

Monday 25 June 2012 – Afternoon**GCSE TWENTY FIRST CENTURY SCIENCE
CHEMISTRY A****A322/02** Unit 2: Modules C4 C5 C6 (Higher Tier)

Candidates answer on the Question Paper.
A calculator may be used for this paper.

OCR supplied materials:
None

Other materials required:

- Pencil
- Ruler (cm/mm)

Duration: 40 minutes

Candidate forename		Candidate surname	
Centre number		Candidate number	

INSTRUCTIONS TO CANDIDATES

- Write your name, centre number and candidate number in the boxes above. Please write clearly and in capital letters.
- Use black ink. HB pencil may be used for graphs and diagrams only.
- Answer **all** the questions.
- Read each question carefully. Make sure you know what you have to do before starting your answer.
- Write your answer to each question in the space provided. Additional paper may be used if necessary but you must clearly show your candidate number, centre number and question number(s).
- Do **not** write in the bar codes.

INFORMATION FOR CANDIDATES

- The number of marks is given in brackets [] at the end of each question or part question.
- The total number of marks for this paper is **42**.
- This document consists of **16** pages. Any blank pages are indicated.
- The Periodic Table is printed on the back page.

2

Answer **all** the questions.

- 1 The table shows data about the properties of some Group 1 elements.

Element	Properties			
	Melting point in °C	Boiling point in °C	Density in g/cm ³	Formula of hydroxide
Lithium	180.0	1330	0.53	LiOH
Sodium	97.8	890	0.97	NaOH
Potassium	63.7	774	0.86	KOH
Rubidium	38.9	688	1.53	RbOH

- (a) Elements in the same group show similarities and trends in their properties.

- (i) What similarities and trends are shown in the table?

.....

.....

.....

..... [3]

- (ii) Which property in the table does **not** show a clear trend? Explain your reasoning.

.....

.....

..... [2]

3

(b) Caesium is another element in Group 1. It is below rubidium in the Periodic Table.

(i) Which of the statements about caesium are **true** and which are **false**?

Put one tick (✓) in each row.

	true (✓)	false (✓)
Caesium is more reactive than sodium.		
Caesium is a non-metal.		
An atom of caesium has one electron in its outer shell.		
Caesium has fewer protons than lithium.		
Caesium reacts with water to make hydrogen gas.		

[2]

(ii) Predict the formula of caesium hydroxide.

formula [1]

[Total: 8]

4

- 2 The table below shows the number of protons and electrons in five particles, **A**, **B**, **C**, **D** and **E**.

Each particle is either an atom or an ion.

Particle	Number of protons	Number of electrons
A	3	3
B	9	9
C	3	2
D	8	10
E	17	17

- (a) Use the letters **A**, **B**, **C**, **D** and **E** to answer the following questions.

- (i) Which two particles are atoms from Group 7 of the Periodic Table?

answer and [1]

- (ii) Which two particles are an atom and an ion of the same element?

answer and [1]

- (iii) Which particle is a negative ion?

answer [1]

- (b) Particle **C** is an ion.

What is the charge on particle **C**?

answer [1]

[Total: 4]

5

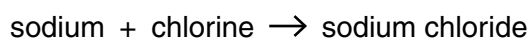
3 Chlorine, bromine and iodine are in Group 7 of the Periodic Table.

(a) Draw straight lines to show the **colour** and **state** of each **element** at room temperature and pressure.

colour	element	state
grey	chlorine	(s)
green	bromine	(l)
red-brown	iodine	(aq)
white		(g)

[2]

(b) Sodium reacts with chlorine gas to form sodium chloride.



Write a balanced symbol equation for this reaction.

..... [2]

[Total: 4]

6

4 Four gases that are in the air are nitrogen, oxygen, argon and carbon dioxide.

(a) Draw four lines to connect the **name** of each gas to the correct **arrangement of atoms and its relative mass**.

name	arrangement of atoms and relative mass
nitrogen	 relative mass = 32
oxygen	 relative mass = 40
argon	 relative mass = 44
carbon dioxide	 relative mass = 28

[2]

(b) Which of the following statements about gases in the air are **true**?

