NEET–2018
CHEMISTRY PAPER

1. The correct order of N-compounds in its decreasing order of oxidation states is

(1) HNO_3, NH_4Cl, NO, N_2 (2) HNO_3, NO, NH_4Cl, N_2

(3) HNO_3, NO, N_2, NH_4Cl (4) NH_4Cl, N_2, NO, HNO_3

Solution

(3) The decreasing order of oxidation states of N-compounds is as follows:

$$H\overset{(+5)}{N}O_3 > \overset{(+2)}{N}O > \overset{0}{N}_2 > \overset{(-3)}{N}H_4Cl$$

2. Which one of the following elements is unable to form MF_6^{3-} ion?

(1) B (2) Al (3) Ga (4) In

Solution

(1) Boron does not contain vacant *d* orbitals hence it cannot extend its covalency beyond 4.

3. Considering Ellingham diagram, which of the following metals can be used to reduce alumina?

(1) Mg (2) Zn (3) Fe (4) Cu

Solution

(1) In a number of processes, one metal is used to reduce the oxide of another metal. Any metal will reduce the oxide of other metals which lie above it in the Ellingham diagram because the Gibbs energy will become more negative by an amount equal to the difference between the two graphs at that particular temperature. Mg is below Al_2O_3 in the Ellingham diagram hence it can reduce alumina.

4. The correct order of atomic radii in group 13 elements is

(1) B < Ga < Al < Tl < In (2) B < Al < Ga < In < Tl

(3) B < Al < In < Ga < Tl (4) B < Ga < Al < In < Tl

Solution

(4) The metallic radii of the atoms do not increase regularly on descending the group. Ga, In and Tl follow immediately after a row of ten transition elements. They therefore have ten *d* electrons, which are less efficient at shielding the nuclear charge than the *s* and *p* electrons. (Shielding is in the order $s > p > d > f$.) Poor shielding of the nuclear charge results in the outer electrons being more firmly held by the nucleus. Thus atoms with a d^{10} inner shell are smaller than would otherwise be expected. Hence, the correct order is B < Ga < Al < In < Tl.

5. Which of the following statements is not true for halogens?

(1) All but fluorine show positive oxidation states. (2) All are oxidizing agents.

(3) All form monobasic oxyacids. (4) Chlorine has the highest electron-gain enthalpy.

WILEY

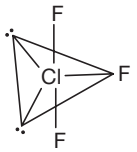
Solution

(1) The ionization energy for fluorine is appreciably higher than for the others, because of its small size. F always has an oxidation state of (–I) except in F_2. It forms compounds either by gaining an electron to form F^-, or by sharing an electron to form a covalent bond.

6. In the structure of ClF_3, the number of lone pairs of electrons on central atom 'Cl' is
(1) four. (2) two. (3) one. (4) three.

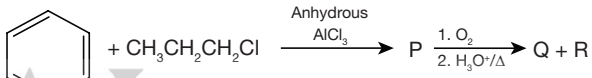
Solution

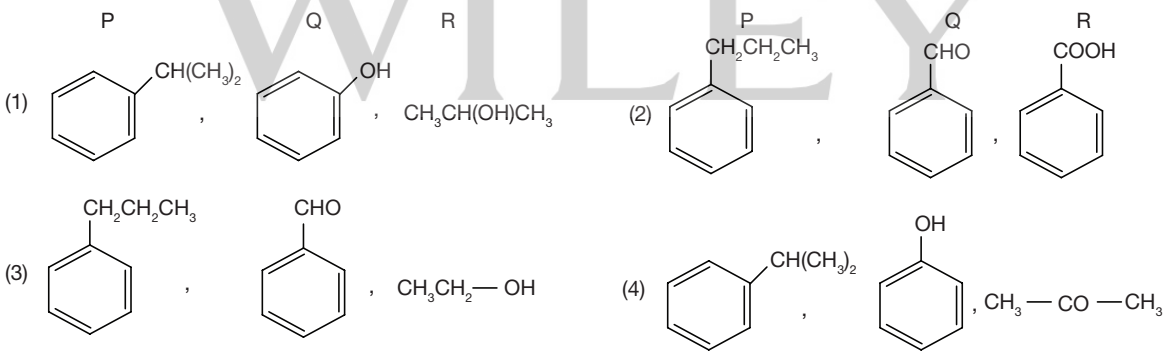
(2) The structure of ClF_3 is as follows:



There are two lone pairs of electrons on central atom Cl.

