

Centre Number						Candidate Number				
Surname										
Other Names										
Candidate Signature										

For Examiner's Use	
Examiner's Initials	
Question	Mark
1	
2	
3	
4	
5	
6	
7	
TOTAL	



General Certificate of Secondary Education  
Higher Tier  
June 2012

# Chemistry

## CHY3H

Unit Chemistry C3

# H

Written Paper

Thursday 24 May 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 U N 1 2 C H Y 3 H 0 1

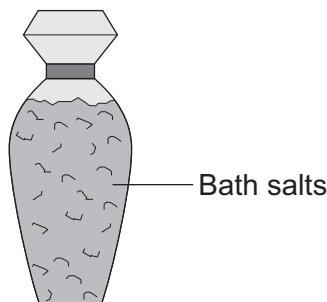
G/T80529 6/6/6/

## CHY3H

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

- 1** In some areas of the UK the water is hard.  
Bath salts are added to bath water to soften the water.

- 1 (a)** Bath salts contain sodium carbonate.



The equation shows one reaction in which sodium carbonate removes hardness from bath water.



Use the equation and your knowledge of hard water to explain;

- why this bath water is hard
- and**
- how sodium carbonate removes hardness from bath water.

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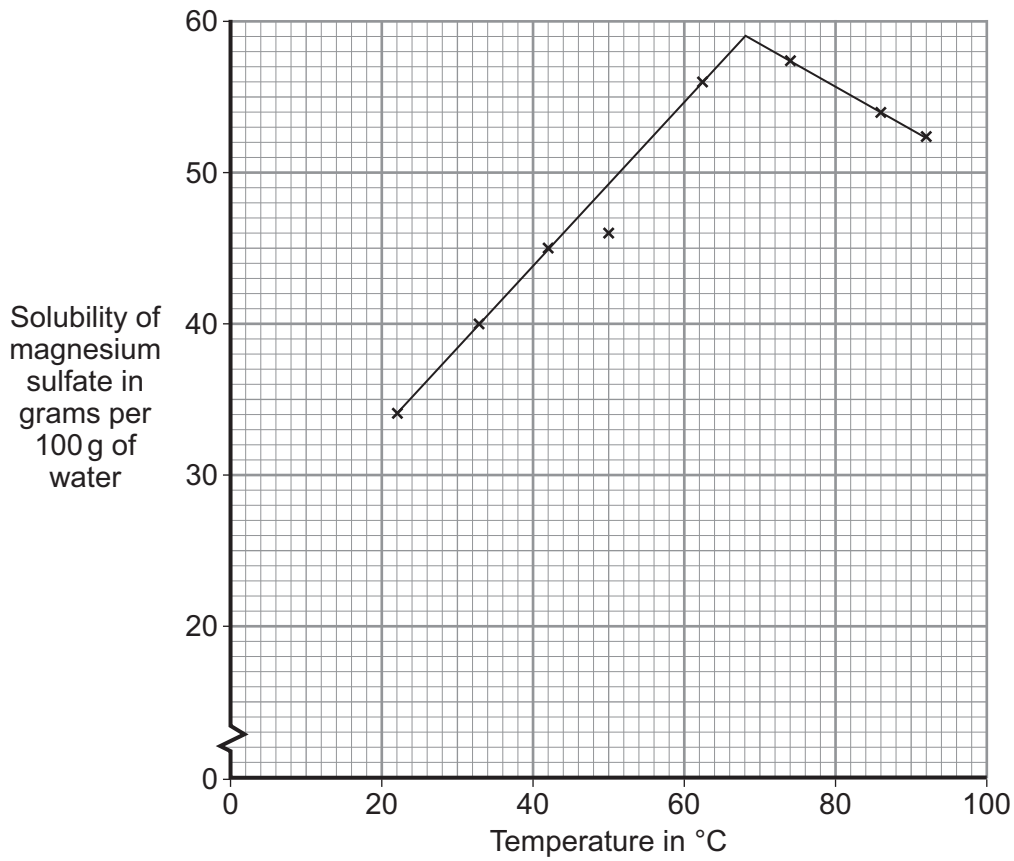
(3 marks)

- 1 (b)** The bath water contains magnesium sulfate.

A student did experiments to find the maximum amount of magnesium sulfate that dissolves in water at different temperatures.

The student's results are shown on the graph.





1 (b) (i) Why did the student **not** draw a line through the point at 50°C?

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 .....  
 (1 mark)

1 (b) (ii) Suggest why the student did **not** do an experiment at 100°C.

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 .....  
 (1 mark)

1 (b) (iii) At what temperature is the solubility of magnesium sulfate greatest?

Temperature = ..... °C  
 (1 mark)

1 (b) (iv) Suggest why the student was surprised by the shape of the solubility graph line.

