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233/2

CHEMISTRY

PAPER II 2020

THEORY

2 HOURS

Instructions to Candidates

a) Write your name and admission number in the spaces provided.
b) Answer all the questions in the spaces provided.
c) Mathematical tables and electronic calculators may be used.
d) All working must be clearly shown where necessary.
e) Students should check the question paper to ascertain that all the pages are printed as indicated and that no questions are missing.

For Examiner's Use Only

Question	Maximum Score	Candidate's Score
1		
2		
3		
4		
5		
6		
7		

1. Study the data in the table below to answer the questions that follow. The letters do not represent actual symbols of the elements.

Elements	Atomic number	Melting point °C	Boiling point °C	Ionic radius
A	11	98	890	0.095
B	12	650	1140	0.065
C	13	660	2470	0.050
D	14	1410	2360	0.034
E	15	44.2 590	280	0.212
F	16	113 119	445	0.184
G	17	-101	-35	0.181
H	18	-189	-186	-

i) Write the electronic arrangement for the atoms represented by letters B and F. (2 Marks)

B F

ii) State the nature of oxides of the elements represented by B and F. (2 Marks)

Oxide of B

Oxide of F

iii) Why does the element represented by letters E have two values of melting point?(1 Mark)

iv) Explain the following observations in terms of structure and bonding.

a) There is increase in boiling point from A to C. (2 Marks)

b) Element D has a high melting point and boiling point. (2 Marks)

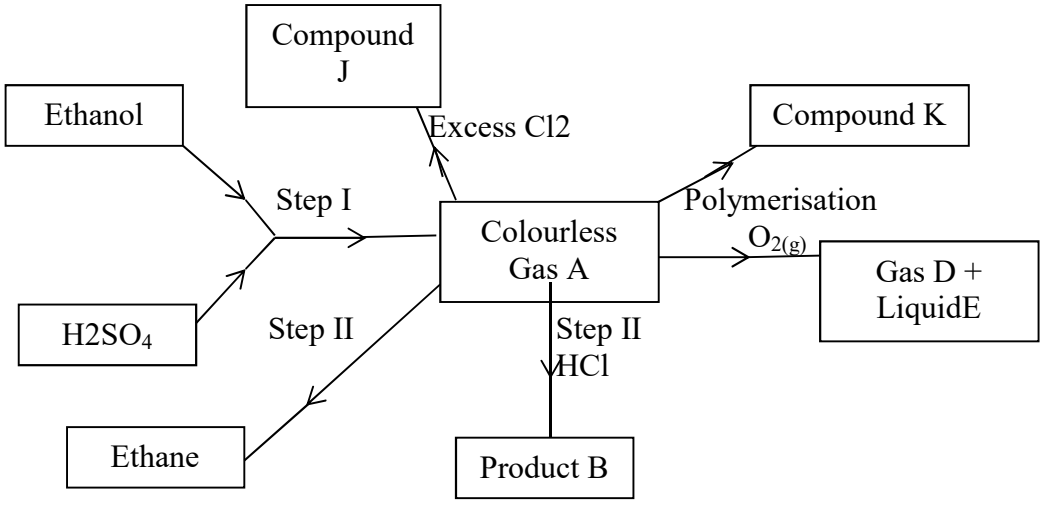
c) There is a decrease in boiling point from E to H. (2 Marks)

v) Explain the difference in ionic radius between elements represented by letters A and G.

(2 Marks)

vi) Write the formulae and the electronic arrangement of the two ions of E whose ionic radius are shown in the table. (2 Marks)

2. Study the chart below and answer the questions that follow.



i) State the reagents and conditions necessary in the following steps. (3 Marks)

Step	**Conditions**	**Reagents**
Step I		
Step II		

ii) Name: (2 Marks)

a) Colourless gas A

b) Compound B

c) Compound J

d) Compound K

iii) Write a chemical equation that lead to formation of gas D and liquid E. (1 Mark)

iv) Write the structural formula of compound B. (1 Mark)

v) State the importance of reaction taking place in Step II. (1 Mark)

B. The table below gives some information of some members of a homologous series of hydrocarbons.

	No. of Carbons	**Relative Molecular Mass**
A	1	16
B	2	30
C	3	44
D	4	58
E	5	72
F	6	86

