

1. Match List-I with List-II and select the correct option:

3. Match List-I with List-II

| List-I (Types of redox reactions) | List-II (Examples)                                                                                           |
|-----------------------------------|--------------------------------------------------------------------------------------------------------------|
| a. Combination reaction           | i. $\text{Cl}_{2(g)} + 2\text{Br}^-_{(aq)} \rightarrow 2\text{Cl}^-_{(aq)} + \text{Br}_{2(l)}$               |
| b. Decomposition reaction         | ii. $2\text{H}_2\text{O}_{2(aq)} \rightarrow 2\text{H}_2\text{O}_{(l)} + \text{O}_{2(g)}$                    |
| c. Displacement reaction          | iii. $\text{CH}_{4(g)} + 2\text{O}_{2(g)} \xrightarrow{\Delta} \text{CO}_{2(g)} + 2\text{H}_2\text{O}_{(l)}$ |
| d. Disproportionation reaction    | iv. $2\text{H}_2\text{O}_{(l)} \xrightarrow{\Delta} 2\text{H}_{2(g)} + \text{O}_{2(g)}$                      |

Choose the correct answer from the options given below.

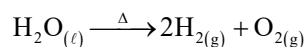
- (1) a-iv, b-iii, c-i, d-ii      (2) a-ii, b-i, c-iv, d-iii      (3) a-iii, b-iv, c-i, d-ii      (4) a-iii, b-ii, c-i, d-iv

**Ans. 3**

**Solution :**

Combination reaction – no example given

Decomposition reaction -  $\text{H}_2\text{O}_{2(aq)} \rightarrow \text{H}_2\text{O}_{(l)} + \text{O}_{2(g)}$



Displacement reaction -  $\text{Cl}_{2(g)} + 2\text{Br}^-_{(aq)} \rightarrow 2\text{Cl}^-_{(aq)} + \text{Br}_{2(g)}$

Disproportionation reaction -  $2\text{H}_2\text{O}_{2(aq)} \rightarrow 2\text{H}_2\text{O}_{(l)} + \text{O}_{2(g)}$

4. In the following pairs, the one in which both transition metal ions are colourless is

- (1)  $\text{Sc}^{3+}$ ,  $\text{Zn}^{2+}$       (2)  $\text{V}^{2+}$ ,  $\text{Ti}^{3+}$       (3)  $\text{Zn}^{2+}$ ,  $\text{Mn}^{2+}$       (4)  $\text{Ti}^{4+}$ ,  $\text{Cu}^{2+}$

**Ans. 1**

**Solution :**

Ions with  $d^0$  and  $d^{10}$  donot show d.d transitions, hence colorless

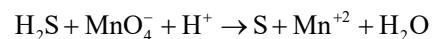


5. In the reaction between hydrogen sulphide and acidified permanganate solution,

- (1)  $\text{H}_2\text{S}$  is reduced to S,  $\text{MnO}_4^-$  is oxidised to  $\text{Mn}^{2+}$   
 (2)  $\text{H}_2\text{S}$  is oxidised to  $\text{SO}_2$ ,  $\text{MnO}_4^-$  is reduced to  $\text{MnO}_2$   
 (3)  $\text{H}_2\text{S}$  is reduced to  $\text{SO}_2$ ,  $\text{MnO}_4^-$  is oxidised to  $\text{Mn}^{2+}$   
 (4)  $\text{H}_2\text{S}$  is oxidised to S,  $\text{MnO}_4^-$  is reduced to  $\text{Mn}^{2+}$

**Ans. 4**

**Solution :**

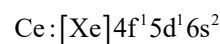


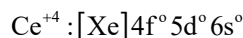
6. A member of the Lanthanoid series which is well known to exhibit +4 oxidation state is

- (1) Samarium      (2) Europium      (3) Erbium      (4) Cerium

**Ans. 4**

**Solution :**





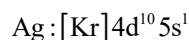
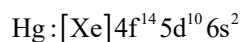
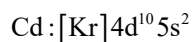
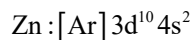
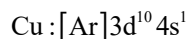
Since  $\text{Ce}^{+4}$  has stable noble gas configuration, it is well known to show +4 oxidation state.

7. In which of the following pairs, both the elements do not have  $(n-1)d^{10}ns^2$  configuration?

(1) Cu, Zn                      (2) Zn, Cd                      (3) Cd, Hg                      (4) Ag, Cu

**Ans. 4**

**Solution :**



8. A ligand which has two different donor atoms and either of the two ligates with the central metal atom/ion in the complex is called \_\_\_\_\_

(1) Chelate ligand              (2) Unidentate ligand      (3) Polydentate ligand      (4) Ambidentate ligand

**Ans. 4**

**Solution :**

Any ligand which has two different donor atoms and only one atom can ligate with metal is ambidentate ligand

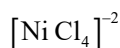
9. Which of the following statements are true about  $[\text{NiCl}_4]^{2-}$ ?

(a) The complex has tetrahedral geometry  
 (b) Co-ordination number of Ni is 2 and oxidation state is +4  
 (c) The complex is  $sp^3$  hybridised  
 (d) It is a high spin complex  
 (e) The complex is paramagnetic

(1) a,c,d and e              (2) a,b,d and e              (3) b,c,d and e              (4) a,b,c and d

**Ans. 1**

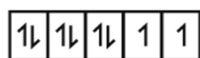
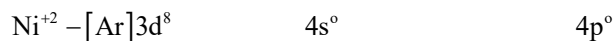
**Solution :**



O.S. of Ni = +2

Coordination no. of  $\text{Ni}^{+2}$  = 4

$\text{Cl}^-$  is weak field ligand, pairing does not take place



$sp^3$  hybridization

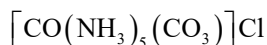
$[\text{NiCl}_4]^{2-}$  is paramagnetic

10. Which formula and its name combination is incorrect?

- (1)  $K_3[Cr(C_2O_4)_3]$ , Potassium trioxalatochromate (III)  
 (2)  $[CoCl_2(en)_2]Cl$ , Dichloridobis (ethane – 1,2 – dimine) cobalt (III) chloride  
 (3)  $[Co(NH_3)_5(CO_3)]Cl$ , Pentaamine carbonylcobalt (III) chloride  
 (4)  $[Pt(NH_3)_2Cl(NO_2)]$  Diamine chloridonitrito – N – Platinum (II)

**Ans. 3**

**Solution :**



Penta ammine carbonate cobalt (III) chloride.

