Candidate forename		Candidate surname	

Centre number						Candidate number				

OXFORD CAMBRIDGE AND RSA EXAMINATIONS
GENERAL CERTIFICATE OF SECONDARY EDUCATION

A322/01

TWENTY FIRST CENTURY SCIENCE
CHEMISTRY A

Unit 2: Modules C4 C5 C6 (Foundation Tier)

TUESDAY 28 JUNE 2011: Morning
DURATION: 40 minutes

SUITABLE FOR VISUALLY IMPAIRED CANDIDATES

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 (AC/SW) 11MEP06239 47201

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. Pencil may be used for graphs and diagrams only.**
- **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).**
- **Answer ALL the questions.**

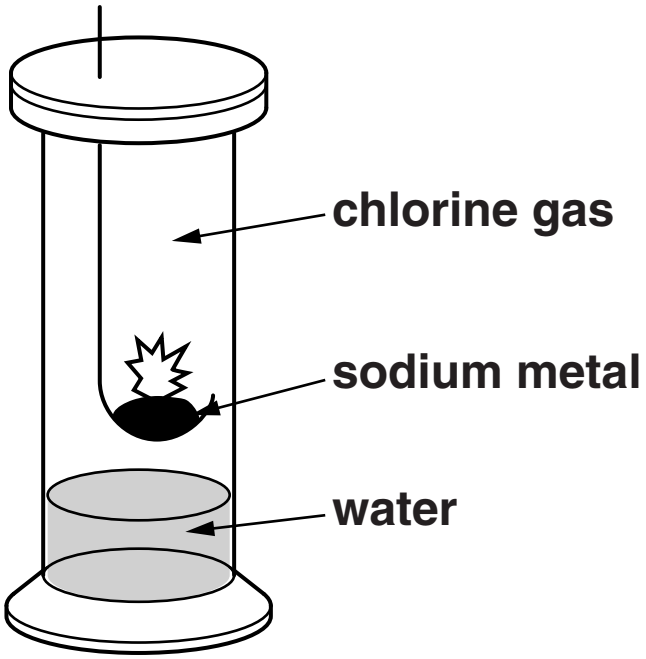
INFORMATION FOR CANDIDATES

- **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.**
- **The Periodic Table is provided.**

Answer ALL the questions.

1 Hot sodium metal reacts with chlorine gas to make sodium chloride.

Eve does the reaction in a gas jar that contains a small amount of water.



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

sodium + chlorine → [ ]

2 [ ] + Cl_2 → 2NaCl

[2]

(b) Which one of the following statements about chlorine is true?

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

Chlorine gas has two atoms in each molecule.	☐
Chlorine is a brown gas.	☐
It is not necessary to take any safety precautions when handling chlorine gas.	☐
Chlorine is an alkali metal.	☐

[1]

(c) Sodium chloride dissolves in water to make a solution.

What happens when sodium chloride dissolves in water?

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

The solid compound melts. ☐

The regular arrangement of ions breaks down. ☐

The ions get smaller. ☐

The ions move around in the water. ☐

The water changes colour. ☐

[2]

(d) Eve repeats the experiment using bromine instead of chlorine.

At room temperature, bromine is a liquid.

Draw a straight line from the correct STATE SYMBOL to BROMINE LIQUID.

Then draw a line from BROMINE LIQUID to the correct FORMULA.

STATE SYMBOL		FORMULA
		B_2
(s)		
		BR_2
(*l*)	BROMINE LIQUID	
		Be_2
(g)		
		Br_2

[2]

(e) Suggest the name of the product of the reaction between sodium and bromine.

Put a (ring) around the correct answer.

SODIUM HYDROXIDE

POTASSIUM BROMIDE

SODIUM BROMIDE

SODIUM CHLORIDE

[1]

[Total: 8]

2 This question is about Group 1 elements.

(a) Caesium is an element in Group 1.

