

## ***A model of the Earth and Moon***

### **Background Information**

This activity demonstrates the relative sizes of the Earth and Moon and the distance between them. The Moon is our nearest neighbour. It orbits the Earth following an elliptical path and therefore the distance between the Moon and the Earth varies from about 350 000 km to 400 000 km. On average the Moon is 385 000 km away. This seems like a large distance; however, the Moon is close compared to the planets in our Solar System.

The diameter of the Moon is about 3500 km which means that the face of the Moon is roughly the same width as Australia. The Earth has a diameter of approximately 12 800 km. The Moon is a little less than a quarter the diameter and is approximately one-fiftieth the volume of the Earth.

### **What you need**

- Handful of modelling clay, plasticine or play-dough
- Ruler
- Calculator

### **What to do**

#### **Part A - Estimating the relative size of the Earth and the Moon**

1. Give each student or group of students a handful of clay.
2. Allow about 5 minutes to divide the clay into two balls or spheres so that one represents what they consider to be the size of the Earth (when compared to the size of the Moon) and the other represents the size of the Moon.
3. Comment on the differences demonstrated by the models made by each group or student.
4. Tell them to re-combine their 2 balls or spheres into one lump of clay again.
5. Ask them to divide the lump of clay into 50 pieces of approximately equal size.
6. Have them choose one piece then re-combine the other 49 into a single chunk.
7. Ask them to roll each piece into the shape of a ball so that they end up with two spheres. Explain to them that they now have a scale model of the Earth and the Moon, with the small ball (made of 1 piece) representing the Moon and the large ball (made of 49 pieces) representing the Earth.

#### **Part B - Estimating the ratio of the Earth's diameter to that of the Moon**

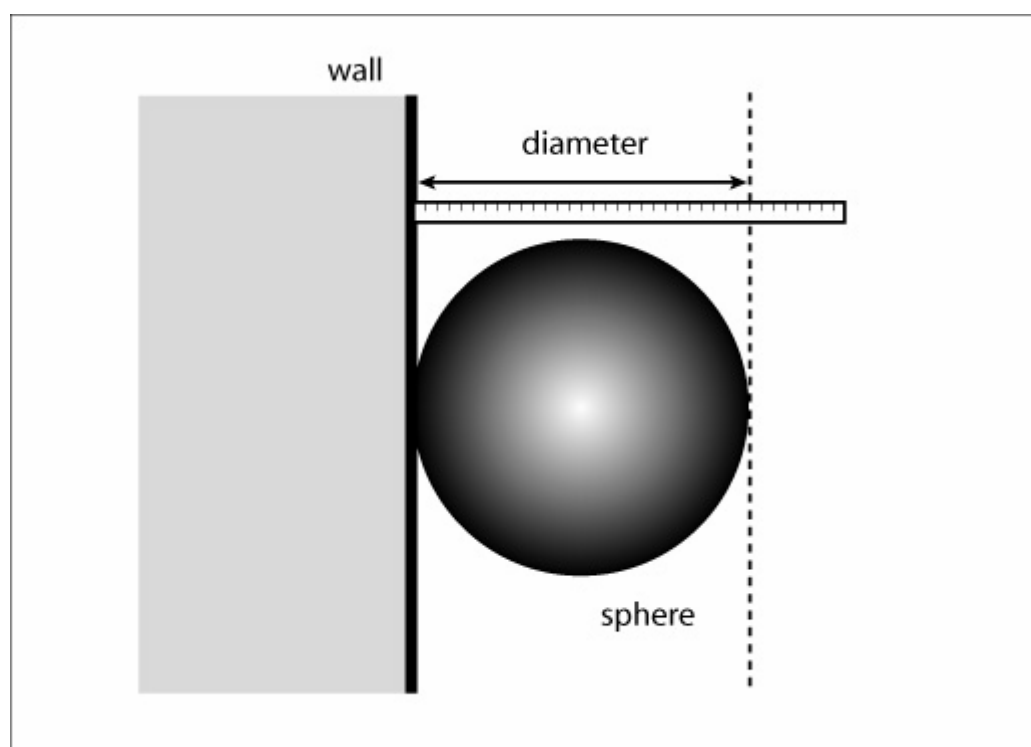
8. Ask the students to predict the ratio of the Earth's diameter to that of the Moon.
9. Their predictions can be checked by measuring the diameters of both objects. (Students can measure the diameter of the ball of clay by putting the ball against a wall and placing a ruler gently alongside it. The distance from the wall to the outer edge of the ball of clay should approximate the diameter. Refer to the diagram on the next page).
10. Take an average of the class results and you should obtain a ratio of approximately 4:1. (The size of the Earth's diameter is approximately 4 x the diameter of the Moon. More precisely, the ratio of the Earth's diameter to that of the Moon is 3.7:1.

