National
Qualifications
SPECIMEN ONLY

S813/75/02

Chemistry
Section 1 — Questions

Date — Not applicable

Duration — 2 hours

Instructions for completion of Section 1 are given on *page 02* of your question and answer booklet S813/75/01.

Record your answers on the answer grid on *page 03* of your question and answer booklet.

You may refer to the Chemistry Data Booklet for National 5.

You must leave your answer booklet on your desk; if you do not, you could lose all the marks for this paper.

S8137502

Qualifications Scotland
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SECTION 1 — 20 marks

Attempt ALL questions

1. Which of the following elements usually exists as diatomic molecules?

A Helium

B Nitrogen

C Silicon

D Sulfur

2. Which line in the table correctly describes a proton?

	Mass (atomic mass units)	**Charge**
A	negligible	+1
B	negligible	−1
C	1	+1
D	1	0

3. Ionic compounds conduct electricity when molten because they have

A metal atoms

B a lattice structure

C delocalised electrons

D ions that are free to move.

4. The table shows information about some particles.

Which line in the table shows the particle which is a negative ion?

	Number of		
Particle	**protons**	**neutrons**	**electrons**
A	9	10	10
B	11	12	11
C	15	16	15
D	19	20	18

5. The table shows the colours of some ionic compounds in solution.

Compound	Colour
Copper nitrate	blue
Copper chromate	green
Strontium nitrate	colourless
Strontium chromate	yellow

The colour of the chromate ion is

A blue

B green

C colourless

D yellow.

6. Which of the following statements correctly describes the concentrations of $H^+(aq)$ and $OH^-(aq)$ ions in pure water?

A The concentrations of $H^+(aq)$ and $OH^-(aq)$ ions are equal.

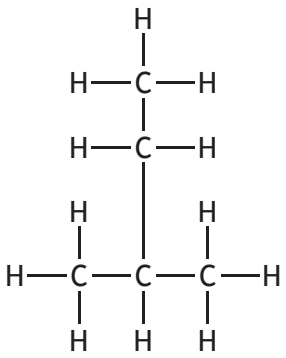
B The concentrations of $H^+(aq)$ and $OH^-(aq)$ ions are zero.

C The concentration of $H^+(aq)$ ions is greater than the concentration of $OH^-(aq)$ ions.

D The concentration of $H^+(aq)$ ions is less than the concentration of $OH^-(aq)$ ions.

[Turn over

7.



The name of this compound is

A 2-ethylpropane

B 1,1-dimethylpropane

C 2-methylbutane

D 3-methylbutane.

8. In which of the following types of reaction is oxygen a reactant?

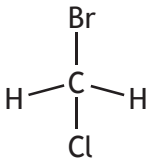
A Combustion

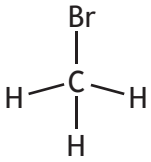
B Neutralisation

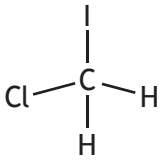
C Polymerisation

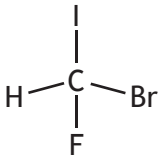
D Precipitation

9. Molecules in which four different atoms are attached to a carbon atom are said to be chiral. Which of the following molecules is chiral?

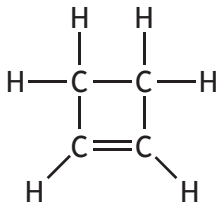
A 

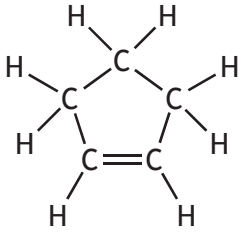
B 

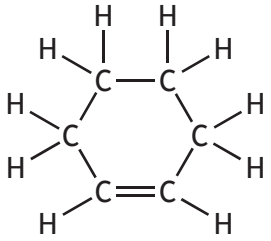
C 

D 

10. Three members of the cycloalkene family are







The general formula for the cycloalkene family is

A C_nH_{2n-2}

B C_nH_{2n-4}

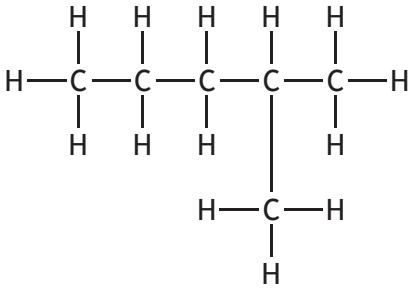
C C_nH_{2n}

D C_nH_{2n+2}

[Turn over

11. Which of the following molecules is an isomer of hept-2-ene?

A



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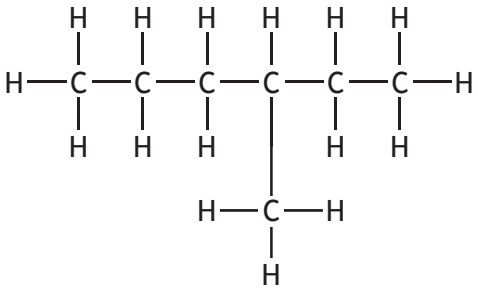

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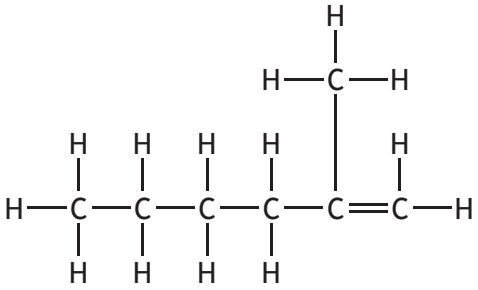

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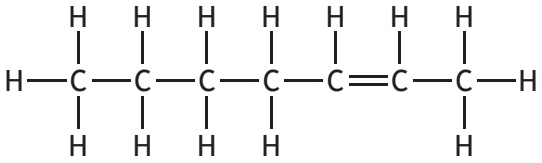
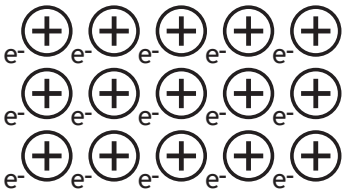


12. Which of the following diagrams could be used to represent the structure of a metal?

A



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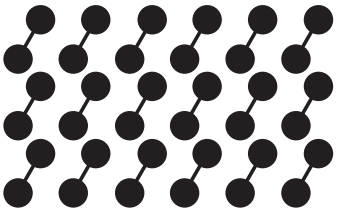

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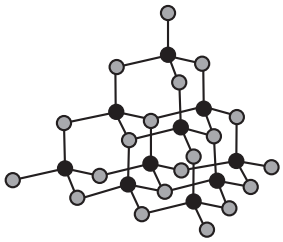
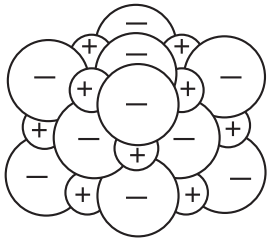


