KCET PYQ 2025

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CHEMISTRY

Q1 Match List-I with List-II and select the correct option:

	List-I (Molecule / ion)		List-II (Bond order)
1.	NO	(i)	15
2.	CO	(ii)	2.0
3.	O_2^-	(iii)	2.5
4.	O_2	(iv)	3.0

[KCET 2025]

(A) a-iii, b-iv, c-i, d-ii

(B) a-i, b-iv, c-iii, d-ii

(C) a-ii, b-iii, c-iv, d-i

(D) a-iv, b-iii, c-ii, d-i

Q2 The electronic configuration of X and Y are given below:

$X: 1s^2 2s^2 2p^6 3s^2 3p^3$

$Y: 1s^2 2s^2 2p^6 3s^2 3p^5$

Which of the following is the correct molecular formula and type of bond formed between X and Y ? **[KCET 2025]**

(A) X_3Y, ionic bond

(B) X_2Y_3, coordinate bond

(C) XY_3, covalent bond

(D) X_2Y, covalent bond

Q3 Match List-I with List-II

	List-I (Types of redox reactions)		List-II (Examples)
(a)	Combination reaction	(i)	$Cl_{2(g)} + 2\,Br^-_{(aq)} \rightarrow 2\,Cl^-_{(aq)} + Br_{2(l)}$
(b)	Decomposition reaction	(ii)	$2H_2O_{2(aq)} \rightarrow 2H_2O_{(l)} + O_{2(g)}$
(c)	Displacement reaction	(iii)	$CH_{4(g)} + 2O_{2(g)} \xrightarrow{\Delta} CO_{2(g)} + 2H_2O_{(l)}$
(d)	Disproportionation reaction	(iv)	$2H_2O_{(l)} \xrightarrow{\Delta} 2H_{2(g)} + O_{2(g)}$

Choose the correct answer from the options given below. **[KCET 2025]**

(A) a-iv, b-iii, c-i, d-ii

(B) a-ii, b-i, c-iv, d-iii

(C) a-iii, b-iv, c-i, d-ii

(D) a-iii, b-ii, c-i, d-iv

Q4 In the following pairs, the one in which both transition metal ions are colourless is **[KCET 2025]**

(A) Sc^{3+}, Zn^{2+} (B) V^{2+}, Ti^{3+}

(C) Zn^{2+}, Mn^{2+} (D) Ti^{4+}, Cu^{2+}

Q5 In the reaction between hydrogen sulphide and acidified permanganate solution, **[KCET 2025]**

(A) H_2S is reduced to S, MnO_4^- is oxidised to Mn^{2+}

(B) H_2S is oxidised to SO_2, MnO_4^- is reduced to MnO_2

(C) H_2S is reduced to SO_2, MnO_4^- is oxidised to Mn^{2+}

(D) H_2S is oxidised to S, MnO_4^- is reduced to Mn^{2+}

Q6 A member of the Lanthanoid series which is well known to exhibit +4 oxidation state is **[KCET 2025]**

(A) Samarium (B) Europium

(C) Erbium (D) Cerium

Q7 In which of the following pairs, both the elements do not have $(n-1)d^{10}ns^2$ configuration? **[KCET 2025]**

(A) Cu, Zn (B) Zn, Cd

(C) Cd, Hg (D) Ag, Cu

Q8 A ligand which has two different donor atoms and either of the two ligates with the central metal atom/ion in the complex is called _____ **[KCET 2025]**

(A) Chelate ligand

(B) Unidentate ligand

(C) Polydentate ligand

(D) Ambidentate ligand

Q9 Which of the following statements are true about $[NiCl_4]^{2-}$?

(a) The complex has tetrahedral geometry

(b) Co-ordination number of Ni is 2 and oxidation state is +4

(c) The complex is sp^3 hybridised

(d) It is a high spin complex

(e) The complex is paramagnetic **[KCET 2025]**

(A) a,c,d and e (B) a,b,d and e

(C) b,c,d and e (D) a,b,c and d

Q10 Which formula and its name combination is incorrect? **[KCET 2025]**

(A) $K_3[Cr(C_2O_4)_3]$, Potassium trioxalatochromate (III)

(B) $[CoCl_2(en)_2]Cl$, Dichloridobis(ethane $-1,2-$ dimine) cobalt(III) chloride

(C) $[Co(NH_3)_5(CO_3)]Cl$, Pentaamine carbonylcobalt (III) chloride

(D) $[Pt(NH_3)_2Cl(NO_2)]$ Diamine chloridonitrito $-N-$ Platinum (II)

Q11 In the complex ion $[Fe(C_2O_4)_3]^{3-}$, the co-ordination number of Fe is **[KCET 2025]**

(A) 4 (B) 5

(C) 6 (D) 3

Q12 Match List-I with List-II for the following reaction pattern

$$\text{Glucose} \xrightarrow{\text{Reagent}} \text{Product ? Structural prediction}$$

	List - I (Reagents)		List-II (Structural prediction)
(a)	Acetic anhydride	(i)	Glucose has an aldehyde group
(b)	Bromine water	(ii)	Glucose has a straight chain of six carbon atoms
(c)	Hydroiodic acid	(iii)	Glucose has five hydroxyl group
(d)	Hydrogen cyanide	(iv)	Glucose has a carbonyl group

Choose the correct answer from the options given below. **[KCET 2025]**

(A) a-iv, b-iii, c-ii, d-i

(B) a-iii, b-i, c-ii, d-iv

(C) a-i, b-ii, c-iii, d-iv

(D) a-iii, b-ii, c-i, d-iv

Q13 The correct sequence of α—amino acids, hormone, vitamin, carbohydrates respectively is **[KCET 2025]**

(A) Thiamine, Thyroxine, Vitamin A, Glucose
(B) Glutamine, Insulin, Aspartic acid, Fructose
(C) Arginine, Testosterone, Glutamic acid, Fructose
(D) Aspartic acid, Insulin, Ascorbic acid, rhamnose

Q14 Which examples of carbohydrates exhibit α–link, (α–glycosidic link) in their structure? **[KCET 2025]**

(A) Maltose and Lactose
(B) Amylose and Amylopectin
(C) Cellulose and Glycogen
(D) Glucose and Fructose

Q15 In the titration of potassium permanganate ($KMnO_4$) against Ferrous ammonium sulphate (FAS) solution, dilute sulphuric acid but not nitric acid is used to maintain acidic medium, because **[KCET 2025]**

(A) It is difficult to identify the end point
(B) Nitric acid doesn't act as an indicator
(C) Nitric acid itself is an oxidizing agent
(D) Nitric acid is a weak acid than sulphuric acid

Q16 The group reagent $NH_4Cl(s)$ and aqueous NH_3 will precipitate which of the following ion? **[KCET 2025]**

