IMPLICATIONS OF INERTIA ANSWER KEY

***Instructions**: There are many more applications of Newton's 1st Law of Motion. Several applications are listed below; use inertia to explain the situations below. Please use full sentences.*

1. Blood rushes from your head to your feet while quickly stopping when riding on a descending elevator.

   Your blood's inertia (resistance to changes in motion) causes it to continue moving downward while you're stopping, so it rushes from you head to your feet.

2. The head of a hammer can be tightened onto the wooden handle by banging the bottom of the handle against a hard surface.

   Because the head of the hammer is more massive, it has more inertia. This means that it resists the change in motion more, so it continues moving downward after the handle stops, thus tightening the head of the hammer.

3. A brick is painlessly broken over the hand of a physics teacher by slamming it with a hammer. (CAUTION: do not attempt this at home!)

   The inertia of the rock is not overcome by the strike from the hammer, so it moves very little (if at all) and the teacher's hand is safe. (PHEW!)

4. To dislodge ketchup from the bottom of a ketchup bottle, it is often turned upside down and thrust downward at high speeds and then abruptly halted.

   The inertia of the ketchup causes it to continue moving downward after the bottle is halted. This means that the ketchup moves closer to the top of the bottle.

5. Headrests are placed in cars to prevent whiplash injuries during rear-end collisions.

   The inertia of your head causes it to continue moving forward at the same speed (constant velocity – resistance to change in motion) even though the car is accelerating forward because of the impact. This would cause your neck to snap backwards in the headrest wasn't there, which would lead to whiplash.

6. While riding a skateboard (or wagon or bicycle), you fly forward off the board when hitting a curb or rock or other object that abruptly halts the motion of the skateboard.

   Both you and the skateboard are moving along; but when the skateboard stops, your inertia continues to carry you forward. Thus you will fly off the skateboard. Ouch!

***Instructions**: Use your understanding of inertia to answer the questions below. Please use full sentences.*

7. Imagine a place in the cosmos far from all gravitational and frictional influences. Suppose that you visit that place and throw a rock. Will the rock gradually stop or continue in motion in the same direction at constant speed?

   It will continue in the same direction at a constant speed. This is because there is no unbalanced force to cause a change in its motion, so it continues with constant motion as Newton's 1st law describes.

8. Mac and Tosh are arguing in the cafeteria. Mac says that if he flings his Jell-O with a greater speed it will have a greater inertia. Tosh argues that inertia does not depend upon speed, but rather upon mass. Who do you agree with? Explain why.

   Tosh is correct! Inertia is that quantity which depends solely upon mass. The more mass, the more inertia on object has. A more massive object will resist changes in its motion more as the demo with the two rocks showed.

9. Supposing you were in space in a *weightless environment;* would it require a force to set an object in motion?

   Even in space objects have mass. And if they have mass, they have inertia. That is, an object in space resists changes in its state of motion. A force must be applied to set a stationary object in motion. Newton's laws rule - everywhere!

10. Ben Tooclose is being chased through the woods by a bull moose that he was attempting to photograph. The enormous mass of the moose is extremely intimidating. Yet, if Ben makes a zigzag pattern through the woods, he will be able to use the large mass of the moose to his own advantage. Explain.

    The large mass of the bull moose means that the bull moose has a large inertia. Thus, Ben can more easily change his own state of motion (make quick changes in direction) while the moose has extreme difficulty changing its state of motion. Physics can save your life!

11. Little Cindy Lou Who stands on her toes and spots two bricks resting on the edge of a table. She acquires an intense desire to know which of the two bricks are most massive. Since Cindy is vertically challenged, she is unable to reach high enough and lift the bricks; she can however reach high enough to give the bricks a push. Discuss how the process of pushing the bricks will allow Cindy to determine which of the two bricks is most massive. What difference will Cindy observe and how can this observation lead to the necessary conclusion?

    The bricks, like any object, possess inertia. That is, the bricks will resist changes in their state of motion. If Cindy gives them a push, then the bricks will offer resistance to this push. The one with the most mass will be the one with the most inertia. This will be the brick which offers the most resistance.