



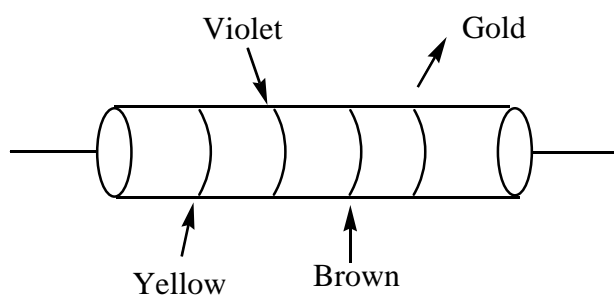
JEE-MAIN MODEL GRAND TEST- 4

Time : 3 hrs]

[Number of questions : 90

PHYSICS

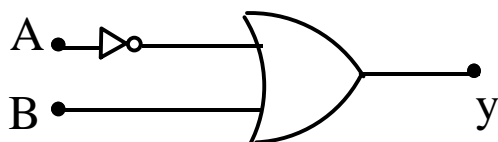
- Order of magnitude of density of Uranium nucleus is, $[m_p = 1.67 \times 10^{-27} \text{ kg}]$
 - $10^{20} \text{ kg} / \text{m}^3$
 - $10^{17} \text{ kg} / \text{m}^3$
 - $10^{14} \text{ kg} / \text{m}^3$
 - $10^{11} \text{ kg} / \text{m}^3$
- A circular plate of radius $\frac{R}{2}$ is cut from one edge of a thin circular plate of radius R of mass M. The moment of inertia of the remaining portion about an axis passing through centre and perpendicular to plane of the original plate is
 - $\frac{11}{24} MR^2$
 - $\frac{7}{12} MR^2$
 - $\frac{13}{32} MR^2$
 - $\frac{5}{7} MR^2$
- Each division on the main scale is 1mm. Which of the following vernier scales give least count equal to 0.01 mm?
 - 9mm divided into 10 divisions
 - 90 mm divided into 100 divisions
 - 99 mm divided into 100 divisions
 - 9 mm divided into 100 divisions
- The figure shows a colour- coded resistor , the resistance of this resistor is



- $52 \times 10^3 \pm 20\%$
- $47 \times 10^1 \pm 5\%$
- $53 \times 10^6 \pm 10\%$
- $42 K \Omega \pm 10\%$

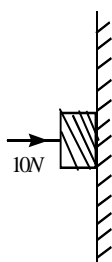
5. Two photons having same frequency moving in same medium must have
 1) Same linear momenta and same wavelengths
 2) Same linear momenta and same speeds
 3) Same energies and same speed
 4) Same energies and same linear momenta
6. Which of the following pairs have same dimensions?
 A) $\frac{L}{R}, CR$ B) LR and CR C) $\frac{L}{R}$ and \sqrt{LC} D) CR and $\frac{L}{LC}$
 1) A and C 2) B and D 3) A and D 4) A only
7. An U tube of uniform bore of cross-sectional area A is set up vertically with open ends up. A liquid of mass M and density d is poured into it. The liquid column will oscillate with a period
 1) $2\pi\sqrt{\frac{M}{g}}$ 2) $2\pi\sqrt{\frac{MA}{dg}}$ 3) $2\pi\sqrt{\frac{M}{Adg}}$ 4) $2\pi\sqrt{\frac{M}{2Adg}}$
8. The ratio of the adiabatic modulus to the isothermal bulk modulus of a perfect gas with f degrees of freedom is
 1) $\frac{2}{f}$ 2) $1 + \frac{1}{f}$ 3) $1 + \frac{2}{f}$ 4) $1 + \frac{f-1}{4}$
9. In an experiment with post office box, the ratio arms are 1000: 10, If the values of third resistance is 999Ω , the unknown resistance is
 1) 3.33Ω 2) 1.11Ω 3) 9.99Ω 4) 4.44Ω
10. In germanium the energy gap is about 0.75 eV. The wavelength of light which germanium starts absorbing is (nearly)
 1) 5000\AA 2) 1650\AA 3) 16500\AA 4) 165000\AA
11. A parallel plate condenser of capacity 200 pF is connected to 230 V of AC supply of 600 rad/sec frequency. The rms value of displacement current is
 1) $6.9\mu\text{A}$ 2) $27.6\mu\text{A}$ 3) $9.2\mu\text{A}$ 4) $4.6\mu\text{A}$
12. If K.E. of free electron doubles. then the ratio of final to the initial de-Broglie wavelength is
 1) $1/\sqrt{2}$ 2) $\sqrt{2}$ 3) $1/2$ 4) 2
13. If the ratio of the concentration of electrons to that of holes in a semiconductor is $\frac{7}{5}$ and the ratio of currents is $\frac{7}{4}$ then what is the ratio of their drift velocities?
 1) $\frac{4}{7}$ 2) $\frac{5}{8}$ 3) $\frac{4}{5}$ 4) $\frac{5}{4}$
14. The focal lengths of objective and eyepiece of an astronomical Telescope are 2m and 5 cm respectively, final image is formed at i) infinity and ii) the minimum distance of distinct vision $D = 25$ cm. The magnifying power of telescope in the two cases will be
 1) $-40; -32$ 2) $-48; -32$ 3) $-48; -40$ 4) $-40; -48$

