PYQ 2024

CUET Test Series

Chemistry

Q1 The total number of ions produced from the complex $[Cr(NH_3)_6]Cl_3$ in aqueous solution will be

(A) 2 (B) 3
(C) 4 (D) 5

Q2 Arrange the following in decreasing order of number of molecules contained in

(A) $16g$ of O_2
(B) $16g$ of CO_2
(C) $16g$ of CO
(D) $16g$ of H_2

Choose the correct order from the options given below

(A) (A), (B), (C), (D)
(B) (D), (C), (A), (B)
(C) (B), (A), (D), (C)
(D) (C), (B), (D), (A)

Q3 A molecule X associates in a given solvent as per the following equation

$X \rightleftharpoons (X)_n$

For a given concentration of X, the van't Hoff factor was found to be 0.80 and the fraction of association of molecules was 0.3. The correct value of 'n' is

(A) 2 (B) 3
(C) 1 (D) 5

Q4 The oxidation number of cobalt in the complex $[Co(H_2NCH_2CH_2NH_2)_3]_2(SO_4)_3$

(A) 3 (B) 4
(C) 2 (D) 5

Q5 The correct structure of dipeptide, Gly-Ala (glycyl alanine) is

(A) $H_2N-CH_2-CO-NH-CH(CH_3)-COOH$
(B) $HOOC-CH_2-NH-CO-CH(CH_3)-NH_2$
(C) $HOOC-CH(CH_3)-NH-CO-CH_2-NH_2$
(D) $H_2N-CH(CH_3)-CO-NH-CH_2-COOH$

Q6 The Cu metal crystallises into fcc lattice with a unit cell edge length of $361\ pm$. The radius of Cu atom is

(A) 127 pm (B) 181 pm
(C) 157 pm (D) 108 pm

Q7 If 75% of first-order reaction gets completed in 32 minutes, time taken for 50% completion of this reaction is

(A) 16 minutes (B) 78 minutes
(C) 8 minutes (D) 4 minutes

Q8 Which of the following compounds will be repelled when placed in an external magnetic field?

(A) $Na_2[CuCl_4]$ (B) $Na_2[CdCl_4]$
(C) $K_4[Fe(CN)_6]$ (D) $K_3[Fe(CN)_6]$

Q9 The spin only magnetic moment of Hexacyanidomanganate(II) ion is

(A) 5.90 (B) 1.73
(C) 4.90 (D) 3.87

Q10 The correct order of increasing boiling points of the following compounds is

Pentan-1-ol, n-butane, Pentanal, Ethoxyethane

(A) Ethoxyethane, Pentanal, n-butane, Pentan-1-ol
(B) Pentanal, n-butane, Ethoxyethane, Pentan-1-ol
(C) n-butane, Pentanal, Ethoxyethane, Pentan-1-ol
(D) n-butane, Ethoxyethane, Pentanal, Pentan-1-ol

Q11 In the following reaction, identify the product D

$C_6H_5OH \xrightarrow{Zn \text{ dust}} A \xrightarrow{CH_3Cl+\text{anhyd } AlCl_3} B$

$B \xrightarrow{K_2Cr_2O_7+H_2SO_4} C \xrightarrow{H_2SO_4+HNO_3} D$

(A) o-nitrobenzoic acid

(B) p-nitrobenzoic acid

(C) o,p-dinitrobenzoic acid

(D) m-nitrobenzoic acid

Q12 The gold number range of some of the lyophilic colloids is given below

A : 0.005 - 0.01

B : 0.15 - 0.25

C : 0.04 - 1.0

D : 15 - 25

Which among these can be used as a better protective colloid?

(A) A (B) B

(C) C (D) D

Q13 Reaction of aniline with conc. HNO_3 and conc. H_2SO_4 at 298 K will produce 47% of

(A) p-Nitroaniline

(B) o-Nitroaniline

(C) m-Nitroaniline

(D) 2,4-Dinitroaniline

Q14 What will be the increasing order of basic strength of the following compounds?

$C_2H_5NH_2$, $(C_2H_5)_2NH$, $(C_2H_5)_3N$, $C_6H_5NH_2$

(A) $C_2H_5NH_2 < (C_2H_5)_2NH < (C_2H_5)_3N < C_6H_5NH_2$

(B) $C_6H_5NH_2 < C_2H_5NH_2 < (C_2H_5)_3N < (C_2H_5)_2NH$

(C) $(C_2H_5)_3N < (C_2H_5)_2NH < C_6H_5NH_2 < C_2H_5NH_2$

(D) $(C_2H_5)_2NH < (C_2H_5)_3N < C_2H_5NH_2 < C_6H_5NH_2$

Q15 Which of the following compounds will give Hell-Volhard-Zelinsky reaction?

