

Competishun

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

Date: 10/06/2024


Time: 3 hours

Max. Marks: 300

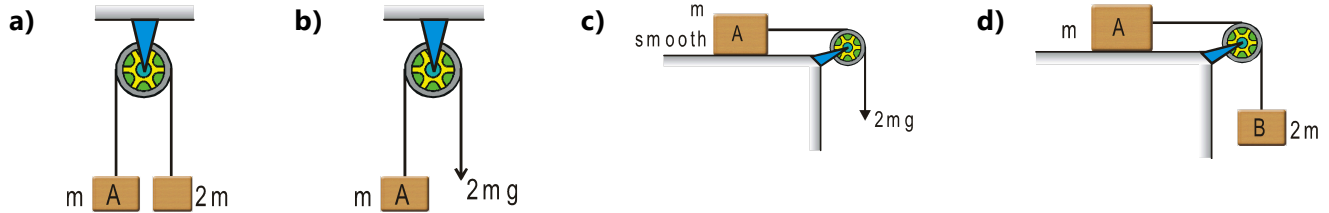
PRATHAM-1_(24-25) MPT-2

Physics

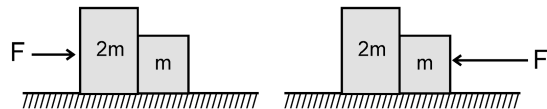
Single Choice Question

- Q1** A car travels from A to B at a speed of 20 km h^{-1} and returns at a speed of 30 km h^{-1} . The average speed of the car for the whole journey is :
- a) 5 km h^{-1} b) 24 km h^{-1} c) 25 km h^{-1} d) 50 km h^{-1}
- Q2** The equation of motion of a projectile is $y = 12x - \frac{3}{4}x^2$. Given that $g = 10 \text{ ms}^{-2}$. What is the range of the projectile?
- a) 36m b) 30.6 m c) 16 m d) 12.4 m
- Q3** A particle is dropped from a tower. It is found that it travels 35 m in the last second of its journey. The height of the tower is.
- a) 125 m b) 80 m c) 100 m d) 90 m
- Q4** Velocity of rain w.r.t. ground is $(-3\hat{i} - 3\hat{j}) \text{ m/s}$. If rain appears to be falling vertically to a man, then velocity of man w.r.t. ground in m/s is
- 
- a) $3\hat{i}$ b) $-3\hat{i}$ c) $-3\hat{j}$ d) $3\hat{j}$
- Q5** A hall has the dimensions $10 \text{ m} \times 10 \text{ m} \times 10 \text{ m}$. A fly starting at one corner ends up at a farthest corner. The magnitude of its displacement is:
- a) $5\sqrt{3} \text{ m}$ b) $10\sqrt{3} \text{ m}$ c) $20\sqrt{3} \text{ m}$ d) $30\sqrt{3} \text{ m}$
- Q6** A body covers first $\frac{1}{3}$ part of its journey with a velocity of 2 m/s , next $\frac{1}{3}$ part with a velocity of 3 m/s and rest of the journey with a velocity 6 m/s . The average velocity of the body will be
- a) 3 m/s b) $\frac{11}{3} \text{ m/s}$ c) $\frac{8}{3} \text{ m/s}$ d) $\frac{4}{3} \text{ m/s}$
- Q7** Let E, G and N represents the magnitude of electromagnetic, gravitational and nuclear forces between two protons at a given separation (1 fermi) . Then
- a) $N < E < G$ b) $E > N > G$ c) $G > N > E$ d) $N > E > G$

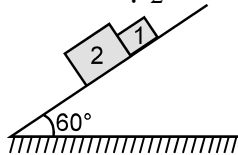
- Q8** In which of the following cases the magnitude of acceleration of the block A will be maximum (Neglect friction, mass of pulley and string)



