N5

National Qualifications 2022

X813/75/02

Chemistry
Section 1 — Questions

FRIDAY, 29 APRIL
1:00 PM – 3:30 PM

Instructions for the completion of Section 1 are given on *page 02* of your question and answer booklet X813/75/01.

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.

Before leaving the examination room you must give your question and answer booklet to the Invigilator; if you do not, you may lose all the marks for this paper.

SQA

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A/SA

SECTION 1 — 25 marks

Attempt ALL questions

1. Which of the following is the atomic number of a metal?

   A 1

   B 33

   C 45

   D 86

2. An atom is neutral because:

   A the number of protons equals the number of neutrons

   B the number of electrons equals the number of protons

   C the number of electrons equals the number of protons plus neutrons

   D the number of neutrons equals the number of electrons plus protons.

3. When liquid water changes to steam:

   A weak forces of attraction between the water molecules are broken

   B strong forces of attraction between the water molecules are broken

   C weak forces of attraction between the atoms in the water molecules are broken

   D strong forces of attraction between the atoms in the water molecules are broken.

4. Which line in the table shows how the concentration of a solution changes when more solute or solvent is added?

	Adding solute	Adding solvent
A	concentration decreases	concentration increases
B	concentration decreases	concentration decreases
C	concentration increases	concentration decreases
D	concentration increases	concentration increases

5. Which of the following structures would be described as angular?

A
$$\left[\begin{array}{c} H \\ H-N\cdots H \\ H \end{array}\right]^{+}$$

B
$$O{=}S{=}O$$

C
$$O{=}C{=}O$$

D
$$H-N\cdots H \\ H$$
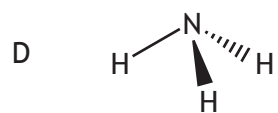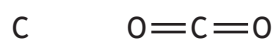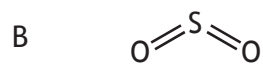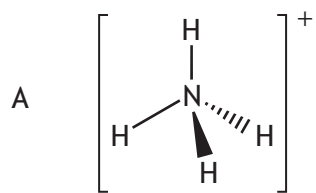
6. Electronegativity is a measure of the attraction a nucleus has for the shared pair of electrons in a covalent bond.

When two nuclei that have different electronegativity values are bonded together, the bond formed is described as 'polar covalent'.

The bigger the difference in the electronegativity values the more polar the bond.

The table contains electronegativity values for some atoms.

Atom	Electronegativity value
H	2.2
C	2.6
N	3.0
O	3.4

Which of the following bonds would be the most polar?

A   O–H

B   N–H

C   C–H

D   C–O

7. Which line in the table shows what would be observed during the electrolysis of copper chloride, using a d.c. supply?

|	At the positive electrode	At the negative electrode
A	gas forms	solid forms
B	gas forms	gas forms
C	solid forms	gas forms
D	solid forms	solid forms

8. Which of the following compounds is a salt?

    A   Calcium oxide

    B   Hydrogen nitrate

    C   Sodium hydroxide

    D   Potassium ethanoate

9. The pH of the solution formed when ammonia is bubbled into water is most likely to be:

    A   3

    B   5

    C   7

    D   9.

10. The apparatus shown can be used to identify the products of combustion.
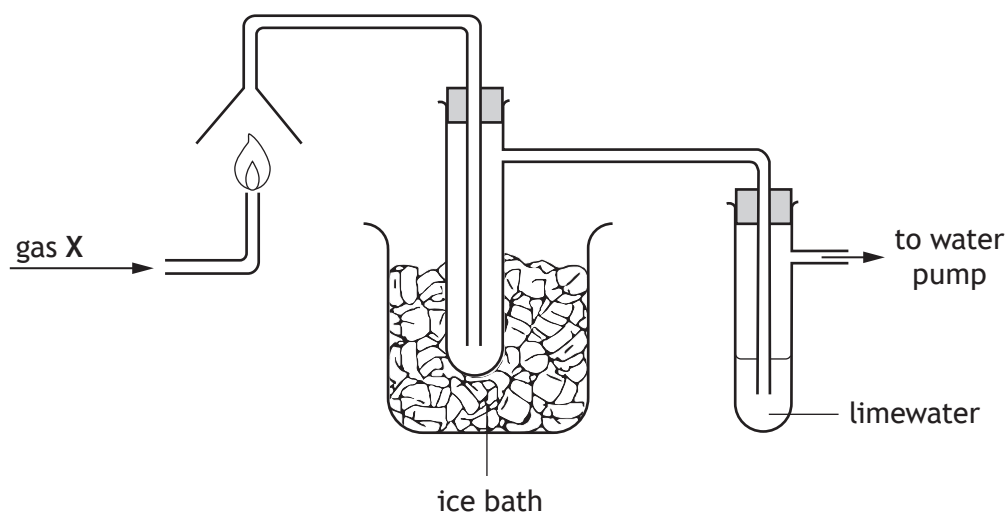
When gas **X** was burned, a colourless liquid collected in the cooled test tube but there was no change in the limewater.
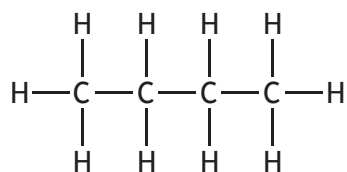
Gas **X** could be:

    A   methane

    B   carbon monoxide
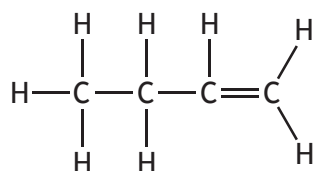
    C   hydrogen

    D   ethane.

