



மாகாணக் கல்வித் திணைக்களம்
வடக்கு மாகாணம்
முன்னோடிப் பரீட்சை - 2019



Grade - 13

Chemistry

time : 3.00

$$N_A = 6.022 \times 10^{23} \text{ mol}^{-1} \quad h = 6.626 \times 10^{-34} \text{ JS}$$

$$C = 3 \times 10^8 \text{ ms}^{-1} \quad R = 8.314 \text{ Jmol}^{-1} \text{ K}^{-1}$$

1) What of the following element has highest second ionization energy?

1. Ar 2. Ne 3. Al 4. He 5. Mg

2) $\left[\begin{array}{c} \text{:}\ddot{\text{O}}\text{:} \\ | \\ \text{H}-\text{A}-\ddot{\text{O}}\text{:} \\ | \\ \text{:}\ddot{\text{O}}\text{:} \end{array} \right]$ In the given structure, element A belongs to P - Block. To which group the element A shall belongs to?

1. Group 17 / VII A 2. Group 14 / IV A
3. Group 15 / V A 4. Group 13 / III A
5. Group 16 / VI A

3) Which of the following statement id true regarding the chemical species $[\text{Fe}(\text{CO})_5]$?

1. Hybridization of central atom is SP^3
2. Total number of lone pairs is 10.
3. In this species, ionic, covalent and dative bonds are available.
4. There are 5 - Sigma (σ) bonds present in this compound.
5. Aqueous solution of this compound gives blood red color.

4) Select the IUPAC name of the following compound.

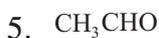
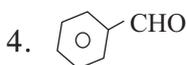
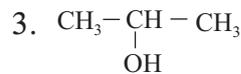
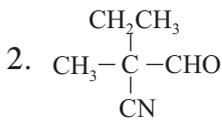
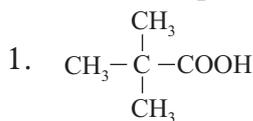


1. methyl 5-formyl - 2 - oxo -3 - Pentenoate
2. methyl 2,6 - dioxo - 3 - hexenoic acid
3. methyl 6 - al - 2 - oxo -3 - hexenoic acid
4. methyl - 5 - formyl - 2 - oxo -3 - pentenoate
5. None of the above.

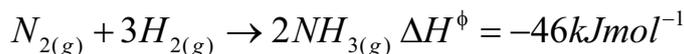
5) Which of the following industrial process contributes in greater extent fro global warming?

1. Soap production 2. Nitric acid production
3. Iron Production 4. Sulpharic acid production
5. Bio - diesel production.

6) Select the compound involves self condensation in basic conditions?

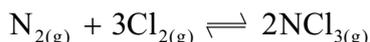


- 7) By considering the following reaction at 250c select the incorrect statement out of the following statements.



1. ΔS^θ is always a negative value for this reaction.
 2. ΔG^θ of reaction changes with temperature.
 3. We can determine the spontaneity of reaction by observing.
 4. This reaction is spontaneous at any given temperature.
 5. At higher temperatures value of ΔG^θ becomes positive.
- 8) Select the appropriate statement out of the following.
1. Half life time always dependent on concentration of reactants.
 2. Half life time is dependent on concentration of reactants.
 3. Half life time is directly proportional to temperature.
 4. Half life time always depends on rate constant of respective reaction.
 5. Half life time shows directly proportional relationship towards rate order.
- 9) Which of the following is most effective in distinguishing Ba(NO₃)₂ AND Mg Cl₂.
1. Na₂ CO₃
 2. CaCl₂
 3. (NH₄)₂ SO₄
 4. RbHCO₃
 5. Na₂S
- 10) W₁ mass of K₃ PO₄ and W₂ mass of Al₂ (SO₄)₃ were dissolved in water to form a 1 dm³ solution. When excess BaCl₂ solution was added to a 100cm³ portion of the solution. hence the mass of the product is,
- Molar mass of K₃PO₄ = M₁ gmol⁻¹
Molar mass of Al₂(SO₄)₃ = M₂ gmol⁻¹
Molar mass of Ba₃(PO₄)₂ = M₃ gmol⁻¹
Molar mass of BaSO₄ = M₄ gmol⁻¹
1. $\left(\frac{W_1 M_3}{2M_1} + \frac{W_2 M_4}{M_2} \right)$
 2. $\left(\frac{W_1 M_3}{2M_1} + \frac{3W_2 M_4}{M_2} \right) 10$
 3. $\left(\frac{W_1 M_3}{2M_1} + \frac{W_2 M_4}{3M_2} \right) 10$
 4. $\left(\frac{2W_1 M_3}{M_1} + \frac{3W_2 M_4}{M_2} \right) 1/10$
 5. $\left(\frac{W_1 M_3}{2M_1} + \frac{W_2 M_4}{M_2} \right) 1/10$
- 11) Which of the following statements regarding nitration of the organic compound Toluene is correct?
1. Rate of nitration in Toluene is greater than that of Aniline.
 2. Con. H₂SO₄ decrease the rate of nitration by acting as an oxidizing agent.
 3. In this mechanism con. HNO₃ acts as acid.
 4. In meta position of Toluene nitration is most probable to take place.
 5. HSO₄⁻ accepts a proton from Sp³ hybridized carbon atom.
- 12) Which of the following statement is inappropriate regarding the membrane cell used in NaOH production?
1. Anode of the cell is Titanium.
 2. NaOH is produced in cathodic chamber and H₂ gas is released there.
 3. OH⁻ ions cannot move through the membrane.
 4. NaOH is produced in the cathodic chamber and OH⁻ ions are reduced there.
 5. Cl₂ gas is produced in anodic chamber.

