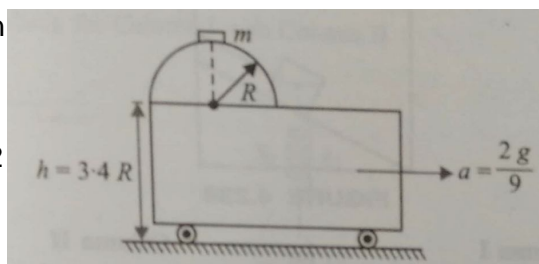


SECTION – IV
COMPREHENSION TYPE

This section contains 1 group of questions. Each group has 3 multiple choice questions based on a paragraph. Each question has 4 choices (A), (B), (C) and (D) for its answer, out of which **ONLY ONE** is correct. (+4, -1) 3 x 4 = 12M

A vertical frictionless semicircular track of radius R is fixed on the edge of movable trolley. Initially the system is at rest and a mass m is kept at the top of the track. The trolley starts moving to the right with a uniform horizontal acceleration $a = 2g/9$. The mass slides down the track, eventually losing contact with it and dropping to the floor h below the trolley



12. The angle θ with vertical, at which it loses contact with the trolley is

- A. 37° B. 53° C. $\cos^{-1}\left(\frac{2}{3}\right)$ D. $\frac{\pi}{2} - \cos^{-1}\left(\frac{2}{3}\right)$

13. The speed of mass with respect to trolley when it loses contact with it is

- A. \sqrt{gR} B. $\sqrt{2gR}$ C. $\sqrt{2gR/3}$ D. $\sqrt{gR/3}$

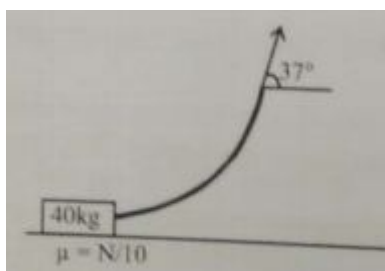
14. The time taken by the mass to drop on the floor, after losing contact is

- A. $\sqrt{2R/3g}$ B. $\sqrt{6R/g}$ C. $\sqrt{3R/2g}$ D. $2\sqrt{3R/g}$

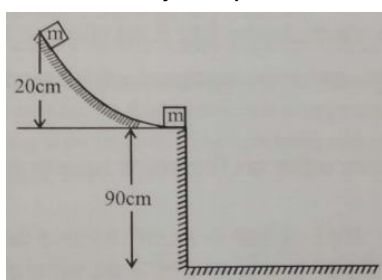
SECTION – V
INTEGER ANSWER TYPE

This section contains 5 questions. The answer to each of the questions is a single-digit integer, ranging from 0 to 9. The appropriate bubbles below the respective question numbers in the ORS have to be darkened. (+4, -1) 5 x 4 = 20M

15. A mass 40 kg is kept on a rough surface as shown. A person tries to pull this mass by attaching a uniform string of mass 6 kg. The mass 40 kg is about to move when the person pulls the top end of string at an angle 37° with horizontal while tangent at lower end of string is horizontal. If coefficient of friction between mass and ground is $\frac{N}{10}$, find N .



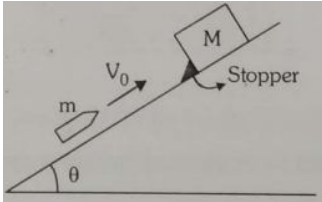
16. In a physics lab, a small cube slides down a frictionless incline as shown in figure, it strikes elastically and horizontally with another cube that is only one-half of its mass. If the incline is 20cm high and the table is 90 cm off the floor, big and small cubes strike the ground at a distance x & y meter respectively from the table. Then y/x equal to



17. A tuning fork of known frequency is held at the open end of a long tube which is dipped into water. The tuning fork of frequency 165 Hz resonates for the first time when air columns have length $l_1 = 50 \pm 0.5$ cm and for second time when air columns have length $l_2 = 150 \pm 0.1$ cm. If the speed of sound in air is $[330 \pm \alpha (0.99)]$ m/s then the value of α is

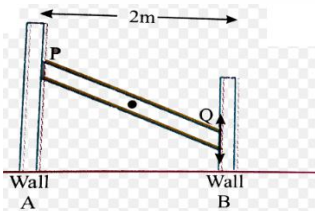
18. A block of mass M is kept at rest on a long smooth inclined plane by a stopper. A bullet of mass m travelling at velocity v_0 parallel to inclined plane collides with block at $t = 0$ and gets embedded. The time elapsed since $t = 0$ when block hits the stopper is $2/n$ sec. Find n .

(Given $m = 5$ kg, $M = 10$ kg, $v_0 = 5 \text{ ms}^{-1}$, $g = 10 \text{ ms}^{-2}$, $\theta = 30^\circ$)



19. Two vertical walls are separated by a distance of 2m. Wall A is smooth while wall B is rough with a coefficient of friction 0.5. A uniform rod is placed between them as shown. The length (in m) of longest rod that can be placed between walls is $\frac{\sqrt{17}}{n}$ then $n =$ _____

rod that can be placed between walls is $\frac{\sqrt{17}}{n}$ then $n =$ _____



THE-END