NEET-2017
Chemistry Paper

This paper contains 45 **multiple choice questions** and there is **only one** correct response for each questions.

1. Which of the following is a sink for CO?

(1) Microorganisms present in the soil. **(2)** Oceans

(3) Plants **(4)** Haemoglobin

Solution

(1) Certain medium present in the environment absorb or take up some amounts of the pollutants and is known as sink for that pollutant. For example, microorganisms present in the soil act as sink for carbon monoxide.

2. The element $Z = 114$ has been discovered recently. It will belong to which of the following family/ group and electronic configuration?

(1) Carbon family, $[Rn]5f^{14}6d^{10}7s^27p^2$ **(2)** Oxygen family, $[Rn]5f^{14}6d^{10}7s^27p^4$

(3) Nitrogen family, $[Rn]5f^{14}6d^{10}7s^27p^6$ **(4)** Halogen family, $[Rn]5f^{14}6d^{10}7s^27p^5$

Solution

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(1) The new element that has been discovered is Flerovium with atomic number Z = 114. It belongs to group 14, that is, carbon family with electronic configuration $[Rn]\ 5f^{14}6d^{10}7s^27p^2$.

3. For a given reaction $\Delta H = 35.5$ kJ mol^{-1} and $\Delta S = 83.6$ JK^{-1} mol^{-1}. The reaction is spontaneous at (Assume that ΔH and ΔS do not vary with temperature)

(1) $T > 425$ K **(2)** all temperatures.

(3) $T > 298$ K **(4)** $T < 425$ K

Solution

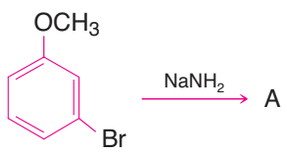
(1) Gibbs free energy is given by $\Delta G = \Delta H - T\Delta S$ (1)

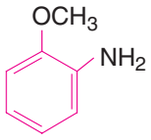
Substituting $\Delta H = 35500\,J\,mol^{-1}$, $\Delta S = 83.6\,J\,K^{-1}mol^{-1}$ and $\Delta G = 0$ (At equilibrium) in Eq. (1), we get

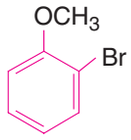
$$\Delta G = \Delta H - T\Delta S$$
$$0 = 35500 - T \times 83.6$$
$$T = \frac{35500}{83.6} = 424.64\,K \approx 425\,K$$

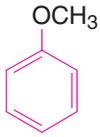
Since, both ΔH and ΔS are positive, thus, reaction will be spontaneous at high temperature, that is, when $T > 425$ K.

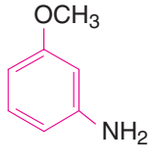
4. Identify A and predict the type of reaction.



(1)  and elimination addition reaction

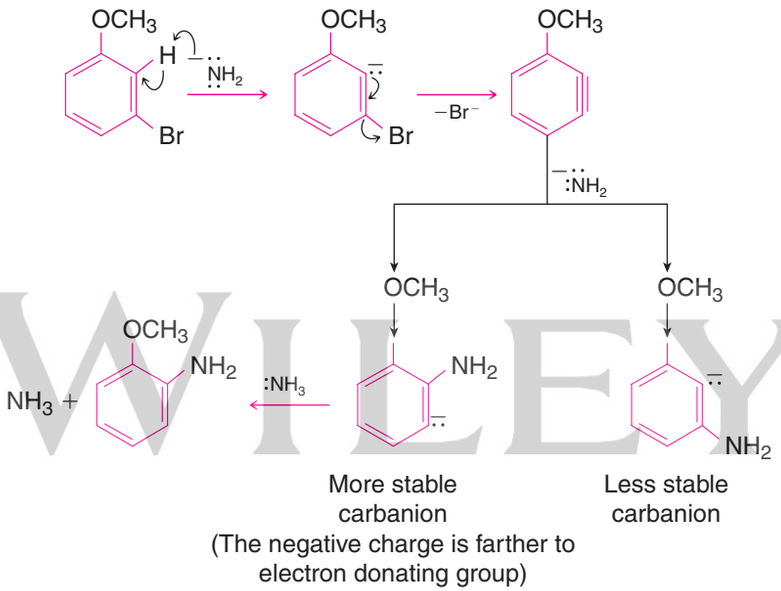
(2)  and cine substitution reaction

(3)  and cine substitution reaction

(4)  and substitution reaction

Solution

(1) This is an example of elimination addition reaction.



More stable carbanion (The negative charge is farther to electron donating group)

Less stable carbanion

5. Which of the following is dependent on temperature?

(1) Molarity **(2)** Mole fraction

(3) Weight percentage **(4)** Molality

Solution

(1) Molarity of a solution is defined as the number of moles of solute per liter of solution.

$$\text{Molarity} = \frac{\text{Moles of solute}}{\text{Litres of solution}}$$

Since, volume is a function of temperature, therefore, molarity changes with temperature.

6. With respect to the conformers of ethane, which of the following statements is true?

(1) Bond angle changes but bond length remains same.

(2) Both bond angle and bond length change.

(3) Both bond angles and bond length remains same.

(4) Bond angle remains same but bond length changes.

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Solution

(3) Any three-dimensional arrangement of atoms that results from rotation about a single bond is called a conformation. In conformation of ethane, there is no change in bond length and bond angle. Change occurs only in dihedral or torsional angle.

