MOCK TEST PAPER 1

Time : 3 Hours **Total Marks : 300**

General Instructions :

1. *There are three subjects in the question paper consisting of Physics (Q. no. 1 to 30), Chemistry (Q. no. 31 to 60) and Mathematics (Q. no. 61 to 90).*
2. *Each subject is divided into two sections. Section A consists of 20 multiple choice questions & Section B consists of 10 numerical value type questions. In Section B, candidates have to attempt any five questions out of 10.*
3. *There will be only one correct choice in the given four choices in Section A. For each question 4 marks will be awarded for correct choice, 1 mark will be deducted for incorrect choice for Section A questions and zero mark will be awarded for not attempted question.*
4. *For Section B questions, 4 marks will be awarded for correct answer and zero for unattempted and incorrect answer.*
5. *Any textual, printed or written material, mobile phones, calculator etc. is not allowed for the students appearing for the test.*
6. *All calculations / written work should be done in the rough sheet is provided with Question Paper.*

Physics

Section A

Q. 1. The position of a particle in x–y plane is described by the variables $x = at^3$ and $y = 2at$. Then the acceleration of the particle.....

(1) is $6a$ at $t = 0$ **(2)** is $6a$ at $t = 1$

(3) is $3a$ at $t = 0$ **(4)** is $3a$ at $t = 1$

Q. 2. Which of the following options may be the correct estimate of the mean free path of gas particles ? [n : Number of gas particle per unit volume, d : diameter]

(1) $\lambda = \dfrac{1}{d^2n^2}$ **(2)** $\lambda = \dfrac{n^2d}{\sqrt{2}}$

(3) $\lambda = \dfrac{nd^2}{\sqrt{2}}$ **(4)** $\lambda = \dfrac{1}{\sqrt{2}nd^2}$

Q. 3. The SI unit of Magnetic Permiability is :

(1) Am^{-1} **(2)** Am^{-2}

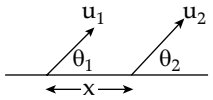
(3) Hm^{-1} **(4)** Hm^{-2}

Q. 4. If T be the total time of flight of a current of water and H be the maximum height attained by it from the point of projection, then H/T will be : (u = projection velocity, θ = projection angle)

(1) $\left(\frac{1}{2}\right)u\sin\theta$ **(2)** $\left(\frac{1}{4}\right)u\sin\theta$

(3) $u\sin\theta$ **(4)** $2u\sin\theta$

Q. 5. Two particles are projected simultaneously from the level ground as shown figure. They may collide after a time :



(1) $\dfrac{x\sin\theta_2}{u_1}$ **(2)** $\dfrac{x\sin\theta_2}{u_2}$

(3) $\dfrac{x\sin\theta_2}{u_1\sin(\theta_2-\theta_1)}$ **(4)** $\dfrac{x\sin\theta_2}{u_2\sin(\theta_2-\theta_1)}$

Q. 6. If a body of mass m is moving on a rough horizontal surface of coefficient of kinetic friction μ, the net electromagnetic force exerted by surface on the body is :

(1) $mg\sqrt{1+\mu^2}$ **(2)** μmg

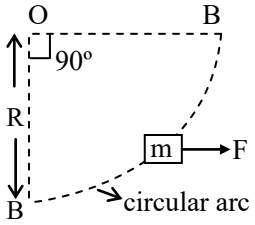
(3) mg **(4)** $mg\sqrt{1-\mu^2}$

Q. 7. An electric fan has blades of length 30 cm as measured from the axis of rotation. If the fan is rotating at 1200 r.p.m. The acceleration of a point on the tip of the blade is about :

(1) 1600 m/s^2 **(2)** 4740 m/s^2

(3) 2370 m/s^2 **(4)** 5055 m/s^2

Q. 8. A block of mass m is taken from A to B slowly under the action of a constant force F. Work done by this force is :



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

Q. 9. A monkey of mass 20 kg rides on a 40 kg trolley moving with constant speed of 8 m/s along a horizontal track. If the monkey jumps vertically to grab the overhanging branch of a tree, the speed of the trolley after the monkey has jumped off is :

(1) 8 m/s **(2)** 1 m/s
(3) 4 m/s **(4)** 12 m/s

Q. 10. A rod of mass 'm' hinged at one end is free to rotate in a horizontal plane. A small bullet of mass m/4 travelling with speed 'u' hits the rod and attaches to it at its centre. Find the angular speed of rotation of rod just after the bullet hits the rod 3.

