Competishun

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

Date: 23/09/2024

Time: 3 hours **Max. Mark**

PRATHAM-1 (24-25)_ACT-3_PAPER-1

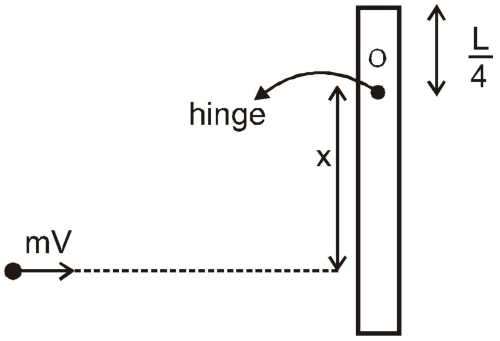
Physics

Single Choice Question

Q1 A particle executes S.H.M. of amplitude A along x-axis. At t = 0, the position of th particle is $x = \frac{A}{2}$ and it moves along positive x-axis the displacement of particle in time t as the function of x = A sin (ωt + δ), then the value δ will be :

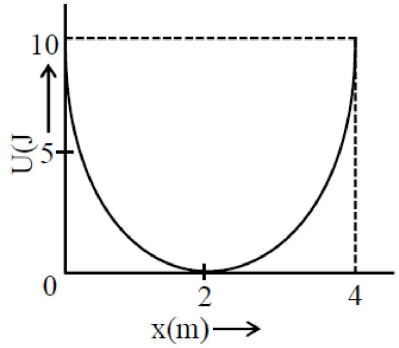
a) $\frac{\pi}{6}$ **b)** $\frac{\pi}{3}$ **c)** $\frac{\pi}{4}$ **d)** $\frac{\pi}{2}$

Q2 A vertical rod of mass m and length L is hinged at point 'O' as shown in figure. It i free to rotate in a vertical plane about a horizontal axis passing through hinge. A b of same mass moving horizontally with velocity V collides at a distance x from hi Then value of x so that linear impulse from the hinge is zero is :



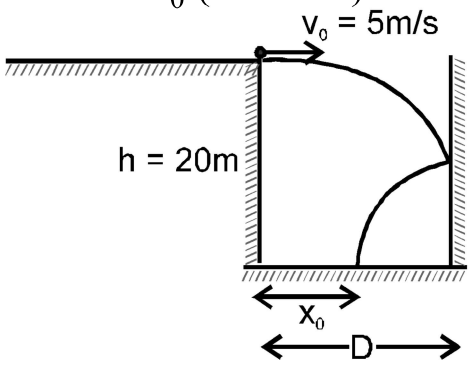
a) $\frac{7L}{12}$ **b)** $\frac{7L}{13}$ **c)** $\frac{7L}{14}$ **d)** $\frac{L}{4}$

Q3 A mass of 5 kg is connected to a spring. The potential energy curve of the simple harmonic motion executed by the system is shown in the figure. A simple pendulu length 4 m has the same period of oscillation as the spring system. What is the val of acceleration due to gravity on the planet where these experiments are performe



a) 10 m/s^2 **b)** 5 m/s^2 **c)** 4 m/s^2 **d)** 9.8 m/s^2

Q4 A ball leaves a horizontal table with velocity v_0 = 5 m/s. The ball bounces elastica from a vertical wall at a horizontal distance D (= 8m) from the table, as shown in figure. The ball then strikes the floor a distance x_0 from the table (g = 10 m/s^2). Th value of x_0 (in metre) is

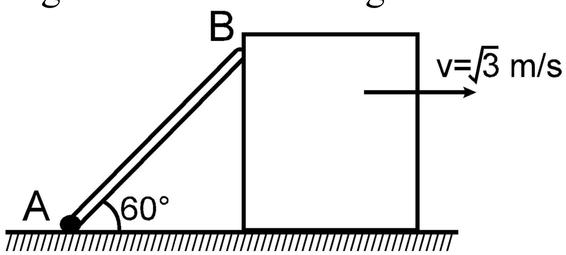


a) 6 **b)** 4 **c)** 8 **d)** 2

Q5 A standing man observes rain falling with speed 20 m/s at an angle 30° with vertic with what velocity man should run so that rain appears to fall vertically :

