Our country, our future

525/1

S6 CHEMISTRY

Exam 29

PAPER 1

DURATION: 2 HOUR 45 MINUTES

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

Instructions

- This paper consists of two sections A and B
- Section A is compulsory
- Attempt only six questions in section B
- Answers must be written in the spaces provided only.

Where necessary use the following:

Molar gas constant, R   = 8.31JK^{-1}mol^{-1}

Molar volume of a gas at s.t.p   = 22.4litres

Standard temperature   = 273K

Standard pressure   = 10125Nm^{-2}

For Examiner's Use Only																
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17

SECTION A : (46 MARKS)

1. a) Bond energies for some bonds are given below

Bond	Bond energy (kJmol^{-1})
C≡C	+813
C-C	+346
C-H	+413
H-H	+436

.Calculate enthalpy of hydrogenation of ethyne   (3marks)

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(b) State whether hydrogenation of ethyne is feasible or not. Give a reason for your answer.
(1 ½ mark)

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2. State what is observed and write equation of the reaction in each case when the following compounds are mixed
   (i)   Methanoic acid and ammoniacal silver nitrate solution heated
            Observation

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Equation

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(b) Benzoic acid and aqueous sodium bicarbonate solution

Observation

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Equation

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(c) Propanone and Brady's solution

Observation

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Equation

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3. Calculate the pH of solution formed by mixing $80cm^3$ of 0.1M hydrochloric acid with $120cm^3$ of 0.1M potassium hydroxide

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4. (a) State three reasons for the difference in properties between fluorine and other elements of group VII   (3marks)

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(b) Write equation for the reaction that takes place between the following compounds

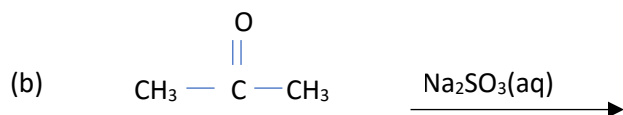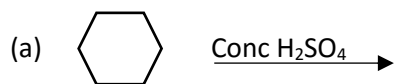(i) Silicon (iv) oxide and hydrofluoric acid   (1 ½ marks)

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(ii)   Fluorine and water   (1 ½ marks)

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5. Complete the following reactions and write the accepted mechanism

(a)   [hexagon] $\underline{Conc\ H_2SO_4}$ →

(b) $CH_3 - \overset{\overset{O}{\|}}{C} - CH_3$ $\underline{Na_2SO_3(aq)}$ →

6. (a) (i)   Explain what is meant by the order of chemical reaction.   (1mark)

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(ii)   Name two methods used to determine orders of reactions.   (1mark)

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(b) The results obtained for the kinetics of the decomposition of nitrogen (V) oxide are given in the table below:

$[N_2O_5]$/moldm^{-3}	Initial rate/moldm^{-3}s^{-1}
1.6×10^{-3}	0.12
2.4×10^{-3}	0.18
3.2×10^{-3}	x

Calculate

(i)   Order of reaction   (4marks)

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(ii)   Value of x

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7. Write the electronic configuration of;

(i)   Nitrogen   (1mark)

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(ii)   Phosphorus   (1mark)

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(b) Explain why nitrogen form (NCl_3) whereas phosphorus forms the chlorides PCl_3 and PCl_5.

(1 ½ marks)

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(c) Write equations for the hydrolysis of phosphorus chlorides by water (3marks).

    (i)   Phosphorus (V) chloride

            Equation

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    (ii)   Phosphorus (III) chloride

            Equation

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8. (a) When $20cm^3$ of hydrocarbon Z was exploded in $200cm^3$ of oxygen (excess), it completely burnt with a sooty flame. The volume of residual gas after cooling to room temperature was $160cm^3$. On addition of aqueous potassium hydroxide to the residual gas, the final volume was $20cm^3$.

Calculate the molecular formula of Z.   (3marks)

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(b) When Z was heated with alkaline potassium permanganate (VII) solution forms a colorless solution which cooled in presence of dilute sulphuric acid to form a crystalline solid P.

    (i)   Identify   (1mark)

            Z: …………………………………………………………………………………………………

            P: ……………………………………………………………………………………………….

    (ii)   Write equations to show how P is formed.

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9. (a) Explain why diffusion in solution is very slower than in gases.

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(c) 141.4cm^3 of gas X diffuse through a porous plug in the same time as it took 50cm^3 of oxygen to diffuse through the same plug under identical conditions. Calculate the relative molecular mass of X

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SECTION B: (54 MARKS)

10. State what is observed and write equation for the reaction that takes place when;

(a) Potassium iodide is added to acidified hydrogen peroxide solution

Observation

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Equation

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(b) Concentrated hydrochloric acid is added drop wise until in excess to aqueous solution containing cobalt (II) ions.