7. Identify the major products P, Q and R in the following sequence of reactions:

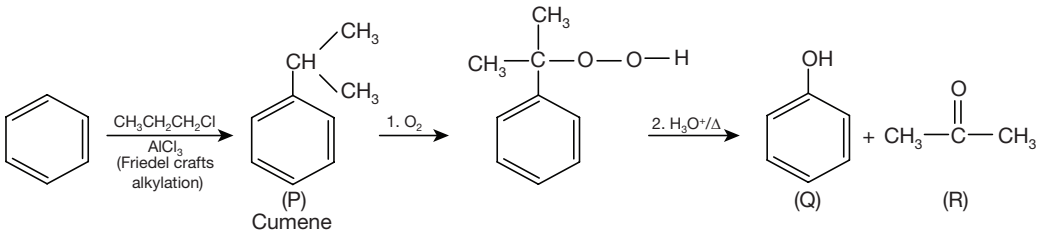




WILEY

Solution

(4)



8. Which of the following compounds can form a zwitterion?
(1) Benzoic acid (2) Acetanilide (3) Aniline (4) Glycine

Solution

(4) Amino acids exist as dipolar ions, a form in which the carboxyl group is present as a carboxylate ion, $-CO_2^-$, and the amino group is present as an aminium ion, $-NH_3^+$. Dipolar ions are also called zwitterions. Among the given compounds, glycine can exist as zwitterion.

$$\underset{\text{Glycine}}{H_2NCH_2CO_2H} \rightleftharpoons \underset{\text{Zwitterion}}{H_3\overset{+}{N}CH_2CO_2^-}$$

9. Regarding cross-linked or network polymers, which of the following statements is incorrect?
(1) Examples are bakelite and melamine.
(2) They are formed from bi-and tri-functional monomers.
(3) They contain covalent bonds between various linear polymer chains.
(4) They contain strong covalent bonds in their polymer chains.

Solution

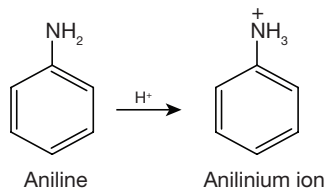
(4) When the functionality of monomer is 3 and above, cross-linked three-dimensional network of polymer is formed. They are linked by strong covalent bonds. In fact, whenever a multifunctional monomer is polymerized, the polymer ultimately forms a network polymer. For example, bakelite, urea–formaldehyde, etc.

10. Nitration of aniline in strong acidic medium also gives *meta*-nitroaniline because
(1) In absence of substituents nitro group always goes to *meta*-position.
(2) In electrophilic substitution reactions amino group is *meta*-directive.
(3) In spite of substituents nitro group always goes to only *meta*-position.
(4) In acidic (strong) medium aniline is present as anilinium ion.

WILEY

Solution

(4)



$-NH_3^+$ is a *meta* directing group, hence besides *ortho* and *para*, *meta* product also formed.

11. The difference between amylose and amylopectin is
(1) amylopectin have $1 \rightarrow 4$ α-linkage and $1 \rightarrow 6$ β-linkage.
(2) amylose have $1 \rightarrow 4$ α-linkage and $1 \rightarrow 6$ β-linkage.
(3) amylopectin have $1 \rightarrow 4$ α-linkage and $1 \rightarrow 6$ α-linkage.
(4) amylose is made up of glucose and galactose.

Solution

(3) Amylose typically consists of more than 1000 D-glucopyranoside units connected in α linkages between C1 of one unit and C4 of the next.

Amylopectin has a structure similar to that of amylose [i.e., $\alpha(1 \rightarrow 4)$ links], except that in amylopectin the chains are branched. Branching takes place between C6 of one glucose unit and C1 of another and occurs at intervals of 20–25 glucose units.

12. A mixture of 2.3 g formic acid and 4.5 g oxalic acid is treated with conc. H_2SO_4. The evolved gaseous mixture is passed through KOH pellets. Weight (in g) of the remaining product at STP will be

(1) 2.8 (2) 3.0 (3) 1.4 (4) 4.4

Solution

(1) Number of moles of formic acid = $\frac{2.3}{46} = 0.05$ mol

Number of moles of oxalic acid = $\frac{4.5}{90} = 0.05$ mol

The reactions involved are as follows:

	$HCOOH$	$\xrightarrow{\text{conc.}H_2SO_4}$	$CO(g)$ +	$H_2O(l)$
Initial moles	0.05 mol		0	0
Final moles	0		0.05 mol	0.05 mol

	$H_2C_2O_4$	$\xrightarrow{\text{conc.}H_2SO_4}$	$CO_2(g)$ +	$CO(g)$ +	$H_2O(l)$
Initial moles	0.05 mol		0	0	0
Final moles	0		0.05 mol	0.05 mol	0.05 mol

KOH will absorb CO_2 and H_2SO_4 will absorb water. Hence, the remaining product will be CO.
Total number of moles of CO = (0.05 + 0.05) mol = 0.1 mol
Therefore, weight of CO = 0.1 mol × 28 g mol^{-1} = 2.8 g

WILEY

13. Which of the following oxides is most acidic in nature?

(1) BaO (2) BeO (3) MgO (4) CaO

Solution

(2) As the atoms get larger, the ionization energy decreases and the elements also become more basic. Therefore, the basic strength increases on moving down the group while acidic strength decreases. Hence, BeO will be most acidic.

