XIITH QUARTERLY EXAMINATION CHEMISTRY ANSWER KEY - 2024
DINDIGUL DISTRICT

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PART -A

I. CHOOSE THE CORRECT ANSWER: (15 x 1 =15)

1. Wolframite ore is separated from tinstone by the process of

d) Electromagnetic separation

2. Which of these is not a monomer for a high molecular mass silicone polymer?

a) Me_3SiCl

3. P_4O_6 reacts with cold water to give a) H_3PO_3

4. In acid medium, potassium permanganate oxidizes oxalic acid to b) Carbon dioxide

5. Potassium has a bcc structure with nearest neighbor distance 4.52 Aº.

Its atomic weight is 39. its density will be a) 915 kg m^{-3}

6. If the initial concentration of the reactant is doubled, the time for half reaction is also doubled. Then the order of the reaction is a) Zero

7. For the reaction, 2A+B→3C+D, which of the following does not express the reaction rate c) -d[C]/3dt

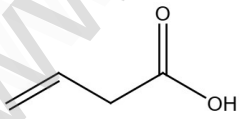
8. Equal volumes of three acid solutions of pH 1, 2 and 3 are mixed in a vessel. What will be the H^+ ion concentration in the mixture? (a) 3. 7 x 10^{-2}

9. Asseration: Tertiary alcohols undergo dehydration more readily than primary alcohol

Reason : Tertiary alcohols are less acidic than primary alcohols

Answer: b) Both assertion and reason are true and reason is not the correct explanation of assertion.

10. HO- CH_2 - CH_2 – OH on heating with periodic acid gives ..... (c) methanal

11. The IUPAC name of 

a) but- 3- enoicacid

12. Which one of the following pairs is not correctly matched:

b) $LiAlH_4$ - Wolf- kisher's reduction

13. the oxidation state of chlorine in Cl_2O_7 is b) +7

14. Reason for Lanthanoid contraction is d) Both (a) & (c)

15. In diborane, the number of electrons that accounts for banana bonds is c) four

II. ANSWER ANY SIX QUESTIONS: (Q.NO.24 IS COMPULSORY) (6 X 2 =12)

16. Give the basic requirements for vapour phase refining.

- The metal should form a volatile compound with the reagent.
- The volatile compound decomposes to give the pure metal.

17. CO is a reducing agent. justify with an example.

- CO is a strong reducing agent.
- It reduces metallic oxide into metals. Ex: $3CO + Fe_2O_3 \rightarrow 2\ Fe + 3CO_2$

18. What are inter halogen compounds? Give examples.

- Each halogen combines with other halogens to form a series of compounds called inter halogen compounds.
- Ex : IF_7, ClF_3

19. Why do transition elements form more number of complexes?

Transition elements have a tendency to form coordination complexes with ligands.

Reasons for complex formation are

- Small size
- High positive charge density.
- Availability of low energy vacant orbitals to accept an electron pairs

20. Define unit cell.

A Basic repeating the structural unit of crystalline solid is called unit cell.

21. Identify the order for the following reactions

1. Rusting of Iron:

   Theoritically order value may be more than one but practically one.

2. Radioactive disintegration of $_{92}U^{238}$:

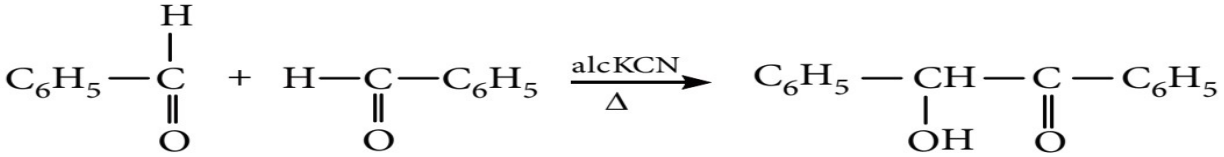
   All radioactive disintegrations are first-order reactions

22. Write the limitation of Arrhenius concept.

- It fails to explain the behavior of acids and base in non-aqueous solutions like acetone.
- It fails to explain the Basicity of Ammonia which do not have OH^- ions.