Put ticks (✓) in the boxes next to the **two** correct answers.

- All of the gases in the air are elements. ☐
- Air contains only non-metal elements. ☐
- There are weak attractions between molecules in the air. ☐
- All the gases have high melting points and boiling points. ☐
- The gases are good conductors of electricity. ☐

[2]

7

- (c) Molecules in the air contain atoms that are held together by strong covalent bonds.

Which of the following statements are the **best** descriptions of covalent bonds in these molecules?

Put ticks (✓) in the boxes next to the **two** best answers.

A covalent bond is made by sharing electrons.

☐

The atoms gain positive or negative charges when the bond is made.

☐

The atoms are held together by the attractions between the nuclei of the atoms and the electrons between them.

☐

Each atom is surrounded by a sea of electrons that can move.

☐

The atoms are bonded covalently into large, three dimensional structures.

☐

[2]

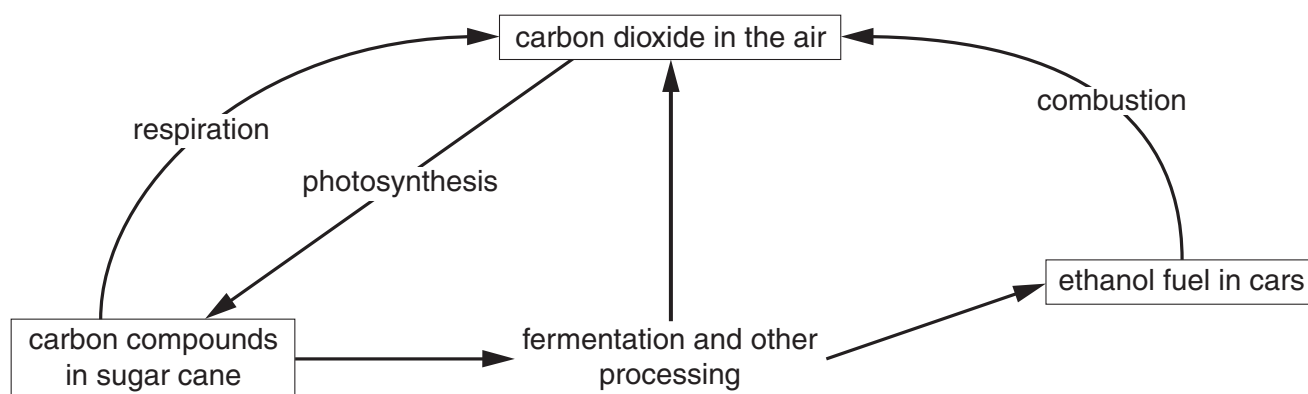
[Total: 6]

- 5 In some parts of the world ethanol is used as a fuel for cars.

Some people use ethanol because they say it is a **carbon neutral fuel**.

A carbon neutral fuel does not add to the amount of carbon dioxide in the air.

The diagram shows how the ethanol is made and used.



Use the diagram to explain why ethanol is a **carbon neutral fuel**.

.....

.....

.....

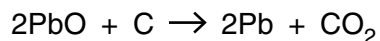
.....

..... [3]

[Total: 3]

- 6 Massicot is a mineral. It contains lead oxide, PbO.

Lead metal can be extracted from massicot by heating it with carbon.



- (a) What is the maximum mass of lead that can be extracted from 446 g of lead oxide?

Look up the relative atomic masses in the Periodic Table.

Start by working out the relative formula mass of lead oxide.

relative formula mass of lead oxide, PbO =

mass of lead that can be extracted from 446 g lead oxide =g
[3]

- (b) Aluminium is extracted from aluminium oxide, Al_2O_3 , by electrolysis.

Why is it **not** possible to extract aluminium by heating aluminium oxide with carbon?

Put a tick (✓) in the box next to the correct answer.

Too much carbon would be needed.

