

# CHEM ACADEMY

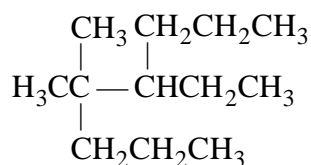
DELHI UNIVERSITY 2016

SECTION - A

- Which of the following statement is correct
  - Only one bond length is observed in both  $\text{PF}_5$  and  $\text{SF}_6$ .
  - Two different bond lengths are observed in both  $\text{PF}_5$  and  $\text{SF}_6$
  - Only the equatorial bond lengths are uniform in  $\text{PF}_5$  and the axial bond lengths in are different
  - Two different bond lengths are observed in  $\text{PF}_5$  and only one bond length in  $\text{SF}_6$
- When  ${}_{11}^{23}\text{Na}$  nuclide is bombarded with alpha particles the resultant products will be
  - ${}_{12}^{24}\text{Mg}$  and  ${}^2_1\text{H}$
  - ${}_{12}^{26}\text{Mg}$  and  ${}^1_1\text{H}$
  - ${}_{11}^{26}\text{Mg}$  and  ${}^1_0\text{n}$
  - ${}_{12}^{25}\text{Na}$  and  ${}^1_1\text{He}$
- The magnetic moments of the lanthanoid compounds arise from
  - Spin-only angular momentum
  - only-from orbital angular momentum
  - both from spin and orbital angular momentum
  - all of the above
- Which is the best way of identifying a given colourless liquid to be water or not?
  - by tasting
  - by adding methyl orange
  - by smelling
  - by adding a pinch of copper sulphate
- The addition of KI and  $\text{CuSO}_4$  gives
  - $\text{CuI}_2$  and  $\text{K}_2\text{SO}_4$
  - $\text{Cu}_2\text{I}_2$  and  $\text{K}_2\text{SO}_4$
  - $\text{K}_2\text{SO}_4$ ,  $\text{CuI}_2$  and  $\text{I}_2$
  - $\text{K}_2\text{SO}_4$ ,  $\text{Cu}_2\text{I}_2$  and  $\text{I}_2$
- In diborane,
  - there exists a direct bond between boron and boron
  - all the atoms are in one plane
  - the number of electrons in B-H-B is formed by two electrons
  - the number of electrons in B-H-B is formed by three electrons
- Which of the following is the correct order of increasing acidity sequence?
  - $\text{HI} < \text{HBr} < \text{HCl} < \text{HF}$
  - $\text{HI} < \text{HCl} < \text{HBr} < \text{HF}$
  - $\text{HF} < \text{HCl} < \text{HBr} < \text{HI}$
  - $\text{HF} \approx \text{HBr} < \text{HCl} < \text{HI}$
- For a transition metal with seven electrons the effective magnetic moment will be
  - 3.16 BM
  - 3.87 BM
  - 15 BM
  - 5.92 BM

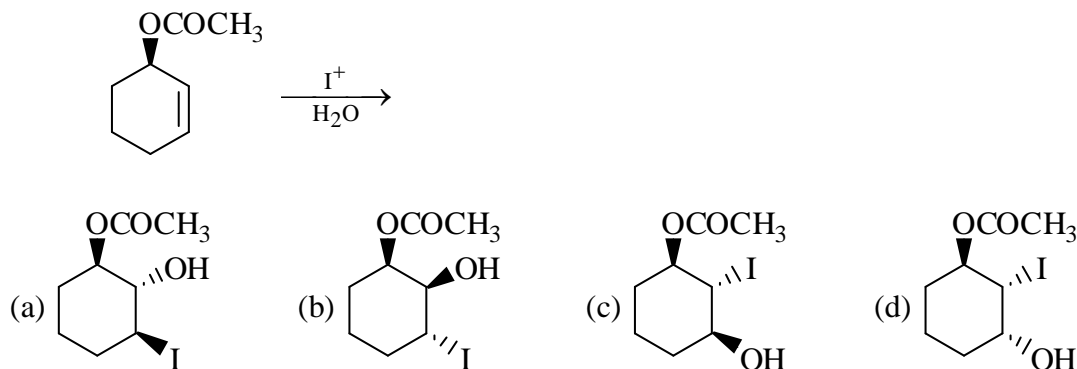
9. Schottky defects from in a crystal  
(a) when unequal number of cations and anions are missing from the lattice  
(b) when equal number of cations and anions are missing from the lattice  
(c) when cations leave its normal positions in the lattice and move in to interstitial sites  
(d) when the density of the crystal is increased
10. Decreasing order of the dipole moments is  
(a)  $\text{AsH}_3 > \text{BiH}_3 > \text{SbH}_3 > \text{NH}_3 > \text{PH}_3$       (b)  $\text{BiH}_3 > \text{SbH}_3 > \text{AsH}_3 > \text{NH}_3 > \text{PH}_3$   
(c)  $\text{NH}_3 > \text{PH}_3 > \text{AsH}_3 > \text{SbH}_3 > \text{BiH}_3$       (d)  $\text{PH}_3 > \text{NH}_3 > \text{AsH}_3 > \text{SbH}_3 > \text{BiH}_3$
11. The metal ions responsible for  $\text{N}_2$  fixation by the enzyme nitrogenase are  
(a) Co and Fe      (b) Cu and Fe      (c) W and Cu      (d) Fe and Mo
12. The speed of the electron is  $1.2 \times 10^6 \text{ ms}^{-1}$  and the mass of the electron is  $9.1 \times 10^{-31} \text{ Kg}$  its de Broglie wavelength is  
(a)  $1.46 \times 10^{-10} \text{ m}$       (b)  $6.07 \times 10^{-15} \text{ m}$       (c)  $6.907 \times 10^{-10} \text{ m}$       (d)  $6.071 \times 10^{-10} \text{ m}$
13. A radioactive element lost 50% activity in 3 days and 20 hrs. The decay constant of the element is  
(a)  $7.53 \times 10^{-3} \text{ hr}^{-1}$       (b)  $5.73 \times 10^{-3} \text{ hr}^{-1}$       (c)  $7.35 \times 10^{-2} \text{ hr}^{-1}$       (d)  $9.73 \times 10^{-3} \text{ hr}^{-1}$
14. Which of the following sulphides is not black?  
(a) ZnS      (b) NiS      (c) CoS      (d) CuS
15. The pH and pOH of 0.1 M  $\text{H}_2\text{SO}_4$  are  
(a) 0.1, 13.9      (b) 0.3, 13.7      (c) 0.7, 13.3      (d) 1.0, 13.0
16. The symmetry possessed by a cubic crystal system, all axes being equal and all angles at  $90^\circ$  is due to the  
(a) nine planes of symmetry      (b) six two-fold axes ( $C_2$ ) of symmetry  
(c) three four fold axes ( $C_4$ ) of symmetry      (d) four three fold axes ( $C_3$ ) of symmetry
17. The Ziegler-Natta catalysts used for the polymerization of olefins is  
(a)  $\text{TiO}_2$  and  $\text{Al}_2\text{O}_3$       (b)  $\text{TiCl}_3$  and  $\text{Al}(\text{C}_2\text{H}_5)_3$   
(c)  $\text{TiCl}_4$  and ZnO      (d)  $\text{PdCl}_4$
18. A delta ( $\delta$ ) bond formation is known in  
(a)  $\text{Na}[\text{Re}(\text{CO})_5]$       (b)  $\text{ReO}_3$       (c)  $[\text{Re}_2\text{Cl}_8]^{2-}$       (d)  $\text{ReOCl}_4$
19. The tetragonal elongation resulting in the increase of the two trans M-L bond distances occur in octahedral complexes of transition metal ions with a configuratio of  
(a)  $d^{10}$       (b)  $d^7$       (c)  $d^2$       (d)  $d^9$
20. The increasing orde of the observed Infra Red (IR)  $\nu(\text{CO})$  ( $\text{cm}^{-1}$ ) among the isoelectronic complexes will be  
(a)  $[\text{V}(\text{CO})_6]^- < \text{Cr}(\text{CO})_6 < [\text{Mn}(\text{CO})_6]^+$       (b)  $[\text{V}(\text{CO})_6]^- < [\text{Mn}(\text{CO})_6]^+ < \text{Cr}(\text{CO})_6$   
(c)  $\text{Cr}(\text{CO})_6 < [\text{V}(\text{CO})_6]^- < [\text{Mn}(\text{CO})_6]^+$       (d)  $[\text{Mn}(\text{CO})_6]^+ < \text{Cr}(\text{CO})_6 < [\text{V}(\text{CO})_6]^-$
21. Which of the following has a higher crystal field splitting energy ( $\Delta_0$ )  
(a)  $[\text{Co}(\text{CN})_6]^{3-}$       (b)  $[\text{Co}(\text{NH}_3)_6]^{3+}$       (c)  $[\text{CoF}_6]^{3-}$       (d)  $[\text{Co}(\text{H}_2\text{O})_6]^{3+}$

