Model Questions – 2078 (2022)

Subject: Chemistry (3021) **Full Marks: 75**

Time: 3 hrs.

SET A

Attempt all questions.

GROUP – A

Circle the best alternative to the following questions. **[11×1=11]**

1. Number of moles of solute dissolved in 1000gm of water is
   a) Molality
   b) Molarity
   c) Mole fraction
   d) % (W/V)
2. Enthalpy of a compound is equal to its
   a) Heat of combustion
   b) Heat of formation
   c) Heat of solution
   d) Heat of dilution
3. The atomic number is changed by which type of radioactive decay?
   a) β
   b) α
   c) γ
   d) All of the above
4. Which of the following compound is known as Schweitzer's reagent?
   a) $CuSO_4.5H_2O$
   b) $CaSO_4$
   c) $[Cu(NH_3)_4]SO_4$
   d) Anhydrous Copper
5. Which of the following is not true regarding crystal field theory?
   a) Action between metal and ligand is electrostatic
   b) Ligand are treated as point charge
   c) There is no orbital interaction between ligand and metal
   d) Hybridization explain the shape of the complexes

6. Ether is always purified before distillation because,
   a) It is highly poisonous in nature
   b) It forms poisonous phosgene gas
   c) It is converted into explosive peroxide
   d) All of above
7. Which of the following is an organometallic compound?
   a) CH_3ONa
   b) CH_3SNa
   c) CH_3MgCl
   d) All of the above
8. Solubility of a salt M_2X_3 is "x " $moleL^{-1}$.The solubility product of the salt will be
   a) x^5
   b) $16x^2$
   c) $96x^5$
   d) $108x^5$
9. Alcoholysis of acid anhydride gives
   a) Carboxylic acid and ester
   b) Ester and alcohol
   c) Carboxylic acid and alcohol
   d) Only ester
10. An organic compound 'A' reacts with nitrous acid to form N - Methyl - N - nitrosoethanamine. A can be obtained by the reduction of …..
    a) Propanenitrile
    b) Methylisocyanate
    c) Ethylisocyanide
    d) Propylisocyanide
11. Given, $E^0_{Cr/Cr+3} = 0.74$ V, $E^0_{Fe+2/Fe} = -0.42$ V. The standard cellpotential for the cell Cr/Cr^{+3} (0.1M)//Fe^{+2} (0.01M)/Fe is,
    a) 1.14V
    b) 0.492 V
    c) 0.329 V
    d) -0.26 V

GROUP – B

Give short answer to the following questions. **[8×5=40]**

1. Zinc blende is the major ore of Zinc from where the metal is extracted by pyro metallurgical process.
   a) Draw and explain vertical retort process for reduction of ZnO into Zn. [3]
   b) Could we use sodium hydroxide to separate zinc and silver from each other? If yes how? [1]
   c) What happens when, zinc is exposed to moist air for long time? [1]
2. We need food, clothes, medicine, dyes etc. all these compounds are obtained from either naturally or artificially. Many large compounds are synthesized from combination of small compounds under suitable conditions. Some of them are classified as polymers or drugs or dyes orfertilizers etc. So that, give the answer to the following questions.
   a) Define polymerization.
   b) Write the reaction involved in the preparation of polyester. [2]
   c) What is an ideal requirement for a dye? [1]
   d) Azobenzene is a colored compound but not a dye Explain. [1]
3. Transition elements are defined as elements that have partially filled d-orbitals.
   a) What is d-orbital degeneracy? [1]
   b) Give a possible reason for a fact that transition metal have high heat of atomization. [1]
   c) A transition metal forms alloy with other transition metal easily, Explain. [1]
   d) $K_4[Fe(CN)_6]$, Potassium hexacyanoferrate(II) is a complex salt formed by iron. Write the complex ion present in it. [1]
   e) Why $[Ti(H_2O)_6]^{3+}$ is violet in color in $[Ti(H_2O)_6]Cl_3$,but when water molecules are removed it becomes colorless? [1]
4. The sum of the powers of concentration terms in the rate law equation is called the order of reaction.
   a) Write the three possible rate laws for the given second order reaction. [3]
   A+ B→ product

b) A reaction is of first order in reactant P and second order in reactant Q. How is the rate of reaction affected when
   i. Concentration of Q alone is increased 3 times. [1]
   ii. The concentrations of P as well as Q are doubled. [1]

5. Cement is one of the major component of construction field. Nepal have many cement factories. Limestone is a dominant raw material used for the manufacture of cement. When cement comes in contact with water, it sets to hard mass showing exothermic reaction.
   a) You are asked to bring 1500 tons of cement for the dam construction of 400 MW hydropower station. What type of cement do you prefer and why? [2]
   b) While manufacturing the Portland cement, the % composition of MgO is not exceeded than 6%, why? [1]
   c) After preparing the cement clinker it is cooled to a temperature of 60-150^{0}C before grinding, why? [1]
   d) What is the role of Fe_2O_3 in the Portland cement? [1]

6. In an organic chemistry some reactions are known as their names such reactions are called name reactions and they have great synthetic utility. Write down the reaction of the following name reactions. [5x1=5]
   a) Perkin condensation
   b) Fehling reaction
   c) Wolff-Kishner reduction
   d) Clemmenson's reduction
   e) Cannizzaro's reaction

   Or

   Give a suitable chemical reaction for the preparation of ethanoic acid from
   a) Ethane nitrile
   b) Methyl magnesium chloride
   c) Ethanol

   Also, convert ethanoic acid to propanoic acid. [3+2]

7. An organic compound 'A' reacts with sodium metal to give hydrogen gas. The compound A on treatment with alkaline iodine forms yellow crystalline substance and on oxidation with acidified potassium dichromate forms aldehyde with molecular formula C_2H_4O. Identify the compound and write a chemical equation for these reactions. [5]

8. 12 gm of impure Zn is made to react with excess of dilute H_2SO_4. The total volume of H_2 gas liberated was found to be 4.2L at 570 mm of Hg pressure and 279K temperature. Determine the percentage purity of Zinc.

