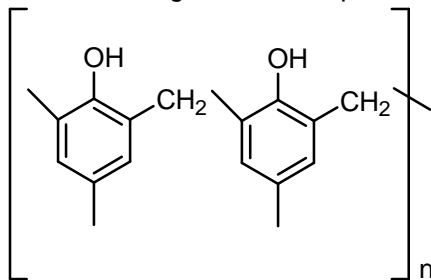# FIITJEE

NSEC – 2012-13
SOLUTIONS

1. An electron releasing group will not stabilize which of the following groups ?
(A) Carbocation   (B) Carbanion   (C) Free radical   (D) Any of the above
Ans. **(B)**
Sol. Lesser the charge more is the stability.

2. The bond order for a species with the configuration
$\sigma 1s^2\ \sigma^*1s^2\ \sigma 2s^2\ \sigma^*2s^2\ \sigma p_x^1$ will be :

(A) 1   (B) $\dfrac{1}{2}$ (C) Zero   (D) $\dfrac{3}{2}$

Ans. **(B)**

Sol. B. O = $\dfrac{N_b - N_a}{2}$

3. The widest range over which electronic excitations in organic compounds occur, is :
(A) 200 nm – 780 nm   (B) 220 – 500 nm   (C) 250 nm – 700 nm   (D) 290 nm – 1000 nm
Ans. **(D)**
Sol. Factual

4. Which of the following compounds has the least tendency to form hydrogen bonds between molecules ?
(A) NH_3 (B) H_2NOH (C) HF   (D) CH_3F
Ans. **(D)**
Sol. Tendency depends upon the Electronegativity difference between highly electronegative atom (N, O, F) & Hydrogen, more is the electronegative difference more is the tendency.

5. The species in which the central atom uses sp^2 hybrid orbitals is :
(A) PH_3 (B) NH_3 (C) CH_3^+ (D) SbH_3
Ans. **(C)**
Sol. $CH_3^+ - sp^2$

6. α-D(+) glucose and β-D(+) glucose are :
(A) Enantiomers   (B) Geometrical isomers   (C) Epimers   (D) Anomers
Ans. **(D)**
Sol. Anomers are similar molecules differing in the configuration at the C_1 atom of an aldose or C_2 atom of ketose.

7. The chemical formula of 'laughing gas' is :
(A) NO   (B) N_2O (C) N_2O_4 (D) N_2O_5
Ans. **(B)**
Sol. Factual

8. The enzyme which hydrolyses triglycerides to fatty acids and glycerol is :
(A) lipase   (B) maltase   (C) pepsin   (D) zymase
Ans. **(A)**
Sol. Factual

9. In which of the following ion/molecule, the 'S' atom does not assume sp^3 hybridization ?
(A) SO_4^{2-} (B) SF_4 (C) SF_2 (D) S_8
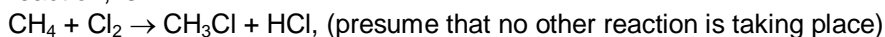**Ans.** **(B)**
Sol. $SF_4 - sp^3d$

10. The most stable free radical which can be isolated is :
(A) Trityl radical
(B) Diphenyl methyl radical
(C) 2,4,6-Tri-ter-butylphenoxy radical
(D) tert-butyl radical

Ans. **(C)**

11. Phosphine is prepared by the reaction of :
(A) P and HNO_3 (B) P and H_2SO_4 (C) P and NaOH   (D) P and H_2S

Ans. **(C)**

Sol. $3NaOH + P_4 + H_2O \rightarrow 3NaH_2PO_2 + PH_3$

12. Pheromones are chemical substances which are :
(A) formed by fermentation process of fungi
(B) secreted by endocrine glands of man
(C) secreted by insects
(D) plant growth hormones

Ans. **(C)**

13. Which of the following does not reduce Benedict's solution ?
(A) Glucose   (B) Fructose   (C) Sucrose   (D) Aldehyde

Ans. **(C)**

14. The inorganic precipitate which acts as a semipermeable membrane is :
(A) Calcium phosphate   (B) Nickel phosphate   (C) Plaster of paris   (D) Copper ferrocyanide

Ans. **(D)**

15. The genetic material of a cell is made of :
(A) nucleic acid   (B) proteins   (C) carbohydrates   (D) fats

Ans. **(A)**

16. Lanthanide contraction is caused due to :
(A) the appreciable shielding on outer electrons by 4f electrons from the nuclear charge
(B) the appreciable shielding on outer electrons by 5d electrons from the nuclear charge
(C) the same effective nuclear charge from Ce to Lu
(D) the imperfect shielding on outer electrons by 4f electrons from the nuclear charge

Ans. **(D)**

Sol. Lanthanide contraction is due to the improper shielding of inner electrons due to the diffused shape of f-subshell.