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 (2 marks)

8
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Turn over ►



2 John Newlands was a chemist who worked in a sugar factory.

In 1866 he designed a periodic table.

He arranged the elements in order of their relative atomic masses.

He found a repeating pattern for some of the elements.

Newlands wrote, 'the eighth element starting from a given one, is a kind of repetition of the first, like the eighth note in an octave of music'.

H	Li	G	Bo	C	N	O
F	Na	Mg	Al	Si	P	S
Cl	K	Ca	Cr	Ti	Mn	Fe
Co, Ni	Cu	Zn	Y	In	As	Se
Br	Rb	Sr	Ce, La	Zr	Di, Mo	Ro, Ru
Pd	Ag	Cd	U	Sn	Sb	Te
I	Cs	Ba, V	Ta	W	Nb	Au
Pt, Ir	Tl	Pb	Th	Hg	Bi	Os

**Newlands' periodic table**

2 (a) In Newlands' periodic table, the elements lithium, sodium and potassium are grouped together.

Give **two** properties of these elements which support the idea that they should be grouped together.

1 .....

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2 .....

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(2 marks)



**2 (b)** Newlands' periodic table was not accepted by most chemists in 1866.

Suggest reasons why.

Use the information on page 4 to help you to answer this question.

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(3 marks)

**2 (c)** State **and** explain **one** way in which Mendeleev improved Newlands' periodic table.

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(2 marks)

7

**Turn over for the next question**

**Turn over ►**



- 3** Platinum and gold are transition elements.  
They can both be used to make wedding rings.



- 3 (a)** Platinum and gold are good materials for making wedding rings.

Use your knowledge of the properties of transition elements to suggest why.

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(2 marks)

- 3 (b)** Explain, in terms of electronic structure, why transition elements have similar chemical properties.

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(2 marks)

4



- 4 Vinegar can be added to food. Vinegar is an aqueous solution of ethanoic acid.



Ethanoic acid is a *weak* acid.

- 4 (a) Which ion is present in aqueous solutions of all acids?

.....  
(1 mark)

- 4 (b) What is the difference between the pH of a *weak* acid compared to the pH of a strong acid of the same concentration?

Give a reason for your answer.

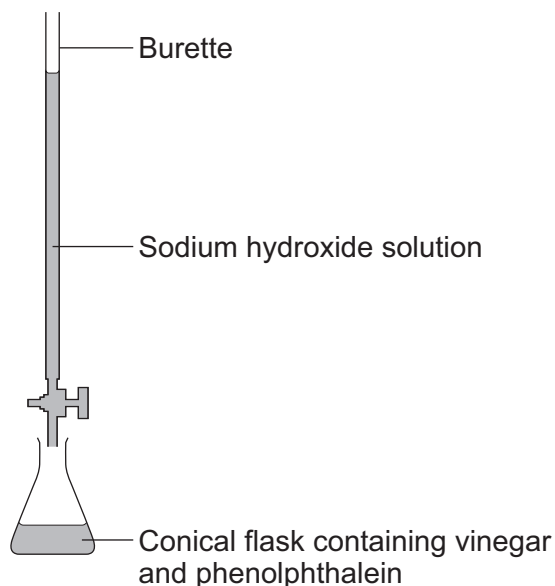
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(2 marks)

**Question 4 continues on the next page**

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- 4 (c)** The diagram shows the apparatus used to find the concentration of ethanoic acid in vinegar.



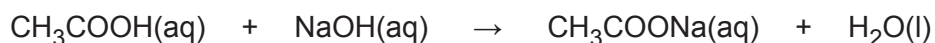
- 4 (c) (i)** Why should phenolphthalein indicator be used for this titration instead of methyl orange?

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 .....

(1 mark)

- 4 (c) (ii)** 25.00 cm<sup>3</sup> of vinegar was neutralised by 30.50 cm<sup>3</sup> of a solution of sodium hydroxide with a concentration of 0.50 moles per cubic decimetre.

The equation for this reaction is:



Calculate the concentration of ethanoic acid in this vinegar.

.....  
 .....

Concentration of ethanoic acid in this vinegar = ..... moles per cubic decimetre  
 (2 marks)





- 4 (d)** The concentration of ethanoic acid in a different bottle of vinegar was 0.80 moles per cubic decimetre.

Calculate the mass in grams of ethanoic acid ( $\text{CH}_3\text{COOH}$ ) in  $250\text{ cm}^3$  of this vinegar.  
The relative formula mass ( $M_r$ ) of ethanoic acid = 60.

