JUNIOR LYCEUMS ANNUAL EXAMINATIONS 2000

Educational Assessment Unit - Education Division

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

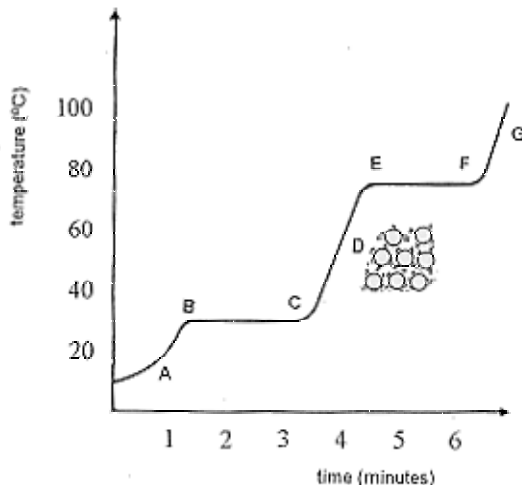Name: _____   Class: _____

Useful Data: A copy of the Periodic Table is provided with this paper.
Relative atomic masses: C = 12, H = 1, O = 16, Na = 23

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

1.   The graph below shows a heating curve for a substance Z, starting from the solid state.

a)   What is the melting point of Z? _____.

b)   What is the state of the substance –

(i)   at D _____   (ii) at G _____?

c)   What term is used to describe the change that occurs –

(i)   from B to C _____   (ii)   from F to E _____

(iii) directly from A to G _____   (6 marks)

d)   The arrangement of the particles at point D is shown on the graph. Draw similar
diagrams, near the graph above, to show the arrangement of particles at A and G.
(4 marks)

2. (a) Some solids dissolve in water to form clear solutions.

Other solids do not dissolve in water, they are insoluble.

State if the following substances are soluble or insoluble in water.

(i) sodium nitrate _____ (ii) lead chloride _____

(iii) copper (II) sulphate _____ (3 marks)

(b) When some solids dissolve in water, they make it 'hard'.

(i) Give the name or formula of a substance which causes –

temporary hardness _____

permanent hardness _____

(ii) State a method which removes –

temporary hardness only _____

both temporary and permanent hardness _____

_____ (4 marks)

(c) Water is a covalent compound. Draw a dot / cross diagram, showing only the OUTER shell electrons, to show the bonding in a molecule of water. (3 marks)
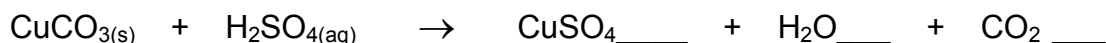
3. (a) Write the following word equation in symbols and formulae

magnesium + oxygen → magnesium oxide

(b) Balance the following equation.

C_3H_8 + _____O_2 → _____CO_2 + _____H_2O

(c) Fill in the missing state symbols for the following equation.

$CuCO_{3(s)}$ + $H_2SO_{4(aq)}$ → $CuSO_4$_____ + H_2O_____ + CO_2 _____

(5 marks)

4. (a) Complete the following statement which describes the properties of metals.

Most elements are metals. They usually have _____ melting and boiling

points, are _____ conductors of heat and _____ and are

usually physically _____.   (4 marks)

(b) Metals form ions when they react with non – metals.
Using aluminium, $^{27}_{13}Al$, as an example, draw diagrams showing ALL the electron
shells to show –
(i)   how the protons, neutrons and electrons are arranged in an <u>atom</u> of aluminium,

(3 marks)

(ii)   the electron configuration and charge of the aluminium ion.
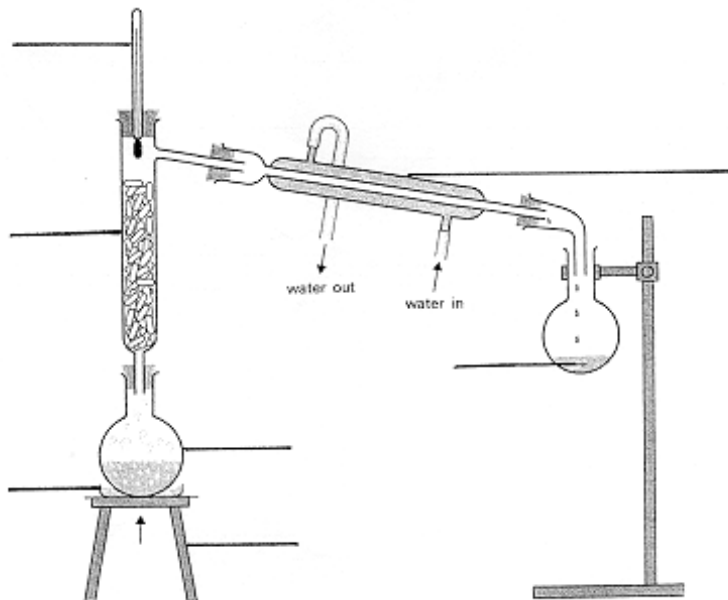

