National Qualifications 2019

# X813/75/02

# Chemistry
# Section 1 — Questions

FRIDAY, 10 MAY

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.

**SECTION 1 — 25 marks**

**Attempt ALL questions**

**Questions 1 and 2 refer to an experiment to investigate the rate of a reaction.**

The volume of gas collected in 2 minutes was 5 $cm^3$.

**1.** What was the average rate of reaction over this time?

A 0·2

B 0·4

C 2·5

D 5·0

**2.** The unit for the average rate of this reaction is

A $cm^3/min^{-1}$

B $cm^3\,min^{-1}$

C $min/cm^3$

D $min\,cm^{-3}$

**3.** Tennessine is a newly discovered element with a predicted electron arrangement of 2,8,18,32,32,18,7.

In which group of the periodic table should Tennessine be placed?

A 1

B 2

C 7

D 8

**4.** Which of the following is a positively charged ion?

| | Protons | Neutrons | Electrons |
|---|---|---|---|
| A | 9 | 10 | 10 |
| B | 10 | 9 | 10 |
| C | 11 | 12 | 11 |
| D | 12 | 13 | 10 |

**5.** To turn a gas into a liquid it must be cooled below a temperature known as its critical temperature.

| Gas | Formula | Relative formula mass | Critical temperature (°C) |
|---|---|---|---|
| hydrogen | $H_2$ | 2 | −240 |
| helium | He | 4 | −268 |
| ammonia | $NH_3$ | 17 | 133 |
| oxygen | $O_2$ | 32 | −119 |
| carbon dioxide | $CO_2$ | 44 | 31 |

Identify the true statement based on the information in this table.

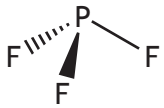
A Carbon dioxide can be a liquid at 40 °C

B Compounds have higher critical temperatures than elements

C Critical temperature increases as relative formula mass increases

D Diatomic elements have lower critical temperatures than Noble gases

**6.** A molecule of phosphorus trifluoride is shown.




Which term can be used to describe the shape of a phosphorus trifluoride molecule?

A Linear

B Angular

C Tetrahedral

D Trigonal pyramidal

**[Turn over**

**7.** In which of the following compounds do the ions have the same electron arrangement? You may wish to use the data booklet to help you.

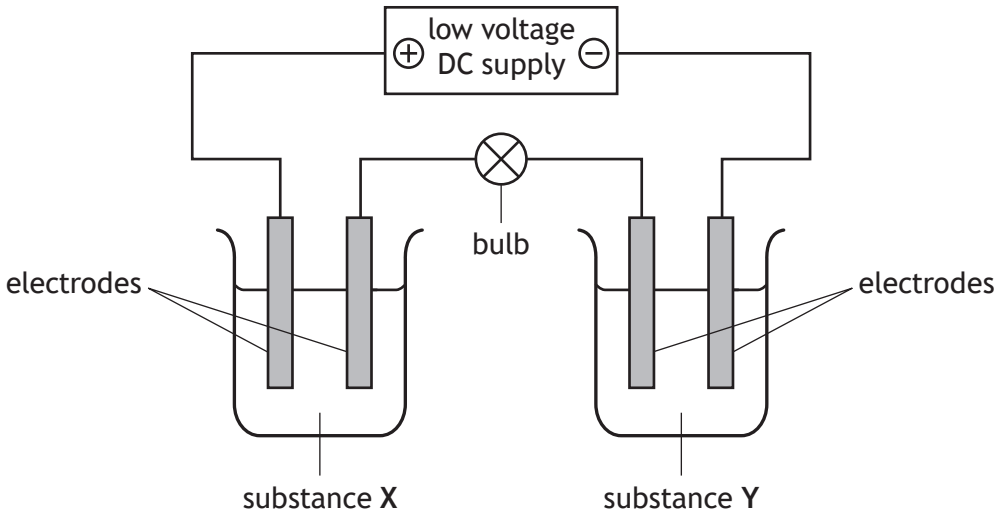
A $Na_2O$

B LiF

C KBr

D $MgCl_2$

**8.** Several conductivity experiments were carried out using the apparatus below.




Identify the experiment in which the bulb would light.

| | **Substance X** | **Substance Y** |
|---|---|---|
| A | solid copper sulfate | liquid mercury |
| B | copper chloride solution | molten sodium chloride |
| C | solid potassium nitrate | nickel bromide solution |
| D | sodium chloride solution | liquid hexane |

**9.** Limewater can be made by dissolving calcium hydroxide in water.
Which of the following terms correctly describes calcium hydroxide?

A Solute
B Solvent
C Solution
D Insoluble

**10.** Ammonium nitrate, $NH_4NO_3$, has a gram formula mass of 80.
The percentage by mass of nitrogen in ammonium nitrate is equal to

A $\frac{14}{80} \times 100$
B $\frac{28}{80} \times 100$
C $\frac{28}{100} \times 80$
D $\frac{80}{28} \times 100$.

**11.** As an alkaline solution is diluted with water

A the pH increases
B the pH stays the same
C the concentration of hydroxide ions increases
D the concentration of hydroxide ions decreases.

