



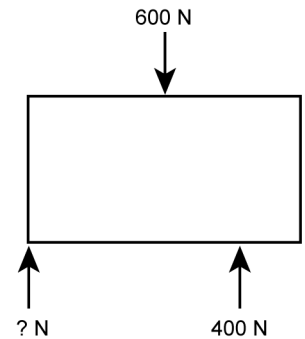
## 5.3 Equilibrium

### READ



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

Remember that an unbalanced force results in acceleration. Therefore, the forces acting on an object that is not accelerating must be balanced. These objects may be at rest, or they could be moving at a constant velocity. Either way, we say that the forces acting on these objects are in *equilibrium*.



### EXAMPLE



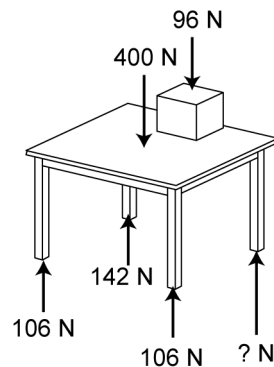
What force is necessary in the free-body diagram at right to achieve equilibrium?

<p><b>Looking for</b> The unknown force: ? N</p>	<p><b>Solution</b></p> $600 \text{ N} = 400 \text{ N} + ? \text{ N}$ $600 \text{ N} - 400 \text{ N} = 400 \text{ N} - 400 \text{ N} + ? \text{ N}$ $200 \text{ N} = ? \text{ N}$
<p><b>Given</b> 600 N is pressing down on the box. 400 N is pressing up on the box.</p>	
<p><b>Relationship</b> You can solve equilibrium problems using simple equations: <math>600 \text{ N} = 400 \text{ N} + ? \text{ N}</math></p>	

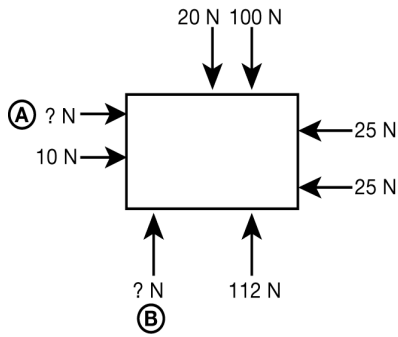
### PRACTICE



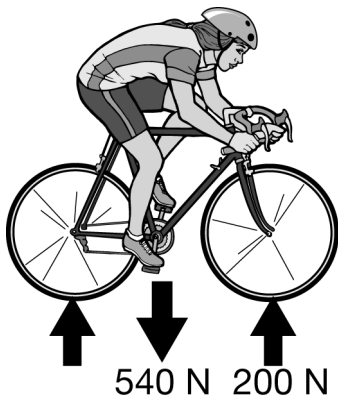
- Supply the missing force necessary to achieve equilibrium.



2. Supply the missing forces necessary to achieve equilibrium.



3. In the picture, a girl with a weight of 540 N is balancing on her bike in equilibrium, not moving at all. If the force exerted by the ground on her front wheel is 200 N, how much force is exerted by the ground on her back wheel?



**Challenge Question:**

4. 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?