11. Which of the following compounds has the highest boiling point?

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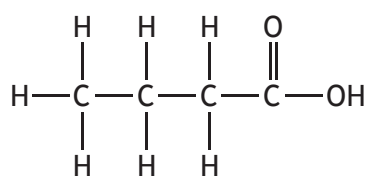
A

```
     H   H   H   H
     |   |   |   |
H —  C — C — C — C — H
     |   |   |   |
     H   H   H   H
```

B

```
     H   H   H      H
     |   |   |     /
H —  C — C — C =  C
     |   |          \
     H   H           H
```

C

```
     H   H   H   O
     |   |   |   ||
H —  C — C — C — C — OH
     |   |   |
     H   H   H
```

D

```
     H   H   OH  H
     |   |   |   |
H —  C — C — C — C — H
     |   |   |   |
     H   H   H   H
```
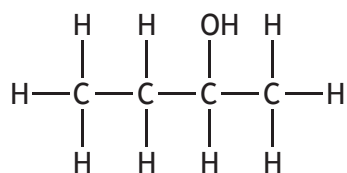
12. Which of the following molecules will decolourise bromine solution and also form an acidic solution when added to water?

A

```
        H   H   H   H   H   O
        |   |   |   |   |   ||
   H —  C — C — C — C — C — C — OH
        |   |   |   |   |
        H   H   H   H   H
```
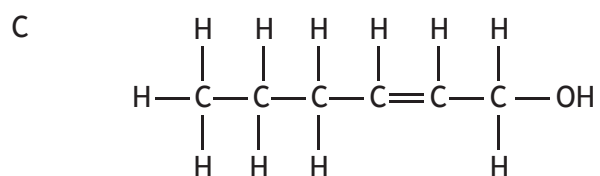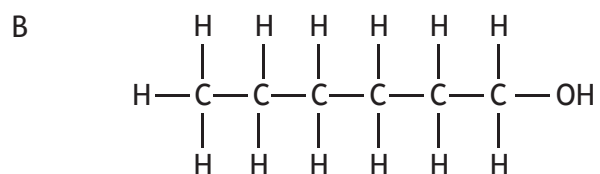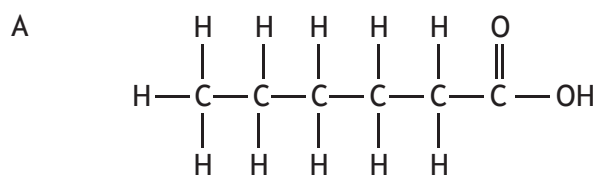
B

```
        H   H   H   H   H   H
        |   |   |   |   |   |
   H —  C — C — C — C — C — C — OH
        |   |   |   |   |   |
        H   H   H   H   H   H
```

C

```
        H   H   H   H   H   H
        |   |   |   |   |   |
   H —  C — C — C — C = C — C — OH
        |   |   |           |
        H   H   H           H
```

D

```
        H   H   H   H   H   O
        |   |   |   |   |   ||
   H —  C — C — C — C = C — C — OH
        |   |   |
        H   H   H
```
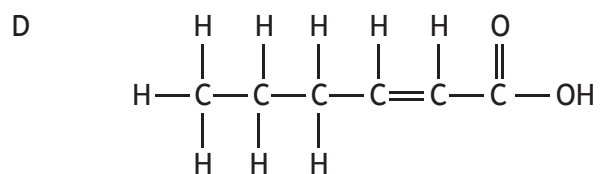
13. The first three members of the alkanones are

$$
\begin{array}{ccc}
\overset{\displaystyle H}{\underset{\displaystyle H}{H-C}}-\overset{\displaystyle O}{C}-\overset{\displaystyle H}{\underset{\displaystyle H}{C-H}} & \quad & \quad
\end{array}
$$

Structures shown:

- $H_3C{-}CO{-}CH_3$ (propanone)
- $H_3C{-}CO{-}CH_2{-}CH_3$ (butanone)
- $H_3C{-}CO{-}CH_2{-}CH_2{-}CH_3$ (pentan-2-one)
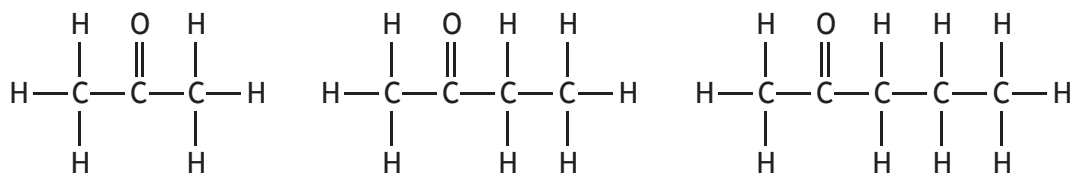
The general formula for the alkanones is:

A $C_nH_{2n-2}O$

B $C_nH_{2n}O$

C $C_nH_{2n+1}O$

D $C_nH_{2n+2}O$

14. Which of the following could be the formula mass of a cycloalkane?

   A   40

   B   42

   C   54

   D   58

15. Metallic bonding is a force of attraction between:

   A   positive ions and delocalised electrons

   B   negative ions and delocalised electrons

   C   negative ions and positive ions

   D   a shared pair of electrons and two nuclei.

16. Metals used to make aircraft have a density of less than $3\ \mathrm{g\,cm^{-3}}$ and have to withstand temperatures up to 600 °C.

