2 Previous Year Paper

25th May 2023 (Shift 3)

Q1. Mn_2O_7, CrO and V_2O_5 respectively are:
(a) Acidic, amphoteric and basic
(b) Basic, acidic and amphoteric
(c) Amphoteric, basic and acidic
(d) Acidic, basic and amphoteric

Q2. In the given equations (Note: equations are not balanced

$Zn + \text{Conc } HNO_3 \rightarrow Zn(NO_3)_2 + \boxed{x} + H_2O$ .... (1)

$Zn + \text{Dil. } NHO_3 \rightarrow Zn(NO_3)_2 + \boxed{y} + H_2O$ .... (2)

the compounds x and y respectively are:
(a) NO_2 and NO
(b) NO_2 and NO_2
(c) N_2O and NO_2
(d) NO_2 and N_2O

Q3. For a substance at a given temperature, the osmotic pressure of its concentrated solution
(a) is same as that of dilute solution
(b) is lower than that of dilute solution
(c) is higher than that of dilute solution
(d) cannot be compared with osmotic pressure of dilute solution

Q4. The molecular formula of dodecacarbonyltrimanganese (0)
(a) $[Mn_2(CO)_{11}]$
(b) $[Mn_3(CO)_{12}]$
(c) $[Mn_3(CO)_{10}]$
(d) $[Mn_2(CO)_{12}]$

Q5. Oxidation of acetaldehyde with SeO_2 forms:
(a) Ethanoic acid
(b) Methanoic acid
(c) Glyoxal
(d) Oxalic acid

Q6. In a pure crystal, the lattice point cannot be occupied by _____
(a) an atom
(b) a molecule
(c) an Ion
(d) an electron

Q7. The most effective electrolyte for the coagulation $Fe_2O_3.H_2O$/ Fe^{3+} is
A. AgCl3
B. $FeCl_3$
C. $MgCl_2$
D. $K_4[Fe(CN)_6]$
E. KCl

Choose the **correct** answer from the options given below:
(a) A and B only
(b) D only
(c) E only
(d) C only

Q8. Chlorine is extracted from brine by-
(a) Oxidation
(b) Leaching
(c) Distillation
(d) Reduction

Q9. Match **List-I** with **List-II**:

List-I		List-II	
(A)	XeF_6	(I)	sp^3d^3 distorted octahedral
(B)	XeO^3	(II)	sp^3d^2 square planar
(C)	$XeOF_4$	(III)	sp^3 pyramidal
(D)	XeF_4	(IV)	sp^3d^2 square pyramidal

Choose the **correct** answer from the options given below:
(a) (A)-(I), (B)-(III), (C)-(IV), (D)-(II)
(b) (A)-(I), (B)-(II), (C)-(III), (D)-(IV)
(c) (A)-(IV), (B)-(III), (C)-(I), (D)-(II)
(d) (A)-(II), (B)-(III), (C)-(IV), (D)-(I)

Q10. Which of the following are the characteristics of chemisorption?
A. Highly specific in nature
B. Low activation energy
C. High heat of adsorption
D. Reversible in nature

Choose the **correct** answer from the options gixen below:
(a) A and D only
(b) A and C only
(c) B and D only
(d) B and C only

Q11. Match **List-I** with **List-II**:

List-I		List-II	
(A)	$(CH_3)_3N$, $CH_3CH_2CH_2NH_2$	(I)	Tollen's test
(B)	$HCOOH$, CH_3COOH	(II)	Lucas test
(C)	$CH_3-\overset{\overset{O}{\|}}{C}-CH_2-CH_2-CH_3$, $CH_3-CH_2-\overset{\overset{O}{\|}}{C}-CH_2-CH_3$	(III)	Carbylamine test
(D)	$CH_3-CH_2-CH_2-CH_2-OH$, $CH_3-\overset{\overset{CH_3}{\|}}{C}-OH$	(IV)	Iodoform test

Choose the **correct** answer from the options given below:

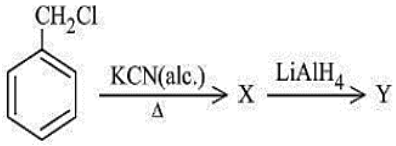
(a) (A)-(I), (B)-(II), (C)-(III), (D)-(IV)
(b) (A)-(III), (B)-(II), (C)-(I), (D)-(IV)
(c) (A)-(III), (B)-(I), (C)-(IV), (D)-(II)
(d) (A)-(III), (B)-(IV), (C)-(II), (D)-(I)

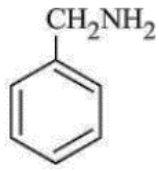
Q12. Match **List-I** with **List-II**:

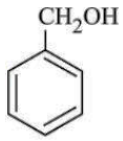
List-I		List-II	
(A)	Mathematical expression for rate of reaction	(I)	rate constant
(B)	Rate of reaction for zero order reaction is equal to	(II)	rate law
(C)	Unit for rate constant for zero order reaction is same as that of	(III)	order of slowest step
(D)	Order of a complex reaction is determined by	(IV)	rate or reaction

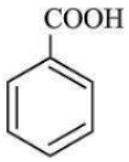
Choose the **correct** answer from the options given below:
(a) (A)-(III), (B)-(IV), (C)-(II), (D)-(I)
(b) (A)-(I), (B)-(II), (C)-(III), (D)-(IV)
(c) (A)-(II), (B)-(I), (C)-(IV), (D)-(III)
(d) (A)-(IV), (B)-(III), (C)-(I), (D)-(II)