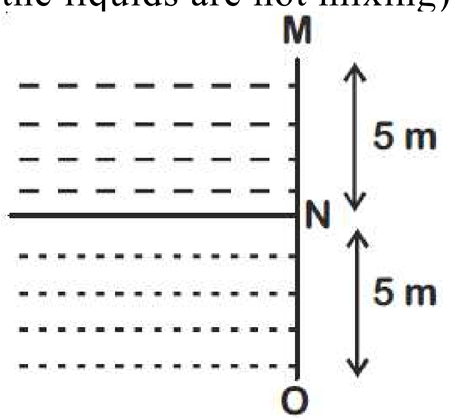
a) 10 m/s **b)** $10\sqrt{3}$ m/s **c)** 5 m/s **d)** 20 m/s

Q6 A rod AB is shown in figure. End A of the rod is fixed on the ground. Block is mov with velocity $\sqrt{3}$ m/s towards right. The velocity of end B of rod when rod makes angle of 60° with the ground is:



a) $\sqrt{3}$ m/s b) 2 m/s c) $2\sqrt{3}$ m/s d) 3 m/s

Q7 Two liquids of densities ρ_1 and ρ_2 ($\rho_2 = 2\rho_1$) are filled up behind a square wall of s 10 m as shown in figure. Each liquid has a height of 5 m. The ratio of the forces du to these liquids exerted on upper part MN to that at the lower part NO is (Assume the liquids are not mixing)

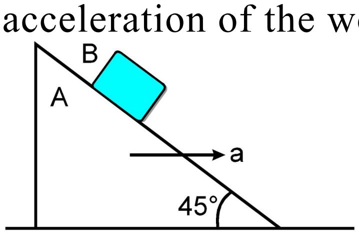


a) 1/4 b) 1/2 c) 2/3 d) 1/3

Q8 A body is projected up a rough inclined plane from the bottom with some velocity. travels up the incline and then returns back. If the time of ascent is t_a and time of descent is t_d, then

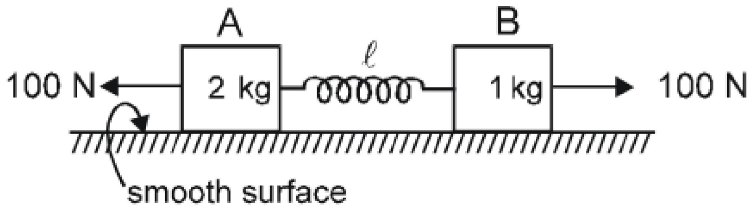
a) $t_a = t_d$ b) $t_a > t_d$ c) $t_a < t_d$ d) data insufficie

Q9 If the coefficient of friction between A and B is μ, the maximum horizontal acceleration of the wedge A for which B will remain at rest w.r.t the wedge is :



a) μg b) $g\left(\frac{1+\mu}{1-\mu}\right)$ c) $\frac{g}{\mu}$ d) $g\left(\frac{1-\mu}{1+\mu}\right)$

Q10 In the figure shown initially spring is in relexed state & blocks are at rest. Now 10 force is applied on block A & B as shown in figure. After some time velocity of 'A becomes 2 m/s and that of ' B ' 4 m/s and block A displaced by amount 10 cm towa left and spring is stretched by amount 30 cm. Then work done by spring force on A will be :

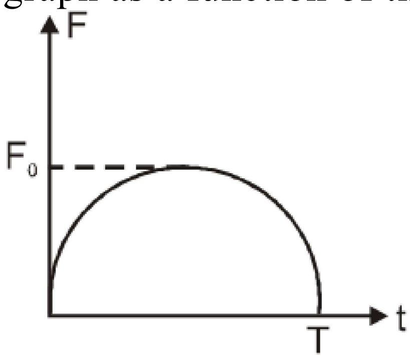


a) 9/3 J **b)** – 6 J **c)** 6 J **d)** None of these

Q11 A horse drinks water from a cubical container of side 1 m. The level of the stomac horse is at 2 m from the ground. Assume that all the water drunk by the horse is at level of 2 m from the ground. Then minimum work done by the horse in drinking t entire water of the container is (Take $\rho_{water} = 1000\ kg/m^3$ and $g = 10\ m/s^2$) :

a) 10 kJ **b)** 15 kJ **c)** 20 kJ **d)** zero

Q12 A particle of mass m initially at rest, is acted upon by a variable force F for a brief interval of time T. It attains a velocity u after the force stops acting. F is shown in graph as a function of time. The curve is a semicircle, find u.