(A) NH_4^+ (B) Al^{3+}
(C) Ba^{2+} (D) Ca^{2+}

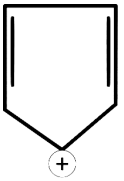
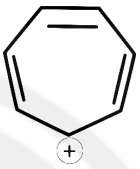
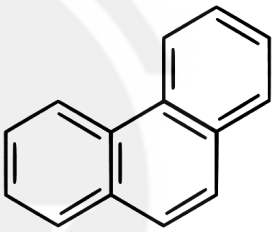
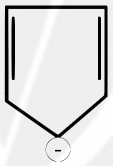
Q17 In the preparation of sodium fusion extract, the purpose of fusing organic compound with a piece of sodium metal is to **[KCET 2025]**

(A) Convert the organic compound into vapour state
(B) Convert the elements of the compound from covalent form to ionic form
(C) Convert the elements of the compound from ionic form to covalent form
(D) Decrease the melting point of the compound

Q18 The sodium fusion extract is boiled with concentrated nitric acid while testing for halogens. By doing so, it **[KCET 2025]**

(A) helps in precipitation of AgCl
(B) increases the solubility of AgCl
(C) increases the concentration of NO_3^- ion
(D) decomposes Na_2S and NaCN, if formed

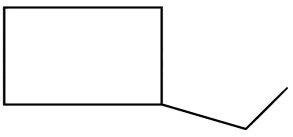
Q19 Which of the following is not an aromatic compound **[KCET 2025]**

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

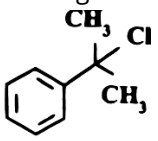
Q20 The IUPAC name of the given organic compound is $HC \equiv C - CH = CH - CH = CH_2$ **[KCET 2025]**

(A) Hexa - 1 - yn - 3,5 - diene
(B) Hexa - 5 - yn - 1,3 - diene
(C) Hexa -1,3 - dien - 5 - yne
(D) Hexa - 3,5 - dien - 1 - yne

Q21 Among the following, identify the compound that is not an isomer of hexane **[KCET 2025]**

(A) $CH_3 - CH_2 - \underset{\displaystyle CH_3}{\underset{|}{CH}} - CH_2 - CH_3$
(B) $CH_3 - CH_2 - CH_2 - CH_2 - CH_2 - CH_3$
(C) 
(D) $CH_3 - \underset{\displaystyle CH_3}{\underset{|}{CH}} - CH_2 - CH_2 - CH_3$

Q22 The organic compound



can be classified as _____ **[KCET 2025]**

(A) Allylic halide (B) Benzyl halide
(C) Aryl halide (D) Alkyl halide

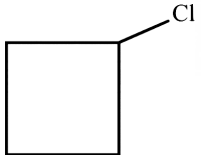
Q23 Chlorobenzene reacts with bromine gas in the presence of Anhyd $AlBr_3$ to yield p-Bromochlorobenzene. This reaction is classified as _____ **[KCET 2025]**

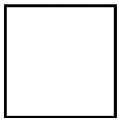
(A) Elimination reaction
(B) Nucleophilic substitution reaction
(C) Electrophilic substitution reaction
(D) Addition reaction

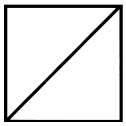
Q24 The organometallic compound $(CH_3)_3CMgBr$ on reaction with D_2O produces **[KCET 2025]**

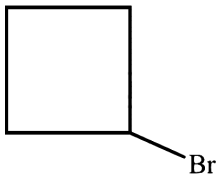
(A) $(CH_3)_3COD$ (B) $(CD_3)_3CD$
(C) $(CD_3)_3COD$ (D) $(CH_3)_3CD$

Q25 The major product formed when 1– Bromo –3– Chlorocyclobutane reacts with metallic sodium in dry ether is **[KCET 2025]**

(A) 

(B) 

(C) 

(D) 

Q26 Ethyl alcohol is heated with concentrated sulphuric acid at 413 K . The major product **[KCET 2025]**

(A) $C_2H_5-O-C_2H_5$
(B) $CH_3-O-C_3H_7$
(C) $CH_2=CH_2$
(D) $CH_3COOC_2H_5$

Q27 Phenol can be distinguished from propanol by using the reagent **[KCET 2025]**

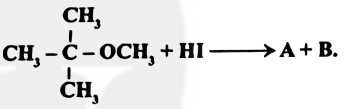
(A) Bromine water
(B) Iron metal
(C) Iodine in alcohol
(D) Sodium metal

Q28 Match the following with their pKa values

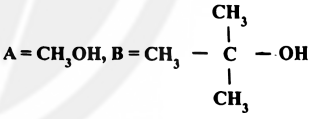
	Acid		pka
(I)	Phenol	(a)	16
(II)	p-Nitrophenol	(b)	0.78
(III)	Ethyl alcohol	(c)	10
(IV)	Picric acid	(d)	7.1

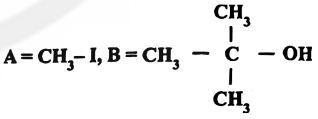
[KCET 2025]

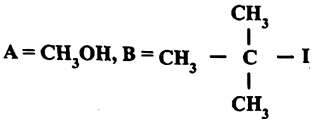
(A) I-c, II-d, III - a, IV - b
(B) I-a, II - d, III - c, IV - b
(C) I-a, II-b, III-c, IV - d
(D) I-b, II-a, III - d, IV - c

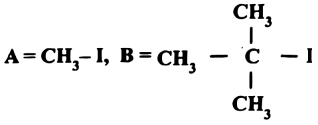
Q29 

A and B respectively are **[KCET 2025]**

(A) 

(B) 

(C) 

(D) 

Q30 Oxidation of Toluene with chromyl chloride followed by hydrolysis gives Benzaldehyde. This reaction is known as _____ **[KCET 2025]**

(A) Etard Reaction
(B) Kolbe reaction
(C) Stephen reaction
(D) Cannizzaro Reaction

Q31 Statement - I : Reduction of ester by DIABL-H followed by hydrolysis gives aldehyde.
Statement - II : Oxidation of benzyl alcohol with aqueous $KMnO_4$ leads to the formation to Benzaldehyde.
Among the above statements, identify the correct statement. **[KCET 2025]**
(A) Both statements - I and II are false
(B) Statement - I is true but statement - II is false
(C) Statement - I is false but statement - II is true
(D) Both statements - I and II are true.

Q32 Arrange the following compounds in their decreasing order of reactivity towards Nucleop addition reaction.
$CH_3COCH_3, CH_3COC_2H_5, CH_3CHO$
[KCET 2025]
(A) $CH_3CHO > CH_3COCH_3 > CH_3COC_2H_5$
(B) $CH_3COCH_3 > CH_3CHO > CH_3COC_2H_5$
(C) $CH_3COC_2H_5 > CH_3COCH_3 > CH_3CHO$
(D) $CH_3CHO > CH_3COC_2H_5 > CH_3COCH_3$

Q33 Which of the following has most acidic Hydrogen ? **[KCET 2025]**
(A) Propanoic acid
(B) Dichloroacetic acid
(C) Trichloroacetic acid
(D) Chloroacetic acid

Q34 Which of the following reagents are suitable to differentiate Aniline and N-methylaniline chemical **[KCET 2025]**
(A) Acetic anhydride
(B) Br_2 water
(C) Conc. Hydrochloric acid and anhydrous zinc chloride
(D) Chloroform and Alcoholic potassium hydroxide

Q35 Which of the following reaction/s does not yield an amine?

