Competishun

52/6, Opposite Metro Mas Hospital, Shipra Path, Mansarovar

Date: 16/09/2024

Time: 3 hours **Max. Mark**

PRAVEEN-2_(24-25)_ACT-3_PAPER-2

Physics

Multiple Choice Question

Q1 The x-coordinate of a particle moving on x-axis is given by x = 3 sin 100t + 8 $\cos^2$ 50t, where x is in cm and t is time in seconds. Which of the following is/are correc about this motion.

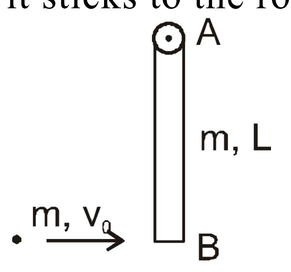
a) the motion of the particle is not S.H.M.

b) the amplitude of the S.H.M. of the particle is 5 cm

c) the amplitude of the resultant S.H. M. is $\sqrt{73}$ cm

d) the maximum displacement of the particle from the origin is 9 cm.

Q2 A thin uniform rod is free to rotate about a fixed smooth horizontal axis as shown. point mass hits horizontally with velocity v_0 to the one end B of the rod. When it h it sticks to the rod, then :



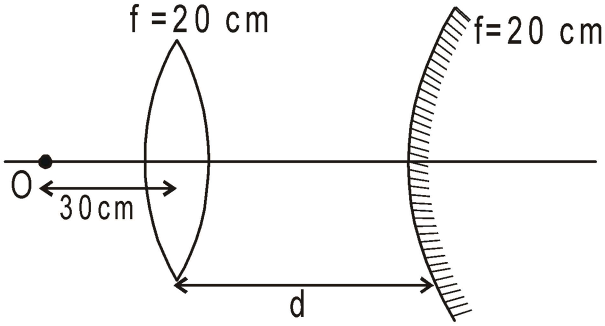
a) Minimum value of v_0 for the rod to rotate by an angle $\frac{\pi}{2}$ is $2\sqrt{gL}$.

b) Angular acceleration of the rod when the rod is horizontal is $\frac{9g}{8L}$.

c) Force applied by the axis on the rod in the horizontal state is 5 mg/16

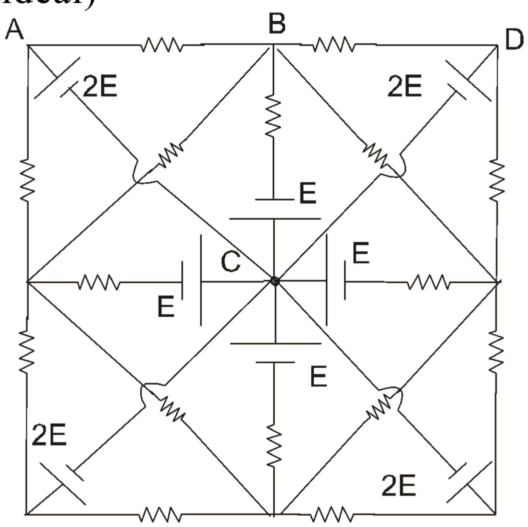
d) For a small value of v_0 the rod performes small oscillations with a period of $\frac{4}{3}\pi$

Q3 A convex lens and convex mirror are placed coaxially and seperated by distance d The focal length of both is 20 cm each. A point object is placed at a distance 30 cn from lens as shown. Then the value of d so that image is formed on the object itsel



a) 10 cm **b)** 60 cm **c)** 30 cm **d)** 20 cm

Q4 Consider the circuit shown in the figure. If E = 4 Volts and each resistance is 1 Ω . Take $V_C = 0$ Volt then choose correct options for the given situation (All batteries ideal)



