PHYSICS

DPP

DAILY PRACTICE PROBLEMS

DPP No. 21

Total Marks : 24

Max. Time : 24 min.

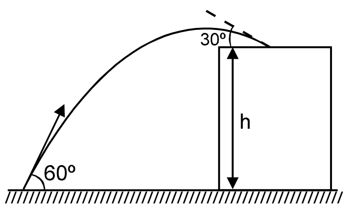
Topics : Relative Motion, Projectile Motion, Newton's Law of Motion

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

1. Two points P and Q move in same plane such that the relative acceleration of P with respect to Q is zero. They are moving such that the distance between them is decreasing. Pick the correct statement for P and Q to collide

(A) The line joining P and Q should not rotate.
(B) The line joining P and Q should rotate with constant angular speed
(C) The line joining P and Q should rotate with variable angular speed
(D) All the above statement are correct

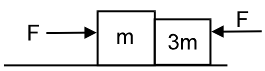
2. A stone projected at an angle of 60º from the ground level strikes at an angle of 30º on the roof of a building of height 'h'. Then the speed of projection of the stone is :

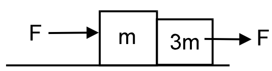


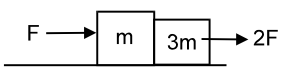
(A) $\sqrt{2gh}$ (B) $\sqrt{6gh}$ (C) $\sqrt{3gh}$ (D) $\sqrt{gh}$

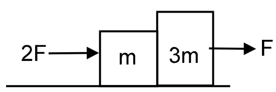
3. A man is on ship which is moving in east direction with speed 60 km/hr. Waves of ocean is taking ship towards west with speed 20 km/hr. Man start running on ship with flag in his hand in north direction with speed 30 km/hr and wind is blowing with 50 km/hr, 37º towards south of west then find the direction of flutter the flag as seen by man on ground.

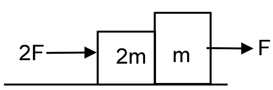
(A) 37º south of west (B) 53º south of west
(C) 37º west of north (D) flag will not flutter

4. (i)


(ii)


(iii)


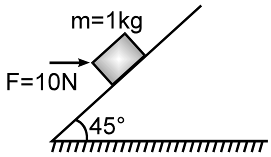
(iv)


(v)


In all the given cases blocks are in contact and the forces are applied as shown. All the surfaces are smooth. Then in which of the following cases, normal reaction between the two blocks is zero :

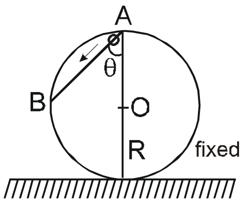
(A) (i) , (iv) (B) (ii) , (iii) (C) (iii) (D) (v)

5. A body of mass 1 kg lies on smooth inclined plane. A force F = 10N is applied horizontally on the block as shown. The magnitude of normal reaction by inclined plane on the block is:



(A) $10\sqrt{2}$ N (B) $\frac{10}{\sqrt{2}}$ N (C) 10 N (D) none of these

6. A frictionless wire is fixed between A and B inside of a hollow sphere of radius R as shown. A bead slips along the wire starting from the rest at point A. The time taken by the bead to slip from A to B will be



(A) $2\sqrt{R/g}$ (B) $gR/\sqrt{g\cos\theta}$ (C) $\frac{2\sqrt{gR}}{g\cos\theta}$ (D) $\frac{2\sqrt{gR\cos\theta}}{g}$

7. At t = 0, a particle at (1,0,0) moves towards point (4,4,12) with a constant velocity of magnitude 65 m/s. The position of the particle is measured in metres and time in sec. Assuming constant velocity, the position of the particle at t = 2 sec is :

(A) $(13\hat{i} - 120\hat{j} + 40\hat{k})$ m (B) $(40\hat{i} + 31\hat{j} - 120\hat{k})$ m

(C) $(13\hat{i} - 40\hat{j} + 12\hat{k})$ m (D) $(31\hat{i} + 40\hat{j} + 120\hat{k})$ m

8. A constant force acts on a mass m at rest. Velocity acquired in travelling a fixed distance is directly proportional to :

(A) $\sqrt{m}$ (B) m (C) $\frac{1}{\sqrt{m}}$ (D) none

Answers Key

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

Hint & Solutions

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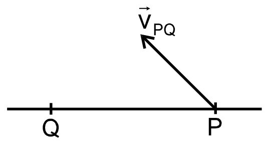
1.



Q measures acceleration of P to be zero.

