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| 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)

WEDNESDAY 27 JANUARY 2010: Afternoon

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

INSTRUCTIONS TO CANDIDATES

- **Write your name clearly in capital letters, your Centre Number and Candidate Number in the boxes on the first page.**
- **Use black ink. Pencil may be used for graphs and diagrams only.**
- **Read each question carefully and make sure that you know what you have to do before starting your answer.**
- **Answer ALL the questions.**
- **Write your answer to each question in the space provided, however additional paper may be used if necessary.**

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.**
- **A copy of the Periodic Table is provided.**

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Answer ALL the questions.

- 1 (a) The diagram on page 5 opposite shows the Periodic Table.

Complete the labels on the diagram.

Choose words from this list.

ELEMENT

GROUP

METAL

PERIOD

SERIES

[1]

- (b) Complete the information about calcium.

Use the Periodic Table provided to help you.

NAME

calcium

GROUP

SYMBOL

Ca

ATOMIC (PROTON) NUMBER

[1]

I

[illegible]

5

(ii) Which element is a non-metal?

Put a ring around the correct answer.

CARBON

GALLIUM

MAGNESIUM

POTASSIUM

[1]

[Total: 4]

2 Liz makes some notes about the properties of some elements in Group 1, as shown on page 9 opposite.

(a) Explain how Liz could use her notes to predict the properties of potassium.

[2]

(b) Describe TWO patterns in the properties of Group 1 elements shown by the information.

[2]

Group 1

| | | | |
|----------------------|---------------------|-----------------------|-----------------------|
| lithium Li | sodium Na | potassium K | rubidium Rb |
|----------------------|---------------------|-----------------------|-----------------------|

Lithium

Atomic number: 3
Melting point: 181°C
Density: 0.53 g/cm³

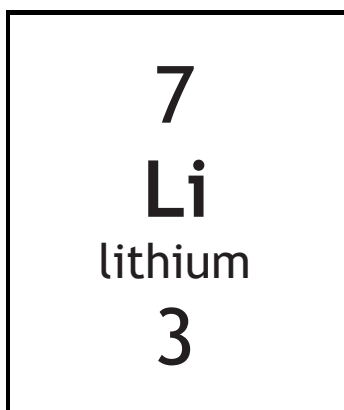
Rubidium

Atomic number: 37
Melting point: 39°C
Density: 1.53 g/cm³

Sodium

Atomic number: 11
Melting point: 98°C
Density: 0.97 g/cm³

- (c) This is the information for lithium on the Periodic Table.



Complete the sentences about the structure of a lithium atom.

Choose words from this list.

ELEMENTS

IONS

MOLECULES

NEUTRONS

PROTONS

The shells around a lithium nucleus contain three

_____ .

The central nucleus of the atom is made up of three

and four _____ .

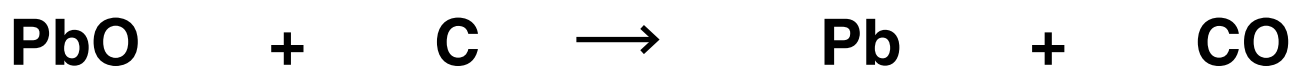
[2]

[Total: 6]

3 Some types of car batteries contain metals such as lead.

(a) Lead can be extracted by heating lead oxide with carbon.

The equation shows what happens when lead oxide is heated with carbon.



(i) Which statement about the reaction is true?

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

The reaction involves only oxidation.

☐

The reaction involves only reduction.

☐

The reaction involves both oxidation and reduction.

☐

The reaction does not involve either oxidation or reduction.

☐

[1]

- (ii) Which other metals can be extracted by heating their oxides with carbon?

Put a ring around each of the TWO correct answers.

ALUMINIUM

COPPER

POTASSIUM

SODIUM

ZINC

[2]

Some car batteries also contain small amounts of other metals including lithium and calcium.

(b) Lithium cannot be extracted by heating lithium oxide with carbon.

Which of the statements gives the BEST reason for this?

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

Lithium metal reacts with water.

☐

Lithium oxide is ionic.

☐

Lithium is very reactive.

☐

Lithium oxide has a very high melting point.

