Competishun

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

Date: 18/11/2024

Time: 3 hours **Max. Marks:** 180

PRATHAM-1 (24-25)-ACT-4-PAPER-1

Physics

Multiple Choice Question

Q1 A particle moves along a straight line and its velocity depends on time 't' as $v = 4t - t^2$. Here v is in m/sec. and t is in second. Then for the first 5 seconds :

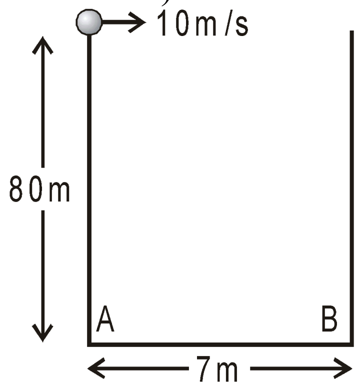
a) Magnitude of average velocity is $\frac{5}{3}$ m/s

b) Average speed is $\frac{13}{5}$ m/s

c) Average speed is $\frac{11}{5}$ m/s

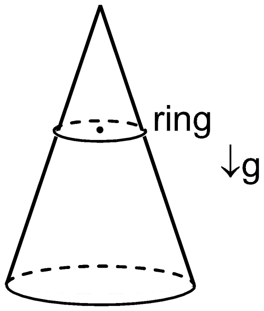
d) Average acceleration is -1m/s^2

Q2 A ball is projected horizontally from top of a 80 m deep well with velocity 10 m/s. Then particle will fall on the bottom at a distance of (all the collisions with the wall are elastic) :



a) 5 m from A **b)** 5 m from B **c)** 2 m from A **d)** 2 m from B

Q3 An elastic ring of mass 'm' and force constant k (stiffness) is released from rest in a smooth cone of semi vertex angle θ from horizontal position as shown in figure. Initially the ring was in natural length :



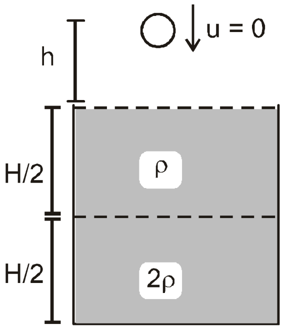
a) initial acceleration of any point on circumference of ring is g

b) initial acceleration of centre of ring is $g\cos^2\theta$

c) maximum vertical displacement of centre of ring is $\frac{mg\cot^2\theta}{2\pi^2 k}$

d) at the moment maximum vertical displacement acceleration of centre of ring is zero.

Q4 A small ball of mass m is released from rest from a height h above the liquid surface. The density of ball is $\frac{\rho}{3}$: (assume no splash)



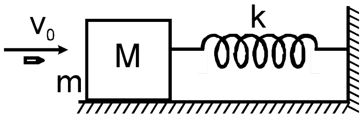
a) If $h \geq H$, then the ball will be able to enter the liquid of higher density

b) If $h \geq \frac{7H}{2}$, then the ball will be able to strike the bottom of the vessel

c) If $h = 2H$, then the ball will cross the interface of two liquids with kinetic energy $= mgH$

d) If $h = 0$ then ball will float on the surface

Q5 A bullet of mass m = 1kg strikes a block of mass M =2kg connected to a light spring of stiffness k =3N/m with a speed V_0 = 3m/s. If the bullet gets embedded in the block then.



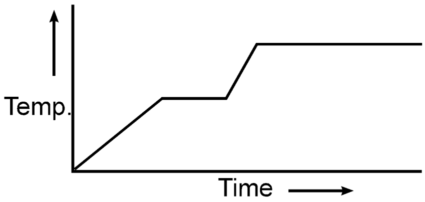
a) linear momentum of bullet and block system is not conserve during impact because spring force is impulsive.

b) linear momentum of bullet and block system isconserve during impact because spring force is nonimpulsive.

c) Maximum compression in the spring is 2m.

d) The maximum compression in the spring is 1m.

Q6 Heat is supplied to a certain homogeneous sample of matter at a uniform rate. Its temperature is plotted against time as shown in the figure. Which of the following conclusions can be drawn?



a) its specific heat capacity is greater in the solid state than in the liquid state.