22. The poisoning in the Minamata Bay in Japan was due to  
 (a) compounds of lead (b) methylmercury compounds  
 (c) arsenic (d) uranium
23. Resistance of solid  $C_{60}$  disappears when formed compounds with  
 (a) K, Rb, Cs (b) S, Se, Te (c) Zn, Cd, Hg (d) Ti, Y, Sc
24. Ground state for  $d^4$  electronic configuration is  
 (a)  $^5F$  (b)  $^5D$  (c)  $^2D$  (d)  $^3F$
25. Which of the following elements has a more stable oxidation state of III as compared to an oxidation state of I?  
 (a) Al (b) Ga (c) Tl (d) B
26. The structure of  $ICl_2^-$  is  
 (a) linear (b) tetrahedral  
 (c) trigonal bipyramidal (d) octahedral
27. Which of the following materials show Meissner effect  
 (a) metallic and paramagnetic (b) superconducting and diamagnetic  
 (c) semiconducting and diamagnetic (d) antiferromagnetic and insulating
28. In methane which of the following symmetry operations will result in a  $C_2$  symmetry operation?  
 (a) one  $S_3$  and one  $S_1$  operations (b) two  $S_4$  operations  
 (c) one  $C_3$  and one  $C_1$  operations (d) One  $C_3$  and E operations
29. Five experimental determinations of Fe in an iron ore by volumetric method gave the percentages 67.48, 67.37, 67.43 and 67.40. The standard, average and probable deviation of the mean are  
 (a) 0.047, 0.031, 0.036 (b) 0.031, 0.036, 0.047  
 (c) 0.047, 0.036, 0.031 (d) 0.036, 0.047, 0.031
30. The IUPAC name of the following compound is



- (a) 4, 4-dimethyl-5-ethyloctane (b) 4-ethyl-5, 5-dimethyloctane  
 (c) 2-methyl-2,3-dipropylpentane (d) 5-ethyl-4,4-dimethyloctane
31. The correct increasing order of Trans effects shown by the  $\sigma$  donor ligands is  
 (a)  $\text{OH}^- < \text{Br}^- < \text{SCN}^- < \text{PR}_3$  (b)  $\text{OH}^- < \text{Br}^- < \text{PR}_3 < \text{SCN}^-$   
 (c)  $\text{Br}^- < \text{PR}_3 < \text{OH}^- < \text{SCN}^-$  (d)  $\text{Br}^- < \text{OH}^- < \text{SCN}^- < \text{PR}_3$

32. In the following reactions which will be the preferred product?



33. The general molecular formula of sesquiterpenoids is

- (a)  $C_{10}H_{16}$       (b)  $C_{10}H_{22}$       (c)  $C_{15}H_{24}$       (d)  $C_{15}H_{32}$

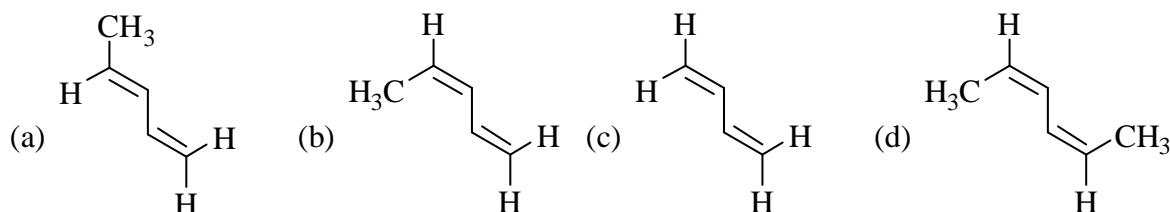
34. Which of the following is not true?

- (a) Sun rays contain vitamin D  
 (b) sun's ultraviolet rays assist in the synthesis of vitamin D from a precursor present in our skin  
 (c) Vitamin D deficiency could develop brittle bones  
 (d) Vitamin D can be ingested through diet or supplements

35. Pick out the incorrect match?

- (a) Sanger reagent      1-fluoro-2,4-dinitrobenzene  
 (b) Edman reagent      phenyl isothiocyanate  
 (c) Strecker amino acid synthesis      i. aldehyde + HCN; ii. hydrolysis  
 (d) Merrifield peptide synthesis      polystyrene resin

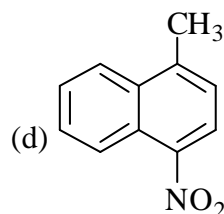
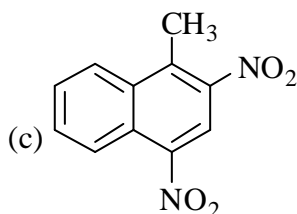
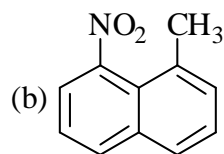
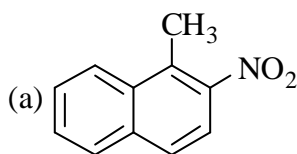
36. In Diels-Alder reaction which of the following will react most slowly with tetracyanoethene



37. Which of the following structures will not have detergent properties?

- (a)  $CH_3(CH_2)_{11}CH_2C(=O)OCH_3$       (b)  $CH_3(CH_2)_{11}CH_2CH_2O$  – glucose  
 (c)  $CH_3(CH_2)_{11}CH_2CH_2OSO_3H$       (d)  $CH_3(CH_2)_{11}CH_2CH_2N^+(CH_3)_3 Cl^-$

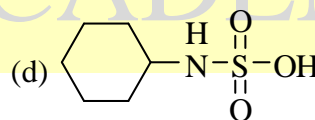
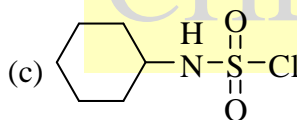
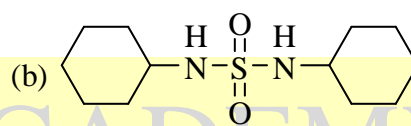
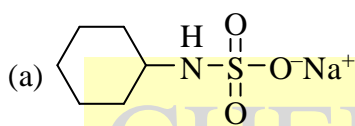
38. The major organic product of aromatic nitration of 1-methyl naphthalene is



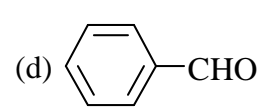
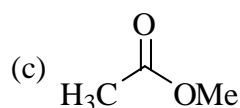
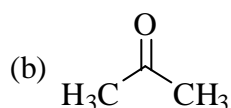
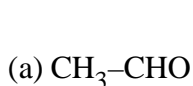
39. Which of the following aldehydes can undergo self condensation?