11. In the complex ion  $[Fe(C_2O_4)_3]^{3-}$ , the co-ordination number of Fe is

- (1) 4 (2) 5 (3) 6 (4) 3

**Ans. 3**

**Solution :**

The coordination no. of Fe is 6

3 as it is forming 6 bonds with the legand.

12. Match List-I with List-II for the following reaction pattern

Glucose  $\xrightarrow{\text{Reagent}}$  Product  $\longrightarrow$  Structural prediction

| List – I (Reagents) | List-II (Structural prediction)                      |
|---------------------|------------------------------------------------------|
| a. Acetic anhydride | i. Glucose has an aldehyde group                     |
| b. Bromine water    | ii. Glucose has a straight chain of six carbon atoms |
| c. Hydroiodic acid  | iii. Glucose has five hydroxyl group                 |
| d. Hydrogen cyanide | iv. Glucose has a carbonyl group                     |

Choose the correct answer from the options given below.

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

**Ans. 2**

**Solution :**

a – iii

b – i

c – ii

d – iv

13. The correct sequence of  $\alpha$  – amino acids, hormone, vitamin, carbohydrates respectively is

- (1) Thiamine, Thyroxine, Vitamin A, Glucose  
 (2) Glutamine, Insulin, Aspartic acid, Fructose  
 (3) Arginine, Testosterone, Glutamic acid, Fructose  
 (4) Aspartic acid, Insulin, Ascorbic acid, rhamnose

**Ans. 4**

**Solution :**

Aspartic acid  $\rightarrow$   $\alpha$  – amino acid

Insulin  $\rightarrow$  hormone

Ascorbic acid (Vitamin C)  $\rightarrow$  Vitamin

Rhamnose (deoxy sugar)  $\rightarrow$  Carbohydrate

14. Which examples of carbohydrates exhibit  $\alpha$  – link, ( $\alpha$  – glycosidic link) in their structure?

(1) Maltose and Lactose

(2) Amylose and Amylopectin

(3) Cellulose and Glycogen

(4) Glucose and Fructose

**Ans. 2**

**Solution :**

$\alpha$  – links are found in the structure of starch which consists of amylose and amylopectin.

15. In the titration of potassium permanganate ( $\text{KMnO}_4$ ) against Ferrous ammonium sulphate (FAS) solution, dilute sulphuric acid but not nitric acid is used to maintain acidic medium, because

(1) It is difficult to identify the end point

(2) Nitric acid doesn't act as an indicator

(3) Nitric acid itself is an oxidizing agent

(4) Nitric acid is a weak acid than sulphuric acid

**Ans. 3**

**Solution :**

Nitric acid is not used in the redox titration because it is a strong OA itself.

16. The group reagent  $\text{NH}_4\text{Cl(s)}$  and aqueous  $\text{NH}_3$  will precipitate which of the following ion?

(1)  $\text{NH}_4^+$

(2)  $\text{Al}^{3+}$

(3)  $\text{Ba}^{2+}$

(4)  $\text{Ca}^{2+}$

**Ans. 2**

**Solution :**

Nylon in presence of  $\text{NaCl}$  is used for detection of group III cations which are  $\text{Al}^{3+}$ ,  $\text{Fe}^{3+}$ ,  $\text{Cr}^{3+}$

17. In the preparation of sodium fusion extract, the purpose of fusing organic compound with a piece of sodium metal is to

(1) Convert the organic compound into vapour state

(2) Convert the elements of the compound from covalent form to ionic form

(3) Convert the elements of the compound from ionic form to covalent form

(4) Decrease the melting point of the compound

**Ans. 2**

**Solution :**

The purpose of sodium fusion extract is to convert the element in the organic compound into ionic compound so that the detection could become easier.

18. The sodium fusion extract is boiled with concentrated nitric acid while testing for halogens. By doing so, it

(1) helps in precipitation of  $\text{AgCl}$

(2) increases the solubility of  $\text{AgCl}$

(3) increases the concentration of  $\text{NO}_3^-$  ion

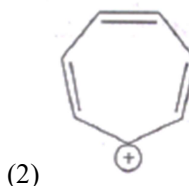
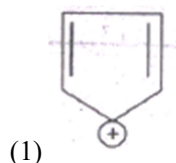
(4) decomposes  $\text{Na}_2\text{S}$  and  $\text{NaCN}$ , if formed

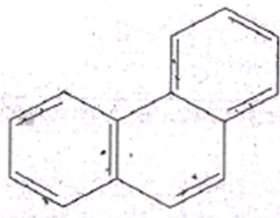
**Ans. 4**

**Solution :**

It is done so that if there is any  $\text{Na}_2\text{S}$  or  $\text{NaCN}$ , it can be decomposed.

19. Which of the following is not an aromatic compound





(3)



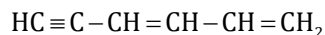
(4)

**Ans. 1**

**Solution :**

1 is antiaromatic as it has  $4\pi e^-$ .

