HIGHER SECONDARY SECOND YEAR PUBLIC EXAMINATION

MARCH - 2024

CHEMISTRY – ANSWER KEY

PART-I

	TYPE-A		TYPE-B	
1.	B	Both assertion and reason are true but reason is not the correct explanation of assertion.	B	First order
2.	C	potassiumtrioxalatoaluminate(III)	B	Acetyl salicylic acid
3.	B	HI	D	Carbondioxide
4.	C	dry ice	C	potassiumtrioxalatoaluminate(III)
5.	C	Cytosine and Uracil	A	Sodium chloride
6.	B	Acetyl salicylic acid	B	(i) and (iv)
7.	D	Carbondioxide	D	Impure Copper
8.	C	Acetanilide	B	Both assertion and reason are true but reason is not the correct explanation of assertion.
9.	A	Sodium chloride	C	Nucleophillic addition
10.	B	(i) and (iv)	C	dry ice
11.	C	Nucleophillic addition	D	PCC
12.	B	First order	B	HI
13.	D	Impure Copper	C	Acetanilide
14.	C	Al_2O_3	C	Cytosine and Uracil
15.	D	PCC	C	Al_2O_3

PART-II

Answer any six of the following questions. Question no.24 is compulsory. [6 x 2 = 12]

16. What is calcination?

- Ore is strongly heated in the absence of air (or) a limited supply of air.
- Used for carbonate and hydrated ores.CO_2 is produced along with metal oxide

$$CaCO_3 \xrightarrow{\Delta} CaO + CO_2\uparrow$$

$$PbCO_3 \xrightarrow{\Delta} PbO + CO_2\uparrow$$

$$ZnCO_3 \xrightarrow{\Delta} ZnO + CO_2\uparrow$$

17. How will you convert boric acid to boron nitride?

- Fusion of urea with $B(OH)_3$, in an atmosphere of ammonia at 800 - 1200 K gives boron nitride.

$$B(OH)_3 + NH_3 \xrightarrow{800-1200\ K} BN + 3H_2O$$

18. Give a reason to support that sulphuric acid is a dehydrating agent?

❖ It is highly soluble in water and has strong affinity towards water and hence it can be used as a dehydrating agent.

- $C_{12}H_{22}O_{11} + H_2SO_4 - \rightarrow 12C + H_2SO_4.11H_2O$
- $HCOOH + H_2SO_4 - CO + H_2SO_4.H_2O$
- $(COOH)_2 + H_2SO_4 - CO + CO_2 + H_2SO_4.H_2O$

19. Explain common ion effect with an example.

- The dissociation of a weak acid (CH_3COOH) is suppressed in the presence of a salt (CH_3COONa) containing an ion common to the weak electrolyte. It is called the common ion effect.
- For example, the addition of sodium acetate to acetic acid solution leads to the suppression in the dissociation of acetic acid which is already weakly dissociated.
- In this case, CH_3COOH and CH_3COONa have the common ion , CH_3COO^-
- Acetic acid **(CH_3COOH)** is a weak acid. Hence it is not completely dissociated in aqueous solution.

$$\mathbf{CH_3COOH \rightleftharpoons CH_3COO^- + H^+}$$

- Sodium acetate**(CH_3COONa)**completely dissociates to produce Na^+ & CH_3COO^-

$$\mathbf{CH_3COONa \longrightarrow CH_3COO^- + Na^+}$$

20. Can Fe^{3+}oxidises bromide to bromine under standard conditions?

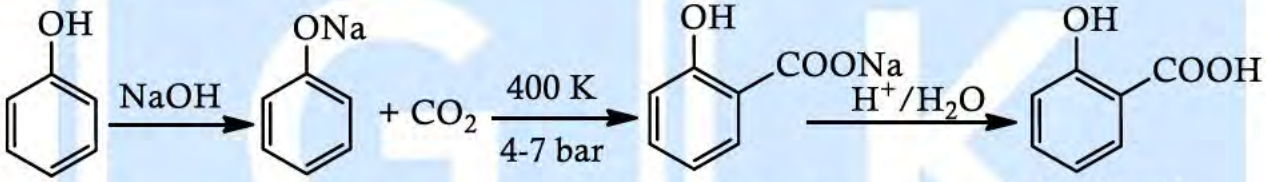
Given: $\mathbf{E^o_{Fe^{3+}|Fe^{2+}} = 0.771V}$ $\mathbf{E^o_{Br_2|Br^-} = 1.09V}$