- (a) PhCHO                      (b) HCHO                      (c)  $(\text{CH}_3)_3\text{CCHO}$                       (d)  $(\text{CH}_3\text{CH}_2)_2\text{CHCHO}$

40. Cyclamate, an artificial sweetner can be prepared by the reaction of cyclohexylamine and chlorosulfonic acid, followed by the treatment with sodium hydroxide. Which of the struct of this cyclamate?



41. Which one of the following is un-reactive to  $\text{NaBH}_4$  reduction?



42. Aspirin is

- (a) salicylic acid                      (b) 2-acetoxybenzoic acid  
(c) methyl salicylate                      (d) 2-acetoxy benzaldehyde

43. The octane rating of gasoline refers to its

- (a) percentage  $\text{C}_8\text{H}_{18}$  in gasoline                      (b) radiation dose  
(c) percentage of unsaturated hydrocarbons                      (d) ability to resist engine knocking

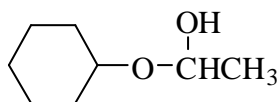
44. The compound  $\text{CFCl}_3$  is used as a/an

- (a) enzyme                      (b) anesthetic                      (c) gaseous fuel                      (d) refrigerant

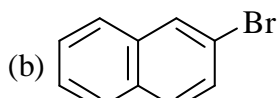
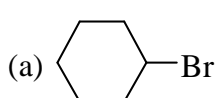
45. An increase in the amount of particulate matter (dust and smoke) in the atmosphere may result in cooler world temperature because

- (a) more sunlight is absorbed by Earth                      (b) more IR is emitted into space  
(c) the dust reflects solar radiation                      (d) dust reacts with ozone in an exothermic reaction

46. Polacrylonitrile, characterized by the repeating units made from which of the following monomers?  
 (a)  $\text{CH}_3\text{CH}_2\text{CN}$  (b)  $\text{HOCH}_2\text{CH}_2\text{CH}_3$  (c)  $\text{CH}_3\text{CH}=\text{CHCN}$  (d)  $\text{CH}_2=\text{CHCN}$
47. The functional group in the following compound is

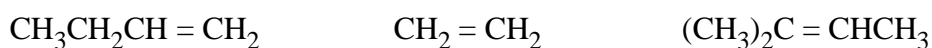


- (a) hemiacetal (b) hemiketal (c) acetal (d) ketal
48. Which of the following compounds could not be used to prepare a Grignard reagent



- (c)  $\text{HOCH}_2\text{CH}_2\text{CH}_2\text{Br}$  (d)  $\text{CH}_3\text{C}\equiv\text{CCH}_2\text{CH}_2\text{I}$

49. Which of the following alkenes will react most readily with  $\text{HBr}$ ?



- (a)  $(\text{CH}_3)_2\text{C}=\text{CHCH}_3$  (b)  $\text{CH}_2=\text{CH}_2$   
 (c)  $\text{CH}_2\text{CH}_2\text{CH}=\text{CH}_2$  (d) no difference in reactivity
50. In Williamson synthesis, ethers are produced by reacting an  
 (a) alcohol with a metal (b) an alkyl halide with alkoxide  
 (c) alkoxide with a metal (d) an aldehyde with alkyl halide
51. Which reaction produces ethyl alcohol as one of the principal products?  
 (a) an esterification reaction (b) a neutralization reaction  
 (c) a dehydration reaction (d) a fermentation reaction
52. The maximum number of hydrogen bonds that a molecule of water can have is  
 (a) 1 (b) 2 (c) 3 (d) 4
53. The major product of dehydration of neopentyl alcohol is  
 (a)  $(\text{CH}_3)_2\text{C}=\text{CHCH}_3$  (b)  $(\text{CH}_3)_3\text{C}-\text{CHO}$   
 (c)  $\text{H}_2\text{C}=\text{CHCH}(\text{CH}_3)_2$  (d) None of the above
54. Identify the correct order for placing the following compounds in increasing oxidation structure  
 $\text{CH}_3\text{CH}_2\text{OH}$ ,  $\text{CH}_3\text{COOH}$ ,  $\text{CO}_2$ ,  $\text{CH}_2=\text{CH}_2$   
 (a)  $\text{CH}_2=\text{CH}_2 < \text{CH}_3\text{CH}_2\text{OH} < \text{CH}_3\text{COOH} < \text{CO}_2$   
 (b)  $\text{CH}_2=\text{CH}_2 = \text{CH}_3\text{CH}_2\text{OH} < \text{CH}_3\text{COOH} < \text{CO}_2$   
 (c)  $\text{CH}_3\text{CH}_2\text{OH} < \text{CH}_2=\text{CH}_2 < \text{CH}_3\text{COOH} < \text{CO}_2$   
 (d)  $\text{CH}_2=\text{CH}_2 < \text{CH}_3\text{CH}_2\text{OH} < \text{CO}_2 < \text{CH}_3\text{COOH}$
55. List of following compounds in order of decreasing acidity  
 (i)  $\text{C}_6\text{H}_5\text{CH}_2\text{CH}_2\text{OH}$  (ii)  $\text{CH}_3\text{CH}_2\text{OH}$  (iii)  $\text{CH}_3\text{C}_6\text{H}_4\text{CHOH}$  (iv)  $\text{C}_6\text{H}_5\text{CH}_2\text{CH}_2\text{OH}$   
 (a) I > II > III > IV (b) III > IV > I > II (c) III > I > IV > II (d) II > IV > I > III
56. A protein that has been reversibly denatured has  
 (a) temporarily lost part or all of its secondary or tertiary structure