23. Write the Benzoin condensation:

The Benzoin condensation involves the treatment of an aromatic aldehyde with aqueous alcoholic KCN. The products are a hydroxy ketone.



Benzaldehyde — Benzoin (2-hydroxy – 1, 2 – diphenyl ethanone)

24. Alcohols have higher boiling points than aldehydes, alkanes and ethers of comparable masses. Why?

Alcohols have higher boiling points than the corresponding other organic compounds such as alkanes, aldehydes, ethers etc., this is due to the presence of intermolecular hydrogen bonding present in alcohols.

III. ANSWER ANY SIX QUESTIONS: (Q.NO.33 IS COMPULSORY) (6 X 3 =18)

25. Give the limitations of Ellingham diagram.

- It does not explains the rate of the reaction
- It does not explain the possibility of the reactions
- When the reactants and the products are in equilibrium the value of ΔG is not true value.

26. Explain McAfee process of preparation of $AlCl_3$.

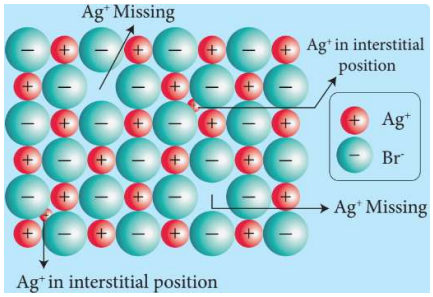
Aluminium chloride is obtained by heating a mixture of alumina and coke in a current of chlorine.

$$2Al_2O_3 + 3C + 6Cl_2 \longrightarrow 4AlCl_3 + 3CO_2$$

27. Write the uses of $KMnO_4$.

- It is used as a strong oxidizing agent.
- It is used for the treatment of various skin infections and fungal infections of the foot.
- It used in water treatment industries to remove iron and hydrogen sulphide from well water.
- It is used as Bayer's reagent for detecting unsaturation in an organic compound.

28. Write a note on Frenkel Defect.



- Arises due to dislocation of ions from its crystal lattice.
- The ion which is missing from the lattice point occupies an interstitial position.
- This defect found in ionic solids in which size of anion and cation differ
- Does not affect the density of crystal
- Ex : AgBr (Br^- larger size)

29. Derive integrated rate law for a zero order reaction A→ product.

A reaction in which the rate is independent of the concentration of the reactant over a wide range of concentrations is called as zero order reactions. Such reactions are rare.

$A \longrightarrow product$

The rate law can be written as,

$$Rate = k[A]^0$$

$$\frac{-d[A]}{dt} = k(1) \qquad (\because [A]^0 = 1)$$

$$\Rightarrow \; -d[A] = k\,dt$$

Integrate the above equation between the limits of $[A_0]$ at zero time and [A] at some later time 't',

$$-\int_{[A_0]}^{[A]} d[A] = k\int_0^t dt$$

$$-([A])_{[A_0]}^{[A]} = k(t)_0^t$$

$$[A_0]-[A] = kt$$

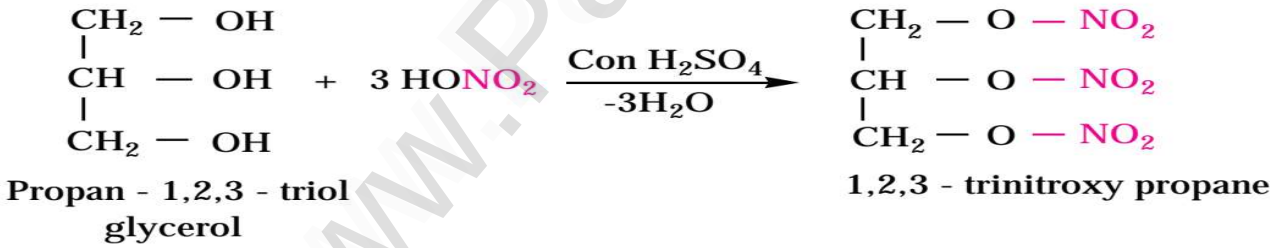
$$k = \frac{[A_0]-[A]}{t}$$

30. Distinguish Lewis Acid and Lewis Base.

	LEWIS ACID	LEWIS BASE
1.	Electron deficient molecules. Ex: BF_3	Molecules with one (or) more lone pairs of electrons. Ex: NH_3
2.	All metal ions Examples: Fe^{2+}	All anions F^-,Cl^-
3.	They contain Polar double bonds. Ex: CO_2	They contain carbon-carbon double Bond. Ex: Ethylene
4.	They are CarboCation.	They are Carbanion. Ex.$CH3^-$