a) $\frac{\pi F_0^2}{2m}$ **b)** $\frac{\pi T^2}{8m}$ **c)** $\frac{\pi F_0 T}{4m}$ **d)** $\frac{F_0 T}{2m}$

Multiple Choice Question

Q13 A particle is projected in such a way that it follows a curved path with constant acceleration . For finite interval of motion. Which of the following option(s) may l correct :

$\overrightarrow{u}$ = initial velocity

$\overrightarrow{a}$ = acceleration of particle

$\overrightarrow{v}$ = instant velocity for t > 0

a) $|\overrightarrow{a} \times \overrightarrow{u}| \neq 0$ **b)** $|\overrightarrow{a} \times \overrightarrow{v}| = 0$ **c)** $|\overrightarrow{u} \times \overrightarrow{v}| = 0$ **d)** $\overrightarrow{u} . \overrightarrow{v} = 0$

Q14 A particle moves in xy plane in such a way that its position 'r' from the origin depends upon time 't' as r = 3t. The angle 'θ' made by its position vector with the positive x-axis at any time 't' is given as ; θ = 2t. Here r is in metres, θ in rad and t seconds.

a) The particle moves in circular motion.

b) At time t = 0.5 s, its speed is $3\sqrt{2}$ m/s.

c) At time t = 0.5 s, its velocity vector makes an angle 45° with its position vector the same time.

d) At time t = 0.5 s, its velocity vector makes an angle 30° with its position vector the same time.

Q15 Force exerted by the floor of a lift on the foot of a boy standing on it is more than actual weight of the boy if the lift is moving

a) down and speed is increasing **b)** up and speed is increasing

c) up and speed is decreasing **d)** down and speed is decreasing

Q16 Two blocks of mass m and 2m are fixed to the ends of a spring. The spring is initia compressed & then the system is released in air (neglecting the air resistance). Aft time t

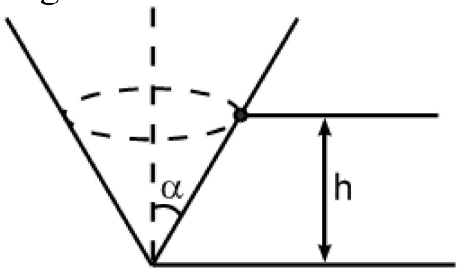
a) the momentum of the system will be zero

b) the momentum of the system will be 3 m g t

c) the momentum of the system will be m g t

d) the momentum of the system will not depend on the value of spring constant.

Q17 A particle is describing circular motion in a horizontal plane in contact with the smooth inside surface of a fixed right circular cone with its axis vertical and vertex down. The height of the plane of motion above the vertex is h and the semivertical angle of the cone is α. The period of revolution of the particle:



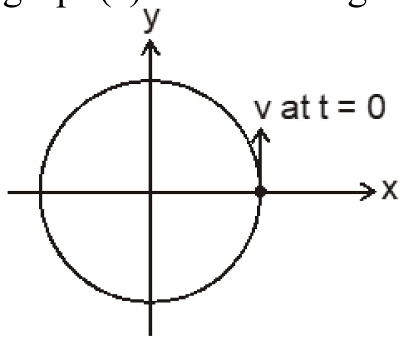
a) increases as h increases

b) decreases as h increases

c) increases as α increases

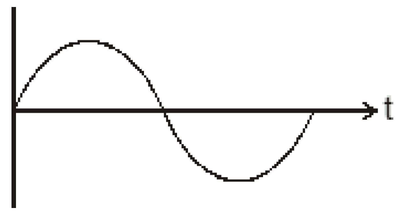
d) decreases as α increases

Q18 A particle is moving in a uniform circular motion on a horizontal surface. Particle position and velocity at time t = 0 are shown in the figure in the coordinate system Which of the indicated variable on the vertical axis is/are correctly matched by the graph(s) shown alongside for particle's motion ?

