Forces Science Activities

Feel the force with Professor Pickle's home science activities!

These science activities are suitable for children aged 5+ with adult supervision.

Experiment 1: COIN TOWER

This experiment puts friction to the ultimate test.

You will need:

- A stack of coins (about 10 should do)
- A dinner knife
- Adult supervision

1. Stack the coins into a neat, straight tower.
2. Slide a dinner knife quickly across the table to swipe a coin out from the bottom of the tower.
3. Keep doing this until the tower topples over.

How does it work?

Why does the tower not topple at first? It is all down to the force called **friction**.

The tower of coins is at rest (not moving). Objects at rest don't move unless you push or pull them. So, to make the bottom coin move, you need to push or pull it. To make it move without toppling the tower, you need to push or pull quickly. Why? It is due to friction. Friction is the sticky force that occurs when two objects rub against each other. If you push or pull slowly, friction will pull the rest of the coin tower along with the bottom coin and it will topple. If you push or pull quickly, the coins still rub, but the friction force doesn't have time to get the stack moving. So the coin shoots out without pulling the tower with it!

Experiment 2: MONEY BOTTLE

This experiment puts Newton's First Law of Motion into action (and might earn you a few quid pocket money in the process).

You will need:

- Paper money
- An empty bottle (preferably plastic)
- Adult supervision and permission
- Nerves of steel

Ask an adult first if you can borrow some paper money and an empty bottle.

1. Place the note flat on the table and place an empty bottle open end down on top and make sure it is centred and steady.

2. Tell your adult that if they can whip the note out from underneath the bottle without the bottle toppling over, you will double their cash. They will try it just like the old tablecloth trick…and fail!

3. When you think they have embarrassed themselves enough, it is now time for you to sweep in to claim your prize.

4. Instead of simply pulling the note, start to *roll it up* from one end. Once you have rolled the note as far as the bottle, gently keep rolling and carefully nudge the bottle to the end of the note. Be patient!

How does it work?

It is all down to the forces **friction** and **inertia.**

Inertia: Newton's First Law of Motion states that an object in motion (or at rest) tends to stay that way unless a force acts on it to change its speed, direction or to stop or start it. This means that the bottle will stay where it is unless you exert a force on it.

The tablecloth trick involves quickly whipping the cloth out from under the china and this does help overcome inertia, but can be messy if you get it wrong. The key to safely removing the bottle is to go slowly and have patience. When you try and move the note by pulling it, you apply an outside force that causes the bottle to topple over.

This is because of **friction.** There is lots of friction between the note and the bottle and the note and the table top. So much friction, in fact, that if you try to pull on the note it pulls the bottle with it. To reduce the amount of friction, you slow the process by *rolling* the note instead and it doesn't provide as much force to topple the bottle. And the cash is yours (if your grown up says so!).

Experiment 3: SUPER STRONG TOILET PAPER

Toilet paper isn't strong, right? This experiment tests the tensile strength of the humble TP and may surprise you.

You will need:

- A sheet of toilet paper or (preferably) a tissue
- An empty toilet roll tube
- An elastic band
- Salt
- A wooden dowel (or the blunt end of a pencil)
- Adult supervision and permission

1. Place the tissue paper over one end of the toilet roll tube and secure with the elastic band.

2. Push the dowel through the tube – it punctures the tissue paper easily.

3. Next, replace the tissue over the tube and secure with the elastic band. This time, pour in salt until the tube is about ¾ full. Tap the covered end of the tube on a flat surface to pack down the salt.

4. Try to push the dowel through the salt and break the toilet paper. Can you do it? The dowel or pencil should not be able to break the tissue paper!

How does it work?

Why does the salt help prevent the tissue from breaking? This time, it is all to do with **pushing** force and **surface area**.

The amount of pushing force you add to the tube remains the same (you might even add more) but the thousands of grains of salt offer more surface area to dissipate the force that you added. The force will spread from tiny grain to tiny grain and then spread across the entire surface area of the tissue paper. This increase in surface area makes the tissue seem 10 times as strong as before!