15. It takes 10 minutes to cool a liquid from 61°C to 59°C . If room temperature is 30°C , then time taken in cooling from 51°C to 49°C is
 1) 10 minutes 2) 11 minutes 3) 13 minutes 4) 15 minutes
16. An ammeter gives full scale deflection when a current of 2A flows through it. The resistance of ammeter is 12Ω . If the same ammeter is to be used for measuring a maximum current of 5A , then ammeter must be connected with a resistance of
 1) 18Ω in parallel 2) 8Ω in parallel 3) 18Ω in series 4) 8Ω in series
17. What is the Boolean equation for the logic gate shown



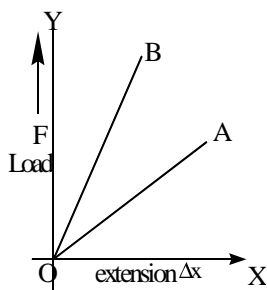
- 1) $y = A + \bar{B}$ 2) $y = \overline{A + B}$ 3) $y = \bar{A} + B$ 4) $y = \bar{A} + \bar{B}$
18. A boy playing on the roof of a 10m high building throw a ball with a speed of 10ms^{-1} at an angle of 30° with the horizontal. How far away from the throwing point will the ball be, at the same height of 10m from the ground ?

$$\left[g = 10 \text{ ms}^{-2}, \sin 30^{\circ} = \frac{1}{2}, \cos 30^{\circ} = \frac{\sqrt{3}}{2} \right]$$
- 1) 8.66 m 2) 5.20 m 3) 4.33 m 4) 2.60 m
19. A horizontal (and perpendicular to the wall) force of 10 N is necessary to just hold a block stationary against a vertical wall. The coefficient of friction between the block and the wall is 0.2 . Weight of the block is:

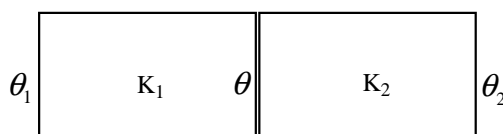


- 1) 2 N 2) 20 N 3) 50 N 4) 100 N
20. An ideal gas with pressure P , volume V and temperature T is expanded isothermally to a volume $2V$ and final pressure P_1 . The same gas is expanded adiabatically to a volume $2V$ and the final pressure P_2 . In terms of the ratio of the two specific heats γ for the gas, the ratio $\frac{P_1}{P_2}$ is:
 1) 2^{γ} 2) 2γ 3) $2^{1-\gamma}$ 4) $2^{\gamma-1}$

