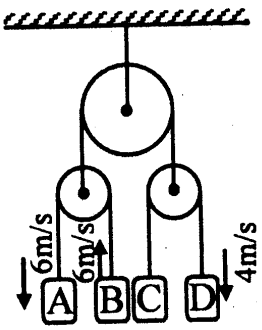
# JEE Main MODEL GRAND TEST

**Time: 3 Hrs** **No. of Questions: 90** **Max.Marks: 360**

***NOTE:*** **Each of the following questions has four choices of which ONLY ONE is correct. Choose the correct option. Each correct answer carries 4 marks. Each wrong answer carries −1 mark.**

## PHYSICS

**1.** In the figure the velocity of different blocks is shown.

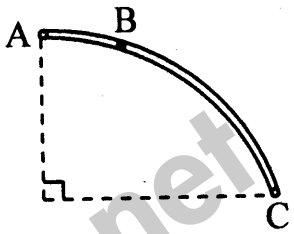



The velocity of C is

A) 6 m/s B) 4 m/s

C) 0 m/s D) None of these

**2.** The tube AC forms a quarter circle in a vertical plane.




The ball B has an area of cross section slightly smaller than that of the tube, and can move without friction through it.

B is placed at A and displaced slightly. It will

A) always be in contact with inner wall of the tube

B) always be in contact with the outer wall of the tube

C) initially be in contact with the inner wall and later with the outer wall

D) initially be in contact with outer wall and later with inner wall

**3.** Two billiard balls undergo a head-on collision. Ball 1 is twice as heavy as ball 2. Initially, ball 1 moves with a speed v towards ball 2 which is at rest. Immediately after the collision, ball 1 travels at a speed of v/3 in the same direction. What type of collision has occurred?

A) inelastic B) elastic C) completely inelastic

D) cannot be determined from the information given

**4.** A block of mass m slides down a plane inclined at an angle θ. Which of the following will NOT increase the energy lost by the block due to friction?

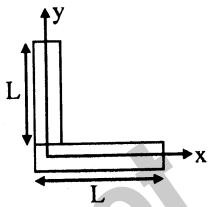
A) Increasing the angle of inclination

B) Increasing the distance that the block travels

C) Increasing the acceleration due to gravity

D) Increasing the mass of the block

**5.** Centre of mass of two thin uniform rods of same length but made up of different materials and kept as shown, can be, if the meeting point is the origin of coordinates




A) $\left(\frac{L}{2}, \frac{L}{2}\right)$ B) $\left(\frac{2L}{3}, \frac{L}{2}\right)$ C) $\left(\frac{L}{3}, \frac{L}{3}\right)$ D) $\left(\frac{L}{3}, \frac{L}{6}\right)$

**6.** Two points P and Q move in same plane such that the relative acceleration of P with respect to Q is zero. They are moving such that the distance between them is decreasing. Pick the correct statement for P and Q to collide.

A) The line joining P and Q should not rotate

B) The line joining P and Q should rotate with constant angular speed

C) The line joining P and Q should rotate with variable angular speed

D) All the above statements are correct.

**7.** Typical salt (hard mud) particle of radius 20 mm is on the top of lake water, its density is 2000 kg /$m^3$ and the viscosity of lake water is 1.0 m Pa-s, density is 1000 kg /$m^3$ . If the lake is still (has no internal fluid motion), the terminal speed with which the particle hits the bottom of the lake is ..... mm/s.

A) 0.67 B) 0.77 C) 0.87 D) 0.9

**8.** A satellite can be in a geostationary orbit around a planet at a distance r from the centre of the planet. If the angular velocity of the planet about its axes doubles, a satellite can now be in a geostationary orbit around the planet if its distance from the centre of the planet is

A) $\frac{r}{2}$ B) $\frac{r}{2\sqrt{2}}$ C) $\frac{r}{4^{1/3}}$ D) $\frac{r}{2^{1/3}}$

**9.** A uniform disk of mass 300 kg is rotating freely about a vertical axis through its centre with constant angular velocity $\omega_0$. A boy of mass 30 kg starts from the centre and moves along a radius to the edge of the disk. The angular velocity of the disk now is

A) $\frac{\omega_0}{6}$ B) $\frac{\omega_0}{5}$ C) $\frac{4\omega_0}{5}$ D) $\frac{5\omega_0}{6}$

**10.** A hollow sphere of inner radius R and outer radius 2R is made of a material of thermal conductivity K. It is surrounded by another hollow sphere of inner radius 2R and outer radius 3R made of same material of thermal conductivity K. The inside of smaller sphere is maintained at 0°C and the outside of bigger sphere at 100°C. The system is in steady state. The temperature of the interface will be:

A) 50°C B) 70°C C) 75°C D) 45°C

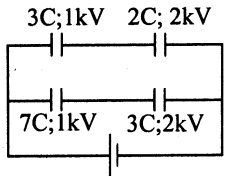
**11.** A heavy brass sphere is hung from a light spring and is set in vertical small oscillation with a period T. The sphere is now immersed in a non-viscous liquid with a density $1/10^{th}$ the density of the sphere. If the system is now set in vertical SHM, its period will be