D



13. Which of the following substances does **not** produce water when it reacts with dilute acid?

A Sodium hydroxide

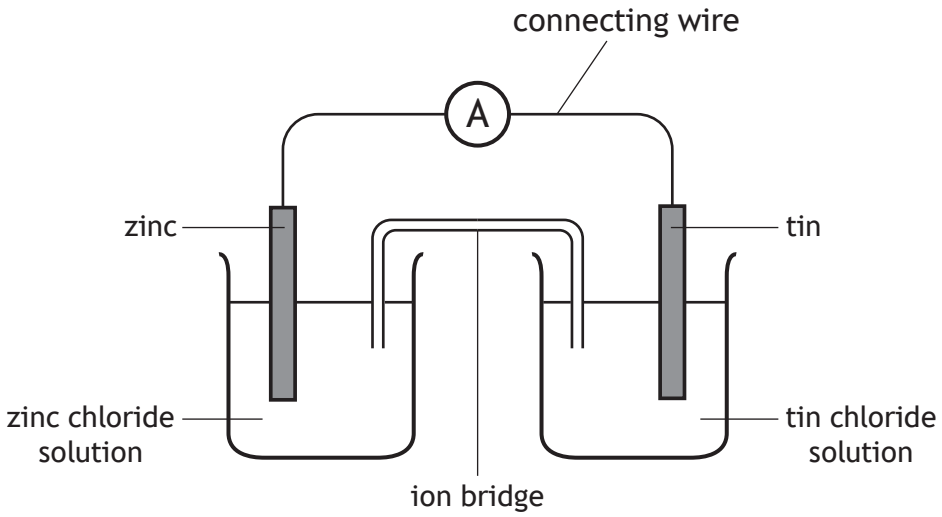
B Magnesium

C Copper oxide

D Ammonia solution

[Turn over

14.



In the cell shown above, electrons flow through

A the solution from tin to zinc

B the solution from zinc to tin

C the connecting wire from tin to zinc

D the connecting wire from zinc to tin.

15. The ion-electron equation for the oxidation and reduction steps in the reaction between magnesium and silver(I) ions are

$Mg \rightarrow Mg^{2+} + 2e^-$

$Ag^+ + e^- \rightarrow Ag$

The overall redox equation is

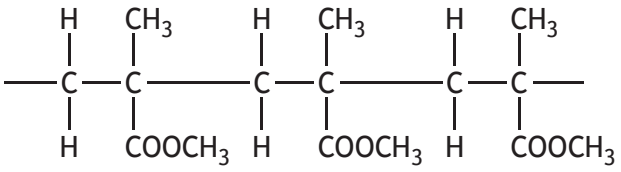
A $Mg + 2Ag^+ \rightarrow Mg^{2+} + 2Ag$

B $Mg + Ag^+ \rightarrow Mg^{2+} + Ag$

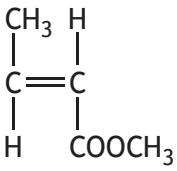
C $Mg + Ag^+ + e^- \rightarrow Mg^{2+} + Ag + 2e^-$

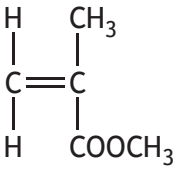
D $Mg + 2Ag \rightarrow Mg^{2+} + 2Ag^+$

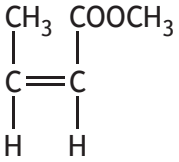
16. The structure below shows a section of an addition polymer.

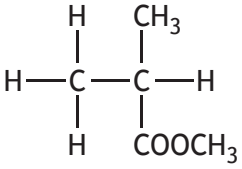


Which of the following molecules is used to make this polymer?

A 

B 

C 

D 

[Turn over

17. Hydrogen gas

A turns damp pH paper red

B relights a glowing splint

C turns limewater cloudy

D burns with a pop.

18. What is the charge on an iron ion in $Fe_2(SO_4)_3$?

A 3–

B 3+

C 2–

D 2+

19. Sodium sulfate solution reacts with barium chloride solution.

$Na_2SO_4(aq) + BaCl_2(aq) \rightarrow BaSO_4(s) + 2NaCl(aq)$

The spectator ions present in this reaction are

A Ba^{2+} and Cl^-

B Ba^{2+} and SO_4^{2-}

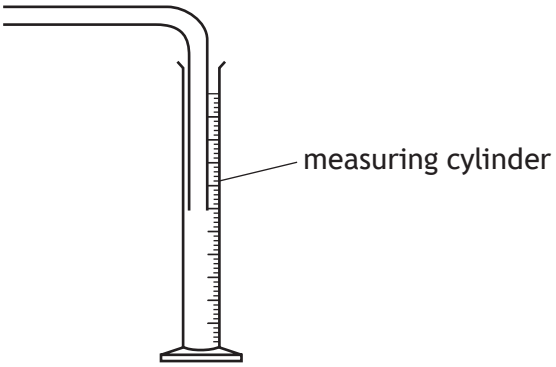
C Na^+ and Cl^-

D Na^+ and SO_4^{2-}

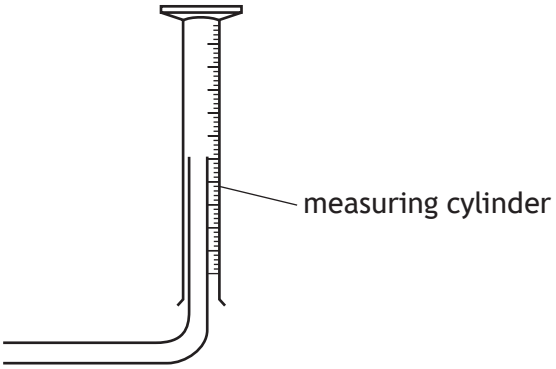
20. But-1-ene is a colourless, insoluble gas which is more dense than air but less dense than water.

Which of the following diagrams shows the most appropriate apparatus for collecting and measuring the volume of but-1-ene?

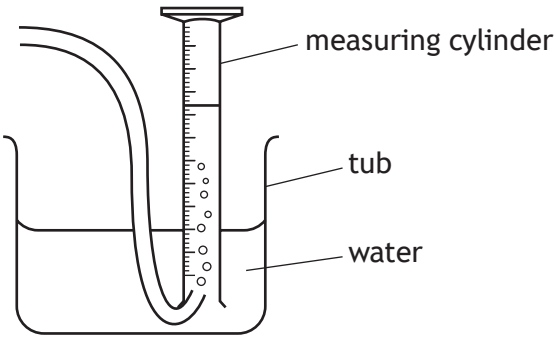
A



B



C



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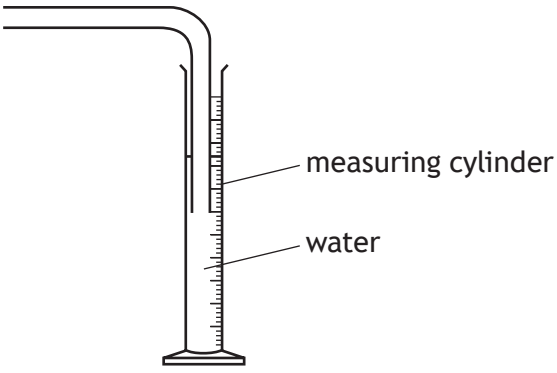

[END OF SECTION 1. NOW ATTEMPT THE QUESTIONS IN SECTION 2 OF YOUR QUESTION AND ANSWER BOOKLET]

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Mark

S813/75/01

Chemistry
Section 1 — Answer grid and Section 2

Date — Not applicable

Duration — 2 hours

S8137501

Fill in these boxes and read what is printed below.

