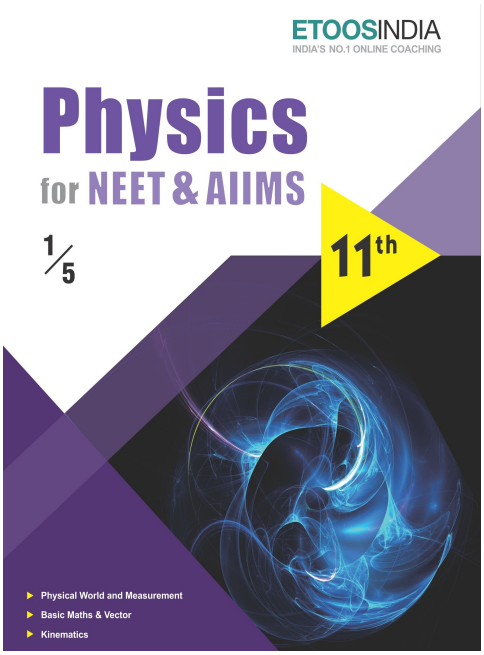
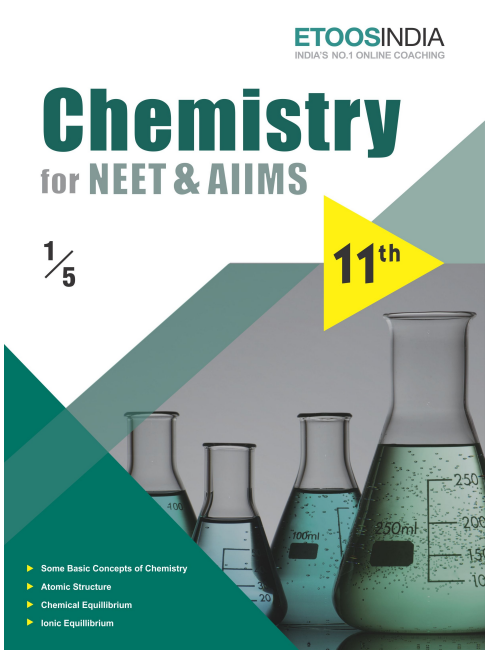
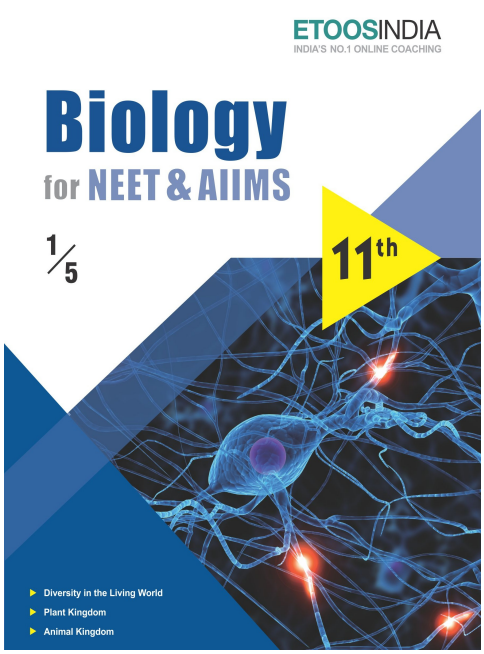
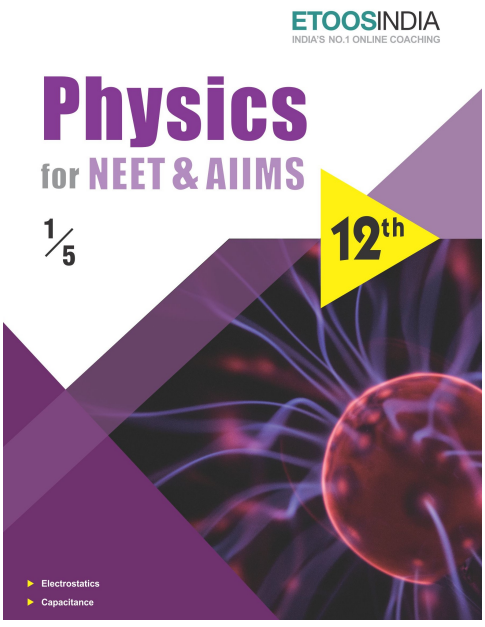
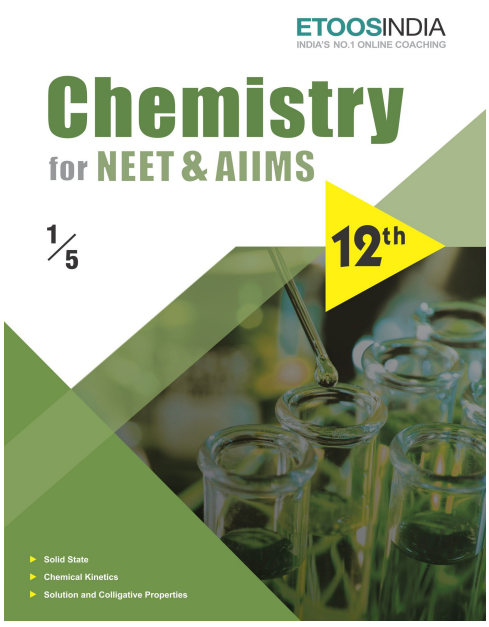
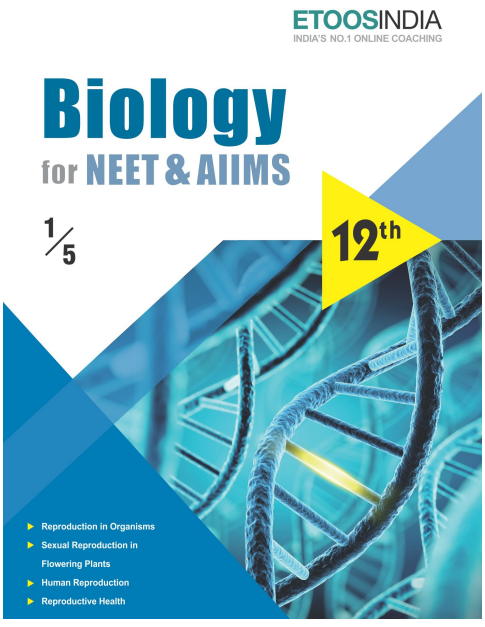