17. Which of the following contain maximum number of electrons in the antibonding molecular orbital :
(A) O_2^{2-} (B) O_2 (C) O_2^{-1} (D) O_2^{+}

Ans. **(A)**

18. Lattice energy for an ionic compound is calculated by using :
(A) Kirchoff's equation   (B) Markownikoff's rule   (C) Born Haber cycle   (D) Carnot cycle

Ans. **(C)**

19. If the radius of the first Bohr orbit is r, then the deBroglie wavelength in the third Bohr orbit is :
(A) $2\pi r$ (B) 9r   (C) r/3   (D) $6\pi r$

Ans. **(D)**

Sol. $r_n = r \times n^2 = n \times 3^2 = 9r$

$$mv = 3.\frac{h}{2\pi r_3} = \frac{h}{2\pi.9r} = \frac{h}{6\pi r}$$

$$\lambda = \frac{h}{mv} \Rightarrow \lambda = 6\pi r$$

20. The IUPAC name of $[Co(ONO)(NH_3)_5Cl_2]$ is :
(A) Pentamminenitrocobalt (II) chloride
(B) Pentamminenitrosocobalt (III) chloride
(C) Pentamminenitritocobalt (III) chloride
(D) Pentammineoxo-nitrocobalt (III) chloride

Ans. **(C)**

21. In the Vander waal equation of state for a non ideal gas the term that accounts for intermolecular force is :

(A) (V-b)   (B) RT   (C) $\left(P + \dfrac{a}{v^2}\right)$ (D) 1/RT

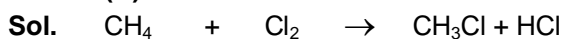**Ans.** **(C)**

22. The structure given below represents :

(A) Isoprene Rubber   (B) Bakelite   (C) PVC   (D) Nylon 6, 6

Ans. **(B)**

23. The maximum amount of CH_3Cl that can be prepared from 20g of CH_4 and 10g of Cl_2 by the following reaction, is :
$CH_4 + Cl_2 \rightarrow CH_3Cl + HCl$, (presume that no other reaction is taking place)
(A) 3.625 mole   (B) 0.141 mole   (C)1.41 mole   (D) 0.365 mole

Ans. **(B)**

Sol. CH_4 + Cl_2 $\rightarrow$ $CH_3Cl + HCl$

$\dfrac{20}{13} = 1.25$ $\dfrac{10}{71} = 0.140$

Since chlorine is a limiting reagent the amount of CH_3Cl formed depends on the amount of chlorine taken.

24. Which isomer of xylene can give three different monochloroderivatives?
(A) o-xylene   (B) m-xylene
(C) p-xylene   (D) xylene cannot give a monochloro derivative

Ans. **(B)**

25. The most Carbocations, carbanions, free radicals and radical cation are reactive carbon intermediates. Their hybrid orbitals respectively are :
(A) sp^2, sp^2, sp^3, sp (B) sp^2, sp^2, sp, sp^3 (C) sp^2, sp^3, sp^2, sp (D) sp^3, sp^2, sp, sp^2

Ans. **(C)**

26. Effective electrolyte the cause the flocculation of negatively charged arsenium sulphide colloid is :
(A) NaCl   (B) $BaCl_2$ (C) $K_3Fe(CN)_6$ (D) $AlCl_3$

Ans. **(D)**

Sol. Higher the charge of the cation better will be the flocculating power.
$Al^{+3} > Ba^{+2} > Na^+$

27. The electronegativities of acetylene, ethylene and ethane are in the order :
(A) ethylene > acetylene > ethane   (B) acetylene > ethylene > ethane
(C) ethane > acetylene > ethylene   (D) acetylene > ethane > ethylene

Ans. **(B)**

Sol. $sp > sp^2 > sp^3$ more is the s character in a hybrid orbital higher will be electronegativity.