31. What is TNG? How it is prepared?

Glycerol reacts with concentrated nitric acid in the presence of concentrated sulphuric acid to form TNG (nitroglycerine).



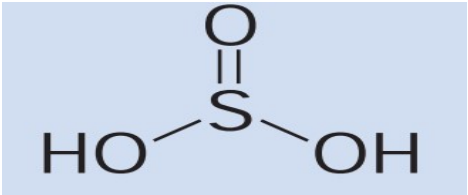
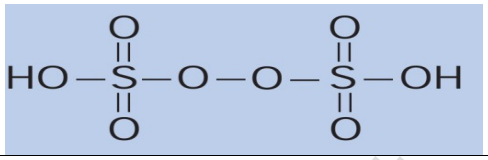
Propan - 1,2,3 - triol
glycerol

1,2,3 - trinitroxy propane

32. Write the test for Carboxylic acids.

- In aqueous solution carboxylic acid turn blue litmus red.
- Carboxylic acids give brisk effervescence with sodium bicarbonate due to the evolution of carbon-di -oxide.
- When carboxylic acid is warmed with alcohol and Con H2SO4 it forms an ester, which is detected by its fruity odour.

33. Write the molecular formula and draw the structure of sulphurous acid and Marshall's acid.

Name	Molecular Formula	Structure
Sulphurous acid	H_2SO_3	
Peroxodisulphuric acid /Marshall's acid	$H_2S_2O_8$	

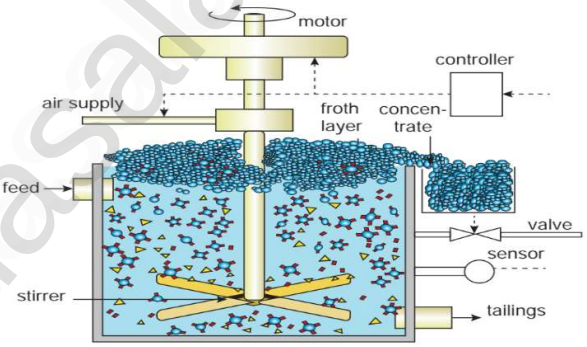
IV. ANSWER ALL THE QUESTIONS: (5 X 5 =25)

34. a) Explain froth floatation process.

Used for the separation of Sulphide minerals from ores based on differences in their hydrophobicity.

Process Steps:

- The ore is crushed and ground to liberate the minerals from the gangue.
- The ground ore is mixed with water and chemical reagents
- Collectors - (e.g., Sodium ethyl xanthate for sulfide ores)
- Frothers: e.g., pine oil,
- This step helps the minerals to become hydrophobic.



- Air is blown into the mixture, creating bubbles.
- Hydrophobic particles attach to the bubbles and float to the surface, forming a froth.
- The ore particles rise to the surface and collected separately.
- The Impurities settles at the bottom of the container.

[OR]

B) i) How will you prepare inorganic benzene.

When treated with excess ammonia at low temperatures diborane gives diboranediammonate. On heating at higher temperatures it gives borazole.

$$3B_2H_6 + 6NH_3 \xrightarrow{-153\ K} 3(B_2H_6.2NH_3)$$

$$3(B_2H_6.2NH_3) \xrightarrow[\text{Closed vessel}]{\text{High temp}} 2B_3N_3H_6 + 12H_2$$

$2B_3N_3H_6$ (Borazole or Borazine - Inorganic benzene)

ii) Write the uses of silicones.