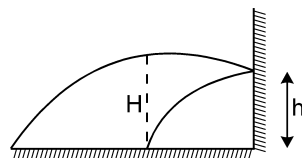
- Q9** Two blocks are in contact on a frictionless table. One has mass m and the other $2m$. A force F is applied on $2m$ as shown in the figure. Now the same force F is applied from the right on m . In the two cases respectively, the ratio of force of contact between the two blocks will be :



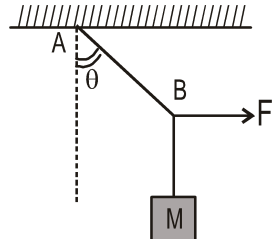
- a) same b) 1 : 2 c) 2 : 1 d) 1 : 3
- Q10** In the figure shown if friction co-efficient of block 1 and 2 with inclined plane is $\mu_1 = 0.5$ and $\mu_2 = 0.4$ respectively, then find out the correct statement.



- a) both block will move together b) both block will move separately
c) there is a non-zero contact force between two blocks d) none of these
- Q11** A stone is projected from a horizontal plane. It attains maximum height 'H' & strikes a stationary smooth wall & falls on the ground vertically below the maximum height. Assuming the collision to be elastic the height of the point on the wall where ball will strike is



- a) $\frac{H}{10}$ b) H c) $\frac{3H}{4}$ d) None of these
- Q12** A mass M is suspended by a rope from a rigid support at A as shown in figure. Another rope is tied at the end B, and it is pulled horizontally with a force F . If the rope AB makes an angle θ with the vertical in equilibrium, then the tension in the string AB is :

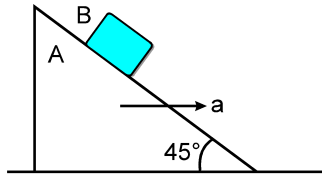


- a) $F \sin \theta$ b) $F/\sin \theta$ c) $F \cos \theta$ d) $F/\cos \theta$

Q13 A balloon of gross weight w newton is falling vertically downward with a constant acceleration $a (< g)$. The magnitude of the air resistance is : (Neglecting buoyant force)

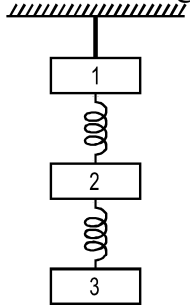
- a) w b) $w\left(1 + \frac{a}{g}\right)$ c) $w\left(1 - \frac{a}{g}\right)$ d) $w \frac{a}{g}$

Q14 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) $g\left(\frac{1-\mu}{1+\mu}\right)$

Q15 Three identical blocks are suspended by two identical springs one below the other as shown in figure. If thread that supports block 1 is cut, then just after the cut :



- a) The second block has zero acceleration b) The first block has zero acceleration
c) Both (1) & (2) are wrong d) Both (1) & (2) are correct

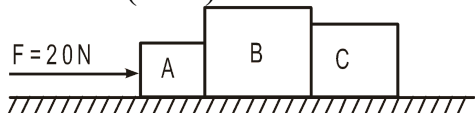
Q16 A point mass is projected, making an acute angle with the horizontal. If angle between velocity \vec{v} and acceleration \vec{g} is θ at any time t during the motion, then θ is given by

- a) $0^\circ < \theta < 90^\circ$ b) $\theta = 90^\circ$ c) $\theta < 90^\circ$ d) $0^\circ < \theta < 180^\circ$

Q17 A projectile is thrown with a speed v at an angle θ with the upward vertical. Its average velocity between the instants at which it crosses half the maximum height is

- a) $v \sin \theta$, horizontal and in the plane of projection
b) $v \cos \theta$, horizontal and in the plane of projection
c) $2v \sin \theta$, horizontal and perpendicular to the plane of projection
d) $2v \cos \theta$, vertical and in the plane of projection.

