

CBSE Test Paper 05
Chapter 09 Forces and Laws of Motion

1. 'Any two forces which are equal and opposite form an action and reaction pair' The above statement is **(1)**
- false
 - true
 - partially true
 - partially false

2. Statement A: Rocket can propel its self in vacuum.
Statement B: Newton's laws are universal.

Which of the two statements is true? **(1)**

- statement B
 - both A and B
 - none of these
 - statement A
3. Match the following with correct response.

Column A	Column B
(1) Friction	(A) Force just sufficient to move the object
(2) Limiting friction	(B) Friction when one object rolls over another
(3) Sliding friction	(C) Force sufficient to slide one object over another
(4) Rolling friction	(D) Force which opposes motion

- 1-A, 2-C, 3-B, 4-D
 - 1-B, 2-D, 3-A, 4-C
 - 1-C, 2-B, 3-D, 4-A
 - 1-D, 2-A, 3-C, 4-B
4. Fill in the gap using given analogy.(i) Momentum conservation : $F = 0$ (ii) Uniform motion in rough surface : _____ . **(1)**

- a. Frictional force
 - b. Non-zero force
 - c. Internal force
 - d. Gravitational force
5. A jet engine works on the principle of Newton's **(1)**
- a. second law of motion
 - b. first law of motion
 - c. none of these
 - d. third law of motion
6. Write the SI unit of impulse. **(1)**
7. Using a horizontal force of 200 N, we intend to move a wooden cabinet across a floor at a constant velocity. What is the friction force that will be exerted on the cabinet? **(1)**
8. When a body moves on a flat surface, will its speed change? **(1)**
9. Name the principle on which a rocket works. **(1)**
10. A body is moving with uniform acceleration. Is its momentum constant? **(1)**
11. A boy throws a stone upward with a velocity of 60 m/s. **(3)**
- a. How long will it take to reach the maximum height ($g=10 \text{ m/s}^2$)
 - b. What will be the maximum height reached by the stone?
 - c. What will be its velocity when it reaches the ground?
12. When a force of 40 N is applied on a body it moves with an acceleration of 5 ms^{-2} . Calculate the mass of the body. **(3)**
13. Two friends on roller-skates are standing 5 m apart facing each other. One of them throws a ball of 2 kg towards the other, who catches it. How will this activity affect the position of the two? Explain your answer. **(3)**

- 14.** An object of mass 1 kg travelling in a straight line with a velocity of 10 ms^{-1} collides with, and sticks to, a stationary wooden block of mass 5 kg. Then, they both move off together in the same straight line. Calculate the total momentum just before the impact and just after the impact. Also, calculate the velocity of the combined object. **(3)**
- 15.** Explain the following: **(5)**
- i. Why do we jerk wet clothes before spreading them on wire?
 - ii. Why does dust flies off when carpet is hit with stick?
 - iii. Why fruits fall off the branches in strong wind?
 - iv. Why a pillion rider falls forward, when the driver of a two wheeler suddenly applies brakes?

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Answers

1. b. true

Explanation: The two forces acting on same body, which are in equal and opposite direction form action and reaction pair. This is the newton's third law of motion.

2. b. both A and B

Explanation: Rocket moves forward according to newton's third law of motion. The gas and other substance coming out from the tail push the rocket in forward direction. Newton's laws are universal.

3. d. 1-D, 2-A, 3-C, 4-B

Explanation: Friction is the force that makes it difficult for one object to slide along the surface of another.

The limiting friction is the frictional force just sufficient to move the object. Sliding friction refers to the resistance created by two objects sliding against each other.

Rolling friction refers to the resistance created by an object rolling across a surface.

4. b. Non-zero force

Explanation: Any object which face non zero force will have some change in speed if the body is at rest or moving. So it is not possible to travel with constant speed. The forces can do work against each other. For example, you could push the object at constant speed over a rough surface. The net force on the object is zero.

5. d. third law of motion

Explanation: Jet engine sucks air in at the front with a fan. A compressor raises the pressure of the air. The compressor is made with many blades attached to a shaft. The blades spin at high speed and compress or squeeze the air. The compressed air is then sprayed with fuel and an electric spark lights

the mixture. The burning gases expand and blast out through the nozzle, at the back of the engine. As the jets of gas shoot backward, the engine and the aircraft are thrust forward (Newton's third law of motion).