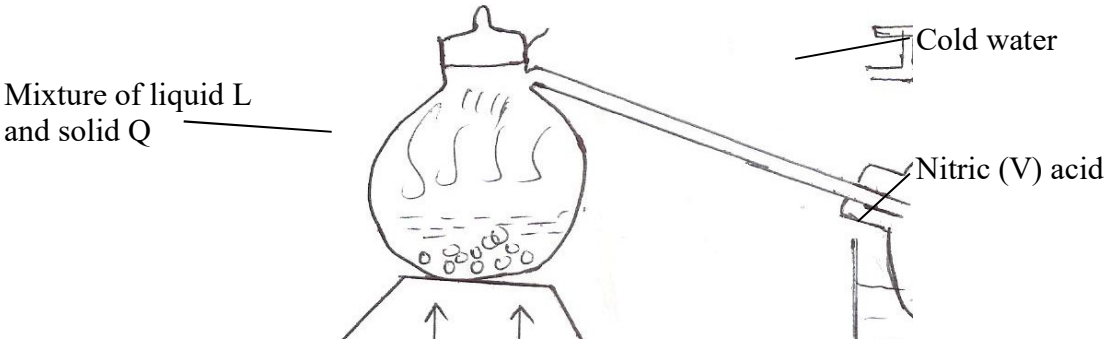
i) What do you understand by the term homologous series? (1 Mark)

ii) To which group of hydrocarbon do they belong? (1 Mark)

iii) Give the condensed structural formula of the compound represented by letter E. (1 Mark)

iv) Explain why the compound represented by letter F is liquid while that of letter B is a gas at room temperature.(1 Mark)

3. The diagram below shows the preparation of Nitric (V) acid.



i) Name the liquid L and solid Q used to prepare Nitric (V) acid. (2 Marks)

L

Q

ii) What is the colour of the Nitric (V) acid produced? Give reasons. (2 Marks)

iii) What is the purpose of cold water? (1 Mark)

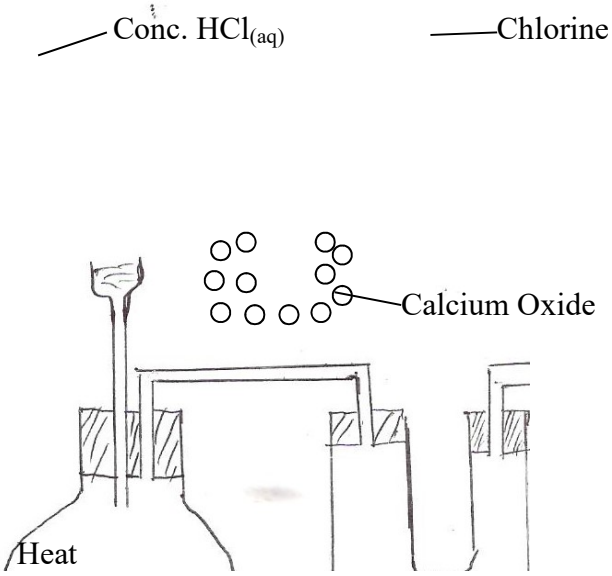
iv) Explain why Nitric (V) acid is stored in dark bottles. (1 Mark)

v) Red hot carbon reacts with concentrated Nitric (V) acid to give two gases. Name the two gases. (2 Marks)

vi) Write the equation of reaction between Carbon and Concentrated Nitric (V) acid. (1 Mark)

vii) Give two uses of Nitric (V) acid. (2 Marks)

4. The diagram represents a set-up intended for the preparation and collection of dry chlorine gas. Study it and answer the questions that follows.



i) Identify two mistakes in the set-up and give a reason for each. (2 Marks)

ii) State the role of Manganese (IV) Oxide. (1 Mark)

b) Chlorine in the presence of water is a bleaching agent. Name the substance responsible for the bleaching action. (1 Mark)

c) Write down the equation for the reaction between dry chlorine and heated iron fillings. (1 Mark)

d) Write an ionic equation for the reaction between Potassium Bromide solution and Chlorine. (1 Mark)

e) i) Iron (II) Chloride reacts with Chlorine gas to form substance E. Identify substance E. (1 Mark)

ii) During the reaction in C(i) above 6.30g of Iron (II) Chloride were converted to 8.06 of substance E. Calculate the volume of Chlorine used. (2 Marks)
(Cl = 35.5, Molar gas volume at room temperature = 24000cm^3, Fe = 56)

f) Draw and name the structure of the compound formed when excess chlorine gas is reacted with methane gas in presence of UV light. (2 Marks)

g) Give two industrial uses of chlorine. (2 Marks)

5. The reaction between Sulphur (IV) Oxide and Oxygen to form Sulphur (VI) Oxide in the contact process is exothermic.

$2SO_{2(g)} + O_{2(g)} \quad 2SO_{3(g)}$

A factory manufacturing Sulphuric acid by contact process produces 350Kg of Sulphur (VI) Oxide per day.

i) Give the optimum conditions for the above reaction. (3 Marks)

a) Catalyst

b) Temperature

c) Pressure

ii) All the Sulphur (VI) Oxide produced was absorbed in concentrated sulphuric acid to form Oleum.

