PHYSICS

BOOKS - ICSE

LAWS OF MOTION

Topic 1 2 Marks Questions

1. Identify the non-contact forces:

Gravitational force, Tension force, Friction

force, Magnetic force, Air resistance force, Electrostatic force.

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2. Name two contact force?

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3. State two similarities between contact and non contact force.

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4. What is the effect of force on a rigid body ?

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5. What is the effect of force on non-rigid body?

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Topic 1 3 Marks Questions

1. What are non-contact forces ?

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2. State one factor on which the magnitude of a non-contact force depends. How does it depend on the factor stated by you?

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3. What are the differences between contact and non contact forces?

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4. In which of the following events non-contact forces play the key role?

(a) Falling of apple from tree

(b) A football is kicked.

(c) Iron pins are attracted towards a magnet

(d) A porter carries a load.

(e) Charged comb attracts small pieces of paper.

(f) A tug-of-war

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Topic 1 4 Marks Questions

1. Discuss the effects of force with examples.

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Topic 2 2 Marks Questions

1. Mass of a moving body is doubled and velocity is halved . What will be the change in momentum ?

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2. Define linear momentum. On what factors it depends?

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3. Name the S.I. unit of force and define it.

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4. A body of mass 5 kg is moving with velocity $2ms^{-1}$. Calculate its linear momentum.

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5. Define linear momentum and state its S.I. unit.

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6. The linear momentum of a ball of mass 50 g is 0.5 kg m s^{-1}. Find its velocity.

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7. A force of 15 N acts on a body of mass 2 kg. Calculate the acceleration produced.

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8. Calculate the magnitude of force which when applied on a body of mass 0.5 kg produces an acceleration of $5\mathrm{m\ s^{-2}}$.

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9. Write the mathematical form of Newton.s second law of motion. State the conditions if any.

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10. Draw graphs to show the dependence of acceleration on force for a constant mass.

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11. Draw graphs to show the dependence of force on mass for a constant acceleration

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12. How does the acceleration produced by a given force depend on the mass of the body?

Draw a graph to show it.

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13. State Newton's third law of motion.

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14. A light ball falling on ground, after striking the ground rises upwards. Explain the reason.

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15. What is meant by the term inertia?

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16. State and explain the law of inertia (or Newton's first law of motion).

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17. Name the factor on which the inertia of a body depends and state how does it depend

on the factor stated above.

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18. Name the two kinds of inertia.

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19. Give one example in each of the following

constant

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20. Give one example of the following:

inertia of motion.

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21. Why does a person tend to fall when he jumps out from a moving train and tries to stop immediately?

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22. Why does a coin, placed on a card, drop into the tumbler when the card is rapidly flicked with a finger?

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23. “When a train suddenly moves forward, the passenger standing in the compartment tends to fall backwards". Explain.

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24. "People often shake branches of a tree in an attempt to cause the fruits to fall." Explain.

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25. Explain the following

After alighting from a moving bus, one has to run for some distance in the direction of bus in order to avoid falling.

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26. Dust particles are removed from a carpet by beating it.

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27. A ball is hanging by string from the ceiling of the roof. Draw a neat labelled diagram showing the forces acting on the ball and the string.

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28. A spring is compressed against a rigid wall. Draw a neat and labeled diagram showing the forces acting on the spring.

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29. A wooden block is placed on a table top. Name the forces acting on the block and draw a neat and labelled diagram to show the point of application and direction of these forces.

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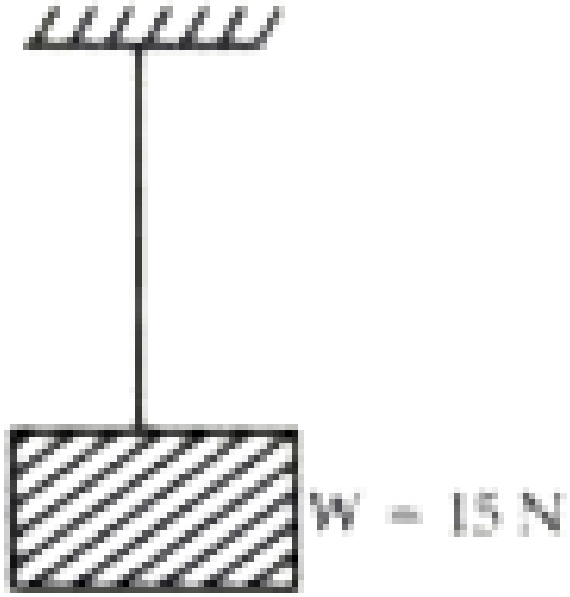
30. In the Fig., a block of weight 15 N is hanging from a rigid support by a string. What force is exerted by (a) a block on the string and (b) a string on the block? Name and show them in the diagram.



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Topic 2 3 Marks Questions

1. A truck carrying 500 kg sand was moving with a velocity $15 \mathrm{ms}^{-1}$. After disposal of 200 kg sand what should be the velocity of the truck to maintain same momentum as before? (say mass of truck = 1000 kg)

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2. State that which is action and which is reaction in the following cases: A person moving on the floor

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3. State that which is action and which is reaction in the following cases: Firing a bullet from a gun

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4. Identify action and reaction forces in the following cases: When you jump to land from a boat.

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5. State Newton.s second law of motion.

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6. Show that the rate of change of momentum = mass x acceleration. Under what condition does this relation hold?

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7. Two bodies A and B of same mass are moving with velocities v and 2v, respectively. Compare their inertia

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8. Two bodies A and B of same mass are moving with velocities v and 2v, respectively. Compare their momentum.

