Spring Cart Challenge

Predict motion when a spring, cart, or track changes.

P.5.6.5 "Predict how a change of force, mass, and/or friction affects the motion of an object to convert potential energy into kinetic energy."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Circle each change to the spring, cart, or track. Underline what happens to the cart's speed or travel distance after each change.

What Makes the Cart Move?

1. A spring waits behind a toy cart on a straight, flat track. Pushing the spring in stores potential energy. When you let go, the spring pushes the cart, and some stored energy becomes kinetic energy, the energy of motion. The cart moves even though the track does not slope downhill. Change one part of this test at a time to predict what the cart will do.

2. If you squeeze the spring farther, it pushes harder and stores more energy. Released behind the same cart, it sends the cart off faster. Next, keep the spring squeezed the same amount but put small blocks in the cart. The heavier cart leaves the spring at a lower speed than the lighter cart because the same stored energy must move more mass. Both carts gain kinetic energy as they move.

3. Now keep the cart and spring the same, but change the track. A strip of rough cloth creates more friction than a smooth track. Friction pushes against the moving cart and changes some energy into heat. On cloth, the cart slows sooner and travels a shorter distance after leaving the spring. On the smooth track, less friction lets it travel farther. The spring still turns stored potential energy into motion.

2 ANSWER WITH EVIDENCE

Use the passage

1. You squeeze the spring farther but use the same cart and track. Predict how fast the cart leaves the spring, and explain why.

2. You add blocks to the cart but squeeze the spring the same amount. Predict how its speed as it leaves the spring changes, and explain why.

3. You use rough cloth instead of a smooth track. Predict how far the cart travels after leaving the spring, and explain why.

4. A lighter cart is pushed by a spring squeezed farther than the spring pushing a heavier cart. Both use the same track. Which cart will leave its spring faster? Explain your prediction.

3 YOUR TURN

Your own words

Design two runs using the same spring-powered cart on a flat track. Change both the spring squeeze and the track surface, then predict which run lets the cart travel farther after leaving the spring. Explain how potential energy becomes kinetic energy and how friction affects your prediction.

ANSWER KEY

Spring Cart Challenge

GRADE 5 · P.5.6.5

PART 1 · READ AND MARK

Circle each change to the spring, cart, or track. Underline what happens to the cart's speed or travel distance after each change. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	You squeeze the spring farther but use the same cart and track. Predict how fast the cart leaves the spring, and explain why.	**It leaves faster because the spring stores more potential energy and pushes harder when released.**
2	You add blocks to the cart but squeeze the spring the same amount. Predict how its speed as it leaves the spring changes, and explain why.	**It leaves at a lower speed because the same stored energy must move more mass.**
3	You use rough cloth instead of a smooth track. Predict how far the cart travels after leaving the spring, and explain why.	**It travels a shorter distance because greater friction slows it sooner.**
4	A lighter cart is pushed by a spring squeezed farther than the spring pushing a heavier cart. Both use the same track. Which cart will leave its spring faster? Explain your prediction.	**The lighter cart will leave faster. Its spring stores more energy and pushes harder, while less mass must be moved.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

In run A, I squeeze the spring farther and use a smooth track. In run B, I squeeze it less and use rough cloth. Run A's spring stores more potential energy, which becomes kinetic energy when the spring pushes the cart. The cart in run A should travel farther because it starts with more energy of motion and the smooth track has less friction to slow it down.

For the open task, accept two clearly different spring squeezes and track surfaces with a prediction supported by both changes. Students may say friction changes some energy into heat.