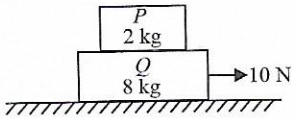
7. Block P of mass 2 kg is placed over block Q of mass 8 kg. The combination is placed over a rough horizontal surface as shown in the figure. Coefficient of friction between Q and the floor is 0.5. Coefficient of friction between P and Q is 0.4. A horizontal force of 10 N is applied on block Q. The force of friction between P and Q is ($g = 10\ \text{m s}^{-2}$)



A. 100 N
B. 40 N
C. 50 N
D. Zero

8. In a rotor, a hollow vertical cylindrical structure rotates about its axis and a person rests against the inner wall. At a particular speed of the rotor, the floor below the person is removed and the person hangs resting against the wall without any floor. If the radius of the rotor is 3 m and the coefficient of static friction between the wall and the person is 0.3, find the minimum speed at which the floor may be removed. (Take $g = 10\ \text{m/s}^2$)

A. 5 m/s
B. 7 m/s
C. 10 m/s
D. 15 m/s

9. In an experiment to determine the acceleration due to gravity g, the formula used for the time period of a periodic motion is $T = 2\pi\sqrt{\frac{7(R-r)}{5g}}$. The value of R and r are measured to be (60 ± 1) mm and (10 ± 1) mm, respectively. In five successive measurements, the time period is found to be 0.52 s, 0.56 s, 0.57 s, 0.54 s and 0.59 s. The least count of the watch used for the measurement of time period is 0.01 s. The error in the determined value of g is

A. 13%
B. 15%
C. 11%
D. 9%

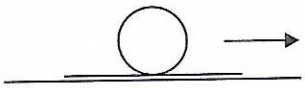
10. Consider a binary star system, constituent stars have masses M_1 and M_2 and separation between them is d. Choose the incorrect statement.

A. Ratio of kinetic energies of the stars is equal to inverse of ratio of their masses.
B. Ratio of orbital radii of the stars is equal to ratio of their masses.
C. Total energy of the binary star system is $-\frac{GM_1M_2}{2d}$.
D. Ratio of accelerations of stars is equal to the inverse of ratio of their masses.

11. A small hollow sphere, which has a small hole in it, is immersed in water to a depth of 0.5 m before any drop penetrates into it. If surface tension for water is 0.073 N/m, the radius of the hole is

A. 0.06 mm
B. 0.03 mm
C. 0.09 mm
D. 0.15 mm.

12. A ball rests upon a flat piece of paper on a table top. The paper is pulled horizontally but quickly towards right as shown. Relative to its initial position with respect to the table, the ball

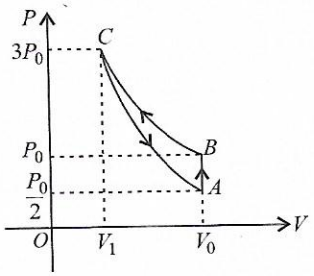


I. Remains stationary if there is no friction between the paper and the ball.
II. Moves to the left and starts rolling backwards, *i.e.* to the left if there is a friction between the paper and the ball.
III. Moves forward, *i.e.*, in the direction in which the paper is pulled.

Here, the correct statements is/are

A. I and II only
B. III only
C. I only
D. II only

13. One mole of an ideal gas undergoes a thermodynamic cyclic process as shown in the figure. The cyclic process consists of an isochoric, an isothermal and an adiabatic process. Adiabatic exponent of gas is



A. 1.5
B. $\frac{\ln 5}{\ln 3}$
C. 1.25
D. $\frac{\ln 6}{\ln 3}$