21. The lengths of two open organ pipes are l and $(l + \Delta l)$ respectively. Neglecting end correction, the frequency of beats will be (v = velocity of sound in air)
- 1) $\frac{v\Delta l}{2l^2}$ 2) $\frac{v}{2\Delta l^2}$ 3) $\frac{v}{4l}$ 4) $\frac{v}{2\Delta l}$
22. For the structural analysis of crystal, X-rays are used because
- 1) X-rays have wavelength of the order of inter atomic spacing
 - 2) X-rays are highly penetrating radiations
 - 3) Wavelength of X-rays is of the order of nuclear size
 - 4) X-rays are coherent radiations.
23. A $3\mu F$ capacitor is charged to a potential of 300 V and a $2\mu F$ capacitor is charged to 200 V. The capacitors are then connected in parallel with plates of opposite polarity joined together. What amount of charge will flow through the connecting wire when the plates are so connected?
- 1) $1300\mu C$ 2) $700\mu C$ 3) $250\mu C$ 4) $600\mu C$
24. The susceptibility is positive and very large for
- 1) Ferromagnetic substance
 - 2) Diamagnetic substance
 - 3) Paramagnetic substance
 - 4) Non magnetic substance
25. In Bohr's model hydrogen atom, the single electron rotates around the nucleus in a circle of radius of 53×10^{-12} m making 6.6×10^{15} revolutions each second. What is the magnetic field at the centre?
- 1) 7 tesla 2) 9 tesla 3) 12.5 tesla 4) 11 tesla
26. Two wires A and B of same length are made of same material. The figure represents the load F versus extension Δx graphs for the two wires. Then



- 1) The cross sectional area of A is greater than that of B
 - 2) The elasticity of B is greater than that of A
 - 3) The cross sectional area of B is greater than that of A
 - 4) The elasticity of A is greater than that of B
27. Two rods having thermal conductivity in the ratio of 5: 3 and having equal length and equal cross-section are joined face to face as shown. If temperature of free-end of first rod is $100^{\circ}C$ and the free end of second rod is $20^{\circ}C$, then calculate the temperature of junction



- 1) $50^{\circ}C$ 2) $70^{\circ}C$ 3) $85^{\circ}C$ 4) $100^{\circ}C$

28. A soap bubble (surface tension T) is charged to a surface charge density σ . If the pressure inside the bubble is equal to outside in equilibrium, the radius of the bubble is given by

- 1) $\frac{\sigma^2}{8\epsilon_0 T}$ 2) $\frac{8\epsilon_0 T}{\sigma^2}$ 3) $\frac{\sigma}{\sqrt{8\epsilon_0 T}}$ 4) $\frac{\sqrt{8\epsilon_0 T}}{\sigma}$

29. A block is kept on a smooth inclined plane of angle of inclination 30° that moves with a constant acceleration so that the block does not slide relative to the inclined plane. Let F_1 be the contact force between the block and the plane. Now the inclined plane stops and let F_2 be the contact force between the two in this case. Then F_1 / F_2 is

- 1) 1 2) $\frac{4}{3}$ 3) 2 4) $\frac{3}{2}$

30. Three discs, A, B and C having radii 2m, 4m and 6m respectively are coated with carbon black on their outer surfaces. The wavelengths corresponding to maximum intensity are 300 nm, 400 nm, and 500 nm respectively. The power radiated by them are Q_A , Q_B , and Q_C respectively. Then

- 1) Q_A is maximum 2) Q_B is maximum 3) Q_C is maximum 4) $Q_A = Q_B = Q_C$

MATHEMATICS

31. If $|z-1| + |z+3| \leq 8$ then the range of values of $|z-4|$ is (z is a complex number in the argand plane)

- 1) (0, 8) 2) [0, 8] 3) [1, 9] 4) [5, 9]

32. The value of $\sum_{k=1}^n (n-k) \cos \frac{2k\pi}{n}$ ($n \geq 3$) is

- 1) $-\frac{n}{2}$ 2) 0 3) $\frac{n}{2}$ 4) $-n$

33. Let $g(x) = \frac{f(x)}{x+1}$ where $f(x)$ is differentiable on $[0, 5]$ such that $f(0) = 4, f(5) = -1$. There exists $c \in (0, 5)$ such that $g'(c)$ is