18) Consider the following equilibrium system.



At 50^oc 'a' moles of N₂ gas and 'b' moles of Cl₂ gas were allowed to mix and attain equilibrium. If 'Z' moles of NCl₃ was found at equilibrium. Find the K_c of the forward reaction where rigid volume of vessel is 1.0dm³

1. $\frac{8Z^2}{(2a-z)(2b-3z)}$
2. $\frac{16Z^2}{(2a-z)(2b-3z)^3}$
3. $\frac{4Z^2}{(2a-z)(2b-3z)}$
4. $\frac{(2a-z)(2a-z)(2b-3z)^3}{8Z^2}$
5. $\frac{(2a-z)(2a-z)(2b-3z)}{8Z^2}$

19) Which of the following compound shows geometrical isomerism?

1. 1, 1 - dibromo - 1 - butene.
2. 1 - bromo - 2 - butene.
3. 2 - bromo - 1 - butene.
4. 3,3 - dibromo - 1 - butene.
5. 1 - bromo - 2 - methyl propane.

20) Consider the following reactions at standard conditions.

1. $2\text{Al}_{(\text{s})} + \frac{3}{2}\text{O}_{2(\text{g})} \rightarrow \text{Al}_2\text{O}_{3(\text{s})} \quad \Delta H^\theta = -x \text{ KJmol}^{-1}$
2. $2\text{Al}_{(\text{g})} + 3\text{O}_{(\text{g})} \rightarrow \text{Al}_2\text{O}_{3(\text{s})} \quad \Delta H^\theta = -y \text{ KJmol}^{-1}$
3. $2\text{Al}^{3+}_{(\text{g})} + \frac{3}{2}\text{O}_{2(\text{g})} \rightarrow \text{Al}_2\text{O}_{3(\text{s})} \quad \Delta H^\theta = -z \text{ KJmol}^{-1}$
4. $2\text{Al}^{3+}_{(\text{g})} + 3\text{O}^{2-}_{(\text{g})} \rightarrow \text{Al}_2\text{O}_{3(\text{s})} \quad \Delta H^\theta = -z \text{ KJmol}^{-1}$
5. $2\text{Al}^+_{(\text{g})} + 3\text{O}^{2-}_{(\text{g})} \rightarrow \text{Al}_2\text{O}_{3(\text{s})} \quad \Delta H^\theta = -b \text{ KJmol}^{-1}$

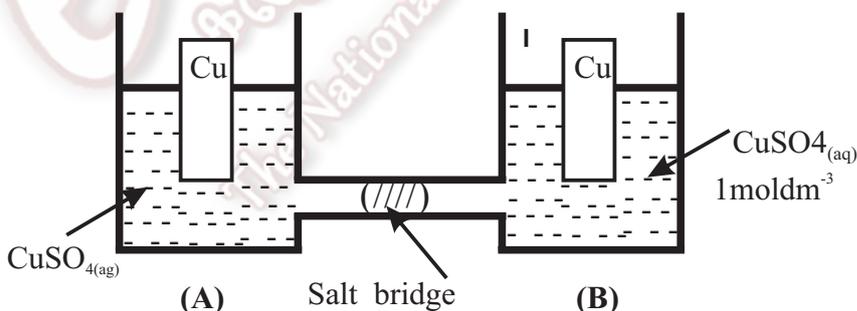
Correct increasing order of the magnitude of above enthalpy values,

1. $x < z < y < a < b$
2. $x < y < a < b < z$
3. $x < y < b < z < z$
4. $x < y < z < b < a$
5. $x < y < b < z < a$

21) At 30^oc Ionic product of water is $1 \times 10^{-13} \text{ mol}^2 \text{dm}^{-6}$ hence what is the pH value of 500cm³, 0.001 mol dm⁻³ NaOH solution?

1. 12
2. 10
3. 11
4. 13
5. 9

22)



Standard electrode potential of Cu is 0.34V. What is wrong about the cell?

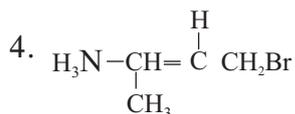
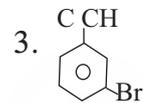
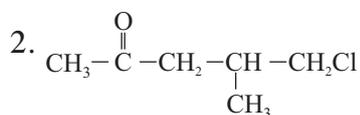
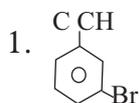
1. Electrode P acts as the anode.
2. SO₄²⁻ ions travel through salt function from B to A when the current flows.
3. Metal deposits on B and a gas is released from P when the current flows.
4. Electromotive force of the cell decreases gradually when the cell operates.
5. ΔH and ΔG values are (-)ve for this process at 25^oc.

23) pH of a 100cm³ KOBr solution at 298K. is 11. What is the approx. mass of KOBr in the solution if $pK_w = 14$, $K_{a(HOBr)} = 2.0 \times 10^{-9} \text{ mol dm}^{-3}$

$$M_{KOBr} = 135$$

1. 0.135g 2. 1.35g 3. 2.7g 4. 1.4g

24) By using which of the following compounds stable grignard's reagent can be produced.



1. A, B only 2. A, C only 3. B only
4. D only 5. None of the above

25) Which of the following statement is correct regarding environment pollution.

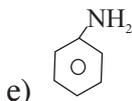
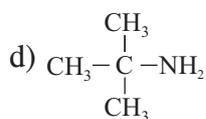
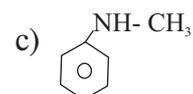
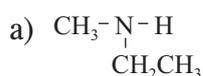
- 1) SO₂ gas in the atmosphere is removed by lighting
- 2) Sulphide present in the water contributes in great extent for eutrophication
- 3) CO, NO gases in vehicle emissions are turned harmless by catalytic converters.
- 4) Major gas responsible for global warming is released by burning of sulphur containing substances.
- 5) Water pollution is suppressed by the presence of free radicals.

