GGSRDN
Educational Services Private Limited
NEET, JEE(Main/Advanced)
अभ्यास ही सबसे बड़ा गुरू है।

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Educational Services Private Limited

9^{th}, 10^{th}, NEET, JEE(Main/Advanced)

अभ्यास ही सबसे बड़ा गुरू है।

CLASS : XI (PHYSICS)

DPP

DAILY PRACTICE PROBLEM

DPP-11 TO 20

PHYSICS

DPP

DAILY PRACTICE PROBLEMS

DPP No. 11

Total Marks : 28

Max. Time : 28 min.

Topic : Rectilinear Motion

Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.1 to Q.5	(3 marks, 3 min.)	[15, 15]
Multiple choice objective ('–1' negative marking) Q.6	(4 marks, 4 min.)	[4, 4]
Comprehension ('–1' negative marking) Q.7 to Q.9	(3 marks, 3 min.)	[9, 9]

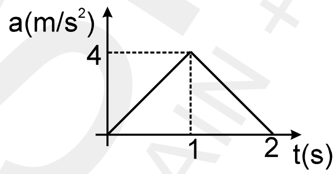
1. A ball is thrown vertically upwards from the ground. It crosses a point at the height of 25 m twice at an interval of 4 secs. The ball was thrown with the velocity of

(A) 20 m/sec. (B) 25 m/sec.
(C) 30 m/sec. (D) 35 m/sec.

2. The distance travelled by a freely falling body is proportional to

(A) the mass of the body (B) the square of the acceleration due to gravity
(C) the square of the time of fall (D) the time of fall

3. The acceleration–time graph of a particle moving on a straight line is as shown in figure. The velocity of the particle at time t = 0 is 2m/s. The velocity after 2 seconds will be



(A) 6 m/s (B) 4 m/s
(C) 2 m/s (D) 8 m/s

4. A parachutist drops freely from an aeroplane for 10 s before the parachute opens out. Then he descends with a net retardation of 2.5 ms^{-2}. If he bails out of the plane at a height of 2495 m and g = 10 ms^{-2}, his velocity on reaching the ground will be

(A) 2.5 ms^{-1} (B) 7.5 ms^{-1}
(C) 5 ms^{-1} (D) 10 ms^{-1}

5. The displacement of a body is given to be proportional to the cube of time elapsed. Acceleration of the body is proportional to :

(A) t^4 (B) t^3
(C) t^2 (D) t

6. A ball is thrown vertically up with a certain velocity. It attains a height of 40 m and comes back to the thrower. Then the:(g = 10m/s^2)

(A) total distance covered by it is 40 m (B) total displacement covered by it is 80 m
(C) total displacement is zero (D) the average velocity for round trip is zero

COMPREHENSION

A particle moves along x-axis. It's velocity is a function of time according to relation V = $(3t^2 - 18t + 24)$ m/s assume at t = 0 particle is at origin.

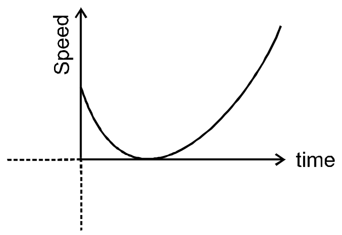
7. Distance travelled by particle in 0 to 3 second time interval is :

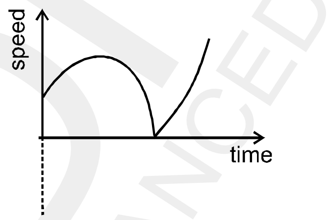
(A) 18 m (B) 20 m (C) 22 m (D) 24 m

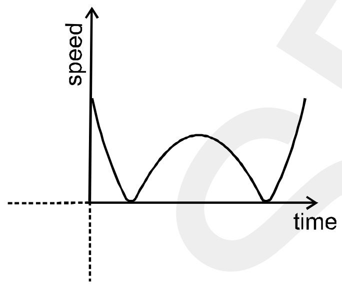
8. Time interval in which particle speed continuous decreases?

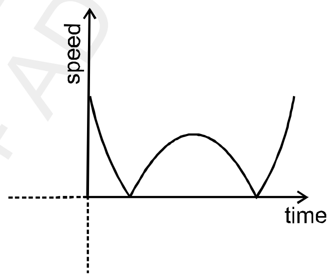
(A) 0 – 3 sec (B) 0 – 2 sec (C) 2–4 sec (D) 2–3 sec

9. Which of the following graph may be correct for the motion of particle

(A)


(B)


(C)


(D)


PHYSICS

DPP

DAILY PRACTICE PROBLEMS

DPP No. 12

Total Marks : 26

Max. Time : 28 min.

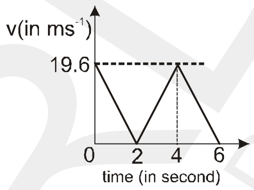
Topic : Rectilinear Motion

Type of Questions		**M.M., Min.**
Single choice Objective ('–1' negative marking) Q.1 to Q.6	**(3 marks, 3 min.)**	**[18, 18]**
Subjective Questions ('–1' negative marking) Q.7 to Q.8	**(4 marks, 5 min.)**	**[8, 10]**

1. A bird flies for 4 seconds with a velocity of $|t - 2|$ m/sec. in a straight line, where t = time in seconds. It covers a distance of

(A) 4 m (B) 6 m (C) 8m (D) none of these

2. The velocity - time graph of a particle is as shown in figure



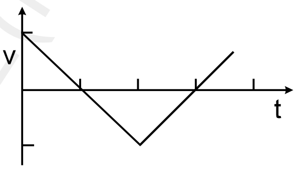
(A) It moves with a constant acceleration throughout

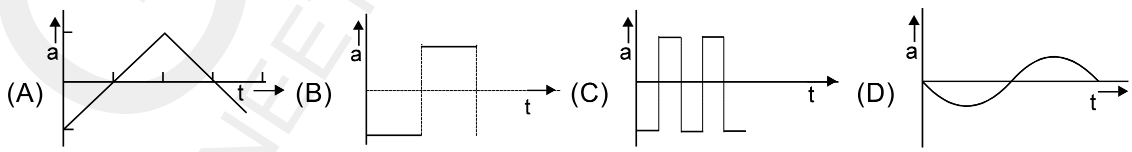
(B) It moves with an acceleration of constant magnitude but changing direction at the end of every two second

(C) The displacement of the particle is zero

(D) The velocity becomes zero at t = 4 second

3. The graph shown in the figure shows the velocity v versus time t of a body. Which of the graphs shown in figure represents the corresponding acceleration versus time graphs?





4. The position vector of a particle is given as $\vec{r} = (t^2 - 4t + 6)\hat{i} + (t^2)\hat{j}$. The time after which the velocity vector and acceleration vector becomes perpendicular to each other is equal to

(A) 1sec (B) 2 sec (C) 1.5 sec (D) not possible

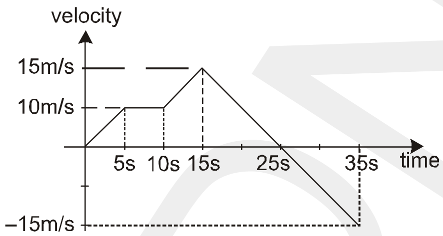
5. A car starts from rest and moves with constant acceleration. The ratio of the distance covered in the n^{th} second to distance covered in n seconds is :

(A) $\frac{2}{n^2} - \frac{1}{n}$ (B) $\frac{2}{n^2} + \frac{1}{n}$ (C) $\frac{2}{n} - \frac{1}{n^2}$ (D) $\frac{2}{n} + \frac{1}{n^2}$

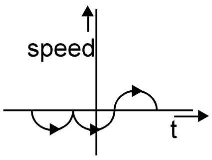
6. An ant is at a corner of a cubical room of side 'a'. The ant can move with a constant speed u. The minimum time taken to reach the farthest corner of the cube is:

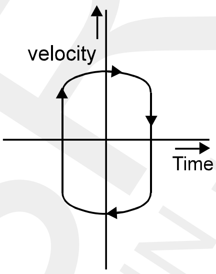
(A) $\frac{3a}{u}$ (B) $\frac{\sqrt{3}a}{u}$ (C) $\frac{\sqrt{5}a}{u}$ (D) $\frac{(\sqrt{2}+1)a}{u}$

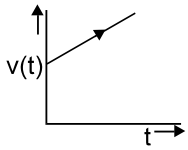
7. A person starts from origin and for his linear motion velocity is given as shown in figure. Draw displacement and acceleration graph with respect to time. Also find maximum displacement of the person.



8. Are the following velocity–time graph and speed–time graphs possible ?

(i)


(ii)


(iii)


PHYSICS

DPP

DAILY PRACTICE PROBLEMS

DPP No. 13

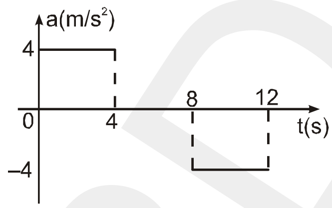
Total Marks : 24

Max. Time : 24 min.

Topic : Rectilinear Motion

Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.1 to Q.5	(3 marks, 3 min.)	[15, 15]
Comprehension ('–1' negative marking) Q.6 to Q.8	(3 marks, 3 min.)	[9, 9]

1. A lift starts from rest. Its acceleration is plotted against time in the following graph. When it comes to rest its height above its starting point is:



(A) 20 m (B) 64 m (C) 32 m (D) 128 m

2. A particle moves through the origin of an xy-cordinate system at t = 0 with initial velocity u = 4i - 5 j m/s. The particle moves in the xy plane with an acceleration a = 2i m/s^2. Speed of the particle at t = 4 second is :

(A) 12 m/s (B) $8\sqrt{2}$ m/s (C) 5 m/s (D) 13 m/s

3. The instantaneous velocity of a particle is equal to time derivative of its position vector and the instantaneous acceleration is equal to time derivative of its velocity vector. Therefore:

(A) the instantaneous velocity depends on the instantaneous position vector

(B) instantaneous acceleration is independent of instantaneous position vector and instantaneous velocity

(C) instantaneous acceleration is independent of instantaneous position vector but depends on the instantaneous velocity

(D) instantaneous acceleration depends both on the instantaneous position vector and the instantaneous velocity.