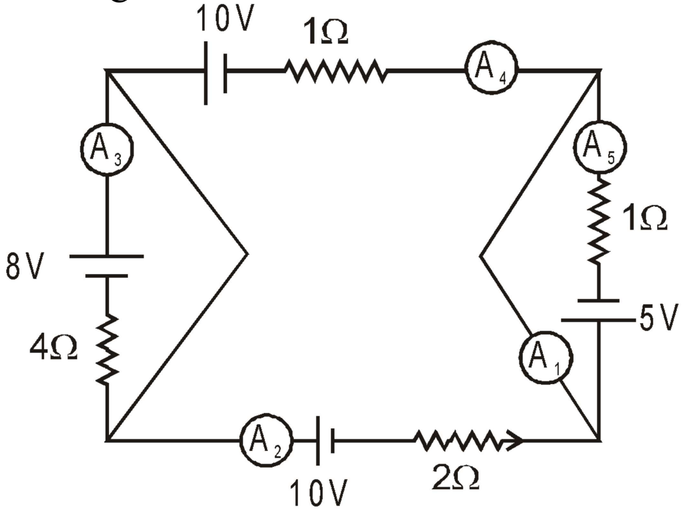
a) Magnitude of current in AB is 4 amp.

b) Magnitude of current in BC is 8 am

c) Potential at A in 8 volt

d) Potential at B in 4 volt

Q5 In the given circuit all ammeters are ideal. Then choose correct statement.



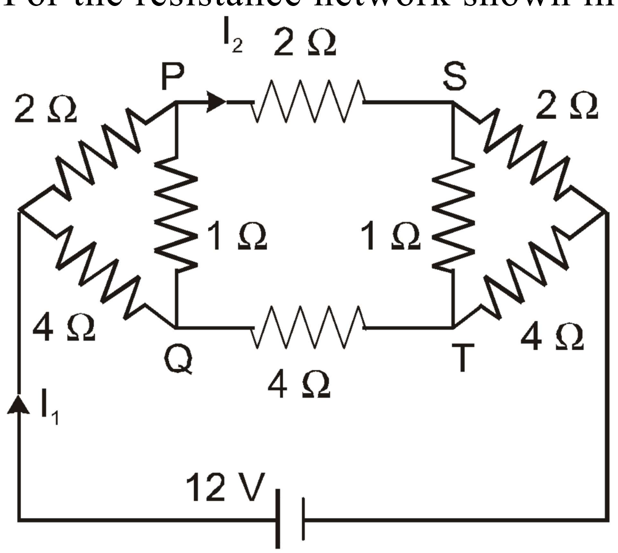
a) Reading of A_2 = Reading of A_5.

b) Reading of A_2 and Reading of A_4 both are zero.

c) Reading of A_1 is 5 amp

d) Reading of A_1 = 2.5 times reading of A_3.

Q6 For the resistance network shown in the figure, choose the correct option(s).



a) The current through PQ is zero.

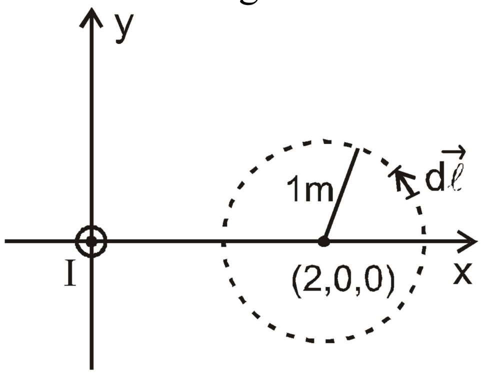
b) $I_1 = 3$ A.

c) The potential at S is less than that at Q.

d) $I_2 = 2$ A.

Single Choice Question

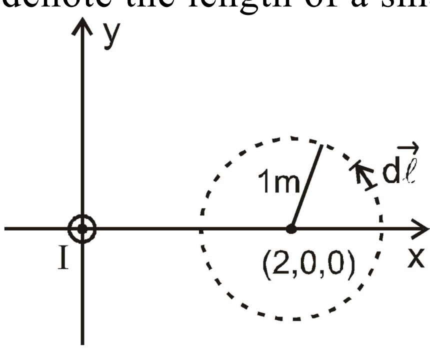
Q7 An infinitely long wire lying along z-axis carries a current I, flowing towards posi z-direction. There is no other current, consider a circle in x-y plane with centre at (meter, 0, 0) and radius 1 meter. Divide the circle in small segments and let $d\vec{\ell}$ denote the length of a small segment in anticlockwise direction, as shown.