Full name of centre

Town

Forename(s)

Surname

Number of seat

Date of birth

Day	Month	Year

Scottish candidate number

Total marks — 80

SECTION 1 — 20 marks

Attempt ALL questions.

Instructions for the completion of Section 1 are given on *page 02*.

SECTION 2 — 60 marks

Attempt ALL questions.

You may refer to the Chemistry Data Booklet for National 5.

Write your answers clearly in the spaces provided in this booklet. Additional space for answers and rough work is provided at the end of this booklet. If you use this space you must clearly identify the question number you are attempting. Any rough work must be written in this booklet. You should score through your rough work when you have written your final copy.

Use **blue** or **black** ink.

Do not remove any exam materials. You must leave this booklet on your desk; if you do not, you could lose all the marks for this paper.

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S8137501 01

SECTION 1 — 20 marks

The questions for Section 1 are contained in the question paper S813/75/02.

Read these and record your answers on the answer grid on *page 03*.

Use **blue** or **black** ink. Do NOT use gel pens or pencil.

1. The answer to each question is **either** A, B, C, or D. Decide what your answer is, then fill in the appropriate bubble (see sample question below).

2. There is **only one correct** answer to each question.

3. Any rough working should be done on the additional space for answers and rough work at the end of this booklet.

Sample Question

To show that the ink in a ball-pen consists of a mixture of dyes, the method of separation would be

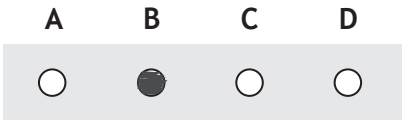
A fractional distillation

B chromatography

C fractional crystallisation

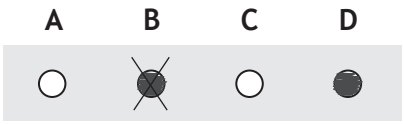
D filtration.

The correct answer is **B** — chromatography. The answer **B** bubble has been clearly filled in (see below).

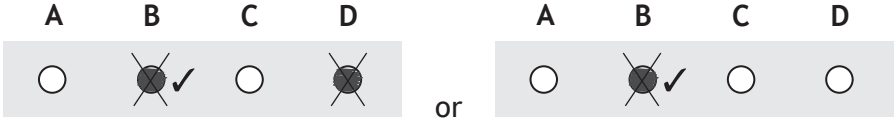


Changing an answer

If you decide to change your answer, cancel your first answer by putting a cross through it (see below) and fill in the answer you want. The answer below has been changed to **D**.



If you then decide to change back to an answer you have already scored out, put a tick (✓) to the **right** of the answer you want, as shown below:



or

SECTION 1 — Answer Grid

OBJ20AD1

	A	B	C	D
1	○	○	○	○
2	○	○	○	○
3	○	○	○	○
4	○	○	○	○
5	○	○	○	○
6	○	○	○	○
7	○	○	○	○
8	○	○	○	○
9	○	○	○	○
10	○	○	○	○
11	○	○	○	○
12	○	○	○	○
13	○	○	○	○
14	○	○	○	○
15	○	○	○	○
16	○	○	○	○
17	○	○	○	○
18	○	○	○	○
19	○	○	○	○
20	○	○	○	○

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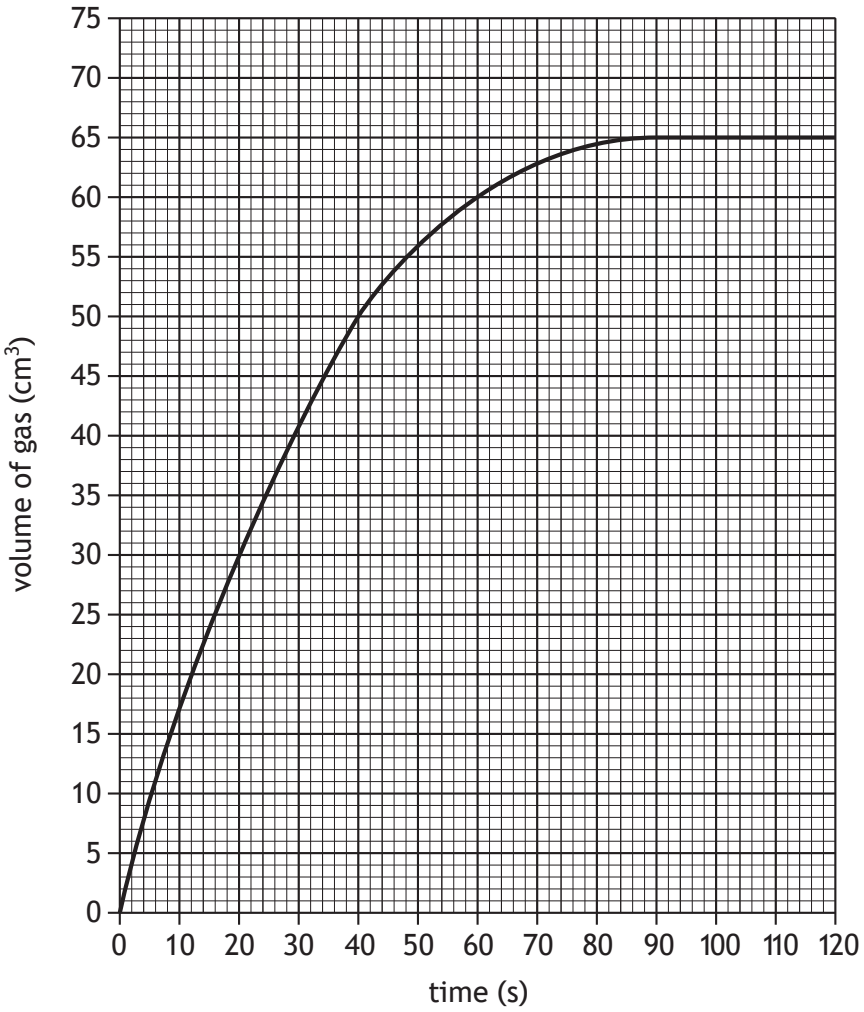
SECTION 2 — 60 marks

Attempt ALL questions

1. Graphs can be used to show the change in the rate of a reaction as the reaction proceeds.

The graph shows the volume of gas produced in an experiment over a period of time.



(a) State the time, in seconds, at which the reaction stopped. **1**

[Turn over

1. (continued)

(b) Calculate the average rate of reaction for the first 20 seconds. **3**

Your answer must include the appropriate unit.

Show your working clearly.

