Name ..... Index No.....

Class .....Adm.....Date: 24/08/2018

233/2
CHEMISTRY
PAPER 2
AUGUST
(THEORY)
TIME: 2 HOURS

YESMARK EDUCATION CENTRE-THIKA

Kenya Certificate of Secondary Education (K.C.S.E)

Mock Examination 2018

233/2
CHEMISTRY
PAPER 2
(THEORY)
AUGUST
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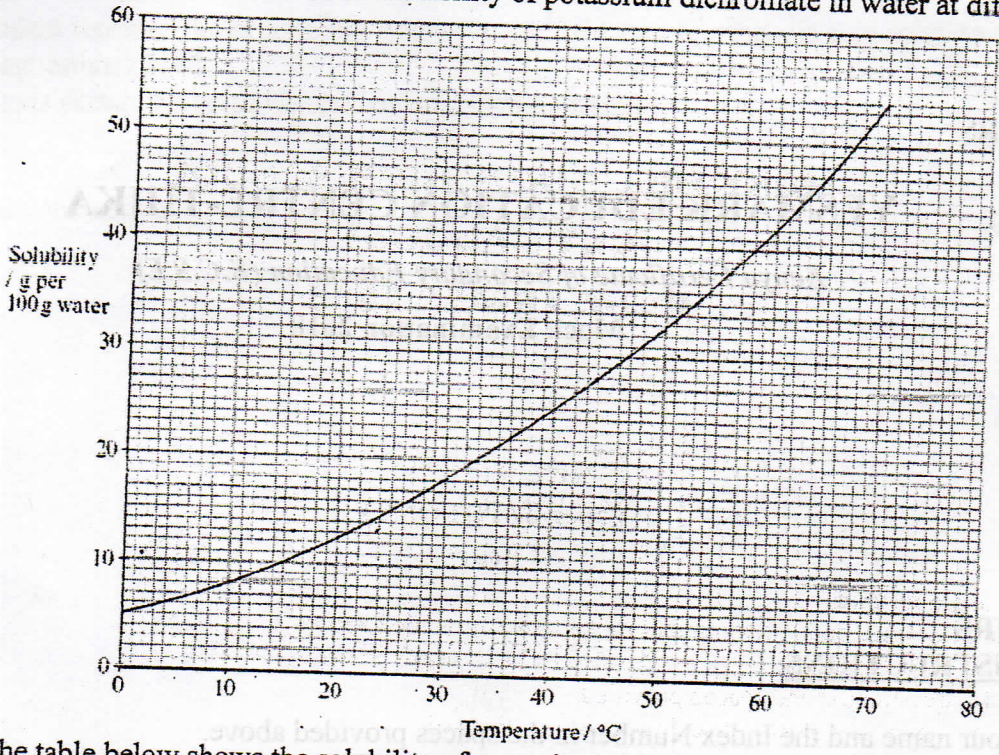
INSTRUCTIONS

a) Write your name and the Index Number in the spaces provided above.
b) Answer **ALL** the questions in the spaces provided after each question.
c) Use of Mathematical sets and electronic calculators may be used.
d) **All** working should be clearly shown.

FOR OFFICIAL USE ONLY

QUESTIONS	EXPECTED SCORE	CANDIDATES SCORE
1	08	
2	12	
3	09	
4	11	
5	12	
6	14	
7	14	
TOTAL	**80**	

1. The graph below shows the solubility of potassium dichromate in water at different temperatur



The table below shows the solubility of potassium chloride in water at different temperatures.

Temperature (°C)	0	20	40	60	80
Solubility (g per 100g of water)	28	34	40	46	52

(a) Plot the graph of the solubility of potassium chloride on the grid on the opposite page. (2 marks)

(b) Using the graphs give

(i) the temperature at which the solubility is the **same** for both potassium chloride and potassium dichromate.

(1mark)

(ii) the **difference** between the solubilities of potassium chloride and potassium dichromate at 30 °C.

(1mark)

(c) How many grams of potassium dichromate are required to saturate 30ml of solution at 40°C?

(2 marks)

(d) Three samples of tap water, **A**, **B** and **C**, are to be tested for hardness using soap solution. It is suspected that sample **A** is the most hard and sample **C** the least hard.