4. The velocity of a car moving on a straight road increases linearly according to equation, v = a + b x, where a & b are positive constants. The acceleration in the course of such motion: (x is the displacement)

(A) increases (B) decreases (C) stay constant (D) becomes zero

5. A point moves in a straight line under the retardation a v^2 , where 'a' is a positive constant and v is speed. If the initial velocity is u , the distance covered in ' t ' seconds is :

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

COMPREHENSION

The velocity 'v' of a particle moving along straight line is given in terms of time t as v = 3(t^2 – t) where t is in seconds and v is in m/s.

6. The distance travelled by particle from t = 0 to t = 2 seconds is :

(A) 2 m (B) 3 m (C) 4 m (D) 6 m

7. The displacement of particle from t = 0 to t = 2 seconds is

(A) 1 m (B) 2 m (C) 3 m (D) 4 m

8. The speed is minimum after t = 0 second at instant of time

(A) 0.5 sec (B) 1 sec. (C) 2 sec. (D) None of these

PHYSICS

DPP
DAILY PRACTICE PROBLEMS

DPP No. 14

Total Marks : 34

Max. Time : 35 min.

Topic : Rectilinear Motion

Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.1 to Q.6	(3 marks, 3 min.)	[18, 18]
Multiple choice objective ('–1' negative marking) Q.7 to Q9	(4 marks, 4 min.)	[12, 12]
Subjective Questions ('–1' negative marking) Q.10	(4 marks, 5 min.)	[4, 5]

1. A particle of mass 2 kg moves in the xy plane under the action of a constant force $\vec{F}$ where $\vec{F} = \hat{i} - \hat{j}$. Initially the velocity of the particle is $2\hat{i}$. The velocity of the particle at time t is

(A) $\frac{1}{2}(t+4)\hat{i} - \frac{1}{2}t\hat{j}$ (B) $t(\hat{i}-\hat{j})$ (C) $\frac{1}{2}t(\hat{i}-\hat{j})$ (D) $\frac{1}{2}t\hat{i} + \frac{1}{2}(t+4)\hat{j}$

2. A point moves rectilinearly. Its position x at time t is given by $x^2 = t^2 + 1$. Its acceleration at time t is:

(A) $\frac{1}{x^3}$ (B) $\frac{1}{x} - \frac{1}{x^2}$ (C) $-\frac{t}{x^2}$ (D) none of these

3. A man moves on his motorbike with speed 54 km/h and then takes a U turn (180°) and continues to move with same speed. The time of U turn is 10 s. Find the magnitude of average acceleration during U turn .

(A) 0 (B) 3 ms^{-2} (C) $1.5\sqrt{2}$ ms^{-2} (D) none of these

4. Distance between a frog and an insect on a horizontal plane is 10 m. Frog can jump with a maximum speed of $\sqrt{10}$ m/s. g =10 m/s^2. Minimum number of jumps required by the frog to catch the insect is :

(A) 5 (B) 10 (C) 100 (D) 50

5. A clock has a minute-hand 10 cm long. Find the average velocity between 6.00 AM to 6.30 AM for the tip of minute-hand.

(A) $\frac{22}{21}$ cm min^{-1} (B) $\frac{2}{21}$ cm min^{-1} (C) $\frac{12}{21}$ cm min^{-1} (D) $\frac{2}{3}$ cm min^{-1}

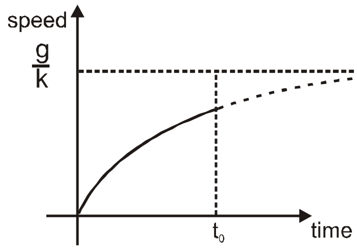
6. A stone is dropped from the top of a tower. When it has fallen by 5m from the top, another stone is dropped from a point 25m below the top. If both stones reach the ground at the same moment, then height of the tower from ground is : (take g = 10m/s^2)

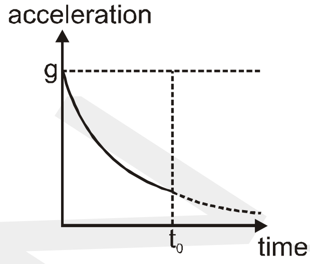
(A) 45 m (B) 50m (C) 60m (D) 65m

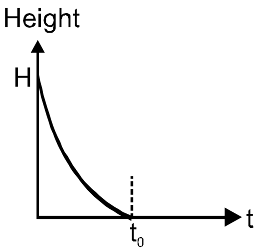
7. Angle made by vector $\sqrt{3}\hat{i} + \sqrt{2}\hat{j} - 2\hat{k}$ with –ve y-axis is :

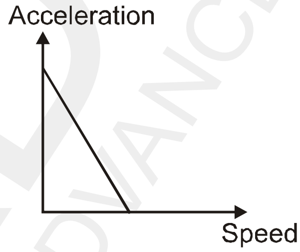
(A) $\cos^{-1}\left(\frac{\sqrt{2}}{3}\right)$ (B) $\cos^{-1}\left(-\frac{\sqrt{2}}{3}\right)$ (C) $\pi - \cos^{-1}\left(\frac{\sqrt{2}}{3}\right)$ (D) $\pi - \cos^{-1}\left(-\frac{\sqrt{2}}{3}\right)$

8. A particle is dropped from a finite height H above the ground level under gravity. Due to air resistance acceleration of particle become a = g – kv in the direction of velocity. Where k = positive constant & v = speed of particle. Then which of the following graph(s) is/are possible (t_0 = time when particle touches the ground):

(A)


(B)


(C)


(D)


9. A particle moves with an initial velocity v_0 along straight line and retardation βv, where v is its velocity at any time t (β is a positive constant).
(A) the particle will cover a total distance of v_0/β
(B) the particle will continue to move for a very long time
(C) the particle will stop shortly
(D) the velocity of particle will become $v_0/2$ after time $1/\beta$.

10. 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 m/s at some moment. Find the distance travelled by the particle in 5 seconds after that moment.

PHYSICS DPP

DAILY PRACTICE PROBLEMS

DPP No. 15

Total Marks : 24

Max. Time : 24 min.

Topic : Projectile Motion

Type of Questions		**M.M., Min.**
Single choice Objective ('–1' negative marking) Q.1 to Q.8	**(3 marks, 3 min.)**	**[24, 24]**

1. A particle travels according to the equation $x = at^3$, $y = bt^3$. The equation of the trajectory is

(A) $y = \frac{ax^2}{b}$ (B) $y = \frac{bx^2}{a}$ (C) $y = \frac{bx}{a}$ (D) $y = \frac{bx^3}{a}$

2. Speed at the maximum height of a projectile is half of its initial speed u. Its range on the horizontal plane is:

(A) $\frac{2u^2}{3g}$ (B) $\frac{\sqrt{3}u^2}{2g}$ (C) $\frac{u^2}{3g}$ (D) $\frac{u^2}{2g}$

3. A cricket ball is hit for a six leaving the bat at an angle of 45° to the horizontal with kinetic energy k. At the top of trajectory the kinetic energy of the ball is :

(A) zero (B) k (C) $\frac{k}{\sqrt{2}}$ (D) $\frac{k}{2}$

4. A particle is projected from a horizontal floor with speed 10 m/s at an angle 30° with the floor and striking the floor after sometime. State which is correct.

(A) Velocity of particle will be perpendicular to initial direction two seconds after projection.

(B) Minimum speed of particle will be 5 m/sec.

(C) Displacement of particle after half second will be 35/4 m.

(D) Noneofthese

5. A body is projected with a speed u at an angle to the horizontal to have maximum range. At the highest point the speed is :

(A) zero (B) u $\sqrt{2}$ (C) u (D) $\frac{u}{\sqrt{2}}$

6. Ratio of the ranges of the bullets fired from a gun (of constant muzzle speed) at angle θ, 2θ & 4θ is found in the ratio x : 2 : 2, then the value of x will be (Assume same muzzle speed of bullets)

(A) 1 (B) 2 (C) $\sqrt{3}$ (D) none of these

7. A particle is projected with a speed $10\sqrt{2}$ m/s making an angle 45° with the horizontal. Neglect the effect of air friction. Then after 1 second of projection. Take $g=10\ m/s^2$

(A) the height of the particle above the point of projection is 5 m.

(B) the height of the particle above the point of projection is 10 m.

(C) the horizontal distance of the particle from the point of projection is 5 m.

(D) the horizontal distance of the particle from the point of projection is 15 m.

8. A particle has initial velocity, $\vec{v} = 3\hat{i}+4\hat{j}$ and a constant force $\vec{F} = 4\hat{i}-3\hat{j}$ acts on the particle. The path of the particle is :

(A) straight line (B) parabolic (C) circular (D) elliptical

PHYSICS DPP

DAILY PRACTICE PROBLEMS

DPP No. 16

Total Marks : 34

Max. Time : 38 min.