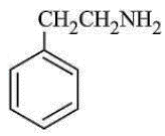
Q13. The product 'Y' in the following reaction sequence is



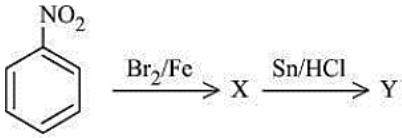
(a) 

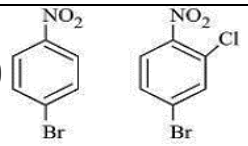
(b) 

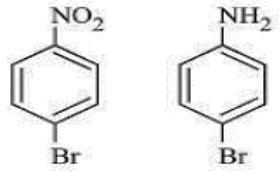
(c) 

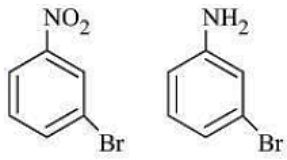
(d) 

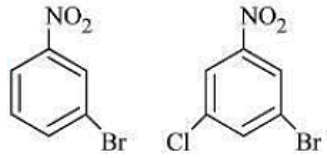
Q14. The products X and Y for the below reaction are:



(a) 

(b) 

(c) 

(d) 

Q15. The synthesis of alkyl fluoride is best accomplished by the following reaction
$CH_3Br + AgF \rightarrow CH_3F + AgBr$
The reaction is termed as:
(a) Swarts reaction
(b) Finkelstein reaction
(c) Wurtz reaction
(d) Fitting reaction

Q16. Isomerism shown by $[Co(NH_3)_3(NO_2)_3]$ is
(a) C is and trans
(b) Facial and meridional
(c) Optical
(d) Solvate

Q17. Chemisorption has the following traits:
A. High enthalpy of adsorption
B. Reversible
C. Favoured by high temperature
D. Requires low activation enthalpy

Choose the **correct** answer from the options given below:
(a) A, B only
(b) A, C only
(c) A, B, C only
(d) A, B, D only

Q18. Since physisorption arises mainly because of van der Waals forces, it means adsorption is: (pick the incorrect option)
(a) Non-specific in nature
(b) Reversible in nature
(c) Multimolecular in layer
(d) Enthalpy dependent

Q19. Out of the following compounds, which will give iodoform test.
A. Isopropyl alcohol
B. Isobutyl alcohol
C. Secondary butyl alcohol

D. Ethyl alcohol
E. Acetic Acid

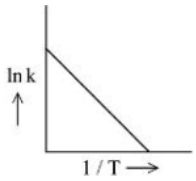
Choose the **correct** answer from the options given below:
(a) A, B, D
(b) A, C, D
(c) A, D
(d) A, D, E

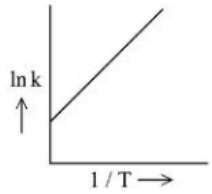
Q20. Arrange the given compounds in order of decreasing oxidation state of nitrogen
A. N_2
B. NO
C. HNO_3
D. NH_4Cl

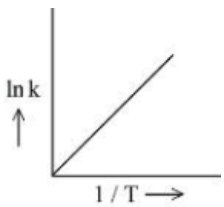
Choose the **correct** answer from the options given below:
(a) $HNO_3>NO>NH_4Cl>N_2$
(b) $HNO_3>NO>N_2>NH_4Cl$
(c) $HNO_3>NH_4Cl>NO>N$
(d) $NO>HNO_3>NH_4Cl>N_2$

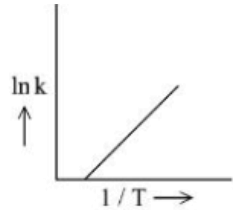
Q21. A solution of copper sulphate cannot be stored in zinc vessel because
(a) Copper is more reactive than zinc
(b) Reduction potential of copper is less than zinc
(c) Oxidation potential of copper is higher than zinc
(d) Reduction potential of copper is higher than zinc

Q22. According to Arrhenius rate equation, rate constant k is equal to $A.e^{-Ea/RT}$. Which of the following options represents the graph of ln k. vs. $\frac{1}{T}$?

(a) 

(b) 

(c) 

(d) 

Q23. Match **List-I** with **List-II**:

List-I		List-II	
(A)	Cubic cell	(I)	$\alpha = \beta = \gamma = 90°$
(B)	Monoclinic cell	(II)	$\alpha = \beta = 90°, \gamma = 120°$
(C)	Triclinic cell	(III)	$\alpha = \gamma = 90°, \beta \neq 90°$
(D)	Hexagonal cell	(IV)	$\alpha \neq \beta \neq \gamma \neq 90°$

Choose the **correct** answer from the options given below:
(a) (A)-(I), (B)-(III), (C)-(II), (D)-(IV)
(b) (A)-(III), (B)-(I), (C)-(II), (D)-(IV)
(c) (A)-(III), (B)-(I), (C)-(IV), (D)-(II)
(d) (A)-(I), (B)-(III), (C)-(IV), (D)-(II)

Q24. What is/are true regarding most of the medicines.
A. They are colloidal in nature
B. Their particle size range from 1-1000 nm
C. They have large surface area
D. They are easily assimilated

Choose the **correct** answer from the options given below:
(a) A, B only
(b) B, C only
(c) A, B, C only
(d) A, B, C, D only

Q25. Which of the following hormone is responsible for the development of secondary female characteristic and participate in control of menstrual cycle?
(a) Adrenal cortex
(b) Estradiol
(c) Androgens
(d) Progesterone

