

4.4 Lessons Balance and Centre of Gravity

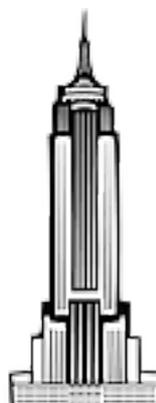
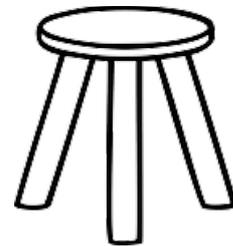
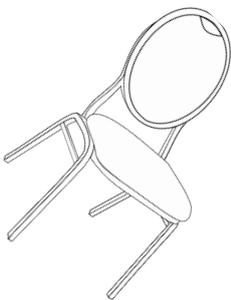
Lesson 1 Being Stable

We have learnt that gravity pulls everything down to the earth.

Unstable Objects topple over easily when gravity pulls down one side because it is not balanced.

Many objects are very stable. They won't topple over easily.

Q. Which of the objects on each row is the most stable:



Experiment 1

Which of the following positions are the most stable? Test each position by getting your partner to push you gently to see if you can return to your balanced position.

1. Stand with feet together and both hands by your side.
2. Stand with feet apart arms out wide.
3. Stand on one leg with both hands high above your head.
4. Sit on the ground, legs out, hands on the ground.
5. Sit on the ground with arms and knees clasped to your chest.

Experiment 2

Try these following balance tricks:

- Face the wall, nose and toes touching. Try to stand on your toes without falling backwards.
- Stand against the wall facing away from it, bend over from the hip keeping your bottom and heels against the wall.
- Stand sideways to the wall with inside leg touching and try to stand on inside leg only by lifting your outside leg.
- Sit on a chair, keeping your lower leg (knees down) vertical. Try to stand up without using your hands.

Q. Why were these so hard or impossible to do?

Question

From your Experiments, what are the rules for something to be stable?

Possible Answers:

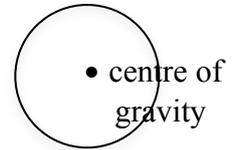
1. It must be touching the ground!
2. The wider its base the better.
3. The shorter it is the better.
4. The centre of the weight needs to be over something touching the ground .

In the next lesson we will explain balance using “Centre of Gravity”

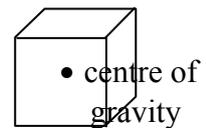
Lesson 2 Centre of Gravity

The **Centre of Gravity** is the point inside an object from where the force of gravity acts. For symmetric shapes it's in the middle. So a ball would have its centre right in the middle.

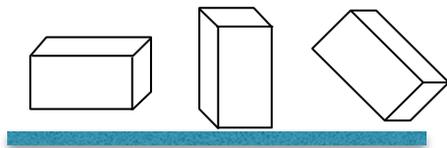
A ball then is stable because although it can roll easily its centre is always above where it touches the ground.



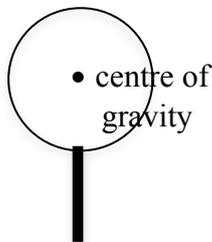
A box is very stable because it has a wide base and has the centre above this base



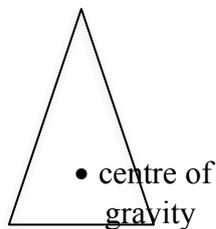
Which of these boxes is more stable and why?



For lopsided objects like a lollipop the **centre of gravity** is where most of the weight is. Examples:



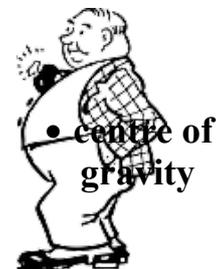
Lollipop



Wedge



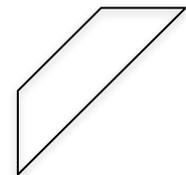
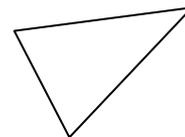
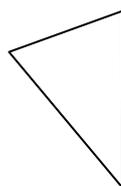
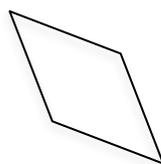
Water drop



Fat man

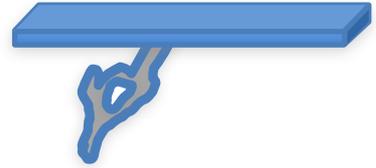
If the centre of gravity is not directly above the place where the object touches the ground it will topple over and be unstable.

Draw where the centre of gravity is in the following objects and draw an arrow to show that gravity will topple it over.



Experiment 1

1. Try to balance a ruler on one index finger. Where did you have to put it?
2. Now add some playdoh to one end. Where must you put your finger now?



Q. How does this show where the Centre of gravity is located?

3. Hold a ruler straight with two fingers. Start in the middle and try to pull them apart keeping the ruler balanced. What happens?



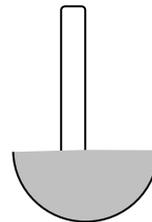
4. Now bring them together again. What did you notice?

Experiment 2

Using half a small orange/ lemon, and a paddle pop stick, make a pop up toy.

That is; when you push the pop stick over it pops back up again.

Q. Why does it always pop back up?



Lesson 3 Balance Investigation

Go to Investigation 4.5 Make Tightrope walker