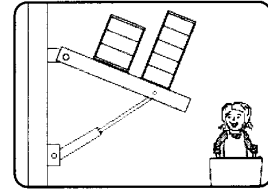


22 Tilt Tester

The concept investigated in this simulation is center of gravity.



Situation A

A furniture company has developed a new file cabinet that is tall, narrow, and extremely light-weight. However, the company is fearful of possible lawsuits if the cabinets fall over. They have decided the new cabinets must be as stable as their previous cabinets, which were shorter and wider. Tammy has developed a special tilt-testing device to test the stability of the new and old cabinets. The device gradually tilts the cabinets until they fall over. Tammy's job is to determine the required location of the new cabinet's center of gravity (CG) so that it will be as stable as the old cabinet.

Make a Prediction

1. Both cabinets have their centers of gravity located at their geometric centers. Predict which cabinet will tip over first when tested with the tilt-tester. Write your prediction below and explain your reasoning.



Run Simulation Set *Horizontal position from center* to 0.00 cm. Set *Vertical position from center* to 0.00 cm. Click the *Run* button and observe the simulation.

2. Was your prediction correct? Explain the result.

3. Using the *Step forward* and *Step backward* buttons, determine the angles at which the cabinets begin to tip over.

Angle at which the short cabinet begins to tip over = _____ degrees.

Angle at which the tall cabinet begins to tip over = _____ degrees.

4. How would each of the following affect the stability of the tall cabinet? Explain your answers.

- a. Increasing the height of the cabinet's center of gravity.

- b. Making the cabinet out of a different material that makes it weigh less but doesn't change its center of gravity.

- c. Making the cabinet's base wider.

5. Run the simulation as directed below to determine where the center of gravity of the tall cabinet must be located for it to be as stable as the shorter cabinet.



Run Simulation Click the *Reset* button. Set *Horizontal position from center* to 0.00 cm. Set *Vertical position from center* to -10.00 cm. Click the *Run* button and observe the simulation. If the tall cabinet tips over before the short cabinet, click the *Reset* button, decrease the *Vertical position from center* by an additional 10.00 cm, and repeat the simulation. Continue this procedure until the tall cabinet is as stable as the short cabinet. Record the values asked for below.

Use the *Step forward* and *Step backward* buttons if necessary to obtain the following values.

Horizontal position from center = 0.00 cm.

Vertical position from center = _____ cm.

Angle at which the tall cabinet begins to tip = _____ degrees.

Make a Prediction

6. Predict whether shifting the tall cabinet's center of gravity to the left will increase its stability. Write your prediction below and explain the reasoning behind it.

7. Run the simulation as directed below to determine how shifting the tall cabinet's center of gravity to the left affects its stability.



Run Simulation Click the *Reset* button. Set *Horizontal position from center* to -8.00 cm. Set *Vertical position from center* to the value obtained in Question 5. Click the *Run* button and observe the simulation. Record the values asked for below.

Use the *Step forward* and *Step backward* buttons if necessary to obtain the following values.

Horizontal position from center = -8.00 cm.

Vertical position from center = _____ cm (from Question 5).

Angle at which the tall cabinet begins to tip = _____ degrees.

8. Was your prediction in Question 6 correct? Explain the result.