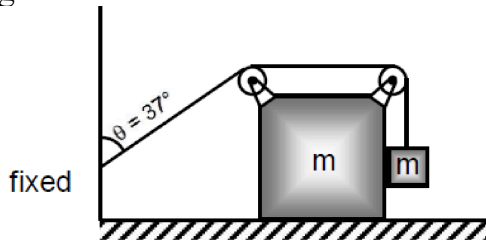
Q18 Three blocks A, B and C of masses 1 kg, 6 kg and 3 kg respectively are placed on a smooth plane surface. A force F of 20 N is applied on A as shown. Then the force of contact (in N) between B and C is :



- a) 2 b) 4 c) 6 d) 12

- Q19** A stone is thrown upwards from a tower with a velocity 50 ms^{-1} . Another stone is simultaneously thrown downwards from the same location with a velocity 50 ms^{-1} . When the first stone is at the highest point, the relative velocity of the second stone with respect to the first stone is (assume that second stone has not yet reached the ground) :
- a) Zero b) 50 ms^{-1} c) 100 ms^{-1} d) 150 ms^{-1}

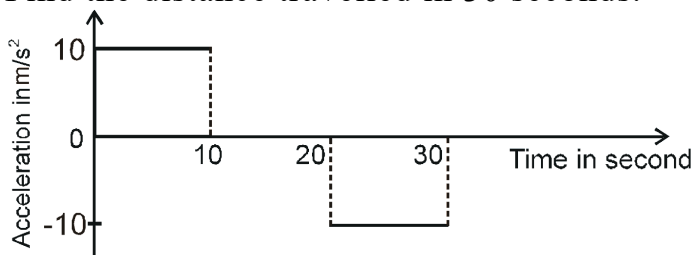
- Q20** Consider the arrangement shown in figure. Pulleys and string are ideal. Both blocks have same mass m . The minimum coefficient of friction between bigger block and ground for which both blocks remains in equilibrium is :



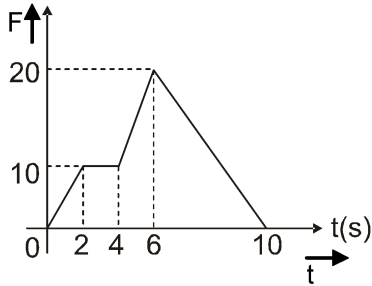
- a) $\frac{2}{7}$ b) $\frac{3}{14}$ c) $\frac{1}{2}$ d) zero

Numerical

- Q21** A bullet is fired from horizontal ground at some angle with horizontal passes through the point $\left(\frac{3R}{4}, \frac{R}{4}\right)$, where 'R' is the range of the bullet. Assume point of the projection to be origin and the bullet moves in x-y plane with x-axis horizontal and y-axis vertically upwards. Then angle of projection (in degree) is :
- Q22** The position vector of a particle is given by $\vec{r} = (2t \hat{i} + 5t^2 \hat{j}) \text{ m}$ (t is time in sec). Then the angle between initial velocity and initial acceleration is $\frac{n\pi}{4}$ then find the value of n.
- Q23** A man who can swim at the rate of 2 km/hr (in still river) crosses a river to a point exactly opposite on the other bank by swimming in a direction of 150° to the flow of the water in the river. The velocity of the water current in km/hr is \sqrt{n} then find the value of n.
- Q24** A cart started at $t = 0$ from rest, its acceleration varies with time as shown in figure. Find the distance travelled in 30 seconds.

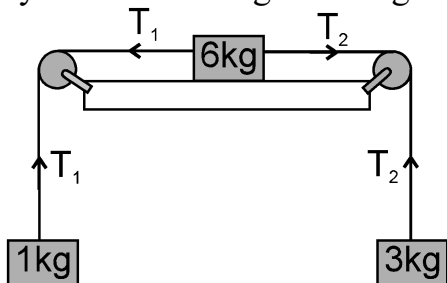


- Q25** A particle of mass 2 kg is initially at rest. A force acts on it whose magnitude changes with time. The force time graph is shown below