28. A catalyst accelerates a reaction primarily by stabilizing the :
(A) Substrate   (B) Product   (C) Intermediate   (D) Transition state

Ans. **(D)**

29. The number of transition states in a unimolecular nucleophilic substitution (S_N^1) reaction is
(A) 0   (B) 1   (C) 2   (D) 3

Ans. **(C)**

30. The dipole moments of halo compounds are in the order
(A) $CHCl_3 > CCl_4 > CHCl_2 > cis\text{-}CHCl=CHCl$ (B) $cis\text{-}CHCl=CHCl > CHCl_3 > CH_2Cl_2 > CCl_4$
(C) $cis\text{-}CHCl=CHCl > CH_2Cl_2 > CHCl_3 > CCl_{40}$ (D) $CHCl_3 > CHCl_2 > cis\text{-}CHCl=CHCl > CCl_4$

Ans. **(C)**

31. Which of the following information is not provided by a reaction mechanism?
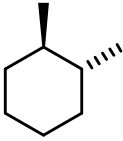(A) Which bonds are formed and which bonds are broken
(B) Which intermediates and transition states are formed
(C) Energy content of the reacting species
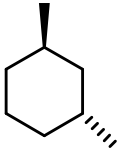(D) Which is the slowest step

Ans. **(C)**

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32. Tollen's reagent is :

(A) Cu_2O (B) $[Cu(OH)_4]^{2-}$ (C) Ag_2O (D) $[Ag(NH_3)_2]^+$

Ans. **(D)**

33. The R/S designation for the following stereoisomer of 1,3-dibromo-2-methylbutane is :

$$
\begin{array}{c}
CH_2Br \\
H_3C \!-\!\!\!\!-\!\!\!\!- H \\
H \!-\!\!\!\!-\!\!\!\!- Br \\
CH_3
\end{array}
$$

(A) 2R, 3R   (B) 2R, 3S   (C) 2S, 3R   (D) 2S, 3S

Ans. **(A)**

34. The bond energy of B-F bond in BF_3 is 646 kJ. mol^{-1}, while that of N-F bond in NF_3 is 280 kJ mol^{-1} this is because :

(A) N is more electronegative than B

(B) The atomic mass of N is higher that that of B

(C) The B-F bond gets a partial double bond character due to p-p overlap

(D) N has a lone pair of electrons while B does not have

Ans. **(C)**

35. The amino acid that cannot be obtained by hydrolysis of proteins is :

(A) $HOOCCH_2CH(\overset{+}{N}H_3)COO^-$

(B)
$$
\begin{array}{c}
CH_2COO^- \\
| \\
H\!-\!\!\!\!- C \!-\!\!\!\!- NH_3 \\
| \quad\quad + \\
SH
\end{array}
$$

(C)
$$
\begin{array}{c}
H_2C\!-\!CH\!-\!COO^- \\
| \\
\overset{+}{N}H_3
\end{array}
$$
(imidazole ring: NH ... N)

(D) $\overset{+}{N}H_3(CH_2)_4CH(NH_2)COO^-$

Ans. **(B)**

36. When equal volumes of the following solutions are mixed precipitations of AgCl ($K_{sp} = 1.8 \times 10^{-10}$) will occur only with)

