Candidate forename		Candidate surname	

Centre number						Candidate number				

OXFORD CAMBRIDGE AND RSA EXAMINATIONS

GCSE

A322/02

TWENTY FIRST CENTURY SCIENCE

CHEMISTRY A

Unit 2: Modules C4 C5 C6 (Higher Tier)

MONDAY 25 JUNE 2012: Afternoon

DURATION: 40 minutes
plus your additional time allowance

MODIFIED ENLARGED

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)

READ INSTRUCTIONS OVERLEAF

DC (LEG/CGW) 12MEP06336 64236/3

INSTRUCTIONS TO CANDIDATES

- **Write your name, centre number and candidate number in the boxes on the first page. 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).**

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.**
- **An enlarged copy of the Periodic Table will be provided.**

BLANK PAGE

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]**

(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]

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]

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.

sodium + chlorine → sodium chloride

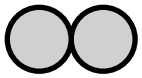
Write a balanced symbol equation for this reaction.

_____ **[2]**

[Total: 4]

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]

(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 opposite shows how the ethanol is made and used.

Use the diagram to explain why ethanol is a CARBON NEUTRAL FUEL.

_____

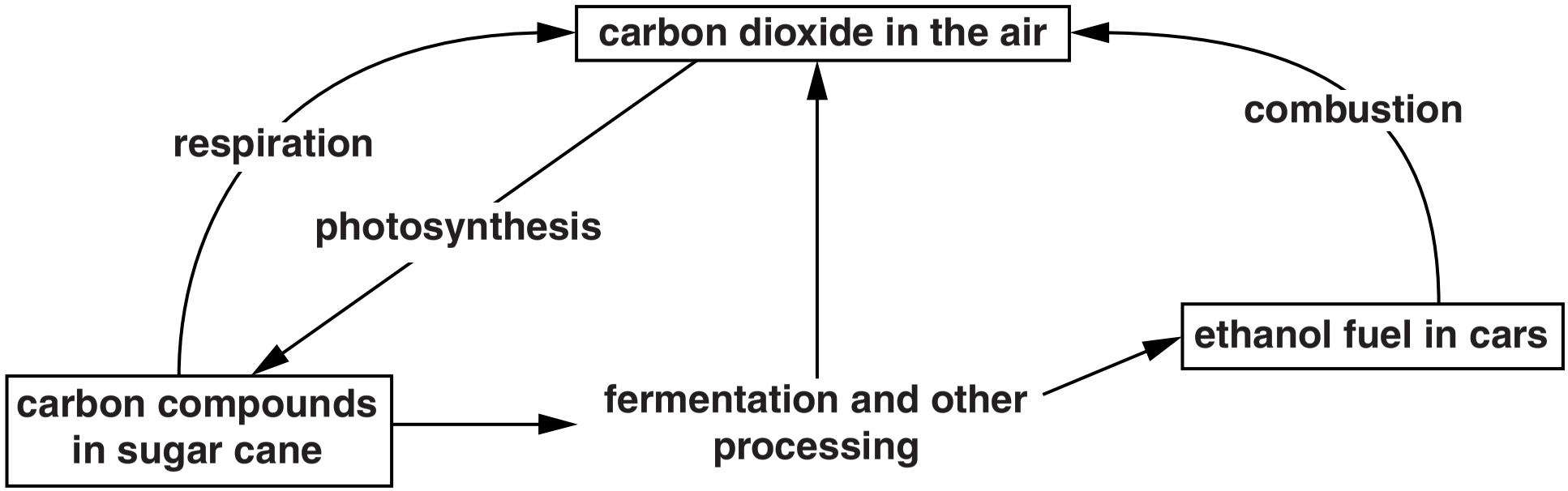
_____

_____

_____

_____ **[3]**

[Total: 3]


carbon dioxide in the air
respiration
photosynthesis
combustion
ethanol fuel in cars
carbon compounds in sugar cane
fermentation and other processing

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

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

$$2PbO + C \rightarrow 2Pb + CO_2$$

(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 provided.

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. ☐

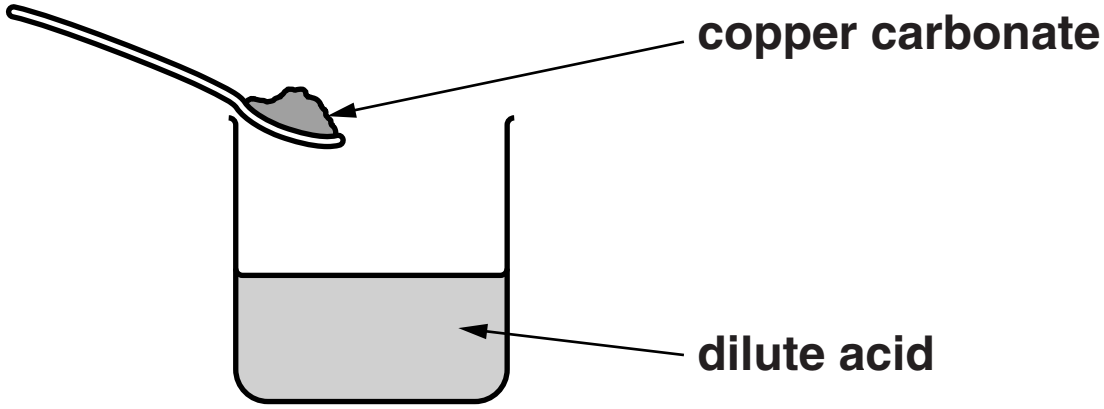
Aluminium is a very reactive metal. ☐

Aluminium oxide has a very high melting point. ☐

[1]

[Total: 4]

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.

copper carbonate + [ ] → copper chloride + carbon dioxide + [ ]

$$CuCO_3 + 2HCl \rightarrow CuCl_2 + CO_2 + \boxed{}$$

[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.

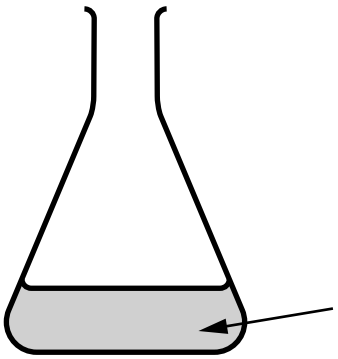
Calculate Sue's percentage yield after she has dried her crystals properly.

percentage yield = _____ % [1]

[Total: 5]

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

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



Alex does titrations to find out the volume of acid that exactly reacts with the 20.0 cm^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 20.0 cm^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 20 cm^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]**

(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