# SAMPLE PAPER - 10

## Physics

### Section A

**Q. 1.** If energy E, velocity (V) and time (T) are chosen as the fundamental quantities, then the dimensions of surface tension will be :

**(1)** $[EV^{-2}T^{-1}]$ **(2)** $[EV^{-1}T^{-2}]$

**(3)** $[EV^{-2}T^{-2}]$ **(4)** $[E^{-2}V^{-1}T^{-3}]$

**Q. 2.** A vector $\vec{P}_1$ is along the positive $x$-axis. If its vector product with another vector $\vec{P}_2$ is zero, then $\vec{P}_2$ could be :

**(1)** $4\hat{j}$ **(2)** $-4\hat{i}$

**(3)** $(\hat{j}+\hat{k})$ **(4)** $-(\hat{i}+\hat{j})$

**Q. 3.** The trajectory of a projectile in a vertical plane is $y = ax - bx^2$, where $a$ and $b$ are constants and $x$ and $y$ are respectively horizontal and vertical distances of the projectile from the point of projection. The maximum height attained by the particle and the angle of projection from the horizontal are:

**(1)** $\frac{b^2}{2a}, \tan^{-1}(b)$ **(2)** $\frac{a^2}{b}, \tan^{-1}(2a)$

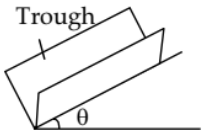
**(3)** $\frac{a^2}{4b}, \tan^{-1}(a)$ **(4)** $\frac{2a^2}{b}, \tan^{-1}(a)$

**Q. 4.** A block of mass M is pulled along a horizontal frictionless surface by a rope of mass $m$. If a force P is applied at the free end of the rope, the force exerted by the rope on the block is :

**(1)** $\frac{Pm}{M+m}$ **(2)** $\frac{Pm}{M-m}$

**(3)** P **(4)** $\frac{PM}{M+m}$

**Q. 5.** A block of mass $m$ slides down an inclined right angled trough as shown in the figure. If the coefficients of kinetic friction between block and material composing the trough is $\mu_k$, find the acceleration of the block :




**(1)** $g(\sin\theta - \sqrt{2}\mu_k \cos\theta)$

**(2)** $g(\sin\theta - \mu_k \cos\theta)$

**(3)** $g(\sin\theta - 2\mu_k \cos\theta)$

**(4)** $g(\sin\theta - \sqrt{\mu}_k \cos\theta)$

**Q. 6.** An insulating solid sphere of radius 'R' is charged in a non-uniform manner such that volume charge density $\rho = \frac{A}{r}$, where A is a positive constant and $r$ is the distance from centre. Electric field strength at any inside point at distance $r_1$ is :

**(1)** $\frac{1}{4\pi\varepsilon_0}\frac{4\pi A}{r_1}$ **(2)** $\frac{1}{4\pi\varepsilon_0}\frac{A}{r_1}$

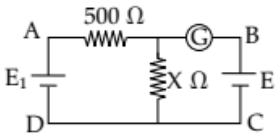
**(3)** $\frac{A}{\pi\varepsilon_0}$ **(4)** $\frac{A}{2\varepsilon_0}$

**Q. 7.** Two metallic charged spheres whose radii are 20 cm and 10 cm, respectively, each having 150 μC positive charge. The common potential after they are connected by a conducting wire is :

**(1)** $9 \times 10^6$ V **(2)** $4.5 \times 10^6$ V

**(3)** $1.8 \times 10^7$ V **(4)** $13.6 \times 10^6$ V

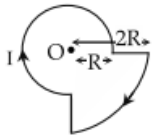
**Q. 8.** In an experiment according to set up, $E_1$ = 12 volt having zero internal resistance and E = 2 volt. The galvanometer reads zero, then X (in ohm) would be :




**(1)** 200 **(2)** 500

**(3)** 100 **(4)** 10

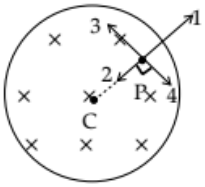
**Q. 9.** A current I flowing through the loop as shown in the adjoining figure. The magnetic field at centre O is :




**(1)** $\frac{7\mu_0 I}{16R}\otimes$ **(2)** $\frac{7\mu_0 I}{16R}\odot$

**(3)** $\frac{5\mu_0 I}{16R}\otimes$ **(4)** $\frac{5\mu_0 I}{16R}\odot$

**Q. 10.** A uniform but time varying magnetic field exists in cylindrical region and directed into the paper. If field decrease with time and a positive charge placed at any point inside the region. Then it moves :




**(1)** along 1 **(2)** along 2

**(3)** along 3 **(4)** along 4

**Q. 11.** A copper disc of radius 0.1 m is rotated about its centre with 20 revolution per second in a uniform magnetic field of 0.1 T with its plane perpendicular to the field. The emf induced across the radius of the disc is :

**(1)** $\frac{\pi}{20}$ volt **(2)** $\frac{\pi}{10}$ volt

**(3)** 20 π milli volt **(4)** 100 π milli volt

**Q. 12.** A bulb is rated at 100 V, 100 W, it can be treated as a resistor. Find out the inductance of an inductor (called choke coil) that should be connected in series with the bulb to operate the bulb at its rated power with the help of an ac source of 200 V and 50 Hz.