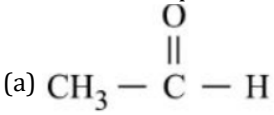
Q26. On the basis of the information available from the reaction
$\frac{4}{3}Al + O_2 \rightarrow \frac{2}{3} Al_2O_3 \Delta G = -827\ kJ\ /\ mol^{-1}$
The minimum e.m.f required to carry the electrolysis of Al_2O_3 is (F = 96500 C mol^{-1})
(a) 2.14 V
(b) 4.29 V
(c) 6.42 V
(d) 8.56 V

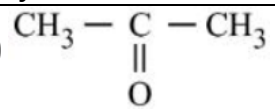
Q27. Identify the product 'X' in the following reaction:

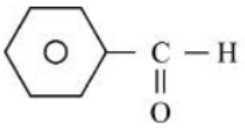
$$C_2H_5COONa \xrightarrow[\text{Heat}]{NaOH + CaO} X + Na_2CO_3$$

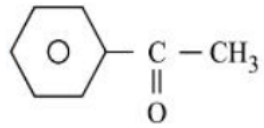
(a) C_2H_4
(b) C_2H_6
(c) C_3H_8
(d) C_3H_6

Q28. Which of the following compound is most reactive towards nucleophilic addition reaction?

(a) 

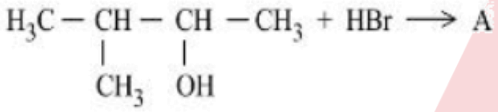
(b) 

(c) 

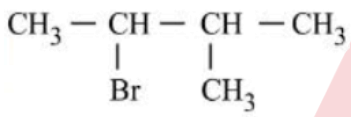
(d) 

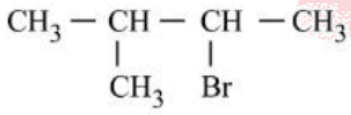
Q29. Aryl halides do not undergo nucleophilic substitution reactions under ordinary conditions because
A. approach of nucleophile is retarded
B. carbon carrying halogen atom is sp^3 hybridised
C. the substrate molecule is destabilised due to resonance
D. of partial double bond character between carbon and halogen.

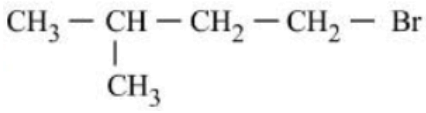
Choose the **correct** answer from the options given below.
(a) A and D only
(b) B and C only
(c) A and C only
(d) B and D only

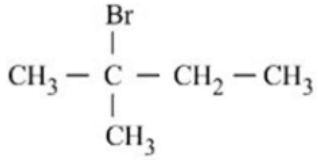
Q30. 

A (predominantly) is

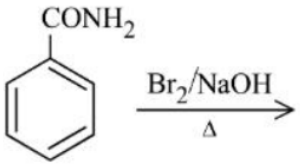
(a) 

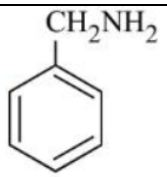
(b) 

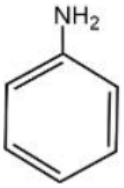
(c) 

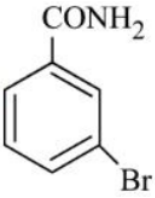
(d) 

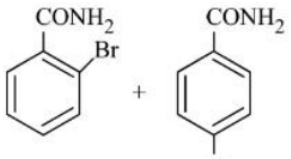
Q31. Predict the product for the following reaction:



(a) 

(b) 

(c) 

(d) 

Q32. The activation energy for a reaction at a temperature T K was found to be 2.303 RT J/mol. The ratio of the rate constant to Arrhenius factor is
(a) 10^{-1}
(b) 10^{-2}
(c) 2×10^{-2}
(d) 2×10^{-3}

Q33. Match **List-I** with **List-II**:

List-I		List-II	
(A)	$K_4[Fe(CN)_6]$	(I)	3
(B)	K_2SO_4	(II)	0.5
(C)	CH_3COOH in benzene	(III)	5
(D)	KCl	(IV)	2

Choose the **correct** answer from the options given below:
(a) (A)-(III), (B)-(I), (C)-(II), (D)-(IV)
(b) (A)-(III), (B)-(I), (C)-(IV), (D)-(II)
(c) (A)-(II), (B)-(I), (C)-(III), (D)-(IV)
(d) (A)-(II), (B)-(III), (C)-(I), (D)-(IV)

Q34. Number of coulombs required for the reduction of 1 mol of MnO_4^- to $Mn^{2+}$is:
(a) 1.93×10^5C
(b) 4.825×10^5C
(c) 5.79×10^5C
(d) 2.89×10^5C

Q35. When Br_2 is treated with aqueous solution of NaF, NaCl, Nal separately
(a) F_2, Cl_2, I_2 are liberated
(b) Only F_2 and Cl_2 are liberated
(c) Only Cl_2 is liberated
(d) Only I_2 is liberated

Q36. Match **List-I** with **List-II**.

