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]

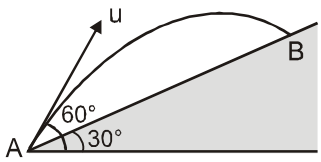
1. A stone projected at angle 'θ' with horizontal from the roof of a tall building falls on the ground after three second. Two second after the projection it was again at the level of projection. Then the height of the building is -

(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 .

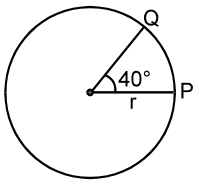


(A) $\frac{ut}{\sqrt{3}}$ (B) $\frac{\sqrt{3}ut}{2}$ (C) $\sqrt{3}ut$ (D) 2 ut

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

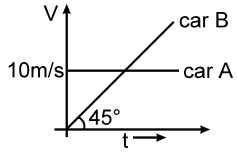
5. A particle is moving in a circle of radius r with constant speed v as shown in the figure. The magnitude of change in velocity in moving from P to Q is :



(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

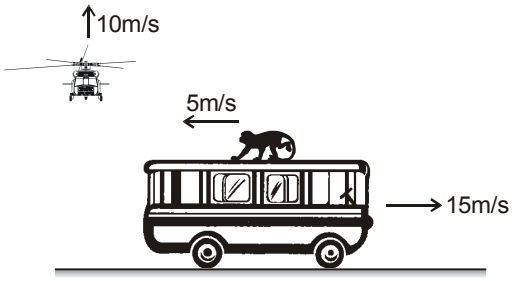


(A) t = 21 sec
(B) t = $2\sqrt{5}$ sec
(C) 20 sec.
(D) None of these

7. Two particles, one with constant velocity 50m/s and the other start from rest with uniform acceleration 10m/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.

Answers Key

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

Hint & Solutions

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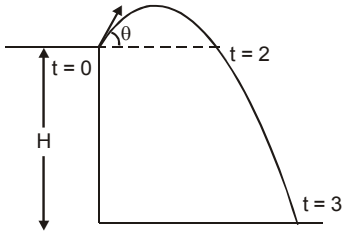
1. $2 = \frac{2u_y}{g} \Rightarrow u_y = 10$ m/s



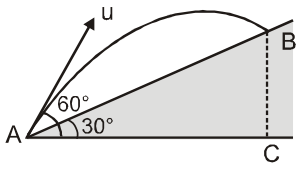
Now, $H = -u_y t + \frac{1}{2} g t^2$

$= -30 + 45 = 15$ m.

3. The horizontal displacement in time t is

$AC = u \cos 60° \, t = \frac{ut}{2}$

$\therefore$ 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. $x_A = x_B$

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

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

7. $S_1 - S_2 = 125$ m $\quad$ 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,

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

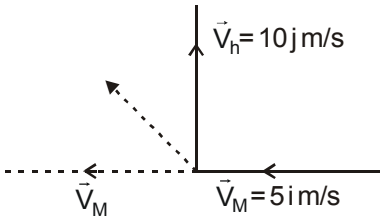
$t^2 - 10\,t - 25 = 0$

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

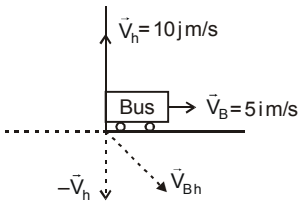
$t = 5\left(1 + \sqrt{2}\right)$ sec.

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

$\therefore \vec{V}_{hM} = 10(-i) + 10\,j$ $\quad \therefore$ 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.