Newton's First Law of Motion - Inertia

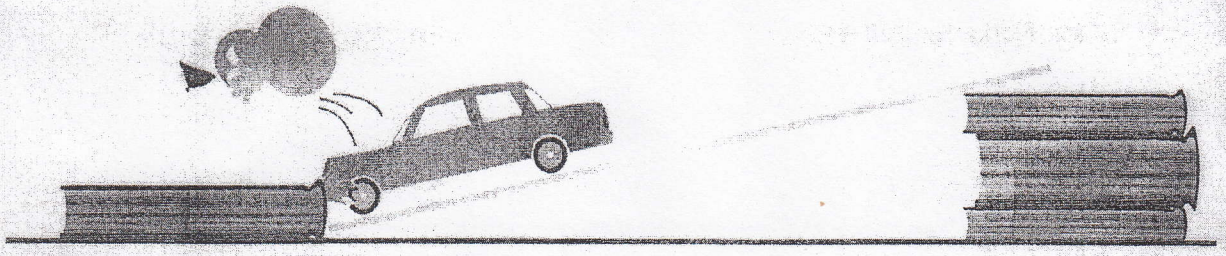
Sir Isaac Newton
(1642-1727)

Draw a picture and write about it.

Use Newton's First Law of Motion (Inertia) to explain why the figure is launched of the front of the car.

a. The small figure is not attached to the car as it rolls down the ramp.

b. The small figure and the car accelerate down the ramp.



c. At the bottom, the car is stopped by the stack of books, but the small figure continues to move.

Newton's First Law of Motion

Newton's first law of motion (inertia) states that the motion of an object will continue until an unbalanced outside force changes the object's motion. Inertia is defined as the tendency of an object to resist changing its state of motion. The amount of force needed to change the motion of an object depends on the amount of inertia an object has. The inertia of an object is directly related to its mass. More force is required to change the motion of an object with large mass and less force is required to change the motion of an object with low mass.

1. What is inertia?

2. Does the law of inertia apply to moving objects, objects at rest, or both?

3. Complete the following sentence: An object in motion will stay in motion and an object at rest will stay at rest unless.....

4. Why does an object at rest stay at rest?

5. Why does an object in motion continue at a constant velocity? (Remember that velocity is speed and direction).

6. What is the relationship between Mass and Inertia?

7. If you were in a spaceship and fired a cannonball into frictionless space how much force would have to be exerted on the cannonball to keep it moving once it has left the cannon? Explain your answer.

8. An elephant and a mouse both have the same weight (zero) in deep-outer-space (far from any gravitational fields). If they were both moving toward you with the same velocity (speed and direction) would they hit you with the same force? Explain your answer.

9. Many automobile passengers have suffered neck injuries when struck by other cars from behind. Headrests were invented for car seats to prevent neck injuries. How does Newton's first law (inertia) apply here?

10. If an elephant were chasing you its mass would seem very threatening. If you ran in a zig-zag pattern the elephant's mass would work to your advantage. Why?

11. Two closed containers look the same, but one is packed with lead and the other with feathers. How could you determine which contains the lead (more mass) if you and the containers were in a weightless environment?

12. If suddenly the force of gravity from the sun stopped acting on the planets what path would the planets travel?

Inertia Lab

Objective: to determine the relationship between Mass and Inertia.

Introduction: Newton's First Law of Motion (Inertia) states that an object with mass has a tendency to resist changing its state of motion. In other words, an object at rest will remain at rest and an object in motion will remain in motion UNLESS acted upon by an unbalanced, outside force. This means that there is a natural tendency of objects to keep doing what they are already doing. All objects with mass resist changes to their state of motion. In the absence of an unbalanced force the motion of an object will not change.

Activity One:

You are given an index card, a glass jar, and three objects that have different masses (low, medium, high). You will place an object on top of the glass jar and "flick" the card sideways.

- Place the index card on top of the jar and place the low mass object on top of the index card.
- With your finger, or a ruler, "flick" the card and record whether the object falls into the jar or not.
    - Repeat this 5 times with each of the objects and record your information in the data table below.

Mass	# of misses	# of hits	Class average
Low			
Medium			
High			

1. Describe what happens to your objects in complete sentences.

2. Use Newton's first law (inertia) to explain why the objects fall into the cup if the card is removed quickly.

3. Explain why pulling on the card slowly will not work even though the objects have inertia. (hint: friction is force)

Activity 2:

- Stack five washers on top of one another so that you form a tower of washers. Aim a sixth washer at the bottom of the stack and give it a hard flick with a ruler so it collides with the stack.

4. Use Newton's first law (inertia) to describe what happens in complete sentences.

5. Why does only the bottom washer move?

Activity 3:

- Fold your arm such that your hand rests on your rests on your shoulder. Place some washers on your elbow.
- Quickly move your hand forward and try to catch the washers before they hit the ground.

6. Use Newton's first law (inertia) to describe what happens in complete sentences.

Activity 4:

- Spin one of each type of egg (hard boiled and raw) then stop the egg from spinning.

7. Using Newton's first law (inertia) describe what you observed after spinning/stopping the egg.

Activity 5:

- Balance the hoop in the center of the glass jar and then balance the pen cap on the hoop aligning it with the center of the opening in the jar. Pull the hoop quickly to either side.

8. Using Newton's first law of motion (inertia), explain why the pen cap falls into the glass jar.

9. State the definition of Inertia in your own words.

10. How are Mass and Inertia related?