A) (9 /10)T B) $(9/10)^2$ T C) (10 / 9)T D) T

**12.** An organ pipe $P_1$ closed at one end vibrating in its first overtone. Another pipe $P_2$ open at both ends is vibrating in its third overtone. They are in a resonance with a given tuning fork. The ratio of the length of $P_1$ to that of $P_2$ is:

A) $\frac{8}{3}$ B) $\frac{3}{8}$ C) $\frac{1}{2}$ D) $\frac{1}{3}$

**13.** The diagram shows four capacitors with capacitances and break down voltages as mentioned. What should be the maximum value of the external emf source such that no capacitor breaks down?




A) 2.5 kV B) 10/3 kV C) 3 kV D) 1 kV

**14.** In a double slit experiment, the separation between slits is d = 0.25 cm and the distance of the screen D = 100 cm from the slits. If the wavelength of light used is $l$ = 6000 Å and $I_0$ is the intensity of the central bright fringe, the intensity at a distance $x = 4 \times 10^{-5}$ m from the central maximum is

A) $I_0$ B) $\frac{I_0}{2}$ C) $\frac{3I_0}{4}$ D) $\frac{I_0}{3}$

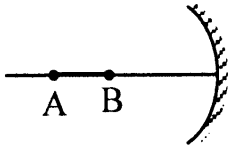
**15.** A silver wire of length 10 metre and cross-sectional are $10^{-8}$ $m^2$ is suspended vertically and a weight of 10 N is attached to it. Young's modulus of silver and its resistivity are $7 \times 10^{10}$ $N/m^2$ and $1.59 \times 10^{-8}$ Ω – m respectively. The increase in its resistance is equal to (keeping volume constant)

A) 0.0455 Ω B) 0.455 Ω C) 0.91 Ω D) 0.091 Ω

**16.** A bubble of conducting liquid is charged to potential v, it has radius a and thickness t << a . It collapses to form a droplet. What is potential of the droplet?

A) $v\left(\frac{2a}{3t}\right)^{1/3}$ B) $v\left(\frac{a}{3t}\right)^{1/3}$ C) $v\left(\frac{a}{3t}\right)^{2/3}$ D) $v\left(\frac{a^2}{3t^3}\right)^{1/3}$

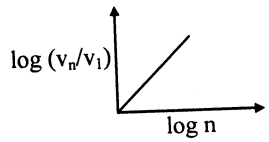
**17.** A linear object AB is placed along the axis of a concave mirror. The object is moving towards the mirror with speed V. The speed of the image of the point A is 4 V and the speed of the image of B is also 4 V. If centre of the line AB is at a distance L from the mirror then length of the

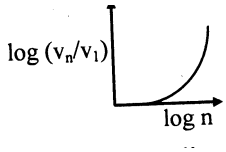


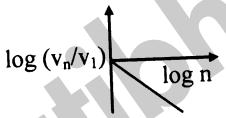
object AB will be

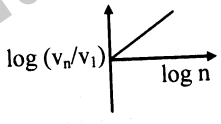
A) $\frac{3L}{2}$ B) $\frac{5L}{3}$ C) L D) $\frac{4L}{3}$

**18.** The frequency of revolution of electron in $n^{th}$ Bohr orbit is $v_n$. The graph between log n and ( $l$og $v_n/v_1$ ) may be

A) 

B) 

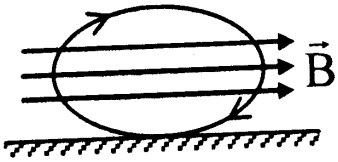
C) 

D) 


**19.** The number of $\alpha$ and $\beta$ emitted during the radioactive decay chain starting from $^{226}_{88}$ Ra and ending at $^{206}_{82}$ Pb is

A) 3$\alpha$ and 6$\beta$ B) 4$\alpha$ and 5$\beta$ C) 5$\alpha$ and 4$\beta$ D) 6$\alpha$ and 6$\beta$

**20.** A conducting ring of mass 2 kg and radius 0.5 m is placed on a smooth horizontal plane. The ring carries a current i = 4 A. A horizontal magnetic field B = 10 T is switched on at time t = 0 shown in figure. The initial angular acceleration of the ring will be

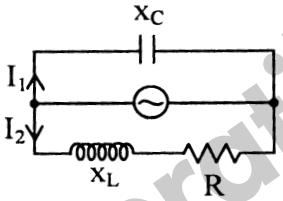



A) 40$\pi$ rad / $s^2$ B) 20$\pi$ rad / $s^2$ C) 5$\pi$ rad / $s^2$ D) 15$\pi$ rad / $s^2$

**21.** In the shown AC circuit phase difference between currents $I_1$ and $I_2$ is

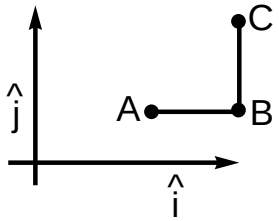
A) $\frac{\pi}{2} - \tan^{-1}\frac{X_L}{R}$