Use the Periodic Table to find the SYMBOL and ATOMIC NUMBER for caesium.

The symbol for caesium is _____.

The atomic number of caesium is _____.

[1]

(b) Lithium (atomic number 3) and potassium (atomic number 19) are also Group 1 elements.

Compare the ATOMIC STRUCTURES of a lithium atom and a potassium atom.

How are they different and how are they similar?

_____

_____

_____

_____

_____

_____ **[4]**

(c) Dawn wants to find out whether a white compound contains lithium.

She carries out a flame test.

What should Dawn look for when she carries out her test?

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

How quickly the compound melts. ☐

The colour of the flame. ☐

Whether the compound burns. ☐

Whether a gas is given off. ☐

[1]

[Total: 6]

3 The compounds in the table can be used to improve soil for growing crops.

COMPOUND NAME	FORMULA
sodium phosphate	Na_3PO_4
sodium nitrate	$NaNO_3$
calcium hydroxide	$Ca(OH)_2$
_____ _____	K_2SO_4
potassium phosphate	K_3PO_4
calcium sulfate	$CaSO_4$

(a) Complete the table by filling in the NAME of the compound with the formula K_2SO_4. [1]

(b) Sometimes compounds are mixed to give a fertiliser that supplies NITROGEN, PHOSPHORUS and POTASSIUM to the soil.

Which two compounds could be used TOGETHER to make a fertiliser that contains all three elements?

Put (rings) around the TWO correct answers.

Na_3PO_4

$NaNO_3$

$CaSO_4$

$Ca(OH)_2$

K_2SO_4

K_3PO_4 **[1]**

(c) Acidic compounds in the soil produce ions that make the soil water acidic.

(i) Which ion is produced by all acids when they dissolve in water?

Put a (ring) around the correct answer.

Cl^-

H^+

OH^-

Na^+

SO_4^{2-} [1]

(ii) One of the compounds given in the table is added to soil to neutralise acids.
This compound dissolves in water to form an alkaline solution.
Which compound dissolves to form an alkaline solution?

Put a (ring) around the correct answer.

Na_3PO_4

$NaNO_3$

$Ca(OH)_2$

K_2SO_4

K_3PO_4 [1]

(d) Sam uses several steps to make some sodium nitrate crystals.

(i) Here are five steps Sam uses to make the crystals.
They are in the wrong order.

A carry out a risk assessment

B crystallise

C dry in an oven

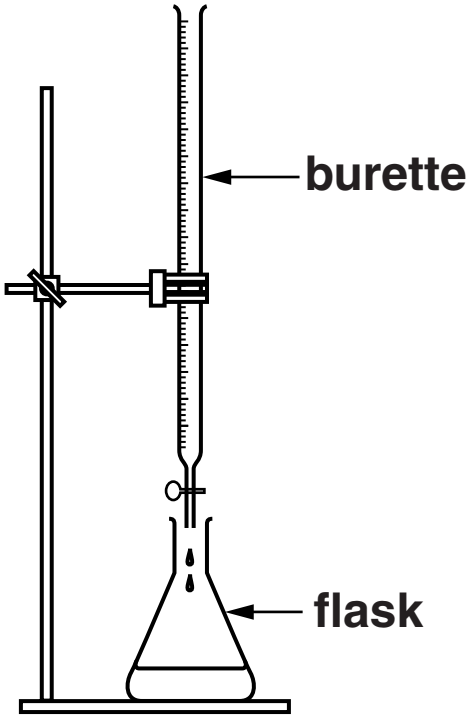
D react chemicals together

E heat to evaporate some water

Put the letters for the steps in the boxes below to show the correct order.

[2]

(ii) **Sam uses this apparatus to react the chemicals together.**



What is the name for this method?