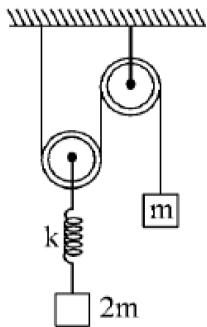


The velocity (in ms^{-1}) of the particle after 10s is

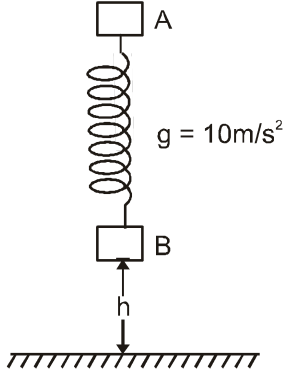
- Q26** A car moving with a speed of 50 km/h, can be stopped by brakes after at least 10m. If the same car is moving at a speed of 100 km/h, the minimum stopping distance (in m) is :
- Q27** Three masses of 1 kg , 6 kg and 3 kg are connected to each other with threads and are placed on table as shown in figure. What is the acceleration (in m s^{-2}) with which the system is moving ? Take $g = 10\text{m s}^{-2}$.



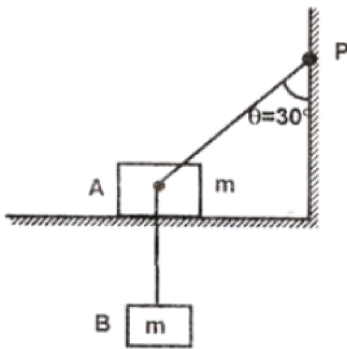
- Q28** In the figure shown, string is light and inextensible, spring is light and ideal, the pulleys are light and frictionless. Initially the spring is in its natural length and the string just taut. Now the system is released from rest. The maximum extension in the spring during consequent motion is $\frac{nmg}{k}$ Find n



- Q29** From what minimum height 'h' in metre must the system be released when spring is in its natural length as shown in the figure. So that after perfectly inelastic collision. ($e = 0$), of block B, with ground, B may be lifted off ground. (Take $k = 40 \text{ N/m}$, $g = 10 \text{ m/s}^2$, $m_A = 2\text{kg}$, $m_B = 4\text{kg}$)



- Q30** Block A is on a frictionless horizontal table. A massless inextensible string fixed at one end passes over a smooth nail fixed with the block A. The other end of the string is connected to block B of mass m. Initially the block B is held at rest so that $\theta = 30^\circ$. What will be the magnitude of acceleration of block B just after it is released (in m/s^2 take $g = 10 \text{ m/s}^2$).



Chemistry

Single Choice Question

Q31 Consider the following statements :

- (a) Electron density in the XY plane in $3d_{x^2-y^2}$ orbital is zero
 - (b) Electron density in the XY plane in $3d_{z^2}$ orbital is zero.
 - (c) 2s orbital has one nodal surface
 - (d) for $2p_z$ orbital, YZ is the nodal plane.
- Which of these are incorrect statements?

- a) a & c b) b & c c) Only b d) a, b, d

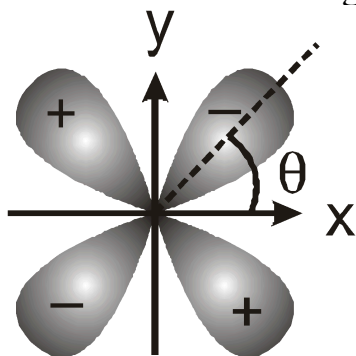
Q32 Which of the following statements incorrect for an electron of quantum numbers $n = 4$ and $m = 2$?

- a) The value of ℓ may be 2.
- b) The value of ℓ may be 3.
- c) The value of s may be $+1/2$.
- d) The value of ℓ may be 0, 1, 2, 3.

