UNEB U.C.E CHEMISTRY (PAPER 2) 2018

1. Sea water contains mainly dissolved sodium chloride and traces of potassium bromide.

a) State one practical method that can be used to obtain the following from sea water.

i) Chlorine

ii) A reasonably pure sample of sodium chloride

iii) Water free from ions

b) A vessel containing a sample of the water in (a) (iii) was connected to an ammeter which in turn was connected to a direct current source.

i) State what was observed

ii) Give a reason for your observation in (b) (i)

2. a) The atomic numbers of hydrogen, magnesium and oxygen are 1, 12 and 8 respectively. Write the electronic configurations of the atoms of the elements.

b) Using outermost energy level electrons only, draw diagrams to show how oxygen forms a compound with

i) hydrogen

ii) magnesium

c) i) Which one of the compounds in (b) when dissolved in water will conduct electric current?

ii) Give a reason for your answer in (c) (i)

3. a) Statewhy ammonia is not dried using

i) anhydrous calcium chloride

ii) concentrated sulphuric acid

b) Name the substance normally used in the laboratory for drying ammonia.

c) Write equation for the reaction that can take place when copper(II)oxide is treated with ammonia.

4. State the condition(s) under which sulphuric acid can react with the following substances and in each case write equation for the reaction that would take place.

a) Sugar $(C_{12}H_{22}O_{11})$

i) Condition(s)

ii) Equations

b) Magnesium

i) Condition(s)

ii) Equations

5. The table below shows some tests carried out on a solution of salt Z and the observations that were made.

Test number	Test	Observation
I	Sodium hydroxide solution was added drop-wise to aqueous Z until in excess	A white precipitate soluble in excess sodium hydroxide
II	Ammonia solution was added drop-wise to aqueous Z until in excess	A white precipitate insoluble in excess ammonia
III	Dilute hydrochloric acid was added to aqueous Z and the mixture warmed	A white precipitate soluble on warming

Use the observations from the table to answer the following questions

a) i) Identify the cation in Z

ii) Write the ionic equation for the reactions in test III

b) Briefly describe how the cation in Z can be confirmed.

6. Compound T, contains 40.0% carbon, 6.7% hydrogen and the rest being pxygen

a) i) Calculate the empirical formula of T (H =1; C=12; O =16)

ii) Determine the molecular formula of T (Relative formula mass of T =60)

b) T dissolved in water to form a solution which turned blue litmus paper red

i) State what would be observed when a few drops of T were added to sodium carbonate

ii) Write an ionic equation for the reaction that takes place in (b) (i)

7. a) State what is meant by the term hard water

b) Name two cations and teo anions present in hard water

i) Cations

ii) Anions

c) When a solution of barium nitrate was added to a sample of hard water, followed by dilute nitric acid, a while precipitate was formed that did not dissolved in the acid. Write equation for the reaction that took place.

8.a)When excess magnesium powder was added to 25cm3 portions of equimolar solutions of compounds of elements Q, W, X,Y and Z, the temperature rise in each case was noted as indicated in the table below

Solution of compounds	Rise in temperature (^{0}C)
X	42
W	32
Y	0
Q	38
Z	14

i) Arrange the elements, Mg, X, W, Y, Q and Z in order of their reactivity, starting with the least reactive.

ii) State why there was no temperature rise when magnesium was added to copper(II)oxide and the mixture heated strongly.

i) State what was observed

ii) Write equation for the reaction that took place.

9. a) When a sample of copper(II)nitrate was strongly heated, a reddish-brown gas was evolved.

i) Identify the gas

ii) Write the formula of the residue

b) A sample of copper (II)nitrate contaminated with zinc nitrste was dissolved in water and the solution was treated with excess sodium hydroxide solution and then filtered. Identify the cation in the
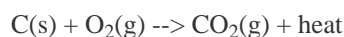
i) filtrate

ii) residue

c) The residue from (b) was strongly heated

i) State what was observed

ii) Write equation for the reaction that took place

10. a) State the difference between endothermic and exothermic reaction.

b) Carbon burns in air according to the following equation.

$C(s) + O_2(g) \rightarrow CO_2(g) + heat$

When 4.00 of carbon was burnt in air, the heat produced raised the temperature of 550g of water by 56.80C. Calculate the molar heat of combustion of carbon

($C = 12$; Specific heat capacity of water $= 4.2 \ Jg^{-1} \ K^{-1}$)

c) From the equation in (b), suggest one use of carbon.

SECTION B

Answer any two questions from this section

11. Hydrogen peroxide produces gas bubbles slowly when exposed to air, but when aqueous iron(III)chloride is added, the production of gas bubbles becomes more rapid.

i) Name the gas produced when hydrogen peroxide is exposed to air

ii) Write equation for the reaction that takes place

iii) State the role of iron(III)chloride in the reaction

iv) Name another substance that can affect the production of the gas in the same way as iron(III)chloride

b) The table below shows the variation in the concentration of hydrogen peroxide with time when a sample of hydrogen peroxide was mixed with iron(III)chloride at room temperature.

Concentration of hydrogen peroxide (mol dm³)	0.05	0.10	0.15	0.20	0.25
Time, t(s)	53	26	17	13	10.5
$\frac{1}{t}(S^{-1})$					

i) Copy and complete the table above by computing and filling in the values of $\frac{1}{t}$

ii) Plot a graph of $\frac{1}{t}$ against concentration of hydrogen peroxide

iii) Using your graph, deduce how the rate of the reaction varies with the concentration of hydrogen peroxide

iv) Determine the slope of the graph

v) State two ways by which the rate of the reaction in (b) could be made faster.

12. a) Explain how a dry sample of hydrogen chloride can be prepared from sodium chloride. (*Your answer should include equation, but no diagram is required*)

b) State what would be observed and write equation for the reaction that would take place if hydrogen chloride was passed

i) over strongly heated iron wire

ii) through aqueous silver nitrate

c) Aqueous hydrogen chloride reacts with sodium carbonate solution to produce carbon dioxide according to the following equation:

$Na_2CO_3(aq) + 2HCl(aq) \rightarrow 2NaCl(aq) + H_2O(l) + CO_2(g)$
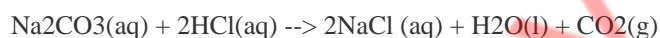
Calculate the volume of carbon dioxide that would be produced at room temperature if excess sodium carbonate solution was added to $50.0cm^3$ of a solution containing 0.2 mol dm^{-3} of hydrogen chloride.

(*1 mole of gas occupies 24.0dm3 at room temperature*)

13. a) i) Describe how sodium hydroxide can be manufactured using the mercury-cathode cell. (*Your answer should include equations of the reactions, but not diagram*)

ii) State one use of the product formed at the anode and one use of the by product.

b) State how sodium hydroxide can react with the following substances and in each case write equation for the reaction

i) Sulphuric acid

ii) Aluminum ion

14. a) i) Draw a labeled diagram of the set-up of apparatus that can be used to prepare a dry sample of carbon dioxide.

ii) Write equation for the reaction leading to the formation of carbon dioxide.

b) Explain the reason for your choice of the

i) drying agent for carbon dioxide

ii) method of collecting carbon dioxide as shown in your diagram in (a) (i)

c) Write equation(s) to show the reaction of carbon dioxide with

i) water

ii) sodium hydroxide

d) State

i) why carbon dioxide is used in making fire extinguishers

ii) the effect of increased concentration of carbon dioxide on the environment.