| Centre Number | | | | | | Candidate Number | | | | |
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| Surname | | | | | | | | | | |
| Other Names | | | | | | | | | | |
| Candidate Signature | | | | | | | | | | |

| For Examiner's Use | |
|---|---|
| Examiner's Initials | |
| Question | Mark |
| 1 | |
| 2 | |
| 3 | |
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| 8 | |
| TOTAL | |

General Certificate of Secondary Education
Foundation Tier
June 2014

# Chemistry
## Unit Chemistry C3

**CH3FP**

**F**

Thursday 15 May 2014 9.00 am to 10.00 am

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

You may use a calculator.

### Time allowed
- 1 hour

A

### 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 8(b)(ii) 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.

*Do not write outside the box*

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

**1** This question is about the periodic table of elements.

Use the Chemistry Data Sheet to help you to answer these questions.

In 1869 Dmitri Mendeleev produced an early version of the periodic table.

**1 (a)** Draw a ring around the correct answer to complete each sentence.

**1 (a) (i)** Mendeleev first arranged the elements in order of their

atomic weight.

date of discovery.

electron number.

**[1 mark]**

**1 (a) (ii)** Mendeleev then placed elements with similar properties in columns called

groups.

periods.

shells.

**[1 mark]**

**1 (a) (iii)** When the next element did not fit the pattern,

Mendeleev

ignored the element.

left a gap.

put the element at the end of the row.

**[1 mark]**

**1 (a) (iv)** Mendeleev was not able to include the noble gases (Group 0) in his periodic table

because the noble gases

are not elements.

are not reactive.

had not been discovered by 1869.

**[1 mark]**

*Do not write outside the box*

**1 (b)** Use the correct word from the box to complete each sentence.

**[2 marks]**

| **electrons** | **molecules** | **neutrons** | **protons** |
|---|---|---|---|

In the modern periodic table elements are arranged in order of the number of ..... in their nucleus. Elements in the same group have the same number of ..... in their highest energy level (outer shell).

**1 (c)** Sodium (Na) is in Group 1 of the periodic table.

Nickel (Ni) is a transition element.

Tick (✓) **two** correct statements about sodium and nickel.

**[2 marks]**

| **Statement** | **Tick (✓)** |
|---|---|
| Sodium and nickel are both metals. | |
| Sodium has a higher melting point than nickel. | |
| Sodium is more reactive than nickel. | |
| Sodium is harder than nickel. | |

**1 (d)** Chlorine, bromine and iodine are in Group 7 of the periodic table.

Chlorine is more reactive than bromine.

**1 (d) (i)** Complete the word equation for the reaction between chlorine and sodium bromide.

**[1 mark]**

chlorine + sodium bromide ⟶ ..... + sodium chloride

**1 (d) (ii)** Why does iodine **not** react with sodium bromide solution?

**[1 mark]**

.....

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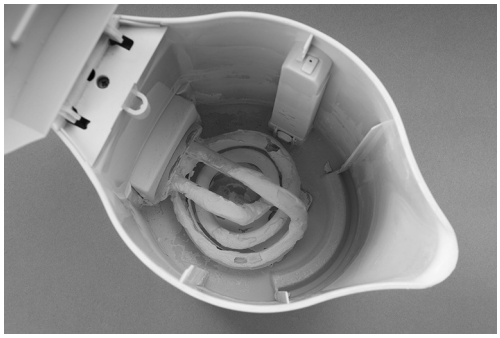
10

**Turn over ▶**

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**2** Hard water causes scale to form in kettles, as shown in **Figure 1**.

**Figure 1**



**2 (a)** The sentences describe how water becomes hard and causes scale.

The sentences are in the wrong order.

**A** Water is heated.

**B** Water flows over rocks.

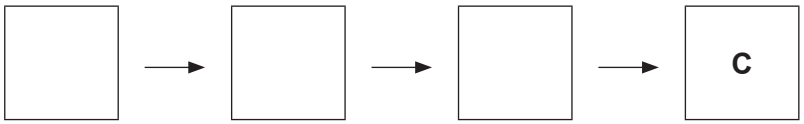
**C** Scale forms.

**D** Ions causing hardness dissolve in the water.

Complete the boxes to show the correct order of the sentences.

The last box has been done for you.