[take length of the rod as 'l']

(1) $\frac{6}{19}\frac{u}{l}$ **(2)** $\frac{6}{13}\frac{u}{l}$

(3) $\frac{3}{19}\frac{u}{l}$ **(4)** $\frac{3}{13}\frac{u}{l}$

Q. 11. If R is the radius of the earth and g is the acceleration due to gravity on the earth's surface, the mean density of the earth is :

(1) $\frac{4\pi G}{3gR}$ **(2)** $\frac{3\pi R}{4gG}$

(3) $\frac{3g}{4\pi RG}$ **(4)** $\frac{Rg}{12G}$

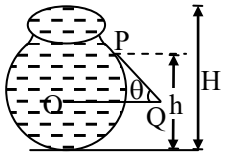
Q. 12. A particle is oscillating according to the equation X = 7 cos 0.5 πt, where 't' is in second. The point moves from the position of equilibrium to maximum displacement in time :

(1) 4.0 seconds **(2)** 2.0 seconds
(3) 1.0 seconds **(4)** 0.5 seconds

Q. 13. A metal wire of length L, area of cross section A and Young's modulus Y behaves as a spring of spring constant k given by:

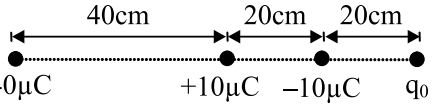
(1) k = YA/L **(2)** k = 2YA/L
(3) k = YA/2L **(4)** k = YL/A

Q. 14. Figure shows the vertical cross-section of a vessel filled with liquid of density ρ. The normal thrust per unit area on the walls of the vessel at point P, as shown will be :



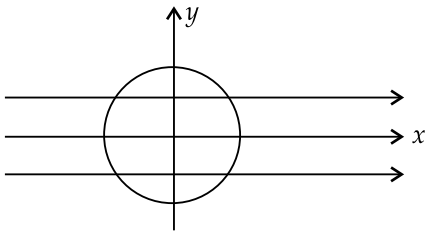
(1) $h\rho g$ **(2)** $(H-h)\rho g$
(3) $(H-h)\rho g\cos\theta$ **(4)** $H\rho g$

Q. 15. Four point charges are placed in a straight line with magnitude and separation as shown in the diagram. What should be the value of q_0 such that + 10μC charge is in equilibrium ?



(1) – 80 μC **(2)** + 40 μC
(3) + 80 μC **(4)** – 20 μC

Q. 16. A conducting loop of resistance R and radius r has its centre at the origin of the coordinate system in a magnetic field of induction B. When it is rotated about y-axis through 90°, the net charge flown in the loop is directly proportional to:

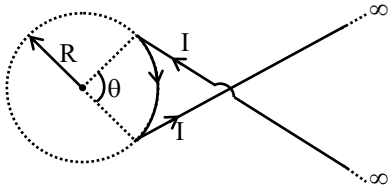


(1) R^{-1} **(2)** R **(3)** r^2 **(4)** r

Q. 17. In copper, each copper atom releases one electron. If a current of 1.1 A is flowing in the copper wire of uniform cross-sectional area of diameter 1 mm, then drift velocity of electrons will approximately be : (Density of copper = 9×10^3 kg /m^3, Atomic weight of copper = 63)

(1) 10.3 mm/s **(2)** 0.1 mm/s
(3) 0.2 mm/s **(4)** 0.2 cm/s

Q. 18. A wire carrying current i has the configuration shown in figure. For the magnetic field to be zero at the centre of the circle, θ must be :



(1) 1 radian **(2)** 2 radian
(3) π radian **(4)** 2π radian

Q. 19. When a clock is viewed in a mirror, the needles exhibit a time which appears to be 08:20. Then the actual time will be :

(1) 04:40 **(2)** 03:40
(3) 08:20 **(4)** 03:20

Q. 20. The value of angular momentum for He^+ ion in the first Bohr orbit is :

(1) $\frac{h}{2\pi}$ **(2)** $4 \times \frac{h}{2\pi}$

(3) $2 \times \frac{h}{2\pi}$ **(4)** nothing can be said

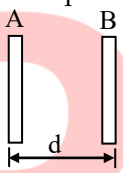
Section B

Q. 21. ^{23}Ne decays to ^{23}Na by negative beta emission. Mass of ^{23}Ne is 22.994465 amu mass of ^{23}Na is 22.989768 amu. The maximum kinetic energy of emitted electrons neglecting the kinetic energy of recoiling product nucleus is .....MeV

