The Turning Point

Read motion data and predict what happens next.

PHY.1.2 "Interpret and predict 1-D motion based on displacement vs. time, velocity vs. time, or acceleration vs. time graphs (e.g., free-falling objects)."

NAME _____ DATE _____

1 READ AND MARK

Read it twice

YOUR JOB Underline the sentences that explain what the slopes of displacement-time and velocity-time graphs tell you, then circle the table values that show when the ball changes direction.

A Ball in Flight

1. In a school courtyard, a student tosses a soft ball straight up and catches it at the same height. Imagine its vertical motion with negligible air resistance. Call upward positive, and measure displacement from the release point. The table records the ball's displacement and velocity at one-second intervals during its flight.

BALL MOTION, UPWARD POSITIVE

Time (s)	Displacement (m)	Velocity (m/s)
0	0	+19.6
1	+14.7	+9.8
2	+19.6	0
3	+14.7	-9.8
4	0	-19.6

2. Consider a toy car rolling along a straight track. On a displacement-time graph, the slope tells its velocity: a rising line means positive velocity, and a falling line means negative velocity. A flat tangent means the car is briefly stopped. The graph's height is position relative to the chosen origin, not the car's speed.

3. For a moving elevator, the slope of a velocity-time graph gives acceleration. A straight slanted line shows constant acceleration. If that line crosses zero and continues through it, the elevator changes direction. On an acceleration-time graph, a horizontal line below zero means constant negative acceleration, even while the elevator is still traveling upward.

2 ANSWER WITH EVIDENCE

Use the passage

1. What is the ball's average velocity from 0 to 1 s? Show how you use the displacement values.

2. When does the ball change direction? Use its displacement and velocity at that time as evidence.

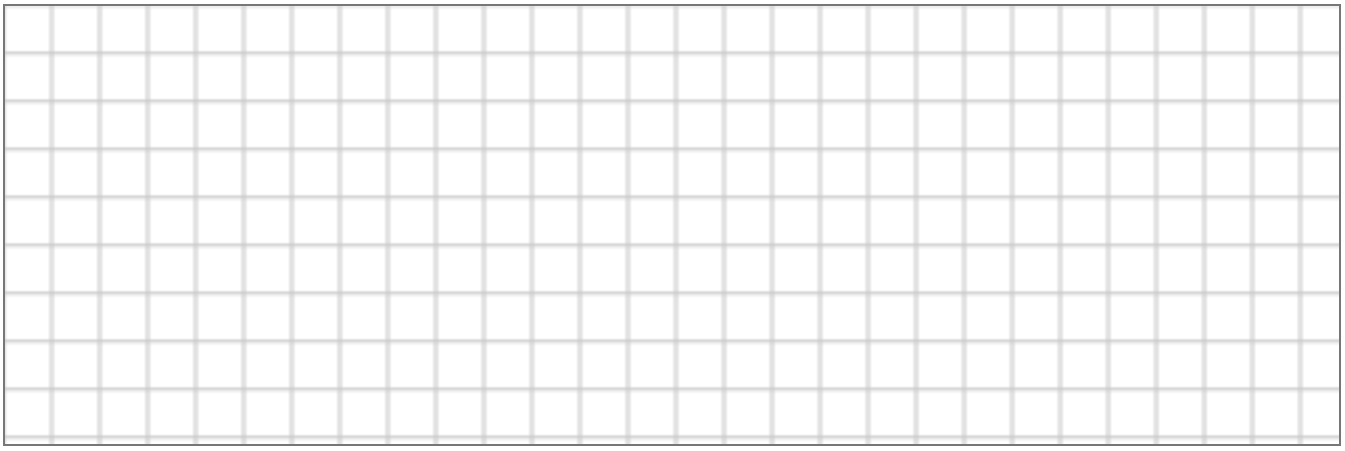
3. What is the ball's acceleration from 1 to 3 s? Show how you use the velocity values.

4. At 3 s, predict the ball's displacement and velocity at 4 s, just before the catch. Explain your prediction using the motion pattern.

3 YOUR TURN

Your own words

Choose your own constant acceleration and starting velocity. On the grid, draw a straight velocity-time line from 0 to 3 s that starts above zero and ends below zero; label both axes with units, then write one sentence predicting when and why the object changes direction.



The Turning Point

PART 1 · READ AND MARK

Underline the sentences that explain what the slopes of displacement-time and velocity-time graphs tell you, then circle the table values that show when the ball changes direction. Accept any marking that follows this job and points at the right text.

PART 2 · ANSWERS

#	QUESTION	ANSWER
1	What is the ball's average velocity from 0 to 1 s? Show how you use the displacement values.	**(14.7 m - 0 m) / 1 s = +14.7 m/s.**
2	When does the ball change direction? Use its displacement and velocity at that time as evidence.	**At 2 s. Its displacement is greatest, +19.6 m, and its velocity is 0 before becoming negative.**
3	What is the ball's acceleration from 1 to 3 s? Show how you use the velocity values.	**(-9.8 m/s - 9.8 m/s) / 2 s = -9.8 m/s^2.**
4	At 3 s, predict the ball's displacement and velocity at 4 s, just before the catch. Explain your prediction using the motion pattern.	**The displacement will be 0 m, and the velocity will be -19.6 m/s. The downward motion mirrors the upward motion, while velocity decreases by 9.8 m/s each second.**

PART 3 · YOUR TURN (SAMPLE ANSWER)

Chosen acceleration: -2 m/s^2. Graph: horizontal axis labeled time (s), vertical axis labeled velocity (m/s), with a straight line through (0, +3), (1, +1), (2, -1), and (3, -3). The object changes direction at 1.5 s because its velocity crosses zero there.

For Question 4, accept a prediction based on equal-time symmetry or constant acceleration. For the graph, accept any labeled straight line that starts at positive velocity, ends at negative velocity, and supports the stated zero-crossing time.