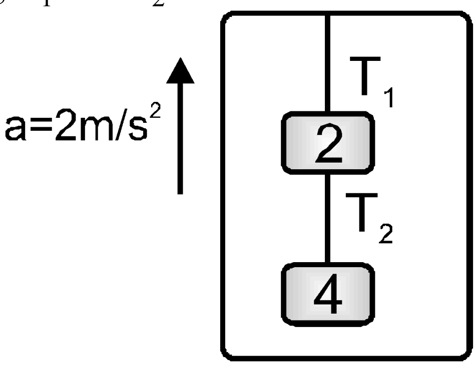
b) its specific heat capacity is greater in the liquid state than in the solid state.

c) its latent heat of vaporization is greater than its latent heat of fusion.

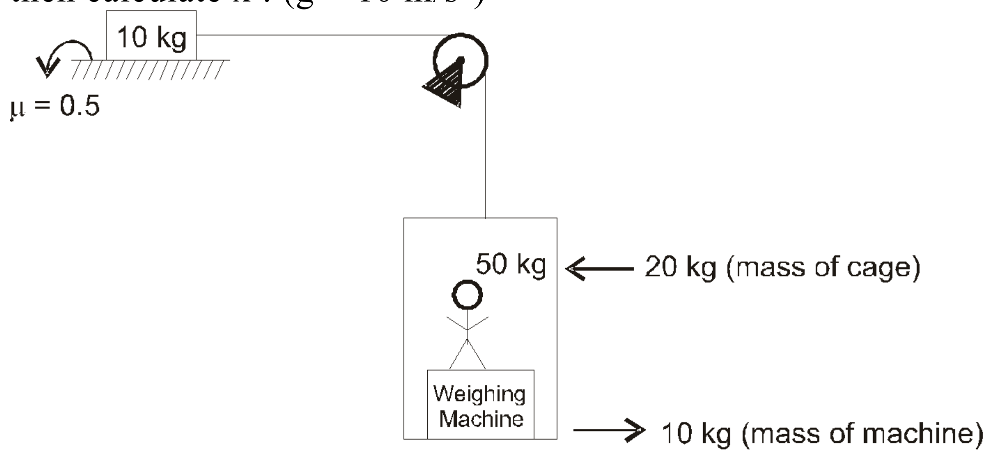
d) its latent heat of vaporization is smaller than its latent heat of fusion.

Numerical

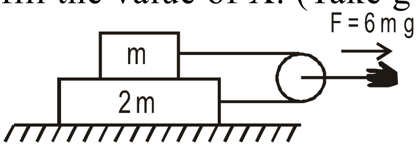
Q7 If ratio of T_1 and T_2 is x then find value of 10x. (strings are massless and inextensible , T_1 and T_2 are tension in the string as shown, g = 10 m/s^2).



Q8 If pulley is ideal and string is massless then reading of weighing machine is $\frac{5x}{3}$ kg then calculate x : (g = 10 m/s^2)

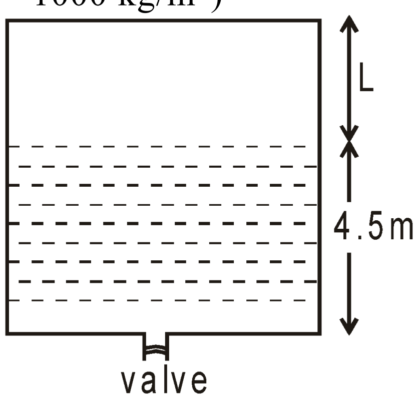


Q9 A block of mass m is placed on top of a block of mass 2m which in turn is placed on fixed horizontal surface. The coefficient of friction between all surfaces is μ = 1. A massless string is connected to each mass and wraps halfway around a massless and frictionless pulley, as shown. The pulley is pulled by horizontal force of magnitude F = 6 mg towards right as shown. If the magnitude of acceleration of pulley is $\frac{X}{2}$ m/s^2, fill the value of X. (Take g = 10 m/s^2)



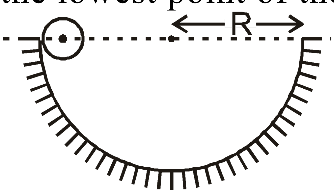
Q10 In a certain thermodynamical process, the pressure of a gas depends on its volume as kV^3. The work done when the temperature changes from 100°C to 300°C will be ____ nR, where n denotes number of moles of a gas.

