Rankers

SAMPLE PAPER – 02

Physics

Section A

Q. 1. The magnitude of vectors $\vec{A}$, $\vec{B}$ and $\vec{C}$ are respectively 12, 5 and 13 units and $\vec{A}+\vec{B} = \vec{C}$, then the angle between $\vec{A}$ and $\vec{B}$ is :

(1) 0   (2) π

(3) $\dfrac{\pi}{2}$ (4) $\dfrac{\pi}{4}$

Q. 2. A wave is represented by $y = a \sin (At - Bx + C)$ where A, B, C are constants and t is in seconds and x is in metre. The Dimensions of A, B, C are :

(1) $[T^{-1}]$, $[L]$, $[M^0L^0T^0]$

(2) $[T^{-1}]$, $[L^{-1}]$, $[M^0L^0T^0]$

(3) $[T]$, $[L]$, $[M]$

(4) $[T^{-1}]$, $[L^{-1}]$, $[M^{-1}]$

Q. 3. A body moves in a straight line along, x-axis. Its distance x (in metre) from the origin is given by $x = 8t - 3t^2$. The average speed in the interval $t = 0$ to $t = 1$ second is :

(1) 5 ms⁻¹   (2) -4 ms⁻¹

(3) 6 ms⁻¹   (4) zero

Q. 4. In a legend the hero-kid kicked a toy pig so that it is projected with a speed greater than that of its cry. If the weight of the toy pig is assumed to be 5 kg and the time of contact 0.01 sec., the force with which the hero-kid kicked him was (Speed of cry = 330 m/s) :
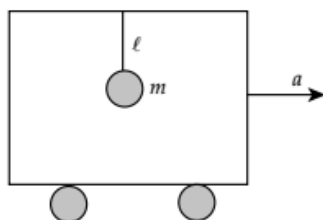
(1) 5×10^{-2} N   (2) 2×10^5 N

(3) 1.65×10^5 N   (4) 1.65×10^3 N

Q. 5. A racing car is travelling along a track at a constant speed of 40 m/s. A T.V. camera man is recording the event from a distance of 30 m directly away from the track as shown in figure. In order to keep the car under view in the position shown, the angular speed with which the camera should be rotated, is :
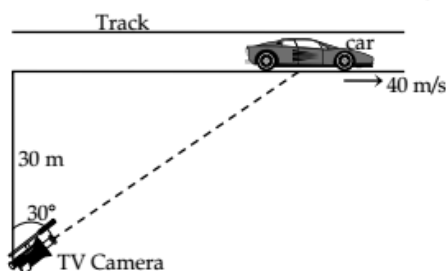

(1) $\dfrac{4}{3}$ rad/s   (2) $\dfrac{3}{4}$ rad/s

(3) $\dfrac{8}{3}\sqrt{3}$ rad/s   (4) 1 rad/s

Q. 6. A pendulum of mass m and length ℓ is suspended from the ceiling of a trolley which has a constant acceleration a in the horizontal direction as shown in figure. Work done by the tension is (In the frame of trolley) :

(1) $\dfrac{mg}{\tan\theta}[\cos(\tan^{-1}(a/g)-1]$

(2) $\dfrac{mg}{\tan\theta}[\sin(\tan^{-1}(a/g)-1]$

(3) $\dfrac{mg}{\cos\theta}[\sin(\tan^{-1}(a/g)-1]$

(4) $\dfrac{mg}{\cos\theta}[\cos^{-1}(\tan^{-1}(a/g)-1]$

Q. 7. Figure shows a small wheel fixed coaxially on a bigger one of double the radius. The system rotates about the common axis. The strings supporting A and B do not slip on the wheels. If x and y be the distances travelled by A and B in the same time interval, then :
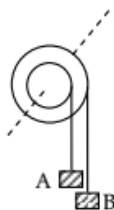
(1) $x = 2y$ (2) $x = y$
(3) $y = 2x$ (4) None of these

Q. 8. The velocities of a particle in SHM at positions x_1 and x_2 are v_1 and v_2, respectively, its time period will be

(1) $2\pi\sqrt{\dfrac{(v_1^2 - v_2^2)}{(x_2^2 - x_1^2)}}$ (2) $2\pi\sqrt{\dfrac{(x_1^2 + x_2^2)}{(v_2^2 - v_1^2)}}$

