CBSE Board
Class XI
Chemistry
Sample Paper 4

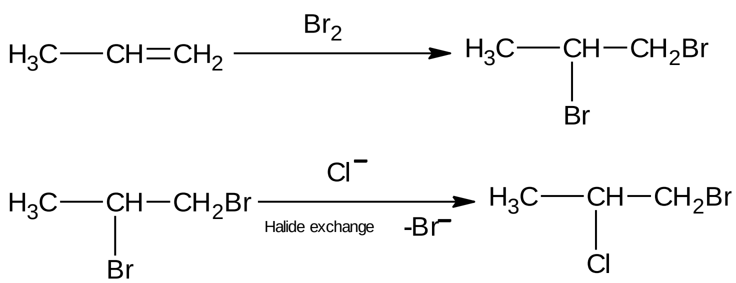
Q1. Consider the following reaction

$$CH_3 - CH = CH_2 \xrightarrow{Br_2/NaCl}$$

Product of the reaction will be

(a) only 1, 2 – dibromopropane
(b) only 1 – bromo – 2 – chloropropane
(c) only – 2 – bromo – 1 – chloropropane
(d) mixture of 1, 2 – dibromopropane and 1 – bromo – 2 – chloropropane

Sol. (d)



Q2. Reaction between iron and steam is reversible if it is carried out

$$3Fe + 4H_2O \longrightarrow Fe_3O_4 + 4H_2$$

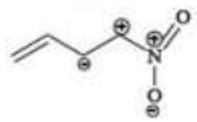
(a) At constant T
(b) At constant P
(c) In an open vessel
(d) In a closed vessel

Sol. (d)

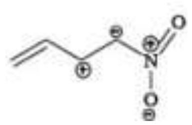
In open vessel H_2 gas will escape.

Q3. Among the following the least stable resonance structure is

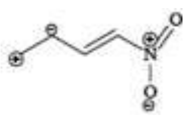
(a)



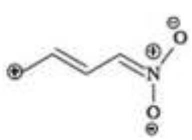
(b)



(c)

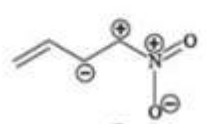


(d)



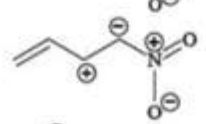
Sol. (a)

(A)

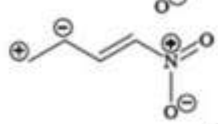


Same charges are present at nearest position (Less stable)

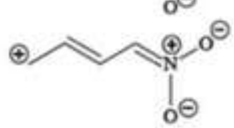
(B)



(C)



(D)



Transweb Educational Services Pvt Ltd
B -147, Sector -6 Noida, UP - 201301,
www.askiitians.com
Email: info@askiitians.com
Tel: 1800-2000-838

Q4. Statement -1: In water, orthoboric acid behaves as a weak monobasic acid. Because

Statement -2: in water, orthoboric acid acts as a proto donor.

(a) Statement -1 is True, Statement -2 is True; statement -2 is correct explanation for statement -1.
(b) Statement -1 is True, statement -2 is True; statement -2 is NOT a correct explanation for statement -1.
(c) Statement -1 is True, statement -2 is False.
(d) Statement -1 is False, statement -2 is True.

Sol. (c)

H_3BO_3(orthoboric acid) is a weak lewis acid.

$H_3BO_3 + H_2O \rightleftharpoons B(OH)_4^- \ H$

It does not donate proton rather it acceptors OH^- form water.

Q5. Consider a titration of potassium dichromate solution with acidified Mohr's salt solution using diphenylamine as indicator. The number of moles Mohr's salt required per mole of dichromate is

(a) 3
(b) 4
(c) 5
(d) 6

Sol. (d)

$Cr_2O_7^{2-} + Fe^{2+} \rightarrow Fe^{3+} + Cr^{3+}$

N factor of $Cr_2O_7^{2-} = 6$

N factor of $Fe^{2+} = 1$

So to reduce one mole of dichromate 6 moles of Fe^{2+} are required.