CHAPTER 03

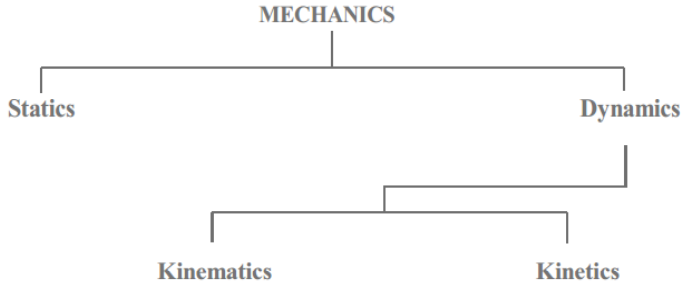
KINEMATICS

Nothing happens until something moves.

"ALBERT EINSTEIN "

INTRODUCTION

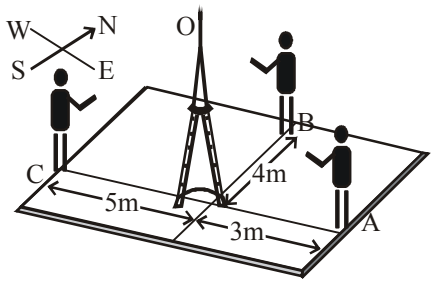
The branch of physics in which motion and the forces causing motion are studies is called mechanics. As a first step is studying mechanics, we describe the motion of particles and bodies in terms of space and time, without studying the cause of motion. This part of mechanics is displacement, velocity and acceleration, then using the objects moving under different conditions. The force causing motion will be discussed later in Dynamics. Mechanics is classified under two stream namely statics and dynamics. Dynamics is further divided into kinematics and kinetics.



RECTILINEAR MOTION

POSITION

An object is situated at point O and three observers from three different places are looking at same object, then all three observers will have different observations about the position of point O and no one will be wrong. Because they are observing the object from different positions.



Observer 'A' says : Point O is 3 m away in west direction.

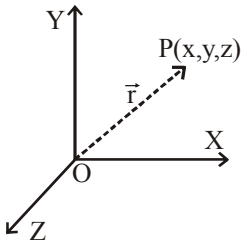
Observer 'B' says : Point O is 4m away in south direction.

Observer 'C' says : Point O is 5 m away in east direction.

Therefore position of any point is completely expressed by two factors: Its distance from the observer and its direction with respect to observer.

That is why position is characterised by a vector known as position vector.

Consider a point P in xy plane and its coordinates are (x, y). Then position vector $(\vec{r})$ of point will be $x\hat{i} + y\hat{j}$ and if the point P is the space and its coordinates are (x, y, z) then position vector can be expressed as $\vec{r} = x\hat{i} + y\hat{j} + z\hat{k}$.



REST & MOTION

If a body does not change its position as time passes with respect to frame of reference, it is said to be at rest.

And if a body changes its position as time passes with respect to frame of reference, it is said to be in motion.

Frame of Reference : It is a system to which a set of coordinates are attached and with reference to which observer describes any event.

A passenger standing on platform observes that a tree on a platform is at rest. But the same passenger passing away in a train through station, observes that tree is in motion. In both conditions observer is right. But observations are different because in first situation observer stands on a platform, which is reference frame at rest and in second situation observer is moving in train, which is reference frame in motion.