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9. A force causes an acceleration of $10\mathrm{m\ s^{-2}}$ in a body of mass 500 g. What acceleration will be caused by the same force in a body of mass 5 kg?

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10. A force acts for 0.1 s on a body of mass 2.0 kg initially at rest. The force is then withdrawn and the body moves with a velocity of $2\mathrm{m\ s^{-1}}$. Find the magnitude of the force.

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11. How can Newton.s first law of motion be obtained from the second law of motion?

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Topic 2 4 Marks Questions

1. A body of mass 500 g, initially at rest, is acted upon by a force which causes it to move a distance of 4 m in 2 s, Calculate the force applied.

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2. A car of mass 480 kg moving at a speed of 54 km per hour is stopped in 10 s. Calculate the force applied by the brakes.

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3. How the S.I. unit and C.G.S. unit of force are related ?

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4. A ball of mass 10 g is moving with a velocity of $50 \mathrm{ms}^{-1}$. On applying a constant force on ball for 2.0 s, it acquires a velocity of $70 \mathrm{ms}^{-1}$. Calculate the initial momentum of ball

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5. A ball of mass 10 g is moving with a velocity of $50 \mathrm{ms}^{-1}$. On applying a constant force on ball for 2.0 s, it acquires a velocity of $70 \mathrm{ms}^{-1}$. Calculate the final momentum of ball

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6. A ball of mass 10 g is moving with a velocity of $50 \mathrm{ms}^{-1}$. On applying a constant force on

ball for 2.0 s, it acquires a velocity of $70 \mathrm{ms}^{-1}$. Calculate the rate of change of momentum

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7. A ball of mass 10 g is moving with a velocity of $50 \mathrm{ms}^{-1}$. On applying a constant force on ball for 2.0 s, it acquires a velocity of $70 \mathrm{ms}^{-1}$. Calculate the acceleration of ball

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8. A ball of mass 10 g is moving with a velocity of $50 \mathrm{ms}^{-1}$. On applying a constant force on ball for 2.0 s, it acquires a velocity of $70 \mathrm{ms}^{-1}$. Calculate the magnitude of force applied.

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9. A cricket ball of mass 100 g moving with a speed of $30 \mathrm{ms}^{-1}$ is brought to rest by a player in 0.03 s. Find the change in momentum of ball.

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10. A cricket ball of mass 100 g moving with a speed of $30\mathrm{ms}^{-1}$ is brought to rest by a player in 0.03 s. Find the average force applied by the player.

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11. Two balls A and B of masses m and 2 m are in motion with velocities 2v and v, respectively. Compare: Their inertia.

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12. Two balls A and B of masses m and 2 m are in motion with velocities 2v and v, respectively. Compare: Their momentum.

Watch Video Solution

13. Two balls A and B of masses m and 2 m are in motion with velocities 2v and v, respectively.

Compare: The force needed to stop them in the same

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14. A force of 10 N acts on a body of mass 2 kg for 3s , initially at rest. Calculate the velocity acquired by the body

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15. A force of 10 N acts on a body of mass 2 kg for 3s , initially at rest. Calculate change in momentum of the body.

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16. A force acts for 10 s on a stationary body of mass 100 kg, after which the force ceases to act. The body moves through a distance of 100 m in the next 5 s. Calculate: The velocity acquired by the body

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17. A force acts for 10 s on a stationary body of mass 100 kg, after which the force ceases to act. The body moves through a distance of 100 m in the next 5 s. Calculate: The acceleration produced by the force

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18. A force acts for 10 s on a stationary body of mass 100 kg, after which the force ceases to

act. The body moves through a distance of 100 m in the next 5 s. Calculate: The magnitude of the force.

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19. A car is moving with a uniform velocity $30\mathrm{ms}^{-1}$. It is stopped in 2 s by applying a force of 1500 N through its brakes.

Calculate the following values: The change in momentum of car.

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20. A car is moving with a uniform velocity $30 \mathrm{ms}^{-1}$. It is stopped in 2 s by applying a force of 1500 N through its brakes.

Calculate the following values: The retardation produced in car.

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21. A car is moving with a uniform velocity $30 \mathrm{ms}^{-1}$. It is stopped in 2 s by applying a

force of 1500 N through its brakes.

Calculate the following values: The mass of car.

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22. A bullet of mass 50 g moving with an initial velocity $100 \mathrm{m\ s^{-1}}$ strikes a wooden block and comes to rest after penetrating a distance 2 cm in it. Calculate : Initial momentum of the bullet

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23. A bullet of mass 50 g moving with an initial velocity $100 \mathrm{m\ s^{-1}}$ strikes a wooden block and comes to rest after penetrating a distance 2 cm in it. Calculate : Final momentum of the bullet

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24. A bullet of mass 50 g moving with an initial velocity $100 \mathrm{m\ s^{-1}}$ strikes a wooden block and comes to rest after penetrating a distance 2

cm in it. Calculate : Retardation caused by the wooden block

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25. A bullet of mass 50 g moving with an initial velocity $100\mathrm{m\ s^{-1}}$ strikes a wooden block and comes to rest after penetrating a distance 2 cm in it. Calculate : Resistive force exerted by the wooden block.

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26. Use Newton.s second law of motion to explain the following instances:

You pull your hands back while catching a fast moving cricket ball.

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27. Use Newton.s second law of motion to explain the following instances:

You prefer to land on sand instead of hard floor while taking a high jump.