List-I		List-II	
(A)	Zone refining	(I)	Titanium
(B)	Mond's process	(II)	Zinc
(C)	Electrolytic refining	(III)	Nickel
(D)	van-Arkel method	(IV)	Germanium

Choose the **correct** answer from the options given below:
(a) (A)-(III), (B)-(I), (C)-(IV), (D)-(II)
(b) (A)-(IV), (B)-(II), (C)-(III), (D)-(I)
(c) (A)-(IV), (B)-(III), (C)-(II), (D)-(I)
(d) (A)-(II), (B)-(IV), (C)-(I), (D)-(III)

Q37. Which among the following are correctly matched?
A. $C_6H_5OCH_2CH_3$ — Phenetole
B. $C_6H_5O(CH_2)_6CH_3$ — Heptyl phenyl ether
C. $C_6H_5OCH_3$ — Dimethyl ether
D. $C_2H_5OCH_2CH_3$ — Methyl ethyl ether

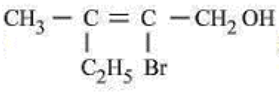
Choose the **correct** answer from the options given below:
(a) A and B only
(b) C and D only
(c) A and C only
(d) B and D only

Q38. Match **List-I** with **List-II**:

List-I		List-II	
(A)	C_6H_5CHO	(I)	Precipitation with 2, 4 DNP
(B)	$CH_3C \equiv CH$	(II)	Precipitation with $AgNO_3$ (ammoniacal)
(C)	HCN	(III)	Nucleophile
(D)	I^-	(IV)	Cyanohydrin formation

Choose the **correct** answer from the options given below:
(a) (A)-(I), (B)-(II), (C)-(III), (D)-(IV)
(b) (A)-(IV), (B)-(III), (C)-(II), (D)-(I)
(c) (A)-(I), (B)-(II), (C)-(IV), (D)-(III)
(d) (A)-(II), (B)-(III), (C)-(I), (D)-(IV)

Q39. The IUPAC name of the compound



is:
(a) 2-Bromo-3-methyl pent-2-en-1-ol
(b) 2-Bromo-3-ethyl but-2-en-1-ol
(c) 2-Bromo-3-methyl but -2-en-l -ol
(d) 2-Ethyl-3-bromo but-2-en-1-ol

Q40. If two substances A and B have $P°_A : P°_B = 1:2$ and mole fraction in the ratio 1:2 then mole fraction of A in vapours is
(a) 0.33
(b) 0.2
(c) 0.25
(d) 0.52

Direction for the question 41 to 45: Answer the question on the basis of passage given below:

In the periodic table, the d-block contains the elements of group 3 to 1(b) The d-orbitals are progressively filled in each of the four long periods. The elements of d block referred as transition metals have partly filled d orbitals and exhibit certain characteristic properties such as variety of oxidation states, formation of coloured ions, act as catalyst and show paramagnetic behaviour.
The two inner transition metals series 4f and 5f are known as Lanthanoids and Actinoids respectively. The lanthanoids resemble one another more closely as compared to ordinary transition elements in any series.

Q41. The catalytic activity of transition metals and their compounds is ascribed mainly to
(a) their ability to adopt variable oxidation states.
(b) their chemical reactivity.
(c) their magnetic behaviour.
(d) their outer most orbital which has two electrons.

Q42. In context of the Lanthanoids, which of the following statements is/are **NOT** correct?
A. There is a gradual decrease in the radii of the members with increasing atomic number in the series
B. Availability of 4f electrons results in the formation of compounds in +4 oxidation state for all the members of the series
C. Because of similar properties, the separation of lanthanoids is not easy
D. La (OH)3 is least basic among hydroxides of lanthanoids
E. Ce^{2+}Ce can act as an oxidising agent

Choose the **correct** answer from the options given below:
(a) A and E only
(b) B and D only
(c) C and D only
(d) B and E only

Q43. The bonds present in the structure of dichromate ion are
(a) Six equivalent Cr-O bonds and one O-O bond
(b) Six equivalent Cr-O bonds and one Cr-Cr bond
(c) Eight equivalent Cr-O bonds
(d) Six equivalent Cr-O bonds and one Cr-O-Cr bond.

Q44. For the four successive transition elements given below, the stability of +2 oxidation state will be
A. Cr (Atomic number, Z = 24)
B. Mn (Z = 25)
C. Fe (Z = 26)
D. Co (Z = 27)

Choose the **correct** answer from the options given below:
(a) Cr>Mn>Co>Fe
(b) Mn>Fe>Cr>Co
(c) Fe>Mn>Co>Cr
(d) Co>Mn>Fe>Cr

Q45. Highest oxidation state of manganese in fluoride is +4 (MnF_4) but highest oxidation state in oxides is +7 (Mn_2O_7) because
(a) Fluorine is more electronegative than oxygen.
(b) Fluorine does not possess d-orbitals.

(c) Fluorine stabilises lower oxidation state.
(d) Fluorine can form single bond only while oxygen forms double bond, in covalent compounds.

Direction for the question 46 to 50: Answer the question on the basis of passage given below:

Proteins are the polymers of about twenty different α-amino acids which are linked by peptide bonds. Proteins perform various structural and dynamic functions in the organisms. Proteins which contain only α-ammo acids are called simple proteins. The secondary or tertiary structure of proteins get disturbed on change of pH or temperature and they are not able to perform their functions. This is called denaturation of proteins. Enzymes are biocatalysts which speed up the reactions in biosystems. Vitamins are accessory food factors required in the diet. They are classified as fat soluble (A, D. E and K) and water soluble (B group and C). Deficiency of vitamins leads to many diseases. Nucleic acids are the polymers of nucleotides which in tum consist of a base, a pentose sugar and phosphate moiety.
Nucleic acids are responsible for the transfer of characters from parents to offsprings. There are two types of nucleic acids - DNA and RNA. DNA contains a five carbon sugar molecule called 2-deoxyribose whereas RNA contains ribose.