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Mass of ethanoic acid = ..... g  
(2 marks)

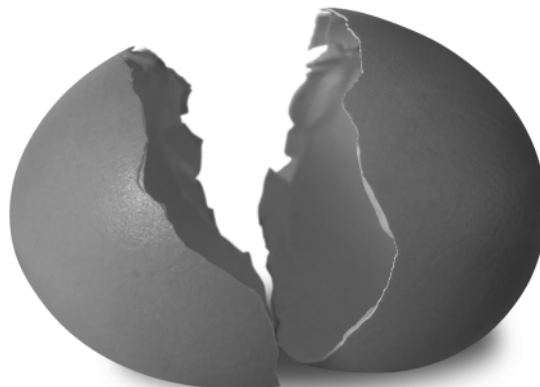
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**Turn over for the next question**

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- 5 A student investigated an egg shell.



- 5 (a) The student did some tests on the egg shell.

The student's results are shown in the table below.

Test		Observation
1	Dilute hydrochloric acid was added to the egg shell.	A gas was produced. The egg shell dissolved, forming a colourless solution.
2	A flame test was done on the colourless solution from test 1.	The flame turned red.
3	Sodium hydroxide solution was added to the colourless solution from test 1.	A white precipitate formed that did not dissolve in excess sodium hydroxide solution.
4	Silver nitrate solution was added to the colourless solution from test 1.	A white precipitate formed.

- 5 (a) (i) The student concluded that the egg shell contains carbonate ions.

Describe how the student could identify the gas produced in test 1.

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(2 marks)



5 (a) (ii) The student concluded that the egg shell contains aluminium ions.

Is the student's conclusion correct? Use the student's results to justify your answer.

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(2 marks)

5 (a) (iii) The student concluded that the egg shell contains chloride ions.

Is the student's conclusion correct? Use the student's results to justify your answer.

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(2 marks)

5 (b) Some scientists wanted to investigate the amount of lead found in egg shells. They used a modern instrumental method which was *more sensitive* than older methods.

5 (b) (i) Name **one** modern instrumental method used to identify elements.

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(1 mark)

5 (b) (ii) What is the meaning of *more sensitive*?

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(1 mark)

8

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ANSWER IN THE SPACES PROVIDED**



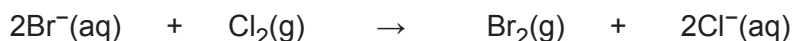
**6** The halogens are in Group 7 of the periodic table.

**6 (a)** Why, in terms of electrons, are the halogens in Group 7?

.....  
.....

(1 mark)

**6 (b)** Sea water contains bromide ions (Br<sup>-</sup>).  
The bromide ions can be changed to bromine by bubbling chlorine gas into sea water.  
Chlorine is able to displace bromine from sea water because chlorine is more reactive than bromine.



Explain, in terms of electrons, why chlorine is more reactive than bromine.

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(3 marks)

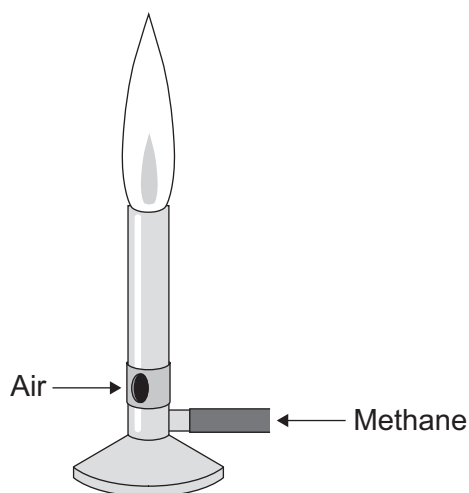
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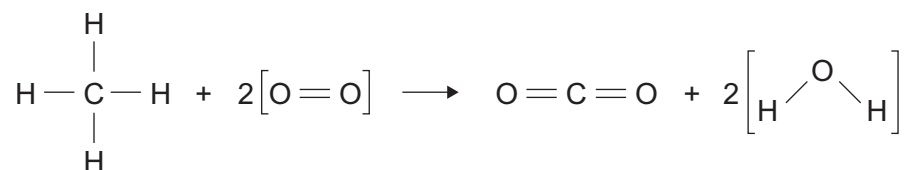


7 A Bunsen burner releases heat energy by burning methane in air.



7 (a) Methane (CH<sub>4</sub>) reacts with oxygen from the air to produce carbon dioxide and water.

7 (a) (i) Use the equation and the bond energies to calculate a value for the energy change in this reaction.



Bond	Bond energy in kJ per mole
C—H	414
O=O	498
C=O	803
O—H	464

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Energy change = ..... kJ per mole  
(3 marks)

**7 (a) (ii)** This reaction releases heat energy.

Explain why, in terms of bond energies.

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(2 marks)

**7 (b)** If the gas tap to the Bunsen burner is turned on, the methane does not start burning until it is lit with a match.

Why is heat from the match needed to start the methane burning?

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(1 mark)

6

**END OF QUESTIONS**



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