Observation

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Equation

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(c) Aqueous sodium hydroxide is added drop wise to aqueous solution containing beryllium (II) ions.

Observation

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Equation

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11. (a) A compound Y contains by mass 22.86% oxygen, 8.5% hydrogen and the rest carbon

   (i)   Calculate the empirical formula of Y.   (2 ½ mmarks)

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(ii)   When 0.30g of Y is vaporized at 80^0C and 700mmHg pressure, it occupied a volume of 134.77cm^3. Determine the molecular formula of Y

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(b) Y forms a yellow precipitate with 2,4-dinitrophenylhydrazine but does not react with Tollens reagent. Identify Y.   (1marks)

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(c) Write equation for the formation of a yellow precipitate (b).   (2marks)

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12. (a) State three characteristics of chemical equilibrium   (2 ½ marks)

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(b) Phosphorus (V) chloride when heated decomposed at according to the following equation.

$$PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)$$

(i)   Write the expression for equilibrium constant, Kc.   (1marks)

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(ii)   When 1 mole of phosphorus (V) chloride was heated in a closed vessel at 350^0C, the equilibrium mixture was found to contain 38.4% of chlorine. Calculate the equilibrium constant, Kc at 350^0C.   (3 ½ marks)

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(iii)   The equilibrium constant at 250^0C is 1.54, state whether the reaction is exothermic or

endothermic. Give a reason for your answer.   (1 ½ mark)

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(c) State what would happen to the concentration of chlorine if the pressure in the vessel was

Decreased white the temperature is maintained at 3500C. give a reason for your answer.

(1 ½ marks)

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13. Write equation to show how the following conversions can be effected. [Include conditions for the reaction] (3marks each)

(a) Benzoic Acid to phenylamine

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(b) Ethene to butanol

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(c) 1-chloroethane to ethanamide

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14. (a) (i) Explain what is meant by an acid- indicator. (1mark)

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(ii) Explain in titration experiments one or two drops of indicators are used

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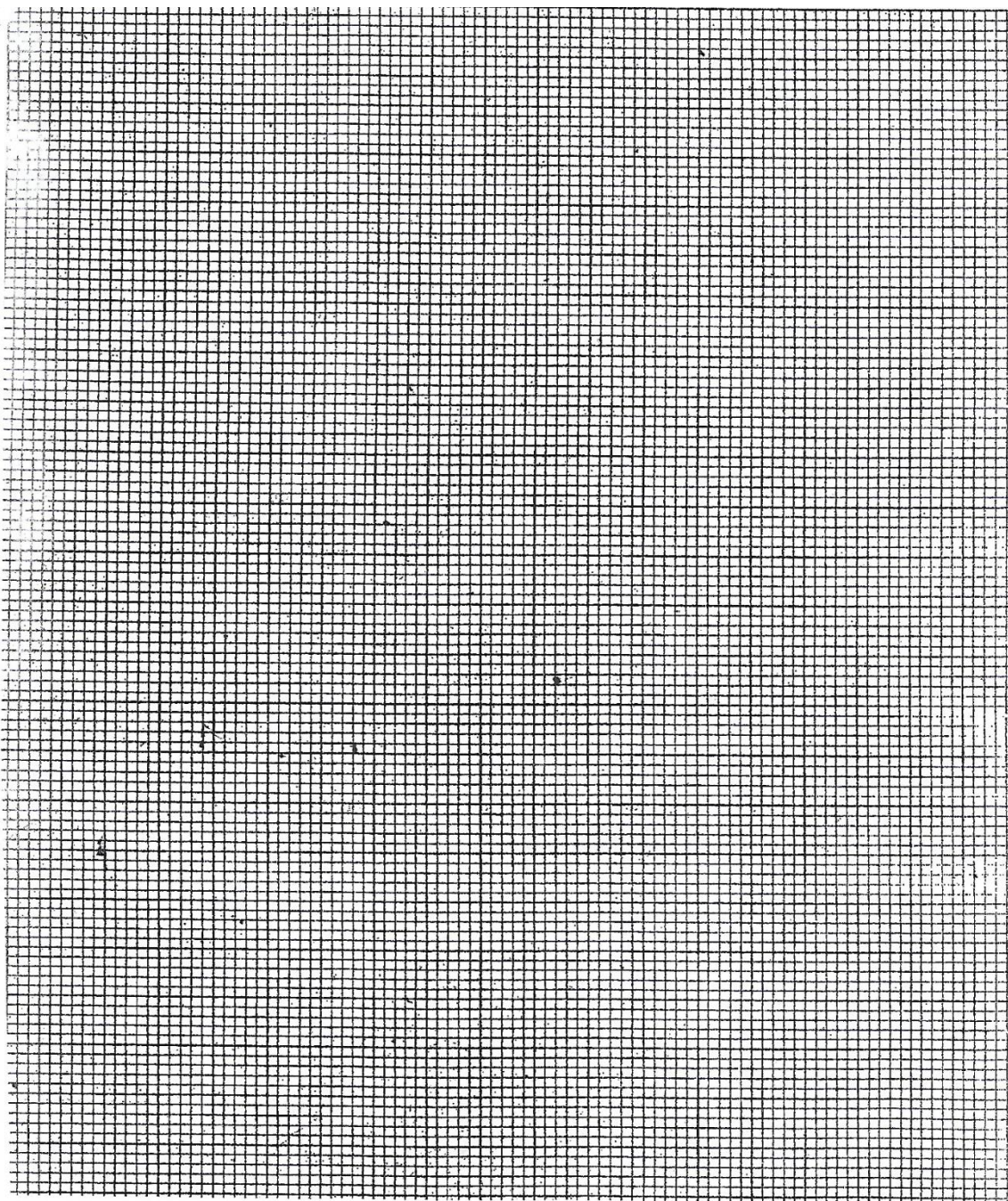
(b) The table below gives data obtained when $100cm^3$ of propanaoic acid was titrated with 1.0M sodium hydroxide solution.