(A) $R-CH_2-COOH$ (B) R_3C-CHO

(C) R_2CO (D) $H-COOH$

Q16 Arrange the following acids in increasing order of their acidic strengths

$HCOOH, FCH_2COOH, NO_2CH_2COOH, ClCH_2COOH$

(A) $HCOOH < FCH_2COOH < NO_2CH_2COOH < ClCH_2COOH$

(B) $HCOOH < NO_2CH_2COOH < ClCH_2COOH < FCH_2COOH$

(C) $NO_2CH_2COOH < HCOOH < ClCH_2COOH < FCH_2COOH$

(D) $HCOOH < ClCH_2COOH < FCH_2COOH < NO_2CH_2COOH$

Q17 In the following compounds, what is the increasing order of their reactivity towards nucleophilic addition reactions?

Benzaldehyde, p-Tolualdehyde, p-Nitrobenzaldehyde, Acetophenone

(A) Benzaldehyde < p-Tolualdehyde < p-Nitrobenzaldehyde < Acetophenone

(B) Acetophenone < Benzaldehyde < p-Tolualdehyde < p-Nitrobenzaldehyde

(C) Acetophenone < p-Tolualdehyde < Benzaldehyde < p-Nitrobenzaldehyde

(D) Benzaldehyde < Acetophenone < p-Tolualdehyde < p-Nitrobenzaldehyde

Q18 The Gatterman-Koch reaction is used in the industrial preparation of benzaldehyde. The electrophile involved in the reaction is

(A) CO^+

(B) $HCl + CO_2 + \text{anhydrous } AlCl_3$

(C) HCO^+

(D) $CO + \text{anhydrous } AlCl_3$

Q19 Formaldehyde undergoes Cannizzaro reaction because

(A) It has alpha-hydrogen atom.

(B) It does not have alpha-hydrogen atom.

(C) It does not undergo self-oxidation and reduction on heating with concentrated alkali.

(D) It undergo self-oxidation and reduction on heating with concentrated alkali.

Choose the correct answer from the options given below

(A) (B) and (D) only

(B) (A) and (C) only
(C) (B) and (C) only
(D) (A) and (D) only

Q20 In the reaction,
$(CH_3)_3C-O-CH_3+HI \rightarrow Products$
CH_3OH and $(CH_3)_3CI$ are the products and not CH_3I and $(CH_3)_3C-OH$. It is because,
(A) in step 2 of the reaction the departure of leaving group $(HO-CH_3)$ creates less stable carbocation.
(B) in step 2 of the reaction the departure of leaving group $(HO-CH_3)$ creates more stable carbocation.
(C) the reaction follows S_N1 mechanism.
(D) the reaction follows S_N2 mechanism.
Choose the correct answer from the options given below
(A) (B) and (D) only
(B) (B) and (C) only
(C) (A) and (D) only
(D) (A) and (C) only

Q21 Aniline does not undergo Friedel-Crafts reaction because
(A) It forms salt with the Lewis acid catalyst, $AlCl_3$
(B) Nitrogen of aniline acquires negative charge.
(C) Nitrogen of aniline acquires positive charge.
(D) Nitrogen acts as a strong deactivating group in the further reaction.
Choose the correct answer from the options given below
(A) (A), (B) and (D) only
(B) (A), (B) and (C) only
(C) (A), (C) and (D) only
(D) (B), (C) and (D) only

Q22 Although chlorine is an electron withdrawing group, yet it is ortho- and para-directing in electrophilic aromatic substitution reaction because
(A) Chlorine withdraws electrons through inductive effect.
(B) Chlorine destabilises the intermediate carbocation formed during electrophilic substitution.
(C) Chlorine accepts electrons through resonance.
(D) Chlorine releases electrons through resonance.
Choose the correct answer from the options given below
(A) (A), (B) and (D) only
(B) (A), (B) and (C) only
(C) (A), (C) and (D) only
(D) (B), (C) and (D) only

Q23 In Etard reaction, the final product is
(A) Aromatic aldehyde
(B) Aromatic chloride
(C) Aromatic amine
(D) Aromatic alcohol

Q24 Match List-I with List-II

List–I	List–II
(A) Amino acids linked in a specific sequence	(I) Primary structure of proteins
(B) Regular folding of a specific sequence of amino acids due to H-bonding	(II) Secondary structure of proteins
(C) Fibrous proteins	(III) Quaternary structure of proteins
(D) Spatial arrangement of two or more polypeptide chains	(IV) Tertiary structure of proteins

Choose the correct answer from the options given below
(A) (A) - (I), (B) - (II), (C) - (III), (D) - (IV)
(B) (A) - (I), (B) - (III), (C) - (II), (D) - (IV)
(C) (A) - (I), (B) - (II), (C) - (IV), (D) - (III)
(D) (A) - (III), (B) - (IV), (C) - (I), (D) - (II)

Q25 Match List-I with List-II

List–I	List–II
(A) Tollen's reagent	(I) Rochelle salt

List–I	List–II
(B) Jones reagent	(II) Conc. HCl and $ZnCl_2$
(C) Lucas reagent	(III) Ammoniacal silver nitrate
(D) Fehling solution	(IV) Chromium trioxide–sulphuric acid