20. The IUPAC name of the given organic compound is



(1) Hexa - 1 - yn - 3,5 - diene

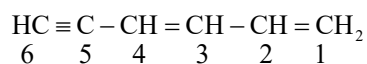
(2) Hexa - 5 - yn - 1,3 - diene

(3) Hexa - 1,3 - dien - 5 - yne

(4) Hexa - 3,5 - dien - 1 - yne

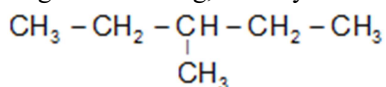
**Ans. 3**

**Solution :**



Double bond is given preference over triple bond.

21. Among the following, identify the compound that is not an isomer of hexane

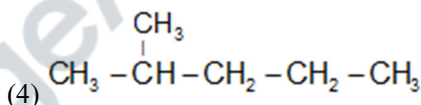


(1)

(2)  $CH_3 - CH_2 - CH_2 - CH_2 - CH_2 - CH_3$



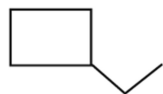
(3)



(4)

**Ans. 3**

**Solution :**

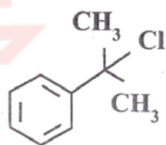


MF :  $C_6H_{12}$



MF :  $C_6H_{14}$

$\therefore$  above compounds are not isomers



22. The organic compound \_\_\_\_\_ can be classified as \_\_\_\_\_

(1) Allylic halide

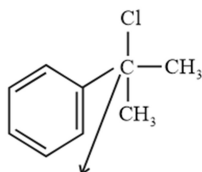
(2) Benzyl halide

(3) Aryl halide

(4) Alkyl halide

**Ans. 2**

**Solution :**



Benzylic Position

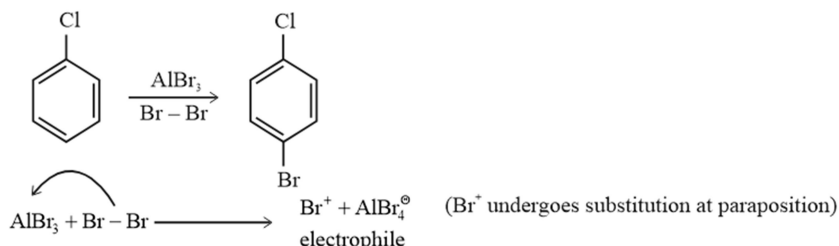
23. Chlorobenzene reacts with bromine gas in the presence of Anhyd  $\text{AlBr}_3$  to yield p-Bromochlorobenzene.

This reaction is classified as \_\_\_\_\_

- (1) Elimination reaction (2) Nucleophilic substitution reaction  
(3) Electrophilic substitution reaction (4) Addition reaction

**Ans. 3**

**Solution :**

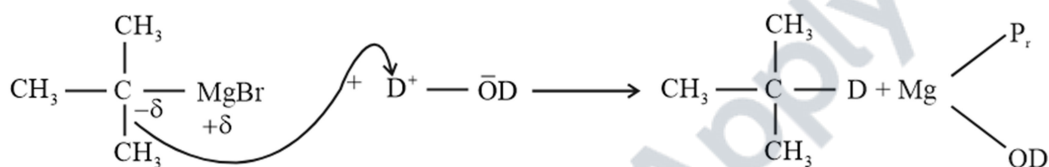


24. The organometallic compound  $(\text{CH}_3)_3\text{CMgBr}$  on reaction with  $\text{D}_2\text{O}$  produces \_\_\_\_\_

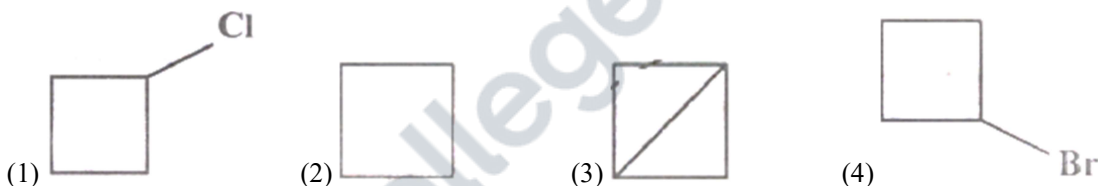
- (1)  $(\text{CH}_3)_3\text{COD}$  (2)  $(\text{CD}_3)_3\text{CD}$  (3)  $(\text{CD}_3)_3\text{COD}$  (4)  $(\text{CH}_3)_3\text{CD}$

**Ans. 4**

**Solution :**

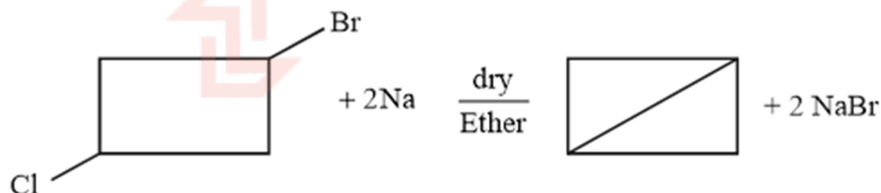


25. The major product formed when 1 - Bromo - 3 - Chlorocyclobutane reacts with metallic sodium in dry ether is



**Ans. 3**

**Solution :**

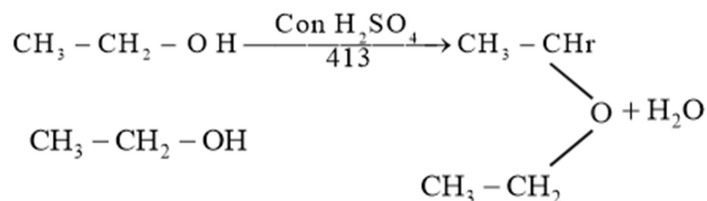


26. Ethyl alcohol is heated with concentrated sulphuric acid at 413 K. The major product

- (1)  $\text{C}_2\text{H}_5 - \text{O} - \text{C}_2\text{H}_5$  (2)  $\text{CH}_3 - \text{O} - \text{C}_3\text{H}_7$  (3)  $\text{CH}_2 = \text{CH}_2$  (4)  $\text{CH}_3\text{COOC}_2\text{H}_5$

