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525/1

S6 CHEMISTRY

Exam 8

PAPER 1

DURATION: 2 HOUR 45 MINUTES

For Marking guide contact and consultations: Dr. Bbosa Science 0776 802709.

Attempt all numbers

1. Complete the following organic reaction and name the major organic products.
   (a) $CH_3CH=CH_2 \xrightarrow{MnO_4^-/OH^-}$ …….. (1 ½)

   Name ……

   (b)  $\xrightarrow{Cr_2O_7^-/H^+, \text{ heat}}$ …….. (1 ½)

   Name ……

   (c) $(CH_3)_2CHCOONa + NaOH(s) \xrightarrow{CaO, \text{ heat}}$ …….. (1 ½)

   Name ……

   (d)

2. (a) Explain what is meant by the term steam distillation?

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(b) A mixture of nitrobenzene and distilled water boiled at 99^0C at one atmosphere. Calculate the percentage composition of the distillate. The saturate vapor pressure of water at 99^0C is 723mmHg.

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3. Draw the structures and namethe shapes of the following species.

Structure Name

(a) HCO_3^-

(b) Cl_2O^-

(c) SO_3^{2-}

4. State what is observed and write equation that occur when
   (a) Dilute sulphuric acid is added to aqueous solution of potassium manganate (VI).
   Observation……
   Equation

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……..

(b) Bromine water is added to hydroxylbenzene

Observation……

Equation

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5. (a) state Raoult's law.

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(c) At 50^0C an aqueous solution of carbamide (CH_3CONH_2) of concentration 60.93gdm-3 has a vapor pressure of 12100Nm^{-2}. Determine the vapor pressure of water at this temperature. (4marks)

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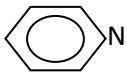
6. Complete the following organic reactions and outline the accepted mechanism.

(a)  $NH_2 + CH_3COCl$ ⟶

(b) $CH_3CH_2Br + CH_3C\equiv CH$ $\xrightarrow{Na/Liq.\ NH_3}$

7. (a) Write electronic configuration of copper (I) and copper (II) ions
   (i) Copper (I) ion ……..
   (ii) Copper (II) ion ……..
   (b) The electrode potentials for the following reactions are given below

	E^0/V
$Cu^+(aq) + e \longrightarrow Cu(s)$	0.52
$Cu^{2+}(aq) + e \longrightarrow Cu^+(aq)$	0.52

   Use the information given above to calculate the e.m.f value for the reaction given below
   $2Cu+(aq) \longrightarrow Cu(s) + Cu^{2+}(aq)$

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(c) What can you deduce from your answer

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8. Write equations for the reactions that occur between each of the following compounds with hot concentrated sodium hydroxide solution
   (a) Chromium (III) oxide

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(b) Fluorine

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(c) Lead (IV) oxide

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9. Define the term buffer solution

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(c) A 0.1M solution of sodium hydroxide was added to 50cm^3
(d) of 0.1M ethanoic acid until when the acid is half way neutralized. Determine the pH of the resultant solution formed. (Ka for ethanoic acid is 1.8 $x10^{-5}$)

(d) State one application of a buffer.

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SECTION B (54MARKS)

(Attempt six questions only)

10. (a) during manufacture of nitric acid, ammonia is catalytically oxidized with air in presence of a catalyst R.

(i) Name the catalyst R

(ii) Write equation for the reaction in (a)(i) above

(b) State other conditions applied in the reaction above

(c) Write equation to show how nitric acid is formed from the product (s) in (a) above

(d) A few drops of concentrate nitric acid were added to aqueous solution of manganese (II) salt in presence of solid Q. A purple was formed.

(i) Name solid Q

(ii) Write equation for the reaction

11. Name the reagent(s) that can be used to distinguish between the following pairs of compounds. In each case state the observations made.
    (a) Phenylethanol and 2-phenylethanol

    (b) 2- aminopropane and dimethylamine

    (c) Ethanol and methanol
12. (a)Explain in what is meant by the term anomalous behavior

(b) State any two anomalous behavior of fluorine as compared to other group (VII) elements. Use equations to illustrate your answer.

(c) Give reasons(s) why fluorine exhibit the type of behaviors mentioned in (b) above.

(d) The acid strength of the following acids are in order: $HClO_2 < HClO_3 < HClO_4$. Explain your answer.

13. (a) Explain what is meant by each of the following terms.
    (i) Order of the reaction