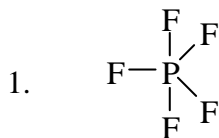
- (b) temporarily lost part or all of its primary structure  
(c) temporarily lost its amino acid residues  
(d) temporarily lost the hydrogen bonding between nitrogenous bases
57. How many moles of  $\text{BH}_3$  are needed to react with 2 moles of 1-pentene?  
(a) 2 moles (b) 1 mole (c)  $2/3$  mole (d)  $3/2$  moles
58. (+) Mandelic acid has a specific rotation of  $+158^\circ$ . What would be the observed specific rotation of 25% (-)-mandelic acid and 75% (+)-mandelic acid?  
(a)  $+79^\circ$  (b) 0 (c)  $-79^\circ$  (d)  $+39.5^\circ$
59. How many peaks will be observed in the  $^1\text{H}$  NMR spectrum of 1-chloro-4-methoxy-benzene?  
(a) 2 (b) 3 (c) 5 (d) 1
60. Arrange the following compounds in order of increasing intensity of infrared absorption the double bond (least intense first) assuming the same concentration and other condition
- (I)  $\text{H}_3\text{C}-\overset{\text{O}}{\parallel}{\text{C}}-\text{CH}_2\text{CH}_3$  (II)  $(\text{CH}_3)_2\text{C}=\text{C}(\text{CH}_3)_2$  (III)  $\text{CH}_3\text{CH}_2\text{CH}=\text{CH}_2$
- (a)  $\text{I} < \text{II} < \text{III}$  (b)  $\text{II} < \text{III} < \text{I}$  (c)  $\text{III} < \text{II} < \text{I}$  (d)  $\text{II} < \text{I} < \text{III}$
61. Increasing the temperature of an aqueous solution causes  
(a) decrease in molality (b) decrease in molarity  
(c) decrease in mole fraction (d) increase in molarity
62. The depression in freezing point for 1M Urea, 1M glucose and 1M NaCl are in the ratio  
(a) 3 : 2 : 2 (b) 1 : 2 : 3 (c) 1 : 2 : 2 (d) None of these
63. The van't Hoff factor  $i$  for a compound which undergoes dissociation in one solvent and association in other solvent is respectively  
(a)  $> 1$  and  $> 1$  (b)  $< 1$  and  $> 1$  (c)  $< 1$  and  $< 1$  (d)  $> 1$  and  $< 1$
64. What will happen if we place Red blood corpuscles (RBC) in (i) 1% (mass/volume) NaCl solution and in (ii) 0.5% (Mass/volume) NaCl solution  
(a) It will shrink in (i) and swell in (ii) (b) It will swell in (i) and shrink in (ii)  
(c) It will swell in both (i) and (ii) (d) It will shrink in both (i) and (ii)
65. The boiling point of carbon tetrachloride is  $77^\circ\text{C}$  and the heat of vaporization is  $31 \text{ kJ mol}^{-1}$ . The vapour pressure of Carbon tetrachloride at  $25^\circ\text{C}$  will be  
(a)  $\sim 0.156 \text{ atm}$  (b)  $\sim 1.21 \text{ atm}$  (c)  $\sim 0.011 \text{ atm}$  (d)  $\sim 2.1 \text{ atm}$
66. The osmotic pressure of a 0.1 M monobasic acid having a pH of 2 at  $25^\circ\text{C}$  is  
(a)  $\sim 5.38 \text{ atm}$  (b)  $\sim 1.34 \text{ atm}$  (c)  $\sim 0.882 \text{ atm}$  (d)  $\sim 2.69 \text{ atm}$
67. In a tetragonal crystal  
(a)  $a = b = c, \alpha = \beta = 90^\circ \neq \gamma$  (b)  $a = b \neq c, \alpha = \beta = \gamma = 90^\circ$   
(c)  $a \neq b \neq c, \alpha = \beta = \gamma = 90^\circ$  (d)  $a = b \neq c, \alpha = \beta = 120^\circ, \gamma = 90^\circ$

68. The standard electrode potential of three metals X, Y and Z are  $-1.3$  V,  $0.6$  V and  $-3.0$  V respectively. The reducing power of these metals follow the order  
(a)  $X > Y > Z$  (b)  $Y > Z > X$  (c)  $Y > X > Z$  (d)  $Z > X > Y$
69. The emf of the given cell  $\text{Pt} | \text{H}_2(\text{P}_1) | \text{H}^+(\text{aq}) | \text{H}_2(\text{P}_2) | \text{Pt}$  is given by  
(a)  $(RT/F)\ln(\text{P}_1/\text{P}_2)$  (b)  $(RT/2F)\ln(\text{P}_1/\text{P}_2)$  (c)  $(RT/F)\ln(\text{P}_2/\text{P}_1)$  (d) None of these
70. Acetaldehyde ( $\text{CH}_3\text{CHO}$ ) decomposes by second order kinetics with a rate constant of  $0.334 \text{ M}^{-1} \text{ s}^{-1}$  at  $500^\circ\text{C}$ . The time it would take for 80% of the acetaldehyde to decompose in a sample that has an initial concentration of  $0.00750 \text{ M}$  is  
(a)  $\sim 1600 \text{ sec}$  (b)  $\sim 1850 \text{ sec}$  (c)  $\sim 1000 \text{ sec}$  (d)  $\sim 5100 \text{ sec}$
71. For a van der Waals gas, the inversion temperature is given by  
(a)  $T_i = 2aR/b$  (b)  $T_i = a/2Rb$  (c)  $T_i = ab/2R$  (d)  $T_i = 2a/Rb$
72. Heat capacity of a diatomic gas in the low temperature range  
(a) is independent of its temperature  
(b) decreases with increase in temperature  
(c) increases with increase in temperature  
(d) increases followed by a decrease with increase in temperature
73. The mole fraction of a gas dissolved in a solvent is given by Henry's law. If the Her.... constant for a gas in water at  $298 \text{ K}$  is  $5.55 \times 10^7$  torr and the partial pressure of the .....  $200$  torr. What is the amount of gas dissolved in  $1.0 \text{ kg}$  of water  
(a)  $\sim 3.6 \times 10^{-7} \text{ mol}$  (b)  $\sim 2.5 \times 10^{-5} \text{ mol}$  (c)  $\sim 2.0 \times 10^{-4} \text{ mol}$  (d)  $\sim 1.2 \times 10^{-3} \text{ mol}$
74. Which of the following facts regarding the viscosity of a gas is correct  
(a) Viscosity of gas is due to intermolecular interaction  
(b) Viscosity of gas is independent of pressure  
(c) Viscosity of gas decreases with increase in temperature  
(d) Viscosity of a gas is independent of molecular mass
75. Pure water has  $[\text{H}_3\text{O}^+] = 10^{-4} \text{ moles L}^{-1}$  at  $90^\circ\text{C}$ , the value of  $K_w$  at this temperature will be  
(a)  $10^{-8} \text{ M}^2$  (b)  $10^{-12} \text{ M}^2$  (c)  $10^{-14} \text{ M}^2$  (d)  $10^{-6} \text{ M}^2$
76. If we titrate  $\text{NH}_4\text{OH}$  against  $\text{HCl}$  at  $25^\circ\text{C}$ , the pH of the solution at equivalence point will be  
(a)  $\sim 5.5$  (b)  $\sim 1.5$  (c)  $\sim 8.5$  (d)  $\sim 9.5$
77. Which of the following ions is the most effective in the coagulation of an Arsen sulphide sol  
(a)  $\text{Ca}^{2+}$  (b)  $\text{K}^+$  (c)  $\text{Al}^{3+}$  (d)  $\text{Cl}^-$
78. For a diatomic gas at high temperature the value of the ratio of  $C_{p,m}$  and  $C_{v,m}$  is  
(a)  $7/5$  (b)  $2/3$  (c)  $9/7$  (d)  $9/11$
79. The ionic strength of a solution which is  $0.1 \text{ m}$  in  $\text{KCl}$  and  $0.2 \text{ m}$  in  $\text{K}_2\text{SO}_4$  is  
(a)  $0.96 \text{ m}$  (b)  $0.70 \text{ m}$  (c)  $0.011 \text{ m}$  (d)  $1.12 \text{ m}$
80. The angular momentum of an electron in  $4f$  orbital is  
(a)  $(24)^{3/2}(\hbar/2\pi)$  (b)  $(12)^{1/2}(\hbar/2\pi)$  (c)  $(6)^{1/2}(\hbar/2\pi)$  (d)  $(2)^{1/2}(\hbar/2\pi)$