Choose the correct answer from the options given below

(A) (A) - (III), (B) - (IV), (C) - (II), (D) - (I)
(B) (A) - (IV), (B) - (III), (C) - (I), (D) - (II)
(C) (A) - (I), (B) - (IV), (C) - (II), (D) - (III)
(D) (A) - (III), (B) - (I), (C) - (IV), (D) - (II)

Q26 Match List-I with List-II

List–I	Reaction Name	List–II	Reaction / Equation
(A)	Swarts Reaction	(I)	$C_6H_5NH_2 + NaNO_2 + HX + Cu_2X_2 \rightarrow C_6H_5X + N_2$
(B)	Finkelstein Reaction	(II)	$2RX + 2Na \rightarrow R - R + 2NaX$
(C)	Sandmeyer's Reaction	(III)	$RX + AgF \rightarrow R - F + AgX$
(D)	Wurtz Reaction	(IV)	$RX + NaI \rightarrow R - I + NaX$

Choose the correct answer from the options given below

(A) (A) - (I), (B) - (II), (C) - (III), (D) - (IV)
(B) (A) - (I), (B) - (III), (C) - (II), (D) - (IV)
(C) (A) - (I), (B) - (II), (C) - (IV), (D) - (III)
(D) (A) - (III), (B) - (IV), (C) - (I), (D) - (II)

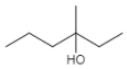
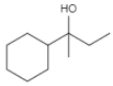
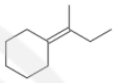
Q27 Match List-I with List-II

List–I (Biomolecule)	List–II (Function/Disease)
(A) Vitamin A	(I) Menstrual cycle
(B) Thymine	(II) Xerophthalmia
(C) Glucocorticoids	(III) Beri-beri
(D) Estradiol	(IV) Addison's disease

Choose the correct answer from the options given below

(A) (A) - (III), (B) - (II), (C) - (I), (D) - (IV)
(B) (A) - (II), (B) - (III), (C) - (I), (D) - (IV)
(C) (A) - (III), (B) - (II), (C) - (IV), (D) - (I)
(D) (A) - (II), (B) - (III), (C) - (IV), (D) - (I)

Q28 In the following table, match the reactants given in List-I with the correct product in List-II as per the reaction of hydration of alkene under acidic condition

List-I (Reactants)	List-II (Products)
(A) 	(I) 
(B) 	(II) 
(C) 	(III) 
(D) 	(IV) 

Choose the correct answer from the options given below

(A) (A) - (I), (B) - (II), (C) - (III), (D) - (IV)
(B) (A) - (I), (B) - (III), (C) - (II), (D) - (IV)
(C) (A) - (II), (B) - (I), (C) - (IV), (D) - (III)
(D) (A) - (III), (B) - (IV), (C) - (I), (D) - (II)

Q29 Which among the following is not an Analgesic?

(A) Morphine (B) Heroin
(C) Codeine (D) Ranitidine

Q30 The increasing order of acidity of the following compounds based on pKa values is

(A) $BrCH_2COOH$
(B) $ClCH_2COOH$
(C) FCH_2COOH
(D) $HCOOH$

Choose the correct answer from the options given below

(A) (D) < (A) < (B) < (C)
(B) (A) < (D) < (C) < (B)
(C) (B) < (A) < (D) < (C)
(D) (C) < (B) < (D) < (A)

Q31 For S_N2 reaction, the increasing order of the reactivity of the following alkyl halides is

(A) $CH_3CH_2CH_2CH_2Br$
(B) $CH_3CH_2CH(Br)CH_3$
(C) $(CH_3)_3CBr$
(D) $(CH_3)_2CHCH_2Br$

Choose the correct answer from the options given below
(A) (A) < (B) < (C) < (D)
(B) (A) < (C) < (B) < (D)
(C) (B) < (A) < (D) < (C)
(D) (C) < (B) < (D) < (A)

Directions (32-36) Read the following passage and answer the given questions.

Read the following passage and answer the next five questions based on it

Battery or cell converts chemical energy of the redox reaction to electrical energy. In fuel cell (a galvanic cell), the chemical energy of combustion of fuels like hydrogen, ethanol, etc. are directly converted to electrical energy. In a fuel cell, H_2 and O_2 react to produce electricity, where H_2 gas is oxidised at anode and oxygen is reduced at cathode and the reactions involved are

Anode reaction :

$H_2 + 2OH^- \rightarrow 2H_2O + 2e^-$

Cathode reaction :

$O_2 + 2H_2O + 4e^- \rightarrow 4OH^-$

67.2 of H_2 at STP reacts in 15 minutes

Q32 The number of moles of hydrogen oxidised is
(A) 0.33 moles (B) 33.3 moles
(C) 3.0 moles (D) 1.33 moles

Q33 The number of moles of electrons produced in the oxidation of 67.2 L of H_2 at STP is
(A) 2 (B) 4
(C) 1 (D) 6

Q34 The quantity of electricity produced in the oxidation of 67.2 L of H_2 at STP is
(A) 96500 C (B) 579000 C
(C) 193000 C (D) 48250 C

Q35 If the entire current produced is used for the electrodeposition of Silver (at.wt. 108 g/mol) from Silver (I) solution, the amount of silver deposited will be
(A) 324 g (B) 648 g
(C) 108 g (D) 216 g

Q36 The source of electrical energy on the Apollo moon flight was
(A) Lead storage battery
(B) A generator set
(C) $Ni - Cd$ cells
(D) $H_2 - O_2$ Fuel cell

Directions (37-41) Read the following passage and answer the given questions.