I. $R\ X + \underset{(alc)}{NH_3} \xrightarrow[\Delta]{}$

II. $R\ C{=}N \xrightarrow[Na(Hg)/C_2H_5OH]{H_2/Ni}$

III. $R-C=N+H_2O \xrightarrow{H^+}$

IV. $R-\overset{O}{\overset{\|}{C}}-NH_2 + 4[H] \xrightarrow[(ii)\ H_3O^+]{(i)\ LiAlH_4}$

[KCET 2025]
(A) Both I and III (B) Only II
(C) Only III (D) Both II and IV

Q36 Match the compounds given in List - I with the items given in List - II.

	List - I		List - II
(I)	Benzenesulphonyl Chloride	(a)	Zwitterioin
(II)	Sulphanilic acid	(b)	Hinsberg reagent
(III)	Alkyl Diazonium salts	(c)	Dyes
(IV)	Aryl Diazonium salts	(d)	Conversion to alcohols

[KCET 2025]
(A) I-c, II-b, III-a, IV - d
(B) I-a, II-c, III-b, IV - d
(C) I-c, II-a, III - d, IV - b
(D) I-b, II-a, III - d, IV - c

Q37 The number of orbitals associated with ' N ' shell of an atom is **[KCET 2025]**
(A) 16 (B) 32
(C) 3 (D) 4

Q38 According to the Heisenberg's Uncertainty principle, the value of $\Delta b.\Delta x$ for an object whose mass is 10^{-6} kg is $\left(h = 6.626 \times 10^{-34}\ Js\right)$ **[KCET 2025]**

(A) $3.0 \times 10^{-24}\ m^{-2}\ s^{-1}$

(B) $4.0 \times 10^{-26}\ m^{-2}\ s^{-1}$

(C) $3.5 \times 10^{-25}\ m^{-2}\ s^{-1}$

(D) $5.2 \times 10^{-29}\ m^{-2}\ s^{-1}$

Q39 Given below are two statements.

Statement-I : Adiabatic work done is positive when work is done on the system and internal energy of the system increases.

Statement - II : No work is done during free expansion of an ideal gas.

In the light of the above statements, choose the correct answer from the options given below. **[KCET 2025]**

(A) Both statements - I and Statement - II are false

(B) Statement - I is true but statement - II is false

(C) Statement - I is false but statement - II is true

(D) Both statements - I and Statement - II are true.

Q40 Which one of the following reactions has $\Delta H = \Delta U$? **[KCET 2025]**

(A) $CaCO_3\left(s\right) \xrightarrow{\Delta} CaO\left(s\right) + CO_2\left(g\right)$

(B) $C_6H_6\left(I\right) + \frac{15}{2}O_2\left(g\right) \rightarrow 6\,CO_2\left(g\right) + 3H_2O\left(I\right)$

(C) $2\,HI(g) \rightleftharpoons H_2(g) + I_2(g)$

(D) $N_2(g) + 3H_2(g) \rightleftharpoons 2\,NH_3(g)$

Q41 Identify the incorrect statements among the following:

(a) All enthalpies of fusion are positive

(b) The magnitude of enthalpy change does not depend on the strength of the intermolecular interactions in the substance undergoing phase transformations.

(c) When a chemical reaction is reversed, the value of ΔrH° is reversed in sign.

(d) The change in enthalpy is dependent of path between initial state (reactants) and final state (products)

(e) For most of the ionic compounds, $\Delta_{sol}H^\circ$ is negative **[KCET 2025]**

(A) a, b and d (B) b, d and e

(C) a, d and e (D) a and e only

Q42 Which of the following statements is/are true about equilibrium?

(a) Equilibrium is possible only in a closed system of at a given temperature

(b) All the measurable properties of the system remain constant at equilibrium

(c) Equilibrium constant for the reverse reaction is the inverse of the equilibrium constant for the reaction in the forward direction. **[KCET 2025]**

(A) Only b (B) Only c

(C) a, b and c (D) Only a

Q43 According to Le Chatelier's principle, in the reaction

$CO(g) + 3H_2(g) \rightleftharpoons CH_4(g) + H_2O(g)$,

the formation of methane is favoured by

(a) Increasing the concentration of CO

(b) Increasing the concentration of H_2O

(c) Decreasing the concentration of CH_4

(d) Decreasing the concentration of H_2 **[KCET 2025]**

(A) a and c (B) b and d

(C) a and d (D) a and b

Q44 The equilibrium constant at 298 K for the reaction A + B⇌C + D is 100 . If the initial concentrations of all the four species were 1 M each, then equilibrium concentration of D (in mol L^{-1}) will be **[KCET 2025]**

(A) 0.182 (B) 1.818

(C) 1.182 (D) 0.818

Q45 Among the following 0.1 m aqueous solutions, which one will exhibit the lowest boiling point elevation, assuming complete ionization of the compound in solution? **[KCET 2025]**

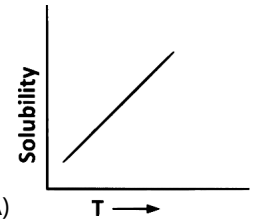
(A) Aluminium chloride

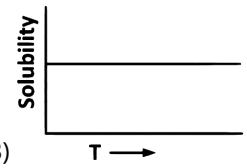
(B) Aluminmium sulphate

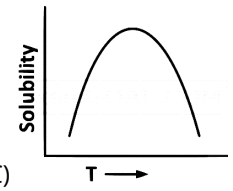
(C) Potassium sulphate

(D) Sodium chloride

Q46 Variation of solubility with temperature t for a gas in liquid is shown by the following graphs. The correct representation is **[KCET 2025]**

(A) 

(B) 

(C) 

(D) 

Q47 180 g of glucose, $C_6H_{12}O_6$, is dissolved in 1 kg of water in a vessel. The temperature at which water boils at 1.013 bar is _____ (given, K_b for water is 052 K kg mol^{-1}. Boiling point for pure water is 373.15 K) **[KCET 2025]**

(A) 373.67 K (B) 373015 K
(C) 373.0 K (D) 373.202 K

Q48 If N_2 gas is bubbled through water at 293 K , how many moles of N_2 gas would dissolve in 1 litre of water? Assume that N_2 exerts a partial pressure of 0.987 bar.
[Given K_H for N_2 at 293 K is 76.48 K bar] **[KCET 2025]**

(A) 0.716×10^{-3}
(B) 7.16×10^{-5}
(C) 7.16×10^{-4}
(D) 7.16×10^{-3}

Q49 The correct statement/s about Galvanic cell is/are
(a) Current flows from cathode to anode
(b) Anode is positive terminal
(c) If $E_{cell} < 0$, then it is spontaneous reaction
(d) Cathode is positive terminal
(A) a and b only (B) a, b and c
(C) a and d only (D) bonly

