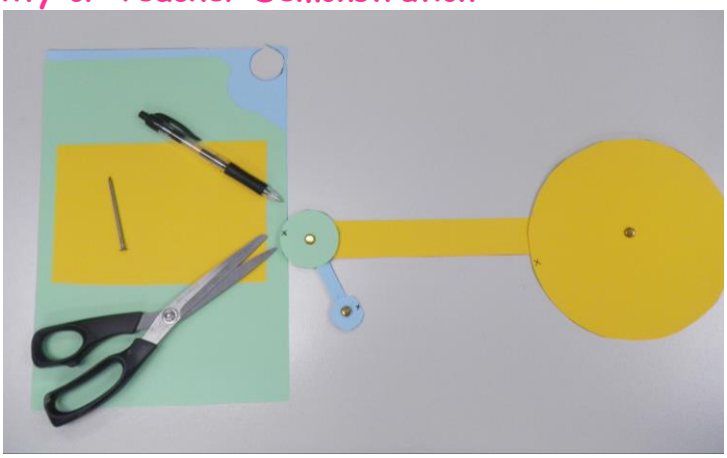
# Rotation and Orbit Models - Teacher's Notes

## Student Misconception - Rotation and revolution are the same

It is often easier to use the term **rotation** for turning or spinning about an axis and **orbiting** for taking a path around a sun or planet. Roughly, the Earth rotates on its axis once every day (24 hours) and orbits the Sun once every year (365 days). The Moon rotates on its axis once every 28 days and orbits the Earth every 28 days. In each case the smaller object orbits round the nearest larger object.

## Rotation and Orbit Model (Not to scale)
## Student Activity or Teacher Demonstration



**Materials per group**

- Three sheets of different coloured paper or card. Alternatively paint the paper after it has been cut.
- Pen or pencil
- 3 round objects to trace around of different sizes – approximately 20cm, 8cm and 3cm diameter (E.g., plate, cup and bottle lid)
- Ruler
- Scissors
- Three split pins
- A nail or pin to pierce paper

# Rotation and Orbit Models - Teacher's Notes

**Method**

1. One student traces and then cuts out the largest circle possible from one sheet of paper or card. I found a side plate (from the staffroom) made a good-sized circle for A4 paper. This circle represents our Sun. They then cut a long thin strip from what remains.
2. The second student cuts out a much smaller circle (using a cup) from another coloured sheet to represent the Earth, our planet.
3. The third student cuts a very small circle of another colour to represent the Moon. They also cut a small strip that will permit the Moon to circle the Earth and not touch the Sun.

Why can't we make this model to scale? If we tried to make this to scale, we would require a great deal of cardboard and it would need to cover a very large area.

This model will display the relative movements of the Sun, Earth and Moon.

**Earth and Moon**

4. Start by making holes at the center of your Earth and Moon and join the Moon coloured (small) paper strip to the centers of the Earth and Moon with split pins.
5. Rotate the Earth, once for every day and orbit the Moon round it so that one orbit takes 28 days.
6. As the Moon orbits, rotate it on its axis. Its rotation takes just as long as it takes to orbit round the Earth. That is the reason that the same side of the moon is always facing Earth.

**Earth, Sun and Moon**

7. Now join the Earth to the Sun with the longer (Sun coloured) strip and split pins



8. The Earth orbits round the Sun every ~365 days.

The Sun is so big it could not travel between the Earth and the Moon.

Our solar system is whirling round the center of the Milky Way galaxy which itself is travelling round a galactic central point. Nothing is stationary.

## Orbit and Rotation Using Students as Models

This activity is only recommended for students who follow directions in an orderly manner or a single group of three chosen students can be used to demonstrate first to minimise disruption. It is difficult to manage more than four "months" without students collapsing in fits of giggles or being "spun out". If it is performed at the beginning of the session, recovery time needs to be factored in.
Group students into threes in an open space. One represents the Sun, another the Earth and the third the Moon. You may have to count the days loudly to keep all students acting together.

1. **Moon rotates once as it orbits round the Earth in 28 days**
   (1 lunar month on Earth)

The Earth has to evenly rotate 28 times as the Moon makes one complete rotation. The Moon must slowly turn to complete one rotation as it makes one orbit of the Earth. Students should be able to see that the Moon always keeps its face towards the Earth.

2. **Earth rotates 365 times as it orbits round the Sun. The Sun rotates on its axis while that happens**

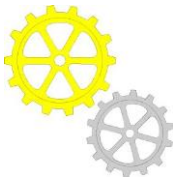
One student is nominated as the Sun. They rotate on the spot. (Of course, different parts of the Sun move around at different speeds however even



the wobbliest or flexible student would soon get in a twist if they tried that). You could use a student with a hula-hoop to represent the differences in movement of the Sun's surface as it rotates.
If the student who represents the Earth takes one step sideways during each revolution, that can represent 1 day's orbital movement round the Sun.

3. **Getting all the moving parts/people working together.**

Start the Earth rotating, then the Moon orbits the Earth making one rotation per lunar month. Finally start the Earth and Moon on their trip round the Sun with the Moon orbiting the Earth and the Earth orbiting the Sun. All three rotate on their axes.



This pattern of wheels within wheels is the reason that Newton and other early scientists referred to the Judeo-Christian God as "The divine watchmaker" because interlocking rotating cogs worked inside old watches. Some tried to make machines that copied this movement, but very accurate observations were needed to make the machines accurate.

Interestingly, the colour of the Sun is actually white. Most people draw or paint it as yellow, perhaps because it is less painful to glimpse at dawn and dusk when the light is travelling through a greater thickness of atmosphere, giving it a yellowish red tinge.