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Newton's Third Law of Motion

Pre-Test - Post-Test

1. An archer shoots an arrow. Consider the action force to be the bow string against the arrow. The reaction to this force is the _____.

A) air resistance against the bow.

B) friction of the ground against the archer's feet.

C) weight of the arrow.

D) arrow's push against the bowstring.

E) grip of the archer's hand on the bow.

2. An unfortunate bug splatters against the windshield of a moving car. Compared to the force of the car on the bug, the force of the bug on the car is _____.

A) smaller.

B) larger.

C) Need more information to say.

D) the same.

3. An unfortunate bug splatters against the windshield of a moving car. Compared to the deceleration of the car, the deceleration of the bug is _____.

A) smaller.

B) the same.

C) larger.

4. A Mack truck and a Volkswagen traveling at the same speed have a head-on collision. The vehicle to undergo the greater change in velocity will be the _____.

A) Volkswagen.

B) Mack truck.

C) Both the same

5. A rocket is able to accelerate in the vacuum of space when it fires its engines. The force that propels the rocket is the force _____.

A) of the exhaust gases on the rocket.

B) of the rocket on the exhaust gases.

C) neither A nor B

6. Two people pull on a rope in a tug-of-war. Each pulls with 400 N of force. What is the tension in the rope?

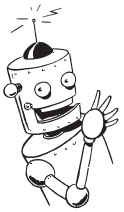
A) 400 N

B) Zero

C) 600 N

D) 800 N

E) none of the above



Newton's Third Law of Motion: Action-Reaction

Whenever one object extorts a force on a second object, the first object exerts and equal and opposite force on the first.

7.1 Forces and Interactions

1. Two blocks of different masses are attached by a stretched rubber band. After they are release, which block pulls harder on the other?

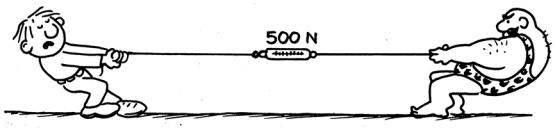
2. Newton's third law of motion redefines the meaning of a force, explain.

3. What happens when an object exerts a force on another object?

4. Give a situation in which a force can be applied to an object without the object applying a force back.

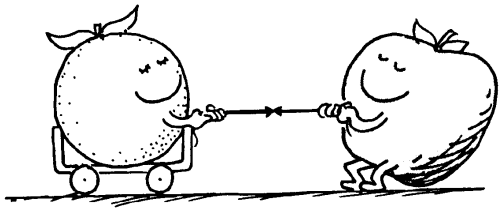
7.2 Tug-of-War

5. In a game of tug-of-war who pulls harder, the winning side or the loosing side?



6. Explain walking in terms of Newton's third law.

7. How do you win in a game of tug-of-war?

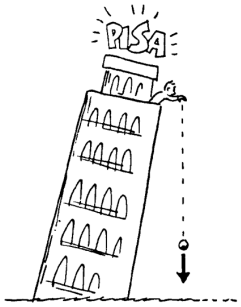


8. Who wins when you play tug-of-war on ice?

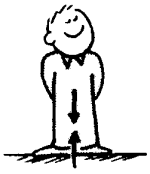
9. Does the Earth pull on the moon, or does the moon pull on the earth? Which pulls harder?

7.3 Gravity

10. What is the reaction force to the gravitational force that acts on a falling object?

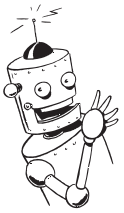


11. Your weight is the result of a gravitational force of the earth on your body. What is the corresponding reaction force?



7.04 Mass, Force, and Acceleration

12. When you jump up, the world really does recoil downward. Why can't this motion of the world be noticed?



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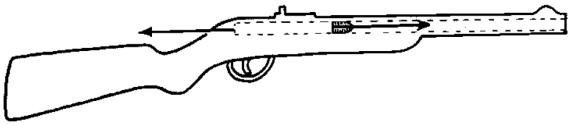
Chapter 7 Newton's Third Law of Motion

13. If all forces have an equal and opposite reaction force how is it possible that anything can move?

14. If the forces that act on a bullet and the recoiling gun from which it is fired are equal in magnitude, why do the bullet and gun have very different accelerations?