Describe an experiment you would carry out to show that the above statement is true.
Include your expected observations.
(3 marks)

(e) State why hard water is considered to be
(i) good for our health, (1mark)

(ii) a problem in kettles and boilers. (1mark)

2. Butanol, C_4H_9OH, can be produced by the fermentation of sugars using the bacterium *Clostridium acetobutylicum*. It is mixed with petrol and used as a fuel for cars.
(a) Butanol produced by fermentation is described as a biofuel. Suggest what is meant by the term **biofuel?** (1mark)

(b) State the conditions required for fermentation. (1mark)

(c) Butanol produces fewer harmful environmental emissions from cars than petrol.
Explain, without using equations, the role of catalytic converters in reducing the harmful environmental emissions from petrol engines. (3 marks)

(d) There are four alcohols which have the formula C_4H_9OH.
(i) Draw the structures for each of these alcohols and name them. (2 marks)

(ii) Some of these alcohols can be oxidised. State the reagent necessary for the oxidation and name the organic products formed in each complete oxidation. (2 marks)
Reagent:

Names of products:

(e) Butanol can also be converted back to an alkene.

(i) Name the type of reaction involved.

(½ mark)

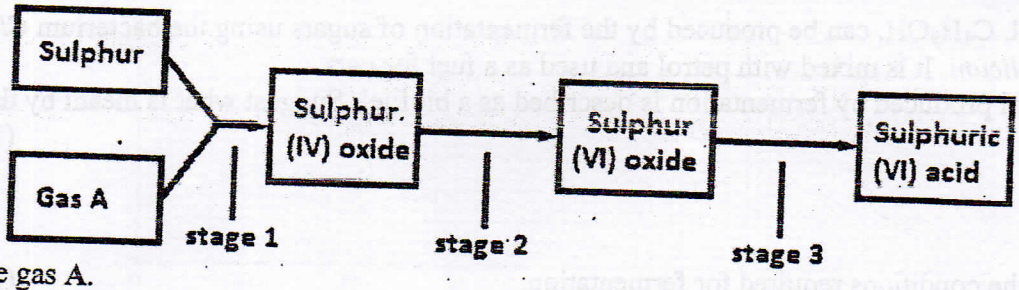
(ii) name the reagent required for this reaction.

(½ mark)

(iii) Write an equation for this reaction.

(1mark)

3 (a) The following diagram shows a flow chart for the manufacture of sulphuric acid using the Contact Process.



(i) Name gas A.

(½ mark)

(ii) Give the equation for the reaction taking place in stage 2.

(1mark)

(iii) Give the optimum conditions for stage 2.

(1½ marks)

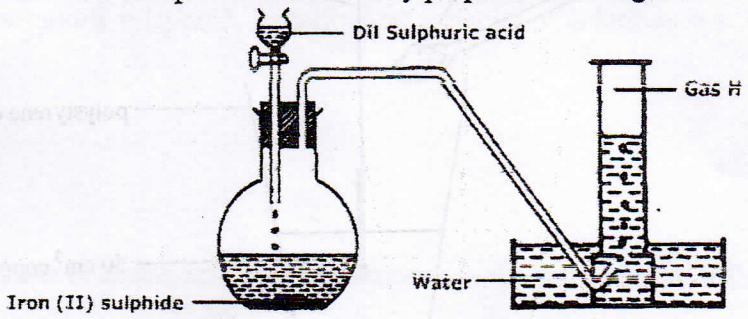
(iv) Describe the reactions that occur in stage 3.

(2 marks)

(b) Explain the observations made when concentrated sulphuric (VI) acid is added to sugar, $C_{12}H_{22}O_{11}$, in a crucible.

(2 marks)

(c) The diagram below shows a set up for the laboratory preparation of a gas H.



(i) Write an equation for the production of gas H. (1mark)

(ii) Name one impurity in gas H. Explain. (1½ marks)

(iii) Explain the observations made when gas H is bubbled into:

I. iron (III) chloride solution. (1½ marks)

II. bromine water. (1½ marks)

III. dilute nitric (V) acid. (1½ marks)

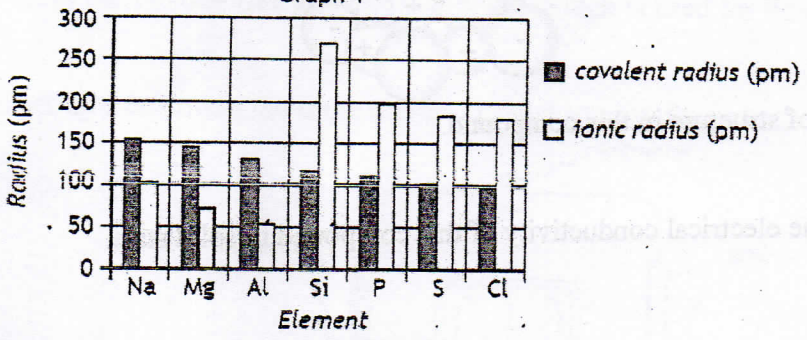
4. Four pupils investigated the temperature change which occurred when increasing amounts of powdered magnesium were added to 50 cm^3 of copper (II) sulphate solution in a polystyrene cup as shown in the diagram below.