**12.** Which of the following compounds is a base?

A Sodium oxide
B Calcium chloride
C Potassium nitrate
D Ammonium sulfate

**[Turn over**

**13.** Which of the following compounds does **not** have an isomer?

A Cyclopropane

B But-1-ene

C Pentane

D Ethene

**14.** The systematic name for $CH_3CH_2C(CH_3)CHCH_3$ is

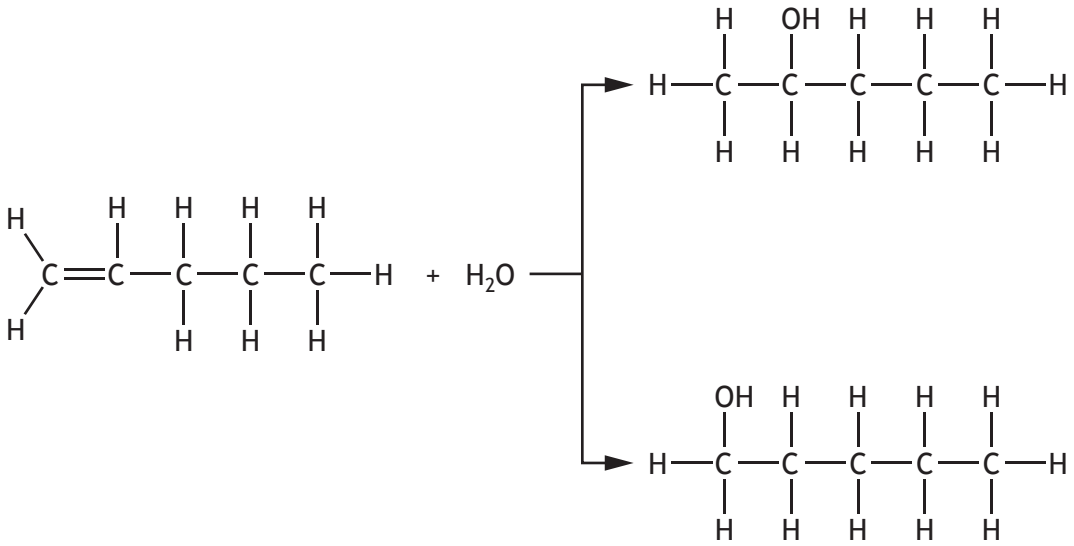
A 3-methylpentane

B 2-methylpentane

C 3-methylpent-2-ene

D 2-methylpent-3-ene.

**15.** When pent-1-ene undergoes an addition reaction with water, two products are formed.



Which of the following alkenes will also produce two products when it undergoes an addition reaction with water?

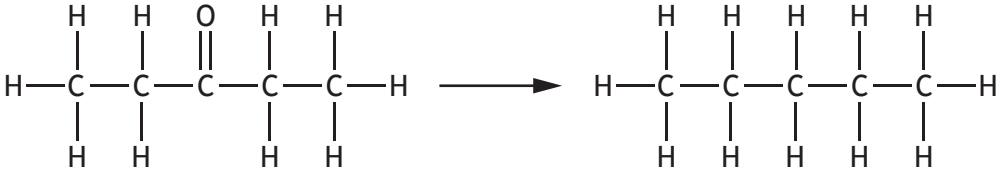
A Oct-2-ene

B Hex-3-ene

C But-2-ene

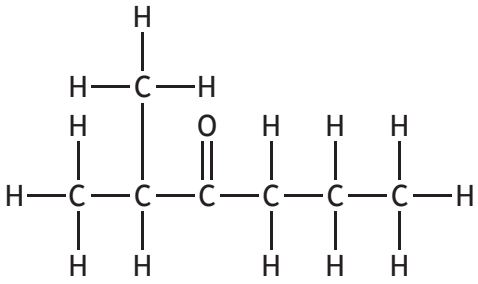
D Ethene

**16.** In the Clemmensen reaction, ketones can be converted to alkanes as shown.



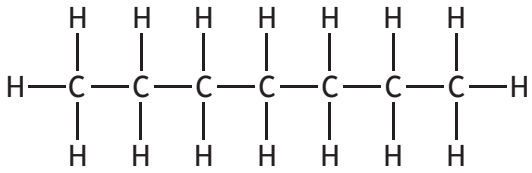
ketone alkane

Identify the alkane produced if the following ketone was used in this reaction?

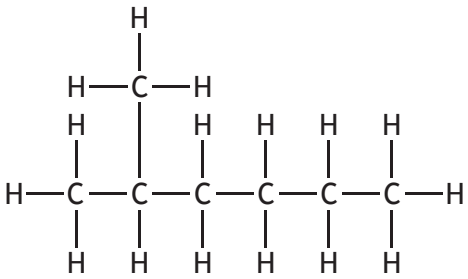


ketone

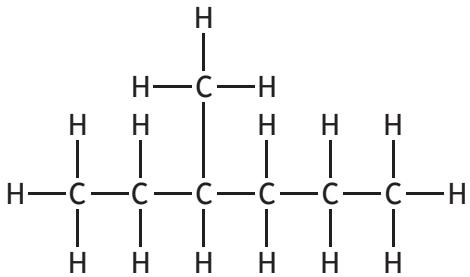
A



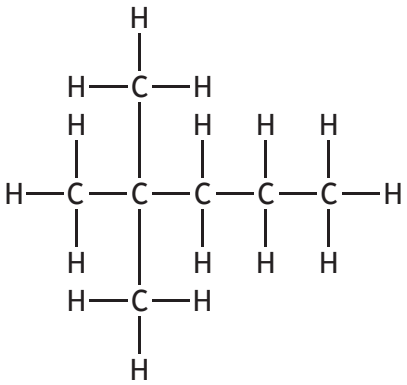
B



C



D



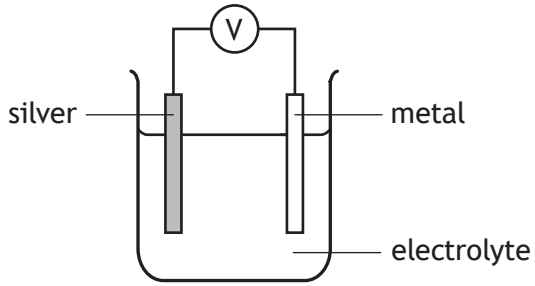
**[Turn over**

**17.** Which line in the table correctly describes the trends going from hexanoic acid to butanoic acid?

| | **Formula mass** | **Solubility in water** |
|---|---|---|
| A | increasing | decreasing |
| B | decreasing | increasing |
| C | decreasing | decreasing |
| D | increasing | increasing |

**18.** Four cells were made by joining silver to different metals.

The cells produced the following voltages 2·7 V, 1·1 V, 0·9 V and 0·5 V.




The metals used were copper, zinc, iron and magnesium.

Which voltage was produced in the cell containing silver and copper?

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

A 2·7 V

B 1·1 V

C 0·9 V

D 0·5 V

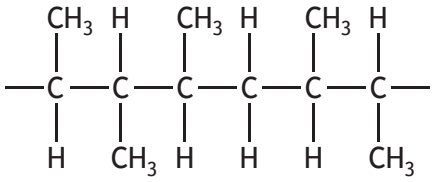
**19.** Information about the reactions of three different metals, **X**, **Y** and **Z** is given in the table.

| Metal | Reaction with dilute acid | Reaction with water |
|---|---|---|
| **X** | reacts | no reaction |
| **Y** | no reaction | no reaction |
| **Z** | reacts | reacts |

Which of the following shows the metals in order of **increasing** reactivity?

A Y, Z, X
B Z, X, Y
C Y, X, Z
D X, Y, Z

**20.** A co-polymer is formed when two different monomers polymerise.
Part of the structure of a co-polymer, showing three monomer units, is given below.