Q6. For the process $H_2O(1)(1 \text{ bar}, 373 \text{ K}) \rightarrow H_2O(g)(1 \text{ bar}, 373 \text{ K})$, the correct set of thermodynamic parameters is

(a) $\Delta G = 0, \Delta S = +ve$
(b) $\Delta G = 0, \Delta S = -ve$
(c) $\Delta G = +ve, \Delta S = 0$
(d) $\Delta G = -ve, \Delta S = +ve$

Sol. (a)

$$\underset{(1\ \text{bar}, 373\ \text{K})}{H_2O(\ell)} \rightleftharpoons \underset{(1\ \text{bar}, 373\text{K})}{H_2O(g)}$$

At 100°C $H_2O(\ell)$ has equilibrium with $H_2O(g)$ therefore ΔG=0.

Because liquid molecules are converting into gases molecules therefore ΔG = + ve

Q7. The number of stereoisomers obtained by bromination of trans-2 butene is

(a) 1
(b) 2
(c) 3
(d) 4

Sol. (a)

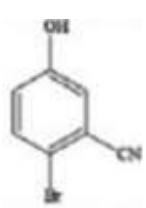
Q8. Statement -1: Molecules that are not superimposable on their mirror images are chiral because

Statement-2 : All chiral molecules have chiral centres.

(a) Statement -1 is True, Statement -2 is True Statement -2 is a correct explanation for statement -1
(b) Statement -1 is True, Statement -2 is True; Statement -2 is NOT a correct explanation for Statement -1
(c) Statement -1 is True, Statement -2 is False
(d) Statement -1 is False, Statement -2 is True

Sol. (c)

Q10. The IUPAC name of the following compound is



(a) 4-Bromo-3-cyanophenol
(b) 2-Bromo-5-hydroxybenzonitrile
(c) 2-Cyno-4hydroxybromobenzocne

(d) 6-Bromo-3hdyroxybenzonitrile

Sol. (b)

Priority of CN is highest.

Q11. A gas described by van der Waal's equation

(a) Behaves similar to an ideal gas in the limit of large molar volumes
(b) Behaves similar to an ideal gas in the limit of large pressures
(c) Is characterized by van der Waal's coefficients that are dependent on the identify of the gas but are independent of the temperature
(d) Has the pressure that is lower than the pressure exerted by the same gas behaving ideally

Sol. (a, c, d)

$$\left(P+\frac{n^2a}{V^2}\right)(V-nb)=nRT$$

At low pressure, when the sample occupies a large volume, the molecules are so far apart for most of the time that the intermolecular forces play no significant role, and the gas behaves virtually perfectly.

A and B are characteristic of a gas and are independent of temperature. Then term $\left(P+\frac{n^2\,a}{V^2}\right)$ represents the pressure exerted by an ideal gas while P represents the pressure exerted by a real gas.

Q12. 2.5 mL of $\frac{2}{5}$ M weak monoacidic base ($K_b = 1 \times 10^{12}$ at 25°C) is titrated with $\frac{2}{15}$ M HCl in water at 25°C. The concentration of H^+ at equivalence point is ($K_w = 1 \times 10^{-14}$at 25°C)

(a) 3.7×10^{13} M
(b) 3.2×10^{-7} M
(c) 3.2×10^{-2} M
(d) 2.7×10^{-2} M

Sol. (d)

$$BOH + HCl \rightarrow BCl + H_2O$$

$$B^+ \quad + \quad H_2O \rightleftharpoons BOH \quad + \quad H^+$$

$$C(1-h) \qquad\qquad Ch \qquad\qquad Ch$$

Volume of HCl used $= \frac{2.5\frac{2}{5}}{2/15} = 7.5\text{ ml}$

Concentration of Salt, $C = \frac{2.5\frac{2}{5}}{10} = 0.1\text{ M}$

$\therefore \frac{Ch^2}{1-h} = \frac{K_w}{K_b}$

Solving h = 0.27

$[H^+] = Ch = 0.1 \times 0.27 = 2.7 \times 10^{-2}\text{ M}$

Q13. The term that corrects for the attractive forces present in a real gas in the van der Waals equation is

