NEET II 2016
SOLVED CHEMISTRY PAPER

1. Which one of the following is **incorrect** for ideal solution?

(1) $\Delta U_{mix} = 0$ (2) $\Delta p = pP_{obs} - p_{calculated\ by\ Raoult's\ law} = 0$

(3) $\Delta G_{mix} = 0$ (4) $\Delta H_{mix} = 0$

Solution:

For an ideal solution; $\Delta H_{mix} = 0$; $\Delta U_{mix} = 0$ and $\Delta S_{mix} \neq 0$

We know that, $\Delta G = \Delta H_{mix} - T\Delta S_{mix} \Rightarrow \Delta G \neq 0$

Hence, the correct option is (3).

2. The solubility of AgCl (s) with solubility product 1.6×10^{-10} in 0.1 M NaCl solution would be

(1) 1.6×10^{-9} M (2) 1.6×10^{-11} M

(3) zero (4) 1.26×10^{-5} M

Solution:

In the solution, NaCl will ionize and at equilibrium, 0.1 M of NaCl will completely dissociate as

$$NaCl(aq) \rightleftharpoons Na^{+}(aq) + Cl^{-}(aq)$$

0 M 0.1M 0.1M

Let the solubility of AgCl be S mol L^{-1} in the presence of 0.1 M NaCl, then, $[Ag^{+}] = S$ M and $[Cl^{-}] = (S + 0.1)$M.

$$AgCl(s) \rightleftharpoons Ag^{+}(aq) + Cl^{-}(aq)$$

x 0 0

$x - S$ S $S + 0.1$

$$k_{sp} = 1.6 \times 10^{-10} = [Ag^{+}][Cl^{-}] = S(0.1 + S)$$

Since, k_{sp} is small, therefore, S can be neglected with respect to 0.1 M. Hence,

$$1.6 \times 10^{-10} = S \times 0.1 \Rightarrow S = 1.6 \times 10^{-9}\text{M}$$

Hence, the correct option is (1).

3. Suppose the elements X and Y combine to form two compounds XY_2 and X_3Y_2. When 0.1 mole of XY_2 weighs 10 g and 0.05 mole of X_3Y_2 weighs 9 g, the atomic weights of X and Y are

(1) 60, 40 (2) 20, 30

(3) 30, 20 (4) 40, 30

Solution:

Let us assume that atomic weight of X is A_X and Y is A_Y.

Then number of moles of XY_2 is

$$n_{XY_2} = \frac{10}{A_X + 2A_Y} = 0.1$$

$$A_X + 2A_Y = 100 \qquad \text{(i)}$$

Then number of moles of X_3Y_2 is

$$n_{X_3Y_2} = \frac{9}{3A_X + 2A_Y} = 0.05$$

$$3A_X + 2A_Y = 180 \qquad \text{(ii)}$$

On solving Eq. (i) and Eq. (ii), we get $A_X = 40$ and $A_Y = 30$.

Hence, the correct option is (4).

4. The number of electrons delivered at the cathode during electrolysis by a current of 1 ampere in 60 seconds is (charge on electron = 1.60×10^{-19} C)

(1) 6×10^{20} (2) 3.75×10^{20}

(3) 7.48×10^{23} (4) 6×10^{23}

Solution:

Given that $I = 1$ A; $t = 60$ s; $e = 1.6 \times 10^{-19}$ C.

From Faraday's first law of electrolysis,

$Q = ne$ or $It = ne$

where, Q is the charge or quantity of electricity passed through the electrolyte and n is the number of electrons. Substituting the values, we get

$$n = \frac{I \times t}{e} = \frac{1 \times 60}{1.6 \times 10^{-19}} = 3.75 \times 10^{20}$$

Hence, the correct option is (2).

5. Boric acid is an acid because its molecule

(1) gives up a proton.

(2) accepts OH^- from water releasing proton.

(3) combines with proton from water molecule.

(4) contains replaceable H^+ ion.

Solution:

Boric acid behaves as weak acid as it partially reacts with water by accepting hydroxyl ion to form $[B(OH)_4]^-$ and releasing a proton (H_3O^+) The reaction is

$$B(OH)_3 + H_2O \rightleftharpoons [B(OH)_4]^- + H^+$$

Hence, the correct option is (2).

6. AlF_3 is soluble in HF only in presence of KF. It is due to the formation of

(1) $K_3[AlF_6]$ (2) AlH_3

(3) $K[AlF_3H]$ (4) $K_3[AlF_3H_3]$

Solution:

AlF_3 is soluble in HF only in presence of KF due to the formation of $K_3[AlF_6]$.

$AlF_3 + 3KF \rightarrow K_3[AlF_6]$

Hence, the correct option is (1).

7. Zinc can be coated on iron to produce galvanized iron but the reverse is not possible. It is because

(1) zinc has lower melting point than iron.

(2) zinc has lower negative electrode potential than iron.

(3) zinc has higher negative electrode potential than iron.

(4) zinc is lighter than iron.

Solution:

When a protective coating of zinc is applied to iron (or steel) surface to prevent rusting (or corrosion), the process is called galvanization. . The reverse is not possible because zinc has higher negative electrode potential than iron.

Hence, the correct option is (3).

8. The suspension of slaked lime in water is

(1) quick lime. (2) milk of lime.

(3) aqueous solution of slaked lime. (4) lime water.

Solution:

Slaked lime is calcium hydroxide. When slaked lime is dissolved in water and dissolved $Ca(OH)_2$ filtered off, the clear solution obtained is called lime water. When excess is added to this solution, a milky suspension of calcium hydroxide particles is observed and is called milk of lime.

Hence, the correct option is (2).