14. Which oxide of nitrogen is not a common pollutant introduced into the atmosphere both due to natural and human activity?

(1) N_2O (2) NO_2 (3) N_2O_5 (4) NO

Solution

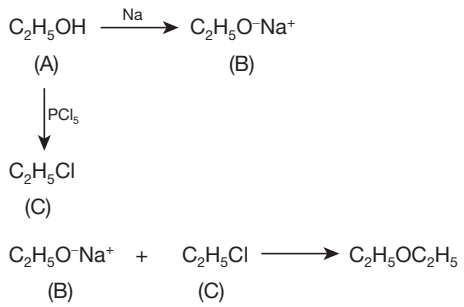
(3) The major nitrogen oxide produced from soil micro-organisms includes nitrous oxide (N_2O). Major anthropogenic releases of nitrogen oxides come primarily from fuel combustion, biomass burning and certain production processes. These processes emit a mixture of nitric oxide (NO) and nitrogen dioxide (NO_2). Thus, N_2O_5 is the least common pollutant.

15. The compound A on treatment with Na gives B, and with PCl_5 gives C. B and C react together to give diethyl ether. A, B and C are in the order

(1) C_2H_5Cl, C_2H_6, C_2H_5OH
(2) C_2H_5OH, C_2H_5Cl, C_2H_5ONa
(3) C_2H_5OH, C_2H_6, C_6H_5Cl
(4) C_2H_5OH, C_2H_5ONa, C_2H_5Cl

Solution

(4)



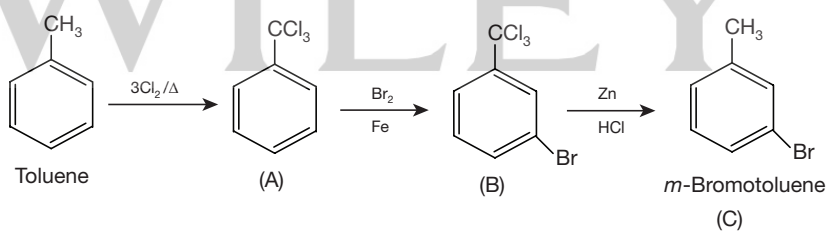
16. The compound C_7H_8 undergoes the following reactions:

$$C_7H_8 \xrightarrow{3Cl_2/\Delta} A \xrightarrow{Br_2/Fe} B \xrightarrow{Zn/HCl} C$$

The product 'C' is
(1) 3-bromo-2,4,6-trichlorotoluene.
(2) *o*-bromotoluene.
(3) *m*-bromotoluene.
(4) *p*-bromotoluene.

Solution

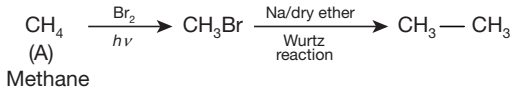
(3)



17. Hydrocarbon (A) reacts with bromine by substitution to form an alkyl bromide which by Wurtz reaction is converted to gaseous hydrocarbon containing less than four carbon atoms. (A) is
(1) $CH_3—CH_3$
(2) $CH_2=CH_2$
(3) $CH\equiv CH$
(4) CH_4

Solution

(4) Formation of higher alkanes from alkyl halides in the presence of sodium and dry ether is named Wurtz reaction.



18. Which of the following molecules represents the order of hybridization sp^2, sp^2, sp, sp from left to right atoms?
(1) $CH_2=CH—CH=CH_2$
(2) $CH_2=CH—C\equiv CH$
(3) $HC\equiv C—C\equiv CH$
(4) $CH_3—CH=CH—CH_3$

Solution

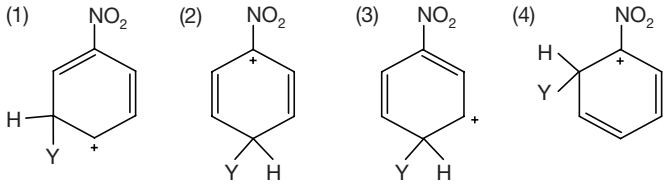
(2) (a) Carbon–carbon double bonds are comprised of sp^2-hybridized carbon atoms.

