

INDIAN ASSOCIATION OF CHEMISTRY TEACHERS
NATIONAL STANDARD EXAMINATION IN CHEMISTRY 2011-2012

1. The number of water molecules present in 0.20 g sample of $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ (molar mass = 249.7) is -
 (A) 1.2×10^{21} (B) 2.14×10^{21}
 (C) 2.14×10^{22} (D) 1.2×10^{23}

Ans. [B]

Sol. 249.7 gm of $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ contain $5 \times 6.023 \times 10^{23}$ molecule

$$\therefore 0.2\text{g of } \text{CuSO}_4 \cdot 5\text{H}_2\text{O} \text{ contain } \frac{5 \times 6.023 \times 10^{23}}{249.7} \times 0.2$$

$$= 2.14 \times 10^{21}$$

2. The group that has the species correctly listed in the order of decreasing radius is -
 (A) Cu^{2+} , Cu^+ , Cu (B) V, V^{2+} , V^{3+}
 (C) F, Br, I (D) B, Be, Li

Ans. [B]

Sol. Cationic radii $\propto \frac{1}{\text{effective nuclear charge}}$

$$\text{size} = \frac{\text{V} > \text{V}^{+2} > \text{V}^{+3}}{z_{\text{eff}} \uparrow \text{ size } \downarrow}$$

3. The number of isomers of dibromobiphenyl (Biphenyl – $\text{C}_6\text{H}_5\text{-C}_6\text{H}_5$) is -
 (A) 8 (B) 10
 (C) 12 (D) 14

Ans. [C]

4. The enthalpies of decomposition of methane (CH_4)(g) and ethane (C_2H_6)(g) are 400 and 670 kJ mol^{-1} , respectively. The $\Delta H_{\text{C-C}}$ in kJmol^{-1} is -
 (A) 270 (B) 70
 (C) 200 (D) 240

Ans. [B]

Sol. $\text{CH}_4 \rightarrow \text{C} + 4\text{H} \quad \Delta H = 400 \text{ KJ/mol}$

$$\therefore \Delta H = (\Sigma \text{B. E})_{\text{R}} - (\Sigma \text{B. E})_{\text{P}}$$

$$400 = 4 \text{ C} - \text{H}$$

$$\therefore \text{C-H} = 100 \text{ kJ/mol}$$

In $\text{C}_2\text{H}_6 \rightarrow 2\text{C} + 6\text{H} \quad \Delta H = 670 \text{ kJ/mol}$

$$\therefore \Delta H = [\text{C-C} + 6 \text{ C-H}]_{\text{R}} - [0]$$

$$670 = \text{C-C} + 6 \times 100$$

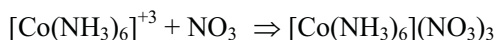
$$\therefore \text{C-C} = 70 \text{ kJ/mol}$$

5. The correct formula for hexaaminocobalt (III) nitrate is -



Ans. [D]

Sol. Formula of hexaammine cobalt (III) nitrate



6. For the reaction $\text{PCl}_3(\text{g}) + \text{Cl}_2(\text{g}) \rightleftharpoons \text{PCl}_5(\text{g})$, K_c is 26 at 250°C . K_p at the same temperature is -
($R = 8.314 \text{ J K}^{-1} \text{ mol}^{-1}$)

(A) 4.6×10^3

(B) 5.7×10^3

(C) 6.0×10^3

(D) 8.3×10^3

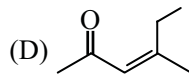
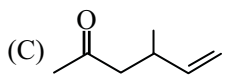
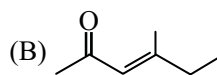
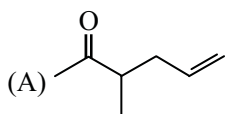
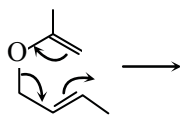
Ans. [C]

Sol. $k_p = k_c (RT)^{\Delta n_g}$

$$k_p = 26 (8.314 \times 523)^{-1}$$

$$k_p = \frac{26}{4348.2} = 5.9 \times 10^{-3}$$

7. Curved arrows are used in Organic chemistry to show the movements of electrons in the mechanism of a reaction. The correct product of the following reaction is -



Ans. [C]

8. Denaturation of protein due to change in pH could be due to -

(A) loss of van der Waal's interaction

(B) hydrophobic interaction

(C) change in ionic interaction

(D) breaking of covalent bonds

Ans. [C]

9. The initial activity of a radionuclide is 9750 counts per min and 975 counts after 5 min. The decay constant of the radionuclide in min^{-1} is about -

(A) 0.23

(B) 0.46

(C) 0.69

(D) 0.99

Ans. [B]