B) $\tan^{-1}\frac{X_L - X_C}{R}$




C) $\frac{\pi}{2} + \tan^{-1}\frac{X_L}{R}$ D) $\tan^{-1}\frac{X_L - X_C}{R} + \frac{\pi}{2}$

**22.** There is a uniform magnetic field B normal to the XY plane. A conductor ABC has length AB = $l_1$, parallel to the X – axis, and length BC = $l_2$ , parallel to the Y – axis. ABC moves in the XY plane with velocity $v_x\hat{i} = v_y\hat{j}$. The potential difference between A and C is proportional to




A) $v_x l_1 + v_y l_2$ B) $v_x l_2 + v_y l_1$

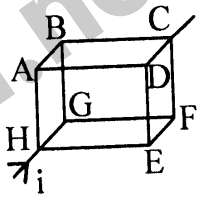
C) $v_x l_2 - v_y l_1$ D) $v_x l_1 - v_y l_2$

**23.** One mole of an ideal gas at temperature $T_1$ expands according to the law $P/V^2$ = a constant . The work done by the gas till temperature of gas becomes $T_2$ is:

A) $\frac{1}{2}R(T_2 - T_1)$ B) $\frac{1}{3}R(T_2 - T_1)$

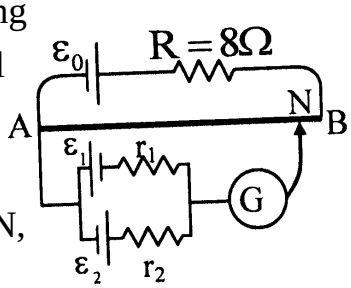
C) $\frac{1}{4}R(T_2 - T_1)$ D) $\frac{1}{5}R(T_2 - T_1)$

**24.** In the box shown current i enters at H and leaves at C. If $i_{AB} = \frac{i}{6}$, $i_{DC} = \frac{2i}{3}$, $i_{HA} = \frac{i}{2}$, $i_{GF} = \frac{i}{6}$, $i_{HE} = \frac{i}{6}$, choose the branch in which current is zero.



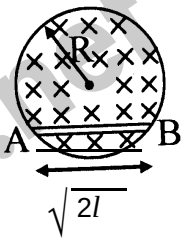

A) BG B) FC C) ED D) None

**25.** A battery of emf $E_0$ = 12 V is connected across a 4 m long uniform wire having resistance 4 Ω/m. The cells of small emfs $\varepsilon_1$ = 2 V and $\varepsilon_2$ = 4 V having internal resistance 2 Ω and 6 Ω respectively, are connected as shown in the figure. If galvanometer shows no deflection at the point N, the distance of point N from the point A is equal to




A) 15 m B) 20 m C) 25 cm D) 50 cm

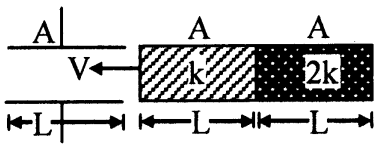
**26.** A uniform magnetic field, B = $B_0$t (where $B_0$ is a positive constant), fills a cylindrical volume of radius R, then the emf induced in the conducting rod AB is:

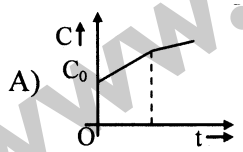


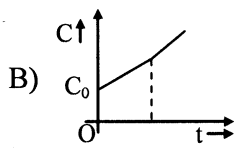

A) $B_0 lR$ B) $B_0 \sqrt{R^2 - l^2}$

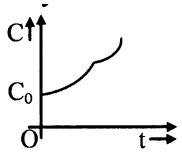
C) $B_0 l\sqrt{R^2 - l^2}$ D) $B_0 R \sqrt{R^2 - l}$

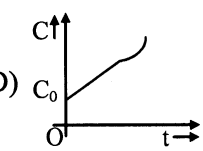
**27.** A parallel plate capacitor without any dielectric has capacitance $C_0$. A dielectric slab is made up of two dielectric slabs of dielectric constants K and 2K and is of same dimensions as that of capacitor plates and both the parts are of equal dimensions arranged serially as shown. If this dielectric slab is introduced (dielectric K enters first) in between the plates at constant speed, then variation of capacitance with time will be best represented by:




A) 


B) 


C) 


D) 


**28.** A quantity X is given by $\varepsilon_0 L$, where $\varepsilon_0$ is the permittivity of free space, L is length, $\Delta V$ is potential difference and $\Delta t$ is time interval. The dimensional formula for X is the same as that of

A) resistance B) charge C) voltage D) current

**29.** A tiger running 100 m race, accelerates for one third time of the total time and then moves with uniform speed. Then the total time taken by the tiger to run 100 m, if the acceleration of the tiger is 8 m / $s^2$, is

A) $3\sqrt{5}$ s B) $5\sqrt{3}$ s C) 12 s D) 9 s

**30.** A cylindrical tank of height 0.4 m is open at the top and has a diameter 0.16 m. Water is filled in it up to a height of 0.16 m. How long it will take to empty the tank through a hole of radius $5 \times 10^{-3}$ in its bottom?