One of the monomers used is propene.
Identify the other monomer.

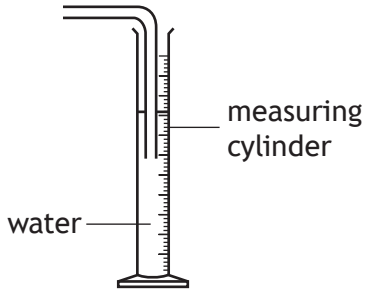
A Pent-2-ene
B Pent-1-ene
C But-2-ene
D But-1-ene

**[Turn over**

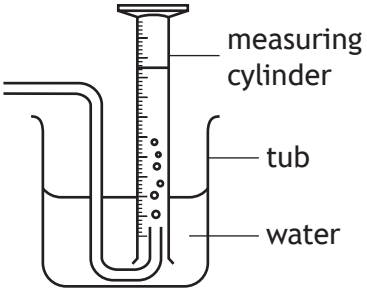
**21.** Nitrogen dioxide is a brown coloured gas that is soluble in water and more dense than air.

Which of the following diagrams shows the most appropriate method for collecting and measuring the volume of nitrogen dioxide?

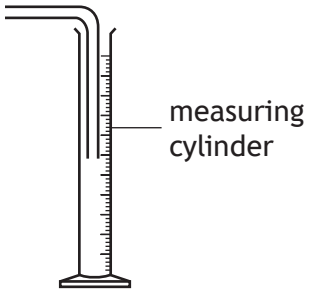
A



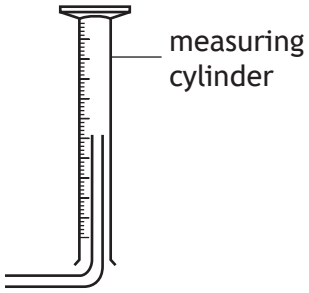

B




C




D



**22.** A solution of a metal chloride burns with a green flame.

Which of the following metal ions could be present in the metal chloride?

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

A $Ba^{2+}$

B $Ca^{2+}$

C $K^{+}$

D $Na^{+}$

**23.** Identify the gas that turns limewater cloudy.

A Oxygen

B Nitrogen

C Hydrogen

D Carbon dioxide

Questions **24** and **25** refer to the equation shown.

$$AgNO_3(aq) + NaBr(aq) \rightarrow NaNO_3(aq) + AgBr(s)$$

**24.** The reaction shown by the equation is an example of

A addition

B combustion

C precipitation

D neutralisation.

**25.** Which of the following ions are spectator ions in the reaction?

A $Ag^{+}$ and $NO_3^{-}$

B $Na^{+}$ and $NO_3^{-}$

C $Ag^{+}$ and $Br^{-}$

D $Na^{+}$ and $Br^{-}$

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

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FOR OFFICIAL USE

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N5

National Qualifications 2019

Mark

# X813/75/01

# Chemistry
# Section 1 — Answer grid and Section 2

FRIDAY, 10 MAY
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 ©

*X8137501 01*

## SECTION 1 — 25 marks

The questions for Section 1 are contained in the question paper X813/75/02.

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

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

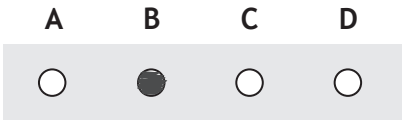
A fractional distillation

B chromatography

C fractional crystallisation

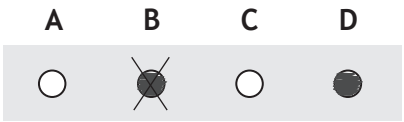
D filtration.

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

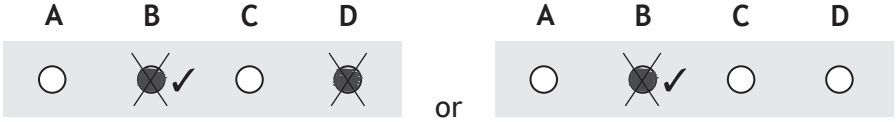



**Changing an answer**

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

*0BJ25AD1*

| | A | B | C | D |
|---|---|---|---|---|
| 1 | ○ | ○ | ○ | ○ |
| 2 | ○ | ○ | ○ | ○ |
| 3 | ○ | ○ | ○ | ○ |
| 4 | ○ | ○ | ○ | ○ |
| 5 | ○ | ○ | ○ | ○ |
| 6 | ○ | ○ | ○ | ○ |
| 7 | ○ | ○ | ○ | ○ |
| 8 | ○ | ○ | ○ | ○ |
| 9 | ○ | ○ | ○ | ○ |
| 10 | ○ | ○ | ○ | ○ |
| 11 | ○ | ○ | ○ | ○ |
| 12 | ○ | ○ | ○ | ○ |
| 13 | ○ | ○ | ○ | ○ |
| 14 | ○ | ○ | ○ | ○ |
| 15 | ○ | ○ | ○ | ○ |
| 16 | ○ | ○ | ○ | ○ |
| 17 | ○ | ○ | ○ | ○ |
| 18 | ○ | ○ | ○ | ○ |
| 19 | ○ | ○ | ○ | ○ |
| 20 | ○ | ○ | ○ | ○ |
| 21 | ○ | ○ | ○ | ○ |
| 22 | ○ | ○ | ○ | ○ |
| 23 | ○ | ○ | ○ | ○ |
| 24 | ○ | ○ | ○ | ○ |
| 25 | ○ | ○ | ○ | ○ |

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**[Turn over for next question**

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**SECTION 2 — 75 marks**

**Attempt ALL questions**

**1.** There are many different types of glass.

Glass is made from the chemical silica, $SiO_2$, which is obtained from sand.

(a) Silica has a melting point of 1713 °C.

State the term used to describe the structure of silica. **1**

(b) Borosilicate glass is a type of glass that also contains the element boron.

A sample of boron contains two different types of atom.

$^{10}_{5}B$ $^{11}_{5}B$

(i) State the term used to describe these different types of boron atom. **1**

(ii) Explain why the mass number of each type of boron atom is different. **1**

(iii) The relative atomic mass of boron is 10·8.

State the mass number of the most common type of atom in the sample. **1**

**1. (continued)**

(c) Glass that contains a minimum of 24% lead oxide is known as crystal glass.