WILEY

(b) Carbon–carbon triple bonds are comprised of *sp*-hybridized carbon atoms.

$$\overset{sp^2}{CH_2}=\overset{sp^2}{CH}-\overset{sp}{C}\equiv\overset{sp}{CH}$$

19. Which of the following carbocations is expected to be most stable?



Solution

(1) Structure (1) is most stable because —I effect of NO_2 is exerted to least extent in (1), which make the carbocation most stable.

20. Which of the following is correct with respect to —I effect of the substituents? (R = alkyl)

(1) $—NH_2 > —OR > —F$ (2) $—NR_2 < —OR < —F$

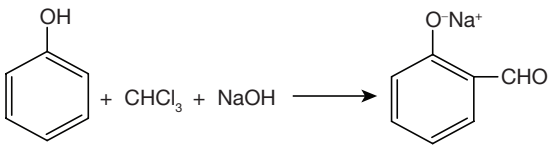
(3) $—NH_2 < —OR < —F$ (4) $—NR_2 > —OR > —F$

Solution

(2), **(3)** —I effect increases with increase in the electronegativity of the atom. Fluorine is most electronegative followed by alkoxy group. The electronegativity of amine and their derivative would be less than that of alkoxy group as oxygen is more electronegative than that of nitrogen.

WILEY

21. In the reaction



The electrophile involved is

(1) dichloromethyl anion $(\overset{+}{C}HCl_2)$ (2) formyl cation $(\overset{+}{C}HO)$

(3) dichloromethyl cation $(\overset{+}{C}HCl_2)$ (4) dichlorocarbene $(:CCl_2)$

Solution

(4) The reaction is Reimer–Tiemann reaction. The electrophile involved in the reaction is dichlorocarbene $(:CCl_2)$.

$$CHCl_3 + NaOH \xrightleftharpoons{\text{Fast}} \overset{+}{Na}\overset{-}{C}Cl_3 + H_2O$$

$$\overset{-}{C}Cl_3 \xrightarrow{\text{Slow}} :CCl_2 + Cl^-$$

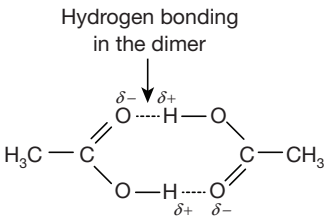
22. Carboxylic acids have higher boiling points than aldehydes, ketones and even alcohols of comparable molecular mass. It is due to their

(1) more extensive association of carboxylic acid via van der Waals force of attraction.

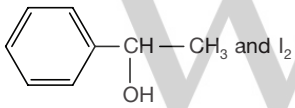
(2) formation of carboxylate ion.
(3) formation of intramolecular H-bonding.
(4) formation of intermolecular H-bonding.

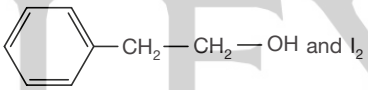
Solution

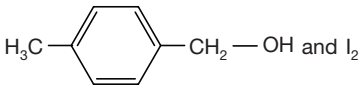
(4) Carboxylic acids generally have boiling points higher than other types of organic compounds of comparable molecular weights, such as alcohols, aldehydes and ketones. For example, butanoic acid has a higher boiling point than either 1-pentanol or pentanal. The higher boiling points of carboxylic acids result from their polarity and from the fact that they form very strong intermolecular hydrogen bonds which are not broken completely even in the vapor phase. In the liquid and solid states, carboxylic acids are associated by intermolecular hydrogen bonding into dimers, as shown for acetic acid.

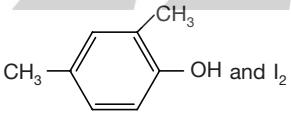


23. Compound A, $C_8H_{10}O$, is found to react with NaOI (produced by reacting Y with NaOH) and yields a yellow precipitate with characteristic smell. A and Y are respectively

(1)  and I_2

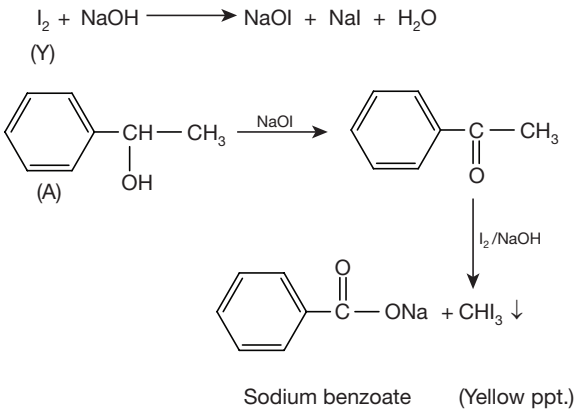
(2)  and I_2

(3)  and I_2

(4)  and I_2

Solution

(1) All compounds containing the grouping $CH_3\overset{|}{C}HOH$ when treated with a halogen and excess of alkali (i.e., sodium hypohalite, NaOX) form haloforms. If the halogen used is iodine yellow precipitates of iodoform are formed and the reaction is called iodoform reaction.



