JUNIOR LYCEUM ANNUAL EXAMINATIONS 2003

Educational Assessment Unit - Education Division

FORM 3 **CHEMISTRY** **TIME: 1hr 30 mins**

Name: _____ Class: _____

Useful Data: A copy of the Periodic Table is provided with this paper.
Relative atomic masses: C = 12, Cl = 35.5, Mg = 24, O = 16

Section A: **Answer ALL questions in this section, using the spaces provided. This section carries 60 marks.**

1. a) The statements below describe the usual size and shape taken by each state of matter. Fill in the correct state of matter.

   i) _____ take any size or shape (fill all the space available).

   ii) _____ have a fixed size and keep their shape, unless a force is applied.

   iii) _____ have a fixed size but take the shape of the container that they are put in. (3 marks)

   b) i) Describe the *arrangement* and *movement* of **particles** in a solid.

   _____

   _____

   ii) Describe what happens to the **particles** of a solid when it melts to a liquid.

   _____

   _____

   (4 marks)

   c) The state in which a substance normally exists depends on its melting point and boiling point in relation to room temperature. If room temperature is 25°C, in which state of matter will each substance, given below, exist?

Substance	Melting point	Boiling point	State
ethane	-183°C	-88°C	
naphthalene	80°C	218°C	
butanol	-89°C	118°C	

(3 marks)

2. The table below gives the atomic number and the relative atomic mass (RAM) of three elements.

Element	Atomic number	Relative Atomic mass
chlorine	17	35.5
argon	18	40
calcium	20	40

a) Explain why:

i) the relative atomic mass of chlorine is not a whole number,

_____

ii) argon has a different atomic number than calcium, but their relative atomic mass is the same. _____

_____ (3 marks)

The table below gives the atomic number of three elements.

element	atomic number
oxygen	8
neon	10
magnesium	12

Use the information given above to answer the following questions:

b) State, *in terms of the electron configuration*, why -

i) neon is stable or unreactive _____

ii) magnesium is a metal _____

iii) oxygen is a non-metal _____ (3 marks)

c) Give the name or symbol of the element whose atom -

i) forms an ion of the type X^{2+} (by losing two electrons) _____

ii) forms an ion of the type Y^{2-} (by gaining two electrons) _____

(2 marks)

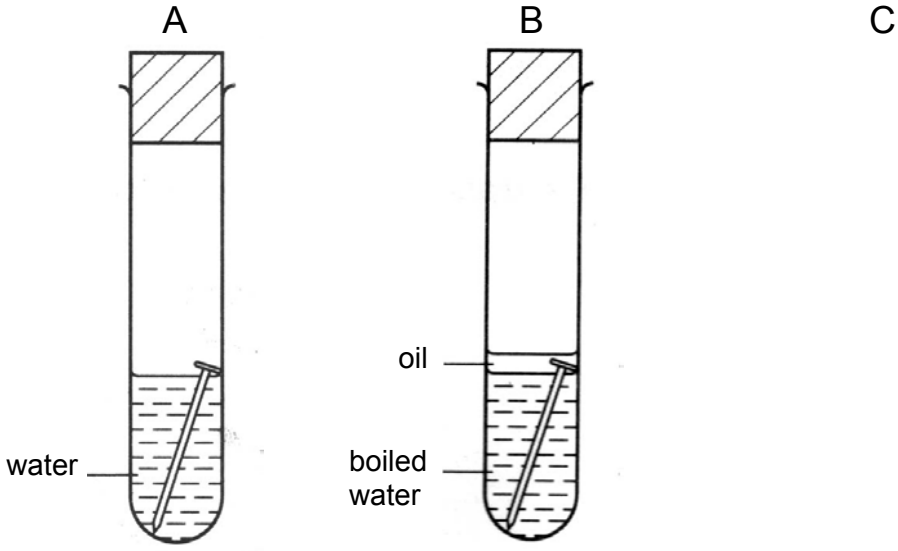
d) Draw a diagram, showing OUTER shell electrons only, to show the bonding in a molecule of the element chlorine, Cl_2.