(3) $2\pi\sqrt{\dfrac{(x_1^2 - x_2^2)}{(v_2^2 - v_1^2)}}$ (4) $2\pi\sqrt{\dfrac{(x_1^2 + x_2^2)}{(v_2^2 + v_1^2)}}$

Q. 9. One cubic plate, having 15 cm side, floats on water surface. If surface tension of water is 60 dyne/cm. To lift this plate from water, Find the extra force required against weight.
(1) 3600 dyne (2) 1800 dyne
(3) 900 dyne (4) 7200 dyne

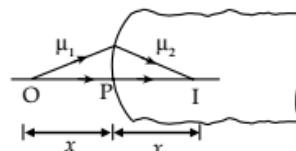**Q. 10.** A train moving at 25 m/s emits a whistle of frequency 200 Hz. If the speed of sound in air is 340 m/s, find the frequency observed by a stationary observer.
(i) if observer is in front of the source
(ii) if observer is behind the train
(1) 186 Hz, 216 Hz (2) 216 Hz, 186 Hz
(3) 172 Hz, 220 Hz (4) 220 Hz, 172 Hz

Q. 11. Two coherent sources of different intensities send waves which interfere. The ratio of maximum intensity to the minimum intensity is 25. The intensities of the sources are in the ratio :
(1) 25 : 1 (2) 5 : 1
(3) 9 : 4 (4) 625 : 1

Q. 12. A spherical surface of radius R separates two medium of refractive indices μ_1 and μ_2, as shown in figure. Where should an object be placed in the medium 1 so that a real image is formed in medium 2 at the same distance ?

(1) $\left(\dfrac{\mu_2 - \mu_1}{\mu_2 + \mu_1}\right)R$ (2) $\left(\dfrac{\mu_2 + \mu_1}{\mu_2 - \mu_1}\right)R$

(3) $\left(\dfrac{\mu_2 + \mu_1}{\mu_2}\right)R$ (4) $\left(\dfrac{\mu_2}{\mu_2 + \mu_1}\right)R$

Q. 13. The dispersive powers of flint glass and crown glass are 0.053 and 0.034, respectively and their mean refractive indices are 1.68 and 1.53 for white light. Calculate the angle of the flint glass prism required to form an achromatic combination with a crown glass prism of refracting angle 4° :
(1) 2° (2) 4°
(3) 5° (4) 6°

Q. 14. In young's double slit experiment $\dfrac{d}{D} = 10^{-4}$ (d = distance between slits, D = distance of screen from the slits). At a point P on the screen resulting intensity is equal to the intensity due to individual slit l_0. Then the distance of point P from the central maximum is ($\lambda = 6000$ Å)
(1) 2 mm (2) 1 mm
(3) 0.5 mm (4) 4 mm

Q. 15. The mobility of electrons in a semiconductor chip of length 10 cm is observed to be 1000 cm^2/Vs. When a potential difference of v is applied across it. What is the drift speed of electrons.

(1) 1 cm/s   (2) 5 cm/s

(3) 2000 m/s   (4) 1000 m/s

Q. 16. The energy levels of a certain atom for first, second and third levels are E, 4E/3 and 2E, respectively. A photon of wavelength λ is emitted for a transition $3 \to 1$. What will be the wavelength of emission for transition $2 \to 1$?

(1) $\dfrac{\lambda}{3}$ (2) $\dfrac{4\lambda}{3}$

(3) $\dfrac{3\lambda}{4}$ (4) 3λ

Q. 17. The graph of $\ell n\left(\dfrac{R}{R_0}\right)$ versus $\ell n\, A$ (R = radius of a nucleus and A = its mass number) is :

(1) a straight line   (2) a parabola

(3) an ellipse   (4) none of these

Q. 18. A square coil ABCD with its plane vertical is released from rest in a horizontal uniform magnetic field $\vec{B}$ of length 2L. The acceleration of the coil is :
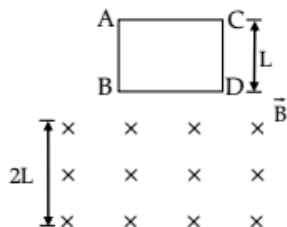
(1) less than g for all the time till the loop crosses the magnetic field completely

(2) less than g when it enters the field and greater than g when it comes out of the field

(3) g all the time

(4) less than g when it enters and comes out of the field but equal to g when it is within the field

Q.19. We have three identical perfectly black plates. The temperatures of first and third plate is T and 3T. What is the temperature of second plate if system is in equilibrium ?