☐

[1]

(c) Calcium can be extracted using electrolysis.

Complete the passage about the extraction of calcium.

Choose words from this list.

ELECTRODES

EVAPORATES

IONS

MELTS

MOLECULES

NEGATIVE

NEUTRAL

POSITIVE

Calcium oxide is heated until it

_____.

This allows the _____ to move.

During electrolysis calcium metal collects at the

_____ electrode.

Oxygen gas is made at the

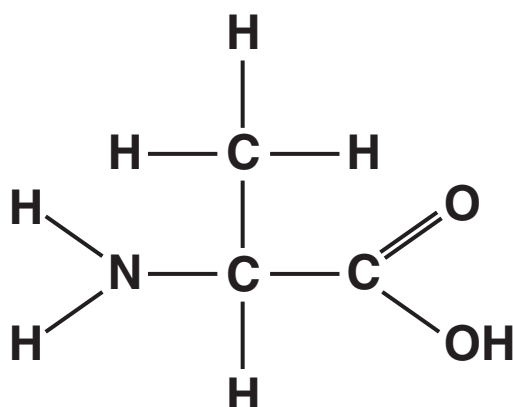
_____ electrode.

[3]

[Total: 7]

- 4 Proteins in the human body are formed from amino acids.

The diagram shows the structure of an amino acid.



The table below shows some information about the elements in the amino acid.

Complete the table by filling in the three empty boxes.

| NAME OF ELEMENT | NUMBER OF ATOMS IN MOLECULE | PERCENTAGE (%) BY MASS |
|-----------------|-----------------------------|------------------------|
| carbon | 3 | 40 |
| oxygen | 2 | 36 |
| _____ | 1 | 16 |
| hydrogen | _____ | _____ |

[3]

[Total: 3]

5 Space probes have gathered data about the atmosphere on Mars.

The table compares the gases in the atmosphere on Mars and on Earth.

| NAME OF GAS | PERCENTAGE (%) IN ATMOSPHERE ON MARS | PERCENTAGE (%) IN ATMOSPHERE ON EARTH |
|-----------------------|---|--|
| carbon dioxide | 95.3 | less than 1.0 |
| nitrogen | 2.7 | 78.0 |
| argon | 1.6 | 0.9 |
| oxygen | 0.2 | 20.7 |

(a) Put ticks (✓) in the correct boxes to show whether each gas is an element or a compound.

| <u>NAME OF GAS</u> | <u>ELEMENT</u> | <u>COMPOUND</u> |
|---------------------------|--------------------------|--------------------------|
| carbon dioxide | <input type="checkbox"/> | <input type="checkbox"/> |
| nitrogen | <input type="checkbox"/> | <input type="checkbox"/> |
| argon | <input type="checkbox"/> | <input type="checkbox"/> |
| oxygen | <input type="checkbox"/> | <input type="checkbox"/> |

[2]

(b) Look at the table.

Describe two ways that the atmospheres of Mars and Earth are SIMILAR and two ways that they are DIFFERENT.

[4]