	$2\,Br^- \longrightarrow Br_2 + 2e^-$	$(E^o_{ox}) = -1.09$ V
	$2\,Fe^{3+} + 2e^- \longrightarrow 2\,Fe^{2+}$	$(E^o_{red}) = +0.771$ V
Overall Rxn	$2\,Fe^{3+} + 2\,Br^- \longrightarrow 2\,Fe^{2+} + Br_2$	$\mathbf{E^o_{cell} = (E^o_{ox}) + (E^o_{red}) = -0.319\ V}$

- $\mathbf{E^o_{cell}}$ is $-$ve $\mathbf{\Delta G}$ is + ve and the cell reaction is non spontaneous.
- Hence Fe^{3+} cannot oxidises Br^- to Br_2

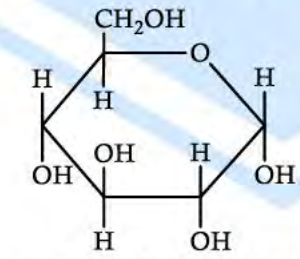
21 Explain Kolbe's reaction

- Phenol is first converted into sodium phenoxide which is more reactive than phenol towards electrophilic substitution reaction with CO_2 . Treatment of sodium phenoxide with CO_2 at 400K, 4-7 bar pressure followed by acid hydrolysis gives salicylic acid.

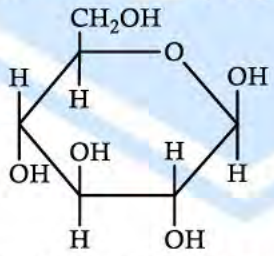


Phenol sodium phenoxide sodium salicyclate Salicyclic acid

22. Write the structure of α – D(+) glucopyranose and β – D(+) glucopyranose



α - D(+) glucopyranose.



β - D(+) glucopyranose.

23. What are antibiotics?

- The medicines that have the ability to kill the pathogenic bacteria are grouped as antibiotics.

Example: (i) Penicillins (ii) amoxicillin (iii) cefpodoxime

24. What is an order of a reaction?

- Sum of the powers of concentration terms involved in the experimentally determined rate law.

PART-III

Answer any six of the following questions. Question no.33 is compulsory. [6 x 3 = 18]

25. Give the uses of helium.

- It is much less denser than air and hence used for filling air balloons.
- Helium has lowest boiling point and hence used in cryogenics.
- Helium is used to provide inert atmosphere in electric arc welding metals.
- He – O_2 mixture is used by the divers in place of air oxygen mixture. This prevents the painful dangerous condition called bends.

26. Which is more stable? Fe^{3+} or Fe^{2+} -Explain.

Fe^{3+}	Fe^{2+}
Electronic configuration =[Ar] $3d^5 4s^0$	Electronic configuration =[Ar] $3d^6 4s^0$
It consists of 5 unpaired electrons	It consists of 4 unpaired electrons
Half filled d^5 sub shell and more stable.	Partially filled d sub shell and less stable
• Hence Fe^{3+} is more stable than Fe^{2+}.	

27. Aluminium crystallizes in a cubic close packed structure. Its metallic radius is 125pm.Calculate the edge length of unit cell.