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28. State that which is action and which is reaction in the following cases: Firing a bullet from a gun

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29. State that which is action and which is reaction in the following cases: (b) Hammering a nail

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30. State that which is action and which is reaction in the following cases: A book lying on a table

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31. State that which is action and which is reaction in the following cases: A moving rocket

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32. State that which is action and which is reaction in the following cases: A person moving on the floor

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33. State that which is action and which is reaction in the following cases: A moving train colliding with a stationary train.

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34. Explain how from Newton.s 1^{st} law of motion the qualitative idea of inertia and force develops.

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Topic 3 2 Marks Questions

1. Define gravitational constant G.

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2. The force of attraction between two bodies at certain separation is 10 N. What will be the force of attraction between them if the separation between them is reduced to half?

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3. Mass of a body is 5 kg. What is its weight ?

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4. What is the force of attraction between two masses each of 1 kg kept at a separation of 1 m?

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5. Calculate the weight of a body of mass 10 kg in kgf . Take $g = 9.8\mathrm{m\ s^{-2}}$.

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6. Calculate the weight of a body of mass 10 kg in newton . Take $g = 9.8\mathrm{m\ s^{-2}}$.

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7. A body is projected vertically upward with an initial velocity u. If acceleration due to gravity is g, find the time for which it remains in air.

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8. An object falling freely from rest reaches ground in 2 s. If acceleration due to gravity is $9.8 \mathrm{m\ s^{-2}}$, then what will be the velocity of object on reaching the ground?

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9. The value of g at the centre of Earth is zero. What will be the weight of a body of mass 10 kg at the centre of the Earth?

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Topic 3 3 Marks Questions

1. State Newton's law of gravitation.

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2. The weight of a body on Earth is 98 N, where acceleration due to gravity is $9.8 \mathrm{m\ s^{-2}}$? What will be its weight on the Moon, where acceleration due to gravity is $1.6 \mathrm{m\ s^{-2}}$?

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3. The weight of a body on Earth is 98 N, where acceleration due to gravity is $9.8 \mathrm{m\ s^{-2}}$? What will be its weight on the Moon, where acceleration due to gravity is $1.6 \mathrm{m\ s^{-2}}$?

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4. A man weighs 600 N on the Earth. What would be his approximate weight on the Moon

if the value of acceleration due to gravity of moon is $1/6^{th}$ of that of the earth?

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5. A ball is released from a height and it reaches the ground in 3 s. If $g = 9.8\mathrm{m\,s^{-2}}$, find the value of the height from which the ball was released.

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6. A ball is released from a height and it reaches the ground in 3 s. If $g = 9.8\mathrm{m\,s^{-2}}$, find the value of the velocity with which the ball will strike the ground.

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7. Distinguish between mass and weight .

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Topic 3 4 Marks Questions

1. A ball is thrown vertically upwards. It goes to a height 20 m and then returns to the ground. Taking acceleration due to gravity g to be $10\mathrm{m\ s^{-2}}$?, find the initial velocity of the ball

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2. A ball is thrown vertically upwards. It goes to a height 20 m and then returns to the ground. Taking acceleration due to gravity g to

be $10\mathrm{m\ s^{-2}}$?, find the final velocity of ball on reaching the ground

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3. A ball is thrown vertically upwards. It goes to a height 20 m and then returns to the ground. Taking acceleration due to gravity g to be $10\mathrm{m\ s^{-2}}$?, find the total time of journey of ball.

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4. A ball is thrown vertically upwards. It returns 6 s later. Calculate the greatest height reached by the ball

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5. A ball is thrown vertically upwards. It returns 6 s later. Calculate the initial velocity of the ball. (Take $g = 10\mathrm{m\ s^{-2}}$)

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6. How long will a stone take to fall to the ground from the top of a building 80 m high and What will be the velocity of the stone on reaching the ground? (Take $g = 10\mathrm{m\ s^{-2}}$)

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7. A pebble is dropped freely in a well from its top. It takes 20 s for the pebble to reach the water surface in the well. Taking $g = 10\ \mathrm{m\ s^{-2}}$ and speed of sound = $330\mathrm{m\ s^{-1}}$. Find the depth of water surface

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8. A pebble is dropped freely in a well from its top. It takes 20 s for the pebble to reach the water surface in the well. Taking $g = 10\ \mathrm{m\ s^{-2}}$ and speed of sound = $330\mathrm{m\ s^{-1}}$. Find the time when sound is heard after the pebble is dropped.

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9. A ball is thrown vertically upwards from the top of a tower with an initial velocity of $19.6\mathrm{m\ s^{-1}}$. The ball reaches the ground after 5 s. Calculate the height of the tower . Take $g = 9.8\mathrm{ms^{-2}}$?

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10. A ball is thrown vertically upwards from the top of a tower with an initial velocity of $19.6\mathrm{m\ s^{-1}}$. The ball reaches the ground after

5 s. Calculate the velocity of the ball on reaching the ground.Take $g = 9.8\text{ms}^{-2}$?

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Examples

1. How much force is required to produce an acceleration of $2ms^{-2}$ in a body of mass 0.8 kg ?

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2. A force acts for 0.1 s on a body of mass 1.2 kg initially at rest. The force then ceases to act and the body moves thorugh 2 m in the next 1.0 s . Find the magnitude of force.