9. The hybridizations of atomic orbitals of nitrogen in NO_2^+, NO_3^- and NH_4^+ respectively are

(1) sp^2, sp^3 and sp

(2) sp, sp^2 and sp^3

(3) sp^2, sp and sp^3

(4) sp, sp^3 and sp^2

Solution:

Molecule	Hybridization	Shape
NO_2^+	sp	Linear
NO_3^-	sp^2	Trigonal planar
NH_4^+	sp^3	Tetrahedral

Hence, the correct option is (2).

10. Which of the following fluoro-compounds is most likely to behave as a Lewis base?

(1) PF_3 (2) CF_4

(3) SiF_4 (4) BF_3

Solution:

Phosphorous has five outer shell electrons, of which three are used in covalent bonding with fluorine atoms to form PF_3 and there is one lone pair. It is due to presence of this lone pair that PF_3acts as Lewis base. CF_4 and SiF_4 do not have any lone pair of electrons whereas BF_3 is electron deficient.

Hence, the correct option is (1) .

11. Which of the following pairs of ions is isoelectronic and isostructural?

(1) ClO_3^-, CO_3^{2-} (2) SO_3^{2-}, NO_3^-

(3) ClO_3^-, SO_3^{2-} (4) CO_3^{2-}, NO_3^-

Solution:

The molecules that are isoelectronic and isostructural are:

Molecule	No. of electrons	Shape
ClO_3^-, SO_3^{2-}	42	Pyramidal
CO_3^{2-}, NO_3^-	32	Trigonal planar

Hence, the correct options are (2) and (3).

12. In context with beryllium, which one of the following statements is **incorrect**?

(1) It forms Be_2C.

(2) Its salts rarely hydrolyze.

(3) Its hydride is electron-deficient and polymeric.

(4) It is rendered passive by nitric acid.

Solution:

Beryllium forms covalent compounds; hence its salts hydrolyze easily. It forms unusual carbide, Be_2C, brick-red in colour. Beryllium hydride is electron deficient, so it generally exists as clusters through the formation of three-centre two electron (banana) bonds. Be is rendered passive by concentrated HNO_3. This is because, HNO_3 is a strong oxidizing agent and forms a thin layer of oxide on the surface of the metal, making it unreactive to further attack of acid.

Hence, the correct option is (2).

13. Hot concentrated sulphuric acid is a moderately strong oxidizing agent. Which of the following reactions **does not** show oxidizing behaviour?

(1) $3S + 2H_2SO_4 \rightarrow 3SO_2 + 2H_2O$

(2) $C + 2H_2SO_4 \rightarrow CO_2 + 2SO_2 + 2H_2O$

(3) $CaF_2 + H_2SO_4 \rightarrow CaSO_4 + 2HF$

(4) $Cu + 2H_2SO_4 \rightarrow CuSO_4 + SO_2 + 2H_2O$

Solution:

In the following reaction, oxidation number of all the atoms remains unchanged.

$$CaF_2 + H_2SO_4 \rightarrow CaSO_4 + 2HF$$

Hence, H_2SO_4 is not acting as oxidizing agent in this reaction.

Hence, the correct option is (3).

14. Which of the following pairs of *d*-orbitals will have electron density along the axes?

(1) d_{xz}, d_{yz}

(2) $d_{z^2}, d_{x^2-y^2}$

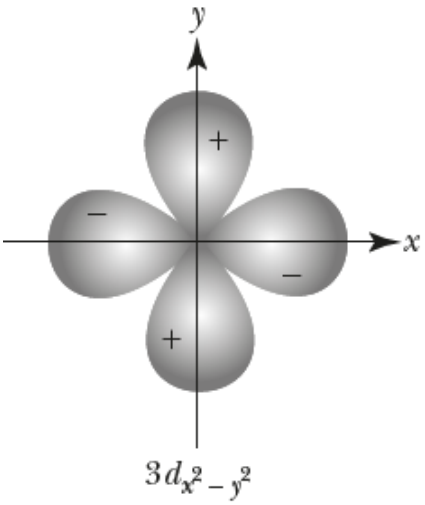
(3) $d_{xy}, d_{x^2-y^2}$

(4) d_{z^2}, d_{xz}

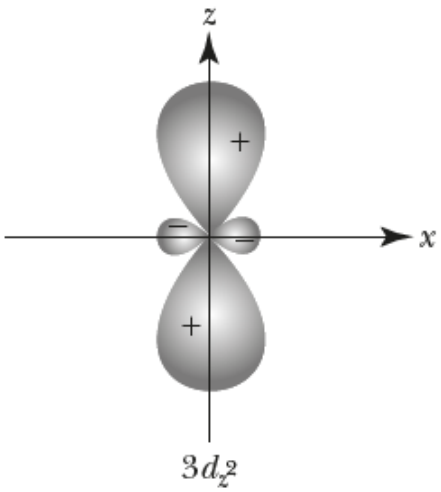
Solution:

From the shapes of the *d*-orbitals, it can be seen that the lobes of d_z^2 and $d_{x^2-y^2}$ orbitals are along the axes. Hence, the electron density is concentrated along the axes and these are called axial orbitals. The

lobes of d_{xy}, d_{yz} and d_{xz} orbitals are not along the axes and these are called non-axial orbitals.



$3d_{x^2-y^2}$



$3d_{z^2}$

Hence, the correct option is (2).

15. The **correct** geometry and hybridization for XeF_4 are

(1) trigorial bipyramidal, sp^3d

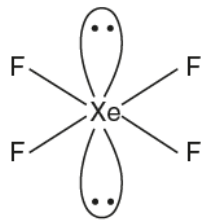
(2) planar triangle, sp^3d^3

(3) square planar, sp^3d^2

(4) octahedral, sp^3d^2

Solution:

XeF_4 is a molecule of the type AB_4L_2, where the central atom (Xe) is surrounded by four other atoms (F) with which it forms bond pairs and two lone pairs. Here the steric number is 6, so hybridization is sp^3d^2 and expected geometry is octahedral. However, due to presence of two lone pairs, the shape of the molecule is square planar.