WILEY

24. Match the metal ions given in Column I with the spin magnetic moments of the ions given in Column II and assign the correct code:

Column I	Column II
(a) Co^{3+}	(p) $\sqrt{8}$ BM
(b) Cr^{3+}	(q) $\sqrt{35}$ BM
(c) Fe^{3+}	(r) $\sqrt{3}$ BM
(d) Ni^{2+}	(s) $\sqrt{24}$ BM
	(t) $\sqrt{15}$ BM

	(a)	(b)	(c)	(d)
(1)	s	p	q	r
(2)	p	q	r	s
(3)	s	t	q	p
(4)	r	t	p	q

Solution

(3) Spin magnetic moment can be calculated as $\mu = \sqrt{n(n+2)}$
where n is the number of unpaired electrons.

$Co^{3+} = [Ar]3d^6$; Unpaired electrons (n) = 4; $\mu = \sqrt{4(4+2)} = \sqrt{24}$ BM

$Cr^{3+} = [Ar]3d^3$; Unpaired electrons (n) = 3; $\mu = \sqrt{3(3+2)} = \sqrt{15}$ BM

$Fe^{3+} = [Ar]3d^5$; Unpaired electrons (n) = 5; $\mu = \sqrt{5(5+2)} = \sqrt{35}$ BM

$Ni^{2+} = [Ar]3d^8$; Unpaired electrons (n) = 2; $\mu = \sqrt{2(2+2)} = \sqrt{8}$ BM

WILEY

25. Which one of the following ions exhibits *d-d* transition and paramagnetism as well?

(1) MnO_4^- (2) CrO_7^{2-} (3) CrO_4^{2-} (4) MnO_4^{2-}

Solution

(4)

MnO_4^-: $Mn^{7+} = [Ar]d^0$; Unpaired electrons = 0; Diamagnetic

$Cr_2O_7^{2-}$: $Cr^{6+} = [Ar]d^0$; Unpaired electrons = 0; Diamagnetic

CrO_4^{2-}: $Cr^{6+} = [Ar]d^0$; Unpaired electrons = 0; Diamagnetic

MnO_4^{2-}: $Mn^{6+} = [Ar]d^1$; Unpaired electrons = 1; Paramagnetic

Ions containing d^0 and d^{10} configuration do not exhibits *d-d* transition.

26. Iron carbonyl, $Fe(CO)_5$ is

(1) trinuclear. (2) mononuclear. (3) tetranuclear. (4) dinuclear.

Solution

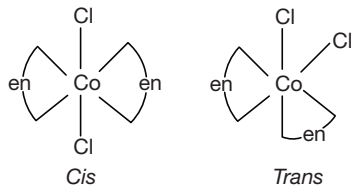
(2) Based on the number of metal atoms present in a complex, they can be categorized into mononuclear, dinuclear, trinuclear and tetranuclear. Hence, $Fe(CO)_5$ is a mononuclear complex.

27. The type of isomerism shown by the complex $[CoCl_2(en)_2]$ is

(1) ionization isomerism. (2) coordination isomerism.
(3) geometrical isomerism. (4) linkage isomerism.

Solution

(3) Complex $[CoCl_2(en)_2]$ shows geometrical isomerism, that is, *cis* and *trans*.

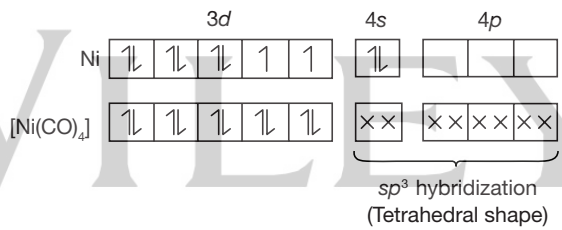


28. The geometry and magnetic behavior of the complex $[Ni(CO)_4]$ are

(1) square planar geometry and paramagnetic. (2) tetrahedral geometry and diamagnetic.
(3) square planar geometry and diamagnetic. (4) tetrahedral geometry and paramagnetic.

Solution

(2) $[Ni(CO)_4]$: The arrangement of electrons in Ni^0 ($3d^8\ 4s^2$) will be



WILEY

29. Following solutions were prepared by mixing different volumes of NaOH and HCl of different concentrations:

(I) $60\ mL\ \frac{M}{10}\ HCl + 40\ mL\ \frac{M}{10}\ NaOH$ (II) $55\ mL\ \frac{M}{10}\ HCl + 45\ mL\ \frac{M}{10}\ NaOH$

(III) $75\ mL\ \frac{M}{5}\ HCl + 25\ mL\ \frac{M}{5}\ NaOH$ (IV) $100\ mL\ \frac{M}{10}\ HCl + 100\ mL\ \frac{M}{10}\ NaOH$

pH of which one of them will be equal to 1?