- r = 125pm

$a = 2\sqrt{2} \times r$

$= 2 \times 1.414 \times 125$

$a = 353.5\text{pm}$

edge length of unit cell = 353.5pm

28. Write Arrhenius equation and explains the terms involved.

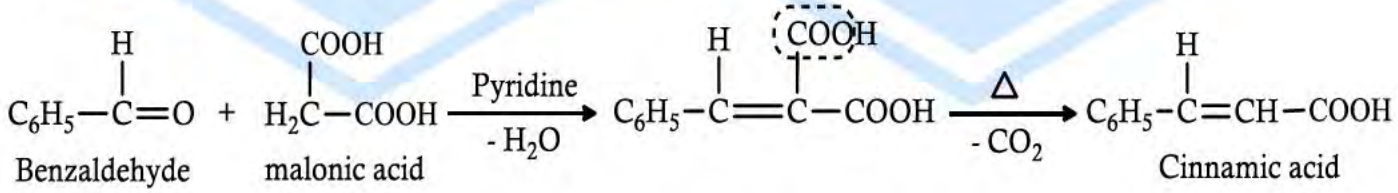
$$k = A\, e^{-E_a/RT}$$

A ⇒ frequency factor,
R ⇒ gas constant
E_a ⇒ the activation energy
T⇒ the absolute temperature (in K)

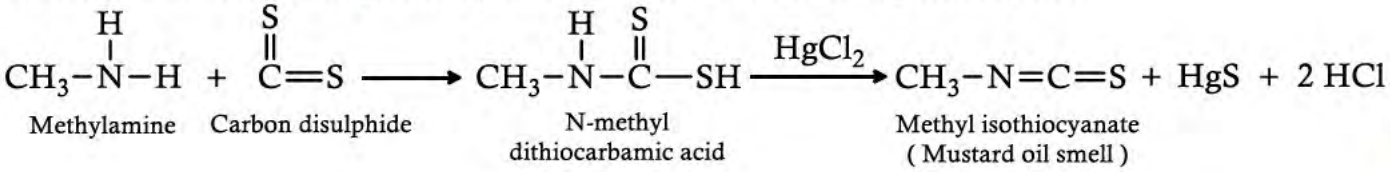
29. Explain the effect of temperature and pressure on physisorption and chemisorption

Chemical adsorption	Physical adsorption
Chemical adsorption is fast with increase pressure, it cannot alter the amount.	when pressure increases the extent of adsorption increases
When temperature is raised chemisorption first increases and then decreases.	Physisorption decreases with increase in temperature.

30. Explain the Knoevenagal reaction

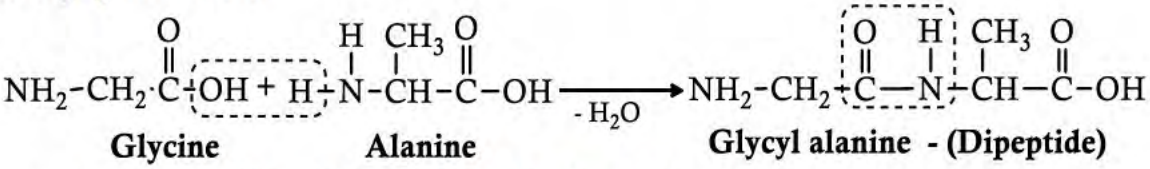


31. Write the reaction of primary amine with carbon disulphide.(CS_2)



32. Write a short note on peptide bond.

- The carboxyl group of the first amino acid react with the amino group of the second amino acid to give an amide linkage between these amino acids. This amide linkage is called peptide bond



33. In the complex, $[Co(CN)_2\ Cl_2]Cl$. Identify the following

**
- **IUPAC name :** Dichloridodicyanido κ-C cobalt(V) chloride
- **Central metal ion :** Co^{+5}
- **Coordination number :** 4

PART-IV

Answer all the questions. **[5 x 5 = 25]**

34. a) (i) What are the differences between minerals and ores?

Minerals	Ore
Naturally occurring substances obtained by mining which contain the metals in free state or in the form of compounds like oxides, sulphides, etc. are called minerals.	Minerals that contain high percentage of metal from which it can be extracted conveniently and economically are called ores.
All the minerals are not ores	All the ores are minerals
Bauxite and China clay are mineral of Al	Bauxite is a ore of Al

(ii) What is the role of Silica in the extraction of copper?