- 1) $-\frac{1}{6}$ 2) $\frac{1}{6}$ 3) $-\frac{5}{6}$ 4) -1

34. If $4x^4 + 9y^4 = 64$ then the maximum value of $x^2 + y^2$ is (where x and y are real)

- 1) $\frac{4}{\sqrt{3}}$ 2) $\frac{4}{3}\sqrt{13}$ 3) $\frac{32}{3}$ 4) $\frac{32}{13}$

35. A chord of the circle $x^2 + y^2 - 4x - 6y = 0$ passing through origin subtends an angle $\tan^{-1}(7/4)$ at the point where the circle meets positive y -axis, then equation of the chord is

- 1) $2x + 3y = 0$ 2) $x + 2y = 0$ 3) $x - 2y = 0$ 4) $2x - 3y = 0$

36. The number of points of extremum of the function $f(x) = (x-2)^{2/3}(2x+1)$ is

- 1) 1 2) 0 3) 2 4) 3

37. **Statement-I :-** Let the vector $\vec{a} = \hat{i} + \hat{j} + \hat{k}$ be vertical. The line of greatest slope on a plane with normal $\vec{b} = 2\hat{i} - \hat{j} + \hat{k}$ is along the vector $\hat{i} - 4\hat{j} + 2\hat{k}$.

Statement-II:- If \vec{a} is vertical then the line of greatest slope on a plane with normal \vec{b} is along the vector $(\vec{a} \times \vec{b}) \times \vec{b}$

- 1) Both Statement - 1 and Statement - 2 are true and Statement - 2 is the correct explanation of Statement - 1
 - 2) Both Statement - 1 and Statement - 2 are true but Statement - 2 is not the correct explanation of Statement - 1
 - 3) Statement - 1 is true, Statement - 2 is false
 - 4) Statement - 1 is false, Statement - 2 is true
38. The probability that the triangle formed by choosing any three vertices from the vertices of a cube is equilateral is
- 1) $\frac{3}{7}$
 - 2) $\frac{6}{7}$
 - 3) $\frac{4}{7}$
 - 4) $\frac{1}{7}$

39. Let $A = \begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \end{bmatrix}$, $X = \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$, $Y = \begin{bmatrix} y_1 \\ y_2 \end{bmatrix}$ (X^1, Y^1 denote the transpose of X and Y)

Statement-I:- If A is symmetric then $X^1 A Y = Y^1 A X$ for each pair of

Statement-II:- for each pair of then A is symmetric

- 1) Both Statement - 1 and Statement - 2 are true and Statement - 2 is the correct explanation of Statement - 1
 - 2) Both Statement - 1 and Statement - 2 are true but Statement - 2 is not the correct explanation of Statement - 1
 - 3) Statement - 1 is true, Statement - 2 is false
 - 4) Statement - 1 is false, Statement - 2 is true
40. Consider the following relations

$$R = \{(x, y) / x, y \text{ are real numbers and } x = wy \text{ for some rational number } w\}$$

$$S = \left\{ \left(\frac{m}{n}, \frac{p}{q} \right) \right\} \text{ m,n,p,q are integers such that } n \cdot q \neq 0 \text{ and } qm = pn$$

Statement I:- S is an equivalence relation but R is not an equivalence relation

Statement II:- R and S both are symmetric

- 1) Both Statement - 1 and Statement - 2 are true and Statement - 2 is the correct explanation of Statement - 1
- 2) Both Statement - 1 and Statement - 2 are true but Statement - 2 is not the correct explanation of Statement - 1
- 3) Statement - 1 is true, Statement - 2 is false
- 4) Statement - 1 is false, Statement - 2 is true

59. Consider all functions that can be defined from the set $A = \{1,2,3\}$ to the set $B = \{1,2,3,4,5\}$. A function $f(x)$ is selected at random from these functions. The probability that, selected function satisfies $f(i) \leq f(j)$ for $i < j$, is equal to

