Roll No. 2017058.758

Total No. of Questions : 26]

053/A [Total No. of Printed Pages : 4

SS

2037

ANNUAL EXAMINATION SYSTEM

CHEMISTRY (Theory)

(Common for Science & Agriculture Groups)

(English Version)

(Evening Session)

Time allowed : Three hours

Maximum marks : 70

- Note: (i) You must write the subject code/paper code 053/A in the box provided on the title page of your answer-book.
 - (ii) Make sure that the answer-book contains 30 pages (including title page) and are properly serialed as soon as you receive it.
 - (iii) Question/s attempted after leaving blank page/s in the answer-book would not be evaluated.
 - (iv) Log tables may be asked for if needed.
 - (v) Use of simple calculator is allowed.
 - (vi) Marks allotted to each question are indicated against it.
 - (vii) The paper comprises of 26 questions. Attempt total 26 questions. Internal choice is given in Q. No. 19, 23, 24, 25 and 26.
 - (viii) Question No. 1 to 8 carry one mark each. Answer in one line.
 - (ix) Question No. 9 to 16 will be of two marks each. All questions are compulsory. They are short answer type questions.
 - (x) Question No. 17 to 23 will be of 4 marks each. All questions are compulsory. Internal choice is given for Q. No. 19 and 23.
 - (xi) Question No. 24, 25 and 26 (Three questions) will be of 6 marks each. All questions are compulsory. Full internal choice is given.

All questions are compulsory.

Under what conditions the van't Hoff factor is greater than one?

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Define order of reaction. Write down IUPAC name of CH₃-NH Complete the following reaction :-OH CooNa NaOH Cao, Heat Write down an isomer of C₂H₅OH. 5. What are food preservatives? What are antacids ? **T**.: What are disaccharides ?... 8, The radius of Na⁺ ion is 95 pm and that of Cl⁻ ion is 181 pm. Predict whether the Co-ordination 9. number of Na⁺ ion is 6 or 4. A first order reaction is 20% complete in 20 minutes. Calculate the time it will take the reaction 10 to complete 80%. . What is gravity separation method for concentration of ore? 12. Write down differences between terylene fibres and Buna-s rubber (elastomers). Express Linkage isomerism in [Co (NH₃)₅ NO₂]Cl₂. 14 Write down any two differences between nucleoside and nucleotide... 15. Write down carbylamine reaction. Write down reactions involved in preparation of Potassium dichromate from chromite . 16, оге. 053/A-SS

17. Determine the type of cubic lattice to which the crystal of the element indicated here belongs. It has an edge length of 290 pm and a density 7.80 g cm⁻³. Atomic mass of element = 56 amu.
18. (4) Prove that osmotic pressure is a colligative property.
(ii) Calculate the molar concentration of urea solution if it exerts an osmotic pressure of 2.45 atmosphere at 300K. [R = 0.0821 L atm.mol⁻¹ K⁻¹]
19. What is electro chemical theory of rusting of iron and give two methods of prevention of rusting of iron ?
4
Ni/Ni²⁺ (0.01M)#Cu²⁺ / Cu (0.01M)
Given E° (Cu²⁺ /Cu) = + 0.34V, E°(Ni²⁺ /Ni) = -0.22V
20. Define Tyndall effect. Differentiate between electrophoresis and electroosmosis.

21. (i) Why are interhalogen compounds more reactive than halogens? (ii) All the five bonds in PCl₅ are not equivalent. Justify.

22. (i) Phenol has higher boiling point than toluene. Why ?
(ii) Why alcohols are easily protonated but phenols are not protonated ?
23. Write Hell-Volhard-Zelinsky reaction.

(ii) Write cross aldol condensation.

(iii) Ethanoic acid is weaker acid than benzoic acid. Why?