The path integral $\oint \vec{B}\cdot d\vec{\ell}$ of the total magnetic field $\vec{B}$ along the perimeter of the given circle is,

a) $\frac{\mu_0 I}{8}$ **b)** $\frac{\mu_0 I}{2}$ **c)** $\mu_0 I$ **d)** 0

Q8 An infinitely long wire lying along z-axis carries a current I, flowing towards posi z-direction. There is no other current, consider a circle in x-y plane with centre at (meter, 0, 0) and radius 1 meter. Divide the circle in small segments and let $d\vec{\ell}$ denote the length of a small segment in anticlockwise direction, as shown.



Consider two points A(3,0,0) and B(2,1,0) on the given circle. The path integral $\int_A^B \vec{B}\cdot d\vec{\ell}$ of the total magnetic field $\vec{B}$ along the perimeter of the given circle from A to B is,

a) $\frac{\mu_0 I}{\pi}\tan^{-1}\frac{1}{2}$ **b)** $\frac{\mu_0 I}{2\pi}\tan^{-1}\frac{1}{2}$ **c)** $\frac{\mu_0 I}{2\pi}\sin^{-1}\frac{1}{2}$ **d)** 0

Q9 A non uniform but spherically symmetric distribution of charge has a charge densi ρ(r) given as follows

$\rho(r) = \rho_o(1-\frac{r}{R})$ for $r \le R$

$\rho(r) = 0$ for $r \ge R$

ρ_0 is a positive constant $= \frac{3Q}{\pi R^3}$

Total charge contained in charge distribution

a) –Q **b)** -2Q **c)** Q **d)** 2Q

Q10 A non uniform but spherically symmetric distribution of charge has a charge densi ρ(r) given as follows

$\rho(r) = \rho_o(1-\frac{r}{R})$ for $r \le R$

$\rho(r) = 0$ for $r \ge R$

ρ_0 is a positive constant $= \frac{3Q}{\pi R^3}$

Electric field in region $r \ge R$ is equal to

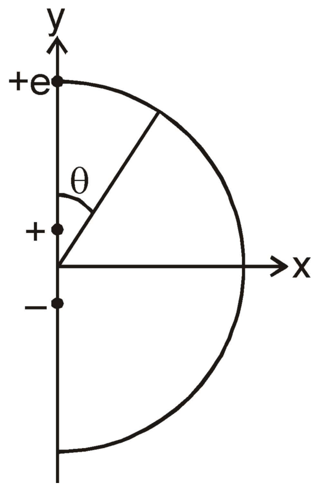
a) $\frac{Q}{4\pi\varepsilon_0 r^2}$ **b)** $\frac{Q}{4\pi\varepsilon_0 (R+r)^2}$ **c)** $\frac{Q}{4\pi\varepsilon_0 (R-r)^2}$ **d)** Zero

Numerical

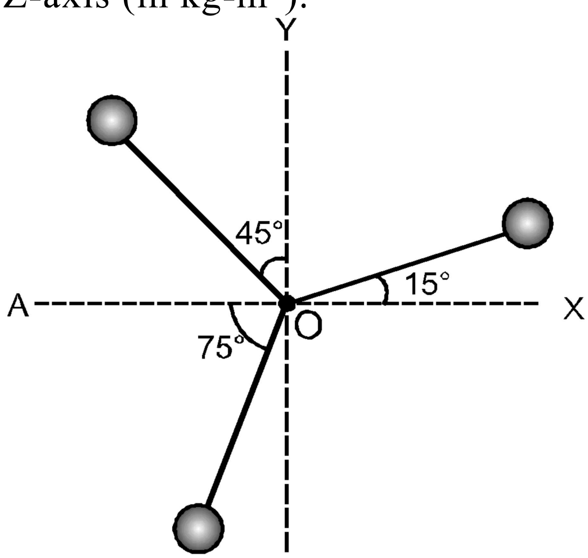
Q11 Two particles of total mass 3kg are separated by a distance 1m. Find the magnitud acceleration of one particle with respect to other in Å/s^2. Given G = $\frac{20}{3} \times 10^{-11}$ S.I units.