A) 46.26 sec B) 4.6 sec C) 462.6 sec D) 0.46 sec

## CHEMISTRY

**31.** The heat of neutralization of HC*l* by NaOH is –55.9 kJ /mol. If the heat of neutralization of HCN by NaOH is –12.1 kJ /mol, the energy of dissociation of HCN is

A) –43.8 kJ B) 43.8 kJ C) 68 kJ D) –68 kJ

**32.** $H_2O_2$ restores the colour of old lead paintings, blackened by the action $H_2S$ gas, by

A) converting $PbO_2$ to Pb B) by oxidizing PbS to $PbSO_4$

C) converting $PbCO_3$ to Pb D) oxidizing $PbSO_3$ to $PbSO_4$

**33.** A substance $A_xB_y$ crystallizes in a fcc lattice in which atoms A occupy each corner of the cube and atoms B occupy the centres of each face of the cube. Identify the correct composition of the substance $A_xB_y$

A) $AB_3$ B) $A_4B_3$ C) $A_3B$ D) None of these

**34.** The standard reduction potentials of the following half cell reactions are given below:

$Fe^{3+} + 3e^- \rightarrow Fe$; $E^\circ = -0.036$ volt

$Fe^{2+} + 2e^- \rightarrow Fe$; $E^\circ = -0.440$ volt

The standard electrode potential $E^\circ$ for $Fe^{3+} + e^- \rightarrow Fe^{2+}$ is

A) –0.476 volt B) –0.404 volt C) 0.440 volt D) +0.772 volt

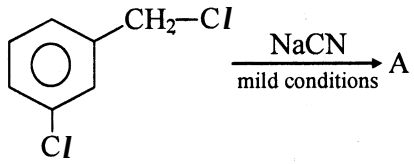
**35.** Compound $PdCl_4 .6H_2O$ is a hydrated complex; 1 molal aqueous solution of it has freezing point 269.28 K. Assuming 100% ionization of complex, calculate the molecular formula of the complex. ($K_f$ for water = 1.86 K Kg $mol^{-1}$)

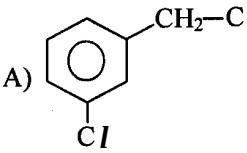
A) $[Pd(H_2O)_6]Cl_4$ B) $[Pd(H_2O)_4Cl_2]Cl_2 . 2H_2O$

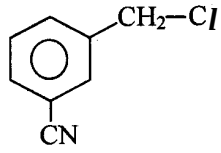
C) $[Pd(H_2O)_3Cl_3]Cl . 3H_2O$ D) $[Pd(H_2O)_2Cl_4]4H_2O$

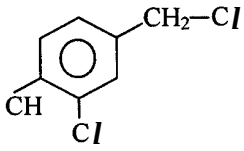
**36.** Two liquids A and B have vapour pressure in the ratio $P_A^\circ : P_B^\circ = 2 : 3$ at a certain temperature. Assume A and B form an ideal solution and the ratio of mole fractions of A to B in the vapour phase is 1 : 3, then the mole fraction of A in the solution at the same temperature is

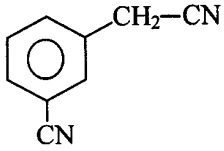
A) 1/3 B) 2/3 C) 1/4 D) 3/4

**37.** 

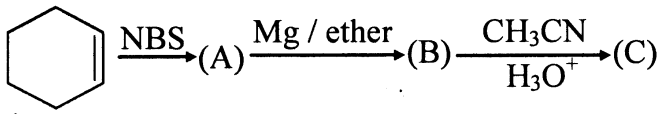

A) 

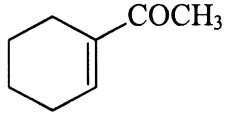

B) 

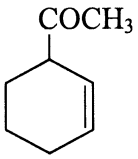

C) 

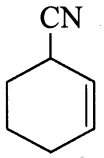

D) 

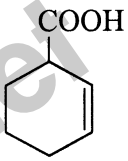

**38.** End product of the following sequence of reaction is

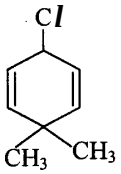



A) 

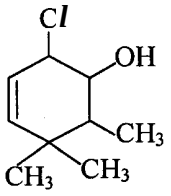

B) 

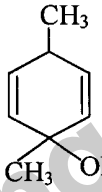

C) 

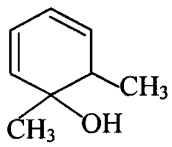

D) 

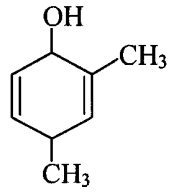

**39.** 

on treatment with aqueous KOH gives:

A) 


B) 


C) 


D) 