(1) $41^{1/4}$ T   (2) $51^{1/4}$ T

(3) $2^{1/4}$ T   (4) $37^{1/4}$ T

Q. 20. If a baseball player can throw a ball at maximum distance $= d$ over a ground, the maximum vertical height to which he can throw it, will be (Ball has same initial speed in each case) :

(1) $\dfrac{d}{2}$ (2) d

(3) $2d$ (4) $\dfrac{d}{4}$

Section B

Q. 21. A ball falls from a height of 1 m on a ground and it loses half its kinetic energy when it hits the ground. What would be the total distance covered by the ball after sufficiently long time ?

Q. 22. Consider a gravity-free hall in which an experimenter of mass 50 kg is resting on a 5 kg pillow, 8 ft above the floor of the hall. He pushes the pillow down so that it starts falling at a speed of 8 ft/s. The pillow makes a perfectly elastic collision with the floor, rebounds and reaches the experimenter's head. The time elapsed in the process is......s

Q. 23. A battery of EMF 10V sets up a current of 1A when connected across a resistor of 8Ω. If the resistor is shunted by another 8Ω resistor, what would be the current in the circuit ? (in A)

Q. 24. A liquid flows out drop by drop from a vessel through a vertical tube with an internal diameter of 2 mm, then the total number of drops that flows out during 10 grams of the liquid flow out..... [Assume that the diameter of the neck of a drop at the moment it breaks away is equal to the internal diameter of tube and surface tension is 0.02 N/m].

Q. 25. A cylinder of area 300 cm² and length 10 cm made of material of specific gravity 0.8 is floated in water with its axis vertical. It is then pushed downward, so as to be just immersed. The work done by the agent who pushes the cylinder into the water is.....J.

Q. 26. A copper ball of density 8.6 g/cm³, 1 cm in diameter is immersed in oil of density 0.8 g/cm³. The charge in µC on the ball, if it remains just suspended in an electric field of intensity 3600 V/m acting in upward direction is..... µC.

Q. 27. In a YDSE experiment two slits S_1 and S_2 have separation of $d = 2$ mm. The distance of the screen is D = 8/5 m. Source S starts moving from a very large distance towards S_2 perpendicular to S_1S_2 as shown in figure. The wavelength of monochromatic light is 500 nm. The number of maximas observed on the screen at point P as the source moves towards S_2 is $3995 + n$. The value of n is.....
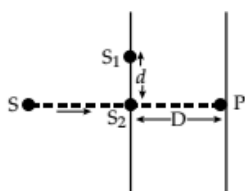
Q. 28. A leaky parallel plate capacitor is filled completely with a material having dielectric

constant K = 5 and electric conductivity $\sigma = 7.4 \times 10^{-12}\ \Omega^{-1}\ m^{-1}$. If the charge on the plate at the instant $t = 0$ is $q = 8.85$ µC, then the leakage current at the instant $t = 12$ s is.........$\times 10^{-1}$ µA.

Q. 29. Potential difference between the points A and B in the circuit shown is 16 V, then potential difference across 2Ω resistor is .....V. volt. $(V_A > V_B)$
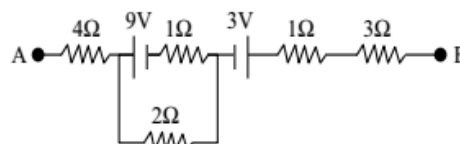
Q. 30. The half-value thickness of an absorber is defined as the thickness that will reduce exponentially the intensity of a beam of particles by a factor of 2. The half-value thickness in (µm) for lead assuming X-ray beam of wavelength 20 pm, µ = 50 cm⁻¹ for X-rays in lead at wavelength λ = 20 pm, is..... µm

Chemistry

Section A

Q. 31. The chloride of a metal contains 71% chlorine by weight and the vapour density of it is 50. The atomic mass of the metal will be (valency of metal is 2) :
(1) 29   (2) 58
(3) 35.5   (4) 71

Q. 32. Orthorhombic crystal has the following unit cell dimensions
(1) $a \neq b \neq c$ and $\alpha = \beta = \gamma \neq 90°$
(2) $a \neq b \neq c$ and $\alpha = \beta = \gamma = 90°$
(3) $a \neq b \neq c$ and $\alpha = \gamma = 90°, \beta \neq 90°$
(4) $a \neq b \neq c$ and $\alpha \neq \beta \neq \gamma = 90°$