81. In an atomic orbital the sign of lobes indicates  
(a) Sign of Charge (b) sign of the probability distribution  
(c) sign of the wave function (d) presence and absence of electrons
82. The energy of the electron in the first Bohr orbit for hydrogen is  $-13.6$  eV. Which one of the following is the possible energy of the excited state for electron in Bohr orbits of hydrogen atom?  
(a)  $-3.4$  eV (b)  $-6.8$  eV (c)  $+1.9$  eV (d)  $13.6$  eV
83. A particle of mass  $2.0 \times 10^{-26}$  g is in a one dimensional box of length  $4.0$  nm. The wavelength of the photon emitted when this particles goes from  $n = 3$  to  $n = 2$  level is  
(a)  $1.11 \times 10^{-5}$  m (b)  $3 \times 10^{-10}$  m (c)  $8.96 \times 10^{-6}$  m (d)  $2.32 \times 10^{-4}$  m
84. An electrochemical cell can behave like an electrolytic cell when  
(a)  $E_{\text{cell}} = 0$  (b)  $E_{\text{cell}} > E_{\text{ext}}$  (c)  $E_{\text{ext}} > E_{\text{cell}}$  (d)  $E_{\text{cell}} = E_{\text{ext}}$   
( $E_{\text{ext}}$ : external emf)
85. The rate of diffusion of methane at a given temperature is twice that of a gas 'P'. The molecular weight of P is  
(a) 64 (b) 36 (c) 40 (d) 16
86. Which of the following expression about logarithm is incorrect  
(a)  $\log (2)^{2n} = n \log 4$  (b)  $\log (m + n) = \log m + \log n$   
(c)  $\log (m/n) = \log m - \log n$  (d)  $\log 1000 = 3$
87. Which of the following is not true for X-rays  
(a) These radiation can ionize gases (b) It causes ZnS to fluoresce  
(c) These are deflected by electric and magnetic fields  
(d) Have wavelength shorter than ultraviolet radiations
88. Which of the following statement is not correct for the order of a reaction  
(a) The order of a reaction is the sum of coefficients of the reactants in the balanced chemical equation  
(b) The order of a reaction is an experimentally determined quantity  
(c) The order of a reaction can be fractional  
(d) The order of a reaction can be zero
89. Which of the following represent the wave number of radiation lying in the visible region  
(a)  $2 \times 10^4$   $\text{cm}^{-1}$  (b)  $1 \times 10^7$   $\text{cm}^{-1}$  (c)  $4 \times 10^9$   $\text{cm}^{-1}$  (d)  $4 \times 10^{12}$   $\text{cm}^{-1}$
90. Which of the following expressions is not correct (the symbols have their usual meanings)  
(a)  $A = \log (I_0 / I)$  (b)  $\mu = m_1 m_2 / (m_1 + m_2)$   
(c)  $v = (1/2\pi c)(\mu/K)^{1/2}$  (d)  $E_v = (V + 1/2)h\nu$

## SOLUTION

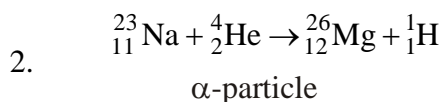


due to berry pseudo rotation only one type of bond length in  $\text{PF}_5$  (axial = equatorial bond length)



In octahedral all bond lengths are equal if substituent are same

Correct option is (a)



$$23 + 4 = 27$$

$$26 + 1 = 27$$

$$11 + 2 = 13$$

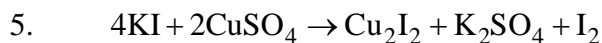
$$12 + 1 = 13$$

Correct option is (b)

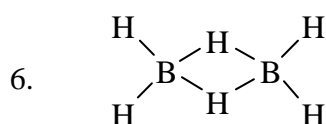
3. Correct option is (c)

4. because it form blue coloured solution.

Correct option is (d)



Correct option is (d)



B–H–B bond is 3 centred 2 electron bond.

Correct option is (c)

7.  $\text{HF} < \text{HCl} < \text{HBr} < \text{HI}$  because  $\text{F}^- < \text{Cl}^- < \text{Br}^- < \text{I}^-$  conjugate base stability order.

Correct option is (c)

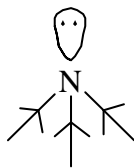


$$\mu(\text{M.M}) = \sqrt{n(n+2)} = \sqrt{3(3+2)} = \sqrt{15} = 3.87 \text{ BM}$$

Correct option is (b)

9. Correct option is (b)

10.  $\text{NH}_3 > \text{PH}_3 > \text{AsH}_3 > \text{SbH}_3 > \text{BiH}_3$



Nitrogen is most electronegative hence it's dipole moment is highest then decreases down the group.

Correct option is (c)

11. Correct option is (d)

$$12. \lambda = \frac{h}{mv} = \frac{6.626 \times 10^{-34}}{9.1 \times 10^{-31} \times 1.2 \times 10^6} = 6.07 \times 10^{-10} \text{ m.}$$

Correct option is (d)

$$13. K = \frac{2.303}{t} \log \frac{A_0}{A} = \frac{2.303}{92} \log^2 = \frac{2.303 \times 0.301}{92} \text{ hr}^{-1} = 7.53 \times 10^{-3} \text{ hr}^{-1}$$

Correct option is (a)

14. Correct option is (a)

15.  $0.1\text{M H}_2\text{SO}_4 \rightarrow 0.2\text{M H}^{\oplus}$

$$\text{pH} = -\log [\text{H}^+] = -\log [0.2]$$

$$= -[0.301 - 1] = 0.691 \approx 0.7$$

$$\text{pOH} = 14 - 0.7 = 13.3$$

Correct option is (c)

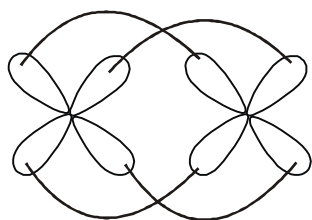
16. Nine plane of symmetry

Correct option is (a)

17.  $\text{TiCl}_3$  and  $\text{Al}(\text{C}_2\text{H}_5)_3$

Correct option is (b)

18.  $\delta$ (delta) bond form when all 4 lobes of d-orbital overlap with another d orbital lobes.



$[\text{Re}_2\text{Cl}_8]^{2-}$  have delta bond.

Correct option is (c)

19. Correct option is (d)

20.  $[\text{V}(\text{CO})_6]^- < \text{Cr}(\text{CO})_6 < \text{Mn}(\text{CO})_6^+$

backbonding decreases as we move from V to Cr to Mn hence CO stretching increases.

Correct option is (a)

21. (a)  $\text{CN}^\ominus > \text{NH}_3 > \text{H}_2\text{O} > \text{F}^-$  (strength of ligand)

Hence splitting in  $[\text{Co}(\text{CN})_6]^{3-}$  is highest.

Correct option is (a)

22. correct option is (b)

23. correct option is (a)

24. 

↑	↑	↑	↑	
---	---	---	---	--

$$L = l_1 + l_2 + l_3 + l_4$$

$$= 2 + 1 + 0 - 1 = 2 \rightarrow \text{D}$$

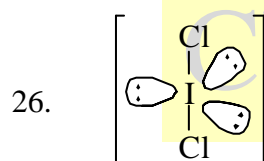
$$S = +\frac{1}{2} \times 4 = 2$$

$$SM = 2S + 1 = 2 \times 2 + 1 = 5$$

Ground state term is  $^5\text{D}$

Correct option is (b)

25. Correct option is (d)



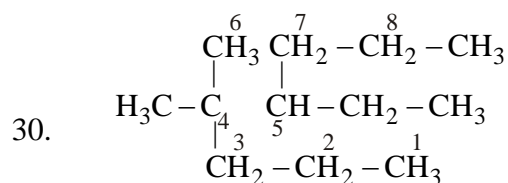
Linear

Correct option is (a)

27. Correct option is (b)

28. Correct option is (b)

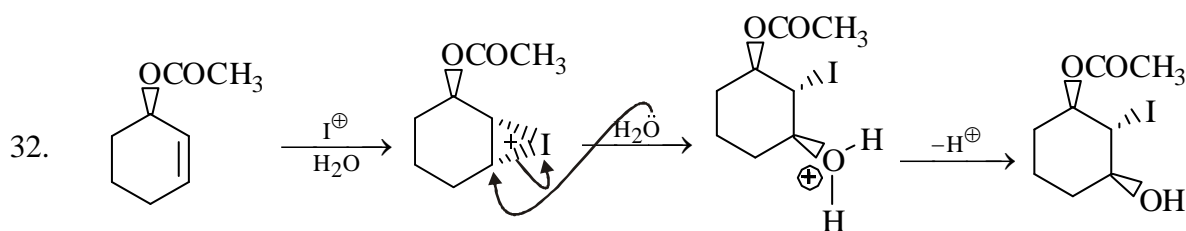
29. Correct option is (c)



5-ethyl-4,4dimethyloctane.