(e) Calculate the molar enthalpy change for the reaction in the polystyrene cup. (Mg = 24, Cu = 63.5, O = 16, S = 32, density of solutions = 1g/cm3, Specific heat capacity of solutions = 4.2J/g/K).

(3 marks)

5 (a) Graph 1 shows the sizes of atoms and ions for elements in the third period of the Periodic Table.

Graph 1



The covalent radius is a measure of the size of an atom.

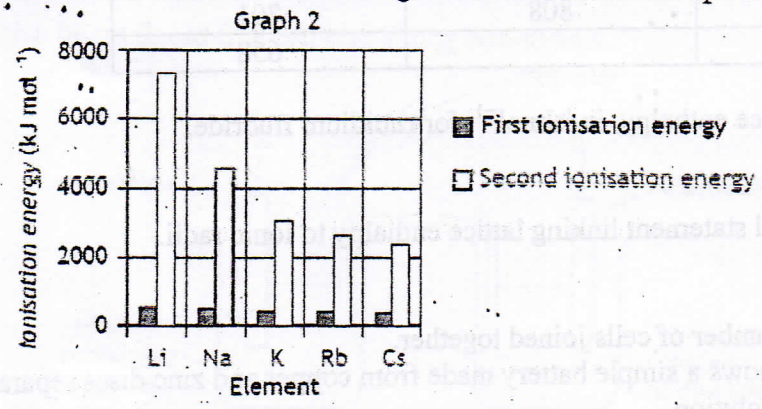
(i) Explain why covalent radius decreases across the period from sodium to chlorine. (2 marks)

(ii) Explain **fully** why the covalent radius of sodium is larger than the ionic radius of sodium.

(2 marks)

(b) Graph 2 shows the first and second ionisation energies of elements in Group 1 of the Periodic Table.

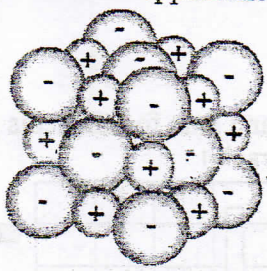
Graph 2



(i) Explain why the first ionisation energy decreases going down Group 1. (2 marks)

(ii) Explain **fully** why the second ionisation energy is much greater than the first ionisation energy for Group 1 elements. (2 marks)

(c) The diagram below shows the 3-dimensional appearance of a sample of a compound.



(i) Name the type of structure in this compound. (1mark)

(ii) Comment on the electrical conductivity of this compound in solid state. (1mark)

(d)

Table 1 shows the size of selected ions.

Table 1

Ion	Li^+	Na^+	K^+	Rb^+	F^-	Cl^-
Ionic radius (pm)	76	102	138	152	133	181

Table 2 shows the lattice enthalpies, in kJ mol^{-1}, for some Group 1 halides.

Table 2

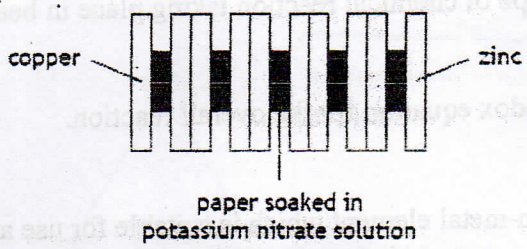
Ions	**F^-**	**Cl^-**
Li^+	1030	834
Na^+	910	769
K^+	808	701
Rb^+		658

(i) Predict the lattice enthalpy, in $kJmol^{-1}$, for rubidium fluoride. (1mark)

(ii) Write a general statement linking lattice enthalpy to ionic radii. (1mark)

6. A battery is a number of cells joined together.

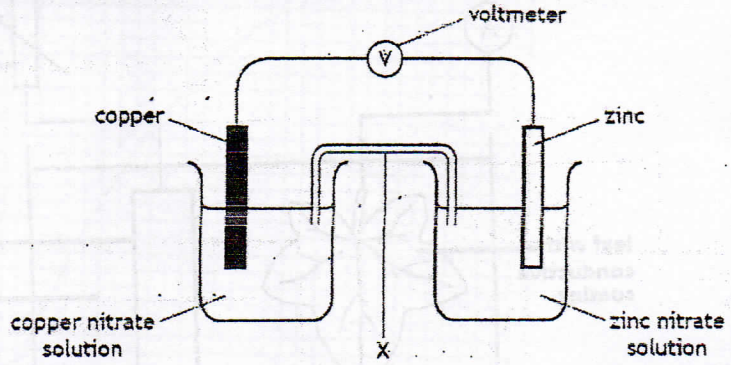
(a) The diagram shows a simple battery made from copper and zinc discs separated by paper soaked in potassium nitrate solution.