Hence, the correct option is (3).

16. Among the following, which one is a **wrong** statement?

(1) $p\pi$-$d\pi$ bonds are present in SO_2.

(2) SeF_4 and CH_4 have same shape.

(3) I_3^+ has bent geometry.

(4) PH_5 and $BiCl_5$ do not exist. bonding

Solution:

Option (1): SO_2 molecule consists of two sigma bonds and two π bonds. The first π bond is a $p\pi$-$p\pi$ bond and the second π bond involves overlap between $2p_z$ orbital with $3d_{xz}$ orbital, thus $p\pi$-$d\pi$ bond is present.

Option (2): For CH_4, the steric number is 4, so the hybridization is sp^3 and the geometry is regular tetrahedron. In SeF_4, the steric number is 5 and the molecule is of the type AB_4L, so the hybridization is sp^3d. The presence of lone pair affects the shape of the molecule and geometry is see-saw.

Option (3): In I_3^+, the hybridization is sp^3, and with the presence of two lone pairs the shape is bent.

Option (4): $BiCl_5$ is known to exit as all apart from nitrogen all other element is Group 15 elements are known to form pentahalides due to presence of suitable *d*-orbitals.

Hence, the correct option is (2).

17. The **correct** increasing order of trans-effect of the following species is

(1) $CN^- > C_6H_5^- > Br^- > NH_3$

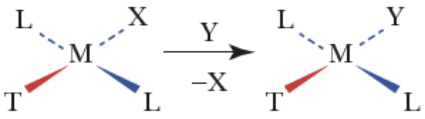
(2) $Br^- > CN^- > NH_3 > C_6H_5^-$

(3) $CN^- > Br^- > C_6H_5^- > NH_3$

(4) $NH_3 > CN^- > Br^- > C_6H_5^-$

Solution:

Trans effect is the property of a ligand to direct substitution at the position *trans* to itself in substitution reactions in square planar complexes. For example in the following complex, the substitution of ligand X by nucleophile Y is directed by ligand T at the position *trans* to it.



This effect arises due to kinetic (stabilization of transition state) and thermodynamic (weakening of M-L bond at the *trans* position) factors.

The order of trans effect: – $C\bar{N} > C_6H_5^- > Br^- > NH_3$

Hence, the correct option is (1).

18. Which one of the following statements related to lanthanons is **incorrect**?

(1) The basicity decreases as the ionic radius decreases from Pr to Lu.

(2) All the lanthanons are much more reactive than aluminium.

(3) Ce (+ 4) solutions are widely used as oxidizing agent in volumetric analysis.

(4) Europium shows +2 oxidation state.

Solution:

For option (1): In lanthanoids, the basic character gradually decreases from$Ce(OH)_3$ to $Lu(OH)_3$ due to high polarization caused by gradual decrease in size of M^{3+} ions.

For option (2): Lanthanons are less reactive than aluminium due to their high ionization potential. This is a consequence of lanthanoid contraction which results from outer orbital electrons being incompletely shielded by extra nuclear charge. .

For option (3):Ce^{4+} is a good oxidizing agent and easily converted to Ce^{3+} (most stable oxidation state).

For option (4): The electronic configuration of Eu(63) is [Xe] $4f^7 5d^0\ 6s^2$, the stability of oxidation state +2 for Eu can be explained ion the basis of extra stability associated with the half-filled *f*-orbitals.

Hence, the correct option is (2).

19. Jahn-Teller effect is **not** observed in high spin complexes of

(1) d^8 (2) d^4

(3) d^9 (4) d^7

Solution:

According to Jahn-Teller effect, molecules or complexes of any shape (other than linear), which have unequally filled set of orbitals (either t_{2g} or e_g) will be distorted. The asymmetrical electronic arrangements are observed in d^4 (high spin), d^7 (low spin) and d^9 (high and low spin) complexes. The d^8 electronic configuration is symmetrical, hence no distortion is observed. .

Hence, the correct option is (1).

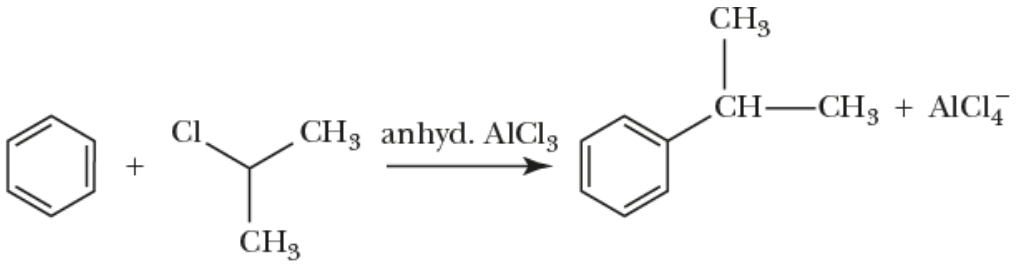
20. Which of the following can be used as the halide component for Friedel-Crafts reaction?

(1) Bromobenzene (2) Chloroethene

(3) Isopropyl chloride (4) Chlorobenzene

Solution:

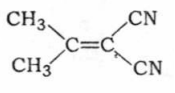
From the given option, chlorobenzene, bromobenzene and chloroethene cannot be used as halide component for Friedal-Crafts reaction because the lone pair on halogen is delocalized with the π – bond(s) of the parent molecule and hence not available for abstraction by $AlCl_3$ to form $AlCl_4^-$ Only isopropyl chloride is a suitable reagent.