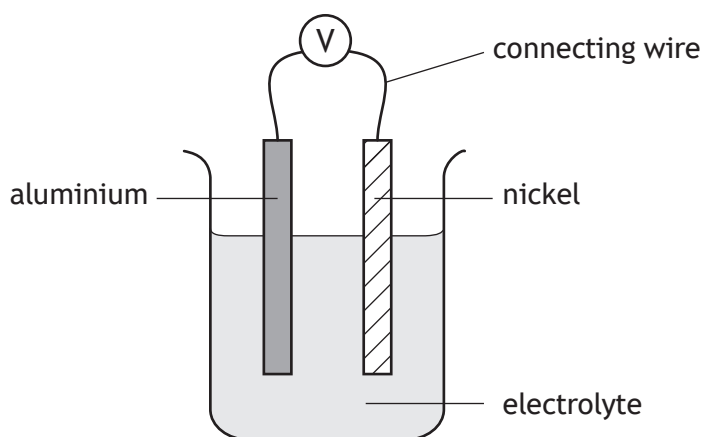Which line in the table gives the correct data for a metal used to make aircraft?

	Melting point (°C)	Density ($\mathrm{g\,cm^{-3}}$)
A	98	0.97
B	660	2.70
C	1854	6.52
D	1085	8.96

17. Which of these metals can only be extracted from its ore by electrolysis and forms an oxide that is insoluble in water?

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

    A   Aluminium

    B   Calcium

    C   Copper

    D   Lead

18.

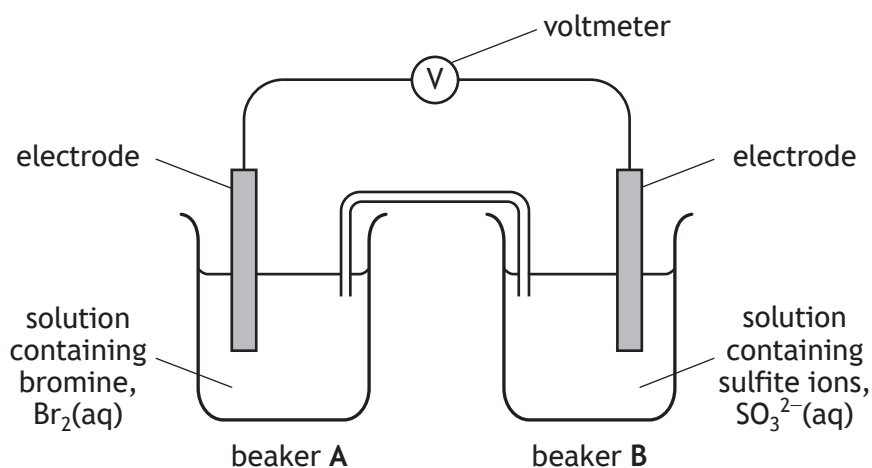Which statement correctly describes the electron flow in the cell?

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

    A   Through the electrolyte from aluminium to nickel.

    B   Through the electrolyte from nickel to aluminium.

    C   Through the connecting wire from nickel to aluminium.

    D   Through the connecting wire from aluminium to nickel.

19. Which metal, when paired with magnesium in a cell, will produce the highest voltage?
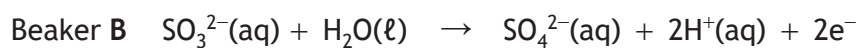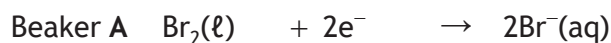
You may wish to use the data booklet to help you.

    A   Iron

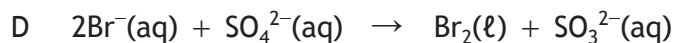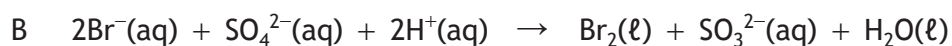   B   Lead

    C   Tin

    D   Zinc

[Turn over

20.

The reactions occurring at each electrode are:

Beaker **A** $\quad Br_2(\ell) \quad + 2e^- \quad \rightarrow \quad 2Br^-(aq)$

Beaker **B** $\quad SO_3^{2-}(aq) + H_2O(\ell) \quad \rightarrow \quad SO_4^{2-}(aq) + 2H^+(aq) + 2e^-$

Which of the following equations is the overall redox reaction in the cell?

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

A $\quad Br_2(\ell) + SO_3^{2-}(aq) + H_2O(\ell) + 2e^- \quad \rightarrow \quad 2Br^-(aq) + SO_4^{2-}(aq) + 2H^+(aq) + 2e^-$

B $\quad 2Br^-(aq) + SO_4^{2-}(aq) + 2H^+(aq) \quad \rightarrow \quad Br_2(\ell) + SO_3^{2-}(aq) + H_2O(\ell)$

C $\quad Br_2(\ell) + SO_3^{2-}(aq) + H_2O(\ell) \quad \rightarrow \quad 2Br^-(aq) + SO_4^{2-}(aq) + 2H^+(aq)$

D $\quad 2Br^-(aq) + SO_4^{2-}(aq) \quad \rightarrow \quad Br_2(\ell) + SO_3^{2-}(aq)$
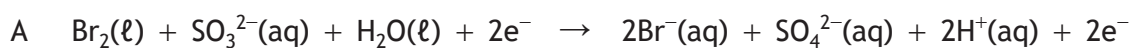
21. Polymethylmethacrylate is a polymer used in the manufacture of aircraft windows. A section of the polymer chain is drawn below.
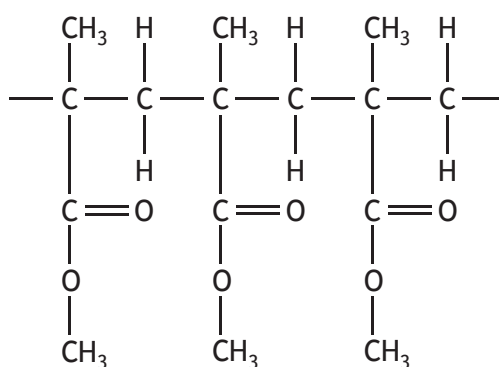
The monomer used to make this polymer is:

A

B

C

D

[**Turn over**
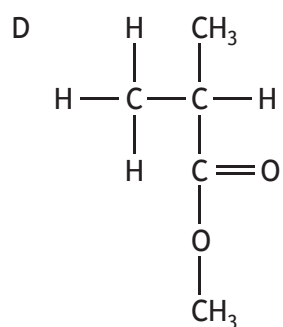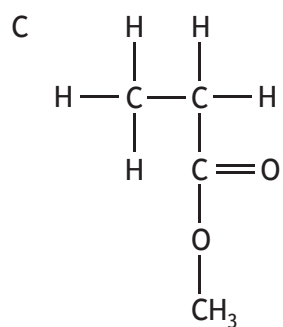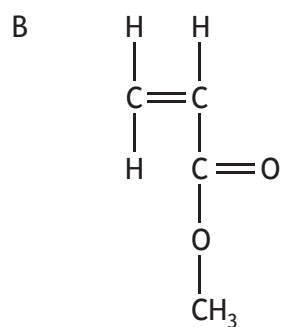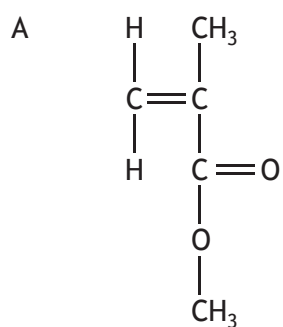
22. Which line in the table is correct for the Ostwald process?

	Product	Catalyst
A	HNO_3	iron
B	HNO_3	platinum
C	NH_3	iron
D	NH_3	platinum

23. Radon-222 is a radioisotope present in the Earth's atmosphere. Plants can absorb radon-222 through their roots.

Compared with radon-222 in the atmosphere, the half-life of the radon-222 in the plant cells will be:

A   shorter

B   longer

C   the same

D   dependent on the size of the plant.

24. A radioisotope is used to monitor blood flow around the body. In order to prevent damage to the body the radiation emitted must be able to escape through the skin.

Which line in the table describes the type of radiation emitted and half-life that would make a radioisotope suitable for this use?

	Type of radiation emitted	Half-life
A	alpha	long
B	beta	long
C	alpha	short
D	beta	short

25. A student measured 25 cm^3 of sodium hydroxide for a titration experiment using a 100 cm^3 measuring cylinder. Their teacher suggested that there was a more accurate piece of apparatus to measure this volume.

Which piece of apparatus should the student have used to more accurately measure out the 25 cm^3 volume of sodium hydroxide?

A   100 cm^3 beaker

B   25 cm^3 measuring cylinder

C   25 cm^3 pipette

D   100 cm^3 conical flask

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

N5

National
Qualifications
2022

Mark

X813/75/01

Chemistry
Section 1 — Answer grid
and Section 2

FRIDAY, 29 APRIL
1:00 PM – 3:30 PM

X8137501

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 — 100

SECTION 1 — 25 marks

Attempt ALL questions.

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

SECTION 2 — 75 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.

Before leaving the examination room you must give this booklet to the Invigilator; if you do not, you may lose all the marks for this paper.
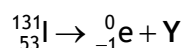
SQA

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B/PB

SECTION 2 — 75 marks

Attempt ALL questions

1. Research shows that if nuclear power reactors are not constantly monitored and maintained, radioisotopes can be released into the environment.

   Three such radioisotopes are xenon-133, iodine-131 and caesium-137.

   (a) The equation for the decay of iodine-131 is

   $$^{131}_{53}\text{I} \rightarrow \, ^{0}_{-1}\text{e} + \text{Y}$$

   (i) Name the **type** of radiation emitted by the iodine-131 radioisotope. **1**

   (ii) Name element **Y**. **1**

   (b) The half-life of the three radioisotopes is shown in the table.

Radioisotope	xenon-133	iodine-131	caesium-137
Half-life	5 days	8 days	30 years

   (i) Calculate the length of time taken for the radioactivity of xenon-133 to fall to $\frac{1}{8}$ of its original value. **2**

   Show your working clearly.

1. **(b)** **(continued)**

   (ii) Suggest which of the radioisotopes from the table would be responsible for long term radiation, if released into the environment. **1**

                          [Turn over

2. Calcium reacts with water as shown in the equation.

$$Ca(s) \ + \ 2H_2O(\ell) \ \rightarrow \ Ca(OH)_2(aq) \ + \ H_2(g)$$
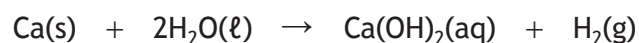
In an experiment, the progress of a reaction was monitored by measuring the volume of hydrogen gas produced.

Time (min)	0	1	2	3	4	5
Volume of gas produced (cm³)	0	32	40	46	48	48

(a) Complete the graph to show the volume of gas produced against time.

The first two points have been plotted for you.

(Additional graph paper, if required, can be found on *page 31*.)