**(1)** $\frac{\pi}{\sqrt{3}}$ H **(2)** 100 H

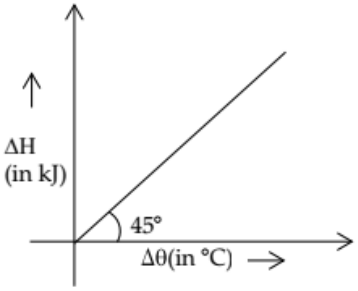
**(3)** $\frac{\sqrt{2}}{\pi}$ H **(4)** $\frac{\sqrt{3}}{\pi}$ H

**Q. 13.** Consider a solid cube of uniform charge density of insulating material. What is the ratio of the electrostatic potential at a corner to that at the centre: (Take the potential to be zero at infinity, as usual)

**(1)** $\frac{1}{1}$ **(2)** $\frac{1}{2}$

**(3)** $\frac{1}{4}$ **(4)** $\frac{1}{9}$

**Q. 14.** A solid of mass 2 kg is heated and ΔH (Heat given) vs Δθ (change in temperature) is plotted. Specific heat of solid is :




**(1)** 1 J/kg/°C **(2)** 0.5 J/kg/°C

**(3)** 2 kJ/kg/°C **(4)** 0.5 kJ/kg/°C

**Q. 15.** A parallel plate capacitor of plate area A and separation d is provided with thin insulating spacers to keep its plates aligned in an environment of fluctuating temperature. If the coefficient of thermal expansion of material of plate is α then the coefficient of thermal expansion ($\alpha_S$) of the spacers in order that the capacitance does not vary with temperature (ignore effect of spacers on capacitance)

**(1)** $\alpha_S = \frac{\alpha}{2}$ **(2)** $\alpha_S = 3\alpha$

**(3)** $\alpha_S = 2\alpha$ **(4)** $\alpha_S = \alpha$

**Q. 16.** A wire is 4 m long and has a mass 0.2 kg. The wire is kept horizontally. A transverse pulse is generated by plucking one end of the taut (tight) wire. The pulse makes four trips back and forth along the cord in 0.8 sec. The tension is the cord will be : (Assume uniform tension throughout the wire)

**(1)** 80 N **(2)** 160 N

**(3)** 240 N **(4)** 320 N

**Q. 17.** Consider a plane standing sound wave of frequency $10^3$ Hz in air at 300 K. Suppose the amplitude of pressure variation associated with this wave is 1 dyne/cm$^2$. The equilibrium pressure is $10^6$ dyne/cm$^2$. The amplitude of displacement of air molecules associated with this wave is :

(Given speed of sound : 340 m/s

Molar mass of air : $29 \times 10^{-3}$ kg/mol)

**(1)** $4 \times 10^{-6}$ m **(2)** $40 \times 10^{-6}$ m

**(3)** $400 \times 10^{-6}$ m **(4)** $40000 \times 10^{-6}$ m

**Q. 18.** In RLC circuit, at a frequency v, the potential different across each device are $(\Delta V_R)_{max}$ = 8.8 V, $(\Delta V_L)_{max}$ = 2.6 V and $(\Delta V_C)_{max}$ = 7.4 V. The combined potential difference $(\Delta V_L + \Delta V_C)_{max}$ across the inductor and capacitor is :

**(1)** 10 V **(2)** 7.8 V

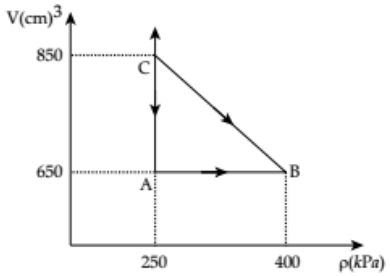
**(3)** 7.4 V **(4)** 4.8 V

**Q. 19.** A body is heated to temperature 40° and kept in a chamber maintained at 20°. If temperature decreases to 36° in 2 minutes. Time after it will further decrease by 4° is :

**(1)** 2 min **(2)** 2 min 33 sec

**(3)** 2 min 55 sec **(4)** 3 min

**Q. 20.** A gas is taken through a cyclic process ABCA as shown in figure. If 3.6 calories of heat is given in the process, one calorie is equivalent to :




**(1)** 4.20 J **(2)** 4.19 J

**(3)** 4.18 J **(4)** 4.17 J

## Section B

**Q. 21.** A block of mass $m$ = 1 kg moving on horizontal surface with speed $u$ = 2 m/s enters a rough horizontal patch ranging from $x$ = 0.10 $m$ to $x$ = 2.00 m. If the retarding force $f_r$ on the block in this range is inversely proportional to $x$ over this range i.e.