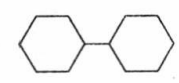


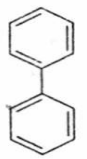
Hence, the correct option is (3).

21. In which of the following molecules, all atoms are coplanar?

(1) 

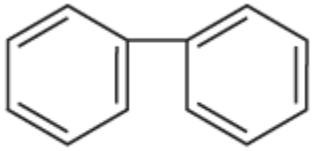
(2) 

(3) 

(4) 

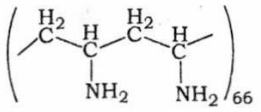
Solution:

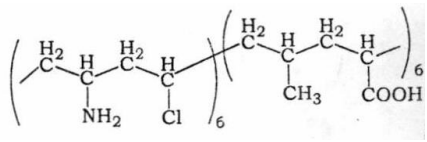
The coplanarity of atoms in the given compounds can be determined on the basis of the hybridizations of the carbon atoms. In option (1), cyclohexane, all carbons are sp^3 hybridized, so not planar. The compound in option (2) has carbons in sp^2 and sp^3 hybridization, so non-planar. In option (3), all carbons are again sp^3 hybridized. In option (4), carbon atoms of biphenyl are sp^2 hybridized so coplanar.

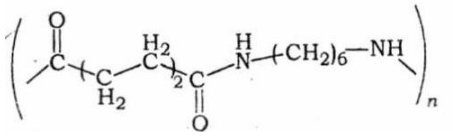


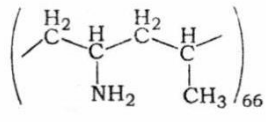
Hence, the correct option is (4).

22. Which one of the following structures represents nylon 6,6 polymer?

(1) 

(2) 

(3) 

(4) 

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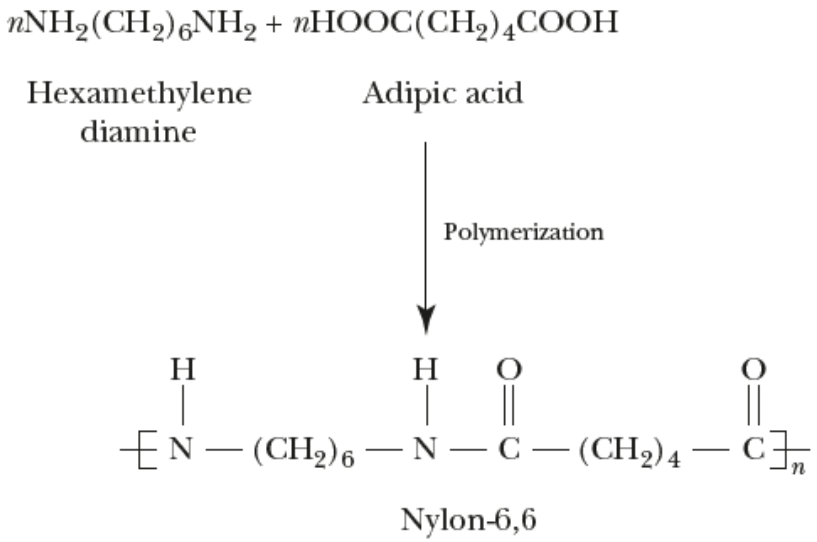
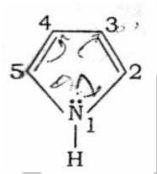


Hence, the correct option is (3).

23. In pyrrole



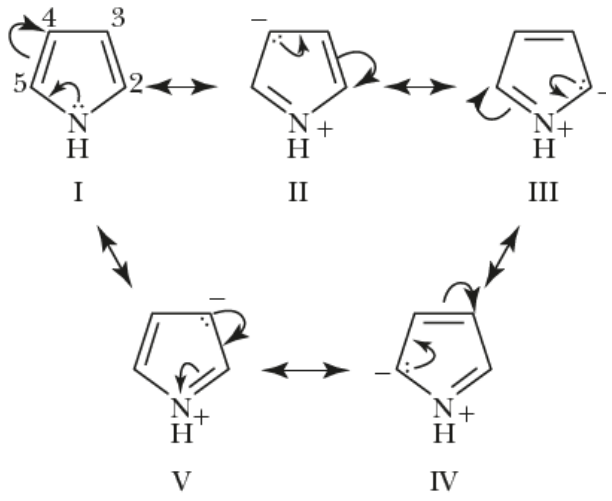
the electron density is maximum on

(1) 3 and 4 (2) 2 and 4

(3) 2 and 5 (4) 2 and 3

Solution:

In pyrrole, the four π- electrons are contributed by the carbon atoms of the pyrrole ring and two by sp^2 hybridized nitrogen to complete the aromatic sextet. The possible resonance structures are as follows.



From the resonance structures we can see that the maximum electron density is at position (2) and (5) in the ring as resonating structures (III)and (IV) are more stable than (II) and (V) so are the major contributors.

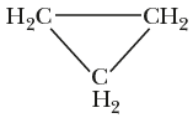
Hence, the correct option is (3).

24. Which of the following compounds shall **not** produce propene by reaction with HBr followed by elimination or direct only elimination reaction?

