

# 5<sup>th</sup> Year

## Separate Award Paper 1

### Chemistry



REIGATE GRAMMAR SCHOOL

### Practice Paper 1

**Instructions:**

Attempt **ALL** the questions.

Make your answers in the spaces provided on the question paper.

Mark allocations are given in brackets.

This exam paper consists of 16 questions plus a  
**PERIODIC TABLE AT THE BACK**

**Total / 130 Marks**

1. The element bromine exists as a mixture of two isotopes.

a) i) Complete the table to show the number of protons and neutrons in the nuclei of the two isotopes of bromine.

Atomic number of isotope	Mass number of isotope	Number of protons	Number of neutrons
35	79	.....	.....
35	81	.....	.....

[3]

ii) The relative atomic mass of bromine is 80.

Deduce the percentage abundance of the two isotopes in bromine.

.....

.....

[1]

b) Bromine water is used as a test to distinguish alkenes from alkanes.

i) Give the name and structure, showing all covalent bonds, of the alkene containing three carbon atoms.

.....

[3]

ii) State the colour change when bromine water is shaken with an alkene.

Initial colour .....

Final colour .....

[2]

iii) Predict what you would **see** if bromine water were added to a sample of poly(ethene). Explain your answer in terms of the bonding in poly(ethene).

Prediction .....

.....

Explanation .....

.....

[2]

**(Total 11 marks)**

2. Lithium and carbon are in the same period in the periodic table.  
Lithium is a metal and carbon is a non-metal.

In terms of the structure of lithium,

- a) i) explain why lithium is malleable.

.....  
.....  
.....

[1]

- ii) explain how lithium conducts an electric current.

.....  
.....  
.....

[1]

- b) One form of carbon is graphite.

The carbon atoms in graphite are joined by covalent bonds.

- i) Describe how a covalent bond is formed between two carbon atoms.

.....  
.....

[2]

- ii) Describe the structure of graphite and explain how it is able to conduct an electric current.

.....  
.....  
.....  
.....

[3]

- iii) Explain why diamond and graphite have extremely high sublimation temperatures.

.....  
.....  
.....  
.....

[3]

**(Total 10 marks)**

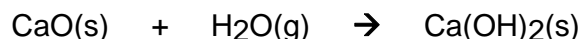
3. a) Calcium oxide is held together by ionic bonds.  
Draw a dot and cross diagram to show the bonding in calcium oxide.  
You need only show the outer electrons.

[3]

- b) Water is held together by covalent bonds.  
Draw a dot and cross diagram to show the bonding in water.  
You need only show the outer electrons.

[3]

- c) In industry calcium oxide is often used to remove water vapour from gas mixtures.  
The water reacts to form calcium hydroxide.  
The equation for the reaction of calcium oxide with water vapour is



- i) Calculate the relative formula masses of calcium oxide and water.  
(Relative atomic masses: H = 1.0; O = 16; Ca = 40)

calcium oxide .....

water .....

[2]

- ii) Use your answers to part (i) to calculate the minimum mass of water vapour needed to react with 100g of calcium oxide.

.....  
.....  
.....  
.....

[3]

Carbon dioxide vapour can also be removed from gas mixtures by passing them over calcium oxide. The carbon dioxide forms calcium carbonate.

- d) Write the balanced equation for the reaction between calcium oxide and carbon dioxide.

.....

[2]

**(Total 13 marks)**

4. Crude oil is an important raw material but it needs to be refined to obtain useful products. One stage in oil refining is fractional distillation. The larger hydrocarbon molecules obtained from the fractional distillation of oil are then subjected to a process known as cracking.

a) What is meant by a 'hydrocarbon'?

.....  
.....

[1]

b) What is meant by 'cracking'?

.....  
.....  
.....

[2]

Poly(ethene) can be made from ethane, a common product from cracking.

c) i) Draw the structure of a molecule of ethene, showing all bonds.

[2]

ii) Draw the repeating unit of a poly(ethene) molecule, showing all bonds.

iv) Explain how molecules of ethene combine to form a poly(ethene) molecule.

[2]

.....  
.....  
.....

[2]

**(Total 9 marks)**

5. This question is about alkali metals and their compounds.

a) An alkali metal (**X**) reacts violently with water. A gas (**Y**) and a solution (**Z**) are formed during this reaction. A lilac-coloured flame is seen.

i) Name the substances **X**, **Y** and **Z**.

alkali metal **X** .....

gas **Y** .....

solution **Z** ..... [3]

ii) State what you SEE when Universal indicator is added to solution **Z**.  
Give a reason for your answer.

.....

..... [2]

b) Find lithium (atomic number 3) in the periodic table.

i) Name a non-metal **in the same period** as lithium.

..... [1]

ii) Name another metal **in the same period** as lithium.

..... [1]

**(Total 7 marks)**

6. Name the gas which

a) relights a glowing splint ..... [1]

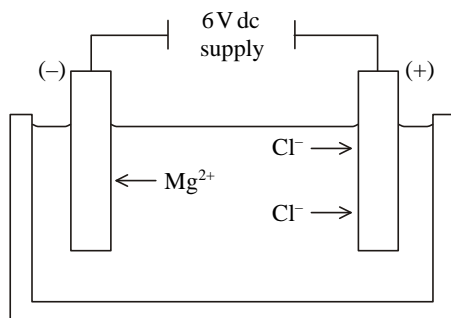
b) turns damp red litmus paper blue ..... [1]

c) turns blue cobalt chloride pink ..... [1]

d) gives a squeaky pop when ignited ..... [1]

**(Total 4 marks)**

7. Magnesium is extracted by the electrolysis of molten magnesium chloride. A simplified diagram of the electrolysis of molten magnesium chloride is shown.