**[2 marks]**




**2 (b)** Draw a ring around the correct answer to complete the sentence.

**[1 mark]**

Hardness in water is caused by dissolved

- calcium ions.
- chloride ions.
- sodium ions.

Do not write outside the box

**2 (c)** Vinegar is used to remove scale in kettles.

Vinegar contains the acid with the formula $CH_3COOH$

**2 (c) (i)** Draw a ring around the correct answer to complete the sentence.

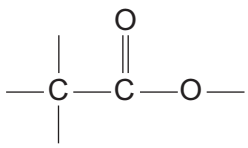
**[1 mark]**

Vinegar contains

| |
|---|
| ethanoic acid. |
| nitric acid. |
| sulfuric acid. |

**2 (c) (ii)** Complete the displayed structure of the acid $CH_3COOH$

**[1 mark]**



**2 (c) (iii)** Scale in kettles contains calcium carbonate.

When vinegar reacts with scale, a gas is produced.

Name the gas.

**[1 mark]**

.....

**2 (d)** Why does removing the scale from a kettle save money?

**[1 mark]**

.....

.....

**2 (e)** Hard water reacts with soap.

Complete the sentence.

**[1 mark]**

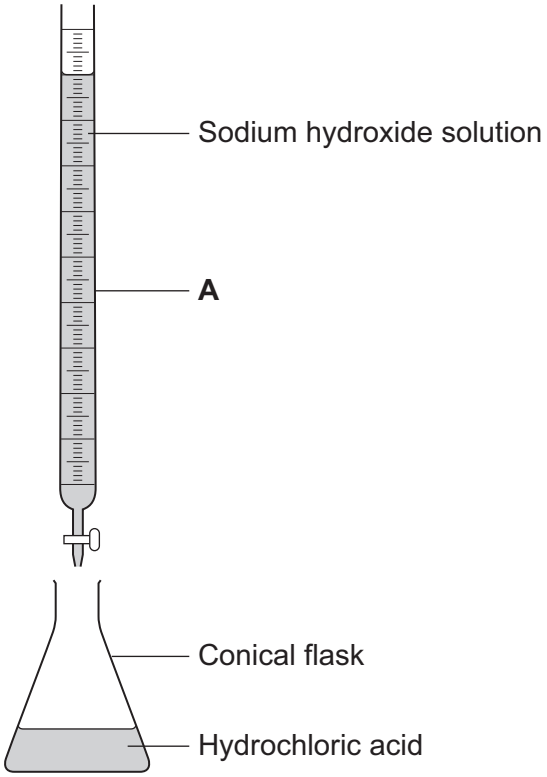
When hard water reacts with soap, it forms ..... .

8

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**3** A student used the apparatus in **Figure 2** to do a titration.

**Figure 2**




**3 (a) (i)** What is the name of the piece of apparatus labelled **A**?

Draw a ring around the correct answer.

**[1 mark]**

**burette** **measuring cylinder** **test tube**

**3 (a) (ii)** What should the student add to the acid in the conical flask?

Draw a ring around the correct answer.

**[1 mark]**

**catalyst** **indicator** **water**

**3 (a) (iii)** What would the student see when the end point of the titration has been reached?

**[1 mark]**

.....

*Do not write outside the box*

**3 (b)** The student does the titration three times.

**3 (b) (i)** State **one** variable that the student needs to keep the same to make it a fair test.

**[1 mark]**

.....

**3 (b) (ii)** The student's results are shown in **Table 1**.

**Table 1**

| Titration | Volume of sodium hydroxide solution added in $cm^3$ |
|---|---|
| **1** | 22.40 |
| **2** | 22.20 |
| **3** | 22.30 |

Calculate the mean volume of sodium hydroxide solution added.

**[1 mark]**

..... $cm^3$

5

**Turn over for the next question**

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**4** In 1909 Fritz Haber invented a process to produce ammonia from nitrogen and hydrogen.