Q12 A positive charge $+q_1$ is located to the left of a negative charge $-q_2$. On a line pass through the two charges, there are two places where the total potential is zero. The reference is assumed to be at infinity. The first place is between the charges and is 4.00 cm to the left of the negative charge. The second place is 7.00 cm to the right the negative charge. If $q_2 = -12/11$ μC, what is the value of charge q_1 in μC.

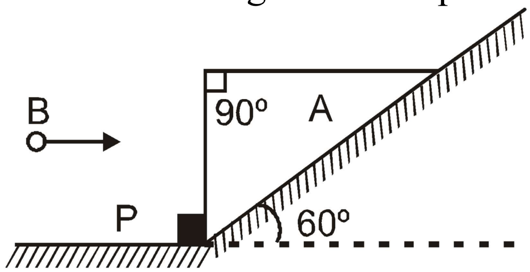
Q13 In figure shown below, a particle of charge +e is initially at coordinate 16 nm on tl dipole axis. The origin of y is at the dipole centre. The particle is then moved alon circular path around the dipole centre until it is at coordinate y = – 16 nm. The wo: done by the external force in moving the particle slowly is -9×10^{-30} J. Find dipc moment and express your answer in multiple of 10^{-38} C-m. ($e = 1.6 \times 10^{-19}$ C)



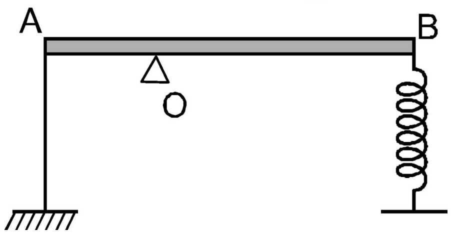
Q14 Each point mass 2 kg is connected at the end of each uniform rod of length 1 m an mass 1 kg. All the masses are in XY plane. Find the moment of inertia of system a Z-axis (in kg-m^2).



Q15 A wedge A of mass 1kg is held at rest on the smooth incline plane of inclination 6(from the horizontal by an stopper P. A bullet B of mass 500 grams, travelling horizontally with 90 m/s strikes the wedge as shown. Assuming all the impacts are perfectly inelastic and duration of impact is negligible. Find the velocity in m/s wi which the wedge moves up the incline just after collision.

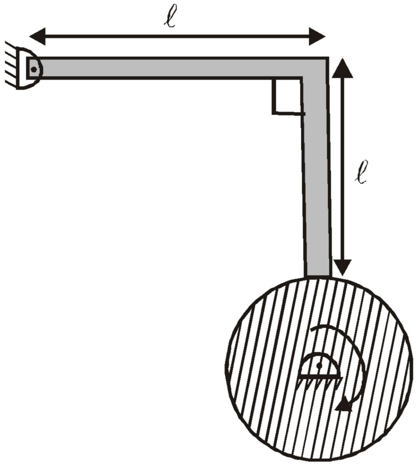


Q16 A uniform rod AB of mass 2kg and length 1m is placed on a sharp support O such AO = 0.4 m and OB = 0.6 m. A spring of force constant k = 600 N/m is attached tc end B. To keep the rod horizontal, its end A is tied with a thread such that spring is elongated by 1cm. If reaction of support O on the rod when thread is burnt is R the find the value of $\frac{R}{10}$.



Q17 A binary star has a time period 3 years (time period of earth is one year) while distance between these two stars is 9 times distance between the earth and the sun. Mass of one star is equal to mass of the sun and mass of other star is 20n times ma of the sun then calculate n.