7. Name the gas that can readily decolorize acidified $KMnO_4$ solution.

(1) SO_2 **(2)** NO_2

(3) P_2O_3 **(4)** CO_2

Solution

(1) Sulphur dioxide (SO_2) decolorizes acidified $KMnO_4$ solution. The reaction is

$$\underset{\text{Purple}}{MnO_4^-} + SO_2 \xrightarrow{H^+} \underset{\text{Colorless/ Light pink}}{Mn^{2+}} + SO_4^{2-} + H_2O$$

8. It is because of inability of ns^2 electrons of the valence shell to participate in bonding that

(1) Sn^{2+} is oxidizing while Pb^{4+} is reducing.

(2) Sn^{2+} and Pb^{2+} are both oxidizing and reducing.

(3) Sn^{4+} is reducing while Pb^{4+} is oxidizing.

(4) Sn^{2+} is reducing while Pb^{4+} is oxidizing.

Solution

(4) Due to inert pair effect, the stability of the lower oxidation state increases on descending the group. Thus Sn^{2+} is a reducing agent while Pb^{4+} is oxidizing agent as Pb^{2+} is more stable than Pb^{4+}.

9. Mechanism of a hypothetical reaction $X_2 + Y_2 \rightarrow 2XY$ is given below:

(i) $X_2 \rightarrow X + X$ (fast)

(ii) $X + Y_2 \rightleftharpoons XY + Y$ (slow)

(iii) $X + Y \rightarrow XY$ (fast)

The overall order of the reaction will be

(1) 2 **(2)** 0

(3) 1.5 **(4)** 1

Solution

(3) The overall rate of the reaction depends on the rate of the slowest step. Since, two reagents are involved in the rate determining step; the overall rate of reaction is proportional to the concentrations of only those reagents.

$$\text{Rate} = k[X][Y_2] \quad (1)$$

From $X_2 \rightarrow X + X$

$$k_{eq} = \frac{[X]^2}{[X_2]}$$

$$[X] = \sqrt{k_{eq}}[X_2]^{1/2} \quad (2)$$

From Eq. (1) and Eq. (2), we get

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$$\text{Rate} = k\sqrt{k_{eq}}[X_2]^{1/2}[Y_2]$$
$$= k'[X_2]^{1/2}[Y_2]$$

Thus, the overall order of the reaction = 1 + 0.5 = 1.5

10. The equilibrium constants of the following are

$$N_2 + 3H_2 \rightleftharpoons 2NH_3 \quad K_1$$
$$N_2 + O_2 \rightleftharpoons 2NO \quad K_2$$
$$H_2 + \frac{1}{2}O_2 \rightarrow H_2O \quad K_3$$

The equilibrium constant (K) of the reaction $2NH_3 + \frac{5}{2}O_2 \overset{K}{\rightleftharpoons} 2NO + 3H_2O$ will be

(1) $K_2K_3^3/K_1$ **(2)** K_2K_3/K_1

(3) $K_2^3K_3/K_1$ **(4)** $K_1K_3^3/K_2$

Solution

(1) We have

$$N_2 + 3H_2 \rightleftharpoons 2NH_3 \quad K_1 \qquad (1)$$
$$N_2 + O_2 \rightleftharpoons 2NO \quad K_2 \qquad (2)$$
$$H_2 + \frac{1}{2}O_2 \rightarrow H_2O \quad K_3 \qquad (3)$$

Target reaction: $2NH_3 + \frac{5}{2}O_2 \rightleftharpoons 2NO + 3H_2O \quad K \qquad (4)$

Now, Eq. (4) = Eq. (2) + 3 × Eq. (3) –Eq. (1)

Therefore, $K = \frac{K_2K_3^3}{K_1}$

11. Which one is the wrong statement?

(1) The uncertainty principle is $\Delta E \times \Delta t \geq h/4\pi$.

(2) Half-filled and fully filled orbitals have greater stability due to greater exchange energy, greater symmetry and more balanced arrangement.

(3) The energy of 2*s* orbitals is less than energy of 2*p* orbitals in case of hydrogen like atoms.

(4) de-Broglie's wavelength is given by $\lambda = \frac{h}{mv}$, where m = mass of the particle, v = group velocity of the particle.

Solution

(3) In case of hydrogen or hydrogen like species, the energy of electron is determined only by the principal quantum number. The energy of all the orbitals in a given shell is the same, irrespective of the shape of the orbital. Thus, the order of energy levels is $1s < 2s = 2p < 3s = 3p = 3d$

12. Which one of the following statements is not correct?

(1) The value of equilibrium constant is changed in the presence of a catalyst in the reaction at equilibrium.

(2) Enzymes catalyze mainly bio-chemical reactions.

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(3) Coenzymes increase the catalytic activity of enzyme.

(4) Catalyst does not initiate any reaction.

Solution

(1) A catalyst in a system that reaches a point of equilibrium increases the rate of both the forward and reverse reactions proportionally, but does not change the point of equilibrium. The function of a catalyst is simply to reach the point of equilibrium in less time. Hence, the value of equilibrium constant is does not change in the presence of catalyst in the reaction.