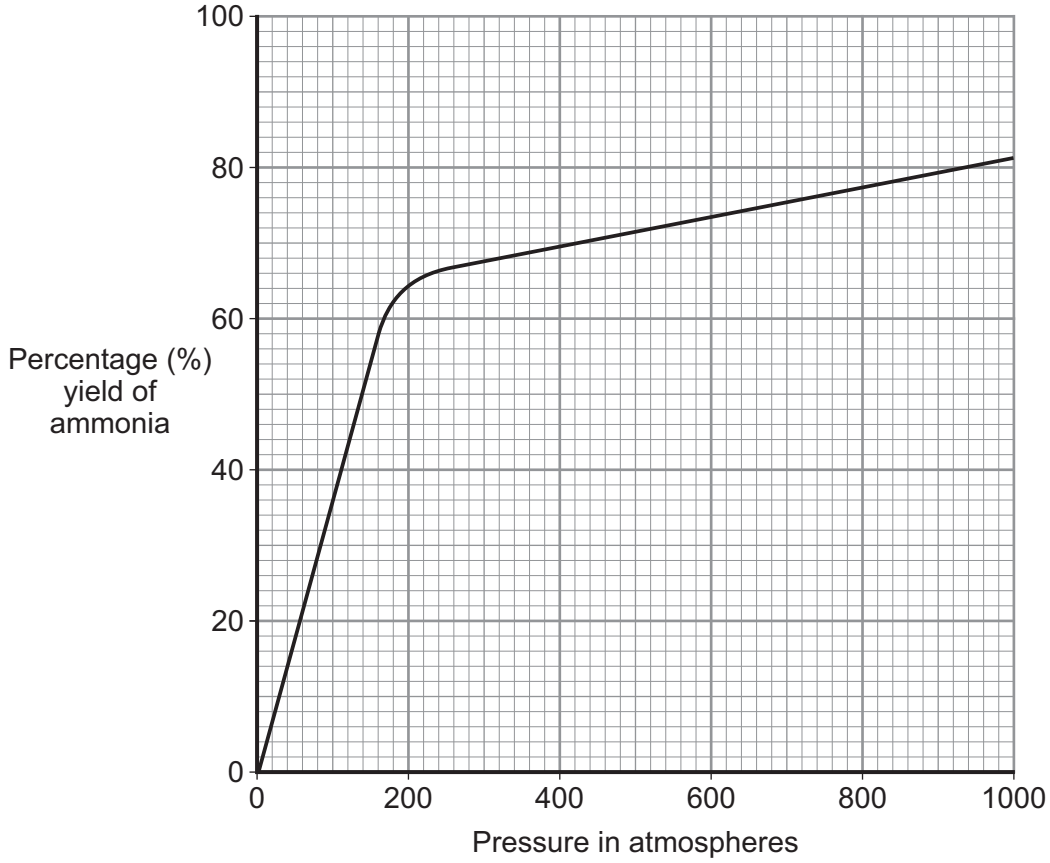
**4 (a)** Complete the word equation, showing that the reaction is reversible.

**[2 marks]**

nitrogen + hydrogen ..... .....

**4 (b)** **Figure 3** shows how the yield of ammonia at 300 °C changes with pressure.

**Figure 3**




Describe how the yield of ammonia changes as the pressure increases.

**[3 marks]**

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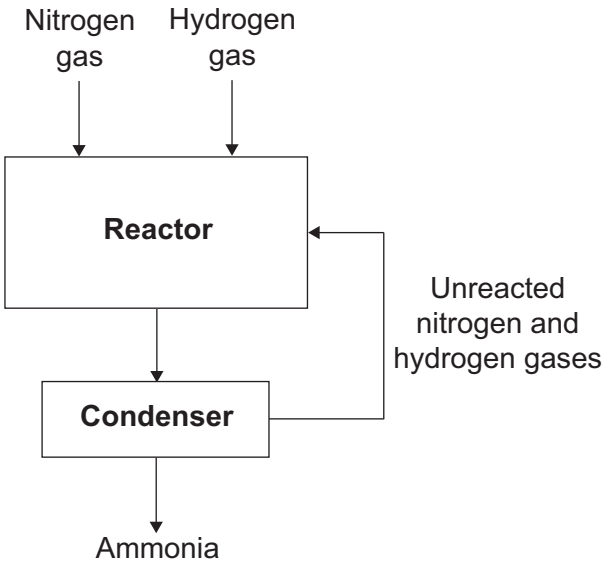
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**4 (c)** **Figure 4** represents the Haber process.

**Figure 4**




How does the Haber process avoid wasting nitrogen and hydrogen?

**[1 mark]**

.....

.....