Calculate the mass, in grams, of lead oxide in a sample of crystal glass weighing 500 g. **1**

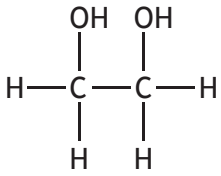
**[Turn over**

**2.** Read the passage below and answer the questions that follow.

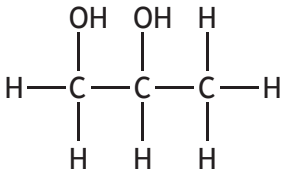
**Antifreeze**

Antifreeze lowers the freezing point of water. When diluted, antifreeze is used in car engines to prevent water-based liquids from freezing.

Different brands of antifreeze can contain either ethane-1,2-diol or propane-1,2-diol.

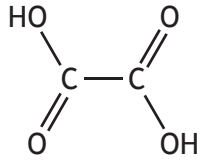


ethane-1,2-diol



propane-1,2-diol

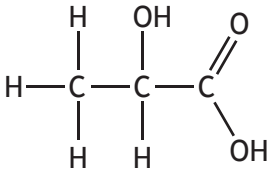
Ethane-1,2-diol is toxic if swallowed. In the liver, an enzyme converts ethane-1,2-diol into oxalic acid.



oxalic acid

The oxalic acid then reacts with calcium in the body to form calcium oxalate. Calcium oxalate is the main component of kidney stones, which can cause extreme pain.

Propane-1,2-diol is not regarded as toxic because the body breaks down the molecule to harmless lactic acid, which is also produced naturally in the body during exercise.



lactic acid

Adapted from *Education in Chemistry, May 2008, Volume 45 Number 3*

**2. (continued)**

(a) Name the functional group found in both ethane-1,2-diol and propane-1,2-diol. **1**

(b) Name the type of substance used to convert ethane-1,2-diol into oxalic acid. **1**

(c) Name the salt mentioned in the passage. **1**

(d) Calculate the mass, in grams, of 1 mole of the harmless product formed, in the body, from propane-1,2-diol. **1**

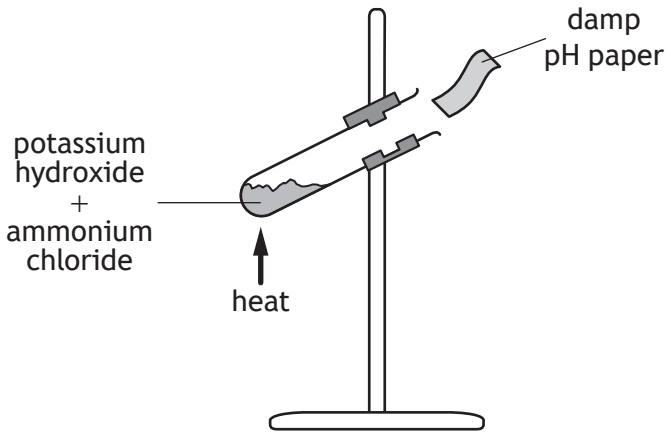
**[Turn over**

**3.** Nitrogen and hydrogen react together to form ammonia.

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

(a) Draw a diagram, showing **all** outer electrons, to represent a molecule of nitrogen gas, $N_2$. **1**

(b) The following method can be used to prepare small quantities of ammonia in the laboratory.




Suggest what colour the damp pH paper would be after the mixture is heated. **1**

MARKS

DO NOT WRITE IN THIS MARGIN

(c) In industry, ammonia can be produced by the Haber process.

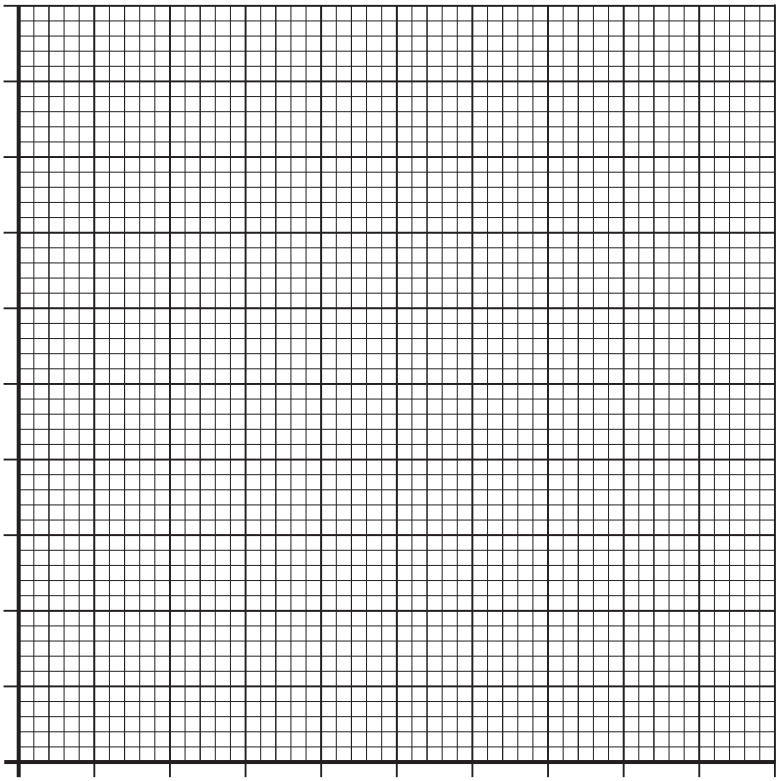
The table shows the yield of ammonia produced at different temperatures by this process.

| **Temperature (°C)** | 100 | 200 | 400 | 500 | 600 | 700 |
|---|---|---|---|---|---|---|
| **Percentage yield of ammonia (%)** | 97 | 87 | 46 | 28 | 17 | 10 |

(i) Describe the relationship between temperature and percentage yield of ammonia. **1**

(ii) Draw a graph of the percentage yield of ammonia against temperature. **4**

(Additional graph paper, if required, can be found on *page 33*.)



