

Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

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



General Certificate of Secondary Education  
Foundation Tier  
January 2012

# Chemistry

**CHY3F**

Unit Chemistry C3

**F**

Written Paper

Thursday 26 January 2012 9.00 am to 9.45 am

**For this paper you must have:**

- a ruler
  - the Data Sheet (enclosed).
- You may use a calculator.

### Time allowed

- 45 minutes

### 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 45.
- You are expected to use a calculator where appropriate.
- You are reminded of the need for good English and clear presentation in your answers.

### Advice

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



J A N 1 2 C H Y 3 F 0 1

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

- 1 By 1869, about 60 elements had been discovered. Mendeleev arranged these elements in a table, in order of their atomic weight. He put elements with similar chemical properties in the same column. Mendeleev and part of his table are shown below.



Column						
1	2	3	4	5	6	7
H						
Li	Be	B	C	N	O	F
Na	Mg	Al	Si	P	S	Cl

Use the periodic table on the Data Sheet to help you to answer these questions.

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

In the periodic table the columns are known as

groups.
periods.
rows.

(1 mark)

- 1 (b) Suggest **one** reason why hydrogen should **not** have been put in column 1.

.....  
(1 mark)

- 1 (c) In 1895, the first of a new family of elements was discovered. One of the new elements was called helium.

Where has this new family of elements been placed in the modern periodic table?

.....  
(1 mark)

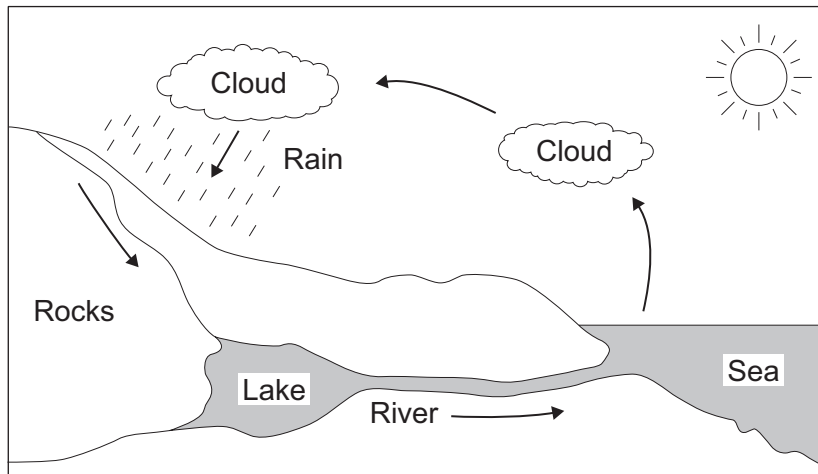
- 1 (d) Complete the sentence.

In the periodic table on your Data Sheet, the elements are arranged in order of their atomic .....

(1 mark)



- 2 Most drinking water used in the UK is taken from lakes and rivers. The water cycle shows how water gets into lakes and rivers.



- 2 (a) Draw a ring around the correct answer to complete the sentences.

- 2 (a) (i) During the water cycle, water is

dissolved

evaporated

from the sea to form water vapour.

filtered

(1 mark)

- 2 (a) (ii) The water vapour rises, cools and is

condensed

dissolved

to form clouds and rain.

sterilised

(1 mark)

- 2 (a) (iii) Some substances in the rocks are

condensed

dissolved

by rainwater.

sterilised

(1 mark)

- 2 (a) (iv) Drinking water taken from rivers and lakes is

condensed

evaporated

to remove solids

filtered

and

dissolved

filtered

with chlorine.

sterilised

(2 marks)

Question 2 continues on the next page

Turn over ►



2 (b) The water in the lake is hard water.

2 (b) (i) What happens when soap is added to hard water?

.....  
(1 mark)

2 (b) (ii) Magnesium ions cause hardness in water.

Which other ions cause hardness in water?

Tick (✓) **one** answer.