Q. 33. Which is low spin complex :
(1) $Fe(CN)_6^{4-}$ (2) $Co(NO_2)_6^{3-}$
(3) $Mn(CN)_6^{3-}$ (4) All of these

Q. 34. An inorganic salt solution gives a yellow precipitate with silver nitrate. The precipitate dissolves in dilute nitric acid as well as in ammonium hydroxide. The solution contains :
(1) Bromide   (2) Iodide
(3) Phosphate   (4) Chromate

Q. 35. The arrangement of oxygen atoms around phosphorus atoms in P_4O_{10} is :
(1) Pyramidal   (2) Octahedral
(3) Square planar   (4) Tetrahedral

Q. 36. Glucose with excess of phenyl hydrazine forms :
(1) Fructosazone
(2) Glucose phenyl hydrazone
(3) Glucosazone
(4) Phenyl hydrazone of glucosazone

Q. 37. The correct set of the products obtained in the following reactions :
(A) RCN $\xrightarrow{\text{reduction}}$
(B) RCN $\xrightarrow[\text{(ii) H}_2\text{O}]{\text{(i) CH}_3\text{MgBr}}$
(C) RNC $\xrightarrow{\text{hydrolysis}}$
(D) $RNH_2 \xrightarrow{\text{HNO}_2}$

The answer is –

(1)

A	B
2° Amine	Methyl ketone
C	D
1°Amine	Alcohol

(2)

A	B
1° Amine	Methyl ketone
C	D
2° Amine	Alcohol

(3)

A	B
2° Amine	Methyl ketone
C	D
2° Amine	Acid

(4)

A	B
2° Amine	Methyl ketone
C	D
2° Amine	Aldehyde

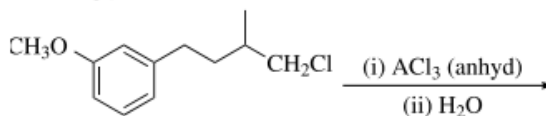**Q. 38.** The major product of the following reaction is :
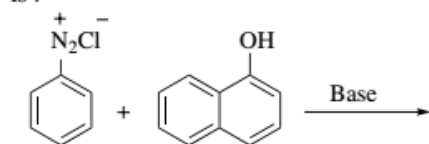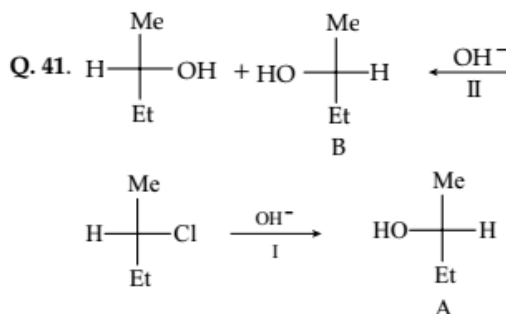

(1)

(2)

(3)

(4)

Q. 39. If a compound on analysis was found to contain C = 18.5%, H = 1.55%, Cl = 55.04% and O = 24.81%, then its empirical formula is :

(1) $CHClO$ (2) CH_2ClO

(3) C_2H_2OCl (4) $ClCH_2O$

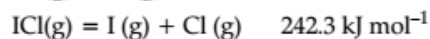**Q. 40.** The major product of the following reaction is :

(1)

(2)

(3)

(4)

Q. 41.

Steps I and II are :

(1) Both S_{N1} (2) Both S_{N2}

(3) I S_{N1}, II S_{N2} (4) I S_{N2}, II S_{N1}

Q. 42. The correct order of bond strength is

(1) $O_2^- < O_2 < O_2^+ < O_2^{2-}$

(2) $O_2^{2-} < O_2^- < O_2 < O_2^+$

(3) $O_2^- < O_2^{2-} < O_2 < O_2^+$
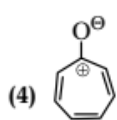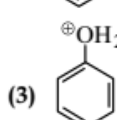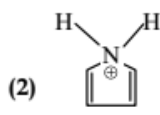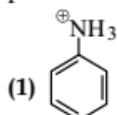
(4) $O_2^+ < O_2 < O_2^- < O_2^{2-}$

