

Please write clearly in block capitals.

Centre number

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Candidate number

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Surname

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Forename(s)

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# 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	
<b>TOTAL</b>	



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]

<b>densities</b>	<b>numbers</b>	<b>weights</b>
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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]

<b>electrons</b>	<b>neutrons</b>	<b>protons</b>
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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**

Na																				

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

[1 mark]

\_\_\_\_\_



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  $\longrightarrow$  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**

**Turn over ►**



**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



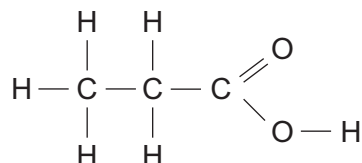
1 (e) Propanoic acid is a compound containing carbon atoms.

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

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**Turn over for the next question**

**Turn over ►**



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**

Filter

To add dissolved salts

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



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

Why is distillation expensive?

[1 mark]

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

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

[1 mark]

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**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]

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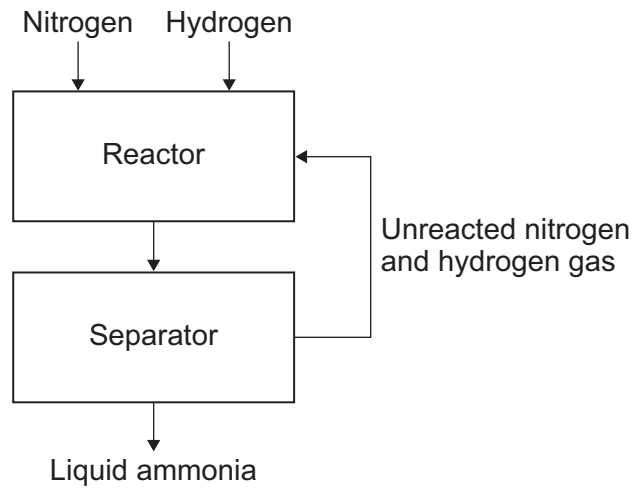
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3 This question is about the Haber process.

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
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Nitrogen for the Haber process is obtained from \_\_\_\_\_ .





**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]

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

[1 mark]

nitrogen + \_\_\_\_\_  $\rightleftharpoons$  \_\_\_\_\_

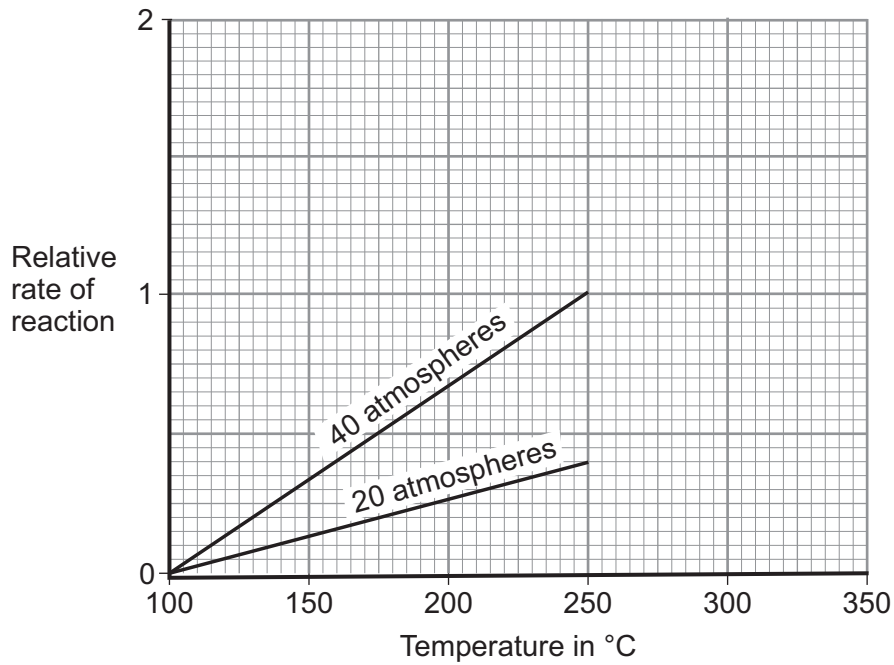
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- 3 (c) **Figure 4** shows how, in the Haber process, the rate of reaction changes as the temperature and pressure increase.

**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



**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]**

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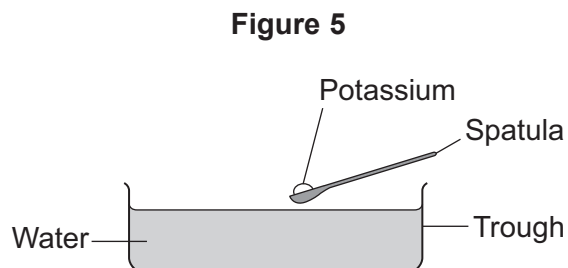
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4 This question is about potassium and its compounds.

4 (a) Potassium reacts with water.

