PHYSICS

BOOKS - CHHAYA PHYSICS (BENGALI ENGLISH)

NEWTON'S LAWS OF MOTION

NUMERICAL EXAMPLES

1. A force of 100 dyn acts on a mass of 25g for 5 s. Find the velocity attained.

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2. A force acts on a mass of 16 g for 3 s and then ceases to act. In the next 3 seconds, the mass travels 81 cm. What was the magnitude of the force?

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3. A bullet of mass 50 g moving at 400 m $\cdot$ s^{-1} penetrates a wall with an average force of 4

$\times 10^4$ N. It comes out of the other side of the wall at 50 m $\cdot s^{-1}$. Find the thickness of the wall.

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4. The force on a particle of mass 10 g is $\left(10\hat{i} + 5\hat{j}\right)$ N. If it starts from rest what would be its position at time t = 5s ?

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5. Raindrops of radius 1 mm and mass 4 mg are falling with a speed of 30 m/s on the head of a bald person.The drops splash on the head and come to rest. Assuming equivalently that the drops cover a distance equal to their radii on the head, estimate the force exerted by each drop on the head.

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6. A paratrooper of mass 75 kg falls with a constant velocity. Find the air resistance acting on him.

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7. The graph ABCD in represents the change in force (N) against time (μs). Find the impulse on the body between 4 μs to 16 μs.

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8. The initial speed of a body of mass 2.0 kg is 5.0 m/s. A force acts for 4 s in the direction of motion of the body. The force-time graph is shown in Calculate the impulse of the force and the final speed of the body.

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9. A hammer of mass 1 kg hits a nail at a speed of 10 m. s^{-1} . For this, the nail penetrates 2

cm through a wooden plank. Calculate (i) impulse due to the hammer, (ii) the applied force and (iii) the time of contact between the hammer and the nail.

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10. Water, ejected from the jet of a fire fighting engine, hits a wall perpendicularly at the rate of 12.2 m $\cdot s^{-1}$. Assuming that the water does not recoil from the wall, calculate the pressuer

developed on the wall. Mass of 1 m^3 of water 10^3 kg.

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11. Two bodies of equal mass are at rest, side by side. A constant force F is applied on the first body while at the same instant an impulsive force, producing an impulse I is applied in the same direction on the second body. Determine the time taken by them, in terms of F and I, to be side by side again.

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12. A cricket ball of mass 150 g, moving at 12 m $\cdot s^{-1}$, is hit by a cricket bat. The ball recoils with a velocity of 20 m $\cdot s^{-1}$. If the bat was in contact with the ball for 0.01 s, find the average force imparted on the ball by the bat.

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13. A person of mass 60 kg jumps from a height of 5 m, onto the ground. If he does not

bend his knees on touching the ground, he comes to rest in $\frac{1}{10}$ s. But if he bends his knees, he takes 1 s to come to rest. Find the force exerted by the ground on him in the two cases. [g = 10 m $\cdot s^2$]

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14. Two masses M and m are connected at the two ends of an inextensible string. The string passes over a smooth frictionless pulley.

Calculate the acceleration of the masses . Given M > m.

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15. Two blocks of masses 2.9 kg and 1.9 kg are suspended from a rigid support, using two inextensible wires, each of length 1m , as shown in. The mass of the upper string is negligible and that of the lower string is 0.2 kg $\cdot m^{-1}$. If the whole system is moving up with an acceleration of 0.2 m $\cdot s^{-2}$, find (i) the

tension at the midpoint of the lower string and (ii) the tension at the midpoint of the upper string. Acceleration due to gravity $9.8\ m \cdot s^{-2}$.

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16. Two bodies of masses 7 kg and 5 kg are joined with a rope of mass 4 kg . An upward force of 200 N is applied on the upper body. Find (i) the acceleration of the system, (ii)

tension t the top end of the rope and (iii) tension at the midpoint of the rope.

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17. A spring balance has a scale that reads from 0 to 50kg. The length of the scale is 20cm. A body suspended from this balance, when displaced and released, oscillates with period of 0.6s. What is the weight of the body ?

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18. A body of mass 1 kg is suspended from a spring balance calibrated for acceleration due to gravity of 10 m $\cdot s^{-2}$. What is the reading on the spring balance when the system (i) is ascending with an acceleration of 5 m $\cdot s^{-2}$ and (ii) is descending with the same acceleration? [g = 10 $m \cdot s^{-2}$]

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19. A man of 50 kg is standing on a weighing machine in a lift. As the lift moves with a constant acceleration, the weighing machine registers the man's weight as 45 kg. State whether the lift is ascending or descending. Give reasons for your answer. What is the acceleration of the lift? [g = 9.8 $m \cdot s^{-2}$]

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20. A man of mass 70 kg is sitting in a motor car. The car is moving with an acceleration of 5 $m \cdot s^{-2}$. What is the gravitational force on the man?

[g = 9.8 $m \cdot s^{-2}$]

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21. A man of mass 60 kg is standing in a lift at rest. What will be the reaction force on the man when the lift is (i) stationary, (ii) moving

up with an acceleration of 4.9 $m \cdot s^{-2}$, (iii) moving up at a constant speed, and (iv) moving up with a retardation of 4.9 m $\cdot s^2$? [g = 9.8 m $\cdot s^2$]

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22. A man of mass 98 kg, is standing on a weighing machine in a lift. What will be the readings of the weighing machine in the following cases: (i) the lift ascends at 100 cm per second. (ii) The lift descends with an

acceleration of 30 cm $\cdot s^{-2}$?

[g = 980 cm $\cdot s^{-2}$]

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23. A man weighing 60 kg is in a lift that descends with an acceleration of 4 cm $\cdot s^{-2}$. What force will the man exert on the floor of the lift?

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24. A lift of mass 200 kg is moving up with an acceleration of 4 $m \cdot s^{-2}$. What is the tension in the lift cable? If the lift moves down with the same acceleration, what will be the tension in that case?

[g = 9.8 $m \cdot s^{-2}$]

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25. A lift of mass 2000 kg is supported by thick steel ropes. If maximum upward acceleration

of the lift be 1.2 m / s^2, and the breaking stress for the ropes be $2.8 \times 10^8 \mathrm{N} / m^2$, what should be the minimum diameter of the rope?

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26. A bullet of mass 6 g is fired with a velocity of 500 m $\cdot s^{-1}$ from a gun of mass 4 kg. Find the recoil velocity of gun.

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27. While firing a bullet of mass 8 g, the recoil velocity of the gun of mass 5 kg becomes 64 $cm \cdot s^{-1}$. The bullet penetrates 50 cm through a target and then stops. Express the average resistance on the bullet in newton.

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28. A body of mass m moving with velocity V along the X-axis, collides with another mass M moving with velocity v along the Y-axis. The

masses coalesce after collision. Find the velocity and the direction of motion of the combined mass.