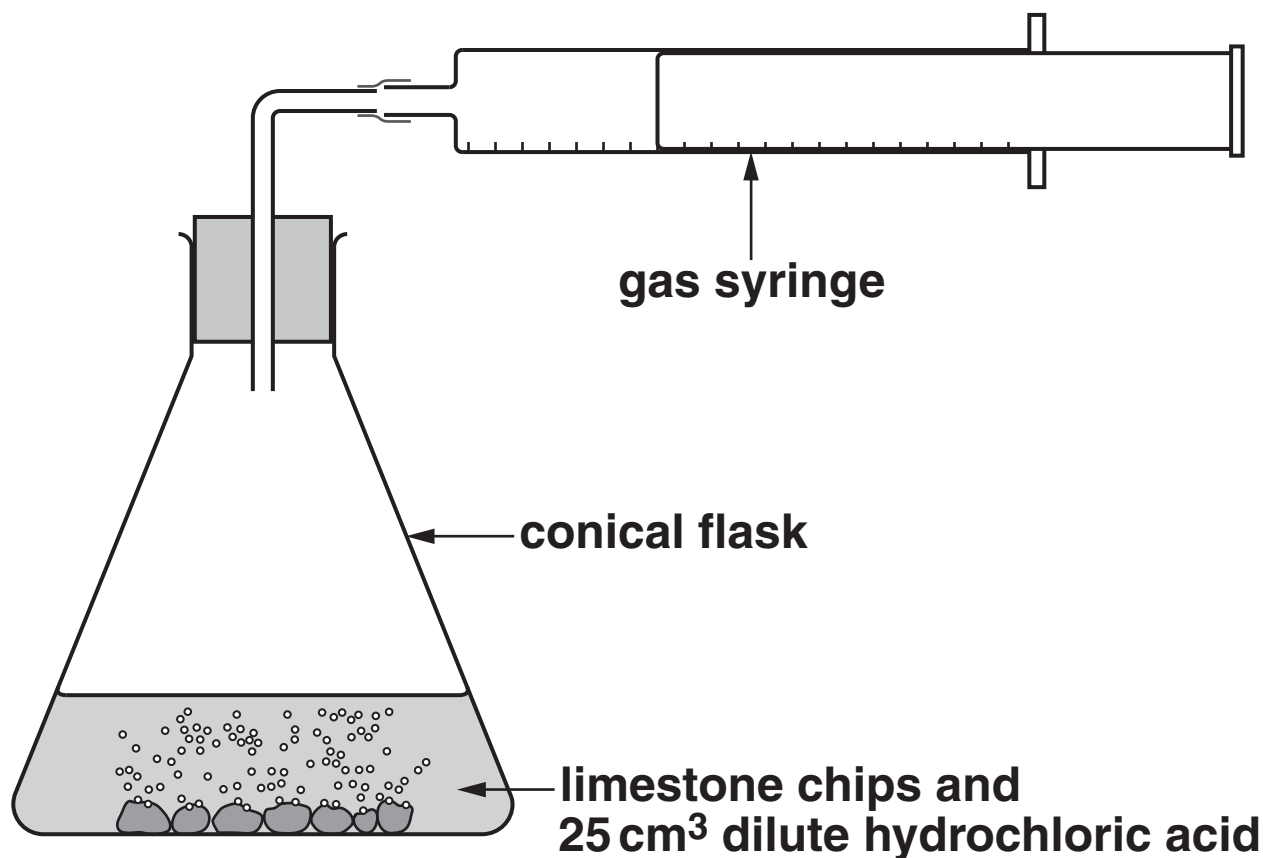
(c) The percentages in the table for gases on Mars do not add up to 100%.

Suggest a reason why.

[1]

[Total: 7]

- 6 Eve carries out an experiment. She adds 25 cm^3 of dilute hydrochloric acid to limestone chips (calcium carbonate). Once every 30 seconds she records the total volume of gas that has been given off.



The table shows her results.

| TIME IN s | TOTAL VOLUME OF GAS IN cm^3 |
|-----------|--------------------------------------|
| 0 | 0 |
| 30 | 80 |
| 60 | 120 |
| 90 | 140 |
| 120 | 150 |
| 150 | 150 |

- (a) (i) How long does it take for the reaction to finish?

answer _____ s [1]

- (ii) When the reaction ends, lumps of limestone are left in the flask.

Why does the reaction stop?

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

The temperature cools during the reaction.

☐

All the gas has been used up.

☐

All the acid has been used up.

☐

The limestone chips become unreactive.

☐

[1]

- (b) During the reaction, solid calcium carbonate reacts with dilute hydrochloric acid and the gas syringe fills with a gas.

At the end of the experiment the flask contains a solution of calcium chloride in water.

- (i) What is the name of the gas made during the reaction?

Put a ring around the correct answer.

CARBON DIOXIDE

CARBON MONOXIDE

HYDROGEN

NITROGEN

OXYGEN

[1]

(ii) Draw a line from each CHEMICAL to the correct STATE symbol.

CHEMICALSTATE
SYMBOL

water

(s)

calcium carbonate

(g)

gas made in the reaction

(aq)

calcium chloride solution

(l)

[2]

(iii) Draw a line from each CHEMICAL to the correct FORMULA.