2

time (min)

2. (continued)
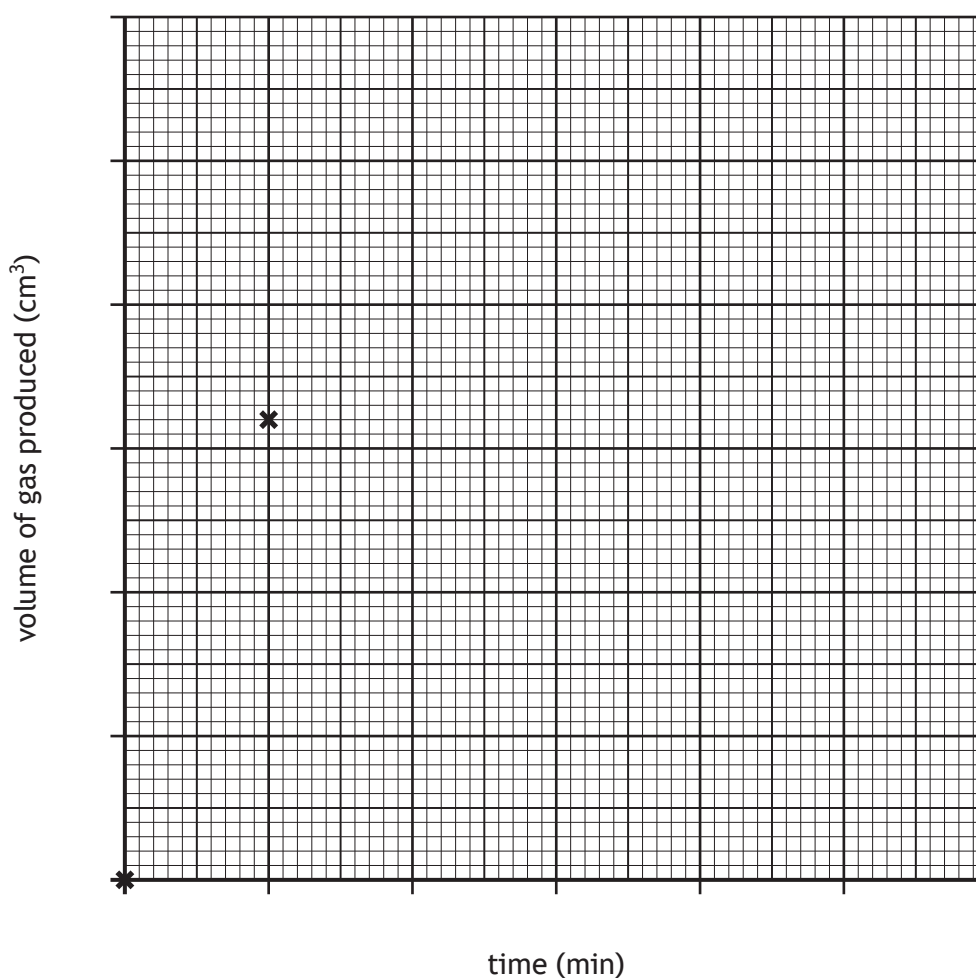
(b) Calculate the average rate of reaction, in $cm^3 min^{-1}$, between 1 and 4 minutes. **2**

Show your working clearly.

(c) Suggest a different measurement that could be used to follow the progress of this chemical reaction. **1**

(d) A student repeated the experiment at a higher temperature, using the same mass of calcium and the same volume of water.

Predict the final volume of gas, in cm^3, produced in this experiment. **1**

[Turn over

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

> **Diesel Exhaust Fluid**
>
> Diesel Exhaust Fluid, DEF, is a chemical that can be added to diesel cars to lower pollution.
>
> DEF is a solution that consists of urea and water only; 32.5% of the mass of this solution is urea.
>
> When DEF is heated in the exhaust system, urea reacts with water to make ammonia and carbon dioxide. The ammonia then reacts with two of the harmful gases in the exhaust fumes, nitrogen monoxide and nitrogen dioxide, to produce two harmless substances, water and nitrogen.
>
> DEF is preferred to solutions of ammonia because it is not considered a dangerous chemical; it is not toxic or flammable making it safer and easier to store.

(a) State the name of the two products formed when DEF is heated in the exhaust system.

1

(b) Calculate the mass of urea, in kg, used to make 5 kg of DEF.

1

(c) Circle the words to complete the sentence.

1

The harmful gases in the exhaust fumes, if released, can dissolve in water to

form a solution which contains more $\left\{\begin{array}{l}\text{hydrogen}\\\text{hydroxide}\end{array}\right\}$ ions than $\left\{\begin{array}{l}\text{hydrogen}\\\text{hydroxide}\end{array}\right\}$ ions.

3. **(continued)**

(d) State a reason why DEF is not considered a dangerous substance.   **1**

(e) Another use of urea, $CO(NH_2)_2$, is as a fertiliser.

Urea is known as a 'single nutrient' fertiliser because it contains only one of the elements essential for healthy plant growth.

(i) Diammonium hydrogen phosphate, $(NH_4)_2HPO_4$, is another common fertiliser.

Explain why diammonium hydrogen phosphate, $(NH_4)_2HPO_4$, is not classified as a 'single nutrient' fertiliser.   **1**

(ii) Calculate the percentage by mass of nitrogen in diammonium hydrogen phosphate, $(NH_4)_2HPO_4$.   **3**

[Turn over

4. Haloalkanes are alkane molecules in which one or more hydrogen atoms have been replaced by an atom of a group 7 element.