Volume of NaOH (1M) added (cm^3)	0.0	1.0	5.0	9.0	9.5	10.5	11.0	15.0
pH of solution	2.94	3.92	4.87	5.82	6.15	11.70	12.00	12.70

(i)   Draw a graph of pH against the volume of sodium hydroxide

(ii)   Explain the shape of the graph you have drawn in b(i).   (2 ½ marks)

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(iii)   Determine the pH of the solutions at equivalent point.   (1 mark)

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(iv)   Which of the following indicators would be suitable for titration above? Give a reason
         for you answer.

Indicator	Methyl red	Bromothymol blue	Phenol red
pH range	4.2-6.3	6.0-7.6	6.8-8.4

         Indicator …………………………………………………………………….   (½ mark)
         Reasons   (1 ½ marks)

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15. (a)Compare the following properties of group (II) and group (I) elements. In each case, give a
    reason for your answer.   (1 ½ mark each)
    (i)   First ionization energy

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(ii)   Melting points

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(iii)   Electroposivity

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(b) The decomposition temperatures of the carbonates of group (II) element are given below

Carbonates	$MgCO_3$	$CaCO_3$	$SrCO_3$	$BaCO_3$
Decomposition temperature ^0C	404	826	1098	1370

(i)   State how the decomposition temperatures vary   (1mark)

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(ii)   Explain your answer in (b)(i)   (3 ½ mark)

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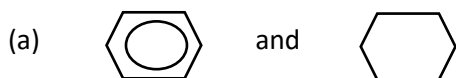
16. Name a reagent that can be used to differentiate between the following pairs of compounds. State what would be observed if each compound is treated with the reagent you have named

(3marks each)

(a)   and

Reagent

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Observation

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(b)

$$O$$
$$\parallel$$
H-C-OH   and $$O \quad O$$
$$\parallel \quad \parallel$$
HO-C - C - OH
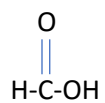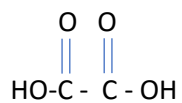
Reagent

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Observation

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(c) ⬡—NH_2 and ⬡—CH_2NH_2
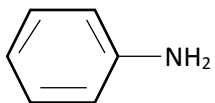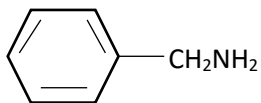
Reagent

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Observation

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17. Ethanol can be produced by fermentation of molasses.

(a) (i) Name two other raw material from which ethanol can be produced by fermentation.

(1mark)

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(iii)   Write equation to show how crude ethanol can be obtained from the materials named

above   (3marks)

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(b) Describe how 100% (absolute) ethanol can be produced from crude ethanol produced in

(a)(ii) above.   (2marks)

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(c) Write equations(s) stating conditions for the reaction leading to the formation of the

following compounds from ethanol.   (1 ½ marks each)

(i)   Polyethene

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(ii)   Ethoxyethane

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END

c) i   Write equation(s) to show how each of the following compounds could be obtained from ethanol.

i)   Polythene.

(1½ marks)

ii)   ethoxyethane.

(1½ marks)

END

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