



Sixth Form Scholarship Examination

Chemistry

Please enter your name here: _____

Time allowed: 1 hour 30 minutes

Instructions:

You are asked to attempt **ALL** the questions in the spaces provided. Should you need more space, write your extended answer on lined paper and include this sheet with this examination booklet.

For Information we provide on the next two pages:

- A Data Sheet
- Periodic Table

The questions start after that.

Data Sheet

1. Reactivity Series of Metals

Potassium Sodium Calcium Magnesium Aluminium <i>Carbon</i> Zinc Iron Tin Lead <i>Hydrogen</i> Copper Silver Gold Platinum	most reactive least reactive
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(elements in italics, though non-metals, have been included for comparison)

2. Formulae of Some Common Ions

Positive ions		Negative ions	
Name	Formula	Name	Formula
Hydrogen	H ⁺	Chloride	Cl ⁻
Sodium	Na ⁺	Bromide	Br ⁻
Silver	Ag ⁺	Fluoride	F ⁻
Potassium	K ⁺	Iodide	I ⁻
Lithium	Li ⁺	Hydroxide	OH ⁻
Ammonium	NH ₄ ⁺	Nitrate	NO ₃ ⁻
Barium	Ba ²⁺	Oxide	O ²⁻
Calcium	Ca ²⁺	Sulfide	S ²⁻
Copper(II)	Cu ²⁺	Sulfate	SO ₄ ²⁻
Magnesium	Mg ²⁺	Carbonate	CO ₃ ²⁻
Zinc	Zn ²⁺		
Lead	Pb ²⁺		
Iron(II)	Fe ²⁺		
Iron(III)	Fe ³⁺		
Aluminium	Al ³⁺		

Turn over ►

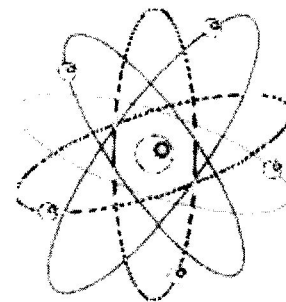
3. The Periodic Table of Elements

1 2 3 4 5 6 7 0

Key		relative atomic mass atomic symbol name atomic (proton) number		1 H hydrogen 1		4 He helium 2																																																																																					
7 Li lithium 3	9 Be beryllium 4	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	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	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	

* The Lanthanides (atomic numbers 58 – 71) and the Actinides (atomic numbers 90 – 103) have been omitted.
Cu and Cl have not been rounded to the nearest whole number.

Chemistry Department



Sixth Form Scholarship Examination Chemistry

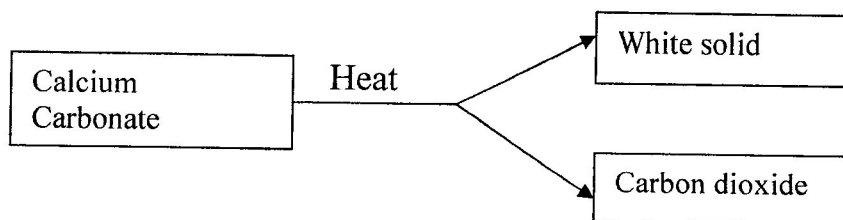
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Time allowed: 90 minutes

Instructions: You are asked to attempt **ALL** the questions in the spaces provided. Should you need more space, write your extended answer on lined paper and include this sheet with this examination booklet.

A Periodic Table is provided.

1. The flow chart below shows the action of heat on calcium carbonate.



Write a symbol equation for the action of heat on calcium carbonate.

.....

(2)

Describe a test for the gas carbon dioxide.

.....

.....(2)

A few drops of water were added to the white solid. Some of the water turned to steam.

Explain what caused some of the water to turn to steam.

..... (1)

Name the substance formed when water was added to the white solid, and write a symbol equation for the reaction.

Name of substance formed

..... (1)

Symbol equation

..... (2)

2. Magnesium can be burnt in a gas jar of oxygen.

State two observations that could be made when magnesium burns in oxygen.

