PHYSICS

BOOKS - NAND LAL PUBLICATION

FORCE AND LAWS OF MOTION

Activity

1. Make a pile of similar carrom coins on a table Then remove the lower coin without touching the other coins. With your fingers,

you may give a shart! horizontal hit at the bottom of the pile using another carom coin or striker.

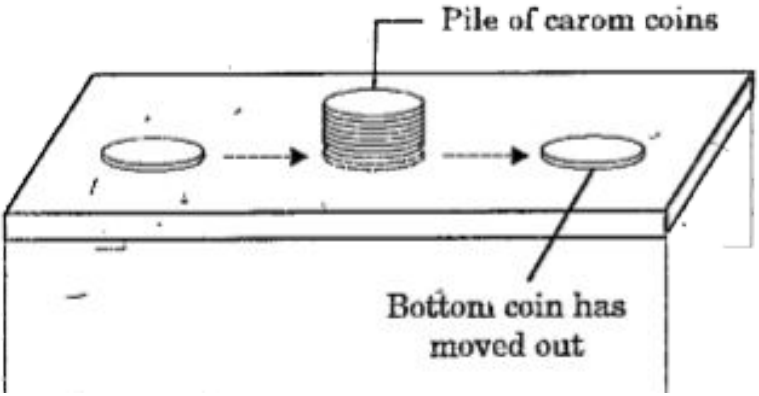
What will happen if the hit is strong enough?

View Text Solution

2. Make a pile of similar carrom coins on a table Then remove the lower coin without touching the other coins. With your fingers, you may give a shart horizontal hit at the bottom of the pile using another carom coin

or striker.

What will happen to the other coins once the lower coin is removed?



View Text Solution

3. Take an empty glass. Place a square cardboard on the glass. Place a 50 paisa coin

on the card. Now snap the card. We will find that the card moves on, but the coin falls into the glass.

View Text Solution

4. Place a water-filled tumbler on a tray. Hold the tray and turn around as fast as you can. What will you observe and why?

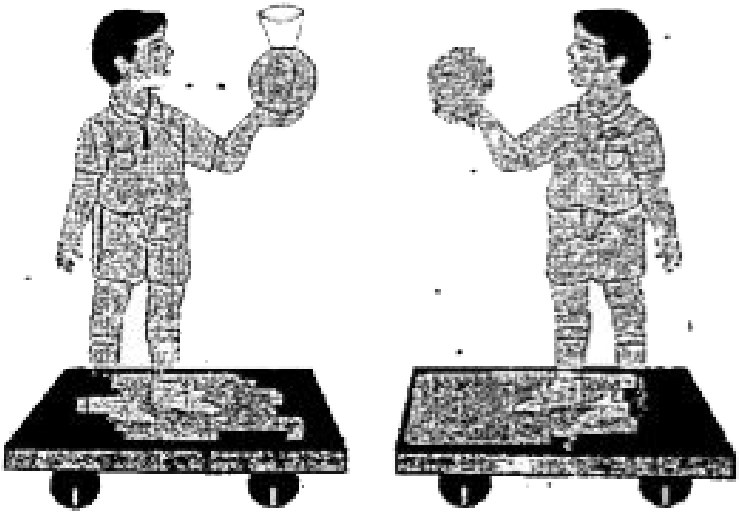
View Text Solution

5. Why is a groove provided in a saucer to place the cup?

Watch Video Solution

6. Request two children to stand an two separate carts-as shown in the figure. Give them a bag full of sand or some other heavier object. Ask them to play a game of catch with the bag.

Does each of them receive an instantaneous reaction as a result of throwing the sand bag (action) You can paint a white line on cartwheels to observe the motion of the two carts when the children throw the bag towards each other.



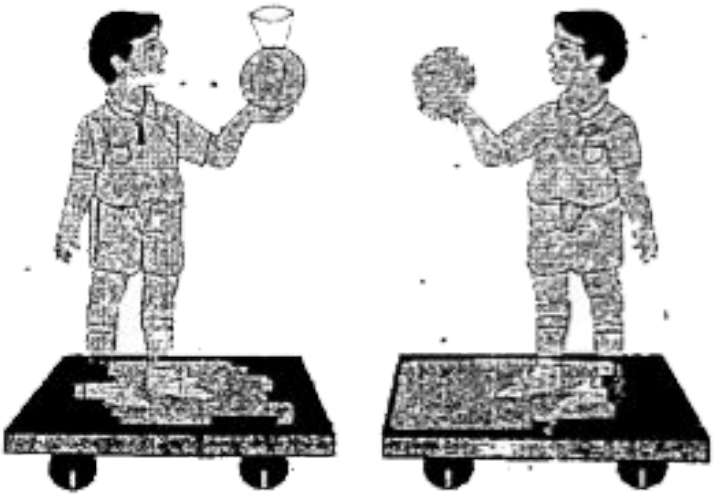
Motion of children on cartwheels.