13. $HgCl_2$ and I_2 both when dissolved in water containing I^- ions the pair of species formed is

(1) HgI_2, I^- **(2)** HgI_4^{2-}, I_3^-

(3) Hg_2I_2, I^- **(4)** HgI_2, I_3^-

Solution

(2) The reactions are as follows:

$$Hg^{2+} \xrightarrow{KI} \underset{\text{Scarlet red ppt.}}{HgI_2} \xrightarrow{\text{excess KI}} \underset{\text{Colourless soluble complex}}{[HgI_4]^{2-}}$$

$$I_2 + I^-(\text{excess}) \longrightarrow \underset{\text{(Dark brown complex)}}{I_3^-}$$

14. The correct increasing order of basic strength for the following compound is

(I) (II) (III)

(1) III < I < II **(2)** III < II < I

(3) II < I < III **(4)** II < III < I

Solution

(3) Aryl amines are basic in nature due to the presence of lone pair of electrons on nitrogen atom. Among the given compounds, (III) is most basic as electron donating alkyl group increases the electron density on the nitrogen atom while in compound (II) electron density decreases due to the presence of electron withdrawing nitro group, thus is less basic than aniline (I). Hence, the increasing order of basic strength is (II) < (I) < (III).

15. An example of a sigma bonded organometallic compound is

(1) Grignard's reagent. **(2)** ferrocene.

(3) cobaltocene. **(4)** ruthenocene.

Solution

(1) Compounds that contain carbon–metal bonds are called organometallic compounds. This bond can be either a direct carbon to metal bond (σ bond or sigma bond) or a metal complex bond (π bond or pi bond). Among the given compounds, Grignard reagent is an example of sigma bonded organometallic compound RMgX.

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16. A 20 L container at 400 K contains $CO_2(g)$ at pressure 0.4 atm and an excess of SrO (neglect the volume of solid SrO). The volume of the container is now decreased by moving the movable piston fitted in the container. The maximum volume of the container, when pressure of CO_2 attains its maximum value, will be

(Given that: $SrCO_3(s) \rightleftharpoons SrO(s) + CO_2(g)$, $K_p = 1.6$ atm)

(1) 10 L **(2)** 4 L

(3) 2 L **(4)** 5 L

Solution

(4) We have $$SrCO_3(s) \rightleftharpoons SrO(s) + CO_2(g)$$

Also, $$K_p = p_{CO_2} = 1.6 \text{ atm}$$

From combined gas law $$p_1V_1 = p_2V_2 \quad (1)$$

Substituting $p_1 = 0.4$ atm, $V_1 = 20$ L and $p_2 = 1.6$ atm in Eq. (1), we get

$$0.4 \times 20 = 1.6 \times V_2$$

$$V_2 = \frac{0.4 \times 20}{1.6} = 5\text{L}$$

17. Mixture of chloroxylenol and terpineol acts as

(1) antiseptic. **(2)** antipyretic.

(3) antibiotic. **(4)** analgesic.

Solution

(1) Antiseptics are chemical substances that prevent the growth of microorganisms or kill them but are not harmful when applied to human tissues. Mixture of mixture of chloroxylenol and terpineol is known as dettol which is an example of antiseptic.

18. Pick out the correct statement with respect to $[Mn(CN)_6]^{3-}$

(1) It is sp^3d^2 hybridized and tetrahedral.

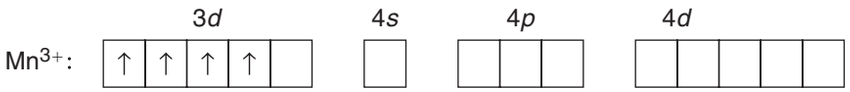
(2) It is d^2sp^3 hybridized and octahedral.

(3) It is dsp^2 hybridized and square planar.

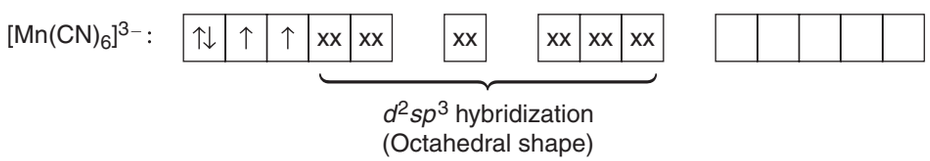
(4) It is sp^3d^2 hybridized and octahedral.

Solution

(2) Mn atom has the outer electronic structure $3d^54s^2$. Thus, a Mn^{3+} ion will have the structure $3d^4$, and the electrons will be arranged as:



CN^- is a strong field ligand; therefore, pairing of electrons takes place which leads to d^2sp^3 hybridization with octahedral shape.



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19. Match the interhalogen compounds of Column I with the geometry in Column II and assign the correct code.

Column I	Column II
(a) XX'	(i) T-shape
(b) XX'_3	(ii) Pentagonal bipyramidal
(c) XX'_5	(iii) Linear
(d) XX'_7	(iv) Square pyramidal
	(v) Tetrahedral

Code:

	(a)	(b)	(c)	(d)
(1)	(iii)	(i)	(iv)	(ii)
(2)	(v)	(iv)	(iii)	(ii)
(3)	(iv)	(iii)	(ii)	(i)
(4)	(iii)	(iv)	(i)	(ii)

Solution

(1) The correct shape of interhalogen compounds is as follows:

Compounds	Shape	Hybridization
XX′	Linear	
XX'_3	Bent T-Shaped	sp^3d
XX'_5	Square-pyramidal	sp^3d^2
XX'_7	Pentagonal bipyramidal	sp^3d^3

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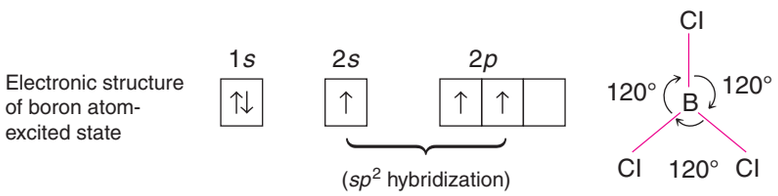
20. The species, having bond angles at 120° is

(1) ClF_3 **(2)** NCl_3 **(3)** BCl_3 **(4)** PH_3

Solution

(3) The shape of the BCl_3 molecule is a planar triangle with bond angles of 120°.