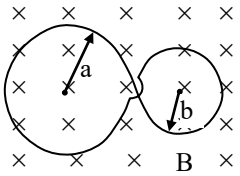
Q. 22. If photons of ultraviolet light of energy 12 eV are incident on a metal surface of work function of 4 eV, then the stopping potential (in eV) will be :

Q. 23. A light is entering from one medium refractive index $\left(\text{RI} = \frac{5}{3}\right)$ to another medium at an angle 30°. The angle of refraction for other medium is $\sin^{-1}\left(\frac{5}{6}\right)$. then the increase in angle of incidence is ....., such that the ray of light reflected back into the same medium.

Q. 24. Two plates A and B of a parallel plate capacitor are arranged in such a way, that the area of each plate is $S = 5 \times 10^{-3}$ m^2 and distance between them is d = 8.85 mm. Plate A has a positive charge $q_1 = 10^{-10}$ C and Plate B has charge $q_2 = +2 \times 10^{-10}$ C. Then the charge induced on the plate B due to the plate A be – (..... $\times 10^{-11}$)C



Q. 25. A plane loop is shaped in the form as shown in figure with radii $a = 20$ cm and $b = 10$ cm and is placed in a uniform time varying magnetic field $B = B_0 \sin \omega t$, where $B_0 = 10\ m$T and $\omega = 100$ rad/s. The amplitude of the current induced in the loop if its resistance per unit length is equal to 50×10^{-3} Ω/m. The inductance of the loop is negligible is ..... A.

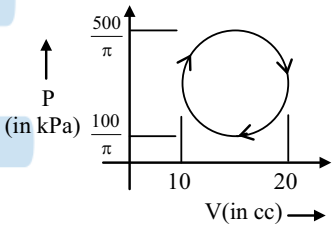


Q. 26. A series LCR circuit containing a resistance of 120 Ω has angular resonance frequency 4×10^5 rad s^{-1}. At resonance the voltage across resistance and inductance are 60 V and 40 V respectively. At what frequency the current in the circuit lags the voltage by 45°. Give answer in .....$\times 10^5$ rad s^{-1}.

Q. 27. On an X temperature scale, water freezes at –125°X and boils at 375°X. On a Y temperature scale, water freezes at –70°Y and boils at –30°Y. The value of temperature on X scale is..... on which value of temperature on y scale becomes 50° Y

Q. 28. A diatomic molecule can be modelled as two rigid balls connected with spring such that the balls can vibrate with respect to centre of mass of the system (spring + balls). Consider a diatomic gas made of such diatomic molecule. If the gas performs 20 Joule of work under isobaric condition, then heat given to the gas is ..... J.

Q. 29. Work done by gas in cyclic process is ..... J.



Q. 30. Drift speed of electrons, when 1.5 A of current flows in copper wire of cross sectional area 5 mm^2 is v_d. If the electron density of copper is 9×10^{28}/m^3. The value of v_d is ... $\times 10^{-5}$ m/s. (Take charge of electron 1.6×10^{-19}C).

Chemistry

Section A

Q. 31. At 25°C and 1 atm pressure, the enthalpy of combustion of benzene (l) and acetylene (g) are –3268 kJ mol^{-1} and –1300 kJ mol^{-1}, respectively. The change in enthalpy for the reaction $3\ C_2H_2\ (g) \rightarrow C_6H_6(l)$, is

(1) +324 kJ mol^{-1} **(2)** +632 kJ mol^{-1}

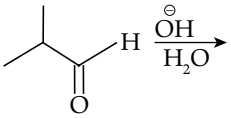
(3) –632 kJ mol^{-1} **(4)** –732 kJ mol^{-1}

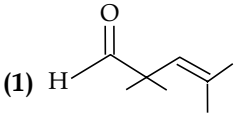
Q. 32. Which of the following options of species have identical shapes?

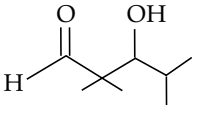
(1) $BeCl_2$, XeF_2, CO_2 **(2)** PF_5, IF_5, IF_7

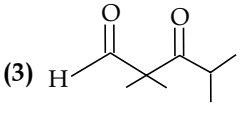
(3) BF_3, NH_3, PCl_3, **(4)** CF_4, SF_4, XeF_4

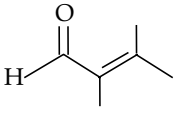
Q. 33. What is the major product of the following reation?