(c) The graph shows that the rate of reaction decreases as the reaction proceeds.

Suggest a reason for this decrease. **1**

2. Bromine is an element found in group 7 of the periodic table.

A sample of bromine consists of a mixture of two isotopes, $^{79}_{35}Br$ and $^{81}_{35}Br$.

(a) State what is meant by the term isotope. **1**

(b) Complete the table for $^{79}_{35}Br$. **1**

Isotope	Number of protons	Number of neutrons
$^{79}_{35}Br$		

(c) The sample of bromine has an average atomic mass of 80.

Suggest what this indicates about the amount of each isotope in this sample. **1**

[Turn over

2. (continued)

(d) Bromine was first discovered in 1826.

Using your knowledge of chemistry, comment on the chemistry of bromine. **3**

3. A student investigated the reaction of metal carbonates with dilute hydrochloric acid.

(a) In one reaction calcium carbonate reacted with dilute hydrochloric acid.

The equation for the reaction is

$$CaCO_3(s) + HCl(aq) \rightarrow CaCl_2(aq) + H_2O(\ell) + CO_2(g)$$

(i) Balance this equation. **1**

(ii) Identify the salt produced in this reaction. **1**

(b) In another reaction 1.0 g of lithium carbonate reacted with excess dilute hydrochloric acid, HCl(aq).

(i) A solution of lithium chloride, LiCl(aq) is produced in this reaction.

Name the technique that could be used to obtain a dry sample of the lithium chloride, LiCl(s). **1**

(ii) Calculate the mass, in grams, of lithium chloride, LiCl(s), formed when 1 g of lithium carbonate reacted with excess dilute hydrochloric acid, HCl(aq).

$$Li_2CO_3(s) + 2HCl(aq) \rightarrow 2LiCl(aq) + CO_2(g) + H_2O(\ell)$$ **3**

[Turn over

4. Read the passage and answer the questions that follow.

Potassium Permanganate ($KMnO_4$)

Potassium permanganate's strong oxidising properties make it an effective disinfectant. Complaints such as athlete's foot and some fungal infections are treated by bathing the affected area in $KMnO_4$ solution.

In warm climates vegetables are washed in $KMnO_4$ to kill bacteria such as *E. coli*. Chemists use $KMnO_4$ in the manufacture of saccharin and benzoic acid.

Baeyer's reagent is an alkaline solution of $KMnO_4$ and is used to detect unsaturated organic compounds. The reaction of $KMnO_4$ with alkenes is also used to extend the shelf life of fruit. Ripening fruit releases ethene gas which causes other fruit to ripen. Shipping containers are fitted with gas scrubbers that use alumina or zeolite impregnated with $KMnO_4$ to stop the fruit ripening too quickly.

$$C_2H_4 + 4KMnO_4 \rightarrow 4MnO_2 + 4KOH + 2CO_2$$

Adapted from an article by Simon Cotton on 'Soundbite molecules' in 'Education in Chemistry' November 2009.

(a) Suggest an experimental test, including the result, to show that potassium is present in potassium permanganate. **1**

You may wish to use the data booklet to help you.

(b) Suggest a pH for Baeyer's reagent. **1**

(c) Name the gas removed by the scrubbers. **1**

(d) Zeolite is a substance that contains aluminium silicate.

Name the elements present in aluminium silicate. **1**

5. Alkanes are commonly used as fuels.

(a) Alkanes are an example of a homologous series.

State what is meant by the term homologous series. **1**

(b) Methane is the first member of the alkane homologous series.

(i) Draw a diagram, showing all the outer electrons, to represent a molecule of methane, CH_4. **1**

(ii) As the number of carbon atoms in an alkane molecule increases the boiling point increases.

Explain why increasing the number of carbon atoms in an alkane molecule increases the boiling point. **2**

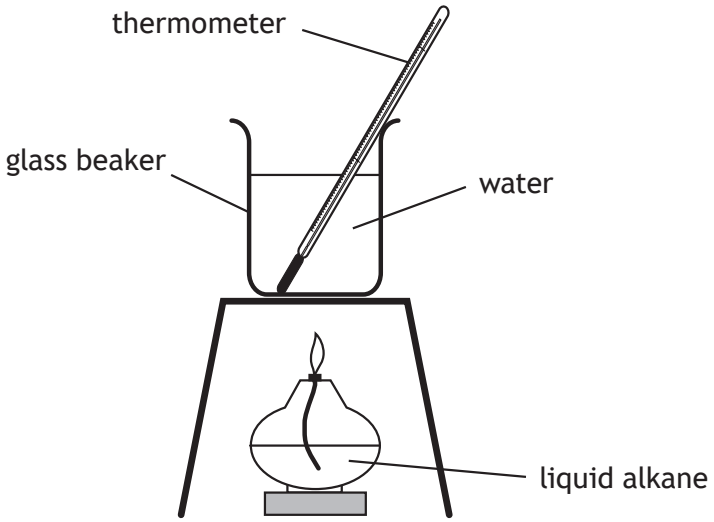
[Turn over

5. (continued)

(c) Alkanes burn, releasing heat energy.

(i) State the term used to describe all chemical reactions that release heat energy. **1**

(ii) A student investigated the amount of energy released when an alkane burns using the apparatus shown.



The student recorded the following data.

Mass of alkane burned	1 g
Volume of water	200 cm^3
Initial temperature of water	15 °C
Final temperature of water	55 °C

(A) Calculate the energy released, in kJ. **3**

Show your working clearly.

5. (c) (ii) (continued)

(B) Suggest **one** improvement to the student's experiment. **1**

(d) The table gives information about the amount of energy released when one mole of some alkanes are burned.

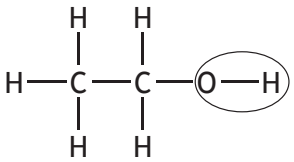
Name of alkane	Energy released when one mole of alkane is burned (kJ)
Methane	891
Ethane	1561
Propane	2219
Butane	2878

Predict the amount of heat released, in kJ, when one mole of pentane is burned. **1**

[Turn over

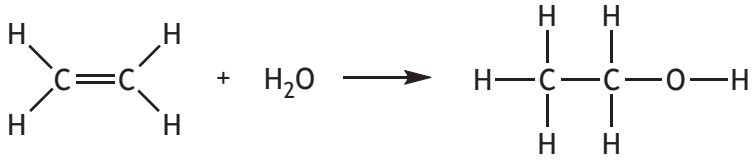
6. Ethanol is an alcohol commonly used in food and drink.

(a) The structure of ethanol is shown below.



Name the functional group circled in the diagram. **1**

(b) Ethanol can be produced from ethene as shown.