Three singly occupied orbitals (2*s* and 2*p*) form bonds with unpaired electrons from three chlorine atoms.

21. Predict the correct intermediate and product in the following reaction:

$$H_3C-C\equiv CH \xrightarrow[HgSO_4]{H_2O,\ H_2SO_4} \underset{(A)}{\text{Intermediate}} \longrightarrow \underset{(B)}{\text{Product}}$$

(1) A : $H_3C-\underset{\displaystyle OH}{\underset{|}{C}}=CH_2$ B : $H_3C-\underset{\displaystyle SO_4}{\underset{|}{C}}=CH_2$

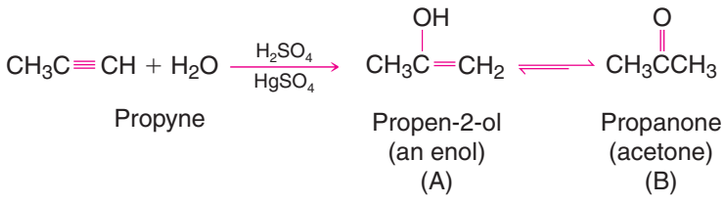
(2) A : $H_3C-\underset{\displaystyle O}{\underset{\|}{C}}-CH_3$ B : $H_3C-C\equiv CH$

(3) A : $H_3C-\underset{\displaystyle OH}{\underset{|}{C}}=CH_2$ B : $H_3C-\underset{\displaystyle O}{\underset{\|}{C}}-CH_3$

(4) A : $H_3C-\underset{\displaystyle SO_4}{\underset{|}{C}}=CH_2$ B : $H_3C-\underset{\displaystyle O}{\underset{\|}{C}}-CH_3$

Solution

(3) In the presence of concentrated sulphuric acid and mercuric salts, alkynes undergo the addition of water in a reaction that follows Markovnikov's rule; that is, it corresponds to the addition of H to the less substituted carbon of the triple bond and –OH to the more substituted carbon.



22. If molality of the dilute solution is doubled, the value of molal depression constant (K_f) will be

(1) halved. **(2)** tripled.

(3) unchanged. **(4)** doubled.

Solution

(3) Freezing point depression is given by $\Delta T_f = K_f m$, where K_f is constant characteristic of the solvent. The value of K_f for a given solvent corresponds to the number of degrees of freezing point lowering for each molal unit of concentration. Hence, it is independent of molality.

23. The heating of phenyl-methyl ethers with HI produces

(1) iodobenzene. **(2)** phenol.

(3) benzene. **(4)** ethyl chloride.

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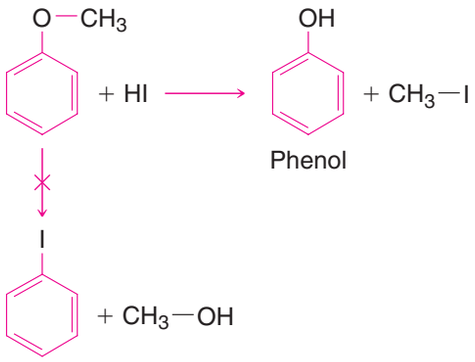
Solution

(2) Phenolic ethers are cleaved at the alkyl–oxygen bond on heating with HI. This is due to the greater stability of aryl–oxygen bond. Because of stabilization of lone pair of atom on oxygen atom on the sp^2 hybridized carbon atom of the aryl ring the reaction is



24. In the electrochemical cell

$Zn|ZnSO_4(0.1\ M) \parallel CuSO_4\ (1.0\ M)|Cu$, the emf of this Daniel cell is E_1. When the concentration of $ZnSO_4$ is changed to 1.0 M and that of $CusO_4$ changed to 0.01 M, the emf changed to E_2. From the followings, which one is the relationship between E_1 and E_2 (Given: $\frac{RT}{F} = 0.059$) ?

(1) $E_1 < E_2$ **(2)** $E_1 > E_2$

(3) $E_2 = 0 \neq E_1$ **(4)** $E_1 = E_2$

Solution

(2) The overall cell reaction is $Zn + Cu^{2+} \rightarrow Zn^{2+} + Cu$

According to Nernst equation $E_{cell} = E^{o}_{cell} - \frac{2.303RT}{nF}\log Q$

For cell: $Zn|ZnSO_4(0.01M)\|CuSO_4(1M)|Cu$

$$E_1 = E^{o}_{cell} - \frac{0.059}{2}\log\frac{[Zn^{2+}]}{[Cu^{2+}]}$$
$$= E^{o}_{cell} - \frac{0.059}{2}\log\frac{0.01}{1}$$
$$= E^{o}_{cell} + 0.059\log 2 \quad (1)$$

For cell: $Zn|ZnSO_4(1M)\|CuSO_4(0.01M)|Cu$

$$E_2 = E^{o}_{cell} - \frac{0.059}{2}\log\frac{[Zn^{2+}]}{[Cu^{2+}]}$$
$$= E^{o}_{cell} - \frac{0.059}{2}\log\frac{1}{0.01}$$
$$= E^{o}_{cell} - 0.059\log 2 \quad (2)$$

From Eq. (1) and Eq. (2), we know $E_1 > E_2$

25. A first order reaction has a specific reaction rate of $10^{-2}\,s^{-1}$. How much time will it take for 20 g of the reactant to reduce to 5g?