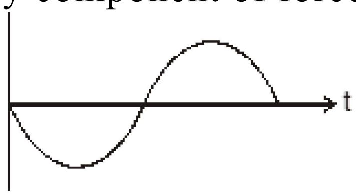


a)

x component of velocity ⟶

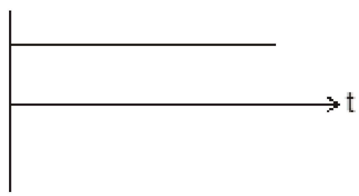


b) y component of force keeping particle moving in a circle ⟶



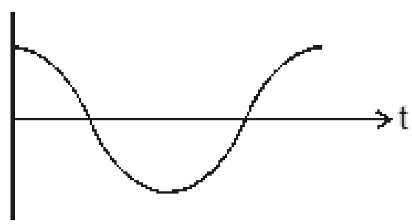
c)

Angular velocity of the particle⟶



d)

x coordinate of the particle⟶



Chemistry

Single Choice Question

Q19 The dipole moment of chlorobenzene is 1.73 D. The dipole moment of p-dichlorobenzene is expected to be:

a) 3.46 D **b)** 0.00 D **c)** 1.73 D **d)** 1.00 D

Q20 Air is compressed in a vertical cylinder by weight of piston. When a weight is add to the Piston, the volume of the gas decreases from 500 mL to 400 mL. If another weight of same magnitude is added, the volume of the gas will decreases (2^{nd} decrease) by (Assume ideal behaviour) :

a) another 100 mL **b)** less than 100 mL

c) more than 100 mL **d)** Insufficient Information

Q21 Which of the following process is exothermic ?

a) $M_{(g)}^{2-} \longrightarrow M_{(g)}^{-}$ **b)** $M_{(g)} \rightarrow M_{(g)}^{+}$ **c)** $M_{(g)}^{+} \rightarrow M_{(g)}^{2+}$ **d)** $M_{(g)}^{2+} \rightarrow M_{(g)}^{3+}$

Q22 A nonpolar molecule AX_4 have all bond angles equal then which of the following conclusion is incorrect?

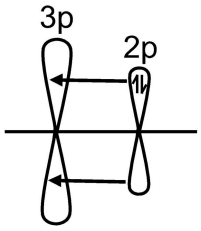
a) Molecule may be tetrahedral.

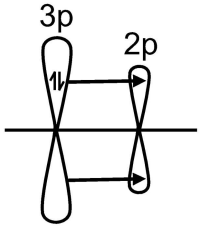
b) Molecule may be square planar.

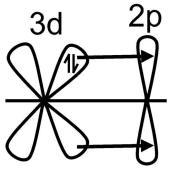
c) Central atom 'A' must have at least six valence electrons.

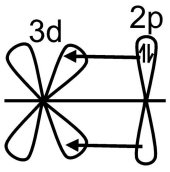
d) Central atom 'A' has either zero lone pair or two lone pairs.

Q23 Which type of overlapping is responsible for π-character in Si-N bond of H_3SiNC

a) 

b) 

c) 

d) 

Q24 Which of the following is correct increasing order of oxidation number of chlorine the given compounds ?
I – Sodium chlorite
II – Sodium hypochlorite
III – Sodium perchlorate
IV – Sodium chlorate

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

Q25 For the reaction $CaCO_3(s) \rightleftharpoons CaO(s) + CO_2(g)$, the value of K_P is

a) P_{CO2} **b)** $\frac{P_{CO_2}}{P_{CaCO_3}}$ **c)** $\frac{[CaO][CO_2]}{[CaCO_3]}$ **d)** $\frac{P_{CaCO_3}}{P_{CaO}P_{CO_2}}$

Q26 The average charge on each O atom and average bond order of I–O bond in IO_6^{5-}

a) –1 and 1.67 **b)** – 5/6 and 1.67 **c)** –5/6 and 1.33 **d)** –5/6 and 1.16

Q27 You are given 4.9 % w/v aqueous solution of H_2SO_4 of density 1.49 g/ml, then wh is **INCORRECT** option?

a) molarity (M) of the solution = 0.5 M **b)** strength = 49 g/litre

c) % by weight of H_2SO_4 = 40% **d)** concentration of H^+ ion = 1 M

Q28 Which of the following statements about diborane is not true ?

