

Name: _____

Date: _____

Lesson 13 Student Assessment

You are riding down the sidewalk on a skateboard (or roller skates, or an electric scooter). You hear your phone ring, so you take it out of your pocket to see what your friends have to say. Without warning, you hit a bump in the road and lose your balance. Lucky for you, you catch yourself against the wall of a building. Unluckily for your phone, it was in your hands when you caught yourself.

1. Draw a force diagram showing the collision forces between your phone and the wall. Only include the phone and the wall and any forces from the interaction of the phone and wall in your diagram.

+1 for showing the phone and wall.

+1 for showing the force of the phone on the wall with an arrow.

+1 for labeling the force of the phone on the wall.

+1 for showing the force of the wall on the phone with an arrow.

+1 for labeling the force of the wall on the phone.

+1 for drawing equal length arrows representing the force of the phone on the wall and the force of the wall on the phone.

2. Sketch what the surface of the wall might look like **before the collision**, and next to it, sketch what the surface of the wall would look like **during the collision**.

+1 for showing deformation in the wall during the collision (relative to the “before collision” picture).

3. Compare the strength of the force of the phone on the wall to the force of the wall on your phone.

+1 for indicating that the two forces are equal in strength.

4. When the phone collided with the wall, the wall didn't change its motion. Why not?

+1 for indicating that there must be some force (like the ground) holding the wall still.

5. Sadly, your phone did not survive the collision. Explain why the phone broke.

+1 for indicating that the force of the wall on the phone was bigger than the elastic limit of the phone.

6. Fortunately, the wall survived the collision just fine. Explain why the wall didn't break.

+1 for indicating that the force of the phone on the wall was smaller than the elastic limit of the wall.

7. Describe a phone protector you might use to protect your phone.

+1 for a reasonable description of some type of padding material.

8. Explain why the phone protector might have protected your phone.

+1 for describing that each layer of the padding material might break but in the process would exert a small force from the wall on the phone (to stop the phone).

+1 for indicating that those small forces will act over a larger distance.

+1 for indicating that the small forces over a larger distances may be smaller than the elastic limit of the phone.

9. Let's say that instead of protecting your phone, there was protective material on the wall. Would it be possible to protect your phone by putting some protective material on the wall? Why or why not?

+1 for indicating that you could protect your phone in a collision by putting protective material on the wall.

+1 for indicating that it doesn't matter which object the padding is attached to. In both cases, there will be smaller forces over a longer distance in the collision.

10. Let's say that the protective material on your phone added a lot of mass to your phone. Would the extra mass protect your phone or could it harm your phone? Why?

+1 for indicating that the extra mass would almost certainly harm the phone.

+1 for indicating that it takes more force to stop objects with more mass. The force it takes to stop the phone is the force on the phone, and bigger forces stopping the phone make it more likely the phone will break.