Laws of motion
Worksheet -2

1. A thief jumps from the roof of a house with a box of weight W on his head. What will be the weight of the box as experienced by the thief during jump?   1

Ans. $W = m(g-g) = 0$

2. Which of the following is scalar quantity? Inertia, force and linear momentum.   1

Ans. Inertia

3. Action and reaction forces do not balance each other. Why?   1

Ans. Because they act on different bodies.

4. A bird is sitting on the floor of a wire cage and the cage is in the hand of a boy. The bird starts flying in the cage. Will the boy experience any change in the weight of the cage?   1

Ans. When the bird starts flying inside the cage the weight of bird is no more experienced as air inside is in free contact with atmospheric air hence the cage will appear lighter.

5. Why does a cyclist lean to one side, while going along curve? In what direction does he lean?   1

Ans. A cyclist leans while going along curve because a component of normal reaction of the ground provides him the centripetal force he requires for turning.
He has to lean inwards from his vertical position i.e. towards the centre of the circular path.

6. How does banking of roads reduce wear and tear of the tyres?   2

Ans. When a curved road is unbanked force of friction between the tyres and the road provides the necessary centripetal force. Friction has to be increased which will cause wear and tear. But when the curved road is banked, a component of normal reaction of the ground provides the necessary centripetal force which reduces the wear and tear of the tyres

7. A monkey of mass 40 kg climbs on a rope which can stand a maximum tension 600 N. In which of the following cases will the rope break? The monkey (a) climbs up with an acceleration of 6m/s2 (b) climbs down with an acceleration of 4m/s2 (c) climbs up with a uniform seed of 5m/s (d) falls down the rope freely under gravity. Take g = 10m/s2 and ignore the mass of the rope.   3

Ans. (a) $R = m(g+a) = 40(10+6) = 40\times16 = 640N$

(b) $R = m(g-a) = 40(10-6) = 40\times4 = 240N$

(c) $R = m(g+a) = 40(10+0) = 40\times10 = 400N$

(d) $R = m(g-g) = 0$

Rope will break only in the first case as the reaction is more than the maximum tension (600N) which the rope can withstand.

8. What is meant by coefficient of friction and angle of friction? Establish the relation between the two?   2
OR
A block of mass 10kg is sliding on a surface inclined at an angle of 30° with the horizontal. Calculate the acceleration of the block. The coefficient of kinetic friction between the block and the surface is 0.5

Ans. Coefficient of friction – It is the ration of force of friction and normal reaction.

$$\mu = \frac{F}{R}$$

Angle of friction – It is the angle between the resultant of force of friction and normal reaction with normal reaction.

Relation: $\mu = \tan\theta$

OR

$a = g(\sin\theta - \mu\cos\theta) = 9.8(\sin 30^0 - 0.5\cos 30^0) = 9.8(0.5 - 0.5 \times 0.86) = 0.657 ms^{-2}$

9. State and prove the principle of law of conservation of linear momentum? 3

Ans. Law of conservation of linear momentum- If no external force acts on a body then the total momentum remains constant.

Prove : $m_1 u_1 + m_2 u_2 = m_1 v_1 + m_2 v_2$