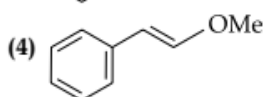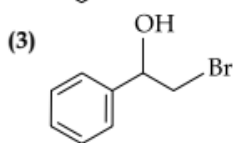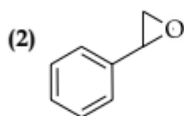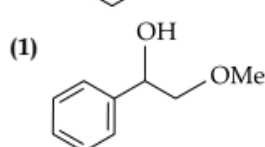**Q. 43.** The enthalpy change states for the following processes are listed below:

$Cl_2(g) = 2Cl(g)$ $242.3 \text{ kJ mol}^{-1}$

$I_2(g) = 2I(g)$ 151 kJ mol^{-1}

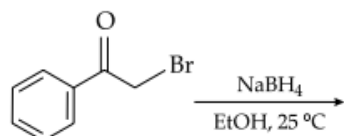$ICl(g) = I(g) + Cl(g)$ $242.3 \text{ kJ mol}^{-1}$

$I_2(s) = I_2(g)$ $62.76 \text{ kJ mol}^{-1}$

Given that the standard states for iodine chlorine are $I_2(s)$ and $Cl_2(g)$, the standard enthalpy of formation for ICl (g) is:

(1) $244.8 \text{ kJ mol}^{-1}$ (2) $-14.6 \text{ kJ mol}^{-1}$

(3) $-16.8 \text{ kJ mol}^{-1}$ (4) 16.8 kJ mol^{-1}
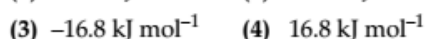
Q. 44. In which delocalization of positive charge is possible :

(1)   (2)

(3)   (4)

Q. 45. The major Product of the following reaction is :

(1)

(2)

(3)

(4)

Q. 46. Which of the following order is correct :

& functional isomer

& metamers

& metamers

& functional isomers

(1) TFTF   (2) FTTF

(3) TTFT   (4) TFFT
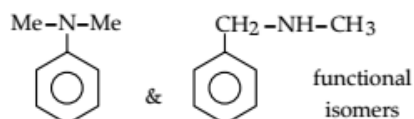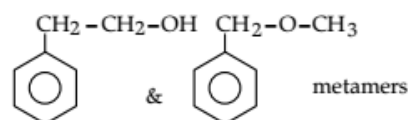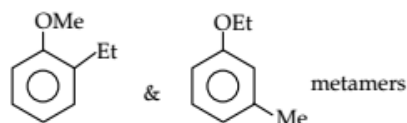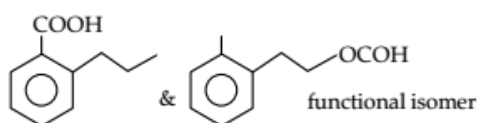
Q. 47. Of the two solvent H_2O and D_2O, NaCl dissolves :

(1) Equally in both the solvents

(2) Only in H_2O but remains insoluble in D_2O

(3) More in D_2O

(4) More in H_2O

Q. 48. In the electrolysis method of boron extraction the cathode is made of :

(1) Carbon   (2) Boric anhydride

(3) Mg   (4) Iron rod

Q.49 Ge (II) compounds are powerful reducing agents, whereas Pb (IV) compounds are strong oxidants. It can be due to :

(1) Lead is more electropositive than germanium

(2) The ionization potential of lead is less than that of germanium

(3) The ionic radii of Pb^{2+} and Pb^{4+} are larger than those of Ge^{2+} and Ge^{4+}

(4) More pronounced inert pair effect in lead than in germanium

Q. 50. Which of the following statements is correct for $CsBr_3$?

(1) It is a covalent compound.

(2) It contains Cs^{3+} and Br^- ions.

(3) It contains Cs^+ and Br_3^- ions.

(4) It contains Cs^+, Br^- and Br_2 molecule.

Section B

Q. 51. A drop of solution (volume 0.05 ml) contains 3.0×10^{-6} mole of H^+. If the rate constant of disappearance of H^+ is 1.0×10^7 mole $l^{-1}s^{-1}$. It would take for H^+ in drop to disappear in..... $\times 10^{-9}s$

Q. 52. The amount of C-14 isotope in a piece of wood is found to be 1/16th of its amount present in a fresh piece of wood. The age of wood, half-life period of C-14 is 5770 years, is.....years

