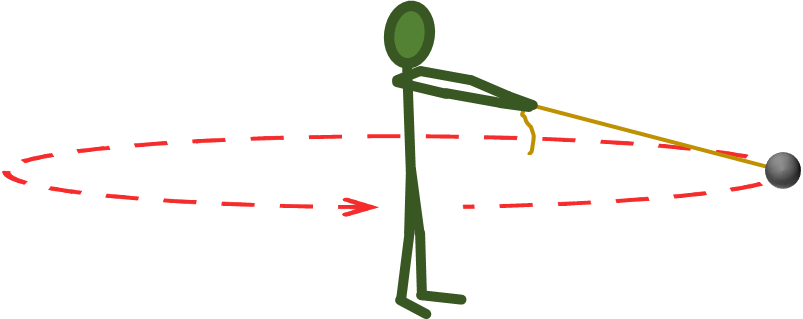
**Modelling gravity**

This model shows how gravity makes the Moon go round the Earth.



**To answer**

1. What things do the ball and the student represent?
2. How is the pull of the string the *same* as gravity?
3. How is the pull of the string *different* to gravity?
4. What happens to the ball if the string is released?
5. What does the pull of the string do to the movement of the ball?

*Physics > Big idea PES: Earth in space > Topic PES1: Solar System and beyond > Key concept PES1.1: Gravity*

|  |
| --- |
| **Response activity** |
| **Modelling gravity** |

**Overview**

|  |  |
| --- | --- |
| Learning focus: | Gravity is the force that holds the Solar System together |
| Observable learning outcome: | * Explain how we know gravity exists in space and describe how its force of attraction decreases with distance. * Explain how gravity pulls planets and moons around in their orbits. |
| Activity type: | Response, critiquing a representation |
| Key words: | Gravity, space |

This activity can help develop students’ understanding by addressing the sticking-points revealed by the following diagnostic question:

* Diagnostic question: Sun trap

|  |  |
| --- | --- |
| **B** | **BRIDGING**  This activity explores ideas that are usually taught at age 14-16, to build a bridge to later stages of learning. |

**What does the research say?**

Stead and Osborne (1980) found that 81% of 13-year-olds (n=258) and 75% of 14-year-olds (n=257) said there was no gravity in space (Driver et al., 1994).

In the diagnostic question: ‘Sun trap’ students considered how the force of gravity of the Sun acts to pull planets towards it and to stop them shooting off into space. This activity gives students the opportunity to develop their understanding of how the force of gravity that ‘pulls’ the Moon *towards* the Earth makes it move in an orbit *around* the Earth.

**Ways to use this activity**

Students should complete this activity in pairs or small groups, and the focus should be on the discussions. It is through the discussions that students can check their understanding and rehearse their explanations.

Philosophically science can be said to be a description of the ‘best model’ we have for the world. In this activity students should identify ways in which this particular model is a good representation of the real world, and ways in which it is not.

Students should work together to follow the instructions on either the worksheet or the PowerPoint. Giving each group one worksheet to complete between them is helpful for encouraging discussion, but each member should be able to report back to the class. Listening in to the conversations of each group will often give you insights into how your students are thinking.

In this activity it can be helpful to take feedback whilst using the model to demonstrate what makes it a useful model and perhaps the ways in which it is less good. A good approach might be to encourage your students to suggest their ideas, and make clear their reasons and to demonstrate how this works with the model. You might ask other students why they think it was a good contribution, or when appropriate, if they can improve on the idea’s clarity.

Ending with the students completing the worksheet or questions from the PowerPoint individually, might help them to consolidate their learning.

*Differentiation*

You may choose to use simplified worksheets for some students, for example with gaps to fill in so they can focus on the science. In some situations it may be more appropriate for a teaching assistant to read and/or scribe for one or two students.

**Equipment**

For each student/pair/group:

* Rubber bung with a hole bored through it
* A length of string (about 1 m long) threaded through and tied to the bung

**Health and safety**

If this is done as a class practical, students need space to swing the rubber bungs safely.

Instruction will probably be necessary to limit the speed at which students rotate the bung.

Practical work should be carried out in accordance with local health and safety requirements, guidance from manufacturers and suppliers, and guidance available from CLEAPSS.

**Expected answers**

1. The ball represents the Moon, the student (specifically their head) the Earth.
2. The string pulls towards the centre of the (model) Earth.
3. The string is attached to the ball, whereas gravity is a non-contact force.

Gravity also gets weaker as distance away from the Earth increases.

1. The ball will shoot off (in a straight line at a tangent to its orbit).
2. The pull of the string pulls the ball sideways to make it curve – into a circular orbit.

**Acknowledgments**

Developed by Peter Fairhurst (UYSEG)

Images: Peter Fairhurst (UYSEG)

**References**

Driver, R., et al. (1994). *Making Sense of Secondary Science: Research into Children's Ideas,* London, UK: Routledge.

Stead, K. and Osborne, R. (1980). Gravity. Hamilton, New Zealand: LISP Working Paper 20, Science Education Research Unit, University of Waikato.