Correct option is (d)

31. Correct option is (a)

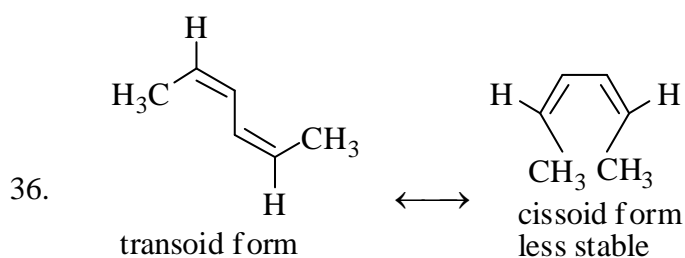


Correct option is (c)

33. Correct option is (c)

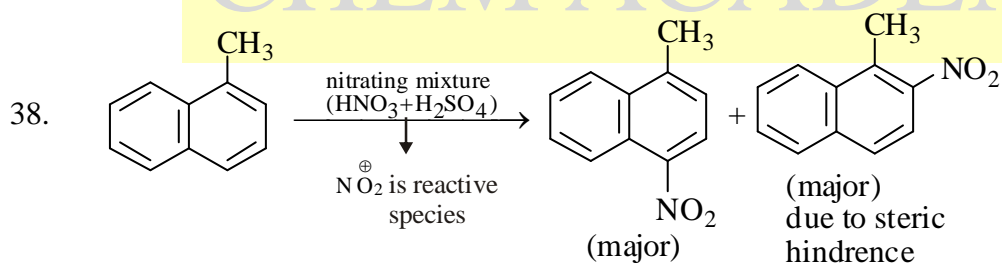
34. Correct option is (d)

35. Correct option is (d)



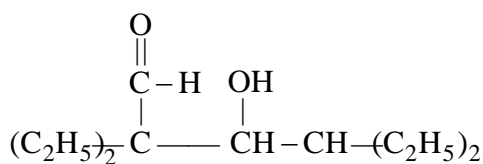
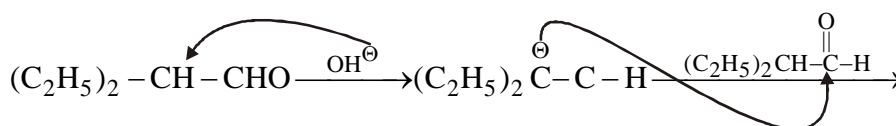
Correct option is (d)

37. Correct option is (b)

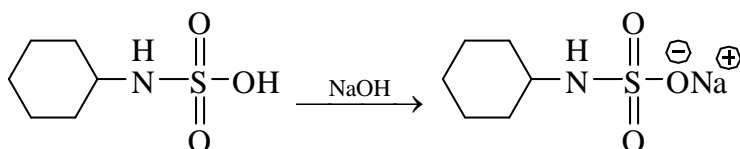
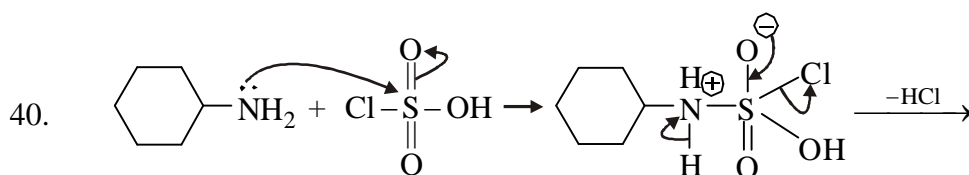


Correct option is (d)

39.  $(\text{CH}_3\text{CH}_2)_2\text{CH}-\text{CHO}$  It is having  $\alpha$ -hydrogen hence it can undergoes self condensation



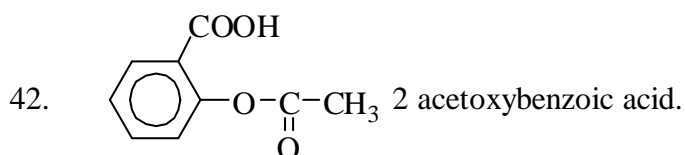
Correct option is (d)



Correct option is (a)

41. Esters don't react with  $\text{NaBH}_4$

Correct option is (c)

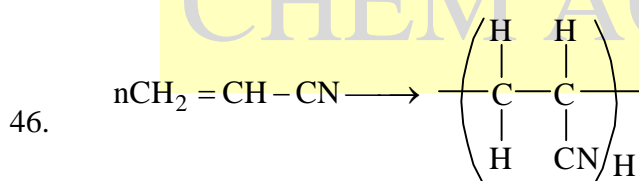


Correct option is (b)

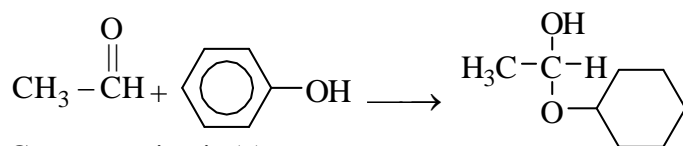
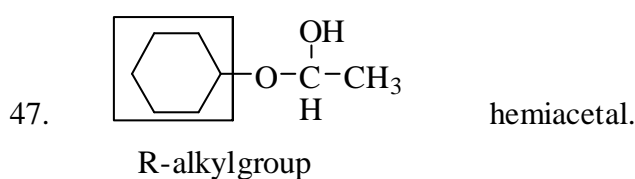
43. Correct option is (d)

44. Correct option is (d)

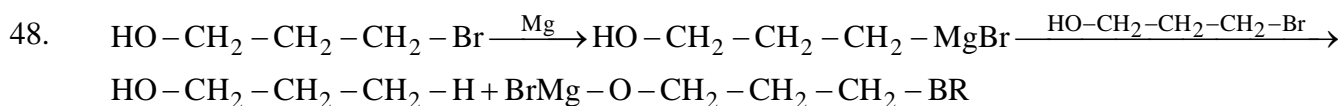
45. Correct option is (c)\*



Correct option is (d)



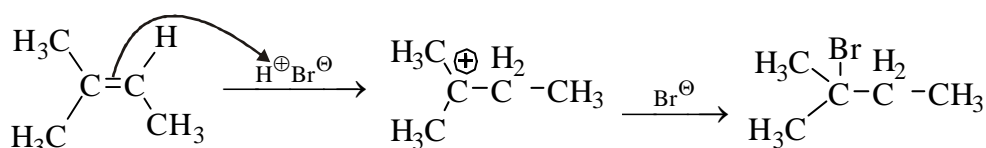
Correct option is (a)



Due to presence of proton which is abstracted by the Grignard reagent formed first one hence we can't generate.