Topics : Projectile Motion, Rectilinear Motion

Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.1 to Q.6	(3 marks, 3 min.)	[18, 18]
Subjective Questions ('–1' negative marking) Q.7 to Q.8	(4 marks, 5 min.)	[8, 10]
Match the Following (no negative marking) (2 × 4) Q.10	(8 marks, 10 min.)	[8, 10]

1. For ground to ground projectile motion equation of path is $y = 12x - 3/4\,x^2$. Given that $g = 10\ ms^{-2}$. What is the range of the projectile?
(A) 36m (B) 30.6 m (C) 16 m (D) 12.4 m

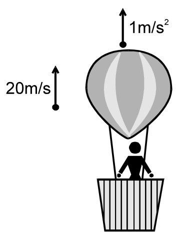
2. The vertical height of the projectile at time t is given by $y = 4t - t^2$ and the horizontal distance covered is given by $x = 3t$. What is the angle of projection with the horizontal?
(A) $\tan^{-1} 3/5$ (B) $\tan^{-1} 4/5$ (C) $\tan^{-1} 4/3$ (D) $\tan^{-1} 3/4$

3. A particle A is projected with speed V_A from a point making an angle 60º with the horizontal. At the same instant, second particle B (lie in the same horizontal plane) is thrown vertically upwards from a point directly below the maximum height point of parabolic path of A, with velocity V_B. If the two particles collide then the ratio of V_A/V_B should be ;
(A) 1 (B) $2/\sqrt{3}$ (C) $\sqrt{3}/2$ (D) $\sqrt{3}$

4. A car accelerates from rest at a constant rate α for some time after which it decelerates at a constant rate β to come to rest. If total time taken by car is t, then maximum velocity V will be :
(A) $V = t\dfrac{\alpha\beta}{\alpha-\beta}$ (B) $V = t\left(\dfrac{\beta^2}{\alpha-\beta}\right)$ (C) $V = t\left(\dfrac{\alpha^2}{\alpha+\beta}\right)$ (D) $V = t\left(\dfrac{\alpha\beta}{\alpha+\beta}\right)$

5. A lift is moving in upward direction with speed 20 m/s and having acceleration 5 m/s^2 in downward direction. A bolt drops from the ceiling of lift at that moment. Just after the drop, the :
(A) velocity of bolt with respect to ground is zero
(B) velocity of bolt with respect to ground is 20 m/s in upward direction
(C) acceleration of bolt with respect to ground is 5 m/s^2
(D) none of these

6. A balloon is moving with constant upward acceleration of 1 m/s^2. A stone is thrown from the balloon downwards with speed 10 m/s with respect to the balloon. At the time of projection balloon is at height 120 m from the ground and is moving with speed 20 m/s upward. The time required to fall on the ground by the stone after the projection will be-

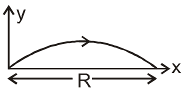
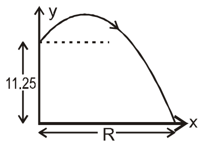
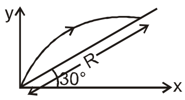
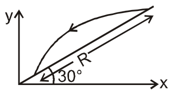


(A) 4 sec. (B) 5 sec.
(C) 6 sec. (D) None of these

7. A particle is projected under gravity at an angle of projection 45° with horizontal. Its horizontal range is 36 m. Find maximum Height attained by particle.

8. A bullet is fired with speed 50 m/s at 45° angle with horizontal. Find the height of the bullet when its direction of motion makes angle 30° with the horizontal.

9. In the column-I, the path of a projectile (initial velocity 10 m/s and angle of projection with horizontal 60° in all cases) is shown in different cases. Rangle 'R' is to be matched in each case from column-II. Take g = 10 m/s^2. Arrow on the trajectory indicates the direction of motion of projectile.

Column-I	**Column-II**
(A) 	(p) $R = \dfrac{15\sqrt{3}}{2}$ m
(B) 	(q) $R = \dfrac{40}{3}$m
(C) 	(r) $R = 5\sqrt{3}$m
(D) 	(s) $R = \dfrac{20}{3}$m

PHYSICS
DPP
DAILY PRACTICE PROBLEMS

DPP No. 17

Total Marks : 28

Max. Time : 28 min.

Topics : Projectile Motion, Rectilinear Motion, Mathematical Tools

Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.1 to Q.6	(3 marks, 3 min.)	[18, 18]
Multiple choice objective ('–1' negative marking) Q.7	(4 marks, 4 min.)	[4, 4]
Comprehension ('–1' negative marking) Q.8 to Q.9	(3 marks, 3 min.)	[6, 6]

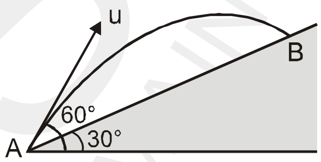
1. A stone projected at angle 'θ' with horizontal from the roof of a tall building falls on the ground after three second. Two second after the projection it was again at the level of projection. Then the height of the building is -

(A) 5 m (B) 25 m (C) 20 m (D) 15 m

2. The maximum height attained by a projectile thrown over a horizontal ground is increased by 5%, keeping the angle of projection constant. What is the percentage increase in the horizontal range?

(A) 20% (B) 15% (C) 10% (D) 5%

3. A stone is projected from point A with speed u making an angle 60° with horizontal as shown. The fixed inclined surface makes an angle 30° with horizontal. The stone lands at B after time t. Then the distance AB is equal to .

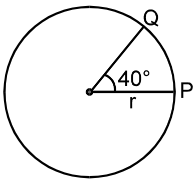


(A) $\frac{ut}{\sqrt{3}}$ (B) $\frac{\sqrt{3}ut}{2}$ (C) $\sqrt{3}ut$ (D) 2 ut

4. The velocity of a particle moving on the x-axis is given by $v = x^2 + x$ (for $x > 0$) where v is in m/s and x is in m. Find its acceleration in m/s^2 when passing through the point x = 2m

(A) 0 (B) 5 (C) 11 (D) 30

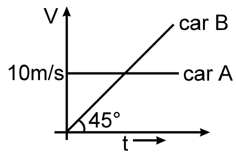
5. A particle is moving in a circle of radius r with constant speed v as shown in the figure. The magnitude of change in velocity in moving from P to Q is :



(A) 2 v cos 40° (B) 2 v sin 20°

(C) 2 v cos 20° (D) none of these

6. Initially car A is 10.5 m ahead of car B. Both start moving at time t = 0 in the same direction along a straight line. The velocity time graph of two cars is shown in figure. The time when the car B will catch the car A, will be



(A) t = 21 sec

(B) t = $2\sqrt{5}$ sec

(C) 20 sec.

(D) None of these

7. Two particles, one with constant velocity 50m/s and the other start from rest with uniform acceleration $10 m/s^2$, start moving simultaneously from the same position in the same direction. They will be at a distance of 125m from each other after

(A) 5 sec.

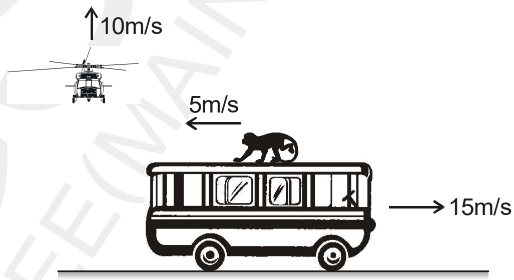
(B) $5(1 + \sqrt{2})$ sec.

(C) 10sec.

(D) $10(\sqrt{2} + 1)$sec.

COMPREHENSION

A bus is moving rightward with a velocity of 15 m/sec and on the bus a monkey is running oppositely with a velocity of 5 m/sec (with respect to the bus). Nearby a helicopter is rising vertically up with a velocity of 10 m/sec.



8. Find out the direction of the helicopter as seen by the monkey.

9. Find out the direction of the bus as seen by the helicopter's pilot.

PHYSICS
DPP
DAILY PRACTICE PROBLEMS

DPP No. 18

Total Marks : 32

Max. Time : 35 min.

Topics : Relative Motion, Rectilinear Motion, Projectile Motion

Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.1 to Q.4	(3 marks, 3 min.)	[12, 12]
Multiple choice objective ('–1' negative marking) Q.5 to Q.6	(4 marks, 4 min.)	[8, 8]
Subjective Questions ('–1' negative marking) Q.7	(4 marks, 5 min.)	[4, 5]
Match the Following (no negative marking) (2 × 4) Q.8	(8 marks, 10 min.)	[8, 10]

1. Person A observes B moving in east direction with speed 10 m/s, B observes C moving in south direction with speed 20 m/s, C observes D moving in west direction with speed 30 m/s & D observes a tree moving with speed 40 m/s in north direction. Then the actual direction of motion of person 'A' (with respect to ground) will be -

(A) north - west (B) north - east (C) south - east (D) none of these

2. A boat has a velocity 4 m/s towards east with respect to river and river is flowing towards north with velocity 2 m/s. Wind is blowing towards north with velocity 6 m/s. The direction of the flag blown over by the wind hoisted on the boat is:

(A) north-west (B) south-east (C) $\tan^{-1}\frac{1}{2}$ with east (D) north

3. For a particle undergoing rectilinear motion with uniform acceleration, the magnitude of displacement is one third the distance covered in some time interval. The magnitude of final velocity is less than magnitude of initial velocity for this time interval. Then the ratio of initial speed to the final speed for this time interval is :

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

4. A man is sitting inside a moving train and observes the stationary objects outside of the train. Then choose the single correct choice from the following statements -

(A) all stationary objects outside the train will move with same velocity in opposite direction of the train with respect to the man.

(B) stationary objects near the train will move with greater velocity & object far from train will move with lesser velocity with respect to the man.

(C) large objects like moon or mountains will move with same velocity as that of the train.

(D) all of these.

5. A particle is projected in such a way that it follows a curved path with constant acceleration $\vec{a}$. For finite interval of motion. Which of the following option(s) may be correct :

$\vec{u}$ = initial velocity $\vec{a}$ = acceleration of particle $\vec{v}$ = velocity at t > 0

(A) $|\vec{a}\times\vec{u}|\neq 0$ (B) $|\vec{a}\times\vec{v}|=0$ (C) $|\vec{u}\times\vec{v}|=0$ (D) $\vec{u}.\vec{v}=0$

6. A particle is projected vertically upwards in vacuum with a speed u.

(A) When it rises to half its maximum height, its speed becomes u/2.

(B) When it rises to half its maximum height, its speed becomes $u/\sqrt{2}$.

(C) The time taken to rise to half its maximum height is half the time taken to reach its maximum height.

(D) The time taken to rise to three-fourth of its maximum height is half the time taken to reach its maximum height.

