

## SAMPLE PAPER – 08

### Physics

#### Section A

**Q. 1.** In the integral

$$\int \frac{dx}{(2ax - x^2)^{1/2}} = a^n \sin^{-1} \left( \frac{x}{a} - 1 \right), \text{ the value}$$

of  $n$  should be :

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

**Q. 2.** Force acting on a particle is  $(2\hat{i} + 3\hat{j})$  N. Work done by this force is zero, when a particle is moved on the line  $3y + kx = 5$ . Here value of  $k$  is :

- (1) 2                      (2) 4  
 (3) 6                      (4) 8

**Q. 3.** A gun fires bullets of mass 40 g horizontally towards a square platform of area 50 sq. cm. Pressure registered by a device connected to the platform is  $2.88 \times 10^4$  pa. If speed of bullets is 1200 m/s. How many bullets hit the platform?

- (1) 3 bullets per second  
 (2) 3 bullets in 2 seconds  
 (3) 6 bullets per second  
 (4) 2 bullets in 0.5 seconds

**Q. 4.** The radiation emitted, when an electron jumps from  $n = 3$  to  $n = 2$  orbit is a hydrogen atom, falls on a metal to produce photoelectron. The electrons from the metal

surface with maximum kinetic energy are made to move perpendicular to a magnetic field of  $\frac{1}{320}$  T in a radius of  $10^{-3}$  m. Find the work function of metal :

- (1) 1.03 eV              (2) 1.89 eV  
 (3) 0.86 eV              (4) 2.03 eV

**Q. 5.** In a  $p$ -type semiconductor the acceptor level is situated 57 meV above the valence band. The maximum wavelength of light required to produce a hole will be :

- (1) 57 Å                      (2)  $57 \times 10^{-3}$  Å  
 (3) 217100 Å              (4)  $11.61 \times 10^{-33}$  m

**Q. 6.** A TV tower has a height of 100 m. How much population is covered by TV broadcast, if the average population density around the tower is 1000/km<sup>2</sup>? ( $R = 6400$  km)

- (1)  $40.19 \times 10^5$               (2)  $19.5 \times 10^6$   
 (3)  $29.5 \times 10^7$               (4)  $9 \times 10^4$

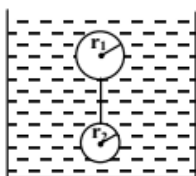
**Q. 7.** The count rate of activity of a radioactive sample of a very large population decreased from 1024 to 128 in 3 minutes. Then the rate of disintegration at the end of 5 minutes is :

- (1) 96                      (2) 64  
 (3) 48                      (4) 32

Q. 8. Magnification produced by astronomical telescope for normal adjustment is 10 and length of telescope is 1.1 m. The magnification when the image is formed at least distance of distinct vision ( $D = 25$  cm) is :

- (1) 14 (2) 6  
(3) 16 (4) 18

Q. 9. Two solid spherical balls of radius  $r_1$  and  $r_2$  ( $r_2 < r_1$ ), of density  $\sigma$  are tied up with a long string and released in a viscous liquid column of lesser density  $\rho$  and coefficient of viscosity  $\eta$ , with the string just taut as shown. The terminal velocity of spheres is :



- (1)  $\frac{2 r_2^2 g}{9 \eta} (\sigma - \rho)$   
(2)  $\frac{2 r_1^2 g}{9 \eta} (\sigma - \rho)$   
(3)  $\frac{2 (r_1^3 + r_2^3) (\sigma - \rho) g}{9 r_1 + r_2 \eta}$   
(4)  $\frac{2 (r_1^3 - r_2^3) (\sigma - \rho) g}{9 r_1 - r_2 \eta}$

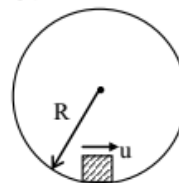
Q. 10. A coaxial cylinder made of glass is immersed in liquid of surface tension 'S'. Radius of inner and outer surface of cylinder are  $R_1$  and  $R_2$  respectively. Height till which liquid will rise is (Density of liquid is  $\rho$ ) :

- (1)  $\frac{2S}{R_2 \rho g}$  (2)  $\frac{2S}{R_1 \rho g}$   
(3)  $\frac{S}{(R_2 - R_1) \rho g}$  (4)  $\frac{2S}{(R_2 - R_1) \rho g}$

Q. 11. A body is displaced from (0, 0) to (1 m, 1 m) along the path  $x = y$  by a force  $\vec{F} = (x^2 \hat{j} + y \hat{i})$  N. The work done by this force will be :