   (a) Haloalkanes are produced by the reaction of an alkene with a hydrogen halide, such as hydrogen bromide.

   ethene   hydrogen   bromoethane
                   bromide
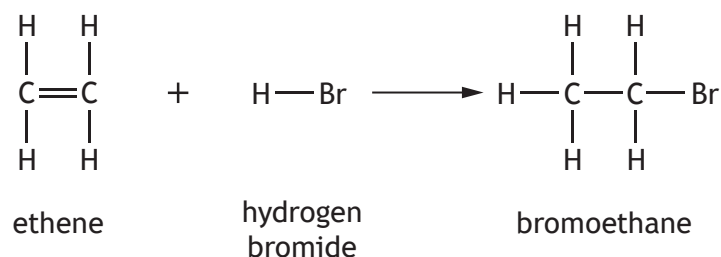
   (i) Name the type of chemical reaction taking place when ethene reacts with hydrogen bromide.   **1**

   (ii) Draw a diagram, showing **all** the outer electrons, for a molecule of hydrogen bromide, HBr.   **1**

   (iii) Name the chemical that can be reacted with ethene to make chloroethane.   **1**

4. (continued)

(b) Haloalkanes can be used to produce carboxylic acids in a two-step process.
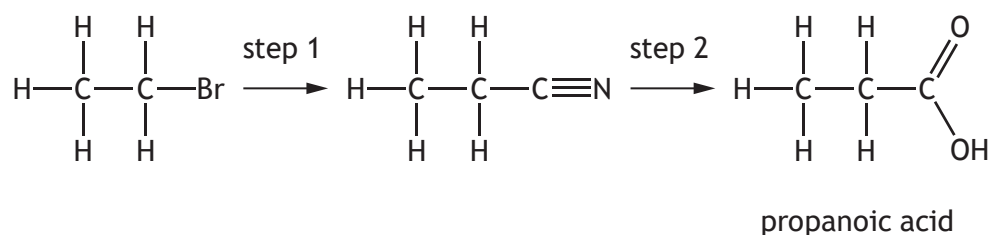
propanoic acid

(i) Draw a structure for the haloalkane used in **step 1** that would react in this way to produce ethanoic acid. **1**
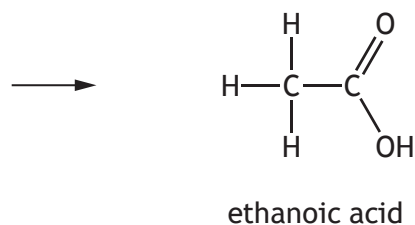
ethanoic acid

(ii) A dilute solution of ethanoic acid is often used in food and household cleaning products.

State the name given to a dilute solution of ethanoic acid. **1**

[Turn over

5. Indigestion is caused by excess stomach acid and is treated using indigestion tablets, a medicine containing chemicals such as calcium carbonate, that neutralise the excess stomach acid.
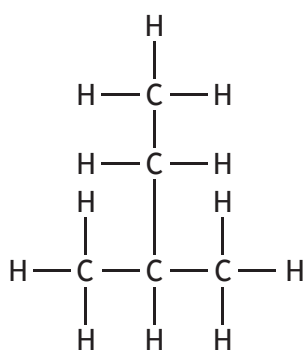
A group of students were given two brands of indigestion tablet and asked to carry out an experiment to determine which of the two brands is the most effective at neutralising an acid.

Using your knowledge of chemistry, comment on how the students could determine experimentally which tablet is the most effective.　**3**

6. Isopentane is an alkane.

$$H$$
$$|$$
$$H—C—H$$
$$|$$
$$H—C—H$$
$$H \qquad H$$
$$| \qquad | \qquad |$$
$$H—C—C—C—H$$
$$| \qquad | \qquad |$$
$$H \quad H \quad H$$

isopentane

(a) State the systematic name for isopentane. **1**

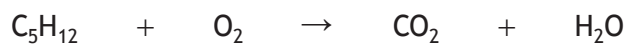(b) Isopentane will react with oxygen in a combustion reaction to release heat energy.

(i) State the term used to describe a substance that burns to release heat energy in a combustion reaction. **1**

(ii) The equation for the combustion reaction of isopentane is shown.

$$C_5H_{12} \quad + \quad O_2 \quad \rightarrow \quad CO_2 \quad + \quad H_2O$$

Balance this equation. **1**

[Turn over

6. (b) (continued)

(iii) A chemist calculated the energy absorbed by water when isopentane is burned. The chemist recorded the following data.

Initial mass of isopentane (g)	275.6
Final mass of isopentane (g)	274.8
Mass of water heated (g)	200
Initial temperature of water (°C)	23
Final temperature of water (°C)	35

Calculate the energy, in kJ, absorbed by the water in the chemist's experiment.

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

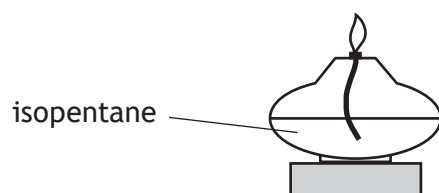**Show your working clearly.**

3

6. (b) (continued)

(iv) Complete the diagram to show an experimental setup that could be used to determine the quantity of heat energy absorbed by water when isopentane burns.

You **must** label your diagram. **2**

(An additional diagram, if required, can be found on *page 32*.)

isopentane

7. A student carried out an investigation to find out how concentration affects the boiling point of a sodium chloride solution.

   (a) Before the investigation was carried out the student prepared 500 cm^3 of a sodium chloride solution.

   This solution had an accurate concentration of 1.5 mol l^{-1}.

   (i) Calculate the mass, in grams, of solid sodium chloride, NaCl, required to prepare 500 cm^3 of 1.5 mol l^{-1} solution.

   3

   (ii) Name the piece of apparatus which should be used to accurately measure the mass of solid sodium chloride required to make the 1.5 mol l^{-1} solution.

   1

7. (continued)

(b) The student heated three samples of the 1.5 mol l^{-1} sodium chloride solution until they boiled and measured the temperature each time.

The boiling points were 105 °C, 107 °C and 108 °C.

(i) Calculate the student's average boiling point, in °C, for the 1.5 mol l^{-1} sodium chloride solution.