Sol.
$$K = \frac{2.303}{t} \log \frac{a}{(a-x)}$$

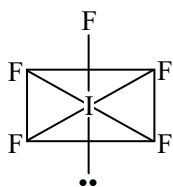
$$= \frac{2.303}{5} \log \frac{9750}{975}$$

$$= 0.46$$

- 10.** According to VSEPR theory the shape of IF_5 molecule will be -
 (A) tetrahedral (B) trigonal bipyramid
 (C) square pyramid (D) trigonal planar

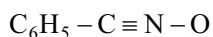
Ans. [C]

Sol. $:\text{IF}_5$
 $\therefore \text{sp}^3\text{d}^2$



Square pyramid

- 11.** The formal charges on the atoms underlined are -



- (A) $\text{C} = 0, \text{N} = -1, \text{O} = +1$ (B) $\text{C} = -1, \text{N} = +1, \text{O} = -1$
 (C) $\text{C} = 0, \text{N} = +1, \text{O} = -1$ (D) $\text{C} = +1, \text{N} = 0, \text{O} = -1$

Ans. [C]

Sol. $\text{C}_6\text{H}_5 - \text{C} \equiv \text{N} - \ddot{\text{O}}:$

$$\text{FC} = \text{valance e} - \frac{1}{2}(\text{bonded e}) - (\text{non-bonded})$$

$$\text{For C : FC} = 4 - \frac{1}{2} \times 8 = 0$$

$$\text{For N : FC} = 5 - \frac{1}{2}(8) = 0 + 1$$

$$\text{For O : FC} = 6 - \frac{1}{2}(2) + 6 = -1$$

- 12.** The number of α -particles emitted per second by a radioactive element reduces to 6.25% if the original value is 48 days. The half-life period of the element in days is -
 (A) 3 (B) 8
 (C) 12 (D) 16

Ans. [C]

Sol.
$$K = \frac{2.303}{48} \log \frac{100}{6.25}$$

$$= \frac{2.303}{48} \log 2^4$$

$$= \frac{2.303 \times 4 \times 0.3}{48} = 0.0575$$

$$t_{1/2} = \frac{0.693}{k} = \frac{0.693}{0.0575} = 12$$

13. The compound that does not have a π -bond is -

(A) SO_2

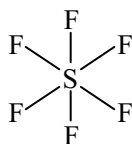
(B) SF_6

(C) O_2

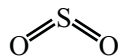
(D) SO_3

Ans. [B]

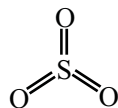
Sol. SF_6



SO_2



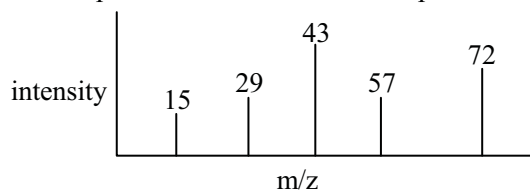
SO_3



O_2



14. In mass spectrometry a compound is bombarded with high energy electrons to break it into smaller fragments, which are recorded in the form of their masses (m/Z). For example butane gives fragments like m/z 58, 43, 29, 15, etc. The mass spectrum of an unknown compound is shown below -



The likely compound among the following is -

(A) CH_3COCl

(B) $\text{CH}_2=\text{CH}-\text{CH}_2\text{CH}_2\text{OH}$

(C) $\text{CH}_3\text{CH}_2\text{COOH}$

(D) $\text{CH}_3\text{COCH}_2\text{CH}_3$

Ans. [D]

15. The solubility of calcium phosphate is $S \text{ mol dm}^{-3}$. Hence, the solubility product is -

(A) S^5

(B) $27S^3$

(C) $54S^4$

(D) $108S^5$

Ans. [D]

Sol. $\text{Ca}_3(\text{PO}_4)_2$

$$\therefore k_{sp} = 108 S^5$$

16. The number of valence electrons in an atom with the configuration $1s^2 2s^2 2p^6 3s^2 3p^2$ is -

- (A) 6 (B) 5
(C) 4 (D) 2

Ans. [C]

17. The elevation in boiling point of a solution containing 13.44g of CuCl_2 in 1 kg of water is ($K_b = 0.52 \text{ K/kg mol}^{-1}$)

- (A) 0.05 (B) 0.10
(C) 0.16 (D) 0.21

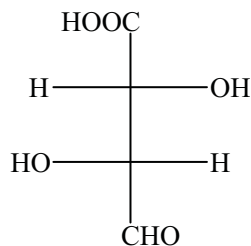
Ans. [C]

Sol.
$$\Delta T_b = K_b \times \frac{w_A \times 1000}{M_A \times w_B} i$$

$$= 0.52 \times \frac{13.44 \times 1000}{134.5 \times 1000} \times 0.3$$

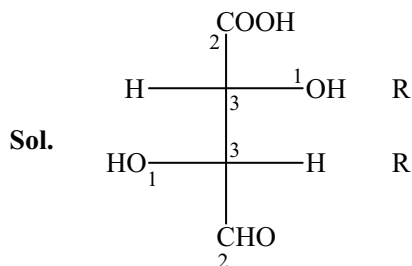
$$= 0.16$$

18. The configuration of the carbon atoms C_2 and C_3 in the following compound are respectively -



- (A) R, R (B) S, S
(C) R, S (D) S, R

Ans. [A]