Read the following passage and answer the next five questions based on it

Sc	Ti	V	Cr	Mn	Fe	Co	Ni	Cu	Zn
Y	Zr	Nb	Mo	Tc	Ru	Rh	Pd	Ag	Cd
La	Hf	Ta	W	Re	Os	Ir	Pt	Au	Hg

In any transition series, as we move from left to right the d-orbitals are progressively filled and their properties vary accordingly

Ce	Pr	Nd	Pm	Sm	Eu	Gd	Tb	Dy	Ho	Er	Tm	Yb	Lu
Th	Pa	U	Np	Pu	Am	Cm	Bk	Cf	Es	Fm	Md	No	Lr

The above are the two series of f-block elements in which the chemical properties won't change much. The 5f-series elements are radioactive in nature and mostly are artificially synthesized in laboratories and thus much is not known about their chemical properties

Q37 Identify the incorrect statement
(A) Second ionisation enthalpy of silver is greater than second ionisation enthalpy of palladium
(B) Zirconium and Hafnium shares almost identical nuclear properties.
(C) Melting point of Manganese is lower than that of Chromium
(D) Interstitial compounds are non-stoichiometric and neither ionic nor covalent in nature.

Q38 Which of the following is the correct order of second ionisation enthalpy?
(A) $V > Cr > Mn$ (B) $V < Cr < Mn$
(C) $V < Cr > Mn$ (D) $V > Cr < Mn$

Q39 Which of the following pair of compounds exhibits same colour in aqueous solution?
(A) $FeCl_2, CuCl_2$ (B) $VOCl_2, CuCl_2$
(C) $VOCl_2, FeCl_2$ (D) $VOCl_2, MnCl_2$

Q40 Which metal has the highest oxidation state in the first row transition series?
(A) Cr (B) Fe
(C) Mn (D) V

Q41 Why do the actinoids exhibit higher number of oxidation states than lanthanoids?
(A) 4f orbitals are more diffused than the 5f orbitals
(B) Energy difference between 5f and 6d is less with respect to the energy difference between 4f and 5d
(C) Energy difference between 5f and 6d is more with respect to the energy difference between 4f and 5d
(D) Actinoids are more reactive in nature than the lanthanoids

Q42 Camphor in nitrogen gas is a type of solution
(A) Gas – Gas
(B) Solid – Gas
(C) Liquid – Gas
(D) Solid – Liquid

Q43 Identify the correct order of organic compounds in the following chemical reaction

$$\underline{?} + Mg \xrightarrow{\text{Dry Ether}} \underline{?} \xrightarrow{H_2O} \underline{?} \xrightarrow{Cl_2,\ \Delta} \underline{?}$$

(A) CH_3MgBr
(B) CH_3Br
(C) CH_3Cl
(D) CH_4
Choose the correct answer from the options given below
(A) (B), (A), (D), (C)
(B) (A), (C), (B), (D)
(C) (B), (A), (C), (D)
(D) (C), (B), (D), (A)

Q44 Consider the following statements regarding osmotic pressure
(A) Molar mass of a protein can be determined using osmotic pressure method.
(B) The osmotic pressure is proportional to the molarity.
(C) Reverse osmosis occurs when a pressure larger than osmotic pressure is applied to the concentrated
solution side.
(D) Edema occurs due to retention of water in tissue cells as a result of osmosis
Choose the correct statements with reference to osmotic pressure
(A) (A), (B) and (D) only
(B) (A), (B) and (C) only
(C) (A), (B), (C) and (D)
(D) (B), (C) and (D) only

Q45 Vapour pressures of pure liquids 'A' and 'D' at 50^oC are $500\ mm\ Hg$ and $800\ mm\ Hg$ respectively. The binary solution of 'A' and 'D' boils at 50^oC and $700\ mm\ Hg$ pressure. The mole percentage of 'D' in the solution is
(A) 33.33 mole percent
(B) 66.67 mole percent
(C) 25.75 mole percent
(D) 75.25 mole percent

Q46 For the following reaction
$2A_2\,(g) + \frac{1}{4}X\,(g) \rightarrow 2A_2X\,(g)$
volume is increased to double its value by decreasing the pressure on it. If the reaction is first order with respect to X and second order with respect to A_2, the rate of reaction will
(A) Decrease by eight times of its initial value
(B) Increase by eight times of its initial value
(C) Increase by four times of its initial value
(D) Remain unchanged