$f_r = \frac{-k}{x}$, $0.10 < x < 2.00$

$= 0$ for $x < 0.10$ and $x > 2.00$

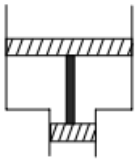
If $k$ = 0.5 J then the speed of this block as it crosses the patch is ..... m/s. (use $\ell n\ 20 = 3$)

**Q. 22.** A sphere of mass $m$ = 0.5 kg carrying positive charge $q$ = 110 μC is connected with a light, flexible and inextensible spring of length $r$ = 60 cm and whirled in a vertical circle. If a vertically upwards electric field of strength E = $10^5$ N/C exists in the space then the minimum velocity of sphere ..... m/s required at highest point so that it may just complete the circle is (g = 10 m/s$^2$)

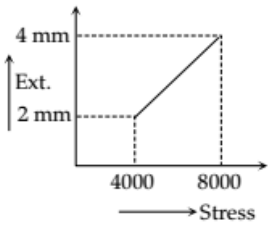
**Q. 23.** The electric potential difference between two points is 50kV. If a charge of 20C, having a mass of 200 kg, is placed at the high-potential end, then find the final speed of the charge as it reaches the low- potential end in m s$^{-1}$ is.....

**Q. 24.** A uniform ball of radius R = 10 cm rolls without slipping between two rails such that the horizontal distance is $d$ = 16 cm between two contact points of the rail to the ball. If the angular velocity is 5 rad/s, then the velocity of centre of mass of the ball is ..... cm/s.

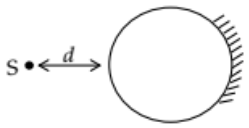
**Q. 25.** A smooth vertical conducting tube have two different section is open from both ends and equipped with two piston of different areas. Each piston slides in respective tube section. 1 liter of ideal gas at pressure $1.5 \times 10^5$ Pa is enclosed between the piston connected with a light rod. The cross section area of upper piston is $10\pi$ cm$^2$ greater than lower one. Combined mass of two piston is 1.5 kg. If the piston is displaced slightly. Time period of oscillation will be ..... $\times 10^{-1}$ s.



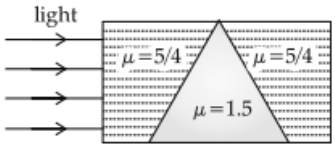
**Q. 26.** In determination of young modulus of elasticity of wire, a force is applied and extension is recorded. Initial length of wire is '1 m'. The curve between extension and stress is depicted then young modulus of wire will be $K \times 10^9$ N/m$^2$, where K is ..... $\times 10^9$ N/m$^2$.




**Q. 27.** A very expensive diamond is polished into a perfect sphere of radius 5 cm. The back surface of the sphere is then covered with silver. If $d$ is the distance of source of light from surface of sphere so that image coincide with the source. The index of refraction of diamond is 2.4, then $d$ = ..... cm.




**Q. 28.** A thin isosceles prism with angle 4° and refractive index 1.5 is placed inside a transparent tube with water (refractive index = $\frac{5}{4}$) as shown. The deviation of light whether upward or downward due to prism will be in degree is .....




**Q. 29.** Consider the interference at P between waves emanating from three coherent sources in same phase located at $S_1$, $S_2$ and $S_3$. If intensity due to each source is $I_0$ = 12 W/m$^2$ at P and $\frac{d^2}{2D} = \frac{\lambda}{3}$ then resultant intensity at P will be ..... W/m$^2$.

**Q. 30.** When the voltage applied to an X-ray tube is increased from 10 kV to 20 kV, the wavelength interval between the $k_\alpha$ line the short wave cut off the continuous X-Ray spectrum increases by a factor of 3. The atomic number of element for which the tube anticathode is made, is ..... (Rydberg's constant $10^7$ m$^{-1}$).

# Chemistry

## Section A

**Q. 31.** Polarisation may be called as the distortion of the shape of an anion by an adjacently placed cation. Which of the following statements is/are correct ?