Q46. During denaturation of proteins
(a) Biological activity remains unaltered
(b) 3° Structure remains unaltered
(c) 2° Structure remains unaltered
(d) 1° Structure remains unaltered

Q47. RNA and DNA differ due to presence absence of oxygen at which carbon of sugar moiety?
(a) 4^{th}
(b) 3^{rd}
(c) 2^{nd}
(d) 1^{st}

Q48. Deficiency of which of following vitamins can cause scurvy (loosening and bleeding of gum)?
(a) Vitamin A
(b) Vitamin C
(c) Vitamin D
(d) Vitamin K

Q49. Which of the following is an essential amino acid?
(a) Leucine
(b) Glycine
(c) Alanine
(d) Aspartic acid

Q50. Which of the following vitamin cannot be stored in our body?
(a) Vitamin D
(b) Vitamin
(c) Vitamin K
(d) Vitamin B_2

SOLUTIONS

S1. Ans. (d)

Sol. Mn_2O_7 is acidic, V_2O_5 is amphoteric acid and CrO is basic.

S2. Ans. (d)

Sol. $4Zn + 10HNO_3$ (warm, dilute) $\rightarrow$

$$4Zn(NO_3)_2 + N_2O + 5H_2O$$

$4Zn + 10HNO_3$ (cold very dilute) $\rightarrow$

$$4Zn(NO_3)_2 + NH_4NO_3 + 3H_2O$$

$Zn + 4HNO_3$ (hot and conc.) $\rightarrow Zn(NO_3)_2 + 2NO_2 + 2H_2O$

S3. Ans. (c)

Sol. Osmotic pressure is a colligative property that depends only on the number of particles of solute dissolved in a definite amount of the solvent and does not depend on the nature of the solute.

The expression for osmotic pressure is given as:

$\pi = CRT$

Where,

π = osmotic pressure

C = concentration of solution

T = absolute temperature

From the expression, it can be observed that osmotic pressure is directly proportional to the concentration of the solution at a fixed temperature. Thus, the more is the concentration of the solution, the more will be its osmotic pressure. So, on dilution, as the concentration decreases, the osmotic pressure also decreases.

Therefore, at a given temperature, the osmotic pressure of a concentrated solution of a substance is higher than that of a dilute solution.

S4. Ans. (b)

Sol. The correct IUPAC name of $Mn_3(CO)_{12}$ is dodecacarbonyltrimanganese(0). The central metal atom is a cobalt atom in zero oxidation state. The oxidation state is written in parenthesis. Three such Mn atoms are present. Hence, the prefix tri is used. 12 carbonyl groups are present. Hence, the prefix dodeca is used.

S5. Ans. (c)

Sol. Oxidation of acetaldehyde with SeO2 gives glyoxal.

$CH_3CHO + SeO_2 \rightarrow OHC - CHO(glyoxal) + Se + H_2O$

S6. Ans. (d)

Sol. The lattice site in a pure crystal cannot be occupied by electrons; because in each lattice point of a pure crystal (no impurity) there is only space for either molecule or atom or ions which are essentially joined together in straight lines and leads to a specific geometrical shape for each crystal.

They are also arranged in the stoichiometric ratio which is fixed in proportion.

But electrons can only occupy lattice points when there is a vacancy or defect in the corresponding crystal, i.e., when crystal is no more in its pure form (when crystal have impurities).

Hence, the lattice site in a pure crystal cannot be occupied by electrons.

S7. Ans. (b)

Sol. $K_4[Fe(CN)_6]$ is the most effective electrolyte for the coagulation of $Fe_2O_3.H_2O/Fe^{3+}$ solution.

Fe3+ is positive so it is coagulated by negative ion.

More the valency of negative ion, more is the coagulating power.

S8. Ans. (a)

Sol. The extraction of chlorine from brine is based on the oxidation of Cl- ion.

$2H_2O + 2Cl^- \rightarrow H_2 + Cl_2 + 2OH^-$

S9. Ans. (a)

Sol. [A] The molecular geometry of XeF_6 is the sp^3d^3, which is also called a distorted octahedral or square bipyramidal after Hybridization.

[B] XeO_3

Hybridisation of Xe $= \frac{\text{No. of valence} + \text{No. of surrounding atoms} - \text{cationic charge} + \text{anionic charge}}{2}$

(Oxygen is not counted as surrounding atom while calculating hybridisation using this formula)

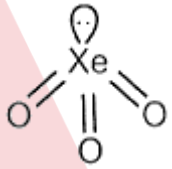
$= \frac{8}{2}$

$= 4$

$= sp^3$

Geometry = tetrahedral (1 lone pair)

Shape = pyramidal



[C] The Xenon oxyfluoride( ) is square pyramidal in shape with sp^3d^2 hybridization.

[D] The shape of XeF_4 is square planar. The central Xe atom has 4 bond pairs of electrons and two lone pairs of electrons. It undergoes sp^3d^2 hybridization which results in octahedral electron geometry and square planar molecular geometry.

S10. Ans. (b)

Sol. In Chemisorption, which is extremely specific, chemical bonds between the adsorbate and adsorbent are formed, which might be covalent or ionic.

Chemisorption has high adsorption enthalpy, nearly 80 to 240 kJ/mol. It favours low temperature.

S11. Ans. (c)

Sol. [A] Carbylamine reaction occurs only with primary amines and not secondary and tertiary amines. It is used for distinguishing primary amine from secondary and tertiary amine, and the Carbylamine reaction, in this case, is known as Hoffmann's isocyanide test.