26) Structures of A, B respectively are,



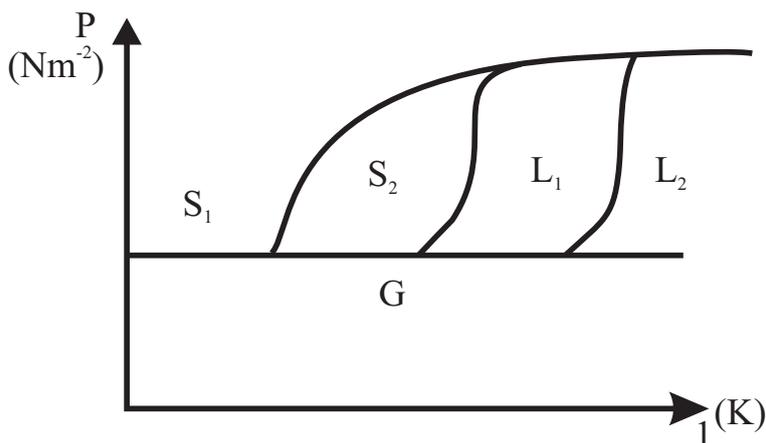
1. CH₃CHO, CH₃CH₂-C≡C⁻Na⁺
2. CH₃CH₂OH, CH₃CH₂-C≡C⁻Na⁺
3. CH₃CHO, CH₃CH₂-CH(Cl)-CH₂-CH₃
4. CH₃CH₂OH, CH₃-C≡C⁻Na⁺
5. CH₃COOH, CH₃, CH₂-C≡C⁻Na⁺

27) Ascending order of basicity of given compounds be.

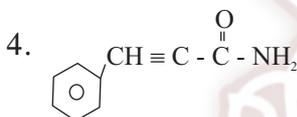
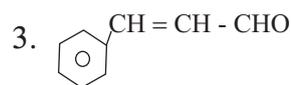
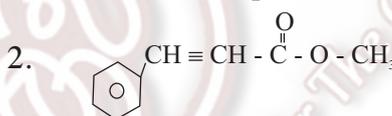
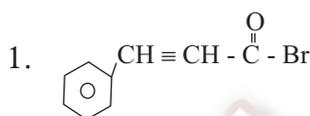


- 1) a < b < d < c < e 2) e < c < d < b < a 3) e < c < b < d < a
4) a < b < d < e < c 5) a < b < d < c < e

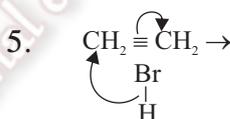
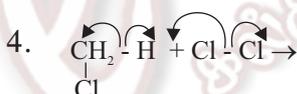
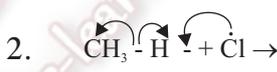
- 28) Phase diagram of a hypothetical Non-metal is given below. Find out the wrong statement in the given responses.



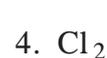
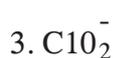
- 1) Here two triple points cannot be observed.
 - 2) Only for one T,P condition G, S₁, L₁ are found in equilibrium.
 - 3) Here 5 different phases can be observed.
 - 4) Only 2 of T,P conditions have more than 2 phases existing in equilibrium.
 - 5) In only one TP condition S₂, S₁ and G exist in equilibrium with each other.
- 29) In which of the following compound rate of nucleophilic addition is high?



- 30) Which of the following step of mechanism is nit feasible?



- 31) Which of the following ionic species have more number of neutrons than the number of electrons in which ³⁵Cl and ¹⁶O are found only.



- 32) Which of the following statement is/are in appropriate regarding H₂O and H₂O₂

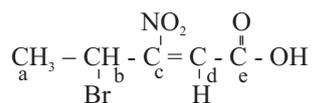
1. H₂O and H₂O₂ are planer molecules.

2. H₂O₂ is used as both oxidizing and reducing agent

3. Each oxygen atoms H₂O and H₂O₂ molecules have same number of lone pair electrons.

4. H₂O₂ used in the ripening of fruits.

33) Which of the following statement / s regarding the given compound is/ are correct?



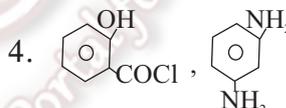
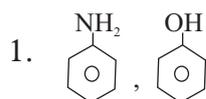
1. All the oxygen atoms are in the same plane.
2. Carbon atoms named as a, b, c tie un the straight line.
3. $\text{C}_d - \text{C}_e$, $\text{C}_e - \text{O}$ bond angle may not be 120°
4. $\text{C}_d - \text{C}_e$ bond length is less than that of $\text{C}_a - \text{C}_b$

34) Select the correct statement / S regarding electrodes electro chemical cells. and electrolysis

- a) Anode is always (t) re electrode.
- b) Anions are discharged in anode always.
- c) Electrode reactions would be equilibrium reactions when there is no current flow.
- d) In simple cells element in lower part of electrochemical series becomes positive pole and upper most element becomes negative pole.

35) Two organic compounds A, B are made as a mixture and following observations were mode.

- i) Separates into two layers when shakende with $\text{NaOH}_{(aq)}$ and allowed to cool.
- ii) Separates into two layers when heated with dil. H_2SO_4 and allowed to cool.