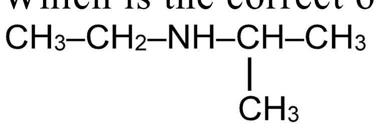
a) The B atoms in it are sp^3 –hybridized

b) It contains two 3-centre-2-electron bonds

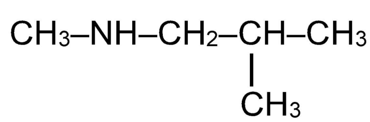
c) All B–H bond lengths are equal due to resonance

d) The molecule is non-planar

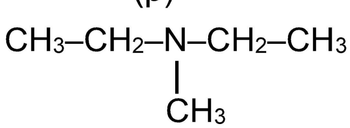
Q29 Which is the correct option:



(p)



(q)



(r)

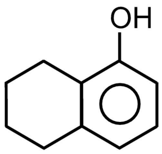
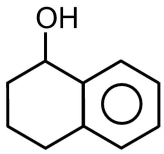
$CH_3–CH_2–NH–CH_2–CH_2–CH_3$

(s)

a) (q) & (s) are chain isomers **b)** (q) & (s) are position isomers

c) (p) & (r) are metamers **d)** (p) & (r) are functional isomers

Q30 Select the incorrect statement:

a)  &  are functional isomers

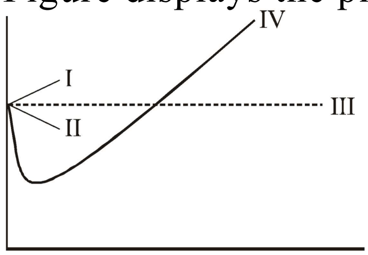
b) $C_2H_4Cl_2$ has two structural isomers.

c) Cyclobutane on dichlorination will give 3 structural isomers.

d) Cyclohexa-1,3-diene on reductive ozonolysis gives only one product.

Multiple Choice Question

Q31 Figure displays the plot of the compression factor Z verses p for a few gases



Which of the following statements is/are correct for a van-der waals gas :

a) The plot I is applicable provided the vander waals constant a is negligible.

b) The plot II is applicable provided the vander waals constant b is negligible.

c) The plot III is applicable provided the vander waals constants a and b are negligible.

d) The plot IV is applicable provided the temperature of the gas is much higher tha its critical temperature.

Q32 Which of the following is a conjugated system ?

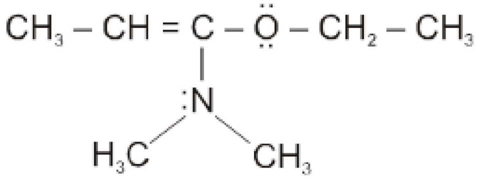
a) $CH_2=CH-CH=CH_2$

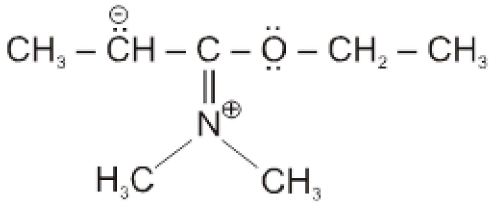
b) $CH_2=C=CH_2$

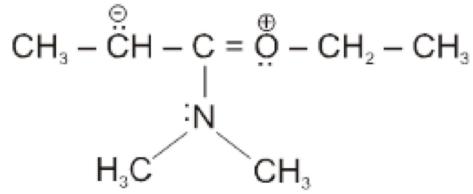
c) $CH_2=CH-CH_2-CH=CH_2$

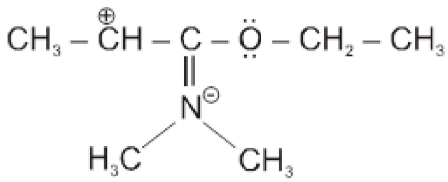
d) $CH_2=CH-CH=O$

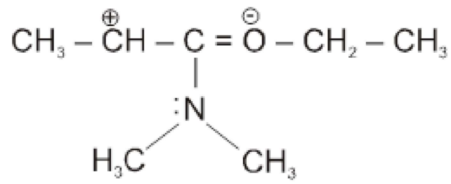
Q33 The acceptable resonating structure(s) of the following molecule is/are :



a) 

b) 

c) 

d) 