19. 0.1 dm^3 of 0.1 M acetic acid is titrated against 0.1 M NaOH . When 50 cm^3 of 0.1 M NaOH are added, the pH of the solution will be ($\text{p}K_a = 4.74$)

- (A) 2.37 (B) 4.74
(C) 1.34 (D) 5.74

Ans. [B]



Initial Meq	10	5	0	0
Final	5	0	5	-

Resulting solution is an acidic buffer

$$\therefore p^H = p^{K_a} + \log \frac{[\text{Salt}]}{[\text{Acid}]} = 4.74 + \log \frac{5}{5}$$

$$p^H = 4.74$$

20. The IUPAC name of complex $[\text{Cu}(\text{en})_2(\text{H}_2\text{O})_2]^+$ is -

- (A) ethylene diamine Cu(II) dihydrate (B) diaquobis(ethylenediamine) Cu(II) ion
 (C) diaquobisdiethylamine Cu(II) ion (D) diaquobis(ethylenediamine) cuprate (II)

Ans. [B]

Sol. $[\text{Cu}(\text{en})_2(\text{H}_2\text{O})_2]^+$

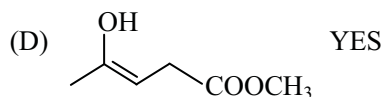
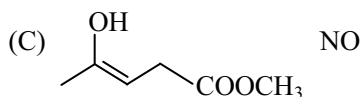
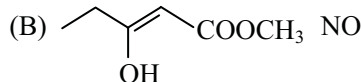
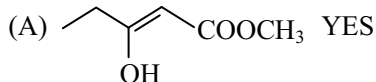
Diaqua bis(ethylene diamine)Cu(II) ion

21. Two protein molecules with the same average molecular mass (molecular weight) can absorb different amount of ultraviolet radiation due to difference in the content of -

- (A) tyrosine (B) glutamic acid (C) lysine (D) methionine

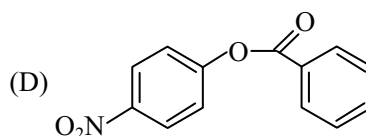
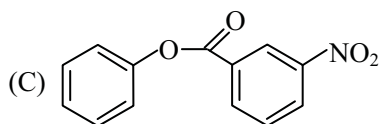
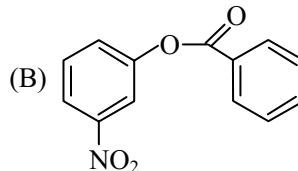
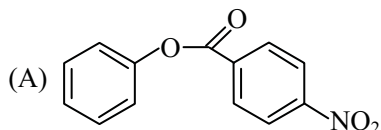
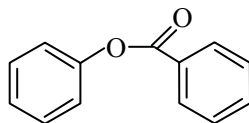
Ans. [A]

22. Each of the following options contains a structure and a description indicating the existence of given structure. The correct option for methyl 3-hydroxypent-2-enoate is -



Ans. [B]

23. Major product of mononitration of the following compound is



Ans. [D]

24. If $a \neq b \neq c$ and $\alpha = \beta = \gamma = 90^\circ$, the crystal system is -

- (A) monoclinic (B) triclinic (C) hexagonal (D) orthorhombic

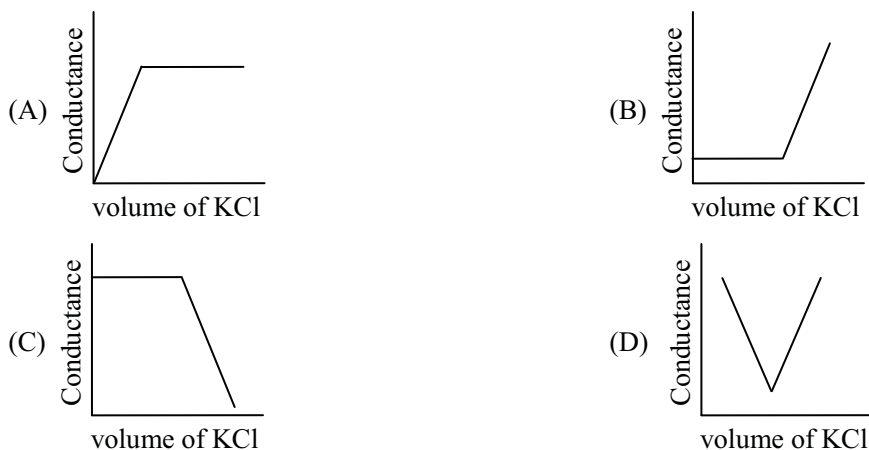
Ans. [D]