Q. 53. The overall formation constant for the reaction of 6 mol of CN^- with Cobalt(II) is 1×10^{19}. The formation constant for the reaction of 6 mol of CN^- with Cobalt(III) is ..... $X10^{63}$. Given that,
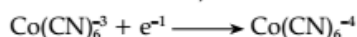
$$Co(CN)_6^{-3} + e^{-1} \longrightarrow Co(CN)_6^{-4}$$
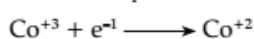$$E^{\circ}_{Rp} = 0.83 \text{ V}$$
$$Co^{+3} + e^{-1} \longrightarrow Co^{+2}$$
$$E^{\circ}_{Rp} = 1.82 \text{ V}$$

Q. 54. An element has body centered cubic structure with a cell edge of 3.0 Å. The density of the metal is 2 amu/Å^3. Atoms present in 243×10^{24} amu of the element are ..... $\times 10^{24}$

Q. 55. Phenol associates in benzene to a certain extent to form a dimer. A solution containing 20×10^{-3} kg of phenol in 1.0 kg of benzene has its freezing point depressed by 0.69 K. The fraction of phenol that has dimerised is..... (K_f for benzene = 5.12 K kg mol^{-1})

Q. 56. Finely divided catalyst has greater surface area and has greater catalytic activity than the compact solid. If a total surface area of 6291456 cm^2 is required for adsorption of gaseous reaction in a catalysed reaction, then the number of splits should be made of a cube exactly 1 cm in length is..... [Given : After each split new cubes of equal dimensions are formed.]

Q. 57. The first ionization energy of H is 21.79×10^{-19} J. The second ionization energy of He atom is...... $\times 10^{-19}$J

Q. 58. E.N. of Si is..... (Covalent radius of Si = 1.175 Å)

Q. 59. The number of π–bonds present in C_2 (Vap.) molecule according to molecular orbital theory are.....

Q. 60. In an experiment O_3 undergo decomposition as

$$O_3 \longrightarrow O_2 + O$$

by the radiations of wavelength 310 Å. The total energy falling on the O_3 gas molecules is 2.4×10^{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 above reactions is..... (Assuming no change in volume of H_2O)

$$H_2O + O \longrightarrow H_2O_2$$

[Given : N_A (Avogadro's No.) = 6×10^{23}

Mathematics

Section A

Q. 61. The co-ordinates of the point where the line joining the points (2, –3, 1), (3, –4, –5) cuts the plane $2x + y + z = 7$ are :
(1) (2, 1, 0)　　　　(2) (3, 2, 5)
(3) (1, –2, 7)　　　(4) None of these

Q. 62. If D, E, F are the mid points of the sides BC, CA and AB respectively of a triangle ABC and 'O' is any point, then, $|\overrightarrow{AD} + \overrightarrow{BE} + \overrightarrow{CF}|$, is :
(1) 1　　　　　　(2) 0
(3) 2　　　　　　(4) 4

Q. 63. $\int \dfrac{dx}{e^x + e^{-x}}$ equals :
(1) $\log(e^x + e^{-x}) + c$　(2) $\log(e^x - e^{-x}) + c$
(3) $\tan^{-1}(e^x) + c$　　(4) $\tan^{-1}(e^{-x}) + c$

Q. 64. $\int\limits_0^1 |3x - 1|\,dx$ equals :
(1) 5/6　　　　　(2) 5/3
(3) 10/3　　　　(4) 5

Q. 65. The area of the region bounded by the curve $y = \sin x$ and the x-axis in $[-\pi, \pi]$ is :
(1) 4　　　　　　(2) 8
(3) 12　　　　　(4) 2

Q. 66. The curve passing through (0, 1) and satisfying $\sin\left(\dfrac{dy}{dx}\right) = \dfrac{1}{2}$ is:
(1) $\cos\left(\dfrac{y+1}{x}\right) = \dfrac{1}{2}$　(2) $\sin\left(\dfrac{y-1}{x}\right) = \dfrac{1}{2}$
(3) $\cos\left(\dfrac{x}{y+1}\right) = \dfrac{1}{2}$　(4) $\sin\left(\dfrac{x}{y-1}\right) = \dfrac{1}{2}$