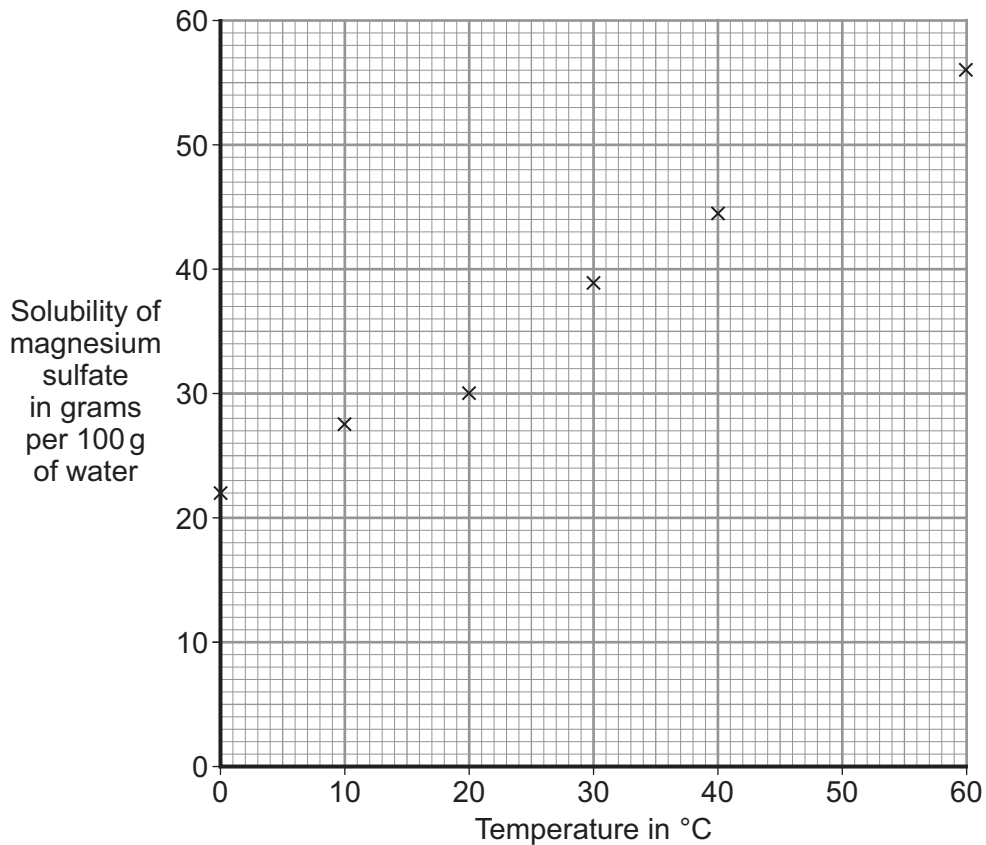
	Tick (✓)
calcium ions	
hydrogen ions	
sodium ions	

(1 mark)

2 (c) The water in the lake contains magnesium sulfate.

A student did an investigation to find the maximum mass of magnesium sulfate that dissolves in 100 g of water at different temperatures.

The points on the graph show the results of the investigation.



2 (c) (i) Complete the graph by drawing a line of best fit.

(1 mark)

2 (c) (ii) Use the graph to find the maximum mass of magnesium sulfate that dissolves in 100 g of water at 50°C.

Mass = ..... g  
(1 mark)

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

As the temperature increases, the maximum mass of magnesium sulfate that dissolves

in 100 g of water

decreases.
increases.
stays the same.

(1 mark)

10

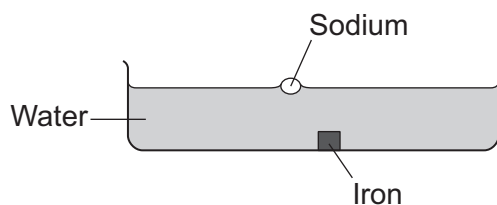
**Turn over for the next question**

**Turn over ►**



3 How a metal is used depends on its properties.

A teacher demonstrated some of the properties of sodium (an alkali metal) and iron (a transition element) by placing a small cube of each metal into water.



A student observed that:

Sodium	Iron
floated on the surface of the water	sank to the bottom of the water
melted to form a molten ball of sodium	did not melt
reacted to produce a gas	did not react
no sodium was left after 5 minutes	the cube of iron remained after 5 minutes

3 (a) Tick (✓) **two** properties of sodium compared with iron that are shown by the student's observations.