Q50 The electronic conductance depends on **[KCET 2025]**
(A) Nature of electrolyte added
(B) The number of valence electrons per atom
(C) Concentration of the electrolyte
(D) Size of the ions

Q51 For a given half cell, $Al^{3+} + 3e^- \rightarrow Al$ on increasing of aluminium ion, the electrode potential will **[KCET 2025]**
(A) Decrease
(B) No change
(C) First increase then decrease
(D) Increase

Q52 Match the following select the correct option for the quantity of electricity, in C mol^{-1} required to deposit various metals at cathode

	List-I		List-II
(a)	Ag^+	(i)	386000 C mol^{-1}
(b)	Mg^{2+}	(ii)	289500 C mol^{-1}
(c)	Al^{3+}	(iii)	96500 C mol^{-1}
(d)	Ti^{4+}	(iv)	193000 C mol^{-1}

[KCET 2025]
(A) a-ii, b-i, c-iv, d-iii
(B) a-iii, b-iv, c-ii, d-i
(C) a-iv, b-iii, c-i, d-ii
(D) a-i, b-ii, c-iii, d-iv

Q53 Catalysts are used to increase the rate of a chemical reaction. Because it **[KCET 2025]**

(A) Increases the activation energy of the reaction

(B) Decreases the activation energy of the reaction

(C) Brings about improper orientation of reactant molecules

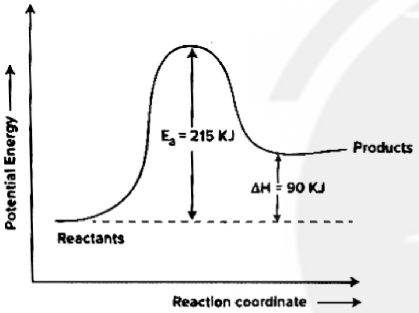
(D) Increases the potential energy barrier

Q54 Half-life of a first order reaction is 20 seconds and initial concentration of reactant is 0.2 M . The concentration of reactant left after 80 seconds is **[KCET 2025]**

(A) 0.1 M (B) 0.05 M

(C) 0.0125 M (D) 0.2 M

Q55 In the given graph, Ea for the reverse reaction will be



[KCET 2025]

(A) 125 KJ (B) 215 KJ

(C) 90 KJ (D) 305 KJ

Q56 For the reaction $2N_2O_{5(g)} \rightarrow 4NO_{2(g)} + O_{2(g)}$ initial concentration of N_2O_5 is 2.0 mol L^{-1} and after 300 min , it is reduced to 1.4 mol L^{-1}. The rate of production of NO_2 (in mol L^{-1} min^{-1}) is **[KCET 2025]**

(A) 2.5×10^{-4}

(B) 4×10^{-4}

(C) 2.5×10^{-3}

(D) 4×10^{-3}

Q57 Which of the following methods of expressing concentration are unitless? **[KCET 2025]**

(A) Mole fraction and Mass percent (W/W)

(B) Molality and Mole fraction

(C) Mass percent (W/W) and Molality

(D) Molality and Molarity

Q58 Select the INCORRECT statement/s from the following:

(a) 22 books have infinite significant figures

(b) In the answer of calculation 2.5 × 1.25 has four significant figures,.

(c) Zero's preceding to first non-zero digit are significant

(d) In the answer of calculation 12.11 + 18.0 + 1.012 has three significant figures **[KCET 2025]**

(A) b, c and d (B) b and c only

(C) b and d only (D) a and b only

Q59 Given below and the atomic masses of the elements:

Element:	Li	Na	Cl	K	Ca	Br	Sr	I	Ba
Atomic Mass $\left(g\,mol^{-1}\right)$:	7	23	35.5	39	40	80	88	127	137

Which of the following doesn't form triad? **[KCET 2025]**

(A) Ba, Sr, Ca (B) Cl, Br, I

(C) Cl, K, Ca (D) Li, Na, K

Q60 The change in hybridization (if any) of the 'Al' atom in the following reaction is $AlCl_3 + Cl^- \rightarrow AlCl_4^-$ **[KCET 2025]**

(A) No change in the hybridization state

(B) sp^2 to sp^3

(C) sp^3 to sp^3d

(D) sp^3 to sp^2

Answer Key

Q1	A
Q2	C
Q3	C
Q4	A
Q5	D
Q6	D
Q7	D
Q8	D
Q9	A
Q10	C
Q11	C
Q12	B
Q13	D
Q14	B
Q15	C
Q16	B
Q17	B
Q18	D
Q19	A
Q20	C
Q21	C
Q22	B
Q23	C
Q24	D
Q25	C
Q26	A
Q27	A
Q28	A
Q29	C
Q30	A
Q31	B
Q32	A
Q33	C
Q34	D
Q35	C
Q36	D
Q37	A
Q38	D
Q39	D
Q40	C
Q41	B
Q42	C
Q43	A
Q44	B
Q45	D
Q46	A
Q47	A
Q48	C
Q49	C
Q50	B
Q51	D
Q52	B
Q53	B
Q54	C
Q55	A
Q56	D
Q57	A
Q58	B
Q59	C
Q60	B

Hints & Solutions

Note: scan the QR code to watch video solution

Q1 Text Solution:

To calculate bond order,

we use the formula :

Bond order

$= \frac{1}{2}$(number of bonding electrons

− number of antibonding electrons)

Here′s how the bond order is calculated for each molecule /ion :

For the NO molecule : $BO = \frac{1}{2}(8-3)$

$= 2.5$

For the CO molecule : $BO = \frac{1}{2}(10-4)$

$= 3.0$

For the O_2^- ion : $BO = \frac{1}{2}(6-3) = 1.5$

For the O_2 molecule : $BO = \frac{1}{2}(6-2)$

$= 2.0$

Q2 Text Solution:

The electronic configurations of elements X and Y are as follows:

X: $1s^2 2s^2 2p^6 3s^2 3p^3$

Y: $1s^2 2s^2 2p^6 3s^2 3p^5$

For element X, the configuration corresponds to phosphorus (P), which is in group 15 of the periodic table. For element Y, the configuration corresponds to chlorine (CI), which is in group 17.

Phosphorus (P) has a valency of 3 or 5.

Chlorine (CI) has a valency of 1.

Given these valencies, possible compounds could form:

PCl_3, where phosphorus uses its valency of 3 to bond with three chlorine atoms.

PCl_5, where phosphorus uses an expanded valency of 5 to bond with five chlorine atoms.

Both PCl_3 and PCl_5 are covalent compounds. In both scenarios, sharing of electrons occurs between phosphorus and chlorine atoms, resulting in covalent bonds.

Q3 Text Solution:

Combination reaction

– no example given

Decomposition reaction – $H_2O_{2(aq)} \rightarrow H_2O_{(\ell)} + O_{2(g)}$

$H_2O_{(\ell)} \xrightarrow{\Delta} 2H_{2(g)} + O_{2(g)}$

Displacement reaction – $Cl_{2(g)} + 2Br^-_{(aq)} \rightarrow 2Cl^-_{(aq)} + Br_{2(g)}$

Disproportionation reaction – $2H_2O_{2(aq)} \rightarrow 2H_2O_{(\ell)} + O_{2(g)}$

Q4 Text Solution:

In transition metal ions, the coloration typically depends on the presence of unpaired electrons in the d-orbitals. Ions with either completely empty d-orbitals (d^0) or fully filled d-orbitals (d^{10}) do not exhibit d-d transitions, which are responsible for colored compounds. As a result, these ions tend to be colorless.