(1) 138.6 s **(2)** 346.5 s

(3) 693.0 s **(4)** 238.6 s

Solution

(1) For first order reactions, we have $t = \frac{2.303}{k}\log\frac{[A_0]}{[A_t]}$ (1)

Substituting the values in Eq. (1), we get

$$t = \frac{2.303}{10^{-2}}\log\left(\frac{20}{5}\right)$$
$$= \frac{2.303}{10^{-2}} \times 0.60205$$
$$= 138.6\,s$$

26. Which of the following pairs of species have the same bond order?

(1) O_2, NO^+ **(2)** CN^-, CO

(3) N_2, O_2^- **(4)** CO, NO

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Solution

(2) The bond order of given species are as follows:

Species	Bond order
O_2, NO^+	2 and 3
CN^-, CO	3 and 3
N_2, O_2^-	3 and 1.5
CO, NO	3 and 2.5

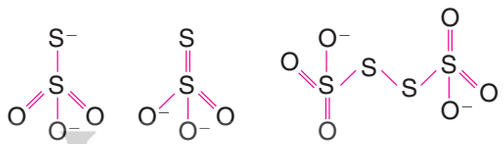
27. In which pair of ions both the species contain S—S bond?

(1) $S_4O_6^{2-}$, $S_2O_3^{2-}$ **(2)** $S_2O_7^{2-}$, $S_2O_8^{2-}$

(3) $S_4O_6^{2-}$, $S_2O_7^{2-}$ **(4)** $S_4O_7^{2-}$, $S_2O_3^{2-}$

Solution

(1) $S_4O_6^{2-}$ and $S_2O_3^{2-}$ have S—S bond. Their structures are as follows:



$S_2O_3^{2-}$ $S_4O_6^{2-}$

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28. Concentration of the Ag^+ ions in a saturated solution of $Ag_2C_2O_4$ is 2.2×10^{-4} mol L^{-1}. Solubility product of $Ag_2C_2O_4$ is

(1) 2.66×10^{-12} **(2)** 4.5×10^{-11}

(3) 5.3×10^{-12} **(4)** 2.42×10^{-8}

Solution

(3) The reaction involved is

$$Ag_2C_2O_4(s) \rightleftharpoons 2Ag^+ + C_2O_4^{2-}$$

$$[Ag^+] = 2.2 \times 10^{-4}$$

$$[C_2O_4^{2-}] = 0.5[Ag^+]$$

$$= 0.5 \times 2.2 \times 10^{-4}$$

$$= 1.1 \times 10^{-4} \text{ mol L}^{-1}$$

$$K_{sp} = [Ag^+]^2[C_2O_4^{2-}]$$

$$= (2.2 \times 10^{-4})^2 \times (1.1 \times 10^{-4})$$

$$= 5.3 \times 10^{-12}$$

29. Ionic mobility of which of the following alkali metal ions is lowest when aqueous solution of their salts is put under an electric field?

(1) K **(2)** Rb

(3) Li **(4)** Na

Solution

(3) Ionic mobility is defined as the ability of an ion to move in an aqueous solution. Larger the hydrated radius, lesser is the ionic mobility, that is,

$$\text{Ionic radius} \propto \frac{1}{\text{Hydrated radius}}$$

Thus, the order of ionic mobility is in the reverse order of the hydrated radius order, for example

$$Li^+(aq) < Na^+(aq) < K^+(aq) < Rb^+(aq) < Cs^+(aq)$$

30. A gas is allowed to expand in a well insulated container against a constant external pressure of 2.5 atm from an initial volume of 2.50 L to a final volume of 4.50 L. The change in internal energy ΔU of the gas in joules will be

(1) –500 J **(2)** –505 J

(3) +505 J **(4)** 1136.25 J

Solution

(2) Work done by a gas in an irreversible expansion is given by

$$\begin{aligned} w &= -p\Delta V \\ &= -2.5(4.5-2.5) = -5 \text{ L atm} \\ &= -5 \times 101.3 \text{ J} = -506.5 \text{ J} \end{aligned}$$

Since the system is well insulated, $q = 0$. Form first law of thermodynamics, we have

$$\begin{aligned} \Delta E &= q + w \\ \Delta E &= 0 + w = 506.5 \text{ J} \end{aligned}$$

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31. The reason for greater range of oxidation states in actinoids is attributed to

(1) actinoid contraction.

(2) 5*f*, 6*d* and 7*s* levels having comparable energies.

(3) 4*f* and 5*d* levels being close in energies.

(4) the radioactive nature of actinoids.

Solution

(2) In actinoids, the 5*f* orbitals extend in space beyond 6*s* and 6*p* orbitals and participate in bonding as energy difference between 5*f*, 6*d* and 7*s* levels is comparable.

32. The most suitable method of separation of 1:1 mixture of *ortho* and *para*-nitrophenols is

(1) chromatography. **(2)** crystallization.

(3) steam distillation. **(4)** sublimation.

Solution

(3) The *ortho* and *para* isomers can be separated by steam distillation. Steam distillation is used for purifying substances that are steam volatile and immiscible with water. *Ortho*-nitrophenol is steam volatile due to intramolecular hydrogen bonding while *para*-nitrophenol is less volatile due to intermolecular hydrogen bonding which cause association of molecules.