Q11 The vertical water tank, shown has uniform cross section, closed at the top and initial level of water in it is 4.5 m from bottom. The empty space of length L contains air at atmospheric pressure (10^5 Pa), that can be considered as an ideal gas. When the valve at the bottom is opened, the level of water decreases by 0.5 m when the flow of water ceases though valve remains opened. Neglecting any variation in temperature during the process, find initial length of empty space L in cm. (g = 10 m/s^2; density of water = 1000 kg/m^3)

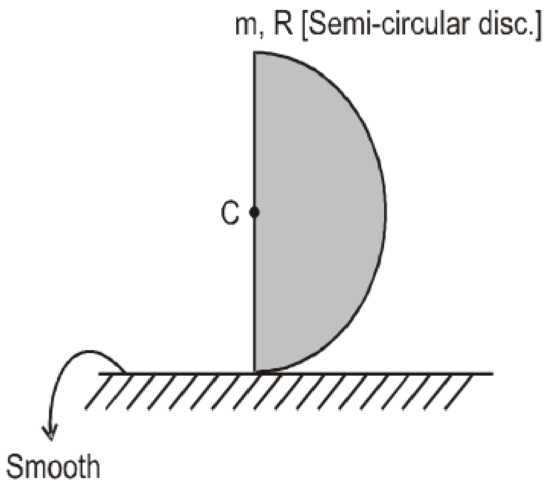


Q12 M grams of steam at 100°C is mixed with 200 g of ice at its melting point in a thermally insulated container. If it produces liquid water at 40°C [heat of vaporization of water is 540 cal/g and heat of fusion of ice is 80 cal/g], the value of M is ______.

Q13 In the figure shown, a small uniform spherical (solid) ball of mass 'm =0.7kg' can move without sliding in a fixed semicircular track of radius R = 10m in vertical plane. It is released from the top. Then find the magnitude of resultant force on the ball at the lowest point of the track in Newtons.

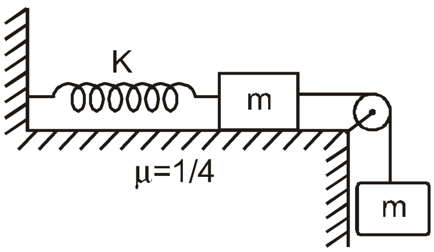


Q14 If angular acceleration of the uniform semi-circular disc just after release from rest position shown in figure is $\frac{8\pi g}{NR}$, then calculate N. (C is centre of semi-circular disc.) ($\pi^2 = 10$)



Single Choice Question

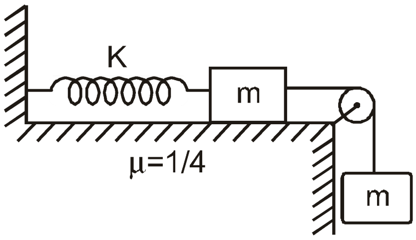
Q15 Consider the system shown below, with two equal masses m and a spring with spring constant K. The coefficient of friction between the left mass and horizontal table is $\mu = 1/4$, and the pulley is frictionless. The string connecting both the blocks is massless and inelastic. The system is held with the spring at its unstretched length and then released.



