Please write clearly in block capitals.

Centre number | | | | | | Candidate number | | | | |

Surname _____

Forename(s) _____

Candidate signature _____

GCSE
CHEMISTRY

F

Foundation Tier Unit Chemistry C3

Wednesday 14 June 2017 Morning Time allowed: 1 hour

Materials
For this paper you must have:
- a ruler
- the Chemistry Data Sheet (enclosed).

You may use a calculator.

Instructions
- Use black ink or black ball-point pen.
- Fill in the boxes at the top of this page.
- Answer **all** questions.
- You must answer the questions in the spaces provided. Do not write outside the box around each page or on blank pages.
- Do all rough work in this book. Cross through any work you do not want to be marked.

Information
- The marks for questions are shown in brackets.
- The maximum mark for this paper is 60.
- You are expected to use a calculator where appropriate.
- You are reminded of the need for good English and clear presentation in your answers.
- Question 6(c)(i) should be answered in continuous prose. In this question you will be marked on your ability to:
  – use good English
  – organise information clearly
  – use specialist vocabulary where appropriate.

Advice
- In all calculations, show clearly how you work out your answer.

For Examiner's Use	
Examiner's Initials	
Question	Mark
1	
2	
3	
4	
5	
6	
TOTAL	

Do not write outside the box

Answer **all** questions in the spaces provided.

1 This question is about elements and compounds.

1 (a) (i) Use the correct answer from the box to complete the sentence.

[1 mark]

densities	**numbers**	**weights**

The elements in the modern periodic table are arranged in order of their atomic _____ .

1 (a) (ii) Use the correct answer from the box to complete the sentence.

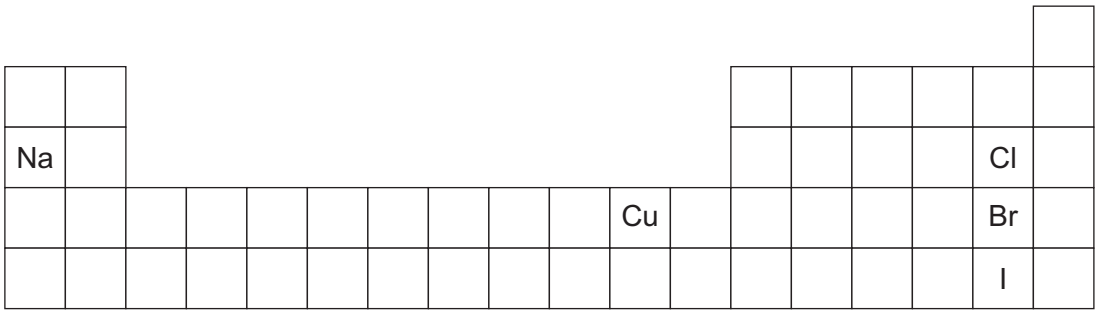
[1 mark]

electrons	**neutrons**	**protons**

The outer shells of atoms of elements in the same group have the same number of _____ .

1 (b) **Figure 1** shows the position of five elements in the modern periodic table.

Figure 1



1 (b) (i) Which **one** of the elements in **Figure 1** is a gas at room temperature?

[1 mark]

_____

Do not write outside the box

1 (b) (ii) Which **one** of the elements in **Figure 1** is a transition metal?

[1 mark]

_____

1 (b) (iii) Complete the sentence.

[1 mark]

In the modern periodic table, bromine (Br) is in Group _____ .

1 (c) Bromine reacts with sodium iodide to produce iodine.

The word equation for the reaction is:

bromine + sodium iodide ⟶ iodine + sodium bromide

1 (c) (i) What type of reaction is this?

[1 mark]

Tick (✓) **one** box.

Combustion ☐

Displacement ☐

Neutralisation ☐

1 (c) (ii) Use the Chemistry Data Sheet to help you answer this question.

Which halogen would react with sodium chloride solution to produce chlorine?

[1 mark]

Tick (✓) **one** box.