(2 marks)

(c) Give one typical property of compounds composed of ions.
_____   (1 mark)

5. The apparatus shown below can be used to separate a mixture of ethanol and water.
    (a) Give the name of this process _____   (1 mark)
    (b) Label the diagram as indicated.   (8 marks)

water out

water in

6. Acid indigestion is caused by an excess of hydrochloric acid in the stomach. The labels from two bottles containing 'antiacid' preparations to relieve acid indigestion stated that the active ingredients are magnesium hydroxide and magnesium carbonate.

a) Give the formulae of these magnesium compounds.

   magnesium hydroxide _____   magnesium carbonate _____   (2 marks)

b) State if hydrochloric acid is a strong or weak acid and give its approximate pH value.

   _____ _____   (2 marks)

c) (i) How does the pH change when the antiacid 'relieves the acid indigestion?

   _____

   (ii) What type of reaction occurs? _____ (2 marks)

d) Give balanced equations for the reactions of magnesium hydroxide and magnesium carbonate with dilute hydrochloric acid.

   _____

   _____ (4 marks)

7. A compound, composed of carbon and hydrogen only, contains 80% by mass of carbon and 20% by mass of hydrogen.
   (a) Calculate the empirical (simplest) formula of this compound   (4 marks)

   (b) If the relative molecular mass of the compound is 30, find its molecular formula.
                                                                            (2 marks)

8. a) Describe, with the help of a diagram, an experiment to show that about $\frac{1}{5}$ by volume of air is used up when a substance burns in a fixed volume of air. (10 marks)

    b) (i) <u>Name</u> a compound that is usually decomposed to provide oxygen gas in the laboratory.
    (ii) <u>Name</u> the compound that is used as a catalyst in this reaction. (2 marks)

    c) Copper and carbon both react with oxygen when heated in air.
    For each element:
    (i) give <u>one</u> observation that would be made,
    (ii) write a balanced equation for the reaction,
    (iii) state the type of oxide formed. (8 marks)

9. (a) Some metals and non-metals react with cold water.

    (i) Describe in detail what is <u>seen</u> and <u>name</u> the products obtained when a small piece of potassium metal is added to a trough half filled with water containing pH indicator. Write a balanced equation for this reaction including the state symbols.
    (7 marks)
    (ii) Describe what is <u>seen</u> and <u>name</u> <u>one</u> product obtained when chlorine gas is bubbled into water containing pH indicator.
    Give the <u>formula</u> for <u>one</u> of the products. (3 marks)

    (b) A student wanted to find the value of x in $Na_2CO_3.xH_2O$. The student heated some of the crystals, and he found that the mass of anhydrous sodium carbonate remaining was 1.06g while 1.8g of water was driven off.
    (i) Calculate the relative formula mass of Na_2CO_3 and the relative molecular mass of H_2O.
    (ii) How many moles of anhydrous sodium carbonate remained?
    (iii) How many moles of water were driven off?
    (iv) Use your answers, to parts (ii) and (iii), to find the value of x in the formula $Na_2CO_3.xH_2O$. (10 marks)

10. A student prepared a sample of hydrated magnesium sulphate crystals. First she measured out approximately 50cm^3 of a dilute acid. She then warmed the acid and added magnesium metal until it was in excess. When the reaction was complete, she filtered the mixture. She *partially evaporated* the filtrate *on a steam bath* and then allowed the remaining solution to cool and crystallise.

    (a) (i) Name the acid that the student used.
    (ii) Name the gas formed by the reaction and describe a test for this gas.
    (iii) Write a balanced equation for the reaction.
    (iv) Why did the student use excess magnesium metal?
    (v) Give <u>two</u> observations which would show that the reaction was complete.
    (vi) What does the term 'hydrated' mean?
    (vii) Why was the filtrate only *partially evaporated* instead of evaporating to dryness?
    (12 marks)

    (b) Draw a large, clear diagram of the apparatus required to carry out the partial evaporation *as described above*. Label the diagram clearly. (8 marks)