Q33 Which of the following statements is INCORRECT :

- a) Zeeman effect and Stark effect are failures of Bohr model.
- b) One p-orbital can accomodate a total of six electrons.
- c) In d_{xy} orbital, there is zero probability of finding electrons along X and Y axes.
- d) According to Planck's quantum theory, energy of a photon can be calculated using the formula $E = hc\bar{\nu}$.
(where symbols have their usual meanings)

Q34 Which of the following statement is incorrect for $3d_{xy}$ orbitals?



- a) The orbitals drawn has two nodal planes, xz and yz.
- b) The minimum probability point lie along $\theta = 45^\circ$.
- c) +ve and -ve signs represent sign of amplitude of electron wave.
- d) The electrons has equal probability of finding electron along x-axis, y-axis and z-axis.

Q35 The orbital angular momentum of a $4p$ electron will be

- a) $4 \cdot \frac{h}{2\pi}$ b) $\sqrt{2} \cdot \frac{h}{2\pi}$ c) $\sqrt{6} \cdot \frac{h}{4\pi}$ d) $\sqrt{2} \cdot \frac{h}{4\pi}$

Q36 Which of the following configuration is violating Pauli's exclusion principle ?

- a) $2s$ $2p$ **b)** $2s$ $2p$ **c)** $2s$ $2p$
- d) (b) and (c)

Q37 The orbital angular momentum corresponding to $n = 4$ and $m = -3$ is :

- a) 0 **b)** $\frac{h}{\sqrt{2}\pi}$ **c)** $\frac{\sqrt{6}h}{2\pi}$ **d)** $\frac{\sqrt{3}h}{\pi}$

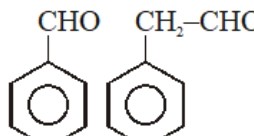
Q38 A bulb emits light of $\lambda = 4500 \text{ \AA}$. The bulb is rated as 150 watt and 8% of the energy is emitted as light. Number of photons emitted by bulb per second are : $\lambda (\text{\AA}^\circ) =$

$$\frac{12400}{E(\text{eV})}$$

- a) 4.5×10^{19} **b)** 5.4×10^{19} **c)** 1.5×10^{19} **d)** 2.7×10^{19}

Q39 Which of the following matter waves will have the shortest wavelength, if travelling with same kinetic energy ?

- a) Electron **b)** Alpha particle **c)** Neutron **d)** Proton

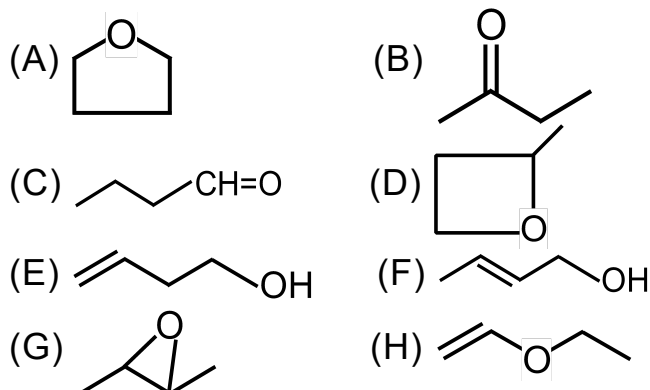
Q40  and can be distinguished by :

- a) Iodoform test **b)** Tollen's test **c)** Fehling solution test **d)** 2,4-DNP test

Q41 What is the total mass of products formed when 34 g of H_2S is oxidised by excess of oxygen gas to produce water & sulphur dioxide?