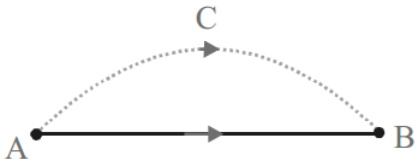
So rest and motion are relative terms depending upon the choice of frame of reference.

Etoos Tips & Formulas

RECTILINEAR MOTION

1. Distance and Displacement

Total length of path (ACB) covered by the particle, in definite time interval is called distance. Displacement vector or displacement is the minimum distance (AB) are directed from initial position to final position.

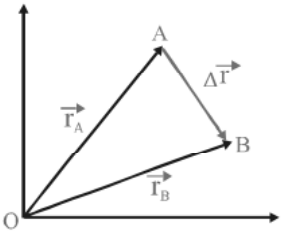


2. Displacement in terms of position vector

From ΔOAB $\quad \Delta\vec{r} = \vec{r}_B - \vec{r}_A$

$\vec{r}_B = x_2\hat{i} + y_2\hat{j} + z_2\hat{k}$ and $\vec{r}_A = x_1\hat{i} + y_1\hat{j} + z_1\hat{k}$

$\Delta\vec{r} = (x_2 - x_1)\hat{i} + (y_2 - y_1)\hat{j} + (z_2 - z_1)\hat{k}$



3. Average velocity $= \dfrac{\text{Displacement}}{\text{Time interval}} = \vec{v}_{av} = \dfrac{\Delta\vec{r}}{\Delta t}$

4. Average speed $= \dfrac{\text{Distance travelled}}{\text{Time interval}}$

5. For uniform motion

Average speed = |average velocity| = |intantaneous velocity|

6. Velocity $\vec{v} = \dfrac{d\vec{r}}{dt} = \dfrac{d}{dt}\left(x\hat{i} + y\hat{j} + z\hat{k}\right) = \dfrac{dx}{dt}\hat{i} + \dfrac{dy}{dt}\hat{j} + \dfrac{dz}{dt}\hat{k} = v_x\hat{i} + v_y\hat{j} + v_z\hat{k}$

7. Average Acceleration $= \dfrac{\text{total change in velocity}}{\text{total time taken}} = \vec{a}_{av} = \dfrac{\Delta\vec{v}}{\Delta t}$

8. Acceleration

$\vec{a} = \dfrac{d\vec{v}}{dt} = \dfrac{d}{dt}\left(v_x\hat{i} + v_y\hat{j} + v_z\hat{k}\right) = \dfrac{dv_x}{dt}\hat{i} + \dfrac{dv_y}{dt}\hat{j} + \dfrac{dv_z}{dt}\hat{k} = a_x\hat{i} + a_y\hat{j} + a_z\hat{k}$

9. Important points about 1D motion

(a) Distance $\geq$ |displacement| and Average speed $\geq$ | average velocity |

(b) If distance > | displacement | this implies

(i) atleast at one point in path, velocity is zero.

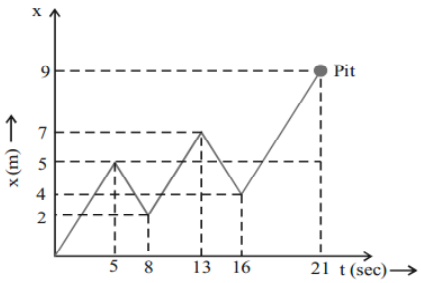
(ii) The body must have retarded during the motion

(c) Acceleration positive indicates velocity increases and speed may increase or decrease

(d) Speed increase if acceleration and velocity both are positive or negative (i.e. both have same sign)

SOLVED EXAMPLE

Ex.1 A drunkard walking in a narrow lane takes 5 steps forward and 3 steps backward, followed again by 5 steps forward and 3 steps backward, and so on. Each step is 1 m long and requires 1s. Plot the x-t graph of his motion. Determine graphically or otherwise how long the drunkard takes to fall in a pit 9 m away from the start.



Sol. From x-t graph time taken = 21 s

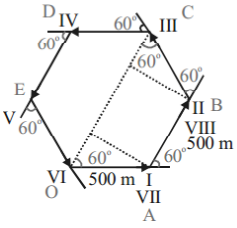
or

$(5m-3m)+(5m-3m)+5m=9m$

$\Rightarrow$ total steps = 21 $\Rightarrow$ time = 21 s

Ex.2 On an open ground a motorist follows a track that turns to his left by an angle of 60° after every 500 m. Starting from a given turn, specify the displacement of the motorist at the third, sixth and eight turn. Compare the magnitude of displacement with the total path length covered by the motorist in each case.

Sol.