The extension in spring when the masses come to momentary rest for the first time is

a) $\frac{3\ mg}{2K}$ b) $\frac{mg}{2K}$ c) $\frac{mg}{K}$ d) $\frac{2mg}{K}$

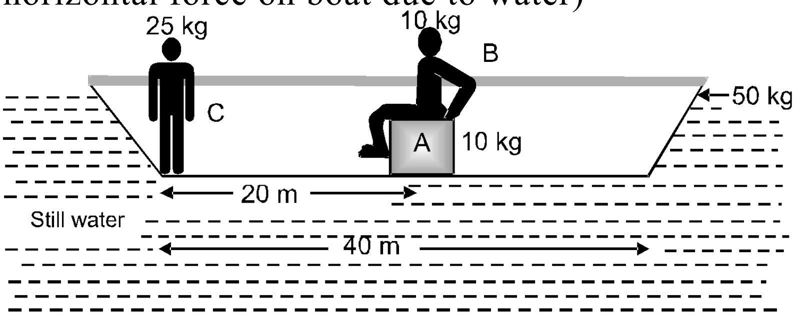
Q16 Consider the system shown below, with two equal masses m and a spring with spring constant K. The coefficient of friction between the left mass and horizontal table is μ = 1/4, and the pulley is frictionless. The string connecting both the blocks is massless and inelastic. The system is held with the spring at its unstretched length and then released.



The minimum value of μ for which the system remains at rest once it has stopped for the first time is

a) $\frac{1}{\sqrt{3}}$ **b)** $\frac{1}{3}$ **c)** $\frac{1}{2}$ **d)** $\frac{1}{\sqrt{2}}$

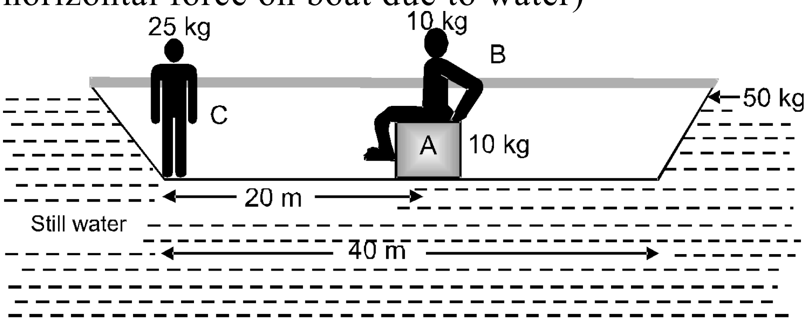
Q17 A boy C of mass 25 kg, another boy B of mass 10 kg and a block A of mass 10 kg are in a boat of mass 50 kg. Length of boat is 40 m. Initial positions at t = 0 are shown in figure. There is sufficient friction between boy C and boat also sufficient friction between boy B and block A but there is no friction between block A and boat. Now boy C starts running with a speed of 2 m/s w.r.t boat towards boy B. (there is no horizontal force on boat due to water)



Time taken by boy C to reach boy B :

a) 10 sec. **b)** 15 sec. **c)** 20 sec. **d)** 7.5 sec.

Q18 A boy C of mass 25 kg, another boy B of mass 10 kg and a block A of mass 10 kg are in a boat of mass 50 kg. Length of boat is 40 m. Initial positions at t = 0 are shown in figure. There is sufficient friction between boy C and boat also sufficient friction between boy B and block A but there is no friction between block A and boat. Now boy C starts running with a speed of 2 m/s w.r.t boat towards boy B. (there is no horizontal force on boat due to water)



Displacement of boat w.r.t. water during above time interval :

a) 10 m **b)** 5 m **c)** 15 m **d)** zero

Chemistry

Multiple Choice Question

Q19 The radial probability distribution function [P(r)] is used to determine the most probable radius, which is used to find the electron in a given orbital. $\frac{dP(r)}{dr}$ for 1s-orbital of hydrogen like species having atomic number Z is :

$$\frac{dP}{dr} = \frac{4Z^3}{a_0^3}\left(2r - \frac{2Zr^2}{a_0}\right)e^{-2Zr/a_0}$$

a) At the point of maximum value of radial probability distribution function $\frac{dP(r)}{dr} = 0$

b) Most probable radius of Li^{2+} is $\frac{a_0}{3}$

c) Most probable radius of He^{+} is $\frac{a_0}{2}$

d) None of these

Q20 Which of the following is/are correctly matched for given species ?