..... (2)

The substance formed in the reaction is mixed with water. What happens when Universal indicator is added to the solution and explain your answer.

..... (2)

Write a symbol equation for this reaction of the product with water.

.....(2)

Calculate the mass of magnesium oxide that could be formed if 1.2g of magnesium is burnt in oxygen.

(Relative Atomic Masses: Mg=24, O=16)

.....
.....
.....
.....
(4)

3. Chlorine and Argon are adjacent (next) to each other in the Periodic table. However, they differ greatly in their chemical properties.

Give one use of Argon

.....
(1)

Explain why argon is an inert (unreactive) gas.

.....
.....
(2)

Give one use of chlorine.

.....
(1)

State the electronic structure of a chlorine atom

.....
(1)

Chlorine reacts with sulphur to form the compound sulphur dichloride SCl_2 . Draw a diagram to show the bonding in this substance and state the type of bonding involved.

Bonding Diagram

Type of bonding (3)

..... (1)

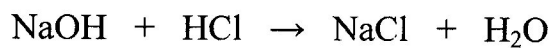
When chlorine is bubbled into potassium bromide solution the colourless solution becomes an orange-red colour. What causes the orange-red colour that develops?

..... (1)

Write a symbol equation for this reaction

..... (2)

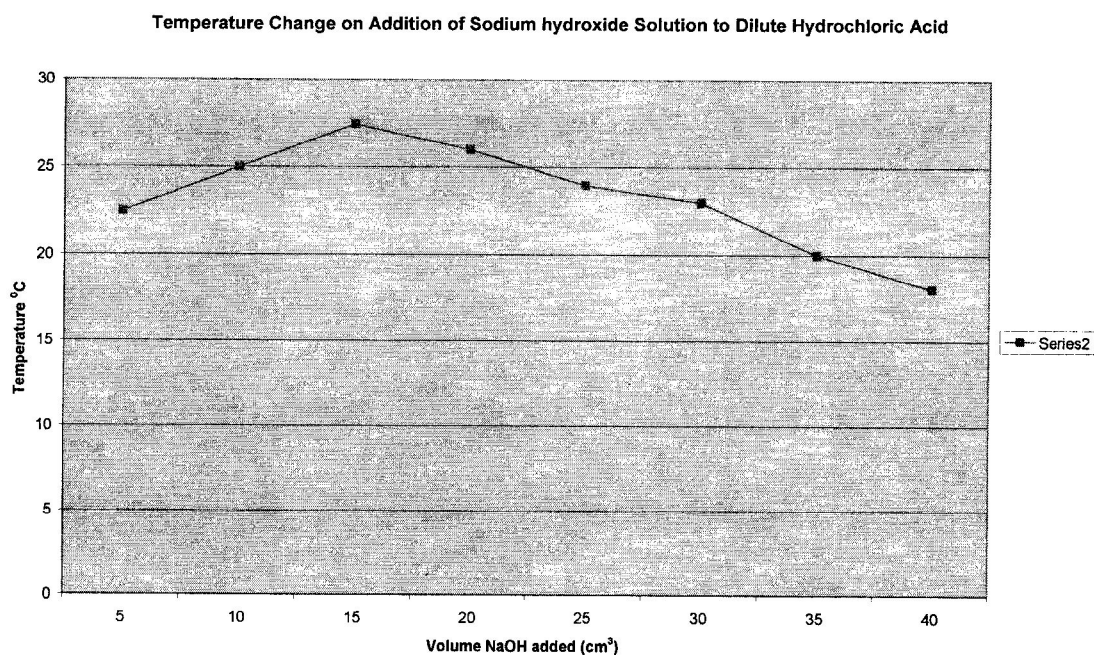
4. The reaction on mixing solutions of sodium hydroxide and hydrochloric acid is shown below.