**40.** 2 - butene (trans) $\xrightarrow{Br_2}$ (A). Which is true statement?

A) (A) is formed by anti addition and is meso

B) (A) is formed by syn addition and is meso

C) (A) is formed by anti addition and is racemic

D) (A) is formed by syn addition and is racemic

**41.** The observed dipole moment of HC*l* molecule is 1.03 D. If H – C*l* bond distance is 1.275A° and electronic charge is $4.8 \times 10^{-10}$ e.s.u. The percentage of polarity

in HC*l* will be

A) $1.275 \times 1.03\%$ B) $\frac{4.8 \times 1.275 \times 10^{-8}}{1.03}\%$

C) $\frac{1.03 \times 100}{4.8 \times 1.275}\%$ D) $\frac{4.8 \times 10^{-10}}{1.03} \times 100\%$

**42.** The hybridization at carbons involved in $\overset{*}{C} - \overset{*}{C}$ bond is in $HC \equiv \overset{*}{C} - \overset{*}{C} H \equiv CH_2$

A) $sp^3 - sp^2$ B) $sp^3 - sp^3$ C) $sp - sp^2$ D) $sp - sp^3$

**43.** Which of the following has same bond order as $NO^+$ has?

A) $CN^-$ B) $O^{2-}$ C) $CN^+$ D) None of these

**44.** The correct order of increasing bond angles is

A) $PF_3 < PCl_3 < PBr_3 < PI_3$ B) $PI_3 < PCl_3 < PBr_3 < PF_3$

C) $PI_3 < PBr_3 < PCl_3 < PF_3$ D) $PCl_3 < PBr_3 < PI_3 < PF_3$

**45.** For a first order reaction,

A) the degree of dissociation is equal to $(1 - e^{kt})$

B) a plot of the reciprocal concentration of the reactant vs time gives a straight line.

C) the time taken for the completion of 75% reaction is twice the $t_{1/2}$ of the reaction.

D) the pre-exponential factor in the Arrhenius equation has the dimension of T.

**46.** One mole of $N_2O_4$ (g) at 300 K is kept in a closed container under one atmosphere. It is heated to 600 K when 20% by mass of $N_2O_4$ (g) decomposes to $NO_2$ (g). The resultant pressure is

A) 1.2 atm B) 2.4 atm C) 2.0 atm D) 1.0 atm

**47.** 50 m*l* of 0.1 M of $H_3CCOOH$ is titrated against 0.1 M NaOH solution. What will be the pH of the solution when 25 m*l* of NaOH is added?

[Given: $K_a$ of $H_3C - COOH = 2 \times 10^{-5}$; log 2 = 0.3 ]

A) 3.50 B) 7.00 C) 4.70 D) 5.30

**48.** When equal volumes of the following solutions are mixed, precipitation of AgC*l* ($K_{sp} = 1.8 \times 10^{-10}$) 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 $[Cl^-]$

**49.** A silver cup is plated with silver by passing 965 coulombs of electricity, the amount of silver deposited is: (Mass no. of Ag = 108)

A) 1.08 g B) 1.002 g C) 108 g D) 9.89 g

**50.** The $E^o_{cell}$ of the reaction $MnO_4^- + Fe^{2+} + H^+ \rightarrow Mn^{2+} + Fe^{3+} + H_2O$ is 0.59 V at 25°C. The equilibrium constant for the reaction is

A) 50 B) 10 C) 1050 D) 105

**51.** The ratio of $(E_2 - E_1)$ to $(E_4 - E_3)$ for the hydrogen atom is approximately equal to

A) 11 B) 12 C) 15 D) 10

**52.** The root mean square velocity of one mole of a monatomic gas having molar mass M is $U_{rms}$. The relation between average kinetic energy (E) of the gas and $U_{rms}$ is:

A) $U_{rms} = \frac{\sqrt{3E}}{2M}$ B) $U_{rms} = \frac{\sqrt{2E}}{3M}$

C) $U_{rms} = \frac{\sqrt{2E}}{M}$ D) $U_{rms} = \frac{\sqrt{E}}{3M}$

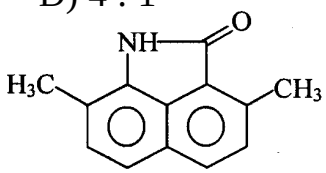
**53.** In the corrections made in the ideal gas equation for real gases, the reduction in pressure due to attractive forces is directly proportional to

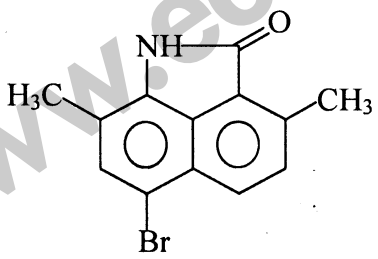
A) $\frac{n}{V}$ B) nb C) $\frac{n^2}{V^2 b}$ D) $\frac{n^2}{V^2}$