Bromine ☐

Fluorine ☐

Iodine ☐

Question 1 continues on the next page

Do not write outside the box

1 (d) Silver nitrate in the presence of dilute nitric acid is used to test for iodide ions.

What colour precipitate is produced?

[1 mark]

Tick (✓) **one** box.

Cream ☐

White ☐

Yellow ☐

Do not write outside the box

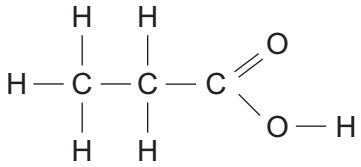
1 (e) Propanoic acid is a compound containing carbon atoms.

1 (e) (i) **Figure 2** shows the displayed structure of propanoic acid.

Draw a ring around the functional group of propanoic acid in **Figure 2**.

[1 mark]

Figure 2



1 (e) (ii) Use the correct answer from the box to complete the sentence.

[1 mark]

carbon dioxide	hydrogen	oxygen

Propanoic acid reacts with carbonates to produce _____ .

1 (e) (iii) Use the correct answer from the box to complete the sentence.

[1 mark]

alkalis	esters	fuels

Propanoic acid reacts with alcohols to produce pleasant smelling compounds called _____ .

11

Turn over for the next question

Do not write outside the box

2 This question is about drinking water.

2 (a) Water in reservoirs is filtered and sterilised to make it suitable for drinking.

2 (a) (i) Draw **one** line from each treatment to the reason for the treatment.

[2 marks]

Treatment	Reason
	To add dissolved salts
Filter	To kill microbes
Sterilise	To remove solids
	To soften the water

2 (a) (ii) Which substance is used to sterilise the water?

[1 mark]

Tick (✓) **one** box.

- Ammonia ☐
- Chlorine ☐
- Limewater ☐
- Sodium carbonate ☐

Do not write outside the box

2 (b) Pure water can be produced by distillation.

Why is distillation expensive?

[1 mark]

2 (c) Some water companies add fluoride to drinking water.

2 (c) (i) Give **one** benefit of adding fluoride to drinking water.

[1 mark]

2 (c) (ii) There is a lot of evidence to support the benefit of adding fluoride to drinking water.

Suggest why some people disagree with adding fluoride to drinking water.

[1 mark]

6

Turn over for the next question

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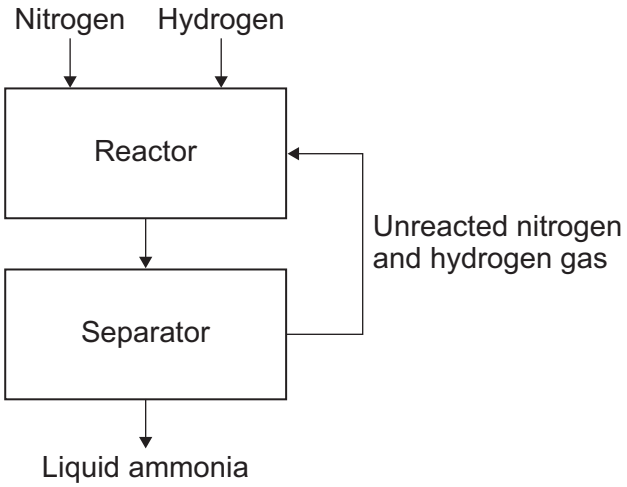
3 This question is about the Haber process.

Figure 3 shows a flow diagram of the Haber process.

Figure 3



3 (a) (i) Use the correct answer from the box to complete the sentence.

[1 mark]

air	**crude oil**	**natural gas**	**water**

Nitrogen for the Haber process is obtained from _____ .

Do not write outside the box

3 (a) (ii) Iron is used as a catalyst in the reactor.

How does a catalyst speed up a reaction?

[1 mark]

Tick (✓) **one** box.

Changes the pressure in the reactor ☐

Lowers the activation energy ☐

Makes the particles move faster ☐

3 (a) (iii) Describe how the ammonia is separated from the other gases.

[2 marks]

_____

_____

_____

_____

3 (b) Complete the word equation for the reaction in the Haber process.