7. When two bodies move uniformly towards each other, the distance between them diminishes by 16 m in every 10 s. If bodies move with velocities of the same magnitude (as before)and in the same direction then distance between them will decrease 3 m every 5 s. Calculate the velocity of each body.

8. Two particles A and B moving in x-y plane are at origin at t = 0 sec. The initial velocity vectors of A and B are $\vec{u}_A = 8\hat{i}$ m/s and $\vec{u}_B = 8\hat{j}$ m/s. The acceleration of A and B are constant and are $\vec{a}_A = -2\hat{i}$ m/s^2 and $\vec{a}_B = -2\hat{j}$ m/s^2. Column I gives certain statements regarding particle A and B. Column I gives corresponding results. Match the statements in column I with corresponding results in Column II.

Column I	**Column II**
(A) The time (in seconds) at which velocity of A relative to B is zero	(p) $16\sqrt{2}$
(B) The distance (in metres) between A and B when their relative velocity is zero.	(q) $8\sqrt{2}$
(C) The time (in seconds) after t = 0 sec, at which A and B are at same position	(r) 8
(D) The magnitude of relative velocity of A and B	(s) 4

PHYSICS DPP

DAILY PRACTICE PROBLEMS

DPP No. 19

Total Marks : 25

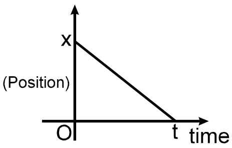
Max. Time : 26 min.

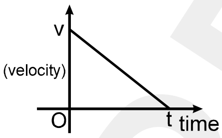
Topics : Rectilinear Motion, Projectile Motion

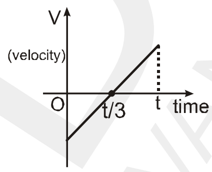
Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.1 to Q.4	(3 marks, 3 min.)	[12, 12]
Subjective Questions ('–1' negative marking) Q.5	(4 marks, 5 min.)	[4, 5]
Comprehension ('–1' negative marking) Q.6 to Q.8	(3 marks, 3 min.)	[9, 9]

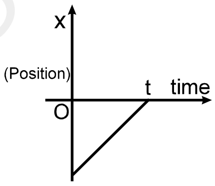
1. For a given acceleration - time graph , there exist ________ velocity - time graph.
(A) 1 (B) 2 (C) 3 (D) many

2. For which of the following graphs the average velocity of a particle moving along a straight line for time interval (0, t) must be negative -

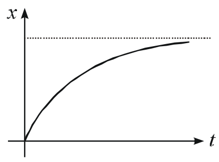
(A) 

(B) 

(C) 

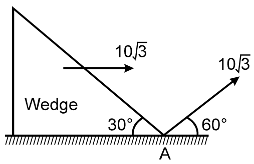
(D) 

3. Variation of displacement x of a particle moving on a straight line with time t is shown in following figure. The figure indicates :



(A) the particle starts with a certain speed but the motion is retarded
(B) the velocity of particle is constant throughout motion
(C) the acceleration of the particle is constant throughout motion
(D) the particle starts with certain speed and moves with increasing speed .

4. A particle is projected at angle 60° with speed $10\sqrt{3}$ m/s from the point 'A' as shown in the figure. At the same time the wedge is made to move with speed $10\sqrt{3}$ m/s towards right. Then the time after which particle will strike with wedge is (g = 10 m/sec^2) :

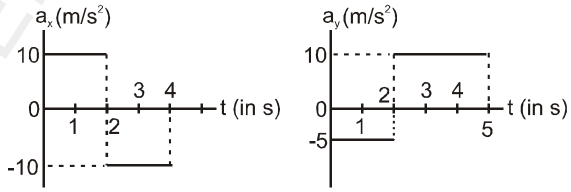


(A) 2 sec (B) $2\sqrt{3}$ sec (C) $\frac{4}{\sqrt{3}}$ sec (D) none of these

5. Two cars A and B are racing along straight line. Car A is leading, such that their relative velocity is directly proportional to the distance between the two cars. When the lead of car A is ℓ_1 = 10 m, its running 10 m/s faster than car B. Determine the time car A will take to increase its lead to ℓ_2 = 20 m from car B.

COMPREHENSION

A particle which is initially at rest at the origin, is subjected to an acceleration with *x*- and *y*-components as shown. After time *t* = 5 , the particle has no acceleration.



6. What is the magnitude of velocity of the particle at t = 2 seconds ?
(A) $10\sqrt{5}$ m/s (B) $5\sqrt{10}$ m/s (C) $5\sqrt{5}$ m/s (D) None of these

7. What is the magnitude of average velocity of the particle between t = 0 and t = 4 seconds?
(A) $\frac{5}{2}\sqrt{13}$ m/s (B) $\frac{5}{2}\sqrt{17}$ m/s (C) 30 m/s (D) None of these

8. When is the particle at its farthest distance from the y-axis?
(A) 3 sec. (B) 2 sec. (C) 4 sec. (D) 1 sec.

PHYSICS DPP

DAILY PRACTICE PROBLEMS

DPP No. 20

Total Marks : 26

Max. Time : 28 min.

Topics : Rectilinear Motion, Relative Motion, Newton's Law of Motion

Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.1 to Q.6	(3 marks, 3 min.)	[18, 18]
Subjective Questions ('–1' negative marking) Q.7 to Q.8	(4 marks, 5 min.)	[8, 10]

1. Mark the correct statement(s).
(A) if speed of a body is varying, its velocity must be varying and it must have zero acceleration
(B) if velocity of a body is varying, its speed must be varying
(C) a body moving with varying velocity may have constant speed
(D) a body moving with varying speed may have constant velocity if its direction of motion remains constant.

2. At a harbour, a boat is standing and wind is blowing at a speed of $\sqrt{2}$ m/sec. due to which, the flag on the boat flutters along north–east. Now the boat enters in to river, which is flowing with a velocity of 2 m/sec. due north. The boat starts with zero velocity relative to the river and its constant acceleration relative to the river is 0.2 m/sec^2 due east. In which direction will the flag flutter at 10 seconds ?
(A) south-east (B) south–west (C) 30º south of west (D) west

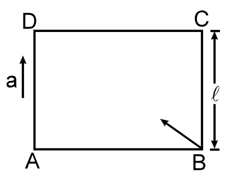
3. A point moves in a straight line under the retardation a v^2 , where 'a' is a positive constant and v is speed. If the initial speed is u , the distance covered in 't' seconds is :
(A) a u t (B) $\frac{1}{a}$ ln(a u t) (C) $\frac{1}{a}$ ln (1 + a u t) (D) a ln (a u t)

4. The velocity of a car moving on a straight road increases linearly according to equation, v = a + b x, where a & b are positive constants. The acceleration in the course of such motion: (x is the distance travelled)
(A) increases (B) decreases (C) stay constant (D) becomes zero

5. Which one of the following cannot be explained on the basis of Newton's third law of motion?
(A) rowing of boat in a pond (B) motion of jet in the sky
(C) rebounding of a ball from a wall (D) returning back of body thrown above

6. At a particular instant velocity and acceleration of a particle are $(-\hat{i}+\hat{j}+2\hat{k})$m/s and $(3\hat{i}-\hat{j}+\hat{k})$m/s^2 respectively at the given instant particle's speed is :
(A) increasing (B) decreasing (C) constant (D) can't be say

7. In the figure the top view of a compartment of a train is shown. A man is sitting at a corner 'B' of the compartment. The man throws a ball (with respect to himself) along the surface of the floor towards the corner 'D' of the compartment of the train. The ball hits the corner 'A' of the compartment, then find the time at which it hits A after the ball is thrown. Assume no other collision during motion and floor is smooth. The length of the compartment is given as 'ℓ' and the train is moving with constant acceleration 'a' in the direction shown in the figure.



8. A balloon is ascending vertically with an acceleration of 0.4 m/s^{-2}. Two stones are dropped from it at an interval of 2 sec. Find the distance between them 1.5 sec. after the second stone is released.
(g = 10 m/sec^2)

DPP 11 TO 20 (ANSWER KEY)

DPP NO. - 11

1. (C) **2.** (C) **3.** (A) **4.** (C) **5.** (D)
6. (C,D) **7.** (C) **8.** (B) **9.** (D)

DPP NO. - 12

1. (A) **2.** (B) **3.** (B) **4.** (A) **5.** (C)
6. (C) **7.** 212.5 m. **8.** Only graph (iii) is possible.

DPP NO. - 13

1. (D) **2.** (D) **3.** (B) **4.** (A) **5.** (C)
6. (B) **7.** (B) **8.** (B)

DPP NO. - 14

1. (A) **2.** (A) **3.** (B) **4.** (B) **5.** (D)
6. (A) **7.** (B)(C) **8.** (A,B,D) **9.** (A,B)
10. 26 m.

DPP NO. - 15

1. (C) **2.** (B) **3.** (D) **4.** (D) **5.** (D)
6. (D) **7.** (A) **8.** (B)

DPP NO. - 16

1. (C) **2.** (C) **3.** (B) **4.** (D) **5.** (B)
6. (C) **7.** 9

8. $h = \frac{125}{3}$ m above point of projection

9. (A) r (B) p (C) s (D) q

DPP NO. - 17

1. (D) **2.** (D) **3.** (A) **4.** (D) **5.** (B)
6. (A) **7.** (A), (B) **8.** ($\nwarrow$) **9.** ($\searrow$) .