25. The electronic spectrum of $[\text{Ni}(\text{H}_2\text{O})_6]^{++}$ shows a band at 8500 cm^{-1} due to d-d transition. $[\text{Ph}_4\text{As}]_2[\text{NiCl}_4]$ will have such a transition in cm^{-1} at -

- (A) 3778 (B) 8500 (C) 4250 (D) 850

Ans. [A]

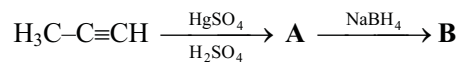
26. In the conductometric titration of silver nitrate against KCl, the graph obtained is -



Ans. [B]



27. The product obtained from the following sequence of reactions is -



- (A) propanal (B) 2-propanol (C) 1-propanol (D) propane

Ans. [B]

28. The compound in which Mn has oxidation state of +3 is

- (A) KMnO_4 (B) $\text{K}_2[\text{Mn}(\text{CN})_6]$
 (C) MnSO_4 (D) $\text{CsMn}(\text{SO}_4)_2 \cdot 12\text{H}_2\text{O}$

Ans. [D]

29. The SI units of viscosity is

- (A) Nsm^2 (B) Ns^2m (C) Nsm^{-2} (D) Ns^{-2}m

Ans. [C]

30. If titration of an amino acid present in the solution yielded pI (isoelectric point) value of 10.80, the amino

acid present in the solution may be

- (A) glycine (B) arginine (C) histidine (D) proline

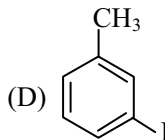
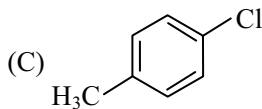
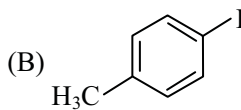
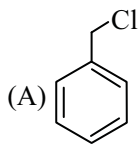
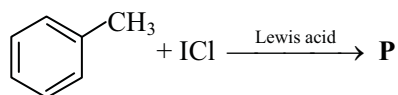
Ans. [B]

31. In the coordination compound, $\text{Na}_2[\text{Pt}(\text{CN})_4]$, the Lewis acid is -

- (A) $[\text{Pt}(\text{CN})_4]^{2-}$ (B) Na^+ (C) Pt^{2+} (D) CN

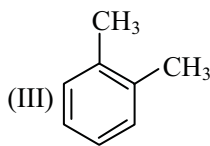
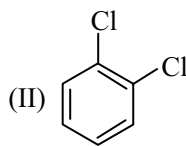
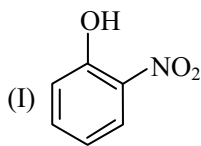
Ans. [C]

32. The product (P) of the following reaction is



Ans. [B]

33. The correct order of dipole moment for the following molecules is -



- (A) $I = II = III$ (B) $I < II < III$ (C) $I > II > III$ (D) $II < III < I$

Ans. [C]

34. Lead dissolves most readily in dilute -

- (A) acetic acid (B) sulphuric acid
(C) phosphoric acid (D) sodium hydroxide

Ans. [A]

35. The degrees of freedom for the system $\text{CaCO}_3(\text{s}) \rightleftharpoons \text{CaO}(\text{s}) + \text{CO}_2(\text{g})$ are -

- (A) 1 (B) 2 (C) 3 (D) 4

Ans. [A]

36. Semipermeable nature of the cell membrane can be attributed to the presence of -

- (A) protein and DNA
(C) polysaccharide and lipid
- (B) lipid and protein
(D) DNA and lipid

Ans. [B]

37. The emf of the cell (Zn | ZnSO₄ (0.1M) || CdSO₄ (0.0.1M) | Cd) is

$$(E^{\circ}_{\text{Zn}^{2+}|\text{Zn}} = -0.76 \text{ V}, E^{\circ}_{\text{Cd}^{2+}|\text{Cd}} = 0.40 \text{ V at 298 K})$$

- (A) + 0.33 V (B) + 0.36 V (C) + 1.13 V (D) - 0.36 V

Ans. [C]

Sol. $E^{\circ}_{\text{cell}} = 0.76 + 0.4 = 1.16$

$$\text{Emf} = E^{\circ}_{\text{cell}} - \frac{0.059}{n} \log \frac{[\text{Zn}^{+2}]}{[\text{Cd}^{+2}]}$$

$$= 1.16 - \frac{0.059}{2} \log \frac{0.1}{0.01}$$

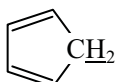
$$= 1.16 - 0.03 \log 10 = 1.13 \text{ V}$$

38. The nitrogen compound formed when Ca(CN)₂ reacts with steam or hot water is

- (A) N₂O (B) NO
(C) NO₂ (D) NH₃

Ans. [D]

39. The order of acidities of the H-atoms underlined in the following compounds is in the order

- (I) Ph-CH₂-CH₃ (II) Ph-C≡CH (III) Ph-CH=CH₂ (IV) 