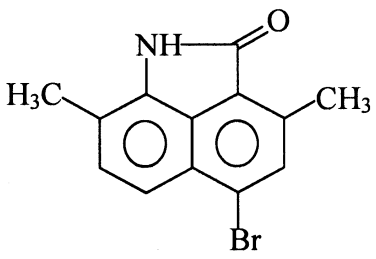
**54.** Densities of two gases, neon and argon, are in the ratio 1 : 2 and their temperatures are in the ratio 2 : 1. Then, the ratio of pressures of neon to that of argon is

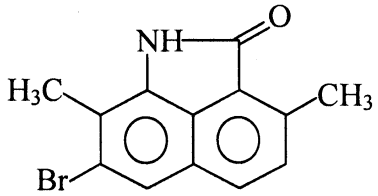
A) 1 : 1 B) 1 : 2 C) 2 : 1 D) 4 : 1

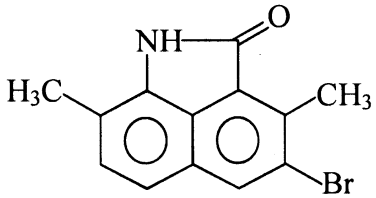
**55.** The major product obtained when $Br_2$/ Fe is treated with




A)



B)


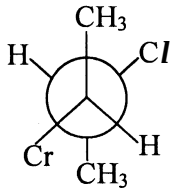

C)


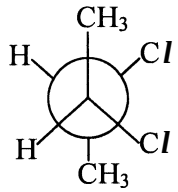

D)


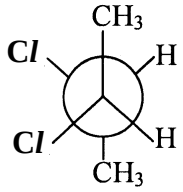
**56.** Isopentane can form foru monobromo isomeric derivatives. How many of them are optically active?

A) 1 B) 2 C) 3 D) None of these

**57.** Which of the following is a meso compound?

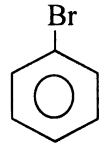
(1) 

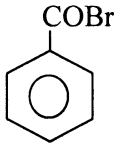

(2) 

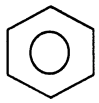

(3) 

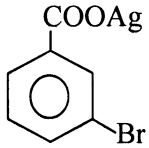

A) only (1) B) only (2) C) only (3) D) Both (2) and (3)

**58.** Silver benzoate reacts with bromine in acetone to form

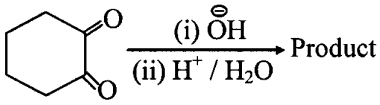
A) 

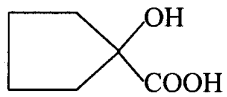

B) 

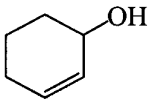

C) 

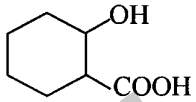
D) 

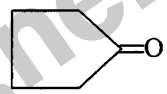

**59.** Predict the product in the following reaction:

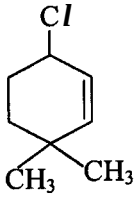



A) 

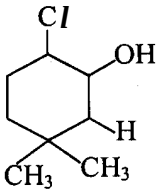

B) 

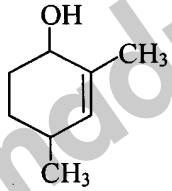

C) 

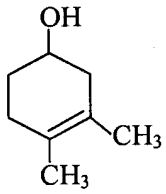

D) 

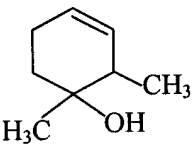

**60.** 

on treatment with aqueous KOH gives:

A) 


B) 


C) 


D) 


## Mathematics

**61.** Coefficient of $x^6$ in $((1 + x)(1 + x^2)^2(1 + x^3)^3 \ldots (1 + x^n)^n)$ is

A) 26 B) 28 C) 30 D) 35

**62.** The locus of mirror image of (4, 7) in the line $(2x + y - 5) + m(2y - 3x + 4)$; (m is varying) is

A) $x^2 - 4x - 2y + 10 = 0$ B) $x^2 + y^2 + 2x + 4y + 2xy + 3 = 0$

C) $x^2 + y^2 - 4x - 2y + 35 = 0$ D) $x^2 - y^2 - 2x - 4y = 0$

**63.** $\tan^{-1}(\sin x) \geq \sin^{-1}(\tan x)$, then range of values of x can be

A) $[0, \infty)$ B) $(-\infty, 0]$ C) $\left[0, \frac{\pi}{4}\right]$ D) $\left[-\frac{\pi}{4}, 0\right]$

**64.** From a point P outside a circle with centre at C, tangents PA and PB are drawn such that $\frac{1}{(CA)^2} + \frac{1}{(PA)^2} = \frac{1}{16}$, then the length of chord AB is

A) 8 B) 12 C) 16 D) None of these

**65.** Let $I_1 = \int_0^1 \frac{e^x}{1+x}\,dx$ and $I_2 = \int_0^1 \frac{x^2\,dx}{e^{x^3}(2-x^3)}$. Then $\frac{I_1}{I_2}$ is