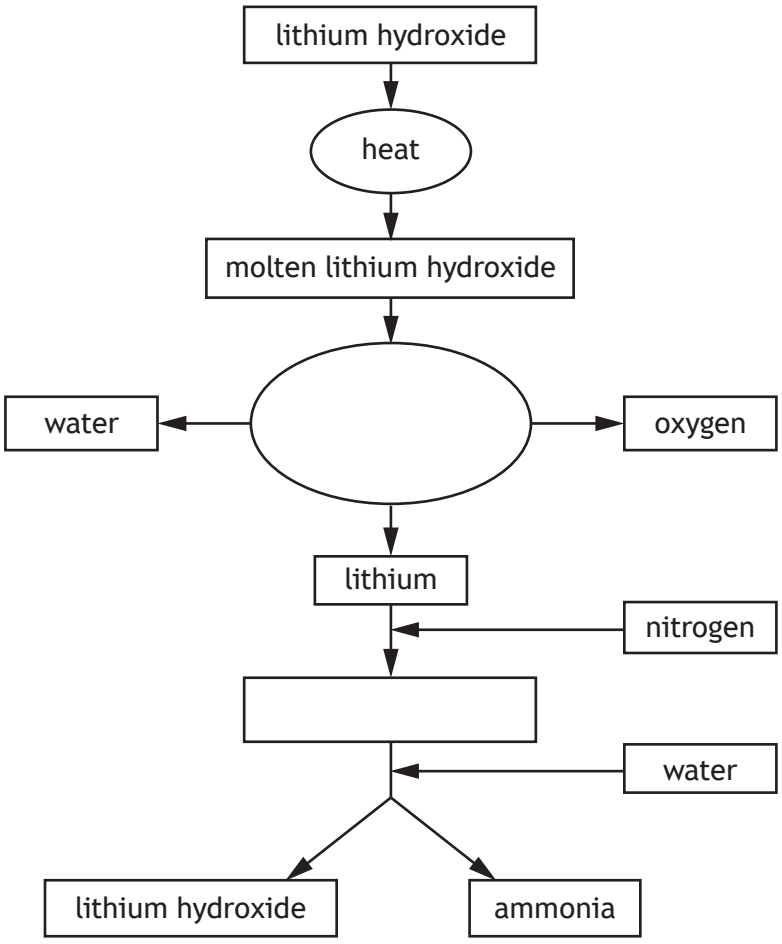
**3. (continued)**

(d) Scientists are developing an alternative industrial process to produce ammonia, which is more efficient than the Haber process.

This involves the electrolysis of molten lithium hydroxide to produce lithium, water and oxygen. Lithium is then reacted with nitrogen gas, which is obtained from air, to produce lithium nitride. Ammonia and lithium hydroxide are produced when lithium nitride reacts with water.

(i) Complete the flow diagram using the information above. **1**

(An additional diagram, if required, can be found on *page 34*.)




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

**4.** Radioisotopes emit radiation to become more stable.

(a) State where the radioactive decay occurs in an atom. **1**

(b) Iodine-131 is a radioisotope with a half-life of 8 days and can be used in the treatment of thyroid cancer.

(i) State what is meant by the term half-life. **1**

(ii) Calculate the percentage of iodine-131 that would have **decayed** after 24 days. **3**

(iii) Different concentrations of iodine-131 are used to treat different types of cancer.

Circle the correct words to complete the sentence. **1**

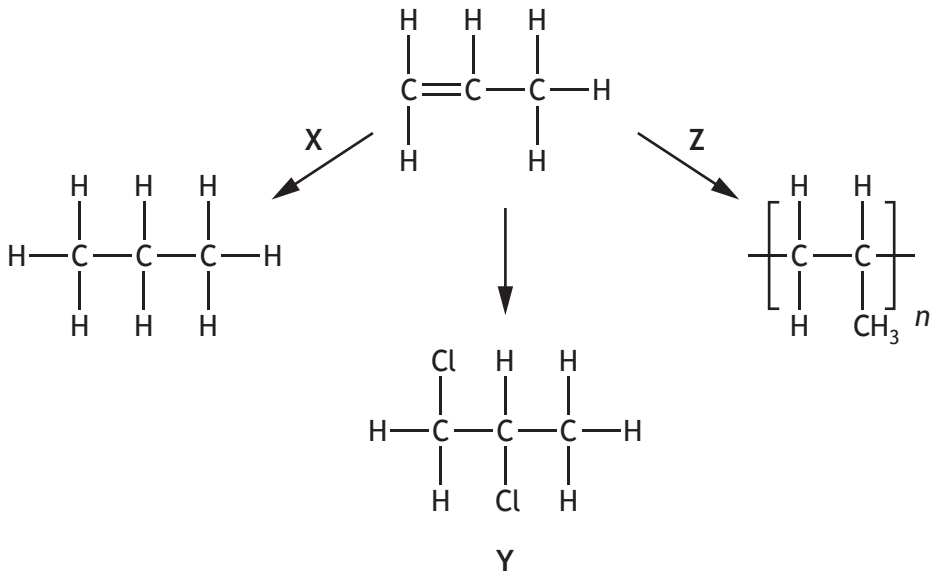
When an iodine-131 solution is diluted,

the half-life { gets longer / stays the same / gets shorter }.

**5.** The alkenes are a family of unsaturated hydrocarbons.

(a) Describe the chemical test, including the result, to show that a hydrocarbon is unsaturated. **1**

(b) Propene is an alkene that can take part in a range of addition reactions.




**Y**

(i) Name the type of addition reaction taking place in reaction **X**. **1**

(ii) Name the chemical that reacts with propene to form compound **Y**. **1**

(iii) Name the polymer formed in reaction **Z**. **1**

**5. (continued)**

(c) The cycloalkenes are another family of unsaturated hydrocarbons.

(i) Cyclohexene can be made by reacting ethene with butadiene in a reaction called the Diels-Alder reaction as shown.

$$\underset{\text{ethene}}{C_2H_4} + \underset{\text{butadiene}}{C_4H_6} \rightarrow \underset{\text{cyclohexene}}{C_6H_{10}}$$

Calculate the mass, in grams, of ethene required to make 410 g of cyclohexene. **3**

**Show your working clearly.**

(ii) The table gives information about cyclopentene and cyclohexene.

| Cycloalkene | Boiling point (°C) |
|---|---|
| cyclopentene | 45 |
| cyclohexene | 83 |

Explain why cyclopentene has a lower boiling point than cyclohexene. **2**

**6.** An oxide is a compound that contains at least one oxygen atom and **only one** other element in its chemical formula.

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

**[Turn over for next question**

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**7.** Paraffin wax is a mixture of hydrocarbon molecules that belong to the same homologous series.

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

(b) An example of one hydrocarbon contained in paraffin wax is $C_{25}H_{52}$.

