Analyzing Graphs of Motion Without Numbers

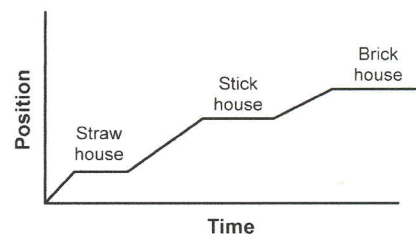**READ** [CPO Science]

Position-time graphs

The graph at right represents the story of "The Three Little Pigs." The parts of the story are listed below.

Position-time graph of the wolf in *The Three Little Pigs*

- The wolf started from his house. The graph starts at the origin.
- Traveled to the straw house. The line moves upward.
- Stayed to blow it down and eat dinner. The line is flat because position is not changing.
- Traveled to the stick house. The line moves upward again.
- Again stayed, blew it down, and ate seconds. The line is flat.
- Traveled to the brick house. The line moves upward.
- Died in the stew pot at the brick house. The line is flat.

The graph illustrates that the pigs' houses are generally in a line away from the wolf's house and that the brick house was the farthest away.

Speed-time graphs

A speed-time graph displays the speed of an object over time and is based on position-time data. Speed is the relationship between distance (position) and time, $v = d/t$. For the first part of the wolf's trip in the position versus time graph, the line rises steadily. This means the speed for this first leg is constant. If the wolf traveled this first leg faster, the slope of the line would be steeper.

The wolf moved at the same speed toward his first two "visits." His third trip was slightly slower. Except for this slight difference, the wolf was either at one speed or stopped (shown by a flat line in the speed versus time graph).
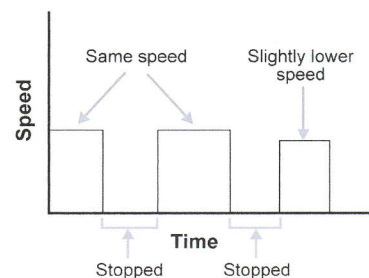
PRACTICE ▷

Read the steps for each story. Sketch a position-time graph and a speed-time graph for each story.

1. Graph Red Riding Hood's movements according to the following events listed in the order they occurred:

- Little Red Riding Hood set out for Grandmother's cottage at a good walking pace.
- She stopped briefly to talk to the wolf.
- She walked a bit slower because they were talking as they walked to the wild flowers.
- She stopped to pick flowers for quite a while.
- Realizing she was late, Red Riding Hood ran the rest of the way to Grandmother's cottage.
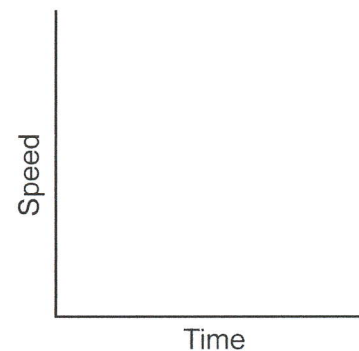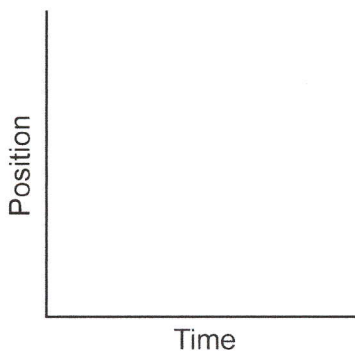
2. Graph the movements of the Tortoise and the Hare. Use two lines to show the movements of each animal on each graph. The movements of each animal is listed in the order they occurred.

- The tortoise and the hare began their race from the combined start-finish line. By the end of the race, the two will be at the same position at which they started.

- Quickly outdistancing the tortoise, the hare ran off at a moderate speed.

- The tortoise took off at a slow but steady speed.

- The hare, with an enormous lead, stopped for a short nap.

- With a startle, the hare awoke and realized that he had been sleeping for a long time.

- The hare raced off toward the finish at top speed.

- Before the hare could catch up, the tortoise's steady pace won the race with an hour to spare.
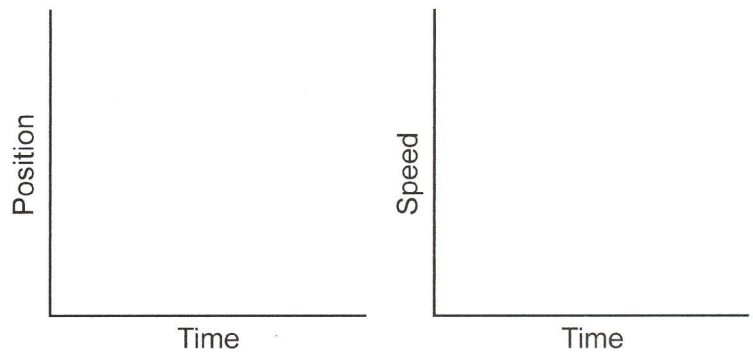
3. Graph the altitude of the sky rocket on its flight according to the following sequence of events listed in order.

- The sky rocket was placed on the launcher.

- As the rocket motor burned, the rocket flew faster and faster into the sky.

- The motor burned out; although the rocket began to slow, it continued to coast even higher.

- Eventually, the rocket stopped for a split second before it began to fall back to Earth.

- Gravity pulled the rocket faster and faster toward Earth until a parachute popped out, slowing its descent.

- The descent ended as the rocket landed gently on the ground.
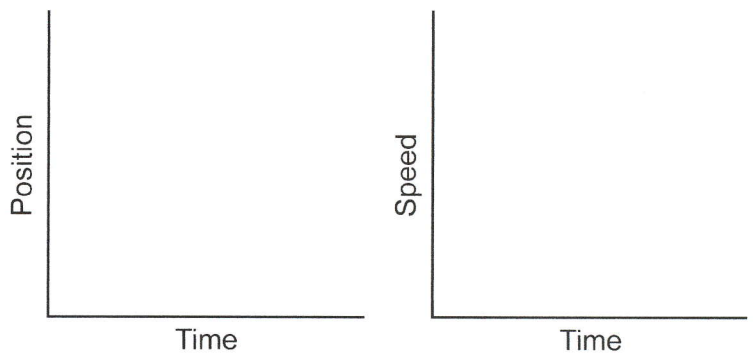
4. A story told from a graph: Tim, a student at Cumberland School, was determined to ask Caroline for a movie date. Use these graphs of his movements from his house to Caroline's to write the story.