- (A) IV > II > I > III (B) II > IV > III > I
(C) III > IV > I > II (D) I > III > II > IV

Ans. [A]

40. The half time for a second order reaction with equal concentrations of the reactants is 35 seconds. 99% reaction will be completed in

- (A) 69s (B) 138s (C) 1733s (D) 3465s

Ans. [D]

Sol. For second order $t_{1/2} = \frac{1}{K_a} = 35$

Let initial is 100 $\therefore \frac{1}{K} = 35 \times 100$

$$\therefore t = \frac{1}{K} \left[\frac{x}{a(a-x)} \right]$$

$$= 3500 \left[\frac{99}{100 \times 1} \right]$$

$$= 3465 \text{ sec}$$

41. The 'd' orbitals will be split under square planar geometry into -
 (A) two levels (B) three levels (C) four levels (D) five levels

Ans. [C]

42. Rotational spectra of molecules are observed in -
 (A) UV region (B) Visible region
 (C) Near infrared region (D) Far infrared region

Ans. [D]

43. The pair of cations which **cannot** be separated by H₂S in a 0.3N acid solution is -
 (A) Al⁺⁺⁺, Hg⁺⁺ (B) Bi⁺⁺⁺, Pb⁺⁺
 (C) Zn⁺⁺, Cu⁺⁺ (D) Ni⁺⁺, Cd⁺⁺

Ans. [B]

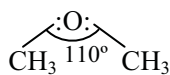
44. Structural features of proteins secreted outside the cells may be stabilised by presence of -
 (A) hydrogen bond (B) disulfide bond
 (C) hydrophobic force (D) phospho-diester bond

Ans. [B]

Sol. Most secreted protein and extra cellular domains of membrane protein contain disulphide bond. These covalent bonds are important for the proper folding and stability of secretory protein.

45. The C–O–C bond angle in dimethyl ether is -
 (A) 109°28' (B) 110° (C) 120° (D) 180°

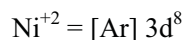
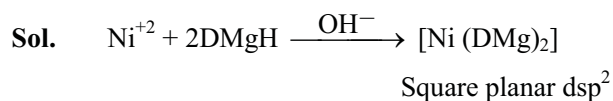
Ans. [B]

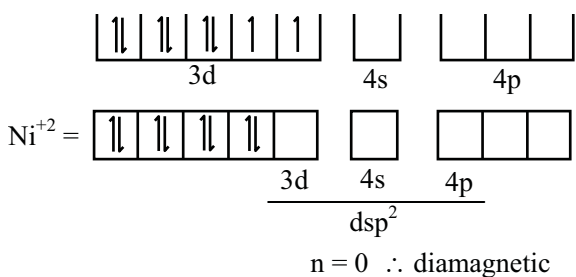


Large size of methyl group. So bond angle greater than 109° 28'

46. Dimethyl glyoxime forms a square planar complex with Ni²⁺. This complex should be
 (A) diamagnetic (B) paramagnetic having 1 unpaired electron
 (C) paramagnetic having 2 unpaired electrons (D) ferromagnetic

Ans. [A]





47. A 0.056 M solution of benzoic acid, C_6H_5COOH , is titrated with a strong base. $[H^+]$ of the solution when half of the solution is titrated before the equivalence point is (K_a of benzoic acid = 6.3×10^{-5})

- (A) $6.3 \times 10^{-5} M$ (B) $1.8 \times 10^{-3} M$ (C) $7.9 \times 10^{-3} M$ (D) $2.6 \times 10^{-2} M$

Ans. [A]

Sol. $[H^+] = K_a \times \frac{[Acid]}{[Salt]}$

$$= 6.3 \times 10^{-5} \times \frac{0.056}{0.056}$$

$$= 6.3 \times 10^{-5} M$$

48. The formula of the isothiocyanate ion is -

- (A) OCN (B) SCN (C) ONC (D) CN

Ans. [B]

49. The compound that is chiral is -

- (A) 3-methyl-3-hexene (B) 4-chloro-1-methylcyclohexane
 (C) 2-phenylpentane (D) 1, 3-diisopropylbenzene

Ans. [C]

50. The monomer/s of the following polymer is/are



- (A) ethylene (B) propylene
 (C) 2-butene (D) ethylene + propylene

Ans. [B]

51. Of the interhalogen compounds, ClF_3 is more reactive than BrF_3 , but BrF_3 has higher conductance in the liquid state. The reason is that

- (A) BrF_3 has higher molecular weight (B) ClF_3 is volatile
 (C) BrF_3 dissociates into BrF^2 and BrF^4 more easily (D) ClF_3 is most reactive

Ans. [C]

Sol. High E.N difference in Br & F

∴ high polarity

∴ Ions form easily

52. An element X is found to combine with oxygen to form X_4O_6 . If 8.40 g of this element combine with 6.50 g of oxygen, the atomic weight of the element in grams is -