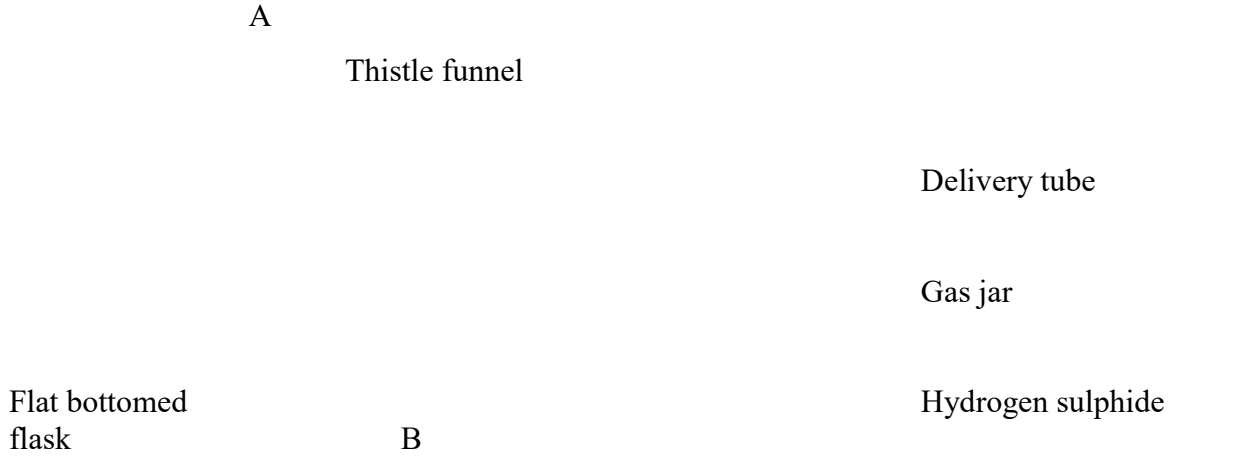
$H_2SO_{4(l)} + SO_{3(g)} \quad H_2S_2O_{7(l)}$

Calculate the mass of oleum that was produced per day.

(S=32, O=16.0, H=1.0) (3 Marks)

iii) Explain why Sulphur (VI) Oxide gas is not dissolved directly in water. (1 Mark)

b) The diagram below shows the laboratory preparation or hydrogen sulphide gas.



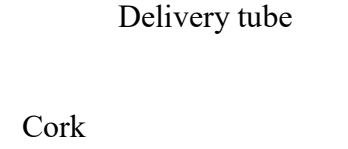
i) Identify substance A and B. (2 Marks)

ii) Write an equation for the reaction taking place in the flat bottomed flask. (1 Mark)

iii) Name a drying agent that can be used to dry hydrogen sulphide. (1 Mark)

iv) Explain why when Sulphur (IV) Oxide is mixed with hydrogen Sulphide in an aqueous environment, yellow deposit is formed. (2 Marks)

6. The diagram below shows a set up used by a student in an attempt to prepare and collect oxygen gas.



Water Water

Solid W

i) Identify one mistake in the set up. (1 Mark)

ii) Name solid W. (1 Mark)

iii) Write a chemical equation of the reaction between solid W and water. (1 Mark)

b) A piece of Phosphorous was burnt in excess air. The product obtained was shaken with a small amount of hot water to make a solution.

i) Write an equation for the burning of Phosphorous in excess air. (1 Mark)

ii) The solution obtained in (b) above was found to have a pH of 2. Give reasons for this observation. (2 Marks)

c) The set-up below was used to investigate the change in mass when 0.96g of Magnesium ribbon burns in air.

Lid

Crucible

Magnesium

Tripod stand

Heat

The results obtained are shown below.

Mass of Crucible + Magnesium before burning = 26.18g

Mass of Crucible + Contents after burning = 26.82g

i) Calculate the mass of oxygen used up in the reaction. (1 Mark)

ii) Determine the emphirical formula of the compound formed from the information given above. (Mg = 24, O = 16). (2 Marks)

7. The diagram below shows an experiment in which Carbon (II) Oxide was reacted completely with a heated oxide of iron. Study the diagram and the data shown below it and answer the questions that follow.

Combustion tube Oxide of Iron Excess Carbon (II) Oxide burning

Carbon
(II) Oxide

Heat

Mass of Porcelain boat = 13.23g

Mass of Porcelain boat + Oxide of Iron = 16.71g

Mass of Porcelain boat + Residue = 15.75g

a) From the data above, calculate: -

i) Mass of the oxide of iron. (1 Mark)

ii) Mass of iron in the oxide. (1 Mark)

iii) Mass of oxygen that react with the iron to form the oxide. (1 Mark)

iv) Determine the empirical formula of the oxide. (2 Marks)

v) If the molecular mass of the oxide is 232, determine its molecular formula. (1 Mark)

vi) Write a chemical equation of the reaction that took place in the combustion tube. (1 Mark)