(i) Name the homologous series to which this hydrocarbon belongs. **1**

(ii) Write the molecular formula for the molecule, containing 72 hydrogen atoms, that belongs to the same homologous series. **1**

**7. (continued)**

(c) The table contains information about some hydrocarbon molecules.

| Number of carbon atoms | Boiling point (°C) |
|---|---|
| 20 | 343 |
| 21 | 356 |
| 22 | 369 |
| 23 | 381 |

Predict the boiling point, in °C, of the hydrocarbon with 24 carbon atoms. **1**

**[Turn over**

**8.** Read the passage below and answer the questions that follow.

**Beryllium**

Beryllium is a rare element in the universe. Unlike most elements it was not formed during the Big Bang or by stars. In fact, beryllium is only formed in supernova explosions.

Beryllium is found in the mineral Beryl, which has the chemical name beryllium aluminium silicate. Beryl makes up a range of glittering gemstones such as emerald and aquamarine.

In 1828 the metal beryllium was extracted from beryllium chloride ($BeCl_2$) by reacting this compound with potassium. Potassium chloride was also produced in this reaction.

In 1932 James Chadwick discovered when a sample of beryllium was bombarded with X-rays from radium, it emitted a new kind of sub-atomic particle that had mass but no charge. He called this new particle a neutron and was awarded the Nobel Prize for his work in 1935.

Adapted from *Education in Chemistry, November 2015, Volume 52, Issue 6*

(a) State where beryllium is formed. **1**

(b) Name the elements found in the mineral Beryl. **1**

**8. (continued)**

(c) Write an equation, using symbols and formulae, to show the reaction taking place when beryllium is extracted from beryllium chloride.

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

(d) During the extraction of beryllium, the beryllium ions are changed to beryllium atoms.

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

(e) Write the nuclide notation for the sub-atomic particle discovered by James Chadwick in 1932. **1**

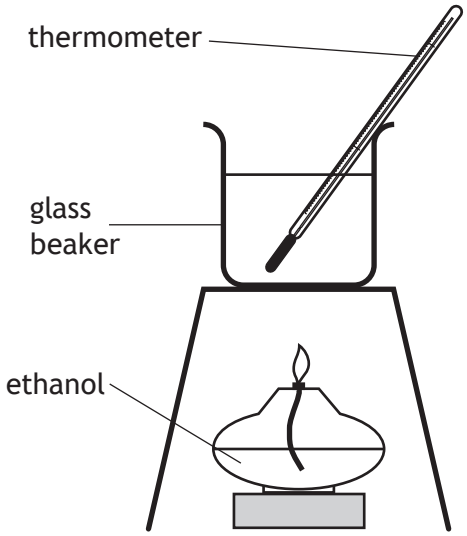
**[Turn over**

**9.** Alcohols can take part in different types of chemical reaction.

(a) When alcohols are burned, heat energy is released.

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

(b) A student carried out the following experiment.




(i) When 0·8 g of ethanol was burned, 8·36 kJ of energy was absorbed by the water.

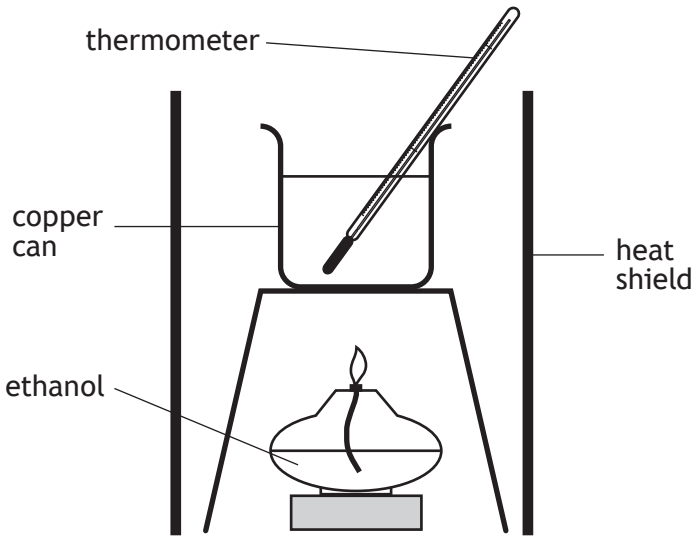
If the temperature of the water increased by 40 °C, calculate the mass, in kg, of water used by the student in this experiment. **3**

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

**Show your working clearly.**

**9. (b) (continued)**

(ii) The experiment was repeated, replacing the glass beaker with a copper can and using a heat shield.




Explain why these changes resulted in more heat energy being absorbed by the water. **2**

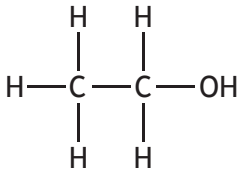
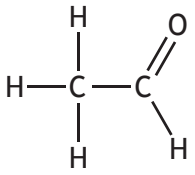
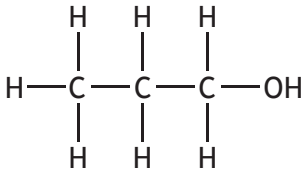
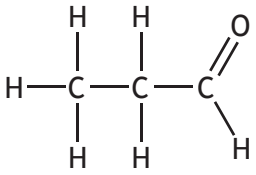
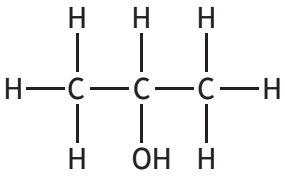
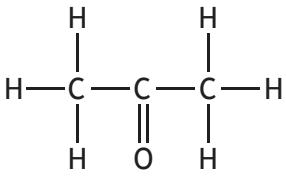
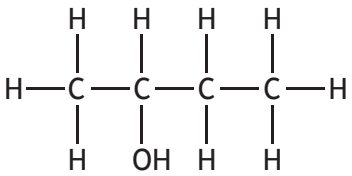
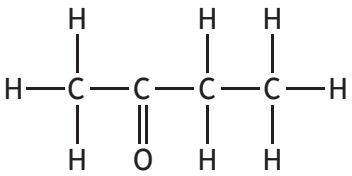
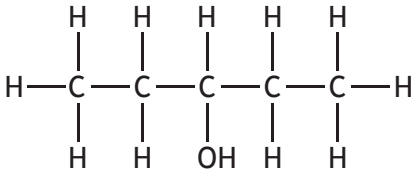
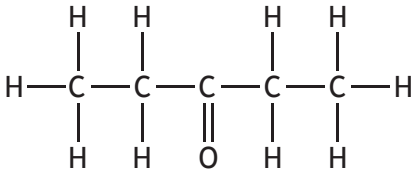
| Improvement | Explanation |
|---|---|
| Use of a copper can | |
| Use of a heat shield | |

**[Turn over**

**9. (continued)**

(c) Alcohols can react with hot copper(II) oxide.