OR

Common ion effect provides the most important method to monitor the concentration of precipitant for the selective precipitation of metallic ion and solubility product principle helps to predict whether the salt precipitate or not in qualitative analysis. Explain, the application of Solubility product principle and common ion effect in qualitative salt analysis. [5]

GROUP – C

Give long answer to the following questions. [3×8=24]

9. In laboratory, chloroform is prepared by reacting ethyl alcohol or acetone using bleaching powder.
   a) Write the principle reactions of oxidation, chlorination and hydrolysis process using ethyl alcohol.
   b) Why is chloroform always stored in a dark colored bottle?
   c) It is used as anaesthetic in past but now discouraged. Why?
   d) Chloroform forms chloretone drug with acetone in presence of aqueous alkali. Write the chemical reaction and mention any one use of this drug.
   e) What happens when, chloroform reacts with conc. Nitric acid? Write an important application of such product. [2+1+1+2+2]

Or

An aromatic compound 'A' on diazotization gives compound 'B' which is warmed with water to give compound 'C'. The compound 'C' is heated with acetyl chloride in presence of pyridine gives 'D' which undergoes rearrangement in presence of anhydrous $AlCl_3$ and CS_2 as solvent gives a mixture of 'E' and 'F'. The compound 'C' is heated with zinc dust to give parent hydrocarbon benzene. Identify A, B, C, D, E and F with their name and suitable chemical reaction involved for it.

   a) What happens when, compound C is heated with conc. HNO_3 and conc. H_2SO_4?
   b) Write any two important uses of Compound 'C'. [6+1+1]

10. a) The solubility product of barium sulphate ($BaSO_4$) is 1×10^{-10} at 298K. Calculate its solubility in
    i. pure water
    ii. $1x10^{-3}M$ H_2SO_4 solution. [1+3]
    b) Write the equation for the formation of naphthalene. Calculate the increase in entropy in the evaporation of 1 mole of water at 100^0C. [Latent heat of vaporization of water is 2.26 $KJgm^{-1}$]. [1+3]
11. Aniline is the most common member of aromatic amines which is used to prepare drugs, dyes etc. [1+2+1+2+2]
    a) Give the preparation of aniline from nitrobenzene.
    b) Aniline is less basic than aliphatic amine. Give reason.
    c) Why is it necessary to protect $-NH_2$ group before nitration of aniline?
    d) What is diazotization reaction? Why is diazotization always carried out at ice cold temperature?
    e) Convert, Aniline into (i) p-aminoazobenzene (ii) Acetanilide

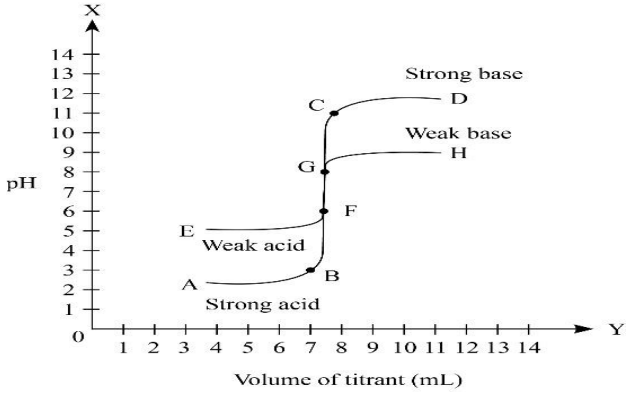
SET B

Attempt all questions

GROUP –A

Circle the best alternative to the following questions. **[11×1=11]**

1. The unit of rate constant for zero order reaction is
   a. $mol^{-1}Ls^{-1}$
   b. $mols^{-1}$
   c. $molL^{-1}s^{-1}$
   d. Ls^{-1}
2. When an alkyl halide reacts with sodium alkoxide to form symmetrical as well as unsymmetrical ether. This reaction is called,
   a) Hoffmann's reaction
   b) Reamer-Tiemann's reaction
   c) Kolbe's reaction
   d) Williamson's reaction
3. The curve obtained by plotting the pH of the solution during titration against the volume of alkali added from burette is known as a titration curve. The curve ABGH in the following curve represent:



   a) Titration curve of strong acid Vs strong base
   b) Titration curve of strong acid Vs weak base
   c) Titration curve of weak acid Vs strong base
   d) Titration curve of weak acid Vs weak base

4. An adiabatic process is the one in which
   a) System is closed to energy transfer
   b) System is closed to heat transfer
   c) The system is closed to both heat and energy transfer
   d) There is no enthalpy change
5. Haloarenes are less reactive than benzene toward electrophilic substitution reaction due to,
   a) Positive inductive effect
   b) Resonance effect
   c) Negative inductive effect
   d) Steric effect
6. Which of the following compound is generally used to prepare paper?
   a) Protein
   b) Fibers
   c) Cellulose
   d) Vitamins
7. All transition element exhibit in general electronic configuration of
   a) $(n-1)d^{1-10}\ ns^{1-2}$
   b) $(n-1)d^{0}\ ns^{1-2}$
   c) $ns^{2}\ (n-1)d^{10}$
   d) None of above
8. Which of the following is the normality of 50mL of HCl required to neutralize 10 g of $CaCO_3$?
   a) 2N
   b) 4N
   c) 5N
   d) 1N
9. Based on the systematic formula of Iron carbonyl, $Fe(CO)_5$, its conductivity is expected to be .....
   a) Zero
   b) One
   c) Five
   d) None