**Ans. 1**

**Solution :**

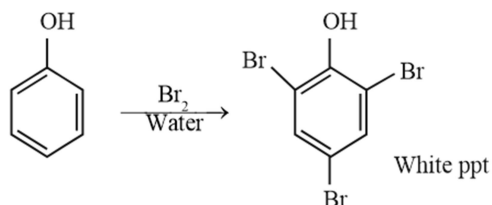


27. Phenol can be distinguished from propanol by using the reagent

- (1) Bromine water      (2) Iron metal      (3) Iodine in alcohol      (4) Sodium metal

**Ans. 1**

**Solution :**



Where as propand Cannot form white ppt with  $\text{Br}_2$  water

28. Match the following with their pKa values

| Acid                | pKa      |
|---------------------|----------|
| (I) Phenol          | (a) 16   |
| (II) p-Nitrophenol  | (b) 0.78 |
| (III) Ethyl alcohol | (c) 10   |
| (IV) Picric acid    | (d) 7.1  |

(1) I – c, II – d, III – a, IV – b

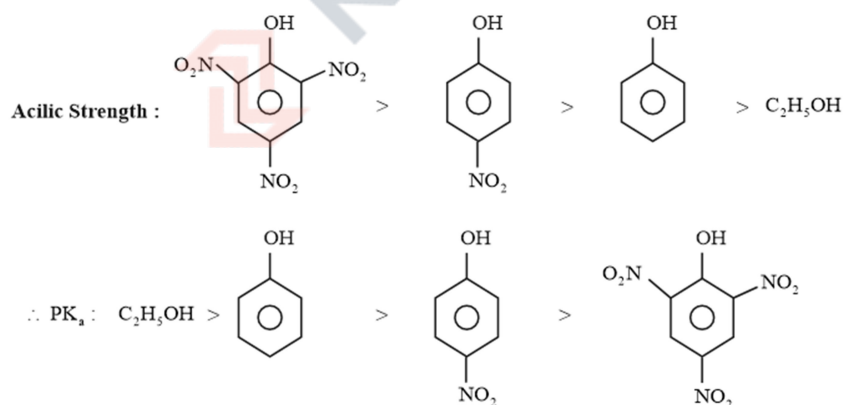
(2) I – a, II – d, III – c, IV – b

(3) I – a, II – b, III – c, IV – d

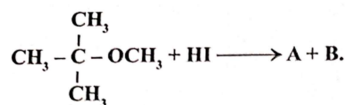
(4) I – b, II – a, III – d, IV – c

**Ans. 1**

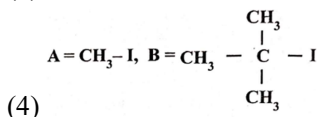
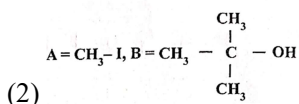
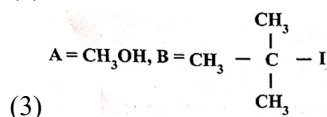
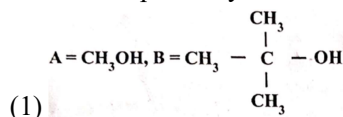
**Solution :**



29.

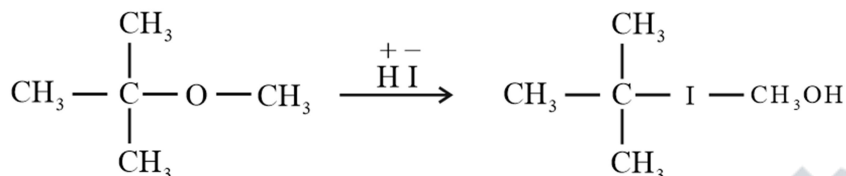


A and B respectively are



Ans. 3

Solution :

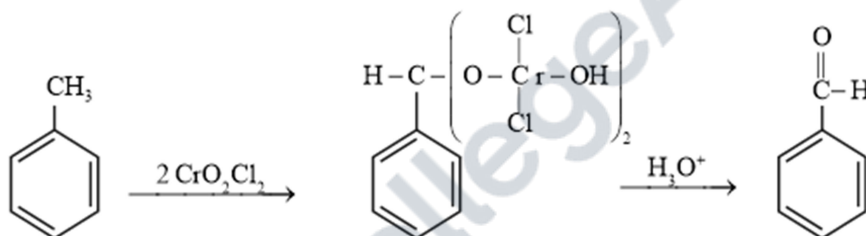


30. Oxidation of Toluene with chromyl chloride followed by hydrolysis gives Benzaldehyde. This reaction is known as \_\_\_\_\_

- (1) Etard Reaction      (2) Kolbe reaction      (3) Stephen reaction      (4) Cannizzaro Reaction

Ans. 1

Solution :



31. **Statement – I :** Reduction of ester by DIABL-H followed by hydrolysis gives aldehyde.

**Statement – II :** Oxidation of benzyl alcohol with aqueous  $\text{KMnO}_4$  leads to the formation to Benzaldehyde.

Among the above statements, identify the correct statement.

- (1) Both statements – I and II are false  
(2) Statement – I is true but statement – II is false  
(3) Statement – I is false but statement – II is true  
(4) Both statements – I and II are true.

Ans. 2

Solution :

Esters reduced to aldehyde with DIBAL-H. Benzyl alcohol oxidized to form Benzoic acid.