- a) 34 g **b)** 68 g **c)** 82 g **d)** 164 g

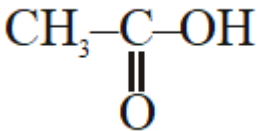
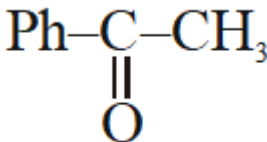
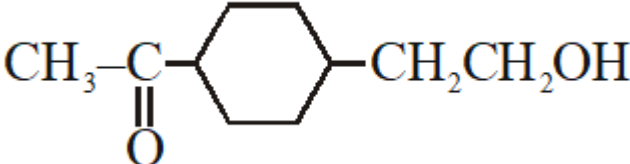
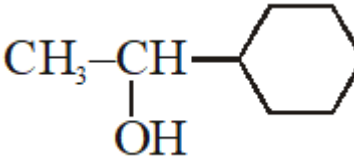
Q42 Observe the isomers with the molecular formula $\text{C}_4\text{H}_8\text{O}$ given below



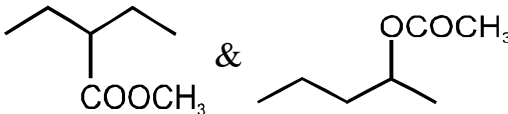
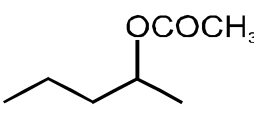
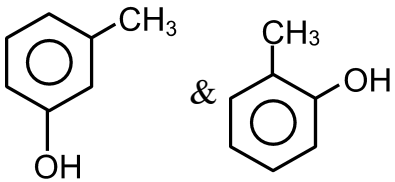
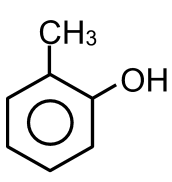
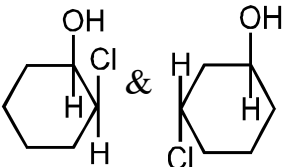
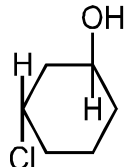
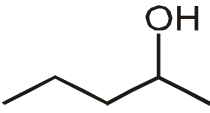
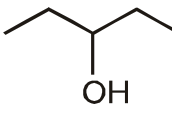
Now select the false statement regarding the above isomers A, B, C, D, E, F, G, H

- a) B and C are functional Isomers **b)** H and A are metamers
c) E and F are position isomers **d)** B and D are functional isomers

Q43 Which of the following will not give positive iodoform test.

- a) 
- b) 
- c) 
- d) 

Q44 Member of which of the following pair of isomers are not position isomers?

- a)  & 
- b)  & 
- c)  & 
- d)  & 

Q45 For $C_4H_{10}O$ which of following isomerism are possible.

- a) Position isomers b) Functional group isomers c) Metamers d) All of these

Q46 Electrons in a H-atom sample are in $(n-1)^{th}$ excited state. They make back-transition upto ground state emitting photons with all possible wavelengths. The wavelength of emitted photon corresponding to maximum energy is λ . The value of n is : (R = Rydberg's constant)

- a) $\left[\frac{\lambda R}{\lambda R - 1} \right]^{1/2}$ b) $\left[\frac{\lambda R + 1}{\lambda R} \right]^{1/2}$ c) $\left[\frac{\lambda R}{\lambda R + 1} \right]^{1/2}$ d) $\left[\frac{R}{R - \lambda} \right]^{1/2}$

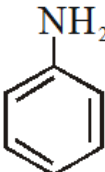
Q47 S_1 : Photoelectric effect can be explained on the basis of wave nature of electromagnetic radiation.

S_2 : An orbital represented by $n = 2, \ell = 1$ is dumb-bell shaped.

S_3 : d_{xy} orbital has zero probability of finding electrons along X-axis and Y-axis.