- (1)  $\frac{4}{3}$  J (2)  $\frac{5}{6}$  J  
(3)  $\frac{3}{2}$  J (4)  $\frac{7}{5}$  J

Q. 12. A particle is given an initial speed  $u$  inside a smooth spherical shell of radius  $R = 1$  m that it is just able to complete the circle. Acceleration of the particle when its velocity is vertical is :



- (1)  $g \sqrt{10}$  (2)  $g$   
(3)  $g \sqrt{2}$  (4)  $3g$

Q. 13. A uniform disc of mass  $M$  and radius 'R' is supported vertically by a pivot at its periphery as shown. A particle of mass  $M$  is fixed to the rim and raised to highest point above the centre. The system is released from rest and it can rotate about pivot freely. The angular speed of system when it attached object is directly beneath the pivot, is :



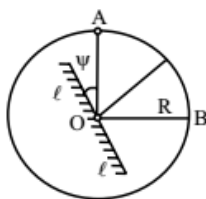
- (1)  $\sqrt{\frac{48g}{19R}}$  (2)  $\sqrt{\frac{24g}{19R}}$   
(3)  $\sqrt{\frac{48g}{11R}}$  (4)  $\sqrt{\frac{24g}{11R}}$

Q. 14. A gas undergoes a process in which the pressure and volume are related by  $VP^n = \text{constant}$ . The bulk modulus of the gas is :

- (1)  $nP$  (2)  $P^{1/n}$   
(3)  $\frac{P}{n}$  (4)  $P^n$

Q. 15. The mirror of length  $2l$  makes 10 revolutions per minute about the axis crossing its mid-point  $O$  and perpendicular to the plane of the figure. There is a light source in point  $A$  and an observer at point  $B$  of the circle of radius  $R$  drawn around centre  $O$  ( $\angle AOB = 90^\circ$ )

What is the proportion  $\frac{R}{l}$  if the observer  $B$  first sees the light source  $A$  when the angle of mirror  $\psi = 15^\circ$  ?



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

**Q. 16.** An object is 20 cm away from a concave mirror and it is within the focal length of the mirror. If the mirror is changed to a plane mirror, the image moves 15 cm closer to the mirror.

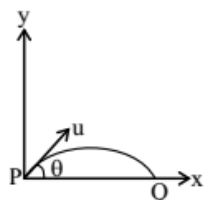
Focal length of the concave mirror is :

- (1) 36.6 cm                      (2) 56.6 cm  
 (3) 66.6 cm                      (4) 46.6 cm

**Q. 17.** If the critical angle for total internal reflection from a medium to vacuum is  $30^\circ$ , the velocity of light in the medium is :

- (1)  $3 \times 10^8$  m/s                      (2)  $1.5 \times 10^8$  m/s  
 (3)  $6 \times 10^8$  m/s                      (4)  $\sqrt{3} \times 10^8$  m/s

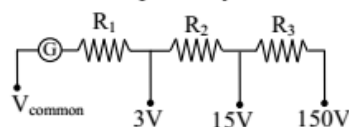
**Q. 18.** Average torque on a projectile of mass  $m$ , initial speed  $u$  and angle of projection  $\theta$  between initial and final positions P and Q as shown in figure about the point of projection is :



- (1)  $\frac{mu^2 \sin 2\theta}{2}$                       (2)  $mu^2 \cos\theta$   
 (3)  $mu^2 \sin\theta$                       (4)  $\frac{mu^2 \cos\theta}{2}$

**Q. 19.** A voltmeter of variable ranges 3 V, 15 V, 150 V is to be designed by connecting resistances  $R_1$ ,  $R_2$ ,  $R_3$  in series with a galvanometer of resistance  $G = 20 \Omega$ , as shown in Fig. The galvanometer gives full pass through its coil for 1 mA current i.e. "gives full pass through it's coil for 1 mA current". Then,

the resistances  $R_1$ ,  $R_2$  and  $R_3$  (in kilo ohms) should be, respectively :



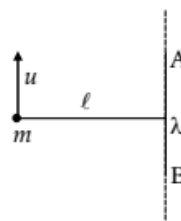
- (1) 3, 12, 135  
 (2) 2.98, 12, 135  
 (3) 2.98, 14.98, 149.98  
 (4) None of these

**Q. 20.** A magnet is suspended horizontally in the earth's magnetic field. When it is displaced and then released it oscillates in a horizontal plane with a period  $T$ . If a piece of wood of same moment of inertia (about the axis of rotation) as the magnet is attached to the magnet, what would the new period of oscillation of the system become ?