(i) State the purpose of the potassium nitrate solution. (1mark)

(ii) State the **term** used to describe an ionic compound which is used for this purpose. (1mark)

(b) A student set up a cell using the same metals as those used in the battery.

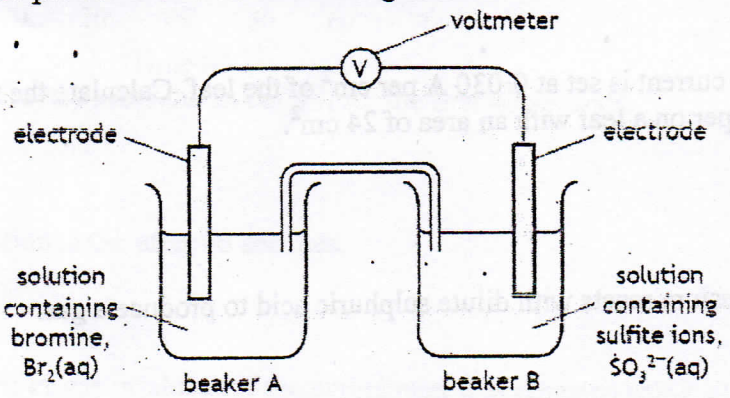


(i) **On the diagram,** draw an arrow to show the path and direction of electron flow. (1mark)

You may wish to use the data booklet to help you.

(ii) Name the piece of apparatus labeled **X**. (1mark)

(c) Electricity can also be produced in a cell containing non-metals.



The reactions occurring at each electrode are

Beaker **A** $Br_{2(l)} + 2e^- \rightarrow 2Br^-_{(aq)}$

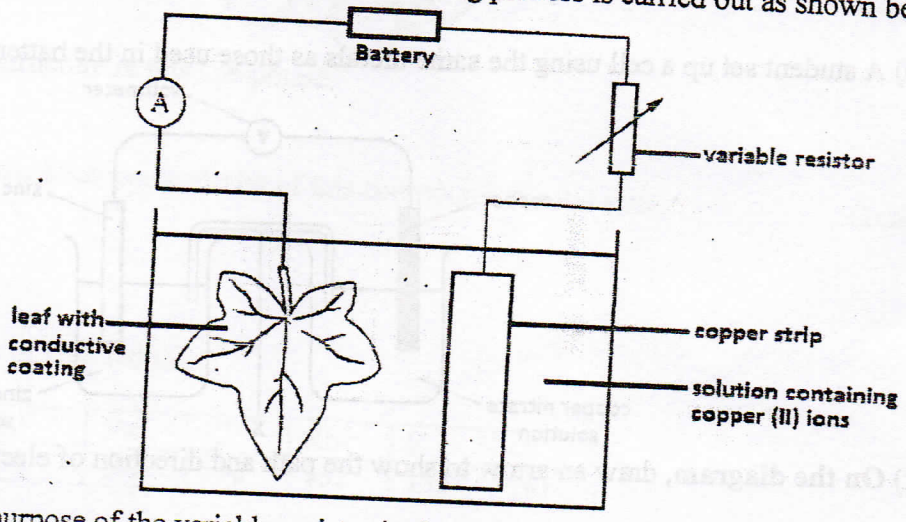
Beaker **B** $SO_3^{2-}{}_{(aq)} + H_2O_{(l)} \rightarrow SO_4^{2-}{}_{(aq)} + 2H^+_{(aq)} + 2e^-$

(i) Name the type of chemical reaction taking place in beaker **B**. (1mark)

(ii) Write the redox equation for the overall reaction. (1mark)

(iii) Name a non-metal element which is suitable for use as the electrodes. (1mark)

(d) Electroforming is a process that can be used to create metal objects by depositing a thick layer o metal on the surface of natural items, such as leaves. Copper is often used. The natural items are fir coated using a conductive spray. The electroforming process is carried out as shown below.