(2 marks)

3. This question is about the effect of air (oxygen) and water (or steam) on iron.

An experiment was set up to prove that iron reacts with air (or oxygen) in the presence of water to form rust, iron (III) oxide.

Two test tubes, A and B, were set up as shown so that the iron nail was given different conditions.



a) Give the formula for rust, iron (III) oxide _____ (1 mark)

b) A third test tube, C, should have been set up, containing a nail and a solid drying agent.

i) Draw this test tube in the space above and label the name of a suitable drying agent. (2 marks)

ii) What type of condition is provided in test tube C?

_____ (1 mark)

c) What is the purpose of:

i) boiling the water in test tube B? _____

_____

ii) the layer of oil in test tube B? _____

_____ (2 marks)

d) Give two methods which can be used to prevent rusting.

_____

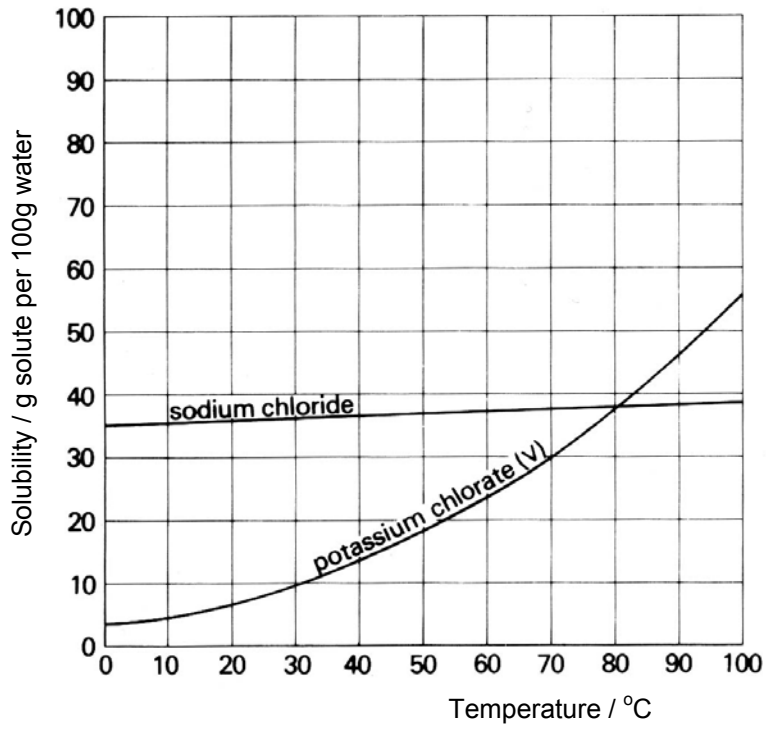
_____ (2 marks)

e) Iron reacts with steam to form tri-iron tetraoxide and hydrogen according to the equation below. Balance this equation.

$Fe + H_2O \quad \forall \quad Fe_3O_4 + H_2$

(2 marks)

4. The graph below shows the solubility curve for two compounds, sodium chloride and potassium chlorate.



a) What do these two graphs show about the solubility with change in temperature for:

i) sodium chloride _____

_____

ii) potassium chlorate _____

_____ (2 marks)

b) Which compound is more soluble.

i) at 21°C _____

ii) in boiling water _____ (2 marks)

c) At what temperature are sodium chloride and potassium chlorate *equally soluble* in water? _____ (1 mark)

d) What mass of potassium chlorate dissolves in 100g water at 70°C? _____ (1 mark)

e) If a saturated solution of potassium chlorate in 100g water cools from 70°C to 30°C, what mass of potassium chlorate will crystallise? _____ (2 marks)

f) In a solution of sodium chloride,

i) what is the solvent? _____

ii) what is the solute? _____ (2 marks)

