Soccer Ball Forces

Trace how forces change motion and move energy.

5.7.A "investigate and explain how equal and unequal forces acting on an object cause patterns of motion and transfer of energy; and"

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline each sentence that tells about equal forces, circle each sentence that tells about unequal forces, and number each sentence that explains an energy transfer or energy change.

A Ball on the Field

1. At the playground, Nia set a soccer ball on flat grass. Her friend pushed the ball east while Nia pushed it west with the same strength. The forces were equal and opposite, so the ball stayed still. No change in motion occurred because the overall force on the ball was zero. Equal forces can also let a moving object keep a constant speed in a straight line.

2. Next, Nia gave the ball a hard kick east. Her foot exerted an unbalanced force, so the ball sped up in that direction. Energy moved from Nia's moving foot to the ball. As the ball rolled across the grass, friction from the grass acted opposite its motion. This unequal force made the ball slow down, and some energy transferred to the grass as thermal energy.

3. At the goal, the moving ball struck a heavy cone. During the brief collision, the ball pushed the cone, and the cone pushed back on the ball. The cone began moving because energy transferred from the ball to the cone. The ball then rolled more slowly. If the cone had been firmly held in place, the ball could have bounced backward because an unequal force would change its direction.

2 ANSWER WITH EVIDENCE

Use the passage

1. What happened when Nia and her friend pushed the ball with equal forces in opposite directions? What can equal forces allow a moving object to do?

2. How did Nia's kick change the ball's motion, and where did energy move?

3. How did friction affect the rolling ball? Include the energy change described in the passage.

4. After the ball struck the cone, what evidence shows that energy transferred during the collision?

3 YOUR TURN

Your own words

Draw a three-panel scene of an object in motion. In Panel 1, show equal forces. In Panel 2, show an unequal force that changes the object's motion and transfers energy. In Panel 3, show another unequal force, such as friction or a collision, and explain the motion and energy change in a caption under each panel.

ANSWER KEY

Soccer Ball Forces

GRADE 5 · TEKS 5.7.A

PART 1 · READ AND MARK

Underline each sentence that tells about equal forces, circle each sentence that tells about unequal forces, and number each sentence that explains an energy transfer or energy change. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	What happened when Nia and her friend pushed the ball with equal forces in opposite directions? What can equal forces allow a moving object to do?	**The ball stayed still because the overall force was zero. Equal forces can allow a moving object to keep a constant speed in a straight line.**
2	How did Nia's kick change the ball's motion, and where did energy move?	**The unbalanced kick made the ball speed up east. Energy moved from Nia's moving foot to the ball.**
3	How did friction affect the rolling ball? Include the energy change described in the passage.	**Friction acted opposite the ball's motion and made it slow down. Some energy transferred to the grass as thermal energy.**
4	After the ball struck the cone, what evidence shows that energy transferred during the collision?	**The cone began moving, and the ball rolled more slowly. Energy transferred from the ball to the cone.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

Panel 1: A toy car sits still while two hands push it equally from opposite sides. Caption: Equal forces keep the car still because the overall force is zero. Panel 2: One hand pushes the toy car to the right. Caption: The unbalanced force makes the car speed up right, and energy transfers from the hand to the car. Panel 3: The rolling car hits a block and the block moves. Caption: The collision slows the car and transfers energy from the car to the block.

Accept accurate descriptions of equal forces producing no change in motion or constant straight-line motion. For unequal forces, accept a change in speed or direction and a correctly identified energy transfer or thermal energy change.