- (1)  $\frac{T}{3}$                                       (2)  $\frac{T}{2}$   
 (3)  $\frac{T}{\sqrt{2}}$                                       (4)  $\sqrt{2} \cdot T$

### Section B

**Q. 21.** AB is a vertical rigid infinite wire carrying a linear charge of density  $\lambda = 10 \mu\text{C/m}$ . A particle having mass  $m = 2$  g and charge  $Q = 1 \mu\text{C}$  is fixed to the wire by means of a light, insulating and inextensible string having length  $= 2\sqrt{2}$  m. The vertical velocity  $u$  in which it should be projected under gravity from the shown position so that the string slacks when its angle with vertical becomes  $45^\circ$  is ..... (correct upto the first two decimal places).

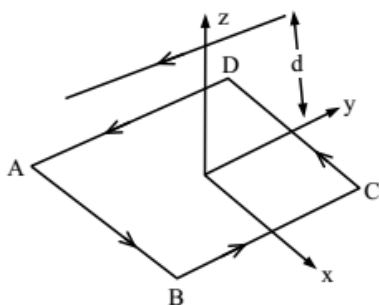


**Q. 22.** A capacitor has charge  $50 \mu\text{C}$ . When the gap between the plate is filled with glass wool, then  $120 \mu\text{C}$  charge flows through the

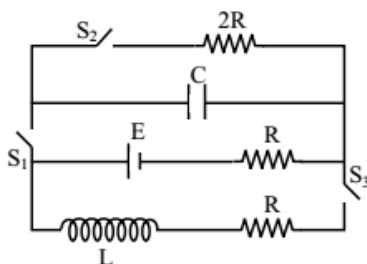
battery to capacitor. The dielectric constant of glass wool is.....

- Q. 23. A block of metal is heated directly by dissipating power in the internal resistance of block. Because of temperature rise, the resistance increases exponentially with time and is given by  $R(t) = 0.5 e^{2t}$ , where  $t$  is in second. The block is connected across a 110 V source and dissipates 7644 J heat energy over a certain period of time. This period of time is..... $\times 10^{-1}$  sec (take  $\ln 0.367 = -1$ ).

- Q. 24. Figure shows a square loop. 20 cm on each side in the  $x$ - $y$  plane with its centre at the origin. The loop carries a current of 7 A. Above it at  $y = 0, z = 12$  cm is an infinitely long wire parallel to the  $x$  axis carrying a current of 10 A. The net force on the loop is ..... $\times 10^{-4}$  N.

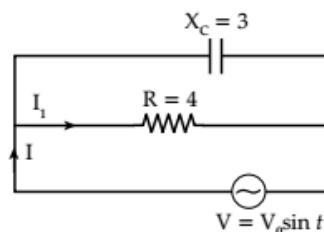


- Q. 25. In the given circuit, initially switch  $S_1$  is closed and  $S_2$  and  $S_3$  are open. After charging of capacitor, at  $t = 0$ ,  $S_1$  is open and  $S_2$  and  $S_3$  are closed. If the relation between inductance capacitance and resistance is  $L = 4CR^2$  then the time (in sec) after which current passing through capacitor and inductor will be same is .....  $\times 10^{-4}$  N. (Given  $R = \ell n(2)_{m\Omega}, L = 2$  mH)



- Q. 26. A capacitor and resistor are connected with an AC source as shown in figure. Reactance

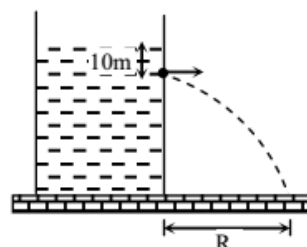
of capacitor is  $X_C = 3 \Omega$  and resistance of resistor is  $4 \Omega$ . Phase difference between current  $I$  and  $I_1$  is approx .....



- Q. 27. A 40 kg wooden crate is being pushed across a wooden floor with a force of 160 N. If  $\mu_k = 0.3$ , the acceleration of the crate is .....  $m/s^2$ . ( $g = 10 m/s^2$ )

- Q. 28. A single conservative force acts on a body of mass 1 kg that moves along the  $x$ -axis. The potential energy  $U(x)$  is given by  $U(x) = 20 + (x - 2)^2$ , where  $x$  is in meters. At  $x = 5.0$  m the particle has a kinetic energy of 20 J, then the maximum kinetic energy of body is ..... J.