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24. (i) Why is H,PO, diprotic in nature ? Draw structure. (fi) Why is H_2S less acidic than H_2Te ? (iii) Give hybridization and draw structure of XeF_6 . How is nitric acid manufactured by Ostwald process ? (i) Write down the reaction of Ozone with black lead sulphide. (ii) (iii) Draw structure of IF,. Scandium (z = 21) is a transition element but zinc (z = 30) is not. Explain. 25 (i) Calculate equivalent weight of KMnO₄ in acidic medium. (ii) What do you mean by Lanthanoid contraction ? (iii) or Write down any three differences between Lanthanoids and Actinoids. (i) (ii) The melting and boiling points of Zy, Cd and Hg are low. Why? (iii) Draw the structure of manganate ion. **26.** Write the following reactions :

(i) Williamson's synthesis

(ii) Mendius reaction

(inf) Friedel Craft's Alkylation

(iv) Haloform reaction

(v) Carbylamine reaction

(vi) Gattermann reaction

- (i) Hydrogen atom of chloroform is acidic. Explain.
- (ii) Why is dehydrohalogenation reaction in haloalkanes termed as Beta-elimination reaction?

or

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SOLUTION

1. Under what conditions the van't Hoff factor is greater than one ?

Answer:

i = observed value of CP / calculated the value of CP (when i > 1)

when the solute undergoes dissociation in the sol^n

2. Define order of reaction.

Answer:

Rate = $K[A]^P [B]^q$

Order of R x n = p + q

3. Write down IUPAC name of CH3-NH-CH3

Answer:

Amine N-methyl methen - amine

4. Complete the following reaction:-



OH OH COO, Heal + NO OH COOND pheno.

5. Write down an isomer of C2H3OH.

Answer:

The isomer of ethanol (CH3-CH2-OH) is diethyl ether. (CH3-O-CH3) this is the functional isomer of ethanol.

6. What are food preservatives

Answer:

Food preservatives are chemicals that prevent food from going bad by preventing microbial growth.

7. What are antacids ?

Answer:

Antacids are the drugs used to prevent the overproduction acid in the stomach.

8. What are disaccharides?

Answer:

Disaccharides are sugars that from when two simple sugars. ie. monasaccharides combine to from a disaccharides.

9. The radius of Na+ ion is 95pmand that of Cl- ion is 181 pm pridict whether the Co-ordination number of Na+ ion is 6 or 4

Answer:

Radius ratio = radius of cation / radius of anion = 95 / 181

Radius of cation = 95 pm, Radius of anion = 181 pm = 0.524

we will check the value of co-ordination no = 0.524 lies b/w 0.732 - 0.414

Therefore the coordination number is 6.

10. A first order reaction is 20% complete in 20 minutes. Calculate the time it will take the reaction to complete 80%

Answer:

First order of Rxn => K =
$$\frac{2.303}{t} \log_{10} \frac{100}{100-20}$$

= $\frac{2.303}{t} \log_{10} \frac{100}{80} => 0.0223 \text{m}^{-1}$

=>Again first order Rxn

 $T = \frac{2.303}{k} \log_{10} \frac{100}{100-80} \implies \frac{2.303}{0.0223} \log_{10} \frac{100}{20} \implies 72.18 \text{min}$

11. what is gravity separation method for concentration of or eg?

Answer:

This method of concentration of the ore is based upon the difference in specific gravities of the metallic ore and gangue particles. Generally, metal ores are heavier than the gangue associated with them.

12. Write down difference between terylence fiberes and Buna-s-rubber (elastromes).

Terylene	Buna-s rubber
Terylene is a fibre	Buna-s is an elastomere
Terylene has stronger intermolecular forces of attraction.	Buna-s rubber has weakest intermolecular forces.
Thread forming solids which possess high tensile strength and high modulus.	Weak binding forces permit the polymer to be stretched.

13. Express linkage isomerism in [Co (NH3) NO2] CL2

Answer:

Linkage isomerism:- This type of isomerism is found in complexes that contain ambidentate ligands.



14. Write down any two Difference between nucleoside and necleotide

Answer:

A nucleoside is formed is formed by attachment of a base to the 1st position of a sugar ie Nucleoside = sugar + Base

Nucleotides on the other hand, all the three basic components of nucleic acids are present in nucleotide.

