

Conceptual Questions for Laws of Motion

Applicable for Class 9 Laws of motion

Question 1

Which is true from Newton's Third law of motion?

- a) For every action force there is a 50% reaction force in the opposite direction.
- b) For every action force there is an equivalent reaction force in the opposite direction.
- c) Both 1 and 2
- d) None of the above

Answer b

Question 2

According to the third law of motion when we push on an object, the object pushes back on us with an equal and opposite force. If the object is a massive truck parked along the roadside, it will probably not move. A student justifies this by answering that the two opposite and equal forces cancel each other. Comment on this logic and explain why the truck does not move?

Answer

The logic is that Action and Reaction always act on different bodies, so they can not cancel each other. When we push a massive truck, the force of friction between its tyres and the road is very large and so the truck does not move

Question 3

In the equation $F = ma$, what does m represent?

- a) Mass
- b) Meters
- c) Force
- d) Acceleration

Answer Mass

Question 4

Arrange the items in order of increasing inertia?

Bicycle, bus, Train, car, Scooter

Answer

Bicycle > Scooter > car > bus > train

Question 5

What is the difference between balanced force and unbalanced force?

Answer

S.no	Balanced Forces	Unbalanced force
1	When two equal forces acting on an object in opposite directions called balanced force. When something does not move the forces are balanced,	If net force on a body is non-zero it is called unbalanced force. Forces whose resultant is not equal to zero are called unbalanced forces.
2	Example: Gravity pulls a table down but that table is pushed up by the floor or the ground it stands on so doesn't move.	Example: An arm wrestling competition among a strong person and a weak one. The resultant force will be in the direction of the force applied by the strong person

Question 6

Newton's First Law of Motion is also called:

- a) Law of Friction
- b) Law of Reaction
- c) Law of Action
- d) Law of Inertia

Answer d
Question 7

State the various effects of force?

Answer

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The various effects produced by a force are as follows:

- a) It can change the speed of an object making it move faster or slower.
- b) It can change the direction of motion of an object.
- c) It can change the shape of an object.

Question 8

True and False Statements

- A) Momentum is a vector quantity
- B) Rate of change of momentum is called Force
- C) Inertia is that property of a body due to which it resists a change in its state of rest or of uniform motion
- D) when a bullet is fired from the Gun and gun recoil. This is based on law of inertia
- E) The unit of momentum is Kg-m
- F) Force is a scalar quantity
- G) Action –Reaction pair of force act on different body
- I) A object can still run with non-zero velocity event the net force acting on the body is zero

Solutions

- A) True
- B) True
- C) True
- D) False
- E) False
- F) False
- G) True
- I) True

Question 9

Give reason for each of these

<u>S.No</u>	<u>Questions</u>	<u>Reason</u>
1	Why can dust be removed by shaking it, or beating it by a carpet?	
2	Why do passengers in the bus tend to fall back when it starts suddenly?	
3	Why is it difficult for a fireman to hose, which ejects large amount of water at a high velocity?	
4	Why is it advised to tie a rope on the luggage while you travel by the bus?	
5	Why do passengers jumping out of a rapidly moving bus fall forward with his face downwards, if he does not run forward?	
6	Why the cricket player moves his hand backwards on catching a fast cricket ball	
7	What is the use of seat belt in Car's	

Solutions

<u>S.No</u>	<u>Questions</u>	<u>Reason</u>
1	Why can dust be removed by shaking it, or beating it by a carpet?	Before the carpet was shaken, the dust was at rest. When the carpet was set in motion, The dust tends to remains at rest due to inertia. As a result dust got removed from carpet
2	Why do passengers in the bus tend to fall back when it starts suddenly?	When the bus accelerates from rest, the lower part of our body comes into motion along with the bus while the upper part of body tends to remain at rest due to inertia of motion and as a result which we fall backwards.
3	Why is it difficult for a fireman to hose, which ejects large amount of water at a	Water is ejected with a large forward force (action). As we know by Newton's third law

	high velocity?	of motion that every action has an equal and opposite reaction so, because of this action fireman experiences a large backward force or reaction. That is why he feels difficulty in holding the hose.
4	Why is it advised to tie a rope on the luggage while you travel by the bus?	Bus starts and stop suddenly during the journey and luggage can move because of law of inertia
5	Why do passengers jumping out of a rapidly moving bus fall forward with his face downwards, if he does not run forward?	The passenger's upper portion will remain in motion due to inertia even on falling on the ground and his lower portion will come to rest. So it will fall forward
6	Why the cricket player moves his hand backwards on catching a fast cricket ball	This is to prevent injuries to the hand. The time taken to reduce the momentum is increased in this way and less force acts on the hand
7	What is the use of seat belt in Car's	1) if the car are stopped due to emergency braking ,then the driver and passengers are no thrown forward so as to hit the steering wheel or wind screen 2)The slightly stretchable seat belts worn by the passengers increase the time taken by the passengers to fall forward and thus less stopping force acts on them

Question 10

State the Law of Conservation of Momentum. Deduce this from Newton's second law of motion?

Solution:

Law of conservation of momentum - This law states that if a number of bodies are interacting with each other, their total momentum remains conserved before and after the interaction, provided there is no external force acting on them.

$$p_1 + p_2 = p'_1 + p'_2$$

Derivation of Law of Conservation of Momentum from Newton's Second Law -

Suppose p_1 and p_2 represent the sum of momentum of a group of objects before and after the collision respectively. Let t is time elapsed during collision. Then according to Newton's Second Law,

External force = Rate of change of momentum

$$\text{or, } F = (p_2 - p_1) / t$$

If there is no external force, $F = 0$ and

$$(p_2 - p_1) / t = 0$$

$$\text{or, } p_1 = p_2$$

Therefore in the absence of an external force, the total momentum of a group of objects remains unchanged or conserved during collision. This is the law of conservation of momentum.