Sodium compared with iron	Tick (✓)
sodium has a higher boiling point	
sodium has a lower density	
sodium is harder	
sodium is more reactive	
sodium is softer	

(2 marks)



**3 (b)** Draw a ring around the correct answer to complete the word equation.

sodium + water → sodium hydroxide +

carbon dioxide
hydrogen
oxygen

(1 mark)

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

Sodium hydroxide is an alkali because it produces

H <sup>+</sup> (aq)
---------------------

OH <sup>-</sup> (aq)
----------------------

 ions

Na <sup>+</sup> (aq)
----------------------

in aqueous solution.

(1 mark)

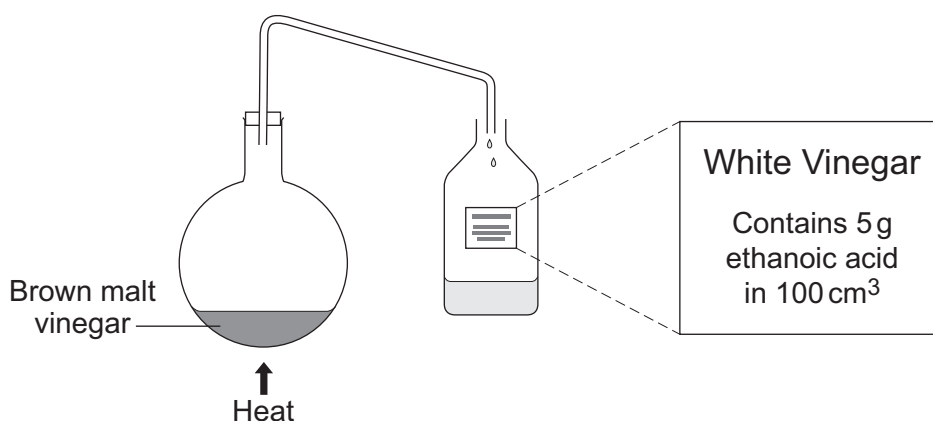
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**Turn over for the next question**

**Turn over ►**



- 4 White vinegar can be made by distillation of brown malt vinegar.



- 4 (a) White vinegar contains only water (boiling point  $100^{\circ}\text{C}$ ) and ethanoic acid (boiling point  $118^{\circ}\text{C}$ ).

Suggest why the brown colour remains in the flask during the distillation.

.....  
 .....

(1 mark)

- 4 (b) Ethanoic acid is a weak acid.

- 4 (b) (i) Draw a ring around the correct answer to complete the sentence.

Weak acids are 

completely
not
partially

 ionised in water.

(1 mark)

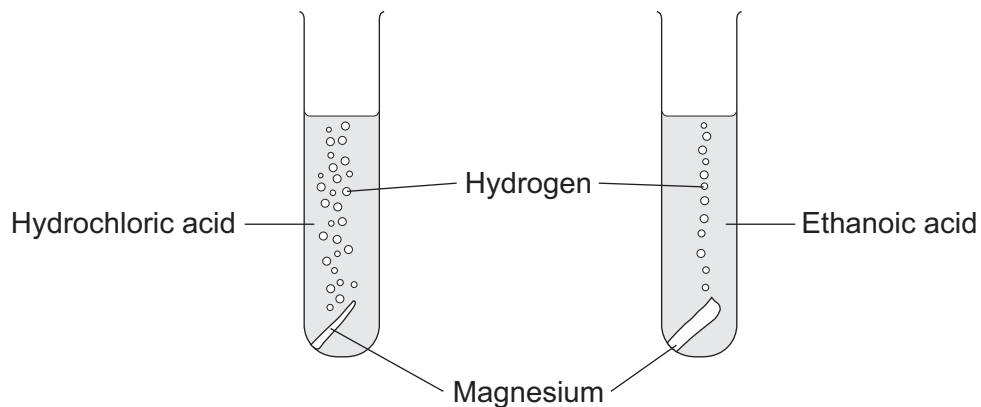




4 (b) (ii) Hydrochloric acid and ethanoic acid were reacted with magnesium metal to produce hydrogen gas.

At the start:

- both acids were the same concentration
- both pieces of magnesium were the same size.



Give **two** observations which show that ethanoic acid is a weaker acid than hydrochloric acid.

- 1 .....
- .....
- 2 .....
- .....