- Q. 29. A large tank is filled with water (density =  $10^3 kg/m^3$ ). A small hole is made at a depth 10 m below water surface. The range of water effluxing out of the hole is  $R$  on ground. The extra pressure (in atm) must be applied on the water surface so that the range becomes  $2R$  is ..... . (Take 1 atm =  $10^5$  Pa and  $g = 10 m/s^2$ )

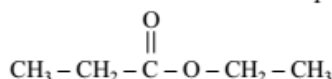


- Q. 30. An insect moves with a constant velocity  $v$  from one corner of a room to other corner which is opposite of the first corner along the largest diagonal of room. If the insect can not fly and dimensions of room is  $a \times a \times a$ , then the minimum time in which the insect can move is  $\frac{a}{v}$  times the square root of a number  $n$ , then  $n$  is equal to .....

## Chemistry

### Section A

Q. 31. The IUPAC name of the compound will be :



- (1) Ethyl propanoate
- (2) Ethyl propionate
- (3) Both (1) and (2)
- (4) None of these

Q. 32. Which of the following compound is optically active :

- (1)  $\text{CH}_3\text{CH}_2\text{OH}$
- (2)  $(\text{CH}_3)_2\text{CHCH}_2\text{OH}$
- (3)  $\text{CH}_3\text{CHOHC}_2\text{H}_5$
- (4)  $\text{CCl}_2\text{F}_2$

Q. 33. Commercial hydrogen is obtained from :

- (1) Coal gas
- (2) Water gas
- (3) Air
- (4) Producer gas

Q. 34. Boron compounds behave as Lewis acids because of their :

- (1) Acidic nature
- (2) Covalent nature
- (3) Electron deficient character
- (4) Ionising property

Q. 35. When chlorine is passed through molten tin, the product obtained is :

- (1)  $\text{SnCl}_2$
- (2)  $[\text{SnCl}_4]^{2-}$
- (3)  $[\text{SnCl}_6]^{2-}$
- (4)  $\text{SnCl}_4$

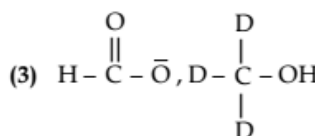
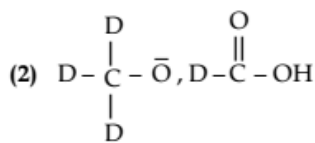
Q. 36.  $\text{MgBr}_2$  and  $\text{MgI}_2$  are soluble in acetone because of

- (1) Their ionic nature
- (2) Their covalent nature
- (3) Their co-ordinate nature
- (4) None is correct

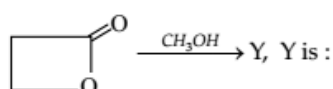
Q. 37.  $2\text{D}-\overset{\text{D}}{\underset{\text{H}}{\text{C}}}=\text{O} + \text{OH}^- \xrightarrow{\text{Cannizzaro}} \text{X and Y}$

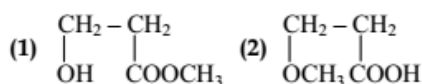
(Y is alcohol, D is deuterium)  
X and Y will have structure :

- (1)  $\text{D}-\overset{\text{D}}{\underset{\text{H}}{\text{C}}}-\bar{\text{O}}, \text{D}-\overset{\text{O}}{\parallel}{\text{C}}-\text{OH}$



- (4) None is correct

Q. 38.  Y, Y is :

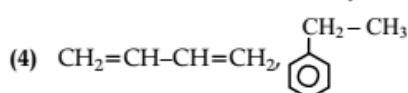
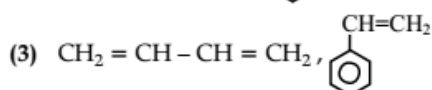
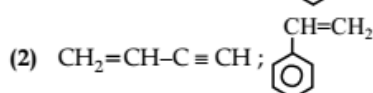
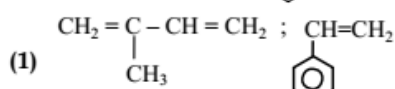
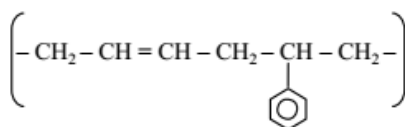
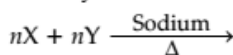