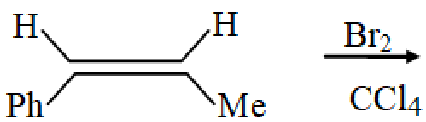
a) XeO_3 : Three (pπ-dπ) bonds

b) H_2SO_3 : One (pπ-dπ) bonds

c) SO_3 : Three (pπ-dπ) bonds

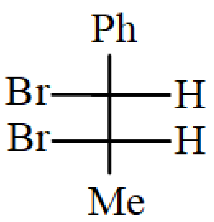
d) $HClO_3$: Two (pπ-dπ) bonds

Q21 The possible products of the reaction

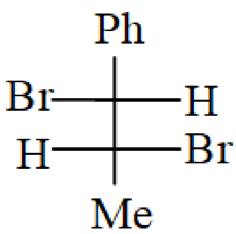


are

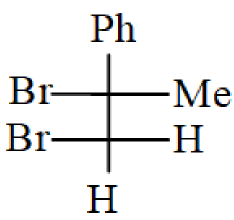
a)



b)



c)



d) None

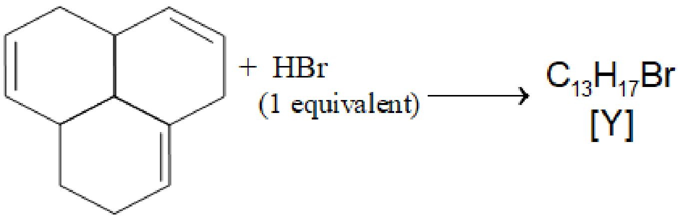
Q22 Which of the following statement(s) about critical constants of gases is/are correct?

a) Larger the $\frac{T_c}{P_c}$ value of a gas, larger would be the excluded volume.

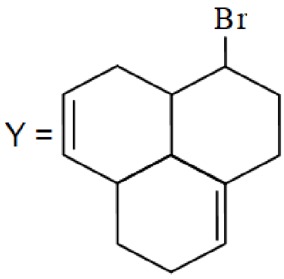
b) Critical temperature (T_c) of gas is greater than it's Boyle's temperature (T_B)

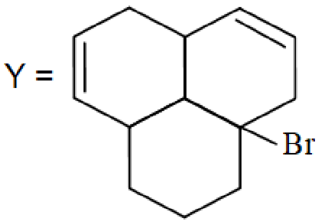
c) At the critical point in the van der Waal's gas isotherm $\left(\frac{\partial P}{\partial V_m}\right)_{T_c} = 0$

d) $V_c = 3a$

Q23 

The correct statement about major product [Y] in reaction is –

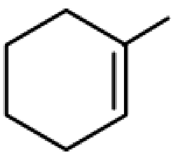
a) 

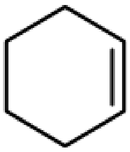
b) 

c) Y is optically active

d) Y is obtained as a racemic mixture

Q24 Hydroboration oxidation and acid hydration will yield the same product in case of -

a) 

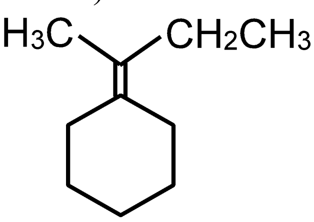
b) 

c) $CH_2 - CH_2$

d) $CH_3 - CH = CH - CH_3$

Numerical

Q25 The total number of contributing structures showing hyperconjugation (involving C–H bonds) for the following compound is :



Q26 Two salts A_2X and MX have the same value of solubility product of 4.0×10^{-12}. The ratio of their molar solubilities i.e. $\frac{S(A_2X)}{S(MX)}$ = ______. (Round off to the Nearest Integer).

