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B -147, Sector -6 Noida, UP - 201301,
www.askiitians.com
Email: info@askiitians.com
Tel: 1800-2000-838

Class: 9
Subject: Physics
Topic: Force and laws motion
No. of Questions: 20

Q1. What is the force and net Force?

Ans. Push or pull that tries to change the configuration of the motion of dimension is called as Force.
Net force: - The sum of all the forces acting on a body is known as net force.

Q2. Difference between Balanced force and unbalanced force.

Ans. Balanced force:- If net force on a body is zero it is called balanced force. Balanced forces do not cause a change in motion. They are equal in magnitude and opposite in direction. Therefore, the resultant of these forces will be zero.
Example: Two persons pushing a box with the same force in opposite directions.

Unbalanced forces:- 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. For 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.

Q3. What Is Inertia?

Ans. By Newton's law we know that, a body at rest will remain at rest and a body in motion will continue in a straight line unless it is compelled by an external force. This tendency of a body is called inertia. So we can say that 'Inertia is that property of a body due to which it resists a change in its state of rest or of uniform motion.'

Q4. When the brakes are applied to the bike the back sweater moves forward why?

Ans. When the bike accelerates suddenly the back sweater who was initially at rest experiences a force of friction at the point of contact between him and the bike. His inertia of rest tries to keep him at rest which results in a backward push. Thus, the back sweater moves backwards when the bike accelerates suddenly.
When the brakes are applied the inertia of motion of the back sweater tries to keep him in motion so he moves forward.

Q5. There are three solids made up of aluminum, steel and wood, of the same shape and same volume. Which of them would have highest inertia?

Ans. Since steel has greatest density and greatest mass, therefore, it has highest inertia.
As the mass is a measure of inertia, the ball of same shape and size, having more mass than other balls will have highest inertia.

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Q6. Two balls of the same size but of different materials, rubber and iron are kept on the smooth floor of a moving train. The brakes are applied suddenly to stop the train. Will the balls start rolling? If so, in which direction? Will they move with the same speed? Give reasons for your answer

Ans: Yes. The balls will start rolling in the direction in which the train was moving. Due to the application of the brakes, the train comes to rest but due to inertia the balls try to remain in motion, therefore, they begin to roll.

Since the masses of the balls are not the same, therefore, the inertial forces are also not same on both the balls. Thus, the balls will move with different speeds.

Q7. Horse need continues force in order to move a cart with a constant speed. Why?

Ans: Horse need continues of force in order to move a cart with a constant speed to balances the Force of friction.

Q8. Write a short note on third law of motion

Ans. Third law of motion: This law deals with the forces between bodies that appear in pairs. It says that "every action has an equal and opposite reaction"

When you stand on the ground, your weight pushes the ground downwards; does this make the ground to move downward? No, because the ground pushes you upward with a force equal to your weight and hence these equal and opposite forces cancel out and you stand on the ground balanced.

Force by you on the ground and force on you by the ground are two equal and opposite forces acting in pairs at the surface that is common to both you and the ground.

Newton's 3 rd law of motion is applicable wherever there is action-reaction force pair. Like walking, shooting with a pistol, collision, rocket propelling, etc.

Q9. How a karate player can break a pile of tiles with a single blow of his hand?

Ans. Karate player strikes the piles in a very short time in a very small area. Since, impulse, $I = F \times t$

$F = I/t$. If 't' will be very short time, the force becomes very large and act on smaller area .This produce enough pressure by his hand on brick to break it.

Q10. Define momentum?

Ans. Momentum (Linear momentum) for moving body is defined as the product of mass and velocity. If a body is moving with velocity, v and having mass, m then momentum of body is $p = m\ v$.

Momentum is a vector quantity. Its direction is the same as that of velocity. SI unit of momentum (p) is kg-m/s

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Q11. Explain why it is easier to stop a tennis ball than a cricket ball moving with the same speed?

Cricket ball has more momentum than the tennis ball due to greater mass. That's why it is easier to stop a tennis ball than a cricket ball moving with the same speed.

Q12. Why a goalkeeper in a game of football pulls his hands backwards after holding the ball shot at the goal.

Ans. To reduce the force exerted by ball on hand by increasing time as F = I/t.

Q13. A passenger in a moving train tosses a coin which falls behind him. Why?

Ans. Because that motion of the train is accelerated.

Q14 State and explain the three laws of Newton?

Ans. First law of motion: Newton's First law explains the "natural" motion of an object when it is left free. The law says that- Every object continues in its state of rest, or of uniform motion in a straight line with unchanging speed, unless compelled to do otherwise by forces acting upon it. So, naturally an object at rest will remain at rest and an object moving with a constant speed in a straight line will keep moving, unless they are disturbed by a force.
This property of matter to continue its state of rest or of uniform motion is called "Inertia". Hence, this law is also called the Law of Inertia.
Second law of motion: Newton's 2nd law of motion relates the external force (F) acting on a body with the mass (m) of the body; and is mathematically written as F = ma, 'a' is the acceleration of the body due to the force. It states that the acceleration of a body due to net external force acting on it is equal to the net force divided by the mass of the body.
The difficulty you face while pushing or pulling a heavier box compared to a lighter box is explained by the 2nd law of motion.
Third law of motion: This law deals with the forces between bodies that appear in pairs. It says that every action has an equal and opposite reaction. When you stand on the ground, your weight pushes the ground downwards; does this make the ground to move downward? No, because the ground pushes you upward with a force equal to your weight and hence these equal and opposite forces cancel out and you stand on the ground balanced. Force by you on the ground and force on you by the ground are two equal and opposite forces acting in pairs at the surface that is common to both you and the ground.