6. SI unit of impulse = Unit of force \times Unit of time = $N \times s = Ns$.
7. A force of 200 N is applied in the forward direction. Thus, from Newton's third law of motion, an equal amount of force will act in the opposite direction. Hence, a frictional force of 200 N is exerted on the cabinet.
8. Yes, the body will gradually slow down due to the opposing force of friction.
9. Rocket works on the principle of Newton's third law of motion.
10. No. It is because the body is moving with a uniform acceleration. Hence, its velocity is increasing continuously and as a result the momentum of the body also increases.

11. Initial velocity, $u = 60 \text{ m/s}$

Final velocity, $v = 0$

Acceleration due to gravity, $g = -10 \text{ m/s}^2$

a. From $v = u + gt$

$$\Rightarrow 0 = 60 - 10 \times t$$

$$\Rightarrow 10t = 60$$

$$\Rightarrow t = 6 \text{ s}$$

Therefore, the stone will take 6 s to reach the maximum height.

b. $h = ut + \frac{1}{2}gt^2$

$$\Rightarrow h = 60 \times 6 + \frac{1}{2}(-10) \times 6^2$$

$$\Rightarrow h = 360 - 180$$

$$\Rightarrow h = 180 \text{ m}$$

Therefore, the maximum height reached by the stone is 180 m

c. Total time of flight = 2(time of ascent) = 12 s

Now,

$$v = u + at$$

$$\Rightarrow v = 60 - (10)(12)$$

$$\Rightarrow v = -60 \text{ m s}^{-1}$$

Here, negative sign implies that the velocity is directed downwards.

Therefore, the velocity when it reaches the ground is 60ms^{-1}

12. Let m be the mass of the body

Given : $F = 40\text{ N}$, $a = 5\text{ ms}^{-2}$

From the relation : $F = ma$ we have $40 = m \times 5$

$$\text{or } m = \frac{40}{5} = 8\text{kg}$$

13. Separation between them will increase. Initially the momentum of both of them are zero as they are at rest. In order to conserve the momentum the one who throws the ball would move backward. The second will experience a net force after catching the ball and therefore will move backwards that is in the direction of the force.

14. Here, mass of object $m_1 = 1\text{ kg}$, velocity of object, $v_1 = 10\text{ms}^{-1}$

Total momentum just before the impact = $m_1 \times v_1$

$$= 1\text{ kg} \times 10\text{ms}^{-1} = 10\text{kgms}^{-1}$$

From principle of conservation of momentum, we have

Total momentum just after the impact = Total momentum just before the impact = 10kgms^{-1}

Now, this object of mass 1 kg sticks to a stationary wooden block of mass 5 kg .

So,

Mass of object + mass of block, $m_2 = 1\text{ kg} + 5\text{ kg} = 6\text{ kg}$

velocity of combined object = $v_2 = ?$

According to the law of conservation of momentum, we have

$$m_1v_1 = m_2v_2$$

$$\Rightarrow v_2 = \frac{m_1v_1}{m_2}$$

$$\Rightarrow v_2 = \frac{(1\text{ kg}) \times (10\text{ ms}^{-1})}{6\text{ kg}} = \frac{5}{3}\text{ ms}^{-1}$$

So, the velocity of combined object is $\frac{5}{3}\text{ms}^{-1}$

15. i. In the beginning water and clothes are in the state of rest. When the wet clothes are jerked, the particles of water tend to continue in its state of rest because of inertia of rest. Therefore the removal of water helps wet clothes to dry quickly because the droplets of water fall off from the clothes.
- ii. When a carpet is hit with a stick, the carpet moves, but dust on account of inertia

of rest flies off because of the sudden movement. It is in fact the carpet which comes out of the dust.

- iii. In the beginning the fruits on the branches are in the state of rest. On account of inertia of rest, the fruits tend to continue in their state of rest, but due to strong wind the fruits fall off the branches.
- iv. At first the pillion rider and driver are in a state of motion. When the driver applies brakes, the body of pillion rider continues moving forward on account of inertia of motion. Hence the pillion rider falls forward.

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