14(b)

(b) The student uses universal indicator in his experiment.

Why did the student use universal indicator?

....

.... **[1]**

Most candidates could give the purpose of using universal indicator to determine the pH of the reaction.

Question 14(c)

(c) An acid has a pH of 3. The hydrogen ion concentration of the acid is 1×10^{-3} mol/dm^3.

A different acid has a pH of 1.

What is the hydrogen ion concentration of this acid?

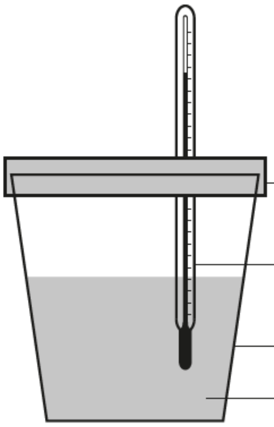
Answer = ... (mol/dm^3) **[1]**

Over half the candidates could calculate the concentration of hydrogen ions and give this value in standard form. Few candidates actually gave their working in the space provided. They were not asked to show workings but good practice would suggest this should be done for all calculations.

Question 14(d)(i)

(d) A student has **two** different acids and **one** alkali.

- She adds 25 cm^3 of the alkali to **Acid A**
- She records the maximum temperature rise for the reaction using the equipment below
- She repeats the experiment with **Acid A** several times to get 6 results in total
- She repeats the whole experiment using **Acid B**.



Look at the student's results.

	Maximum temperature rise (°C)					
	1	**2**	**3**	**4**	**5**	**6**
Acid A	12.2	11.0	12.6	12.5	12.4	8.9
Acid B	4.1	3.2	4.2	3.9	3.9	1.0

(i) What is the range of the results for **Acid A**?

Answer = ... **[1]**

A very high number of candidates gave the answer of 3.7, which was judged to be allowed in this examination. Centres need to be aware that in future examinations a result which lies outside an acceptable range (anomalous result) would be ignored when calculating the range. In this examination the result for experiment 6 should be judged to lie outside the acceptable range and candidates should be encouraged to treat this as an anomalous result and ignore this value when calculating the range. Therefore the preferred response to gain credit as the range would be from 11.0 to 12.6 and so calculated to be 1.6.

Question 14(d)(ii)

(ii) Evaluate the **quality** of the student's results.

....

....

....

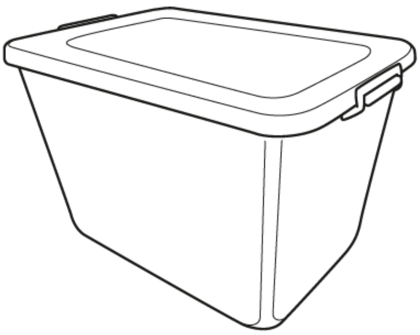
....

.... **[2]**

Communication of ideas was an issue here for some candidates. Key scientific terminology was often missing from responses that were close to describing the results. The first issue was the identification of the anomalous results. Both acids had an anomalous result for experiment 6. This was the mark candidates were credited in most cases. There was little identification of the results in experiment 2 being anomalous – but to a lesser extent. Only higher ability candidates had the confidence to describe the remaining results as 'good quality'. Very few stated that results 1,3,4 and 5 were actually repeatable.

Question 15*

15* The table gives information about three polymers **A**, **B** and **C**.



Polymer	Melting Point (°C)	Relative Flexibility	Density (g/cm^3)	Relative Strength
A	70	Flexible	0.91	11.7
B	150	Rigid	1.32	12.1
C	230	Rigid	0.98	25.2

Explain which polymer would be **best** to make a plastic storage box.

Relate the relative flexibility of polymers **A**, **B** and **C** to a simple model of their structures.

....

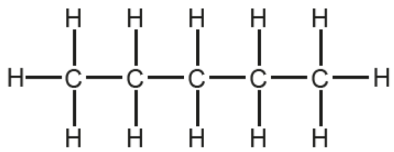
....

.... **[6]**

Only higher ability candidates were credited level 3. The question asked candidates to relate the relative flexibility of the polymers to a simple model of their structure. It was hoped that candidates would identify polymer C as the best polymer to use as its relative strength would mean it wouldn't break, its density would mean it was fairly lightweight to carry and its relative flexibility meant it would not bend or lose its shape. (Melting point was not considered as room temperature would not get this high.) The properties then needed to be related to their structures. This was rarely attempted. It was expected that candidates would relate crosslinking to polymers B and C and weak intermolecular forces between the polymer chains would allow A to have its flexibility. Candidates were expected to process the information they were given to discuss the properties and structures. Lower ability candidates could identify polymers B or C as the best polymers to use and were credited level 1.