(A) 10^{-4} M Ag^+ and 10^{-4} M Cl^-

(B) 10^{-5} M Ag^+ and 10^{-5} M Cl^-

(C) 10^{-6} M Ag^+ and 10^{-6} M Cl^-

(D) 10^{-10} M Ag^+ and 10^{-10} M Cl^-

Ans. **(A)**

37. The quantum numbers for the 19th electron of Cr (Z = 24) are :

(A) n = 3, l = 0, m =0 s = +½   (B) n = 4, l = 0, m =0 s = +½

(C) n = 3, l = 2, m =2 s = +½   (D) n = 4, l = 2, m =2 s = +½

Ans. **(B)**

38. The oxidation of SO_2 by O_2 to SO_3 is an exothermic reaction. the yield of SO_3 can be maximized if :

(A)Temperature is increased and pressure is kept constant

(B) Temperature is decreased and pressure is increased

(C) Both temperature and pressure are increased

(D) Both temperature and pressure are decreased

Ans. **(B)**

39. Which of the following ion is colourless:

(A) Mn^{2+} (B) Cu^+ (C) Cr^{3+} (D) Fe^{2+}

Ans. **(B)**

40. Which of the following has a positive entropy change ?

(A) $H_2O_{(g)} \longrightarrow H_2O_{(l)}$

(B) $BF_{3(g)} + NH_{3(g)} \longrightarrow F_3B\text{-}NH_{3(s)}$

(C) $2SO_{2(g)} + O_{2(g)} \longrightarrow 2SO_{3\,(g)}$

(D) $2NH_4NO_{3(s)} \longrightarrow 2N_{2\,(g)} + 4H_2O_{(l)} + O_{2(g)}$

Ans. **(D)**

41. Equal volumes of two solutions of pH = 2 and pH = 4 are mixed together. The pH of the resulting solutions will be:

(A) 2.0   (B) 3.1   (C) 4.2   (D) 2.3

Ans. **(D)**

Sol. $10^{-2} \times V + 10^{-4} \times V = N \times 2V$

$$\frac{10^{-2} + 10^{-4}}{2} = N$$

pH = 2.29

42. A first order reaction is 20% complete in 600 s. The time required to complete 75% of the same reaction will be:

(A) 3120 s   (B) 3720 s   (C) 4320 s   (D) 4920 s

Ans. **(B)**

Sol. $K = \dfrac{2.303}{t} \log \dfrac{a}{a-x}$

$$\frac{2.303}{600} \log \frac{100}{80} = \frac{2.303}{x} \log \frac{100}{25}$$

x = 3762 sec

43. The vapour density of gas A is four times that of B. If the molecular mass of B is M then molecular mass of A is :

(A) M   (B) 4M   (C) M/4   (D) 2M

Ans. **(B)**

Sol. M.W. = 4 . V.D × 2

44. Among the isomers of dimethylcylohexanes, the chiral ones are :

(A) 1, 2-trans and 1,3-cis   (B) 1, 2-cis and 1,3-trans

(C) 1, 3-trans and 1,4-trans   (D) 1, 2-trans and 1,3-trans

Ans. **(D)**

Sol.

1, 2 trans   1, 3 trans

POS and COS both are absent

45. The relative basic strength of NH_3, CH_3NH_2 and NF_3 are in the order :

(A) $CH_3NH_2 > NH_3 > NF_3$ (B) $NH_3 > CH_3NH_2 > NF_3$

(C) $NF_3 > CH_3NH_2 > NH_3$ (D) $CH_3NH_2 > NF_3 > NH_3$

Ans. **(A)**

Sol. $\underset{\text{+I effect}}{CH_3NH_2} > NH_3 > NF_3$

46. The outermost electronic configuration of the most electronegative element is :

(A) ns^2, np^3 (B) $ns^2, np^6(n-1)d^5$ (C) ns^2, np^5 (D) ns^2, np^6

Ans. **(C)**

Sol. Most electro negative element = F

47. The conductivity of a metal decreases with increase in temperature because :

(A) The kinetic energy of the electrons increases

(B) The movement of electrons becomes haphazard

(C) The ions start vibrating

(D) The metal becomes hot and starts emiting radiation

Ans. **(B)**

Sol. Kernels start vibrating & cause a hindrance to flow of electrons.

48. The lanthanide compound which is used as a most powerful liquid laser after dissolving in selenium oxychloride is :

(A) Cerium oxide   (B) Neodynium oxide

(C) Promethium sulphate   (D) Cerium sulphate

Ans. (C)

Sol. There is a sharp increase from IE_3 to IE_4.

56. An aqueous solutions of salt 'x' gives precipitate with dilute H_2SO_4. The same solution with a few drops of aq. KI gives golden yellow precipitate which dissolves on heating. The salt 'X' is :

(A) $Ba(NO_3)_2$ (B) $Sr(NO_3)_2$ (C) $Pb(NO_3)_2$ (D) $Zn(NO_3)_2$

Ans. (C)

Sol. $Pb(NO_3)_2 + KI \longrightarrow KNO_3 + PbI_2$ yellow ppt.