32. Arrange the following compounds in their decreasing order of reactivity towards Nucleophilic addition reaction.



- (1)  $\text{CH}_3\text{CHO} > \text{CH}_3\text{COCH}_3 > \text{CH}_3\text{COC}_2\text{H}_5$   
 (2)  $\text{CH}_3\text{COCH}_3 > \text{CH}_3\text{CHO} > \text{CH}_3\text{COC}_2\text{H}_5$   
 (3)  $\text{CH}_3\text{COC}_2\text{H}_5 > \text{CH}_3\text{COCH}_3 > \text{CH}_3\text{CHO}$   
 (4)  $\text{CH}_3\text{CHO} > \text{CH}_3\text{COC}_2\text{H}_5 > \text{CH}_3\text{COCH}_3$

**Ans. 1**

**Solution :**

$$\text{NAR reactivity} \propto \frac{\text{Positive charge Nucleophilic centre}}{\text{Steric hindrance at Nucleophilic centre}}$$

33. Which of the following has most acidic Hydrogen ?

- (1) Propanoic acid (2) Dichloroacetic acid  
 (3) Trichloroacetic acid (4) Chloroacetic acid

**Ans. 3**

**Solution :**

Acidic nature  $\propto$  no. of  $-I$  groups

34. Which of the following reagents are suitable to differentiate Aniline and N-methylaniline chemical

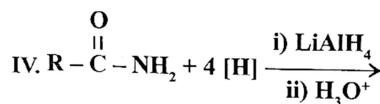
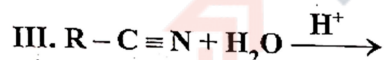
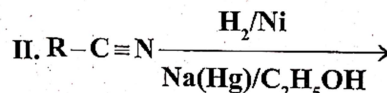
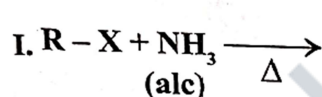
- (1) Acetic anhydride  
 (2)  $\text{Br}_2$  water  
 (3) Conc. Hydrochloric acid and anhydrous zinc chloride  
 (4) Chloroform and Alcoholic potassium hydroxide

**Ans. 4**

**Solution :**

Only i Amines undergo Carbyl amine test

35. Which of the following reaction/s does not yield an amine ?



- (1) Both I and III (2) Only II (3) Only III (4) Both II and IV

**Ans. 3**

**Solution :**

Cyanides on hydrolysis gives Carboxylic acids, where as rest all 3 cases amines can be prepared.

36. Match the compounds given in List – I with the items given in List – II.

| List – I                      | List – II                  |
|-------------------------------|----------------------------|
| (I) Benzenesulphonyl Chloride | (a) Zwitterion             |
| (II) Sulphanilic acid         | (b) Hinsberg reagent       |
| (III) Alkyl Diazonium salts   | (c) Dyes                   |
| (IV) Aryl Diazonium salts     | (d) Conversion to alcohols |

(1) I – c, II – b, III – a, IV – d

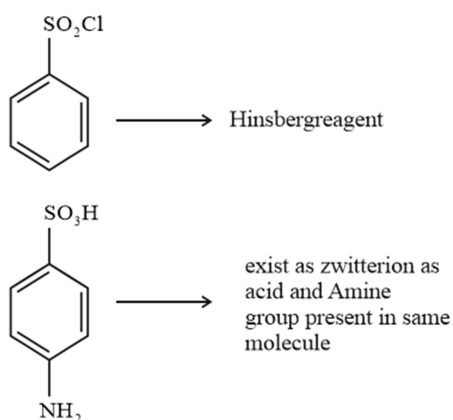
(2) I – a, II – c, III – b, IV – d

(3) I – c, II – a, III – d, IV – b

(4) I – b, II – a, III – d, IV – c

**Ans. 4**

**Solution :**



Alkyl diazonium Salts  $\rightarrow$  Convert to alcohols as Carbocation intermediate formed is unstable.

Aryl diazonium Salts  $\rightarrow$  Participate in dye test

37. The number of orbitals associated with 'N' shell of an atom is

(1) 16

(2) 32

(3) 3

(4) 4

**Ans. 1**

**Solution :**

Maximum number of orbitals in a shell =  $n^2$

Given  $n = 4$   $\therefore n^2 = 16$

38. According to the Heisenberg's Uncertainty principle, the value of  $\Delta b \cdot \Delta x$  for an object whose mass is  $10^{-6}$  kg is ( $h = 6.626 \times 10^{-34}$  Js)

(1)  $3.0 \times 10^{-24} \text{ m}^2 \text{ s}^{-1}$

(2)  $4.0 \times 10^{-26} \text{ m}^2 \text{ s}^{-1}$

(3)  $3.5 \times 10^{-25} \text{ m}^2 \text{ s}^{-1}$

(4)  $5.2 \times 10^{-29} \text{ m}^2 \text{ s}^{-1}$

**Ans. 4**

**Solution :**

$$\Delta v \cdot \Delta x = \frac{h}{4\pi m}$$

$$= \frac{6.625 \times 10^{-34}}{4 \times 3.14 \times 10^{-6}} = 5.2 \times 10^{-29}$$

39. Given below are two statements.

**Statement-I :** Adiabatic work done is positive when work is done on the system and internal energy of the system increases.

**Statement – II :** No work is done during free expansion of an ideal gas.

In the light of the above statements, choose the correct answer from the options given below.

- (1) Both statements – I and Statement – II are false
- (2) Statement – I is true but statement – II is false
- (3) Statement – I is false but statement – II is true
- (4) Both statements – I and Statement – II are true.

**Ans. 4**

**Solution :**

S-I : In adiabatic process  $\Delta U = W$  and work done on the system is positive there fore internal energy increses.

S-II : When external pressure is zero, work done is zero

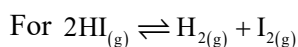
40. Which one of the following reactions has  $\Delta H = \Delta U$  ?

