



PHYSICS

BOOKS - MBD

FORCE AND LAW OF MOTION

Example

1. Which of the following has more inertia :
rubber ball and a stone of the same size ?



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2. Which of the following has more inertia : a bicycle and a train ?



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3. Which of the following has more inertia : a five rupees coin and a one rupee coin ?



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4. 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-keeper. The goal-keeper of 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.



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5. Explain why some of the leaves may get detached from the tree if we vigorously shake its branch.



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6. Why do you fall in the forward direction when a moving bus brakes to a stop and fall backward when it accelerates from rest ?



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7. If action is always equal to reaction, explain how a horse can pull a cart ?



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8. Explain why is it difficult for a fire man to hold a hose, which ejects large amount of water at a high velocity



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9. From a rifle of mass 4 kg, a bullet of mass 50 g is fired with an initial velocity of 35ms^{-1} . Calculate the recoil velocity of the rifle.



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10. Two objects of masses 100 g and 200 g are moving along the same line and direction with velocities of 2ms^{-1} and 1ms^{-1} respectively. They collide and after the collision, the first

object moves with a velocity of $1.67ms^{-1}$

Determine the velocity of the second object.



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11. An object experience a net zero external unbalanced force. Is it possible for the object to be travelling with a non-zero velocity? If yes, state the conditions that must be placed on the magnitude and direction of the velocity. If no, provide a reason.



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12. When a carpet is beaten with a stick, the dust comes out of it ? Explain.



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13. Why is it advised to tie any luggage kept on the roof of a bus with rope ?



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14. A batsman hits a cricket ball which then rolls on a level ground. After covering a short distance, the ball comes to rest. The ball slows to a stop because

A. the batsman did not hit the ball hard enough.

B.

C. velocity is proportional to the force exerted on the ball.

D. there is a force on the ball opposing the motion.

Answer:



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15. A truck starts from rest and rolls down a hill with constant acceleration. It travels a distance of 400 m in 20 s. Find its acceleration. Find the force on it if its mass is 7 metric tonnes.



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16. A stone of 1 kg is thrown with a velocity of 20ms^{-1} across the frozen surface of a lake and comes to rest after travelling a distance of 50 m. What is the force of friction between the stone and the ice ?



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17. A 8000 kg engine pulls a train of 5 wagons, each of 2000 kg, along a horizontal track. If the engine exerts a force of 40000 N and the track offers a friction force of 5000 N, then calculate: the acceleration of the train.



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18. A 8000 kg engine pulls a train of 5 wagons, each of 2000 kg, along a horizontal track. If the engine exerts a force of 40000 N and the

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19. A 8,000 kg engine pulls a train of 5 wagons, each of 2,000 kg along a horizontal track. If the engine exerts a force of 40,000 N and track offers a force of friction of 5,000 N, then calculate the :force of wagon 1 on wagon 2.



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20. An automobile vehicle has mass of 1,500 kg. What must be the force between vehicle and the road if vehicle is to be stopped with negative acceleration of $1.7ms^{-2}$?



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21. What is the momentum of an object of mass m moving with velocity v ?

A. $(mv)^2$

B. mv^2

C. $c(1)(2)mv^2$

D. mv

Answer:



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22. Using a horizontal force of 200 N, we intend to move a wooden cabinet across a floor with constant velocity. What is the friction force that will be exerted on the cabinet ?



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23. Two objects, each of mass 1.5 kg, are moving in the same straight line but in the opposite directions. The velocity of each object is 2.5ms^{-1} before the collision during which they stick together. What will be the velocity of combined object after collision ?



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24. 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.



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25. A hockey ball of mass 200 g travelling at 10m.s^{-1} is struck by a hockey stick so as to return it along its original path with a velocity at 5m.s^{-1} . Calculate the change in momentum occurred in the motion of hockey ball by the force applied by hockey stick.



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26. A bullet of mass 10 kg travelling horizontally with a velocity of 150m.s^{-1} strikes a stationary wooden block and come to rest in

0.03 s. Calculate the distance of penetration of the bullet into the block. Calculate the magnitude of force exerted by the wood in block in the bullet.



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27. An object of mass 1 kg travelling in straight line with a velocity of 10ms^{-1} collides with it and sticks to a stationary wooden block of mass 5 kg. Then both move off together in the same straight line. Calculate the total

momentum before the impact and just after the impact. Also calculate the velocity of combined object.



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28. An object of mass 100 kg is accelerated uniformly from a velocity of 5ms^{-1} to 8ms^{-1} in 6s. Calculate the initial and final momentum of the object. Also find the force exerted on the object.



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29. Akhtar, Kiran and Rahul were riding in a motor car that was moving with a high velocity on an express-way when an insect hit the windshield and got struck on wind-screen.

Akhtar and Kiran started pondering over the situation. Kiran suggested that the insect suffered a greater change in momentum as compared to the change in momentum of motor car (because change in the velocity of insect was much more than that of motor car).

Akhtar said that since the motor car was

moving with a larger velocity, it exerted a larger force on the insect. As a result, the insect died. Rahul while putting in entirely new explanation said that both the motor car and the insect experienced the same force and same change in their momentum. Comment on these suggestions.



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30. How much momentum will a dumb-bell of mass 10 kg transfer to the floor if it falls from

a height of 80 cm ? Take its downward acceleration to be $10ms^{-2}$.