At III turn :

Displacement = $\overrightarrow{OA}+\overrightarrow{AB}+\overrightarrow{BC}=\overrightarrow{OC}$ = 500 cos 60° + 500 + 500 cos 60°

$= 500\times\frac{1}{2}+500+500\times\frac{1}{2}=1000$ m

from O to C

Distance = 500 + 500 + 500 = 1500 m

So $\frac{\text{Displacement}}{\text{Dis tan ce}}=\frac{1000}{1500}=\frac{2}{3}$

At VI turn : $\because$ initial and final positions are same

So displacement

= 0 and distance = 500 × 6 = 3000 m

$\therefore \frac{\text{Displacement}}{\text{Dis tan ce}}=\frac{0}{3000}=0$

At VIII turn :

Displacement = $(500)\cos\left(\frac{60^\circ}{2}\right)$

$=1000\times\cos 30^\circ=1000\times\frac{\sqrt{3}}{2}=500\sqrt{3}$ m

Distance = 500 × 8 4000 m

$\therefore \frac{\text{Displacement}}{\text{Dis tan ce}}=\frac{500\sqrt{3}}{4000}=\frac{\sqrt{3}}{8}$

Ex.3 A man walks on a straight road from his to a market 2.5 km away with a speed of 5 km/h. On reaching the market he initially turns and walks back with a speed of 7.5 km/h. What is the

(a) magnitude of average velocity and

(b) average speed of the man, over the interval of time (i) 0 to 30 min. (ii) 0 to 50 min (iii) 0 to 40 min

Sol. Time taken by man to go from his home to market,

$t_1=\frac{\text{dis tan ce}}{\text{speed}}=\frac{2.5}{5}=\frac{1}{2}$h

Time taken by man to go from market to his home,

$t_2=\frac{2.5}{7.5}=\frac{1}{3}$h

$\therefore$ Total time taken = $t_1+t_2=\frac{1}{2}+\frac{1}{3}=\frac{5}{6}$h

= 50 min

(i) 0 to 30 min

Average velocity = $\frac{\text{displacement}}{\text{time int erval}}=\frac{2.5}{\frac{30}{60}}=5$ km/h

towards market

Average speed = $\frac{\text{dis tan ce}}{\text{time int erval}}=\frac{2.5}{\frac{30}{60}}=5$ km/h

(ii) 0 to 50 min

Exercise # 1 SINGLE OBJECTIVE NEET LEVEL

1. A Body moves 6 *m* north. 8 *m* east and 10*m* vertically upwards, what is its resultant displacement from initial position

(A) $10\sqrt{2}m$ (B) $10m$

(C) $\frac{10}{\sqrt{2}}m$ (D) $10 \times 2m$

2. A man goes 10*m* towards North, then 20*m* towards east then displacement is

(A) 22.5*m* (B) 25*m*

(C) 25.5*m* (D) 30*m*

3. A person moves 30 *m* north and then 20 *m* towards east and finally $30\sqrt{2}$ *m* in south-west direction. The displacement of the person from the origin will be

(A) 10 *m* along north (B) 10 *m* long south

(C) 10 *m* along west (D) Zero

4. An aeroplane flies 400 *m* north and 300 *m* south and then flies 1200 *m* upwards then net displacement is

(A) 1200 *m* (B) 1300 *m*

(C) 1400 *m* (D) 1500 *m*

5. An athlete completes one round of a circular track of radius *R* in 40 *sec*. What will be his displacement at the end of 2 min. 20 *sec*

(A) Zero (B) $2R$

(C) $2\pi R$ (D) $7\pi R$

6. A wheel of radius 1 meter rolls forward half a revolution on a horizontal ground. The magnitude of the displacement of the point of the wheel initially in contact with the ground is

(A) 2π (B) $\sqrt{2}\pi$

(C) $\sqrt{\pi^2 + 4}$ (D) π

7. A person travels along a straight road for half the distance with velocity v_1 and the remaining half distance with velocity v_2 The average velocity is given by

(A) $v_1 v_2$ (B) $\frac{v_2^2}{v_1^2}$

(C) $\frac{v_1 + v_2}{2}$ (D) $\frac{2v_1 v_2}{v_1 + v_2}$

8. The displacement-time graph for two particles *A* and *B* are straight lines inclined at angles of 30^o and 60^o with the time axis. The ratio of velocities of $V_A : V_B$ is

(A) 1 : 2 (B) $1 : \sqrt{3}$

(C) $\sqrt{3} : 1$ (D) 1 : 3

9. A car travels from *A* to *B* at a speed of 20 *km / hr* and returns at a speed of 30 *km / hr* . The average speed of the car for the whole journey is

(A) 25 *km / hr* (B) 24 *km / hr*

(C) 50 *km / hr* (D) 5 *km / hr*

10. A boy walks to his school at a distance of 6 *km* with constant speed of 2.5 *km*/*hour* and walks back with a constant speed of 4 *km/hr*. His average speed for round trip expressed in *km*/*hour*, is

(A) 24/13 (B) 40/13

(C) 3 (D) 1/2

11. A car travels the first half of a distance between two places at a speed of 30 *km*/*hr* and the second half of the distance at 50 *km*/*hr*. The average speed of the car for the whole journey is