Q. 67. If $y = a\log|x| + bx^2 + x$ has its extremum values at $x = -1$ and $x = 2$, then :

(1) $a = 2, b = -1$ (2) $a = 2, b = \dfrac{-1}{2}$

(3) $a = -2, b = \dfrac{1}{2}$ (4) $a = -2, b = \dfrac{-1}{2}$

Q. 68. If $x = a[\cos\theta + \log\tan\dfrac{\theta}{2}]$, $y = a\sin\theta$ then $\dfrac{dy}{dx} =$

(1) $\cos\theta$ (2) $\sin\theta$

(3) $\tan\theta$ (4) $\csc\theta$

Q. 69. The range of the function $y = \dfrac{1}{2-\sin 3x}$ is :

(1) $\left(\dfrac{1}{3}, 1\right)$ (2) $\left[\dfrac{1}{3}, 1\right)$

(3) $\left[\dfrac{1}{3}, 1\right]$ (4) $\left(\dfrac{1}{3}, 1\right]$

Q. 70. $\displaystyle\lim_{x\to 1} \dfrac{x^3 - 2x - 1}{x^5 - 2x - 1} =$

(1) $\dfrac{2}{3}$ (2) $\dfrac{1}{3}$

(3) $\dfrac{4}{3}$ (4) $\dfrac{5}{3}$

Q. 71. A circle touching the x-axis at $(3, 0)$ and making an intercept of length 8 on the y-axis passes through the point:

(1) $(3, 10)$ (2) $(3, 5)$

(3) $(2, 3)$ (4) $(1, 5)$

Q. 72. If the line $y - \sqrt{3}x + 3 = 0$ cuts the parabola $y^2 = x + 2$ at A and B, then PA. PB is equal to (where co-ordinates of P are ($\sqrt{3}$, 0)):

(1) $\dfrac{4\left(\sqrt{3}+2\right)}{3}$ (2) $\dfrac{4\left(2-\sqrt{3}\right)}{3}$

(3) $2\sqrt{3}$ (4) $\dfrac{2\left(\sqrt{3}+2\right)}{3}$

Q. 73. The tangent and the normal at a point P on an ellipse $\dfrac{x^2}{a^2} + \dfrac{y^2}{b^2} = 1$ meet its major axis in T and T' so that $TT' = a$ then $e^2\cos^2\theta + \cos\theta$ (where e is eccentricity of the ellipse) is equal to :

(1) 1 (2) $\dfrac{1}{2}$

(3) $\dfrac{2}{3}$ (4) $\dfrac{1}{4}$

Comment As each nuclear less than 1, the sum can not be equal in 2

Q. 74. The asymptotes of the hyperbola $xy = hx + ky$ are :

(1) $x - k = 0$ & $y - h = 0$
(2) $x + h = 0$ & $y + k = 0$
(3) $x - k = 0$ & $y + h = 0$
(4) $x + k = 0$ & $y - h = 0$

Q. 75. For the roots of the equation $a - bx - x^2 = 0$; $(a > 0, b > 0)$, which statement is true ?

(1) both roots are positive
(2) both roots are negative
(3) roots have opposite sign, negative root has greater magnitude
(4) roots have opposite sign, positive root has greater magnitude

Q. 76. If $\log_{10} 2 = 0.3010 \cdot \log_{10} 3 = 0.4771$ then number of ciphers after decimal before a significant figure comes in $\left(\dfrac{5}{3}\right)^{-100}$ is

(1) 21 (2) 22

(3) 23 (4) 24

Q. 77. If the ratio of the sum of n terms of two AP's is $2n : (n+1)$, then ratio of their 8th terms is :

(1) $15 : 8$ (2) $8 : 13$

(3) $11 : 6$ (4) $5 : 17$

Q. 78. If the 4th term in the expansion of $\left(ax + \dfrac{1}{x}\right)^n$ is $\dfrac{5}{2}$ then the values of a and n respectively are :

(1) $2, 6$ (2) $\dfrac{1}{2}, 6$

(3) $\dfrac{1}{2}, 5$ (4) $2, 5$

Q. 79. The number of positive integers satisfying the inequality $^{n+1}C_{n-2} - {}^{n+1}C_{n-1} \le 100$ is :

(1) Nine (2) Eight

(3) Five (4) Ten

Q. 80. If the orthocentre of the triangle formed by $(1, 3)$ $(4, -5)$ and (a, b) is $(2, 4)$, Then the value of $33b + 22a$ is:

(1) 0 (2) $\dfrac{1}{11}$

(3) 1 (4) $\dfrac{3}{11}$

Section B

Q. 81. Given $f_n(x) = \dfrac{1}{n}\left(\sin^n x + \cos^n x\right)$ for $n = 1, 2, 3, \ldots$ Then the value of $24(f_4(x) - f_6(x))$ is equal to .....

