

Cart Motion Clues

Use position, time, force, and work to explain motion.

PS.8 "The student will investigate and understand that work, force, and motion are related. Key ideas include motion can be described using position and time; and motion is described by Newton's laws."

NAME _____ DATE _____

1 READ AND MARK _____ Read it twice

YOUR JOB Underline details that connect position to time. Circle each force or work detail, then write 1, 2, or 3 beside each statement of Newton's laws.

A Cart in the Hallway

- ① During a hallway test, a student releases a low-friction cart and records its position from a starting line every second. Position tells where the cart is relative to that line, while time tells when each measurement was made. The data show the cart moving farther from the start by the same amount during equal time intervals. This pattern represents constant velocity, meaning both speed and direction stay unchanged.

CART POSITION RECORD

Time (s)	Position from Start (m)
0	0
1	2
2	4
3	6
4	8

- ② Motion changes when a net force, the overall force after all pushes and pulls are combined, acts on an object. Newton's first law says an object keeps its motion unless a net force acts. Newton's second law says a net force causes acceleration, a change in velocity. With the same force, a lighter cart accelerates more than a heavier cart.
- ③ When a student pushes off a skateboard, the board pushes back on the student's foot with an equal force in the opposite direction. This is Newton's third law, forces come in pairs and act on different objects. Work occurs when a force causes movement in its direction. A stronger force or longer movement can mean more work.

2 ANSWER WITH EVIDENCE _____ Use the passage

1 How far does the cart travel from 1 second to 4 seconds?

2 What does the position record show about the cart's velocity?

3 Two carts receive the same net force. Why does the lighter cart accelerate more?

4 What two changes can mean more work is done on an object?

3 YOUR TURN _____ Your own words

Create a position-time record for an object that moves at a constant velocity for its first two intervals, then speeds up because of a net force. Use times from 0 through 4 seconds, and use the final row to name the law that explains the speed-up.

TIME (S)	POSITION (M)	MOTION NOTE

PART 1 • READ AND MARK

Underline details that connect position to time. Circle each force or work detail, then write 1, 2, or 3 beside each statement of Newton's laws. Accept any marking that follows this job and points at the right text.

PART 2 • ANSWERS

#	QUESTION	ANSWER
1	How far does the cart travel from 1 second to 4 seconds?	It travels 6 m, from 2 m to 8 m.
2	What does the position record show about the cart's velocity?	The cart moves 2 m each second, so it has constant velocity.
3	Two carts receive the same net force. Why does the lighter cart accelerate more?	Newton's second law says that with the same force, the cart with less mass accelerates more.
4	What two changes can mean more work is done on an object?	Using a stronger force or moving the object a longer distance can mean more work.

PART 3 • YOUR TURN (SAMPLE ANSWER)

TIME (S)	POSITION (M)	MOTION NOTE
0 s	0 m	Starts at the reference point.
1 s	2 m	Moves 2 m in 1 s.
2 s	4 m	Continues at constant velocity.
3 s	7 m	A net force makes the velocity increase.
4 s	11 m	Newton's second law explains the acceleration.

For the marking task, students should identify position and time details, force or work details, and all three Newton's law statements. Accept any valid position-time record with equal position changes for the first two intervals, larger changes afterward, and a correct reference to Newton's second law.