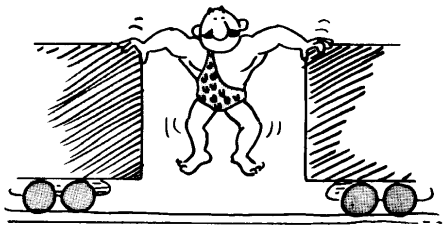


15. Would you care to fire a gun that has a bullet ten times as massive as the gun? Explain.

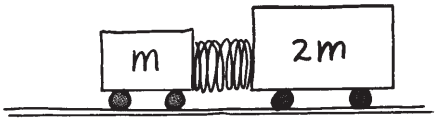
16. Explain how a rocket works.

17. Give two ways to improve the performance of a rocket.

18. The strong man pushes the two initial stationary freight cars of equal mass apart before he himself drops to the ground. Is it possible for him to give either of the cars a greater speed than the other? Explain



19. Suppose two carts, one twice as massive as the other, fly apart when a compressed spring is released. On which cart is the force greater?

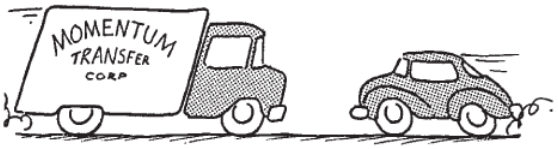


20. How will the speed of cart 2m compare to the speed of car m?

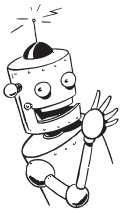
21. Two people of equal mass attempt to play tug-of-war on ice. When they pull on the rope they each slide towards one another. How do their accelerations compare?

22. In the preceding problem suppose one person has twice the mass as the other, how far do they each slide before they meet?

23. If a Mack truck and Volkswagen have a head-on collision, upon which vehicle is the impact force greater?

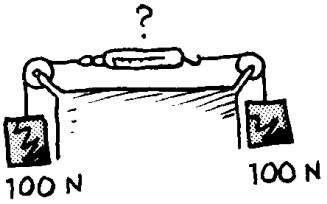


24. Which vehicle undergoes the greater change in its motion? Explain your answers.



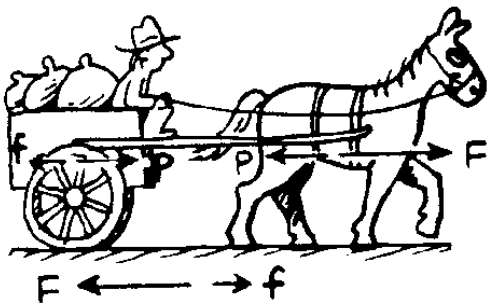
Brain Challenge

Two 100-N weights are attached to a spring scale as shown. Does the scale read 0, 100, or 200 N, or give some other reading?



7.6 The Horse–Cart Problem

1. A horse is urged to pull a milk wagon. The horse refuses to try, citing Newton's third law as his defense: "The pull of the horse on the wagon is opposite and equal to the pull of the wagon on the horse. If I can never exert a force on the wagon greater than it exerts on me, how can I ever start the wagon moving?" asks the horse. How would you reply, knowing that you must deliver the milk or lose your job?



2. Can a dog wag its tail without the tail in turn "wagging the dog"? (Consider a dog with a relatively massive tail.)

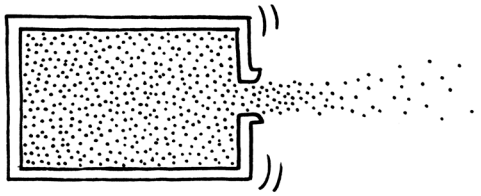
3. Why can't a boxer hit a piece of paper in the air with a force of 50 N?

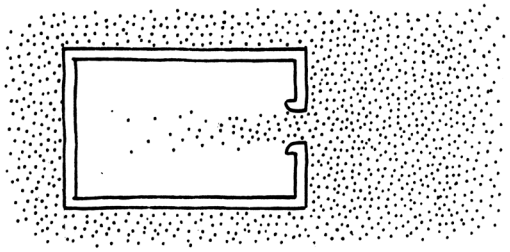
4. Two blocks of different masses are attached by a stretched rubber band. After they are release, which block pulls harder on the other?

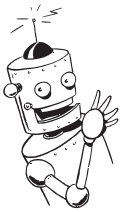
Brain Challenge

This is a stumper. If a can of compressed air is punctured and the escaping air blows to the right, the can will move to the left in a rocket-like fashion. Now consider a vacuum can that is punctured. The air blows in the left as it enters the can. After the vacuum is filled the can will...

a. be moving to the left
b. be moving to the right
c. not be moving







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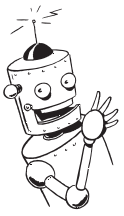

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