57. The rate of the reaction $MnO_{4(aq)}^- + 8H_{aq}^+ + 5Fe_{(aq)}^{2+} \longrightarrow Mn_{aq}^{2+} + 5Fe_{(aq)}^{3+} + 4H_2O$

can be best measured by monitoring colorimetrically the concentration of :

(A) $MnO_{4(aq)}^-$ (B) $Mn_{(aq)}^{2+}$ (C) $Fe_{(aq)}^{2+}$ (D) $Fe_{(aq)}^{3+}$

Ans. (A)

Sol. Intensity of the pink colour of MnO_4^- can be measured.

58. Which of the following observation indicates colligative properties?

I. A 0.5 M NaBr solution has a higher vapour pressure than 0.5 M $BaCl_2$

II. A 0.5 M NaOH solution freezes at a lower temperature than pure water

III. Pure water freezes at a higher temperature than pure ethanol

(A) Only I   (B) Only II   (C) Only III   (D) I and II

Ans. (D)

Sol. In (i) & (ii) Non-volatile solutes are added & they cause lowering in vapour pressure & depression in f.p. In (iii) non-volatile solute has not been added to the solvent.

59. A 500 g toothpaste sample has 0.4g fluoride concentration. The fluoride concentration in terms of ppm will be

(A) 200   (B) 400   (C) 500   (D) 800

Ans. (D)

Sol. ppm $= \dfrac{0.4}{500} \times 10^6 = 800$

60. Among the following carbon centred reactive intermediates, the carbon that has octet of electrons is:

(A) Carbocation   (B) Carbanion   (C) Carbene   (D) Radical

Ans. (B)

Sol. Carbonion has eight electrons

61. The molecule that has maximum covalent character :

(A) NaH   (B) Na_2S (C) $CaCl_2$ (D) $SnCl_4$

Ans.

Ans. (D)

Sol. $Cl-\underset{\underset{Cl}{|}}{\overset{\overset{Cl}{|}}{Sn}}-Cl$ [Smaller cation causes more polarisation so more cavalent character)

62. The mode of expression in which the concentration remains independent of temperature is :
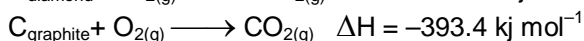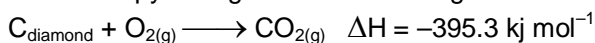
(A) Molarity   (B) Normality   (C) Formality   (D) Molality

Ans. (D)

Sol. Molality $= \dfrac{\text{moles of solute}}{\text{mass of solvent (kg)}}$

So, it is w/w by unit, it doesn't depend on temp.

63. The enthalpy changes for the following reactions are :

$C_{diamond} + O_{2(g)} \longrightarrow CO_{2(g)}$ $\Delta H = -395.3$ kj mol^{-1}

$C_{graphite} + O_{2(g)} \longrightarrow CO_{2(g)}$ $\Delta H = -393.4$ kj mol^{-1}

The enthalpy change for the transtion

$C_{diamond} \longrightarrow C_{graphite}$ will be :

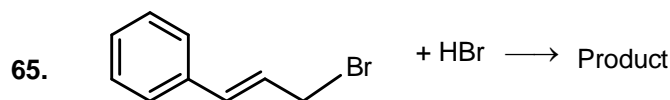(A) -3.8 kj mol^{-1} (B) $+3.8$ kj mol^{-1} (C) -1.9 kj mol^{-1} (D) $+1.9$ kj mol^{-1}

Ans. (C)

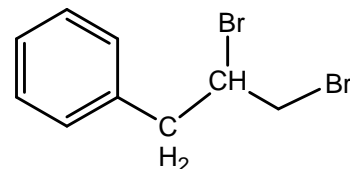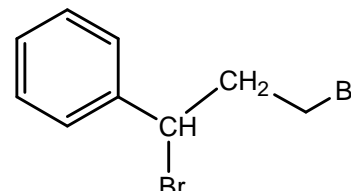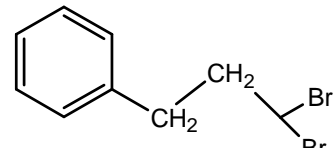**Sol.** equation (1) – equation (2)