The Sc^{3+} ion has the electron configuration [Ar] $3d^0$, meaning its d-orbitals are empty.

The Zn^{2+} ion has the electron configuration [Ar]$3d^{10}$, indicating fully filled d-orbitals.

Since both Sc^{3+} and Zn^{2+} lack the d-d electron transitions necessary for color, they are colorless.

Q5 Text Solution:

$H_2\ S + MnO_4^- + H^+ \rightarrow S + Mn^{+2} + H_2O$

Q6 Text Solution:

The Lanthanoid series element known for exhibiting a +4 oxidation state is Cerium.

The electronic configuration of Cerium (Ce) is:

Ce: $[Xe]4f^1 5d^1 6s^2$

When Cerium is in the +4 oxidation state (Ce+4), it has the electronic configuration:

Ce^{+4}: $[Xe]4f^0 5d^0 6s^0$

In this state, Cerium has a stable noble gas configuration, which is why it is well-known to exhibit a +4 oxidation state.

Q7 Text Solution:

To determine which pairs of elements do not both have the configuration $(n-1)d^{10}ns^2$, let's examine the electronic configurations provided:

Cu (Copper): $[Ar]3d^{10}4s^1$

Zn (Zinc): $[Ar]3d^{10}4s^2$

Cd (Cadmium): $[Kr]4d^{10}5s^2$

Hg (Mercury): $[Xe]4f^{14}5d^{10}6s^2$

Ag (Silver): $[Kr]4d^{10}5s^1$

From the configurations:

Copper (Cu) does not have an ns^2 configuration (as it is $4s^1$).

Silver (Ag) also lacks an ns^2 configuration (as it is $5s^1$).

Thus, in the pair consisting of Ag and Cu, neither element has the $(n-1)d^{10}ns^2$ configuration.

Q8 Text Solution:

The correct answer is **Option D: Ambidentate ligand**.

• An ambidentate ligand has two (or more) different donor atoms but binds through only one donor site at a time.

• Classic examples include SCN (thiocyanate, which can bind through S or N) and NO_2 (nitrite, which can bind through N or O).

Q9 Text Solution:

$[NiCl_4]^{-2}$

$O-S$ of $Ni-+2$

Coordination no. of $Ni^{+2}-4$

Cl^- is weak field ligand,

pairing does not take place

$Ni^{+2}-[Ar]3\ \ 4s^\circ\ \ 4p^\circ$

$[NiCl_4]^{-2}$ is paramagnetic

Q10 Text Solution:

$[CO(NH_3)_5(CO_3)]Cl$

Penta ammine carbonate cobalt (III) chloride.

Q11 Text Solution:

The oxalate ion ($C_2O_4^{2}$) is a bidentate ligand, meaning it donates two oxygen atoms to the central metal. In $[Fe(C_2O_4)_3]^3$:

Number of oxalate ligands = 3

Donor atoms per oxalate = 2

Thus, the coordination number of Fe is

$3 \times 2 = 6.$

Q12 Text Solution:

The correct matching is:

• a. Acetic anhydride iii. Glucose has five hydroxyl groups

(all five –OH's get acetylated to give the penta-acetate)

• b. Bromine water i. Glucose has an aldehyde group

(Br_2/H_2O oxidises the –CHO to –COOH, leaving other –OH's untouched)

• c. Hydroiodic acid ii. Glucose has a straight chain of six carbon atoms

(HI reduces and cleaves C–C bonds to give n-hexane)

• d. Hydrogen cyanide iv. Glucose has a carbonyl group

(HCN adds to the C=O to form a cyanohydrin)

So the answer is Option B:

a–iii, b–i, c–ii, d–iv.

Q13 Text Solution:

Aspartic acid→α-amino acid

Insulin→hormone

Ascorbic acid (Vitamin C) Vitamin

Rhamnose (deoxy sugar) Carbohydrate

Q14 Text Solution:

α - links over found in the structure of starch which consists of any lose and amylopectin.

Q15 Text Solution:

Nitric acid is not used in the redox titration because it is a strong OA itself.

Q16 Text Solution:

Nylon in presence of NaCl is used for detection of group III cations which are $Al^{3+}, Fe^{3+}, Cr^{3+}$

Q17 Text Solution:

The purpose of sodium fusion extract is to convert the element in the organic compound into ionic compound so that the detection could become easier.

Q18 Text Solution:

It is done so that if there is any Na_2S or NaCN, it can be decomposed.

Q19 Text Solution:

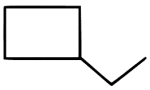
1 is antiaromatic as it has $4\pi e^-$.

Q20 Text Solution:

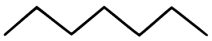
$$\overset{6}{HC} \equiv \overset{5}{C} - \overset{4}{CH} = \overset{3}{CH} - \overset{2}{CH} = \overset{1}{CH_1}$$

Double bond is given preference over triple bond.

Q21 Text Solution:



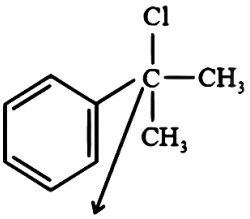
MF : C_6H_2



MF : C_6H_{14}

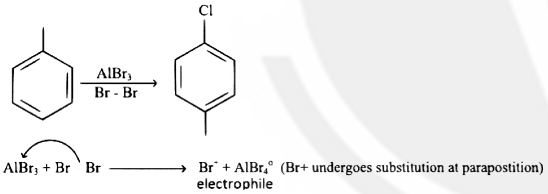
$\therefore$ above compounds are not isomer

Q22 Text Solution:

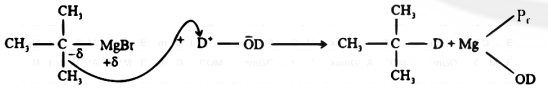


Benzyllic Position

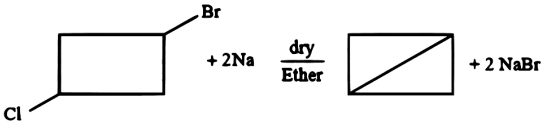
Q23 Text Solution:



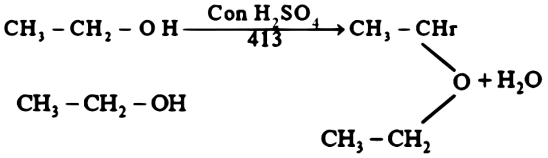
Q24 Text Solution:



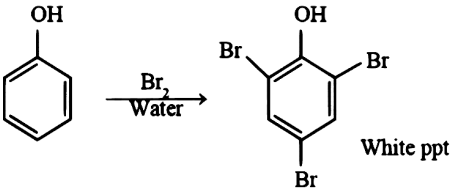
Q25 Text Solution:



Q26 Text Solution:

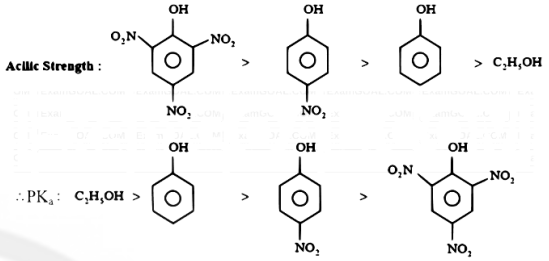


Q27 Text Solution:

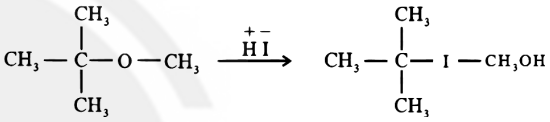


Where as propand Cannot form white ppt with Br2 water

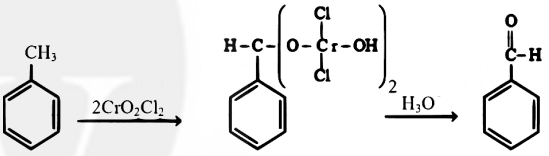
Q28 Text Solution:



Q29 Text Solution:



Q30 Text Solution:



Q31 Text Solution:

Statement I is true, and Statement II is false.

DIBAL-H (diisobutylaluminium hydride) at low temperature selectively reduces an ester to the corresponding aldehyde upon work-up.

Aqueous $KMnO_4$ oxidizes benzyl alcohol all the way to benzoic acid, not benzaldehyde.

Answer: Option B.

Q32 Text Solution:

In considering the reactivity of compounds towards nucleophilic addition reactions, two primary factors need to be evaluated: the positive character of the electrophilic center and the degree of steric hindrance.

Electrophilic Character: The more positive the electrophilic center, the more reactive it is towards a nucleophile. This is typically observed in aldehydes, where the electron-withdrawing effect of the carbonyl group is not counterbalanced by additional alkyl groups.

Steric Hindrance: As steric hindrance increases, reactivity decreases. Larger substituents around the electrophilic center can block the approach of the nucleophile, thus lowering the reaction rate.

Given these considerations, aldehydes are generally more reactive than ketones due to less steric hindrance and a higher degree of positive charge on the carbonyl carbon. Between ketones, those with smaller alkyl groups are usually more reactive. Evaluate each compound based on these criteria to determine their relative reactivity in nucleophilic addition reactions.

Q33 Text Solution:

Trichloroacetic acid (Option C) is the strongest acid. Here's why:

Electron-withdrawing effect

Chlorine atoms pull electron density away from the –COOH group, stabilizing the conjugate base (the carboxylate anion).

More Cl greater stabilization stronger acid.

Comparative pKa values

Propanoic acid, CH_3CH_2COOH: pKa ≈ 4.87

Chloroacetic acid, $ClCH_2COOH$: pKa ≈ 2.86

Dichloroacetic acid, $Cl_2CHCOOH$: pKa ≈ 1.25

Trichloroacetic acid, CCl_3COOH: pKa ≈ 0.66

Since trichloroacetic acid has the lowest pKa, it donates its proton most readily and is thus the most acidic.

Q34 Text Solution:

The only reagent that will "pick out" a primary aromatic amine (aniline) but not a secondary one (N-methylaniline) is the carbylamine test:

• Carbylamine test (Option D: $CHCl_3$ + alcoholic KOH)

– $RNH_2 + CHCl_3 + 3\ KOH \rightarrow R–NC$ (isocyanide, foul smell) + 3 KCl + 3 H_2O

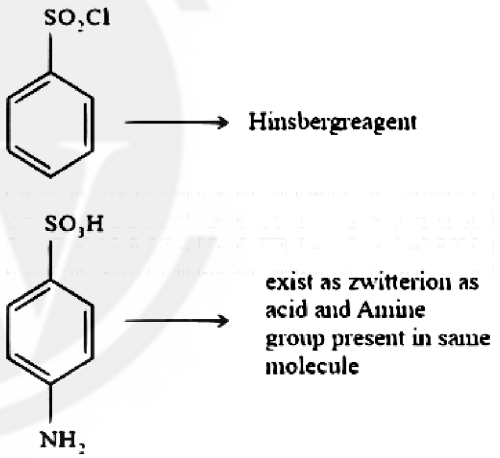
– Only primary amines give the isocyanide; secondary amines (like N-methylaniline) do not react.

Options A, B and C all react (or fail to react) with both aniline and N-methylaniline in essentially the same way, so they cannot be used to tell the two apart.

Q35 Text Solution:

Cyanides on hydrolysis gives Carboxylic acids, where as rest all 3 cases amines can be prepared.

Q36 Text Solution:



Alkyl diazonium Salts→Convert to alcohols as Carbocation intermediate formed is unstable.

Aryl diazonium Salts→Participate in dye test

Q37 Text Solution:

The "N" shell corresponds to principal quantum number n = 4 The total number of orbitals in a shell is given by n^2.

Here, n = 4

So, number of orbitals = $4^2 = 16$

Answer: Option A (16)

Q38 Text Solution:

To determine the value of Δv – Δx for an object with a mass of 10^{-6} kg using Heisenberg's Uncertainty Principle, we start with the formula: $\Delta v \cdot \Delta x = \frac{h}{4\pi m}$

Given:

Planck's constant, h = 6.626 × 10^{-34} Js

Mass, m = 10^{-6} kg

Substitute these values into the formula: $\Delta v \cdot \Delta x = \frac{6.626\times10^{-34}}{4\times3.14\times10^{-6}}$

Calculating the above expression, we get: $\Delta v \cdot \Delta x \approx 5.2 \times 10^{-29}\ m^{-2}\ s^{-1}$

This result provides the required uncertainty product for the given object under the constraints of Heisenberg's principle.

Q39 Text Solution:

Explanation:

Statement I

For an adiabatic process Q = 0.

If "work done" W is taken positive when done on the system, then the first law gives ΔU = + Q + W = 0 + W = W.

Thus if work is done on the system (W > 0), its internal energy increases ($\Delta U > 0$).

Statement II

In a free (Joule) expansion the external pressure $P_{ext} = 0, so$

$P_{ext} = 0, so$

Hence no work is done during the free expansion of an ideal gas.

Both statements are therefore true.

Q40 Text Solution:

To determine which reaction has $\Delta H = \Delta U$ we use the equation:

$\Delta H = \Delta U + \Delta n_g.RT$

Where:

ΔH is the change in enthalpy.

ΔU is the change in internal energy.

Δn_g is the change in the number of moles of gas.

R is the ideal gas constant.

T is the temperature in Kelvin.

For the reaction:

$2\,HI_{(g)} \rightleftharpoons H_{2(g)} + I_{2(g)}$

The change in the number of moles of gas (Δn_g) can be calculated as follows:

On the reactant side, there are 2 moles of gas.