Q27 The rate of diffusion (r) of two gases X and Y is in the ratio of 1 : 5 and that of Y and Z in the ratio of 1 : 6 under similar conditions. Find $\frac{r_z}{r_x}$:

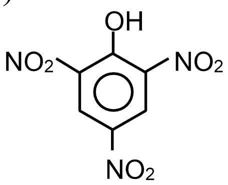
Q28 0.01 moles of a weak acid HA ($K_a = 2.0 \times 10^{-6}$) is dissolved in 1.0 L of 0.1 M HCl solution. The degree of dissociation of HA is _________ $\times 10^{-5}$ (Round off to the Nearest Integer).
[Neglect volume change on adding HA. Assume degree of dissociation <<1]

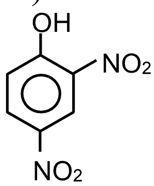
Q29 Determine the value of (y + x) for the double chain silicate anion (amphibole) $[Si_4O_y]^{-x}$.

Q30 When 1 mol of A_2 and 3 mol of B_2 are mixed, the equilibrium $A_2(g) + B_2(g) \rightleftharpoons 2AB(g)$ is established giving rise of 'a' mol of AB at equilibrium. A further addition of 2 mol of $A_2(g)$ gives an additional 'a' mol of AB at equilibrium. If K_C is the equilibrium constant of the reaction, the value of $(10a + K_C)$ is :

Q31 Observe the following compound?

(i) H—I (ii) H—Br (iii) H—Cl
(iv) $PhSO_3H$ (v) RSO_3H (vi) H—F
(vii) HCOOH (viii) PhCOOH (ix) RCOOH

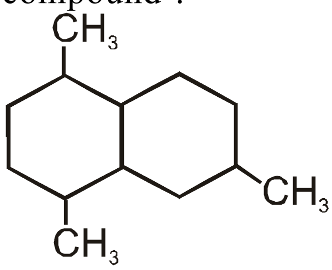
(x) 

(xi) 

(xii) carbolic acid

How many acidic substance are more acidic than carbonic acid (H_2CO_3)

Q32 How many products (structural isomers) are formed by monochlorination of following compound ?



Single Choice Question

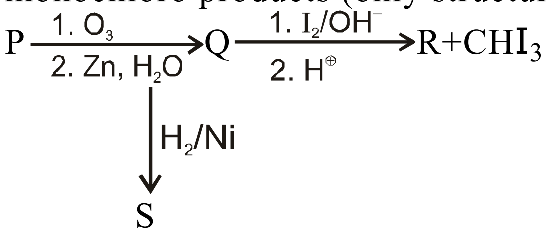
Q33 In the valence bond theory, hybridisation of orbitals is an integral part of bond formation. Hybridisation consists of mixings or linear combination of the "pure" atomic orbitals in such a way as to form new hybrid orbitals such as sp, sp^2, sp^3, sp^3d, sp^3d^2 etc.
Now answer the following questions:
Which of the following atomic orbitals participates in trigonal bipyramidal hybridisation i.e. sp^3d hybridisation?

a) d_{Z^2}, p_z **b)** $d_{x^2-y^2}$, p_z **c)** d_{xy}, p_z **d)** d_{yz}, d_{Z^2}

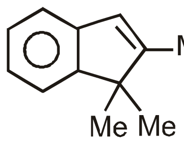
Q34 In the valence bond theory, hybridisation of orbitals is an integral part of bond formation. Hybridisation consists of mixings or linear combination of the "pure" atomic orbitals in such a way as to form new hybrid orbitals such as sp, sp^2, sp^3, sp^3d, sp^3d^2 etc.
Now answer the following questions:
Which of the following atomic orbital takes participitation in hybridisation of SF_6 but not in hybridisation of SF_4 ?

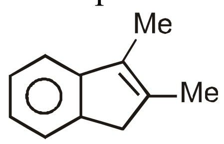
a) s **b)** $d_{x^2-y^2}$ **c)** d_{x^2} **d)** None of these

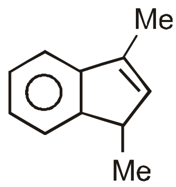
Q35 (Q) gives positive iodoform test and also give red precipitate with fehling solution. Hydrogenation of (P) results benzenoid compound (S). Compound (S) gives three monochloro products (only structural) on monochlorination.