[B] One way to distinguish between formic acid and acetic acid is Tollen's test.

[C] Iodoform test is generally used to determine the presence of methyl group on the adjacent carbon

of the functional group attached carbon atom. This means an iodoform test is performed to distinguish methyl ketones from all the other ketones.

[D] Lucas test is used to differentiate and categorize primary, secondary and tertiary alcohols using a solution of anhydrous zinc chloride in concentrated hydrochloric acid.

S12. Ans. (c)

Sol. [A] Rate laws or rate equations are mathematical expressions that describe the relationship between the rate of a chemical reaction and the concentration of its reactants.

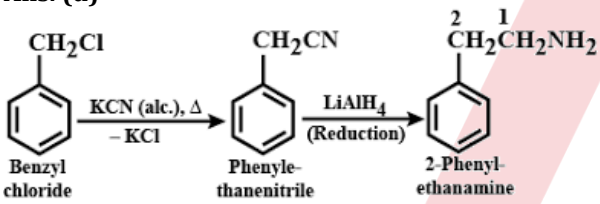
[B] For a zero-order reaction, the rate law is rate = k, where k is the rate constant.

[C] If the value of n is 0, it will be zero order reaction and if it is 1 then it first order reaction and so on. Therefore, in the zero-order reaction, the rate is independent of the concentration of reactants and hence, the units of rate and rate constant becomes equal which is mol/L/time.

[D] Order of a complex reaction can be determined by determining its mechanism, generally using the rate determining step.

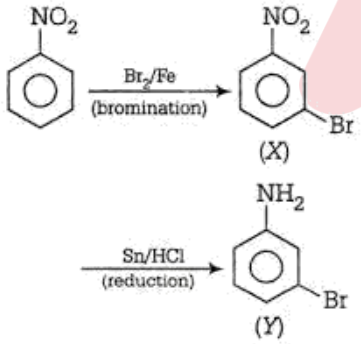
S13. Ans. (d)

Sol.



S14. Ans. (c)

Sol.



S15. Ans. (a)

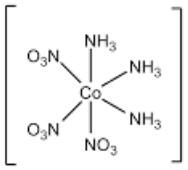
Sol. The synthesis of alkyl fluorides is best accomplished by Swarts reaction.

Alkyl bromides or alkyl chlorides are heated in presence of metallic fluorides such as AgF, CoF_2, SbF_5 or Hg_2F_2 to obtain alkyl fluorides.

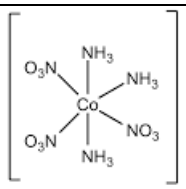
$CH_3-Cl+AgF \rightarrow CH_3-F+AgCl$

S16. Ans. (b)

Sol.



cis or fac or facial



trans or mer or meridional

S17. Ans. (b)

Sol. Chemisorption has high adsorption enthalpy, nearly 80 to 240 kJ/mol. The chemical reaction requires energy (activation energy) to begin. As a result, chemisorption is more advantageous at higher temperatures.

S18. Ans. (d)

Sol. Physical adsorption is considered as an exothermic process, although its enthalpy of adsorption is low (about 20–40kJmol−1) since the attraction between gas molecules and the surface of a solid is solely owing to a weak Van der Waals force.

S19. Ans. (b)

Sol. Isopropyl alcohol (CH3)2CHOH will give a positive iodoform test as it can be easily oxidized to acetone CH3COCH3- a methyl ketone.

Methyl ketone gives a positive iodoform test.

[] sec-butyl alcohol is secondary alcohol that contains Methyl Groups in Alpha Position hence sec-butyl alcohol show the iodoform test.

[D] Ethanol forms acetaldehyde on oxidation, so it gives the iodoform test.

S20. Ans. (b)

Sol. HNO_3=+5

NO=+2

NH_4Cl=−3

N_2=0

So the correct order will be HNO_3, NO, N_2, NH_4Cl

S21. Ans. (d)

Sol. The standard reduction potential is the reduction potential of a molecule under specific, standard conditions.

Standard reduction potentials can be useful in determining the directionality of a reaction. The reduction potential of a given species can be considered to be the negative of the oxidation potential.

The E^0 values of the copper and zinc electrodes are as follows :

$Zn^{2+}(aq)+2e^- \rightarrow Zn(s), E^0=-0.76V$

$Cu^{2+}(aq)+2e^- \rightarrow Cu(s), E^0=-0.34V$

This shows that zinc is a stronger reducing agent than copper. It will lose electrons to Cu^{2+} ions and a redox reaction will immediately set in.

S22. Ans. (a)

Sol. $k=A\, e^{-Ea/RT}$

$\therefore \ln k=\ln A-EaRT.$

Hence, graph of ln k vs 1T will be linear with negative slope and intercept = ln A

S23. Ans. (d)

Sol. [A] The cubic unit cell is the smallest repeating unit

when all angles are 90 o and all lengths are equal

[B] The monoclinic lattice has no sides of equal length, but two of the angles are equal to 90°, with the other angle (usually defined as β) being something other than 90°

[C] In the triclinic lattice none of the sides of the unit cell are equal, and none of the angles within the unit cell are equal to 90°.

[D] A hexagonal crystal structure has two angles equal to 90°, with the other angle (γ) equal to 120°

The fourteen existing arrangements of seven crystal systems are called Bravais Lattices.