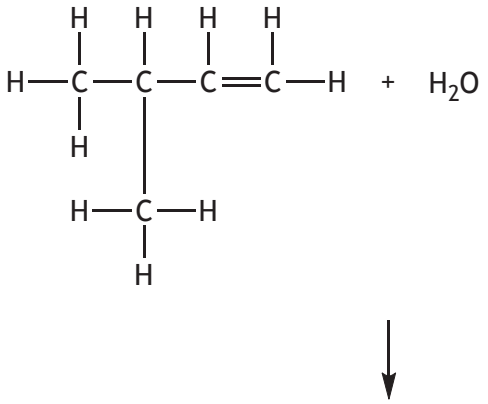


ethene ethanol

(i) Name the **type** of chemical reaction taking place. **1**

6. (b) (continued)

(ii) Draw a structural formula for a product of the following reaction. **1**



(c) Ethanol can be used to produce ethanoic acid.

(i) Draw a structural formula for ethanoic acid. **1**

(ii) Name the family of compounds to which ethanoic acid belongs. **1**

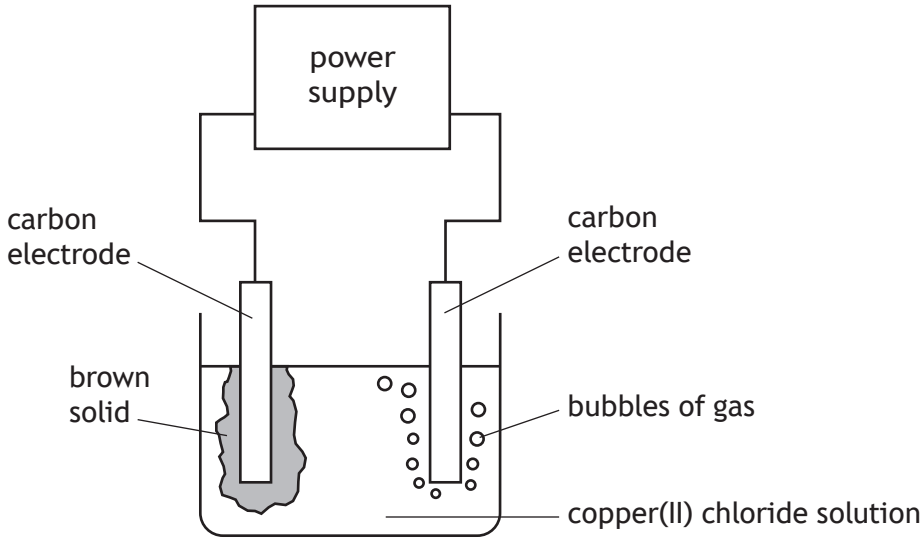
[Turn over

7. Metals can be extracted from metal compounds by electrolysis.

(a) During electrolysis, metal ions are changed to metal atoms.

Name this type of chemical reaction. **1**

(b) A student set up the following experiment to electrolyse copper(II) chloride solution.



(i) Name the type of power supply that **must** be used to electrolyse the solution. **1**

(ii) Complete the table by adding the charge on each electrode. **1**

Observation at the _____ *electrode*	*Observation at the* _____ *electrode*
brown solid formed	bubbles of gas

8. Urea, H_2NCONH_2, can be used as a fertiliser.

MARKS | DO NOT WRITE IN THIS MARGIN

(a) Other nitrogen based fertilisers can be produced from ammonia.

Ammonia is produced in an industrial process using a catalyst.

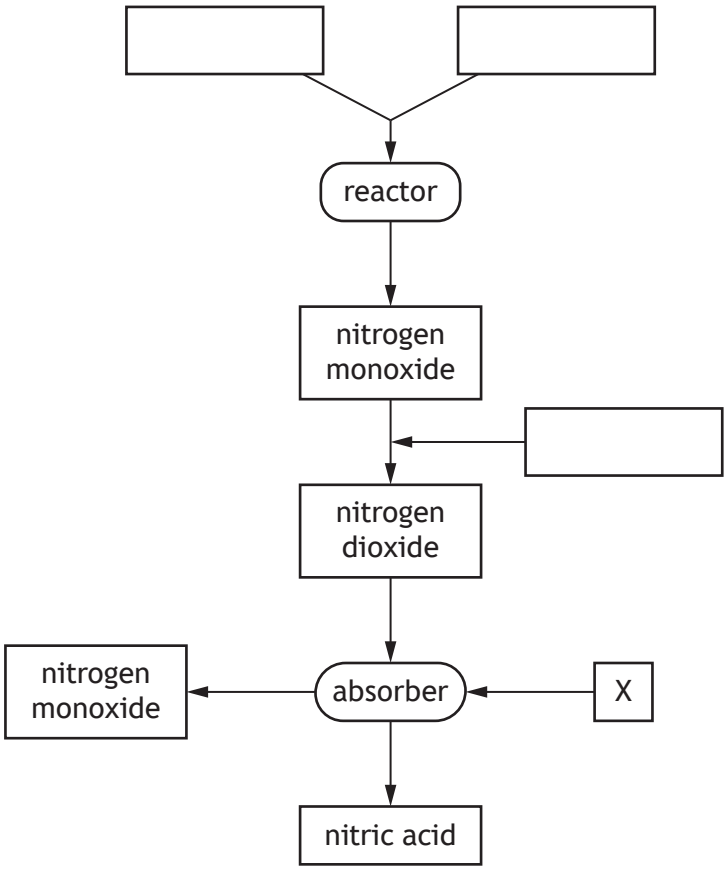
$$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g)$$

(i) Name the industrial process that produces ammonia. **1**

(ii) State the effect of using the catalyst on the reaction. **1**

(b) In the first step of the process, ammonia and air can be added to the reactor producing nitrogen monoxide. The nitrogen monoxide is then reacted with oxygen to produce nitrogen dioxide. This is then converted into nitric acid in an absorber.

(i) Use this information to complete the flow diagram. **1**



(ii) Name substance X. **1**

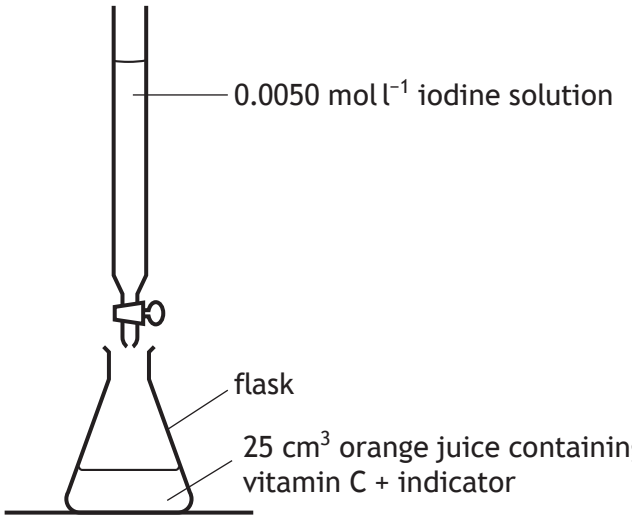
[Turn over

8. (b) (continued)

(iii) **On the flow diagram**, draw an arrow to show how the process can be made more economical. **1**

(iv) Name the process used to produce nitric acid from ammonia. **1**

9. Vitamin C is found in fruits and vegetables.



Using iodine solution, a student carried out experiments to determine the concentration of vitamin C in orange juice.