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3. A ball of mass 10 g is moving with a velocity of $50 \mathrm{ms}^{-1}$. On applying a constant force on ball for 2.0 s, it acquires a velocity of $70 \mathrm{ms}^{-1}$. Calculate the initial momentum of ball

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4. A ball of mass 10 g is moving with a velocity of $50 \mathrm{ms}^{-1}$. On applying a constant force on ball for 2.0 s, it acquires a velocity of $70 \mathrm{ms}^{-1}$. Calculate the final momentum of ball

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5. A ball of mass 10 g is moving with a velocity of $50 \mathrm{ms}^{-1}$. On applying a constant force on

ball for 2.0 s, it acquires a velocity of $70 \mathrm{ms}^{-1}$. Calculate the rate of change of momentum

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6. A ball of mass 10 g is moving with a velocity of $50 \mathrm{ms}^{-1}$. On applying a constant force on ball for 2.0 s, it acquires a velocity of $70 \mathrm{ms}^{-1}$. Calculate the acceleration of ball

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7. A ball of mass 10 g is moving with a velocity of $50 \mathrm{ms}^{-1}$. On applying a constant force on ball for 2.0 s, it acquires a velocity of $70 \mathrm{ms}^{-1}$. Calculate the magnitude of force applied.

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8. A cricket ball of mass 100 g moving with a speed of $30 \mathrm{ms}^{-1}$ is brought to rest by a player in 0.03 s. Find the change in momentum of ball.

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9. A cricket ball of mass 100 g moving with a speed of $30\mathrm{ms}^{-1}$ is brought to rest by a player in 0.03 s. Find the average force applied by the player.

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10. Calculate the gravitational force of attraction between two bodies of masses 40

kg and 80 kg separated by a distance 15 m. Take $G = 6.7 \times 10^{-11} Nm^2 kg^{-2}$

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11. Taking the mass of earth equal to 6×10^{24} kg and its radius equal to 6.4×10^6 m, calculate the value of acceleration due to gravity at a height of 2000 km above the earth surface. Take G = $6.7 \times 10^{-11} Nm^2 kg^{-2}$

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12. A body of mass 10 kg is taken from the earth to the moon. If the value of g on earth is 9.8 m s^{-2} and on moon is 1.6 m s^{-2}, find the weight of the body on earth.

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13. A body of mass 10 kg is taken from the earth to the moon. If the value of g on earth is 9.8 m s^{-2} and on moon is 1.6 m s^{-2}, find the mass and weight of the body on moon.

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14. A stone at rest is dropped from a height and falls freely under gravity. Calculate the distance covered by it in the first two seconds. ($g = 9.8\ ms^{-2}$)

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15. A stone is dropped freely in a river from a bridge. It takes 5 s to touch the water surface

in the river. Calculate : the height of the bridge from the water level .

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16. A stone is dropped freely in a river from a bridge. It takes 5 s to touch the water surface in the river. Calculate :the distance covered by the stone in the first 2 s (g = 9.8 ms^{-2}).

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17. A body is dropped freely under gravity from the top of a tower of height 78.4 m. Calculate :

(i) the time to reach the ground .

Take g = 9.8 ms^{-2}.

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18. A body is dropped freely under gravity from the top of a tower of height 78.4 m. Calculate :

the velocity with which it strikes the ground.

Take g = 9.8 ms^{-2}.

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19. A ball is thrown vertically upwards. It goes to a height 19.6 m and then comes back to the ground, Find the initial velocity of the ball .

Take g = 9.8 ms^{-2}

Watch Video Solution

20. A ball is thrown vertically upwards. It goes to a height 19.6 m and then comes back to the

ground, Find the initial velocity of the ball .

Take g = 9.8 ms^{-2}

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21. A ball is thrown vertically upwards. It goes to a height 19.6 m and then comes back to the ground, Find the final velocity of the ball when it strikes the ground.

Take g = 9.8 ms^{-2}

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22. A ball is thrown vertically upwards from the top of a building of height 24.5 m with an initial velocity 19.6 ms^{-1}. Taking g = 9.8 ms, calculate : the velocity with which it will strike the ground .

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23. A ball is thrown vertically upwards from the top of a building of height 24.5 m with an initial velocity 19.6 ms^{-1}. Taking g = 9.8 ms,

calculate : the velocity with which it will strike the ground .

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24. A ball is thrown vertically upwards from the top of a building of height 24.5 m with an initial velocity 19.6 ms^{-1}. Taking g = 9.8 ms, calculate : the total time of journey.

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Exercise 3 A

1. Explain giving two examples Contact forces .

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2. What are non-contact forces ?

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3. Classify the following amongst contact and non contact forces :

frictional force

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4. Classify the following amongst contact and non contact forces :

normal reaction force.

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5. Classify the following amongst contact and non contact forces :

force of tension in a string

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6. Classify the following amongst contact and non contact forces :

gravitational force.

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7. Classify the following amongst contact and non contact forces :

electrostatic force

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8. Identify the non-contact forces:

Gravitational force, Tension force, Friction force, Magnetic force, Air resistance force, Electrostatic force.

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9. Give one example where :the force is of contact .

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10. Give one example where : force is at a distance .

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11. A ball is hanging by string from the ceiling of the roof. Draw a neat labelled diagram showing the forces acting on the ball and the string.

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12. A spring is compressed against a rigid wall. Draw a neat and labeled diagram showing the forces acting on the spring.

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13. A wooden block is placed on a table top. Name the forces acting on the block and draw a neat and labelled diagram to show the point of application and direction of these forces.

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14. State one factor on which the magnitude of a non-contact force depends. How does it depend on the factor stated by you?

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15. The separation between two masses is reduced to half. How is the magnitude of gravitational force between them affected ?

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16. State the effects of a force applied on (i) a non rigid, and (ii) a rigid body. How does the effect of the force differ in the two cases ?

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17. Give one example of the following case where a force : stops a moving body

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18. Give one example of the following case where a force : moves a stationary body.