- Silicones are used for low temperature lubrication and in vacuum pumps, high temperature oil baths etc...
- They are used for making water proofing clothes
- They are used as insulating material in electrical motor and other appliances.
- They are mixed with paints and enamels to make them resistant towards high temperature, sunlight, dampness and chemicals.

35. A) i) How bleaching powder is prepared?

Bleaching powder is produced by passing chlorine gas through dry slaked lime (calcium hydroxide).

$$Ca(OH)_2 + Cl_2 \longrightarrow CaOCl_2 + H_2O$$

ii) Write a short note on Holme's signal.

- Phosphine is used for producing smoke screen as it gives large smoke.
- In a ship, a pierced container with a mixture of calcium carbide and calcium phosphide, liberates phosphine and acetylene when thrown into sea.
- The liberated phosphine catches fire and ignites acetylene.
- These burning gases serves as a signal to the approaching ships.

[OR]

B) Describe the preparation of Potassium dichromate.

Potassium dichromate is prepared from chromite ore and it is concentrated by gravity separation process.

1. Prepare sodium chromate:

Fuse chromite ore with sodium carbonate in air to form sodium chromate.

$$4FeCr_2O_4 + 8Na_2CO_3 + 7O_2 \rightarrow 8Na_2CrO_4 + 2Fe_2O_3 + 8CO_2$$

2. Convert sodium chromate into sodium dichromate:

Filter and acidify the sodium chromate solution with sulfuric acid to form sodium dichromate. $2Na_2CrO_4 + 2H^+ \rightarrow Na_2Cr_2O_7 + 2Na^+ + H_2O$

3. Convert sodium dichromate to potassium dichromate:

React sodium dichromate with potassium chloride to form potassium dichromate.

$$Na_2Cr_2O_7 + 2KCl \rightarrow K_2Cr_2O_7 + 2NaCl$$

36. a) Calculate the percentage efficiency of packing in case of simple cubic crystal.

Let us calculate the packing efficiency in simple cubic arrangement,

Let us consider a cube with an edge length 'a' as shown in fig.

Volume of the cube with edge length a is = a x a x a = a^3

Let 'r' is the radius of the sphere. From the figure, a=2r ⇒ = r/a 2

∴ Volume of the sphere with radius 'r'

∴ Volume of the sphere with radius 'r'

$$= \frac{4}{3}\pi r^3$$

$$= \frac{4}{3}\pi \left(\frac{a}{2}\right)^3$$

$$= \frac{4}{3}\pi \left(\frac{a^3}{8}\right)$$

$$= \frac{\pi a^3}{6} \quad \ldots (1)$$

In a simple cubic arrangement, number of spheres belongs to a unit cell is equal to one

$$\therefore \text{Total volume occupied by the spheres in sc unit cell} = 1 \times \left(\frac{\pi a^3}{6}\right) \quad \ldots (2)$$

Dividing (2) by (3)

$$\text{Packing fraction} = \frac{\left(\frac{\pi a^3}{6}\right)}{\left(a^3\right)} \times 100 = \frac{100\,\pi}{6}$$

$$= 52.38\%$$

[OR]

B) Define half life of a reaction. Show that for a first order reaction half life is independent of initial concentration.

Definition: The half life of a reaction is defined as the time required for the reactant concentration to reach one half its initial value.

For a first order reaction, the half life is a constant i.e., it does not depend on the initial concentration.

The rate constant for a first order reaction is given by

$$k = \frac{2.303}{t} \log \frac{[A_0]}{[A]}$$

$$\text{at } t = t_{1/2} \; ; \; [A] = [A_0]/2$$

$$k = \frac{2.303}{t_{1/2}} \log \frac{[A_0]}{[A_0]/2}$$

$$k = \frac{2.303}{t_{1/2}} \log 2$$

$$k = \frac{2.303 \times 0.3010}{t_{1/2}} = \frac{0.6932}{t_{1/2}}$$

$$t_{1/2} = \frac{0.6932}{k}$$

37. A. Derive Henderson equation.

The concentration of hydronium ion in an acidic buffer solution depends on the ratio of the concentration of the weak acid to the concentration of its conjugate base present in the solution i.e.,

$$[H_3O^+] = K_a \frac{[\text{acid}]_{eq}}{[\text{base}]_{eq}}$$

The weak acid is dissociated only to a small extent.