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29. A body of mass 50 kg is projected vertically upwards with a velocity of 100 $m \cdot s^{-1}$. After 5 s it splits up into two parts due to an explosion. One part of mass 20 kg moves vertically upwards with a velocity of 150 $m \cdot s^{-1}$.Find the velocity of the second body.

Find the sum of momenta of the two parts 3 s after the explosion and show that if there was no explosion. the momentum of the body would have been constant.

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30. A body P of mass 20 g and another body Q of mass 40 g are projected at the same time from points A and B on the earth's surface. Velocity of projection for each was 49 m $\cdot s^{-1}$ and it was directed at an angle of 45° with the

horizontal. Distance AB = 245m. P and Q collide on the same vertical plane. After collision, P retraces its path to the ground. Find the position where Q touches the ground. How long will Q take to reach the ground after the collision? [g = 9.8 m $\cdot$ s^{-2}]

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31. A car of mass 2000 kg collides with a truck of mass 10^4 kg moving at 48 km $\cdot$ h^{-1}. After

collision the car rides up the truck and the truck-car combination moves at 15 km $\cdot h^{-1}$. What was the velocity of the car before collision?

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32. A ball weighing 100 g was thrown veritcally upwards with a velocity 49 ms^(-1). At the same moment another indentical ball was dropped from a height of 98 m vertically above the first ball. After some time the two balls

collided and got stuck together. This combined mass reached the ground finally. Determine how long the balls were in motion.

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33. A body of mass m is at rest on a smooth horizontal plane. A force F = kt is applied on the body making an angle α with the horizontal. In the equation of force, t is time and k is a constant. At the instant the object loses contact with the plane, how far will it

move along the plane and what will be its velocity?

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34. A cannonball of mass 50 kg is fired with a velocity of 40 m $\cdot s^{-1}$ form a cannon of mass 1000 kg. what will be the recoil velocity of the cannon?

If the force of friction between the surface and the wheels of the cannon is $\frac{1}{10}$th of the weight of the cannon, how far will the cannon

move before coming to rest? [Given, g = 10 $m \cdot s^{-2}$]

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35. Four identical blocks, each of mass m, are connected as shown in and are kept on horizontal table. A force F is applied on the first block.Find the tension in each string, neglecting friction.

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36. A wagon is moving along a straight railway track with a velocity of 3.2 $m \cdot s^{-1}$. The wagon is being loaded with coal in moving condition at a rate of 540 kg. $\min^{-1}$. How much force is to be applied to move the wagon at a constant velocity?Assume, the initial velocity of the coal at horizontal direction is zero.

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37. A rocket loses $\frac{1}{4}$th of its mass in one second, during its upward motion. The speed

of ejection of gas is 4000 $\mathrm{m} \cdot s^{-1}$. Find the acceleration gained.

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38. rocket is using 200 kg of fuel per second for its flight. Gas produced during combustion is ejected at a velocity of 6000 $\mathrm{m} \cdot s^{-1}$. What is the force acting on the rocket?

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39. A machine gun fires bullets at the rate of 180 shots per minute. Each bullet is of mass 20 g and moves with a velocity of 1 km $\cdot s^{-1}$. After colliding perdicularly with a steel plate, the bullets rebound with half the incident speed. What will be the force required to keep the steel plate in position?

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40. Just before take-off, the mass of a rocket is 4000 kg and the velocity of ejection of the burnt fuel is 400 m $\cdot s^{-1}$. What should be the rate of combustion of the fuel so that the rocket can take off vertically?

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SECTION RELATED QUESTION

1. State Newton's second law of motion.

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2. Define unit of force. Write down its units in CGS system and SI and find the relationship between them.

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3. The weight of a body is different at different heights from the earth's surface-why?

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4. State the relation between the SI units of force and momentum.

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5. What are the differences between impulse of a force and impulsive force?

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6. What is meant by impulse of a force? Prove that, impulse of a force on a body is equal to the change in momentum of the body.

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7. What is meant by an impulsive force? Given examples.

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8. Define contact force

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9. Find out the expressions of apparent weight of a man in a lift when the lift is coming down with an acceleration (i) $a = g$ and (iii) $a > g$.

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10. State the law of conservation of linear momentum.

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HIGHER ORDER THINKING SKILL (HOYS) QUESTIONS

1. A metal ball is suspended from the roof of a train by a string. When the train is in uniform motion, will the string remain vertical? What happens to the string if the train accelerates?

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2. When a bullet is fired at a glass window, it creates a round hole on the glass pane without shattering the whole pane. But when we throw a stone, the glass pane shatters. Explain.

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3. A body is kept on the floor of a train. When the train accelerates forward, the body gains a backward acceleration. Which force is responsible for the backward acceleration?

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4. A body of mass m is suspended by two strings making angles α_1 and α_2 with the horizontal. Find the tension in the strings.

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5. A force is applied on a particle in a lift moving upward with an acceleration α. Can Newton's second law of motion be applied to describe the motion of this particle?

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6. Masses 1 kg and 3 kg move towards each other, due to their mutual attraction , no other external force acts on them. When their velocity of approach is 2 m $\cdot s^{-1}$, the velocity

of the centre of mass is 0.5 m $\cdot s^{-1}$. What will be the velocity of the centre of mass of this system when the velocity of approach is 3 m $\cdot s^{-1}$.

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7. Is it possible, for a person sitting inside a car at rest, to make the car move by pushing it from inside?

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8. A meteorite burns in air. Is the momentum of the meteorite conserved?

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9. A man of mass m is standing on a rope-ladder attached to and kept vertical by a balloon af mass m at rest in the air.the man starts climbing up the rope-ladder at a constant speed v with respect to the ladder.what will be the velocity of the balloon at that time?

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10. A ball in thrown up. The magnitude of its momentum first decreases and then increases. Does this violate the conservation of momentum principle.

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11. In a game of tug-of-war, if both the parties exert a force of T dyn from either side, what

will be the tension in the rope?

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12. Two persons pull a rope by its two ends, exerting equal but opposite forces F. In another situation, one end of the rope is tied to a rigid support and a person pulls it with a force of 2F. In which case will the tension in the be greater ?

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13. A uniform rope of length L rests on a smooth plane. One end of the rope is pulled with a force F. what is the tension in the rope at a distance l from that end ?

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14. A boat is floating in still water. A man walks from one end of the boat to the other . What will be the displacement of the boat?

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15. A jet plane usually flies at a considerable height but a propeller plane flies at a low altitude. Explain.

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16. Which principle of conservation can explain the flight of a rocket?

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17. Two persons are facing each other on two boats floating on still water. They are holding the two ends of a rope. When either of them or both pull the rope, then the boats meet at the same point whatever the pull on the rope may be. Give reasons for this. Is there any difference in the times taken by the boats to meet, for different forces applied on the rope?

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18. A block of mass m is suspended from the ceilling using a string C. Another piece of string D is fitted to the other end of block. When the string D is pulled suddenly, it snaps . But when D is pulled slowly. The string C snaps. Explain.