Q47

The total number of sigma bonds present in P_4O_{10} are

(A) 6 (B) 7

(C) 16 (D) 17

Q48 In the electrolysis of alumina to obtain aluminium metal, the cryolite is added mainly to

(A) lower the melting point of alumina

(B) dissolve the alumina in the molten cryolite

(C) remove the impurities of alumina

(D) increase the electrical conductivity

Q49 Identify the order of the reaction if its rate constant is $k = 2 \times 10^{-2} s^{-1}$

(A) Zero order (B) First order

(C) Second order (D) Half order

Q50 For a complex reaction, the order of reaction is equal to

(A) Sum of stoichiometric coefficients in balanced chemical reaction

(B) The molecularity of overall reaction

(C) Order of fastest step of the reaction

(D) The molecularity of slowest step of reaction

Answer Key

Q1	(C)	Q26	(D)
Q2	(B)	Q27	(D)
Q3	(B)	Q28	(C)
Q4	(A)	Q29	(D)
Q5	(A)	Q30	(A)
Q6	(A)	Q31	(D)
Q7	(A)	Q32	(C)
Q8	(C)	Q33	(D)
Q9	(B)	Q34	(B)
Q10	(D)	Q35	(B)
Q11	(D)	Q36	(D)
Q12	(A)	Q37	(B)
Q13	(C)	Q38	(C)
Q14	(B)	Q39	(B)
Q15	(A)	Q40	(C)
Q16	(D)	Q41	(B)
Q17	(C)	Q42	(B)
Q18	(C)	Q43	(A)
Q19	(A)	Q44	(C)
Q20	(B)	Q45	(B)
Q21	(C)	Q46	(A)
Q22	(A)	Q47	(C)
Q23	(A)	Q48	(A)
Q24	(C)	Q49	(B)
Q25	(A)	Q50	(D)

Hints & Solutions

Q1 Text Solution:

Correct Answer: C

In $Cr(NH_3)_6$:

In aqueous solution it dissociates as:

$$[Cr(NH_3)_6]^{3+} + 3Cl^-$$

Total ions = **1 complex ion + 3 chloride ions = 4 ions**

Hence, **C (4)**.

Q2 Text Solution:

$\text{No. of molecules} = \text{No. of moles} \times \text{N}_\text{A}$

$\text{No. of moles of } \text{O}_2 = \frac{16}{32} = 0.50$

$\text{No. of moles of CO} = \frac{16}{28} = 0.57$

$\text{No. of moles of } \text{CO}_2 = \frac{16}{44} = 0.36$

$\text{No. of moles of } \text{H}_2 = \frac{16}{2} = 8$

Since, number of moles of hydrogen are maximum out of the given options, hence, number of molecules will be maximum for (D), followed by (C), (A), (B)

Q3 Text Solution:

X⇌(X)n

Given,

van't Hoff factor, i =0.80

Fraction of associated molecules ,α=0.3

We know,

i=1+α(1/n–1)

or, 0.80=1+0.3(1/n–1)

or, 0.80=1+0.3/n–0.3

or, 0.80=0.70+0.3/n

or, 0.10=0.3/n

or, n=0.30/0.10

or, n=3

Q4 Text Solution:

Since it takes three sulfates to bond with two complex cations, the charge on each complex cation must be +3. Ethylenediammine is a neutral molecule, so the oxidation number of cobalt in the complex ion must be +3

Q5 Text Solution:

The N-terminal is the end of the molecule with a free amino group, and the C-terminal is the end with a free carboxylic acid group. In Gly-Ala, glycine is the N-terminal and alanine is the C-terminal. A peptide bond forms between the amino group of one amino acid and the carboxyl group of the other amino acid. In Gly-Ala, the peptide bond forms between the amino group of glycine and the carboxyl group of alanine. This reaction releases a water molecule

Q6 Text Solution:

A given metal crystallizes out with a FCC structure having edge length of 361 pm.

If there are four metal atoms in one unit cell, the radius of one atom is calculated as,

$\text{r} = \sqrt{2} \times \frac{\text{edge length of unit cell}}{4}$

$\text{r} = \sqrt{2} \times \frac{361}{4}$

$\text{r} = 127 \text{ pm}$

Q7 Text Solution:

If 75% of a first-order reaction is completed in 32 minutes, then 50% of the reaction would be completed in 16 minutes.

The ratio of the time for 75% completion of a first order reaction to the time for 50% completion is 2.

Q8 Text Solution:

Option (C) is a diamagnetic complex as CN^- is a strong field ligand so causes pairing of electrons. Diamagnetic complexes or species will get repelled in the presence of magnetic field due to no unpaired electrons

Q9 Text Solution:

Correct Answer: B

Hexacyanidomanganate(II) → $Mn(CN)_6{}^{4-}$

- Oxidation state of Mn = +2
- $Mn^{2+} \rightarrow 3d^5$
- CN^- is strong field ligand → low spin

Low spin d^5 → 1 unpaired electron

Spin only magnetic moment:

$\mu = \sqrt{n(n+2)}$

$= \sqrt{1(1+2)}$

$= \sqrt{3} \approx$ **1.73 BM**

Hence, **B (1.73)**.