(a) nb
(b) $\frac{an^2}{V^2}$
(c) $-\frac{an^2}{V^2}$
(d) $-\text{nb}$

Sol. (b)

The measure of force of attraction for 'n' moles of real gas $\left[\frac{n^2a}{V^2}\right]$

$\left(P + \frac{n^2a}{V^2}\right)(V - nb) = nRT$

Q14. In the reaction with Tollen's reagent acetylene shows

(a) Oxidizing property
(b) Reducing property
(c) Basic property
(d) Acidic property

Sol. (d)

Acidic hydrogen of acetylene is replaced by Ag^+ ion of Tollen's reagent.

Q15. Statement -1: The geometrical isomers of the complex $[M(NH_3)_4Cl_2]$ are optically inactive. And

Statement -2: Both geometrical isomers of the complex $[M(NH_3)_4Cl_2]$ possess axis of symmetry.

(a) Statement-1 is True, statement-2 is True; statement-2 is correct explanation for statement-1
(b) Statement-1 is True, statement-2 is true; statement-2 is NOT a correct explanation for statement -1
(c) Statement-1 is True, statement -2 is False
(d) Statement -1 is False, statement -2 is True

Sol. (b)

Q16. Solubility product constant (K_{ap}) of salts of types MX, MX_2 and M_3X at temperature 'T' are 4.0×10^{-8}, 3.2×10^{-14} and 2.7×10^{15}, respectively. Solubilities (mole dm^{-3}) of the salts at temperature 'T' are in the order

(a) $MX > MX_2 > M_3X$
(b) $M_3X > MX_2 > mX$
(c) $MX_2 > M_3X > MX$
(d) $MX > M_3X > MX_2$

Sol. (d)

Solubility of $(MX) = \sqrt{4 \times 10^{-8}} = 2 \times 10^{-4}$

Solubility of $(MX_2) = 8 \times 10^{-5}$

Solubility of $(M_3X) = 1 \times 10^{-4}$

$\therefore$ MX $> M_3X > MX_2$

Q17. The species which by definition has ZERO standard molar enthalpy of formation at 298 K is

(a) $Br_2(g)$
(b) $Cl_2(g)$
(c) $H_2O(g)$
(d) $CH_4(g)$

Sol. (b)

Cl_2 is gas at 298 K while Br_2 is a liquid.

Transweb Educational Services Pvt Ltd
B -147, Sector -6 Noida, UP - 201301,
www.askiitians.com
Email: info@askiitians.com
Tel: 1800-2000-838

Q18. Native silver metal forms a water soluble complex with a dilute aqueous solution of NaCN in the presence of

(a) Nitrogen
(b) Oxygen
(c) Carbon dioxide
(d) Argon

Sol. (b)

Ag dissociates in a solution of NaCN in the presence of air, and forms sodium argentocyanide.

$4Ag + 8NaCN + 2H_2O + O_2 \rightarrow 4Na[Ag(CN)_2] + 4NaOH$

Q19. The compound(s) formed upon combustion of sodium metal in excess air is(are)

(a) Na_2O_2
(b) Na_2O
(c) NaO_2
(d) $NaOH$

Sol. (a, b)

In dry air

Q20. Match each of the reactions given in Column I with the corresponding product(s) given in Column II>

Column – I	Column – II
(a) $Cu + dil\ NHO_3$	(p) NO
(b) $Cu + conc\ HNO_3$	(q) NO_2
(c) $Zn + dil\ HNO_3$	(r) N_2O
(d) $Zn + conc\ HNO_3$	(s) $Cu(NO_3)2$