☐

Aluminium oxide contains more oxygen than other metal oxides.

☐

Aluminium is a very reactive metal.

☐

Aluminium oxide has a very high melting point.

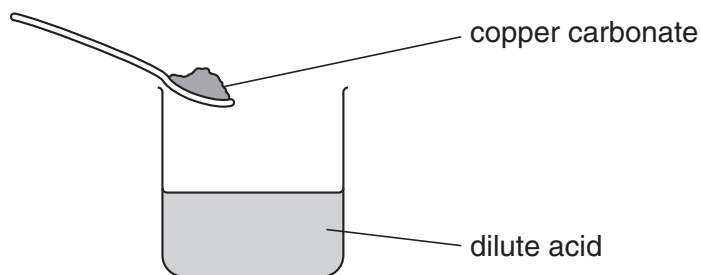
☐

[1]

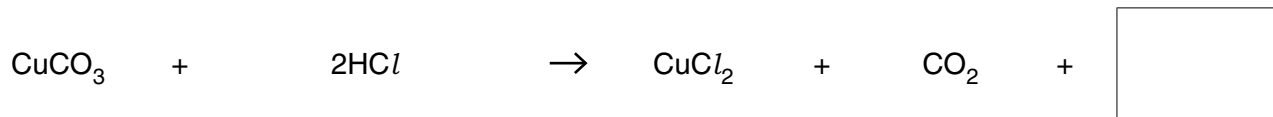
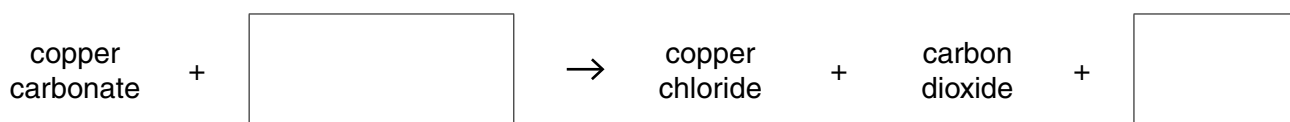
[Total: 4]

10

- 7 Sue reacts copper carbonate with a dilute acid to make copper chloride.



- (a) Complete the word and symbol equations for the reaction by filling in the empty boxes.



[2]

- (b) Which other chemicals react with the same dilute acid to form copper chloride?

Put rings around the **two** correct answers.

copper hydroxide copper nitrate copper oxide copper sulfate

[1]

- (c) Sue makes crystals from her solution. She makes 4.5 g of dry copper chloride crystals.

- (i) She calculates her percentage yield to be 90%.

What is the **theoretical** yield?

Put a ring around the correct answer.

0.05% 4.05 g 5 g 9 g 10% 45%

[1]

- (ii) Sue did not dry her crystals properly.

Her crystals contain 1.0 g of water.

Calculate Sue's percentage yield after she has dried her crystals properly.

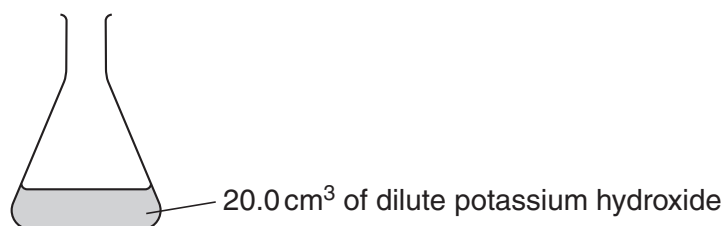
percentage yield = % [1]

[Total: 5]

11

- 8 Alex does a titration to find out the volume of sulfuric acid that reacts with 20.0cm^3 of dilute potassium hydroxide.

(a) Alex measures 20.0cm^3 of dilute potassium hydroxide into a flask.



Alex does titrations to find out the volume of acid that exactly reacts with the 20.0cm^3 of dilute potassium hydroxide.

Describe in detail how Alex does the titrations.

.....

.....

.....

.....

..... [4]

(b) Alex does some more titrations with different concentrations of sulfuric acid.