DPP NO. - 18

1. (C) **2.** (A) **3.** (A) **4.** (A)
5. (A),(D) **6.** (B), (D) **7.** 0.5 m/s.
8. (A) s (B) p (C) r (D) q

DPP NO. - 19

1. (D) **2.** (A) **3.** (A) **4.** (A)
5. $t = (\log_e 2)$ sec **6.** (A) **7.** (B) **8.** (C)

DPP NO. - 20

1. (C) **2.** (B) **3.** (C) **4.** (A) **5.** (D)

6. (B) **7.** $t = \sqrt{\frac{2\ell}{a}}$ **8.** 52 m

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CLASS : XI (PHYSICS)

DPP

DAILY PRACTICE PROBLEM

Solutions

DPP-11 TO 20

DPP NO. - 11

1. Let u be velocity of ball with which it is thrown.

$h = ut + (-\frac{1}{2}gt^2)$ $\quad 25 = ut - 5t^2$

$5t^2 - ut + 25 = 0$ $\quad$ Let t_1, t_2 be its roots

$t_1 + t_2 = u/5,$ $\quad t_1t_2 = 5$

Given, $t_2 - t_1 = 4$ sec.

$(t_2 - t_1)^2 = 16$

$\Rightarrow (t_2 + t_1)^2 - 4t_1t_2 = 16$

$\left(\frac{u}{5}\right)^2 - 4 \times 5 = 16$ $\quad u = 30$ m/sec.

2. For a freely falling body

$S = \frac{1}{2}gt^2$ $\quad S \propto t^2$.

3. v(2) = v(0) + area under a–t graph from t = 0 to t = 2

$= 2 + \frac{1}{2}(2)(4) = 6$ m/s.

4. Distance covered in first 10 sec

$S_i = \frac{1}{2}(10)(10)^2 = 500$ m

Remaining height from ground = 2495 – 500 = 1995 m

u = gt = 10 × 10 = 100 m/s velocity on reaching the ground

$v^2 = (100)^2 + 2(-2.5) \times 1995$

$v^2 = 10000 - 9975 = 25$

v = 5 m/s.

5. Suppose the particle starts from origin at t = 0. Then at any time t,

$x \propto t^3$

$x = kt^3$ $\quad$ (K = constant)

$v = \frac{dx}{dt} = 3kt^2$

$a = \frac{dv}{dt} = 6kt$

$a \propto t$.

6. Displacement = 0 ($\because$ initial position = final position)

average velocity = 0 ($\because$ Total displacement = 0)

7. $V = (3t^2 - 18t + 24)$ m/s

$V = 3(t-2)(t-4)$

$s = \left|\int_0^2 V dt\right| + \left|\int_2^3 V dt\right|$

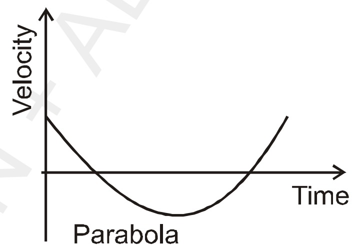
$= \left|\int_0^2 (3t^2 - 18t + 24)dt\right| + \left|\int_2^3 (3t^2 - 18t + 24)dt\right| = |20| + |-2| = 22$ m

8. $V = 3(t-2)(t-4)$

$a = 6(t-3)$

common interval in which V and a both have opposite sign is 0 to 2 sec

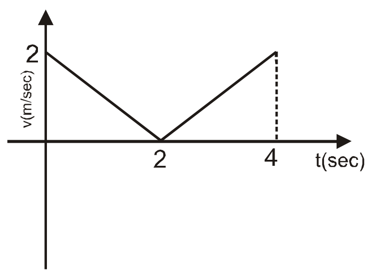
9. Velocity time graph will be



Speed time graph = |Velocity time graph|

DPP NO. - 12

1. Plotting velocity v against time t, we get

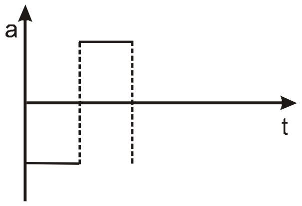


Area under the v–t curve gives distance.

Distance = $\frac{1}{2} \times 2 \times 2 + \frac{1}{2} \times 2 \times 2 = 4$m

2. Obviously slope of v–t graph is changed at t = 2, 4, 6,......... in direction but it has constant magnitude.

3. Instantaneous, acceleration = slope of v–t graph hence, obviously, a – t graph will be as shown,



4. **(A)**

$\vec{r} = (t^2 - 4t + 6)\hat{i} + t^2\hat{j}$; $\vec{v} = \frac{d\vec{r}}{dt} = (2t-4)\hat{i} + 2t\hat{j}$, $\vec{a} = \frac{d\vec{v}}{dt} = 2\hat{i} + 2\hat{j}$

if $\vec{a}$ and $\vec{v}$ are perpendicular

$\vec{a}.\vec{v} = 0$

$(2\hat{i} + 2\hat{j}).((2t-4)\hat{i} + 2t\hat{j}) = 0$

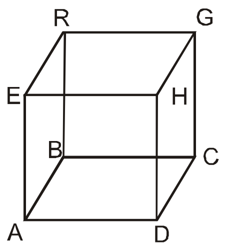
$8t - 8 = 0$

$t = 1$ sec.

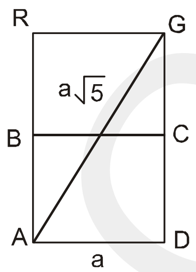
Ans. t = 1 sec.

5. $\frac{S_N}{S} = \frac{\frac{1}{2}a(2n-1)}{\frac{1}{2}a\,n^2} = \frac{2n}{n^2} - \frac{1}{n^2} \qquad \frac{2}{n} - \frac{1}{n^2}$

6.



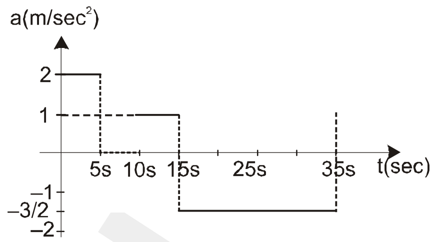
on placing back face and bottom face in same plane.

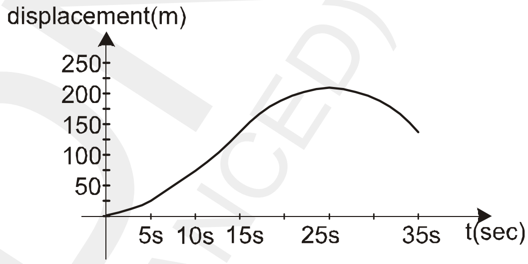


A → starting point G → final point

minimum time = $\frac{\sqrt{5}a}{u}$

7.





Maximum displacement is a 25 sec. displacement = 25 + 50 + 62.5 + 75 = 212.5 m.

8. (i) **Impossible:** Speed is always positive

(ii) **Impossible:** Time never decreases.

(iii) **Possible:** Velocity may increase with time.

DPP NO. - 13

1. At t = 4 sec, V = 0 + (4) (4) = 16 m/sec.

At t = 8 sec, V = 16 m/sec.

At t = 12 sec, V = 16 – 4 (12 – 8) = 0

For 0 to 4 sec ; $s_1 = ½ at^2 = ½ (4) (4)^2 = 32$ m

For 4 to 8 sec ; $s_2 = 16 (8 - 4) = 64$ m

For 8 to 12 sec ; $s_3 = 16 (4) - ½ (4) (4)^2 = 32$ m

So $s_1 + s_2 + s_3 = 32 + 64 + 32 = 128$ m

Alter : Draw v-t graph

Area of v-t graph = displacement.

2. Using $v_x = u_x + a_x t$

= 4 i + (2i) 4

= 12 i

As $a_y = 0$, velocity component in y-direction remains unchanged. Final velocity = 12 i - 5j

speed at t = 4 sec. = $\sqrt{12^2 + (-5)^2}$ = 13 m/s.

$v_x = u_x + a_x t$

= 4 i + (2i) 4

= 12 i

4. $V = a + bx$

(V increases as x increases)

$\frac{dV}{dx} = b; \quad \frac{dx}{dt} = V$

so, acceleration = $V\frac{dV}{dx} = V.b$

hence acceleration increases as V increases with x.

5. The retardation is given by

$\frac{dv}{dt} = -av^2$

integrating between proper limits

$\Rightarrow \; -\int_u^v \frac{dv}{v^2} = \int_0^t a\,dt$

or $\frac{1}{v} = at + \frac{1}{u}$

$\Rightarrow \; \frac{dt}{dx} = at + \frac{1}{u}$

$\Rightarrow \; dx = \frac{u\;dt}{1+aut}$

integrating between proper limits

$\Rightarrow \; \int_0^s dx = \int_0^t \frac{u\,dt}{1+aut}$

$\Rightarrow \; S = \frac{1}{a}\ln(1 + aut)$

Sol. 6 to 8

The velocity of particle changes sign at t = 1 sec.

∴ Distance from t = 0 to t = 2 sec. is

$= \int_1^0 v\,dt + \int_2^1 v\,dt$

$= \left[(t^3 - \frac{3}{2}t^2)\right]_1^0 + \left[(t^3 - \frac{3}{2}t^2)\right]_2^1 = 3 \text{ m}$

Displacement from t = 0 to t = 2 sec. is $\int_0^2 v\,dt$

$= \left[(t^3 - \frac{3}{2}t^2)\right]_0^2 = 2 \text{ m}.$

DPP NO. - 14

1. m = 2kg, $\vec{F} = \hat{i} - \hat{j}$.

$\Rightarrow \; \vec{a} = \frac{\vec{F}}{m} = \frac{1}{2}(\hat{i} - \hat{j})$

Now $\vec{V} = \vec{u} + \vec{a}\,t$.

$\Rightarrow \; \vec{V} = 2\hat{i} + \frac{1}{2}(\hat{i} - \hat{j})\,t.$

$= \left(2 + \frac{t}{2}\right)\hat{i} - \frac{t}{2}\hat{j} = \frac{1}{2}(t+4)\,\hat{i} - \frac{t}{2}\hat{j}.$

Alter : Substitute t = 0 in option and get answer

2. $x^2 = t^2 + 1$

$2x\frac{dx}{dt} = 2t$

$\Rightarrow \; xV = t$

$xa + V^2 = 1$

$a = \frac{1 - V^2}{x} = \frac{1 - \frac{t^2}{x^2}}{x}$

$\Rightarrow \; a = \frac{x^2 - t^2}{x^3} = \frac{1}{x^3}$

3. $54 \text{ km/h} = 54 \times \frac{5}{18} = 15 \text{ m/s}$

$\langle a \rangle = \frac{15 - (-15)}{10} = 3 \text{ m/s}^2$.