    (ii) Molecularity of the reaction

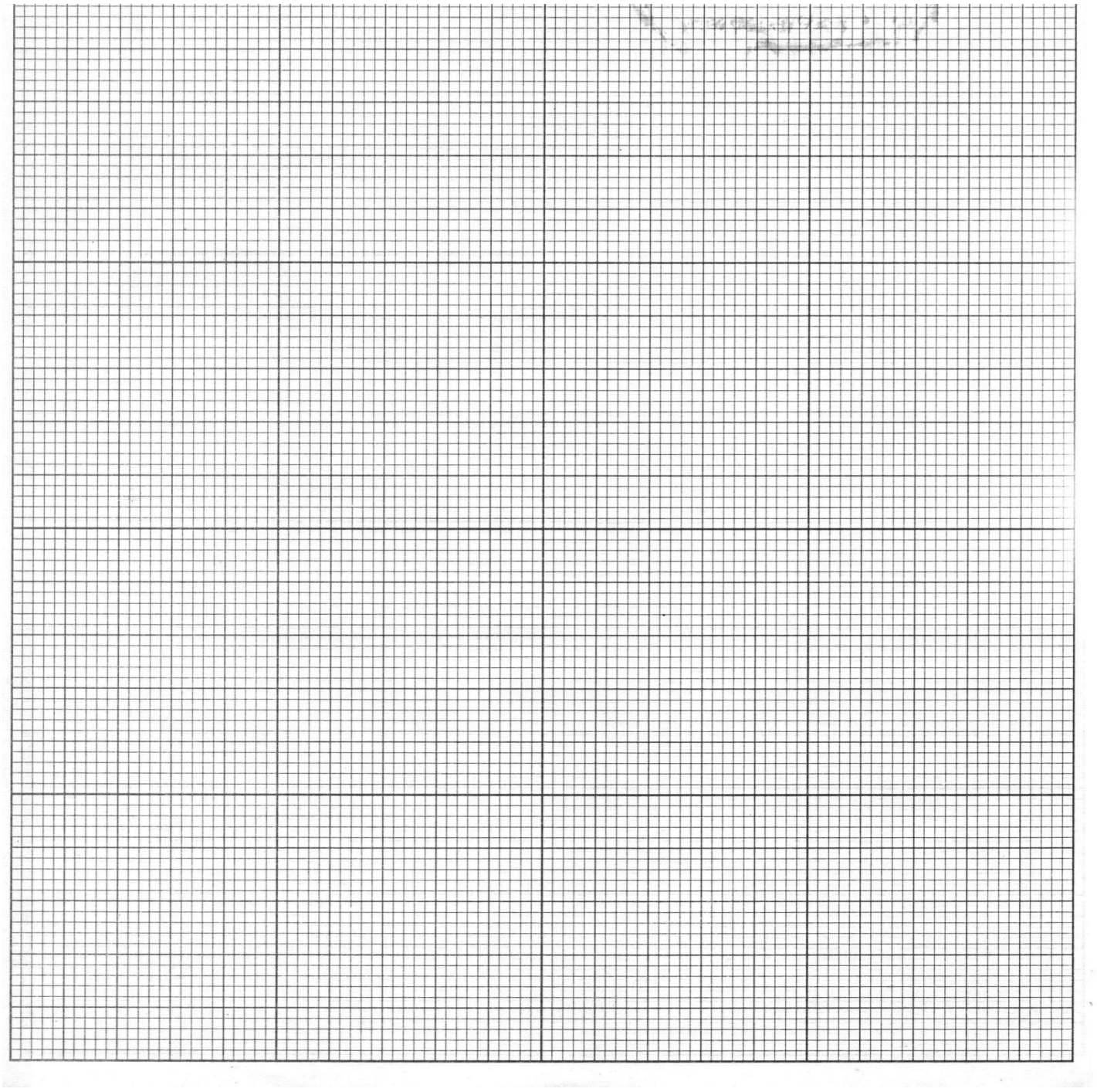
(b) Hydrogen peroxide decomposes as shown below

$2H_2O_2\ (aq) \longrightarrow 2H_2O(l) + O_2\ (g)$

The reaction is catalyzed by adding a known volume of iron (III) chloride. The order of this reaction can be determined by titrating the mixture with standard solutions of acidified potassium permanganate (VII). The following results were obtained during the experiment

Time/min	5	5	10	15	20	25	30
Vol of $KMno_4$	30	23.4	18.3	14.7	14.2	8.7	6.8

(i) Plot a graph of volume of potassium permanganate (VII) against time



(ii) Determine the order of reaction. Give reasons for your answer

(iii) Determine the rate constant for the reaction.

14. (a) State Grahams' law of gaseous diffusion.

(b) Equimolar amounts of an amine, W and oxygen were allowed to diffuse through the same porous medium under the same conditions of pressure and temperature. The amine W diffuses 1.19 times as fast as the time taken by oxygen

(i) Determine the molecular mass of W.

(iii) Determine the molecular formula of W.

(c)(i) Write equation for the reaction that occur when compound W is dissolved in water

(iii) Determine the pH of 0.1M aqueous solution of compound W. the base dissociation constant Kb for compound W is 1.85×10^{-5} and Kw for water at 250C is 1.0×10^{-14}.

15. Write equations to show how the following synthesis can be carried out. In each case indicate the necessary reagents and conditions.

(a)  $=NNH_2$ from cyclohexene

(b) Ethylamine from ethanol

(c) Methylbenzene from benzene sulphonic acid

16. State what is will be observed and write equations for the reactions that occur when

(a) Sodium hydroxide solution is added drop wise until in excess to an aqueous solution of chromium (III) salt followed by hydrogen peroxide solution and the solution warmed

(b) Acidified potassium permanganate solution is added to aqueous solution of tin (II) chloride

17. (a) Boron and silicon show diagonal relationship

(i) What is diagonal relationship

(ii) Briefly explain why silicon and boron show diagonal relation ship

(c) Given any four ways in which both boron and silicon exhibit diagonal relationship

(d) State two other pairs of elements in the periodic table that exhibit diagonal relationship.

(e) Excess hot concentrated sodium hydroxide solution was added to 2.5g of a mixture of aluminium metal and magnesium metal. If the volume of the gas liberated at stp was 2.24cm3. calculate the percentage of magnesium in the mixture.