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19. Rocket is the only means of travel in space - explain.

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20. Two balls of different masses have the same volume. If the air resistance on both the balls are the same, prove that, when dropped from the same height, the heavier ball reaches the ground earlier.

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21. A balloon of mass M, carrying some is descending with an acceleration a. When $\frac{1}{4}$ th

of the sand is emptied out the balloon, the balloon descends with a unifrom velocity. Find the initial mass of sand in the balloon.

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22. Two forces, F_1 and F_1 are applied at the two ends of a rope of length l. $F_2 > F_1$ and they are oppositely directed . What will be the force that will act at a point at a distance x from one of the extreme ends of the rope?

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23. If you stand on the floor it exerts an upward reaction on you. Then why don't you fo up ?

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24. A body of weight W_1 is suspended from from the ceiling of a room by a rope of weight W_2. What is the force exerted by the ceiling on the body?

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25. A ball of mass m is suspended by a light thread attached to the hook of a car. At the precise moment when the car began to descend a smooth inclined plane under gravity, the thread was perpendicular to the plane. When the car begins to descend, what angle will the thread make with the plane? the angle of inclination = α.

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26. A body of mass 1 kg initially at rest explodes and breaks into three fragments of masses in the ration 1 : 1 : 3. The two pieces of equal mass fly off perpendicular to each other with a speed of 30 m/s each. What is the velocity of the heavier fragment?

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EXERCISE (MULTIPLE CHOICE QUESTIONS)

1. Two masses, m and 2m are connected by a string that passes over a frictionless pulley. When the mass 2m is released, acceleration of the mass m upwards, will be

A. $\frac{g}{3}$

B. $\frac{g}{2}$

C. g

D. 2g

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2. Masses of blocks A and B are 2 kg and 3 kg respectively. The blocks are kept at rest on a frictionless horizontal table. When a horizontal force of 10 N is applied on A, force applied on B by A will be

A. 4 N

B. 6 N

C. 8 N

D. 10 N

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3. A person of mass M is at a height h from a floor in a place free from gravitational force. The person throws a ball of mass m, downward with a velocity u. Distance of the person from the floor,when the ball touches the floor, will be

A. $h\left(1+\frac{m}{M}\right)$

B. $h\left(2-\frac{m}{M}\right)$

C. 2h

D. $5h\left(4+\frac{m}{2M}\right)$

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4. A block is released from the top of an inclined plane of inclination θ and height h. Time required to reach the foot of the inclined plane is

A. $\sqrt{\frac{2h}{g}}$

B. $\sin\theta\sqrt{\frac{2h}{g}}$

C. $\frac{1}{\sin\theta}\sqrt{\frac{2h}{g}}$

D. $\frac{1}{\cos\theta}\sqrt{\frac{2h}{g}}$

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5. A plumb line is hanging from the roof of a car. When the car moves with an acceleration a, the angle that the plumb line makes with the vertical is

A. $\tan^{-1}\frac{a}{g}$

B. $\tan^{-1}\frac{g}{a}$

C. $\cos^{-1}\frac{a}{g}$

D. $\sin^{-1}\frac{g}{a}$

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6. Consider an elevator moving downwards with an acceleration a, the force exerted by a passenger of mass m in the floor of the elevator is

A. ma

B. ma - mg

C. mg - ma

D. mg + ma

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7. A monkey is descending from the branch of a tree with a constant acceleration. If the breaking strength of the branch is 75% of the

weight of the monkey, the minimum acceleration with which the monkey can slide down without breaking the branch is

A. g

B. 3 g/4

C. g/2

D. g/4

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8. A car moving with a speed of 50 km/hr can stopped by brakes, over a distance of 6 m. If the same car is moving at a speed of 100 km/hr. the stopping distance is

A. 12 m

B. 18 m

C. 6 m

D. 24 m

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9. The x and y coordiates of a particle at any time t are given by x = 7t + $14t^2$ and y = 5t, where x and y are in metre and t is in second. The acceleration of the particle at t = 5 s is

A. zero

B. 28 m $\cdot$ s^{-2}

C. 20 m $\cdot$ s^{-2}

D. 40 m $\cdot$ s^{-2}

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10. A ball of mass 0.5 kg is moving with a velocity v of 2 $m \cdot s^{-1}$. It is subjected to a force of xN in 2 s. Because of this force, the ball moves with a velocity of $3m \cdot s^{-1}$. The value of x is

A. 5 N

B. 8.25 N

C. 0.25 N

D. 1 N

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11. A force F_1 of 500 N is required to push a car of mass 1000 kg showly at constant speed on a level road. If a force F_2 of 1000 N is applied, the acceleration of the car will be

A. zero

B. 1.5 m $\cdot s^{-2}$

C. 1 m $\cdot s^{-2}$

D. 0.5 m $\cdot s^{-2}$

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12. A cricket ball of mass 0.5 kg, moving at 30 m $\cdot s^{-1}$, hits a bat perpendicularly and rebounces with a velocity of 20 m $\cdot s^{-1}$. Impulse of the force exerted by the ball on the bat is

A. 0.5 $N \cdot s$

B. 1.0 N ·

C. 25 N · s

D. 50 N · s

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13. A rocket consumes fuel at the rate of 100 kg $\cdot s^{-1}$. Gas ejects out of it with a velocity of $5 \times 10^4 m \cdot s^{-1}$. If gravitational pull is

neglected, impulsive force experienced by the rocket is

A. 5×10^2N

B. 5×10^4 N

C. 5×10^6 N

D. 5×10^8N

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14. Two bodies of masses 5 kg and 3 kg respectively are connected to two ends of a light string passing over horinzontal frictionless pulley. The tension in the string is

A. 60 N

B. 36.75 N

C. 73.50 N

D. 18 N

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15. A man of weight w is in a lift which is moving up with an acceleration a.If acceleration due to gravity is g, apparent weight of the man will be

A. $w\left(1+\frac{a}{g}\right)$

B. $w\left(1-\frac{a}{g}\right)$

C. w

D. zero

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16. A thief steals a treasure box of weight w. He then jumps off a wall of height h with the box on his head. The weight felt on his head before he touches the ground is

A. 2w

B. w

C. $\frac{w}{2}$

D. zero

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17. A free particle of mass m was in motion along the x-axis on a horizontal x-y plane kept at a fixed height above the earth. On sudden explosion, the particle broke up into two pieces of masses $\frac{m}{4}$ and $\frac{3m}{4}$. After an interval of time, position of the smaller fragment along y-axis become y = 15 cm. At that moment, position of the larger piece was

A. y = -5 cm

B. $y = +20$ cm

C. $y = +5$ cm

D. $y = -20$ cm

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18. A truck, carrying sand, moves with uniform velocity u on a smooth horizontal road. If Δm mass of sand falls in time Δt from the truck,

then to maintain the speed u, the truck needs a force

A. $\frac{\Delta mu}{\Delta t}$

B. $\frac{\Delta mu}{2\Delta t}$

C. $\frac{\Delta mu^2}{\Delta t}$

D. zero

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19. Steel pellets, each with a mass of 0.60 g, fall vertically onto a horizontal plate at a rate of 100 pellets per minute. They strike the plate with a velocity of 5.0m/s and rebound with a velocity of 4.0m/s. What is the average force exerted on the plate by the pellets?