- a) Write the balanced half-equation for the reaction at the negative electrode.  
 ..... [2]
- b) Why must solid magnesium chloride be melted for electrolysis to occur?  
 .....  
 ..... [1]

The most common ore of aluminium is aluminium oxide, bauxite. Aluminium is also extracted from its ore using molten electrolysis. Cryolite is added to the aluminium oxide before electrolysis takes place.

- c) i) What is the chemical formula of aluminium oxide?  
 ..... [1]
- ii) Explain why Cryolite is added to the alumina before electrolysis takes place.  
 .....  
 ..... [2]

Oxide ions are discharged at the anode to form oxygen gas  $2\text{O}^{2-}(\text{g}) \rightarrow \text{O}_2(\text{g}) + 4\text{e}^-$

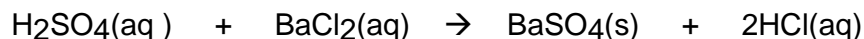
- iii) Why is the reaction at the anode classified as oxidation?  
 ..... [1]
- iv) Explain why the anodes have to be replaced on a regular basis.  
 .....  
 ..... [2]

- d) Explain why aluminium cannot be extracted from bauxite using carbon reduction.  
 .....  
 ..... [1]

**(Total 10 marks)**

8. a) Dilute sulphuric acid and barium chloride solution react to form barium sulphate.

The equation for this reaction is



When an excess of barium chloride solution was added to 100 cm<sup>3</sup> of dilute sulphuric acid, 2.80 g of barium sulphate was formed.

i) Calculate the number of moles of barium sulphate, BaSO<sub>4</sub>, present in the 2.80 g.  
(Relative atomic masses: O = 16; S = 32; Ba = 137)

.....  
..... [2]

ii) Use your answer to part i) to find the number of moles of sulphuric acid, H<sub>2</sub>SO<sub>4</sub>, present in 100 cm<sup>3</sup> of the acid.

..... [1]

iii) Calculate the concentration of dilute sulphuric acid (H<sub>2</sub>SO<sub>4</sub>) in mol dm<sup>-3</sup>.

.....  
..... [2]

b) The concentration of the dilute sulphuric acid could also be found by titration.

The first step is to pipette 25.0 cm<sup>3</sup> of sodium hydroxide solution of known concentration into a conical flask.

Describe how the titration is carried out.

.....  
.....  
.....  
.....  
.....  
.....  
..... [3]

c) Suggest one advantage of the titration method over the method in part a) for finding the concentration of the sulphuric acid.

.....  
..... [1]

**(Total 9 marks)**



9. Two students made the insoluble salt, lead sulphate, and wrote these notes about the experiment.

*'We took 25 cm<sup>3</sup> of lead nitrate solution and slowly added 25cm<sup>3</sup> of acid to it.  
The mixture turned cloudy white.  
We stirred the mixture and filtered it to obtain the solid lead sulphate.'*

a) Describe **one** safety precaution which the students should take during this experiment.

.....  
.....

[1]

b) i) Which acid was added to lead nitrate solution to make lead sulphate?

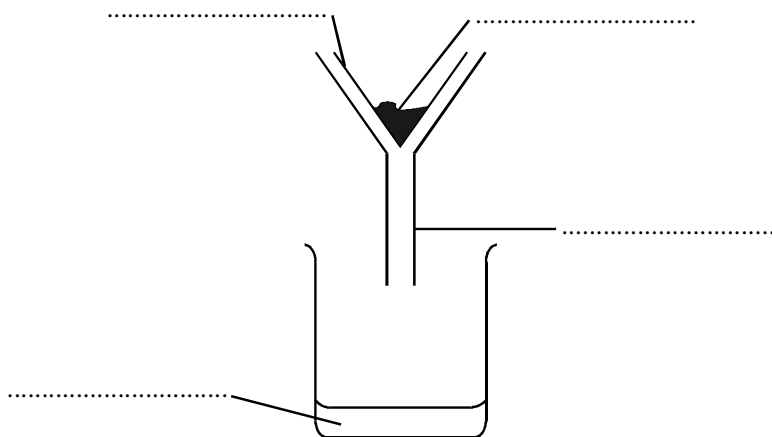
- A** hydrochloric acid
- B** nitric acid
- C** sulphuric acid

Write the correct answer (**A**, **B**, or **C**) in the space provided. .... [1]

ii) Draw, and name, the piece of apparatus that should be used to measure 25 cm<sup>3</sup> of the acid.

[2]

c) Label the diagram below which shows the mixture being filtered to obtain solid lead sulphate.



[4]

**(Total 8 marks)**

10. Tests were carried out on colourless solutions of **X** and **Y**.

a) Tests on the solution of **X**

Some of the solution was mixed with an equal volume of sodium hydroxide solution and boiled. A pungent smelling gas, which turned moist universal indicator paper purple, was given off.

The rest of the solution was mixed with an equal volume of dilute nitric acid followed by a few drops of silver nitrate solution. A white precipitate formed.

i) Name the gas given off when the solution of **X** was heated with sodium hydroxide solution.

..... [1]

ii) Name the cation present in **X**.

..... [1]

iii) Name the white precipitate formed when the acidified solution of **X** reacted with silver nitrate solution.

..... [1]

iv) Name the anion present in **X**.

..... [1]

b) Tests on the solution of **Y**

Some of the solution was mixed with an equal volume of dilute hydrochloric acid followed by a few drops of barium chloride solution. A white precipitate formed.

The rest of the solution was evaporated to dryness. The solid gave a lilac flame test.

i) Name the white precipitate.

..... [1]

ii) Give the name of **Y**.

..... [1]

iii) Describe how you would carry out a flame test on a solid.

.....  
.....  
.....  
.....  
..... [2]

**(Total 8 marks)**