**(1)** Lesser polarization is brought about by a cation of low radius

**(2)** A large cation is likely to bring about a large degree of polarization

**(3)** Larger polarisation is brought about by a cation of high charge

**(4)** A small anion is likely to undergo a large degree of polarisation

**Q. 32.** Lanthanide contraction is related with :

**(1)** Sharp decrease in atomic size in lanthanide series

**(2)** Slow or gradual decrease in atomic size in lanthanide series

**(3)** Constancy in atomic size

**(4)** All of the above

**Q. 33.** The compound which has one isopropyl group is :

**(1)** 2, 2, 3, 3-tetramethyl pentane

**(2)** 2, 2-dimethyl pentane

**(3)** 2, 2, 3-trimethyl pentane

**(4)** 2-methyl pentane

**Q. 34.** $CH_3$–$CH_2$–$CH_2$–$CH_3$. There is free rotation about ($C_2$ σ $C_3$) bond. The same most stable form is repeated after rotation of :

**(1)** 60° **(2)** 120°

**(3)** 240° **(4)** 360°

**Q. 35.** The reaction $H_2S + H_2O_2 \rightarrow S + 2H_2O$ manifests :

**(1)** Acidic nature of $H_2O_2$

**(2)** Alkaline nature of $H_2O_2$

**(3)** Oxidising action of $H_2O_2$

**(4)** Reducing nature of $H_2O_2$

**Q. 36.** Alumina is insoluble in water because ..... .

**(1)** It is a covalent compound

**(2)** It has high lattice energy and low heat of hydration

**(3)** It has low lattice energy and high heat of hydration

**(4)** $Al^{3+}$ and $O^{2-}$ ions are not excessively hydrated.

**Q. 37.** The soldiers of Napolean army while at Alps during freezing winter suffered a serious problem as regards to the tin buttons of their uniforms. White metallic tin buttons get converted to grey powder. This transformation is related to

**(1)** An interaction with water vapour contained in humid air

**(2)** A change in crystalline structure of tin

**(3)** A change in the partial pressure of $O_2$ in air

**(4)** An interaction with $N_2$ of air at low temperature

**Q. 38.** The metal X is prepared by the electrolysis of fused chloride. It reacts with hydrogen to form colourless solid from which hydrogen is released on treatment with water. The metal is :

**(1)** Al **(2)** Ca

**(3)** Cu **(4)** Zn

**Q. 39.** HCHO with conc. alkali forms two compounds. The change in oxidation number would be :

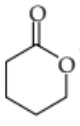
**(1)** (0 to –2) in both the compounds

**(2)** (0 to +2) in both the compounds

**(3)** (0 to +2) in one compound and (0 to –2) in the second compound

**(4)** All are correct

**Q. 40.** $OHC–CH_2–CH_2–CH_2–CH_2–OH$

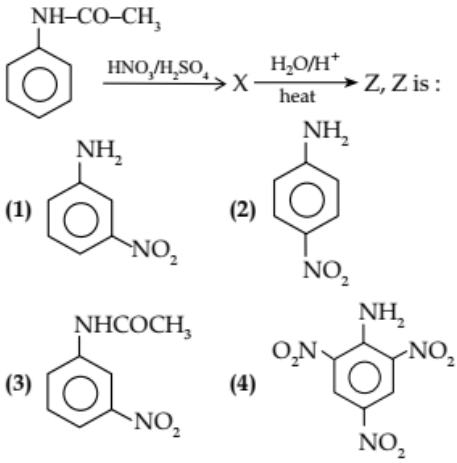
is converted into  by :

**(1)** (i) $KMnO_4$ (ii) $H^+$, $\Delta H$

**(2)** (i) $Na_2Cr_2O_7$ (ii) $H^+$, $\Delta$

**(3)** (i) $Ag_2O$ (ii) $H^+$, $\Delta$

**(4)** All of these

**Q. 41.** 


**(1)** 


**(2)** 


**(3)** 


**(4)** 


**Q. 42.** Glycoside linkage is :

**(1)** an amide linkage **(2)** an ether linkage

**(3)** an ester linkage **(4)** none of these

**Q. 43.** Dumas method involves the determination of nitrogen content in the organic compound in form of

**(1)** $NH_3$ **(2)** $N_2$

**(3)** NaCN **(4)** $(NH_4)_2SO_4$

**Q. 44.** In which of the following molecules, the substituent does not exert its resonance effect?

**(1)** $C_6H_5NH_2$ **(2)** $C_6H_5\overset{\oplus}{N}H_3$

**(3)** $C_6H_5OH$ **(4)** $C_6H_5Cl$

**Q. 45.** The reduction of oct-4-yne with $H_2$ in the presence of $Pd/CaCO_3$ – quinoline gives (as a major product) –(Hydrocarbon)

**(1)** trans-oct-4-ene

**(2)** cis-oct-4-ene

**(3)** a mixture of cis and trans-oct-4-ene

**(4)** a completely reduced product $C_8H_{18}$

**Q. 46.** The species responsible for nitration and sulphonation by nitric acid conc. $H_2SO_4$ and fuming $H_2SO_4$ are :

