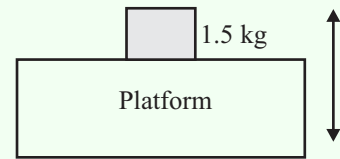
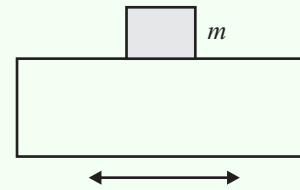


### EXERCISE 9. SIMPLE HARMONIC MOTION 3: PLATFORMS

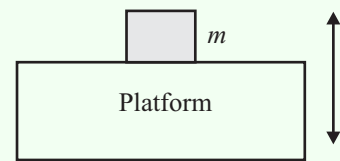
1. A horizontal plane is oscillating vertically in simple harmonic motion with amplitude 0.1 m and period  $\frac{1}{4}\pi$  s. Find the maximum and minimum values of the reaction of the plane on a particle or mass 1.5 kg resting on it.



2. A particle rests on a smooth table, which is oscillating horizontally in simple harmonic motion with amplitude 0.2 m and at a frequency of 5 oscillations per second. Find the least value of the coefficient of friction so that the particle stays at rest relative to the table.



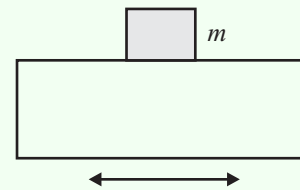
3. A horizontal platform performs vertical simple harmonic oscillations of period  $\frac{4}{5}\pi$  s. Find the amplitude such that a particle on the platform does not lose contact with it.



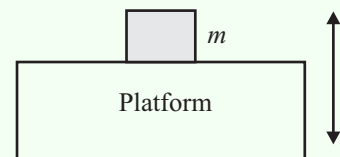
4. If the amplitude in the previous question is 2 m and the particle is of mass 1 kg and is attached by adhesive to the platform, find the maximum force that the adhesive has to exert.

5. A rough plank moves horizontally in simple harmonic motion of amplitude  $r$  and period  $T$ .

Show that a particle on the plank will not slip once  $\mu > \frac{4\pi^2 r}{gT^2}$ .



6. A platform is executing vertical simple harmonic motion oscillations. If for a given period  $T$ ,  $r$  is the greatest amplitude for which a weight can remain on the platform, find  $T$ .



7. A rough horizontal table moves horizontally in simple harmonic motion with a periodic time of 3 s, and a maximum speed of  $4 \text{ m s}^{-1}$ . A small heavy mass is placed on the table. Find the least coefficient of friction if the mass does not slide on the table throughout the motion.
8. A horizontal table top vibrates in its own plane with simple harmonic motion of amplitude 0.6 m and completes 20 complete oscillations per minute. If a mass sits on the table at rest relative to it what is the least value of the coefficient of friction.
9. A particle of mass  $m$  executes simple harmonic motion of amplitude  $r$ . Show that its greatest speed is  $\sqrt{\frac{rP}{m}}$  where  $P$  is the greatest force applied. Find an expression for kinetic energy as a function of displacement.

10. A block rests on a rough platform which moves to and fro horizontally with simple harmonic motion. The amplitude is 0.75 m and 20 complete oscillations occur per minute. If the block remains at rest find the least possible value of the coefficient of friction.
11. A horizontal platform oscillates vertically with simple harmonic motion of amplitude 0.2 m. What is the maximum integral number of oscillations per minute it can make if a body on it must stay in contact with it?

**EXERCISE 9.**

**ANSWERS**

1.

2.

3.  $\frac{4}{25}g$  m

4. 2.7 N

6.  $2\pi\sqrt{\frac{r}{g}}$

7.  $\frac{8}{3}\pi g$

8.

9.

10.  $\frac{\pi^2}{3g}$

11. 66