10. Which of the following reagent is used to make nitroethane from haloethane?
    a) Alc. $AgNO_3$
    b) Alc. $AgNO_2$
    c) Alc. KNO_2
    d) Alc. $NaNO_2$
11. Ethanoyl chloride on treating with methyl magnesium chloride followed by acidic hydrolysis gives
    a) Propan-2-ol
    b) Propan-1-ol
    c) 2-methylpropan-2-ol
    d) 2-methylpropan-1-ol

GROUP – B

Give long answers to the following questions **[8×5=40]**

1. Define the following terms: [1+1+1+1+1]
    a) Isolated system
    b) Internal energy
    c) Enthalpy
    d) Entropy
    e) Isochoric process
2. Sulphide ore is used in the extraction of mercury. Aristotle had named this element liquid silver.
    a) Name the chief ore of mercury.
    b) Why does mercury forms alloy with gold and silver?
    c) How do you convert mercury into Nessler's reagent?
    d) Though Mercury is metal, itexists in liquid state at room temperature.Why?
    e) Instead of electrolytic refining, Hg is purified by treating it with 5% dil.HNO_3.Write reaction involved in it. [1+1+1+1+1]
3. A polymer is a giant molecule with high molecular mass which is made up of a number of small repeating units called monomers which are usually obtained from low molecular mass molecules. So, give the answer to the following questions.

a) Differentiate between condensation polymers and additional polymers. [2]

b) Why is nylon-6,6 called copolymers? [1]

c) Which polymer is obtained when phenol is treated with formaldehyde in the basic medium? Show pertinent reaction. [2]

4. In electrochemical series different electrodes are arranged in order of their increasing standard reduction potential. By using following data

$E^0_{Zn/Zn^{++}} = 0.76V$

$E^0_{Cu^{++}/Cu} = 0.34V$

a) Write the cell reaction

b) Construct a galvanic cell

c) Calculate the standard emf of the cell.

d) Can you store the $CuSO_4$ in Zinc vessel? [2+1+1+1]

5. Write the structure of the organic compound A, B, C, D and E with their name in the following sequence of reaction. [5]

6. What are the main assumptions of CFT (crystal field theory)? Explain, the crystal field splitting in octahedral complex. [2+3]

OR

The compound **A** is an ore of copper called tenorite. Compound **A** reacts with dil. Sulphuric acid to give **B**. The saturated solution of compound **B** when heated to crystallization point gives a hydrated product **C**. Compound **C** when heated above 750^0C produces an oxide **D** which is used to provide light blue or green color to glass. Find A, B, C and D. Also write the use of compound D. [1+1+1+1+1]

7. A When propene reacts with HBr in presence of organic peroxide, it gives major product just opposite to Markovnikov's rule.
   a) Identify major product.
   b) State the rule and write a chemical equation for peroxide effect.
   c) Why HCl& HI do not give Anti-Markovnikov's addition?
   d) What happens when major product is heated with sodium metal in presence of dry ether? [1+2+1+1]
8. An organic compound 'A' reacts with HCN to give 'B'. On hydrolysis of B in acidic medium gives 'C'. Compound A also produce propane when heated with zinc amalgam and HCl. Identify A, B and C with reaction and give their IUPAC name. What product would you expect when A is treated with trichloromethane in alkaline medium?

Or

Nitrobenzene is used to prepare trinitrobenzene which is largely used as an explosive substance in peace work, construction and engineering field.
   a. Write the principle reaction for the preparation of nitrobenzene from benzene.
   b. Starting from nitrobenzene how would you prepare,
      (i) Trinitrobenzene
      (ii) Para-aminophenol
      (iii) N-phenyl hydroxylamine

GROUP –C

Give long answers to the following questions **[8×3=24]**

9. a) How would you distinguish propan-1-ol, propan-2-ol and 2-methyl propan-2-ol by Victor Meyer's method? [5]
   b) What happens when, phenol is treated with
      (i) Aqueous bromine
      (ii) $FeCl_3$ solution
      (iii) Dilute HNO_3 [1+1+1]
10. What happens when?
   a) Methanoic acid is warmed with ammonical $AgNO_3$ solution?
   b) Ethanoic acid reacts with Cl_2 in red phosphorous?
   c) Ethanoyl chloride is reduced with $LiAlH_4$?
   d) Ethanoic anhydride reacts with ammonia?

e) Ethyl ethanoate is hydrolyzed in acidic medium?
Justify with reasons.

(i) Acetic acid is weaker acid than formic acid.

(ii) Amide is amphoteric in nature.