On the product side, there are 1 mole of H_2 plus 1 mole of I_2 totaling 2 moles.

Thus, $\Delta n_g = 2 - 2 = 0$

Since $\Delta n_g = 0$ it follows that:

$\Delta H = \Delta U$

Therefore, for this reaction, the change in enthalpy is equal to the change in internal energy.

Q41 Text Solution:

The incorrect statements are (b), (d) and (e), so the correct choice is Option B.

• (b) is false: ΔH for a phase change does depend on how strong the intermolecular forces are—you must supply enough energy to overcome them.

• (d) is false: Enthalpy is a state function, so ΔH depends only on initial and final states, not on the path.

• (e) is false: Many ionic salts dissolve endothermically ($\Delta_{sol}H° > 0$); only some give off heat on dissolving ($\Delta_{sol}H° < 0$).

(a) and (c) are both true.

Q42 Text Solution:

The correct choice is Option C: all three statements are true.

Here's why:

Equilibrium requires a closed system at constant temperature

If the system isn't closed, reactants or products can escape and you never reach a true dynamic balance.

And since the equilibrium constant depends on temperature, "at a given temperature" ensures K stays fixed.

All macroscopic (measurable) properties remain constant at equilibrium

Even though the forward and reverse reactions continue at the molecular level, their rates are equal, so pressure, concentration, temperature, etc., no longer change.

The equilibrium constant for the reverse reaction is the reciprocal of that for the forward reaction

$\text{If for } A \rightleftharpoons B$

$\text{we have } K_{fivd} = \frac{[B]}{[A]},$

$\text{then for the reverse } B \rightleftharpoons A,\ K_{rev} = \frac{[A]}{[B]} = \frac{1}{K_{fed}}$

Q43 Text Solution:

Here's how Le Chatelier's principle applies to $CO(g) + 3H_2(g) \rightleftharpoons CH_4(g) + H_2O(g)$:

Adding a reactant shifts equilibrium toward products.

• Increasing [CO] (option a) drives the forward reaction.

Removing a product also shifts equilibrium toward products.

• Decreasing [CH_4] (option c) removes a product and pulls the reaction to the right.

Options b (adding H_2O) and d (removing H_2) work against methane formation.

Answer: Option A (a and c).

Q44 Text Solution:

$$A + B \rightleftharpoons C + D$$

$$1 - x1 - x1 + x1 + x$$

$$100 = \frac{(1+x)(1+x)}{(1-x)(1-x)}$$

$$\Rightarrow \frac{1+x}{1-x} = 10$$

$$\Rightarrow 1 + x = 10 - 10x$$

$$\Rightarrow 11x = 9$$

$$x = \frac{9}{11} = 0.818$$

$$(D)\ 1 + x = 1 + 0.818 = 1.818$$

Q45 Text Solution:

To determine which 0.1 m aqueous solution will have the lowest boiling point elevation, we need to consider the Van't Hoff factor (i). This factor represents the number of particles the compound dissociates into in solution. The formula for boiling point elevation, $\Delta T_b \propto i$, indicates that a higher i value leads to a greater elevation in boiling point.

Here are the values of i for each compound, assuming complete ionization:

$$\text{Aluminium chloride } (AlCl_3): i = 4$$

$$\text{Aluminium sulfate } (Al_2(SO_4)_3): i = 5$$

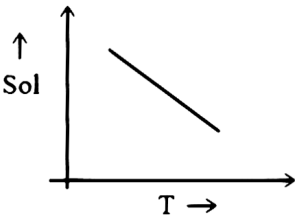
$$\text{Potassium sulfate } (K_2SO_4): i = 3$$

$$\text{Sodium chloride } (NaCl): i = 2$$

The solution with the lowest i value will exhibit the smallest increase in boiling point. Therefore, sodium chloride, which has $i = 2$, will show the lowest boiling point elevation among the options.

Q46 Text Solution:

Henry law solubility$\propto \frac{1}{\text{Temp}}$



Q47 Text Solution:

To find the boiling point of the water solution, we need to calculate the boiling point elevation using the formula:

$$\Delta T_b = i \cdot K_b \cdot m$$

where: ΔT_b is the boiling point elevation, i is the van 't Hoff factor, which is 1 for glucose as it does not dissociate in solution, K_b is the ebullioscopic constant for water, given as 0.52 K kg mol^{-1}, m is the molality of the solution.

To calculate the molality m, use:

$$m = \frac{\text{moles of solute}}{\text{kilograms of solvent}}$$

For glucose ($C_6H_{12}O_6$), with a mass of 180 g:

$$\text{Moles of glucose} = \frac{180\ g}{180\ g/mol} = 1\ mol$$

The solvent (water) is 1 kg:

$$m = \frac{1\ mol}{1\ kg} = 1\ mol/kg$$

Substituting into the formula for ΔT_b:

$$\Delta T_b = 1 \times 0.52 \times 1 = 0.52\ K$$

The normal boiling point of pure water is 373.15 K. Therefore, the boiling point of the solution is:

$$T_b = 373.15 + 0.52 = 373.67\ K$$

Q48 Text Solution:

To determine the number of moles of N_2 gas that would dissolve in 1 liter of water at 293 K, when N_2 exerts a partial pressure of 0.987 bar, we can use Henry's Law. Given that the Henry's Law constant (K_H) for N_2 at 293 K is 76.48 K bar, we apply the following:

Henry's Law $P = K_H \cdot X$

Where:

P is the partial pressure of the gas (0.987 bar),

K_H is Henry's Law constant (76.48 bar)

X is the mole fraction of the gas in the solvent.

Calculating Mole Fraction of N_2

The mole fraction X N_2 is given by:

$$X_{N_2} = \frac{P_{N_2}}{K_H} = \frac{0.987}{76.48 \times 10^3} = 1.29 \times 10^{-5}$$

Determining Moles of Water

The number of moles of water (nH_2O) in 1 liter (1000 grams) is: $n_{H_2O} = \frac{1000}{18} = 55.5$

Relating Mole Fraction and Moles of N_2

The mole fraction can also be expressed as: $X_{N_2} = \frac{n_{N_2}}{n_{N_2}+n_{H_2O}} \approx \frac{n_{N_2}}{55.5}$

Setting this equal to the previously calculated mole fraction: $1.29 \times 10^{-5} = \frac{n}{55.5}$

Solving for n (the moles of N_2): $n_{N_2} = 1.29 \times 10^{-5} \times 55.5 = 7.16 \times 10^{-4}$

Thus, the number of moles of N_2 gas dissolved in 1 liter of water is 7.16×10^{-4}

Q49 Text Solution:

The correct choice is **C: (a) and (d) only**. Here's why:

In a galvanic (voltaic) cell

The anode is where oxidation occurs and is the **negative** terminal.

The cathode is where reduction occurs and is the **positive** terminal.

(b) "Anode is positive" is false, (d) "Cathode is positive" is true.

Conventional current (flow of positive charge) goes **from cathode to anode** through the external circuit.

(a) is true.