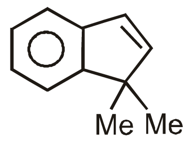


The structure of the aromatic compound P is :

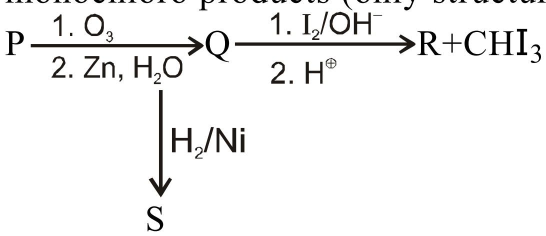
a) 

b) 

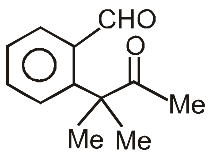
c) 

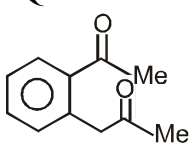
d) 

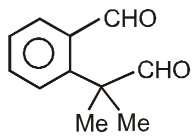
Q36 (Q) gives positive iodoform test and also give red precipitate with fehling solution. Hydrogenation of (P) results benzenoid compound (S). Compound (S) gives three monochloro products (only structural) on monochlorination.

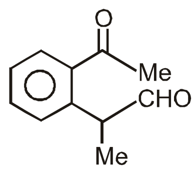


The structure of the product Q is :

a) 

b) 

c) 

d) 

Mathematics

Multiple Choice Question

Q37 The locus of the mid point of the focal radii of a variable point moving on the parabola, $y^2 = 4ax$ is a parabola whose

a) Latus rectum is half the latus rectum of the original parabola

b) Vertex is (a/2, 0) **c)** Directrix is y-axis **d)** Focus has the co-ordinates (a,0)

Q38 Which among the following are true?

a) $81^{(1/\log_5 3)} + 27^{(\log_9 36)} + 3^{(4/\log_7 9)} = 890$

b) $\frac{\log_3 135}{\log_{15} 3} - \frac{\log_3 5}{\log_{405} 3} = 3$

c) $\frac{\log_3 135}{\log_{15} 3} - \frac{\log_3 5}{\log_{405} 3} = 13$

d) All above

Q39 If roots of $(ab - bc)x^2 + (bc - ca)x + ca - ab = 0$ a,b,c $\in$ R are equal then

a) both roots are zero **b)** both roots are one **c)** a,c,b are in H.P. **d)** None

Q40 $\sum_{r=1}^{n} r(r+1) = \frac{(n+a)(n+b)(n+c)}{3}$, where $a < b < c$, then

a) $2b = c$ **b)** $a^3 - 8b^3 + c^3 = 8abc$ **c)** c is prime number **d)** $(a + b)^2 = 0$

Q41 Solutions of the equation $\sin 7x + \cos 2x = -2$ can be the subset of-

a) $x = \frac{2k\pi}{7} + \frac{3\pi}{14}$, n, k $\in$ I **b)** $x = n\pi + \frac{\pi}{4}$, n $\in$ I **c)** $x = n\pi + \frac{\pi}{2}$, n $\in$ I

d) None of these

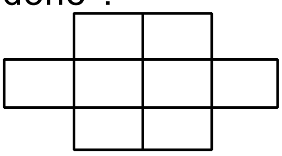
Q42 The general solution of $4\sin^4 x + \cos^4 x = 1$ is-

a) $(2n+1)\frac{\pi}{2}$ **b)** $n\pi$ **c)** $n\pi \pm \sin^{-1}\sqrt{\frac{2}{5}}$ **d)** None of these

Numerical

Q43 The equation $x = t^3 + 9$ & $y = \frac{3t^3}{4} + 6$ represent a straight line where t is a parameter. Then y intercept of line is $-\frac{k}{4}$ where k equals....

Q44 Six x_s have to be placed in the squares of the diagram given in the diagram such that each row contains at least one x. In how many ways can this be done ?



Q45 If the normal to the rectangular hyperbola xy = c^2 at the point $\left(ct, \frac{c}{t}\right)$ meets the curve again at $\left(ct', \frac{c}{t'}\right)$ then t^3t' = (–)........

