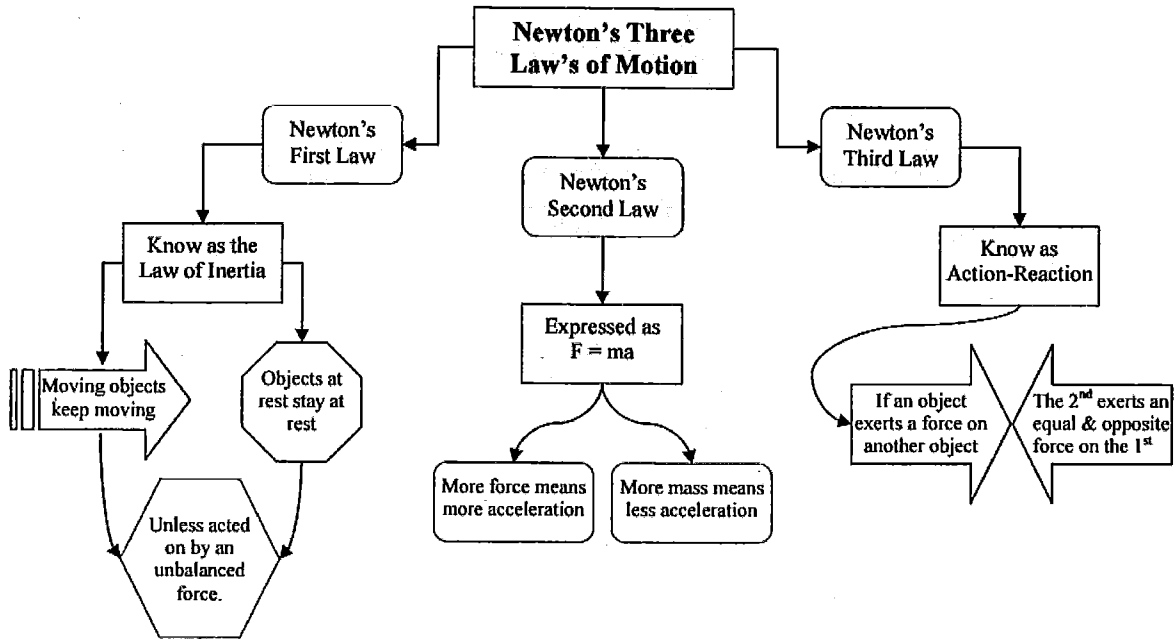


# NEWTON'S LAWS OF MOTION

*If I am anything, which I highly doubt,  
I have made myself so by hard work. – Isaac Newton*

## Information

A **Force** is defined most simply as any push or pull.



## Critical Thinking Questions – Part I

1. Which law is associated with inertia?
2. If you increase the force on an object what happens to the acceleration?
3. If you use the same force on a less massive object what happens to the acceleration?
4. Which law states force is dependent on the mass and acceleration of an object?
5. What causes an object to slowdown or speed-up?
6. What law is known as the law of action-reaction?

7. Which law explains why when you bump into something you fall backwards?
8. If you double the force of an object what happens to the acceleration?
9. If you double the mass of an object what happens to the acceleration?
10. Force is measured in newtons (N). A newton is based on base units in the metric system. What is a newton equal to in terms of units of mass and acceleration?

### **Exercises**

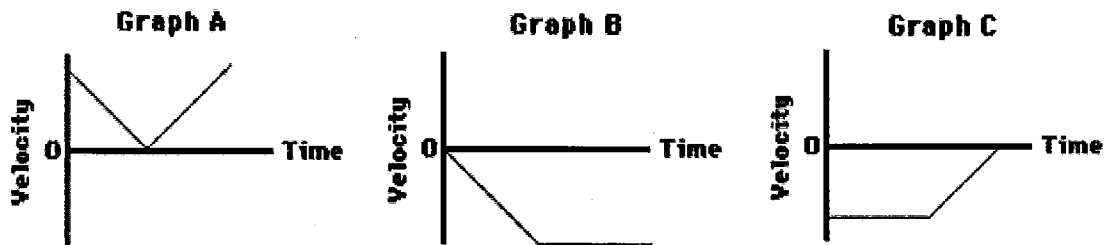
1. When Jane drives to work, she always places her purse on the passenger's seat. By the time she gets to work, her purse has fallen on the floor in front of the passenger seat. One day, she asks you to explain why this happens in terms of physics. What do you say?
2. You are waiting in line to use the diving board at your local pool. While watching people dive into the pool from the board, you realize that using a diving board to spring into the air before a dive is a good example of Newton's third law of motion. Explain how a diving board illustrates Newton's third law of motion.
3. You know the mass of an object and the force applied to the object to make it move. Which of Newton's laws of motion will help you calculate the acceleration of the object?
4. How many newtons of force are represented by the following amount:  $3 \text{ kg}\cdot\text{m}/\text{sec}^2$ ? Justify your answer.

5. Your shopping cart has a mass of 65 kilograms. In order to accelerate the shopping cart down an aisle at  $0.3 \text{ m/sec}^2$ , what force would you need to use or apply to the cart?

6. A small child has a wagon with a mass of 10 kilograms. The child pulls on the wagon with a force of 2 newtons. What is the acceleration of the wagon?

7. You dribble a basketball while walking on a basketball court. List and describe at least 3 pairs of action-reaction forces in this situation.

8. 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?