

# The Simple Physics of Soccer



Everyone knows that kicking a soccer ball causes it to roll across the grass. But what makes this happen? What is required to make the ball move faster? What's the difference, in other words, between passing the soccer ball to a teammate and shooting for the goal?

Kicking a ball may seem simple, but physicists spent years trying to figure out why objects move the way they do. What they discovered is that kicking a soccer ball requires applying force to the surface of the ball. The greater the force, the faster the ball will go, and the further it will travel. How much force you apply to the ball, that is, will often determine whether you score a goal or not.

The combination of force and distance equals what is called "work." In this case, we don't mean the noun form of work, like a job. We are talking about work as a verb, as a form of action. Work can be taking out the trash or cleaning dishes in your house. Furniture movers work by carrying chairs and tables out of one apartment and into another. If the first apartment is on the second floor and the second apartment is on the fourth floor, carrying the furniture into the second apartment will require about twice as much work as the first.

Keep in mind that force and work are not the same things as energy. Energy comes in several forms. But the best way to understand it is as something that creates the ability to do work. When someone says, “I don’t have any energy,” what do they usually mean? Often, they mean they don’t have the strength or motivation to work.

Without energy, it is hard to play soccer or lift furniture. In fact, it may even be difficult to get out of bed. Energy is what allows us to do work. The more energy we have, the more work we can do.

Mathematicians use the following simple equation to define the meaning of work:  $\text{force} \times \text{distance} = \text{work}$ . The heavier an object is, in other words, the more force it exerts in the form of gravity. Picking an anvil up off the ground requires more energy than picking up a feather. If you’re interested in building muscles, though, keep in mind that lifting heavier things will make you stronger over time. And the stronger you are, the more likely you are to win at soccer.

Name: \_\_\_\_\_ Date: \_\_\_\_\_

1. Which sport does the passage use to examine physics?

- A baseball
- B football
- C hockey
- D soccer

2. What does the author describe in the passage?

- A how to score a goal in soccer
- B the relationship between work, force, and distance
- C physics experiments that led to important discoveries
- D different types of energy

3. A soccer ball will travel a greater distance the harder it is kicked. What evidence from the text best supports this statement?

- A Physicists spent years trying to figure out why objects move the way they do.
- B Kicking a soccer ball requires applying force to the surface of the ball.
- C The greater the force, the faster the ball will go, and the further it will travel.
- D How much force you apply to the ball will often determine whether you score a goal or not.

4. What is the difference between passing the ball to a teammate and shooting a goal?

- A the amount of force applied to the ball
- B the way that the ball rolls
- C the distance the ball has to travel
- D it is more difficult to pass the ball

5. What is this passage mostly about?

- A geometry
- B biology
- C physics
- D chemistry

6. Read the following sentences: "Everyone knows that kicking a soccer ball causes it to roll across the grass. But what makes this happen? What is **required** to make the ball move faster?"

What does "**required**" mean?

- A allowed
- B needed
- C ordered
- D stopped

7. Choose the answer that best completes the sentence below.

The tired soccer player does not have any energy left; \_\_\_\_\_, he is unable to do any more work.

- A however
- B finally
- C specifically
- D therefore

8. Define "work."

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9. Why does carrying furniture up four flights of stairs require twice as much work as carrying furniture up two flights of stairs?

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10. Imagine three different soccer players are shooting at the goal. Player A has a lightweight ball and is close to the goal, Player B has a heavy ball and is close to the goal, and Player C has a heavy ball and is far from the goal. Which player will need the most energy to score a goal, and which player will need the least energy? Support your answer using the text.

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## Teacher Guide &amp; Answers

Passage Reading Level: Lexile 870

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8. Define "work."

**Suggested answer:** Work equals the combination of force and distance (work = force x distance).

9. Why does carrying furniture up four flights of stairs require twice as much work as carrying furniture up two flights of stairs?

**Suggested answer:** Carrying furniture up four flights of stairs requires twice as much work as carrying furniture up two flights of stairs because the distance is doubled.

10. Imagine three different soccer players are shooting at the goal. Player A has a lightweight ball and is close to the goal, Player B has a heavy ball and is close to the goal, and Player C has a heavy ball and is far from the goal. Which player will need the most energy to score a goal, and which player will need the least energy? Support your answer using the text.

**Suggested answer:** Player A will need the least energy, because they have to do the least work (the distance is small and the force required is small). Player C will need the most energy, because they have to do the most work (the distance is large and the force required is large).