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VERY SHORT ANSWER TYPE QUESTIONS

1. A lorry and a car moving with the same kinetic energy are brought to rest by the application of brakes, which provide equal retarding forces .Which will come to rest in less distance?

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2. A man, in a train in uniform motion, throws a ball vertically upwards. Will the ball return to his hand?

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3. From the roof of a train, a metal ball is suspended by a string. When the train moves with uniform velocity, will the string remain vertical?

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4. A body in motion is acted upon by a force. Will the body stop at the moment of withdrawal of the force?

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5. A force of 200 dyn acts on a mass of 10 g for 5 s. initially the body was at rest. What will be the final velocity of the mass?

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6. A man is coming down a hanging rope. The rope can bear up to $\frac{2}{3}$ of this weight.

Minimum acceleration with which the mas can come down is_____.

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7. Write the name of the physical quantity whose unit is the same as that of impulse of a force.

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8. A body of weight W_1 is suspended from from the ceiling of a room by a rope of weight W_2. What is the force exerted by the ceiling on the rope?

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9. A spring balance is set in a stationary lift. A person of mass 50 kg is standing on that balance. What will be the change in the

reading of the balance if the lift moves upwards with constant velocity?

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10. A spring balance is set in a stationary lift. A person of mass 50 kg is standing on the balance. What will be the change in the balance reading when the lift moves upwards with constant acceleration?

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11. A man of mass 50 kg is descending at a constant velocity using a parachute. What is the air resistance on the man?

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12. Two bodies of equal masses are kept on the scale pans of a beam balance in a lift. If the lift starts moving up with an acceleration, will the beam balance be in equilibrium?

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13. Can a rocket operate in free space?

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14. What is the principle of Rocket propulsion?

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15. A bomb explodes in mid-air into two equal fragments. What is the direction of motion of the two fragments?

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SHORT ANSWER TYPE QUESTION - I

1. A block of mass M is kept on a smooth horizontal surface. Another block of mass m, moving with velocity v, collides with it and coalesces. What is the resultant velocity of the system?

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2. A motor car and a lorry, moving with the same momentum, are brought to rest by applying the same opposing force. Which of them will come to rest in shorter time?

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3. A ball in thrown up. The magnitude of its momentum first decreases and then increases. Does this violate the conservation of momentum principle.

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4. A body is kept on the floor of a train. When the train accelerates forward, the body gains a backward acceleration. Which force is responsible for the backward acceleration?

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5. The weight of a freely falling body is zero - explain.

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6. Why are blankets beaten with a stick to remove dust?

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7. No force is required to move a body with consant velocity. Explain.

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8. Is the relation $\overrightarrow{F} = \overrightarrow{ma}$ applicable to motion of a rocket?

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9. Two bodies of different masses m_1 and m_2 are falling from the same height. If resistance offered by the air be the same for both the bodies, then will they reach the earth simultaneously? Assume $m_1 > m_2$.

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10. "The total momentum in the universe remains constant." Is this statement true?

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SHORT ANSWER TYPE QUESTION-II

1. Two bodies of masses m_1 and m_2 are connected by a weightless string and are kept on a frictionless, horizontal plane. If the body weighing m_1 is pulled with a horizontal force

F, then determine the common acceleration of the two bodies and the tension in the string.

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2. The masses M and m connected to the two ends of an inextensible string. The string passes over a smooth frictionless pulley. Calculate the acceleration of the masses and the tension in the string. Given, $M > m$.

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3. How Newton's third law of motion helps us in walking?

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4. Define impulse and derive impulse-momentum theorem.

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5. A man stands on a spring scale on an elevator. In which case, will the scale record the minimum reading and the maximum reading: (i) elevator stationary (ii) elevator cable brakes, free fall (iii) elevator accelerating upward and (iv) elevator accelerating downward.

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PROBLEM SET - I

1. A force of 1 N acts for 4 s on a mass of 500 g. If the mass is initially at rest, find its final velocity.

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2. A bullet, of mass 50 g moving at 400 m $\cdot s^{-1}$, penetrates 20 cm into a wall and stops. Find the average resistance offered by the wall.

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3. What force is required to generate a velocity of 36 km $\cdot h^{-1}$ in a body of mass 500 g. within a distance of 2 m?

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4. A force of 500 dyn is applied against the motion of a body of mass 50 g moving at 1 m $\cdot s^{-1}$. When and where will the body stop?

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5. A body of mass 20 kg falls from a height of 20 m on the earth's surface. If the resistance offered by the surface is 10000 N , how far will the body penetrate?

(g = 10 m $\cdot$ s^{-2})

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6. A mass m acquires a velocity v after covering a distance x, when a force F is applied on it for time t. show that, t $= \frac{mv}{F}$ and $x = \frac{1}{2}\frac{mv^2}{F}$.

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7. A block of mass m_1 kg accelerates at 10 m $\cdot s^{-2}$ when a force of 10 N acts on it. Another block of mass m_2 kg accelerates at 5 $m \cdot s^{-2}$ when the same force acts on it. Find the acceleration if both the blocks are tied together and same force acts on the combination.

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8. A hammer of mass 4 kg, falling from a height of 50 cm, hits a nail, partially fixed on a surface, and stops in 0.1 s. find the force exerted on the nail in N.

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9. A cricket ball of mass 125 g, moving horizontally at 30 m $\cdot$ s^{-1} is hit by a bat and then it moves in the opposite direction at 20

$m \cdot s^{-1}$. If the collision takes place for $\frac{1}{20}$s, find the force exerted by the bat.

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10. A rubber ball of mass 100 g falls from a height of 1 m rebounds to a height of 40 cm. Find the impulse and the average force between the ball and the ground if time during which they are in contact was 0.1 s.

Watch Video Solution

11. A block of mass 5 kg lies on a horizontal frictionless plane. A string attached to it passes over a smooth pulley fixed to the edge of the plane and carries a load of mass 1 kg. Find the acceleration of the system.

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12. A mass of 1 kg is suspended from the roof of a lift by a wire. The wire can withstand a maximum tension of 14.7 N. Find the limit of

the acceleration of the lift for which the wire does not snap. G = 9.8 $m \cdot s^{-2}$

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13. A balloon of mass 1000 kg is motionless is the air at some height above the earth's surface. When an object of mass 200 kg is dropped from the balloon, what will be the acceleration with which the balloon starts rising?

(g = 9.8 m $\cdot s^{-2}$)

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14. From a gun of mass 10 kg , a bullet of mass 50 g is fired. Find the recoil velocity of the gun if the velocity of the bullet is 400 m $\cdot s^{-1}$.