Write a balanced ionic equation for this reaction

.....
(1)

Varying amounts of sodium hydroxide solution were added to 20cm³ of the dilute hydrochloric acid. After each addition the temperature of the solution was recorded. The results of this experiment are given in the chart below.



What was the highest temperature recorded?

.....

(1)

What volume of sodium hydroxide was required to neutralize the 20cm³ of Hydrochloric acid.

.....

.....

.....

(2)

Calculate the concentration in mol/dm³ of a solution that was made up by dissolving 100g of sodium hydroxide in 2.0dm³ of distilled water.

(Relative Atomic Masses: H=1, O=16, Na=23)

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.....

.....

.....

(4)

Calculate the total mass of sodium chloride that can be made from 100g of sodium hydroxide.

(Relative Atomic Mass: Cl= 35.5)

.....

.....

.....

(3)

Sodium can be made from the electrolysis of molten sodium chloride. Explain why molten sodium chloride is able to conduct electricity.

.....
.....(2)

5. In industry, ammonia (NH_3) is made by combining nitrogen and hydrogen. Ammonia is then used to make fertilizers such as ammonium sulphate and ammonium nitrate.

Write an equation for the formation of ammonia from nitrogen and hydrogen.

.....
.....(2)

From which natural source is the nitrogen obtained?

.....
.....(1)

The process is carried out at a pressure of 200 atmospheres. This not only increases the reaction rate, but also increases the yield of ammonia.

Explain in terms of Particle Collision Theory why an increased pressure leads to an increase of rate for ammonia formation.

.....
.....
.....
.....
.....(2)

State two other ways by which reaction rate can be increased in this process.

.....
.....

(2)

Write a balanced equation for the formation of ammonium sulphate, $(\text{NH}_4)_2\text{SO}_4$ from ammonia and sulphuric acid.

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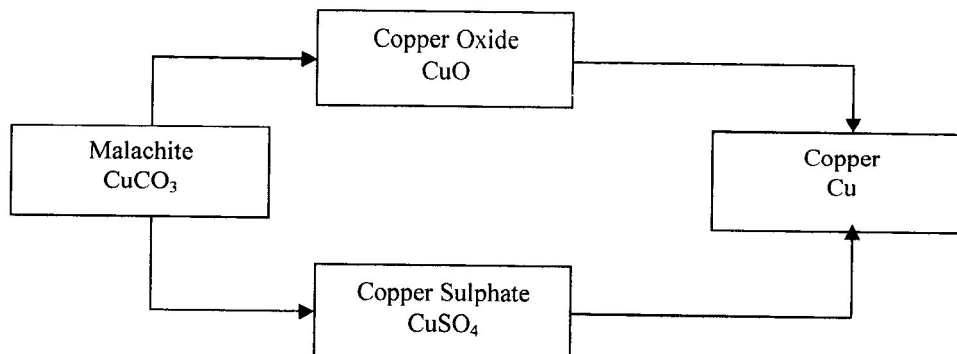
(2)

Calculate the % by mass of nitrogen in ammonium sulphate.
(Relative Atomic Masses: N = 14, H = 1, S = 32, O = 16)

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

(3)

6. Malachite is one of the minerals in copper ores. The flow diagram below shows some of the substances that can be made from malachite.



Name the type of process that takes place when malachite is converted into copper oxide.

.....
(2)

Write an equation for this reaction

.....
(1)

The conversion of copper oxide to copper is a Reduction reaction. What do you understand by this term?

.....
(1)

Describe one way in which this reduction reaction could be carried out in the laboratory.

.....
.....
.....
.....
(2)

In the electrolysis of copper sulphate solution to form copper, at which electrode would you expect to see copper form?

.....
(1)

Calculate the maximum mass of copper which could be obtained from 3.1g of malachite.

(Relative Atomic Masses: Cu = 64, C = 12, O = 16)

.....
.....
.....
.....
(3)

End of Test – please check over your work.

Total mark for this paper = 65 Marks