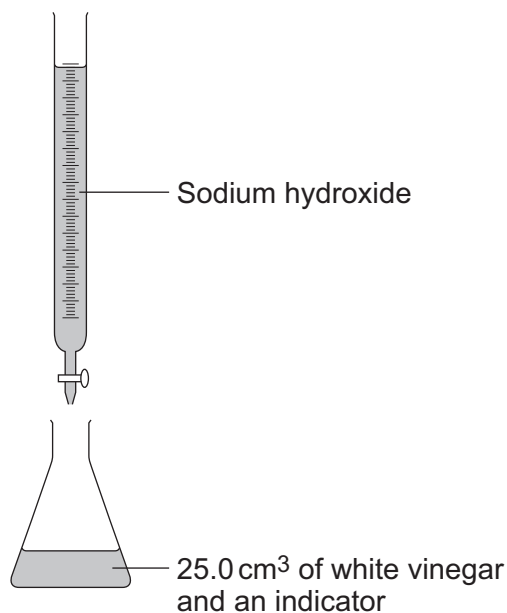
(2 marks)

Question 4 continues on the next page

Turn over ►



- 4 (c)** A student did a titration to find out if the white vinegar contains 5 g of ethanoic acid in  $100\text{cm}^3$ .



- 4 (c) (i)** Choose the correct words from the box to complete the sentences. Use each word once or not at all.

burette

conical flask

pipette

thermometer

To do this titration  $25.0\text{cm}^3$  of the white vinegar is measured

using a .....

The  $25.0\text{cm}^3$  of white vinegar is then run into a .....

An indicator is added to the white vinegar.

Sodium hydroxide solution is added to the white vinegar

from a .....

(3 marks)



4 (c) (ii) How does the student know when to stop adding the sodium hydroxide solution?

.....

.....

.....

.....

(2 marks)

4 (d) The titration is repeated three more times. The results are shown in the table.

Titration	1	2	3	4
Volume of sodium hydroxide in cm <sup>3</sup>	23.5	20.1	19.9	20.0

4 (d) (i) The student decided that the mean of these results was 20.0cm<sup>3</sup>.

Explain why.

Use the figures from the table in your explanation.

.....

.....

.....

.....

(2 marks)

4 (d) (ii) From the results, the student calculated that the concentration of the ethanoic acid was 48g per cubic decimetre.

Did the white vinegar contain 5g of ethanoic acid in 100 cm<sup>3</sup>?

Explain your answer.

.....

.....

(1 mark)

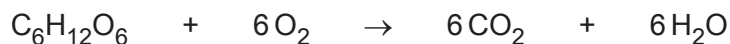
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Turn over for the next question

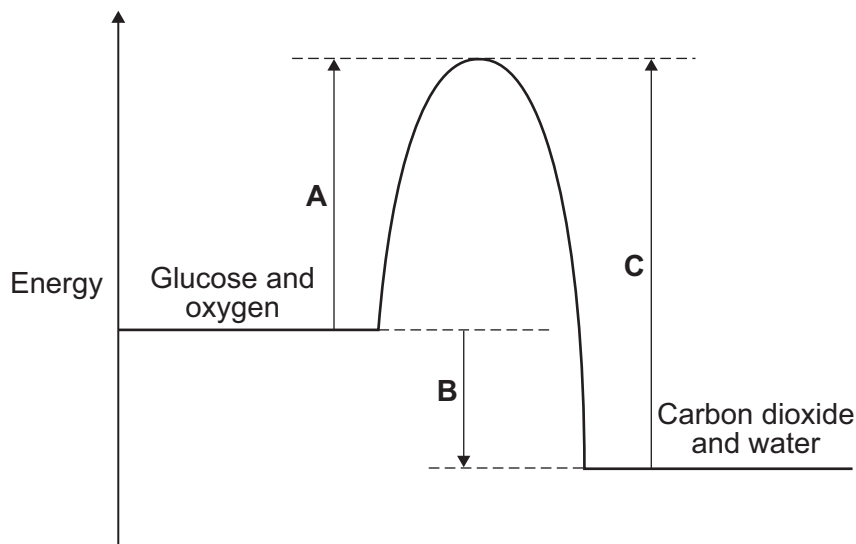
Turn over ►



- 5 Food provides chemicals and energy to keep your body working. In your body, energy is released by respiration when glucose,  $C_6H_{12}O_6$ , reacts with oxygen.