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15. A bomb at rest explodes into three fragments of equal masses. Two fragments fly off at right angles to each other with

velocities 9 $m \cdot s^{-1}$ and 12 $m \cdot s^{-1}$ respectively. Calculate the speed of the third.

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16. A stone of cross - sectional area $10m^2$ completely stops the flow of a river current of 5 $m \cdot s^{-1}$. What is the force exerted on the stone? (denstiy of water = 1000 kg $\cdot m^{-3}$)

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17. A piece of stone of mass m is sliding down a smooth ice surface. Standing on the same surface, a boy of mass M picks up the stone. Find the initial velocity acquired by the boy.

Watch Video Solution

18. A football of mass 200 g moving towards a player with a velocity of $20\text{m} \cdot s^{-2}$ is kicked back by him. If the ball after being kicked moves with a velocity of $30\ \text{m} \cdot s^{-1}$ at an

angle of 45° with the horizontal, then find (i) the net impuse of the force and (ii) the average force acting on the football. (Given , time of contact between football and the foot of the player is 0.1 s)

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PROBLEM SET - II

1. A marble ball of mass 50 g , falls from a height of 5 m on a horizontal plane and

rebounces to rise up to a height of 3.2 m. if the collision lasts for $\frac{1}{10}$s, find the impulsive force imparted by the plane and the impulse of the ball.

(g = 10 m $\cdot s^{-2}$)

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2. A 500 g hammer moving at a speed of 15m $\cdot s^{-1}$ strickes a nail and drives it 75 mm into a block of wood. Assuming that the restoring force in the wood is constant, find (i) the

acceleration of the hammer and (ii) the constant force.

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3. A 2 kg mass, tied with a weightless string that passes over a smooth pulley, is being pulled due to the vertical fall of a 3 kg mass tied to the other end of the string. The string snapped 5 s after the fall started . What further distance does the 2 kg mass rise

through?

(g = 10 m $\cdot s^{-2}$)

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4. A railway engine pulls a bogie of mass 10 tonne (metric ton). Average resistance against motion due to friction etc. is 39.2 N per tonne. What will be the tension on the chain when (i) the train is moving with a uniform velocity (ii) the train is moving with an acceleration of 1 m $\cdot s^{-2}$? (1 tonne =10^3 kg)

Watch Video Solution

5. Two masses 8 kg and 12 kg are connected at the two ends of a light inextensible string that goes over a frictionless pulley. Find the acceleration of the masses, when the masses are released.

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6. Three blocks are connected as shown in on a horizontal frictionless table and pulled to the

right with a force F = 60N. If $m_1 = 5$ kg, $m_2 = 10$ kg and $m_3 = 15$kg, Find the tension T_1 and T_2.

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7. A man of mass 60kg is in a lift and lift is accelerating upwards with acceleration $4\frac{m}{s^2}$. Calculate the effective weight of the man in lift.

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8. A glass plate breaks when a mass of 3 kg or more is kept on it. An iron piece is kept on that plate in a lift. If the upward acceleration of the lift if gradually increased to 245 cm $\cdot s^{-2}$, the plate breaks, what is the mass of the iron piece?

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9. A body (A) of mass 100 g and another body (B) of mass 400 g approach each other with velocities of 100 cm $\cdot s^{-1}$ and $10cm \cdot s^{-1}$

respectively. After a head on collision, the bodies coalesce. After collision, find the displacement of the combined mass in 10 s .

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10. A bomb, while falling vertically downward explodes, just when it attains the velocity u, into two fragments of mass ratio 2 : 1. If the heavier of the two masses starts moving vertically downwards with a velocity 2u, find

the direction and magnitude of velocity of the lighter mass at that moment.

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11. A bullet is fired from a cannon with velocity 500m/s. If the angle of projection is 15° and $g = 10\frac{m}{s^2}$, then find the range.

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12. Bulletss are fired from a machine gun. Each bullet has mass 50 g and is fired at the velocity of 1000 $\mathrm{m} \cdot s(-1)$. Average force applied against recoil of the gun is 200 N. find the maximum number of bullets fired per minute.

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13. A moving ball of mass 0.1kg undergoes an elastic head-to-head collision with another body at rest. After collision, the first ball

rebounds at one-third of its original speed while second ball starts moving forward . find the mass of the second ball.

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14. From a gun of mass M, a bullet of mass m is fired with a velocity v.

If recoil of the gun stops after t seconds, show that $F = \frac{mv}{t}$.

Watch Video Solution

15. A bomb at rest explodes into three parts of the same mass. The momentum of two parts are - $2p\hat{i}$ and $p\hat{j}$. Find the magnitude of the momentum of the third part.

Watch Video Solution

16. A body of mass 1 kg initially at rest explodes and breaks into three fragments of masses in the ration 1 : 1 : 3. The two pieces of equal mass fly off perpendicular to each other

with a speed of 30 m/s each. What is the velocity of the heavier fragment?

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17. Two iron blocks of masses 20 kg and 10 kg are kept adjacent on a smooth horizontal table. A force of 30 N is applied on the blocks such that, the system starts moving in the direction of the force. What force acts at the surface of contact of the blocks?

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18. A spaceship is moving with an acceleration of 9.8 $m \cdot s^{-2}$ in a fixed direction in space, where attraction due to other planets and stars is negligible. Find the magnitude and direction of the force exerted by a body of 98 N, in the spaceship.

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19. Sand grains are being dropped vertically at a rate of 2 kg $\cdot s^{-1}$ on a conveyer belt moving

at a constant velocity of 0.1 m $\cdot s^{-1}$. Find the additional force needed to keep the belt moving.

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20. Free downwared motion of body is stopped in 1 s on application of an upward force when the body has fallen through 10 m. Another force would have stopped the body in 2 s. find the ration between the two forces.

(g = 9.8 $m \cdot s^{-2}$)

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21. A weight of 200 kg is repeatedly dropped freely from a height of 10 m, on the head of a pole of mass 50 kg, to push it into the ground. For every impact, the pole penetrates 7 cm into the ground. Find the average resistance of the ground.

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22. A body is suspended from the roof of a train by a string. What angle is formed by the string with the vertical, when the train moves at a constant acceleration of a ?

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23. A lift of mass 200 kg is ascending with an acceleration of 4 m $\cdot s^{-2}$. What is the tension on the lift cable?

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24. A golf ball of mass 60 g is hit with a striker. Find the impulse of the hit if the ball stops after travelling a horizontal distance of 50 m with a uniform retardation of 4 m $\cdot$ s^{-2}.

Watch Video Solution

25. A body of mass 5kg initially at rest is subjected to a force of 20N. What is the kinetic energy acquired by the body at the end of 10s?