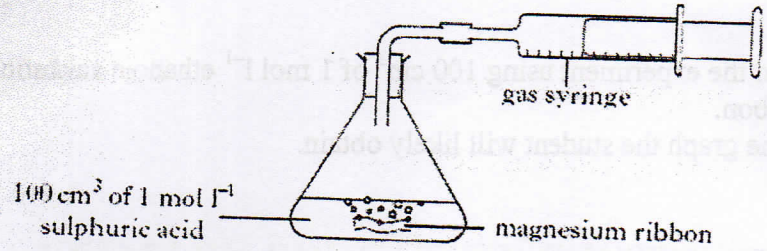
(i) What is the purpose of the variable resistor in the circuit? (1mark)

(ii) Identify the cathode and the anode. (1mark)

(iii) Write the equation for the reaction that occurs each electrode. (2 marks)

(iv) The current is set at 0·030 A per cm^2 of the leaf. Calculate the time taken, in seconds, to deposit 4· g of copper on a leaf with an area of 24 cm^2. (2 marks)

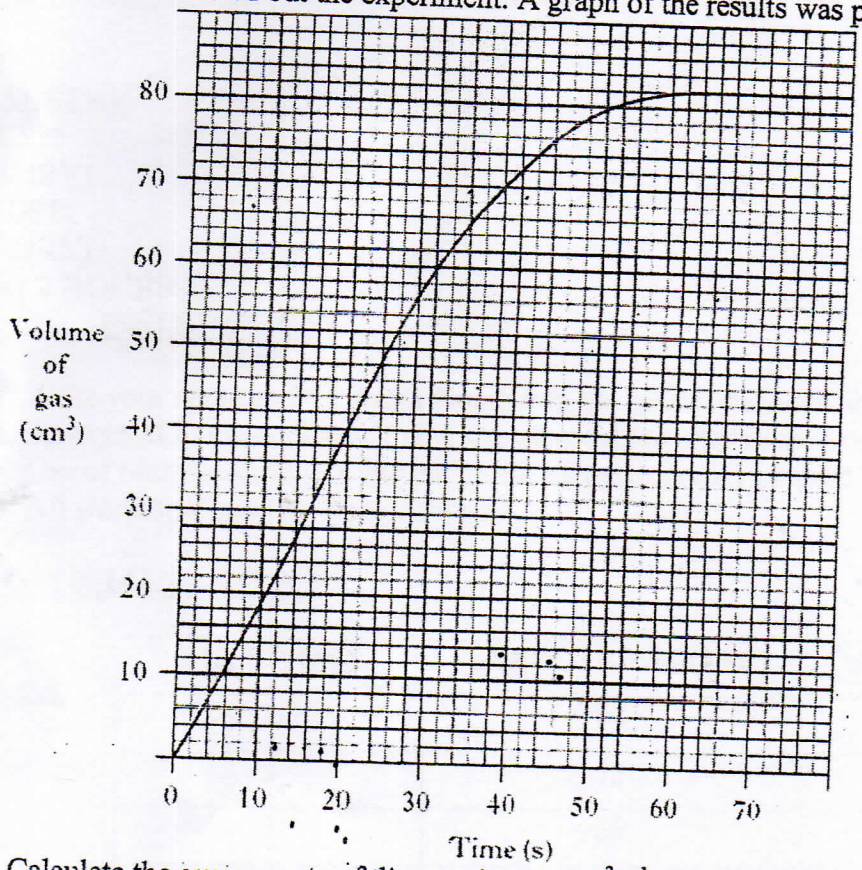
7. Magnesium reacts with dilute sulphuric acid to produce a gas.



(a) Name the gas produced in this reaction.

(1mark)

(b) A student carried out the experiment. A graph of the results was plotted.



(i) Calculate the average rate of the reaction, in cm^3s^{-1}, for the first 40 seconds. (2 marks)

(ii) Calculate the rate of reaction at the after 46 seconds.

(2 marks)

(c) (i) Predict the total volume of gas produced if the experiment was repeated using silver.

(1mark)

(ii) Explain your answer.

(1mark)

(d) The student repeated the experiment using 100 cm^3 of 1 mol l^{-1} ethanoic acid solution and the same mass of magnesium ribbon.

(i) On the axis sketch the graph the student will likely obtain. (1mark)

(ii) Explain your answer. (1mark)

(d) The student repeated the experiment using 100 cm^3 of 1 mol l^{-1} ethanoic acid solution and the same mass of magnesium ribbon.

(i) On the axis sketch the graph the student will likely obtain. (1mark)

(ii) Explain your answer. (1mark)