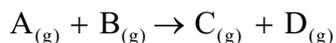
36) Among group 1A carbonates Li_2CO_3 is thermally unstable. When an equimolar mixture of Na_2CO_3 and Li_2CO_3 of mass 3,6g is heated 2,.72g of solid residue obtained. Select the correct statement/s out of following concerning the above observation?

- 1) Li_2CO_3 must have decomposed completely.
- 2) In the solid remaining Li_2O and Na_2CO_3 would be excessively found in 1:1 mole ratio
- 3) Volume of CO_2 collected at STP condition when the solid remaining treated with excess dil, H_2SO_4 is 224 Cm^3
- 4) A minimum of 20 cm^3 , 1 moldm^{-3} HCl is required to dissolve the solid remaining completely.

37) Benzene (B), Toluene (T) able to form ideal solutions by mixing completely. BT is a solution obtained by mixing Benzene and Toluene in equal proportions. hence incorrect statement out of the following regarding BT is/ are.

- 1) In the vapour phase of BT, Benzene and toluene are in equimolar proportions
- 2) Average of pure vapour pressures of Benzene and Toluene is equal to the vapour pressure of BT
- 3) If the gaseous phase behave ideally Dalton's law of partial pressure can be applied.
- 4) All the above statements regarding BT are true.

38) Consider the following reaction.



For certain concentrations of A, B initial rate of reaction is r. When (A(g) is doubled by maintaining the concentration of B(g), as same. rate of reaction be 2r and when [B(g)] doubled maintaining [A(g)] as constant the rate was 4r Hence False responses regarding this system is / are,

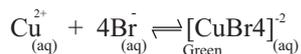
1. Reaction is First order with respect to B(g)
2. Rate of removal of A(g) is lesser than that of removal of B(g)
3. It shall not be a single step reaction.
4. Rate order of this reaction is 3.

39) $2A_{(g)} + B_{(g)} \rightleftharpoons 2C_{(g)}$

By considering the above equilibrium. Which of the given statements is / are true when small amount of A(g) is removed from the system at constant temperature.

- 1) Rate of forward reaction decreases.
- 2) Rate of reverse reaction increases.
- 3) Value of K_p decreases.
- 4) Concentration of B(g) increases.

40) When the following system is cooled. its colour changes from green to blue.



Appropriate statements made regarding the above system when cooled is / are,

- 1) Value of K_c decreases.
- 2) At first Q_c is greater than K_c
- 3) Forward reaction is exothermic
- 4) Value of K_c increases.

41) St-I :- When HCL gas is bubbled through $Pb(NO_3)_2(aq)$ solution a black residue is obtained.

St-II :- In qualitative analysis of cations Pb^{2+} is precipitated as $PbCl_2$ in first group.

42) St I :- In the industrial production of Ammonia the respective reaction mixture is maintained above $1500^{\circ}C$

St-II :- With increase of temperature rate of reaction increases.

43) St-I :- Rate of nucleophilic addition reaction in aldehydes is higher than that of Ketones

St-II :- Positive character present in carbonyl carbon of Aldehydes is greater than ketones

44) St-I :- The potential difference arises when a Cu rod immersed in $ZnSO_4$ solution is greater than the potential difference of Zn rod being immersed in $CuSO_4$ solutions.

- St-II :- When 2 different electrodes are connected by a salt bridge the potential difference between those electrodes is higher than that of cell.
- 45) St-I :- Ionic character of BaF_2 is higher than that of SrCl_2 .
- St-II :- With increases of radius in halides ability to get polarized decrease
- 46) St-I :- $(\text{CaCOCl})_2$ can be obtained by the reaction between Ca(OH)_2 and Cl_2
- St-II :- Ca can function as a reducing agent.
- 47) St-I :- All the saturated polymers are addition polymers
- St-II :- Addition polymers are formed from unsaturated monomer units.
- 48) St-I :- Aq. Solutions of Ag^+ , Cd^{2+} and Zn^{2+} forms clear transparent solutions.
- St-II :- Cations having full filled d- orbitals cannot form coloured solutions with $\text{NH}_{3(\text{aq})}$
- 49) St-I :- An endothermic equilibrium reaction shifts its position of equilibrium in exothermic direction when temperature is increased.
- St-II :- With increase of temperature reaction system. shifts in exothermic direction.
- 50) St-I :- At high pressure any of real gas deviates from ideal nature.
- St-II :- At high pressure the point mass nature of real gas molecules is not valid.

	Provincial Department of Education Northern Province Pilot Exam - A / L (2019) Grade - A / L (2019)	
Chemistry - I		Two hours

1) a. Give the ascending order of the properties indicated in the parenthesis of the following substances.

- I Al, Si, Na (electron affinity)
- II. Cl^- , Ar, K^+ (radius)
- III. C_2H_2 , C_2H_6 , C_2H_4 (electronegativity of C)
- IV. H_2O , H_2S , PH_3 (bond length)

b. The skeletal structure of thiocarbonate ion CS_2^{2-} is given below



I. Draw the most acceptable Lewis structure of the ion

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II. Draw the resonance structures of this ion and comment on their relative stabilities.

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III. Indicate your answer in the following table, considering the lewis structure drawn in (I) regarding the ston C,S and O atoms of CSO_2^- are numbered as follows



- I. VSEPR pairs around the atoms
- II. Electron pair geometry around the atom
- III. Shape around the atom
- IV. Hybridization of the atom.