- (A) 24.0 (B) 31.0 (C) 50.4 (D) 118.7

Ans. [B]

Sol. 6.5 g oxygen combine with 8.4 g

∴ 96 g oxygen combine with $\frac{8.4 \times 96}{6.5} = 124.06$

∴ At. wt of one X = $\frac{124.06}{4} = 31.0$

53. Synthesis of RNA in a cell would be affected adversely due to shortage of

- (A) sulfate (B) acetate (C) oxalate (D) phosphate

Ans. [D]

54. The most abundant element in the earth's crust is -

- (A) aluminium (B) oxygen (C) silicon (D) iron

Ans. [B]

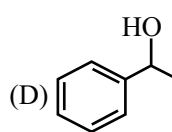
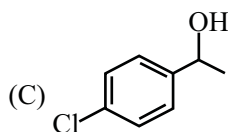
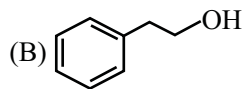
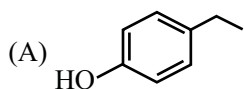
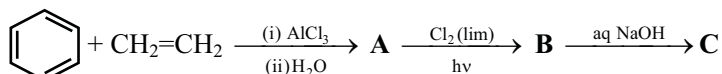
55. A beaker is heated from 27°C to 127°C , the percentage of air originally present in beaker that is expelled is

- (A) 50% (B) 25% (C) 33% (D) 40%

Ans. [B]

Sol. $n_1T_1 = n_2T_2$

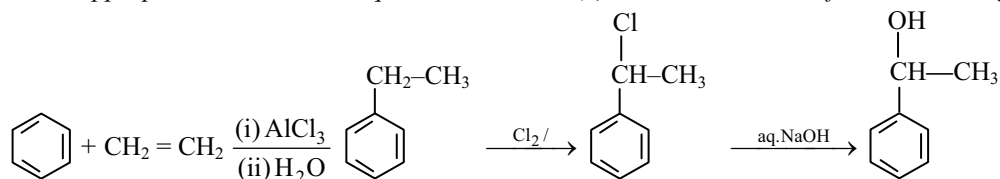
56. The product (C) of the following sequence of reactions is



Ans. [D]

IAPT has given (c) as the correct answer to this question.

But the most appropriate answer to this question should be (d). For more details refer the solution given below.



57. The strongest, but the most reactive bond among the following is -

- (A) C=N (B) C=C
(C) C≡C (D) C=O

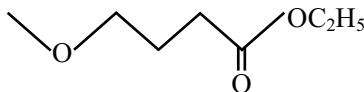
Ans. [C]

58. Radioactive inert gas is -

- (A) technetium (B) radon (C) xenon (D) curium

Ans. [B]

59. The IUPAC name of the following compound is -



- (A) 3-methoxy ethylpropanoate (B) ethyl 4-methoxybutanoate
(C) 1, 4-diethoxybutane (D) ethoxy 3-methoxybutyrate

Ans. [B]

60. Excess of silver nitrate is added to a water sample to determine the amount of chloride ion present in the sample. 1.4 g of silver chloride is precipitated. The mass of chloride ion present in the sample is

Molar masses (g. mol⁻¹); AgNO₃ 169.91, AgCl 143.25

- (A) 0.25 g (B) 0.35 g (C) 0.50 g (D) 0.75 g

Ans. [B]

Sol. 143.25 AgCl obtained from 169.91 g AgNO₃

then 1.4 g AgCl obtained from 169.91 g Ag NO₃

$$= \frac{169.91}{143.25} \times 1.4 = 1.66 \text{ g}$$

In 169.91 g of sample chlorine is 35.5 g

∴ 1.66 g of sample chlorine

$$= \frac{35.5}{169.91} \times 1.66 = 0.35 \text{ g}$$

61. The best nucleophile among the following is -

- (A) H₂O (B) CH₃SH (C) Cl (D) NH₃

Ans. [B]

62. The wavelength of a moving body mass 0.1 mg is 3.31×10^{-29} m. The kinetic energy of the body in J would be -

- (A) 2.0×10^6 (B) 1.0×10^3 (C) 4.0×10^3 (D) 2.0×10^3

Ans. [D]

Sol.
$$\lambda = \frac{h}{\sqrt{2mKE}} = \frac{6.62 \times 10^{-34}}{\sqrt{2 \times 0.1 \times 10^{-6} \times KE}} = 3.31 \times 10^{-29}$$

$$\sqrt{2 \times 10^{-7} \times KE} = 2 \times 10^{-5}$$

$$\therefore 2 \times 10^7 \times KE = 4 \times 10^{10}$$

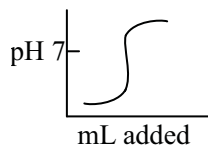
$$KE = 2 \times 10^3$$

63. Secondary structures could be formed in nucleic acid similar to protein due to formation of -

- (A) covalent bond (B) ionic bond (C) co-ordinate bond (D) hydrogen bond

Ans. [D]

