Year 9 Science: Position-time graphs, free-body diagrams and pressure

Name: _____ Date: _____

Try these without your notes first, then check the answer key.

Practice

1. On a position-time graph, a line goes from 0 m at 0 s to 120 m at 20 s in a straight line. What is the speed, and is it steady?

2. Describe the motion shown by a position-time graph that is flat from 5 s to 12 s.

3. A kayak has 150 N of paddle thrust forward and 90 N of drag backward; its weight and the water's upward push are both 800 N. Find the net force.

4. A 60 N force pushes a drawing pin with a point of 0.000 001 m². What pressure does the point make, and why does it go into a cork board?

5. Explain why one wide snowboard and two skis both work on soft snow, but walking in boots does not.

Fix the mistake

6. Correct this statement: "A flat line on a position-time graph means the object is moving at a steady speed."

7. Correct this statement: "A straight line sloping upwards means the object is speeding up."

8. Correct this statement: "The free-body diagram of a box should show the box pushing down on the floor."

9. Correct this statement: "An axe cuts wood because it pushes harder than a hammer."

Answer key (for parents and tutors)

1. On a position-time graph, a line goes from 0 m at 0 s to 120 m at 20 s in a straight line. What is the speed, and is it steady?
   6 m/s, from 120 ÷ 20, and it is steady because the line is straight.
2. Describe the motion shown by a position-time graph that is flat from 5 s to 12 s.
   The object is stopped (stationary) for 7 s, because its position does not change.
3. A kayak has 150 N of paddle thrust forward and 90 N of drag backward; its weight and the water's upward push are both 800 N. Find the net force.
   Vertical forces cancel, so the net force is 150 − 90 = 60 N forward, and the kayak speeds up.
4. A 60 N force pushes a drawing pin with a point of 0.000 001 m². What pressure does the point make, and why does it go into a cork board?
   60 ÷ 0.000 001 = 60 000 000 Pa. The tiny point concentrates the force into a huge pressure that pushes the cork apart.
5. Explain why one wide snowboard and two skis both work on soft snow, but walking in boots does not.
   A snowboard and two skis both spread the weight over a large area, giving a low pressure the snow can hold up. Boots put the same weight on a small area, so the pressure is high and they sink.
6. Correct this statement: "A flat line on a position-time graph means the object is moving at a steady speed."
   A flat line means the position is not changing, so the object is stopped; a straight sloping line is a steady speed.
7. Correct this statement: "A straight line sloping upwards means the object is speeding up."
   A straight line has the same slope all the way, so the speed is steady; only a curve that gets steeper shows speeding up.
8. Correct this statement: "The free-body diagram of a box should show the box pushing down on the floor."
   A free-body diagram shows only the forces acting on the box, such as its weight and the floor's support, not forces it puts on other things.
9. Correct this statement: "An axe cuts wood because it pushes harder than a hammer."
   With the same force, the axe's thin edge has a much smaller area, so the pressure F ÷ A is far bigger.