	C	S	O ²
I.VSEPR pairs			
II.Electron pair geometry			
III. Shape			
IV. Hybridization			

IV. Identify the atomic hybrid orbitals involved in the formation of O' bond in the lewis structure drawn in part (I)

- I. O¹ - C :- O¹ C :-
- II. C - S C: S :-

C) Indicate the secondary interactions in between molecule and ion in each of the following pairs

- I. C₆H₆ (l) and Br₂ (l)
- II. I₂^(s) and I⁻ (aq)
- III. CH₃COOH(l), and H₂O(l)
- IV. Na⁺ (aq) and H₂O (l)

- a) 0.1 moldm^{-3} , 30.0cm^3 KMNO_4 solution is required to react with 0.06moldm^{-3} 25.0cm^3 KI Solution in alkaline medium. Brown colour MnO_2 and are IO_x^- obtained as products.

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II. Find the value of X

.....

- B) a. A metal labelled as 'A' burnt in oxygen with a yellow flame producing a yellow power B. B reacts with water producing oxygen gas and clear colourless solution C. Solution C reacts with aluminum metal and produced a gas D and a colourless solution E.

I. Identity A,B,C,D, and E

A B, C
 D E

II. Write balance chemical equation for the following reaction.

I. $\text{B} + \text{H}_2\text{O} \longrightarrow$
 II. $\text{C} + \text{Al} \longrightarrow$

- C) An aqueous solution of gas x is undergoing the following reactions.
 * decolorise the colour of the acidic KmnO_4
 * Boiled with H_2O_2 and then cooled and BaCl_2 (aq) is added. A white precipitate insoluble in dil HNO_3 is obtained.
 * When H_2S gas is passed through the solution white cloudiness appeared

I. Identify gas X

.....

II. Write balanced equations for all the reaction occurring in the above procedures

- a) $\text{H}_2\text{O}_2(\text{aq}) + 2\text{H}^+(\text{aq}) + 2\text{I}^-(\text{aq}) \rightarrow \text{I}_2(\text{aq}) + 2\text{H}_2\text{O}(\text{l})$ The experimental results obtained in the experiment to study the chemical kinetics of the above reaction at 25°C are given in the following table.

experiment number	Initial $[\text{H}_2\text{O}_2(\text{aq})]$ mol dm^{-3}	Initial $[\text{I}^-(\text{aq})]$ mol dm^{-3}	Initial $[\text{H}^+(\text{aq})]$ mol dm^{-3}	Initial rate of reaction $\text{mol dm}^{-3}\text{s}^{-1}$
1	0.01	0.01	0.10	1.75×10^{-6}
2	0.03	0.01	0.10	5.25×10^{-6}
3	0.03	0.02	0.10	1.05×10^{-5}
4	0.03	0.02	0.20	1.05×10^{-5}
5		0.03	0.50	1.05×10^{-5}

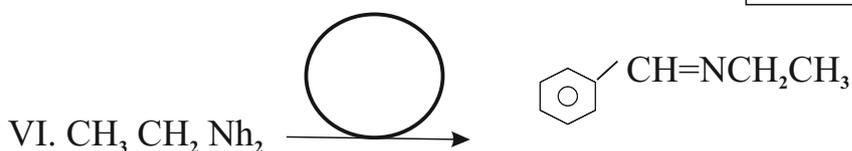
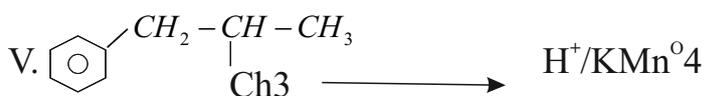
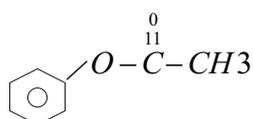
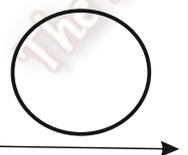
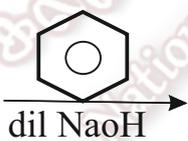
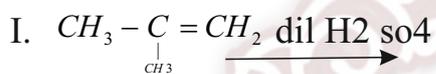
- I. Deduce the orders of the reaction with respect to $\text{H}_2\text{O}_2(\text{aq})$, $\text{I}^-(\text{aq})$, $\text{H}^+(\text{aq})$
 - II. Write an expression for rate law
 - III. Find the value of rate constant
 - IV. Find the initial concentration of $\text{H}_2\text{O}_2(\text{aq})$ in experiment 5
 - V. When the initial concentration of the reactions $[\text{H}_2\text{O}_2(\text{aq})] = 0.2 \text{ mol dm}^{-3}$
 $[\text{I}^-(\text{aq})] = 0.2 \text{ mol dm}^{-3}$, $[\text{H}^+(\text{aq})] = 0.2 \text{ mol dm}^{-3}$ calculate the initial rate of the reaction.
- b) I. State the mathematical equation corresponding to Raoult's law and identify its terms
- II. A & B are two miscible liquids which can result in an ideal solution. Mole fraction of A in solution is $\frac{3}{4}$ while in vapour state $\frac{2}{5}$. Another ideal solution is obtained by mixing A & B in different proportions in which mole fraction of A in solution is $\frac{1}{5}$ hence find the mole fraction of B in vapour phase.
- a) A and B are isomers having the molecular formula $\text{C}_5\text{H}_{10}\text{O}$ and give orange precipitate with Brady reagent. A exhibits optical isomerism, but B does not exhibit optical isomerism. When both compounds A and B are reduced by NaBH_4 in the presence of solvent methanol, compounds C and D are obtained respectively, C and D exhibit optical isomerism.

When C, D are heated with conH_2SO_4 they lose water molecules and form the compounds E, F respectively. But E and F do not exhibit geometrical isomerism. E and F react with HBr and give the compounds G and H respectively, Both do not exhibit optical isomerism.