64. The following titration curve represents the titration of a acid with a base -



- (A) strong, strong (B) weak, strong (C) strong, weak (D) weak, weak

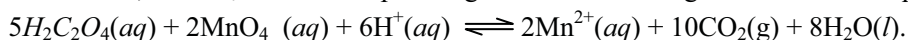
Ans. [A]

65. The element with the lowest electronegativity is -

- (A) S (B) I (C) Ba (D) Al

Ans. [C]

66. Oxalic acid, $H_2C_2O_4$, reacts with permanganate ion according to the balanced equation



The volume in mL of 0.0162 M $KMnO_4$ solution required to react with 25.0 mL of 0.022 M $H_2C_2O_4$ solution is-

- (A) 13.6 (B) 18.5 (C) 33.8 (D) 84.4

Ans. [A]

Sol. Equivalent of $KMnO_4$ = Eq. of $H_2C_2O_4$

$$N_1V_1 = N_2V_2$$

$$0.0162 \times 5 \times V_1 = 0.022 \times 2 \times 25$$

$$V_1 = 13.6 \text{ ml}$$

67. The element that has the highest tendency to catenate is -

- (A) silicon (B) germanium (C) sulphur (D) boron

Ans. [C]

68. The isotope of carbon which is used in carbon dating (a method to estimate the age of an ancient sample containing carbon) is -

- (A) carbon-12 (B) carbon-13 (C) carbon-14 (D) carbon-15

Ans. [C]

69. Electronic configurations for the atoms of four elements are given below. The configuration that indicates colourless aqueous solution is -

- (A) 2,8,14,2 (B) 2,8,16,2 (C) 2,8,18,2 (D) 2,8,13,1

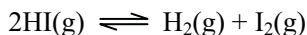
Ans. [C]

70. The number of stereoisomers of compound $CH_3-CH=CH-CH(Br)CH_3$ is -

- (A) 2 (B) 3 (C) 4 (D) 6

Ans. [C]

71. At 445°C, K_c for the following reaction is 0.020.



A mixture of H_2 , I_2 and HI in a vessel at 445°C has the following concentrations :

$[HI] = 2.0 \text{ M}$, $[H_2] = 0.50 \text{ M}$ $[I_2] = 0.10 \text{ M}$. The statement that is true concerning the reaction quotient, Q_c is -

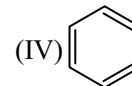
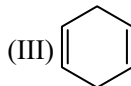
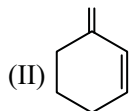
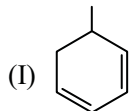
- (A) $Q_c = K_c$; the system is at equilibrium
(B) Q_c is less than K_c ; more H_2 and I_2 will be produced
(C) Q_c is less than K_c ; more HI will be produced
(D) Q_c is greater than K_c ; more H_2 and I_2 will be produced

Ans. [B]

Sol.
$$Q = \frac{[H_2][I_2]}{[HI]^2}$$
$$= \frac{0.5 \times 0.1}{2 \times 2} = 0.0125$$

$\therefore Q < K_c$ and forward reaction.

72. The order of decreasing stability is -



- (A) $IV > I > II > III$ (B) $I > IV > III > II$ (C) $I > II > IV > III$ (D) $IV > II > I > III$

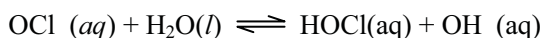
Ans. [A]

73. The number of amino acid residues found in a protein that is synthesized from a RNA molecule with 120 nucleotides is -

- (A) 120 (B) 80 (C) 40 (D) 60

Ans. [C]

74. Hypochlorous acid ionizes as -



K_a for this reaction at 25°C is 3.0×10^{-8} ($K_w = 1.0 \times 10^{-14}$ at 25°C)

Hence, K_b for $HOCl$ is -

- (A) 3.3×10^{-7} (B) 3.0×10^{-6} (C) 3.0×10^{-8} (D) 3.3×10^{-7}

Ans. [A]

Sol.
$$K_h = \frac{K_w}{k_a} = \frac{10^{-14}}{3 \times 10^{-8}} = \frac{1}{3} \times 10^{-6} = \frac{10}{3} \times 10^{-7}$$

$$K_h = 3.3 \times 10^{-7}$$

75. Einsteinium has 11 electrons in the 4f subshell. The number of unpaired electrons in the subshell is -

- (A) 3 (B) 4 (C) 7 (D) 11

Ans. [A]