- (3) Both are correct
- (4) None is correct

Q. 39. Which of the following is not correct :

- (1) Ethyl amine and aniline both have  $\text{NH}_2$  group
- (2) Ethyl amine and aniline both dissolve in HCl
- (3) Ethyl amine and aniline both react with  $\text{CHCl}_3$  and KOH to form unpleasent gas
- (4) Ethyl amine and aniline both react with  $\text{HNO}_2$  to give hydroxy compound

Q. 40. Identify X and Y in following reaction :



Q. 41. The lassaingé's extract is boiled with dil.  $\text{HNO}_3$  before testing for halogens because :

- (1) Silver halides are soluble in  $\text{HNO}_3$
- (2)  $\text{Na}_2\text{S}$  and  $\text{NaCN}$  are decomposed by  $\text{HNO}_3$
- (3)  $\text{Ag}_2\text{S}$  is soluble in  $\text{HNO}_3$
- (4)  $\text{AgCN}$  is soluble in  $\text{HNO}_3$

Q. 42. The complex  $\text{Hg}[\text{Co}(\text{CNS})_4]$  is correctly named as :

- (1) Mercury tetrathiocyanato cobaltate (II)
- (2) Mercury cobalt tetrasulphocyanate (II)
- (3) Mercury tetrasulphocyanide cobaltate (II)
- (4) Mercury sulphocyanato cobalt (II)

Q. 43. Carbon deposition reaction taking place in

- (1) Reduction zone (2) Central zone
- (3) Fusion zone (4) Combustion zone

Q. 44.  $\text{Na}_2\text{CO}_3$  cannot be used in place of  $(\text{NH}_4)_2\text{CO}_3$  for the precipitation of V group because :

- (1)  $\text{NaI}$  interferes in the detection of V group
- (2) Conc. of  $\text{CO}_3^{2-}$  is very low
- (3)  $\text{Na}$  will react with acid radicals
- (4)  $\text{Mg}$  will be precipitated

Q. 45. The hybridisation of carbanion is

- (1)  $sp^3$  (2)  $sp^2$
- (3)  $sp$  (4) All may be

Q. 46. The product of reaction between 1,1,2,2-tetrachloro propane and  $\text{Zn dust}/\Delta$  :

- (1) Propyne (2) Propene
- (3) Iso propene (4) Acetylene

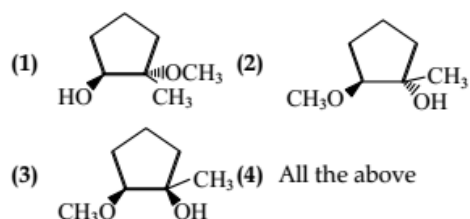
Q. 47. Benzene reacts with benzoyl chloride to form :

- (1) benzophenone (2) Acetophenone
- (3) Benzylchloride (4) Maleic anhydride

Q. 48. In Finkelstein Reaction, which reactants are used :

- (1)  $\text{NaI} + \text{C}_2\text{H}_5\text{OH}$  (2)  $\text{NaF} + \text{acetone}$
- (3)  $\text{NaBr} + \text{CH}_3\text{OH}$  (4)  $\text{NaI} + \text{CH}_2\text{H}_5\text{Br}$

Q. 49. If the starting material is 1-methyl-1,2-epoxy cyclopentane, of absolute configuration, decide which one compound correctly represent the product of its reaction with sodium methoxide in methanol.



Q. 50. A monoprotic acid in a 0.1 M solution ionizes to 0.001%. Its ionisation constant is :

- (1)  $1.0 \times 10^{-3}$  (2)  $1.0 \times 10^{-6}$
- (3)  $1.0 \times 10^{-8}$  (4)  $1.0 \times 10^{-11}$

### Section B

Q. 51. A sample of clay was partially dried and then contained 50% silica and 7% water. The original clay contained 12% water. The percentage of silica in original sample is ..... %.

Q. 52. The line at 434 nm in the Balmer series of the hydrogen spectrum corresponds to a transition of an electron from the  $n^{\text{th}}$  to second Bohr orbit. The value of  $n$  is .....

Q. 53. The reaction  $\text{SO}_2\text{Cl}_2(\text{g}) \rightarrow \text{SO}_2(\text{g}) + \text{Cl}_2(\text{g})$  is a first order gas reaction with  $k = 2.2 \times 10^{-5} \text{ sec}^{-1}$  at  $320^\circ\text{C}$ . The percentage of  $\text{SO}_2\text{Cl}_2$  is decomposed on heating this gas for 90 min, is ..... %.