(1) 

(2) 

(3) 

(4) 

Q. 34. What is the pH of the solution, if the cell potential for the cell $Pt / H_2(g) / H^+(aq) // Cu^{2+}$ (0.01M)/ Cu(s) is 0.576V at 298K.
Given, $E^\circ_{Cu^{2+}/Cu} = 0.3V$.
(1) 4 **(2)** 9 **(3)** 6 **(4)** 2

Q. 35. Given below are two statements : One labelled as Assertion (A) and the other is labelled as Reason (R)
Assertion (A) : Thin layer chromatography is an adsorption chromatography.
Reason (R) : A thin layer of silica gel is spread over a glass plate suitable size in thin layer chromatography which acts as an adsorbent.
In the light of the above statements, choose the correct answer from the options given below:
(1) Both A and R are true and R is correct explanation of A.
(2) Both A and R are true but R is NOT the correct explanation of A.
(3) A is true but R is false.
(4) A is false but R is true.

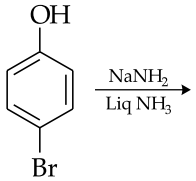
Q. 36. Find the work done when 2 moles of hydrogen expand isothermally from 15 to 50 litres against a constant pressure of 1 atm at 25°C.
(1) 847.0 cals **(2)** 847 k cal
(3) 84.7 cals **(4)** 84.7 k cal

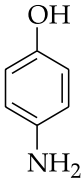
Q. 37. In which of the following species O.N. per atom of the underlined elements is/are equal to + 1?
(1) $\underline{S}_2O_3^{2-}$, $\underline{P}_3O_9^{3-}$ **(2)** $\underline{P}_3O_9^{3-}$, $\underline{N}_2O$
(3) $H_3\underline{P}O_2$, $\underline{Fe}_2O_3$ **(4)** $\underline{N}_2O$, $H_3\underline{P}O_2$

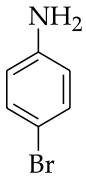
Q. 38. The decomposition of N_2O_4 to NO_2 was carried out in chloroform at 280°C. At equilibrium, 0.2 mol of N_2O_4 and 2 x 10^{-3} mol of NO_2 were present in 2 L of solution. The equilibrium constant for the reaction $N_2O_4 \rightleftharpoons 2NO_2$ is :
(1) 0.01×10^{-3} **(2)** 2.0×10^{-3}
(3) 2.0×10^{-5} **(4)** 1.0×10^{-5}

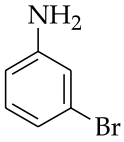
Q. 39. Boric acid (H_3BO_3) is :
(1) Monobasic and weak Lewis acid
(2) Tribasic and strong Lewis acid
(3) Monobasic and weak Bronsted acid
(4) Tribasic and weak Bronsted acid

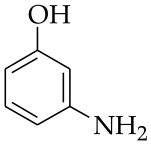
Q. 40. The major product of the following reaction is:



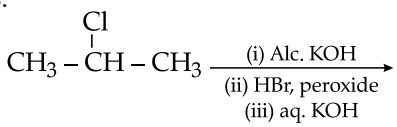
(1) 

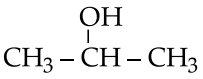
(2) 

(3) 

(4) 

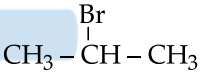
Q. 41. The major product of the following reaction is:



(1) 

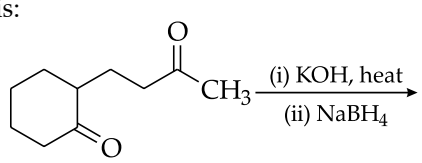
(2) $CH_3 - CH_2 - CH_2 - OH$

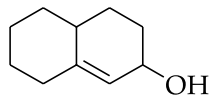
(3) $CH_3CH = CH_2$

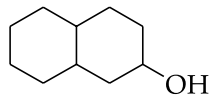
(4) 