1

(ii) The student measured the boiling points for two more concentrations of sodium chloride solution.

The average boiling point for 0.5 mol l^{-1} was 101.3 °C and the average boiling point for 1.0 mol l^{-1} was 104.0 °C.

Present these results and your answer to (b)(i) in a table.

2

(c) State the **type** of graph the student should draw to present these results.

1

(d) The student's aim was to find out how the concentration of a sodium chloride solution affects its boiling point.
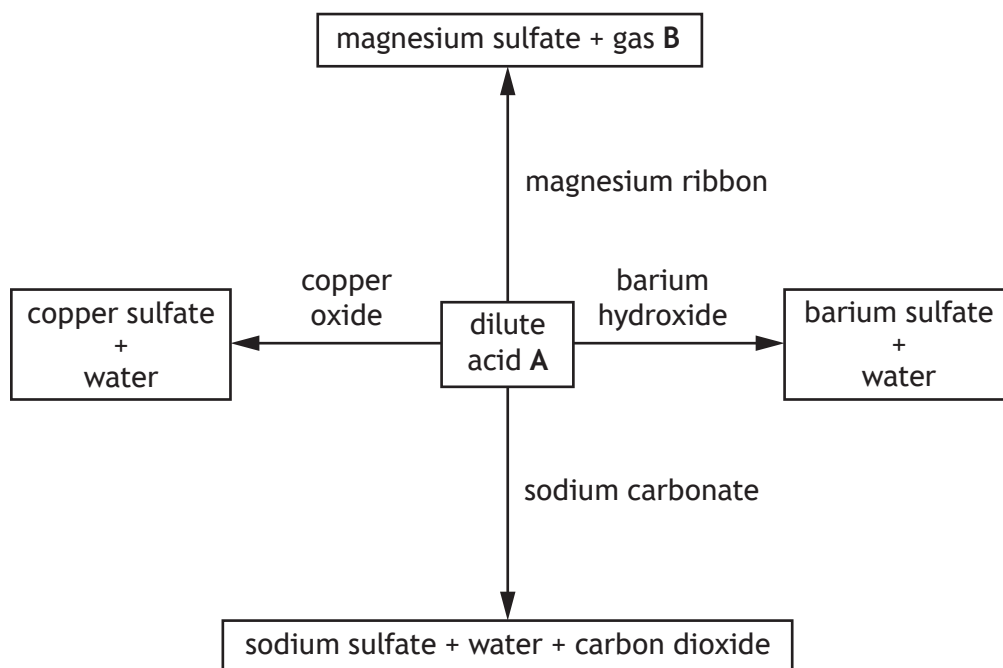
Suggest a conclusion for the experiment based on the student's results.

1

[Turn over

8. A student carried out four reactions with dilute acid **A** as shown in the diagram.

```
                    ┌─────────────────────────────┐
                    │  magnesium sulfate + gas B  │
                    └─────────────────────────────┘
                                  ▲
                                  │
                          magnesium ribbon
                                  │
   ┌──────────────┐    copper     ┌──────────┐   barium      ┌──────────────┐
   │ copper sulfate│    oxide      │  dilute  │  hydroxide    │ barium sulfate│
   │      +       │ ◄─────────────│  acid A  │──────────────►│      +       │
   │    water     │               └──────────┘               │    water     │
   └──────────────┘                    │                     └──────────────┘
                                       │
                               sodium carbonate
                                       │
                                       ▼
              ┌──────────────────────────────────────────────┐
              │  sodium sulfate + water + carbon dioxide      │
              └──────────────────────────────────────────────┘
```

(a) Name dilute acid **A**. **1**

(b) Name gas **B**. **1**

(c) Sodium carbonate is added to dilute acid **A** until the reaction is finished.

Other than measuring the pH, suggest how the student would know when to stop adding sodium carbonate. **1**

8. (continued)

(d) In all of these reactions a salt is produced.

State which of these salts would be produced as a precipitate. **1**

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

(e) Unlike the other reactions in the diagram, the reaction between magnesium and dilute acid **A** cannot be classified as a neutralisation reaction.

State what is meant by a neutralisation reaction. **1**

[Turn over

9. Xenon is an element found in group 0 of the periodic table.

(a) A number of isotopes of xenon exist.

State what is meant by the term isotope. **1**

(b) The elements in group 0 are known as the noble gases and are all very unreactive.

Explain why the noble gases are unreactive. **1**

(c) Under certain conditions xenon can form compounds.

Xenon hexafluoride, XeF_6, is made by reacting xenon difluoride with fluorine using nickel(II) fluoride as a catalyst.

(i) Write a chemical equation, using symbols and formulae, to show the reaction.

There is no need to balance this equation. **1**

(ii) Xenon hexafluoride is a solid at room temperature with a melting point of 49 °C.

State the term used to describe the structure of xenon hexafluoride. **1**

9. (c) (continued)

(iii) When making a sample of xenon hexafluoride, 35 g of nickel(II) fluoride is required to catalyse the reaction.

(A) Suggest what mass of nickel(II) fluoride, in grams, should be present at the end of the reaction. **1**

(B) Calculate the cost, in £, of purchasing the required mass of nickel(II) fluoride if nickel(II) fluoride can only be bought as a 10 g tub for £69.40. **1**

[Turn over

10. Alcohols are a homologous series used for a variety of purposes in everyday life.

(a) State what is meant by the term homologous series.

(b) Alcohols can be classified depending on how many hydrogen atoms are attached to the carbon atom bonded to the functional group.

This carbon atom is circled in the examples shown.