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31. The following is the distance-time table of an object in motion: What conclusion can you draw about acceleration? Is it constant, increasing decreasing or zero?

Time in seconds	Distance in metres
0	0
1	1
2	8
3	27
4	64
5	125
6	216
7	343



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32. The following is the distance-time table of an object in motion: What do you infer about forces acting on object?

Time in seconds	Distance in metres
0	0
1	1
2	8
3	27
4	64
5	125
6	216
7	343



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33. Two persons manage to push a motor car of mass 1,200 kg at uniform velocity on the road. The same motor can be pushed by three persons to produce an acceleration of 0.2ms^{-2} . With what force does each person push the motor car ?(Assume that all persons push motor car with same muscular effort.)



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34. A hammer of mass 500 g moving at 50m.s^{-1} , strikes a nail. The nail stops the hammer in a very short time of 0.01 s. What is the force of the nail on the hammer ?



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36. What are the different types of Forces ?

Explain each with the help of example.



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37. State and explain the Newton's First Law of

Motion.



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38. What is inertia ? What are its different types ? Give examples for each one of them.



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39. State and explain Newton's Second Law of motion with the help of this law how can we measure force.



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40. Derive the mathematical relation for magnitude of force from Newton's Second Law of Motion.



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41. State and explain Newton's third Law of motion.



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42. What is meant by the Law of Conservation of Momentum ? Deduce this law mathematically with the help of Newton's second and third law of motion.



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43. What is force ? Give its units.



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44. Why does the horse rider fall forward when a running horse suddenly stops ?



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45. When a horse suddenly gallops, the rider falls backward. Why ?



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46. Why does a passenger fall forward when he alights from the moving bus ?



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47. Define momentum of a body. Also give its units.



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48. A fast moving bullet when hits the window pane makes a round hole while a stone strikes and shatters it, why ?



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49. Explain how a dirty blanket becomes dust free if it is jerked once or twice ?



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50. Why a fan continues to rotate for sometime even after it is switched off ?



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51. Why does a gun recoil when a bullet is fired from the gun ? Explain.



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52. Why a cricket player lowers his hand while taking of catch of cricket ball ?



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53. Write differences between balanced and unbalanced forces.



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54. Why a boatman exerts a force on water with his oars in the opposite direction to move forward ?



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55. What acceleration will be produced in a body of mass 3 kg, when a force of 12 N is applied?



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56. How much force will be required to produce an acceleration of 4ms^{-2} in a ball of mass 6 kg ?



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57. A man throws a ball of mass 0.5 kg vertically upwards with a velocity of 1ms^{-1} . What will be its initial momentum ? What would be its momentum at the highest point of its reach ?



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58. A steam engine of mass 3×10^4 kg pulls two wagons each of mass 2×10^4 kg with an acceleration of 0.2 m s^{-2} . Neglecting frictional force, calculate the force exerted by the engine.



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acceleration of 0.2ms^{-2} . Neglecting frictional force, calculate the force exerted by the engine.



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60. A bullet of mass 20 g moving with a speed of 500ms^{-1} strikes a wooden block of mass 1 kg and gets embedded in it. Find the speed with which block moves along with the bullet.



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61. A car travelling at the speed of $108\text{km}/\text{h}$ takes 4 s to stop on applying brakes. Calculate the force acting on the car after applying brakes. Total mass of the (including passengers) is 1000 kg.



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62. Which one requires more force, a body of mass 2 kg accelerated at the rate 5ms^{-2} or a body of mass 4 kg accelerated at 2ms^{-2} .



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63. A bullet of mass 0.03 kg is fired from a gun of mass 3 kg which leaves the muzzle of the gun with a velocity of 100ms^{-1} . If bullet takes 0.003 s to come out of the gun then calculate the force acting on the gun.



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64. From a rifle of mass 5000 g a bullet of 20 g is fired with a velocity of 500ms^{-1} with

respect to the ground. Find the velocity of recoil of the rifle.



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65. A girl of 40 kg mass jumps with a horizontal velocity of 5ms^{-1} on a stationary trolley. The wheels of the skate are frictionless. What will be the velocity of the girl in the position of start of the trolley. Suppose no unbalanced force is acting in the horizontal direction.(mass of trolley is 3 kg)



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66. To bring a body into motion, what is required to be done ?



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67. Why does an object fall down ?



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68. Which type of force is required to change the direction of motion of the body - a balanced or unbalanced force ?



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69. Why does a body stop after rolling down for some time ?



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70. How can force of friction be reduced ?



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71. Which scientist postulated the three laws of motion ?



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72. By which other name the first law of motion is known ?



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73. Of heavy and light objects, which have more inertia ?



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74. What is the S.I unit of momentum ?



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75. Why is talcum powder sprinkled on carrom board while playing ?



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76. Why does an athlete run before taking a high jump ?



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77. What is law of conservation of momentum ?



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78. A bus and a ball are moving with the same speed. To stop which one would require more force ?



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79. A vehicle stops on applying brakes. During this activity, what happens to its momentum?



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80. 1 kg wt is equal to how many newtons ?



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81. 1 newton is equal to how many kg wt ?



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82. On which physical quantity inertia of an object depends ?



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83. On which Newton's law of motion, the working principle of rocket is based ?



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