[1 mark]

nitrogen + _____ ⇌ _____

Question 3 continues on the next page

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3 (c) **Figure 4** shows how, in the Haber process, the rate of reaction changes as the temperature and pressure increase.

Figure 4

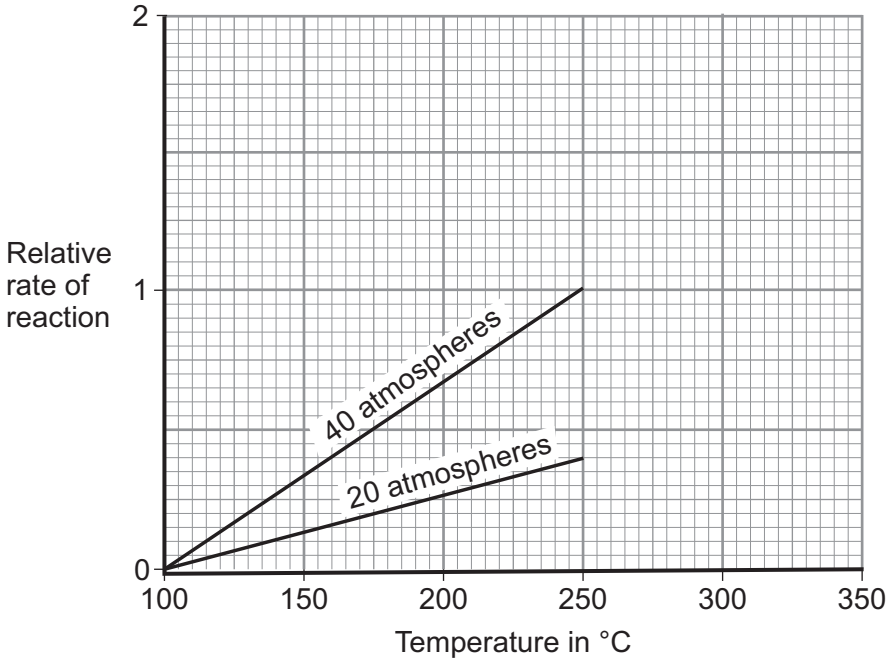

Table 1 shows the relative rate of reaction at 80 atmospheres at different temperatures.

Table 1

Temperature in °C	Relative rate of reaction
100	0.0
150	0.5
200	1.0
250	1.7
300	2.0

Do not write outside the box

3 (c) (i) Plot the data in **Table 1** on the graph in **Figure 4**.

[2 marks]

3 (c) (ii) Draw a straight line of best fit for the points you have plotted.

[1 mark]

3 (c) (iii) What is the relative rate of reaction at 20 atmospheres and 300 °C?

Show your working on **Figure 4**.

[2 marks]

Relative rate of reaction = _____

3 (c) (iv) Describe how the rate of reaction changes as the pressure increases.

[1 mark]

_____

_____

11

Turn over for the next question

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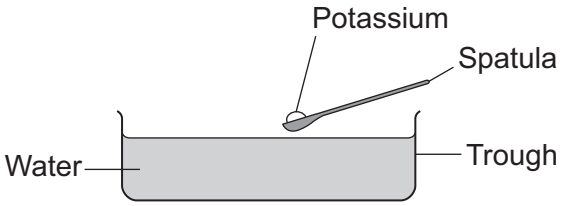
4 This question is about potassium and its compounds.

4 (a) Potassium reacts with water.

Figure 5 shows potassium being added to water.

Figure 5



The word equation for the reaction is:

potassium + water ⟶ potassium hydroxide + hydrogen

Give **two** observations that can be seen when potassium is added to water.

