

Laws of motion

Worksheet -4

1. What is the unit of coefficient of friction? 1

Ans. No unit

2. Name the factor on which coefficient of friction depends? 1

Ans. Nature of surfaces in contact

3. What provides the centripetal force to a car taking a turn on a level road? 1

Ans. force of friction between the tyres and the road

4. Give the magnitude and direction of the net force acting on 2

(a) A drop of rain falling down with constant speed.

(b) A kite skillfully held stationary in the sky.

Ans. $F = 0$ as $a = 0$ in both the cases

5. Two blocks of masses m_1 , m_2 are connected by light spring on a smooth horizontal surface. The two masses are pulled apart and then released. Prove that the ratio of their acceleration is inversely proportional to their masses. 2

Ans. $F_1 = -F_2$

$$m_1 a_1 = -m_2 a_2$$

$$\frac{a_1}{a_2} = -\frac{m_2}{m_1}$$

6. A shell of mass 0.02kg is fired by a gun of mass 100kg. If the muzzle speed of the shell is 80m/s, what is the recoil speed of the gun? 2

Ans. $m_1 u_1 + m_2 u_2 = m_1 v_1 + m_2 v_2$

$$100 \times 0 + 0.02 \times 80 = 100 \times v_1 + 0.02 \times 80$$

$$0 = 100v_1 + 1.6$$

$$v_1 = \frac{-1.6}{100} = -0.0016 \text{ms}^{-1}$$

7. A train runs along an unbanked circular bend of radius 30m at a speed of 54km/hr. The mass of the train is 106kg. What provides the necessary centripetal force required for this purpose? The engine or the rails? What is the angle of banking required to prevent wearing out of the rail? 3

Ans. • Lateral force acting due to rails on the wheels of the train.

• Outer rails

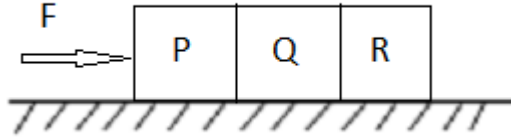
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$$\tan \theta = \frac{v^2}{rg}$$

$$= \frac{15^2}{30 \times 10}$$

$$\theta = \tan^{-1} \left(\frac{3}{4} \right)$$

- 8 Three identical blocks each having a mass m , are pushed by a force F on a frictionless table as shown: 3



What is the acceleration of the blocks? What is the net force on the block P? What force does P apply on Q? What force does Q apply on R?

Ans. •

$$F = 3ma$$

$$a = \frac{F}{3m}$$

$$\bullet F_1 = ma = m \times \frac{F}{3m} = \frac{F}{3}$$

$$\bullet F_2 = 2ma = 2m \times \frac{F}{3m} = \frac{2F}{3}$$

$$\bullet F_3 = ma = m \times \frac{F}{3m} = \frac{F}{3}$$

9. (a) Define impulse. State its S.I. unit?
(b) State and prove impulse momentum theorem?

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Ans.