The results of the experiments are shown.

Experiment	Initial volume of iodine solution (cm^3)	Final volume of iodine solution (cm^3)	Volume of iodine solution added (cm^3)
1	1.2	18.0	16.8
2	18.0	33.9	15.9
3	0.5	16.6	16.1

(a) (i) Name the piece of apparatus used to measure the volume of iodine solution added to the orange juice. **1**

(ii) Suggest why an indicator is added to the flask. **1**

(iii) Calculate the average volume, in cm^3, of iodine solution that should be used in calculating the concentration of vitamin C. **1**

Show your working clearly.

[Turn over

9. (continued)

(b) Name the experimental method, carried out by the student, to accurately determine the concentration of vitamin C in the orange juice. **1**

10. In medicine, technetium-99m is injected into the body to detect damage to heart tissue.

It is a gamma-emitting radioisotope with a half-life of 6 hours.

(a) Calculate the fraction of technetium-99m that would remain after 12 hours. **2**

Show your working clearly.

(b) Suggest one reason why technetium-99m can be used safely in this way. **1**

(c) Technetium-99m is formed when molybdenum-99 decays.

The decay equation is

$$^{99}_{42}\text{Mo} \rightarrow {}^{99}_{43}\text{Tc} + \text{X}$$

Identify **X**. **1**

[Turn over

11. The concentration of chloride ions in water affects the ability of some plants to grow.

A student investigated the concentration of chloride ions in the water at various points along the River Tay.

The concentration of chloride ions in water can be determined by reacting the chloride ions with silver ions.

$$Ag^{+}(aq) + Cl^{-}(aq) \rightarrow AgCl(s)$$

A 20 cm^3 water sample gave a precipitate of silver chloride with a mass of 1.435 g.

(a) Calculate the number of moles of silver chloride, AgCl, present in this sample. **2**

(b) Using your answer to part (a), calculate the concentration, in mol l^{-1}, of chloride ions in this sample. **2**

12. A group of students were given strips of aluminium, iron, tin and zinc.

Using your knowledge of chemistry, suggest how the students could identify each of the four metals. **3**

[END OF SPECIMEN QUESTION PAPER]

DO NOT WRITE IN THIS MARGIN

ADDITIONAL SPACE FOR ANSWERS AND ROUGH WORK

DO NOT WRITE IN THIS MARGIN

ADDITIONAL SPACE FOR ANSWERS AND ROUGH WORK

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National
Qualifications
SPECIMEN ONLY

S813/75/01 **Chemistry**

Marking Instructions

These marking instructions have been provided to show how Qualifications Scotland would mark this specimen question paper.

Qualifications Scotland
Teisteanasan Alba

General marking principles for National 5 Chemistry

This information is provided to help you understand the general principles you must apply when marking candidate responses to questions in this paper. These principles must be read in conjunction with the detailed marking instructions, which identify the key features required in candidate responses.

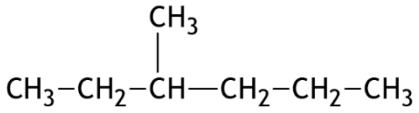
(a) Marks for each candidate response must <u>always</u> be assigned in line with these general marking principles and the detailed marking instructions for this assessment.

(b) If a specific candidate response does not seem to be covered by either the principles or detailed marking instructions, and you are uncertain how to assess it, you must seek guidance from your team leader.

(c) Marking should always be positive. This means that, for each candidate response, marks are accumulated for the demonstration of relevant skills, knowledge and understanding: they are not deducted from a maximum on the basis of errors or omissions.

A guiding principle in marking is to give credit for correct chemistry rather than to look for reasons not to award marks.

Example 1: The structure of a hydrocarbon found in petrol is shown below.



Name the hydrocarbon.

Although the punctuation is not correct, '3, methyl-hexane' should gain the mark.

Example 2: A student measured the pH of four carboxylic acids to find out how their strength is related to the number of chlorine atoms in the molecule.

The results are shown in the table.

Structural formula	*pH*
CH_3COOH	1.65
$CH_2ClCOOH$	1.27
$CHCl_2COOH$	0.90
CCl_3COOH	0.51

State how the strength of the acids is related to the number of chlorine atoms in the molecule.

Although not completely correct, an answer such as 'the more Cl_2, the stronger the acid' should gain the mark.

(d) There are no half marks awarded.

(e) Candidates must respond to the 'command' word as appropriate and may be required to write extended answers in order to communicate fully their knowledge and understanding.

(f) Marks should be awarded for answers that have incorrect spelling or loose language **as long as the meaning of the word(s) is conveyed. Example:** Answers like 'distilling' (for 'distillation') and 'it gets hotter' (for 'the temperature rises') should be accepted.

However, the example below would not be given any credit, as an incorrect chemical term, which the candidate should know, has been given.

Example: If the correct answer is 'ethene', and the candidate's answer is 'ethane', this should not be accepted.

(g) A correct answer followed by a wrong answer should be treated as a cancelling error and no marks should be awarded.

Example: State what colour is seen when blue Fehling's solution is warmed with an aldehyde.

The answer 'red, green' gains no marks.

If a correct answer is followed by additional information which does not conflict, the additional information should be ignored, whether correct or not.

Example: State why the tube cannot be made of copper.

If the correct answer is related to a low melting point, 'Copper has a low melting point and is coloured grey' would not be treated as having a cancelling error.

(h) Unless a numerical question specifically requires evidence of working to be shown, full marks should be awarded for a correct final answer (including units if required) on its own.

The partial marks shown in the marking scheme are for use when working is given but the final answer is incorrect. An exception is when candidates are asked to 'Find, by calculation', when full marks cannot be awarded for the correct answer without working.

(i) In most questions units are not required. However, if the candidate writes units then they must be correct. An incorrect unit would not be acceptable and one mark would not be awarded.

This marking instruction must only be applied a maximum of once per paper.

(j) Where the marking instructions specifically allocate a mark for units in a calculation, this mark should not be awarded if the units are incorrect or missing. Missing or incorrect units at intermediate stages in a calculation should be ignored.

(k) As a general rule, where a wrong numerical answer (already penalised) is carried forward to another step, credit will be given provided the result is used correctly. The exception to this rule is where the marking instructions for a numerical question assign separate 'concept marks' and an 'arithmetic mark'. In such situations, the marking instructions will give clear guidance on the assignment of partial marks.

(l) Ignore the omission of one H atom from a full structural formula provided the bond is shown or one carbon to hydrogen bond missing provided the hydrogen is shown.

(m) A symbol or correct formula should be accepted in place of a name **unless stated otherwise in the marking instructions**.

(n) When formulae of ionic compounds are given as answers it will only be necessary to show ion charges if these have been specifically asked for. However, if ion charges are shown, they must be correct. If incorrect charges are shown, no marks should be awarded.

(o) If an answer comes directly from the text of the question, no marks should be awarded.