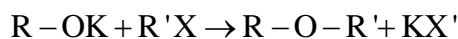
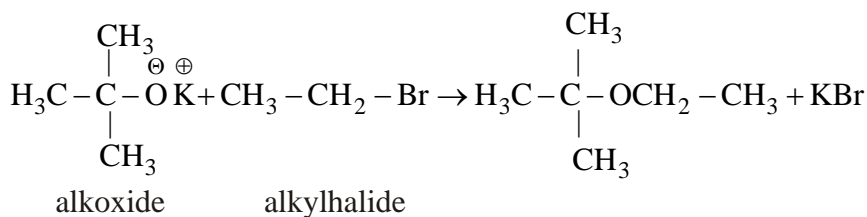
Correct option is (c)

49. Most readily reactive alkene with HBr is  $(\text{CH}_3)_2\text{C}=\text{CHCH}_3$  because it is more nucleophilic due to 9 hyperconjugation.



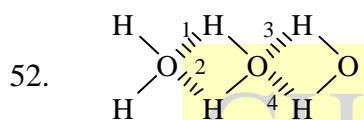
Correct option is (a)

50. An alkyl halide with dioxide.

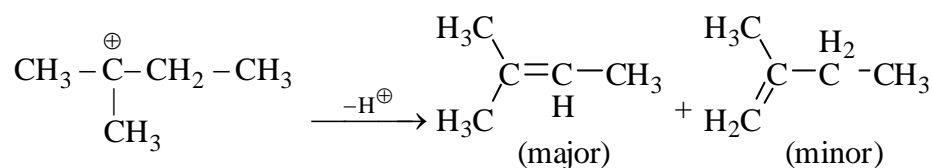
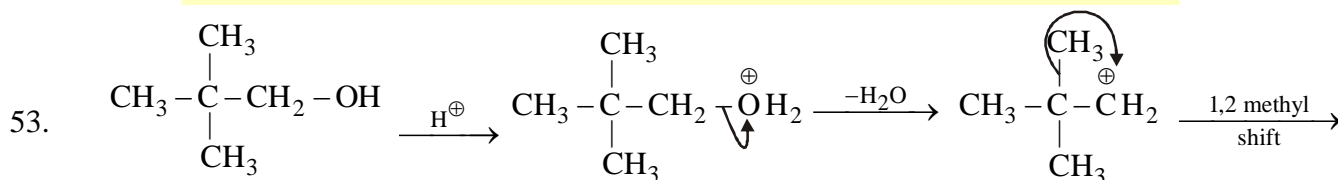


Correct option is (b)

51. Correct option is (d)\*

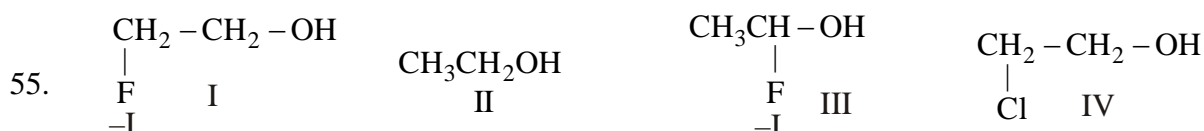


Correct option is (d)



Correct option is (a)

54. Correct option is (a)



Acidic strength  $\alpha$ -I effect

Inductive effect also depend on distance

$$\text{Inductive effect} \propto \frac{1}{\text{distance}}$$

III > I > IV > II

Correct option is (c)

56. Correct option is (b)

57.  $\text{CH}_3 - \text{CH}_2 - \text{CH}_2 - \text{CH} = \text{CH}_2 + \text{BH}_3 \rightarrow$   
2 moles

3 moles of pentene reacts with 1 mole of  $\text{BH}_3$

2 moles of pentene reacts with  $\frac{2}{3}$  moles of  $\text{BH}_3$

Correct option is (c)

58. x is the concentration of (+) mandelic acid

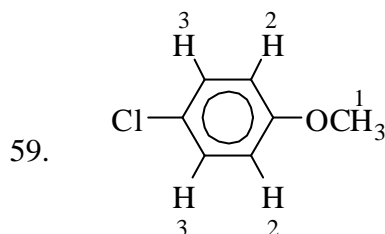
$\therefore (1 - x)$  is the concentration of (-) mandelic acid

$$[\alpha]_{\text{soln.}} = x \times 158 + (1 - x)(-158)$$

$$= \frac{75}{100} \times 158 + \frac{25}{100}(-158)$$

$$= \left( \frac{75}{100} - \frac{25}{100} \right) 158 = \frac{50}{100} \times 158 = +79$$

Correct option is (a)



There is 3 type of hydrogen hence 3 peaks are observed in  $^1\text{H}$  NMR.

Correct option is (b)

60. Correct option is (b)

61. molarity  $\propto \frac{1}{V}$       molality  $\propto \frac{1}{M}$

V = volume, M = mass

$V \propto T$  hence with increase of T, volume increases.

Therefore molarity decreases, there is no effect on molality.

Correct option is (b)

62.  $\Delta T_b = K_b m$

1 m urea  $\rightarrow$  have 1 mole of urea



1 m glucose  $\rightarrow$  have 1 mole of glucose

1 m NaCl  $\rightarrow$   $\begin{matrix} \text{Na}^+ & + & \text{Cl} \\ 1 \text{ mole} & & 1 \text{ mole} \end{matrix}$  total 2 moles

Urea and Glucose must have equal  $\Delta T_b$  and since NaCl dissociates in two moles

Hence the ratio should be

1 : 1 : 2

Correct option is (d)

63. Van't Hoff factor (i) for dissociation is  $\boxed{i > 1}$

for association  $\boxed{i < 1}$

Correct option is (d)

64. (i) 1% (mass/volume) NaCl solution

Since RBC has  $\sim$  0.8% (w/v) NaCl concentration.

So, In this case water from lower concentration of NaCl moves of higher concentration of NaCl.

i.e. RBC  $\rightarrow$  Outside solutions

i.e. cell with shrink.

(ii) 0.5% (w/v) NaCl Here

water moves from lower conc. of salt (i.e. outside) to higher conc. of salt i.e. inside.

Outside  $\rightarrow$  RBC

i.e. cell will swell.

Correct option is (a)

$$65. \quad T_B = \left( \frac{R[\ln(P_0) - \ln(101.325 \text{ kPa})] + \frac{1}{T_0}}{\Delta H_{\text{vap}}(\text{J/mol})} \right)^{-1}$$

$$(273 + 77) = \left[ \frac{8.314 \text{ J k}^{-1} \text{ mol}^{-1} (\ln(P_0) - \ln(101.325 \text{ kPa}))}{31 \times 1000 \text{ J mol}^{-1}} + \frac{1}{298} \right]^{-1}$$

$$\ln(P_0) - \ln(101.325 \text{ kPa}) = \left( \frac{1}{350} - \frac{1}{298} \right) \times \frac{31000}{8.314}$$

$$\ln(P_0) = -1.859 + \ln(101.325)$$

$$\ln(P_0) = 2.76$$

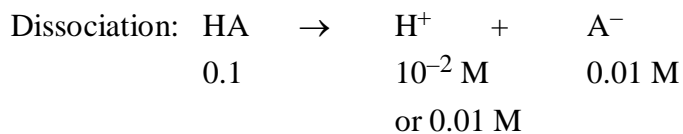
$$P_0 = 15.7998 \text{ kPa}$$

$$P_0 = 15.7998 \times 10^{-2} \text{ atm} \quad (\because 1 \text{ kPa} = 0.00987 \text{ atm or } 1 \text{ kPa} \sim 10^{-2} \text{ atm})$$

$$P_0 = 0.157 \text{ atm}$$

Correct option is (a)