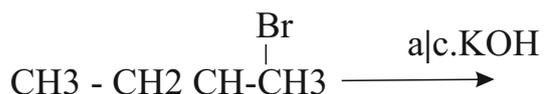
I. Write the structure of A, B, C, D, E, F, G, H in the boxes given below.

A	B	C	D
E	F	G	H

B) Write the important organic products in the boxes and reagents in the circles of the following reactions



C) Give the mechanism of the following reaction.



Essay Part IIB

Answer any of 2 questions

5) The following equilibrium is established at 328° C when a few amount of $\text{PCl}_{5(g)}$ is taken in a closed rigid vessel.



Equilibrium pressure was $2 \times 10^5 \text{ Nm}^{-2}$. Where volume percentage of $\text{Cl}_{2(g)}$ was 40%

1. Calculate the partial pressure of each component at 328° C
2. Find the value of K_p with respect to the above equilibrium hence calculate K_c
[$A + 328^\circ \text{C}$ $RT = 5000 \text{ Jmol}^{-1}$]
3. In the above described vessel, additional amount of $\text{Cl}_{2(g)}$ is added at 328° C and allow to added equilibrium. At this time ratio between partial pressures of $\text{PCl}_3(g)$ and $\text{PCl}_5(g)$ is 5:6. Find the partial pressure of $\text{Cl}_2(g)$ under this condition.

b) There is a necessity to find the best fuel among $\text{H}_2(g)$, $\text{CH}_4(g)$ and $\text{C}_3\text{H}_8(g)$

	OH+	OHC
H_2	0	0
CH_4	-72	-280
C_3H_8	-	-890
		-2220

- I. Find the OH + of $\text{C}_3\text{H}_8 (g)$
- II. Find the amount of heat energy released in the combustion at 1g of $\text{H}_2(g)$, $\text{CH}_4(g)$, and $\text{C}_3\text{H}_8(g)$
- III. Hence, find which one is used as fuel

- C) 100cm^3 , 0.1M HCl(aq) is present in a calorimeter, 100cm^3 , 0.1M NaOH(aq) is added to the above calorimeter and mixed well, Temperature of the system raised by 0.6K . Heat capacity of calorimeter is $1/5 \text{ JK}^{-1}$ specific heat capacity of water is $4.2 \text{ Jg}^{-1}\text{K}^{-1}$, $d_w = 1\text{gcm}^{-3}$ Find the ΔH between HCl and NaOH.

$$\text{Heat energy released in the reaction} = \text{heat energy gained by aq solution} + \text{heat energy gained by calorimeter}$$

- 6) (a) I. Ionization constant of Ethanoic acid at 25°C is K_a , Ionization constant of its conjugated base is K_b , Ionization constant of water is K_w . By considering the related equilibrium reaction for aqueous cautions, Get a relationship between K_a , K_b and K_w

II. K_a value of ethanoic acid at 25°C is $1.8 \times 10^{-5} \text{ mol dm}^{-3}$ $K_w = 1 \times 10^{-14} \text{ mol}^2 \text{ dm}^{-6}$. Find the volume of 0.1 mol dm^{-3} NaOH solution needed for complete reaction of 100cm^3 0.1 mol dm^{-3} ethanoic acid.

III. Find the pH of resultant solution obtained above?

- b) Saturated solution is obtained by dissolving $\text{Mg}_3(\text{PO}_4)_2$ in water at 25°C
 K_{sp} at $\text{Mg}_3(\text{PO}_4)_2$ at $25^\circ\text{C} = 9.78 \times 10^{-17} \text{ mol}^5 \text{ dm}^{-15}$

I. Give the reaction for the above equilibrium

II. Obtain expression for solubility product of above system

III. Find the concentration of Mg^{2+} (aq) in the above saturated solution at 25°C

IV. Find the mass of $\text{Mg}_3(\text{PO}_4)_2$ can be dissolved in 1000m^3 water at 25°C
 (Mg -24, P-31, O-16)

- C) Mixture containing Iodine, Chloroform and water attained equilibrium at room temperature. In this equilibrium mixture for the complete reaction at 50ml water layer with given sodium thiosulphate, volume of 10ml is needed. Similarly for the complete reaction at 50ml chloroform layer with same given sodium thiosulphate, 100ml is needed. Find the partition coefficient of Iodine between water and chloroform at room temperature.

- 7) a) Standard electrode potential of $\text{X}^{3+}_{(\text{aq})} / \text{X}_{(\text{s})}$ and $\text{Y}^{2+}_{(\text{aq})} / \text{Y}_{(\text{s})}$ electrodes are -1.14 v and -2.20V respectively

- I. Indicate the cell formed the above two electrodes using IUPAC notation
- II. Identify the anode and cathode of the above cell by giving reasons.
- III. Write the electrode reactions takes place in each anode and cathode.
- IV. Hence write the full cell reaction
- V. Calculate the electromotive force of cell.
- VI. How many moles of electrons are displaced when one mole of $Y^{2+}_{(aq)}$ is observed in the reaction.
- VII. Calculate the electromotive force of cell.

VI. How many moles of electrons are displaced when one mole of $Y^{2+}_{(aq)}$ is observed in the reaction.

VII. Calculate the mass of $y_{(s)}$ in grams deposited when 1A of current is passed through the circuit for an hour. at $25^{\circ}C$ ($y = 119$, Faraday's constant = $96500C$)

VIII. IF distilled water is added to $X^{3+}_{(g)}$ solution what shall be the change in electromotive force cell.

- b) Two hydrated species A & B were obtained when 2 different compounds of an element in +3 oxidation state were mixed together. Molecular formula of A, B are $CrH_{10}C_{10}, S$
Where A & B have octahedral geometrical shape. To find the molecular structure of the chromium complex following analysis were carried out.