Example: A student found that 0·05 mol of propane, C_3H_8 burned to give 82.4 kJ of energy.

$$C_3H_8(g)+5O_2(g)\rightarrow 3CO_2(g)+4H_2O(l)$$

Name the type of enthalpy change which the student measured.

No marks should be awarded for 'burning' since the word ‘burned’ appears in the text.

(p) Unless the question is clearly about a non-chemistry issue, eg costs in industrial chemical process, a non-chemical answer gains no marks.

Example: Suggest why the (catalytic) converter has a honeycomb structure.

A response such as ‘to make it work’ may be correct but it is not a chemical answer and the mark should not be awarded.

Marking instructions for each question

Section 1

Question	Answer	Mark
1.	B	1
2.	C	1
3.	D	1
4.	A	1
5.	D	1
6.	A	1
7.	C	1
8.	A	1
9.	D	1
10.	A	1
11.	C	1
12.	A	1
13.	B	1
14.	D	1
15.	A	1
16.	B	1
17.	D	1
18.	B	1
19.	C	1
20.	C	1

Section 2

Question			Expected response	Max mark	Additional guidance
1.	(a)		86–90 (seconds)	**1**	Unit not required but if given must be correct. This marking instruction must only be applied a maximum of once per paper.
	(b)		1.5 $cm^3 s^{-1}$ **(3)** For partial marking 1.5 with no unit/incorrect unit. **(2)** $\frac{30-0}{20-0}$ **OR** $\frac{30}{20}$ **OR** $\frac{0-30}{0-20}$ **(1)** Correct unit $cm^3 s^{-1}$. **(1)**	**3**	Accept cm^3/s. Do not accept cm^3/s^{-1}.
	(c)		Reactants are used up. **OR** Concentration of reactants decreases. **OR** Less chance of particles colliding. **OR** Particle size of the reactants decrease. **Or equivalent answer**.	**1**	

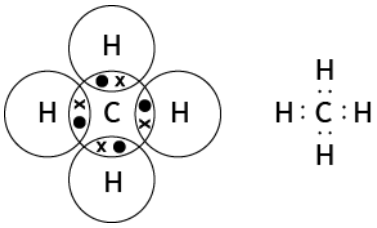
Question			Expected response	Max mark	Additional guidance
2.	(a)		Atoms with same atomic number/number of protons but different mass number/number of neutrons.	**1**	
	(b)		Protons = 35 Neutrons = 44	**1**	Both required for **1 mark**.
	(c)		Equal amounts/proportions/ abundance. **OR** Same number of each. **OR** 50:50. **Or equivalent answer**.	**1**	

Question			Expected response	Max mark	Additional guidance
2.	(d)		This is an open ended question. **1 mark:** The candidate has demonstrated a limited understanding of the chemistry involved. The candidate has made a/some statement(s) which is/are relevant to the situation, showing that at least a little of the chemistry within the problem is understood. **2 marks:** The candidate has demonstrated a reasonable understanding of the chemistry involved. The candidate has made a/some statement(s) which is/are relevant to the situation, showing that the problem is understood. **3 marks:** The candidate has demonstrated a good understanding of the chemistry involved. The candidate shows a good comprehension of the chemistry of the situation and has provided a logically correct answer to the question posed. This type of response might include a statement of the principles involved, a relationship or an equation, and the application of these to respond to the problem. This does not mean the answer has to be what might be termed an "excellent" answer or a "complete" one.	**3**	**0 marks**: The candidate has demonstrated no understanding of the chemistry involved. There is no evidence that the candidate has recognised the area of chemistry involved or has given any statement of a relevant chemistry principle. This mark would also be given when the candidate merely restates the chemistry given in the question.

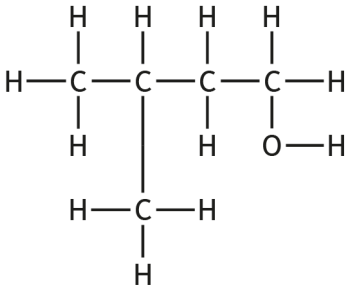
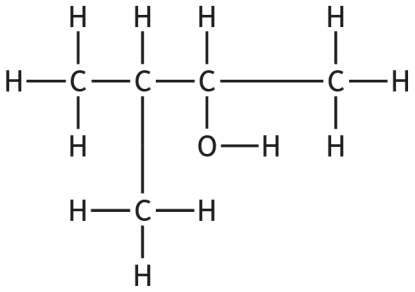
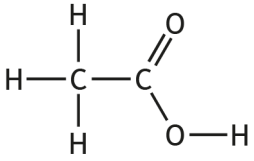
Question			Expected response	Max mark	Additional guidance
3.	(a)	(i)	$CaCO_3 + 2HCl \rightarrow CaCl_2 + H_2O + CO_2$	**1**	Accept correct multiples.
		(ii)	$CaCl_2$ **OR** Calcium chloride	**1**	Accept formula for $CaCl_2$ circled or highlighted in the equation.
	(b)	(i)	Evaporation	**1**	
		(ii)	1.149/1.15/1.1 (g) **(3)** Partial marks can be awarded for a maximum of two of the following three steps. **<u>Method A</u>** **1 mark** for correctly calculating the number of moles of lithium carbonate ie n = m/GFM = 1/74 = 0.0135 mol **(1)** **1 mark** for calculating the moles of lithium chloride by correctly applying the molar ratio ie 2 × candidate's calculated moles of lithium carbonate. **(1)** 0.027 (mol) on its own. **(2)** **1 mark** for calculating the mass of lithium chloride ie m = n × GFM using candidates calculated moles of lithium chloride and candidate's calculated GFM of lithium chloride.	**3**	Unit not required but if given must be correct. This marking instruction must only be applied a maximum of once per paper. A **maximum of 2 marks** can be awarded where the candidate has carried out the calculation using lithium carbonate and one wrong chemical provided working is shown. ie if a candidate calculates the mass of CO_2 or H_2O instead of lithium chloride, a **maximum of 2 marks** can be awarded for 0.59 (g) for using CO_2 or 0.24 (g) for using H_2O provided the GFM of each of these chemicals is correct. Award **0 marks** if candidate's working does not use lithium carbonate.