Nucleotide = Sugar + Base + Phosphoric acid

15. Write down carbylamine reation

Answer:

A primary amine (both aliphatic and aromatic) when warmed with chloroform and alcoholic potassium hydroxide gives isocyanides. This is called a Carbylamine reaction.

 $\text{R-NH2} + \text{CHCl3} + 3\text{KOH} \rightarrow \text{RNC} \text{ (Carbylamine)} + 3\text{KCl} + 3\text{H20}.$

16. Write down reactions involved in preparation of Potassium dichromate from chromite ore?

Answer:

- I. $2FeCr2O4 + 8NaOH + 7/2O2 \rightarrow 4Na2Cr2O4 + Fe2O3 + 4H2O.$ (Chromite) (Sodium Chromate)
- II. $2FeCr204 + H3SO4 \rightarrow Na2Cr204 + Na2SO4 + H2O$ (Sodium chromate) (Sodium dichromate)
- III. Na2Cr207 + 2KCl \rightarrow K2Cr207 + 2NaCl (Sodium dichromate) (potassium dichromate).

17. Determine the type of cubic lattice to which the crystal of the element indicated here belongs It has an edge length of 290 pm and a density 80 g cm-3 Atomic mass of element = 56amu

Answer:

$$d = \frac{ZM}{a^{3}NA}$$

$$d = 7.80gcm^{-3}$$

$$M = 56gmol^{-1}$$

$$a = 2900m \text{ or } a^{3} = 2.43*10^{-23}$$

$$Z = \frac{a^{3}*d*NA}{M}$$

$$Z = \frac{2.43*10^{-23}*7.80*6.022*10^{23}}{56}$$

$$=>2.03$$

It belongs to crystal lattice.

18 (i) Prove that osmotic pressure is colligative property.

(ii) Calculate the molar concentration of urea solution if it exerts an osmotic pressure of 2.45 atmosphere at 300K. [R= 0.0821 Latm.mol-1 K-1]

Answer:

(i) Collative property depends only on the number of dissolve parties in solⁿ& not on their identity. Both solⁿ have the same freezing point, boiling point, vapour pressure & osmotic pressure because that collagative property of a solⁿ only depend on the number of dissolved particles

=> Colligative property is proportional to the molarity & temperature

 $\pi v = n R T$ the basic equation for ideal solⁿ or

$$\pi=CRT$$
 where $rac{n}{v}=v$

 π is osmotic pressure,

C is concentration, V is volume, T is absolute Temperature, n is the number of males of the solute of the solution.

(ii) $\Pi = \frac{nrt}{v}$

Osmotic pressure = 2.45 atm

T = 300 K

R = gas constant = 0. 0821L

so n/v is molar concentration that is $\frac{n}{v} = \frac{\pi}{rt}$

molar concentration = 2.45 / (300 * 0.0821)

= 2.45 / 24.63

= 0. 099 mol

19. What is electro chemical theory of rusting of iron and give two methods of prevention of rusting of iron?

Answer:

Electrochemical theory of rusting of iron and two methods of prevention of rusting of iron.

At Anode: Fe_(s) undergoes oxidation to release electrons.

 $Fe_{(s)} \rightarrow Fe^{2+}_{(aq)} + 2e^{-}$

At Cathode: $O_{2(g)} + 4H_{(aq)} + 4e^{-1} \rightarrow 2H_2O_{(I)}$

Electrons released at the anode move to another metal and reduce oxygen in presence of H^+ . It is available from H_2CO_3 formed from the dissolution of CO_2 from air into water. H^+ in water may also be available through dissolution of other acidic oxides from the atmosphere.