**(1)** $NO_2$ and $SO_3$

**(2)** $\overset{\oplus}{N}O_2$ and $SO_3$

**(3)** $\overset{\oplus}{N}O$ and $SO_2$

**(4)** $NO_2$ and $SO_2$

**Q. 47.** Ester A ($C_4H_8O_2$) + $CH_3MgBr$ (2 parts) $\xrightarrow{H_3O^+}$ $C_4H_{10}O$ (alcohol) (B)

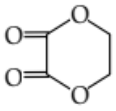
Alcohol B reacts slowly with sodium metal. Hence A and B are

**(1)** $CH_3-\overset{\overset{O}{\|}}{C}-O-C_2H_5$, $(CH_3)_3COH$

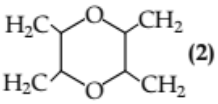
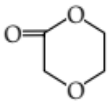
**(2)** $H-\overset{\overset{O}{\|}}{C}-O-C_3H_7$, $(CH_3)_2CHOH$

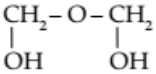
**(3)** $CH_3-\overset{\overset{O}{\|}}{C}-O-C_2H_5$, $(CH_3)_2CHOH$

**(4)** $H-\overset{\overset{O}{\|}}{C}-O-C_3H_7$, $(CH_3)_3COH$

**Q. 48.** Oxalic acid + A → 

hence A $\xrightarrow{\text{conc. } H_2SO_4}$ B, B is :

**(1)**  **(2)** 

**(3)**  **(4)** None of these

**Q. 49.** pH of $10^{-7}$ M HCl solution is :

**(1)** 7 – log2 **(2)** 7 – log 1.618

**(3)** 7 **(4)** 6.95

**Q. 50.** A gas at a pressure of 5.0 atm is heated from 0° to 546 °C and simultaneously compressed to one-third of its original volume. Hence final pressure is :

**(1)** 10.0 atm **(2)** 30.0 atm

**(3)** 45.0 atm **(4)** 5.0 atm

## Section B

**Q. 51.** In an ore the only oxidizable material is $Sn^{2+}$. This ore is titrated with a dichromate solution containing 2.5 g of $K_2Cr_2O_7$ in 0.50 litre. A 0.40 g sample of the ore required 10.0 $cm^3$ of titrant to reach equivalence point. The percentage of tin in ore is ..... .
(K = 39.1, Cr = 52, Sn = 118.7)

**Q. 52.** 28.0 g of $N_2$ gas at 350 K and 25 atm was allowed to expand isothermally against a constant external pressure of 1 atm. The value of '*q*' for the gas is ..... J.

**Q. 53.** In the preparation of quick lime from lime stone, the reaction is:

$CaCO_3(s) \rightleftharpoons CaO(s) + CO_2(g)$

Experiments carried out between 850°C and 950°C led to set of $K_p$ values fitting an empirical equation

$\log K_p = 7.282 - \frac{8500}{T}$

where T is absolute temp. If the reaction is carried out in quite air, the temperature predicted from this equation for complete decomposition of the lime stone would be ..... K.

**Q. 54.** Two particles A and B are in motion. If the wavelength associated with the particle A is $5 \times 10^{-8}$ m, if its momentum is half of A. Then the wavelength of particle B is ..... $\times 10^{-8}$ m.

**Q. 55.** At room temperature (20°C) orange juice gets spoilt in about 64 hours. In a refrigerator at 3°C juice can be stored three times as long before it gets spoling. The time taken by juice to get spoilt at 40°C is ..... hours.

**Q. 56.** The voltage of the cell :

$Pb|PbSO_4|Na_2SO_4.10H_2O(salt)|Hg_2SO_4|Hg$

is + 0.9647 at 25°C. The temperature coefficient is $1.74 \times 10^{-4}$ V. $K^{-1}$.

The values of $\Delta S$ is ..... $ak^{-1}$ $mol^{-1}$.

**Q. 57.** An element crystallizes in a structure having FCC unit cell of an edge 200 pm. The density, if 200 g of this element contains $24 \times 10^{23}$ atoms is ..... g $cm^3$.

**Q. 58.** 1.5 g of a monobasic acid when dissolved in 150 g of water lowers the freezing point by 0.165°C. 0.5 g of the same acid when titrated, after dissolution in water, requires 37.5 ml of N/10 alkali. The degree of dissociation of the acid is ..... %. ($K_f$ for water = 1.86°C $mol^{-1}$).

**Q. 59.** In order to coagulate 400 ml of $Fe(OH)_3$ sol completely 60 ml of 0.1M KCl is required. The coagulation power of KCl will be ..... .

