

Competishun

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

Date: 20/05/2024

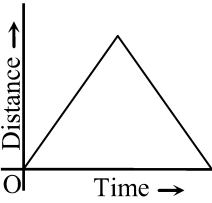
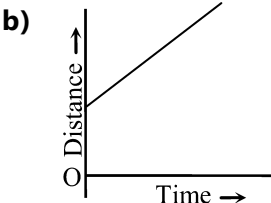
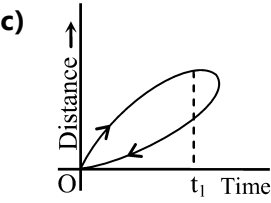
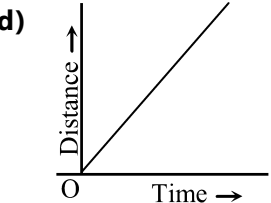
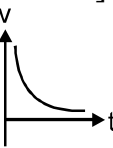
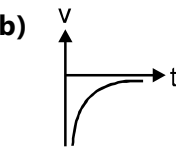
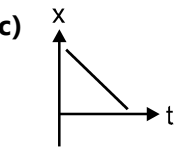
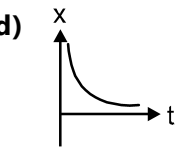
Time: 3 hours

Max. Marks: 180

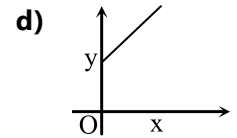
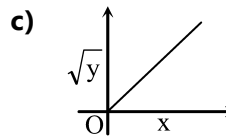
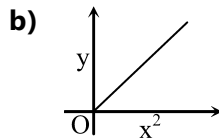
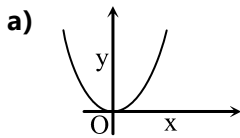
PRATHAM-1_(24-25)_ACT-1_PAPER-1

Physics

Multiple Choice Question

- Q1** A body moves so that it follows the following relation $\frac{dv}{dt} = -v^2 + 2v - 1$ where v is speed in m/s and t is time in second. If at $t = 0$, $v = 0$ then
- terminal velocity is 1 m/s
 - the magnitude of initial acceleration is 1 m/s^2
 - instantaneous speed is $v = \frac{-1}{1+t}$
 - the speed is 1.5 m/s when acceleration is one fourth of its initial value
- Q2** Which of the following graph(s) is/are not possible ?
- 
 - 
 - 
 - 
- Q3** A projectile is projected with a speed of 40 m/s at an angle θ with horizontal such that $\tan \theta = \frac{3}{4}$. After 2 sec, the projectile is moving with speed v at an angle α with horizontal then, ($g = 10 \text{ m/s}^2$)
- $\tan \alpha = \frac{1}{8}$
 - $\cot \alpha = \frac{1}{8}$
 - $v = 32.25 \text{ m/s}$
 - 32 m/s
- Q4** Which of the following graph(s) represent retardation ? [v :velocity, t :time ; x :position]
- 
 - 
 - 
 - 
- Q5** Vector \vec{R} is the resultant of the vectors \vec{A} and \vec{B} . Ratio of maximum value of $|\vec{R}|$ to the minimum value of $|\vec{R}|$ is $\frac{3}{1}$. The $\frac{|\vec{A}|}{|\vec{B}|}$ may be equal to
- $\frac{2}{1}$
 - $\frac{1}{2}$
 - $\frac{4}{1}$
 - $\frac{3}{1}$

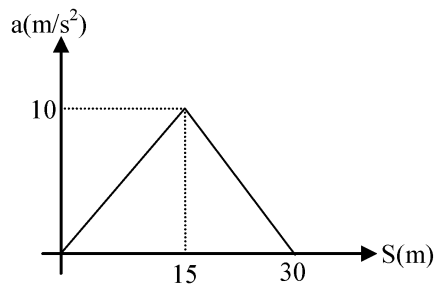
Q6 If $y = kx^2$ where k is positive non-zero constant, then which of the following graphs is/are correct ?



Numerical

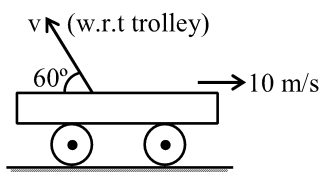
Q7 The angle θ between directions of forces \vec{A} and \vec{B} is 90° where $A = 8$ dyne and $B = 6$ dyne. If the resultant \vec{R} makes an angle α with \vec{A} then find the value of ' α ' ?