**Part C - Estimating the distance between the Earth and the Moon**

11. Ask the students to predict how far apart their model Moon and Earth should be to represent the Moon-Earth distance (according to the scale of the models they have made).
12. Encourage them to hold the Moon up to the Earth and try to visualise how far away the Moon should be. Each group should reach a consensus, then measure their distance.
13. Explain to the students that the actual Moon-Earth separation is about 30 Earth diameters.
14. Students then calculate how long this distance would be in their model and ask them to now place their Moon at that distance.

**Optional**

- Ask the students to determine the accuracy of their prediction by dividing their predicted distance by the actual distance. A score of one is perfect.
- Ask each group of students to trace the shape (circumferences) of their models on A3 poster paper. Attach A3 sheets of poster paper together so the distance between the Moon and the Earth can also be shown (approximately) to scale. The posters can be labelled, coloured and stuck around the room.
- Students are generally amazed at how far apart the Earth and the Moon are in their model. Ask them what the next closest object in space to Earth is. The answer is Venus. At its closest approach it is 3000 Earth diameters away! That's one hundred times further than the Moon. Have them calculate where to place a model of Venus on the same scale.
- Ratio exercise – see below



## ***A model of the Earth and Moon Worksheet***

### **Introduction**

The Earth's diameter is about 4 times as big as the Moon's diameter. If we multiply the Earth's diameter by 30, the distance would approximate how far away the Moon is from the Earth.

### **Part A: The diameters of the Moon and Earth**

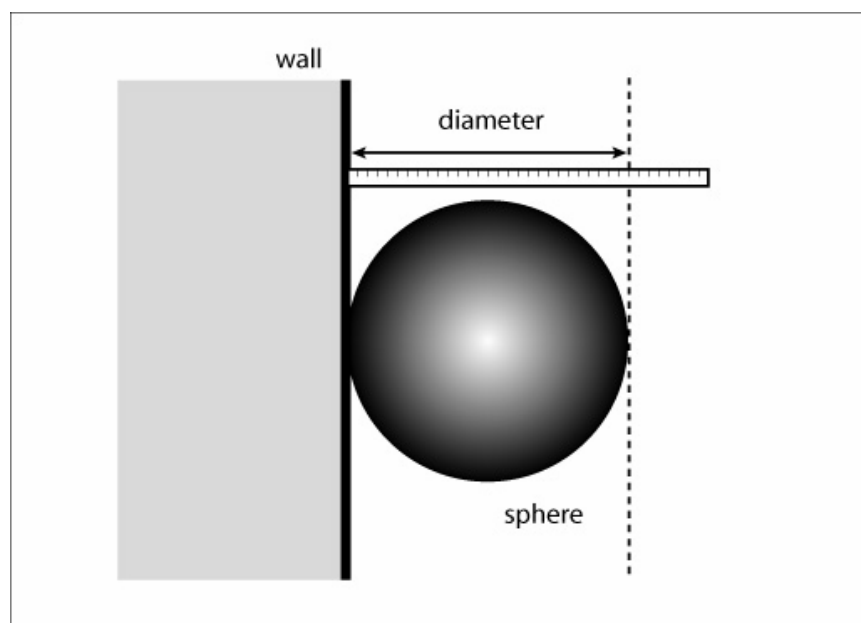
#### **What you need**

- About 10 different types of balls (eg. basket balls, tennis balls, soccer balls)
- Graph paper
- Calculator

#### **What to do**

The balls will represent the size of Earth.

1. Choose one ball and measure the diameter by putting it against a wall and placing a ruler lightly over the top. The distance from the wall to the edge of the ball will approximate the diameter. (Refer to the diagram below.)



2. Record the type of ball and the measured diameter in the table provided.
3. Calculate the diameter of the Moon if this ball represents Earth. Record this value in the table.
4. Repeat steps 1-4 for the different balls.

## Part B - The distance from the Earth to the Moon

1. Calculate how far away the Moon would be if the size of Earth was represented by each of the balls.
2. Record these values in the table below.

Type of ball representing Earth	Measured diameter Earth (cm) D	Calculated Moon diameter (cm) D/4	Distance between the Earth and Moon (cm) D x 30

### Questions:

1. How much smaller is the diameter of the Moon compared to the diameter of the Earth?
2. How far away is the Earth from the Moon (How many Earth diameters)?
3. Graph Earth diameter versus Moon diameter. What do you notice?
4. Graph Earth diameter versus distance. What do you notice?