

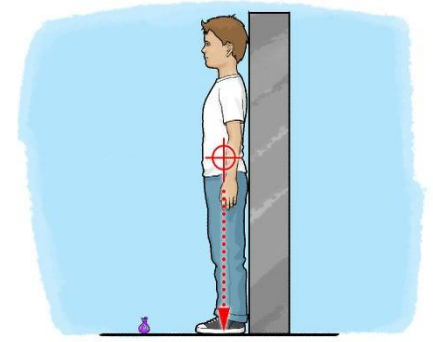
# A Science Phenomena Exploring Center of Gravity/Center of Mass

## Start here:

Challenge someone to bend at the waist and touch their toes or pick up a small object while standing with their back against the wall, keeping their knees straight (not locked) and heels on the floor and against a wall.

### If you follow the rules, IS IT POSSIBLE?

Hmm... I wonder what's happening here?  
If you can't, can you find anyone in your house that can?



Source: Scientific American

## Science Skills:

### Gather data:

- Record how many attempts are made, and the results.
- Record the angle (sketch or estimate) of different people before they fall; is there a difference?

### Ask questions and predict:

Write "what if...questions."

- What if I could lift my heels?
- What if I wore shoes with a heel or thick sole?

Predict what would happen if you changed one variable (height of person, type of shoe)

- "If we could change \_\_\_\_\_, then I think \_\_\_\_\_ might happen."

### Record your observations:

- Draw and label a model of the experiment.
- Write a sequence of the experiment. (first, next, then, finally)
- Tell someone what happened.
- Tell how this challenge might look different when you're not against a wall?
- Record a video, or take pictures, and add voice or text to explain what happened.

### Try a related experiment:

- Try one of your "what if" questions? Record your observations.

### Make sense of data:

- Talk about any patterns you see in the results.
- Write a statement that sums up the results.
- Make a graph or visual representation of the results.
- Compare and contrast picking up an item when ~~not~~ standing against a wall vs not standing against a wall.

### Draw a conclusion: (Families: let kids make their own conclusions based on their thinking.)

- Draw and label a model that explains the phenomena.
- Write a CER (**C**laim, **E**vidence, **R**easoning) format paragraph that explains the why.
- Tell someone why you think the task is impossible.

## The Science Behind the Phenomena:

Every person (and every solid item) has a center of mass. Where this point is located determines whether you (or the solid item) will be balanced or will fall over. When you stand against the wall, your center of mass is above your feet so you are balanced. When you bend over, the mass of your head and torso moves forward. As a result, your center of mass moves forward and away from your feet; you feel you are about to lose your balance and fall over. You can save yourself by moving a foot forward so your center of mass falls in between your two feet—but that is not allowed in the challenge. It is not possible to pick up that object! The laws of physics prevent it.

### Explore this topic more:

Try a few of these and apply your science skills.

- Try standing sideways against a wall and lifting the leg farthest from the wall.
- Try squatting down and grabbing your toes. Try to hop forward and backward without letting go of your toes. Have a partner stand nearby to make sure the area is clear and to “spot” you.
- Try standing up from sitting feet forward in a chair while someone gently prevents your head from moving forward.
- Make a mobile. Tie a ruler, Popsicle stick, paint stir stick or similar item so it hangs down from something stable. Can you make the item level? Can you make it balance with objects on it from your home?
- Can you make a pan balance out of items from home?
- Use a broom handle or long dowel and balance it in your open palm. Try putting clay or playdough around part of the stick. Does the position of the dough change the balance?



Source: Bing images