

## FORM FOUR CLUSTER KCSE MODEL10

### CHEMISTRY PAPER 2 QUESTIONS

1. The table below shows some properties of elements in the third period of the periodic table. Use it to answer the questions that follow.

Element	Na	Mg	Al	Si	P	S	Cl	Ar
Atomic number	11	12	13	14	15	16	17	18
Atomic radii	0.157	0.136	0.135	0.117	0.110	0.104	0.099	—
Boiling point (°C)	890	1110	2470	2360	280	445	-34.7	-186
Formula of chloride								
B.pt of chloride (°C)	1465	1418	183	57	74	59	-35	—

a) i) Fill the formula of the chlorides. (2marks)

ii) Explain why atomic radii decrease gradually across the period. (1mark)

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b) Explain the variation in boiling point (i) from sodium to Aluminium . (1mark)

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ii) from phosphorous to chlorine. (2marks)

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iii) Aluminium Chloride exists as a dimer, using an equation show how the dimer is formed (1mark)

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iv) Aluminium chloride has a low boiling point compared to sodium chloride. Explain (1mark)

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c) Study the grid below showing parts of the periodictable.

						D		
B								

i) An element A is in the same group as chlorine. Write the formula of the compound formed when A reacts with magnesium metal... (1mark)

ii) Select the element that is the strongest reducing agent. Explain. (2marks)

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iii) Element D can form ion D<sup>3+</sup> and D<sup>3-</sup>. Explain which one is more stable. (1mark)  
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iv) On the grid, indicate the position of element Y that forms an ion Y<sup>2+</sup> with electron configuration 2,8,8. (1mark) .....

2. By using the same axes plot graphs of solubility of substances X and Y against temperature (X-axis), using the table below.

Temperature (°C)	15	25	35	45	55	65	75
Solubility of X in 100g of water	26	38	53	72	98	124	155
Solubility of Y in 100g of water	35.8	36.2	36.6	37.0	37.4	38	38

From the graph, answer the following questions. i) At what temperature are the solubilities of X and Y the same. (1mark) .....

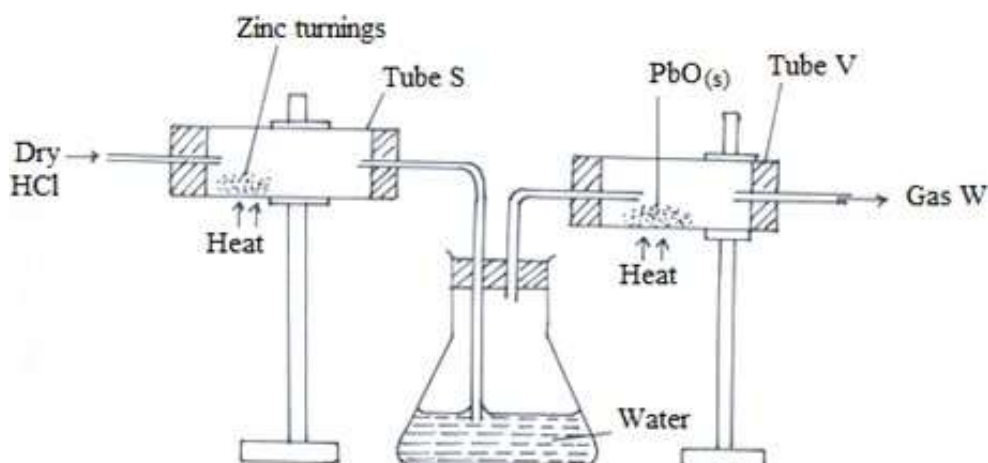
ii) By how many gram of solute does solubility of substance X exceed that of substance Y at 500C. (2marks) .....

iii) What mass of substance Y is necessary to saturate 35g of water at 700C? (1mark)  
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iv) 40g of X solution saturated at 600C are cooled to 150C. What mass of solid will separate out? (3marks) .....

v) Given a mixture of equal mass of X and Y, how would you obtain some pure substance of X? (2marks) .....

3. In an experiment, dry hydrogen chloride gas was passed through heated zinc turnings as shown in the diagram below. The gas produced was then passed through lead (II) oxide.



- a) i) What is the function of the water in the flask? (1mark)  
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- ii) Write equations for the reactions that took place in the tubes S and V. (2marks)  
 .....  
 .....
- iii) How would the total mass of tube S and its contents compare before and after the experiment. Explain. (2marks) .....

b) Chlorine can be prepared by using the following three reagents: Sodium chloride, concentrated sulphuric (VI) acid and potassium manganate (VII).

- i) What is the role of each of the following in the reaction?  
 I) Concentrated sulphuric (VI) acid. (1mark)  
 .....  
 II) Potassium manganate (VII) (1mark)  
 .....
- ii) Name the bleaching agent formed when chlorine gas is passed through cold dilute sodium hydroxide solution. (1mark) .....
- iii) Name one other use of the compound formed in (ii) above other than bleaching. (1mark)  
 .....
- iv) State one environmental effect of chlorine containing compounds. (1mark)  
 .....