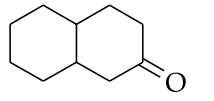
Q. 42. In S_N1 reactions, the correct order of reactivity for the following compounds: CH_3Cl, CH_3CH_2Cl, $(CH_3)_2CHCl$ and $(CH_3)_3CCl$ is:
(1) $(CH_3)_3CCl > (CH_3)_2CHCl > CH_3Cl > CH_3CH_2Cl$
(2) $(CH_3)_3CCl > (CH_3)_2CHCl > CH_3CH_2Cl > CH_3Cl$
(3) $CH_3Cl > (CH_3)_2CHCl > CH_3CH_2Cl > (CH_3)_3CCl$
(4) $CH_3Cl > CH_3CH_2Cl > (CH_3)_2CHCl > (CH_3)_3CCl$

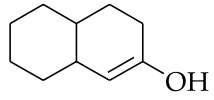
Q. 43. The major product of the following reaction is:



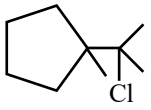
(1) 

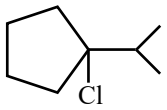
(2) 

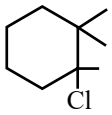
(3) 

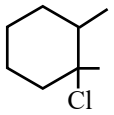
(4) 

Q. 44. Major product of the reaction is :

(1) 

(2) 

(3) 

(4) 

Q. 45. Among the following statements on the nitration of aromatic compounds, the false one is :

(1) The rate of nitration of benzene is almost the same as that of hexadeuterobenzene

(2) The rate of nitration of toluene is greater than that of benzene

(3) The rate of nitration of benzene is greater than that of hexadeuterobenzene

(4) Nitration is an electrophilic substitution reaction

Q. 46. To prepare 3-ethylpentane-3-ol, the reactants needed are :

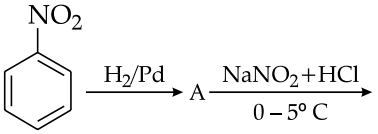
(1) $CH_3CH_2MgBr + CH_3COCH_2CH_3$

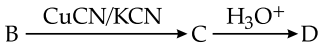
(2) $CH_3MgBr + CH_3CH_2CH_2COCH_2CH_3$

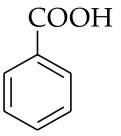
(3) $CH_3CH_2MgBr + CH_3CH_2COCH_2CH_3$

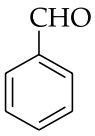
(4) $CH_3CH_2CH_2MgBr + CH_3COCH_2CH_3$

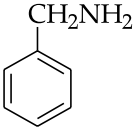
Q. 47. In a set of reactions nitrobenzene gave a product D. Identify the product D.

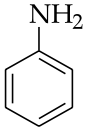




(1) 

(2) 

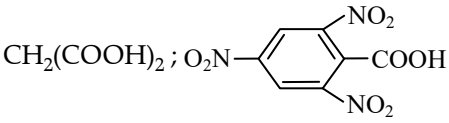
(3) 

(4) 

Q. 48. Give the order of decarboxylation of the following acid :

CH_3COOH; $CH_2=CH-CH_2-COOH$;

I II

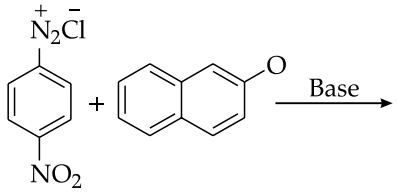


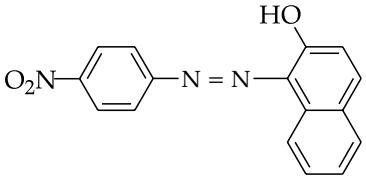
III IV

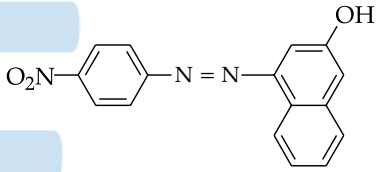
(1) I > II > III > IV **(2)** III > IV > II > I

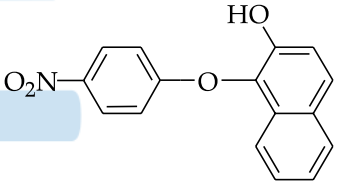
(3) IV > III > II > I **(4)** I > III > II > IV

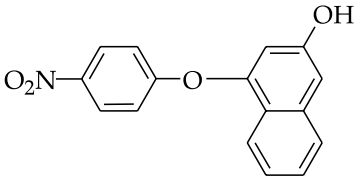
Q. 49. The major product of the following reaction is:



(1) 

(2) 

(3) 

(4) 

Q. 50. The number of asymmetric carbon atom in the glucose molecule in open and cyclic form is:

(1) Four, Five **(2)** Four, Four

(3) Five, Four **(4)** Five, six

Section B

Q. 51. The specific rate constant of the decomposition of N_2O_5 is 0.008 min^{-1}. The volume of O_2 collected after 20 minutes is 16 ml. The volume that would be collected at the end of reaction. NO_2 formed is dissolved in CCl_4 ..... mL.