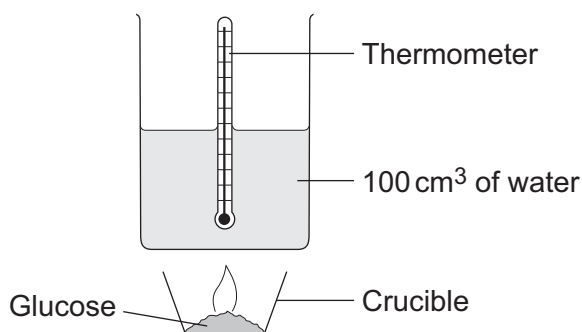
- 5 (a) The energy level diagram for the reaction of glucose with oxygen is shown.



- 5 (a) (i) Which energy change, **A**, **B** or **C**, represents the activation energy?  (1 mark)

- 5 (a) (ii) Which energy change, **A**, **B** or **C**, shows that the reaction is exothermic?  (1 mark)

- 5 (b) A student did an investigation to find the amount of energy released when 1 g of glucose burns in air.



The student:

- recorded the room temperature
- placed 1 g of glucose into the crucible
- set up the equipment as shown in the diagram
- lit the glucose
- recorded the highest temperature of the water.



5 (b) (i) One of the main errors in this experiment is energy loss to the surroundings.  
Suggest **one** way that the equipment could be changed to reduce this energy loss.

.....  
.....

(1 mark)

5 (b) (ii) The room temperature was 20 °C and the highest temperature recorded was 42 °C.  
Use these temperature readings to calculate how much energy is released when 1 g of glucose burns.  
The equation that you need to use is:

$$\text{Energy released in joules} = 100 \times 4.2 \times \text{temperature change}$$

Show clearly how you work out your answer.

.....  
.....  
.....

Burning 1 g of glucose releases ..... joules  
(2 marks)

5 (b) (iii) The amount of energy released by 1 g of glucose should be 16 000 J.

Apart from energy loss to the surroundings, suggest **two** other reasons why the student's value was less than expected.

1 .....

2 .....

(2 marks)

5 (c) Suggest **one** reason why food labels provide information about the energy released by the food.

.....  
.....

(1 mark)

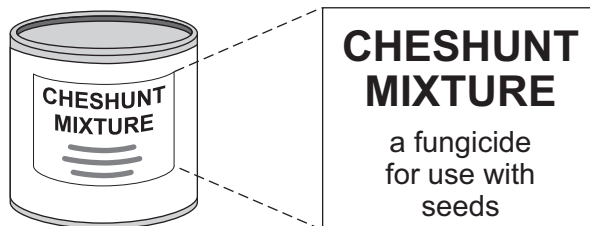
Turn over for the next question

8

Turn over ►



- 6 Cheshunt mixture is a powder containing copper sulfate,  $\text{CuSO}_4$ , and ammonium carbonate,  $(\text{NH}_4)_2\text{CO}_3$



- 6 (a) A student tested the Cheshunt mixture.

- 6 (a) (i) Hydrochloric acid was added.  
A gas was produced that turned limewater milky.

Complete the sentence.

The gas was ..... which shows  
that ..... ions are in the mixture.

(2 marks)

- 6 (a) (ii) Sodium hydroxide solution was added.  
A gas was produced that indicates that ammonium ions are in the mixture.

Complete the sentence.

The gas was ..... which turns  
damp red ..... blue.

(2 marks)



**6 (b)** Cheshunt mixture is dissolved in water before it is used.  
When the student dissolved the Cheshunt mixture in water it formed a blue solution.

**6 (b) (i)** Suggest how the student knew that copper ions are in this solution.

.....  
.....

(1 mark)

**6 (b) (ii)** The student tested the Cheshunt solution and the result of the test indicated that sulfate ions are in the solution.

Complete the sentence.

The student added a solution of ..... in the presence of  
dilute hydrochloric acid and a ..... precipitate was produced.

(2 marks)

7

**END OF QUESTIONS**



**There are no questions printed on this page**

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