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64. The sequence of steps involved in aromatic nucleophilic substitution involving a benzyne intermediate is :
  (A) Addition-elimination   (B) Elimination-addition
  (C) Addition-rearrangement   (D) Elimination-rearrangement
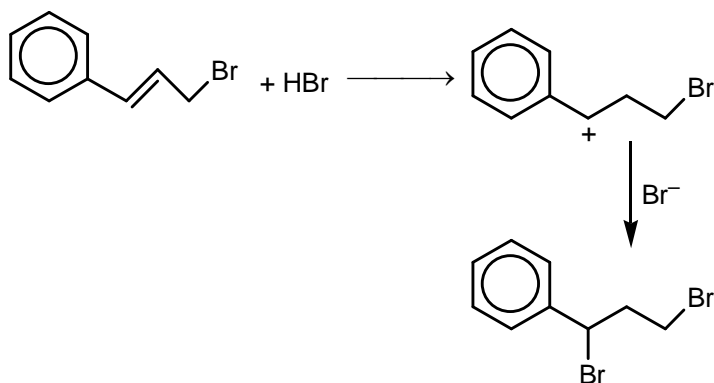**Ans.** **(B)**
Sol. Elimination – addition.

65.

+ HBr ⟶ Product

The product in the above reaction is :

(A)

(B)

(C)

(D)   This reaction can not take place

Ans. **(B)**
Sol.

66. The commercial name of calcium hydride is :
  (A) lime   (B) hydrolyth   (C) slaked lime   (D) calgon
Ans. **(B)**
Sol. CaH_2(hydrolith)

67. The number of moles of $KMnO_4$ that will be needed to react completely with one mole of ferrous oxalate $[Fe(C_2O_4)]$ in acidic solution is :
  (A) 1   (B) 2/5   (C) 3/5   (D) 4/5
Ans. **(C)**
Sol. $Fe^{+2} + MnO_4^- + C_2O_4^{-2} \longrightarrow Mn^{+2} + CO_2 + Fe^{+3}$
equivalent of = equivalent $Fe(C_2O_4)$
$KMnO_4$ 1×3
moles = 3/5

68. Protein and DNA being charged molecules, can be separated by :
  (A) Electrophoresis   (B) Centrifugation   (C) Filtration   (D) Spectrophotometry
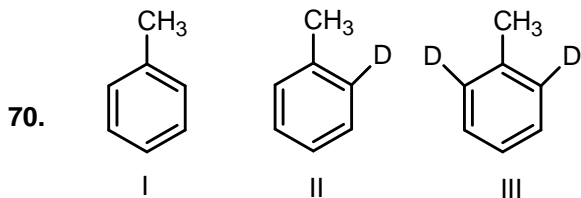**Ans.** **(A)**
Sol. Being charged molecules they move in electric field and can be separated by electrophoresis.

69. The biomolecule which does not have a secondary structure is :
  (A) protein   (B) lipid   (C) DNA   (D) RNA
Ans. **(B)**
Sol. Lipids don't have a secondary structure.

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70.

I   II   III

The rate of o-nitration of the above compounds, (I) toluene, (II) 2-D-toluene and (III) 2, 6-D_2-toluene is in the following order

(A) I > II > III   (B) II > I > III

(C) III > I > II   (D) The rate is the same for all the three compounds

Ans. **(D)**

Sol. I = II = III

In the rds step C – D bond cleavage is not involved.

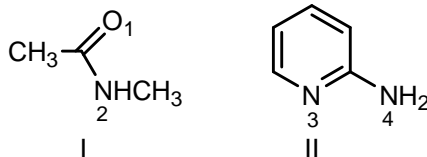**71.** In which of the following reaction is kp > kc

(A) $H_2 + I_2 \longrightarrow 2HI$ (B) $N_2 + 3H_2 \longrightarrow 2NH_3$

(C) $2SO_3 \longrightarrow 2SO_2 + O_2$ (D) $PCl_3 + Cl_2 \longrightarrow PCl_5$

Ans. **(C)**

Sol. $\Delta n = +ve$

$k_P > k_C$

72. The preferred sites of protonation in the following compounds are :

I   II

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

Ans. **(A)**

Sol. Because of Resonance

1 & 3 site will have higher electron density.