Q34 Which of the following is/are incorrect order w.r.t. to given properties ?

a) Ni > Cu > Zn (size)

b) Ag < Cu < Au (size)

c) O > S > Se (Electron affinity)

d) B > Al > Ga (Ionisation Energy)

Q35 Choose the correct statement(s) :

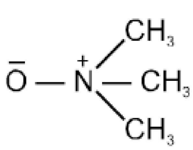
a) The shape of an atomic orbital depends upon azimuthal quantum number

b) The orientation of an atomic orbital depends upon the magnetic quantum numb

c) The energy of an electron in an atomic orbital of multi-electron atom depends upon principal quantum number only

d) The number of degenerate atomic orbitals of one type depends upon the value o azimuthal quantum number

Q36 In which cases delocalisation of charge is possible?

a) 

b) O^{-} — $P(CH_3)_2$

c) O^{-} — $C(CH_3)_3$

d) O^{-} — $B(CH_3)_2$

Mathematics

Single Choice Question

Q37 A person writes letters to 6 friends and addresses the corresponding envelopes. In many ways can the letters be placed in the envelopes so that at least 4 of them are wrong envelopes ?

a) 72 **b)** 719 **c)** 664 **d)** 135

Q38 The locus of the centres of circles passing through the origin and intersecting the fixed circle $x^2 + y^2 - 5x + 3y - 1 = 0$ orthogonally is:

a) a straight line of the slope 3/5 **b)** a circle

c) a pair of straight lines **d)** none of the above

Q39 In a ΔABC, if $r = r_2 + r_3 - r_1$ and $\angle A > \frac{\pi}{3}$ then range of $\frac{s}{a}$ is equal to -

a) $\left(\frac{1}{2}, 2\right)$ **b)** $\left(\frac{1}{2}, \infty\right)$ **c)** $\left(\frac{1}{2}, 3\right)$ **d)** $(3, \infty)$

Q40 If α and β are roots of the equation $ax^2 + bx + c = 0$ then roots of the equation $a(2x-1)^2 - b(2x+1)(3-x) + c(3-x)^2 = 0$ are:

a) $\frac{2\alpha+1}{\alpha-3}, \frac{2\beta+1}{\beta-3}$

b) $\frac{3\alpha+1}{\alpha-2}, \frac{3\beta+1}{\beta-2}$

c) $\frac{2\alpha-1}{\alpha-2}, \frac{2\beta+1}{\beta-2}$

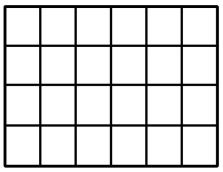
d) None of these

Q41 $\left|x + \frac{2}{x}\right| < 3$, then x belongs to -

a) $(-2, -1) \cup (1, 2)$ **b)** $(-\infty, -2) \cup (-1, 1) \cup (2, \infty)$

c) $(-2, 2)$ **d)** $(-3, 3)$

Q42 Number of rectangles in fig. shown which are not squares is



a) 159 **b)** 160 **c)** 161 **d)** None

Q43 The maximum sum of the A.P. 40, 38, 36, 34,....is

a) 390 b) 420 c) 460 d) None of these

Q44 The number of terms in $\left(x^3 + 1 + \frac{1}{x^3}\right)^{100}$ is -

a) 300 b) 200 c) 100 d) 201

Q45 Let P be a variable point on the parabola y = $4x^2$ +1. Then, the locus of the mid-po of the point P and the foot of the perpendicular drawn from the point P to the line y x is :

a) $(3x - y)^2 + (x - 3y) + 2 = 0$

b) $2(3x - y)^2 + (x - 3y) + 2 = 0$

c) $(3x - y)^2 + 2(x - 3y) + 2 = 0$

d) $2(x - 3y)^2 + (3x - y) + 2 = 0$

Q46 The locus of the mid-point of the line segment joining the focus of the parabola y^2 4ax to a moving point of the parabola, is another parabola whose directrix is :

a) $x = -\frac{a}{2}$ b) $x = \frac{a}{2}$ c) x = 0 d) x = a

Q47 The number of different words of three letters which can be formed from the word "PROPOSAL", if a vowel is always in the middle are-

a) 53 b) 52 c) 63 d) 32

Q48 Equation of a straight line on which length of perpendicular from the origin is four units and the line makes an angle of 120° with the x-axis, is-

a) $x\sqrt{3} + y + 8 = 0$ b) $x\sqrt{3} - y = 8$ c) $x\sqrt{3} + y = 8$ d) $x - \sqrt{3}y + 8 =$