5. a) Write the chemical formula for:

i) sodium hydroxide _____ (ii) sulphuric acid _____

iii) sodium sulphate _____ (iv) sodium hydrogensulphate _____

(4 marks)

b) Write i) the positive ion found in all dilute acids _____

ii) the negative ion found in all alkalis _____ (2 marks)

c) What terms are used to describe the different types of salt:

i) sodium sulphate is called _____

ii) sodium hydrogensulphate is called _____ (2 marks)

d) Give a balanced equation to show the formation, from sodium hydroxide and sulphuric acid, of <u>one</u> of the two salts named in (c).

_____ (2 marks)

6. The questions below are about *bonding* in compounds and *moles* of compounds. Consider the compounds magnesium chloride and carbon dioxide.

a) What type of *bonding* is present in:

i) magnesium chloride _____

ii) carbon dioxide _____ (2 marks)

b) Give <u>one</u> property that you would expect these compounds to have due to their type of bonding.

i) magnesium chloride _____

ii) carbon dioxide _____ (2 marks)

c) i) What is the relative formula mass of magnesium chloride, $MgCl_2$?

_____ (1 mark)

ii) Calculate the mass of 0.4 moles of magnesium chloride.

(2 marks)

d) i) What is the relative molecular mass of carbon dioxide?

_____ (1 mark)

ii) Calculate the number of moles of carbon dioxide present in 8.8g of the compound.

(2 marks)

Section B: Answer any TWO questions from this section on the separate sheets provided. Each question carries 20 marks.

7. A student carried out the following simple experiments:

Experiment 1: A small piece of sodium metal was added to the surface of some water in a trough.

Experiment 2: Some common salt (sodium chloride) was added to water in a beaker and stirred.

a) State, giving important observations or reasons, whether a 'physical' or 'chemical' change took place in each experiment. (6 marks)
b) Give a test that could be carried out on both of the solutions formed in Experiment 1 and Experiment 2 to prove what type of change took place. (2 marks)
c) Give two *general differences* between physical and chemical changes. (2 marks)

Another student was provided with a **mixture** of iron and sulphur, and the **compound** iron (II) sulphide.
The student carried out the following tests on separate samples of each substance.

Test 1: appearance Test 2: action of magnet Test 3: action of water

d) Describe or tabulate the results of Tests (1) to (3) on the mixture **and** compound in each case (i.e. six results in all). (8 marks)
e) Give two *general differences* between mixtures and compounds. (2 marks)

8. Oxygen can be prepared in the laboratory by dropping liquid hydrogen peroxide on to solid manganese (IV) oxide.

a) Draw a clear, well labelled diagram to show the apparatus needed for the *preparation* and *collection* of oxygen. (6 marks)
b) (i) Write an equation for the decomposition of hydrogen peroxide and state the function of the manganese (IV) oxide. (3 marks)
(ii) Describe a test for oxygen gas. (1 mark)
c) If magnesium and sulphur are ignited, then lowered into a gas jar of oxygen, they continue to burn to form an oxide.
For **each reaction** give: (i) an observation,
(ii) a balanced equation, and (iii) name the type of oxide formed. (8 marks)
d) Give two important uses of oxygen. (2 marks)

9. A student was asked to separate potassium chloride from a mixture of potassium chloride, sand and ammonium chloride.
The student decided to carry out the separation in two stages:
stage 1: solution stage 2: filtration.

a) Suggest why this sequence would **not** be suitable. (2 marks)
b) Describe and explain why **sublimation** would be suitable to obtain ammonium chloride from the mixture. Include a labelled diagram of the apparatus. (5 marks)
c) The remaining mixture of potassium chloride and sand can be separated by the method of 'solution, filtration and evaporation to dryness'.
List the important **practical steps** which should be followed in each stage, including the names of the **apparatus** needed. (13 marks)