Competishun

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

Date: 20/05/2024

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

PRATHAM-1_(24-25)_ACT-1_PAPER-2

Physics

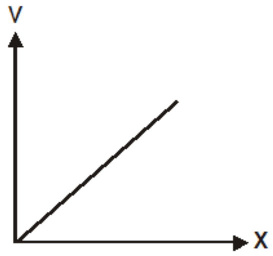
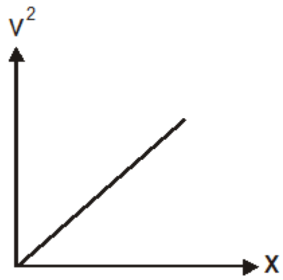
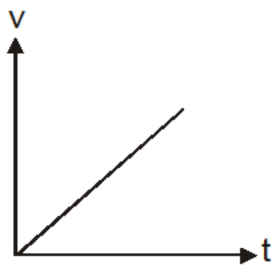
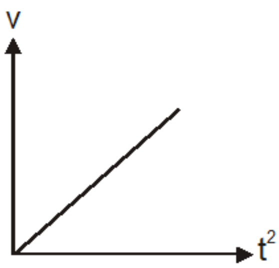
MTC-SCQ

Q1 **Match the Listing :**
A particle is projected from level ground. Assuming projection point as origin, x-axis along horizontal and y-axis along vertically upwards. If particle moves in x-y plane and its path is given by $y = ax - bx^2$ where a, b are positive constants. Then match the physical quantities given in list-I with the values given in list-II. (g in list-II is acceleration due to gravity.)

List-I	List-II
(P) Horizontal component of velocity	(1) $\frac{a}{b}$
(Q) Time of flight	(2) $\frac{a^2}{4b}$
(R) Maximum height	(3) $\sqrt{\frac{g}{2b}}$
(S) Horizontal range	(4) $\sqrt{\frac{2a^2}{bg}}$

a) P→3 Q→4 R→2 S→1 **b)** P→1 Q→4 R→3 S→2 **c)** P→4 Q→2 R→1 S→3
d) P→4 Q→1 R→2 S→3

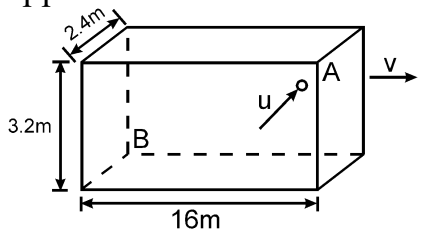
Q2 Column I gives some graphs for a particle moving along x-axis in positive x–direction. The variables v, x and t represent velocity of particle, x–coordinate of particle and time respectively. Column II gives certain resulting interpretation. Match the graphs in Column I with the statements in Column II.

Column I	**Column II**
(a)  v - x graph	(p) Acceleration of particle is uniform
(b)  v^2 - x graph	(q) Acceleration of particle is nonuniform
(c)  v - t graph	(r) Acceleration of particle is directly proportional to ‘t’
(d)  v - t^2 graph	(s) Acceleration of particle is directly proportional to ‘x’.

a) (a) p, q ; (b) s; (c) r; (d) q, r
b) (a) q, r ; (b) p; (c) s; (d) p, q
c) (a) q, s ; (b) p; (c) p; (d) q, r
d) (a) s, r ; (b) q; (c) p; (d) p, s,q

Multiple Choice Question

Q3 A railway compartment is 16 m long, 2.4 m wide and 3.2 m high. It is moving with a velocity υ. A particle moving horizontally with a speed u, perpendicular to the direction of υ, enters through a hole at an upper corner A and strikes the diagonally opposite corner B. Assume g = 10 m/s^2.



a) υ = 20 m/s **b)** u = 3 m/s

c) to an observer inside the compartment, the path of the particle is a parabola

d) to a stationary observer outside the compartment, the path of the particle is a parabola