(iii) Acyl halide is most reactive acid derivatives. [5+3]

11. a) The process of determining the concentration of unknown solution is titration.Define redox titration. Calculate the molality of one liter of 93% H_2SO_4 solution (weight by volume). The density of the solution is 1.84g mL^{-1}. [1+3]

b) Calculate the pH of 1 molar solution of acetic Acid. To what volume, one litre of this solution be diluted so that the pH of the solution that is formed will be twice of the original value. ($K_a = 1.8 \times 10^{-5}$) [4]

OR

a) You are given a two acid having equimolar Concentration with ionization constant as:

Acid	CH_3COOH	HCN
Concentration	1M	1M
Ionization Constant (K_a)	$1.8x10^{-5}$	$4.0x10^{-10}$

Calculate the pH of these Acids & Identify, which acid is stronger? [2+2+2]

b) Acids A, B, C&D have a following pKa Values

Acid	pKa
A	4.74
B	3.69
C	3.34
D	4.21

Arrange these acids in increasing order of their acidic strength. [2]

SET C

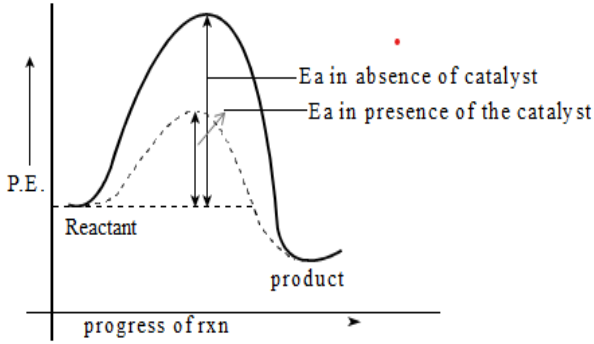
Attempt all questions.

GROUP –A

Circle the best alternative to the following questions. **[11×1=11]**

1. Salt bridge contains
   a) Calomel
   b) Corrosives sublimate
   c) H_2O
   d) agar – agar paste
2. The reaction of benzene with alkyl halide in presence of anhydrous $AlCl_3$ is called,
   a) Wurtz's reaction
   b) Friedel Craft's alkylation
   c) Carbylamine reaction
   d) Friedel Craft's acetylation
3. Which thermodynamic property provides a measure of randomness in the system?
   a) Enthalpy
   b) Entropy
   c) Free energy
   d) PV-work
4. Most of the transition metal easily forms complex because…
   a) of smaller size
   b) of high positive charge density
   c) of presence of empty d-orbital
   d) All of above
5. Mercury is transported in metal container made of
   a) Gold
   b) Copper
   c) Lead
   d) Iron

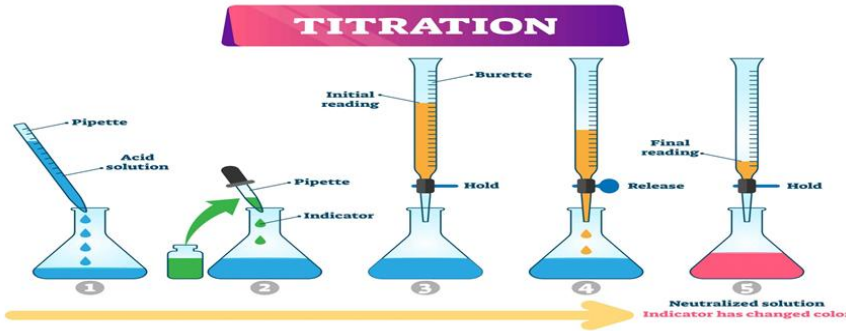
6. By observing the following graph



A presence of positive catalyst increases the rate of a chemical reaction by

a) Increasing the kinetic energy of reactants
b) By decreasing the value of activation energy
c) By providing the reactants with an alternate path where the value of activation energy is low
d) By increasing the temperature

7. During titration, a pipette is used to transfer a base into a conical flask sitting under a burette filled with acid. The pipette, the conical flask and the burette should be rinsed with ...



a) Base, distilled water and acid
b) Distilled water, base and acid.
c) Base, distilled water and base.
d) Base, distilled water and base.

8. Which of the following compound cannot reduce Fehling's reagent?
   a) Ethanal
   b) Benzaldehyde
   c) Formic acid
   d) Methanal
9. When ethyl alcohol is treated with acidified potassium dichromate then aldehyde is formed. This is an example of,
   a) Oxidation reaction
   b) Hydrolysis reaction
   c) Reduction reaction
   d) Rearrangement reaction
10. In the nitration of benzene Conc. HNO_3 acts as …
   a) base
   b) acid
   c) reducing agent
   d) catalyst
11. Order of basic strength of primary, secondary and tertiary amines in aqueous phase is
   a) $1^0 > 2^0 > 3^0$
   b) $3^0 > 2^0 > 1^0$
   c) $2^0 > 1^0 > 3^0$
   d) $2^0 > 3^0 > 1^0$

GROUP –B

Give short answer to the following questions. **[8×5=40]**

1. Write one example of each:
   a) Bronsted Lowery Acid
   b) Bronsted Lowery Base
   c) Lewis Acid
   d) Lewis Base
   e) Conjugate acid and base of NH_3

2. Gold, Silver, Copper are classified as coinage metals. All coinage metals are extracted from their ore. Copper pyrite is the chief ore of Copper from which Copper is extracted.
   a) Why is blister copper called so?
   b) Write the composition of bronze.
   c) When a strip of metal "X" is inserted in copper sulphate solution, blue color of $CuSO_4$ fades away. Which is more reactive copper or metal "X"? Write the reaction involved. [1+1+1+2]
3. Describe the electrochemical theory for the rusting of iron. List any two method of prevention of rusting. [3+2]
4. Write a chemical equation for; [5×1=5]
   a) Aldol condensation
   b) Benzoin condensation
   c) Rosenmund's reduction
   d) Oxidation reaction of acetaldehyde
   e) Reaction of acetone with hydrazine
5. Write an example of primary and secondary alcohol of $C_4H_{10}O$ with IUPAC name. How would you apply Victor Meyer's method to distinguish them? [2+3]

