

# Physics

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## (Chapter 4) (Laws of Motion) (Exercises) (Class 11)

### Question 4.1:

Give the magnitude and direction of the net force acting on

- (a) a drop of rain falling down with a constant speed,
- (b) a cork of mass 10 g floating on water,
- (c) a kite skillfully held stationary in the sky,
- (d) a car moving with a constant velocity of 30 km/h on a rough road,
- (e) a high-speed electron in space far from all material objects, and free of electric and magnetic fields.

### Answer 4.1:

- (a) Zero net force  
The rain drop is falling with a constant speed.  
Hence, its acceleration is zero. As per Newton's second law of motion, the net force acting on the rain drop is zero.
- (b) Zero net force  
The weight of the cork is acting downward. It is balanced by the buoyant force exerted by the water in the upward direction.  
Hence, no net force is acting on the floating cork.
- (c) Zero net force  
The kite is stationary in the sky, i.e., it is not moving at all.  
Hence, as per Newton's first law of motion, no net force is acting on the kite.
- (d) Zero net force  
The car is moving on a rough road with a constant velocity.  
Hence, its acceleration is zero. As per Newton's second law of motion, no net force is acting on the car.
- (e) Zero net force  
The high speed electron is free from the influence of all fields.  
Hence, no net force is acting on the electron.

### Question 4.2:

A pebble of mass 0.05 kg is thrown vertically upwards. Give the direction and magnitude of the net force on the pebble.

- (a) during its upward motion,
- (b) during its downward motion,
- (c) at the highest point where it is momentarily at rest. Do your answers change if the pebble was thrown at an angle of  $45^\circ$  with the horizontal direction?  
Ignore air resistance.

### Answer 4.2:

0.5 N, in vertically downward direction, in all cases.

Acceleration due to gravity, irrespective of the direction of motion of an object, always acts downward. The gravitational force is the only force that acts on the pebble in all three cases. Its magnitude is given by Newton's second law of motion as:  $F = m \times a$

Where,  $F$  = net force and  $m$  = Mass of the pebble = 0.05 kg

$$a = g = 10 \text{ m/s}^2$$

$$\therefore F = 0.05 \times 10 = 0.5 \text{ N}$$

The net force on the pebble in all three cases is 0.5 N and this force acts in the downward direction.

If the pebble is thrown at an angle of  $45^\circ$  with the horizontal, it will have both the horizontal and vertical components of velocity. At the highest point, only the vertical component of velocity becomes zero. However, the pebble will have the horizontal component of velocity throughout its motion. This component of velocity produces no effect on the net force acting on the pebble.

# Chapter 4 Physics

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