Satellites & Trays in Motion

SUITE SCIENCE

CLASS: 4th- 6th | Demonstration | SESE (SCIENCE)

Learning Objectives - WALT (We are learning to…)

1. Explore how satellites and planets orbit one another.
2. Learn about centripetal force and how we experience it in our daily lives.

Curriculum links
Science

- Stand – Forces. To appreciate that gravity is a force
- Gravity is force in the universe and not just on Earth
- Materials – Strength and use

Teaching Methodologies

- **Talk and Discussion** - listening, questioning
- **Collaborative/Cooperative Learning** - group work
- **Active Learning** – Hands on learning experience with real life examples.
- **Skills through Content:** observing, predicting, describing, recording, classifying.

Why don't satellites fall to Earth?

You may think of a satellite as a type of machine that orbits Earth, taking pictures and collecting information. You'd be right there are thousands of satellites orbiting Earth but did you know that the Earth is a satellite too? It orbits the sun going around and around in much the same way. How do they keep doing that —and why don't our satellites just fall out of the sky?

If you anything up into the air, the ball comes right back down. That's because of gravity—the same force that holds us on Earth and keeps us all from floating away.

To get into orbit, satellites first have to launch on a rocket. That's fast enough to overcome the strong pull of gravity and leave Earth's atmosphere. Once the rocket reaches the right location above Earth, it lets go of the satellite.

The satellite uses the energy it picked up from the rocket to stay in motion. That motion is called momentum.

But how does the satellite stay in orbit? Wouldn't it just fly off in a straight line out into space?

Not quite. You see, even when a satellite is thousands of miles away, Earth's gravity is still tugging on it. That tug toward Earth--combined with the momentum from the rocket… …causes the satellite to follow a circular path around Earth: an orbit.

When a satellite is in orbit, it has a perfect balance between its momentum and Earth's gravity. Finding this balance is sort of tricky as it depends on how far you are away and how fast you're going. Guess you're just going to have to get some practice in!

So, what's the demo?

You can do this with a tray or even a bucket of water that has a strong handle. Either way you're going to have to have something to swing. Take care to not swing something too heavy. Start out by making the tray. The base can be made from a square piece of plastic or wood measuring approximately 30cm. Drill holes in all four corners large enough to hold a piece of rope. Attach the ropes to each corner of the platform and tie big secure knots to stop them coming out. Then join the ropes together in a knot about half a meter.

Now that all of the difficult work is finished, it's time to swing the tray and plastic cup (several plastic cups if you're feeling brave!) around in a complete circle without spilling the liquid or flinging materials around the room. It's the tendency for the plastic container and its contents to go in a straight line that allows it to seemingly defy gravity. The centripetal force provided by the tension in the cords is large enough to create enough friction to hold the plastic containers in place.

Also, practice swinging the tray around without the cups in order to get the feel of a smooth, circular motion. Then add the cup filled half full with water. The liquid adds mass to the cup and helps to keep the cups in place. You shouldn't have to make the board below sticky but you can if you like.

What you're demonstrating here is how the string acts like gravity to keep pulling the body back towards the centre. The water stays in the bucket because its falling at the same rate. The string acts as the centripetal force that pulls the bucket and water into the centre and keeps them from following their paths of inertia, giving the illusion that centrifugal force is pulling the water away from the centre.

WORDS OF WARNING In order for the bucket to keep falling with the water, the bucket must travel fast enough to keep up with the water. If you spin the bucket too slowly, you get wet – which is hilarious… so consider it ☺

REFER BACK TO YOUR **WALT** GOALS AND HAVE THE CHILDREN SHARE WHAT THEY LEARNED TODAY AS WELL AS RECAPPING ON ANYTHING THEY MISSED!

Fondúireacht Eolaíochta Éireann
Dá bhfuil romhainn
Science Foundation Ireland
For what's next

UCD DUBLIN

Insight
SFI RESEARCH CENTRE FOR DATA ANALYTICS