RXN $Fe_{(s)} + 2H^{+}_{(aq)} + 1/2O_{2(g)} \rightarrow Fe^{2+}_{(aq)} + H_2O_{(I)}$

Fe²⁺ is oxidised again to form rust.

$$2Fe^{2+}(s) + 1/2O_{2(g)} + 2H_2O_{(I)} \rightarrow Fe_2O_{3(s)} + 4H^{+}(aq)$$

(rust)

OR

19. Write the Nernst equation and calculate the emf of following cell at 298K:-Ni/Ni²⁺ (0.01M) || Cu²⁺ / Cu (0.01M) Given E⁰ (Cu²⁺/Cu) = + 0.34V, E⁰(Ni²⁺/Ni)= -0.22V

$$E^{0}cell = (E_{C} - E_{a}) = \frac{0.059}{n} log \frac{Anode}{Cathode}$$

$$E_{c} - E_{a} = 0.34 - (0.22) = 0.56V$$

$$E^{0}cell = 0.56 - \frac{0.059}{2} log \frac{0.01}{0.01}$$

$$= 0.56 - \frac{0.059}{2}$$

$$= 0.56 - 0.03 = 0.52$$

$$E_{cell} = 0.53V$$

20. Define Tyndall effect. Differentiate between electrophoresis and electroosmosis

Answer:

Tyndall effect is the phenomenon of scattering of light of colloidal particle and hence the path of the beam becomes visible is called tyndall effect.

Electrophoresis	Electroosmosis
Refers to the movement	Refers to the movement of molecules of the dispersion
of colloidal particles	medium under the influence of electric field where
under an applied electric	colloidal particles are not allowed to move
field	

21. (i) Why are interhalogen compounds more reactive than halogens. (ii) All the five bonds in PCI_5 are not equivalent. Justify.

Answer:

(i) Interhalogens are generally more reactive than halogens except fluorine. This is because A-X bonds in interhalogens are weaker than the X-X in dihalogen molecules. Reaction of interhalogens is similar to halogens. Hydrolysis of interhalogen compounds yields halogen acid and oxy-acid.

(ii) PCl_5 has a trigonal bipyramidal structure due to SP^3 hybridisation. As a result of this, two Cl atoms lie along axial line along equatorial plane. Hence all atoms which lie along the axis have different bond length than that of Cl atoms lying on the equatorial plane.

Structure of PCI₅



22. (i) Phenol has a higher boiling point than toluene. Why?

(ii) why alcohol easily protonated but phenGtrs'.are not protonated?

Answer:

(i) Phenol has a higher boiling point then toluene due to the presence of intermolecular hydrogen bonding in phenols. The formation of hydrogen bonds increases intermolecular forces of attraction among phenol molecules hence the increase in boiling point.

(ii) In phenol, the lone pair of electrons on oxygen involved in delocalization is not freely available for protonation whereas in alcohols, the electrons on oxygen atom are not delocalized so they are available for protonation.

23. (i) Write Hell-Volhard-Zelinslry reaction.

- (ii) Write cross aldol condensation.
- (iii) Ethanoic acid is weaker acid than benzoic acid. Why?

Answer:



(i) Equation for the reaction Hell-Volhard-Zelinsky reaction:-

(ii) Equation Goss-Aldol condensation reaction:-



(iii) Stronger acids have a lower PKa value. Ethanoic acid is a weaker acid than benzoic acid due to presence of a benzene ring in benzoic acid, delocalization of electrons makes it more acidic than ethanoic acid but such stabilisation is not present in ethanoic acid.

24. (i)Why is H₃PO₃ diprotic in nature ? Draw structure.

- (ii) Why is H_2S less acidic than H_2Te ?
- (iii) Give hybridization and draw structure of XeF₆.

Answer:

(i) H_3PO_3 is dipole in nature because H atoms are attached to oxygen. As a result phosphorus acid is dibasic as it has two P-OH bonds. Similarly, phosphoric acid, H_3PO_4 is tribasic as it has three P-OH.



(ii) Acidic character increases, H_2 Te has less bond dissociation enthalpy than H_2 S, hence less energy is required to break H_2 Te bond easily releasing [H⁺] hence acidity of H_2 Te is higher whereas H_2 S has high bond dissociation energy and hence its acidity is less.