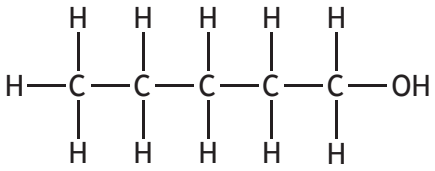
Depending on the structure of the alcohol used, the product will be either an aldehyde or a ketone.

| Structural formula of alcohol | Type of product | Structural formula of product |
|---|---|---|
|  | aldehyde |  |
|  | aldehyde |  |
|  | ketone |  |
|  | ketone |  |
|  | ketone |  |

(i) Write a general statement linking the position of the functional group in an alcohol to the **type** of product formed. **1**

**9. (c) (continued)**

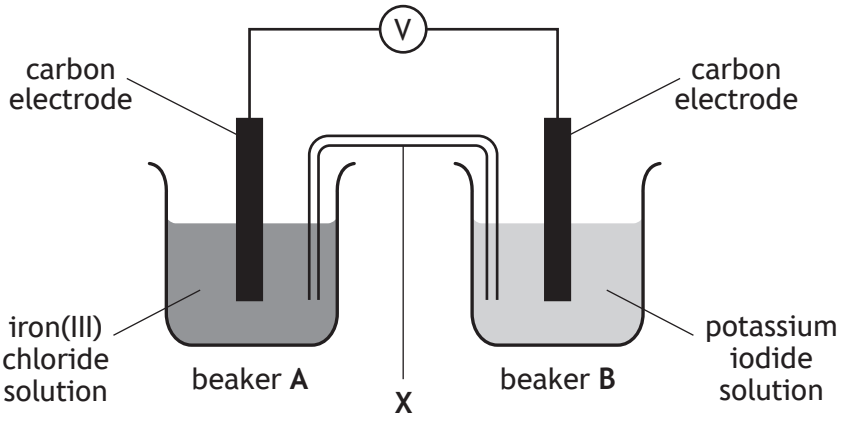
(ii) The following alcohol reacts with hot copper(II) oxide to produce an aldehyde.



Draw the full structural formula for the aldehyde produced when this alcohol reacts with hot copper(II) oxide. **1**

**[Turn over**

**10.** A student set up an electrochemical cell using solutions of iron(III) chloride and potassium iodide.




The reactions taking place are

beaker **A** $Fe^{3+}(aq) + e^- \rightarrow Fe^{2+}(aq)$

beaker **B** $2I^-(aq) \rightarrow I_2(\ell) + 2e^-$

(a) Name the piece of apparatus labelled **X**. **1**

(b) (i) **On the diagram**, draw an arrow to show the path and direction of electron flow. **1**

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

(ii) Name the type of chemical reaction taking place in beaker **B**. **1**

**10. (b) (continued)**

(iii) Write the redox equation for the overall reaction. **1**

(c) Carbon in the form of graphite is a suitable material for use as an electrode as it does not react with the solutions.

Suggest another reason why it is a suitable material. **1**

**[Turn over**

**11.** A student was asked to prepare the soluble compound, calcium propanoate.

A section of the procedure used by the student is shown.

## Preparation of calcium propanoate

***Procedure***

1. Using a measuring cylinder add 20 $cm^3$ of dilute acid to a beaker.
2. Add a spatulaful of calcium carbonate to the acid and stir the reaction mixture with a glass rod.
3. Continue adding the calcium carbonate until . . .

(a) Write the formula, showing the charge on each ion, for calcium carbonate. **1**

(b) Name the acid used to prepare calcium propanoate. **1**

(c) Complete the instruction for step 3 of the procedure. **1**

**Continue adding the calcium carbonate until . . .**

(d) After step 3 has been completed a further two techniques are carried out to prepare a dry sample of calcium propanoate.

Name the two techniques, in the correct order, that must be carried out. **1**

1st technique _____

2nd technique _____

**12.** A student carried out a titration experiment to calculate the concentration of a solution of hydrochloric acid.

(a) Before the titration was carried out the student prepared a 200 $cm^3$ solution of sodium carbonate.

This solution had an accurate concentration of 1·0 mol $l^{-1}$.

(i) State the term given to a solution of accurately known concentration. **1**

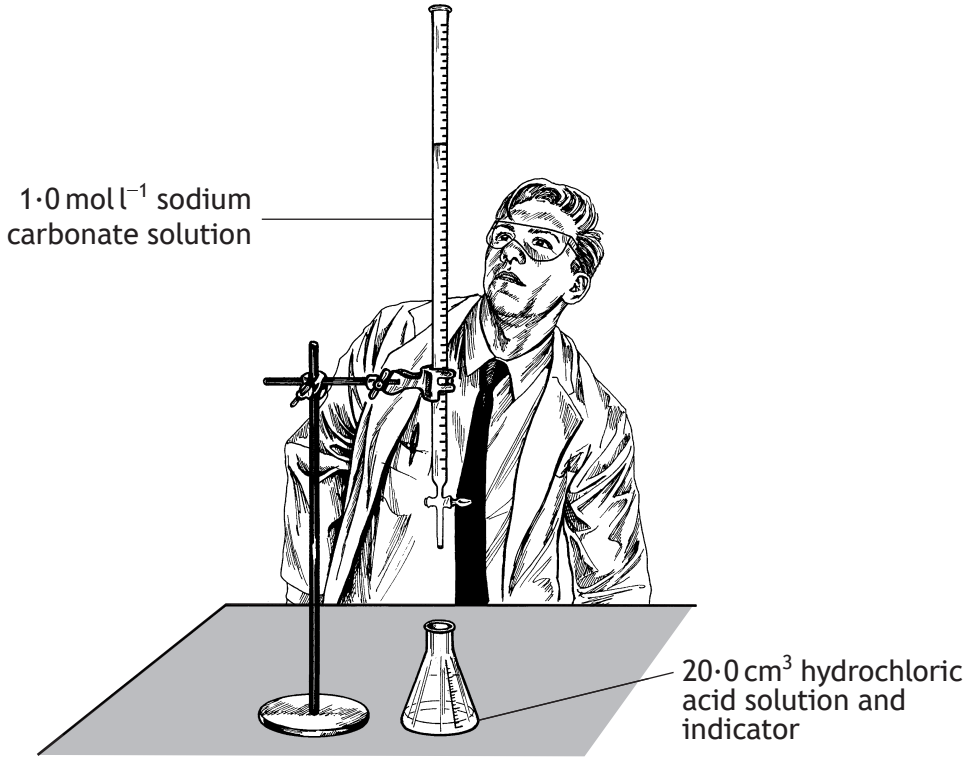
(ii) Calculate the mass, in grams, of sodium carbonate, $Na_2CO_3$, required to prepare 200 $cm^3$ of 1·0 mol $l^{-1}$ solution. **3**

**Show your working clearly.**

**[Turn over**

**12. (continued)**

(b) The student performed the titration as shown.