(1) $H_3C-CH_2-CH_2OH$

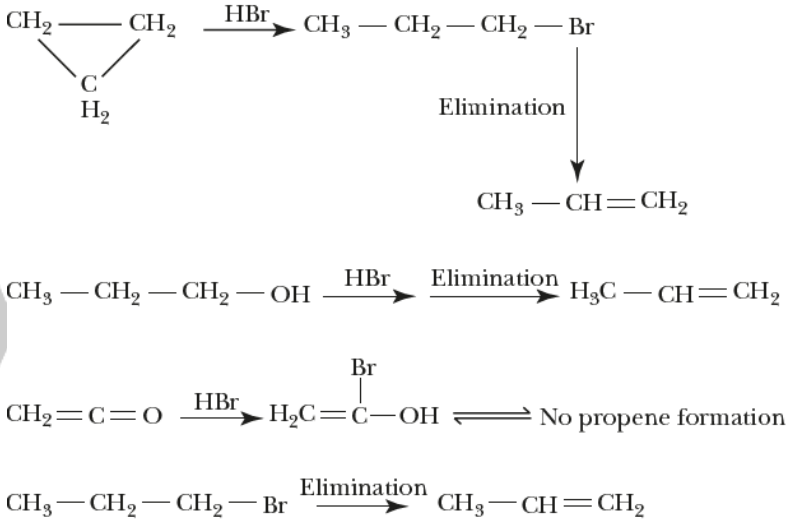
(2) $H_2C=C=O$

(3) $H_3C-CH_2-CH_2Br$

(4) 

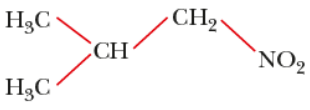
Solution:

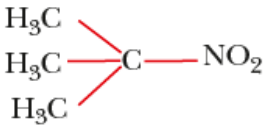
The reactions with the given compounds are as follows:

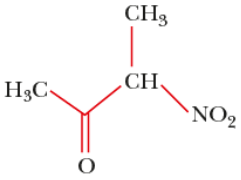


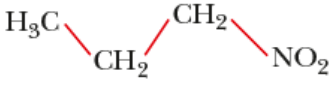
Hence, the correct option is (2).

25. Which one of the following nitro-compounds **does not** react with nitrous acid?

(1) 

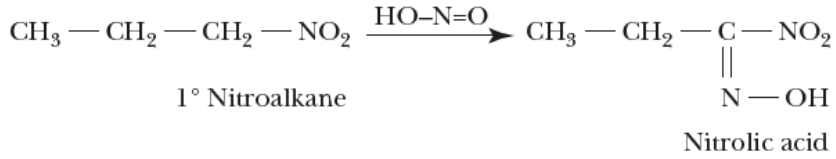
(2) 

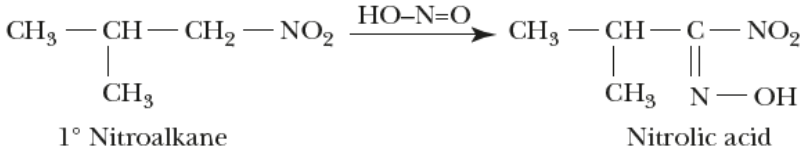
(3) 

(4) 

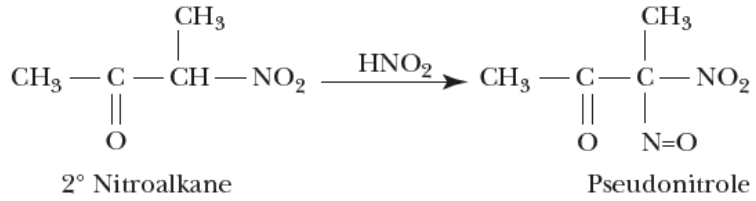
Solution:

Primary nitroalkanes react with nitrous acid to form nitrolic acids which dissolve in NaOH to give a red solution.





Secondary nitro alkanes react with nitrous acid to form pseudonitroles which do not dissolve in NaOH but are blue in colour.



Tertiary nitro alkanes do not react with nitrous acid since they do not contain any alpha hydrogen atoms.

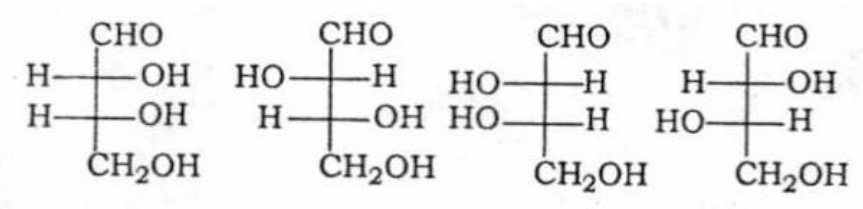
Hence, the correct option is (2).

26. The central dogma of molecular genetics states that the genetic information flows from
(1) DNA → Carbohydrates → Proteins
(2) DNA → RNA → Proteins
(3) DNA → RNA → Carbohydrates
(4) Amino acids → Proteins → DNA

Solution:

Hence, the correct option is (2).

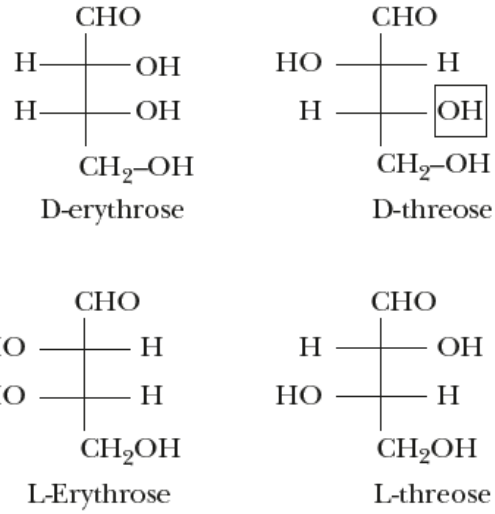
27. The **correct** corresponding order of names of four aldoses with configuration given below



respectively, is

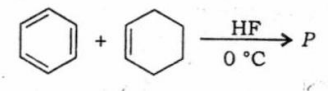
(1) D-threose, D-erythrose, L-threose, L-erythrose
(2) L-erythrose, L-threose, D-erythrose, D-threose
(3) D-erythrose, D-threose, L-erythrose, L-threose
(4) L-erythrose, L-threose, L-erythrose, D-threose

Solution:

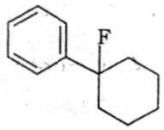


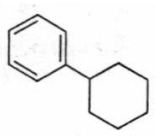
Hence, the correct option is (3).