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26. A stone of mass m tied to the end of a string revolves in a vertical circle of radius R. The net force at the lowest and highest points of the circle directed vertically downwards are:

[Choose the correct alternative]

	Lowest Point	Highest point
(a)	mg +T_1	$mg + T_2$
(b)	mg +T_1	$mg - T_2$
(c)	mg + $T_1 - \left(mv_1^2\right)/R$	$mg - T_2 + \left(mv_1^2\right)/R$
(d)	**mg -**	

$T_1 - \left(mv_1^2\right)/R$ $mg + T_2 + \left(mv_1^2\right)/R$

T_1 and v_1 denote the tension and speed at the lowest point. T_2 and v_2 denote corresponding values at the highest point.

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HOTS NUMERICAL PROBLEMS

1. A truck, of mass 1000 kg pulls a trailer of mass 3000 kg using a rope. Frictional force between truck and road, and trailer and road

are 1000 N and 2000 N respectively. If the truck engine applies a force of 8000 N, (i) what is the acceleration of the trailer and (ii) what is the tension in the rope between the truck and the trailer?

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2. At the two ends of a light string, passing over a stationary, light, smooth pulley, two masses m and 2m are attached. Length of the string on either side of the pulley was the

same initially, and the two masses were at a height of 13.08. After the system is released, what will be the velocities of the two masses when the mass m rises by 6.54m? At that moment, if the string snaps suddenly, find the time taken by the masses to reach the ground.

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3. A string passes over a weightless pulley and has two weights of 1 kg and 4 kg tide at its two ends. The pulley is hung from the hook of

a spring balance. When the attached weights start moving due to the action of gravity, what will be the reading on the spring balance?

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4. A monkey of mass 40 kg climbs a rope. Which can stand a maximum tension of 600 N. In which of the following cases will the rope break? The monkey

A. climbs up with an acceleration of 6 m $\cdot s^{-2}$

B. climbs down with an acceleration of 4 m $\cdot s^{-2}$

C. climbs up with a uniform speed of 5 m $\cdot s^{-1}$

D. falls down the rope nearly freely under gravity (ignore the mass of the rope).

Answer: A::B::C::D

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5. A cannon is set on a wooden platform fitted with wheels. Total mass of cannon, cannonball, artillery man and platform is M, and that of a cannonball is m. What will be the velocity of the platform when n number of cannonballs are fired horizontally at velocity v?

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6. A weightless string can carry a maximum mass M. what maximum mass can this string raise, at constant acceleration, up to height h in time t?

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7. Air is incident vertically on the wall of a room of area 50 m^2, at a velocity of 100 km $\cdot h^{-1}$. After hitting the wall surface, air moves parallel to the wall. If the density of air is 1.184

$\times 10^{-3}$ $\mathrm{g} \cdot cm^{-3}$. Find the force exerted on the wall by air.

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8. A rocket of total mass 6000 kg (mass of fuel is 5000 kg) is to be launched vertically upwards. If the rate of consumption of the fuel is 60 kg $\cdot s^{-1}$, find the minimum veloctiy of ejection of gas so that the rocket can start its upward motion as soon as the gas is

ejected.What will be the impulse at that time?

(g = 9.8 m $\cdot$ s^{-2})

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9. Mass of sphere A is 100 g and that of B is 250 g. They are put on the smooth surface of a table and are connected to the two ends of an extended, weightless spring. When both spheres are released at the same time, initial acceleration of B becomes 10 cm $\cdot$ s^{-2}

towards east. Find the magnitude and direction of initial acceleration of A.

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10. At the moment of launching, the mass of a rocket is 150 kg and the mass of fuel in it is 450 kg. Maximum velocity of ejection of the spent fuel is 2 km $\cdot s^{-1}$. What should be the rate of consumption of fuel so that the initial acceleration is 30 m $\cdot s^{-2}$?

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11. A disc of mass 10 g can remain in air, stationary in a horizontal position, if 10 marbles hit the disc per second from below. Each marble has a mass of 5 g. find the velocity with which the marbles hit the disc. Assume that the marbles hit the disc perpendicularly and rebound from the disc perpendicularly as well.

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12. A particle of mass 10^{-2}kg, under the action of a force $F(x) = -\frac{k}{2x^2}$, is in motion along the positive x-direction. At time t = 0, the position of the particle is x = 1.0 m, and velcoity = 0, If k = 10^{-2} N $\cdot$ m^2, find the velocity when the particle is at x = 0.50 m.

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ENTRANCE CORNER

1. Satement I: A cloth covers a table. Some dishes are kept on it. The cloth can be pulled out without dislodging the dishes from the table.

Statement II: For every action there is an equal and opposite reaction.

A. Statement I is true, statement II is true, statement II is a correct explanation for statement I.

B. Statement I is true, statement II is true, statement II is not a correct explanation for statement I.

C. Statement I is true, statement II is false.

D. Statement I is false, statement II is true.

Answer: B

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2. Statement I: A reference frame attached to the earth is an inertial frame of reference.

Statement II: The reference frame which has zero acceleration is called a inertial frame of reference.

A. Statement I is true, statement II is true, statement II is a correct explanation for statement I.

B. Statement I is true, statement II is true, statement II is not a correct explanation

for statement I.

C. Statement I is true, statement II is false.

D. Statement I is false, statement II is true.

Answer: D

View Text Solution

3. Statement I: A concept of pseudo forces is valid both for inertial as well as non-inertial frame of reference.

Statement II: A frame accelerated with respect to an inertial frame is a non-inertial frame.

A. Statement I is true, statement II is true, statement II is a correct explanation for statement I.

B. Statement I is true, statement II is true, statement II is not a correct explanation for statement I.

C. Statement I is true, statement II is false.

D. Statement I is false, statement II is true.

Answer: D

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4. Statement I: During free fall of a person one feels weightlessness because his weight becomes zero.

Statement II: He falls with an acceleration of g.

A. Statement I is true, statement II is true, statement II is a correct explanation for statement I.

B. Statement I is true, statement II is true, statement II is not a correct explanation for statement I.

C. Statement I is true, statement II is false.

D. Statement I is false, statement II is true.

Answer: A

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5. Statement I: When a person walks on a rough surface, the net force exerted by surface on the person in the direction of his motion.

Satement II: It is the force exerted by the road on the person that causes the motion.

A. Statement I is true, statement II is true, statement II is a correct explanation for statement I.

B. Statement I is true, statement II is true, statement II is not a correct explanation

for statement I.

C. Statement I is true, statement II is false.

D. Statement I is false, statement II is true.

Answer: D

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MULTIPLE CORRECT ANSWERS TYPE

1. Suppose a body that is acted on by exactly two forces is accelerated. For this situation

mark out the incorrect statements.

