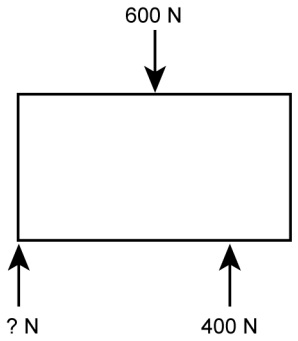
Name:

Skill Sheet 6.3 Equilibrium

When all forces acting on a body are balanced, the forces are in equilibrium. Here are free-body diagrams for you to use for practice working with equilibrium.

1. Equilibrium

Remember that an unopposed force results in acceleration. Therefore, the forces acting on a body that is at rest or moving at a constant velocity must be at equilibrium. Conceptually, free-body equilibrium problems are identical to solving equations.



600 N = 400 N + ? N

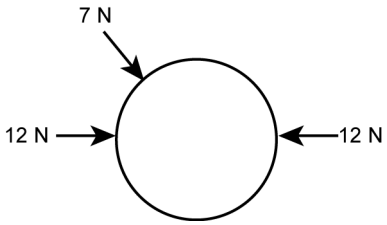
200 N = ? N

You can see that the free-body diagram is conceptually interchangeable with the equation. However, it is important to keep in mind that equilibrium means that forces are in balance; the condition tells us nothing about the magnitude of those forces.

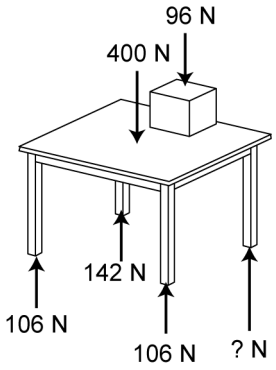
2. Achieving equilibrium

For each free-body diagram, supply the force or forces necessary to achieve equilibrium.

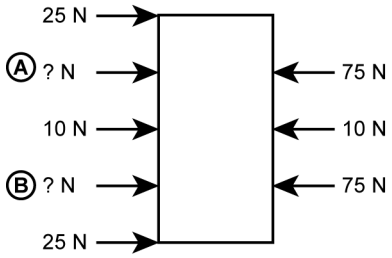
1. Draw a force arrow, and write in the force.



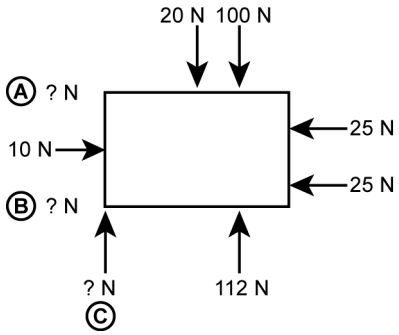
2. Supply the missing force.



3. Distribute the unknown forces evenly to prevent rotation.

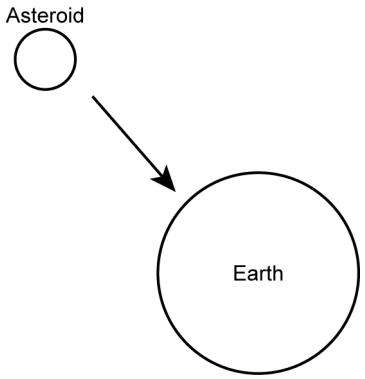


4. Supply the missing force.



3. Think about these

1. Here is the classic "asteroid destroys Earth" scenario. The momentum of the asteroid is beyond the forces that even thermonuclear bombs might apply to stop its approach. Assuming that you can apply only modest forces, where might they best be applied to result in a new acceleration that will, as they say, "save the world"? Draw an arrow to show the best location on the asteroid to apply force so that it avoids hitting Earth.



2. Helium balloons stay the same size as you hold them, but swell and burst as they rise to high altitudes when you let them go. Draw and label force arrows inside and/or outside the balloons on the graphic at right to show why the near Earth balloon does not burst, but the high altitude balloon does eventually burst. Hint: What are the forces on the inside of the balloon? What are the forces on the outside of the balloons?