Q8 The particle moves with rectilinear motion given the acceleration-displacement (a-S) curve is shown in figure, determine the velocity after the particle has traveled 30 m. If the initial velocity is 10 m/s.



Q9 The minimum speed in m/s with which a projectile must be thrown from origin at ground so that it is able to pass through a point P (30 m, 40 m) is : ($g = 10 \text{ m/s}^2$)

Q10 For an observer on trolley direction of projection of particle is shown in figure, while for observer on ground ball rises vertically. Maximum height (in meter) reached by ball minus 10m is -



Q11 A particle moving along a straight line with a constant acceleration of -4 m/s^2 passes through a point A on the line with a velocity of $+8 \text{ m/s}$ at some moment. Find the distance travelled (in m) by the particle in 5 seconds after that moment.

Q12 Two cars are moving in same direction with a speed of 30 km/h. They are separated by a distance of 5 km. What is the speed of a car (in kmph) moving in opposite direction if it meets the two cars at an interval of 4 min ?

Q13 The velocity vector of a particle moving in xy plane is given by $\vec{v} = (t \hat{i} + x \hat{j})$ where t is time and x is position. If initially the particle was at origin, and equation of trajectory (path) of the particle is $ax^3 = by^2$, then the minimum value of $(a + b)$ is (where a and b are integer)

Q14 Find $\frac{\int_0^{\pi/2} \sin x \, dx}{\int_0^{\infty} e^{-x} \, dx} = ?$

Single Choice Question

- Q15** A man is driving out of his driveway by backing up. He realizes he has forgotten his lunch, so he pulls back into the driveway. Car experts agree that the best way to do this is to press on the brake until the car comes to a complete stop, shift from reverse into first gear, then accelerate forward. The driver, however, shifts into first gear while the car is rolling backward and pushes on the accelerator until he is going forward. This causes some wear on the transmission. The following chart shows some data about his progress. (Negative velocity = backwards)

t(s)	x(m)	v(m/s)
0.0	1.35	-1.8
0.5	0.60	-1.2
1.0	0.15	-0.6
1.5	0.00	0.0
2.0	0.15	0.6
2.5	0.60	1.2
3.0	1.35	1.8

What is the value of his average velocity ?

- a) -1.8 m/s b) 0.0 m/s c) 1.2 m/s d) 1.8 m/s
- Q16** A man is driving out of his driveway by backing up. He realizes he has forgotten his lunch, so he pulls back into the driveway. Car experts agree that the best way to do this is to press on the brake until the car comes to a complete stop, shift from reverse into first gear, then accelerate forward. The driver, however, shifts into first gear while the car is rolling backward and pushes on the accelerator until he is going forward. This causes some wear on the transmission. The following chart shows some data about his progress. (Negative velocity = backwards)

t(s)	x(m)	v(m/s)
0.0	1.35	-1.8
0.5	0.60	-1.2
1.0	0.15	-0.6
1.5	0.00	0.0
2.0	0.15	0.6
2.5	0.60	1.2
3.0	1.35	1.8

Which of the following is evidence that the acceleration is uniform ?

- a) The displacement x is always non-negative b) The velocity is always increasing
c) The velocity becomes zero at t = 1.5 s
d) Equal intervals of time correspond to equal intervals of velocity

Q17 A particle is moving along a straight line and its position is given by $x = t^3 - t^2 + 1$, velocity is given by $\frac{dx}{dt}$ and acceleration is given by $\frac{d^2x}{dt^2}$

Velocity of the particle at $t = 2$ s is

- a)** 2 m/s **b)** 4 m/s **c)** 6 m/s **d)** 8 m/s

Q18 A particle is moving along a straight line and its position is given by $x = t^3 - t^2 + 1$, velocity is given by $\frac{dx}{dt}$ and acceleration is given by $\frac{d^2x}{dt^2}$

Time at which acceleration is zero

- a)** $t = \frac{4}{3}$ sec **b)** $t = \frac{2}{3}$ sec **c)** $t = 1$ sec **d)** $t = \frac{1}{3}$ sec

Chemistry

Multiple Choice Question

- Q19** Which of the following samples contain $5 N_A$ atoms :
- a) 67.2 L of CH_4 at STP b) 1 gram molecules of N_2O_3 c) 1.25 moles of P_4
 d) $0.5 N_A$ molecules of Ethene (C_2H_4)

- Q20** Which of the following options is/are independent of both n and Z ?