Q. 52. The e.m.f. of cell Zn | $ZnSO_4$ || $CuSO_4$| Cu at 25°C is 0.03 V and the temperature coefficient of e.m.f. is -1.4×10^{-4} V per degree. The heat of reaction for the change taking place inside the cell is ..... kJ/mole.

Q. 53. The reaction between X and Y is first order with respect to X and zero order with respect to Y.

Experiment	[X] / mol L^{-1}	[Y] / mol L^{-1}	Initial rate / mol L^{-1} min^{-1}
I	0.1	0.1	2×10^{-3}
II	L	0.2	4×10^{-3}
III	0.4	0.4	$M \times 10^{-3}$
IV	0.1	0.2	2×10^{-3}

Examine the data of table and calculate ratio of numerical values of M and L. (Nearest Integer)

Q. 54. 2.4g coal is burnt in a bomb calorimeter in excess of oxygen at 298 K and 1 *atm* pressure. The temprature of the calorimeter rises from 298 K to 300 K. The enthalpy change during the combustion of coal is $-x$ kJ mol^{-1}. The value of x is _____(Nearest Integer).

Q. 55. If weight of the non-volatile solute urea (NH_2—CO—NH_2) to be dissolved in 100 g of water, in order to decrease the vapour-pressure of water by 25%, then the weight of the solute will be ..... g.

Q. 56. The osmotic pressure of blood is 7.47 bar at 300 K. To inject glucose to a patient intravenously, it has to be isotonic with blood. The concentration of glucose solution in gL^{-1} is _____.
(Molar mass of glucose = 180 g mol^{-1}
R = 0.083 L bar K^{-1} mol^{-1}) (Nearest integer)

Q. 57. Amongst BeF_2,BF_3, H_2O, NH_3, CCl_4 and HCl, the number of molecules with non-zero net dipole moment is _____.

Q. 58. The effective atomic number (EAN) of a metal carbonyl, $m(Co)_x$ is 36. The atomic number of the metal is 26. The value of 'x' is ..... .

Q. 59. The magnetic moment of central atom of $[Co(NH_3)_6]^{3+}$ is ……..

Q. 60. PCl_5 dissociates as
$PCl_5(g) \rightleftharpoons PCl_3(g)+Cl_2(g)$
5 moles of PCl_5 are placed in a 200 litre vessel which contains 2 moles of N_2 and is maintained at 600 K.
The equilibrium pressure is 2.46 atm. The equilibrium constant Kp for the dissociation of PCl_5 is _____$\times 10^{-3}$. (nearest integer)
(Given : R = 0.082 L atm K^{-1} mol^{-1}; Assume ideal gas behaviour)

Mathematics

Section A

Q. 61. Let $\hat{a}$, $\hat{b}$ be unit vectors. If $\vec{c}$ be a vector such that the angle between $\hat{a}$ and $\hat{c}$ is $\frac{\pi}{12}$ and $\hat{b} = \vec{c} + 2(\vec{c} \times \hat{a})$, then $|6\vec{c}|^2$ is equal to

(1) $6(3-\sqrt{3})$ **(2)** $3+\sqrt{3}$

(3) $6(3+\sqrt{3})$ **(4)** $6(\sqrt{3}+1)$

Q. 62. $2\sin\left(\frac{\pi}{22}\right)\sin\left(\frac{3\pi}{22}\right)\sin\left(\frac{5\pi}{22}\right)\sin\left(\frac{7\pi}{22}\right)\sin\left(\frac{9\pi}{22}\right)$
is equal to :

(1) $\frac{3}{16}$ **(2)** $\frac{1}{16}$ **(3)** $\frac{1}{32}$ **(4)** $\frac{9}{32}$

Q. 63. The mean of a data set consisting of 20 observations is 40. If one observation 53 was wrongly recorded as 33, then the correct mean will be