View Text Solution

7. Request two children to stand an two separate carts-as shown in the figure. Give them a bag full of sand or some other heavier object. Ask them to play a game of catch with the bag.

Now, place two children on one cart and one on another cart. Ask them to repeat the

activity. What will you observe?



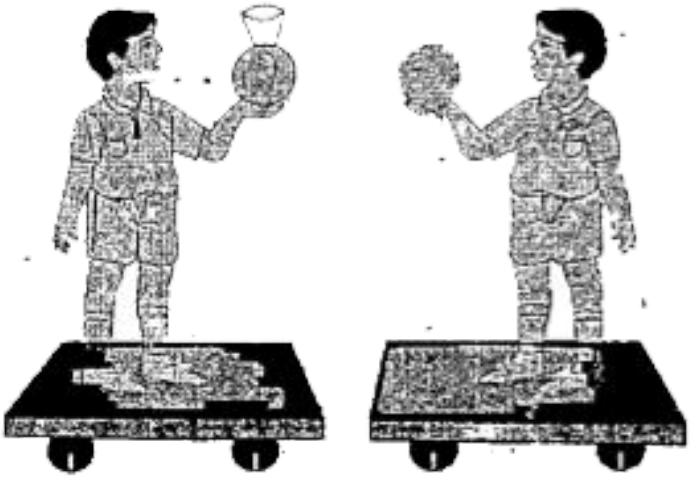
Motion of children on cartwheels.

View Text Solution

8. Request two children to stand an two separate carts-as shown in the figure. Give them a bag full of sand or some other heavier

object. Ask them to play a game of catch with the bag.

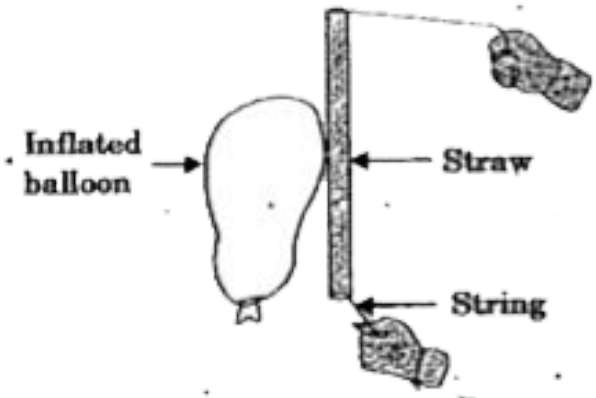
Why are skateboards not effective in the above activity?



Motion of children on cartwheels.

View Text Solution

9. Take a big size rubber balloon and inflate it fully- Tie its neck using a thread. Also using adhesive tape, fix a straw on the surface of this balloon. Pass a thread through the straw and hold one end of the thread in your hand. Ask your friend to hold the other end of the thread at some distance.

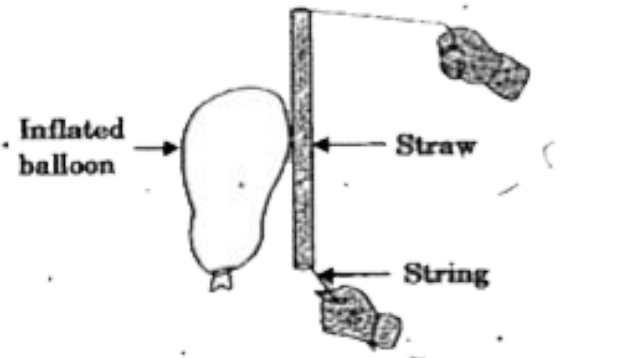


An inflated rubber balloon with a straw fixed on the surface of the balloon.

What will happen if we remove the thread tied on the neck of the balloon?

View Text Solution

10. Take a big size rubber balloon and inflate it fully-Tie its neck using a thread. Also using adhesive tape, fix a straw on the surface of this balloon. Pass a thread through the straw and hold one end of the thread in your hand. Ask your friend to hold the other end of the thread at some distance.



An inflated rubber balloon with a straw fixed on the surface of the balloon.

In which direction will the cart move?