Q4 A balloon, which is initially at rest, starts rising with an acceleration of 1.25 m/s^2 after 8 seconds. A stone is released from the balloon. Then :

a) Speed of the stone just after releasing is 10 m/s

b) Acceleration of the stone just after releasing is 1.25 m/s^2

c) Magnitude of acceleration of the stone just after releasing is 10 m/s^2

d) The stone will reach the ground 4 seconds after releasing

Q5 From the top of a tower of height 200 m, a ball A is projected up with 10 m s^{-1} and two seconds later another ball B is projected vertically down with the same speed. Then : (Take g = 10 m/s^2)

a) both A and B will reach the ground simultaneously

b) the ball A will hit the ground 2 seconds later than B hitting the ground

c) both the balls will hit the ground with the same velocity

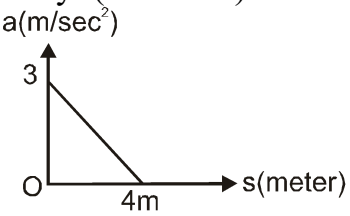
d) if the collisions on the ground are perfectly elastic both will rise to the same height above the

Q6 The magnitude of scalar product of two vectors is 8 and that of vector product is 8 . The angle between them is :

a) 30º **b)** 60º **c)** 120º **d)** 150º

Numerical

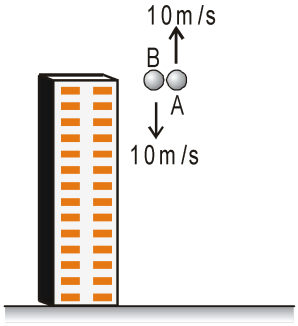
Q7 The acceleration (a) –displacement(s) graph of a body moving in a straight line is given. If the speed of the body at S = 4 m is 4 m/sec. Find the initial speed of the body. (in m/sec).



Q8 A particle is projected under gravity at an angle of projection 45°. If for ground to ground projectile motion its range is 36 m. Find maximum Height (in m) attained by particle

Q9 A ball is thrown vertically upwards from the ground with an initial speed u(in m/s). The ball crosses a height of 80m two times at an interval of 6 sec. Find the value of $\frac{u}{10}$. (g = 10 m/s^2)

Q10 Both A & B are thrown simultaneously as shown from a very high tower. If distance between the two balls after 1 seconds is 10n (in meter) then value of n is. (Assume that the balls are thrown from the same point simultaneously)



Q11 The rectangular components of a vector are (2, 2). The corresponding rectangular components of another vector are (1, $\sqrt{3}$). The angle between these two vectors is θ (in degree) find θ/5

Q12 Six forces, 9.81 N each, acting at a point are coplanar. If the angles between neighboring forces (in N) are equal, then the resultant is

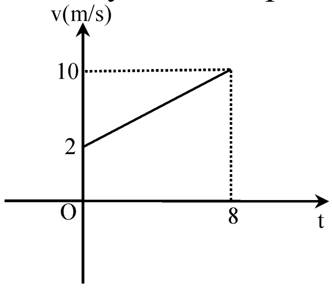
Q13 Two balls of equal masses are thrown upward, along the same vertical line at an interval of 2 seconds, with the same initial velocity of 40 m/s. Then these collide at a height h (in m) from ground. Find h/15 (Take g = 10 m/s^2)

Q14 Two particles are moving with velocity $\vec{v}_1 = \hat{i} - 2t\hat{j} m/s$ and $\vec{v}_2 = 4\hat{i} + \hat{j} m/s$ respectively Time at which they are moving perpendicular to each other is

Q15 If y = 4x^2 – 4x + 7. Find the minimum value of y

Q16 An insect moves with a constant velocity v from one corner of a room to other corner which is opposite of the first corner along the largest diagonal of room. If the insect can not fly and dimensions of room is a × a × a, then the minimum time in which the insect can move is $\frac{a}{v}$ times the square root of a number n, then n is equal to ?

Q17 Figure shows the graph of velocity versus time for a particle going along x axis. Initially at t = 0, particle is at x = 3m. Find position of particle at t = 2s. (in m)



Q18 An astronaut is on the surface of a planet whose air resistance is negligible. To measure the acceleration due to gravity (g), he throws a stone upwards. He observer that the stone reaches to a maximum height of 10m and reaches the surface 4 second after it was thrown. Find the acceleration due to gravity (g) on the surface of that planet in m/s^2 .