Name of Crystal System	Possible Variations	Edge Lengths	Interaxial Angles	Example
1. Cubic	(a) Primitive (b) Body-Centred (c) Face-Centred	a = b = c	α = β = γ = 90°	Ag, Cu, Zinc blende NaCl, KCl, diamond
2. Tetragonal	(a) Primitive (b) Body-Centred	a = b ≠ c	α = β = γ = 90°	$CaSO_4$, white tin, TiO_2, SnO_2
3. Orthorhombic	(a) Primitive (b) Body-Centred (c) Face-Centred (d) End-Centred	a ≠ b ≠ c	α = β = γ = 90°	Rhombic Sulphur KNO_3, $PbCO_3$, $CaCO_3$, $BaSO_4$, K_2SO_4
4. Monoclinic	(a) Primitive (b) End-Centred	a ≠ b ≠ c	α = γ = 90° β ≠ 90°	Monoclinic Sulphur $Na_2SO_4.10H_2O$ $PbCrO_4$
5. Triclinic	Primitive	a ≠ b ≠ c	α ≠ β ≠ γ ≠ 90°	$K_2Cr_2O_7$, $CuSO_4.5H_2O$ H_3BO_3
6. Hexagonal	Primitive	a = b ≠ c	α = β = 90° γ = 120°	Graphite, ZnO, CdS
7. Rhombohedral or Trigonal	Primitive	a = b = c	α = β = γ ≠ 90°	Calcite ($CaCO_3$) Cinnabar (HgS) Quartz, Sb

Hence, the crystal system cannot be Hexagonal Crystal System and Monoclinic crystal syste,.

S24. Ans. (d)

Sol. Most of the medicines are colloidal in nature as colloidal medicines are more effective because they have large surface area and are therefore easily assimilated. The range of diameter of colloidal particles is between 1 and 1000 nm.

S25. Ans. (d)

Sol. Estrogen and progesterone are the sex hormones in females. Estrogen is responsible for the development of secondary sexual characters in females and progesterone is required to maintain pregnancy and delivery.

S26. Ans. (a)

Sol. $4/3\ Al + O_2 \rightarrow 2/3Al_2O_3$,

$\Delta G = -827\ kJ\ mol^{-1}$

$\Delta G = -nFE^0$ (n = 4)

$-827 \times 10^3\ J = -4 \times E^0 \times 96500$

$E = 827 \times 10^3/4 \times 96500$

$E = 2.14\ V$

S27. Ans. (b)

Sol. (1)

$$\underset{\text{Sodium propanoate}}{C_2H_5COONa} + \underset{\text{Sodium hydroxide}}{NaOH} \longrightarrow \underset{\text{Ethane}}{C_2H_6} + Na_2CO_3$$

S28. Ans. (a)

Sol. Carbonyl compounds undergoes nucleophilic addition reaction. (image i)

If group or atom attached with carbonyl carbon shows negative inductive effect, then it decreases electron density or carbonyl carbon and facilitate the attack of nucleophiles, hence reactive of carbonyl compound increases. (image ii)

If group or atom attached with carbonyl carbon shows positive inductive effect, then it increases electron density or carbonyl carbon and suppress the attack of nucleophiles, hence reactivity of carbonyl compound decreases.

The aromatic aldehydes and ketones are less reactive than their aliphatic analogues. This is due to the +R effect of benzene ring.

On the basis of above information the increasing order of the nucleopihilic addition reaction in the following compound will be

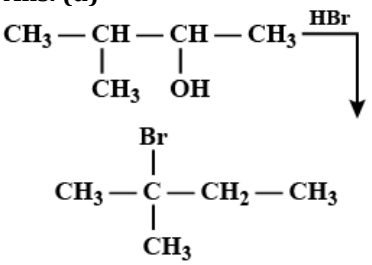
$CH_3CHO > CH_3COCH_3 > PhCOCH_3 > PhCOPh$

S29. Ans. (a)

Sol. Because of the + R effect of halogen atom, CX bond of aryl halide has some double bond character, hence it is inert towards nucleophile and approach of nucleophile is retarded.

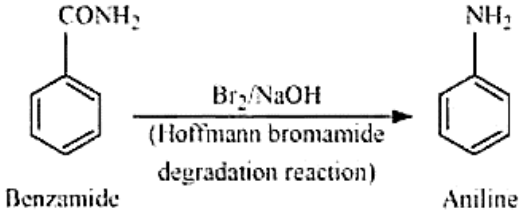
S30. Ans. (d)

Sol.



S31. Ans. (b)

Sol.



S32. Ans. (a)

Sol. $2.303 \log K = 2.303 \log A - E_a/RT$

Given $E_a = 2.303\ RT$

$2.303 \log K = 2.303 \log A - 2.303\ RT/RT$

(or) $\log K = \log A - 1$

$\text{Log } K/A = -1$ or $K/A = 10^{-1}$

S33. Ans. (a)

Sol. [A] $K_4[Fe(CN)_6] \rightarrow 4\ K^+ + [Fe(CN)_6]^{4-}$

Since one molecule of $K_4[Fe(CN)_6]$ dissociates to produce 5 ions, the value of van't Hofff factor is 5.

[B] At infinite dilution, each molecule gives 3 ions, hence the Van't Hoff factor, i = 3

[C] In benzene, two molecules of ethanoic acid associate to form a dimer.

$2CH_3COOH \rightleftharpoons (CH_3COOH)_2$

The van't Hoff factor i = number of solute particles in solution/theoretical number of solute particles for no association

i=1/2=0.5

[D] The van't Hoff factor is the number of particles into which the atom divides itself in the solution. It can also be defined as the number of ions formed by the compound in the solution, is known as van't Hoff factor. Therefore, van't Hoff factor is 2 KCl

S34. Ans. (b)

Sol. First let's write down the reaction.