4. a) In an experiment to determine the molar heat of reaction when magnesium displaces copper, 0.15g of magnesium powder were added to 25.0cm<sup>3</sup> of 2.0M copper (II) Chloride solution. The temperature of copper (II) Chloride solution was 25°C, while that of the mixture was 43°C.
- i) Other than increase in temperature, state and explain the observation which were made during the reaction. (3marks) .....
- .....

ii) Calculate the heat change during the reaction (S.H.C of the solution =  $4.2\text{Jg}^{-1}\text{k}^{-1}$  and the density of the solution =  $1\text{g/cm}^3$ ). (2marks)

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iii) Determine the molar heat of displacement of copper by magnesium. ( $\text{Mg}=24.0$ ) (2marks)

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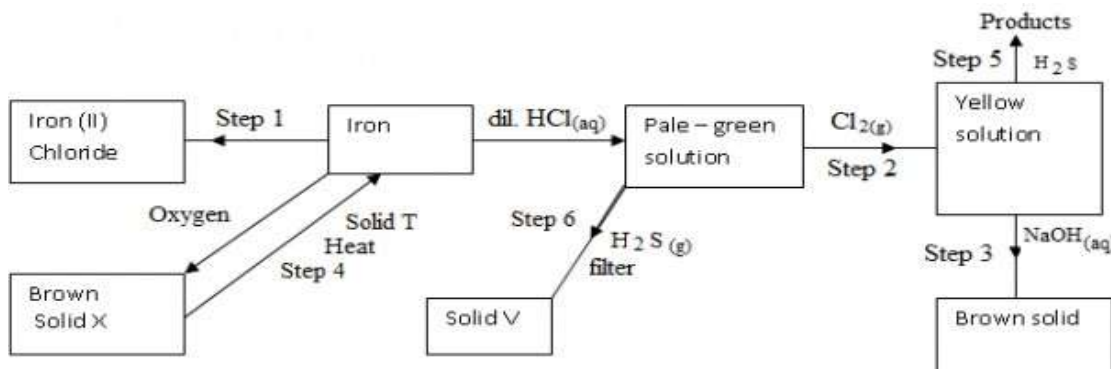
iv) Write the ionic equation for the reaction. (1mark)

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v) Sketch on energy level diagram for the reaction. (3marks)

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5. The flow chart below shows a sequence of reactions starting with iron. Study it answer the questions that follow.



a) Write balanced equations in step 1, 2, 3 and step 6. (4marks)

Step 1.....

Step 2.....

Step 3.....

Step 6.....

b) Name substance; (2marks)

X.....

T.....

c) Explain the colour change in step 2. (1mark)

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d) The reaction between hydrogen sulphide gas and pale yellow solution in step 5 is a redox reaction.

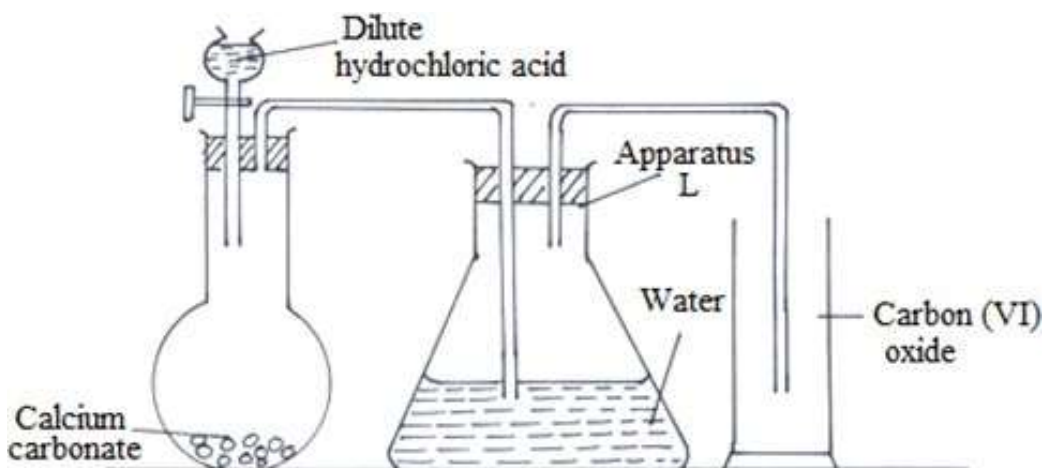
i) Write the ionic equation for this reaction. (1mark)

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ii) Write the oxidation and reduction reaction for the above reaction. (2marks)