Chemistry

MTC-SCQ

Q19 **LIST-I**

(P) Ratio of ionisation energy for He^+ ion and Be^{3+} ion, respectively

(Q) Ratio of total energy of electron in 1^{st} excited state of He^+ ion and potential energy of electron in 5^{th} excited state of Li^{2+} ion, respectively

(R) Ratio of time period of revolution of electron in 1^{st} orbit of He^+ ion and 2^{nd} orbit of Be^{3+} ion, respectively

(S) Ratio of radius of 3^{rd} excited state of He^+ ion and 1^{st} excited state of H–atom respectively

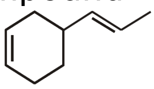
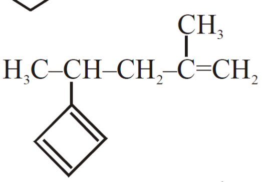
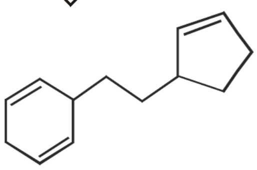
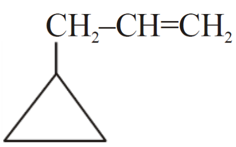
LIST-II

(1) 2 : 1
(2) 1 : 2
(3) 1 : 4
(4) 1 : 1

a) P→3 Q→1 R→2 S→1 **b)** P→3 Q→1 R→2 S→4 **c)** P→1 Q→2 R→3 S→4

d) P→2 Q→1 R→3 S→2

Q20 Match the following :

Column I Compound	**Column II** Degree of unsaturation
(P) 	(1) 2
(Q) 	(2) 5
(R) 	(3) 4
(S) 	(4) 3

a) P→1 Q→2 R→3 S→4 **b)** P→4 Q→3 R→1 S→2 **c)** P→4 Q→3 R→2 S→1

d) P→3 Q→1 R→4 S→2

Multiple Choice Question

Q21 Which of the following statement(s) is/are **CORRECT** ?

a) All spectral lines belonging to Paschen series in He^+ spectrum lie in visible region

b) If light of frequency ν falls on a metal surface having work function $h\nu_0$, photoelectric effect can take place only if $\nu \geq \nu_0$.

c) A metal with lesser work function produce more number of photoelectrons if intensity and frequency of radiation is same as that for metal with more work function.

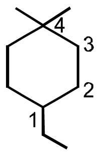
d) As temperature of a blackbody is increased the intensity at smaller wavelength increases and that at longer wavelength decreases

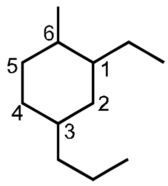
Q22 Which of the following is/are correct order of energy for Li^{2+}-atom?

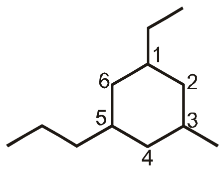
a) 1s < 2s < 2p < 3s < 3p **b)** 1s < 2s = 2p < 3s = 3p **c)** 1s < 2p < 3d < 4s

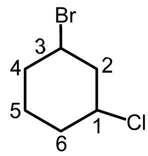
d) 1s < 2s < 4s < 3d

Q23 In which of the following compound IUPAC numbering is correct ?

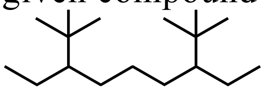
a) 

b) 

c) 

d) 

Q24 Which of the following substituent/s is/are present on the parent carbon chain of the given compound ?



a) Ethyl **b)** Methyl **c)** Tertiary butyl **d)** Propyl

Numerical

Q25 When 4f level is completely filled with electrons the next electron will enter into a subshell whose $(n + \ell)$ is equal to ....

Q26 A sample of hydrogen atoms containing all the atoms in a particular excited state absorb radiations of a particular wavelength by which the atoms get excited to another excited state. When the atoms finally de-excite to the ground state, they emit the radiations of 10 different wavelengths. Out of these 10 radiations, 7 have wavelengths shorter than the absorbed radiation and 2 have wavelength longer than the absorbed radiation. The orbit number for the initial excited state of atoms is

Q27 Two particles having same q/m ratio are projected towards gold nucleus in different experiments with the same speed. The ratio of their distance of closest approach will be :

Q28 In a sample of hydrogen atoms, all the electron jump from n = 5 to ground level finally (directly or indirectly) without emitting any line in Balmer series. The number of possible different lines is :

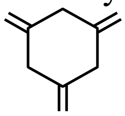
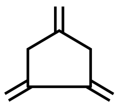
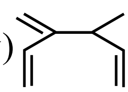
Q29 How many gram ions of SO_4^{-2} are present in 1 gram molecule of $K_2SO_4 . Al_2(SO_4)_3 . 24H_2O$:

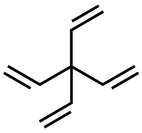
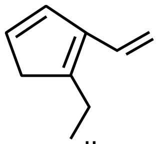
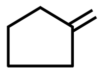
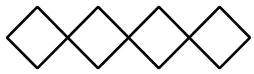
Q30 An LED of powers X watt emits twice as many photons at 1000 nm as another LED of power 5 watt at 400 nm in one second. Find X.

