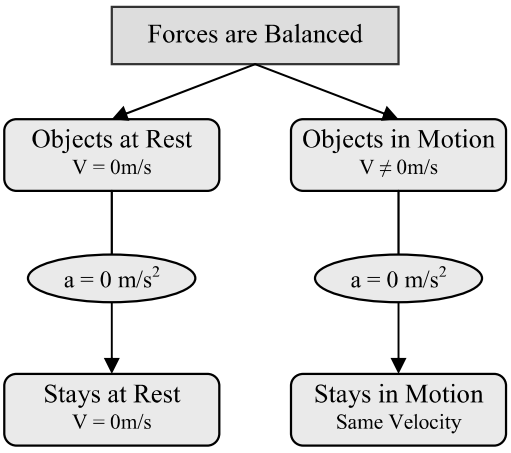
Information

Newton's First Law



Newton's first law of motion is often stated as an object at rest tends to stay at rest and an object in motion tends to stay in motion with the same speed and in the same direction unless acted upon by an unbalanced force.

In fact, it is the natural tendency of objects to resist changes in their state of motion. This tendency is described as inertia. A more massive object has a greater tendency to resist changes in its state of motion.

Inertia: the resistance an object has to a change in its state of motion.

Forces are said to be *balanced* when the net force on the object are zero. That is when all the forces are added up the result is zero. For example when you are standing the force of gravity is balanced by the force of the floor holding you up.

Forces are *unbalanced* when the net force is not zero. In a tug-of-war both teams apply forces. For a team to win the forces must be unequal or unbalanced. You want the net force to be in your direction.

Critical Thinking Questions – Part II

1. Restate Newton's first law in terms of acceleration.

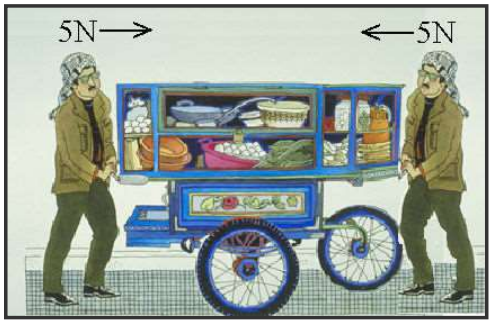
2. If the forces are balanced what is the resulting acceleration?

3. An object's resistance to change in motion is dependent solely on what quantity?

4. Inertia is the resistance to change in motion so inertia depends solely on what?

5. What is required to cause acceleration?

6. What is the net force if you push a cart to the right with 5N of force and a friend pushes the cart to the left with 5N of force?



7. What is the net force if you start to pull instead of pushing in #6?

Exercises

1. Imagine a place in the *cosmos* far from all gravitational and frictional influences. Suppose that you visit that place (just suppose) and throw a rock. What will the rock do? Why?

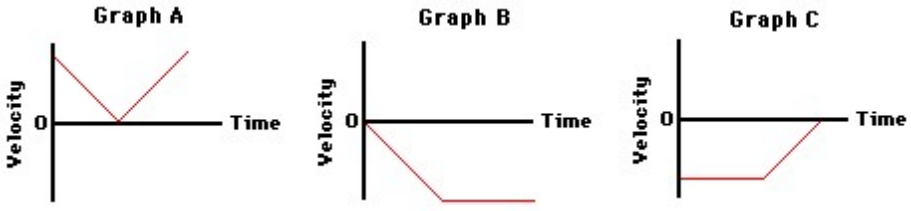
2. Supposing you were in space in a *weightless environment*, would it require a force to set an object in motion? Explain.

3. Why doesn't a ball roll on forever after being kicked at a soccer game?

4. A 2-kg object is moving horizontally with a speed of 4 m/s. How much net force is required to keep the object moving at this speed and in this direction? Explain.

5. Ben Tooclose is being chased through the woods by a bull moose which he was attempting to photograph. The enormous mass of the bull 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 this in terms of inertia and Newton's first law of motion.

6. Luke Autbeloe drops an approximately 5.0 kg object (weight = 50.0 N) off the roof of his house into the swimming pool below. Upon encountering the pool, the object encounters a 50.0 N upward resistance force (assumed to be constant). Use this description to answer the following questions. *(Down is usually considered a negative direction)*
   a. Which one of the velocity-time graphs best describes the motion of the object? Why?



   b. True or False: Once the object hits the water, the forces are balanced and the object will stop. Support your answer with reasoning.