66.  $\pi = iCRT$



$$\text{No. of moles} \quad (0.1-0.01) \times V \quad 0.01 \times V \quad 0.01 \times V$$

$$\text{pH} = 2$$

$$-\log[\text{H}^+] = 2$$

$$\log [\text{H}^+] = -2$$

$$[\text{H}^+] = 10^{-2} \text{ M}$$

$$i = \frac{(0.1-0.01)V + 0.01V + 0.01V}{0.1 \times V} \frac{\text{(after dissociation)}}{\text{(before dissociation)}}$$

$$i = 1$$

$$\Rightarrow \pi = 1.1 \times 0.1 \times 8.314 \times 298$$

$$\pi = 272.53 \text{ kPa}$$

$$\pi = 2.69 \text{ atm.}$$

Correct option is (d)

67.  $a = b \neq c, \alpha = \beta = \gamma = 90$

Correct option is (b)

68.  $E_X^\circ = -1.3\text{V}$

$$E_Y^\circ = 0.6\text{V}$$

$$E_Z^\circ = -3.0\text{V}$$

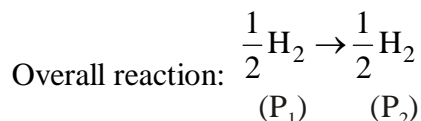
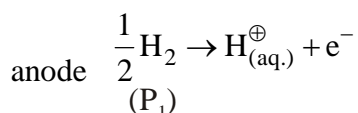
More the standard reduction value more will be reduced.

Hence the trend will be

$$Y > X > Z$$

Correct option is (c)

69.  $\text{Pt} | \text{H}_2(\text{P}_1) | \text{H}^\oplus(\text{aq.}) | \text{H}_2(\text{P}_2) | \text{Pt}$



$$E = E^\circ - \frac{RT}{nF} \ln \frac{P_2^{1/2}}{P_1^{1/2}}$$

$$n = 1$$

$$E = E^\circ - \frac{RT}{F} \ln \left( \frac{P_2}{P_1} \right)^{1/2} = E^\circ - \frac{RT}{2F} \ln \frac{P_2}{P_1} \quad (E^\circ = 0)$$

$$E = \frac{RT}{2F} \ln \frac{P_1}{P_2}$$

Correct option is (b)

70.  $\text{CH}_3\text{CHO} \rightarrow$

$$\frac{1}{[A]} = \frac{1}{[A_0]} + kt$$

$$\frac{1}{0.2 \times 0.0075} = \frac{1}{0.0075} + 0.334t$$

$$\frac{50000}{75} = \frac{10000}{75} + 0.334t$$

$$t = \frac{40000}{75 \times 0.334} = \frac{40000 \times 3}{75 \times 1} = 1600 \text{ S}^{-1}$$

Correct option is (a)

71.  $T_i = \frac{2a}{Rb}$

Correct option is (d)

72. is independent of its temperature.

Correct option is (a)

73.  $k_H = 5.55 \times 10^7$  torr at 298 K

$p = 200$  torr

From Henry's law  $p = k_H m$

$$200 \text{ torr} = 5.55 \times 10^7 \text{ torr} \times \frac{n}{1}$$

$$n = \frac{200 \times 10^{-7}}{5.55} = 3.604 \times 10^{-6}$$

Correct option is (a)

74. Correct option is (c)

75.  $[\text{H}_3\text{O}^+] = 10^{-4} \text{ M}$   $[\text{OH}^-] = 10^{-4} \text{ M}$

$$K_w = [\text{H}_3\text{O}^+][\text{OH}^-] = 10^{-4} \times 10^{-4} = 10^{-8} \text{ M}^2$$

Correct option is (a)

76. Correct option is (a)

77. Correct option is (c)

$$78. \quad u = \frac{5}{2}RT + RT = \frac{7}{2}RT$$

$$C_V = \frac{7}{2}R$$

$$C_P = \frac{9}{2}R$$

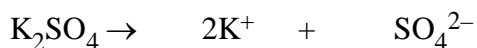
$$\gamma = \frac{C_P}{C_V} = \frac{9}{7}$$

Correct option is (c)

$$79. \quad 0.1 \text{ m in KCl} + 0.2 \text{ m in K}_2\text{SO}_4$$



$$0.1 \text{ m} \quad 0.1 \quad 0.1$$



$$0.2 \text{ m} \quad 0.4 \quad 0.2$$

$$I = \frac{1}{2} \sum m_i z_i^2$$

$$= \frac{1}{2} \left[ (0.1)(1)^2 + (0.1)(1)^2 + (0.4)(1)^2 + (0.2)(2)^2 \right]$$

$$= \frac{1}{2} [1.4] = 0.7 \text{ m}$$

Correct option is (b)

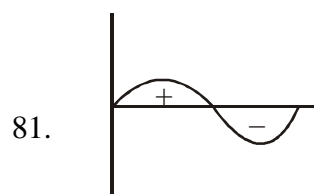
$$80. \quad \text{Angular momentum} = \sqrt{\ell(\ell+1)} \frac{h}{2\pi}$$

$$4f \rightarrow \ell = 3$$

$$\Rightarrow \sqrt{3(3+1)} \frac{h}{2\pi}$$

$$= \sqrt{12} \frac{h}{2\pi}$$

Correct option is (b)



Correct option is (c)

$$82. \quad E = -13.6 \frac{z^2}{n^2} \text{ eV}$$

$$z = 1$$

$$n = 1$$

$$\Rightarrow E = -13.6 \text{ eV}$$

Excited state for electron i.e.  $n = 2$

$$E = -13.6 \times \frac{1}{(2)^2} = -\frac{13.6}{4} = -3.4 \text{ eV}$$

Correct option is (a)

$$83. \quad m = 2.0 \times 10^{-26} \text{ g}$$

$$\ell = 4.0 \text{ nm}$$

For 1-D box:

$$E = \frac{n^2 h^2}{8m\ell^2}$$

$$\Delta E_{n_1 \rightarrow n_2} = (2n_1 + 1) \frac{h^2}{8m\ell^2}$$

$$\Delta E_{2 \rightarrow 3} = \frac{(4+1)h^2}{8 \times 2.0 \times 10^{-26} \times 10^{-3} \text{ kg} \times (4.0)^2 \times 10^{-18} \text{ m}}$$

$$\Delta E = 0.01953125 \times h^2 \times 10^{47}$$

$$E = \frac{hc}{\lambda} \quad \Rightarrow \quad \lambda = \frac{h \times 3.0 \times 10^8}{0.01953125 \times h^2 \times 10^{47}}$$

$$\lambda = \frac{3.0 \times 10^8}{0.01953125 \times 6.624 \times 10^{-34} \times 10^{47}}$$

$$\lambda = 2.32 \times 10^{-4} \text{ m}$$

Correct option is (d)

84. Correct option is (b)

$$85. \quad \frac{R_1}{R_2} = \sqrt{\frac{M_2}{M_1}} \quad (R_1 \text{ for methane})$$

$$\frac{2R}{R} = \sqrt{\frac{M}{16}}$$

$$M = 64$$

Correct option is (a)

86.  $\log(m+n) \neq \log m + \log n$

Correct option is (b)

87. Correct option is (a)

88. Correct option is (a)

89. Wave number ( $\bar{\nu}$ ) =  $\frac{1}{\lambda}$

Range of visible region 400 – 800 nm

$$2 \times 10^4 \text{ cm}^{-1}$$

$$\bar{\nu} = 2 \times 10^4 \text{ cm}^{-1}$$

$$\Rightarrow \lambda = \frac{1}{2 \times 10^4 \text{ cm}^{-1}} = 0.5 \times 10^{-4} \text{ cm}$$

$$= 500 \times 10^{-7} \text{ cm}$$

$$= 500 \times 10^{-9} \text{ m}$$

$$= 500 \text{ nm}$$

Correct option is (a)

90. Correct option is (c)

CHEM ACADEMY