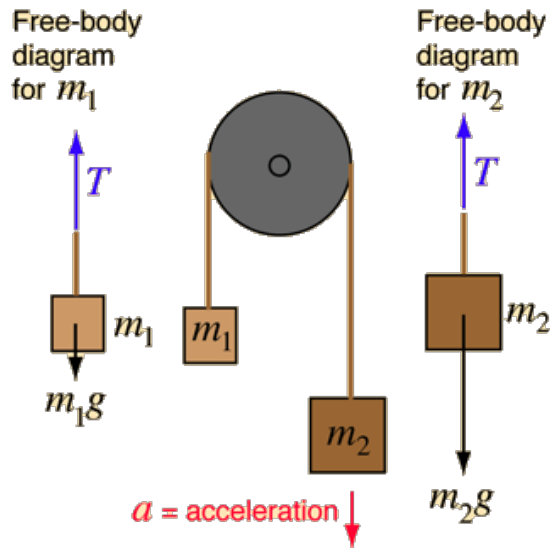


**A: What are Atwood Machines?**

An Atwood machine is a device used to measure and test Newton's Laws.

Diagram of an Atwood Machine:



In Part 1: We will understand the Atwood Machine as a *full system*:  
[Which is by far the easier, more coherent way of understanding at Atwood Machine.]

In order to do this, there are only two formulas necessary:

**Force of Gravity (Weight)**

$$F_g = mg$$

Force of Gravity = Mass \* Free-Fall Acceleration

in which, on earth, Free-Fall Acceleration =  $9.8 \text{ m/s}^2$ .

**Newton's Second Law**

$$\Sigma F = ma$$

Net force of a system = (mass of the system) \* (Acceleration of the System)

**B: Simple Atwood Machine Problems**

**B.1.** An Atwood machine has two masses on it.

[Assume the Atwood machine is frictionless and the string is massless.]

Mass 1 = 0.5 kg [is on the right side]

Mass 2 = 0.3 kg [is on the left side]

Assume the Atwood machine is frictionless, and that the string is massless.

A) Draw a schematic of the Atwood machine

B) Draw a free-body diagram of the Atwood machine as a *full system*.

There are only two external forces acting on the Atwood Machine:

Unlike most Free-body diagrams that you create, in this free-body diagram forces will be directly *clockwise* or *counterclockwise*.

C) Find the net force acting on the Atwood Machine:

D) Find the *total mass* of the Atwood machine. [Remember that the string is massless.]

[We are thinking about *total mass* because the Atwood machine is a *system*.]

E) Use Newton's second law to find the acceleration of the Atwood machine.

Find both the magnitude and direction of acceleration.

**B.2** An Atwood machine has two masses on it.

Mass 1 = 1.5 kg [is on the right side]

Mass 2 = 2.2 kg [is on the left side]

Assume the Atwood machine is frictionless, and that the string is massless.

- A) Draw a schematic of the Atwood machine.
- B) Draw a free-body diagram of the Atwood machine.
- C) Find the net force acting on the Atwood machine.
- D) Find the total mass of the Atwood machine.
- E) Use Newton's Second Law to find the acceleration of the Atwood machine. Give magnitude and direction.

**B.3** An Atwood machine has two masses

Mass 1 [left side] = 0.9 kg

Mass 2 [right side] = 0.8 kg

- A) Draw a schematic of the Atwood machine.
- B) Draw a free-body diagram of the Atwood machine.
- C) Find the net force acting on the Atwood machine.
- D) Find the total mass of the Atwood machine.
- E) Use Newton's Second Law to find the acceleration of the Atwood machine. Give magnitude and direction.

**Answers:**

B.1  $2.45 \text{ m/s}^2$  clockwise

B.2  $1.85 \text{ m/s}^2$  counterclockwise

B.3  $0.576 \text{ m/s}^2$  counterclockwise