OR

Write a chemical reaction for; [5×1=5]
   a) Chloroethane reacts with moist silver oxide.
   b) Ethanamine reacts with nitrous acid in cold condition.
   c) Propan-2-ol is oxidized with acidified $KMnO_4$ solution.
   d) Ethanol is warmed with iodine in presence of NaOH.
   e) Ethyl alcohol is heated with acetic acid in presence of Conc. H_2SO_4.
6. Aniline is million times more reactive than benzene towards the electrophilic substitution reaction. Aniline gives coupling reaction with azodye.
   a) Show your familiarity with coupling reaction.
   b) Why is diazotization reaction carried out in ice cold temperature?
   c) Write the structure and name of the compounds A, B and C in the given sequence of reactions. [1+1+3]

7. An aromatic compound "A" gives parent hydrocarbon "B" when heated with Zn dust. The compound "B" can also be obtained by polymerization of acetylene. The compound "A" gives characteristic violet color with $FeCl_3$ solution. Identify "A" and "B" with their names and suitable chemical reaction. Why is compound "A"slightly acidic in nature? [4+1]
8. Acommercial sample of sulphuric acid has a specific gravity 1.8gm/cc. 10 mL of this acid was diluted to 1 litre with water. 10 mL of the diluted acid required 30 ml of decinormal NaOH for complete neutralization. Calculate the percentage purity of H_2SO_4 in the commercial sample. [5]

Or

In the titration of acidified $KMnO_4$ and oxalic acid, $KMnO_4$ is reactant as well as indicator.

a) Is the titration redox or acid base? [1]
b) Why does $KMnO_4$ act as self-indicator? Define indicator? [2]
c) $KMnO_4$ is not primary standard substance, why? [1]
d) If 100 cc of N/10 $KMnO_4$ solution is to prepared, what mass of $KMnO_4$ is required. [1]

GROUP –C

Give long answer to the following questions. [3×8 =24]

9. a) State Hess's law of constant heat summation. Calculate the enthalpy change for the combustion of butane.

Given

i. $C(s) + O_2(g) \rightarrow CO_2(g)$,$\Delta H = -393.5$ kJmol–1
ii. $H_2(g) + 12O_2(g) \rightarrow H_2O(g)$ $\Delta H = -285.5$ kJmol–1
iii. $4C + 5H_2(g) \rightarrow C_4H_{10}(g)$ $\Delta H = -126$ kJ mol–1 [1+3]

b) What is reference electrode? How is standard hydrogen electrode constructed? Write the electrode reaction when SHE act as anode and cathode. [1+1+1+1]

10. Show your acquaintance with habit forming drug and drug addiction.If your friend is having high fever since last night, name the class of drug that you recommend to lower his body temperature. What is penicillin? What medicinal effectdoes it produce on human body? [1+1+1+1+1]

11. A carbonyl compound 'A' reduce Tollen's reagent and itself reduced with metal hydride to give compound 'B'. Similarly another carbonyl compound 'C' does not reduce Tollen's reagent and itself reduced with metal hydride to give compound 'D'. The compound A and C can be obtained by the ozonolysis of compound 'E'. The compound B and D both response positive iodoform test. The compound C can also be obtained by catalytic hydration of propyne. Identify A, B, C, D and E with suitable chemical reaction.

    Write a suitable chemical test to distinguish A from C. [6+1+1]

    OR

    An organic compound A ($C_4H_6O_3$) on treating with an organic compound B gives compounds C and D. Compound C on acid hydrolysis gives compounds B and D. When compound D is heated with P_2O_5 it gives compound A. Reduction of compounds A, C and D with $LiAlH_4$ give compound B. Identify A to D with necessary chemical reactions.

    Convert, methanoic acid into ethanoic acid. [5+3]

SET D

Attempt all questions

GROUP –A

Choose the best alternative to thefollowing questions. **[11×1 =11]**

1. Hydrolysis of ester to give carboxylic acid and alcohol is an example of …..…reaction.
   a) Zero order
   b) Pseudo first order
   c) Second order
   d) Third order
2. A process can be termed spontaneous at ordinary condition, if
   a) ΔS = +ve and ΔH = –ve
   b) ΔS = -ve& ΔH = –ve
   c) ΔS = -ve& ΔH = +ve
   d) ΔH = +ve& Δ = +ve
3. Primary and secondary valency in $[Zn(NH_3)_4]^{2+}$ is .....
   a) 4 and 2
   b) 2 and 4
   c) 3 and 2
   d) all of above
4. Percentage of silver in German silver is
   a) Zero
   b) 0.25
   c) 0.5
   d) 0.75
5. First prepared organometallic compound is
   a) Grignard reagent
   b) Organolithium
   c) Ferrocene
   d) Organocadmium
6. In the reaction, $NH_3+H_2O \rightleftharpoons NH_4^+ + OH^-$, which of the following is the conjugate acid-base pair?
   a) $NH_3 + H_2O$
   b) $NH_4+ + OH-$
   c) $NH_3 + NH_4 +$
   d) $NH_3 + OH-$

7. Which of the following is wrong statement?
   a) Chloroform is used in surgery as an anaesthetic drug
   b) Chloroform is prepared from chlorination of chloral
   c) Chloroform on exposure to air and sunlight gives carbonyl chloride
   d) Insecticide chloropicrin is prepared from nitration of chloroform
8. The first step of manufacturing paper is
   a) Logs are conveyed to the chipper
   b) Debarking of raw material
   c) Digestion in pressure cooker (digester)
   d) All of the above
9. Which of the following does not show acidic nature?
   a) Primary nitroalkane
   b) Secondary nitroalkane
   c) Tertiary nitroalkane
   d) All of the above
10. Phenol is more acidic than alcohols due to,
   a) Resonance stabilization of phenoxide ion
   b) Weak bond of –OH group
   c) Electron releasing nature of –OH group
   d) All of above
11. How much sodium chloride is produced when 100 mL of N/10 HCl is mixed with 200 mL of N/10 sodium hydroxide?
   a) 58.5gm
   b) 5.85gm
   c) 0.585gm
   e) 0.0585gm