$\therefore$ Q measures velocity of P, i.e. $\vec{v}_{PQ}$, to be constant. Hence Q observes P to move along straight line.

$\therefore$ For P and Q to collide Q should observe P to move along line PQ.

Hence PQ should not rotate.

2. Let initial and final speeds of stone be u and v.

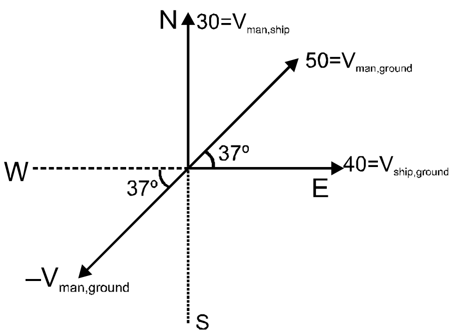
$\therefore$ $v^2 = u^2 - 2gh$ ....(1)

and v cos 30° = u cos 60° ....(2)

solving 1 and 2 we get $u = \sqrt{3gh}$

3. Flag will flutter in the direction of wind and opposite to the direction of velocity of man

i.e. in the direction of V_{wm}



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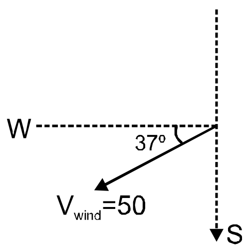

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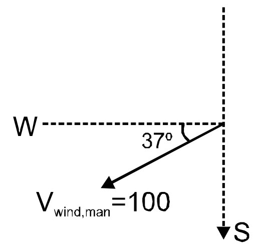
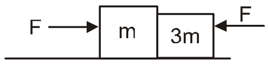
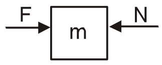


4. (i)

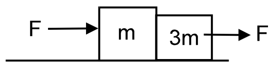


a = 0

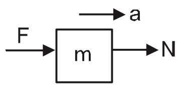


N = F.

(ii)



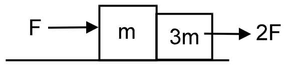
$$a = \frac{2F}{4m} = \frac{F}{2m}$$



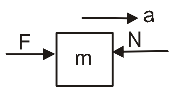
F – N = ma

$$N = F - m\left(\frac{F}{2m}\right) = \frac{F}{2}.$$

(iii)



$$a = \frac{3F}{4m}$$



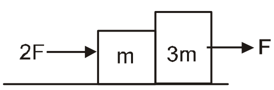
F – N = ma

N = F – ma

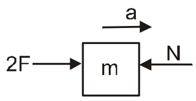
$$N = F - m\left(\frac{3F}{4m}\right)$$

$$N = \frac{F}{4}.$$

(iv)

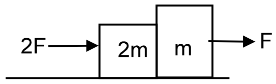


$$a = \frac{3F}{4m}$$

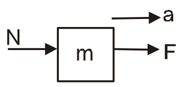


$2F - N = ma \qquad N = 2F - m\left(\frac{3F}{4m}\right)$

$N = \frac{5F}{4}$.

(v) 

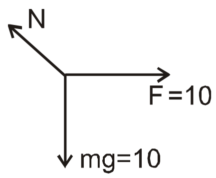
$$a = \frac{3F}{3m} = \frac{F}{m}$$



$N + F = ma \qquad N + F = m\left(\frac{F}{m}\right)$

$N = 0$.

5. F.B.D. of block



$N^2 = F^2 + (mg)^2$

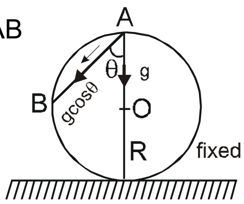
$N = 10\sqrt{2}$ N

6. $AB = 2R\cos\theta$

acceleration along AB

$a = g\cos\theta$

$u = 0$ from A to B



$S = ut + \frac{1}{2}at^2$

$2R\cos\theta = 0 + \frac{1}{2}(g\cos\theta)t^2$

$t = 2\sqrt{\frac{R}{g}}$

7. Unit vector in direction of (1,0,0) to (4,4,12) is

$$\frac{(4-1)\hat{i} + (4-0)\hat{j} + (12-0)\hat{k}}{13}$$

Hence position of particle at t = 2 sec is :

$$\vec{r}_f = \vec{r}_i + \vec{v} \times 2 = 31\hat{i} + 40\hat{j} + 120\hat{k}$$

8. $a = \frac{F}{m} \qquad V^2 = u^2 + 2as \quad (u = 0)$

$V \propto \sqrt{2\left(\frac{F}{m}\right)S} \quad V \propto \frac{1}{\sqrt{m}}$.