(A) 42.5 *km/hr* (B) 40.0 *km/hr*

(C) 37.5 *km*/*hr* (D) 35.0 *km/hr*

12. One car moving on a straight road covers one third of the distance with 20 *km/hr* and the rest with 60 *km/hr.* The average speed is

(A) 40 *km/hr* (B) 80 *km/hr*

(C) $46\frac{2}{3}$ *km/hr* (D) 36 *km/hr*

13. A car moves for half of its time at 80 *km/h* and for rest half of time at 40 *km/h*. Total distance covered is 60 *km*. What is the average speed of the car

(A) 60 *km / h* (B) 80 *km / h*

(C) 120 *km / h* (D) 180 *km / h*

14. A train has a speed of 60 *km/h*. for the first one hour and 40 *km/h* for the next half hour. Its average speed in *km/h* is

(A) 50 (B) 53.33

(C) 48 (D) 70

Exercise # 2

SINGLE OBJECTIVE | AIIMS LEVEL

1. A particle moves in straight line in same direction for 20 seconds with velocity 3 m/s and then moves with velocity 4 m/s for another 20 sec and finally moves with velocity 5 m/s for next 20 seconds. What is the average velocity of the particle?

(A) 3 m/s (B) 4 m/s

(C) 5 m/s (D) Zero

2. A bird moves from point $(1, -2, 3)$ to $(4, 2, 3)$. If the speed of the bird is 10 m/s, then the velocity vector of the bird is :-

(A) $5\left(\hat{i} - 2\hat{j} + 3\hat{k}\right)$ (B) $5\left(4\hat{i} + 2\hat{j} + 3\hat{k}\right)$

(C) $0.6\hat{i} + 0.8\hat{j}$ (D) $6\hat{i} + 8\hat{j}$

3. A particle is moving in x–y–plane at 2 m/s along x–axis. 2 seconds later, its velocity is 4 m/s in a direction making 60° with positive x–axis. Its average acceleration for this period of motion is:-

(A) $\sqrt{5}$ m/s^2, along y–axis

(B) $\sqrt{3}$ m/s^2, along y–axis

(C) $\sqrt{5}$ m/s^2, along at 60° with positive x–axis

(D) 3m/s^2, at 60° with positive x–axis.

4. The coordinates of a moving particle at time t are given by $x = ct^2$ and $y = bt^2$. The speed of the particle is given by :–

(A) $2t(c + b)$ (B) $2t\sqrt{c^2 - b^2}$

(C) $t\sqrt{c^2 + b^2}$ (D) $2t\sqrt{c^2 + b^2}$

5. The velocity of a particle moving along x–axis is given as $v = x^2 - 5x + 4$ (in m/s) where x denotes the x–coordinate of the particle in metres. Find the magnitude of acceleration of the particle when the velocity of particle is zero?

(A) 0 m/s^2 (B) 2 m/s^2

(C) 3 m/s^2 (D) None of these

6. A, B, C and D are points in a vertical line such that AB = BC = CD. If a body falls from rest from A, then the times of descend through AB, BC and CD are in the ratio :-

(A) $1 : \sqrt{2} : \sqrt{3}$

(B) $\sqrt{2} : \sqrt{3} : 1$

(C) $\sqrt{3} : 1 : \sqrt{2}$

(D) $1 : (\sqrt{2} - 1) : (\sqrt{3} - \sqrt{2})$

7. A body starts from rest and is uniformly accelerated for 30 s. The distance travelled in the first 10 s is x_1, next 10 s is x_2 and the last 10 s is x_3. Then $x_1 : x_2 : x_3$ is the same as:-

(A) 1 : 2 : 4 (B) 1 : 2 : 5

(C) 1 : 3 : 5 (D) 1 : 3 : 9

8. A particle has an initial velocity of $(3\hat{i} + 4\hat{j})$ m/s and a constant acceleration of $(4\hat{i} - 3\hat{j})$ m/s^2. Its speed after one second will be equal to :-

(A) 0 (B) 10 m/s

(C) $5\sqrt{2}$ m/s (D) 25 m/s

9. A particle is projected vertically upwards and it reaches the maximum height H in T seconds. The height of the particle at any time t will be :-

(A) $H - g(t - T)^2$ (B) $g(t - T)^2$

(C) $H - \frac{1}{2}g(t - T)^2$ (D) $\frac{g}{2}(t - T)^2$

10. A particle is projected vertically upwards from a point A on the ground. It takes t_1 time to reach a point B but it still continues to move up. If it takes further t_2 time to reach the ground from point B then height of point B from the ground is :-

(A) $\frac{1}{2}g(t_1 + t_2)^2$ (B) gt_1t_2

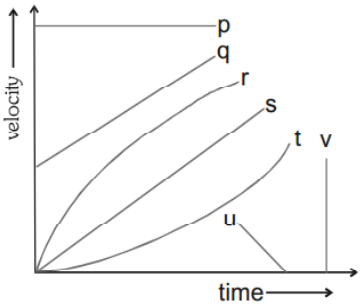
(C) $\frac{1}{8}g(t_1 + t_2)^2$ (D) $\frac{1}{2}gt_1t_2$

Exercise # 3 PART - 1 MATRIX MATCH COLUMN

Following question contains statements given in two columns, which have to be matched. The statements in Column-I are labelled as A, B, C and D while the statements in Column-II are labelled as p, q, r and s. Any given statement in Column-I can have correct matching with one or more statement(S) in Column-II.