Q. 54. For the cell process :

$\text{Sn}(\text{s}) + \text{Pb}^{+2}(\text{aq}) \rightarrow \text{Pb}(\text{s}) + \text{Sn}^{+2}(\text{aq})$  The ratio of  $\text{Pb}^{+2}$  to  $\text{Sn}^{+2}$  ion concentration for spontaneity is .....

Given

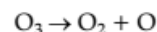
$$E_{\text{Sn}^{2+}/\text{Sn}}^0 = -0.136 \text{ V}$$

$$E_{\text{Pb}^{2+}/\text{Pb}}^0 = -0.126 \text{ V}$$

Q. 55. Gold crystallizes in a face centered cubic lattice. If the length of the edge of the unit cell is 407 pm. The density of gold assuming it to be spherical is .....  $\text{g/cm}^3$ . Atomic mass of gold = 197 amu.

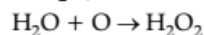
Q. 56. The degree of dissociation of  $\text{Ca}(\text{NO}_3)_2$  in a dilute aqueous solution containing 7 g of the salt per 100 g of water at  $100^\circ\text{C}$  is 70%. If the vapour pressure of water at  $100^\circ\text{C}$  is 760 mm. The vapour pressure of the solution is ..... mm.

- Q. 57. The sum of number of  $\sigma$ -bonds to  $\pi$ -bonds in  $C_2(CN)_4$  molecule is .....
- Q. 58. 10 ml of  $H_2O_2$  solution when reacted with KI solution produced 0.5 g of iodine. The percentage of purity of  $H_2O_2$  (by volume) is .....
- Q. 59. Through an aqueous solution of an unknown salt of metal M ( $M = 200$  g/mol) a current of 1.93 A is passed for 50 min. If 4 g of metal is produced at cathode. The charge on metal ion in solution is .....
- Q. 60. In an experiment  $O_3$  undergo decomposition as



by the radiations of wavelength 310 Å. The total energy falling on the  $O_3$  gas molecules is  $2.4 \times 10^{26}$  eV and quantum yield of the reaction is 0.2.

The volume strength of the  $H_2O_2$  solution which is obtained from reaction of 1 l  $H_2O$  and nascent oxygen [O] obtained from the reactions as (Assuming no change in volume of  $H_2O$ ) is .....



[Given :  $N_a$  (Avogadro's No.) =  $6 \times 10^{23}$ ]

## Mathematics

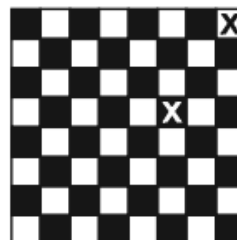
### Section A

- Q. 61. The number of values of  $c$  such that the straight line  $3x + 4y = c$  touches the curve  $\frac{x^4}{2} = x + y$  is  
(1) 0 (2) 1  
(3) 2 (4) 4
- Q. 62. The function  $f(x) = \frac{|x-1|}{x^2}$  is monotonically decreasing on :  
(1)  $(0, 1) \cup (2, \infty)$  (2)  $(0, \infty)$   
(3)  $(-\infty, 1) \cup (2, \infty)$  (4)  $(-\infty, \infty)$
- Q. 63.  $\int \frac{dx}{\sqrt{5x-6-x^2}}$  equals :  
(1)  $\sin^{-1}(2x+5) + c$   
(2)  $\cos^{-1}(2x+5) + c$   
(3)  $\sin^{-1}(2x-5) + c$   
(4)  $\cos^{-1}(2x-5) + c$
- Q. 64. If  $\beta + 2 \int_0^1 x^2 e^{-x^2} dx = \int_0^1 e^{-x^2} dx$ , then the value of  $\beta$  is :  
(1)  $e$  (2) 1  
(3) 0 (4)  $1/e$
- Q. 65. Area of figure bounded by straight lines  $x = 0$ ,  $x = 2$  and the curves  $y = 2^x$ ,  $y = 2x - x^2$  is :  
(1)  $3 \log_2 e - \frac{3}{4}$  (2)  $\frac{3}{\ln 2} - \frac{4}{3}$   
(3)  $\frac{3}{\ln 2} + \frac{3}{4}$  (4)  $\frac{3}{\ln 2} + \frac{4}{3}$
- Q. 66. The locus of the point of intersection of the lines  $x \cos \alpha + y \sin \alpha = a$  and  $x \sin \alpha - y \cos \alpha = b$  (where  $\alpha$  is a variable) is :  
(1)  $x^2 + y^2 = a^2 + b^2$   
(2)  $x^2 - y^2 = a^2 + b^2$   
(3)  $x^2 + y^2 = a^2 - b^2$   
(4)  $x^2 - y^2 = a^2 - b^2$
- Q. 67. The abscissae of two points A and B are the roots of the equation  $x^2 + 2ax - b^2 = 0$ , and their ordinates are the roots of the equation  $x^2 + 2px - q^2 = 0$ . The radius of the circle with AB as diameter is :  
(1)  $\sqrt{a^2 + b^2 + p^2 + q^2}$  (2)  $\sqrt{a^2 + p^2}$   
(3)  $\sqrt{b^2 + q^2}$  (4)  $\sqrt{a^2 + b^2 - p^2 - q^2}$
- Q. 68. The equation to the line touching both the parabolas  $y^2 = 4x$  and  $x^2 = -32y$  is :  
(1)  $x + 2y + 4 = 0$  (2)  $2x + y - 4 = 0$   
(3)  $x - 2y - 4 = 0$  (4)  $x - 2y + 4 = 0$
- Q. 69. The equation of the ellipse with its centre at (1, 2), one focus at (6, 2) and passing through the point (4, 6) is :  
(1)  $\frac{(x-1)^2}{45} + \frac{(y-2)^2}{20} = 1$   
(2)  $\frac{(x-1)^2}{35} + \frac{(y-2)^2}{20} = 1$   
(3)  $\frac{(x-1)^2}{45} + \frac{(y-2)^2}{25} = 1$   
(4)  $\frac{(x-1)^2}{50} + \frac{(x-2)^2}{25} = 1$