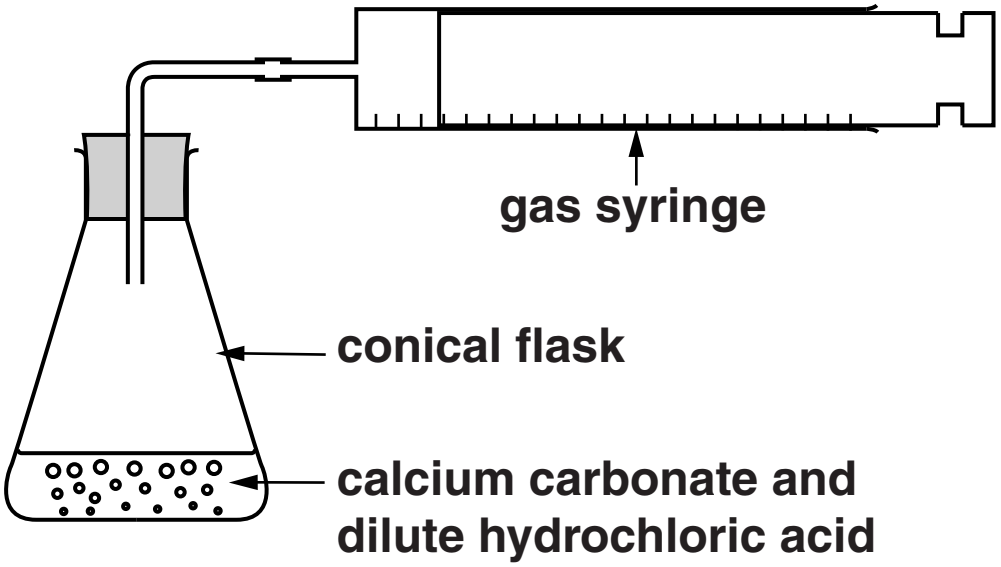
Put a tick (✓) in the box next to the correct answer.

filtration	☐
concentration	☐
oxidation	☐
titration	☐

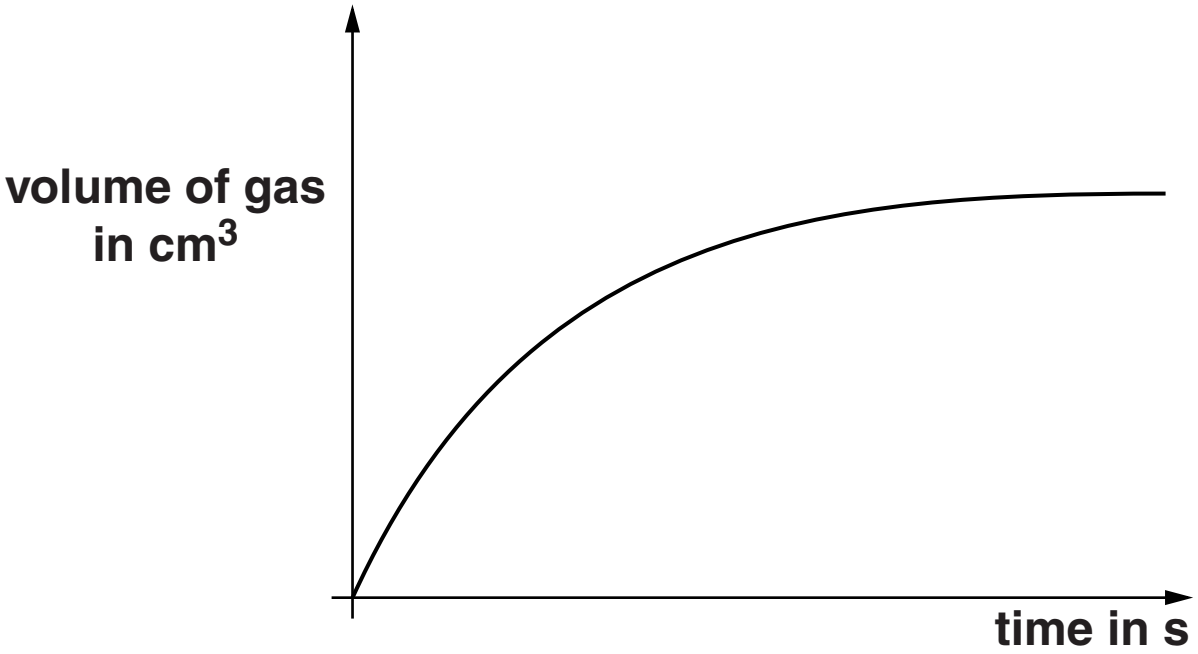
[1]