Q18 Figure shows a uniform rigid rod of 'L' shape whose mass is 'm' and is lying in a vertical plane. It is hinged at one end and the other rod is rubbing with a rotating s cylinder of mass m and radius R = 1m. If the initial angular velocity of the cylinde 50 rad/sec., after how much time (in seconds) will the cylinder stop rotating. (Co–efficient of friction between the rod and the cylinder is $\mu = 0.5$, Take $g = 10\ m/s^2$)



Chemistry

Multiple Choice Question

Q19 Which of the following is/are ambident nucleophile(s) ?

a) NO_2^- **b)** $CN^{\ominus}$ **c)** $NaHSO_3$ **d)** $Cl^{\ominus}$

Q20 In which of following silicate(s), the number of corners shared per tetrahedron is ≥

a) Four membered cylic silicate **b)** Pyrosilicate

c) Chain silicate **d)** 2-D silicate

Q21 Which of the following is/are correct?

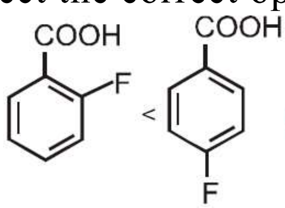
a) vander Waal's radius of iodine is more than its covalent radius

b) All isoelectronic ions belong to the same period of periodic table

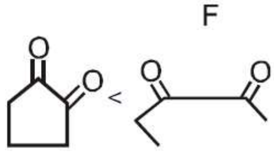
c) First ionisation energy of Be is more than that of C

d) Electron affinity of N as well as noble gases is negative.

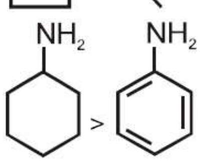
Q22 Select the correct options:

a) 

(pKa order)

b) 

(% enol content)

c) 

(Kb order))

d) Both the C – O bond lengths in HCOOK are equal

Q23 On electrolysis, in which of the following, O_2 would be liberated at the anode ?

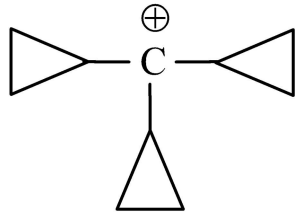
a) dilute H_2SO_4 with Pt electrodes

b) aqueous $AgNO_3$ solution with Pt electrodes

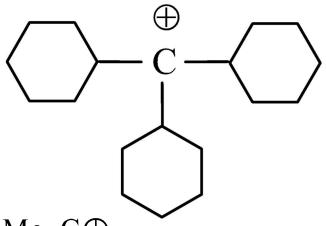
c) dilute H_2SO_4 with Cu electrodes

d) aqueous NaOH with a Fe cathode & a Pt anode

Q24 For carbocations

(I) 

(II) $Ph_3C^{\oplus}$

(III) 

(IV) $Me_3C^{\oplus}$

The correct order of stability is –

a) I > II **b)** III > I **c)** IV > III **d)** IV > I

Single Choice Question

Q25 Solution of an acid and it's anion (that is, it's conjugate base) or of a base and it's common cation are buffered. When we add a small amount of acid or base to any c of them, the pH of solution changes very little. pH of buffer solution can be compu as

For acidic buffer : $pH=pK_a + \log \frac{[\text{conjugate base}]}{[\text{acid}]}$

For basic buffer : $pOH=pK_b + \log \frac{[\text{conjugate acid}]}{[\text{base}]}$

It is generally accepted that a solution has useful buffer capacity (pH change resist power) provided that the value of [salt or conjugate base] / [acid] for acidic buffer within the range of 1 : 10 to 10 : 1. Buffer capacity is maximum when [conjugate base] = [acid]

Select correct statement -

a) when we add small amount of NaOH in acidic buffer solution, pOH is increase

b) when we add small amount of NaOH in basic buffer solution, pH of solution is increased

c) when we add small amount of water in acidic buffer solution, pH of solution is decreases

d) when 100 ml of 0.2 M CH_3COOH react with 200 ml of 0.1 M NaOH buffer solution is formed.