- (1)  $\text{CaCO}_3(\text{s}) \xrightarrow{\Delta} \text{CaO}(\text{s}) + \text{CO}_2(\text{g})$
- (2)  $\text{C}_6\text{H}_6(\text{l}) + \frac{15}{2}\text{O}_2(\text{g}) \longrightarrow 6\text{CO}_2(\text{g}) + 3\text{H}_2\text{O}(\text{l})$
- (3)  $2\text{HI}(\text{g}) \rightleftharpoons \text{H}_2(\text{g}) + \text{I}_2(\text{g})$
- (4)  $\text{N}_2(\text{g}) + 3\text{H}_2(\text{g}) \rightleftharpoons 2\text{NH}_3(\text{g})$

**Ans. 3**

**Solution :**

$$\Delta H = \Delta U + \Delta n_g RT$$



$$\Delta n_g = 0$$

$$\therefore \Delta H = \Delta U$$

41. Identify the incorrect statements among the following:

- (a) All enthalpies of fusion are positive
- (b) The magnitude of enthalpy change does not depend on the strength of the intermolecular interactions in the substance undergoing phase transformations.
- (c) When a chemical reaction is reversed, the value of  $\Delta_r H^\circ$  is reversed in sign.
- (d) The change in enthalpy is dependent of path between initial state (reactants) and final state (products)
- (e) For most of the ionic compounds,  $\Delta_{\text{sol}} H^\circ$  is negative

- (1) a, b and d                      (2) b, d and e                      (3) a, d and e                      (4) a and e only

**Ans. 2**

**Solution :**

- (a) Fusion is endothermic  $\rightarrow$  correct
- (b) It depends  $\rightarrow$  Incorrect
- (c) Correct
- (d) Incorrect
- (e) Incorrect

42. Which of the following statements is/are true about equilibrium?
- Equilibrium is possible only in a closed system of at a given temperature
  - All the measurable properties of the system remain constant at equilibrium
  - Equilibrium constant for the reverse reaction is the inverse of the equilibrium constant for the reaction in the forward direction.
- (1) Only b                      (2) Only c                      (3) a, b and c                      (4) Only a

**Ans. 3**

**Solution :**

- True
- True
- True

43. According to Le Chatelier's principle, in the reaction  $\text{CO(g)} + 3\text{H}_2\text{(g)} \rightleftharpoons \text{CH}_4\text{(g)} + \text{H}_2\text{O(g)}$ , the formation of methane is favoured by
- Increasing the concentration of CO
  - Increasing the concentration of  $\text{H}_2\text{O}$
  - Decreasing the concentration of  $\text{CH}_4$
  - Decreasing the concentration of  $\text{H}_2$
- (1) a and c                      (2) b and d  
(3) a and d                      (4) a and b

**Ans. 1**

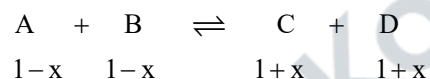
**Solution :**

- True
- False
- True
- False

44. The equilibrium constant at 298K for the reaction  $\text{A} + \text{B} \rightleftharpoons \text{C} + \text{D}$  is 100. If the initial concentrations of all the four species were 1M each, then equilibrium concentration of D (in  $\text{mol L}^{-1}$ ) will be
- (1) 0.182                      (2) 1.818                      (3) 1.182                      (4) 0.818

**Ans. 2**

**Solution :**



$$100 = \frac{(1+x)(1+x)}{(1-x)(1-x)}$$

$$\Rightarrow \frac{1+x}{1-x} = 10$$

$$\Rightarrow 1+x = 10 - 10x$$

$$\Rightarrow 11x = 9$$

$$x = \frac{9}{11} = 0.818$$

$$\text{(D) } 1+x = 1+0.818 = 1.818$$

45. Among the following 0.1 m aqueous solutions, which one will exhibit the lowest boiling point elevation, assuming complete ionization of the compound in solution?
- Aluminium chloride
  - Aluminum sulphate
  - Potassium sulphate
  - Sodium chloride

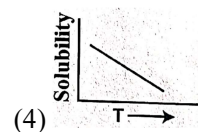
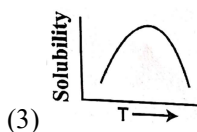
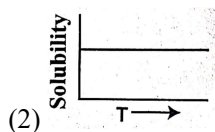
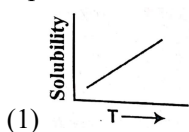
**Ans. 4**

**Solution :**

$$\Delta T_b \propto i$$

- (1)  $\text{AlCl}_3$   $i = 4$   
 (2)  $\text{Al}_2(\text{SO}_4)_3$   $i = 5$   
 (3)  $\text{K}_2\text{SO}_4$   $i = 3$   
 (4)  $\text{NaCl}$   $i = 2$  (Lowest Boiling)

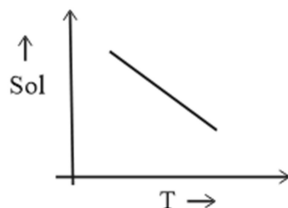
46. Variation of solubility with temperature  $t$  for a gas in liquid is shown by the following graphs. The correct representation is



**Ans. 4**

**Solution :**

$$\text{Henry law solubility} \propto \frac{1}{\text{Temp}}$$



47. 180g of glucose,  $\text{C}_6\text{H}_{12}\text{O}_6$ , is dissolved in 1 kg of water in a vessel. The temperature at which water boils at 1.013 bar is \_\_\_\_\_ (given,  $K_b$  for water is  $0.52 \text{ K kg mol}^{-1}$ . Boiling point for pure water is  $373.15 \text{ K}$ )
- (1) 373.67 K                      (2) 373.015 K                      (3) 373.0 K                      (4) 373.202 K

**Ans. 1**

**Solution :**

$$\Delta T_b = i K_b m \quad (i = 1) \text{ glucose}$$

$$T_b - 373.15 = 1 \times 0.52 \times \frac{180}{180 \times 1}$$

$$T_b = 0.52 + 373.15 = 373.67 \text{ K}$$

48. If  $\text{N}_2$  gas is bubbled through water at 293 K, how many moles of  $\text{N}_2$  gas would dissolve in 1 litre of water? Assume that  $\text{N}_2$  exerts a partial pressure of 0.987 bar.