(1) (IV) (2) (I) (3) (II) (4) (III)

Solution

(4) Total volume of $75\ mL\ \frac{M}{5}\ HCl + 25\ mL\ \frac{M}{5}\ NaOH$ is (75 + 25) mL = 100 mL

25 mL of $\frac{M}{5}$ NaOH will neutralize 25 mL of $\frac{M}{5}$ HCl

Remaining $\frac{M}{5}$ HCl = 75 − 25 = 50 mL

$$[H^+] = [HCl] = \frac{M}{5} \times \frac{50}{100} = \frac{M}{10}$$

pH can be calculated as $pH = -\log[H^+] = -\log \frac{1}{10} = 1$

30. On which of the following properties does the coagulating power of an ion depend?
(1) Both magnitude and sign of the charge on the ion.
(2) Size of the ion alone.
(3) The magnitude of the charge on the ion alone.
(4) The sign of charge on the ion alone.

Solution

(1) According to Hardy-Schulze rule, greater the valency of the active ion or flocculating ion, greater will be its coagulating power.

31. Given van der Waals constant for NH_3, H_2, O_2 and CO_2 are respectively 4.17, 0.244, 1.36 and 3.59, which one of the following gases is most easily liquefied?
(1) O_2 (2) H_2 (3) NH_3 (4) CO_2

Solution

(3) *a* is a van der Waal's constant. The value of *a* depends upon intermolecular force of attraction. Higher the value of *a*, easier will be the liquefaction of gas. Therefore, NH_3 will be liquefied most easily.

32. The solubility of $BaSO_4$ in water is 2.42×10^{-3} gL^{-1} at 298 K. The value of its solubility product (K_{sp}) will be (Given molar mass of $BaSO_4$ = 233 $g\,mol^{-1}$)
(1) 1.08×10^{-14} $mol^2\,L^{-2}$ (2) 1.08×10^{-12} $mol^2\,L^{-2}$
(3) 1.08×10^{-10} $mol^2\,L^{-2}$ (4) 1.08×10^{-8} $mol^2\,L^{-2}$

Solution

(3) Solubility of $BaSO_4$ (in mol L^{-1}) = $\frac{2.42 \times 10^{-3}\ g\,L^{-1}}{233\ g\ mol^{-1}} = 1.04 \times 10^{-5}\ (mol\,L^{-1})$

$$BaSO_4(s) \rightleftharpoons Ba^{2+}(aq) + SO_4^{2-}(aq)$$

The equilibrium concentrations of Ba^{2+} and SO_4^{2-} are $[Ba^{2+}] = 1.04 \times 10^{-5}\ mol\,L^{-1}$ and $[SO_4^{2-}] = 1.04 \times 10^{-5}\ mol\,L^{-1}$. Substituting the values in the expression for solubility product, we get

$$\begin{aligned} K_{sp} &= [Ba^{2+}][SO_4^{2-}] \\ &= (1.04 \times 10^{-5})^2 \\ &= 1.08 \times 10^{-10}\ mol^2 L^{-2} \end{aligned}$$

33. In which case is the number of molecules of water maximum?
(1) 0.00224 L of water vapors at 1 atm and 273 K (2) 0.18 g of water
(3) 18 mL of water (4) 10^{-3} mol of water

Solution

(3) Option (1): Number of moles of water = $\frac{0.00224}{22.4} = 10^{-4}$ mol

Number of molecules of water = $N_A \times$ Number of moles

WILEY

$$= 10^{-4} N_A$$

Option (2): Number of molecules of water = $\frac{0.18 \text{ g}}{18 \text{ g mol}^{-1}} N_A = 10^{-2} N_A$

Option (3): Number of molecules of water = $\frac{18 \text{ g}}{18 \text{ g mol}^{-1}} N_A = N_A$

Option (4): Number of molecules of water = $10^{-3} N_A$

34. The correct difference between first and second order reactions is that

(1) a first order reaction can be catalyzed; a second order reaction cannot be catalyzed.

(2) the half-life of a first-order reaction does not depend on $[A]_0$; the half-life of a second order reaction does depend on $[A]_0$.

(3) the rate of a first order reaction does not depend on reactant concentrations; the rate of a second order reaction does depend on reactant concentrations.

(4) the rate of a first order reaction does depend on reactant concentrations; the rate of a second order reaction does not depend on reactant concentrations.