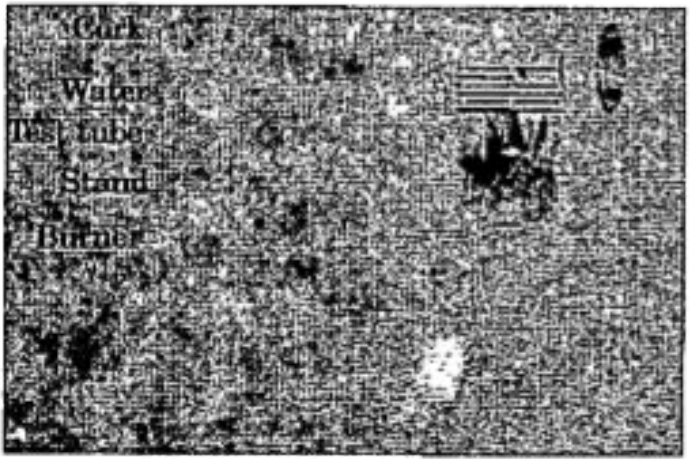
View Text Solution

11. Take a dry test tube and put a small amount of water in it. Place a stop cork on the mouth of it. Now suspend the test tube horizontally by two strings or wires as shown in the figure.

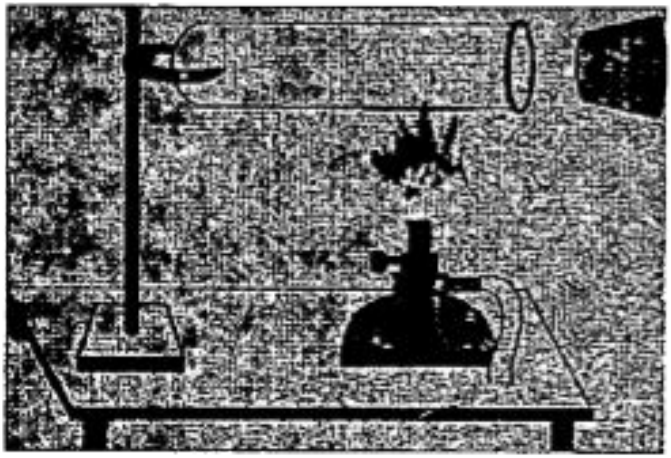
Heat the test tube with a burner until water vapourises and the cork blows out.

What happens to the test tube when the cork

blows out ?



(a)

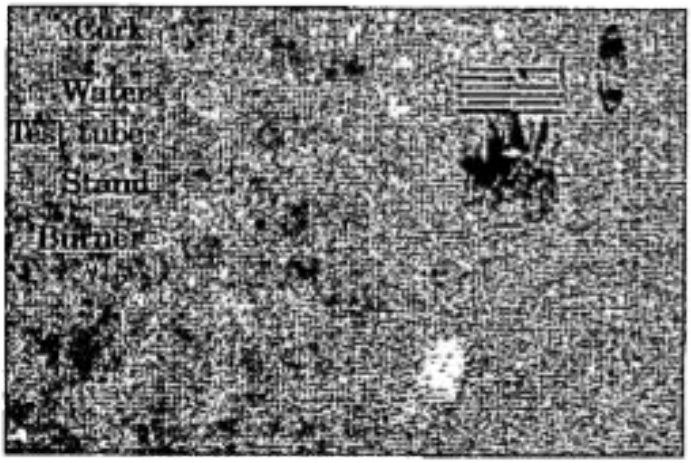


(b)

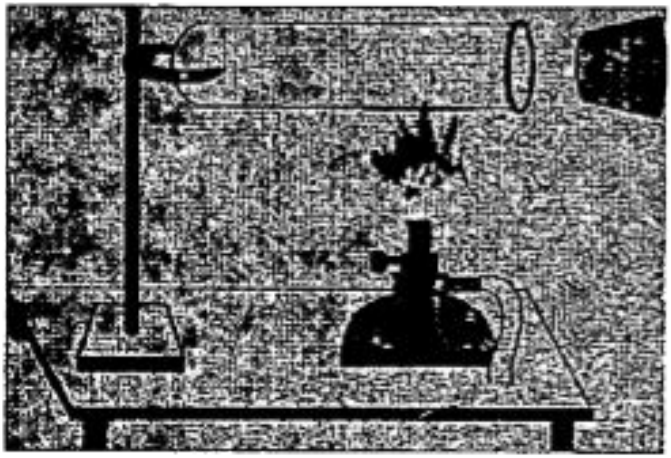
View Text Solution

12. Take a dry test tube and put a small amount of water in it. Place a stop cork on the mouth of it. Now suspend the test tube horizontally by two strings or wires as shown in the figure. Heat the test tube with a burner until water vapourises and the cork blows out. How will you calculate the velocity of the cork

?



(a)



(b)

View Text Solution

Intext Questions

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

Watch Video Solution

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

Watch Video Solution

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

Watch Video Solution

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.

Watch Video Solution

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

Watch Video Solution

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

Watch Video Solution

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

Watch Video Solution

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

Watch Video Solution

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.

Watch Video Solution

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.