- In copper extraction, silica acts as an <u>acidic flux</u> to remove FeO as slag $FeSiO_3$
- $\underset{\text{Gangue}}{FeO_{(s)}} + \underset{\text{Flux}}{SiO_{2(s)}} - \underset{\text{Slag}}{FeSiO_{3(s)}}$

(OR)

b) (i) Write uses of boric acid

- Manufacture of pottery glasses, enamels and pigments.
- Used as an antiseptic and as an eye lotion.
- Used as a food preservative.

(ii) What is silicate?

- The mineral which contains silicon and oxygen in tetrahedral $[SiO_4]^{4-}$ units linked together indifferent patterns are called silicates

35. a) What is lanthanoid contraction and what are the effects of lanthanoid contraction?

<u>Lanthanoid contraction</u>

As we move across 4f series, the atomic and ionic radii of lanthanoids show gradual decrease with increase in atomic number. This decrease in ionic size is called lanthanoid contraction.

<u>Consequences (effects)of lanthanoid contraction</u>

- From Ce^{3+} to Lu^{3+}, the basic character of Ln^{3+} ions decreases.

- Due to the decrease in the size of Ln^{3+} ions, the ionic character of Ln – OH bond decreases (covalent character increases) which results in the decrease in the basicity.
- Lanthanoids has very small change in radii, so their chemical properties are quite similar.
- The elements of second and third transition series resemble each other more closely than the elements of the first and second transition series.

For example,

- 4d series – Zr – Atomic radius 145 pm
- 5d series – Hf – Atomic radius 144 pm

(OR)

b) (i) Write a short note on double salts and coordination compounds.

Double salt	Coordination compound
Double salts lose their identity in aqueous solution by completely dissociating in to ions in the solvent	They don't lose their identity in aqueous solution as they do not ionize completely.
They give test for all the constituent ions	They do not show test for all their constituent ions
Example : $K_2SO_4.Al_2(SO_4)_3.24\ H_2O$	Example : $K_4[Fe(CN)_6]$

(ii) Give an example of coordination compound used in medicine and two examples of biologically important coordination compounds.

- ❖ Ca-EDTA chelate, is used in the treatment of lead and radioactive poisoning. That is for removing lead and radioactive metal ions from the body.
- ❖ Cis-platin is used as an antitumor drug in cancer treatment.

Biologically important coordination compounds

Metal complexes	Uses
Fe^{2+} Porphyrin complex.(RBC)	Carrying oxygen from lungs to tissues and CO_2 from tissues to lungs.
Mg^{2+} as central metal ion surrounded corrin ring.	• Chlorophyll, a green pigment present in green plants and algae • Photosynthesis, by which plants converts CO_2 and water into carbohydrates and oxygen.
Zinc ion coordinated to the protein.	Carboxypeptidase is a protease enzyme that hydrolytic enzyme important in digestion,
Co^{+} surrounded by Porphyrin like ligand.	Vitamin B_{12} (cyanocobalamine) is the only vitamin consist of metal ion.

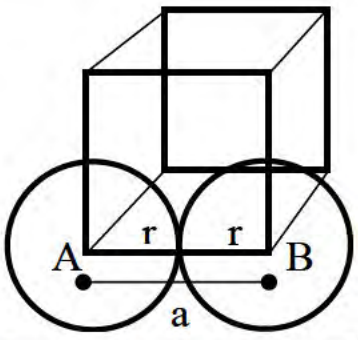
36. a) Calculate the packing efficiency of sc unit cell

- $a = 2r \qquad r = \frac{a}{2}$

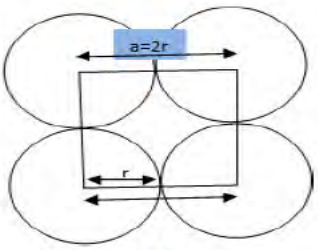
Volume of the sphere with radius 'r' $= \frac{4}{3}\pi r^3$

$$= \frac{4}{3}\pi\left(\frac{a}{2}\right)^3 = \frac{4}{3}\pi\left(\frac{a^3}{8}\right) = \frac{\pi\ a^3}{6}$$

- Number of spheres belong to a unit cell in bcc arrangement is equal to <u>one</u>.