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19. Give one example of the following case where a force : changes the shape of a body

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Exercise 3 A Multiple Choice Type

1. Which of the following is a contact force :

A. electrostatic force

B. gravitational force

C. frictional force

D. magnetic force

Answer: C

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2. Identify the non-contact forces:

Gravitational force, Tension force, Friction force, Magnetic force, Air resistance force, Electrostatic force.

A. force of reaction

B. force due to gravity

C. tension in string

D. force of friction

Answer: B

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Exercise 3 B

1. Name the physical quantity which causes motion in a body.

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2. Is force needed to keep a moving body in motion ?

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3. A ball moving on a table top eventually stops. Explain the reason.

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4. A ball is moving on a perfectly smooth horizontal surface. If no force is applied on it, will its speed decrease, increase or remain unchanged ?

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5. What is Galileo's law of inertia ?

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6. State and explain the law of inertia (or Newton's first law of motion).

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7. State and explain the law of inertia (or Newton's first law of motion).

Watch Video Solution

8. What is meant by the term inertia?

Watch Video Solution

9. Give qualitative definition of force on the basis of Newton's first law of motion.

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10. Name the factor on which inertia of a body depends and state how it depends on the factor stated by you.

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11. Give two examples to show that greater the mass, greater is the inertia of the body.

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12. More the mass, more difficult it is to move the body from rest'. Explain this statement by giving an example.

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13. Name the two kinds of inertia.

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14. Give one example of the following:

inertia of rest .

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15. Give one example of the following:

inertia of motion.

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16. Two equal and opposite forces act on a stationary body. Will the body move ? Give reason to your answer.

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17. Two equal and opposite forces act on a moving object. How is its motion affected ? Give reason.

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18. An aeroplane is moving uniformly at a constant eight under the action of two forces (i) upward force (lift) and (ii) downward force (weight). What is the net force on the aeroplane.

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19. Why does a person tend to fall when he jumps out from a moving train and tries to stop immediately?

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20. Why does a ball thrown vertically upwards in a moving train, come back to the thrower's hand ?

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21. Explain the following

When a train suddenly moves forward, the passenger standing in the compartment tends to fall backwards.

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22. Explain the following

When a corridor train suddenly starts, the sliding doors of some compartments may open.

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23. Explain the following

People often shake branches of a tree for getting down its fruits.

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24. Explain the following

After alighting from a moving bus, one has to run for some distance in the direction of bus in order to avoid falling.

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25. Explain the following

Dust particles are removed from a carpet by

beating it.

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26. Explain the following

It is advantageous to run before taking a long jump.

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Exercise 3 B Multiple Choice Type

1. The property of inertia is more in :

A. a car

B. a truck

C. a horse cart

D. a toy car.

Answer: B

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2. A tennis ball and a cricket ball, both are stationary. To start motion in them :

A. a less force is required for the cricket ball than for the tennis ball

B. a less force is required for the tennis ball than for the cricket ball

C. same force is required for both the balls

D. nothing can be said.

Answer: B

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3. A force is needed to:

A. change the state of motion or state of rest of the body

B. keep the body in motion

C. keep the body stationary

D. keep the velocity of body constant.

Answer: A

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Exercise 3 C

1. Name the two factors on which the force needed to stop a moving body in a given time, depends.

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2. Define linear momentum and state its S.I. unit.

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3. A body of mass m moving with a velocity v is acted upon by a force. Write expression for change in momentum of the following case: when $v < \ < c$

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4. A body of mass m moving with a velocity v is acted upon by a force. Write expression for

change in momentum of the following case:

when $v \to c$

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5. A body of mass m moving with a velocity v is acted upon by a force. Write expression for change in momentum of the following case:

when $v < \ < c$

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6. Show that the rate of change of momentum = mass $\times$ acceleration. Under what condition does this relation hold ?

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7. Two bodies A and B of same mass are moving with velocities v and 2v, respectively. Compare their inertia

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8. Two balls A and B of masses m and 2 m are in motion with velocities 2v and v, respectively. Compare: Their momentum.

Watch Video Solution

9. Two balls A and B of masses m and 2 m are in motion with velocities 2v and v, respectively. Compare: Their inertia.

Watch Video Solution

10. Two balls A and B of masses m and 2 m are in motion with velocities 2v and v, respectively. Compare: Their momentum.

Watch Video Solution

11. Two balls A and B of masses m and 2 m are in motion with velocities 2v and v, respectively. Compare: The force needed to stop them in the same

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12. State Newton.s second law of motion.

Watch Video Solution

13. How does Newton's second law of motion differ from first law of motion ?

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14. Write the mathematical form of Newton.s second law of motion. State the conditions if

any.

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15. State Newton's second law of motion. Under what condition does it take the form F = ma ?

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16. How can Newton.s first law of motion be obtained from the second law of motion?

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17. Draw graphs to show the dependence of acceleration on force for a constant mass.

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18. Draw graphs to show the dependence of force on mass for a constant acceleration .

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19. How does the acceleration produced by a given force depend on mass of the body ? Draw a graph to show it.

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20. Name the S.I. unit of force and define it.

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21. What is the C.G.S. unit of force ? How is it defined?

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22. State the S.I. and C.G.S. units of density. How are they related ?

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23. Why does a glass vessel break when it falls on a hard floor, but it does not break when it falls on a carpet ?

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24. Use Newton.s second law of motion to explain the following instances:

You pull your hands back while catching a fast moving cricket ball.

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25. Use Newton.s second law of motion to explain the following instances:

You prefer to land on sand instead of hard floor while taking a high jump.