Question 16(a)

16 The molecule below has a simple molecular structure. It has a boiling point of 36.1 °C.



(a) Explain why the molecule has a low boiling point.

....

....

....

.... **[2]**

Candidates who struggled to discuss the correct type of bonding in question 11(a) also tended to struggle with this question for the opposite reason. They talked about covalent bonds as this is what they were shown in the displayed formula in the stem of the question. Only higher ability candidates could clearly state weak intermolecular forces between the molecules were responsible for the low boiling point. Many incorrect responses discussed 'weak covalent bonds' or 'forces between the atoms' and so were unable to have marks credited.

Exemplar 7

It has a low boiling point because little energy is required to break the single bonds inbetween each atom.

This response describes the breaking of the covalent bond between the atom rather than the low boiling point being related to the weak intermolecular forces between the molecules. Unfortunately this was a common misconception.

Question 16(b)

(b) Look at the displayed formula of carbon dioxide.

O = C = O

The bonds between the carbon atom and the oxygen atoms are **covalent** bonds.

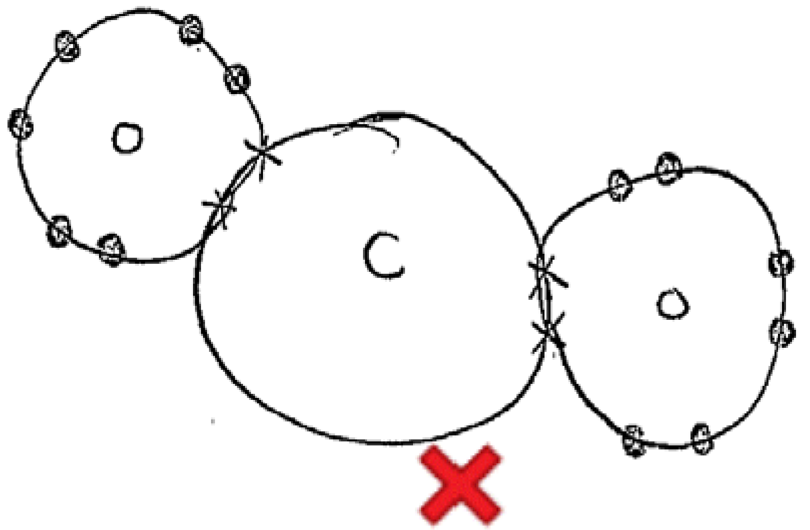
Draw a 'dot and cross' diagram to show the bonding in carbon dioxide.

Only draw the outer shell electrons.

[2]

Candidates' responses were generally not creditworthy. Almost all candidates attempted covalent dot and cross diagrams (a very small number were ionic). Errors included insufficient numbers of electrons involved in the two double covalent bonds, choosing instead to give single bonds between carbon and oxygen and placing pairs of electrons on the ring of carbon. Lower ability candidates gave the wrong formula for the molecule of carbon dioxide, usually CO rather than CO_2.Almost all candidates did use the 'dot and cross' symbols as directed in the question. Centres could perhaps encourage candidates to do a quick check of full shells to ensure their diagrams are feasible.

Exemplar 8



Dot and cross diagrams were generally well drawn but as you can see from this example the candidate has ensured the oxygen atoms have 8 electrons in their outer shell but unfortunately no electrons are shared so carbon only has 4 electrons in its outer shell.

Question 16(c)

(c) Some elements bond to form compounds by **ionic bonding**.

Describe what is meant by ionic bonding.

....

....

.... **[2]**

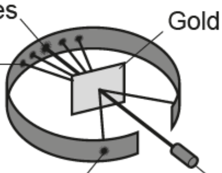
This question was only answered well by the very high ability candidates. They often identified there was a transfer of electrons but did not show which element (metal or non-metal) lost or gained the electrons. The idea of electrostatic attraction between oppositely charged ions was rarely seen. Responses were often confused.

Question 17(a)

17 The atomic model has changed over time.

J.J.Thomson suggested the 'plum pudding' model of atoms. Rutherford, working with Geiger and Marsden, tested J.J.Thomson's 'plum pudding' model.

Look at the diagram of the experiment they did.



(a) What conclusions did Rutherford, Geiger and Marsden draw from the experiment?

Explain how their results supported their conclusions.

....

....

....

....

....

....

