PHYSICS

DPP

DAILY PRACTICE PROBLEMS

DPP No. 81

Total Marks : 22

Max. Time : 22 min.

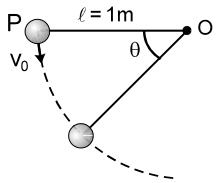
Topics : Wave on a String , Circular Motion, Relative Motion

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

1. Three waves producing displacement in the same direction of same frequency and of amplitudes 10μ m, 4μm and 7μ m arrive at a point with successive phase difference of π / 2. The amplitude of the resultant wave is
(A) 2μm (B) 7μm (C) 5μm (D) 1

2. A string fixed at both ends has consecutive standing wave modes for which the distances between adjacent nodes are 18 cm and 16 cm respectively. The length of the string is -
(A) 144 cm (B) 152 cm (C) 176 cm (D) 200 cm

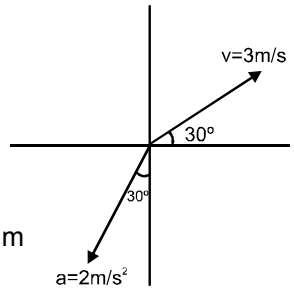
3. The sphere at P is given a downward velocity v_0 and swings in a vertical plane at the end of a rope of ℓ = 1m attached to a support at O. The rope breaks at angle 30° from horizontal, knowing that it can withstand a maximum tension equal to three times the weight of the sphere. Then the value of v_0 will be :
($g = \pi^2$ m/s^2)



(A) $\frac{g}{2}$ m/s (B) $\frac{2g}{3}$ m/s

(C) $\sqrt{\frac{3g}{2}}$ m/s (D) $\frac{g}{3}$ m/s

4. Initial velocity and acceleration of a particle are as shown in the figure. Acceleration vector of particle remain constant. Then radius of curvature of path of particle :

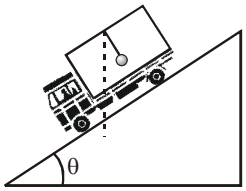


(A) is 9m initially (B) is $\frac{9}{\sqrt{3}}$ m initially

(C) will have minimum value of $\frac{9}{8}$ m (D) will have minimum value $\frac{3}{8}$ m

COMPREHENSION

A van accelerates uniformly down an inclined hill going from rest to 30 m/s in 6 s. During the acceleration, a toy of mass m = 0.1 kg hangs by a light string from the van's ceiling. The acceleration is such that string remains perpendicular to the ceiling. (Take g = 10 m/s^2)



5. The angle θ of the incline is :
(A) 30° (B) 60° (C) 90° (D) 45°

6. The tension in the string is

(A) 1.0 N (B) 0.5 N (C) $\frac{\sqrt{3}}{2}$ N (D) $\sqrt{3}$ N

7. The friction force on the van is
(A) Zero (B) mg cosθ (C) mg sinθ (D) mg tanθ

Answers Key

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

Hint & Solutions

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2. $L = \frac{m\lambda_1}{2}$ and $L\ (m+1)\ \frac{\lambda_2}{2}$

Where m is no. of harmonic

$m.36 = (m+1)\ 32$

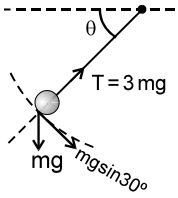
$\Rightarrow m = 8$

$L = 8 \times 18 = 144$ cm

3. $T - mg\sin\theta = \frac{mv^2}{R}$

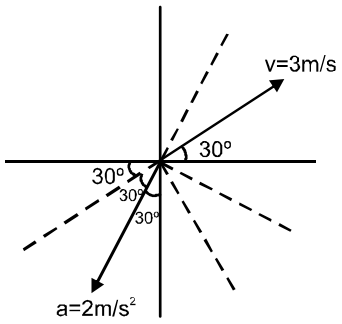
$\Rightarrow\ 3mg - mg\sin30^\circ$

$= \frac{m.(u_0^2 + 2g\ell\sin30^\circ)}{\ell}$



$\therefore\ u_0 = \sqrt{3g/2}$

4. Initially ROC $= \frac{v^2}{a\sin30^\circ} = \frac{9}{1}m$



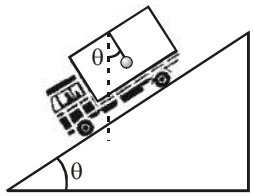
For minimum ROC $= \frac{(v\sin30^\circ)^2}{a} = \frac{9}{8}m.$

5. to 7 Acceleration of the van $= \frac{30}{6} = 5\ m/s^2$

$g \sin\theta = a$

$\Rightarrow \quad \sin\theta = \frac{1}{2}$

$\Rightarrow \quad \theta = 30°$



6. Tension

$T = mg\cos\theta \quad = \frac{\sqrt{3}}{2}$ N

7. Since accelerationof the van is g sinθ, there is no friction.