

## Laws of motion

### Worksheet -3

1. Why is it desired to hold a gun tight to one's shoulder when it is being fired? 1
- Ans. Since the gun recoils after firing so it must be held lightly against the shoulder because gun and the shoulder constitute one system of greater mass so the back kick will be less.
2. Why does a swimmer push the water backwards? 1
- Ans. So that due to reaction of water he is able to swim in the forward direction
3. Friction is a self adjusting force. Justify. 1
- Ans. Friction is a self adjusting force as its value varies from zero to the maximum value to limiting friction.
4. A force is being applied on a body but it causes no acceleration. What possibilities may be considered to explain the observation? 2
- Ans. (1) If the force is deforming force then it does not produce acceleration.  
(2) The force is internal force which cannot cause acceleration.
5. Force of 16N and 12N are acting on a mass of 200kg in mutually perpendicular directions. Find the magnitude of the acceleration produced? 2
- Ans. 
$$F = \sqrt{F_1^2 + F_2^2 + 2F_1F_2 \cos \theta}$$
$$= \sqrt{16^2 + 12^2 + 2 \times 16 \times 12 \cos 90^\circ}$$
$$= \sqrt{256 + 144}$$
$$= \sqrt{400}$$
$$= 20N$$
$$F = ma$$
$$20 = 200a$$
$$a = 0.1ms^{-2}$$
6. An elevator weighs 3000kg. What is its acceleration when the in the tension supporting cable is 33000N. Given that  $g = 9.8m/s^2$ . 2
- Ans.  $T = m(g + a)$ 
$$33000 = 3000(9.8 + a)$$
$$11 = 9.8 + a$$
$$a = 1.2ms^{-2}$$
7. Write two consequences of Newton's second law of motion? 3
- Ans. (1) It shows that the motion is accelerated only when force is applied.  
(2) It gives us the concept of inertial mass of a body.
8. How is centripetal force provided in case of the following? 3
- (i) Motion of planet around the sun,  
(ii) Motion of moon around the earth.  
(iii) Motion of an electron around the nucleus in an atom.
- Ans. (i) Gravitational force acting on the planet and the sun.  
(ii) Force of gravity due to earth on the moon.  
(iii) Electrostatic force attraction between the electron and the proton

9. State Newton's second, law of motion. Express it mathematically and hence obtain a relation between force and acceleration. 3

Ans.

10. A railway car of mass 20 tonnes moves with an initial speed of 54km/hr. On applying brakes, a constant negative acceleration of  $0.3\text{m/s}^2$  is produced. 3

(i) What is the breaking force acting on the car?

(ii) In what time it will stop?

(iii) What distance will be covered by the car before it finally stops?

Ans. (i)  $F = ma = 20000(-0.3) = -6000N$

(ii)

$$v = u + at$$

$$0 = 15 + (-0.3)t$$

$$-15 = -0.3t$$

$$t = 50s$$

(iii)

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

$$0^2 - 15^2 = 2(-0.3)s$$

$$-225 = -0.6t$$

$$s = 375m$$