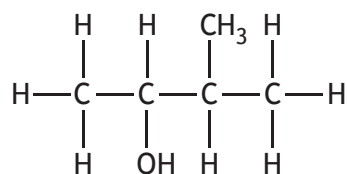| Number of hydrogen atoms attached to carbon bonded to the functional group	Example	Alcohol classification
2	H H OH H—C—C—Ⓒ—H H H H	primary
1	H OH H H—C—Ⓒ—C—H H H H	secondary
0	H CH₃ H H—C—Ⓒ—C—H H OH H	tertiary

(i) Name the functional group present in all alcohols.

10. (b) (continued)

(ii) The structure for 3-methylbutan-2-ol is shown.

$$H-\overset{\overset{\displaystyle H}{|}}{\underset{\underset{\displaystyle H}{|}}{C}}-\overset{\overset{\displaystyle H}{|}}{\underset{\underset{\displaystyle OH}{|}}{C}}-\overset{\overset{\displaystyle CH_3}{|}}{\underset{\underset{\displaystyle H}{|}}{C}}-\overset{\overset{\displaystyle H}{|}}{\underset{\underset{\displaystyle H}{|}}{C}}-H$$

Identify the alcohol classification of 3-methylbutan-2-ol. **1**

(iii) Draw an isomer of 3-methylbutan-2-ol which has a different alcohol classification. **1**

[Turn over

11. The 'Screaming Jelly Baby' is a popular chemistry demonstration where the sugars in a jelly baby reacts with oxygen.

(a) In the demonstration, potassium chlorate, $KClO_3$, is first heated in a boiling tube until it decomposes, producing oxygen gas.

$$2KClO_3 \rightarrow 2KCl + 3O_2$$

(i) Describe how you could test for the presence of oxygen. **1**

(ii) Write the formula for potassium chlorate, $KClO_3$, showing the charge on both ions. **1**

(b) The jelly baby is then added to the reaction mixture.

The sugars in the jelly baby undergo an exothermic reaction with oxygen.

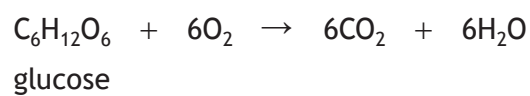(i) State what is meant by the term exothermic. **1**

(ii) During the demonstration, brightly coloured flames are produced.

Suggest why the flames are lilac coloured. **1**

11. (continued)

(c) The equation for the reaction of the sugar, glucose, is shown.

$$C_6H_{12}O_6 \ + \ 6O_2 \ \rightarrow \ 6CO_2 \ + \ 6H_2O$$
glucose

Calculate the mass, in grams, of oxygen required to react completely with 2.25 g of glucose, $C_6H_{12}O_6$.   **3**

[Turn over

12. The covalent radius is a measurement used to indicate the size of an atom.

The diagram below shows the covalent radius for elements in groups 1 to 7 of the periodic table.

H						
• 32						

Li	Be	B	C	N	O	F
130	99	84	75	71	64	60
Na	**Mg**	**Al**	**Si**	**P**	**S**	**Cl**
160	140	124	114	109	104	100
K	**Ca**	**Ga**	**Ge**	**As**	**Se**	**Br**
200	174	123	120	120	118	117
Rb	**Sr**	**In**	**Sn**	**Sb**	**Te**	**I**
215		142	140	140	137	136

covalent radius (picometres)

(a) (i) Describe the trend in covalent radius going from sodium to chlorine. **1**

(ii) Describe the **general** trend in covalent radius going down a group in the periodic table. **1**

(iii) Predict a value, in picometres, for the covalent radius of strontium. **1**

12. (continued)

(b) The covalent radius is defined as being 'half the distance between two bonded nuclei'.

distance between
two nuclei

covalent
radius
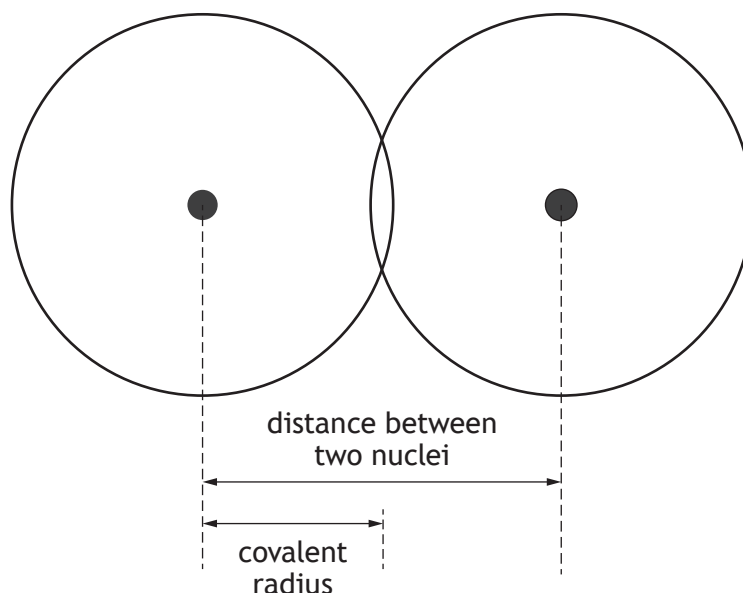
Calculate the distance, in picometres, between the nuclei in bromine, Br_2. **1**

(c) The radius of the sodium ion, Na^+, is smaller than the radius of the sodium atom.

   (i) Write the electron arrangement for the sodium ion, Na^+. **1**

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

   (ii) Suggest why the radius of a Na^+ ion is smaller than the radius of the sodium atom. **1**

[Turn over

13. Redox reactions involve both an oxidation and reduction reaction.

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

[END OF QUESTION PAPER]