**Q. 60.** The standard molar enthalpies of formation of $IF_3$ (g) and $IF_5$ (g) are –470 kJ and –847 kJ, respectively. Valence shell electron pair repulsion theory predicts that $IF_5$ (g) is square pyramidal in shape in which all I–F bonds are equivalent while $IF_3$ (g) is T-shaped (based on trigonalbipyramidal geometry) in which I–F bonds are of different lengths. It is observed that the axial I–F bonds in $IF_3$ are equivalent to the I–F bonds in $IF_5$. The equatorial I–F bond strength in $IF_3$ is ..... kJ/mol. Some other informations given are :

$I_2(s) \rightarrow I_2(g)$ ; $\Delta H = 62$ kJ

$F_2(g) \rightarrow 2F(g)$; $\Delta H = 155$ kJ

$I_2(g) \rightarrow 2I(g)$ ; $\Delta H = 149$ kJ

## Mathematics

### Section A

**Q. 61.** **(1)**

Let $z \in C$ be such that $|z| < 1$. If $\omega = \frac{5+3z}{5(1-z)}$, then:

**(1)** $5\,\mathrm{Re}(\omega) > 4$ **(2)** $4\,\mathrm{Im}(\omega) > 5$

**(3)** $5\,\mathrm{Re}(\omega) > 1$ **(4)** $5\,\mathrm{Im}(\omega) < 1$

**Q. 62.** **(3)** The logical statement $(p \Rightarrow q) \wedge (q \Rightarrow \sim p)$ is equivalent to:

**(1)** $p$ **(2)** $q$

**(3)** $\sim p$ **(4)** $\sim q$

**Q. 63.** The inequality $\log_4(2x^2 + x + 1) - \log_2(2x - 1) \leq -\tan\frac{7\pi}{4}$ satisfies for all

**(1)** $x \geq -1$ **(2)** $x \geq 1$

**(3)** $x \leq -1$ **(4)** $x \geq 0$

**Q. 64.** If the roots of the equation $ax^2 + x + b = 0$ be real and different, then the roots of the equation $x^2 - 4\sqrt{ab}\,x + 1 = 0$ will be :

**(1)** rational **(2)** irrational

**(3)** real **(4)** imaginary

**Q. 65.** If $a$, $b$, $c$ be the first, third and $n^{th}$ terms respectively of an A.P., then sum to $n$ terms is :

**(1)** $\frac{c+a}{2} + \frac{c^2-a^2}{b-a}$ **(2)** $\frac{c+a}{2} - \frac{c^2-a^2}{b-a}$

**(3)** $\frac{c+a}{2} + \frac{c^2+a^2}{b-a}$ **(4)** $\frac{c+a}{2} + \frac{c^2+a^2}{b+a}$

**Q. 66.** The coefficient of $x^m$ in $(1+x)^k + (1+x)^{k+1} + \ldots\ldots + (1+x)^n$, $(k \leq m \leq n)$, is given by

**(1)** ${}^{n+1}C_m$ **(2)** ${}^nC_m$

**(3)** ${}^{n-1}C_{m-1}$ **(4)** ${}^{n+1}C_{m+1}$

**Q. 67.** How many numbers of four digits greater than 2300 can be formed with the digits 0, 1, 2, 3, 4, 5 and 6; no digit being repeated in any number ?

**(1)** 560 **(2)** 590

**(3)** 90 **(4)** 360

**Q. 68.** The area of the pentagon whose vertices are (4, 1), (3, 6), (–5, 1), (–3, –3) and (–3, 0) is :

**(1)** 30 unit$^2$ **(2)** 60 unit$^2$

**(3)** 120 unit$^2$ **(4)** 150 unit$^2$

**Q. 69.** The equation to the circle which passes through the points (1, –2) and (4, –3) and which has its centre on the straight line $3x + 4y = 7$ is :

**(1)** $15x^2 + 15y^2 + 94x + 18y + 55 = 0$

**(2)** $15x^2 + 15y^2 - 94x - 18y + 55 = 0$

**(3)** $15x^2 + 15y^2 - 94x + 18y + 55 = 0$

**(4)** $15x^2 + 15y^2 + 94x - 18y - 55 = 0$

**Q. 70.** The vertex, focus, directrix and length of the latus rectum of the parabola $y^2 - 4y - 2x - 8 = 0$ are respectively equals to

**(1)** A(6, 2), S $\left(-\frac{11}{2}, 2\right)$

Eq. of directrix $x = -\frac{13}{2}$, L. of L.R. = 2

**(2)** A(–6, 2), S $\left(\frac{11}{2}, 2\right)$

Eq. of directrix $x = -\frac{13}{2}$, L. of L.R. = 3

**(3)** A(–6, 2), S $\left(-\frac{11}{2}, 2\right)$

Eq. of directrix $x = -\frac{13}{2}$, L. of L.R. = 2

**(4)** A(–6, 2), S $\left(-\frac{11}{2}, 2\right)$

Eq. of directrix $x = \frac{13}{2}$ and L.L.R. = 2

**Q. 71.** The equation $\frac{x}{a}\cos\theta - \frac{y}{b}\sin\theta = 1$ will touch ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$ at point P whose eccentric angle is :