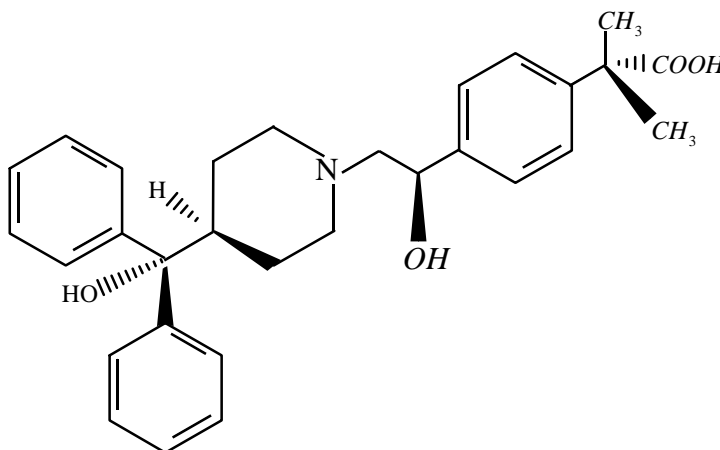
- 1) $\frac{6}{25}$ 2) $\frac{7}{25}$ 3) $\frac{2}{5}$ 4) $\frac{12}{25}$

60. $\int_0^{\pi} [\cot x] dx =$ (where $[.]$ denotes the greatest integer function)

- 1) $\frac{\pi}{2}$ 2) 1 3) -1 4) $-\frac{\pi}{2}$

CHEMISTRY

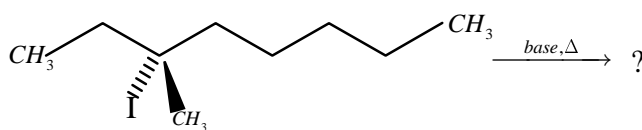
61. Which of the following statement is wrong regarding CH_2F_2
- 1) It has perfect tetrahedral structure
 - 2) All bond angles are equal
 - 3) All the hybrid orbitals have same s and p character
 - 4) All are wrong
62. The interplanar distance between the closest packed layers in the face-centered cubic unit cell is
- 1) equal to the edge length
 - 2) equal to the half the edge length
 - 3) equal to the one third of body diagonal
 - 4) equal to the half of face diagonal.
63. Allegra, a common prescription drug with the structure shown below, is given for the treatment of seasonal allergies. How many stereogenic carbon does allegra possess ?



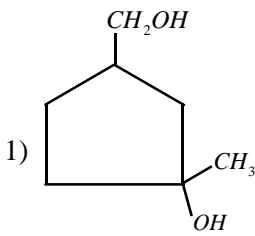
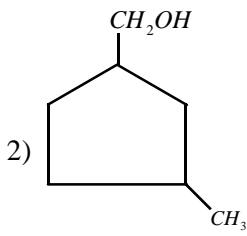
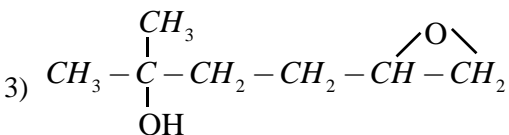
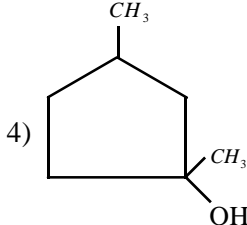
- 1) 2 2) 1 3) 3 4) 5
64. The maximum number of angles between bond pair of electrons is observed in
- 1) dsp^3 hybridization
 - 2) sp^3d^2 hybridization
 - 3) dsp^2 hybridization
 - 4) sp^3d hybridization