U_n = Potential energy of electron in n^{th} orbit

KE_n = Kinetic energy of electron in n^{th} orbit

ℓ_n = angular momentum of electron in n^{th} orbit

v_n = Speed of electron in n^{th} orbit

f_n = Frequency of revolution of electron in n^{th} orbit

T_n = Time period of revolution of electron in n^{th} orbit

- a) $\frac{KE_n}{U_n}$ b) $\frac{r_n \times v_n}{\ell_n}$ c) $\frac{T_n}{F_n}$ d) $\frac{\ell_n \times f_n}{v_n^2}$

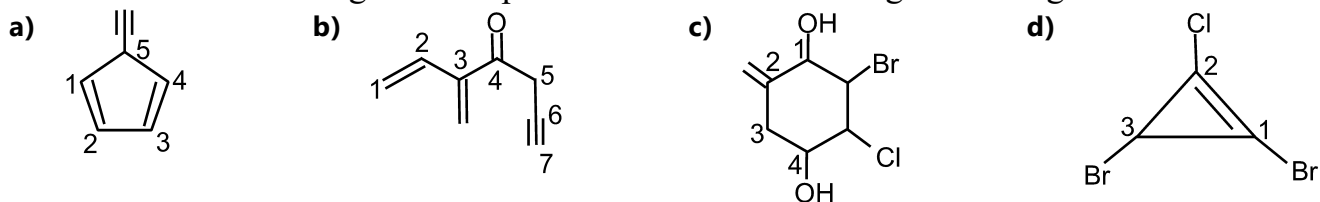
- Q21** Which of the following set of quantum numbers is/are possible?

- a) $n \rightarrow 2$ $\ell \rightarrow 0$ $m_\ell \rightarrow 0$ $m_s \rightarrow -1/2$ b) $n \rightarrow 3$ $\ell \rightarrow 1$ $m_\ell \rightarrow 0$ $m_s \rightarrow +1/2$
 c) $n \rightarrow 2$ $\ell \rightarrow 2$ $m_\ell \rightarrow 0$ $m_s \rightarrow -1/2$ d) $n \rightarrow 3$ $\ell \rightarrow 1$ $m_\ell \rightarrow 0$ $m_s \rightarrow +1/2$

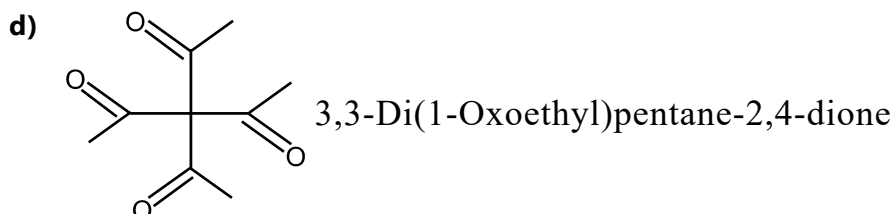
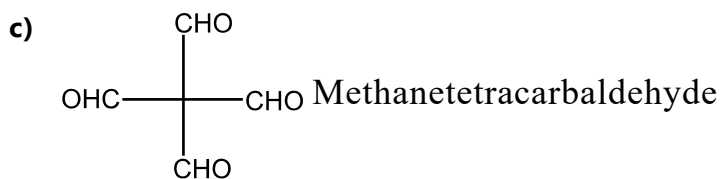
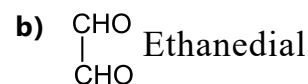
- Q22** Which of the following statement(s) are wrong ?

- a) Photons having energy 400 kJ will break 4 mole bonds of a molecule A_2 where A—A bond dissociation energy is 100kJ/mol
 b) Two bulbs are emitting light having wavelength 2000Å & 3000Å respectively. If the bulbs A & B are 40 watt and 30 watt respectively then the ratio of no. of photons emitted by A & B per day is 1 : 2.
 c) When an electron make transition from lower to higher orbit, photon is emitted
 d) None of the above

- Q23** Which of the following is/are represent correct numbering according to IUPAC.



Q24 Which of the following is/are represent correct IUPAC name?