73. Which of the following vibrational modes show no IR absorption bands ?

(A) Symmetrical CO_2 stretch   (B) Antisymmetric CO_2 stretch

(C) Symmetric S = C = O stretch   (D) Antisymmetric S = C = O stretch

Ans. **(A)**

Sol. In symmetric CO_2 stretch there is no charge of polarity.

74. The crimson colour imparted to flame is due to a salt of :

(A) barium   (B) copper   (C) caleium   (D) strontium

Ans. **(D)**

Sol. Sr gives crimson red colour to flame.

75. Which of the following weighs less when weighed in magnetic field ?

(A) $ScCl_3$ (B) $FeCl_3$ (C) $TiCl_3$ (D) VCl_3

Ans. **(A)**

Sol. SC^{3+} is diamagnetic & weight less in magnetic field.

76. Essential vitamin required for the production of RBCs is :

(A) Folic acid   (B) Nicotinic acid

(C) pantothenic acid   (D) none of the above

Ans. **(A)**

Sol. Folic acid is required for the production of RBC.

77. For the reaction $NH_4^+ + NO_2^- \longrightarrow N_2 + 2H_2O$ the following data was recorded

Set	NH_4^+/M	NO_2^-/M	Rate/MS^{-1}
1	0.010	0.020	0.020
2	0.015	0.020	0.030
3	0.010	0.010	0.005

(A) rate = $K[NH_4^+] [NO_2^-]$ (B) rate = $K[NH_4^+]^2 [NO_2^-]$

(C) rate = $K[NH_4^+] [NO_2^-]^2$ (D) rate = $K[NH_4^+]^2 [NO_2^-]^2$

Ans. **(C)**

Sol. Rate = $K[NH_4^+][NO_2^-]^2$

78. In a nitration experiment, 10.0gof benzene gave 13.2g of nitrobenzene. The percentage yield is :

(A) 83.5%   (B) 62.7%   (C) 88.9%   (D) 26.7%

Ans. **(A)**
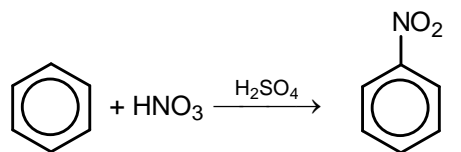
Sol.

78 g .... 123 g

10 g .... $\dfrac{123}{78} \times 10 = 15.76$ g

Percentage yield = $\dfrac{13.2}{15.76} \times 100 = 83.5\%$

79. The rate constant of a reaction increases by 5% when the temperature is increased from 27°C to 28°C. Therefore, the Energy of activation of the reaction is :
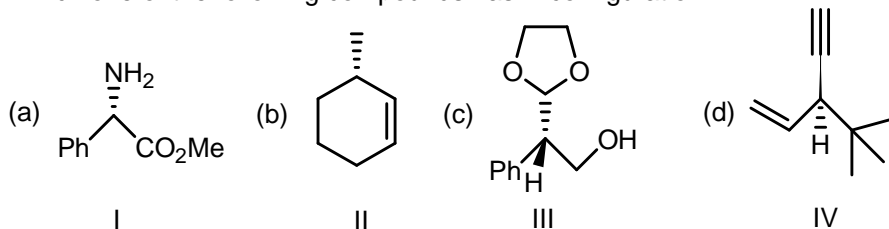
(A) 36.6 kJ mol^{-1} (B) 46.6 kJ mol^{-1} (C) 16.6 kJ mol^{-1} (D) 26.6 kJ mol^{-1}
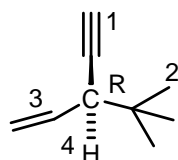
Ans. **(A)**

Sol.
$$\log\frac{K_2}{K_1} = \frac{Eq}{2.303\,R}\left[\frac{1}{T_1} - \frac{1}{T_2}\right]$$

80. Which one of the following compounds has R configuration ?

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

Ans. **(D)**

Sol.

* * * * *