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Exercise 3 C Multiple Choice Type

1. The linear momentum of a body of mass m moving with velocity v is :

A. v/m

B. m/v

C. mv

D. 1/mv

Answer: C

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2. The unit of linear momentum is :

A. N s

B. $kgms^{-2}$

C. Ns^{-1}

D. kg^2ms^{-1}

Answer: A

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3. The correct form of Newton's second law is :

A. $F = \frac{\Delta p}{\Delta t}$

B. $F = m\frac{\Delta v}{\Delta t}$

C. $F = v\frac{\Delta m}{\Delta t}$

D. $F = mv$

Answer: A

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4. The acceleration produced in a body by a force of given magnitude depends on

A. size of the body

B. shape of the body

C. mass of the body

D. none of these.

Answer: C

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Exercise 3 C Numericals

1. A body of mass 5 kg is moving with velocity 2 ms^{-1}. Calculate its linear momentum.

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2. The linear momentum of a ball of mass 50 g is 0.5 kg m s^{-1}. Find its velocity.

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3. A force of 15 N acts on a body of mass 2 kg. Calculate the acceleration produced.

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4. A force of 10 N acts on a body of mass 5 kg. Find the acceleration produced.

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5. Calculate the magnitude of force which when applied on a body of mass 0.5 kg produces an acceleration of 5 ms^{-2}

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6. A force of 10 N acts on a body of mass 2 kg for 3s , initially at rest. Calculate the velocity acquired by the body

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7. A force of 10 N acts on a body of mass 2 kg for 3s , initially at rest. Calculate change in momentum of the body.

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8. A force acts for 10 s on a stationary body of mass 100 kg, after which the force ceases to act. The body moves through a distance of 100 m in the next 5 s. Calculate: The velocity acquired by the body

 Watch Video Solution

9. A force acts for 10 s on a stationary body of mass 100 kg, after which the force ceases to act. The body moves through a distance of 100

m in the next 5 s. Calculate: The acceleration produced by the force

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10. A force acts for 10 s on a stationary body of mass 100 kg, after which the force ceases to act. The body moves through a distance of 100 m in the next 5 s. Calculate: The magnitude of the force.

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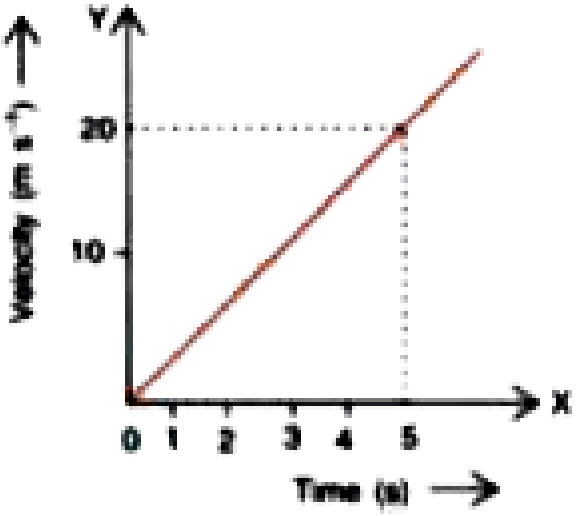
11. Fig. shows the velocity-time graph of a particle of mass 100 g moving in a straight line. Calculate the force acting on the particle.



(Hint : Acceleration = slope of v-t graph)

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12. A force causes an acceleration of 10 m s^{-2} in a body of mass 500 g. What acceleration will be caused by the same force in a body of mass 5 kg?

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13. A cricket ball of mass 150 g moving at a speed of 25 ms^{-1} is brought to rest by a player in 0.03 s. Find the average force applied by the player.

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14. A force acts for 0.1 s on a body of mass 2 kg initially at rest. The force is then withdrawn and the body moves with a velocity of 2 m/s. Find the magnitude of force.

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15. A body of mass 500 g, initially at rest, is acted upon by a force which causes it to move

a distance of 4 m in 2 s, Calculate the force applied.

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16. A car of mass 480 kg moving at a speed of 54 km per hour is stopped in 10 s. Calculate the force applied by the brakes.

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17. A car is moving with a uniform velocity $30 \mathrm{ms}^{-1}$. It is stopped in 2 s by applying a force of 1500 N through its brakes.

Calculate the following values: The change in momentum of car.

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18. A car is moving with a uniform velocity $30 \mathrm{ms}^{-1}$. It is stopped in 2 s by applying a force of 1500 N through its brakes.

Calculate the following values: The retardation produced in car.

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19. A car is moving with a uniform velocity $30\mathrm{ms}^{-1}$. It is stopped in 2 s by applying a force of 1500 N through its brakes.

Calculate the following values: The mass of car.

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20. A bullet of mass 50 g moving with an initial velocity $100 \mathrm{m\ s^{-1}}$ strikes a wooden block and comes to rest after penetrating a distance 2 cm in it. Calculate : Initial momentum of the bullet

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21. A bullet of mass 50 g moving with an initial velocity $100 \mathrm{m\ s^{-1}}$ strikes a wooden block and comes to rest after penetrating a distance 2

cm in it. Calculate : Final momentum of the bullet

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22. A bullet of mass 50 g moving with an initial velocity $100\mathrm{m\ s^{-1}}$ strikes a wooden block and comes to rest after penetrating a distance 2 cm in it. Calculate : Retardation caused by the wooden block

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23. A bullet of mass 50 g moving with an initial velocity $100 \mathrm{m\ s^{-1}}$ strikes a wooden block and comes to rest after penetrating a distance 2 cm in it. Calculate : Resistive force exerted by the wooden block.