Q26 Solution of an acid and it's anion (that is, it's conjugate base) or of a base and it's common cation are buffered. When we add a small amount of acid or base to any c of them, the pH of solution changes very little. pH of buffer solution can be compu as

For acidic buffer : $pH=pK_a + \log \frac{[\text{conjugate base}]}{[\text{acid}]}$

For basic buffer : $pOH=pK_b + \log \frac{[\text{conjugate acid}]}{[\text{base}]}$

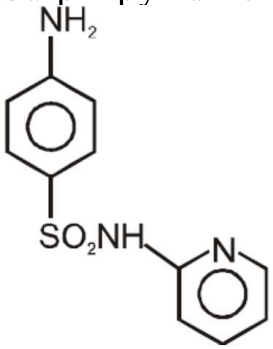
It is generally accepted that a solution has useful buffer capacity (pH change resist power) provided that the value of [salt or conjugate base] / [acid] for acidic buffer within the range of 1 : 10 to 10 : 1. Buffer capacity is maximum when [conjugate base] = [acid]

Fixed volume of 0.1 M benzoic acid ($pK_a = 4.2$) solution is added into 0.2 M sodiu benzoate solution & formed a 300 mL, resultant acidic buffer solution. If pH of thi buffer solution is 4.5 then find added volume of benzoic acid -

a) 100 ml **b)** 200 ml **c)** 50 ml **d)** 300 ml

Q27 Sulphur forms numerous compounds and show variety of oxidation states. It also exhibit a good tendency of catenation. It forms variety of oxoacids and oxoanions also. Sulphur also occur in several biomolecules and is also used in chemotherapy sulphadrugs.

Sulphapyridine was shown to be effective drug against pneumonia



(Sulphapyridine)

What is the hybridization of 'S' in this compound.

a) sp^2 **b)** sp^3d **c)** sp^3 **d)** sp^3d^2

Q28 Sulphur forms numerous compounds and show variety of oxidation states. It also exhibit a good tendency of catenation. It forms variety of oxoacids and oxoanions also. Sulphur also occur in several biomolecules and is also used in chemotherapy sulphadrugs.

Among the following compounds of sulphur, which contain sulphur–sulphur bond'

a) $H_2S_2O_5$ **b)** $H_2S_2O_3$ **c)** $Na_2S_4O_6$ **d)** CaS_2O_7

Numerical

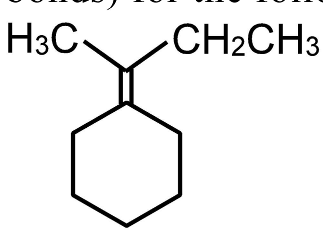
Q29 $\Delta_{vap} H^{\ominus}$ for water is $+40.49$ kJ mol^{-1} at 1 bar and $100^{\circ}C$. Change in internal energy for this vapouris
under same condition is_______kJ
mol^{-1}. (Integer answer)
(Given $R = 8.3 JK^{-1} mol^{-1}$)

Q30 An organic compound contains C, H and O atoms. One molecule of the compound contains H-atoms equal to 66.67 % of total atoms and mass ratio of C to O is 3:2. I the molecular formula of the compound is $C_xH_yO_z$, what is the value of X + Y + Z (Given vapour density of compound is 23 g/mol)

Q31 Number of compounds with one lone pair of electrons on central atom amongst following is O_3, H_2O, SF_4, ClF_3, NH_3, BrF_5, XeF_4

Q32 Equilibrium constant for the given reaction is $K = 10^{20}$ at temperature 300 K
$A(s) + 2B\ (aq.) \rightleftharpoons 2C\ (s) + D\ (aq.)\ K = 10^{20}$
Calculate the equilibrium concentration of B (in mol/L) starting with mixture of 1 mole of A and 1/2
mole/litre of B in a container of volume 1L at 300 K
(Give your answer by multiplying it with 10^{12})

Q33 The total number of contributing structures showing hyperconjugation (involving (bonds) for the following compound is :



Q34 Consider the sulphides HgS, PbS, CuS, Sb_2S_3, As_2S_3 and CdS. Number of these sulphides soluble in 50% HNO_3 is ________.