GROUP –B

Give short answer to thefollowing questions. **[8×5=40]**

1. Silver is commonly used for ornamental purpose.Its chief ore is Argentite (Ag_2S) from where the metal can be extracted economically and conveniently.
   a) Discuss cyanide process for extraction of silver from horn silver.

b) Why does indelible ink made of silver nitrate is used to produce stain during election or polio drop campaign? Elucidate showing valid reaction. [3+2]

2. Chemical kinetics is the branch of chemistry that deals with rate and mechanism of the reaction. There are numerous factors that alter the rate of chemical reaction.
   a) How does the surface area of the reactant affect the rate of reaction? [1]
   b) What is the role of temperature in the rate of reaction? [2]
   c) What do you mean by a catalyst? What is role of catalyst in kinetics? [2]
3. Define S_N1 and S_N2 reaction. "Haloarenes are less reactive than haloalkane toward nucleophilic substitution reaction", Give reason. What happens when chlorobenzene reacts with aqueous NaOH followed by acidic hydrolysis? [2+2+1]
4. Radioactivity is a nuclear phenomenon exhibited by radioactive element and their compounds and the radiation emitted by radioactive substance are α, β and γ radiation.
   a) How α and β- rays are produced? [2]
   b) For nuclear reaction, α- particles and protons are accelerated but neutrons must be slowed down. Explain. [2]
   c) Write the medical uses of radioisotopes. [1]
5. Describe chemical method for the separation of primary, secondary and tertiary amines by Hoffmann's method. [5]

Or

Identify A, B, C, D and E with their names.

6. An organic compound 'P' reacts with nitrous acid under ice cold condition gives 'Q'. The compound 'Q' is heated with Lucas reagent gives 'R' and R is boiled with aqueous alkali gives again 'Q'. The compound Q is primary alcohol that gives positive iodoform test. Identify P, Q and R with their IUPAC name and write a suitable chemical reaction involved for it. [5]
7. What happens when
   a) Methanoic acid is warmed with ammonical $AgNO_3$?

b) Ethanoic acid reacts with Cl_2 in red phosphorous?

c) Ethanoyl chloride is reduced?

d) Ethanoic anhydride reacts with ammonia?

e) Ethyl ethanoate reacts with $LiAlH_4$?

8. Write the action of

a) Calomel with ammonia

b) Corrosive sublimate with potassium thiocyanate

c) Mercuric sulphate when grinded with sodium chloride in presence of MnO_2.

d) Mercury with excess chlorine

e) Mercury(II)chloride with potassium iodide. [1+1+1+1+1]

OR

Give reason:

a) Open hearth process provides better quality of steel than any other method.

b) A piece of Al or Zn can partially protect iron tank from rusting.

c) Presence of acidic gases in the atmosphere increases the rate of rusting.

d) Haematite ore is separated by gravity separation method but not with froth floatation method. [1+1+1+2]

GROUP –C

Give long answer to thefollowingquestions **[8×3 =24]**

9. Generally, Alcohol is the best chemical for the preparation of haloalkane by using different reagents. Write any three methods of preparation of haloalkane from alcohols.

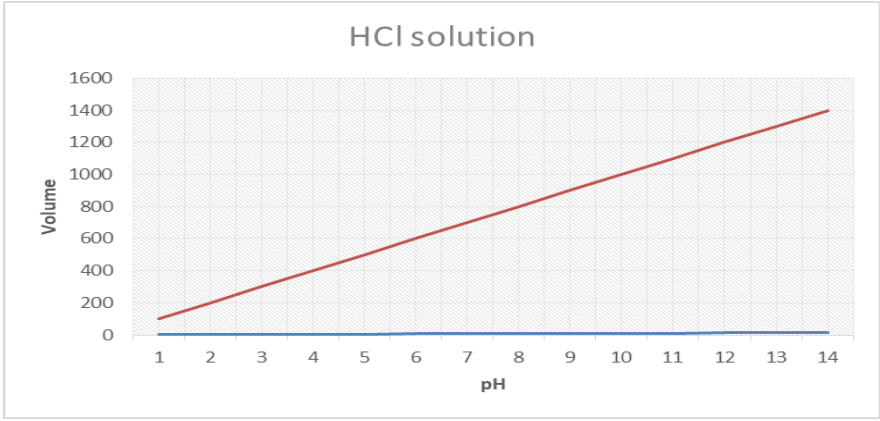
a) What is Lucas reagent?

b) Is $ZnCl_2$ necessary for tertiary alcohol with HCl? If not why?

c) Haloalkane are slightly soluble in water. Give reason?

d) What is the order of boiling point for n-propyl chloride, isopropyl chloride and tertiary butyl chloride? Describe with suitable reason. [3+1+1+1+2]

10. a) The volume vs pH plot of HCl solution is given as:



The volume at pH 2 of HCl is added to 300ml of NaOH with pH 12. What will be the resultant pH of the mixture solution? If the solution having pH 5 is diluted 1000 times with water, find the pH of the resulting solution. The concentration of above solution of acid given in graph cannot be expressed more than 7 in pH scale, why? [2+2+1]

b) The standard reduction potential of Cu and Ag electrodes are 0.34V and 0.80V respectively. Construct a galvanic cell and calculate the standard emf.