**4 (d)** Before the Haber process, nitrates had been mined in South America. Nitrates are used for making fertilisers.

The Haber process allowed nitrates to be produced on a large scale, anywhere in the world.

**4 (d) (i)** Suggest what effect the Haber process had on the miners in South America.

**[1 mark]**

.....

.....

**4 (d) (ii)** Suggest **one** advantage of producing nitrates on a large scale.

**[1 mark]**

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8

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**5** Some cars are powered by hydrogen fuel cells.

**Figure 5**




**5 (a)** What type of energy is released by hydrogen fuel cells?

Draw a ring around the correct answer.

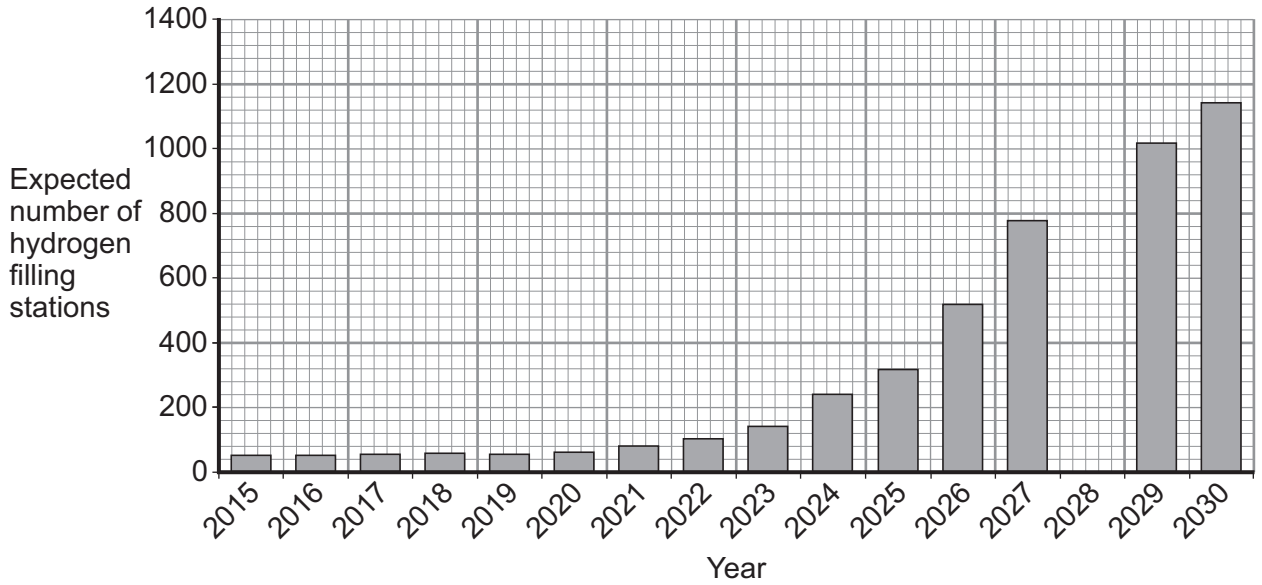
**[1 mark]**

**chemical** **electrical** **light**

**5 (b)** Owners of cars powered by fuel cells buy hydrogen from hydrogen filling stations.

**Figure 6** shows how the number of hydrogen filling stations in the UK is expected to increase up to the year 2030.

**Figure 6**



Do not write outside the box

**5 (b) (i)** Suggest the total number of hydrogen filling stations expected in 2028.

**[1 mark]**

.....

**5 (b) (ii)** The number of hydrogen filling stations will still be very low compared with the number of petrol filling stations.

Suggest **one** reason why.

**[1 mark]**

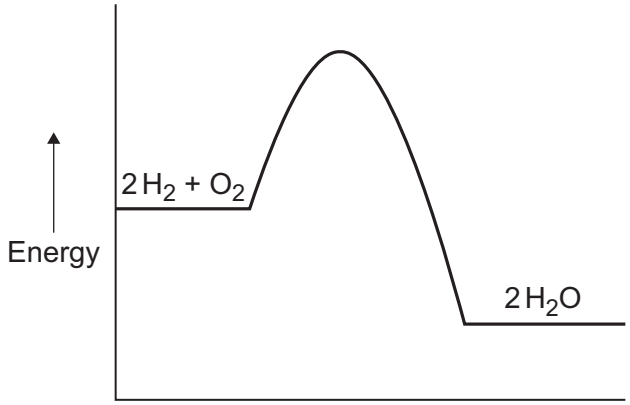
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**5 (c)** Hydrogen reacts with oxygen to produce water.