[Total: 7]

4 Jake carries out an experiment to investigate the rate of reaction between calcium carbonate and dilute hydrochloric acid.



This is a graph of Jake's results.



(a) What happens to the RATE of the reaction during the experiment?

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

slows down then speeds up ☐

stays constant all the time ☐

starts fast and slows down ☐

keeps getting faster ☐

[1]

(b) Jake uses these conditions for his first experiment.

CONDITIONS FOR EXPERIMENT 1
acid: dilute hydrochloric acid
calcium carbonate: 5 g, large pieces
temperature: 20 °C

Jake does the experiment again. He wants to make the reaction happen faster.
He does not want to change the volume of acid or the mass of calcium carbonate.

Suggest TWO ways that Jake could change the conditions to make the reaction faster.

_____

_____

_____

_____ **[2]**

(c) Jake uses universal indicator to measure the pH of the acid at the start of the experiment.
Write instructions to tell Jake how to use universal indicator to measure pH.

_____

_____

_____ **[2]**

(d) Jake writes word and symbol equations for the reaction of calcium carbonate with hydrochloric acid.

Complete the equations by filling in the boxes.

calcium carbonate + hydrochloric acid → [ ] + [ ] + water

$$CaCO_3 + 2HCl \rightarrow CaCl_2 + CO_2 + \square$$

[3]

[Total: 8]

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5 The tables give information about the elements in the air and in the Earth's crust.

ELEMENTS IN THE AIR	
ELEMENT	**PERCENTAGE**
nitrogen	78%
oxygen	21%
other gases (including carbon dioxide)	1%

ELEMENTS IN THE EARTH'S CRUST	
ELEMENT	**PERCENTAGE**
silicon	47%
oxygen	28%
aluminium	8%
all other elements (including iron)	_____ %

(a) (i) Complete the table to show the percentage of all other elements in the Earth's crust. [1]

(ii) Which of the following statements are TRUE and which are FALSE?
Use information from the tables to help you.

Put a tick (✓) in one box in each row.

STATEMENT	TRUE	FALSE
There is more oxygen than nitrogen in the air.		
There is more oxygen than nitrogen in the Earth's crust.		
None of the elements in the air are also in the Earth's crust.		
Some of the elements in the Earth's crust are metals.		

[2]

(b) Which of the chemicals in the table below are elements and which are compounds?

Put ticks (✓) in the correct boxes.

CHEMICALS	FORMULA	ELEMENT	COMPOUND
oxygen	O_2		
nitrogen	N_2		
carbon dioxide	CO_2		
silicon dioxide	SiO_2		

[2]

(c) The boxes show how atoms are arranged in some of the chemicals in the air and in the Earth's crust.

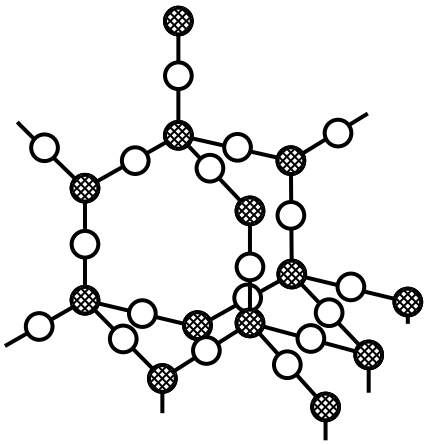
In the air.

oxygen 

nitrogen 

carbon dioxide 

In the Earth's crust silicon and oxygen are mainly found as silicon dioxide.