1.

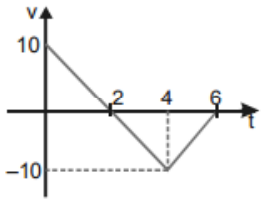
Column I	Column II
(A) Zero acceleration	
(B) Infinite acceleration	
(C) Constant positive acceleration, with zero initial velocity	
(D) Constant positive acceleration, with non–zero initial velocity	
(E) Constant Negative acceleration	
(F) Increasing acceleration	
(G) Decreasing acceleration	



2. The equation of one dimensional motion of the particle is described in column I. At t= 0, particle is at origin and at rest. Match the column I with the statements in Column II.

Column I	Column II
(A) $x = (3t^2 + 2)$m	(P) Velocity of particle at t = 1s is 8 m/s
(B) v = 8t m/s	(Q) Particle moves with uniform acceleration
(C) a = 16 t	(R) Particle moves with variable acceleration
(D) $v = 6t - 3t^2$	(S) Particle will change its direction some time.

3. For the velocity–time graph shown in figure, in a time interval from t = 0 to t = 6 s, match the following:



Column I	Column II
(A) Change in velocity	(P) – 5/3 SI unit
(B) Average acceleration	(Q) – 20 SI unit
(C) Total displacement	(R) – 10 SI unit
(D) Acceleration at t=3s	(S) – 5 SI unit

Exercise # 4 PART - 1 PREVIOUS YEAR (NEET/AIPMT)

MOTION IN A STRAIGHT LINE

1. Motion of a particle is given by equation $s = (3t^3 + 7t^2 + 14t + 8)$ m. The value of acceleration of the particle at t = 1 sec is [2000]
(A) 10 m/s^2 (B) 32 m/s^2
(C) 23 m/s^2 (D) 16 m/s^2

2. A particle is thrown vertically upward. Its velocity at half of the height is 10 m/s, then the maximum height attained by it (g = 10 m/s^2) [2001]
(A) 8 m (B) 20 m
(C) 10 m (D) 16 m

3. If a ball is thrown vertically upwards with speed u, the distance covered during the last t seconds of its ascent is [2003]
(A) ut (B) $\frac{1}{2}gt^2$
(C) $ut - \frac{1}{2}gt^2$ (D) (u + gt) t.

4. A man throws balls with the same speed vertically upwards one after the other at an interval of 2 seconds. What should be the speed of the throw so that more than two balls are in the sky at any time ? (Given g = 9.8 m/s^2) [2003]
(A) more than 19.6 m/s
(B) at least 9.8 m/s
(C) any speed less than 19.6 m/s
(D) only with speed 19.6 m/s

5. The displacement x of a particle varies with time t as $x = ae^{-\alpha t} + be^{\beta t}$, where a, b, a and B are positive constants. the velocity of the particle will
(A) be independent of β [2005]
(B) drop to zero when α = β
(C) go on decreasing with time
(D) go on increasing with time.

6. A ball is thrown vertically upward. It has a speed of 10 /msec when it has reached one half of its maximum height. How high does the bass rise take g = 10 m/s^2. [2005]
(A) 10 m (B) 5 m
(C) 15 m (D) 20 m

7. A particle moves along a straight line OX. At a time t (in seconds) the distance x (in metres) of the particle from O is given by $x = 40 + 12t - t^3$. How long would the particle travel before coming to rest ? [2006]
(A) 16 m (B) 24 m
(C) 40 m (D) 56 m

8. A car runs at a constant speed on a circular trackof radius 100 m, taking 62.8 seconds for every circular lap. The average velocity and average speed for each circular lap respectively is [2006]
(A) 10 m/s, 0 (B) 0, 0
(C) 0, 10 m/s (D) 10 m/s, 10 m/s.