Q10 Text Solution:

The correct order of increasing boiling points for the compounds pentan-1-ol, n-butane, pentanal, and ethoxyethane is n-butane < ethoxyethane < pentanal < pentan-1-ol.

Alcohols have higher boiling points due to intermolecular hydrogen bonding. Ethers have lower boiling points than aldehydes due to weak polarity, but slightly higher than corresponding alkanes.

Q11 Text Solution:

Product A will be benzene, then on friedel crafts alkylation, we get, toluene as product B, then, on oxidation, we will get benzoic acid as product C, and lastly on nitration, we will get, m-nitrobenzoic acid as carboxylic group is deactivating group.

Q12 Text Solution:

The Gold number is a measure of the protective power of a lyophilic colloid, particularly in preventing the coagulation or precipitation of a lyophobic sol (a colloidal solution where the dispersed phase and dispersion medium are immiscible or insoluble in each other). A lower Gold number indicates better protective colloidal behavior because it means that smaller amounts of the lyophilic colloid are needed to prevent coagulation. This is because the protective colloid forms a stable layer around the dispersed particles, preventing them from coming together and precipitating out of the solution.

Q13 Text Solution:

When aniline reacts with a mixed acid of concentrated nitric acid and concentrated sulfuric acid at 298 K, the product that is 47% is the meta product. The other products are para (51%) and ortho (2%). This is because the formation of anilinium ion, which is m-directing, results in the production of the meta product in significant yield

Q14 Text Solution:

Aniline will be least basic as lone pair of nitrogen atom is not available for donation, and diethylamine will be most basic due to solvation and steric hindrance factors. Hence, option B will be relevant choice due to steric and solvation considerations in aqueous medium

Q15 Text Solution:

For a compound to give HVZ reaction, it must posses alpha hydrogen, hence option A will be the correct answer. Alpha carbon is the carbon directly attached to the functional group. Alpha carbon has alpha hydrogens

Q16 Text Solution:

Electron withdrawing groups enhance the acidic strength, nitro group is a strong electron withdrawing group, hence, it will enhance the acidic strength more than fluoro, chloro groups that are less electron withdrawing.

Q17 Text Solution:

Aldehydes are more reactive than ketones towards nucleophilic addition reactions, and electron withdrawing groups further enhances the rate of nucleophilic addition reaction due to more positive charge creation on the carbonyl carbon.

Q18 Text Solution:

The correct answer is option C

Carbon monoxide reacts with hydrochloric acid to form formyl chloride. Formyl chloride reacts with aluminum chloride to form the electrophile, HCO^+

Q19 Text Solution:

Formaldehyde undergoes Cannizzaro reaction because it does not have alpha-hydrogen atom. It undergoes self-oxidation and reduction on heating with concentrated alkali.

Q20 Text Solution:

Statements B and C are correct as unimolecular nucleophilic substitution reaction involves the formation of stable carbocation intermediate. There is a possibility of formation of tertiary carbocation, so it will be formed after the departure of the leaving group, so this enhances the rate of the reaction.

Q21 Text Solution:

Aniline does not undergo Friedel-Crafts reactions because the nitrogen of aniline acquires a positive charge and acts as a strong deactivating group for further reaction. This is due to the formation of a salt with aluminum chloride, which is used as a Lewis acid catalyst in the reaction

Q22 Text Solution:

Chlorine is an electron withdrawing group, but it is ortho- and para-directing in electrophilic aromatic substitution reactions because of two opposing effects. Chlorine's lone pair of electrons can conjugate with the ring, increasing electron density at the ortho and para positions. This effect is called the +R effect. Chlorine withdraws electrons from the benzene ring through the -I effect. This effect deactivates the benzene ring. The resonance effect opposes the inductive effect, making deactivation less at the ortho and para positions

Q23 Text Solution:

The final product of the Etard reaction is benzaldehyde. The Etard reaction is a chemical reaction that oxidizes a methyl group in an aromatic or heterocyclic ring to form an aldehyde

Q24 Text Solution:

Primary structure - The sequence of amino acids in a protein's polypeptide chain.
Secondary structure - The local arrangement of atoms in the polypeptide's backbone, which is mainly caused by hydrogen bonding. The most common secondary structures are alpha-helices and beta-pleated sheets.
Tertiary structure - The three-dimensional structure of the entire polypeptide chain. This structure is determined by the interactions of side chains from the polypeptide backbone.
Quaternary structure - The spatial arrangement of subunits in a multi-subunit protein. This structure is formed by side-chain interactions between two or more polypeptides

Q25 Text Solution:

A solution of silver nitrate dissolved in ammonium hydroxide is known as Tollen's reagent. This is used to detect the presence of an aldehydic group in an organic compound. It is used to distinguish between aldehydes and ketone. Fehling's test consists of a solution that is usually prepared fresh in laboratories. Initially, the solution exists in the form of two separate solutions which are labelled as Fehling's A and Fehling's B. Fehling's A is a solution containing copper(II) sulphate, which is blue in colour. Fehling's B is a clear liquid consisting of potassium sodium tartrate (Rochelle salt) and a strong alkali, usually sodium hydroxide. Lucas reagent is a solution of anhydrous zinc chloride (Lewis acid) in concentrated hydrochloric acid. It is used as a reagent to test alcohols and classify them in accordance to their reactivity. Jones reagent is chromium trioxide-sulphuric acid.

Q26 Text Solution:

The Swarts reaction is an organic reaction that converts alkyl chlorides or alkyl bromides into alkyl fluorides. It's also known as the Swarts fluorination or halogen exchange reaction.
$RX + AgF \rightarrow R - F + AgX$
In Finkelstein reaction, an alkyl halide is treated with an alkali metal halide, such as sodium iodide in acetone, to replace the halogen with iodine.
$RX + NaI \rightarrow R - I + NaX$
The Sandmeyer reaction is a chemical reaction that replaces an amino group on an aromatic ring with a variety of substituents.
$C_6H_5NH_2 + NaNO_2 + HX + Cu_2X_2 \rightarrow C_6H_5X + N_2$
The Wurtz reaction is a coupling reaction in organic chemistry that creates alkanes by combining alkyl halides with sodium metal.

2RX + 2Na → R – R + 2NaX

Q27 Text Solution:

- Xerophthalmia, also known as dry eye syndrome (DES), is a medical condition that occurs when the eyes don't produce enough tears. It's usually caused by a vitamin A deficiency.
- Beriberi is a disease caused by a deficiency of thiamine (vitamin B1) in the body.
- Addison's disease, also known as primary adrenal insufficiency, is a rare, long-term condition that occurs when the adrenal glands don't produce enough of the hormones cortisol and aldosterone.
- Estradiol is an ovarian hormone that fluctuates throughout the menstrual cycle in premenopausal women

Q28 Text Solution:

Markovnikov's rule states that when water is added to an alkene, the hydrogen atom bonds to the carbon atom with more hydrogen atoms already attached. This is because the more substituted the carbocation, the more stable it is. The addition of water to an alkene is called hydration, and it's a direct addition of water to the carbon-carbon double bond. This reaction produces alcohols

Q29 Text Solution:

Ranitidine is a histamine-2 blocker, which decreases the amount of acid created by the stomach. Prescription ranitidine is approved for multiple indications, including treatment and prevention of ulcers of the stomach and intestines and treatment of gastroesophageal reflux disease

Q30 Text Solution:

Electron withdrawing groups increases the acidity of the compound, and in the given options, fluoro is the most electron withdrawing followed by chloro and bromo, hence acidity varies accordingly.

Q31 Text Solution:

The rate of the reaction depends on the structure of the alkyl halide, the strength of the nucleophile, and the stability of the leaving group. The reaction rate is fastest for small alkyl halides, such as methyl, and is slowest for tertiary alkyl halides

Q32. Text Solution:

$$\text{Moles of } H_2 = \frac{\text{Volume of } H_2}{\text{Volume at STP}}$$
$$= \frac{67.2}{22.4}$$
$$= 3 \text{ moles}$$

Q33. Text Solution:

If 1 mole of hydrogen produces 2 moles of electrons, then 3 moles of will produce 6 moles of electrons (in accordance with the anode reaction)

Q34. Text Solution:

$$\text{Charge on 1 mole electrons} = 96500 \text{ C}$$
$$\text{Total charge} = 6 \times 96500$$
$$= 579000 \text{ C}$$

Q35. Text Solution:

Using Faraday's laws of electrolysis

Amount of silver deposited will be

$$\frac{Q \times M}{n \times F} = \frac{579000 \times 108}{1 \times 96500}$$
$$= 648g$$

Q36. Text Solution:

The Apollo moon flight used an $H_2 - O_2$ fuel cell for electrical energy as it provided a high energy-to-weight ratio and produced water.

Q37. Text Solution:

The electrons in the f-subshell of Hafnium and Zirconium have a weak shielding effect, which means that the effective nuclear charge on the valence electrons is similar. This causes the size of the atoms to constrict, making them almost equal. The atomic radius of Zirconium is 206 pm and the atomic radius of Hafnium is 208 pm. This is despite Hafnium having a new shell, which usually causes an increase in the size of an atom. The properties of an element depend on its

atomic radius, so Zirconium and Hafnium have similar properties

Q38. Text Solution:

Second ionization enthalpy generally increases from left to right across a period in the periodic table. However, Chromium has a higher second ionization enthalpy than Manganese because of its extra-stable $3d^5$ configuration.