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6. In preparation of Carbon (IV) oxide in the laboratory, dilute hydrochloric acid was added to marble chips ( $\text{CaCO}_3$ ) as shown in the diagram below.



a) i) What observations are made when the acid is added to the marble chips? (1mark)

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ii) Why is dilute hydrochloric acid preferred to dilute Sulphuric (VI) acid in the above reaction? (2marks)

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iii) Why was the gas passed through water in apparatus L? (1mark)

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iv) Write an ionic equation for the reaction which occurs in the flask. (1mark)

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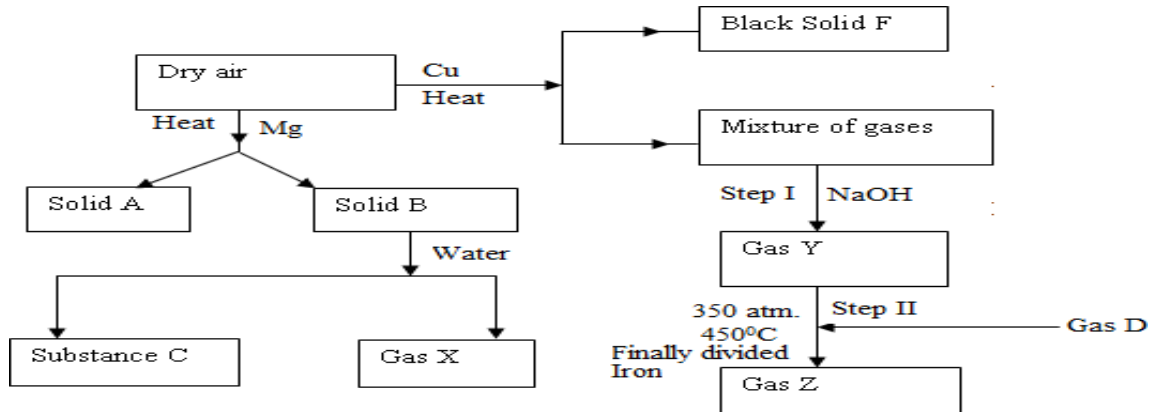
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v) Explain why calcium hydroxide is used to detect presence of carbon (IV) oxide while sodium hydroxide is not used. (1mark) .....

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b) Study the diagram below that shows some reactions of dry air then answer the questions that follow.



i) Identify:

Solid B..... (1mark)

Gas D.....(1mark)

Gas Z..... (1mark)

ii) Why is the amount of solid B obtained much less than solid A? (1mark)

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iii) Write a balanced equation for the reaction between solid B and water. (1mark)

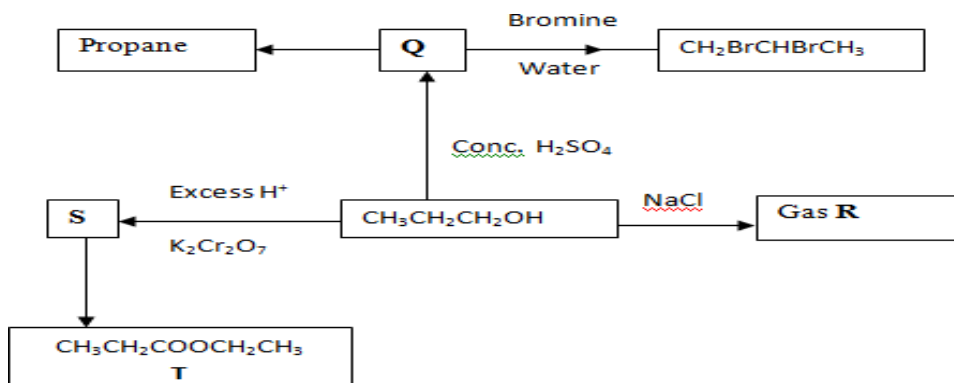
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iv) How can gas Y be obtained from gas X in the laboratory? (1mark)

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7. The scheme below shows several reactions starting with propanol. Study it and answer the questions that follow.



- a) i) Name gas R (1mark)

- ii) Draw and name the structural formula of compound Q (2marks)

- iii) What conditions and reagents are necessary to convert S to T. (2marks)

Reagent:.....

Condition:.....

- iv) Write an equation for the reaction that takes place when one mole of chlorine gas reacts with propane. (1mark)

- b) The table below shows some properties of the organic compounds U, V and W. Use the information to answer the questions that follow.

	U	V	W
Reaction with liquid bromine	Decolourless Very fast	No reaction	Decolourise Bromine slowly
Combustion	Burns with a yellow smoky flame	Burns with a blue flame leaving no residue	Burns with a clear yellow flame
Reaction with concentrated sulphuric (VI) acid	No reaction	It is dehydrated to form compound W	No reaction

- i) To which homologous series do the following compounds belong? (3marks)

U.....

V.....

W.....

- ii) Name two uses of compound V. (2marks)

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