65. An electron is allowed to move freely in a closed cubic box of length of side 10 cm. The minimum uncertainty in its velocity will be:
 1) $3.33 \times 10^{-4} \text{ m sec}^{-1}$ 2) $5.8 \times 10^{-4} \text{ m sec}^{-1}$ 3) $4 \times 10^{-5} \text{ m sec}^{-1}$ 4) $4 \times 10^{-6} \text{ m sec}^{-1}$
66. Arrange the following compounds in the order of increasing tendency to undergo electrophilic substitution
 1) Nitrobenzene 2) Benzene 3) Phenol 4) Toluene
 5) Trimethyl phenyl ammonium ion
 1) $5 < 1 < 2 < 4 < 3$ 2) $3 > 2 > 1 > 4 > 5$ 3) $1 > 2 > 5 > 3 > 4$ 4) $5 < 2 < 4 < 1 < 3$
67. Which of the bonding conversions show minimum energy release
 1) $C \rightarrow C^-$ 2) $H \rightarrow H^-$ 3) $O \rightarrow O^-$ 4) $F \rightarrow F^-$
68. For a real gas $PV > RT$ at all pressure ranges, then :
 1) The gas is less compressible 2) The gas is highly compressible
 3) The gas is not compressed at all 4) The gas is liquefied easily
69. $CaC_2 + H_2O \rightarrow (A) \xrightarrow{H_2SO_4, HgSO_4} (B)$ Then A and B are
 1) CH_4 and $HCOOH$ 2) C_2H_4 and CH_3COOH 3) C_2H_2 and CH_3CHO 4) C_2H_2 and CH_2COOH
70. Which of the following is diamagnetic ?
 1) $[Fe(H_2O)_5(NO)]^{2+}$ 2) $[Fe(CN)_5(NO)]^{3-}$
 3) $[Fe(CN)_5(NO)]^{2-}$ 4) $[Fe(H_2O)_5(NO)]^{3+}$
71. 20 ml of an H_2O_2 solution on reaction with excess of acidified $KMnO_4$ released 224 CC of O_2 . What is the volume strength of that H_2O_2 ?
 1) 5.6 vol 2) 11.2 vol 3) 22.4 vol 4) 2.8 vol

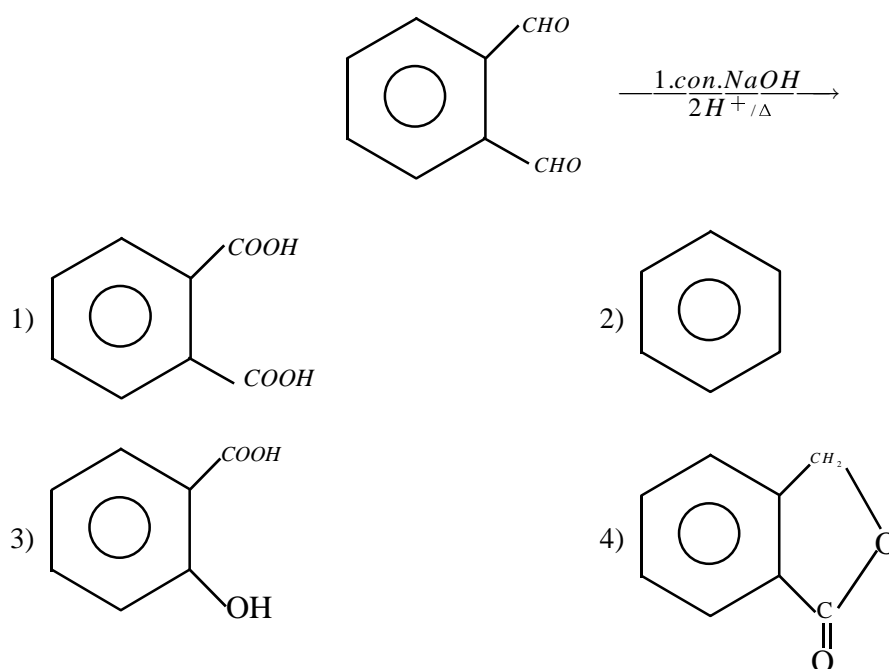
72. How many distinct alkene products are possible when the alkyl iodide below undergoes E2 elimination ?