33. The correct order of the stoichiometries of AgCl formed when $AgNO_3$ in excess is treated with the complexes: $CoCl_3 \cdot 6NH_3$, $CoCl_3 \cdot 5NH_3$, $CoCl_3 \cdot 4NH_3$ respectively is

(1) 3 AgCl, 1 AgCl, 2 AgCl **(2)** 3 AgCl, 2 AgCl, 1 AgCl

(3) 2 AgCl, 3 AgCl, 1 AgCl **(4)** 1 AgCl, 3 AgCl, 2 AgCl

Solution

(2) The reactions involved are as follows:

$$CoCl_3 \cdot 6NH_3 = [Co(NH_3)_6]Cl_3$$

$$[Co(NH_3)_6]Cl_3 + 3AgNO_3 \rightarrow [Co(NH_3)_6](NO_3)_3 + 3AgCl\downarrow$$

$$CoCl_3 \cdot 5NH_3 = [Co(NH_3)_5Cl]Cl_3$$

$$[Co(NH_3)_5Cl]Cl_2 + 2AgNO_3 \rightarrow [Co(NH_3)_5Cl](NO_3)_2 + 2AgCl\downarrow$$

$$CoCl_3 \cdot 4NH_3 = [Co(NH_3)_4Cl_2]Cl$$

$$[Co(NH_3)_4Cl_2]Cl + AgNO_3 \rightarrow [Co(NH_3)_4Cl_2](NO_3) + AgCl\downarrow$$

34. Correct increasing order for the wavelengths of absorption in the visible region for the complexes of Co^{3+} is

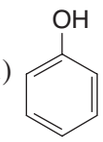
(1) $[Co(H_2O)_6]^{3+}$, $[Co(en)_3]^{3+}$, $[Co(NH_3)_6]^{3+}$ **(2)** $[Co(H_2O)_6]^{3+}$, $[Co(NH_3)_6]^{3+}$, $[Co(en)_3]^{3+}$

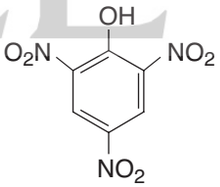
(3) $[Co(NH_3)_6]^{3+}$, $[Co(en)_3]^{3+}$, $[Co(H_2O)_6]^{3+}$ **(4)** $[Co(en)_3]^{3+}$, $[Co(NH_3)_6]^{3+}$, $[Co(H_2O)_6]^{3+}$

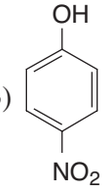
Solution

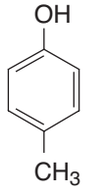
(4) Energy absorbed is inversely proportional to the absorbed wavelength, that is, $E \propto \frac{1}{\lambda}$. Presence of strong field ligand increases the energy gap Δ_0 between the t_{2g} and e_g levels, therefore, decreases the wavelength of light absorbed. The order of ligand field strength is $H_2O < NH_3 <$en. Hence, increasing order for the wavelength of absorption in the visible region is $[Co(en)_3]^{3+} < [Co(NH_3)_6]^{3+} < [Co(H_2O)_6]^{3+}$

35. Which one is the most acidic compound?

(1) 

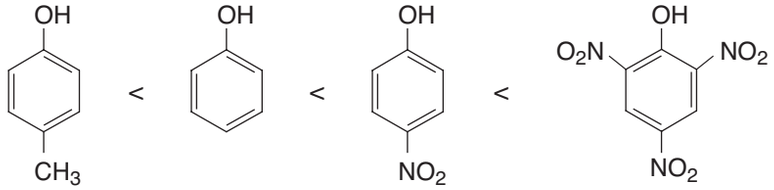
(2) 

(3) 

(4) 

Solution

(3) An electron-withdrawing group ($-NO_2$) increases the acidity of a phenol while electron donating ($-CH_3$) group decrease the acidity of a phenol relative to phenol itself. 2, 4, 6-Trinitrophenol (picric acid) contains three electron withdrawing nitro groups therefore is most acidic among the given compounds. The increasing order of acidity is



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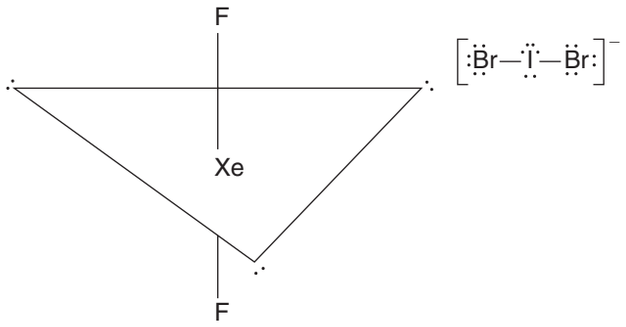
36. Which of the following pairs of compounds is isoelectronic and isostructural?

(1) TeI_2, XeF_2 **(2)** IBr_2^-, XeF_2

(3) IF_3, XeF_2 **(4)** $BeCl_2$, XeF_2

Solution

(2) Both XeF_2 and IBr_2^- are linear molecules. Their structures are as follows:



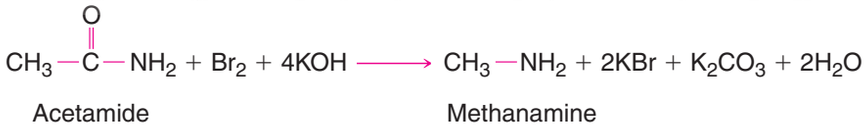
37. Which of the following reactions is appropriate for converting acetamide to methanamine?