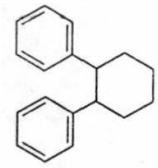
28. In the given reaction

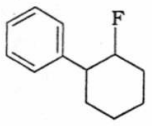


the product *P* is

(1) 

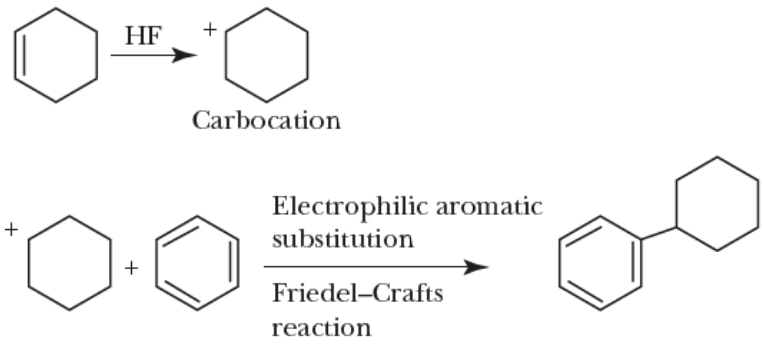
(2) 

(3) 

(4) 

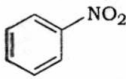
Solution:

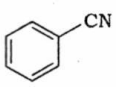
The reaction involves generation of a carbocation in the first step followed by electrophilic aromatic substitution.

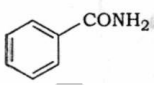


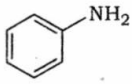
Hence, the correct option is (2).

29. A given nitrogen-containing aromatic compound *A* reacts with Sn/HCl, followed by HNO_2 to give an unstable compound *B*. *B*, on treatment with phenol, forms a beautiful coloured compound *C* with the molecular formula $C_{12}H_{10}N_2O$. The structure of compound *A* is

(1) 

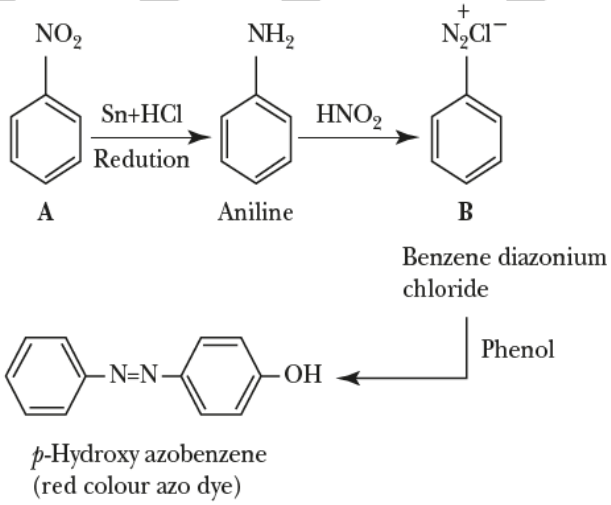
(2) 

(3) 

(4) 

Solution:

The given reaction sequence can be represented as follows.



Hence, the correct option is (1).

30. Consider the reaction

$CH_3CH_2CH_2Br + NaCN \rightarrow CH_3CH_2CH_2CN + NaBr$

This reaction will be the fastest in

(1) methanol.

(2) *N*,*N*′-dimethylformamide (DMF).

(3) water.
(4) ethanol.

Solution:

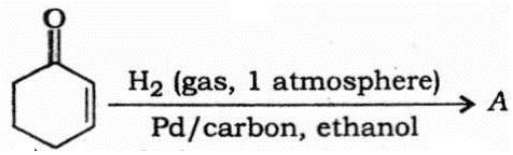
The given reaction is an example of nucleophilic substitution reaction of alkyl halides.

$CH_3{-}CH_2{-}CH_2Br + NaCN \rightarrow CH_3CH_2CH_2CN + NaBr$

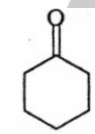
Primary alkyl halides undergo the reaction by S_N2 mechanism that is favoured by polar aprotic solvents like DMF or DMSO.

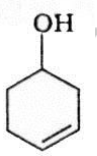
Hence, the correct option is (2).

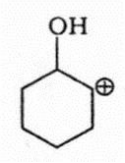
31. The **correct** structure of the product *A* formed in the reaction

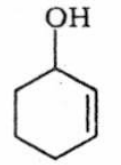


is

(1) 

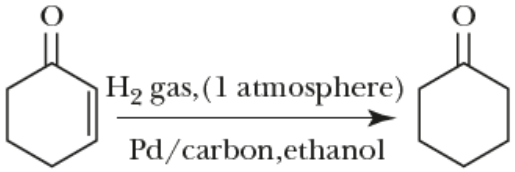
(2) 

(3) 

(4) 

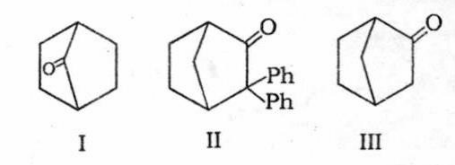
Solution:

In α, β- unsaturated carbonyl compounds, when reduction is carried out using hydrogen gas with palladium as catalyst, the carbon-carbon double bond is selectively reduced.



Hence, the correct option is (1).