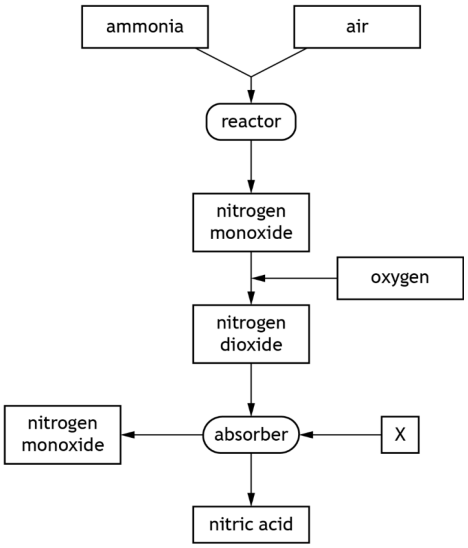
Question			Expected response	Max mark	Additional guidance
3.	(b)	(ii)	(continued)		
			Method B Both GFMs 74 and 42.5 **(1)** 74 ↔ 85 This step on its own is worth **2 marks**. **(2)** Correct application of mole ratio to candidate's GFM of lithium carbonate ie $1 \times \frac{2 \times \text{candidates GFM of lithium chloride}}{\text{candidates GFM of lithium carbonate}}$ Where the candidate has been awarded the mark for correct proportionality, shown by GFM of lithium chloride over GFM of lithium carbonate with or without the mole ratio applied, a further mark can be awarded for correct follow through to a final answer. **(1)**		Award **2 marks** for $\frac{42.5}{74} \times 1 = 0.57$ Award **1 mark** for $\frac{\text{candidates GFM of LiCl}}{\text{candidates GFM of } LiCO_3}$ Working **must** be shown to support an incorrect GFM to allow the concept mark to be awarded.

Question			Expected response	Max mark	Additional guidance
4.	(a)		Flame test (or correct description). **AND** Lilac/purple.	**1**	Both required for **1 mark**.
	(b)		Greater than 7. **OR** Any numerical value greater than seven.	**1**	
	(c)		Ethene	**1**	Accept correct formula.
	(d)		Aluminium, silicon and oxygen	**1**	Accept correct formulae.

Question			Expected response	Max mark	Additional guidance
5.	(a)		Group/family/chemicals/ compounds with same general formula and same/similar chemical properties.	**1**	Both parts required for **1 mark**.
	(b)	(i)	Diagram showing carbon with four hydrogen atoms: each of the four overlap areas must have two electrons in or on overlap area (cross, dot, petal diagram). eg  	**1**	The diagram does not need to show tetrahedral shape.
		(ii)	Stronger forces **(1)** between molecules/ intermolecular. **(1)**	**2**	
	(c)	(i)	Exothermic	**1**	
		(ii) (A)	33.44 (kJ) **(3)** --- For partial marking Using $cm\Delta T$ with c = 4.18. **(1)** To be awarded this concept mark, candidates do not specifically need to write $cm\Delta T$. The concept mark is awarded for using this relationship with three values, one of which must be 4.18. For values 0.2 (kg) **and** 40 (°C). **(1)** A further mark can be awarded for arithmetical follow through to the candidate's answer only if the mark for the $cm\Delta T$ concept has been awarded. **(1)**	**3**	Unit not required but if given must be correct. This marking instruction must only be applied a maximum of once per paper.

Question			Expected response	Max mark	Additional guidance
5.	(c)	(ii) (B)	Draught insulation. **OR** Use metal beaker. **Or any reasonable answer.**	**1**	
	(d)		3520 to 3550 (kJ)	**1**	Unit not required but if given must be correct. This marking instruction must only be applied a maximum of once per paper.

Question			Expected response	Max mark	Additional guidance
6.	(a)		Hydroxyl	**1**	
	(b)	(i)	Addition **OR** Hydration	**1**	
		(ii)	 **OR** 	**1**	Accept full or shortened structural formula.
	(c)	(i)		**1**	Accept full or shortened structural formula.
		(ii)	Carboxylic acid	**1**	Accept alkanoic acid.

Question			Expected response	Max mark	Additional guidance
7.	(a)		Reduction	**1**	
	(b)	(i)	d.c.	**1**	
		(ii)	Negative – (brown solid formed) Positive - (bubbles of gas)	**1**	Both required for **1 mark**.
8.	(a)	(i)	Haber (Bosch)	**1**	
		(ii)	Speeds up reaction. **OR** Less energy/temperature/heat required.	**1**	
	(b)	(i)		**1**	
		(ii)	Water/H_2O	**1**	
		(iii)	Arrow from nitrogen monoxide from absorber to nitrogen monoxide below reactor (anywhere below the reactor and above nitrogen dioxide).	**1**	
		(iv)	Ostwald process	**1**	

Question			Expected response	Max mark	Additional guidance
9.	(a)	(i)	Burette	**1**	
		(ii)	To identify the end point of the reaction.	**1**	
		(iii)	16 **OR** 16.0 (cm^3)	**1**	Unit not required but if given must be correct. This marking instruction must only be applied a maximum of once per paper.
	(b)		Titration	**1**	
10.	(a)		$\frac{1}{4}$/25%/0.25 **(2)** For partial marking **1 mark** can be awarded for either 2 half lives. **OR** Fraction correctly calculated for an incorrect number of half-lives shown.	**2**	Unit not required but if given must be correct. This marking instruction must only be applied a maximum of once per paper.
	(b)		Short half-life. **OR** Would not last long in the body. **OR** Gamma would go right through body. **Or equivalent response**.	**1**	
	(c)		Beta/β/ $^{0}_{-1}e$ / $^{0}_{-1}\beta$	**1**	The charge on the beta particle does not need to be shown. Do not accept electron without atomic and mass numbers, ie e or e^-.

Question			Expected response	Max mark	Additional guidance
11.	(a)		0.01 (mol) **(2)** For partial marking **1 mark** can be awarded for either 143.5 g **OR** Correctly calculated answer for 1.435 divided by candidates calculated GFM.	**2**	Unit not required but if given must be correct. This marking instruction must only be applied a maximum of once per paper.
	(b)		0.5 (mol l^{-1}) **(2)** For partial marking **1 mark** can be awarded for either $\frac{0.01}{0.02}$ **OR** correctly calculated answer for $\frac{0.01}{20}$	**2**	Unit not required but if given must be correct. This marking instruction must only be applied a maximum of once per paper. Allow follow through from answer to 11(a). If correct relationship is used but volume not converted to litres eg 0.01/20 **maximum 1 mark**.

Question			Expected response	Max mark	Additional guidance
12.			This is an open ended question. **1 mark:** The candidate has demonstrated a limited understanding of the chemistry involved. The candidate has made a/some statement(s) which is/are relevant to the situation, showing that at least a little of the chemistry within the problem is understood. **2 marks:** The candidate has demonstrated a reasonable understanding of the chemistry involved. The candidate has made a/some statement(s) which is/are relevant to the situation, showing that the problem is understood. **3 marks:** The candidate has demonstrated a good understanding of the chemistry involved. The candidate shows a good comprehension of the chemistry of the situation and has provided a logically correct answer to the question posed. This type of response might include a statement of the principles involved, a relationship or an equation, and the application of these to respond to the problem. This does not mean the answer has to be what might be termed an "excellent" answer or a "complete" one.	**3**	**0 marks**: The candidate has demonstrated no understanding of the chemistry involved. There is no evidence that the candidate has recognised the area of chemistry involved or has given any statement of a relevant chemistry principle. This mark would also be given when the candidate merely restates the chemistry given in the question.

[END OF SPECIMEN MARKING INSTRUCTIONS]

Published: August 2026

Change since last published:

The duration of the paper has been shortened and the number of marks reduced. Some questions have been removed from the previous specimen question paper, some have been edited or updated, and some have been replaced.