(1) 41 **(2)** 49 **(3)** 40.5 **(4)** 42.5

Q. 64. In a triangle ABC, in usual notation, $(a+b+c)(b+c-a) = \lambda bc$ will be true if

(1) $\lambda < 0$ **(2)** $\lambda > 0$

(3) $0 < \lambda < 4$ **(4)** $\lambda > 4$

Q. 65. In an equilateral triangle of side $2\sqrt{3}$ cm, the circum radius is

(1) 1 cm **(2)** $\sqrt{3}$ cm

(3) 2 cm **(4)** $2\sqrt{3}$ cm

Q. 66. The expression $\log_p \log_p \underbrace{\sqrt[p]{\sqrt[p]{\sqrt[p]{\ldots\ldots\sqrt[p]{p}}}}}_{n \text{ radical signs}}$
where $p \geq 2, p \in N$; $n \in N$ when simplified is

(1) independent of p

(2) independent of p and of n

(3) dependent on both p and n

(4) positive

Q. 67. The number of real solutions of the equation $\left(\frac{9}{10}\right)^x = -3 + x - x^2$ is

(1) 1 **(2)** 2 **(3)** 0 **(4)** 3

Q. 68. If $a_1, a_2, a_3, \ldots\ldots$ are an A.P. such that $a_1 + a_5 + a_{10} + a_{15} + a_{20} + a_{24} = 225$, then $a_1 + a_2 + a_3 + \ldots\ldots + a_{23} + a_{24}$ is equal to :

(1) 909 **(2)** 75

(3) 750 **(4)** 900

Q. 69. The middle term in the expansion of $(1-3x + 3x^2 - x^3)^6$ is

(1) ${}^{18}C_{10}\, x^{10}$ **(2)** ${}^{18}C_9\, (-x)^9$

(3) ${}^{18}C_9\, x^9$ **(4)** ${}^{18}C_9\, x^{10}$

Q. 70. If ${}^{m+n}P_2 = 90$ and ${}^{m-n}P_2 = 30$, then (m, n) is given by

(1) (7, 3) **(2)** (16, 8)

(3) (9, 2) **(4)** (8, 2)

Q. 71. The domain of function

$$f(x) = \frac{\sqrt{-\log_{0.3}(x-1)}}{\sqrt{x^2+2x+8}} \text{ is}$$

(1) (1, 4) **(2)** (–2, 4)

(3) (2, 4) **(4)** (2, ∞)

Q. 72. $\lim\limits_{x\to 0} \frac{\sqrt{1-\cos 2x}}{\sqrt{2}x}$ is

(1) 1 **(2)** –1

(3) zero **(4)** does not exist

Q. 73. If $f(x) = \begin{cases} 1 \text{ if } x \text{ is rational} \\ -1 \text{ if } x \text{ is irrational} \end{cases}$ is continuous on

(1) R **(2)** ϕ

(3) (–1, 1) **(4)** (–1, 0)

Q. 74. If $2^x + 2^y = 2^{x+y}$, then $\frac{dy}{dx}$ is equal to

(1) $\frac{\left(2^x+2^y\right)}{\left(2^x-2^y\right)}$ **(2)** $\frac{\left(2^x+2^y\right)}{\left(1+2^{x+y}\right)}$

(3) $2^{x-y}\cdot\frac{2^y-1}{1-2^x}$ **(4)** $\frac{\left(2^{x+y}-2^x\right)}{2^y}$

Q. 75. If m be the slope of a tangent to the curve $e^{2y} = 1 + 4x^2$, then

(1) $m < 1$ **(2)** $|m| \le 1$

(3) $|m| > 1$ **(4)** $|m| \ge 1$

Q. 76. $\int \frac{\left(a^x - b^x\right)^2}{a^x b^x}\, dx$ equals

(1) $\frac{\left(\frac{a}{b}\right)^x - \left(\frac{b}{a}\right)^x}{\ln\left(\frac{b}{a}\right)} + 2x + c$

(2) $\frac{\left(\frac{a}{b}\right)^x - \left(\frac{b}{a}\right)^x}{\ln\left(\frac{a}{b}\right)} + 2x + c$

(3) $\frac{\left(\frac{a}{b}\right)^x - \left(\frac{b}{a}\right)^x}{\ln\left(\frac{b}{a}\right)} - 2x + c$

(4) $\frac{\left(\frac{a}{b}\right)^x - \left(\frac{b}{a}\right)^x}{\ln\left(\frac{a}{b}\right)} - 2x + c$