4. For minimum number of jumps, range must be maximum.

maximum range = $\frac{u^2}{g} = \frac{(\sqrt{10})^2}{10} = 1$ meter.

Total distance to be covered = 10 meter

So total step = 10

5. From 6:00 AM to 6:30 AM

displacement of tip of minute hand

= 2 × 10cm = 20 cm

Hence, average velocity = $\frac{20 \text{ cm}}{30 \text{ min}} = \frac{2}{3} \text{ cm min}^{-1}$.

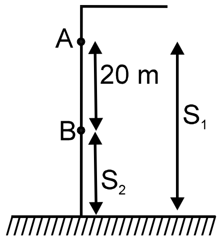
6. Vel. of Ist stone when passing at A →

$V^2 = 0 + 2.10.5$

$V = 10$ m/s

$S_1 - S_2 = 20$ m.

$$\Rightarrow \left(10.t + \frac{1}{2}10.t^2\right) - \left(\frac{1}{2}.10.t^2\right) = 20$$



t = 2s

$S_2 = \frac{1}{2}$. 10 . 4 = 20 m

Ht = 25 + 20 = 45 m.

7. $\cos\theta = \dfrac{(\sqrt{3}\,\hat{i} + \sqrt{2}\,\hat{j} - 2\hat{k})(-\hat{j})}{\sqrt{3+2+4}\,(1)} = \dfrac{-\sqrt{2}}{3}$

$\theta = \cos^{-1}\left(\dfrac{-\sqrt{2}}{3}\right)$ or $\pi - \cos^{-1}\left(\dfrac{\sqrt{2}}{3}\right)$

8. $\dfrac{dv}{dt} = g - kv \qquad \displaystyle\int_0^v \frac{dv}{g-kv} = \int_{t=0}^{t} dt$

$-\dfrac{1}{k}\ln\left(\dfrac{g-kv}{g}\right) = t$

$g - kv = ge^{-kt} \qquad v = \dfrac{g}{k}\left[1 - e^{-kt}\right]$

$a = \dfrac{g}{k}\left[0 - e^{-kt}(-k)\right]$

$= g\,e^{-kt}$

$V = \dfrac{g}{k} - \dfrac{a}{k} = -\dfrac{a}{k} + \dfrac{g}{k}$

$V - \dfrac{g}{k} = -\dfrac{a}{k}$

$kv - g = -a$

$a = g - kv$

$= -kv + g$

9. (i) $V\dfrac{dv}{dx} = -\beta V$ (ii) $a = -\beta V$

$dv = -\beta dx \qquad \dfrac{dv}{dt} = -\beta V$

$\displaystyle\int_{v_0}^{0} dv = -\beta\int_0^x dx \qquad \int_{v_0}^{v}\frac{dv}{v} = -\beta\int_0^t dt$

$-v_0 = -\beta x \qquad \ell n\left(\dfrac{V}{V_0}\right) = -\beta t$

$x = \dfrac{v_0}{\beta} \qquad V = V_0 e^{-\beta t}$

$V = \dfrac{V_0}{e^{\beta t}}$ at $t \to \infty$ V = 0.

∴ A & B are correct answer

10. u = + 8 m/s

$a = -4$ m/s^2

v = 0

⇒ 0 = 8 – 4t or t = 2 sec.

displacement in first 2 sec.

$S_1 = 8 \times 2 + \frac{1}{2}.(-4).2^2 = 8$ m

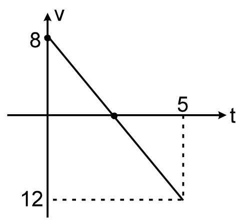
displacement in next 3 sec.

$S_2 = 0 \times 3 + \frac{1}{2}(-4)3^2 = -18$ m.

distance travelled $= |S_1| + |S_2| = 26$ m.

Ans. 26 m.

ALITER :



total distance $= \frac{1}{2} \times 2 \times 8 + \frac{1}{2} \times 3 \times 12$

= 8 + 18 = 26 m

DPP NO. - 15

2. At maximum height v = u cosθ

$\frac{u}{2} = v \Rightarrow \cos\theta = \frac{1}{2} \Rightarrow \theta = 60°$

$R = \frac{u^2 \sin 2\theta}{g} = \frac{u^2 \sin(120°)}{g}$

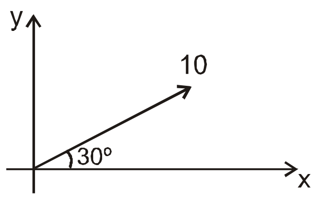
$= \frac{u^2 \cos 30°}{g} = \frac{\sqrt{3}u^2}{2g}$

3. At the top of trajectory,

$K' = \frac{1}{2} m(u \cos\theta)^2$

$= \frac{1}{2} mu^2 . \cos^2 45° = \frac{k}{2}$.

4. For A



Velocity of the particle will be perpendicular to the initial direction when 10 – g sin 30º t = 0

∴ t = 2 s,

but total time of flight $= \frac{2u \sin 30°}{g} = 1$ s.

So not possible

For B

Minimum speed during the motion is

$= u \cos 30° = 10 \times \frac{\sqrt{3}}{2} = 5\sqrt{3}$ m/s.

For B

$t = \frac{1}{2}$ second

∴ particle is at highest point.

where, displacement $= \sqrt{\frac{R^2}{4} + H^2} = \frac{5\sqrt{13}}{4}$ m

5. For maximum range, θ = 45º

At the highest point, $v = u \cos\theta = \frac{u}{\sqrt{2}}$

6. Range is same for 2θ and 4θ.

∴ 2θ + 4θ = 90º ⇒ θ = 15º

∴Ratio of ranges will be sin30º : sin 60º : sin120º.

$\frac{1}{2} : \frac{\sqrt{3}}{2} : \frac{\sqrt{3}}{2} \Rightarrow \frac{2}{\sqrt{3}} : 2 : 2$

7. $y = u_x t - \frac{1}{2} . g t^2 = 10 \times 1 - 5 \times 1^2 = 5$ m

$x = u_x t = 10 \times 1 = 10$ m

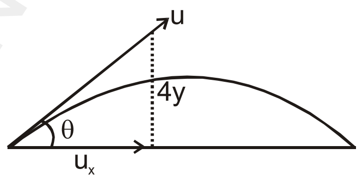
8. For constant acceleration if initial velocity makes an oblique angle with acceleration then path will be parabolic.

DPP NO. - 16

1. $y = x \tan\theta \left(1 - \frac{x}{R}\right)$ $y = (12x)\left(1 - \frac{x}{16}\right)$

⇒ Range = **16 m Ans.**

2.



$y = 4t - t^2$, $x = 3t$

$V_y = \frac{dy}{dt} = 4 - 2t$, $V_x = \frac{dx}{dt} = 3$

$\Rightarrow u_y = v_y \big|_{t=0} = 4, \; u_x = v_x \big|_{t=0} = 3$

The angle of projection :

$\tan\theta = \frac{V_y}{V_x} = \frac{4}{3} \Rightarrow \theta = \tan^{-1}\left(\frac{4}{3}\right)$ **Ans.**

3. $V_A \sin 60° = V_B$

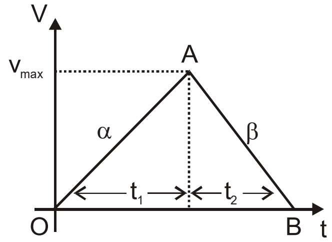
$\Rightarrow \frac{V_A}{V_B} = \frac{2}{\sqrt{3}}$

4. $t = t_1 + t_2$

slope of OA curve $= \tan\theta = \alpha = \frac{V_{max}}{t_1}$

slope of AB curve = $\beta = \dfrac{v_{max}}{t_2}$

$t = t_1 + t_2$



$\Rightarrow t = \dfrac{v_{max}}{\alpha} + \dfrac{v_{max}}{\beta} \Rightarrow v_{max} = \left(\dfrac{\alpha\beta}{\alpha+\beta}\right)t$

5. The velocity of an object released in a moving frame is equal to that of the frame as observed from the frame.

6. velocity of ball w.r.t. ground = 20 – 10 = 10 m/sec upwards.

$x = ut + \dfrac{1}{2}at^2$

$120 = -10\,t + \dfrac{1}{2} \times 10\,t^2$

$24 = -2\,t + t^2$

$t^2 - 2t - 24 = 0$

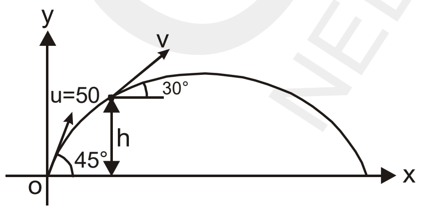
t = 6 sec.

7. $\dfrac{H}{R} = \dfrac{\tan\theta}{4}$

θ = 45° & R = 36 m

H = 9 m

8.



h = height of the point where velocity makes 30° with horizontal.