Q35 N_2O_3 dissociates into NO and NO_2. At equilibrium pressure of 3 atm, all three gas were found to have equal number of moles in a vessel. In another vessel, equimola mixture of N_2O_3, NO and NO_2 are taken at the same temperature but at an initial pressure of 9 atm then find the partial pressure of NO_2 (in atm) at equilibrium in second vessel.
$N_2O_3(g) \rightleftharpoons NO(g) + NO_2(g)$

Q36 A structural isomer of Saturated hydrocarbon of molecular formula C_6H_{12} gives maximum number of mono chloro products (excluding stereoisomers) amongst all possible structural isomers of saturated hydrocarbon. Isomer contains X number of carbons in the ring , Y number of substituents and form Z number of mono chloro products(excluding stereoisomers).
Value of X × Y × Z is -

Mathematics

Multiple Choice Question

Q37 Which of the following functions is/are periodic?

a) $f(x)=\begin{cases} 1 & , x \text{ is integer} \\ 0, & x \text{ is non}-\text{integer} \end{cases}$

b) $f(x)=\begin{cases} x-[x] & ; 2n \le x < 2n+1 \\ \frac{1}{2} & ; 2n+1 \le x < 2n+2 \end{cases}$; where [.] denotes the greatest integer function

c) $f(x)=(-1)^{\left[\frac{2x}{\pi}\right]}$, where [.] denotes the greatest integer function

d) $f(x) = x - [x + 3] + \tan\left(\frac{\pi x}{2}\right)$, where [.] denotes the greatest integer function

Q38 Let C_1 and C_2 are circles defined by $x^2 + y^2 - 20x + 64 = 0$ and $x^2 + y^2 + 30x + 14$ 0. PQ is a common tangent where P and Q are points of contact on circles C_1 and (respectively, then –

a) number of common tangents of both circles is 3

b) number of common tangents of both circles is 4

c) the maximum length of PQ is 25

d) The shortest length of PQ is 20

Q39 The third term of a G.P. is 64. The product of first five terms is :

a) 4^{15}

b) $\frac{2^{33}}{8}$

c) 2^{15}

d) $\frac{2^{17}}{4}$

Q40 Family of lines represented by the equation $(\cos\theta + \sin\theta)x + (\cos\theta - \sin\theta)y - 3($ $\cos\theta + \sin\theta) = 0$ passes through a fixed point M for all real values of θ, then –

a) The reflection of M in the line $x - y = 0$ is (3, 6)

b) The reflection of M in the line $x - y = 0$ is (6, 3)

c) Equation of line passes through (1, 2) and at maximum distance from M is 5x + = 7

d) Equation of line passes through (1, 2) and at maximum distance from M is x – + 9 = 0

Q41 Let sum of all possible products of first 25 natural numbers taken two at a time is ' then k is divisible by –

a) 5 b) 7 c) 11 d) 13

Q42 Let a, x, b are in A.P., a, y, b are in G.P. and a, z, b are in H.P. If x = y + 2 and a = then (where a, b, c ∈ R^+)

a) $x > y > z$ b) $y^2 = xz$ c) $a = 9$ d) $b = 9$

Single Choice Question

Q43 Consider a function f defined by $f(x) = \sin^{-1} \sin\left(\frac{x + \sin x}{2}\right)$, $\forall\, x \in [0, \pi]$, which satisfies $f(x) + f(2\pi - x) = \pi$, $\forall\, x \in [\pi, 2\pi]$ and $f(x) = f(4\pi - x)$ for all $x \in [2\pi, 4\pi]$, then.

If α is the length of the largest interval on which f(x) is increasing, then α -

a) $\pi/2$ b) π c) 2π d) 4π

Q44 Consider a function f defined by $f(x) = \sin^{-1} \sin\left(\frac{x + \sin x}{2}\right)$, $\forall\, x \in [0, \pi]$, which satis $f(x) + f(2\pi - x) = \pi$, $\forall\, x \in [\pi, 2\pi]$ and $f(x) = f(4\pi - x)$ for all $x \in [2\pi, 4\pi]$, then.