- a) FTF b) FTT c) TFT d) TFF

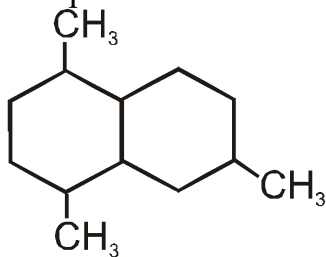
Q48 Compound does not give offensive smell on heating with chloroform and alkali

- a) CH_3-NH_2 b)  c) CH_3-NO_2 d) $Ph-CH_2-NH_2$

- Q49** If electronic configuration of B is written as $1s^3 2s^2$. Which principle is violated during filling electrons?
- a) Aufbau principle b) Hund's maximum multiplicity rule c) Pauli's exclusion principle
d) Hund's maximum multiplicity rule and Pauli's exclusion principle
- Q50** Rearrange the following (I to IV) in the order of increasing masses:
- I. 0.5 mole of O_3
II. 0.5 g atom of oxygen
III. 3.011×10^{23} molecules of O_2
IV. 5.6 litre of CO_2 at STP
- a) $II < IV < III < I$ b) $II < I < IV < III$ c) $IV < II < III < I$ d) $I < II < III < IV$

Numerical

- Q51** Total number of radial and angular nodes for $3P_x$ orbital is equal to :
- Q52** The number of given orbitals which have electron density along the axis is _____
 $p_x, p_y, p_z, d_{xy}, d_{yz}, d_{xz}, d_{z^2}, d_{x^2-y^2}$
- Q53** The haemoglobin from the red blood corpuscles of most mammals contains approximately 0.33% of iron by mass. The molar mass of haemoglobin is 67,200. The number of iron atoms in each molecule of haemoglobin is (atomic mass of iron = 56):
- Q54** A gas XH_2 has molar mass 34 g/mol. What is the molar mass (in g/mol) of XO_3 (nearly) ?
- Q55** The number of structure isomers of $C_3H_5Br_3$ is
- Q56** Find the number of g-molecules of oxygen in 6.023×10^{24} CO molecules -
- Q57** A sample of chlorine has only two isotopes, Cl^{35} and Cl^{37} and its average atomic weight is 35.82. the percentage abundance of isotope Cl^{37} in the given sample is.
- Q58** How many products (structural isomers) are formed by monochlorination of following compound ?



- Q59** A polystyrene having molecular formula $\text{Br}_3(\text{C}_6\text{H}_3)(\text{C}_8\text{H}_8)_n$ was prepared by heating styrene with tribromobenzoyl peroxide in the absence of air. If it was found to contain 10.46% bromine (At wt = 80) by mass, determine the value of 'n' in nearest possible integers.
- Q60** A solution of fatty acid 'X' ($M = 252 \text{ gm/mol}$) in benzene contain 4.2 gm of acid per litre. When this solution is dropped in a water surface the benzene evaporates and fatty acid 'X' forms a monolayer film of solid type. If we wish to cover 10 m^2 area with monolayer film of fatty acid 'X', what volume of solution in ml should we use? Each fatty acid molecule occupy 0.2 nm^2 area.
 $N_A = 6 \times 10^{23}$