A) $\frac{3}{e}$ B) $\frac{e}{3}$ C) 3e D) $\frac{1}{3e}$

**66.** If the area of the triangle on the complex plane formed by the points z, iz and z + iz is 50 square units, then $|z|$ is

A) 5 B) 10 C) 15 D) None of these

**67.** The number of triangles whose vertices are at the vertices of an octagon but none of whose sides happen to be common with the sides of the octagon is

A) 24 B) 52 C) 48 D) 16

**68.** If $\log_2 x + \log_x 2 = \frac{10}{3} = \log_2 y + \log_y 2$ and $x \neq y$, then $x + y =$

A) $\frac{8}{65}$ B) $\frac{65}{8}$ C) $\frac{37}{6}$ D) None of these

**69.** The coefficient of $x^{53}$ in the expansion of $\sum_{m=0}^{100} \left({}^{100}C_m (x-3)^{100-m} \cdot 2^m\right)$ is

A) ${}^{100}C_{47}$ B) ${}^{100}C_{53}$ C) $-{}^{100}C_{53}$ D) $-{}^{100}C_{100}$

**70.** The value of p and q ( $p \neq 0, q \neq 0$) for which p, q are the roots of the equation $x^2 + px + q = 0$ are

A) p = 1, q = 2 B) p = –1, q = 2 C) p = –1, q = –2 D) p =1, q = –2

**71.** Let positive numbers a, b, c and d be in A.P. Then abc, abd, acd, bcd are in

A) A.P. B) G.P. C) H.P. D) None of these

**72.** The period of $\sin\left[2\pi x + \frac{\pi}{3}\right] + 2\sin\left[3\pi x + \frac{\pi}{4}\right] + 3\sin 5\pi x$ is

A) 2 B) 5

C) 3 D) None of these

**73.** Range of $f(x) = \sin^{-1}\left(\sqrt{x^2 + x + 1}\right)$ is

A) $\left(0, \frac{\pi}{2}\right]$ B) $\left(0, \frac{\pi}{3}\right]$ C) $\left[\frac{\pi}{3}, \frac{\pi}{2}\right]$ D) $\left[\frac{\pi}{6}, \frac{\pi}{3}\right]$

**74.** The function, $y = \arccos\left(\frac{|x| - 3}{2}\right) + [\ln(4 - x)]^{-1}$, is defined for

A) $[-1, 0] \cup [1, 5]$ B) $[-5, -1] \cup [1, 4]$

C) $[-5, -1] \cup [1, 4] \sim \{3\}$ D) $[1, 4) \sim \{3\}$

**75.** The value of $\lim_{x \to 1} \cos^{-1}\left(\log_4 \frac{x}{4}\right)$

A) equals $-\frac{\pi}{2}$ B) $\frac{\pi}{2}$ C) 0 D) Does not exist

**76.** Let f(x) be a continuous function such that the area bounded by the curve $y = f(x)$ the X - axis, and the lines $x = 0$ and $x = a$ is $1 + \frac{a^2}{2}\sin a$. Then

A) $f\left(\frac{\pi}{2}\right) = 1 + \frac{\pi^2}{8}$ B) $f(a) = 1 + \frac{a^2}{2}\sin a$

C) $f(a) = a \sin a + \frac{1}{2} a^2 \cos a$ D) None of these

**77.** Solution of $\sec^2 y \frac{dy}{dx} + x \tan y = x^3$ is

A) $\tan y = x^2 + ce^{-x^2}$ B) $\tan y = x^2 - 2 + ce^{-x^2}$

C) $\tan y = x^2 - 2 + ce^{-x^2/2}$ D) None of these

**78.** Number of real roots of the equation $\sec\theta + \operatorname{cosec}\theta = \sqrt{15}$ lying between 0 and $\pi$ is

A) 0 B) 2 C) 4 D) 8

**79.** If $\sin A = x$, $\cos B = y$, $A + B + C = 0$, then $x^2 + 2xy \sin C + y^2$ is equal to

A) $\sin^2 C$ B) $\cos^2 C$ C) $1 + \sin^2 C$ D) $1 + \cos^2 C$

**80.** $\cos^{-1}\left[\cos\left(2\cot^{-1}\left(\sqrt{2} - 1\right)\right)\right]$ is equal to

A) $\sqrt{2} - 1$ B) $1 - \sqrt{2}$ C) $\frac{\pi}{4}$ D) $-\frac{\pi}{4}$

**81.** For $x > -1$, let $f(x) = \int_0^{\pi/4} \log_e(1 + x \tan z)dz$. Then value of $f\left(\frac{1}{2}\right) - f\left(\frac{1}{3}\right)$ equals

A) $\frac{\pi}{4}\log_e\left(\frac{9}{8}\right)$ B) $\frac{\pi}{8}\log_e\left(\frac{9}{8}\right)$ C) $\frac{\pi}{9}\log_e\left(\frac{8}{9}\right)$ D) $\frac{\pi}{8}\log_e\left(\frac{3}{2}\right)$