Analysis A:

Write precipitate is obtained when $100\text{CM}^3, 0.1\text{mol dm}^{-3}$ solution A is treated with excess $AgNO_3$, the precipitate is filtered, dried and weighed until constant mass of 1.435g obtained.

Analysis B:

A write precipitate is obtained when $0.5\text{mol dm}^{-3} 50\text{CM}^3$ solution B is treated with excess of $BaCl_2$.

The obtained precipitate is filtered, dried and weighed until a constant mass of 5.825g is obtained.

(Ba - 137, O-16, S-32, Cl-35.5, Cr -52)

- I. Write the electronic configuration of Cr in A & B
- II. Deduce the structures of A & B

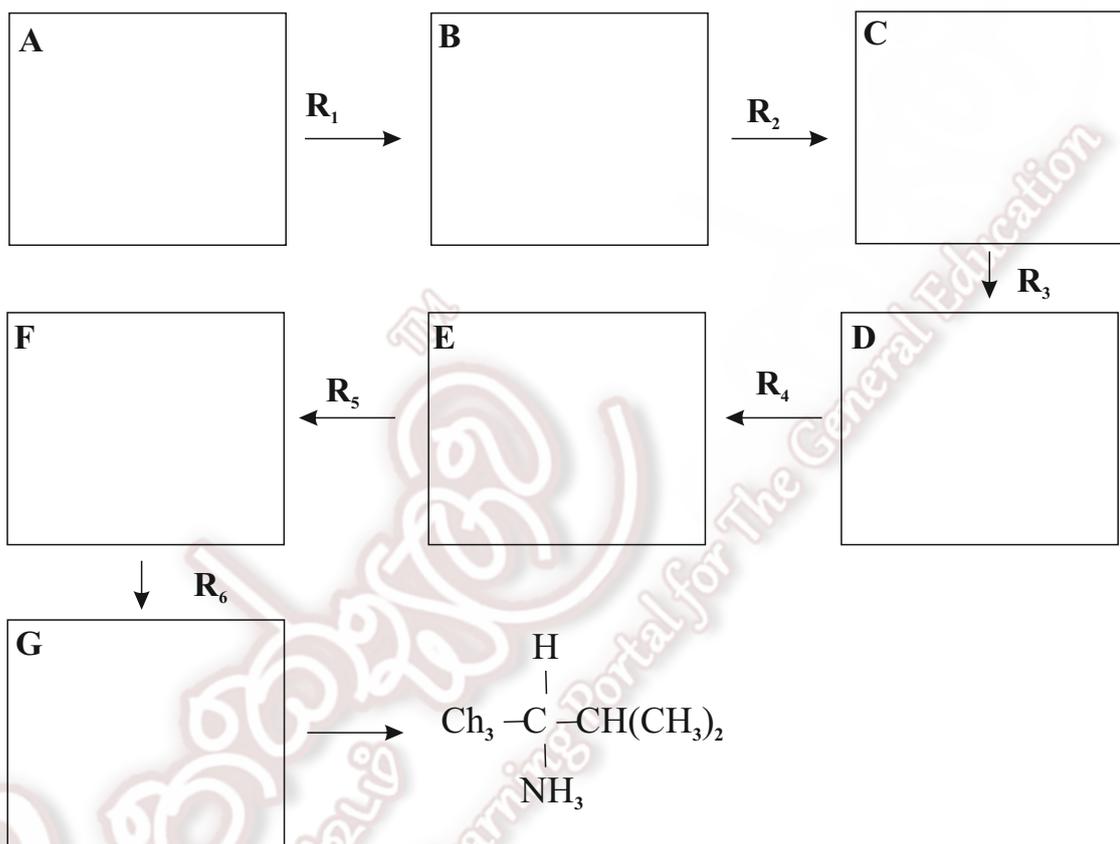
III. Give the IUPAC names of A & B

Part - C

Answer any of 2 questions in this part.

8) Complete the following reaction scheme by using the given compounds.

9) CH_3COCH_3 , $\text{CH}_3\text{-O-CH}_3$, $\text{C}_2\text{H}_5\text{-OH}$, PCl_5 , NaBH_4 , Mg , Zn/Hg , Con.HCl , Hg^{2+} , $\text{dil H}_2\text{SO}_4$, H_2O , Con , NH_3



Draw the structures of A - G in the given spaces provided.

Provide the reagents $\text{R}_1\text{-R}_7$ with necessary conditions.

- B) Synthesize the following compound using C_2H_2 with not more than 8 steps.
 $\text{CH}_3\text{CH}=\text{CH}-\text{CH}=\text{N}-\text{C}_2\text{H}_5$
- C) Organic compound A has C-35.1 %, H-6.6%
 Br = 58.3% by mass (C-12, H-1, Br - 80)