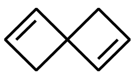
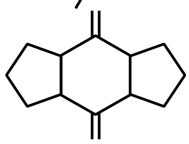
Q31 The atomic number of hydrogen-like ion has the wavelength difference between the first line of Balmer and Lyman series equal to 59.3 nm.

Q32 According to Bohr theory, the electronic energy of a hydrogen atom in the n^{th} Bohr atom is given by $E_n = \frac{-21\times10^{-19}}{n^2}\times Z^2$ J. Calculate the longest wavelength of light that will be needed to remove an electron from the third Bohr orbit of the He^+ ion (If the wavelength is $x \times 10^{-7}$ (in meter) and x is an integer. Report 'x')

Q33 How many of following compound do not have general formula as C_nH_{2n-6}.

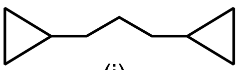
(i)  (ii)  (iii)  (iv) 

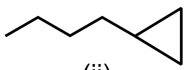
(v)  (vi)  (vii)  (viii) 

(ix)  (x) 

Q34 How many sp^2–sp^2 C–C σ bonds are present in acetophenone

Q35 In how many of following **prop** used as root word ?


(i)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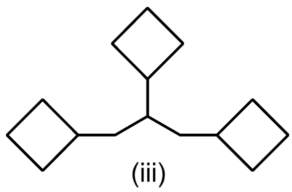
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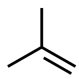
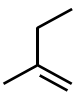

(iv)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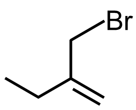

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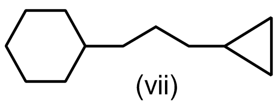
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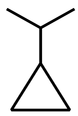
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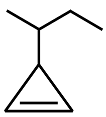
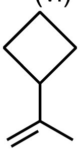
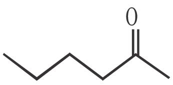
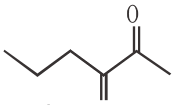
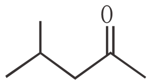

(ix)

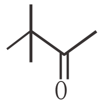

(x)

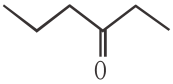
Q36 How many ketones of the following has hex root word ?

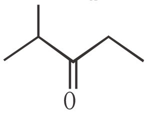
(i) 

(ii) 

(iii) 

(iv) 

(v) 

(vi) 

Mathematics

MTC-SCQ

Q37 Observe the following lists

Column-I	Column-II
(A) $-7x^2 + 8x - 9 > 0$	(P) $R - \{2\}$
(B) $2x^2 - 4x + 5 > 0$	(Q) $(-1, 6)$
(C) $x^2 - 4x + 4 > 0$	(R) $(-\infty, -1) \cup (6, \infty)$
(D) $x^2 - 5x - 6 < 0$	(S) R
	(T) ϕ

a) $A \to P;\ B \to R;\ C \to R;\ D \to T$
b) $A \to Q;\ B \to T;\ C \to S;\ D \to P$
c) $A \to T;\ B \to S;\ C \to P;\ D \to Q$
d) $A \to S;\ B \to R;\ C \to T;\ D \to P$

Q38 Match the following quadratic equations with the intervals for k in which they are having both roots as real:

Column I	Column II
(A) $x^2 - kx - 1 = 0$	(P) $(-\infty, -6] \cup [4, \infty)$
(B) $kx^2 + kx + 1 = 0$	(Q) $(-\infty, \infty)$
(C) $(k-2)x^2 - 8x + (k+4) = 0$	(R) $(-\infty, 0) \cup [4, \infty)$
(D) $(x - a)(x - c) + k(x - b)(x - d) = 0$ $(a < b < c < d)$	

a) $A \to P;\ B \to R;\ C \to R;\ D \to R$
b) $A \to Q,\ B \to R,\ C \to P,\ D \to Q$
c) $A \to R;\ B \to P;\ C \to P;\ D \to Q$
d) $A \to P;\ B \to R;\ C \to Q;\ D \to P$