**Figure 5** shows potassium being added to water.



The word equation for the reaction is:



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

**[2 marks]**

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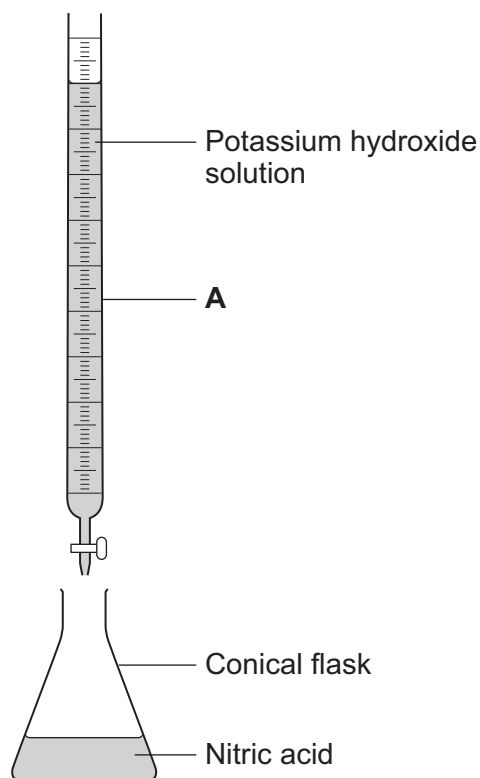
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**4 (b)** Potassium hydroxide solution is used in titrations.

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]

\_\_\_\_\_



**4 (b) (iii)** Describe how the student could use the apparatus in **Figure 6** to complete the titration. **[3 marks]**

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

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

**[1 mark]**

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**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 <sup>3</sup>
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]

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Mean volume of potassium hydroxide solution used = \_\_\_\_\_ cm<sup>3</sup>





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 <sup>3</sup>
<b>Titration 1</b>	24
<b>Titration 2</b>	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]**

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5 This question is about water.

5 (a) Rainwater is soft water.

How is hard water formed from rainwater?

[2 marks]

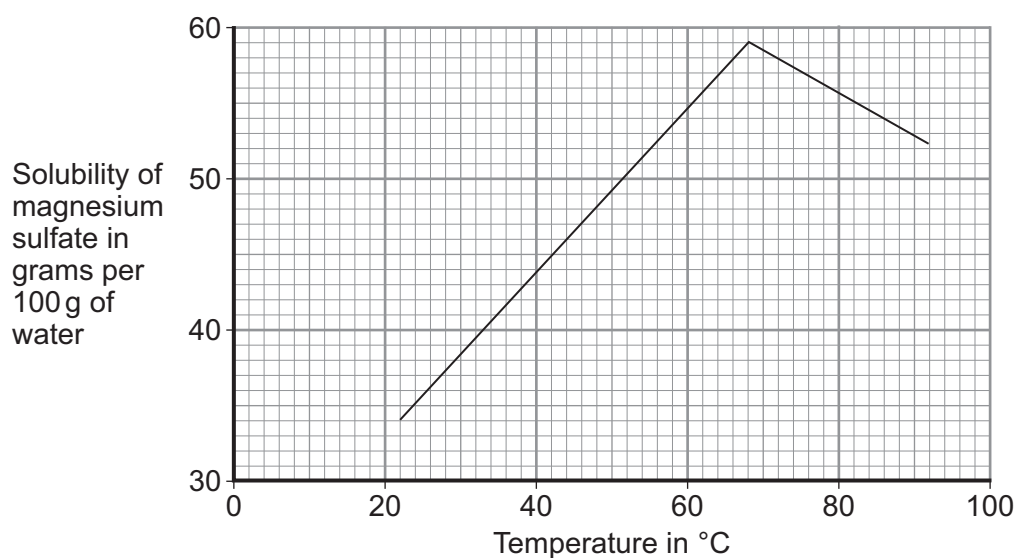
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5 (b) A sample of hard water contains magnesium sulfate.

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]

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**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]**

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

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\_\_\_\_\_

10

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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<sub>3</sub>OH

CH<sub>3</sub>CH<sub>2</sub>OH

CH<sub>3</sub>CH<sub>2</sub>CH<sub>2</sub>OH

CH<sub>3</sub>CH<sub>2</sub>CH<sub>2</sub>CH<sub>2</sub>OH

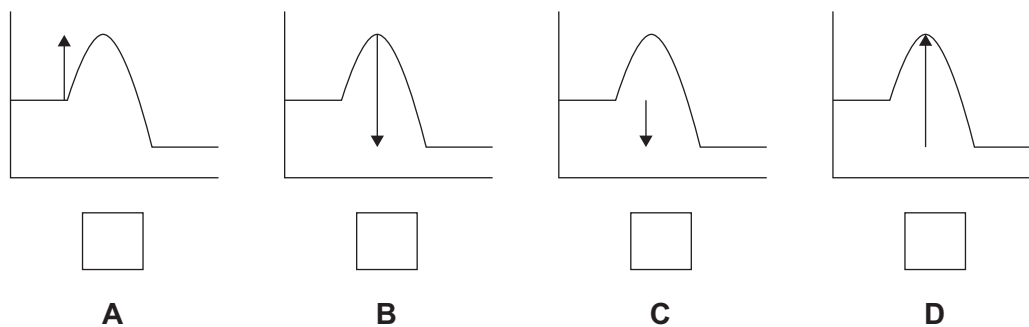
**6 (b)** **Figure 8** shows four energy level diagrams for the combustion of an alcohol.

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

[1 mark]

Tick (✓) **one** box.

**Figure 8**



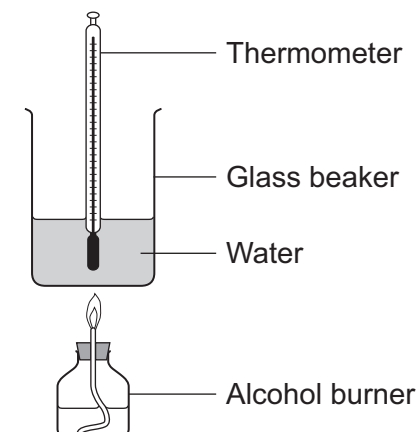
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- 6 (c) **Figure 9** shows apparatus used to measure the energy released when an alcohol is burned.

**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]**

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