- 1) 1 2) 2 3) 3 4) 5
73. The false statement among the following is
 1) Metallic or interstitial hydrides can be considered as solid solutions
 2) Hydrogen can be purified by occlusion process
 3) H-H bond length is longer than D-D bond length and thus D_2 has more bond energy than H_2
 4) High pure hydrogen is obtained by the electrolysis of warm $Ba(OH)_2$ solution
74. $I_2(S)/I^-(0.1M)$ half cell is connected to a $H^+(aq)/H_2(1bar)/Pt$ half cell and emf is found to be 0.7714V. If $E_{I_2/I^-}^0 = 0.535V$, find the P^H of H^+/H_2 half cell.
 1) 5 2) 3 3) 4 4) 6

75. In the reaction sequence $Glycerol \xrightarrow{KHSO_4/\Delta} X \xrightarrow{Zn-Hg/concHCl/\Delta} Y \xrightarrow{NBS/CCl_4} Z$ Z will be
- 1) 1,2-dibromopropane
 - 2) 1-bromopropane
 - 3) 2-bromopropane
 - 4) 3-bromopropene
76. The wrong statement among the following is
- 1) With nitrogen lithium forms nitride but sodium forms azide
 - 2) with sodium carbonate $FeSO_4$ gives basic iron (II) carbonate precipitate but $FeCl_3$ gives reddish brown $Fe(OH)_3$ precipitate
 - 3) Magnesium chloride gives white precipitate with Na_2CO_3 but not with $NaHCO_3$ in cold condition
 - 4) Enthalpies of alkali metal chlorides decreases down the group
77. Equivalent conductivity of $BaCl_2$, H_2SO_4 and HCl are x_1 , x_2 and x_3 $S - cm^{-1} - eq^{-1}$ at infinite dilution. If conductivity of saturated $BaSO_4$ solution is x $S - cm^{-1}$, then K_{sp} of $BaSO_4$ is
- 1) $\frac{500x}{(x_1 + x_2 - 2x_3)^2}$
 - 2) $\frac{2.5 \times 10^5 x^2}{(x_1 + x_2 - 2x_3)^2}$
 - 3) $\frac{10^6 x^2}{(x_1 + x_2 - 2x_3)^2}$
 - 4) $\frac{0.25x^2}{(x_1 + x_2 - x_3)^2}$
78. The major product of the reaction,
- $$CH_2=C(CH_3)-CH_2-CH_2-\underset{\text{O}}{\text{CH}}-CH_2 \xrightarrow{H_3O^+} \text{will be}$$
- 1) 
 - 2) 
 - 3) 
 - 4) 
79. Among $(CH_3)_3N \rightarrow O$ and $(CH_3)_3P \rightarrow O$
- 1) $N \rightarrow O$ bond has more dipole moment than $P \rightarrow O$
 - 2) $N \rightarrow O$ bond is stronger than $P \rightarrow O$ bond
 - 3) $N \rightarrow O$ bond is shorter than $P \rightarrow O$ bond
 - 4) Amine oxides ($R_3N \rightarrow O$) are more stable than phosphine oxides ($R_3P \rightarrow O$)
80. Bredig's arc method cannot be used for the preparation of colloidal sol of :
- 1) copper
 - 2) gold
 - 3) silver
 - 4) sodium

81. Identify the product in the following reaction:



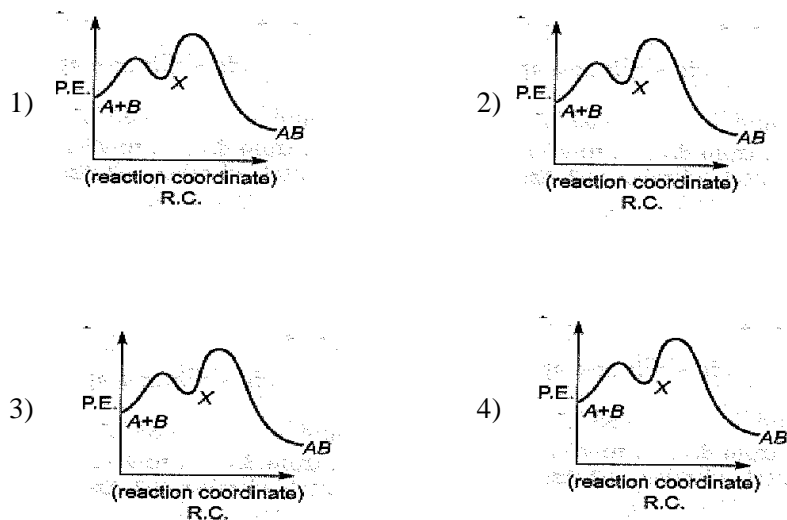
82. The molecule with zero dipole moment is