(a) $\left((A-p,s)(B-q,s)(C-r,t)(D-q,t)\right)$
(b) $\left((A-r,t)(B-q,s)(C-q,p)(D-q,t)\right)$
(c) $\left((A-t,s)(B-q,s)(C-r,t)(D-q,p)\right)$
(d) $\left((A-p,r)(B-q,s)(C-p,t)(D-q,t)\right)$

Sol. (a)

$\left((A-p,s)(B-q,s)(C-r,t)(D-q,t)\right)$

$3Cu + dil\ 8HNO_3 \rightarrow 3Cu(NO_3)_2 + 4H_2O + 2NO$

$Cu + conc.\ 4HNO_3 \rightarrow Cu(NO_3)_2 + 2H_2O + 2NO_2$

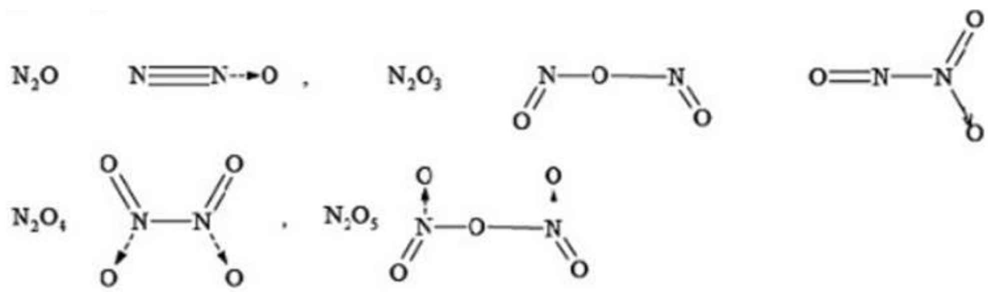
$4Zn + dil\ 10HNO_3 \rightarrow 4Zn(NO_3)_2 + 5H_2O + N_2O$

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

Q21. The nitrogen oxide(s) that contain(s) N-H bond(s) is(are)

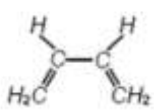
(a) N_2O
(b) N_2O_3
(c) N_2O_4
(d) N_2O_3

Sol. (a, b, c)

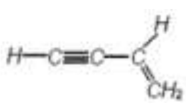


Q22. Amongst the given options, the compound(s) in which all the atoms are in one plane in all the possible conformation (if any), is (are)

(a)



(b)



(c) $H_2C = C = O$
(d) $H_2C = C = CH_2$

Sol. (a, b, c)

Taking only stable conformers in account

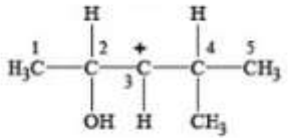
Q23. Among the following, the state functions(s) is(are)

(a) Internal energy
(b) Irreversible expansion work
(c) Reversible expansion work
(d) Molar enthalpy

Sol. (a, d)

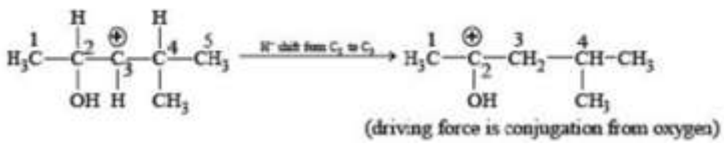
Transweb Educational Services Pvt Ltd
B -147, Sector -6 Noida, UP - 201301,
www.askiitians.com
Email: info@askiitians.com
Tel: 1800-2000-838

Q24. In the following carbocation. H/CH_3 that is most likely to migrate to the positively charged carbon is



(a) CH_3 at $C-4$
(b) H at $C-4$
(c) CH_3at $C-2$
(d) H at $C-2$

Sol. (d)



Q25. Match the entries in Column I with the correctly related quantum number(s) in Column II> Indicate your answer by darkening the appropriate bubbles of the 4 × 4 matrix given in the ORS.