Total volume of all spheres $= 1 \times \frac{\pi\ a^3}{6}$



Packing fraction:

$$= \frac{\textbf{total volume occupied by spheres in a unit cell}}{\textbf{volume of the unit cell}} \times \textbf{100}$$

Packing efficiency $= \frac{\frac{\pi\ a^3}{6}}{a^3} \times 100 = \frac{100\pi}{6} = 52.38\%$

Packing fraction: 52.38%

(OR)

b) (i) 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.

$$\mathbf{A \rightarrow\ products}$$

The rate law can be written as,

$$\text{Rate} = k\,[A]^o$$

$$\frac{-d[A]}{dt} = k\,(1) \therefore\ [A]^o = 1$$

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

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

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

$$-([A])_{[A_o]}^{[A]} = k\,(t)_0^t$$

$$[A_o] - [A] = k$$

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

(ii) What is buffer index?

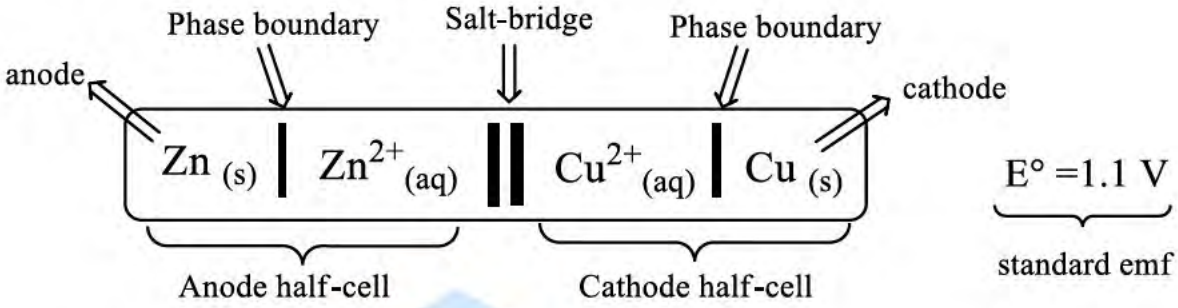
- Buffer index is defined as the number of gram equivalents of acid or base added to 1 litre of the buffer solution to change its pH by unity.
- Buffer index, (β) is a quantitative measure of the buffer capacity.

$$\beta = \frac{dB}{d(pH)}$$

dB = No.of gram equivalents of acid / base added to one litre of buffer solution.

d(pH) = The change in the pH after the addition of acid / base.

37. a) (i) Write the cell terminology.