(i) Draw straight lines from OXYGEN to show its TYPE OF BONDING and its STRUCTURE.

TYPE OF BONDING		STRUCTURE
ionic		atoms held together in a lattice
covalent	OXYGEN	small molecules
metallic		ions with opposite charges attracted to each other

[1]

(ii) Draw straight lines from SILICON DIOXIDE to show its TYPE OF BONDING and its STRUCTURE.

TYPE OF BONDING		STRUCTURE
ionic		atoms held together in a lattice
covalent	SILICON DIOXIDE	small molecules
metallic		ions with opposite charges attracted to each other

[1]

(iii) Complete the sentences about the properties of silicon dioxide.

Put a (ring) around the correct word in each line.

Silicon dioxide has a HIGH / LOW melting point.

Silicon dioxide is very HARD / SOFT.

Silicon dioxide is a GOOD / POOR electrical conductor.

Silicon dioxide DISSOLVES / DOES NOT DISSOLVE in water.

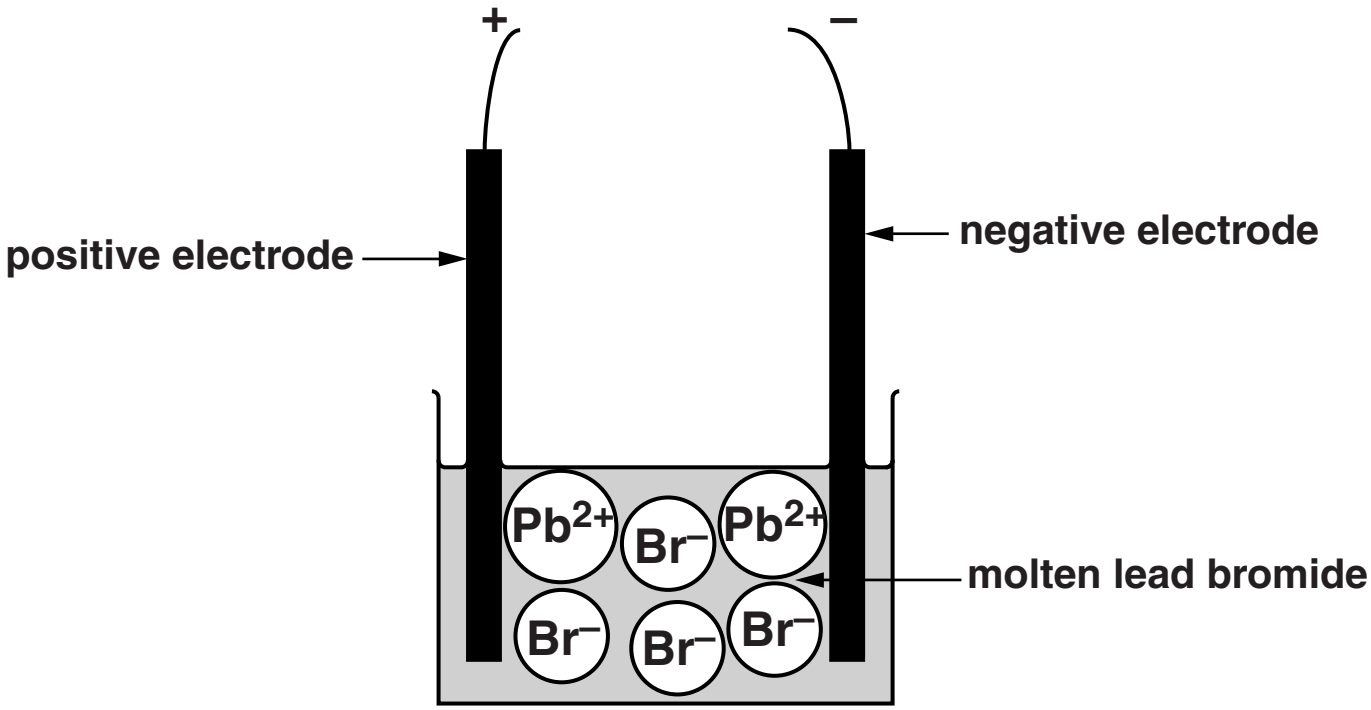
[2]

[Total: 9]

6 Joe does an electrolysis experiment.

He heats some solid lead bromide until it melts.

