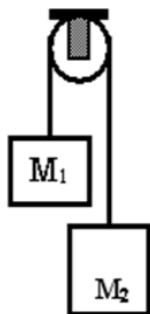
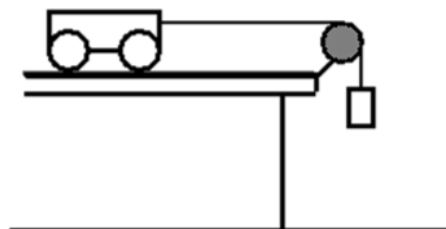


# Force Problems Involving Two or More Connected Objects

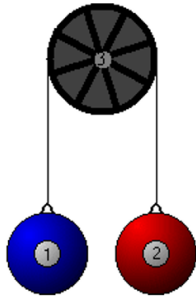
Atwood's Machine



Fletcher's Trolley



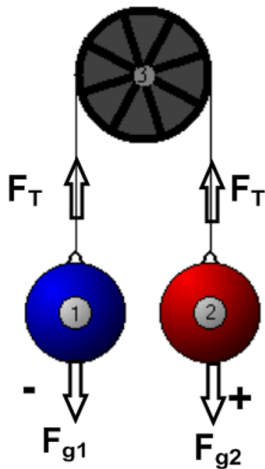
## Atwood Machine Problems



This is an example of a system where there are multiple masses.

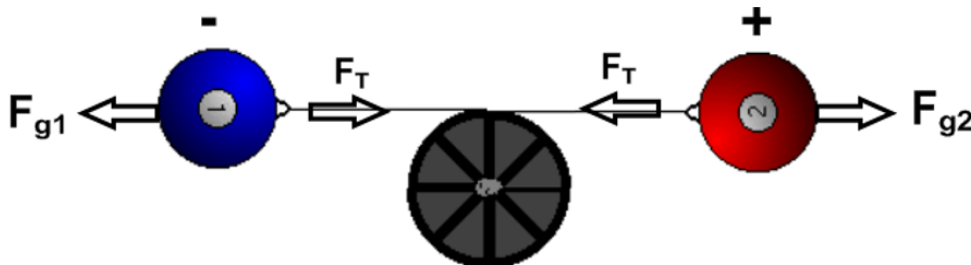
We will apply the concept of forces to determine the resulting acceleration.

### Define the Direction of Forces



Our problems will not include friction and the pulley will always be massless.

You may find it easier to picture, or draw, the system horizontally.



To solve we use the formula:

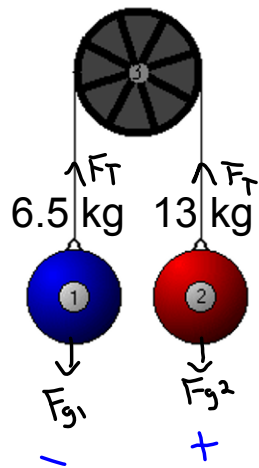
$$\sum \vec{F} = \sum m \times \vec{a}$$

Sum of the forces = sum of the masses x acceleration

\*only forces acting in the direction of motion are to be incorporated.

**Reading Review MHR: 476, 478 - 479.**

Calculate the acceleration of the masses in the diagram below.



$$\sum \vec{F} = \sum m \times a \quad a = ?$$

$$F_{g1} + F_{g2} + \cancel{F_T} + \cancel{F_T} = (m_1 + m_2) a$$

$F_T$  are equal and opposite  
So they cancel out

$$F_{g1} + F_{g2} = (m_1 + m_2) a$$

$$F_g = m g$$

9.81

$$-(6.5)(9.81) + (13)(9.81) = (6.5 + 13) a$$

$$63.8 = 19.5 a$$

$$\boxed{3.27 = a}$$

$m/s^2$

Calculate the magnitude of tension in the string.

\* Apply  $\sum \text{Forces}$  for one mass.

$$\sum \text{Forces on } m_1 = m_1 a$$

$$F_{g1} + F_T = m_1 a$$

$$-m_1 g + F_T = m_1 a$$

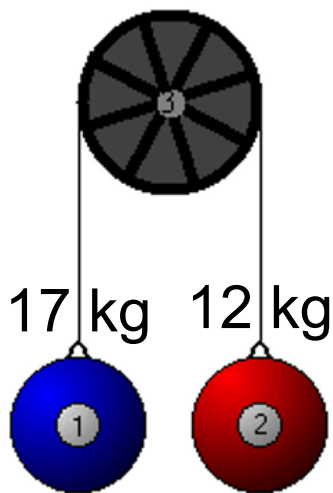
$$-(6.5)(9.81) + F_T = 6.5(3.27)$$

$$-63.8 + F_T = 21.3$$

$$\boxed{F_T = 85 \text{ N}}$$

Your Turn:

Calculate the acceleration of the masses in the diagram below.



$$|\vec{a}| = 1.69 \text{ m/s}^2$$

$$|F_T| = 138 \text{ N}$$

Calculate the magnitude of tension in the string.

## Attachments

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forces-and-motion-basics\_all.jar

forces-1d\_all.jar