As the horizontal component of velocity remain same

50 cos45° = v cos30°

$v = 50\sqrt{\dfrac{2}{3}}$

Now by equation

$v^2 = u^2 + 2a_y y$

$\left(50 \times \sqrt{\dfrac{2}{3}}\right)^2 = 50^2 - 2gxh$

$\Rightarrow 2gh = 50^2 - 50^2 \times \dfrac{2}{3}$

$\Rightarrow 2gh = \dfrac{1}{3} \times 50^2$

$\Rightarrow h = \dfrac{2500}{60} = \dfrac{125}{3}$

$h = \dfrac{125}{3}$ m above point of projection

9. (A) $R = \dfrac{u^2\sin 2\theta}{g} = \dfrac{100\sqrt{3}}{2(10)} = 5\sqrt{3}$m

(B) $11.25 = -10\sin 60^\circ\, t + \dfrac{1}{2}(10)\,t^2$

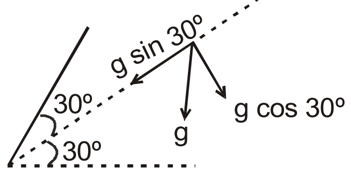
$\Rightarrow 5t^2 - 5\sqrt{3}\,t - 11.25 = 0$

$t = \dfrac{5\sqrt{3} \pm \sqrt{25(3)+4(5)(11.25)}}{10}$

$= \dfrac{5\sqrt{3} \pm \sqrt{3}(10)}{10}$

$= \dfrac{15}{10}\sqrt{3} = \dfrac{3}{2}\sqrt{3}$

$R = 10\cos 60\left(\dfrac{3}{2}\sqrt{3}\right) = 7.5\sqrt{3}$ m



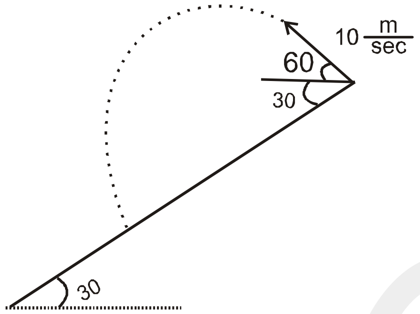
(C) $t = \dfrac{2u\sin 30^\circ}{g\cos 30^\circ} = \dfrac{2(10)\left(\dfrac{1}{2}\right)}{10\left(\dfrac{\sqrt{3}}{2}\right)} = \dfrac{2}{\sqrt{3}}$ sec.

$R = 10\cos 30^\circ\, t - \frac{1}{2} g \sin 30^\circ\, t^2$

$= \frac{10\sqrt{3}}{2}\left(\frac{2}{\sqrt{3}}\right) - \frac{1}{2}(10)\left(\frac{1}{2}\right)\frac{4}{3}$

$= 10 - \frac{10}{3} = \frac{20}{3}$ m

(D) $T = \frac{2(10)}{g\cos 30} = \frac{2(10)}{10\left(\frac{\sqrt{3}}{2}\right)} = \frac{4}{\sqrt{3}}$ sec.

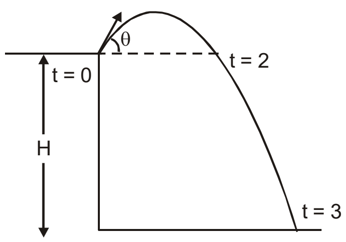


$R = \frac{1}{2} g \sin 30^\circ\, t^2$

$= \frac{1}{2}(10)\left(\frac{1}{2}\right)\frac{16}{3} = \frac{40}{3}$ m

DPP NO. - 17

1. $2 = \frac{2u_y}{g} \Rightarrow u_y = 10$ m/s



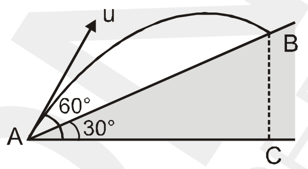
Now, $H = -u_y t + \frac{1}{2} g t^2$

$= -30 + 45 = 15$ m.

3. The horizontal displacement in time t is

$AC = u\cos 60^\circ\, t = \frac{ut}{2}$

$\therefore$ Range on inclined plane $= \frac{AC}{\cos 30} = \frac{ut}{\sqrt{3}}$



4. $V = x^2 + x$

$a = V\frac{dv}{dx} = (x^2 + x)(2x + 1)$

At x = 2 m

$a = (4 + 2)(4 + 1)$

$a = 30$ m/s^2 .

6. $x_A = x_B$

$10.5 + 10t = \frac{1}{2} at^2 \quad a = \tan 45^\circ = 1$

$t^2 - 20t - 21 = 0 \quad t = \frac{20 \pm \sqrt{400 + 84}}{2} \quad t = 21$ sec.

7. $S_1 - S_2 = 125$ m if $S_1 > S_2$ then

$50\,t - \frac{1}{2} \times 10\,t^2 = 125$

$10\,t - t^2 = 25$

$t^2 - 10\,t + 25 = 0$

$t = 5$ sec.

$S_2 - S_1 = 125$m if $S_2 > S_1$ then,

$\frac{1}{2} \times 10\,t^2 - 50\,t = 125$

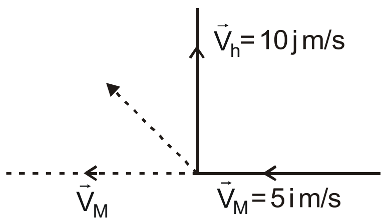
$t^2 - 10\,t - 25 = 0$

$t = \frac{10 + \sqrt{100 + 100}}{2}$

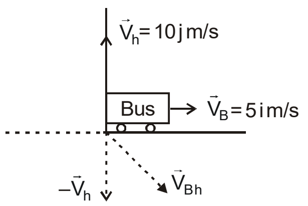
$t = 5\left(1 + \sqrt{2}\right)$ sec.

(8 to9) $\vec{V}_{hM} = \vec{V}_h - \vec{V}_M = 10\,j - 10i = -10i + 10\,j$

$\therefore \vec{V}_{hM} = 10(-i) + 10\,j$ $\therefore$ As seen bny the monkey helicopter is moving in (↖) direction.



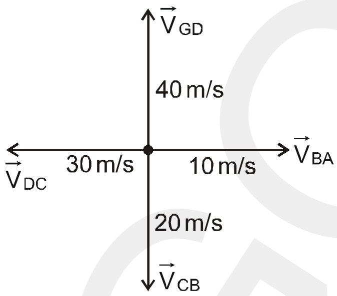
$\vec{V}_{Bh} = \vec{V}_B - \vec{V}_h$ = 15 i – 10 j = 15 i + 10 (j)



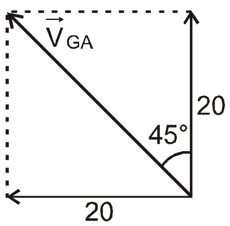
$\therefore$ As seen by helicopter's pilot the bus is moving in (↘) direction.

DPP NO. - 18

1. All the velocities are marked in diagram where G represents ground



adding we get

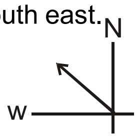


Then $\vec{V}_{GD} + \vec{V}_{DC} + \vec{V}_{CB} + \vec{V}_{BA} = \vec{V}_{GA} = -\vec{V}_{AG}$

Hence velocity of A is towards south east.

2. Vboat , river = $4\hat{i}$

Vriver , ground = $2\hat{i}$



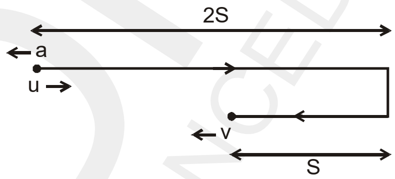
Vwind , ground = $6\hat{j}$

$\vec{V}$ wind, boat = $\vec{V}_{wg} + \vec{V}gr + \vec{V}_{rb}$ = $6\hat{j} - 2\hat{j} - 4\hat{i}$ =

$-4\hat{i} + 4\hat{j}$

so flag blown in north west.

3. Let u and v denote initial and find velocity, then then nature of motion is indicated in diagram



Hence initial and final speed are given by equation

$0^2 = u^2 - 2a \times 2S$ and $v^2 = 0^2 + 2as$

$\therefore \quad v = \frac{u}{\sqrt{2}}$ or $\frac{u}{v} = \sqrt{2}$ **Ans.**

4. $\vec{V}_{O,M} = \vec{V}_O - \vec{V}_M$ $\quad \vec{V}_{O,M} = \vec{V}_O - \vec{V}_{Train}$

$V_{O,M}$ = velocity of object with respect to man

V_O = velocity of object

V_M = velocity of man

Here velocity of object is zero.

So, $\vec{V}_{O,M} = -\vec{V}_M$

5. If $|\vec{a} \times \vec{u}| = 0$ particle will not follow curved path.

Above described motion is a projectile motion with parabolic path

6. At maximum height, velocity = 0

$H = \frac{u^2}{2g}$ &

At height h = H/2 $\quad V^2 = u^2 - 2gh$

$V^2 = u^2 - 2g.\frac{u^2}{4g}$ $\quad V^2 = \frac{u^2}{2}$ $\Rightarrow$ $V = \frac{u}{\sqrt{2}}$

Time taken to rise to maximum height $T = \frac{u}{g}$

for height h = $\frac{H}{2}$ t = $\frac{(u-u/\sqrt{2})}{g} = \frac{(\sqrt{2}-1)u}{\sqrt{2}g}$

Time taken to rise to $\frac{3}{4}$ H = T – time taken to fall down

by $\frac{H}{4}$

$= T - \frac{T}{2} = \frac{T}{2}$

7. Let velocity of bodies be v_1 and v_2.

in first case

$u_1 = v_1 + v_2$ .... (i)

in second case

$u_2 = v_1 - v_2$ .... (i)

$\therefore\ v_1 = \frac{u_1+u_2}{2}$ and $v_2 = \frac{u_1-u_2}{2}$

Here $u_1 = \frac{16}{10}$ m/s and $u_2 = \frac{3}{5}$ m/s

After solving we have

v_1 = 1.1 m/s and v_2 = 0.5 m/s.

8. The initial velocity of A relative to B is $\vec{u}_{AB} = \vec{u}_A - \vec{u}_B$

$= (8\hat{i} - 8\hat{j})$ m/s

$\therefore\ u_{AB} = 8\sqrt{2}$ m/s

Acceleration of A relative to B is -

$\vec{a}_{AB} = \vec{a}_A - \vec{a}_B = (-2\hat{i} + 2\hat{j})$ m/s^2

$\therefore\ a_{AB} = 2\sqrt{2}$ m/s^2

since B observes initial velocity and constant acceleration of A in opposite directions, Hence B observes A moving along a straight line.