Column I	Column II
(a) Orbital angular momentum of the electron in a hydrogen-like atomic orbital	(p) Principal quantum number
(b) A hydrogen-like one-electron wave function obeying pauli principle	(q) Azimuthal quantum number
(c) Shape, size and orientation of hydrogen-like atomic orbitals Probability density of electron at the nucleus in hydrogen-like atom	(r) Magnetic quantum number
(d) Probability density of electron at the nucleus in hydrogen-like atom	(s) Electron spin quantum number

(a) A – q , B – s , C – p,q,r , D – p,q,r
(b) A – p , B – s , C – p,q,r , D – p,q,r
(c) A – s , B – r , C – p,q,r , D – p,q,r
(d) A – s , B – q , C – p,q,r , D – p,q,r

Sol. (a) A- q

B – s

C – p, q, r

D- p, q, r

Q26. Dissolving 120g of urea $(\text{mol. wt } 60)$ in 1000g of water gave a solution of density 1.15g/mL. The molarity of the solution is

(a) 1.78 M
(b) 2.00 M
(c) 2.05 M
(d) 2.22 M

Sol. (c)

Q27. Match the transformation in Column I with appropriate options in Column II

Column I	Column II
(a) $CO_2(s) \rightarrow CO_2(g)$	(p) Phase transition
(b) $CaCO_3(s) \rightarrow CaO(s) + CO_2(g)$	(q) Allotropic change
(c) $2H \rightarrow H_2(g)$	(r) ΔH is positive
(d) $P_{(\text{white,solid})} \square\square\square\square\rightarrow P_{(\text{red,solid})}$	(s) ΔS is positive
	(t) ΔS is negative

(a) a → (p, r, s) , b → (r, s) , c→ (r) , d→ (q, r)
(b) a → (p, r, s) , b → (r, s) , c→ (q) , d→ (q, r)
(c) a → (p, r, s) , b → (r, s) , c→ (t) , d→ (q, r)
(d) a → (p, r, s) , b → (r, s) , c→ (s) , d→ (q, r)

Sol. (c)

a → (p, r, s) b → (r, s) c→ (t) d→ (q, r)

Q28. Dissolving 120g of urea (mol. Wt 60) in 1000g of water gave a solution of density 1.15g/mL. The molarity of the solution is

(a) 1.78 M
(b) 2.00 M
(c) 2.05 M
(d) 2.22 M

Sol. (c)

Q29. Aqueous solutions of HNO_3, KOH, CH_3COOH, and CH_3COONa of identical concentrations are provided. The pair (s) of solutions which form a buffer upon mixing is(are)

(a) HNO_3 and CH_3COOH

Transweb Educational Services Pvt Ltd
B -147, Sector -6 Noida, UP - 201301,
www.askiitians.com
Email: info@askiitians.com
Tel: 1800-2000-838

(b) KOH and CH_3COONa
(c) HNO_3 and CH_3COONa
(d) CH_3COOH and CH_3COONa

Sol. (c, d)

IN option (C), if HNO_3 is present in limiting amount then this mixture will be a buffer. And the mixture given in option (D), contains a weak acid (CH_3COOH) and its salt with strong base $NaOH$, i.e. CH_3COONa.

Q30. The reagent(s) used for softening the temporary hardness of water is(are)

(a) $Ca_3(PO_4)_2$
(b) $Ca(OH)_2$
(c) Na_2CO_3
(d) $NaOCl$

Sol. (b, c, d)

$Ca(HCO_3)_2 + Ca\,(OH)_2 \rightarrow 2CaCO_3 \downarrow\ + 2H_2O$

[Clarke's method]

$NaOCl + H_2O \rightleftharpoons HOCl + NaOH$

$OH^- + CHO_3^- \rightarrow CO_3^{2-} + H_2O$

$Ca(HCO_3)_2 + Na_2CO_3 \rightarrow CaCO_3 \downarrow\ + 2NaHCO_3$