the concentration of the conjugate base is nearly equal to the initial concentration of the added salt.

$$[H_3O^+] = K_a \frac{[\text{acid}]}{[\text{salt}]}$$

Taking logarithm on both sides of the equation

$$\log [H_3O^+] = \log K_a + \log \frac{[\text{acid}]}{[\text{salt}]}$$

reverse the sign on both sides

$$-\log [H_3O^+] = -\log K_a - \log \frac{[\text{acid}]}{[\text{salt}]}$$

We know that

$$pH = -\log [H_3O^+] \text{ and } pK_a = -\log K_a$$

$$\Rightarrow pH = pK_a - \log \frac{[\text{acid}]}{[\text{salt}]}$$

$$\Rightarrow pH = pK_a + \log \frac{[\text{salt}]}{[\text{acid}]}$$

Similarly for a basic buffer, $pOH = pK_b + \log \frac{[\text{salt}]}{[\text{base}]}$

[OR]

B) An organic compound (A) molecular formula (C_2H_6O) react with conc. H_2SO_4 at 443K to give compound (B) react with Bayer's reagent to give compound (C) molecular formula ($C_2H_6O_2$). Identify (A), (B), and (C) and write the equation.

A compound is Ethanol.

When alcohols are heated with a suitable dehydrating agents like sulphuric acid, the H and OH present in the adjacent carbons of alcohols are lost, and it results in the formation of a carbon – carbon double bond.

$$CH_3 - CH_2 - OH \xrightarrow[443\ K]{H_2SO_4} CH_2 = CH_2 + H_2O$$

Ethanol (A) Ethene(B)

the hydroxylation of ethylene using cold alkaline solution of potassium permanganate (Baeyer's reagent) gives ethylene glycol.

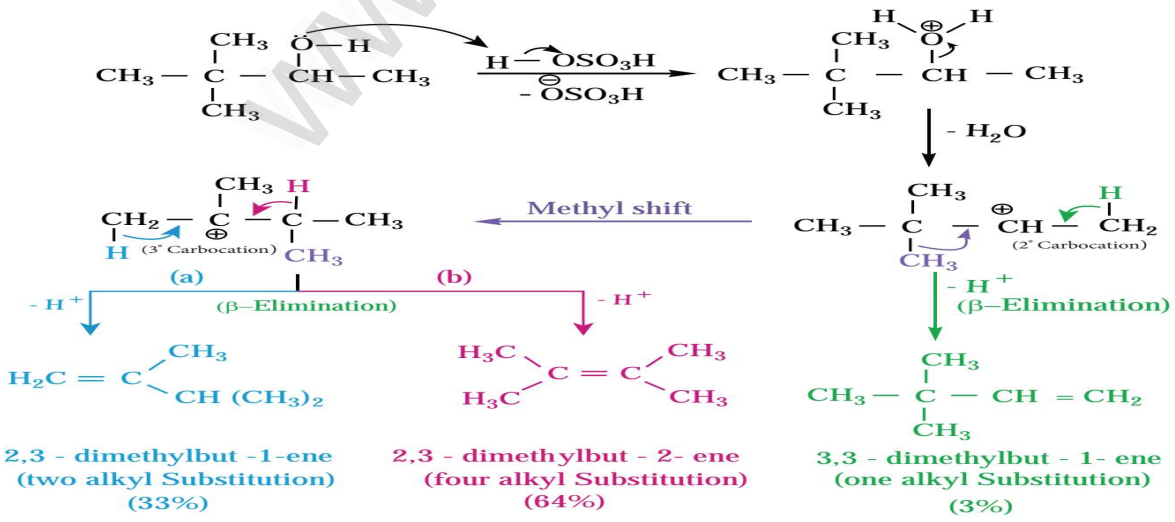
$$\underset{\text{ethene}}{CH_2 = CH_2} + H_2O \xrightarrow[[O]]{\text{Cold alkaline } KMnO_4} \underset{\text{ethane-1,2-diol}}{CH_2(OH) - CH_2(OH)}$$

COMPOUND	NAME	STRUCTURAL FORMULA
A	Ethanol	CH_3-CH_2-OH
B	Ethene	$CH_2 = CH_2$
C	Ethylene glycol	HO- CH_2 - CH_2 - OH

38. A) Explain Saytzeff's rule with example.

During intramolecular dehydration, if there is a possibility to form a carbon – carbon double bond at different locations, the preferred location is the one that gives the more (highly) substituted alkene i.e., the stable alkene.