**(1)** $\theta$ **(2)** $(\pi - \theta)$

**(3)** $(\pi + \theta)$ **(4)** $2\pi - \theta$

**Q. 72.** The equation of the hyperbola whose conjugate axis is 5 and the distance between the foci is 13 is :

**(1)** $9x^2 - 144y^2 = 900$

**(2)** $25x^2 - 144y^2 = 900$

**(3)** $25x^2 - 144y^2 = 200$

**(4)** $25x^2 - 36y^2 = 900$

**Q. 73.** Which of the following function from $A = \{x : -1 \le x \le 1\}$ to itself is bijection :

**(1)** $f(x) = \frac{x}{2}$ **(2)** $g(x) = \sin\left(\frac{\pi x}{2}\right)$

**(3)** $h(x) = |x|$ **(4)** $k(x) = x^2$

**Q. 74.** Let $f(a) = g(a) = k$ and their $n^{th}$ derivatives exist and are not equal for some $n$. Further if $\lim_{x\to a} \frac{f(a)g(x) - f(a) - g(a)f(x) + g(a)}{g(x) - f(x)} = 4$ then $k$ is equal to :

**(1)** 0 **(2)** 4

**(3)** 2 **(4)** 1

**Q. 75.** If $f(x) = \begin{cases} 1 & \text{if } x \text{ is rational} \\ -1 & \text{if } x \text{ is irrational} \end{cases}$ is continuous

**(1)** $\forall x \in R$

**(2)** for no real values of $x$

**(3)** $\forall x \in (-1, 1)$

**(4)** $\forall x \in (-1, 0, 1)$

**Q. 76.** Differentiation of $\log_e x$ w. r. t. $\log_{1/5} x$ is :

**(1)** $\log_e \frac{1}{5}$ **(2)** $-\log_e \frac{1}{5}$

**(3)** $\log_{1/5} e$ **(4)** $\log 5^e$

**Q. 77.** All the points on the curve $y = \sqrt{x + \sin x}$ at which the tangents are parallel to $x$ axis lie on

**(1)** straight line **(2)** circle

**(3)** parabola **(4)** ellipse

**Q. 78.** In a submarine telegraph cable the speed of signaling varies as $x^2 \log\left(\frac{1}{x}\right)$ where $x$ is the ratio of the radius of the cable to that of covering. Then the greatest speed is attained when this ratio is :

**(1)** $1 : \sqrt{e}$ **(2)** $\sqrt{e} : 1$

**(3)** $e : 1$ **(4)** $1 : e$

**Q. 79.** Let the complex numbers $z_1$, $z_2$, $z_3$ represent vertices of an equilateral triangle. If $z_0$ be the circumcentre of the triangle then $z_1^2 + z_2^2 + z_3^2 =$

**(1)** $z_0^2$ **(2)** $2z_0^2$

**(3)** $3z_0^2$ **(4)** $9z_0^2$

**Q. 80.** The projections of a line segment on $x$, $y$ and $z$ axes are respectively 3, 4 and 5, then the length and direction cosines of the line segment are respectively equal to :

**(1)** $5\sqrt{2}$ ; $\frac{3}{5\sqrt{2}}, \frac{4}{5\sqrt{2}}, \frac{1}{\sqrt{2}}$

**(2)** $3\sqrt{2}$ ; $\frac{3}{3\sqrt{2}}, \frac{4}{5\sqrt{2}}, \frac{1}{\sqrt{2}}$

**(3)** $5\sqrt{2}$ ; $\frac{3}{5\sqrt{2}}, \frac{4}{3\sqrt{2}}, \frac{1}{\sqrt{2}}$

**(4)** $3\sqrt{2}$ ; $\frac{3}{5\sqrt{2}}, \frac{4}{5\sqrt{2}}, -\frac{1}{\sqrt{2}}$

## Section B

**Q. 81.** If the value of expression $\sin 5° . \sin 55° \sin 115°$ can be expressed as $\frac{\sqrt{a} - b}{\sqrt{c}}$, then $\frac{c + 4b}{11a}$ is equal to ..... (where $a$, $b$, $c$ are mutually coprime)

**Q. 82.** If the solution set of inequality $\left(\cos x + \frac{\sqrt{3}}{2}\right)\left(\cos x - \frac{1}{2}\right) \le 0$ in $[0, 2\pi]$ is,

$\left[\frac{\alpha\pi}{6},\frac{\beta\pi}{6}\right]\cup\left[\frac{\gamma\pi}{6},\frac{\delta\pi}{6}\right]$ where $\alpha, \beta, \gamma, \delta \in I^+$, then the value of $|\beta - \alpha + \delta - \gamma|$ is ..... .