- Q. 70. The number of possible tangents which can be drawn to the curve  $4x^2 - 9y^2 = 36$ , which are perpendicular to the straight line  $5x + 2y - 10 = 0$  is :
- (1) zero (2) 1  
(3) 2 (4) 4
- Q. 71. The point in which the join of  $(-9, 4, 5)$  and  $(11, 0, -1)$  is met by the perpendicular from the origin is :
- (1)  $(2, 1, 2)$  (2)  $(2, 2, 1)$   
(3)  $(1, 2, 2)$  (4)  $(1, 1, 2)$
- Q. 72. The position vectors of points A, B, C are respectively  $\vec{a}, \vec{b}, \vec{c}$ . If L divides AB in 3 : 4 and M divides BC in 2 : 1 both externally, then  $\vec{LM}$  is :
- (1)  $4\vec{a} - 2\vec{b} + 2\vec{c}$  (2)  $4\vec{a} + 2\vec{b} + 2\vec{c}$   
(3)  $-4\vec{a} + 2\vec{b} + 2\vec{c}$  (4)  $4\vec{a} - 2\vec{b} - 2\vec{c}$
- Q. 73. The total number of matrices formed with the help of 6 different numbers are :
- (1) 6 (2)  $6!$   
(3)  $2(6!)$  (4)  $4(6!)$
- Q. 74. 
$$\begin{vmatrix} b+c & c & b \\ c & c+a & a \\ b & a & a+b \end{vmatrix} =$$
- (1)  $a + b + c$  (2)  $2a + b + c$   
(3)  $ab + bc + ca$  (4)  $4abc$
- Q. 75. If  $\frac{z^2}{(z-1)}$  is always real, then  $z$ , can lie on :
- (1) real axis (2) a parabola  
(3) imaginary axis (4) pair of lines
- Q. 76. The variance of first 50 even natural numbers is
- (1) 437 (2)  $\frac{437}{4}$   
(3)  $\frac{833}{4}$  (4) 833
- Q. 77.  $x^{\log_5 x} > 5$  implies :
- (1)  $x \in (0, \infty)$  (2)  $x \in (0, 1/5) \cup (5, \infty)$   
(3)  $x \in (1, \infty)$  (4)  $x \in (1, 2)$
- Q. 78. Sum of roots of the equation  $(x + 3)^2 - 4|x + 3| + 3 = 0$  is :
- (1) 4 (2) 12  
(3) -12 (4) -4
- Q. 79. The sum of the last eight coefficients in the expansion of  $(1 + x)^{16}$  is equal to :
- (1)  $2^{15}$  (2)  $2^{14}$   
(3)  $2^{15} - \frac{1}{2} \frac{(16)!}{(8!)^2}$  (4)  $2^{16} - \frac{16!}{(8!)^2}$
- Q. 80. Let  $x$  and  $y$  be real numbers satisfying the equation  $x^2 - 4x + y^2 + 3 = 0$ . If the maximum and minimum values of  $x^2 + y^2$  are  $a$  and  $b$  respectively. Then the numerical value of  $a - b$  is :
- (1) 1 (2) 2  
(3) 7 (4) 8