.... **[4]**

The main ideas of the Rutherford et al experiment was that the unexpected movement of the alpha particles lead to a new suggested structure of the atom. Rutherford's conclusions were based on the movement of the alpha particles so it was expected that candidates would be able to link the movement of particles to new ideas about the atom. That was rarely seen. Instead, candidates repeated the information about deflection of particles without giving any further information.

'Most particles went straight through the gold foil showing the atom was mainly empty space' was the most common two marks credited. Candidates had to add the detail about the number of particles involved in each deflection (or not) as this was not given on the diagram.

Candidates tended to use the word 'some' as a substitute for knowing the proportions of particles identified in each conclusion. This was allowed for the second idea of 'some' or 'few' alpha particles were slightly deflected due to the nucleus being positive.

The last conclusion had to include the idea of 'very few' alpha particles were 'greatly' deflected as these alpha particles showed that most of the mass of the atom was found in a central nucleus.

A good distribution of marks were seen for this question.

Question 17(b)

(b) Rutherford, Geiger and Marsden published their results.

Why is it important that scientists publish their results?

....

....

....

.... **[2]**

Candidates of all abilities accessed this question with several inventive reasons seen as to why scientists share their ideas. A Lot of creditworthy ideas were seen.

Question 17(c)

(c) What new idea did Bohr add to the model of the atom?

....

.... **[1]**

Candidates could usually give ideas about electrons occupying shells or energy levels. Where candidates had misconceptions were surrounding the ideas about the nucleus and neutrons. This question was generally well answered.

Question 18

18 Ammonium carbonate reacts with nitric acid. Ammonium nitrate, water and carbon dioxide are made.

Look at the equation for the reaction.

$(NH_4)_2CO_3 + 2HNO_3 \rightarrow 2NH_4NO_3 + H_2O + CO_2$

Calculate the mass of ammonium nitrate, NH_4NO_3, that can be made from 3.84 g of ammonium carbonate, $(NH_4)_2CO_3$.

Answer = ... g **[2]**

This question had the highest amount of blank spaces on the examination. Candidates struggled to engage fully with the question to calculate the reacting mass. A number of higher ability candidates successfully calculated the number of moles of ammonium carbonate used in the reaction but they did not know what to do with the information to get to the mass of ammonium nitrate made.

Responses were disorganised and lots of crossing out was seen all over the page. Perhaps centres could guide candidates to list the important information from the question, give an equation for the calculation and substitute number followed by the evaluation of the numbers to give a final answer. This may give more clarity to responses in future examinations.

Exemplar 9

$$\underbrace{(NH_4)_2CO_3}_{3.84g} + 2HNO_3 \rightarrow \underbrace{2NH_4NO_3}_{?} + H_2O + CO_2$$

Mr of $(NH_4)_2CO_3$:

$(14\times2)+(1\times8)+(1\times12)+(3\times16)$ Answer = 6.4 g [2]

$= 96$

Mr of $\cancel{2}NH_4NO_3$

$(1\times14)+(1\times4)+(1\times14)+(3\times16)$

$= 80$

$\text{moles} = \dfrac{\text{mass}}{Mr}$ $\quad \text{moles} = \cancel{96}\ \dfrac{3.84}{96}$

$(NH_4)_2CO_3 = 0.04\text{ mol}$

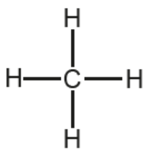
1 : 2

This is an example of a very well presented calculation that is easy to follow. Excellent example of how a calculation of this type should be expressed. This also allows the candidate the ability and confidence to complete the calculation. Several candidates stopped at 3.2 rather than using the stoichiometry of the equation to find the mass of ammonium nitrate made. It is fine to use the space below the answer line provided the candidate stays within the boxed area.

Question 19

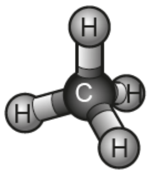
19 Methane, CH_4, is the simplest alkane.

The diagrams below are three ways to show the structure of methane.



A

B



C

Write about the **advantages** and **disadvantages** of each of these diagrams.

[4]

This question was generally well answered by candidates. The difficulty seemed to be in communicating their ideas in a scientific way. The diagrams clearly have scientific merit and the candidates were essentially asked to compare the merit of the diagrams.

Candidates often commented on which they though was the 'best' diagram but this was not asked for in the question. Ideas about the relative size of the atoms and the type of bonding were seen less frequently than ideas about the 2D and 3D nature of the diagrams or the number and types of atoms present.

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Section A, Q13

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