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## CLASS: XI(PHYSICS)

1. An insect crawls up a hemisphere surface very slowly as shown in figure. The coefficient of friction between the insect and the surface is 1/3. If the line joining the centre of the hemispherical surface to insect makes an angle α with the vertical, what is the maximum possible value of α?
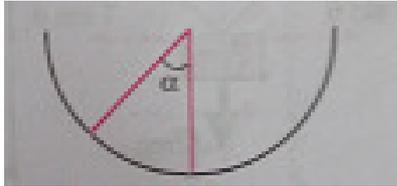


**[α= cot⁻¹(3) ]**

2. A block P of mass m is placed on a horizontal frictionless plane. A second block Q of same mass m is placed on it and is connected to the spring of spring constant k. The two blocks are pulled by same distance A. Block Q oscillates without slipping. What is the maximum force of friction between the two blocks?

**[kA/2]**

3. Two particles of mass m each are tied at the ends of a light string of length 2a. The whole system is kept on a frictionless horizontal surface with the string held tight so that each mass is at a distance a from the centre P(as shown in the figure). Now the mid-point of the string is pulled vertically upwards with a small but constant force F. As the result, the particles move towards each other on the surface. Find the magnitude of acceleration when the separation between them is 2x?
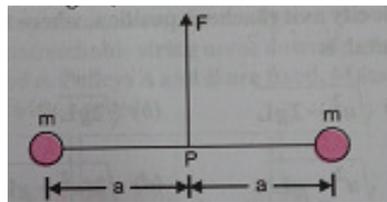


$$[a=\frac{F}{2m}\frac{a}{(a2-x2)1/2}]$$

4. A ball of mass(m) 0.5 kg is attached to the end of a string having length (l) 0.5 m. the ball is rotated on a horizontal circular path about vertical axis. The maximum tension, the string can bear is 324 N.What is the maximum possible value of angular velocity of ball(in radian/s)?
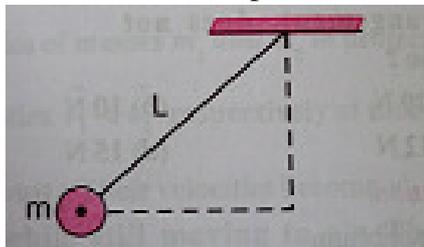


**[36 rad/s]**

5. A ball of mass 0.2 kg rests on a vertical post of height 5m. A bullet of mass 0.01 kg travelling with a velocity v m/s in a horizontal direction, hits the centre of the ball. After

the collision, the ball and bullet travel independently. The ball hits the ground at a distance 20 m and the bullet at a distance of 100 m from the foot of the post. What is the initial velocity of the bullet?
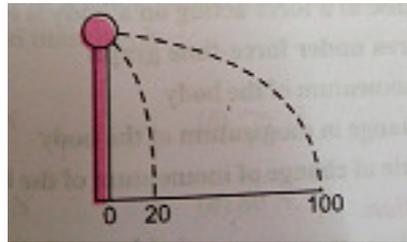


**[ 500 m/s]**

6. A particle is moving with a uniform speed $v$ in a circular path of radius r with the centre at O. When the particle moves from a point P to Q on the circle such that $\angle POQ = \Theta$, then what is the magnitude of change in velocity?
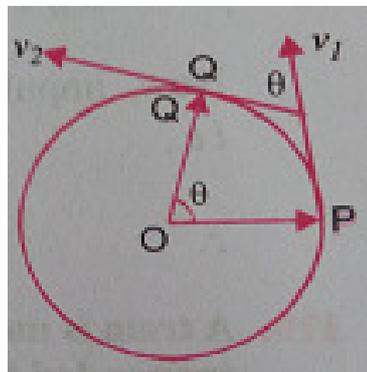


**[2$v$sin $\Theta$/2]**

7. In a lift moving up with an acceleration of 5 ms$^{-2}$ , a ball is dropped from a height of 1.25 m. What is the time taken by the ball to reach the floor of the lift?

**[0.4 s]**

8. A small block of mass of 0.1 kg lies on a fixed inclined plane PQ which makes an angle $\Theta$ with the horizontal. A horizontal force of 1N acts on the block through its centre of mass as shown in the figure. Show that the block remains stationary if i)$\Theta$ =45$^0$ii) $\Theta$ > 45$^0$ and a frictional force acts on the block towards Q.(take g= 10 m/s$^2$)
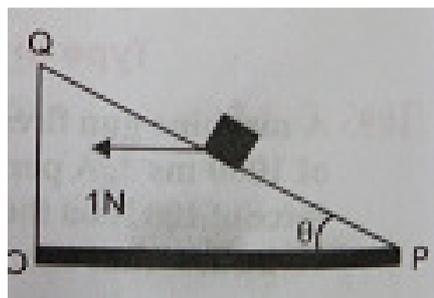


9. A balloon with mass m is descending down with an acceleration a (where a<g). How much mass should be removed from it so that it starts moving up with an acceleration a?

**[2ma/(a+g)]**

10. A system consists of three masses $m_1$, $m_2$ and$m_3$ connected by a string passing over a pulley P. The mass $m_1$ hangs freely, and $m_2$ and $m_3$ are on a rough horizontal table (the

coefficient of friction $=\mu$). The pulley is frictionless and of negligible mass. What is the downward acceleration of mass $m_1$?(assume,$m_1=m_2=m_{3=}m$)
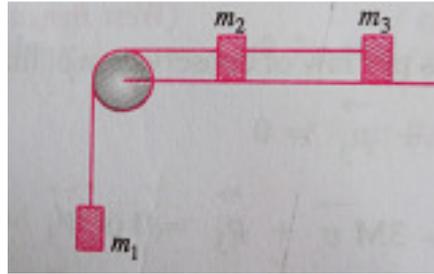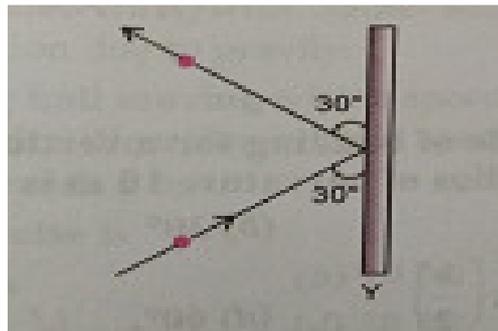


$[\frac{g(1-2\mu)}{2}]$

11. A block of mass m is placed on a surface with a vertical cross section given by $y=x^3/6$. If the coefficient of friction is 0.5, what is the maximum height above the ground at which block can be placed without slipping?

**[1/6 m]**

12. A 0.5 kg ball moving with a speed of 12 m/s strikes a hard wall at an angle of $30^0$ with the wall. It is reflected with the same speed at the same angle.If the ball is in contact with the wall for 0.25 s, calculate the average force acting on the wall.



**[24 N]**