CHEMICALFORMULA

water

 CaCO_3

calcium carbonate

 H_2O

hydrochloric acid

 CaCl_2

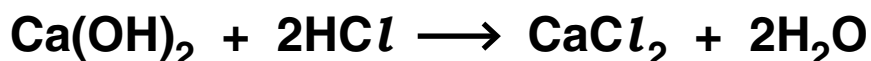
calcium chloride

 HCl

[2]

[Total: 7]

- 7 Joe carries out an experiment to make a salt. He makes calcium chloride by reacting calcium hydroxide with dilute hydrochloric acid.



- (a) Joe works out what mass of calcium chloride he can make.

The box below shows some of Joe's working.

Complete Joe's working by filling in the gaps.

| | RELATIVE ATOMIC MASS |
|-----------|-------------------------|
| Ca | _____ |
| O | _____ |
| H | _____ |
| Cl | 35.5 |

relative formula mass of $\text{Ca(OH)}_2 = 74$

relative formula mass of $\text{CaCl}_2 =$

[2]

- (b) The reaction between calcium hydroxide and hydrochloric acid is a neutralisation reaction.

Which ion is always present in a solution of an alkali?

Put a **ring** around the correct answer in this list.



[1]

- (c) Write the general equation for a neutralisation reaction by filling in the boxes.

Choose from the formulae in this list.



[1]

[Total: 4]

- 8 Sam works for a medicine company.
The company makes zinc sulfate for use in medicines.
She makes some zinc sulfate crystals from zinc sulfate solution.
She measures the mass after each step.**

The flow chart on page 25 opposite shows what she does.

- (a) What happens to the mass of zinc sulfate solution during STEP 1?
Explain why.**

_____ [2]

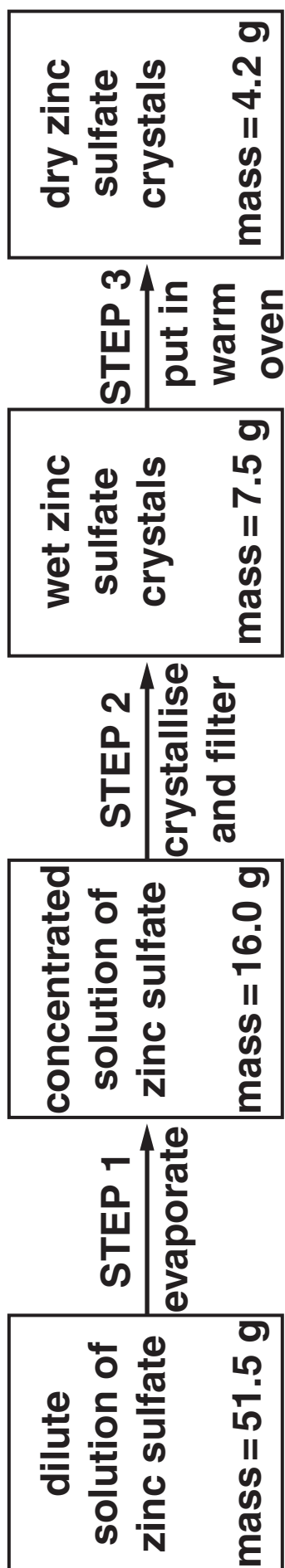
- (b) Suggest why the crystals were put in a warm oven.**
_____ [1]

- (c) What is the actual yield from the experiment?**

answer _____ g [1]

[Total: 4]

END OF QUESTION PAPER



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The Periodic Table of the Elements

| | | | | | | | | | | | | | | | | | | |
|-------------------------------|-----------------------------|---|-------------------------------------|-------------------------------|----------------------------------|--------------------------------|-------------------------------|----------------------------------|------------------------------------|-----------------------------------|---|-----------------------------|-----------------------------|-----------------------------|-------------------------------|-------------------------------|----------------------------|--|
| 1 | 2 | Key | | | | | | | | | | 3 | 4 | 5 | 6 | 7 | 0 | |
| | | relative atomic mass atomic symbol name atomic (proton) number | | | | | | | | | | | | | | | | |
| 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

1
H
hydrogen
1

* 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.