If f(x) is symmetric about x = β, then β =

a) $\alpha/2$ b) α c) $\alpha/4$ d) 2α

Q45 Least positive integral solution (x_1) of the inequality $\frac{5x+8}{4-x} < 2$ is a root of the equation f(x) = 0 where $f(x) = \frac{a}{5}x^2 - \left(\frac{a^2-1}{5}\right)x - 1$ at [0, 1]. Then

Possible values of 'x_1' is (are):

a) 0 b) 4 c) 1 d) 5

Q46 Least positive integral solution (x_1) of the inequality $\frac{5x+8}{4-x} < 2$ is a root of the equation f(x) = 0 where f(x) = $\frac{a}{5}x^2 - \left(\frac{a^2-1}{5}\right)x - 1$ at [0, 1]. Then

Possible values of 'a' is/are

a) 0,5 **b)** 0 **c)** 1/2 **d)** None

Numerical

Q47 The period of the function f(x) = $\left(\sec^2\left(\frac{\pi x}{10}\right) - \tan^2\left(\frac{\pi x}{10}\right)\right)^{\cos^4 4\pi x + 100\{x\}}$ (where {·} den fractional part function) is λ, then (λ/2) is equal to

Q48 If $\tan^{-1}\left(x+\frac{2}{x}\right) - \tan^{-1}\left(x-\frac{2}{x}\right) = \tan^{-1}\frac{4}{x}$ then value of $2x^4 - 3x^2$ is equal to

Q49 If both roots of equation $4x^2 - 20px + 25p^2 + 15p - 66 = 0$ are greater than 2, then sum of all possible integral values of p is —

Q50 Let A be the set of all positive integers greater than or equal to 8 and let f : A → A a function such that f(x + y) = f(xy) ∀ x ≥ 4, y ≥ 4, if f(16) = 9 then f(9)

Q51 A circle passing through the points A (1, –1) and B(3, 1) but not passing through origin is touching the line 3x + y = 0. The equation of this circle is $x^2 + y^2 + ax +$ l c = 0 then a + b + c.

Q52 Coefficient of "–x' in f (x) = $\begin{vmatrix} x & (1+\sin x)^3 & \cos x \\ 1 & \log(1+x) & 2 \\ x^2 & (1+x)^2 & 0 \end{vmatrix}$ is -

Q53 The line 2x + 3y = 6 cuts x-axis at A and y-axis at B. The line Kx + 8y = 11 cuts x- axis at A' and y-axis at B'. If K_1 and K_2 are the values of K for which points A, B, B' are concyclic ($K_1 > K_2$), then the value of $3K_2 - \frac{K_1}{4}$ is

Q54 Let S be the region consistiting of points (x, y) satisfying the inequality $x^2 + y^2 -$
$8y + 21 \leq 0$ and x, y ∈ R. Let minimum and maximum value of $\frac{y}{x}$ be m & M respectively, where (x, y) ∈ S. Then value of $\frac{5}{4}Mm$ is.

Answer Key

Que.	1	2	3	4	5	6	7	8	9	1
Ans.	**B, D**	**A, B, C**	**B, D**	**A, B, C, D**	**B, C, D**	**A, B, C, D**	**D**	**B**	**C**	[illegible]

Que.	11	12	13	14	15	16	17	18	19	2
Ans.	**2**	**04**	**80**	**07**	**20**	**02**	**04**	**10**	**A, B, C**	**A,**
Que.	21	22	23	24	25	26	27	28	29	3
Ans.	**A, D**	**A, C, D**	**A, B, D**	**A, C**	**B**	**B**	**C**	**C**	**38**	[illegible]
Que.	31	32	33	34	35	36	37	38	39	4
Ans.	**04**	**50**	**09**	**04**	**02**	**36**	**A, B, C, D**	**B, D**	**A, B**	**A**

Que.	41	42	43	44	45	46	47	48	49	5
Ans.	**A, B, C, D**	**A, B, C**	**C**	**B**	**D**	**B**	**05**	**02**	**07**	[illegible]

Que.	51	52	53	54
Ans.	**06**	**02**	**08**	**03**