A. the body can not move with constant speed

B. the velocity can never be zero

C. the resultant of two forces cannot be zero

D. the two forces must act in the same line

Answer: A::B::D

View Text Solution

2. Which of the following statements can be explained by Newton's second law of motion ?

A. to stop a heavy body (say truck), greater force is needed than to stop a light body (say motorcycle) in the same time if they are moving with same speed

B. for a body of given mass, the greater the speed, the greater the opposing force to

stop the body in a particular time duration

C. to change the momentum of a body by given value, the force required is independent of time

D. the same force acting on two different bodies for same time causes the same change in momentum for the different bodies

Answer: A::B::D

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COMPREHENSION TYPE

1. Read the following passages carefully and answer the questions at the end of them.

A ball of mass 200 g is thrown with a speed 20 m $\cdot$ s^{-1}. The ball strikes a bat and rebounds along the same line at a speed of 40 $m \cdot s^{-1}$. Variation in the interaction force, as long as the ball remains in contact with the bat, is shown in .

What is the speed of the ball at the instant the force acting on it is maximum?

A. 40 m $\cdot$ s^{-1}

B. 30 m $\cdot$ s^{-1}

C. 20 m $\cdot$ s^{-1}

D. 10 m $\cdot$ s^{-1}

Answer: C

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2. Three blocks $m_1 = 10\text{kg}, \quad m_2 = 20 \text{ kg and } m_3 = 30\text{kg}$ are on a smooth horizontal table, connected to the adjacent blocks by light horizontal strings. A horizontal force F = 60 N is applied to m_3 towards right.

The tension (T_1) acting between m_1 and m_2 is

A. 10 N

B. 15 N

C. 20 N

D. 25 N

Answer: A

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3. Three blocks $m_1 = 10\text{kg}, \quad m_2 = 20 \text{ kg and } m_3 = 30\text{kg}$ are on a smooth horizontal table, connected to the adjacent blocks by light horizontal strings. A horizontal force F = 60 N is applied

to m_3 towards right.

Tension(T_2) acting between m_2 and m_3 is

A. 25 N

B. 30 N

C. 24 N

D. 15 N

Answer: B

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4. Three blocks $m_1 = 10\text{kg}, \quad m_2 = 20 \text{ kg and } m_3 = 30\text{kg}$ are on a smooth horizontal table, connected to the adjacent blocks by light horizontal strings. A horizontal force F = 60 N is applied to m_3 towards right.

Tension (T_2) , if all of a sudden the string between $m_1 \text{ and } m_2$ snaps, is

A. 30 N

B. 24 N

C. 25 N

D. 15 N

Answer: B

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5. A stone of mass 0.05 kg is thrown in vertical by upward direction (take g = 10 $m \cdot s^{-2}$). Neglect air friction.

The net force acting on the stone during its upward motion is

A. 0.5 N, upward

B. 0.5 N, downward

C. 5 N, upward

D. zero

Answer: B

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6. A stone of mass 0.05 kg is thrown in vertical by upward direction (take g = 10 $m \cdot s^{-2}$). Neglect air friction.

The net force acting on the stone during its downwards motion is

A. 0.5 N, upward

B. 0.5 N, downward

C. 5 N, upward

D. zero

Answer: B

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INTEGER ANSWER TYPE

1. On a planet X, a man throws a 500 g mass with a speed of 20 m $\cdot$ s^{-1} and catches it as it comes down 20 second later. Find the weight of the mass (in unit).

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2. A monkey of mass 30 kg climbs a rope which can withstand a maximum tension of 360 N. Find the maximum acceleration (in $m \cdot s^{-2}$)

of the climbing monkey which this rope can tolerate. (g = 10 $m \cdot s^{-2}$)

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EXAMINATION ARCHIVE WITH SOLUTIONS(WBCHSE)

1. A block of mass M is pulled along a frictionless horizontal suface by a rope of mass m by applying a horizontal force F at the

other end of the rope. The force exerted by the rope on the block is

A. $\frac{mF}{m+M}$

B. $\frac{mF}{M-m}$

C. $\frac{MF}{M-m}$

D. $\frac{MF}{m+M}$

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2. Two blocks A and B are standing side-by-side touching each other, on a smooth horizontal table. Masses of the blocks are 3 kg and 2 kg respectively. Block A is pushed towards block B with 10 N horizontal force.

How much force does block A apply on block B.

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3. Two blocks A and B are standing side-by-side touching each other, on a smooth horizontal

table. Masses of the blocks are 3 kg and 2 kg respectively. Block A is pushed towards block B with 10 N horizontal force.

If the 10 N horizontal force were applied on block B towards block A, how much force would block B have applied on block A

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4. A gun is mounted on a platform fitted with frictionless wheels. The mass of the plarform with the gun, shells and the operator is M. The

gun fires shells one after another with a velocity v in the horizontal direction. If mass of each shell is m. show that the velocity of recoil of the platform after N shells are fired, is $V_N = \frac{Nmv}{(M - mN)}$.

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5. Which is easier to lift in the air, 1 kg steel or 1 kg of wool?

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6. What is the difference between impulse of a force and impulsive force?

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7. State the law of conservation of momentum.

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8. Establish Newton's third law from Newton's second law.

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9. A batsman deflects a ball by an angle of 45° without changing its initial speed which is equal to 36 km/h. what is the impulse imparted to the ball? Given, mass of ball is 0.157 kg.

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10. In which frame of reference Newton's first law of motion is applicable?

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11. A balloon of mass m descending with an acceleration a. What mass be dropped from the balloon so that it may go up with the same acceleration so that it

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12. A mass of 1 kg is suspended by a thread. It is

(i) lifted up with an acceleration of $4.9 m \cdot s^{-2}$.

A. $3:1$

B. $1:2$

C. $1:3$

D. $2:1$

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13. A mass of 1 kg is suspended by a thread. It is lifted up with an acceleration $4.9 \frac{m}{s^2}$

(ii) lowered with an acceleration of 4.9 m $\cdot s^{-2}$

. The ratio of the tension on the thread is

A. $3:1$

B. $1:2$

C. $1:3$

D. $2:1$

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14. Define inertial and non-inertial frames of reference with example.

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15. Establish Newton's third law of motion from the principle of conservation of linear momentum. A bullet is fired from a gun. Which one will possess greater momentum-gun or bullet?

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16. A balloon of mass m is descending with an acceleration α. What mass should be dropped from the balloon so that it starts moving upward with the same acceleration α?

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17. Define inertial frame of reference.

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1. A smooth massless string passes over a smooth fixed pulley. Two masses m_1 and $m_2(m_1 > m_2)$ are tied at the two ends of the string. The masses are allowed to move under gravity starting from rest. The acceleration of the two masses is

A. $(m_1 + m_2)g$

B. $\dfrac{(m_1 - m_2)}{m_1 + m_2}g$

C. $(m_1 - m_2)g$

D. $\frac{(m_1+m_2)^2}{m_1-m_2}g$

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2. A mass of 1 kg is suspended by means of a thread. The system is lifted up with an acceleration of 4.9 m/s^2

A. $3:1$

B. $1:2$

C. $1:3$

D. $2:1$

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3. A mass of 1 kg is suspended by a thread. It is lifted up with an acceleration $4.9\frac{m}{s^2}$ (ii) lowered with an acceleration of 4.9 m $\cdot$ s^{-2}. The ratio of the tension on the thread is

A. $3:1$

B. $1:2$

C. $1:3$

D. $2:1$

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4. A block of mass 1 kg starts from rest at x = 0 and moves along the x - axis under the action of a force F = kt, where t is time and k = 1 N/s. The distance the block will travel in 6 seconds is

A. 36 m

B. 72 m

C. 108 m

D. 18 m

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5. The velocity v of a particle (under a force F) depends on its distance (x) from the origin (with x > 0) v $\propto = \frac{1}{\sqrt{x}}$ .Find how the

magnitude of the force (F) on the particle depends on x.