[2 marks]

Question 4 continues on the next page

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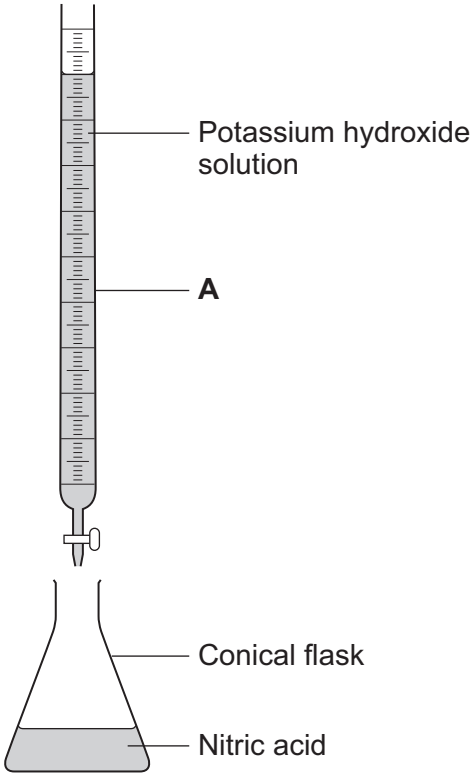
4 (b) Potassium hydroxide solution is used in titrations.

A student used the apparatus in **Figure 6** to do a titration to find the concentration of some nitric acid.

Figure 6



4 (b) (i) Name the piece of apparatus labelled **A**.

[1 mark]

_____

4 (b) (ii) What should the student add to the nitric acid before starting the titration?

[1 mark]

_____

Do not write outside the box

4 (b) (iii) Describe how the student could use the apparatus in **Figure 6** to complete the titration.

[3 marks]

4 (b) (iv) The student did the titration four times.

Give **one** variable the student should keep the same for each titration.

[1 mark]

Question 4 continues on the next page

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4 (c) **Table 2** shows the student's results.

Table 2

	Volume of potassium hydroxide solution used in cm^3
Titration 1	23.8
Titration 2	18.2
Titration 3	19.0
Titration 4	18.6
Mean value	

4 (c) (i) Calculate the mean volume of potassium hydroxide solution used.

Do not use any anomalous results in your calculation.

[2 marks]

Mean volume of potassium hydroxide solution used = _____ cm^3

Do not write outside the box

4 (c) (ii) A second student repeated the experiment and recorded the results in **Table 3**.

Table 3

	Volume of potassium hydroxide solution used in cm^3
Titration 1	24
Titration 2	18

Look at **Table 2** and **Table 3**.

Suggest **two** improvements the second student could make to obtain results that are more accurate.

[2 marks]

_____

_____

_____

_____

12

Turn over for the next question

Do not write outside the box

5 This question is about water.

5 (a) Rainwater is soft water.

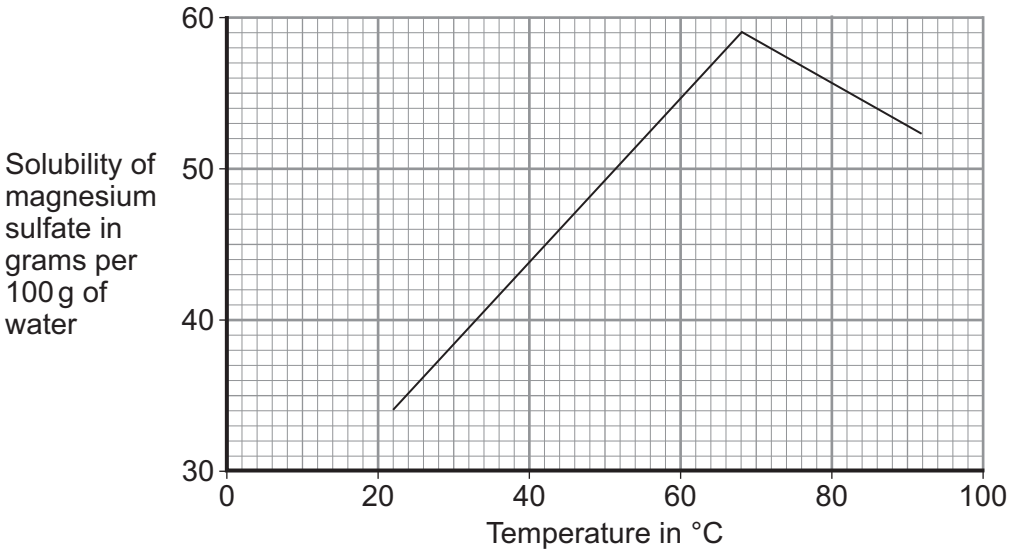
How is hard water formed from rainwater?