Numerical

Q25 The de-Broglie wavelength of electron in a certain orbit 'n' of Be^{3+} ion is found to be 5.83 \AA . Find the value of 'n'. Take 1^{st} Bohr radius for H-atom = 53 pm :

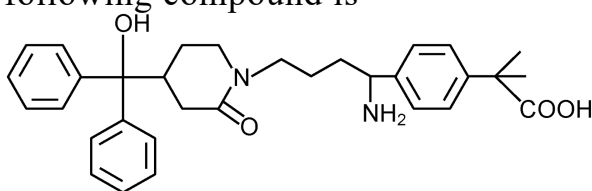
Q26 Threshold frequency of a metal is ν_0 . When light of frequency $\nu = 3\nu_0$ is incident on the metal plate, maximum kinetic energy of emitted photoelectron is x. When frequency of incident radiation is $5\nu_0$, kinetic energy of emitted photoelectron is y. If threshold energy of metal is z. Find value of $\left(\frac{x+y}{z}\right)^2$:

Q27 The uncertainty in position and velocity of a particle are 10^{-11} m and $5.27 \times 10^{-24} \text{ m}\cdot\text{s}^{-1}$, respectively. The minimum mass of the particle (in kg) is

Q28 An α -particle of momentum $3.2 \times 10^{-20} \text{ kg ms}^{-1}$ is projected towards the nucleus of an atom of an element. If the distance of closest approach of α - particle is $1.5 \times 10^{-13} \text{ m}$, then the atomic number of element is (Mass of α -particle = 4 amu , charge on electron = $1.6 \times 10^{-19} \text{ coulomb}$, $N_A = 6 \times 10^{23}$)

Q29 The value of angular momentum of orbit, orbital angular momentum and spin angular momentum for the last electron in sulphur atom ($Z = 16$) be $n_1 \frac{h}{2\pi}$, $\sqrt{n_2} \frac{h}{2\pi}$ and $\sqrt{n_3} \frac{h}{4\pi}$. Find the value of $2(n_1 + n_2 + n_3)$:

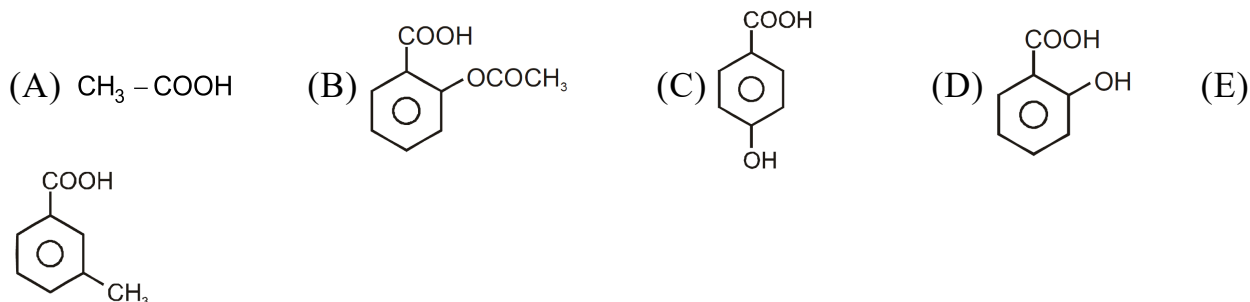
Q30 The sum of number of functional group and index of hydrogen deficiency in the following compound is -



Q31 How many statements are correct for benzene?

- (1) Saturated hydrocarbon. (2) Aromatic compound. (3) DU = 4.
 (4) All carbon atoms are sp^2 . (5) Empirical formula is CH. (6) It's molecular formula is C_6H_6 .
 (7) It has 14 sigma and 3pi bonds. (8) It has 6 phenylic carbon atoms and 6 phenylic hydrogen atoms

Q32 In how many of the following compound secondary suffix name is used as carboxylic acid?



Single Choice Question

Q33 A hydrogen-like species (atomic number Z) is in a higher excited state n . This excited species can make a transition upto the first excited state by successively emitting two photons of energies 10.20 eV and 17.00 eV respectively. Alternatively, the species from the same excited state can make a transition upto the second excited state by successively emitting two photons of energy 4.25 eV and 5.95 eV respectively.