Multiple Choice Question

Q49 If α and β are the roots of $ax^2 + bx + c = 0$ and $D = b^2 - 4ac$ then domain of f(x) = $\log(ax^2 + bx + c)$ is

a) $R - [\alpha, \beta]$, if D > 0 and a > 0

b) R if D < 0 and a > 0

c) $R - \left\{\frac{-b}{2a}\right\}$ if D = 0 and a > 0

d) No where if D = 0 and a < 0

Q50 If a > 2 is a constant & there are 28 positive integers satisfying $(x - a)(x - 2a)(x - a^2) < 0$, then

a) ‘a’ is composite b) ‘a’ is odd c) a > 8 d) $a \in (3, 11)$

Q51 For the series $S = 1+\frac{1}{(1+3)}(1+2)^2 + \frac{1}{(1+3+5)}(1+2+3)^2 + \frac{1}{(1+3+5+7)}(1+2+3+4)^2 + \ldots$

a) 7^{th} term is 16 **b)** 7^{th} term is 18

c) sum of first 10^{th} terms is $\frac{505}{4}$ **d)** sum of first 10^{th} terms is $\frac{405}{4}$

Q52 Let a, x, b be in A.P. ; a, y, b be in G.P. and a, z, b be in H.P. If x = y + 2 and a = 5: then

a) $y^2 = xz$ **b)** $x > y > z$ **c)** $a = 9, b = 1$ **d)** $a = \frac{9}{4}, b = \frac{1}{4}$

Q53 A quadrilateral is formed by the lines $\frac{x}{a}+\frac{y}{b}=1$, $\frac{x}{b}+\frac{y}{a}=1$, $\frac{x}{a}+\frac{y}{b}=2$, $\frac{x}{b}+\frac{y}{a}=$ Then for a > b -

a) Quadrilateral is a rhombus

b) Area of quadrilateral $= \frac{a^2b^2}{a^2-b^2}$

c) Distance between two parallel sides $= \frac{ab}{\sqrt{a^2+b^2}}$

d) Angle between non parallel sides $= \tan^{-1}\left(\frac{a^2-b^2}{2ab}\right)$

Q54 If one diagonal of a square is the portion of the line $\frac{x}{a}+\frac{y}{b}=1$ intercepted by the axes, then the extremities of the other diagonal of the square are

a) $\left(\frac{a+b}{2}, \frac{a+b}{2}\right)$ **b)** $\left(\frac{a-b}{2}, \frac{a+b}{2}\right)$ **c)** $\left(\frac{a-b}{2}, \frac{b-a}{2}\right)$ **d)** $\left(\frac{a+b}{2}, \frac{b-a}{2}\right)$

Answer Key

Que.	1	2	3	4	5	6	7	8	9	1
Ans.	**A**	**A**	**C**	**A**	**A**	**B**	**A**	**C**	**B**	
Que.	11	12	13	14	15	16	17	18	19	2
Ans.	**B**	**C**	**A, D**	**B, C**	**B, D**	**B, D**	**A, C**	**B, C, D**	**B**	
Que.	21	22	23	24	25	26	27	28	29	3
Ans.	**A**	**C**	**D**	**D**	**A**	**D**	**C**	**C**	**D**	
Que.	31	32	33	34	35	36	37	38	39	4
Ans.	**A, B, C**	**A, D**	**A, B**	**A, B, C, D**	**A, B, D**	**B, C, D**	**C**	**D**	**A**	
Que.	41	42	43	44	45	46	47	48	49	5
Ans.	**A**	**B**	**B**	**D**	**B**	**C**	**A**	**C**	**A, B, C, D**	**A**

Que.	51	52	53	54
Ans.	**A, C**	**A, B, C**	**A, B, C, D**	**A, C**