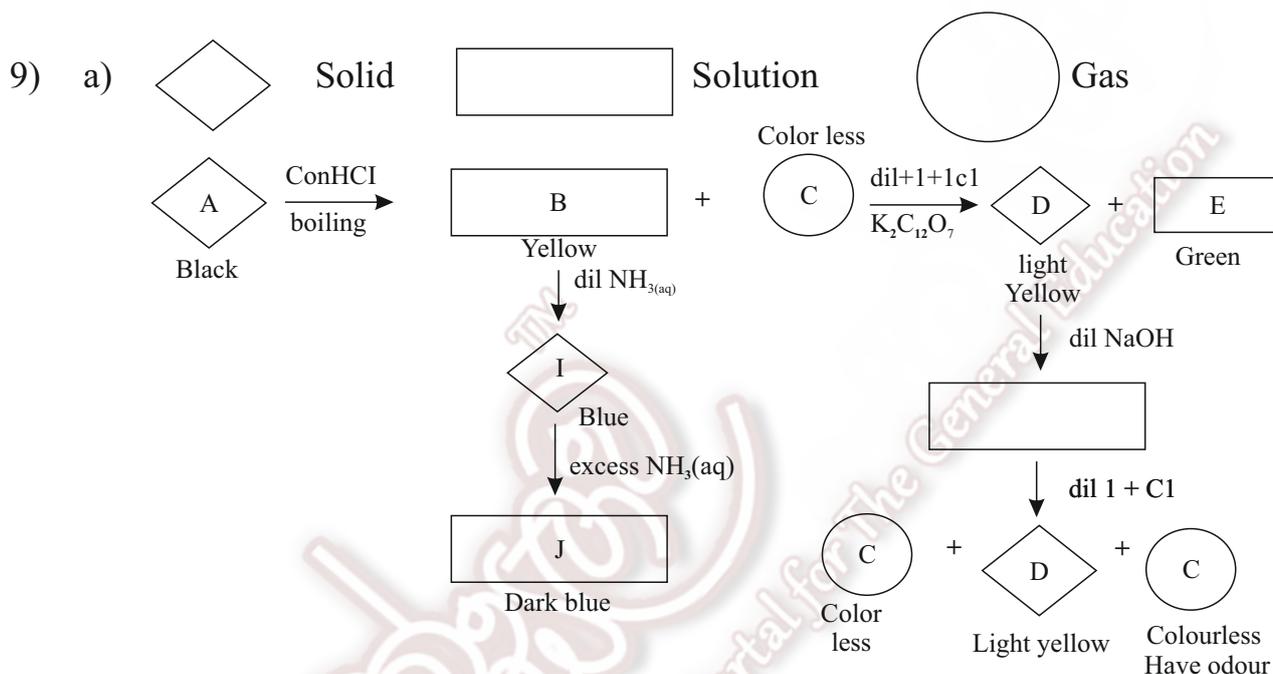
I. Identify the molecular formula of A.

II. 2-methyl - propanoic acid is obtained as A reacts with NaOH . Write the chemical reaction corresponds to above observation.

III. Alkane B is obtained when A reacts with alcoholic KOH. what shall be the molecular formula of B

IV. When B reacts with Hbr positional isomer of 'A' is obtained it is denoted by 'C' hence deduce the structures of C?

V. State a simple test to distinguish A & C



I. Identify and write the chemical formula of A,B,C,D,E,F,G,H,I,J

II. Write the balanced chemical equation for the reaction between D and dil NaOH solution.

III. Write the balanced chemical equation for the reaction between C with $\text{K}_2\text{C}_2\text{O}_7$ in the presence of dil HCl

C) When 4.00g of a solid mixture containing CaCO_3 , Fe_2O_3 and insoluble impurities, was dissolved in 100cm^3 of dil HCl and filtered, solution X was obtained.

When 50cm^3 of solution X above, was treated with excess $(\text{NH}_4)_2\text{C}_2\text{O}_4$ (aq), a precipitate formed. It was filtered, rinsed with water and treated with water to form a suspension. Then it was treated with dil $1+250_4$ and the resulting solution was diluted upto 250.0cm^3 using water. When 25.00cm^3 of this solution, was titrated with 0.02mol dm^{-3} KmnO_4 solution burette reading at the end point was 20.00cm^3

Another 50CM³ portion of the X solution above, was treated with excess KI and diluted up to 250.0CM³ using water. When 25.00CM³ solution, volume of Na₂S₂O₃ consumed was, 25.00CM³

- I. Write the balanced chemical equations for the reactions took place above.
- II. Calculate the mole ratio of CaCO₃ : Fe₂O₃ in the sample.

B) The 3d metal M reacts with O₂ in alkali solution to produce MO₂ as the precipitate. MO₂ acts as an oxidizing agent in acidic medium.

I. Identify M?

II. Give the complete electronic configuration of M?

III. Write two other oxides of M expect MO₂.

State their acid base character?

IV. Write 2 industrial uses of M?

V. Write a balanced chemical equation for MO₂ acting as an oxidizing agent in acidic medium?

10) a. Production of sulphuric acid through contact process is a mojar industrial breakthrough in the past which help create better for energy.

I. State the main raw materials needed for contact process of sulphuric acid.

II. Write the balanced chemical equation along with the appropriate conditions for the reaction corresponds to produce sulphur trioxide.

III. Though suitable conditions have been used the raw materials are not completely converted into products. Give reasons.

IV. Describe the final procedure of obtaining sulphuric acid from sulphur trioxide.

V. "Production of Sulphurtrioxide decreases with increasing temperature. "Explain this statement using enthalpy change.

VI. Describe the way of cooling down the reaction system and mention one positive effect of the process.

VII. Give one ill effect from the production of sulphuric acid using contact process.

B) Motor vehicle emissions & unburnt hydrocarbons cause photo chemical smog.

1. Name some causative factors for photo chemical smog.

2. Explain using some balanced equations how the above factors create

photochemical smog.

3. Explain what is meant by the term photochemical smog.
4. State the effects of photochemical smog and briefly describe them.

C) Polymers are widely used to produce commercially valuable products.

I. State the difference between natural polymers & synthetic polymers.

II. Give some example for natural polymers.

III. State the respective polymer for the following purpose.

1- Producing toys & packing materials

2- Producing heat resistant electrical utensils.

IV) Define the term thermosetting polymer. and write 2 samples.

V) Draw the monomer unit of natural rubber. and its repeating unit along with its chemical name.