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Exercise 3 D

1. State the usefulness of Newton's third law of motion.

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2. State that which is action and which is reaction in the following cases: Firing a bullet from a gun

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3. State that which is action and which is reaction in the following cases: (b) Hammering a nail

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4. State that which is action and which is reaction in the following cases: A book lying on a table

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5. State that which is action and which is reaction in the following cases: A moving rocket

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6. State that which is action and which is reaction in the following cases: A person moving on the floor

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7. State that which is action and which is reaction in the following cases: A moving train colliding with a stationary train.

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8. Explain the motion of a rocket with the help of Newton's third law.

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9. When a shot is fired from a gun, the gun gets recoiled. Explain.

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10. When you step ashore from a stationary boat, it tends to leave the shore. Explain.

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11. When two spring balances joined at their free ends, are pulled apart, both show the same reading. Explain.

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12. To move a boat ahead in water, the boatman has to push the water backwards by his oar. Explain.

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13. A person pushing a wall hard is liable to fall back. Give reason.

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14. The action and reaction both act simultaneously.' Is this statement true ?

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15. The action and reaction are equal in magnitude'. Is this statement true ?

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16. A light ball falling on ground, after striking the ground rises upwards. Explain the reason.

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17. Comment on the statement 'the sum of action and reaction on a body is zero'.

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Exercise 3 D Mutliple Choice Type

1. Newton's third law :

A. defines the force qualitatively

B. defines the force quantitatively

C. explains the way a force acts on a body

D. gives the direction of force.

Answer: C

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2. Action and reaction act on the :

A. same body in opposite directions

B. different bodies in opposite directions

C. different bodies, but in same direction

D. same body in same direction.

Answer: B

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Exercise 3 D Numerical

1. A boy pushes a wall with a force of 10 N towards east. What force is exerted by the wall on the boy ?

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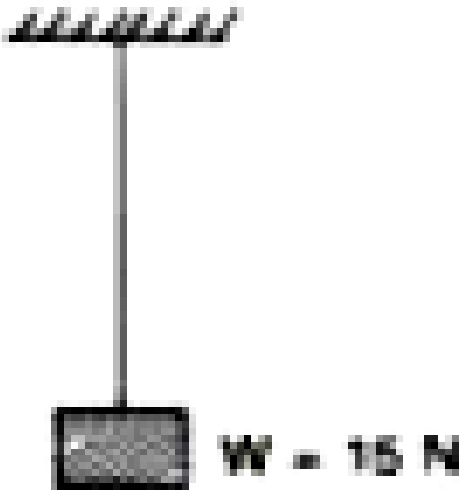
2. In Fig. a block of weight 15 N is hanging from a rigid support by a string. What force is exerted by



block on the string

Name them and show them in the diagram .

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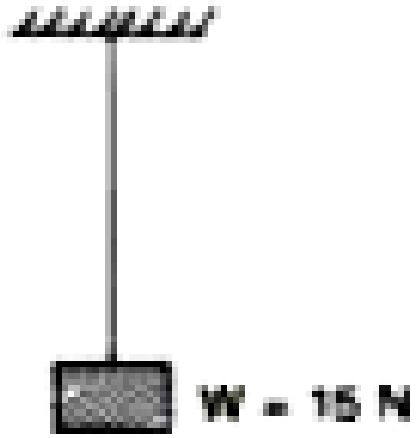
3. In Fig. a block of weight 15 N is hanging from a rigid support by a string. What force is

exerted by



string on the block.

Name them and show them in the diagram .

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Exercise 3 E

1. State Newton's law of gravitational.

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2. State whether the gravitational force between two masses is attractive or repulsive ?

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3. Write an expression for the gravitational force of attraction between two bodies of masses m_1 and m_2 separated by a distance r .

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4. How does the force of attraction between the two bodies depend upon their masses and distance between them ? A student thought that two bricks tied together would fall faster than a single one under the action of gravity.

Do you agree with his hypothesis or not ? Comment.

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5. How is the gravitational force between two masses affected if the separation between them is doubled ?

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6. Define gravitational constant G.

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7. Define gravitational constant G.

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8. What is the importance of universal law of gravitation?

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9. What do you understand by the term force due to gravity ?

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10. Write an expression for the force due to gravity on a body of mass m and explain the meaning of the symbols used in it.

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11. Define the term acceleration due to gravity. State its average value.

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12. Write down the average value of g on the earth's surface.

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13. How is the acceleration due to gravity on the surface of the earth related to its mass and radius ?

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14. How are g and G related ?

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15. A body falls freely under gravity from rest and reaches the ground in time t. Write an expression for the height fallen by the body.

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16. A body is thrown vertically upwards with an initial velocity u. Write an expression for the maximum height attained by the body.

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17. Define the terms mass and weight.

Watch Video Solution

18. State three differences between mass and weight.

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19. Name the S.I. unit of mass and define it.

Watch Video Solution

20. State the S.I. units of weight .

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21. The weight of an object at the centre of the earth of radius R, is

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22. Which quantity : mass or weight, does not change by change of place ?

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23. Explain the meaning of the following statement '1 kgf = 9.8 N' .

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Exercise 3 E Multiple Choice Type

1. The gravitational force between two bodies is :

A. always repulsive

B. always attractive

C. attractive only at large distances

D. repulsive only at large distances.

Answer: B

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2. The value of G is :

A. $9.8Nm^2kg^{-2}$

B. $6.7 \times 10^{-11}Nm^2kg^{-2}$

C. $6.7 \times 10^{-11}ms^{-2}$

D. $6.7Nkg^{-1}$

Answer: B

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3. What is the force of attraction between two masses each of 1 kg kept at a separation of 1 m?

A. 9.8 N

B. 6.7 N

C. 980 N

D. 6.7×10^{-11} N

Answer: D

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4. A body is projected vertically upward with an initial velocity u. If acceleration due to gravity is g, find the time for which it remains in air.

