

# Net Force and Vectors

Changes in \_\_\_\_\_ are produced by a **force** or combination of forces. A force, in the simplest sense, is a **push** or a **pull**. The source of a push or pull may be gravitational, electrical, magnetic, or simple muscular effort.

Here's a box of candy floating in free space. Let's suppose we exert a 5 N force on it (a bit more than 1 lb of force).

**candy** → 5 N

A \_\_\_\_\_ is an arrow that shows the magnitude and direction of a measured property (such as force, velocity, acceleration, and much more). The magnitude is the **extent** of the property (how much it is). The 5 Newton force can produce a pick up in speed of the box.

Suppose we exert a second identical force on the box. The pair of 5 Newton forces will \_\_\_\_\_ the gain in speed.

**candy** ⇒ 10 N

The box reacts the same no matter if it is pushed by **two** 5 Newton forces or just **one** 10 Newton force. Both situations result in a net force of \_\_\_\_\_ Newtons pushing on the box in the same direction. The forces simply add.

Suppose we pull on the box with two oppositely directed forces – one 10 Newtons to the right and the other 5 Newtons to the left.

5 N ← **candy** → 10 N

How does the box move? Here, the forces \_\_\_\_\_ and the box moves as if a single 5 Newton force acts on it. The net force on the box is 5 Newtons to the \_\_\_\_\_.

Suppose a pair of 5 Newton forces act in opposite directions on the box.

5 N ← **candy** → 5 N

In this situation the forces cancel out and the net force on the box is \_\_\_\_\_ which means that the object experiences no change in \_\_\_\_\_. We say that the box is in mechanical \_\_\_\_\_.

Suppose that Nellie Newton hangs from a bar attached to a single rope. If Nellie's mass exerts a downward gravitational force of  $300\text{ N}$ , then the force of tension on the rope is \_\_\_\_\_  $\text{N}$  in the upward direction.

Suppose three evenly spaced ropes support Nellie's mass so that the tension in each rope is the same. We know that the **sum** (addition) of the tensions have to add up to  $300$  Newtons. This means that each rope must hold \_\_\_\_\_  $\text{N}$  of tension.

Lots of fun problems can be thought up by thinking about strings and string tension!