[Given  $K_H$  for  $\text{N}_2$  at 293 K is  $76.48 \text{ K bar}$ ]

- (1)  $0.716 \times 10^{-3}$                       (2)  $7.16 \times 10^{-5}$                       (3)  $7.16 \times 10^{-4}$                       (4)  $7.16 \times 10^{-3}$

**Ans. 3**

**Solution :**

$$\text{Henry law :- } P = K_H X$$

$$X_{\text{N}_2} = \frac{P_{\text{N}_2}}{K_H} = \frac{0.987}{76.48 \times 10^3} = 1.29 \times 10^{-5}$$

$$n_{\text{H}_2\text{O}} = \frac{1000}{18} = 55.5$$

$$X_{\text{N}_2} = \frac{n_{\text{N}_2}}{n_{\text{N}_2} + n_{\text{H}_2\text{O}}}$$

$$1.29 \times 10^{-5} = \frac{n}{n + 55.5} = \frac{n}{55.5}$$

$$n = 1.29 \times 10^{-5} \times 55.5$$

$$n_{\text{N}_2} = 7.16 \times 10^{-4}$$

49. The correct statement/s about Galvanic cell is/are

- (a) Current flows from cathode to anode
- (b) Anode is positive terminal
- (c) If  $E_{\text{cell}} < 0$ , then it is spontaneous reaction
- (d) Cathode is positive terminal

(1) a and b only

(2) a, b and c

(3) a and d only

(4) b only

**Ans. 3**

**Solution :**

|               |                                                  |
|---------------|--------------------------------------------------|
| (a) Correct   | Galvanic Cell<br>Left   Oxidation anode negative |
| (b) Incorrect |                                                  |
| (c) Incorrect |                                                  |
| (d) Correct   |                                                  |

50. The electronic conductance depends on

- (1) Nature of electrolyte added
- (2) The number of valence electrons per atom
- (3) Concentration of the electrolyte
- (4) Size of the ions

**Ans. 2**

**Solution :**

$$(2) \text{ Electronic conductance } \propto \frac{\text{no. of } e^- \text{ per atom}}{\text{Temperature}}$$

51. For a given half cell,  $\text{Al}^{3+} + 3e^- \rightarrow \text{Al}$  on increasing of aluminium ion, the electrode potential will

- (1) Decrease
- (2) No change
- (3) First increase then decrease
- (4) Increase

**Ans. 4**

**Solution :**  $\text{Al}^{3+} + 3e^- \rightarrow \text{Al}(s)$

$$E_{\text{Red}} = E_{\text{Red}}^{\circ} - \frac{0.0591}{3} \log \frac{[\text{Al}(s)]}{[\text{Al}^{3+}]}$$

$$E_{\text{Red}} = E_{\text{Red}}^{\circ} - \frac{0.0591}{4} \log \frac{1}{[\text{Al}^{3+}]} \quad [\text{Since active mass of solid} = 1]$$

$$E_{\text{Red}} = E_{\text{Red}}^{\circ} + \frac{0.0591}{3} \log [\text{Al}^{3+}]$$

$$\text{So } E_{\text{Red}} \propto [\text{Al}^{3+}] \propto \text{conc}^n \text{ of } \text{Al}^{3+}$$

52. Match the following select the correct option for the quantity of electricity, in  $\text{Cmol}^{-1}$  required to deposit various metals at cathode

|   | List – I         |     | List- II                 |
|---|------------------|-----|--------------------------|
| a | $\text{Ag}^+$    | i   | $386000\text{Cmol}^{-1}$ |
| b | $\text{Mg}^{2+}$ | ii  | $289500\text{Cmol}^{-1}$ |
| c | $\text{Al}^{3+}$ | iii | $96500\text{Cmol}^{-1}$  |
| d | $\text{Ti}^{4+}$ | iv  | $193000\text{Cmol}^{-1}$ |

(1) a – ii, b – i, c – iv, d – iii

(2) a – iii, b – iv, c – ii, d – i

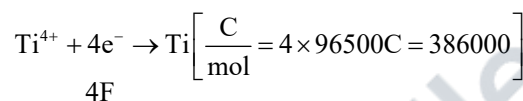
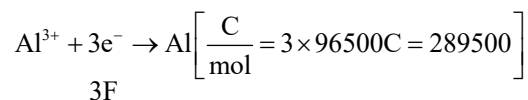
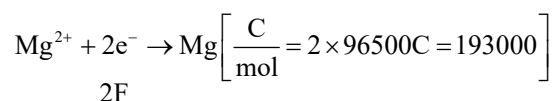
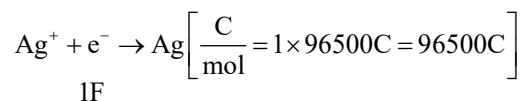
(3) a – iv, b – iii, c – i, d – ii

(4) a – i, b – ii, c – iii, d – iv

**Ans. 2**

**Solution :**

$$1\text{F} = 96500\text{C}$$



53. Catalysts are used to increase the rate of a chemical reaction. Because it

- (1) Increases the activation energy of the reaction
- (2) Decreases the activation energy of the reaction
- (3) Brings about improper orientation of reactant molecules
- (4) Increases the potential energy barrier

**Ans. 2**

**Solution :**

Positive catalyst decreases the activation energy to increase rate of reaction.