Solution

(2) For a first order reaction, half-life is given by $t_{1/2} = \frac{0.693}{k}$

Thus, the half-life time in a first order reaction is independent of concentration of the reactant.

For a second order reaction, half-life is given by $t_{1/2} = \frac{1}{k[A]_0}$

Hence, $t_{1/2}$ of second order reaction is inversely proportional to the initial concentration of reactant.

WILEY

35. Among CaH_2, BeH_2, BaH_2, the order of ionic character is

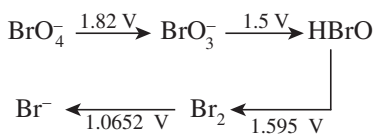
(1) $BeH_2 < BaH_2 < CaH_2$ (2) $CaH_2 < BeH_2 < BaH_2$

(3) $BeH_2 < CaH_2 < BaH_2$ (4) $BaH_2 < BeH_2 < CaH_2$

Solution

(3) On moving down the group, the metallic character of the metals increases, hence ionic character of metal hydrides increases.

36. Consider the change in oxidation state of bromine corresponding to different emf values as shown in the diagram below:



Then the species undergoing disproportionation is

(1) Br_2 (2) BrO_4^- (3) BrO_3^- (4) HBrO

Solution

(4)

$$\overset{+1}{H}\overset{}{Br}O \rightarrow \overset{0}{Br_2} \quad ; E^o = 1.595 \text{ V}$$

$$\overset{+1}{H}\overset{}{Br}O \rightarrow \overset{+5}{BrO_3^-}; \; E^o = -1.5 \text{ V}$$

E^{o}_{cell} for the disproportionation of HBrO can be calculated as

$$E^{o}_{cell} = E^{o}_{HBrO/Br_2} - E^{o}_{BrO_3^-/HBrO}$$
$$= 1.595 - 1.5$$
$$= 0.095\,V$$

Since, the value of E^{o}_{cell} is positive, $\Delta G = -nFE^{o}_{cell}$ therefore, HBrO will undergo disproportionation.

37. For the redox reaction $MnO_4^- + C_2O_4^{2-} + H^+ \rightarrow Mn^{2+} + CO_2 + H_2O$

The correct coefficients of the reactants for the balanced equation are

	MnO_4^-	$C_2O_4^{2-}$	H^+
(1)	2	16	5
(2)	2	5	16
(3)	16	5	2
(4)	5	16	2

Solution

(2) The balanced redox reaction is $2MnO_4^- + 5C_2O_4^{2-} + 16H^+ \rightarrow 2Mn^{2+} + 10CO_2 + 8H_2O$

WILEY

38. Which one of the following conditions will favor maximum formation of the product in the reaction

$$A_2(g) + B_2(g) \rightleftharpoons X_2(g)\ ;\ \Delta_r H = -X\,kJ?$$

(1) High temperature and high pressure.
(2) Low temperature and low pressure.
(3) Low temperature and high pressure.
(4) High temperature and low pressure.

Solution

(3) We have $A_2(g) + B_2(g) \rightleftharpoons X_2(g)\ ;\ \Delta_r H = -X\,kJ$

If we remove heat or decrease the temperature, the reaction shifts in a direction to increase that heat. Therefore, for an exothermic reaction, cooling the reaction mixture increases the concentration of products when equilibrium is re-established.

An increase in pressure shifts the equilibrium in the direction where the number of moles decreases. As there are two moles of gaseous reactant and one mole of gaseous product. Therefore, the increase in pressure shifts the equilibrium in the forward reaction.

39. When initial concentration of the reactant is doubled, the half-life period of a zero order reaction

(1) is tripled.
(2) is doubled.
(3) is halved.
(4) remains unchanged.

Solution

(2) Half-life for zero order reaction is given by $t_{1/2} = \dfrac{[A]_0}{2k}$

The half-life time in a zero order reaction is directly proportional to the initial concentration of the reactants. Hence, half-life will be doubled on doubling the concentration of reactant.

40. The bond dissociation energies of X_2, Y_2 and XY are in the ratio of 1: 0.5: 1. ΔH for the formation of XY is -200 kJ mol^{-1}. The bond dissociation energy of X_2 will be

(1) 800 kJ mol^{-1} (2) 100 kJ mol^{-1} (3) 200 kJ mol^{-1} (4) 400 kJ mol^{-1}

Solution

(1)

$$\frac{1}{2}X_2(g)+\frac{1}{2}Y_2(g)\rightarrow XY(g)$$

The ratio of bond dissociation energy of X_2, Y_2 and XY is z: 0.5 z: z

We know

$$\Delta_r H^o = \sum BE_{reactant} - \sum BE_{product}$$

$$=\left(\frac{z}{2}+\frac{z}{4}\right)-z$$

$$-200 = -\frac{z}{4} \Rightarrow z = 800$$

Bond dissociation energy of $X_2 = z = 800\,\text{kJ mol}^{-1}$

41. The correction factor 'a' to the ideal gas equation corresponds to

(1) electric field present between the gas molecules. (2) volume of the gas molecules.