- 1) ClF_3 2) BrF_5 3) IF_7 4) ClF

83. For an exothermic chemical process occurring in two steps as follows



The process of reaction can be best describe by

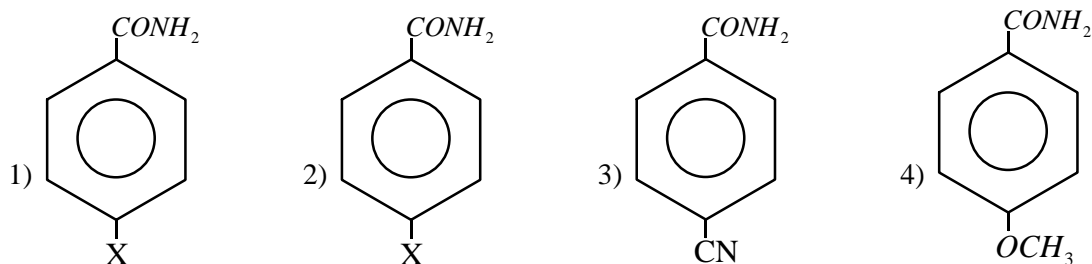


84. Which of the following is most acidic.

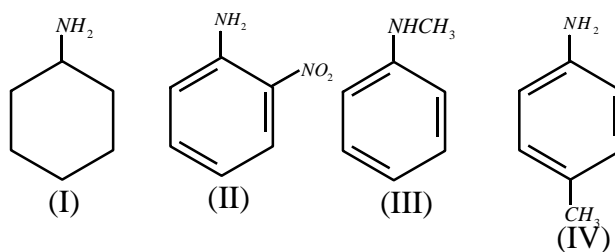
- 1) $\begin{array}{c} \text{COOH} \\ | \\ \text{COOH} \end{array}$ 2) $\begin{array}{c} \text{COOH} \\ \diagup \text{H}_2\text{C} \\ \diagdown \text{COOH} \end{array}$ 3) CH_3COOH 4) $HCOOH$

85. An element of 3d-transition series shows two oxidation states x and y , differ by two units. Then
 1) compounds in oxidation state x are ionic if $x > y$
 2) compounds in oxidation state x are ionic if $x < y$
 3) oxidation state has no relation to the nature of bond
 4) compounds in oxidation state y are covalent is $y < x$
86. The molal elevation constant of water is $0.52K\text{ kgmol}^{-1}$. The boiling point of 1.0 molal aqueous KCl solution (assuming complete dissociation of KCl), should be
 1) 98.96°C 2) 100.52°C 3) 101.04°C 4) 107.01°C

87. Which of the following can undergo Hoffmann reaction most easily?



88. In which of the following the impure metal is not purified by the oxidation of impurities
 1) silver containing lead 2) preparation of wrought iron from pig iron
 3) zinc containing iron and cadmium 4) bessemerisation of pig iron
89. For a particular reversible reaction at temperature T , ΔH and ΔS were found be both + ve. If T_e is the temperature at equilibrium, the reaction would non-spontaneous when
 1) $T = T_e$ 2) $T_e > T$ 3) $T_e < T$ 4) T_e is 2 times T
90. The correct order of decreasing base strength among the amines given is



- 1) III>I>IV>II 2) IV>III>I>II
 3) I>IV>III>II 4) I>III>IV>II