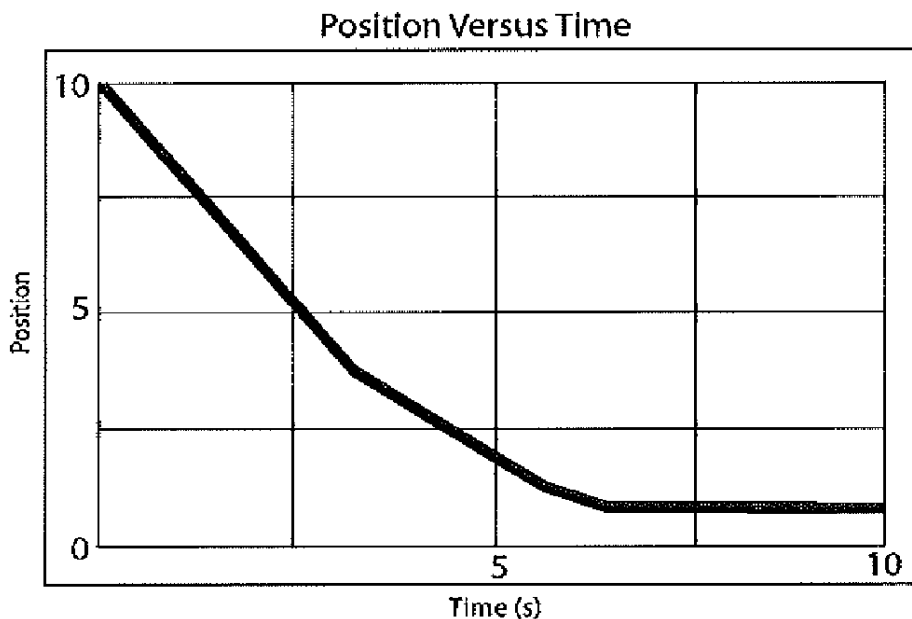


Go-Cart Test Run Probe Teacher Notes

Purpose



The purpose of this probe is to examine how students interpret a graphical representation of motion. The probe is designed to reveal whether students interpret a motion graph pictorially or mathematically.

Related Concepts

Clock readings, constant speed, graph, position, time, time intervals, speed, and uniform motion

Explanation

Karl has the best answer: “I think you were moving quickly, then slowed down to a stop at the end.” The speed of the go-cart is related to the slope of the line on the graph. Between 0 and 3 seconds, the go-cart is moving at a constant speed. Between 3 and 6 seconds, the go-cart is still moving at a constant speed, but slower than the previous interval. Between 6 and 7 seconds, the go-cart is moving at a slower speed. From 7 seconds on, there is no change in position; the go-cart has stopped.

A graph can also be interpreted by the slope of the lines. A straight line with a steep slope indicates constant motion at a greater speed than a straight line with a more gradual slope. When the line on a graph is horizontal, that means that as time goes by, the position of an object is not changing. The horizontal line on this graph means that the go-cart stops at the end of the motion.

Administering the Probe

This probe is appropriate for middle school students and high school students. You may adapt the probe by eliminating the answer choices and having students “tell the story” indicated by the graph. For students who may be unfamiliar with position versus time graphs, it may be helpful to describe the y axis as the milepost or distance marker.

Suggestions for Instruction and Assessment

- Provide multiple opportunities for students to construct and interpret graphs, so you can see what students understand or misunderstand about graphs and graphing.
- Provide students with different types of motion graphs, and have them make up stories about what the graphs show. Encourage discussions about the accuracy of their stories. Do the stories accurately reflect the information on the graphs? This strategy, popular in mathematics classes, can help students overcome the tendency to view graphs as a literal picture.
- Use motion detectors and students’ real movements to help students construct a visual and kinesthetic understanding of position versus time. MBLs (microcomputer-based laboratories) are known to improve the development of students’ abilities to interpret graphs. MBLs are particularly effective in helping middle school students understand that a graph is not a literal picture.
- Most middle school science curricula use distance versus time graphs instead of position versus time graphs. Although both types of graphs can be interpreted in the same way, teachers should help students understand the distinction between distance and position. In some textbooks, distance may mean distance traveled whereas position refers to the location of an object. In some special cases (such as when the motion starts at zero position) these terms mean the same thing. However, to avoid confusion, physics teachers tend to use position, which has a well-defined meaning.

Revised version of probe 5 Go-Cart Test Run Teacher Notes in Vol. 1 of Uncovering Student Ideas in Physical Science (Keeley & Harrington, 2010)