Q46 In how many different ways may 12 things 4 each of three verieties by distributed equally among two persons? Things of the same variety are assumed to be identical.

Q47 Let C be the circle of radius unity centered at the origin: If two positive numbers x_1 and x_2 are such that the line passing through $(x_1, -1)$ and $(x_2, 1)$ is tangent to C then $x_1x_2 = \lambda$, find 16λ.

Q48 If letters of the word “RAJAT' are written down in all possible manner as they are in a dictionary, then the rank of the word “RAJAT' is

Q49 The mean weight of 9 items is 15. If one more item is added to the series, the mean becomes 16. The value of 10th item is

Q50 If the sum of the first 2n terms of the A.P. 2, 5, 8, ... is equal to the sum of the first n terms of the A.P. 57, 59, 61, ..., then n equals

Single Choice Question

Q51 The foot the perpendicular from the origin on a variable chord of the circle $x^2+y^2-2x-2y= 0$ is 'N'. If the variable chord subtends a right angle at the origin, The answer the following questions

The equation of locus of N is :

a) $x^2 + y^2 - x - y = 0$ **b)** $x^2 + y^2 - 3x + y = 0$ **c)** $3x^2 + y^2 - 3x + 4y = 0$
d) $3x^2 + y^2 + 3x - 4y = 0$

Q52 The foot the perpendicular from the origin on a variable chord of the circle $x^2+y^2-2x-2y= 0$ is 'N'. If the variable chord subtends a right angle at the origin, The answer the following questions

The equation of circle having centre at (–1, –2) and intersects the locus of 'N' orthogonally is

a) $x^2 + y^2 - 2x + 4y + 3 = 0$ **b)** $x^2 + y^2 + 2x + 4y + 5 = 0$
c) $x^2 + y^2 + 2x + 4y - 3 = 0$ **d)** $x^2 + y^2 + 2x + 4y - 4y - 5 = 0$

Q53 Let the two foci of an ellipse be (– 1, 0) and (3, 4) and the foot of perpendicular from the focus (3, 4) upon a tangent to the ellipse be (4, 6).

The foot of perpendicular from the focus (–1, 0) upon the same tangent to the ellipse is

a) $\left(\frac{12}{5}, \frac{34}{5}\right)$ **b)** $\left(\frac{7}{3}, \frac{11}{3}\right)$ **c)** $\left(2, \frac{17}{4}\right)$ **d)** (– 1, 2)

Q54 Let the two foci of an ellipse be (– 1, 0) and (3, 4) and the foot of perpendicular from the focus (3, 4) upon a tangent to the ellipse be (4, 6).

The equation of auxiliary circle of the ellipse is

a) $x^2 + y^2 - 2x - 4y - 5 = 0$

b) $x^2 + y^2 - 2x - 4y - 20 = 0$

c) $x^2 + y^2 + 2x + 4y - 20 = 0$

d) $x^2 + y^2 + 2x + 4y - 5 = 0$

Answer Key

Que.	1	2	3	4	5	6	7	8	9	10
Ans.	**A, B, D**	**B, C**	**B, C**	**A, B, C, D**	**B, D**	**A, C**	**15**	**05**	**25**	**50**
Que.	11	12	13	14	15	16	17	18	19	20
Ans.	**75**	**40**	**17**	**30**	**A**	**B**	**B**	**A**	**A, B, C**	**A, B, D**
Que.	21	22	23	24	25	26	27	28	29	30
Ans.	**A, B**	**A, C**	**B, C, D**	**B, C, D**	**09**	**50**	**30**	**2**	**17**	**19**
Que.	31	32	33	34	35	36	37	38	39	40
Ans.	**11**	**13**	**A**	**B**	**C**	**D**	**A, B, C, D**	**A, B**	**B, C**	**A, B, C**
Que.	41	42	43	44	45	46	47	48	49	50
Ans.	**A, C**	**B, C**	**03**	**26**	**01**	**19**	**16**	**39**	**25**	**11**
Que.	51	52	53	54						
Ans.	**A**	**C**	**A**	**B**						