$E^0_{Cu^{++}/Cu} = 0.34V$

$E^0_{Ag^+/Ag} = 0.80V$

Why is KCl not used in salt bridge in Cu-Ag cell? [1+1+1]

11. Concentration terms are related with each other. How normality is related with molarity. Derive normality equation. A piece of Al weighing 2.7 gm is heated with 75 mL of H_2SO_4 (sp. gravity= 1.18 containing 24.7% of H_2SO_4 by wt.). After the metal was carefully dissolved, the solution is diluted to 400mL. Calculate the molarity of the free H_2SO_4 in the resulting solution? [1+2+5]

OR

Derive the Gibb's Helmholtz's equation. Explain the spontaneity of endothermic and exothermic reactions in terms of enthalpy change, entropy change and Gibb's free energy change. [3+5]

SET E

Attempt all questions

GROUP –A

Circle the best alternative to the following question **[11×1 =11]**

1. Conversion of ester into β- keto ester is
   a) Perkin condensation
   b) Aldol condensation
   c) Benzoin condensation.
   d) Claisen condensation
2. Which of the following is an insecticide?
   a) BHC
   b) DDT
   c) Zinc Phosphide
   d) Pentachlorophenol
3. For the reaction,
   $PCl_5(g) \rightleftharpoons PCl_3(g) + Cl_2(g)$, $\Delta H=?$
   a) $\Delta E+2RT$
   b) $\Delta E-2RT$
   c) $\Delta E+RT$
   d) $\Delta E-RT$
4. Lead storage battery is
   a) Primary cell
   b) Secondary cell
   c) Fuel cell
   d) Leclanche cell
5. Iron becomes passive when treated with
   a) Water
   b) Conc.H_2SO_4
   c) Hot and Conc. Fuming HNO_3
   d) Aquaregia

6. Aqueous solution of sodium acetate is
   a) Neutral
   b) Weakly acidic
   c) Strongly acidic
   d) Alkaline
7. Mercurous ion is best represented as
   a) Hg^{+}
   b) Hg_2^{2+}
   c) Hg^{2+}
   d) Hg_2^{2+}

8. The product in this reaction is
   a) Methane
   b) Methanamine
   c) Ethanamine
   d) Propane
9. Urotropine is used in medicine as a
   a) tranquilizer
   b) urinary antiseptic
   c) sulpha drug
   d) sedative
10. Compound 'A' reacts with alkaline iodine to form yellow crystals of iodoform. An IUPAC name of compound A is,
    a) Ethyl alcohol
    b) Acetaldehyde
    c) Ethanol
    d) Acetone
11. The amount of water that is to be added to change the strength of a 100mL HCl solution from 0.5 N to 0.2 N is:
    a) 150 mL
    b) 400mL
    c) 300 mL
    d) 500 mL

GROUP –B

Give Short answers to the following questions **[8×5= 40]**

1. State and explain Ostwald dilution law. Also write the limitation of this law. [1+3+1]
2. How diethyl ether is prepared by using Williamson's synthesis? What happens when diethyl ether is exposed to atmospheric air in presence of sunlight? Why it is dangerous to boil old sample of ether? [2+2+1]
3. What is activation energy?
   Distinguish between.
   a) Order and molecularity
   b) Rate law and rate constant [1+2+2]

OR

For the reaction A_2 (g) + B_2 (g) →2AB (g), the following data are obtained:

S.N	[A_2] Mol L^{-1}	[B_2]Mol L^{-1}	Rate(Mol$L^{-1}Sec^{-1}$)
1.	0.50	0.50	1.6×10^{-4}
2.	0.50	1.00	3.2×10^{-4}
3.	1.00	1.00	3.2×10^{-4}

Determine the order of reaction with respect to A_2, B_2, overall order & rate law for the reaction. Also calculate the rate constant. [1+1+1+1+1]

4. Explain the following giving reasons
   a) Mercury is a transition element but Lithium is not.
   b) Zn^{++} salt are white but Cu^{++} salt are blue.
   c) Transition metal easily forms complex ion and metal complexes.
   d) Cu^{++} is more stable than Cu^{+}.
   e) Iron is used as a catalyst in the Haber's process for the synthesis of Ammonia. [1+1+1+1+1]
5. Consider a reaction sequence,

   The compound E has positive iodoform test. Identify A, B, C, D and E with their IUPAC name and write suitable chemical reaction involved. [5]
6. Grignard's reagent is an important organometallic compound which is widely used in much organic synthesis.
   a) How can you prepare Grignard's reagent? [1]

b) How can you prepare i) ethanol
ii) propan-1-ol
iii) propan-2-ol
iv) 2-methylpropan-2-ol
by using suitable Grignard's reagent? [4]

7. How is steel manufactured by open hearth process? What is used to oxidize the impurities in Basic oxygen process? Write the composition of stainless steel. [3+1+1]

8. Write a chemical equation for;
   a) 2,4-DNP test for aldehyde or ketone
   b) Tollen's test for aldehyde
   c) Fehling's test for aldehyde
   d) Diazotization reaction for aniline
   e) Coupling reaction for phenol [5×1=5]

OR

An organic compound 'P' reduce Tollen's reagent and an oxidation with potassium dichromate forms a compound 'Q'. Q reacts with aqueous Na_2CO_3 to give carbon dioxide. Q on reaction with ethanol in presence of sulphuric acid forms an ester having molecular formula $C_4H_8O_2$ 'R'. Identify P, Q and R and write their IUPAC name. [5]