Q. 82. If the sum of all solutions of equation $\sin x + 2\cos x = 1 + \sqrt{3}\cos x$ in $[0, 2\pi]$ is $\dfrac{k\pi}{6}$ The value of k is .....

Q. 83. The sum of the series

$$\tan^{-1}\left(\frac{1}{3}\right) + \tan^{-1}\left(\frac{2}{9}\right) + ...$$
$$+ \tan^{-1}\left[\frac{2^{n-1}}{1+2^{2n-1}}\right] + ...\infty.$$

is..... $\dfrac{k\pi}{4}$ Then the value of k is.......

Q. 84. If the number of five digit numbers with distinct digits and 2 at the 10th place is $336\,k$, then k is equal to....

Q. 85. In a workshop, there are five machines and the probability of any one of them to be out of service on a day is $\dfrac{1}{4}$. If the probability that at most two machines will be out of service on the same day is $\left(\dfrac{3}{4}\right)^3 k$, then k is equal to...........

Q. 86. If function

$$f(x) = \begin{cases} \dfrac{a\sin x + b\tan x - 3x}{x^3} & , \; x \neq 0 \\ 0 & , \; x = 0 \end{cases} \text{ is}$$

continuous at $x = 0$ then $(a^2 + b^2)$ is equal to.....

Q. 87. Four fair dice are thrown simultaneously. If probability that the highest number obtained is 4 is $\dfrac{25a}{1296}$ then 'a' is equal to.....

Q. 88. If the sides a, b, c of ΔABC satisfy the equation $4x^3 - 24x^2 + 47x - 30 = 0$ and

$$\begin{vmatrix} a^2 & (s-a)^2 & (s-a)^2 \\ (s-b)^2 & b^2 & (s-b)^2 \\ (s-c)^2 & (s-c)^2 & c^2 \end{vmatrix} = \frac{p^2}{q}$$ where p and q

are co-prime and s is semiperimeter of ΔABC, then the value of $(p - q)$ is.....

Q. 89. If $D = \begin{bmatrix} 0 & a\alpha^2 & a\beta^2 \\ b\alpha+c & 0 & a\gamma^2 \\ b\beta+c & (b\gamma+c) & 0 \end{bmatrix}$ is a skew

symmetric matrix (where α, β, γ are distinct)

and the value of $\begin{vmatrix} (a+1)^2 & (1-a) & (2-c) \\ (3+c) & (b+2)^2 & (b+1)^2 \\ (3-b)^2 & b^2 & (c+3) \end{vmatrix}$

is λ then the value of $|10\,\lambda|$ is.....

Q. 90. Let $|z| = |z - 3| = |z - 4i|$, then the value $|2z|$ is.....

ANSWER-KEY

Physics

Q. No.	Answer	Q. No.	Answer
1	(3)	16	(4)
2	(2)	17	(1)
3	(1)	18	(4)
4	(2)	19	(1)
5	(4)	20	(1)
6	(4)	21	3.00
7	(3)	22	2.22
8	(3)	23	1.67
9	(1)	24	780
10	(2)	25	0.06
11	(3)	26	34.00
12	(2)	27	5.00
13	(1)	28	2.00
14	(2)	29	6.00
15	(3)	30	139

Chemistry

Q. No.	Answer	Q. No.	Answer
31	(1)	46	(3)
32	(2)	47	(4)
33	(4)	48	(4)
34	(3)	49	(4)
35	(4)	50	(3)
36	(3)	51	6.00
37	(2)	52	23080
38	(1)	53	1.81
39	(1)	54	9.00
40	(4)	55	0.733
41	(4)	56	20.00
42	(2)	57	87.16
43	(4)	58	1.823
44	(4)	59	2.00
45	(2)	60	22.40

Mathematics

Q. No.	Answer	Q. No.	Answer
61	(3)	76	(2)
62	(2)	77	(1)
63	(3)	78	(2)
64	(1)	79	(1)
65	(1)	80	(3)
66	(2)	81	2.00
67	(2)	82	5.00
68	(3)	83	1.00
69	(3)	84	8
70	(2)	85	$\frac{17}{8}$
71	(1)	86	5.00
72	(1)	87	7.00
73	(1)	88	7.00
74	(1)	89	600
75	(3)	90	5.00