

## Balanced and Unbalanced Forces

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A **force** is a push or a pull on an object. Forces are at work all around you all the time. More than one force can-and usually does- act on an object at the same time. Sometimes two forces act in the same direction. An example is when two people work together to push a heavy object. Sometimes the forces act in different directions.

Imagine a tug-of-war between you and one friend. If you are stronger, you apply more force to the rope. You pull your friend across the line, and you are the winner! If your friend is stronger, he might pull you across the line. Sometimes the forces are equal. Neither you nor your friend moves across the line. The two forces are balanced.



We say that the **net force** on an object is the combination of all the forces acting on it. To find the net force of forces that are acting in the same direction, add them together. For example, if you pull on a box with a force of 25 newtons (N) while your friend pushes the box (in the same direction you are pulling) with a force of 30 N, the net force applied to the box in that direction is 55 newtons.

To find the net force of forces that are acting in opposite directions, subtract the smaller force from the larger one. If you are pulling on a tug-of-war rope with a force of 40 N, and your friend is pulling with a force of 35 N in the opposite direction, the net force on the rope is 5 newtons in your direction. You win!

When the net force on an object is zero, the two forces are balanced. **Balanced forces** don't cause any change in the motion of an object. Balanced forces are equal and in opposite directions. If the object is not moving and two forces are applied to it that equal zero when combined, then the object will not move. If the object is already moving and two balanced forces are applied to it, the object will continue moving at the same speed and in the same direction that it was before the forces were applied.

That doesn't mean that balanced forces have no effect on an object, however. Think about what would happen to an empty soda can if you pushed against it in one direction, and a friend pushed against it in the opposite direction with an equal amount of force. If the amount of force was equal, the can wouldn't move. But the two opposing forces would probably crush the can.

When the net force on an object is greater than zero, the forces are unbalanced. **Unbalanced forces** cause the object to move. An object that is not already moving will begin to move in the direction of the larger force. An object that is already moving will change its speed and/or its direction.

Remember that two forces applied to an object in the same direction will combine by adding the two together. Two forces applied to an object in opposite directions will be subtracted. The

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net force is the combination of the two forces, whether by addition or subtraction. If the net force is zero, no change will happen to the object's motion. If the forces are unbalanced, meaning there is some amount of net force, then the object will move in the direction of the force.

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### Questions

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1. What is a force?

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\_\_\_\_\_ 2. A combination of all the forces acting on an object is called:

- A. balanced force
- B. unbalanced force
- C. gross force
- D. net force

\_\_\_\_\_ 3. To find the net force on an object:

- A. combine the amounts of the forces acting on the object
- B. divide the larger force by the smaller one
- C. multiply the forces together
- D. always subtract the amounts of the forces

\_\_\_\_\_ 4. When the net force on an object is zero, we say that the two forces are:

- A. cancelled out
- B. unbalanced
- C. gross
- D. balanced

\_\_\_\_\_ 5. When the net force on an object is zero, the object's motion will:

- A. not change
- B. change
- C. stop

\_\_\_\_\_ 6. When forces are balanced, they:

- A. have no effect on the object
- B. don't cause any change in the motion of an object
- C. might crush the object
- D. both b and c are correct

- \_\_\_\_\_ 7. If you are pushing a box toward your friend with a force of 20 N, and your friend is pushing the box toward you with a force of 30 N, what will happen to the box?
- A. The box will move toward your friend with a force of 50 N.
  - B. The box will move toward you with a force of 10 N.
  - C. The box will move toward your friend with a force of 10 N.
  - D. The box will move toward you with a force of 50 N.
- \_\_\_\_\_ 8. If you are pulling on a box with a force of 30 N, and your friend is pushing the box in the same direction with a force of 30 N, what will happen to the box?
- A. The box will not move because the forces are balanced.
  - B. The box will move in the direction of your pull with a force of 30 N.
  - C. The box will move in the direction of the push and pull with a force of 60 N.
  - D. The box will move in the direction of your friend's push with a force of 30 N.

**Describe a situation where two unbalanced forces are acting on a box. Be sure to tell the amount of each force and what will happen to the box.**

This image shows a blank sheet of white paper with horizontal ruling lines. The lines are evenly spaced and extend across the width of the page. There are no margins, text, or other markings on the paper.