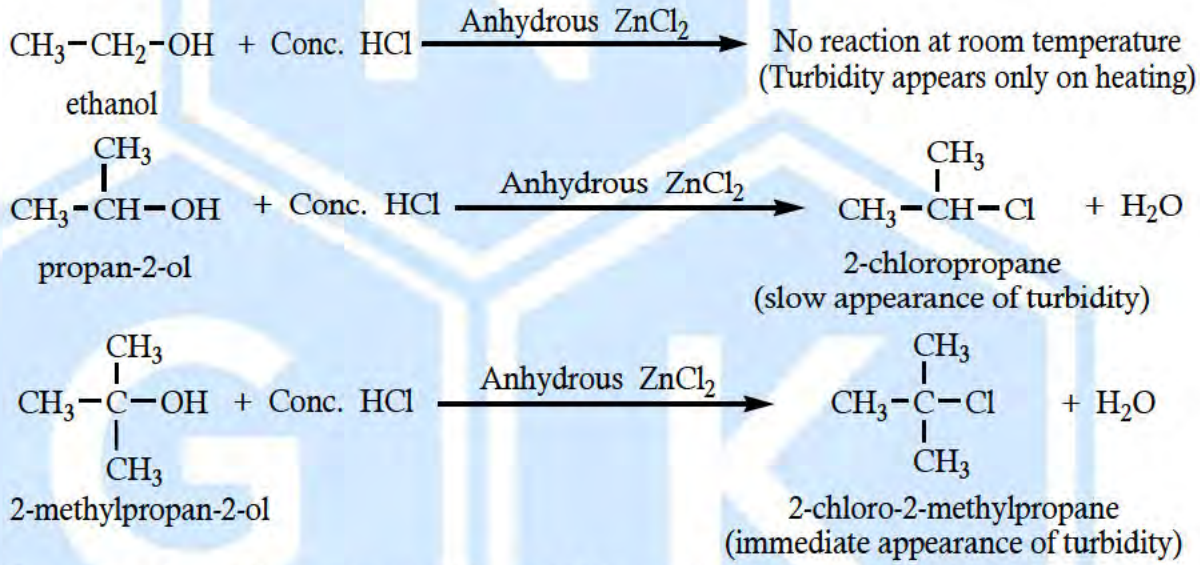


(ii) Define Gold number.

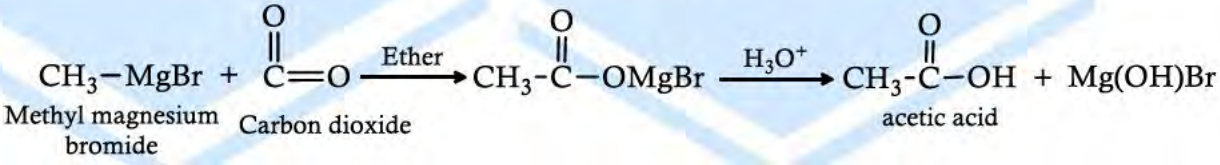
- Gold number is defined as the number of milligrams of hydrophilic colloid that will just prevent the precipitation of 10ml of gold sol on the addition of 1ml of 10% NaCl solution.
- Smaller the gold number greater the protective power.

(OR)

b) (i) Write notes on Lucas test.



38. a) (i) How acetic acid is prepared from Grignard reagent?



(ii) What are bio degradable polymers? Give examples.

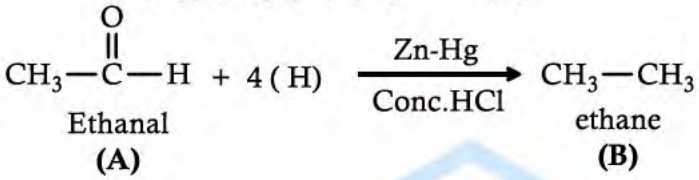
- The materials that are readily decomposed by microorganisms in the environment are called biodegradable.

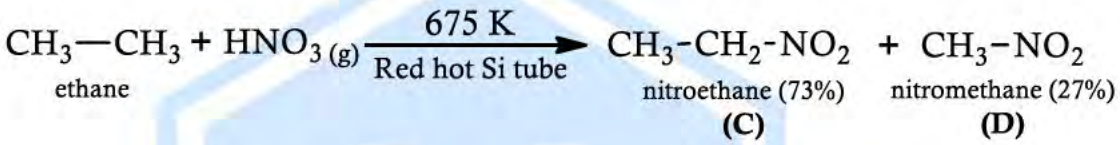
Examples:

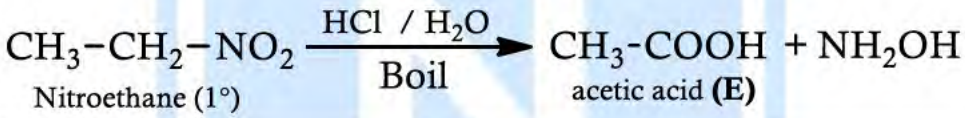
- Poly hydroxy butyrate (PHB)
- Polyglycolic acid (PGA)
- Polylactic acid (PLA)

(OR)

b) (i) An Organic Compound (A) with molecular formula C_2H_4O react with Zn/Hg and conc.HCl gives (B) which react with HNO3 forming compound (C)as major product and compound(D). compound(C) react with Conc HCl to give compound (E)(table vinegar) and hydroxylamine. Identify (A), (B), (C) (D) and (E). Write the equations.







A	**CH_3CHO**	Acetaldehyde (Ethanal)
B	**CH_3CH_3**	Ethane
C	**$CH_3CH_2NO_2$**	Nitroethane
D	**CH_3NO_2**	Nitromethane
E	**CH_3COOH**	Acetic acid (Ethanoic acid)

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