Q. 77. $\int_0^{\pi/4} \frac{\sec^2 x}{(1+\tan x)(2+\tan x)}\, dx$ equals

(1) $\log_e \frac{2}{3}$ **(2)** $\log_e 3$

(3) $\frac{1}{2}\log_e \frac{4}{3}$ **(4)** $\log_e \frac{4}{3}$

Q. 78. Area bounded by $y = \sec^2 x$, $x = \frac{\pi}{6}$, $x = \frac{\pi}{3}$ and x- axis is

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

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

Q. 79. The solution of the differential equation $(1 + y^2) + (x - e^{\tan^{-1} y})\frac{dy}{dx} = 0$, is

(1) $xe^{2\tan^{-1} y} = e^{\tan^{-1} y} + k$

(2) $(x-2) = ke^{2\tan^{-1} y}$

(3) $2xe^{\tan^{-1} y} = e^{2\tan^{-1} y} + k$

(4) $xe^{\tan^{-1} y} = \tan^{-1} y + k$

Q. 80. The smallest positive integer n for which $\left(\frac{1+i}{1-i}\right)^n = -1$ is

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

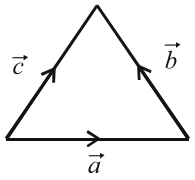
Section B

Q. 81. Two boxes are containing 20 balls each and each ball is either black or white. The total number of black balls in the two boxes is different from the total number of white balls. One ball is drawn at random from each box and the probability that both are white is 0.21 and the probability that both are black is k, then $\frac{100k}{13}$ is equal to ..... .

Q. 82. Let $A=\begin{bmatrix}1 & a & a\\ 0 & 1 & b\\ 0 & 1 & 1\end{bmatrix}$, $a, b \in R$. If for some $n \in N$, $A^n=\begin{bmatrix}1 & 48 & 2160\\ 0 & 1 & 96\\ 0 & 0 & 1\end{bmatrix}$, then $n + a + b$ is equal to

Q. 83. If A is a square matrix such that $A(\text{adj}A)=\begin{bmatrix}3 & 0 & 0\\ 0 & 3 & 0\\ 0 & 0 & 3\end{bmatrix}$, then $\frac{|\text{adj}(\text{adj}A)|}{|\text{adj}A|}$ is equal to ..... .

Q. 84. If $\vec{a}=(\lambda x)\hat{i}+(y)\hat{j}+(4z)\hat{k}$, $\vec{b}=y\hat{i}+x\hat{j}+3y\hat{k}$, $\vec{c}=-z\hat{i}-2z\hat{j}-((\lambda+1)x)\hat{k}$ are sides of triangle as shown is figure then value of λ is ..... . (where x, y, z are not all zero)



Q. 85. If the shortest distance between the lines $\vec{r}=(-\hat{i}+3\hat{k})+\lambda(\hat{i}-a\hat{j})$ and $\vec{r}=(-\hat{j}+2\hat{k})+\mu(\hat{i}-\hat{j}+\hat{k})$ is $\sqrt{\frac{2}{3}}$, then the integral value of a is equal to _____.

Q. 86. A rectangle PQRS has sides $\overline{PQ}$ = 11 and QR = 5. A triangle ABC has P as orthocentre, Q as circumcentre, R as mid point of BC and S as the foot of altitude from A. Then length of BC is k, where $k/4$ is equal to ..... .

Q. 87. If two circles $x^2+y^2+2n_1x+2y+\frac{1}{2}=0$ and $x^2+y^2+n_2x+n_2y+n_1=\frac{1}{2}$, intersect each other orthogonally where $n_1, n_2 \in I$, then number of possible of ordered pairs (n_1, n_2) is ..... .

Q. 88. Let a variable point A be lying on the directrix of parabola $y^2 = 4ax$ ($a > 0$). Tangents AB and AC are drawn to the curve where B and C are points of contact of tangents. The locus of centroid of ΔABC is a conic whose length of latus rectum is λ, then $\frac{\lambda}{a}$ is equal to .....

Q. 89. The ratio of the area of the ellipse and the area enclosed by the locus of mid-point of PS where P is any point on the ellipse and S is the focus of the ellipse, is equal to .....

Q. 90. If the radii of director circles of $\frac{x^2}{a^2}+\frac{y^2}{b^2}=1$ and $\frac{x^2}{a^2}-\frac{y^2}{b^2}=1$ ($a > b$) are $2r$ and r respectively, then $\frac{e_2^2}{e_1^2}$ is equal to (where e_1, e_2 are their eccentricities respectively)