**82.** $\int_0^{\pi} |1 + 2\cos x|\,dx$ is equal to

A) $\frac{\pi}{2} + 2\sqrt{3}$ B) $\frac{\pi}{3} + \sqrt{3}$ C) $\frac{\pi}{3} + 2\sqrt{3}$ D) None of these

**83.** The distance between the origin and the normal to the curve $y = e^{2x} + x^2$ drawn at the point $x = 0$ is

A) $\frac{1}{\sqrt{5}}$ B) $\frac{2}{\sqrt{5}}$ C) $\frac{-1}{\sqrt{5}}$ D) $\frac{2}{\sqrt{3}}$

**84.** If $\phi(x) = f(x) + f(1 - x)$, $f''(x) < 0$ for $0 \le x \le 1$, then

A) $\phi(x)$ increasing in the $\left[0, \frac{1}{2}\right)$ B) $\phi(x)$ decreases in the $\left[0, \frac{1}{2}\right)$

C) $\phi(x)$ increasing in the $\left(\frac{1}{2}, 1\right]$ D) minima at $x = \frac{1}{2}$

**85.** The vector equation of the plane through the point $2\hat{i} - \hat{j} - 4\hat{k}$ and parallel to the plane $\vec{r}.(4\hat{i} - 12\hat{j} - 3\hat{k}) - 7 = 0$ is

A) $\vec{r}.(4\hat{i} - 12\hat{j} - 3\hat{k}) = 0$ B) $\vec{r}.(4\hat{i} - 12\hat{j} - 3\hat{k}) = 32$

C) $\vec{r}.(4\hat{i} - 12\hat{j} - 3\hat{k}) = 12$ D) None of these

**86.** If the straight line $\frac{x-3}{-4} = \frac{y-4}{-4} = \frac{z+3}{13}$ lies in the plane, $5x - y + z = a$, then a equal to

A) 2 B) –3 C) 8 D) 9

**87.** Let $\vec{a} = \hat{i} + 2\hat{j} + \hat{k}$, $\vec{b} = \hat{i} - \hat{j} + \hat{k}$, $\vec{c} = \hat{i} + \hat{j} - \hat{k}$. A vector coplanar to $\vec{a}$ and $\vec{b}$ has a projection along $\vec{c}$ of magnitude $\frac{1}{\sqrt{3}}$, then the vector is

A) $4\hat{i} - \hat{j} + 4\hat{k}$ B) $4\hat{i} + \hat{j} - 4\hat{k}$ C) $2\hat{i} + \hat{j} + \hat{k}$ D) None of these

**88.** If $\vec{a}$ and $\vec{b}$ are unit vectors such that $[\vec{a}.\vec{b}\ \ \vec{a} \times \vec{b}] = \frac{1}{4}$, then the angle between $\vec{a}$ and $\vec{b}$ is

A) $\frac{\pi}{6}$ B) $-\frac{\pi}{6}$ C) $\frac{\pi}{2}$

D) information is not sufficient to find the angle between $\vec{a}$ and $\vec{b}$

**89.** The number of identical terms in two A.P.'s 2, 5, 8, 11, .... to 60 terms and 3, 5, 7, 9, ..... to 50 terms is

A) 33 B) 17 C) 15 D) 21

**90.** If $\alpha, \beta, \gamma$ are the roots of $x^3 + ax^2 + b = 0$, then the value of $\begin{vmatrix} \alpha & \beta & \gamma \\ \beta & \gamma & \alpha \\ \gamma & \alpha & \beta \end{vmatrix}$ is

A) $-a^3$ B) $a^3 - 3b$ C) $a^3$ D) $a^2 - 3b$

# KEY

## PHYSICS

1-B; 2-C; 3-B; 4-A; 5-D; 6-A; 7-C; 8-C; 9-D; 10-C; 11-D; 12-B; 13-B; 14-C; 15-B; 16-B; 17-C; 18-C; 19-C; 20-A; 21-C; 22-C; 23-B; 24-B; 25-C; 26-C; 27-B; 28-D; 29-A; 30-A.

## CHEMISTRY

31-B; 32-B; 33-A; 34-D; 35-C; 36-A; 37-A; 38-B; 39-C; 40-A; 41-C; 42-C; 43-A; 44-A; 45-C; 46-B; 47-C; 48-A; 49-A; 50-C; 51-C; 52-B; 53-D; 54-B; 55-A; 56-B; 57-A; 58-A; 59-A; 60-D.

## MATHEMATICS

61-B; 62-C; 63-D; 64-A; 65-C; 66-B; 67-D; 68-D; 69-C; 70-D; 71-C; 72-A; 73-C; 74-C; 75-D; 76-C; 77-C; 78-C; 79-B; 80-D; 81-B; 82-C; 83-B; 84-A; 85-B; 86-C; 87-A; 88-A; 89-B; 90-C.

(ఈ నమూనా ప్రశ్నపత్రాన్ని హైదరాబాద్‌లోని కృష్ణమూర్తి ఐఐటీ అకాడమీ నిపుణుల బృందం రూపొందించింది.)