### Section B

- Q. 81. A badminton club has 10 couples as members. They meet to organise a mixed double match. If each wife refers to partner as well as oppose her husband in the match, then the number of different ways can the match off will be .....
- Q. 82. The value of the expression  $\frac{\cos^2 12^\circ + 2 \sin 12^\circ (\sin 12^\circ + 1)}{4 \cos^2 39^\circ - \sin^2 78^\circ}$  is .....
- Q. 83. Let  $2\cos 2x + 3\cos x - 2 > 0$  and  $x^2 + x - 2 < 0$  ( $x$  is measured in radians), then number of integral values of  $x$  satisfying both the inequations is .....
- Q. 84. In  $\Delta ABC$  with usual notations, if  $\angle A = 30^\circ$  and  $a = 5$ , then  $\sum \frac{a^5}{\sin A}$  is equal to .....
- Q. 85. Let P denotes the probability of selecting one white and one black square from the chessboard so that they are not in the same row and also not in the same column (an example of this kind of the choice is shown in figure), then  $(1024)P$  is





**Q. 86.** Consider a set containing function

$A = \{\cos^{-1}\cos x, \sin(\sin^{-1}x), \sin x((\sin x)^2 - 1), e^{\tan\{x\}}, e^{|\cos x| + |\sin x|}, \sin(\tan(\cos x)), \sin(\tan x)\}$ . B, C, D, are subsets of A, such that B contains periodic functions, C contains even functions, D contains odd functions then the value of  $n(B \cap C) + n(B \cap D)$  is ..... where  $\{.\}$  denotes the fractional part of functions)

**Q. 87.** If  $m = \lim_{x \rightarrow \infty} \frac{(\ln x)^3}{1 + 2 \ln x + 3(\ln x)^2 + 4(\ln x)^3}$  then the value of  $8m$  is .....

**Q. 88.** If  $f(x) = \begin{cases} \frac{\cos\left(\frac{\pi(\sqrt{1+x}-1)}{x}\right)}{x} & , x \neq 0 \\ \frac{\pi}{k} & , x = 0 \end{cases}$  is

continuous at  $x = 0$ , then  $k^2$  is equal to .....

**Q. 89.** If  $f'(1) = 3$  and  $f'(2) = 2$ , then the value of  $\lim_{h \rightarrow 0} \frac{f(1+2h) - f(1)}{f(2+3h) - f(2)}$  is equal to .....

**Q. 90.** For an increasing G.P.  $a_1, a_2, a_3, \dots, a_n$ , if  $a_6 = 4a_4$ ,  $a_9 - a_7 = 192$ , then the value of  $\sum_{i=1}^{\infty} \frac{1}{a_i}$  is .....

## ANSWER-KEY

### Physics

Q. No.	Answer	Q. No.	Answer
1	(3)	16	(4)
2	(1)	17	(2)
3	(2)	18	(1)
4	(1)	19	(2)
5	(3)	20	(4)
6	(1)	21	5.69
7	(4)	22	3.40
8	(1)	23	5.00
9	(3)	24	0.23
10	(4)	25	1.00
11	(2)	26	53.00
12	(1)	27	1.00
13	(1)	28	29.00
14	(3)	29	3.00
15	(1)	30	5.83

### Chemistry

Q. No.	Answer	Q. No.	Answer
31	(1)	46	(1)
32	(3)	47	(1)
33	(2)	48	(4)
34	(3)	49	(3)
35	(4)	50	(4)
36	(2)	51	47.31
37	(4)	52	5.00
38	(1)	53	11.20
39	(4)	54	0.458
40	(3)	55	19.48
41	(2)	56	746
42	(1)	57	18.00
43	(2)	58	0.669
44	(4)	59	3.00
45	(4)	60	22.40

### Mathematics

Q. No.	Answer	Q. No.	Answer
61	(2)	76	(4)
62	(1)	77	(2)
63	(3)	78	(3)
64	(4)	79	(3)
65	(2)	80	(4)
66	(1)	81	2520.00
67	(1)	82	1.00
68	(4)	83	2.00
69	(1)	84	5.00
70	(1)	85	768.00
71	(3)	86	5.00
72	(3)	87	2.00
73	(4)	88	64.00
74	(4)	89	1.00
75	(1)	90	2.00