The diagram shows lead ions and bromide ions.



(a) Joe switches on the electric current.

What happens to the lead ions and the bromide ions?

_____

_____

_____

_____

_____ **[3]**

(b) Lead metal is made during the electrolysis of lead bromide.

What other product is made at the same time?

Put a (ring) around the correct answer.

ACID

BROMINE

HYDROGEN

OXYGEN

WATER **[1]**

[Total: 4]

END OF QUESTION PAPER

The Periodic Table of the Elements

1	2											3	4	5	6	7	0
							1 **H** hydrogen 1										4 **He** helium 2
7 **Li** lithium 3	9 **Be** beryllium 4											11 **B** boron 5	12 **C** carbon 6	14 **N** nitrogen 7	16 **O** oxygen 8	19 **F** fluorine 9	20 **Ne** neon 10
23 **Na** sodium 11	24 **Mg** magnesium 12											27 **Al** aluminium 13	28 **Si** silicon 14	31 **P** phosphorus 15	32 **S** sulfur 16	35.5 **Cl** chlorine 17	40 **Ar** argon 18
39 **K** potassium 19	40 **Ca** calcium 20	45 **Sc** scandium 21	48 **Ti** titanium 22	51 **V** vanadium 23	52 **Cr** chromium 24	55 **Mn** manganese 25	56 **Fe** iron 26	59 **Co** cobalt 27	59 **Ni** nickel 28	63.5 **Cu** copper 29	65 **Zn** zinc 30	70 **Ga** gallium 31	73 **Ge** germanium 32	75 **As** arsenic 33	79 **Se** selenium 34	80 **Br** bromine 35	84 **Kr** krypton 36
85 **Rb** rubidium 37	88 **Sr** strontium 38	89 **Y** yttrium 39	91 **Zr** zirconium 40	93 **Nb** niobium 41	96 **Mo** molybdenum 42	[98] **Tc** technetium 43	101 **Ru** ruthenium 44	103 **Rh** rhodium 45	106 **Pd** palladium 46	108 **Ag** silver 47	112 **Cd** cadmium 48	115 **In** indium 49	119 **Sn** tin 50	122 **Sb** antimony 51	128 **Te** tellurium 52	127 **I** iodine 53	131 **Xe** xenon 54
133 **Cs** caesium 55	137 **Ba** barium 56	139 **La*** lanthanum 57	178 **Hf** hafnium 72	181 **Ta** tantalum 73	184 **W** tungsten 74	186 **Re** rhenium 75	190 **Os** osmium 76	192 **Ir** iridium 77	195 **Pt** platinum 78	197 **Au** gold 79	201 **Hg** mercury 80	204 **Tl** thallium 81	207 **Pb** lead 82	209 **Bi** bismuth 83	[209] **Po** polonium 84	[210] **At** astatine 85	[222] **Rn** radon 86
[223] **Fr** francium 87	[226] **Ra** radium 88	[227] **Ac*** actinium 89	[261] **Rf** rutherfordium 104	[262] **Db** dubnium 105	[266] **Sg** seaborgium 106	[264] **Bh** bohrium 107	[277] **Hs** hassium 108	[268] **Mt** meitnerium 109	[271] **Ds** darmstadtium 110	[272] **Rg** roentgenium 111	Elements with atomic numbers 112-116 have been reported but not fully authenticated						

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.*