(1) Hoffmann hypobromamide reaction **(2)** Stephens reaction

(3) Gabriels phthalimide synthesis **(4)** Carbylamine reaction

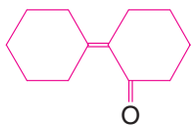
Solution

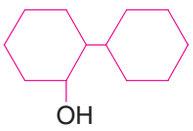
(1) Hoffmann hypobromamide reaction is used for the conversion of an amide into a primary amine with one carbon less. The overall reaction is as follows:

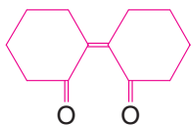


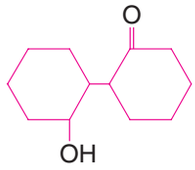
Acetamide Methanamine

38. Of the following, which is the product formed when cyclohexanone undergoes aldol condensation followed by heating?

(1) 

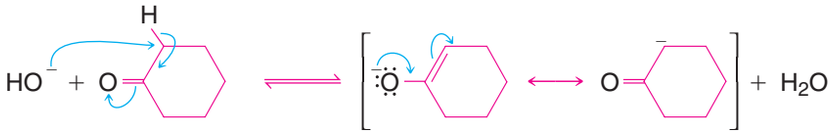
(2) 

(3) 

(4) 

Solution

(1) The reaction involved is as follows:



Enolate anion

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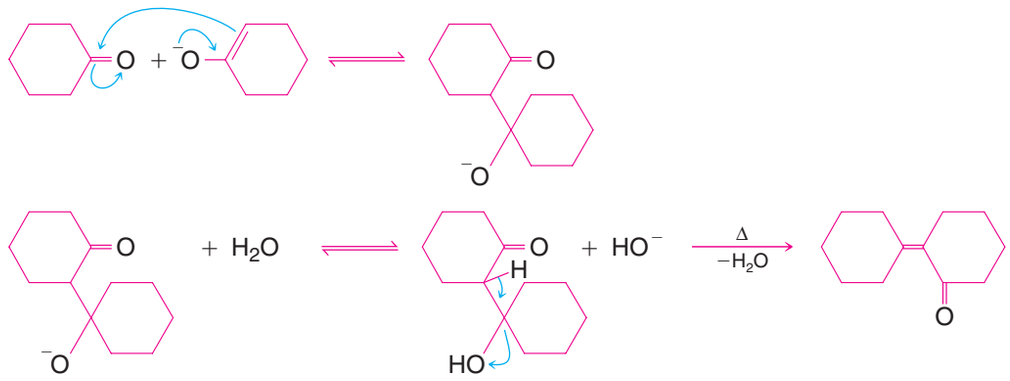

39. Which of the following statements is not correct?

(1) Ovalbumin is a simple food reserve in egg-white.

(2) Blood proteins thrombin and fibrinogen are involved in blood clotting.

(3) Denaturation makes the proteins more active.

(4) Insulin maintains sugar level in the blood of a human body.

Solution

(3) The three-dimensional shapes of proteins are dependent on the temperature. If the environment changes, a protein may lose its characteristic shape (secondary, tertiary and quaternary structure). This process is called denaturation. Denatured proteins are no longer functional or become inactive.

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40. Which one is the correct order of acidity?

(1) $CH \equiv CH > CH_3 - C \equiv CH > CH_2 = CH_2 > CH_3 - CH_3$

(2) $CH \equiv CH > CH_2 = CH_2 > CH_3 - C \equiv CH > CH_3 - CH_3$

(3) $CH_3 - CH_3 > CH_2 = CH_2 > CH_3 - C \equiv CH > CH \equiv CH$

(4) $CH_2 = CH_2 > CH_3 - CH = CH_2 > CH_3 - C \equiv CH > CH \equiv CH$

Solution

(1) The hydrogen bonded to the carbon of a terminal alkyne, called an acetylenic hydrogen atom, is considerably more acidic than those bonded to carbons of an alkene or alkane. Hybridization of terminal carbon is shown as:

$$\overset{sp}{CH} \equiv \overset{sp}{CH} > CH_3 - \overset{sp}{C} \equiv \overset{sp}{CH} > CH_2 = \overset{sp^2}{CH_2} > CH_3 - \overset{sp^3}{CH_3}$$

Greater *s* orbital character in carbon hybridization, greater is its acidity. Being the most electronegative, the *sp*-hybridized carbon atom of ethyne polarizes its C—H bonds to the greatest extent, causing its hydrogens to be most positive. Therefore, ethyne donates a proton to a base more readily. Alkyl being an electron donating group reduces the acidity of alkynes.

41. Extraction of gold and silver involves leaching with CN^- ion. Silver is later recovered by

(1) distillation.

(2) zone refining.

(3) displacement with Zn.

(4) liquation.

Solution

(3) Process used for extraction of silver is cyanide process. Reactions taking place at the different stages in the cyanide process are as follows:

$$Ag_2S + 4NaCN\ (excess) \rightleftharpoons 2Na[Ag(CN)_2] + Na_2S$$

$$4Na_2S + 5O_2\,(air) + 2H_2O \rightarrow 2Na_2SO_4 + 4NaOH + 2S$$

In the step involving precipitation of Ag, a little excess of Zn powder is added by which $Na[Ag(CN)_2]$ becomes the limiting reagent, otherwise the loss of Ag will be more. Here Zn is chosen because it is more electropositive as compared to Ag and the replacement reaction occurs very easily.

$$2Na[Ag(CN)_2] + Zn \rightarrow Na_2[Zn(CN)_4] + 2Ag\downarrow$$

42. The correct statement regarding electrophile is

(1) electrophile is negatively charged species and can form a bond by accepting a pair of electrons from another electrophile.