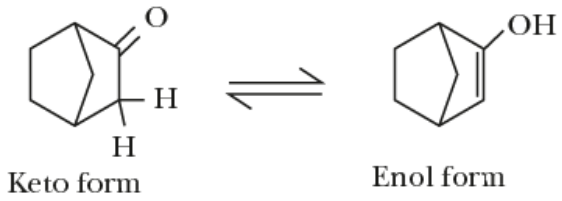
32. Which among the given molecules can exhibit tautomerism?



(1) Both I and III (2) Both I and II
(3) Both II and III (4) III only

Solution:

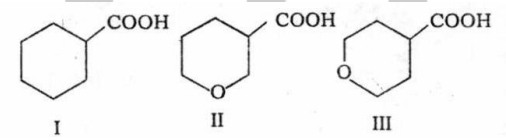
Keto-enol tautomerism is only possible for compound III.



In compound I, the hydrogen atoms at the bridge head cannot participate in keto-enol tautomerism. In compound II, one of the α- positions is at the bridge head and the other does not contain α-hydrogen.

Hence, the correct option is (4).

33. The **correct** order of strengths of the carboxylic acids is

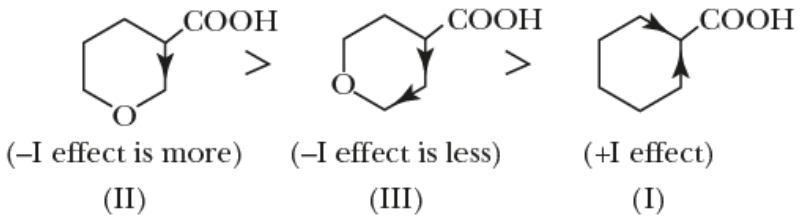


(1) II > III > I (2) III > II > I

(3) II > I > III (4) I > II > III

Solution:

The presence of electron withdrawing groups increases the acidic strength of carboxylic acids due to a combination of inductive and mesomeric effects. Compounds II and III are more acidic than carboxylic acid I due to − I effect of oxygen present in the ring. However, II is more acidic than III as the inductive effect reduces with increase in distance.



Hence, the correct option is (1).

34. The compound that will react most readily with gaseous bromine has the formula

(1) C_2H_2 (2) C_4H_{10}

(3) C_2H_4 (4) C_3H_6

Solution:

Given that the reaction involves gaseous bromine, suggests that the reaction is taking place at higher temperature, as bromine is a liquid at room temperature conditions. Thus the bromination reaction would take place by free radical mechanism which is possible with butane (C_4H_{10}) and propene (C_3H_6). The reaction that results in more stable free radical will take place faster.

$$CH_3–CH=CH_2 \longrightarrow \dot{C}H_2–CH=CH_2$$

Propene

$$CH_3–CH_2–CH_2–CH_3 \longrightarrow CH_3–\dot{C}H–CH_2–CH_3$$

Butane

Gaseous Bromine will react faster with propene because the resulting allylic free radical is more stable due to conjugation.

Hence, the correct option is (4).

35. Which one of the following compounds shows the presence of intramolecular hydrogen bond?

(1) HCN (2) Cellulose

(3) Concentrated acetic acid (4) H_2O_2

Solution:

Intramolecular hydrogen bonding is possible only in cellulose. A fiber of cellulose consistsof parallel strands of glucose molecules linked together. Each glucose unit in a chain is turned over with respect to the preceding glucose molecule and held together bu hydrogen bonds. In HCN, H_2O_2 and acetic acid, only intermoleculsr hydrogen bonding is possible.

In acetic acid, HCN only intermolecular hydrogen bonding is possible.

Hence, the correct option is (2).

36. The molar conductivity of a 0.5mol/dm^3 solution of $AgNO_3$ with electrolytic conductivity of 5.76×10^{-3} S cm^{-1} at 298 K is

(1) 11.52 S cm^2/mol (2) 0.086 S cm^2/mol

(3) 28.8 S cm^2/mol (4) 2.88 S cm^2/mol

Solution:

Given that: $C = 0.5$ mol/dm^3; $\kappa = 5.76 \times 10^{-3}$ S cm^{-1} and $T = 298$ K.

We know that, molar conductivity is given by

$$\lambda_m(\text{Scm}^2\text{mol}^{-1}) = \frac{\kappa(\text{Scm}^{-1}) \times 1000(\text{cm}^3\text{L}^{-1})}{M(\text{molL}^{-1})}$$

$$= \frac{5.76 \times 10^{-3}}{0.5} = 11.52\ \text{Scm}^2/\text{mol}$$

Hence, the correct option is (1).

37. The decomposition of phosphine (PH_3) on tungsten at low pressure is a first-order reaction. It is because the

(1) rate is inversely proportional to the surface coverage.

(2) rate is independent of the surface coverage.

(3) rate of decomposition is very slow.

(4) rate is proportional to the surface coverage.

Solution:

The rate of decomposition of PH_3 at low pressure with tungsten as catalyst

$$PH_3 \xrightarrow{W} P + \tfrac{3}{2} H_2$$

$$\text{Rate} = k[PH_3]$$

Thus it is a first order reaction. The rate is determined by partial pressure of PH_3 which is dependent on the amount of PH_3 absorbed by the surface of the catalyst. From adsorption isotherm, we have

$$\theta = \frac{kp}{1 + kp}$$

Where, θ is the surface area covered by adsorption. For low pressure, the term kp can be neglected, so $\theta = kp$ or rate is proportional to surface area coverage.

Hence, the correct option is (4).