A. $F \propto \frac{1}{x^{3/2}}$

B. $F \propto \frac{1}{x}$

C. $F \propto \frac{1}{x^2}$

D. $F \propto x$

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EXAMINATION ARCHIVE WITH SOLUTIONS (AIPMT)

1. The force F acting on a particle of mass m is indicated by the force-time graph shown below. The change in momentum of the particle over the time interval from zero to 8 s is

A. 24 N.s

B. 20 N.s

C. 12 N.s

D. 6 N.s

View Text Solution

2. A balloon with mass m is decending down with an acceleration a (where a $<$ g) . How much mass should be removed from it so that it strts moving up with an acceleration a?

A. $\frac{2ma}{g+a}$

B. $\frac{2ma}{g-a}$

C. $\frac{ma}{g+a}$

D. $\frac{ma}{g-a}$

Watch Video Solution

3. Three blocks A, B and C, of masses 4 kg , 2 kg and 1 kg respectively, are in contact on a frictionless surface, as shown. If a force of 14 N is applied on the 4 kg block, then the contact force between A and B is

A. 2 N

B. 6 N

C. 8 N

D. 18 N

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EXAMINATION ARCHIVE WITH SOLUTIONS (NEET)

1. A girl jumps down from a moving bus, along the direction of motion of the bus, tilting slightly forward. She falls on

(a) sheet of ice

A. In case (a) she falls backward and in case (b) she falls forward

B. in both cases (a) and (b) she falls forward

C. In both cases (a) and (b) she falls backward

D. In case (a) she falls forward and in case (b) she falls backward

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2. A girl jumps down from a moving bus, along the direction of motion of the bus, tilting slightly forward. She falls on

(b) patch of glue.

A. In case (a) she falls backward and in case (b) she falls forward

B. in both cases (a) and (b) she falls forward

C. In both cases (a) and (b) she falls backward

D. In case (a) she falls forward and in case (b) she falls backward

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3. A block of mass m is placed on a smooth inclined wedge ABC of inclination θ as shown in the figure. The wedge is given an acceleration a towards the right. The relation between a and θ for the block to remain stationary on the wadge is

A. a = g cos θ

B. a = $\frac{g}{\sin\theta}$

C. a = $\frac{g}{\text{cosec}\theta}$

D. $a = g \tan\theta$

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CBSE SCANNER

1. Action and reaction forces do not balance each other Why ?

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2. Two masses m_1 and m_2 are connected to the ends of string passing over a pulley. Find the tension and the acceleration associated.

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3. A person of mass m is standing in a lift. Find his apparent weight when the lift is

(i) moving upwards with uniform acceleration a,

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4. A person of mass m is standing in a lift. Find his apparent weight when the lift is

(ii) moving downwards with uniform acceleration a($<$ g),

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5. A person of mass m is standing in a lift. Find his apparent weight when the lift is

(iii) Falling freely (g is the acceleration due to gravity).

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6. Two masses 8 kg and 12 kg are connected at the two ends of a light inextensible string that goes over a frictionless pulley. Find the acceleration of the masses, and the tension in the string when the masses are released.

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7. Define acceleration.

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8. A monkey of mass 40 kg climbs a rope. Which can stand a maximum tension of 600 N. In which of the following cases will the rope break: The monkey

climbs up with an acceleration of 6 m $\cdot s^{-2}$

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9. A monkey of mass 40 kg climbs a rope. Which can stand a maximum tension of 600 N.

In which of the following cases will the rope break: The monkey

climbs down with an acceleration of 4 m $\cdot$ s^{-2}

Watch Video Solution

10. A monkey of mass 40 kg climbs a rope. Which can stand a maximum tension of 600 N. In which of the following cases will the rope break: The monkey

climbs up with a uniform speed of 5 m $\cdot$ s^{-1}

Watch Video Solution

11. A monkey of mass 40 kg climbs a rope. Which can withstand a maximum tension of 600 N. In which of the following cases will the rope break: The monkey

falls down the rope nearly under gravity

[ignor the mass of the rope. Take g = 10 m $\cdot s^{-2}$]

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12. Define impulse. A cricket ball of mass 150 g moving with speed 12 $m \cdot s^{-1}$ is hit by a bat so that the ball is turned back with a velocity of 20 $m \cdot s^{-1}$. Calculate the impulse received by the ball.

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13. Show that Newton's second law of motion is the real law of motion.

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14. A monkey of mass 40 kg climbs on a rope which can withstand a maximum tension of 600 N.In which of the following cases will the rope break? The monkey-

climbs up with an acceleration of 6 m $\cdot s^{-2}$

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15. A monkey of mass 40 kg climbs on a rope which can withstand a maximum tension of 600 N.In which of the following cases with the

rope break? The monkey-

climbs down with an acceleration of 4 m $\cdot s^{-2}$

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16. A monkey of mass 40 kg climbs on a rope which can withstand a maximum tension of 600 N.In which of the following cases with the rope break? The monkey-

climbs up with a uniform speed of 5 m $\cdot s^{-1}$

(Ignore the mass of the rope. Take g = 10 m $\cdot s^{-2}$

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17. A batsman hits back a ball straight in the direction of the bowler without changing its initial speed of 12 m $\cdot s^{-1}$. If the mass of the ball is 0.15 kg, determine the impulse imparted to the ball.(Assume linear motion of the ball)

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18. A bullet of mass 0.04 kg moving with a speed of 90 $m \cdot s^{-1}$ enters a heavy wooden

block and is stopped after a distance of 60 cm. What is the average resistive force exerted by the block on the bullet?

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19. A car and a truck are moving on a level road so that their linear momenta are equal. Which one is moving faster?

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20. Why a cricket player lowers his hands while catching a cricket ball? Explain.

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21. Calculate the net force acting on a body of mass 10 kg moving with a uniform velocity of 2 m/s ?

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22. Show that impulse of a force is equal to change in linear mometum produced by the force.

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23. A lift of mass 400 kg is hung by a wire. Calculate the tension in the wire when the lift is (a) at rest, (b) moving upward with a constant acceleration of 2.0 m/s^2 and (c)

moving downward with an acceleration 2.0 m/s^2.

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24. State and prove the law of conservation of linear momentum. Write its two applications. The linear momentum of a body can change in the direction of applied force. Comment.

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