$Mn^{7+} + 5e^- \rightarrow Mn^{2+}$

In this reduction reaction, you can see that for 1 mole of Mn^{7+} we will need 5 mole of electrons for conversion to Mn^{2+}

Therefore, we need 5×96500 C = 4.83×10^5 C of charge

S35. Ans. (d)

Sol. In a redox reaction, the element above can push the element below out of a group.

Bromine gas can displace iodine compounds but not fluorine or chlorine when it is passed through solutions of NaF, NaCl, and NaI.

$2NaI + Br_2 \rightarrow 2NaBr + I_2$

Iodine gas is released.

S36. Ans.(c)

Sol. [A] Zone refining is a very useful method to get metals with high purity such as silicon and germanium.

[B] Nickel is refined by the Mond process.

[C] Electrolytic refining is a technique used for the extraction and purification of metals by the process of electrolysis. Metals like copper, nickel, gold, lead, silver, and zinc can be purified using electrolytic refining.

[D] Van arkel method is used to purifiy Ti, B, Hf & Zr.

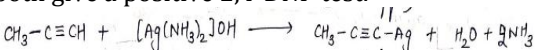
S37. Ans. (a)

Sol. [A] $C_6H_5COCH_2CH_3$ is ethyl phenyl ether or phenetole is an organic compound that is ether.

[B] $C_6H_5O(CH_2)_6CH_3$ Heptyl Phenyl Ether

S38. Ans. (c)

Sol. [A] In the case of the two compounds you mentioned, C6H5CH2CHO and C6H5CHO, both of them contain a carbonyl group, so they should both give a positive 2,4-DNP test.

[B] 

[C] To form a cyanohydrin, a hydrogen cyanide adds reversibly to the carbonyl group of an organic compound thus forming a hydroxyalkanenitrile adducts (commonly known and called as cyanohydrins)

[D] I^- is a strong nucleophile because it is polarizable, making it faster for its orbitals to overlap with the electrophile.

S39. Ans. (a)

S40. Ans. (b)

Sol. Relationship between mole fraction of a component in the vapour phase and total vapour pressure of an ideal solution

$y_A = PA/P_{total} = x_A.P^0_A/x_A.p^0_A + x_B.p^0_B$

$= 1 \times 1/(1 \times 1 + 2 \times 2) = 1/(1+4) = 1/5 = 0.2$

S41. Ans. (a)

Sol. Transition elements exhibit variable valency to form intermediate compounds. Hence they act as a good catalyst. The catalytic activity of the transition metals and their compounds is described to their ability to adopt multiple oxidation states and their complexing ability.

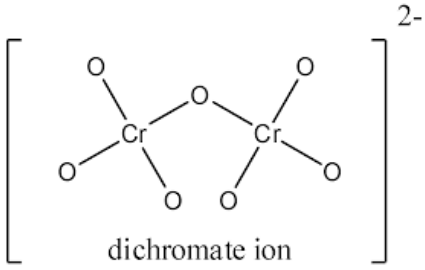
S42. Ans. (b)

Sol. [B] All the members of Lanthanoids exhibit only +3 oxidation state in common without any exception

[D] $La(OH)_3$ is the most basic, while Lu(OH)3 is the least basic.

S43. Ans. (d)

Sol. There ar six equivalent Cr-O bonds and one Cr-O-Cr bond.



S44. Ans. (b)

Sol. The order can be explained using the idea of spin correlation. Spin correlation refers to lowering of energy for like (parallel) spins. Spin correlation leading to decrease in repulsion for electrons of like spins than for electrons of different spins is called exchange energy.
Spin correlation and its exchange energy gives an electronic configuration a special stability which is greatest for half-filled electronic configurations. Mn^{2+} (d^5) gets stabilisation due to half-filled configuration. In Fe^{2+} (d^6) the placing of one extra electron in a subshell destabilises. Placing of 2 electrons in Co^{2+} (d^7) destabilises it more. Cr^{2+} (d^4) has one vacant subshell. Fe^{2+} gets more stabilisation compared to Cr^{2+} through exchange energy. So the order is as follows:
Mn > Fe > Cr > Co

S45. Ans. (d)

Sol. Higher oxidation state is related to the number of bond formation in the compound. Since Fluorine(F) can form only single bonds while Oxygen(O) forms double bond

S46. Ans. (d)

Sol. Denaturation is a biological process that alters a protein's molecular structures.
Denaturation breaks down the protein's secondary and tertiary structures while leaving the fundamental (primary) structure intact.
Final Answer: Only the primary structure of the protein remains intact during denaturation.

S47. Ans. (c)

Sol. The main difference between the sugar molecules in DNA (deoxyribonucleic acid) and RNA (ribonucleic acid) lies in their chemical structure.

S48. Ans. (b)

Sol. Scurvy occurs when there is a lack of vitamin C (ascorbic acid). The deficiency leads to symptoms of weakness, anemia, gum disease, and skin problems. This is because vitamin C is necessary to make collagen, an important component in connective tissues.

S49. Ans. (a)

Sol. Essential amino acids cannot be made by the body. As a result, they must come from food. The 9 essential amino acids are: histidine, isoleucine, leucine, lysine, methionine, phenylalanine, threonine, tryptophan, and valine.

S50. Ans. (a)

Sol. Vitamin D cannot be stored in our body. Reason: Vitamin D is fat soluble vitamin and is excreted out of the body with urine.