(iii) Hybridisation of this molecule is SP³d³. According to VSEPR theory, this molecule has seven electron pairs. It has octahedral structure.



OR

- 24. (i) How is nitric acid manufactured by Qstwald process ?
- (ii) Write down there action of Ozone with blacklead sulphide.
- (iii) Draw structure of IF .

- 25. (i) Scandium (z = 21) is a transition element but zinc (z = 30) is not. Explain.
- (ii) Calculate equivalent weight of KMnO₄ in acidic medium.

(iii) What do you mean by Lanthanoid contraction?

Answer:

(i) Transition metals are elements that form at least stable where the compound has an incomplete d subshell. Zinc is not a transition metal because it forms only Zn²⁺ ions with all the 3d-electrons present. The valence configuration should have at least unpaired electrons.

(ii) Eq.wt = $\frac{158}{5}$ = 31.6g per equivalent.

So equivalent weight = $\frac{molarmass}{3}$

 $\frac{87}{3}$ = 29gm/equivalent.

As Mn7+in KMNO₄ changes to Mn²⁺ in acidic medium, equivalent weight becomes $\frac{M}{5}$

(iii) Lanthanoid contractions is greater than expected decrease in ionic radii of the elements in the lanthanoid series, from atomic number 57, lanthanum to 71, IU resulting in smaller atomic radii.

OR

25. (i) Write down any three differences between Lanthanoids and Actinoids

(ii) The melting and boiling points of Zy, Cd and Hg are low. Why?

(iii) Draw the structure of manganate ion.

(i)	Lanthanoids	Actinoids
	They are generally non-radioactive	They are radioactive
	Most of their ions are colourless.	They have coloured ions
	Less tendency	High tendency

(ii) Zinc has relatively low melting and boiling point. Cadmium (CD) is similar to Zinc in many aspects but forms complex compound. Mercury (Hg) has a low melting point for d-block element.

(iii) Structure of magnetic ion:-



- 26. Write the following reactions :
- (i) Williamson' s synthesis
- (ii) Mendius reaction
- (iii) Friedel Craft's Alkylation
- (iv) Haloform reaction
- (v) Gutterman reaction

Answer:

(i) William synthesis

R-X+R — \ddot{O} Na —> $R-\ddot{O}-R$ + NaX

(alkythalide)(sodium alkoxide) (ether)

(ii) Mendius Rxn

 $\mathsf{RCN} \quad + \quad \mathsf{2H}_2 \quad \rightarrow \quad \mathsf{RCH}_2\mathsf{NH}_2$

(alkylcyanide) (hydrogen)

(iii) Fredal Craft Alkylation:-

X = F, Q, BH, 1 - -R2 -X <u>cat. AIX3</u> (9/ky/ halide) acid R ano matic subsituted Compound avomatic compound

(iv) Halo form Rxn:-

٥ UI2/NOOH 3 H30+ OH

(v) Carbylamine Rxn:-

 RNH_2 + $CHCI_3$ + 3KOH(alc) -> RNC + 3KCI + $3H_2O$

(vi) Gatterman Rxn:-

atterman Rxn ۲ H Ald

26. (i) Hydrogen atom of chloroform is acidic. Explain.

(ii) Why is dehydrohalogenation reaction in haloalkanes termed as Betaelimination?

Answer:

(i) Hydrogen atom of chloroform is acidic because it creates a positive charge, partial deficiency of electron with carbon, more electronegativity than H atom, hence starts to pull electrons from H.

The presence of 3Cl aggravates the pull resulting into loss of H⁺. It also accepts the lone pair of electrons left by H termed back donation into its empty 3d shell thereby stabilising the negative charge on carbon.

Structure of CHCl₃



(ii) Alkenes are generally prepared through B-elimination reaction, in which two atoms on the adjacent carbon atoms are removed in formation of a double bond. Preparations include dehydration of alcohols, dehydrohalogenation of alkyl halides and dehalogenation of alkanes.