(i) Suggest one improvement to the student's experimental technique. **1**

(ii) State why an indicator is used. **1**

**12. (continued)**

(iii) The average volume of sodium carbonate used was 15·0 $cm^3$.

To calculate the average volume of sodium carbonate used, the student only used titre volumes within 0·2 $cm^3$ of each other.

State the term used to describe these titre volumes. **1**

(iv) The equation for the reaction is

$$Na_2CO_3(aq) + 2HCl(aq) \rightarrow 2NaCl(aq) + H_2O(\ell) + CO_2(g)$$

Calculate the concentration, in mol $l^{-1}$, of the hydrochloric acid solution. **3**

**Show your working clearly.**

**[Turn over for next question**

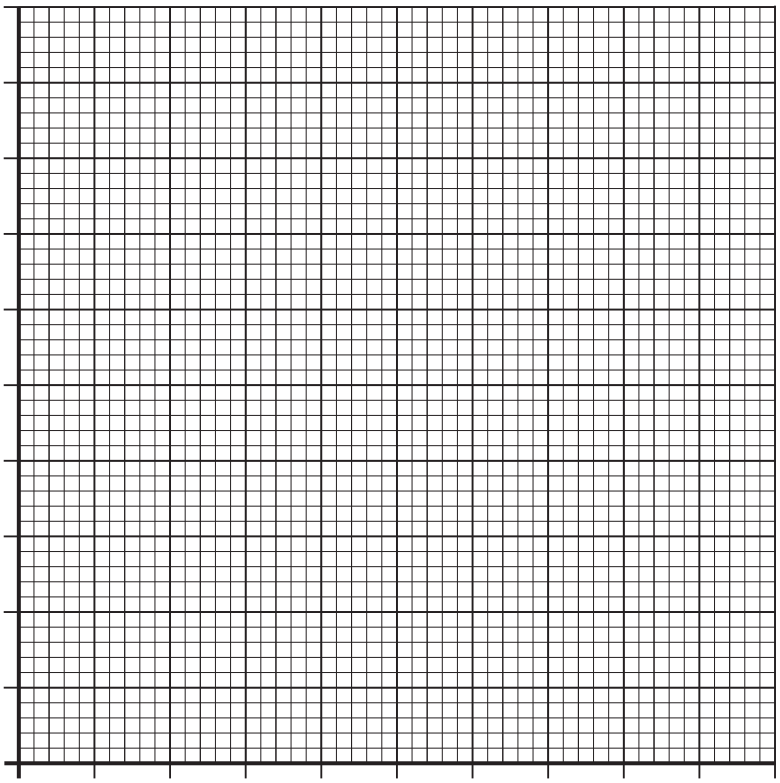
**13.** The force of attraction between oppositely charged particles is important in chemistry.

**Using your knowledge of chemistry**, explain why this force of attraction is important. **3**

**[END OF QUESTION PAPER]**

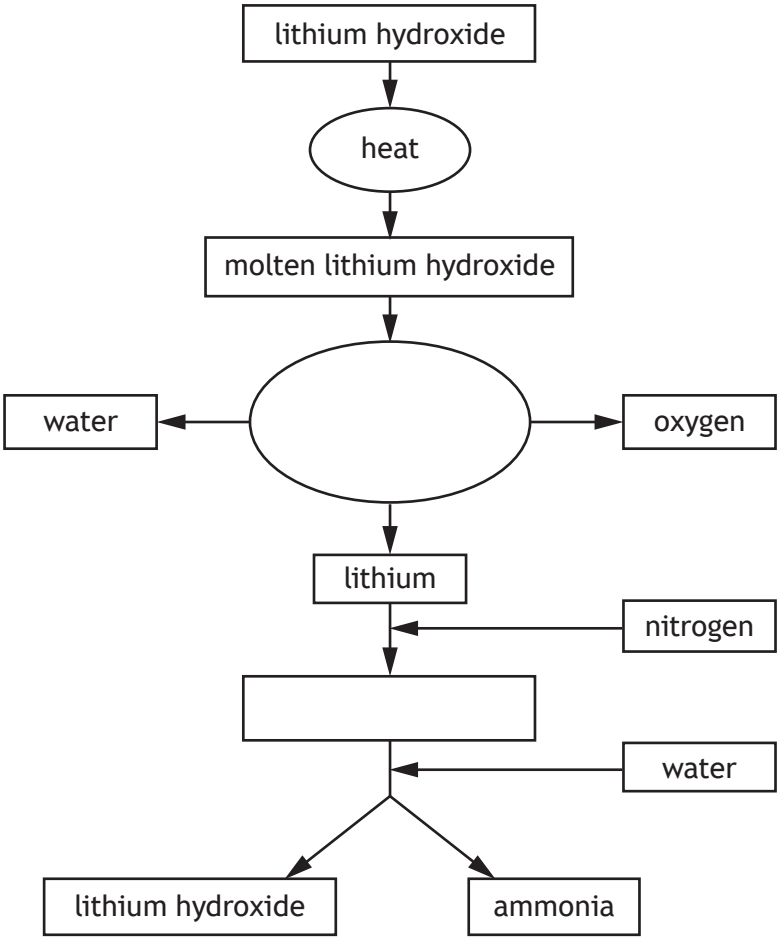
**ADDITIONAL SPACE FOR ANSWERS AND ROUGH WORK**

Additional graph for use with question 3 (c) (ii)



**ADDITIONAL SPACE FOR ANSWERS AND ROUGH WORK**

Additional diagram for question 3 (d) (i)



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**ADDITIONAL SPACE FOR ANSWERS AND ROUGH WORK**

**ADDITIONAL SPACE FOR ANSWERS AND ROUGH WORK**

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