(3) density of the gas molecules. (4) forces of attraction between the gas molecules.

Solution

(4) The correction factor 'a' to the ideal gas equation corresponds to forces of attraction between the gas molecules. Higher the value of a greater is the intermolecular force of attraction.

WILEY

42. Consider the following species:

CN^+, CN^-, NO and CN

Which one of these will have the highest bond order?

(1) CN^+ (2) CN^- (3) NO (4) CN

Solution

(2)

$$NO = \sigma 1s^2\, \sigma^* 1s^2\, \sigma 2s^2\, \sigma^* 2s^2\, \sigma 2p_z^2\, \pi 2p_x^2 = \pi 2p_y^2 \pi^* 2p_x^1 = \pi^* 2p_y^0$$

Bond order = $(N_b - N_a)/2 = (10 - 5)/2 = 5/2 = 2.5$

$$CN = \sigma 1s^2\, \sigma^* 1s^2\, \sigma 2s^2\, \sigma^* 2s^2\, \pi 2p_x^2 = \pi 2p_y^2 \sigma 2p_z^1$$

Bond order = $(N_b - N_a)/2 = (9 - 4)/2 = 5/2 = 2.5$

$$CN^- = \sigma 1s^2\, \sigma^* 1s^2\, \sigma 2s^2\, \sigma^* 2s^2\, \pi 2p_x^2 = \pi 2p_y^2 \sigma 2p_z^2$$

Bond order = $(N_b - N_a)/2 = (10 - 4)/2 = 6/2 = 3$

$$CN^+ = \sigma 1s^2\, \sigma^* 1s^2\, \sigma 2s^2\, \sigma^* 2s^2\, \pi 2p_x^2 = \pi 2p_y^2$$

Bond order = $(N_b - N_a)/2 = (8 - 4)/2 = 4/2 = 2$

43. Magnesium reacts with an element (X) to form an ionic compound. If the ground state electronic configuration of (X) is $1s^2\, 2s^2\, 2p^3$, the simplest formula for this compound is

(1) Mg_2X (2) MgX_2 (3) Mg_2X_3 (4) Mg_3X_2

Solution

(4) Electronic configuration of X is $1s^2\,2s^2\,2p^3$. Therefore, the valency of X is 3 while the valency of Mg is 2. Hence, Mg_3X_2 compound will be formed.

44. Iron exhibits bcc structure at room temperature. Above 900°C, it transforms to fcc structure. The ratio of density of iron at room temperature to that at 900°C (assuming molar mass and atomic radii of iron remains constant with temperature) is

(1) $\frac{3\sqrt{3}}{4\sqrt{2}}$ (2) $\frac{4\sqrt{3}}{3\sqrt{2}}$ (3) $\frac{\sqrt{3}}{\sqrt{2}}$ (4) $\frac{1}{2}$

Solution

(1) Density is given by $\rho = \frac{z \times M}{a^3 \times N_A}$

For bcc, $z = 2,\ a = \frac{4r}{\sqrt{3}}$

For fcc, $z = 4,\ a = 2\sqrt{2}r$

Therefore,

$$\frac{\rho_{25°C}}{\rho_{900°C}} = \frac{\left(zM / a^3 N_A\right)_{bcc}}{\left(zM / a^3 N_A\right)_{fcc}}$$

$$= \frac{2}{4}\left(\frac{2\sqrt{2}r}{4r/\sqrt{3}}\right)^3$$

$$= \frac{3\sqrt{3}}{4\sqrt{2}}$$

WILEY

45. Which one is a wrong statement?

(1) The electronic configuration of N atom is

$1s^2$	$2s^2$	$2p_x^1$	$2p_y^1$	$2p_z^1$
↑↓	↑↓	↑	↑	↓

(2) An orbital is designated by three quantum numbers while an electron in an atom is designated by four quantum numbers.

(3) Total orbital angular momentum of electron in '*s*' orbital is equal to zero.

(4) The value of *m* for d_{x^2} is zero.

Solution

(1) According to Hund's rule, the degenerate orbitals (i.e. orbitals having same energy) will be filled by one electron each having same spin and then only pairing of electrons will take place. Hence the correct electronic configuration of N will be:

$_7N$:	$1s^2$	$2s^2$	$2p^3$		
	↑↓	↑↓	↑	↑	↑
or					
	↑↓	↑↓	↓	↓	↓