Q 15: A car of mass 200 kg moving at 36 km/h is brought to rest after it covered a distance of 10 m. Find the retarding force acting on the car.

Ans. Mass of the car (m) = 200 kg Initial speed (u) = 36 km/h = 10 m/s Final velocity (v) = 0
Distance covered (S) = 10 m
$v^2 - u^2 = 2aS$, $0 - 100 = 2 a \times 10 \Rightarrow - 100 = 20 a = - 100/20 = -5 m/s^2$
F = ma = 200 x 5 = -1000 N
Retarding force = 1000 N

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Q 16: What will be the change in acceleration of a sliding block, if its mass is doubled while a constant force is acting on it?

Answer:

Force exerted on the block (F) = ma

Let force acting on the object when the mass is doubled be equal to F_1 i.e., Mass (m_1) = 2 m

Acceleration produced = a_1 F_1 = 2m x a_1 Given, F = F_1

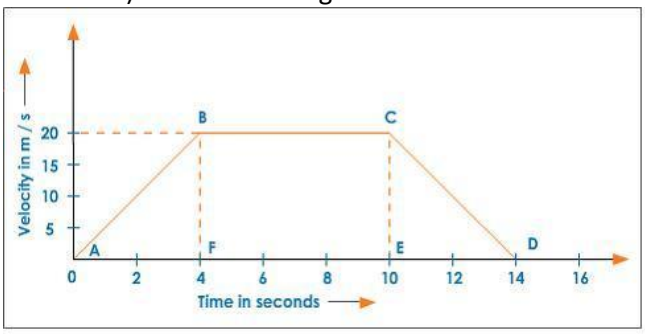
a_1 = a/2

i.e., acceleration is reduced to half.

$ma = 2 ma_1$

$a = 2 a_1$

Q 17: The figure below show a velocity time graph for a scooters having a total mass of 150 kg. From the graph calculate - a) The acceleration in first 4 seconds b) The distance covered in the first 4 seconds. c) The force acting in the first 4 seconds.



Ans. a) The acceleration in the first four seconds is given by the slope of the graph AB.

AB = BF/AF =20-0/4 =5 m/s2

b) The distance covered in the first four seconds = area of Δ ABF

= 1/2 bh = 1/2 AF x BF=1/2 x 4 x 20 = 40m

c) Force acting on the body in the first four seconds =ma = 150 x 5 = 750 N

Q 18: A certain force exerted for 1.2 seconds raises the speed of an object from 1.8 m/s to 4.2 m/s. Later the same force is applied for 2 seconds. How much does the velocity change in 2 seconds?

Ans. Initial velocity (u) = 1.8 m/s. Final velocity (v) = 4.2 m/s Time (t) = 1.2 seconds

First calculate acceleration

$a = (v-u)/t = (4.2 - 1.8)/1.2 = 2 m/s^2$

As the same force acts for the next two seconds the acceleration produced will be the same. The final

Velocity in the first case will now become the initial velocity.

We have to calculate the final velocity at end of 2 seconds.

Acceleration (a) = 2 m/s2

Initial velocity (u) = 4.2 m/s, t = 2 s

Final velocity (v) = ?

[First equation of motion]

v = u + at [First equation of motion]

= 4.2 + 2 x2 = 4.2 + 4 = 8.2 m/s

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Change in velocity in two seconds = 8.2 - 4.2 = 4 m/s

Q19. Which of the following has more inertia: (a) a rubber ball and a stone of the same size? (b) a bicycle and a train? (c) a five-rupees coin and a one-rupee coin?

Ans. Inertia of an object id directly related the mass of the body. The greater is the mass of the body; the greater is its inertia and vice-versa.
(a) Mass of a stone is more than the mass of a rubber ball for the same size.
Hence, inertia of the stone is greater than that of a rubber ball.
(b) Mass of a train is more than the mass of a bicycle.
Hence, inertia of the train is greater than that of the bicycle.
(c) Mass of a five rupee coin is more than that of a one-rupee coin. Hence, inertia of the five rupee coin is greater than that of the one-rupee coin.

Q20. In the following example, try to identify the number of times the velocity of the ball changes:
"A football player kicks a football to another player of his team who kicks the football towards the goal. The goalkeeper of the opposite team collects the football and kicks it towards a player of his own team". Also identify the agent supplying the force in each case.

Ans. The velocity of the ball changes four times.
When a football player kicks the football, its speed changes from zero to a certain value. In this case, force applied by player helps to change the velocity of the ball. This at first changes the velocity of the ball.
Another player kicks the ball towards the goal post. This changes the direction of the ball. Therefore, its velocity also changes. In this case, the player applied a force to change the velocity of the ball. The goalkeeper collects the ball. In other words, the ball comes to rest. Thus, its speed reduces to zero from a certain value. The velocity of the ball has changed 2nd time
The goalkeeper applied an opposite force to stop/change the velocity of the ball. Hence, its velocity changes third time.
The goalkeeper kicks the ball towards his team players. Hence, the speed of the ball increases from zero to a certain value. Hence, its velocity changes once again. In this case, the goalkeeper applied a force to change the velocity of the ball.