(2) electrophiles are generally neutral species and can form a bond by accepting a pair of electrons from a nucleophile.

(3) electrophile can be either neutral or positively charged species and can form a bond by accepting a pair of electrons from a nucleophile.

(4) electrophile is a negatively charged species and can form a bond by accepting a pair of electrons from a nucleophile.

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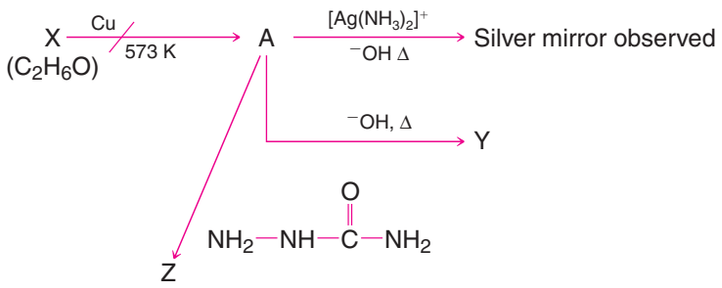
Solution

(3) Electrophiles are reagents that seek electrons so as to achieve a stable shell of electrons like that of a noble gas. They can be neutral (BF_3 and $AlCl_3$) or positively charged (CH_3^+) species and can form a bond by accepting a pair of electrons from a nucleophile.

43. Consider the reactions:



Identify A, X, Y and Z.

(1) A-Methoxymethane, X-Ethanol, Y-Ethanoic acid, Z-Semicarbazide.

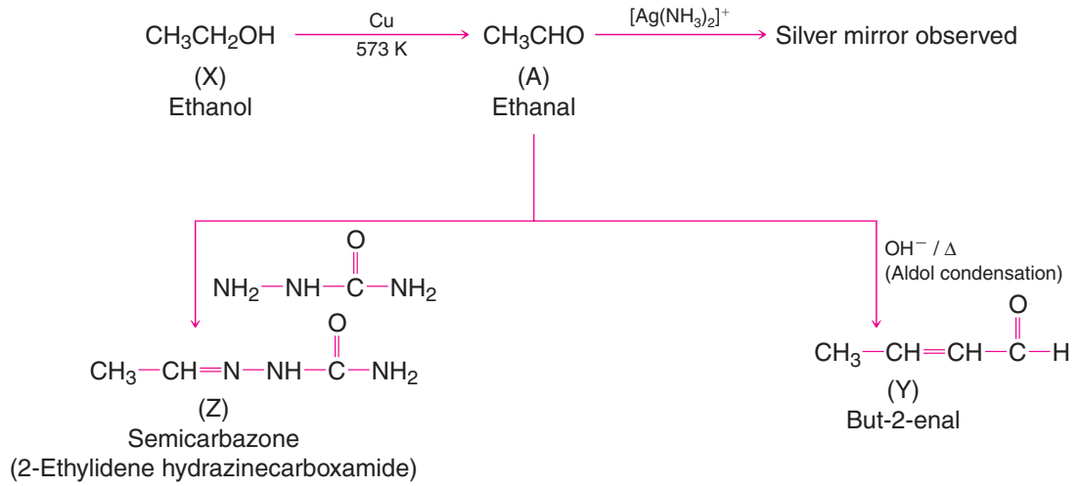
(2) A-Ethanal, X-Ethanol, Y-But-2-enal, Z-Semicarbazone.

(3) A-Ethanol, X-Acetaldehyde, Y-Butanone, Z-Hydrazone.

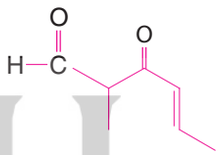
(4) A-Methoxymethane, X-Ethanoic acid, Y-Acetate ion, Z-hydrazine.

Solution

(2) The reactions involved are as follows:



44. The IUPAC name of the compound is



(1) 5-formylhex-2-en-3-one.
(2) 5-methyl-4-oxohex-2-en-5-al.
(3) 3-keto-2-methylhex-5-enal.
(4) 3-keto-2-methylhex-4-enal.

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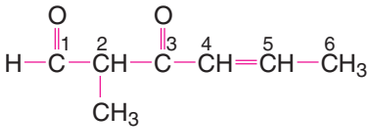
Solution

(4) The IUPAC name of the compound is 3-keto-2-methylhex-4-en-1-al.



45. Which is the incorrect statement?

(1) Density decreases in case of crystals with Schottky's defect.
(2) NaCl(s) is insulator, silicon is semiconductor, silver is conductor, quartz is piezo electric crystal.
(3) Frenkel defect is favored in those ionic compounds in which sizes of cation and anions are almost equal.
(4) $FeO_{0.98}$ has non-stoichiometric metal deficiency defect.

Solution

(3) When an ion is displaced from its regular position to an interstitial position, it creates a vacancy at the original site and a defect at the interstitial site; this pair of vacancy-interstitial is called Frenkel defect. This defect is exhibited by the compounds in which metal ions are generally smaller than the anions. Examples are ZnS, AgCl, AgBr and AgI.