GROUP –C

9. Applied Chemistry is the scientific field for understanding basic chemical properties of materials and for producing new materials with well-controlled functions
   a) Draw the flow sheet diagram for the manufacture of Portland cement.
   b) Show the advantages of Pozzolana Portland cement over Ordinary portlandcement.
   c) What is the technical difference between Sulphate (Kraft) and sulphite process?
   d) What are the major steps in production of paper? Explain each process in detail. [2+2+1+3]

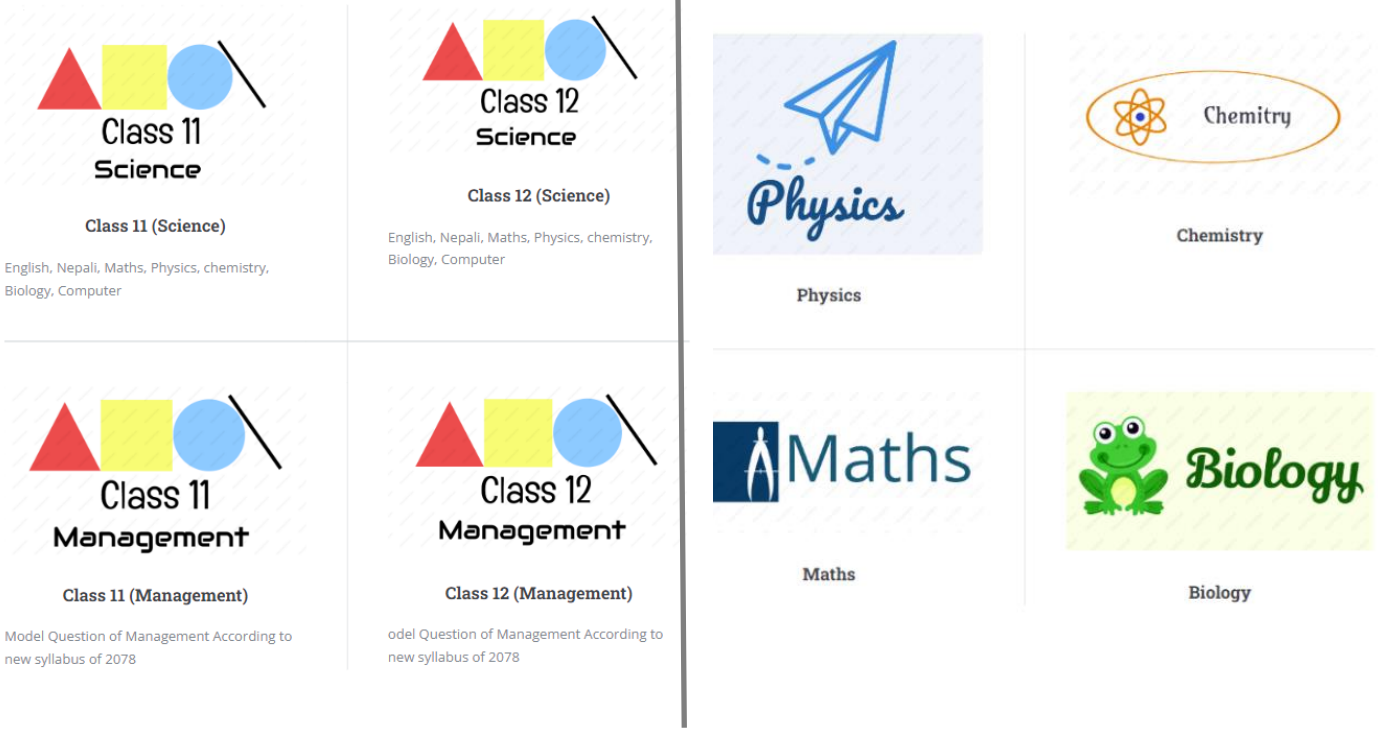
10. Volumetric analysis is a quantitative method where a known solution is usedand react it with a solution of chemical being tested. A typical method ofvolumetric analysis is titration.
    a) Define titration. [1]
    b) Why do you need to repeat titration until concurrent consecutives titres areobtained? [1]
    c) When indicator show the change in color acid is added to base slowly untilend point is reached. Define end point and distinguish it with equivalencepoint. [3]
    d) In a titration between H_2SO_4 and NaOH which indicator is used? Givereason. [2]
    e) What is primary standard substance? [1]
11. Chlorobenzene is an important starting material for the preparation of insecticides like DDT which used in agricultural field.
    a) How would you prepare chlorobenzene by Sandmeyer's and Gattermann's reaction?
    b) Write a chemical reaction for the preparation of DDT by using chlorobenzene.
    c) What happens when chlorobenzene is heated with (i) sodium metal in presence of dry ether (ii) Methyl chloride in presence of sodium and dry ether?
    d) What happens when chlorobenzene is reduced with Ni-Al alloy in presence of NaOH?
    e) Write any two important uses of chlorobenzene. [2+2+2+1+1]

OR

Generally alcohols are used in drinking purpose during ancient time and nowadays it is largely used in industries and laboratories as solvent.
    a) What do you mean by fermentation process?
    b) How ethyl alcohol is prepared in industries by fermentation of molasses?
    c) What is the favorable condition for fermentation of molasses during ethyl alcohol synthesis?
    d) Oxo process is important method to prepare alcohols in industries. Write a chemical reaction for it.
    e) What happens when ethyl alcohol is heated with conc. H_2SO_4 at 140^0C and 170^0C? [1+2+1+2+2]

BIPO's notes

Class 12 complete notes and paper collection and solutions.



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