38. The coagulation values in millimoles per litre of the electrolytes used for the coagulation of As_2S_3 are given below:
I. (NaCl) = 52,
II. ($BaCl_2$) = 0.69,
III. ($MgSO_4$) = 0.22

The **correct** order of their coagulating power is
(1) II > I > III
(2) III > II > I
(3) III > I > II
(4) I > II > III

Solution:

The minimum concentration of the electrolyte (in milimoles) that is required to bring about coagulation of one litre of solution in two hours is called the coagulation value. The reciprocal of coagulation value is the coagulating power of the electrolyte.

$$\text{Coagulating power} \propto \frac{1}{\text{Coagulation value}}$$

Thus, the correct order of coagulating power is III > II > I

Hence, the correct option is (2).

39. During the electrolysis of molten sodium chloride, the time required to produce 0.10 mol of chlorine gas using a current of 3 amperes is

(1) 110 minutes. (2) 220 minutes.

(3) 330 minutes. (4) 55 minutes.

Solution:

On electrolysis of brine solution, the following reactions take place

At the anode: $2Cl^- \rightarrow Cl_2(g) + 2e^-$

At the cathode: $Na + e^- \rightarrow Na$

From first law of electrolysis, we have

$$w = \frac{M}{n \times F} I \times t$$

Substituting values as F = 96500 C, n = 1, I = 3 amp and w =0.1 ×71 g, we get

$$0.1 \times 71 = \frac{35.5}{96500} \times 3 \times t$$

t = 643.33 s = 107.22 min

Hence, the correct option is (1).

40. How many electrons can fit in the orbital for which n = 3 and l = 1?

(1) 6 (2) 10

(3) 14 (4) 2

Solution:

For $n = 3$ and $l = 1$, the orbital is 3p and it can hold two electrons as per Pauli's exclusion principle.

Hence, the correct option is (4).

41. For a sample of perfect gas when its pressure is changed isothermally from p_i to p_f, the entropy change is given by

(1) $\Delta S = nR\ln\left(\frac{p_i}{p_f}\right)$

(2) $\Delta S = nRT\ln\left(\frac{p_f}{p_i}\right)$

(3) $\Delta S = RT\ln\left(\frac{p_i}{p_f}\right)$

(4) $\Delta S = nR\ln\left(\frac{p_f}{p_i}\right)$

Solution:

The entropy change is given by

$$\Delta S = nC_p \ln\frac{T_2}{T_1} + nR\ln\frac{p_1}{p_2}$$

Where, C_p is the specific heat at constant pressure, p_1 and p_2 are initial and final pressures, respectively and T_1 and T_2 are initial and final temperatures, respectively. For an isothermal process, $T_1 = T_2$, so the equation reduces to T

$$\Delta S = nR\ln\frac{p_i}{p_f} \quad \Delta S = nR\ln\frac{Pi}{Pf}$$

Hence, the correct option is (1).

42. The van't Hoff factor (i) for a dilute aqueous solution of the strong electrolyte barium hydroxide is

(1) 1 (2) 2

(3) 3 (4) 0

Solution:

$Ba(OH)_2$ is strong electrolyte, so 100% dissociation occurs in solution.

$Ba(OH)_2 \rightarrow Ba^{2+} + 2OH^-(aq)$

The number of ions formed is 3, therefore, van't Hoff factor, $i = 3$.

Hence, the correct option is (3).

43. The percentage of pyridine (C_5H_5N) that forms pyridinium ion ($C_5H_5N^+H$) in a 0.10 M aqueous pyridine solution (K_b for $C_5H_5N = 1.7 \times 10^{-9}$) is

(1) 0.013% (2) 0.77%

(3) 1.6% (4) 0.0060%

Solution:

Pyridine (C_5H_5N) is a weak base, so in aqueous solution, it dissociates to an extent as

$$C_5H_5N + H_2O \rightleftharpoons [C_5H_5N^+H] + OH^-$$

Let α be the degree of dissociation, then

$$K_b = C\alpha^2 \Rightarrow \alpha = \sqrt{\frac{K_b}{C}}$$

Given $K_b = 1.7 \times 10^{-9}$ and $C = 0.1$. Substituting values, we get

$$\alpha = \sqrt{\frac{1.7 \times 10^{-9}}{0.1}} = 1.3 \times 10^{-4}$$

$\% \alpha = 1.3 \times 10^{-4} \times 100 = 0.013\ \%$

Hence, the correct option is (1).

44. In calcium fluoride, having the fluorite structure, the coordination numbers for calcium ion (Ca^{2+}) and fluoride ion (F^-) are

(1) 6 and 6 (2) 8 and 4

(3) 4 and 8 (4) 4 and 2

Solution:

For CaF_2, in fluorite structure, each calcium atom is surrounded by 8 F^- ions and each fluoride ion is surrounded by 4 Ca^{2+} ions. So, the coordination number for calcium ions is 8 and for fluoride ions is 4.

Hence, the correct option is (2).

45. If the E°_{cell} for a given reaction has a negative value, which of the following gives the **correct** relationships for the values of ΔG° and K_{eq}?

(1) $\Delta G^{\circ} > 0$; $K_{eq} > 1$

(2) $\Delta G^{\circ} < 0$; $K_{eq} > 1$

(3) $\Delta G^{\circ} < 0$; $K_{eq} < 1$

(4) $\Delta G^{\circ} > 0$; $K_{eq} < 1$

Solution:

We know that

$\Delta G^{\circ} = -nFE^{\circ}_{cell}$

Here, n is the number of electrons involved in the reaction and F is faraday of electricity used. When E°_{cell} is negative, ΔG° is positive and hence the reaction is not spontaneous. Also,

$\Delta G^{\circ} = -2.303\, RT \log k_{eq}$

Therefore, for positive value of ΔG° , $k_{eq} < 1$.

Hence, the correct option is (3).