Sol⁰ 5. $u = 0$

Distance travelled = 400 m

time taken = 20 s

$$s = ut + \frac{1}{2}at^2$$

$$\Rightarrow 400 = \frac{1}{2} \times a \times 20 \times 20$$

$$\Rightarrow a = 2 \text{ m/s}^2$$

$F = ma$

$\Rightarrow F = 7 \times 1000 \times 2 = 14000\,N$

Hence, the acc. of the truck is $2\,m/s^2$ and the force acting on the truck is 14000 N.

Sol: 6. Initial velocity = 20 m/s

final velocity = 0

Distance travelled = 50m

Acceleration = ?

$v^2 - u^2 = 2as$

$\Rightarrow -400 = 2 \times 50 \times a$

$\Rightarrow a = -4\,m/s^2$

$F = ma$

$\Rightarrow F = 1 \times (-4) = -4\,N$

Hence, the force of friction between the stone and the ice is $-4\,N$.

Sol: 7. (a) Force exerted by the engine = 40,000 N

Frictional force offered by the track = 5000 N

Net accelerating force =
40,000 − 5000 = 35,000 N

(b) Mass of 1 wagon = 2000 kg
Mass of 5 wagons = 5 × 2000
= 10,000 kg
Net force acting on the train = 35,000 N

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

$\Rightarrow a = \frac{35000}{10000} = 3.5 \text{ m/s}^2$

Hence, the acceleration of the train is 3.5 m/s²

Sol: 8. Mass of vehicle = 1500 kg
Acceleration = −1.7 m/s²
$F = ma$
$\Rightarrow F = 1500 \times \left(-\frac{17}{10}\right)$

$\Rightarrow F = -2550 \text{ N}$

Hence, the force should be −2550 N.

Sol: 9. (d) mv

Sol:- 10. The cabinet will move with constant velocity only when the net force on it is zero.

Therefore, force of friction on the wooden cabinet = 200N in a direction opposite to the ~~motion~~ direction of motion of the cabinet.

Sol:- 11. Mass of one of the objects, m_1 = 1.5 kg

mass of other object, m_2 = 1.5kg

Velocity of m_1 before collision, u_1 = 2.5 m/s

Velocity of m_2 before collision, u_2 = −2.5 m/s

Let v be the velocity of the combined object after collision.

By the law of conservation of momentum

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

$\Rightarrow 1.5 \times 2.5 + 1.5 \times (-2.5) = (1.5+1.5)v$

$\Rightarrow 1.5(2.5 - 2.5) = 3v$

$\Rightarrow 3v = 0 \Rightarrow v = 0$ m/s

Hence, velocity of the combined object after collision is 0.

Sol° 12. 1. When we push a massive truck parked along the road-side, it does not move.

2. The justification given by the student that the two opposite and equal forces cancel each other is totally wrong.

3. This is because force of action and reaction act on two different bodies and cannot cancel each other. never on a single body, so they

4. The truck does not move because the applied force is far less than the force of friction between the truck and the road.

Sol^n 13. Mass of hockey ball, $m = 200g$
Initial velocity of ball, $u = 10 m/s$
Final velocity of ball, $v = -5 m/s$

Change in momentum
$= m(v-u)$
$= \frac{200}{1000} \times (-5-10)$
$= \frac{1}{5} \times (-15) = -3 \text{ kg m/s}$

Hence, the change in momentum is $-3 kg\ m/s$.

Sol^n 14. Mass of bullet $= 10g$
Initial velocity of bullet $= 150 m/s$
Final velocity of bullet $= 0$
Time taken $= 0.03 s$

$v = u + at$
$\Rightarrow 0 = 150 + 0.03a$
$\Rightarrow 0.03a = -150 \Rightarrow a = -\frac{150 \times 100}{3}$

$\Rightarrow a = -5000 m/s^2$

Sol^n 15.

$v^2 - u^2 = 2as$

$\Rightarrow 0 - 225 = -10,000\ s$

$\Rightarrow s = \frac{+10000}{+225}$

$\Rightarrow s = \frac{+22500}{+10,000} = 2.25\ m$

Force $= ma$

$\Rightarrow F = \frac{10}{1000} \times (-5000)$

$\Rightarrow F = -50N$

∴ Force exerted by the wooden block on the bullet is 50N.

Sol⁵15. Mass of object, $m_1 = 1\ kg$

Initial velocity of object, $u_1 = 10\ m/s$

Mass of stationary wooden block $= m_2 = 5\ kg$

Initial velocity of wooden block, $u_2 =$

Total momentum before the impact $= m_1 u_1$

$= 1 \times 10 = 10\ kgm/s$

Total momentum after the impact = Total momentum before the impact.

$\Rightarrow$ Total momentum after the impact = 10 kg m/s

According to law of conservation of momentum

$$m_1u_1 + m_2u_2 = m_1v_1 + m_2v_2$$

$$\Rightarrow 1\times 10 + 5\times 0 = (m_1+m_2)v$$

$$\Rightarrow 10 = 6v \Rightarrow v = \frac{10}{6} = \frac{5}{3} \text{ m/s}$$

Hence, velocity of combined object is $\frac{5}{3}$ m/s