76. The order of reactivity of ammonia with the following compounds is -

- (I) $\text{CH}_2=\text{CHBr}$ (II) $\text{CH}_3-\text{CH}_2-\text{COCl}$ (III) $\text{CH}_3-\text{CH}_2-\text{CH}_2-\text{Cl}$ (IV) $(\text{CH}_3)_3\text{C}-\text{Br}$
 (A) $\text{IV} > \text{II} > \text{I} > \text{III}$ (B) $\text{II} > \text{IV} > \text{III} > \text{I}$ (C) $\text{III} > \text{IV} > \text{II} > \text{I}$ (D) $\text{I} > \text{IV} > \text{II} > \text{III}$

Ans. [B]

77. The freezing point of a solution containing 8.1g of HBr in 100 g of water, assuming the acid to be 90% ionized is [$H=1$, $Br=80$, K_f for water = $1.86 \text{ K kg mol}^{-1}$]

- (A) 0.85°C (B) -3.53°C (C) 0°C (D) -0.35°C

Ans. [B]

Sol.
$$\alpha = \frac{i-1}{n-1} \quad (\Delta T_f)_{\text{obs}} = i \times (\Delta T_f)_{\text{theo}}$$

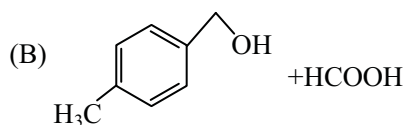
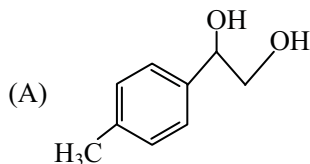
$$0.9 = \frac{i-1}{2-1} = 1.9 \times k_f \times \frac{W_A \times 1000}{M_A \times W_B}$$

$$i = 1.9 = 1.9 \times 1.86 \times \frac{8.1 \times 1000}{81 \times 100}$$

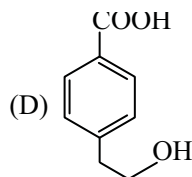
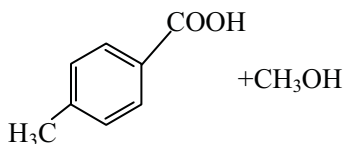
$$(\Delta T_f)_{\text{obs}} = 3.53$$

$$\therefore T' = -3.53^\circ\text{C}$$

78. The reaction of 50% aq KOH on an equimolar mixture of 4-methylbenzaldehyde and formaldehyde followed by acidification gives -



(C
)



Ans. [B]

79. Iodide ion is oxidized by acidified dichromate ions as shown in this equation.

$\text{Cr}_2\text{O}_7^{2-}(\text{aq}) + 9\text{I}^-(\text{aq}) + 14\text{H}^+(\text{aq}) \longrightarrow 2\text{Cr}^{3+}(\text{aq}) + 3\text{I}_3^-(\text{aq}) + 7\text{H}_2\text{O}(\text{l})$. These data were obtained when the reaction was studied at a constant pH. The order of the reaction with respect to $\text{Cr}_2\text{O}_7^{2-}(\text{aq})$ and $\text{I}^-(\text{aq})$ are -

Experiment	$[\text{Cr}_2\text{O}_7^{2-}]$, M	$[\text{I}^-]$ M	Rate, M.s^{-1}
1	0.0050	0.0125	0.00050
2	0.010	0.0125	0.0010
3	0.0150	0.0250	0.0060

- (A) first order with respect to both $\text{Cr}_2\text{O}_7^{2-}$ and I
 (B) second order with respect to both $\text{Cr}_2\text{O}_7^{2-}$ and I
 (C) second order with respect to $\text{Cr}_2\text{O}_7^{2-}$ and first order with respect to I
 (D) first order with respect to $\text{Cr}_2\text{O}_7^{2-}$ and second order with respect to I

Ans. [D]

Sol. $r = k[\text{Cr}_2\text{O}_7^{2-}]^m [\text{I}^-]^n$

$$0.0005 = k[0.005]^m [0.0125]^n \quad \dots(1)$$

$$0.0010 = k[0.01]^m [0.0125]^n \quad \dots(2)$$

$$0.006 = k[0.015]^m [0.025]^n \quad \dots(3)$$

equation (1)/(2)

$$\frac{1}{2} = \left(\frac{1}{2}\right)^m \quad m = 1$$

equation (2)/(3)

$$\frac{1}{6} = \left(\frac{2}{3}\right)^m \left(\frac{1}{2}\right)^n \quad ; \quad \frac{1}{6} = \frac{2}{3} \times \left(\frac{1}{2}\right)^n$$

$$\frac{1}{4} = \left(\frac{1}{2}\right)^n \quad \therefore n = 2$$

80. The number of atoms per unit cell and the number of the nearest neighbours in a body centred cubic structure are -

- (A) 4, 12 (B) 2, 6 (C) 9, 6 (D) 2, 8

Ans. [D]

Sol. No. of per unit cell of BCC = $8 \times \frac{1}{8} + 1 \times 1 = 2$ \therefore and C.No. = 8