54. Half-life of a first order reaction is 20 seconds and initial concentration of reactant is 0.2M. The concentration of reactant left after 80 seconds is

- (1) 0.1 M                      (2) 0.05 M                      (3) 0.0125 M                      (4) 0.2 M

**Ans. 3**

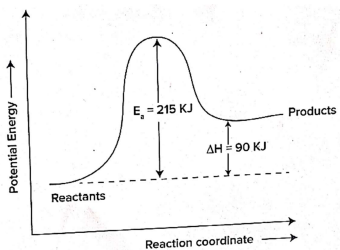
**Solution :**

$$\text{no. of Half lives} = \frac{t}{t_{\frac{1}{2}}} = \frac{80}{20} = 4$$

$$[A_t] = [A_o] \left( \frac{1}{2} \right)^n$$

$$[A_t] = 0.2 \times \left( \frac{1}{2} \right)^4 = 0.0125$$

55. In the given graph,  $E_a$  for the reverse reaction will be



(1) 125 KJ

(2) 215 KJ

(3) 90 KJ

(4) 305 KJ

**Ans. 1**

**Solution :**

$$\Delta H = (E_a)_f - (E_a)_b$$

$$90 = 215 - (E_a)_b$$

$$(E_a)_b = 215 - 90 = 125 \text{ KJ}$$

56. For the reaction  $2\text{N}_2\text{O}_{5(g)} \rightarrow 4\text{NO}_{2(g)} + \text{O}_{2(g)}$  initial concentration of  $\text{N}_2\text{O}_5$  is  $2.0 \text{ mol L}^{-1}$  and after 300 min, it is reduced to  $1.4 \text{ mol L}^{-1}$ . The rate of production of  $\text{NO}_2$  (in  $\text{mol L}^{-1} \text{ min}^{-1}$ ) is

(1)  $2.5 \times 10^{-4}$

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

(3)  $2.5 \times 10^{-3}$

(4)  $4 \times 10^{-3}$

**Ans. 4**

**Solution :**

Rate of formation of  $\text{NO}_2 = 2 \times \text{rate of disappearance of } \text{N}_2\text{O}_5$

$$= 2 \times \left[ \frac{-(1.4 - 2)}{300} \right]$$

$$= 4 \times 10^{-3}$$

57. Which of the following methods of expressing concentration are unitless?

(1) Mole fraction and Mass percent (W/W)

(2) Molality and Mole fraction

(3) Mass percent (W/W) and Molality

(4) Molality and Molarity

**Ans. 1**

**Solution :**

Mole fraction and mass percent (W/w) are unitless

58. Select the INCORRECT statement/s from the following:

(a) 22 books have infinite significant figures

(b) In the answer of calculation  $2.5 \times 1.25$  has four significant figures,.

(c) Zero's preceding to first non-zero digit are significant

(d) In the answer of calculation  $12.11 + 18.0 + 1.012$  has three significant figures

(1) b, c and d

(2) b and c only

(3) b and d only

(4) a and b only

**Ans. 1**

**Solution :**

Facts

59. Given below are the atomic masses of the elements:

| Element:                             | Li | Na | Cl   | K  | Ca | Br | Sr | I   | Ba  |
|--------------------------------------|----|----|------|----|----|----|----|-----|-----|
| Atomic Mass ( $\text{g mol}^{-1}$ ): | 7  | 23 | 35.5 | 39 | 40 | 80 | 88 | 127 | 137 |

Which of the following doesn't form triad?

(1) Ba, Sr, Ca

(2) Cl, Br, I

(3) Cl, K, Ca

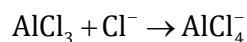
(4) Li, Na, K

**Ans. 3****Solution :**

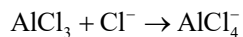
Elements in triad should have similar properties K, Ca are metals

Cl is non metal

60. The change in hybridization (if any) of the 'Al' atom in the following reaction is



(1) No change in the hybridization state

(2)  $\text{sp}^2$  to  $\text{sp}^3$ (3)  $\text{sp}^3$  to  $\text{sp}^3\text{d}$ (4)  $\text{sp}^3$  to  $\text{sp}^2$ **Ans. 2****Solution :** $\text{sp}^2$  $\text{sp}^3$ (3  $\sigma$  bonds)(4  $\sigma$  bonds)

**CHEMISTRY**

|             |    |    |    |    |    |    |    |    |    |    |    |    |    |    |    |
|-------------|----|----|----|----|----|----|----|----|----|----|----|----|----|----|----|
| <b>Que.</b> | 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  | 10 | 11 | 12 | 13 | 14 | 15 |
| <b>Ans.</b> | 1  | 3  | 3  | 1  | 4  | 4  | 4  | 4  | 1  | 3  | 3  | 2  | 4  | 2  | 3  |
| <b>Que.</b> | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 | 25 | 26 | 27 | 28 | 29 | 30 |
| <b>Ans.</b> | 2  | 2  | 4  | 1  | 3  | 3  | 2  | 3  | 4  | 3  | 1  | 1  | 1  | 3  | 1  |
| <b>Que.</b> | 31 | 32 | 33 | 34 | 35 | 36 | 37 | 38 | 39 | 40 | 41 | 42 | 43 | 44 | 45 |
| <b>Ans.</b> | 2  | 1  | 3  | 4  | 3  | 4  | 1  | 4  | 4  | 3  | 2  | 3  | 1  | 2  | 4  |
| <b>Que.</b> | 46 | 47 | 48 | 49 | 50 | 51 | 52 | 53 | 54 | 55 | 56 | 57 | 58 | 59 | 60 |
| <b>Ans.</b> | 4  | 1  | 3  | 3  | 2  | 4  | 2  | 2  | 3  | 1  | 4  | 1  | 1  | 3  | 2  |