From frame of B

Hence time when $v_{AB} = 0$ is $t = \frac{u_{AB}}{a_{AB}}$ = 4 sec.

The distance between A & B when $v_{AB} = 0$ is S = $\frac{u_{AB}^2}{2a_{AB}} = 16\sqrt{2}$ m

The time when both are at same position is -

$T = \frac{2u_{AB}}{a_{AB}}$ = 8 sec.

Magnitude of relative velocity when they are at same position in $u_{AB} = 8\sqrt{2}$ m/s.

DPP NO. - 19

2. In (A) $x_f - x_i$

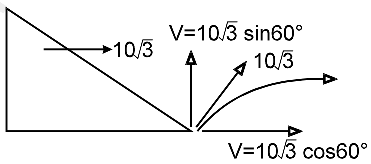
$0 - x = -x = -$ ve

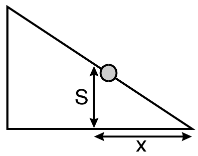
So average velocity is – ve.

3. From the graph ; we observe that slope is non–zero positive at t = 0 & slope is continuously decreasing with time and finally becomes zero. Hence we can say that the particle starts with a certain velocity, but the motion is retarded (decreasing velocity)

4. Suppose particle strikes wedge at height 'S' after time t.

$S = 15t - \frac{1}{2}10\,t^2 = 15t - 5\,t^2$. During this time distance travelled by particle in horizontal direction = $5\sqrt{3}$ t. Also wedge has travelled travelled extra distance





$x = \frac{S}{\tan 30^\circ} = \frac{15t - 5t^2}{1/\sqrt{3}}$

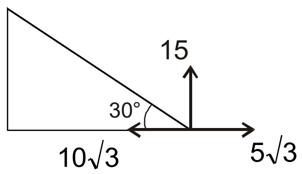
Total distance travelled by wedge in time

$t = 10\sqrt{3}$ t. $= 5\sqrt{3}\,t + \sqrt{3}\,(15 - 5t^2)$

$\Rightarrow$ t = 2 sec.

Alternate Sol.

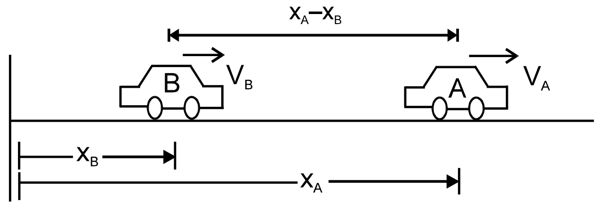
(by Relative Motion)



$$T = \frac{2u\sin 30^\circ}{g\cos 30^\circ} = \frac{2\times 10\sqrt{3}}{10}\times\frac{1}{\sqrt{3}} = 2 \text{ sec.}$$

$\Rightarrow$ t = 2 sec.

5.



As given

$(V_A - V_B) \propto x_A - x_B$

$(V_A - V_B) = K(x_A - x_B)$

when $x_A - x_B = 10$ We have $V_A - V_B = 10$

We get

$10 = K10 \quad \Rightarrow K = 1$

$\Rightarrow V_A - V_B = (x_A - x_B)$.........(1)

Now Let

$x_A - x_B = y$ ....(2)

On differentiating with respect to 't' on both side.

$$\Rightarrow \frac{dx_A}{dt} - \frac{dx_B}{dt} = \frac{dy}{dt} \Rightarrow V_A - V_B = \frac{dy}{dt} \text{ .... (3)}$$

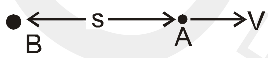
$\Rightarrow$ Using (1) , (2), (3)

We get $\frac{dy}{dt} = y$

Here y represents sepration between two cars

$$\Rightarrow \int_{10}^{20} \frac{dy}{y} = \int_0^t dt \quad \Rightarrow [\log_e y]_{10}^{20} = t$$

t = (log$_e$2) sec ***Required Answer.***



Alter. (Assume to be at rest)

$V \propto s$

$V = ks$

$V = 10, s = 10, k = 1$

$$\frac{ds}{dt} = s \qquad \int_{10}^{20} \frac{ds}{s} = \int_0^t dt$$

6 to 8. At t = 2 sec (t = 2 sec ij)

$v_x = u_x + a_x t = 0 + 10 \times 2 = 20$ m/s

$v_y = u_y + a_y t = 0 - 5 \times 2 = -10$ m/s

$$v = \sqrt{v_x^2 + v_y^2} = \sqrt{(20)^2 + (-10)^2} = 10\sqrt{5} \text{ m/s}$$

From t = 0 to ls t = 4 sec

$$x = \left[\frac{1}{2}(10)(2)^2\right]_{(0\to 2)} + \left[(10\times 2)2 - \frac{1}{2}(10)(2)^2\right]_{(2\to 4)}$$

x = 40 m

$$y = \left[-\frac{1}{2}5(2)^2\right]_{(0\to 2)} - \left[(10(2) - \frac{1}{2}(10)(2)^2\right]_{(2\to 4)}$$

y = – 10 m

Hence, average velocity of particle between t = 0 to t = 4 sec is

$$v_{av} = \frac{\Delta x}{\Delta t} = \frac{\sqrt{(40)^2 + (-10)^2}}{4}$$

$$v_{av} = \frac{5}{2}\sqrt{17} \text{ m/s}$$

At t = 2 sec u = 10 × 2 = 20 m/s

After t = 2sec

v = u + at

0 = 20 – 10t

t = 2 sec.

Hence, at t = 4 sec. the particle is at its farthest distance from the y-axis.

The particle is at farthest distance from y-axis at t $\geq$ 4. Hence the available correct choice is t = 4.

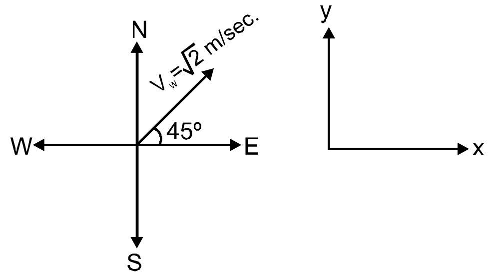
DPP NO. - 20

1. If speed of a particle changes, the velocity of the particle definitely changes and hence the acceleration of the particle is nonzero.

Velocity of a particle change without change in speed.

When speed of a particle varies, its velocity cannot be constant.

2. $V_w = 1\hat{i} + 1\hat{j}$



$V = at$

$V = (0.2)\, 10$

$= 2$ m/sec.

$V_{boat} = 2\hat{i} + 2\hat{j}$

$V_{w/boat} = V_w - V_{boat}$

$V_{w/boat} = (1\hat{i} + 1\hat{j}) - (2\hat{i} + 2\hat{j}) = -1\hat{i} - 1\hat{j}$

So, the flag will flutter towards south–west.

3. The retardation is given by $\dfrac{dv}{dt} = -av^2$

integrating between proper limits

$$\Rightarrow -\int_u^v \frac{dv}{v^2} = \int_0^t a\,dt \quad \text{or} \quad \frac{1}{v} = at + \frac{1}{u}$$

$$\Rightarrow \frac{dt}{dx} = at + \frac{1}{u} \quad \Rightarrow \quad dx = \frac{u\,dt}{1+aut}$$

integrating between proper limits

$$\Rightarrow \int_0^s dx = \int_0^t \frac{u\,dt}{1+aut} \quad \Rightarrow \quad S = \frac{1}{a}\ln(1 + aut)$$

4. $V = a + bx$ (V increases as x increases)

$$\frac{dV}{dt} = b\,\frac{dx}{dt} = bV$$

hence acceleration increases as V increases with x.

6. $\vec{v} = -\hat{i} + \hat{j} + 2\hat{k}$

$\vec{a} = 3\hat{i} - \hat{j} + \hat{k}$

$\vec{a}.\vec{v} = -3 - 1 + 2 < 0$

hence $\theta > 90°$ between $\vec{a}$ and $\vec{v}$

so speed is decreasing

$\vec{a}.\vec{v} = -3 - 1 + 2 < 0$

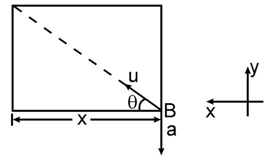
7. Solving the problem in the frame of train. Taking origin as corner 'B'

Along x axis x-

$x = u\cos\theta t$ ....(1)

Along y axis y-

$$y = u_y t + \frac{1}{2} a_y t^2$$



$$0 = u\sin\theta\, t - \frac{1}{2} at^2 \quad ....(2)$$

As the ball is thrown towards 'D'

$$\tan\theta = \frac{\ell}{x} \quad .....(3)$$

From equation (1), (2) & (3) we get

$t = \sqrt{\dfrac{2\ell}{a}}$ required time after which ball hit the corner.

8. At position A balloon drops first particle So, $u_A = 0$, $a_A = -g$, $t = 3.5$ sec.

$$S_A = \left(\frac{1}{2}gt^2\right) \quad ....(i)$$

Balloon is going upward from A to B in 2 sec.so distance travelled by balloon in 2 second.

$$\left(S_B = \frac{1}{2}a_B t^2\right) \quad ....(ii)$$

$a_B = 0.4$ m/s², $t = 2$ sec.

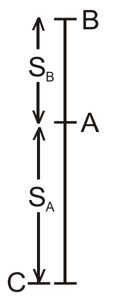
$S_1 = BC = (SB + SA)$ ....(iii)

Distance travell by second stone which is droped from balloon at B

$u_2 = u_B = a_B t = 0.4 \times 2 = 0.8$ m/s

$t = 1.5$ sec.

$$\left(S_2 = u_2 t - \frac{1}{2}gt^2\right) \quad ....(iv)$$



Distance between two stone

$\Delta S = S_1 - S_2$.