

## Motion of Planets and Moons, Kepler's Laws, Eclipse (Demonstration) Teacher Notes

The objective of this lesson is to cover key terminology (see 2<sup>nd</sup> page) and ensure that students understand key concepts. Many of the concepts were already introduced in the first worksheet and the first video. The book is an excellent reference for this material. Two simple demonstrations are proposed in which the students play-act the concepts.

### **Demonstration 1: Rotation and Revolution** (Figure 1)

This requires three students:

Student A – the Sun

Student B – the Earth

Student C – the Moon

The sun stands still in the center. Earth will need to rotate and slowly revolve around the sun. Moon will need to revolve around the Earth always facing the Earth. (This can be expanded to include other planets as well.)

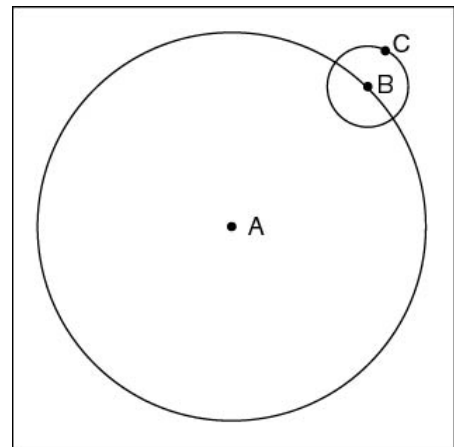


Figure 1: Student positions in demonstration.

### **Demonstration 2: Gravity and Inertia Forming a Circular Orbit** (Figure 2)

Characters: Student Sun, Student Planet, and Narrator.

Sun will stand in the center of an imaginary circle. Planet will stand approximately six feet away. They are connected by holding a length of elastic string. Planet revolves around the sun while the narrator tells the story.

Narrator: Inertia is the tendency of a body in motion to continue moving in a straight line unless a force is applied to it. Earth would move in a straight line if she could. But gravity (represented by the elastic string) is pulling her toward the sun. This result is the Earth moving in a curved orbit.

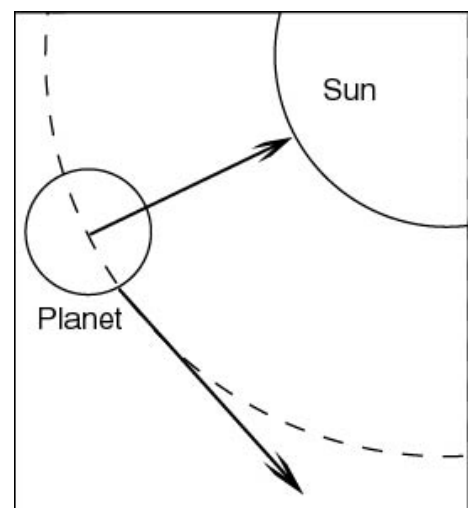


Figure 2: This illustrates the force between the Sun and the planet and what would happen if the planet were "let go".

**Definitions:****Motion of Planets and Moons** (p. 429-432)

**Axis** – An imaginary straight line around which an object rotates.

**Rotation** – The spinning motion of a body on its axis.

**Ellipse** – A closed curve in which the sum of the distances from the edge of the curve to two points inside the ellipse is always the same.

**Orbit** – The elliptical path a body takes as it travels around another body in space (the motion itself).

**Revolution** – The elliptical motion of a body as it orbits another body in space.

**Period of revolution** – The time it takes for one body to make one complete revolution around another body in space.

**Astronomical unit** – The average distance between the Earth and the sun, approximately 150,000,000 km.

**Light-second** – The distance light can travel in one second, which is 300,000 kilometers.

**Light-minute** – The distance light can travel in one minute, which is 18,000,000 kilometers.

**Light year** – The distance light can travel in one year, which is 9,500,000,000,000 kilometers.

**Kepler's laws** (p. 430)

**Kepler's 1<sup>st</sup> law** – The orbits of planets are elliptical.

**Kepler's 2<sup>nd</sup> law** – Planets move faster when they are close to the sun and slower when they are far away so that the "area swept" is constant. (See figure on page 430.)

**Kepler's 3<sup>rd</sup> law** – This law allows provides a connection between the planets period of revolution and the distance from the sun.

**Phases of the moon and eclipse** (p. 465-467)

**Phases of the Moon** – The different appearances of the moon due to the varying amounts of sunlight on the side of the moon that faces the earth.

**Eclipse** – An event in which the shadow of one celestial body falls on another.