For example, the dehydration of 3,3 – dimethyl – 2- butanol gives a mixture of alkenes. The secondary carbocation formed in this reaction undergoes rearrangement to form a more stable tertiary carbocation.



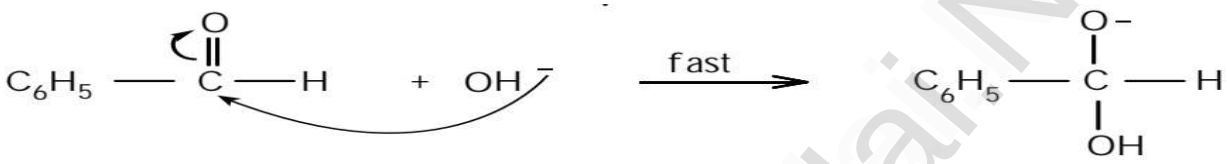
B) Explain Cannizaro mechanism.

- In the presence of concentrated aqueous or alcoholic alkali, aldehydes which do not have α - hydrogen atom undergo self oxidation and reduction (disproportionation) to give a mixture of alcohol and a salt of carboxylic acid.
- This reaction is called Cannizaro reaction.
- Benzaldehyde on treatment with concentrated NaOH (50%) gives benzyl alcohol and sodium benzoate.

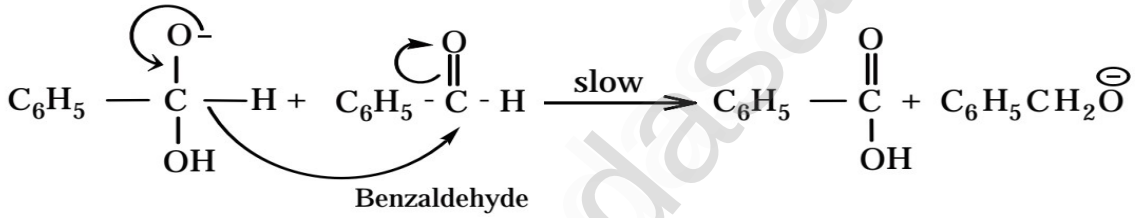
$$\underset{\text{Benzaldehyde}}{C_6H_5CHO} + C_6H_5CHO \xrightarrow{50\%\ NaOH} \underset{\text{Benzylalcohol}}{C_6H_5CH_2OH} + \underset{\text{Sodiumbenzoate}}{C_6H_5COONa}$$

Mechanism of Cannizaro reaction: Cannizaro reaction involves three steps.

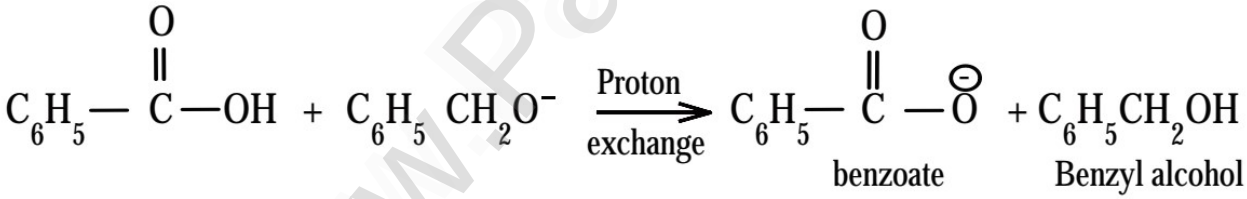
Step 1 : Attack of OH- on the carbonyl carbon.



Step 2 : Hydride ion transfer



Step 3 : Acid – base reaction



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