Mathematics

Single Choice Question

- Q61** If the quadratic equation $x^2 - 4px + 4p(p - 1) = 0$ possess roots of opposite sign then set of values of p is
 a) $(0, 1)$ b) $(-\infty, 0)$ c) $(1, 4)$ d) $(1, \infty)$
- Q62** If $x = 2 + 2^{2/3} + 2^{1/3}$, then the value of $x^3 - 6x^2 + 6x$ is
 a) 3 b) 2 c) 1 d) -2
- Q63** Roots of the quadratic equation $(x^2 - 4x + 3) + \lambda(x^2 - 6x + 8) = 0$, $\lambda \in \mathbb{R}$ will be
 a) always real b) real only when λ is positive c) real only when λ is negative
 d) always imaginary
- Q64** The number of real roots of the equation $x^2 - 3|x| + 2 = 0$ is
 a) 2 b) 1 c) 4 d) 3
- Q65** Let p and q be roots of the equation $x^2 - 2x + A = 0$ and let r and s be the roots of the equation $x^2 - 18x + B = 0$. If $p < q < r < s$ are in arithmetic progression, then the values of A and B are
 a) 3, -77 b) 3, 77 c) -3, -77 d) -3, 77
- Q66** The number of irrational roots of the equation $\frac{4x}{x^2 + x + 3} + \frac{5x}{x^2 - 5x + 3} = -\frac{3}{2}$ is
 a) 4 b) 0 c) 1 d) 2
- Q67** If α, β are the roots of the equation $x^2 - 2x + 3 = 0$. Then the equation whose roots are $P = \alpha^3 - 3\alpha^2 + 5\alpha - 2$ and $Q = \beta^3 - \beta^2 + \beta + 5$ is
 a) $x^2 + 3x + 2 = 0$ b) $x^2 - 3x - 2 = 0$ c) $x^2 - 3x + 2 = 0$ d) none of these
- Q68** If α, β are roots of the equation $2x^2 - 5x + 3 = 0$, then $\alpha^2\beta + \beta^2\alpha$ is equal to
 a) $15/2$ b) $-15/4$ c) $15/4$ d) $-15/2$
- Q69** If $p(q - r)x^2 + q(r - p)x + r(p - q) = 0$ has equal roots, then $\frac{2}{q} =$
 a) $\frac{1}{p} + \frac{1}{r}$ b) $p + r$ c) $p^2 + r^2$ d) $\frac{1}{p^2} + \frac{1}{r^2}$
- Q70** If α and β are roots of equation $x^2 - 7x + 1 = 0$, then the value of $\frac{1}{(\alpha-7)^2} + \frac{1}{(\beta-7)^2}$
 a) 45 b) 47 c) 49 d) 50
- Q71** A quadratic equation whose product of roots x_1 and x_2 is equal to 4 and satisfying the relation $x_1/(x_1 - 1) + x_2/(x_2 - 1) = 2$ is
 a) $x^2 - 2x + 4 = 0$ b) $x^2 + 2x + 4 = 0$ c) $x^2 + 4x + 4 = 0$ d) $x^2 - 4x + 4 = 0$

- Q85** The number of the real roots of the equation $(x+1)^2 + |x-5| = \frac{27}{4}$ is _____.
- Q86** If $f(x) = 4x^2 + 3x - 7$ and α is a common root of equations $x^2 - 3x + 2 = 0$ and $x^2 + 2x - 3 = 0$, then $f(\alpha) =$
- Q87** The number of solutions of the equation $\log_4(x-1) = \log_2(x-3)$ is
- Q88** The number of real roots of the equation $\sqrt{x^2 - 4x + 3} + \sqrt{x^2 - 9} = \sqrt{4x^2 - 14x + 6}$ is :
- Q89** The number of integral solutions x of $\log_{\left(x+\frac{7}{2}\right)}\left(\frac{x-7}{2x-3}\right)^2 \geq 0$ is
- Q90** The number of quadratic equations, with coefficient of x^2 as 1, which are unaltered by squaring their roots is

Answer Key

Que.	1	2	3	4	5	6	7	8	9	10
Ans.	B	C	B	B	B	A	D	C	B	B
Que.	11	12	13	14	15	16	17	18	19	20
Ans.	C	B	C	B	A	D	B	C	C	B
Que.	21	22	23	24	25	26	27	28	29	30
Ans.	53	2	3	200	50	40	2	4	2	2
Que.	31	32	33	34	35	36	37	38	39	40
Ans.	D	D	B	B	B	B	D	D	B	C
Que.	41	42	43	44	45	46	47	48	49	50
Ans.	C	B	A	A	D	A	B	C	C	A
Que.	51	52	53	54	55	56	57	58	59	60
Ans.	2	5	4	80	5	5	41	13	19	5
Que.	61	62	63	64	65	66	67	68	69	70
Ans.	A	B	A	C	D	D	C	C	A	B
Que.	71	72	73	74	75	76	77	78	79	80
Ans.	A	C	B	C	B	B	A	D	C	C
Que.	81	82	83	84	85	86	87	88	89	90
Ans.	3	4	3	6	2	0	1	1	6	4