Watch Video Solution

Exercises

1. An object experiences 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 velocity. If no, provide a reason.

Watch Video Solution

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

Watch Video Solution

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

Watch Video Solution

4. A batsman hits a cricket ball which them rolls on a level ground. After covering a short distance! the ball comes to rest. The ball slows to a stop be cause

A. the batsman did not hit the ball hard enough

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

C. there is a force on the ball opposing the mo tion.

D. there is no unbalanced force on the ball, se , the ball would want to come to rest.

Answer: C

Watch Video Solution

5. 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.

Watch Video Solution

6. 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 ?

Watch Video Solution

7. A 8000 kg engine pulls a train of 5 wagons each of 200 kg, along a horizontal track. If the engine exerts a orce of 40,000 N and the track offers friction force of 5000 N, then calculate : the net accelerating force

Watch Video Solution

8. A 8000 kg engine pulls a train of 5 wagons each of 200 kg, along a horizontal track. If the engine exerts a orce of 40,000 N and the track offers friction force of 5000 N, then calculate : the net accelerating force

Watch Video Solution

9. A 8000 kg engine pulls a train of 5 wagons each of 200 kg, along a horizontal track. If the engine exerts a orce of 40,000 N and the track

offers friction force of 5000 N, then calculate :

the net accelerating force

Watch Video Solution

10. 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 $1.7ms^{-2}$?

Watch Video Solution

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

A. $(mv)^2$

B. mv^2

C. $\frac{1}{2}mv^2$

D. m v

Answer: D

Watch Video Solution

12. 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 ?

Watch Video Solution

13. 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 ?

Watch Video Solution

14. 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 justibes 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.

Watch Video Solution

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

Watch Video Solution

16. A bullet of mass 10 kg travelling horizontally with a velocity of $150ms^{-1}$ 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.

 Watch Video Solution

17. 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.

Watch Video Solution

18. 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.

Watch Video Solution

19. Akhtar, Kiran and Rahul were riding in a motorcar that was moving with a high velocity on an expressway when an insect hit the

windshield and got stuck on the windscreen. 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 the motorcar (because the change in the velocity of the insect was much more than that of the motorcar.) Akhtar said that since the motorcar was moving with a larger velocity, it exerted a larger force on the insect. As a result, the insect died. Rahul, while putting an entirely new explanation, said that both the motorcar and insect experienced the same force and a

change in their momentum. Comment on these suggestions.

Watch Video Solution

20. 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 $10ms^{-2}$.

Watch Video Solution

Additional Exercises

1. The following is the distance -time table of an object in motion.

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

What conclusion can you draw about the acceleration ? Is it constant ? Increasing ? Decreasing ? Or Zero ?

Watch Video Solution

2. The following is the distance -time table of an object in motion.

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

What do you infer about the forces acting on the object ?

Watch Video Solution

3. 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.)

Watch Video Solution

4. A hammer of mass 500 g moving at $50ms^{-1}$, 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 ?

Watch Video Solution

5. A motorcar of mass 1200 kg is moving along a straight line with a uniform velocity of 90km/h. Its velocity is slowed down to 18km/h in 4s by an unbalanced external force.

Calculate the acceleration and change in momentum. Also calculate the magnitude of the force required.

Watch Video Solution

6. A large truck and a car, both moving with a velocity of magnitude 'V' have a head-on collision and both of them come to a halt after that. 'If the collision lasts for 1 s:

Which vehicle experiences the greater force of impact?

Watch Video Solution

7. A large truck and a car, both moving with a velocity of magnitude 'V' have a head-on collision and both of them come to a halt after that. 'If the collision lasts for 1 s:

Which vehicle experiences the greater change in momentum?

Watch Video Solution

8. A large truck and a car, both moving with a velocity of magnitude 'V' have a head-on collision and both of them come to a halt after that. 'If the collision lasts for 1 s:

Which vehicle experiences the greater acceleration?

Watch Video Solution

9. A large truck and a car, both moving with a velocity of magnitude 'V' have a head-on

collision and both of them come to a halt after that. 'If the collision lasts for 1 s:

Why is the car likely to suffer more damage than the truck?

Watch Video Solution

Additional Questions Very Short Answer Questions

1. A ball on the ground when given a small hit does not move forever. What does this

observation suggest ?

Watch Video Solution

2. Name two scientists who developed an entirely different approach to understand motions.

Watch Video Solution

3. What can we do to an object to change its state of motion ?

Watch Video Solution

Additional Questions Short Answer Questions

1. What is force?

Watch Video Solution

2. List two effects of force.

Watch Video Solution

3. List two effects of force.

Watch Video Solution

4. Name some non-SI units of force.

Watch Video Solution

5. Convert 1N into dyne using dimensional analysis.

Watch Video Solution

6. Convert : 1 g-wt into dynes.

Watch Video Solution

7. Convert : 1 kg-wt into newton.

Watch Video Solution

8. Convert : 1-kg-wt into dynes.

Watch Video Solution