**Q. 83.** If $x$ and $y$ are positive integers satisfying, $\tan^{-1}\left(\frac{1}{x}\right)+\tan^{-1}\left(\frac{1}{y}\right)=\tan^{-1}\left(\frac{1}{7}\right)$ then the number of ordered pairs of $(x, y)$ is :

**Q. 84.** In a tournament, four players are participating. Each player plays with every other player. Each player has 50% chance of winning any game and there are no ties. If the probability that at the end of tournament there is neither a winless nor an undefeated player is there is $\frac{a}{b}$, where a and $b$ are relatively prime integers then $|2a - b|$ is equal to ..... .

**Q. 85.** If $\Delta=\begin{vmatrix} 1 & 3\cos\theta & 1 \\ \sin\theta & 1 & 3\cos\theta \\ 1 & \sin\theta & 1 \end{vmatrix}$, then value of $\frac{\Delta_{max}}{2}$ is .....

**Q. 86.** Let $A=\begin{bmatrix} 6 & 4 \\ -9 & -6 \end{bmatrix}, B=\begin{bmatrix} 2 & 3 \\ 3 & 4 \end{bmatrix}$ and $C = A + A^2B + A^3B^2 + ..... A^{100}B^{99}$. If sum of elements of matrix CB is $\lambda$ then $36 + \lambda$ is ..... .

**Q. 87.** If primitive of $\frac{2\cos x}{e^{x+1}+\sin x-\cos x}$ is $\phi(x)$ and $\phi(0)=\ell n(e^2-e)$, then $\phi\left(\frac{\pi}{4}\right)$ is equal to ..... .

**Q. 88.** $\int_{-4}^{0}(|x+1|+[x+3])dx$ (where [.] denotes greatest integer function) is equal to

**Q. 89.** The shortest distance between the curve $y = x^4 + 3x^2 + 2x$ and the straight line $y = 2x - 1$ is expressed as $\frac{1}{\sqrt{p}}$, then $p$ is

**Q. 90.** Curve satisfying differential equation $x(y^2 + x)dx + x^2ydy = 0$ passes through $\left(\sqrt[3]{3}, 0\right)$, then value of $\left[y^2(-2)\right]$ is ..... , where [.] denotes greatest integer function.

# Answers

## Physics

| Q. No. | Answer |
|---|---|
| 1 | (3) |
| 2 | (2) |
| 3 | (3) |
| 4 | (4) |
| 5 | (1) |
| 6 | (4) |
| 7 | (1) |
| 8 | (3) |
| 9 | (1) |
| 10 | (3) |
| 11 | (3) |
| 12 | (4) |
| 13 | (2) |
| 14 | (4) |
| 15 | (3) |

| Q. No. | Answer |
|---|---|
| 16 | (1) |
| 17 | (3) |
| 18 | (4) |
| 19 | (2) |
| 20 | (4) |
| 21 | 1.00 |
| 22 | 6.00 |
| 23 | 100.00 |
| 24 | 30.00 |
| 25 | 5.0 |
| 26 | 2.00 |
| 27 | 25.00 |
| 28 | 0.80 |
| 29 | 36.00 |
| 30 | 30.00 |

## Chemistry

| Q. No. | Answer |
|---|---|
| 31 | (3) |
| 32 | (2) |
| 33 | (4) |
| 34 | (4) |
| 35 | (3) |
| 36 | (1) |
| 37 | (2) |
| 38 | (2) |
| 39 | (3) |
| 40 | (3) |
| 41 | (2) |
| 42 | (2) |
| 43 | (2) |
| 44 | (2) |
| 45 | (2) |

| Q. No. | Answer |
|---|---|
| 46 | (2) |
| 47 | (1) |
| 48 | (1) |
| 49 | (1) |
| 50 | (3) |
| 51 | 15.13 |
| 52 | 2795 |
| 53 | 1667.26 |
| 54 | 10.00 |
| 55 | 6.40 |
| 56 | 8.02 |
| 57 | 41.60 |
| 58 | 18.28 |
| 59 | 2.00 |
| 60 | 272 |

## Mathematics

| Q. No. | Answer |
|---|---|
| 61 | (3) |
| 62 | (3) |
| 63 | (2) |
| 64 | (4) |
| 65 | (1) |
| 66 | (4) |
| 67 | (1) |
| 68 | (1) |
| 69 | (3) |
| 70 | (3) |
| 71 | (4) |
| 72 | (2) |
| 73 | (2) |
| 74 | (2) |
| 75 | (2) |

| Q. No. | Answer |
|---|---|
| 76 | (1) |
| 77 | (3) |
| 78 | (1) |
| 79 | (3) |
| 80 | (1) |
| 81 | 4.00 |
| 82 | 6.00 |
| 83 | 6.00 |
| 84 | 2.00 |
| 85 | 10.00 |
| 86 | 7.00 |
| 87 | 2.00 |
| 88 | 7.00 |
| 89 | 5.00 |
| 90 | 1.00 |