9. Two bodies A (of mass 1 kg) and B (of mass 3 kg) are dropped from heights of 16 m and 25 m, respectively. The ratio of the time taken by them to reach the ground is [2006]
(A) 4/5 (B) 5/4
(C) 12/5 (D) 5/12

10. The position x of a particle with respect to time t along x-axis is given by $x = 9t^2 - t^3$ where x is in metres and t in seconds. What will be the position of this particle when it achieves maximum speed along the +x direction ? [2007]
(A) 54 m (B) 81 m
(C) 24 m (D) 32 m

11. A car moves from X to Y with a uniform speed v_u and returns to Y with a uniform speed v_d. The average speed for this round trip is [2007]
(A) $\sqrt{v_u v_d}$ (B) $\frac{v_d v_u}{v_d + v_u}$
(C) $\frac{v_u + v_d}{2}$ (D) $\frac{2v_d v_u}{v_d + v_u}$

12. A particle moving along x-axis has acceleration *f*, at time *t*, given by $f = f0\left(1 - \frac{t}{T}\right)$, Where f_0 and T are constants. The particle at t = 0 has zero volecity. In the timeinterval between t = 0 and the instant when f = 0, the particle's velocity (v_x) [2007]
(A) $\frac{1}{2}f_0T^2$ (B) f_0T^2
(C) $\frac{1}{2}f_0T$ (D) f_0T

MOCK TEST

STRAIGHT OBJECTIVE TYPE

1. A hall has the dimensions 10 m × 10 m × 10 m. A fly starting at one corner ends up at diagonally opposite corner. The magnitude of its displacement is :

(A) $5\sqrt{3}$ m (B) $10\sqrt{3}$ m (C) $20\sqrt{3}$ m (D) $30\sqrt{3}$ m

2. A body starts from rest and is uniformly accelerated for 30 s. The distance travelled in the first 10 s is x_1, next 10 s is x_2 and the last 10 s is x_3. Then $x_1 : x_2 : x_3$ is the same as :

(A) 1 : 1 : 1 (B) 1 : 2 : 4 (C) 1 : 3 : 5 (D) 2 : 3 : 5

3. A ball is dropped from the top of a building. The ball takes 0.5 s to fall past the 3 m length of a window some distance from the top of the building. If the velocities of the ball at the top and at the bottom of the window are v_T and v_B respectively, then (take $g = 10\ m/s^2$) :

(A) $v_T + v_B = 12\ ms^{-1}$ (B) $v_T - v_B = 4.9\ m\ s^{-1}$ (C) $v_B v_T = 1\ ms^{-1}$ (D) $\frac{v_B}{v_T} = 1\ ms^{-1}$

4. Two trains, which are moving along different tracks in opposite directions, are put on the same track due to a mistake. Their drivers, on noticing the mistake, start slowing down the trains when the trains are 300 m apart. Graphs given below show their velocities as function of time as the trains slow down. The separation between the trains when both have stopped, is :

(A) 120 m (B) 280 m (C) 60 m (D) 20 m.

5. A stone is projected vertically upwards at t = 0 second. The net displacement of stone is zero in time interval between t = 0 second to t = T seconds. Pick up the incorrect statement :

(A) From time $t = \frac{T}{4}$ second to $t = \frac{3T}{4}$ second, the average velocity is zero.

(B) The change in velocity from time t = 0 to $t = \frac{T}{4}$ second is same as change in velocity from $t = \frac{T}{8}$ second to $t = \frac{3T}{8}$ second

(C) The distance travelled from t = 0 to $t = \frac{T}{4}$ second is larger than distance travelled from $t = \frac{T}{4}$ second to $t = \frac{3T}{4}$ second

(D) The distance travelled from $t = \frac{T}{2}$ second to $t = \frac{3T}{4}$ second is half the distance travelled from $t = \frac{T}{2}$ second to t = T second.

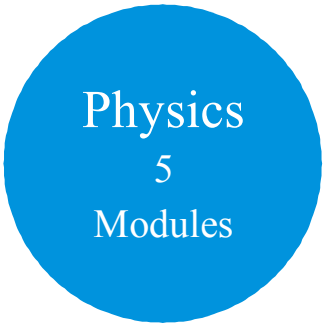
6. A point moves in a straight line under the retardation av^2. If the initial velocity is u , the distance covered in ' t ' seconds is:

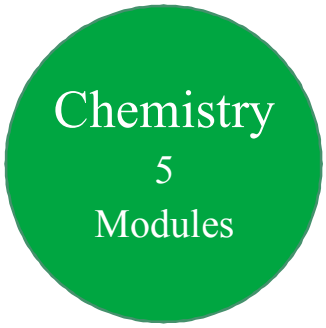
(A) a u t (B) $\frac{1}{a}\ell n\,(a\,u\,t)$ (C) $\frac{1}{a}\ell n\,(1 + a\,u\,t)$ (D) $a\,\ell n\,(a\,u\,t)$

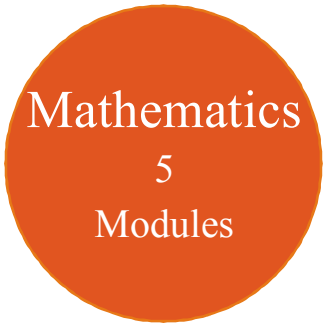
7. A body is thrown horizontally with a velocity $\sqrt{2gh}$ from the top of a tower of height h. It strikes the level ground through the foot of the tower at a distance x from the tower. The value of x is:

(A) h (B) $\frac{h}{2}$ (C) 2h (D) $\frac{2h}{3}$

11th Class Modules Chapter Details

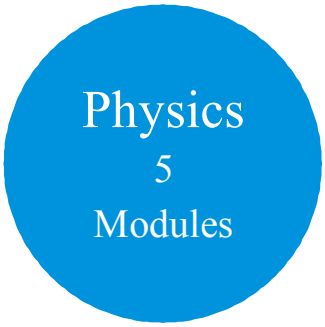


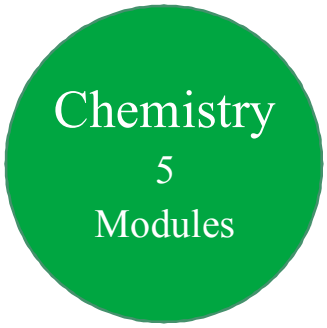


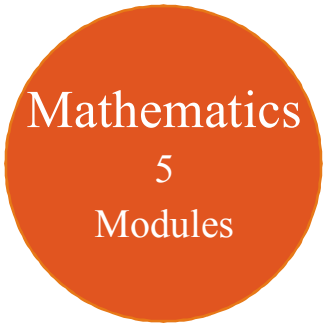


PHYSICS	CHEMISTRY	BIOLOGY
Module-1 1. Physical World & Measurements 2. Basic Maths & Vector 3. Kinematics **Module-2** 1. Law of Motion & Friction 2. Work, Energy & Power **Module-3** 1. Motion of system of particles & Rigid Body 2. Gravitation **Module-4** 1. Mechanical Properties of Matter 2. Thermal Properties of Matter **Module-5** 1. Oscillations 2. Waves	**Module-1(PC)** 1. Some Basic Conceps of Chemistry 2. Atomic Structure 3. Chemical Equilibrium 4. Ionic Equilibrium **Module-2(PC)** 1. Thermodynamics & Thermochemistry 2. Redox Reaction 3. States Of Matter (Gaseous & Liquid) **Module-3(IC)** 1. Periodic Table 2. Chemical Bonding 3. Hydrogen & Its Compounds 4. S-Block **Module-4(OC)** 1. Nomenclature of Organic Compounds 2. Isomerism 3. General Organic Chemistry **Module-5(OC)** 1. Reaction Mechanism 2. Hydrocarbon 3. Aromatic Hydrocarbon 4. Environmental Chemistry & Analysis Of Organic Compounds	**Module-1** 1. Diversity in the Living World 2. Plant Kingdom 3. Animal Kingdom **Module-2** 1. Morphology in Flowering Plants 2. Anatomy of Flowering Plants 3. Structural Organization in Animals **Module-3** 1. Cell: The Unit of Life 2. Biomolecules 3. Cell Cycle & Cell Division 4. Transport in Plants 5. Mineral Nutrition **Module-4** 1. Photosynthesis in Higher Plants 2. Respiration in Plants 3. Plant Growth and Development 4. Digestion & Absorption 5. Breathing & Exchange of Gases **Module-5** 1. Body Fluids & Its Circulation 2. Excretory Products & Their Elimination 3. Locomotion & Its Movement 4. Neural Control & Coordination 5. Chemical Coordination and Integration

12th Class Modules Chapter Details







PHYSICS

Module-1

1. Electrostatics
2. Capacitance

Module-2

1. Current Electricity
2. Magnetic Effect of Current and Magnetism

Module-3

1. Electromagnetic Induction
2. Alternating Current

Module-4

1. Geometrical Optics
2. Wave Optics

Module-5

1. Modern Physics
2. Nuclear Physics
3. Solids & Semiconductor Devices
4. Electromagnetic Waves

CHEMISTRY

Module-1(PC)

1. Solid State
2. Chemical Kinetics
3. Solutions and Colligative Properties

Module-2(PC)

1. Electrochemistry
2. Surface Chemistry

Module-3(IC)

1. P-Block Elements
2. Transition Elements (d & f block)
3. Co-ordination Compound
4. Metallurgy

Module-4(OC)

1. HaloAlkanes & HaloArenes
2. Alcohol, Phenol & Ether
3. Aldehyde, Ketone & Carboxylic Acid

Module-5(OC)

1. Nitrogen & Its Derivatives
2. Biomolecules & Polymers
3. Chemistry in Everyday Life

BIOLOGY

Module-1

1. Reproduction in Organisms
2. Sexual Reproduction in Flowering Plants
3. Human Reproduction
4. Reproductive Health

Module-2

1. Principles of Inheritance and Variation
2. Molecular Basis of Inheritance
3. Evolution

Module-3

1. Human Health and Disease
2. Strategies for Enhancement in Food Production
3. Microbes in Human Welfare

Module-4

1. Biotechnology: Principles and Processes
2. Biotechnology and Its Applications
3. Organisms and Populations

Module-5

1. Ecosystem
2. Biodiversity and Conservation
3. Environmental Issues