A negative cell potential means the reaction is non-spontaneous:

$E_{cell} < 0 \Rightarrow$non-spontaneous

(c) is false. **[KCET 2025]**

Q50 Text Solution:

The electronic conductance is influenced by the number of valence electrons per atom, and this relationship is inversely proportional to temperature. The formula representing this relationship is:

$$\text{Electronic conductance} \propto \frac{\text{number of electrons per atom}}{\text{Temperature}}$$

This indicates that as the number of valence electrons increases, electronic conductance increases, but it decreases with rising temperature.

Q51 Text Solution:

For the half-cell reaction $Al^{3+} + 3e^- \rightarrow Al$, consider the Nernst equation: $E_{Red} = E^0_{Red} - \frac{0.0591}{3}\log\frac{[Al(s)]}{[Al^{3+}]}$

Since the active mass of a solid is constant and equal to 1, the equation simplifies to: $E_{Red} = E^\circ_{Red} - \frac{0.0591}{3}\log\frac{1}{[Al^{3+}]}$

This further simplifies to: $E_{Red} = E^\circ_{Red} + \frac{0.0591}{3}\log[Al^{3+}]$

From this equation, it's clear that E_{Red} is directly proportional to $[Al^{3+}]$ Thus, as the concentration of Al^{3+} increases, the electrode potential increases.

Q52 Text Solution:

To determine the quantity of electricity required to deposit various metals at the cathode, we use Faraday's laws of electrolysis, where 1 Faraday (F) is equivalent to 96500 coulombs (C) per mole of electrons. Let's analyze each metal ion:

Silver (Ag^+):

Reaction : $Ag^+ + e^- \rightarrow Ag$

Calculation : $1 \times 96500\ C = 96500\ C\ mol^{-1}$

Requires 1 Faraday per mole.

Magnesium (Mg^{2+}):

Reaction : $Mg^{2+} + 2e^- \rightarrow Mg$

Calculation : $2 \times 96500\ C = 193000\ C\ mol^{-1}$

Requires 2 Faradays per mole.

Aluminum (Al^{3+}):

Reaction : $Al^{3+} + 3e^- \rightarrow Al$

Calculation : $3 \times 96500\ C = 289500\ C\ mol^{-1}$

Requires 3 Faradays per mole.

Titanium (Ti^{4+}) :

Reaction : $Ti^{4+} + 4e^- \rightarrow Ti$

Calculation : $4 \times 96500\ C = 386000\ C\ mol^{-1}$

Requires 4 Faradays per mole.

The correct matches for the amounts of electricity required to deposit each metal are as follows:

Ag^+ matches with $96500\ C\ mol^{-1}$

Mg^{2+} matches with $193000\ C\ mol^{-1}$

Al^{3+} matches with $289500\ C\ mol^{-1}$

Ti^{4+} matches with $386000\ C mol^{-1}$

Q53 Text Solution:

Positive catalyst decreases the activation energy to increase rate of reaction.

Q54 Text Solution:

To find the concentration of a reactant after a certain time in a first-order reaction, we use the concept of half-life.

Given:

The half-life ($t_{1/2}$) of the reaction is 20 seconds.

Initial concentration ($[A_0]$) is 0.2 M.

We want to find the concentration after 80 seconds.

Calculation:

Determine the number of half-lives:

$$\text{Number of half-lives} = \frac{t}{t_{1/2}} = \frac{80}{20} = 4$$

Calculate the concentration after 4 half-lives:

For a first-order reaction, the concentration after n half-lives is given by: $[A_t]=[A_0]\left(\frac{1}{2}\right)^n$

Substituting the values:

$$[A_t]= 0.2 \times \left(\frac{1}{2}\right)^4 = 0.2 \times \frac{1}{16} = 0.0125\text{M}$$

Thus, the concentration of the reactant after 80 seconds is 0.0125 M.

Q55 Text Solution:

To determine the activation energy (E_a) for the reverse reaction from the given graph, we can use the following energy relationship:

$$\Delta H = (E_a)_{\text{forward}} - (E_a)_{\text{backward}}$$

$$\text{From the graph, we have : } \Delta H = 90 \text{ KJ}$$

$$(E_a)_{\text{forward}} = 215 \text{ KJ}$$

$$\text{Plugging these values into the equation, we get : } 90 = 215 - (E_a)_{\text{backward}}$$

$$\text{Solving for } (E_a)_{\text{backward:}}$$

$$(E_a)_{\text{backward}} = 215 - 90 = 125 \text{ KJ}$$

Therefore, the activation energy for the reverse reaction is 125 KJ.

Q56 Text Solution:

To determine the rate of production of NO_2 for the reaction $2\,N_2O_{5(g)} \rightarrow 4\,NO_{2(g)} + O_{2(g)}$, the fact that the rate of production of a product is related to the rate of disappearance of a reactant.

Given:

Initial concentration of N_2O_5 is 2.0 mol/L.

After 300 minutes, the concentration is reduced to 1.4 mol/L

Calculate the rate of disappearance of N_2O_5:

Rate of disappearance of $N_2O_5 = \frac{-(1.4-2.0)}{300} = \frac{-(-0.6)}{300} = \frac{0.6}{300}$

As per the stoichiometry of the reaction, the rate of formation of NO_2 is twice the rate of disappearance of N_2O_5:

$$\text{Rate of formation of } NO_2 = 2 \times \frac{0.6}{300}$$

$$= \frac{1.2}{300} = 4 \times 10^{-3} \text{ mol/L/min}$$

Therefore, the rate of production of NO_2 is 4×10^{-3} mol/L/min

Q57 Text Solution:

Option A is correct: mole fraction and mass percent (w/w) are both unitless.

Mole fraction $x_i = \frac{n_i}{\sum_j n_j}$

It's simply a ratio of moles, so no units.

Mass percent (w/w) $\text{mass } 1\% = \frac{\text{mass of solute}}{\text{total mass of solution}} \times 100\%$

Again, a ratio of masses, giving a percentage without units.

By contrast, molality has units of mol/kg and molarity has mol/L, so neither is unitless.

Q58 Text Solution:

Let's check each statement:

(a) "22 books have infinite significant figures."

• A counted quantity is exact effectively infinite sig figs. **Correct**

(b) "In the answer of 2.5 × 1.25 there are four significant figures."

•2.5 has 2 sig figs, 1.25 has 3 product limited to 2 sig figs **Incorrect**

(c) "Zeros preceding the first non-zero digit are significant."

• Leading zeros are not significant **Incorrect**

(d) "In 12.11 + 18.0 + 1.012 the result has three significant figures."

• Add match decimal places (fewest is 1 place) result ≈31.1 3 sig figs **Correct**

Incorrect statements are (b) and (c) only **Option B**.

Q59 Text Solution:

Elements in triad should have similar properties K, Ca are metals Cl is non metals

Q60 Text Solution:

$$AlCl_3 + Cl^- \rightarrow AlCl_4^-$$

$$sp^2 \qquad sp^3$$

$$(3\sigma \text{ bonds}) \qquad (4\sigma \text{ bonds}$$