Now answer the following questions

The hydrogen like species which corresponds to the above transition is :

- a) He^+ b) Be^{3+} c) Li^{2+} d) B^{4+}

Q34 A hydrogen-like species (atomic number Z) is in a higher excited state n . This excited species can make a transition upto the first excited state by successively emitting two photons of energies 10.20 eV and 17.00 eV respectively. Alternatively, the species from the same excited state can make a transition upto the second excited state by successively emitting two photons of energy 4.25 eV and 5.95 eV respectively.

Now answer the following questions

When electron jumps from same higher excited state (n) to some lower excited state by emitting a photon of energy 4.25 eV, the value of orbit number for this lower excited state is

- a) 4 b) 5 c) 6 d) Cannot be predicted

Mathematics

Multiple Choice Question

- Q37** If $a \neq 0$ then the in equation $|x - a| + |x + a| < b$
- a) has no solution if $b \leq 2|a|$ b) has a solution set $\left(-\frac{b}{2}, \frac{b}{2}\right)$ if $b > 2|a|$
- c) has a solution set $\left(-\frac{b}{2}, \frac{b}{2}\right)$ if $b < 2|a|$ d) has no solution if $b > 2|a|$
- Q38** If the equation whose roots are the squares of the roots of the cubic $x^3 - ax^2 + bx - 1 = 0$ is identical with the given cubic equation, then
- a) $a = 0, b = 3$ b) $a = b = 0$ c) $a = b = 3$ d) a, b are roots of $x^2 + x + 2 = 0$
- Q39** The value of $\frac{6a^{\ell nb} \log_{a^2} b \log_{b^2} a}{e^{(\ell na)(\ell nb)}}$ is
- a) independent of a b) independent of b c) dependent on a d) dependent of b
- Q40** If $c \neq 0$ and the equation $\frac{p}{2x} = \frac{a}{x+c} + \frac{b}{x-c}$ has two equal roots, then p can be
- a) $(\sqrt{a} - \sqrt{b})^2$ b) $(\sqrt{a} + \sqrt{b})^2$ c) $a + b$ d) $a - b$
- Q41** The value of x satisfying the equation $2^{2x} - 8 \times 2^x = -12$ is
- a) $1 + \frac{\log 3}{\log 2}$ b) $\frac{1}{2} \log 6$ c) $1 + \log \frac{3}{2}$ d) 1
- Q42** If $\sec^2 \theta$ & $\operatorname{cosec}^2 \theta$ are roots of $ax^2 + bx + c = 0$ ($a > 0$) then
- a) $b + c = 0$ b) $b^2 - 4ac \geq 0$ c) $c \geq 4a$ d) $b + 4a \geq 0$

Numerical

- Q43** Let the product of all the solutions of the equation $\sqrt{(\log_3 \sqrt[3]{3x} + \log_x \sqrt[3]{3x}) \log_3 x^3} = 2$ be k , then find the value of $18k$
- Q44** If $x, y \in \mathbb{R}^+$ satisfies $\log_8 x + \log_4 y^2 = 5$ and $\log_8 y + \log_4 x^2 = 7$, then find the value of xy .
- Q45** Find the number of integral values of ' m ' less than 50, so that the roots of the quadratic equation $mx^2 + (2m - 1)x + (m - 2) = 0$ are rational
- Q46** Number of zeros between the decimal point and first non-zero digit on the right of the decimal in decimal expression of the number 6^{-100} (given that $\log_{10} 2 = 0.3010$, $\log_{10} 3 = 0.4771$)
- Q47** Let a is real number then minimum number of real roots of equation $(x^2 + ax + 1)(3x^2 + ax - 3) = 0$ can be —

Answer Key

Que.	1	2	3	4	5	6	7	8	9	10
Ans.	A, B, D	A, C	A, C	A, B, D	A, B	A, B, C	37	20	30	05
Que.	11	12	13	14	15	16	17	18	19	20
Ans.	26	45	11	01	B	D	D	D	B, C	A, B, D
Que.	21	22	23	24	25	26	27	28	29	30
Ans.	A, B, D	A, B, C	A, B, D	A, B, C,	7	36	01	25	16	19
				D						
Que.	31	32	33	34	35	36	37	38	39	40
Ans.	06	04	C	A	B	D	A, B	B, C, D	A, B	A, B
Que.	41	42	43	44	45	46	47	48	49	50
Ans.	A, D	A, B, C	02	512	06	77	02	32	08	03
Que.	51	52	53	54						
Ans.	D	B	D	C						