Multiple Choice Question

Q39 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

Q40 Product of all possible roots of equation $3^{2x^2} - 4.3^{x^2+x+6} + 3^{2x-13} = 0$ is divisible by

a) 2 **b)** 3 **c)** 4 **d)** 5

Q41 The least value of the expression $x^2 + 4y^2 + 3z^2 - 2x - 12y - 6z + 14$ is

a) 1 **b)** no least value **c)** 0 **d)** none of these

Q42 The x-values satisfying the equation $|x-1|^{log_3 x^2 - 2log_x 9} = (x-1)^7$ is/are

a) $\frac{1}{\sqrt{3}}$ **b)** 1 **c)** 2 **d)** 81

Numerical

Q43 Let $P(x) = 4x^2 + 6x + 7$ and $Q(y) = 4y^2 - 12y + 29$. If P(x). Q(y) = 95, then find the value of $|4(x - y)|$.

Q44 If x, y, z be positive real numbers such that $\log_{2x} z = 3$, $\log_{5y} z = 6$ and $\log_{xy} z = 2/3$ then the value of z is in the form of m/n in lowest form then find value of n – m.

Q45 The value of 'a' for which the sum of the squares of the roots of the equation $x^2 - (a - 2)x - a - 1 = 0$ assumes the least value.

Q46 Find out number of solution of equation $\sqrt{x+1} - \sqrt{x-1} = \sqrt{4x-1}$

Q47 Let P(x) be a cubic polynomial with zeroes α, β, γ if $\frac{P(1/2)+P(-1/2)}{P(0)} = 100$ find $\frac{1}{\alpha\beta} + \frac{1}{\beta\gamma} + \frac{1}{\gamma\alpha}$.

Q48 If $\log_{(2x+3)}(6x^2 + 23x + 21) = 4 - \log_{(3x+7)}(4x^2 + 12x + 9)$ then find the value of $64x^2$

Q49 The three different polynomials $x^2 + ax + b$, $x^2 + x + ab$ and $ax^2 + x + b$ have exactly one common zero. Where a, b are non-zero real numbers. Find the value of a + 2b

Q50 If the equation $x^2 + 2(\lambda+1)x + \lambda^2 + \lambda + 7 = 0$ has only negative roots, then the least value of λ is

Q51 The number of solutions of equation $\log_6(x + 3) = 7 - x$ is

Q52 The value of 'a' for which $x^3 + ax - 1 = 0$ & $x^4 + ax^2 + 1 = 0$ have a common root is – k then k equals

Q53 If $\sqrt{\sqrt{\sqrt{x}}} = \sqrt[4]{\sqrt[4]{\sqrt[4]{3x^4+4}}}$, then the value of x^4 is.

Q54 If $x + y + z = 12$ & $x^2 + y^2 + z^2 = 96$ & $\frac{1}{x} + \frac{1}{y} + \frac{1}{z} = 36$ then value of $x^3 + y^3 + z^3$ is

Answer Key

Que.	1	2	3	4	5	6	7	8	9	10
Ans.	**A**	**C**	**2**	**9**	**5**	**2**	**3**	**0**	**5**	**2**
Que.	11	12	13	14	15	16	17	18	19	20
Ans.	**6**	**5**	**9**	**5**	**A, B, C, D**	**A, C, D**	**A, C, D**	**B, C**	**A**	**C**
Que.	21	22	23	24	25	26	27	28	29	30
Ans.	**7**	**3**	**1**	**6**	**4**	**4**	**3**	**2**	**3**	**7**
Que.	31	32	33	34	35	36	37	38	39	40
Ans.	**7**	**2**	**B**	**B, C**	**C**	**A, B**	**C**	**B**	**B**	**A, B**
Que.	41	42	43	44	45	46	47	48	49	50
Ans.	**A**	**C, D**	**9**	**9**	**1**	**0**	**196**	**4**	**0**	**6**
Que.	51	52	53	54						
Ans.	**1**	**2**	**4**	**866**						