

## The Moon Module

The future of extensive manned missions to Mars and beyond may well be linked to our ability to establish lunar outposts. Those future plans will be in the same technological footprints as the earlier Apollo missions.

Although the moon may take on a new face of investigation beyond our images of Apollo, its phases, eclipses and gravitational attraction still have enduring affects upon us earthlings.

The planetarium's background of zodiacal constellations will be used to show the sun-earth-moon positional relationships which cause our solar and lunar eclipses, moon phases and tides.

### **Student Preparation**

Students should have had lessons on rotation and revolution as related to the earth- moon- sun system. They should be familiar with graphing as it relates to longitude and latitude.

### **Facts and Concepts**

- The moon's changing position in relationship to the earth and sun are responsible for the amount of light reflected from it surface.
- The moon's position changes among the stars as it revolves around the earth.
- Eclipses occur as a result of one celestial body moving into the shadow cone of another.
- The moon's orbit and the earth's orbit are not coplanar.
- The tides are caused by the gravitational force of the moon and sun.

### **Standards**

S6CS5a, b. Students will use ideas of system, model, change, and scale in exploring scientific and technological matters.

S6CS6c. Students will communicate scientific ideas and activities clearly.

S6E2. Students will understand the effects of the relative positions of the earth, moon and sun.

- a. Demonstrate the phases of the moon by showing the alignment of the earth, moon, and sun.
- b. explain the alignment of the earth, moon, and sun during solar and lunar eclipses.

### **Procedures**

In the classroom

1. Have your students observe the moon each evening for several weeks before their planetarium visit and report on its appearance and position in the sky. The best times would be from new moon to full in the early evening and full to new in the early morning. Refer to the planetarium's monthly star calendar for moon phase.
2. Paint an 8" diameter ball (the moon) half black and half white. Take your students out into a hallway and position them into a small round group to represent the

earth. Select one end of the hall to represent the direction of the sun's incoming light. Begin the moon phasing activity at new moon by holding the ball between the sun and the earth group of students. Hold the ball so the white side always faces the direction of the sunlight end of the hallway as you begin to walk slowly around your students. They should be able to see the waxing and waning phases of the moon as you make one complete revolution of the group. **(Question: Which direction should the moon begin to revolve in this activity?)**

In the Planetarium

1. The students will plot the position and phase of the moon on an equatorial star chart for 29.5 days.
2. The student will demonstrate what causes the phases of the moon using a sun-earth-moon model.
3. The students will explain through demonstration the kinds of eclipses that can occur.
4. The students will correlate periods of high and lowest tides during a month with relative positions of the sun, earth, and moon.

### **Follow-up Activities**

1. Have the students draw the phases and positions of the moon outside for one month.
2. Have your students make their own moon phase model out of material in the classroom or at home.
3. Have your students figure out why we always see the same side of the moon.
4. Do a web search on various types of eclipses.
5. Give your students a tidal chart or table to plot the height of high tides against the dates, and then correlate the dates with moon phases.

### **Vocabulary**

waxing waning

moon phases: new, crescent, quarter, gibbous, full

eclipses: solar and lunar, total and partial

shadows: penumbra, umbra

tides: high and low, spring and neap

### **Evaluation**

- Completion of planetarium moon phase activity with Styrofoam spheres to show various moon phases by demonstrating the sun-earth-moon positions.
- Show photos of the moon to identify each phase in terms of waxing and waning.
- Ask students demonstrate the kinds of eclipses that can occur.
- Give students positions of the sun and moon relative to earth and ask them to provide the tidal drawings.