The energy level diagram for this reaction is shown in **Figure 7**.

**Figure 7**




Mark clearly with a cross (×) on **Figure 7** where bond breaking happens.

**[1 mark]**

4

**Turn over for the next question**

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**6 (a)** The colours of fireworks are produced by chemicals.

**Figure 8**



Three of these chemicals are lithium sulfate, potassium chloride and sodium nitrate.

**6 (a) (i)** A student wants to carry out flame tests on these three chemicals.

Describe how to carry out a flame test.

**[2 marks]**

.....

.....

.....

.....

**6 (a) (ii)** Draw **one** line from each chemical to the correct flame colour.

The first one has been done for you.

**[2 marks]**

| **Chemical** | **Flame colour** |
|---|---|
| lithium sulfate | crimson |
| potassium chloride | |
| sodium nitrate | |
| | green |
| | yellow |
| | lilac |

Do not write outside the box

**6 (a) (iii)** Dilute nitric acid and silver nitrate solution are added to solutions of the three chemicals.

A white precipitate forms in one of the solutions.

Which chemical produces the white precipitate?

**[1 mark]**

.....

**6 (b)** The student tests a fourth chemical, **X**.

**6 (b) (i)** The student adds sodium hydroxide solution to a solution of chemical **X**.

A blue precipitate is formed.

Which metal ion is in chemical **X**?

**[1 mark]**

.....

**6 (b) (ii)** The student adds dilute hydrochloric acid to a solution of chemical **X** and then adds barium chloride solution.

A white precipitate is formed.

Which negative ion is in chemical **X**?

Draw a ring around the correct answer.

**[1 mark]**

**chloride** **nitrate** **sulfate**

7

**Turn over for the next question**

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**7** Water in Britain is taken from reservoirs to use as drinking water.

**Figure 9**



**7 (a)** What are the **two** main steps used to treat water from reservoirs?

Give **one** reason for each step.

**[4 marks]**

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**7 (b)** Some people use water filters to treat water before drinking it.

**7 (b) (i)** Water filters remove hardness from hard water.

What is in water filters that removes hardness from water?

**[1 mark]**

.....

.....

**7 (b) (ii)** Suggest why water filters used in the home contain particles of silver.

**[1 mark]**

.....

.....

**7 (c)** Pure water can be produced by distillation.

Why is distillation **not** usually an economic method of treating water for drinking?

**[1 mark]**

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**7 (d)** Drinking hard water has health benefits.

State **one** health benefit of drinking hard water.

**[1 mark]**

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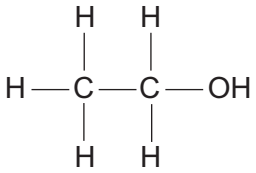
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**Turn over for the next question**

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**8 (a)** The structure of an alcohol is shown in **Figure 10**.

**Figure 10**




**8 (a) (i)** Draw a circle around the functional group in the structure of the alcohol.

**[1 mark]**

**8 (a) (ii)** What is the chemical name of this alcohol?

**[1 mark]**

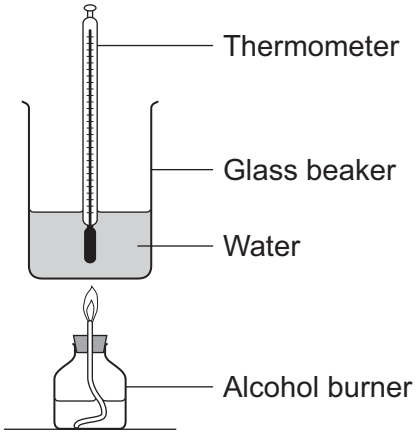
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**8 (b)** Alcohols are used as fuels.

A student plans an experiment to find the energy released per gram of alcohol burned.

The student uses the apparatus shown in **Figure 11**.

**Figure 11**




**8 (b) (i)** Suggest **two** ways that this apparatus could be improved to obtain accurate results.

**[2 marks]**

.....

.....

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

Describe how the student should do this experiment.

You should include any measurements the student should make.

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

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

**[6 marks]**

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Extra space .....

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10

**END OF QUESTIONS**

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