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

B. ug

C. $\frac{2u}{g}$

D. $\frac{u}{2g}$

Answer: C

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5. An object falling freely from rest reaches ground in 2 s. If acceleration due to gravity is $9.8\mathrm{m\,s^{-2}}$, then what will be the velocity of object on reaching the ground?

A. $9.8ms^{-1}$

B. $4.9ms^{-1}$

C. $19.6ms^{-1}$

D. zero

Answer: C

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Exercise 3 E Numericals

1. The force of attraction between two bodies at a certain separation is 10 N. What will be the force of attraction between them if the separation is reduced to half ?

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2. Write the approximate weight of a body of mass 5 kg. What assumption have you made ?

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3. Calculate the weight of a body of mass 10 kg in kgf . Take $g = 9.8\mathrm{m\ s}^{-2}$.

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4. Calculate the weight of a body of mass 10 kg in newton . Take $g = 9.8\mathrm{m\ s}^{-2}$.

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5. State the magnitude and direction of the force of gravity acting on a body of mass 5 kg. Take $g = 9.8ms^{-2}$

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6. The weight of a body is 2.0 N. What is the mass of the body ? (g = 10 m s^{-2})

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7. The weight of a body on earth is 98 N where the acceleration due to gravity is 9.8 ms^{-2}. What will be its mass .

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8. The weight of a body on Earth is 98 N, where acceleration due to gravity is $9.8 \mathrm{m\ s^{-2}}$? What will be its weight on the Moon, where acceleration due to gravity is $1.6 \mathrm{m\ s^{-2}}$?

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9. A man weighs 600 N on the Earth. What would be his approximate weight on the Moon if the value of acceleration due to gravity of moon is $1/6^{th}$ of that of the earth?

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10. What is the force of gravity .

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11. What is the weight of a block of mass 10.5 kg ? Take g=$10ms^{-2}$

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12. A ball is released from a height and it reaches the ground in 3 s. If $g = 9.8\mathrm{m\,s^{-2}}$, find the value of the height from which the ball was released.

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13. A ball is released from a height and it reaches the ground in 3 s. If $g = 9.8\mathrm{m\,s^{-2}}$, find the value of the velocity with which the ball will strike the ground.

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14. What force, in newton, your muscles need to apply to hold a mass of 5 kg in your hand ? State the assumption.

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15. A ball is thrown vertically upwards. It goes to a height 20 m and then returns to the ground. Taking acceleration due to gravity g to

be $10\mathrm{m\,s^{-2}}$?, find the initial velocity of the ball

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16. A ball is thrown vertically upwards. It goes to a height 20 m and then returns to the ground. Taking acceleration due to gravity g to be $10\mathrm{m\,s^{-2}}$?, find the final velocity of ball on reaching the ground

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17. A ball is thrown vertically upwards. It goes to a height 20 m and then returns to the ground. Taking acceleration due to gravity g to be $10\mathrm{m\ s^{-2}}$?, find the total time of journey of ball.

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18. A body is dropped from the top of a tower. It acquires a velocity 20 m s^{-1} on reaching the ground. Calculate the height of the tower. (Take g = 10 m s^{-2})

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19. A ball is thrown vertically upwards. It returns 6 s later. Calculate the greatest height reached by the ball

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20. A ball is thrown vertically upwards. It returns 6 s later. Calculate the initial velocity of the ball. (Take $g = 10\mathrm{m\ s^{-2}}$)

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21. A pebble is thrown vertically upwards with a speed of 20 m s^{-1}. How high will it be after 2 s? (Take g = 10 m s^{-2})

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22. How long will a stone take to fall to the ground from the top of a building 80 m high and What will be the velocity of the stone on reaching the ground? (Take $g = 10\text{m s}^{-2}$)

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23. How long will a stone take to fall to the ground from the top of a building 80 m high and What will be the velocity of the stone on reaching the ground? (Take $g = 10\mathrm{m\ s^{-2}}$)

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24. A body falls from the top of a building and reaches the ground 2.5 s later. How high is the

building ? (Take g = 9.8 ms^{-2})

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25. A ball is thrown vertically upwards with a velocity of 49 m/s. Calculate

(i) the maximum height to which it rises,

(ii) the total time it takes to return to the surface of the earth.

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26. A ball is thrown vertically upwards with an initial velocity of 49 m s^{-1}. Calculate the time taken by it before it reaches the groung again (Take g= 9.8 m s^{-2})

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27. A stone is dropped freely from the top of a tower and it reaches the ground in 4 s. Taking g = 10 m s^{-2}, calculate the height of the tower.

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28. A pebble is dropped freely in a well from its top. It takes 20 s for the pebble to reach the water surface in the well. Taking $g = 10\,\mathrm{m\,s^{-2}}$ and speed of sound = $330\mathrm{m\,s^{-1}}$. Find the depth of water surface

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29. A pebble is dropped freely in a well from its top. It takes 20 s for the pebble to reach the

water surface in the well. Taking $g = 10\ \mathrm{m\ s^{-2}}$ and speed of sound = $330\mathrm{m\ s^{-1}}$. Find the time when sound is heard after the pebble is dropped.

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30. A ball is thrown vertically upwards from the top of a tower with an initial velocity of 19.6 $\mathrm{m}s^{-1}$. The ball reaches the ground after 5s. Calculate the height of the tower .

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31. A ball is thrown vertically upwards from the top of a building of height 24.5 m with an initial velocity 19.6 ms^{-1}. Taking g = 9.8 ms, calculate : the velocity with which it will strike the ground .

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