[2 marks]

5 (b) A sample of hard water contains magnesium sulfate.

Figure 7 shows the solubility of magnesium sulfate at different temperatures.

Figure 7



What conclusions can be made from **Figure 7**?

Use patterns and values from the graph in your answer.

[3 marks]

Do not write outside the box

5 (c) Give **one** advantage and **one** disadvantage of hard water.

[2 marks]

Advantage _____

_____

Disadvantage _____

_____

5 (d) Describe and explain how hard water is softened using an ion exchange column.

[3 marks]

_____

_____

_____

_____

_____

_____

10

Turn over for the next question

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6 This question is about the combustion of alcohols.

6 (a) What is the structure of methanol?

[1 mark]

Tick (✓) **one** box.

CH_3OH ☐

CH_3CH_2OH ☐

$CH_3CH_2CH_2OH$ ☐

$CH_3CH_2CH_2CH_2OH$ ☐

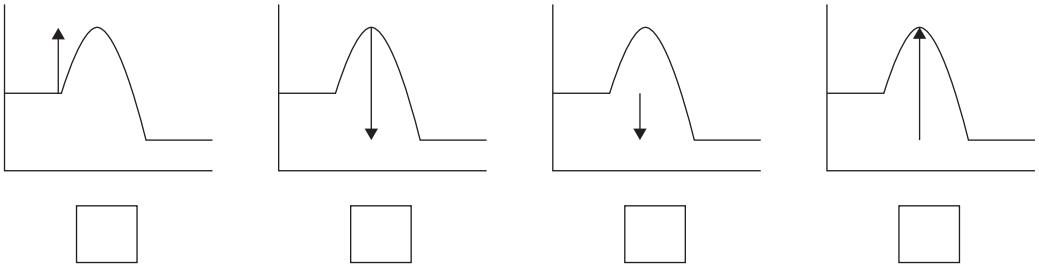
6 (b) **Figure 8** shows four energy level diagrams for the combustion of an alcohol.

Which diagram, **A**, **B**, **C**, or **D**, shows an arrow for the overall energy change?

[1 mark]

Tick (✓) **one** box.

Figure 8



☐ **A** ☐ **B** ☐ **C** ☐ **D**

Question 6 continues on the next page

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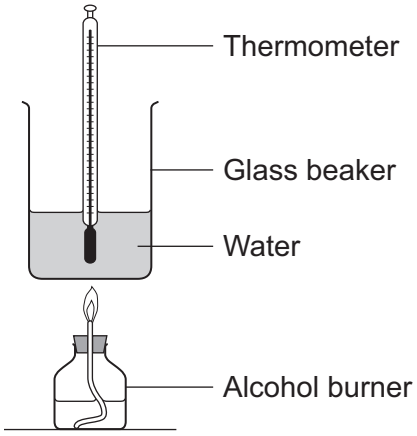
6 (c) **Figure 9** shows apparatus used to measure the energy released when an alcohol is burned.

Figure 9



6 (c) (i) **In this question you will be assessed on using good English, organising information clearly and using specialist terms where appropriate**.

Describe how a student could use the apparatus in **Figure 9** to compare the energy released when methanol and ethanol are burned.

You should include any measurements the student would need to make.

Do **not** describe how to do any calculations.

Do **not** describe any improvements to the apparatus.

[6 marks]

Do not write outside the box

Extra space

6 (c) (ii) The student calculated the energy released by the alcohols.

The calculated values were less than the values in a data book.

Explain how the apparatus in **Figure 9** could be improved to obtain more accurate results.

[2 marks]

10

END OF QUESTIONS

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