He uses 20.0cm^3 of the **same concentration of potassium hydroxide** every time.

The table shows some of Alex's results.

Concentration of sulfuric acid in g/dm^3	Volume of sulfuric acid needed to neutralise 20cm^3 potassium hydroxide in cm^3
10.0	80.0
20.0	
40.0	20.0
	13.3
80.0	10.0

Complete the table by filling in the two empty boxes.

[2]

12

(c) Alex knows that the reaction between the acid and the alkali is called neutralisation.

Complete the ionic equation for the neutralisation reaction.

Choose formulae from this list.

 H^+ H_2 OH^- H_2O O^{2-} O_2 

[2]

[Total: 8]

END OF QUESTION PAPER

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14

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The Periodic Table of the Elements

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16

1	2	Key										3	4	5	6	7	0		
		relative atomic mass atomic symbol name atomic (proton) number																1 H hydrogen 1	
7 Li lithium 3	9 Be beryllium 4																	4 He helium 2	
23 Na sodium 11	24 Mg magnesium 12																	19 F fluorine 9	
23 Na sodium 11	24 Mg magnesium 12																	16 O oxygen 8	
23 Na sodium 11	24 Mg magnesium 12																	14 N nitrogen 7	
23 Na sodium 11	24 Mg magnesium 12																	12 C carbon 6	
23 Na sodium 11	24 Mg magnesium 12																	11 B boron 5	
23 Na sodium 11	24 Mg magnesium 12																	10 Ne neon 10	
23 Na sodium 11	24 Mg magnesium 12																	35.5 Cl chlorine 17	
23 Na sodium 11	24 Mg magnesium 12																	32 S sulfur 16	
23 Na sodium 11	24 Mg magnesium 12																	31 P phosphorus 15	
23 Na sodium 11	24 Mg magnesium 12																	28 Si silicon 14	
23 Na sodium 11	24 Mg magnesium 12																	27 Al aluminium 13	
23 Na sodium 11	24 Mg magnesium 12																	20 Ca calcium 20	
23 Na sodium 11	24 Mg magnesium 12																	19 K potassium 19	
23 Na sodium 11	24 Mg magnesium 12																	18 Ar argon 18	
23 Na sodium 11	24 Mg magnesium 12																	17 Cl chlorine 17	
23 Na sodium 11	24 Mg magnesium 12																	16 S sulfur 16	
23 Na sodium 11	24 Mg magnesium 12																	15 P phosphorus 15	
23 Na sodium 11	24 Mg magnesium 12																	14 Si silicon 14	
23 Na sodium 11	24 Mg magnesium 12																	13 Al aluminium 13	
23 Na sodium 11	24 Mg magnesium 12																	12 C carbon 6	
23 Na sodium 11	24 Mg magnesium 12																	11 B boron 5	
23 Na sodium 11	24 Mg magnesium 12																	10 Ne neon 10	
23 Na sodium 11	24 Mg magnesium 12																	9 F fluorine 9	
23 Na sodium 11	24 Mg magnesium 12																	8 O oxygen 8	
23 Na sodium 11	24 Mg magnesium 12																	7 N nitrogen 7	
23 Na sodium 11	24 Mg magnesium 12																	6 C carbon 6	
23 Na sodium 11	24 Mg magnesium 12																	5 B boron 5	
23 Na sodium 11	24 Mg magnesium 12																	4 He helium 2	
23 Na sodium 11	24 Mg magnesium 12																	3 Li lithium 3	
23 Na sodium 11	24 Mg magnesium 12																	2 He helium 2	
23 Na sodium 11	24 Mg magnesium 12																	1 H hydrogen 1	
23 Na sodium 11	24 Mg magnesium 12																	0 	

16

Key

relative atomic mass
atomic symbol
name
atomic (proton) number

* The lanthanoids (atomic numbers 58-71) and the actinoids (atomic numbers 90-103) have been omitted.

The relative atomic masses of copper and chlorine have not been rounded to the nearest whole number.