Q39. Text Solution:

$VOCl_2$ and $CuCl_2$ are expected to show similar colors in an aqueous medium because they have the same number of unpaired electrons in their d-orbitals

Q40. Text Solution:

Manganese exhibits a high oxidation state because of its electronic configuration and the small energy difference between its 3d and 4s subshells. Manganese can exist in six different oxidation states, from +2 to +7, which is the highest number for any element in the 3d-series.

Q41. Text Solution:

Actinoids have a greater range of oxidation states because the energies of their 5f, 6d, and 7s orbitals are comparable. This means that all of an actinoid's electrons can take part in bond formation. The small energy gap between these subshells makes it easier to excite electrons, resulting in a greater range of oxidation states

Q42 Text Solution:

Camphor in nitrogen gas is an example of a gaseous solution. In this solution, camphor is the solid solute and nitrogen gas is the gaseous solvent

Q43 Text Solution:

The reaction sequence is as follows

$$CH_3Br \xrightarrow{Mg,dry\ \ ether} CH_3MgBr \xrightarrow{H_2O} CH_4$$

$$CH_4 \xrightarrow{Cl_2,\Delta} CH_3Cl$$

Q44 Text Solution:

The osmotic pressure of a solution is directly proportional to the molarity of the solute and the absolute temperature and inversely proportional to the molar mass of the solute. By measuring the osmotic pressure of a protein solution and knowing the other variables, the molar mass of the protein can be determined. The osmotic pressure is proportional to the molarity. Osmotic pressure (π) is given by the equation π=MRT, where M is the molarity of the solute, R is the ideal gas constant, and T is the temperature in Kelvin. This equation shows that osmotic pressure is directly proportional to the molarity. Reverse osmosis occurs when a pressure larger than osmotic pressure is applied to the concentrated solution side. Reverse osmosis is a process where a solvent moves from a region of higher solute concentration to a region of lower solute concentration when a pressure greater than the osmotic pressure is applied to the concentrated solution side. This process is commonly used in water purification systems. Edema is a medical condition characterized by the accumulation of excess fluid in the body's tissues, leading to swelling. In some cases, edema can result from the retention of water in tissue cells due to osmosis, often as a result of imbalances in osmotic pressure between the intracellular and extracellular compartments.

Q45 Text Solution:

Given,

$p_A^o = 500\ mm\ Hg$

$p_D^o = 800\ mm\ Hg$

$p_{total} = 700\ mm\ Hg$

We know, from Raoult's law

$p_A = p_A^o \chi_A$

$p_D = p_D^o \chi_D = p_D^o(1 - \chi_A)$

Therefore, total pressure,

$p_{total} = p_A + p_D$

$p_{total} = p_A^o \chi_A + p_D^o(1 - \chi_A)$

$p_{total} = p_A^o \chi_A + p_D^o - p_D^o \chi_A$

$p_{total} = (p_A^o - p_D^o)\chi_A + p_D^o$

$700 = (500 - 800)\chi_A + 800$

$-100 = -300\chi_A$

$\chi_A = \frac{100}{300}$

$\chi_A = 0.3333$

Therefore,

$\chi_D = 1 - \chi_A$

$\chi_D = 1 - 0.3333$

$\chi_D = 0.6667$

Therefore,

$\%\chi_D = 0.6667 \times 100$

or, %= 66.67 mole percent

Q46 Text Solution:

$$\text{Rate} = k\left(\frac{[A_2]}{2}\right)^2\left(\frac{[X]}{2}\right)$$

$$= k\left(\frac{[A_2]^2}{4}\right)\left(\frac{[X]}{2}\right)$$

$$= \frac{k}{8}[A_2]^2[X]$$

$$= \frac{1}{8} \times \text{Initial Rate}$$

Thus, option A is correct

Q47 Text Solution:

P_4O_{10}, also known as phosphorus (V) oxide, is made up of 4 phosphorus atoms and 10 oxygen atoms. Each phosphorus atom is bonded to oxygen atoms through both single and double bonds. A single bond is made up of one sigma bond, while a double bond is made up of one sigma bond and one pi bond. Since each phosphorus atom forms four bonds, the total number of sigma bonds in P_4O_{10} is 16

Q48 Text Solution:

Cryolite is added to alumina in the Hall-Heroult process to reduce its melting point, making it easier to melt and reducing the energy required for the electrolysis process

Q49 Text Solution:

In a first-order reaction, the reaction rate is directly proportional to the concentration of one of the reactants. First-order reactions often have the general form A → products. If the concentration of A is doubled, the reaction rate doubles; if the concentration of A is increased by a factor of 10, the reaction rate increases by a factor of 10, and so forth. Because the units of the reaction rate are always moles per liter per second, the units of a first-order rate constant are reciprocal seconds

Q50 Text Solution:

The order of a complex reaction is equal to the molecularity of its slowest step. The rate of a complex reaction depends on the total number of molecules involved in the slowest step. The

slowest step of a chemical reaction must contain at least one reactant

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