



Teacher's Notes for

Harold's New Solar System

A Star Theatre (Planetarium) presentation of the H.R. MacMillan Space Centre

Program description: During the past 30 years we have discovered that our solar system is a marvelous place full of unexpected wonders and surprises. Featuring everyone's favorite Star Projector, "Harold", this show uses up-to-date imagery to explore many of the marvels found amongst our Sun's family of planets.

Advance preparation: Studies have shown that people, especially children, learn better when they feel secure in their surroundings and know what is expected of them. We recommend that you orient your students to the main areas of our facility, make sure the purpose of the field trip is clear and link the trip to the students' learning in the classroom. For a map of the facility and more suggestions for a successful field trip download the Orientation Package on our website www.hrmacmillanspacecentre.com.

These Teacher's Notes are designed to help you further prepare your students and include enrichment activities that can be done before or after your visit. *These activities cover topics related to those in your programme and are therefore not necessarily the same.*

Curriculum connections: Grades 2 to 3

Earth and Space Science IRP Connections:

P=Planetarium show

A=Suggested Classroom Activities

It is expected that students will:

Grades 2 to 3	
identify the Earth as part of a system of planets	P
demonstrate how the movements of the Earth cause day, night, and the seasons	A
distinguish between the features of the day and night skies	A
construct a model to show that the Earth is composed of many layers	A

Activity One – Planet Apple

Objective: Using a model, students will identify that the Earth is composed of several layers.

Materials: apple
knife

What to do:

1. Ask the students what they think is inside the Earth, under the hard layer on which we walk. Is it solid? Hollow? Liquid? Discuss.
2. Take an apple and tell students that the apple represents the Earth, and that they are going to take a look at what is inside. Let the students know that people have never gone beyond the Earth's crust, so scientists have had to figure out by different means what is "down there".
3. Cut a quarter section out of the apple and place to the side.
4. Examine the apple, inside and out. The apple and the Earth have quite a lot in common. Ask the students what characteristics they think the two share. Discuss that they are both round and solid (though not completely), they are both surrounded by a very thin skin or crust relative to the whole, they both have a core, and they both have a thick layer between the skin or crust and the core. The thick layer between the crust and the core of the Earth is called the mantle, and it is a molten layer.
5. Have the students look closely at the apple's core. They should see that the seeds are surrounded by a hollow space which is surrounded by a harder shell. This is something like the Earth's inner and outer core; the inner core is solid and the outer core is a thick liquid.

Going further:

Have the students research further into the exact layers of the Earth and then create their own models using a variety of materials.

Activity Two – Wobbler (adapted with permission from [Earth Science for Every Kid](#) by Janice Van Cleave)

Objective: Students will understand that the material(s) of which a planet is composed can affect its motion.

Materials: felt pen
raw eggs (1 per group)
hard-boiled eggs (1 per group)

What to do:

1. Make sure all of the eggs have been standing at room temperature for a minimum of 20 minutes. Mark all the hard-boiled eggs with a number "1" and all the raw eggs with a number "2".

2. Have the students work in groups of three to five. Give each group one raw egg and one hard-boiled egg but do NOT advise them of the difference between the eggs.
3. Ask the students to spin each of the eggs, observing how each one spins and for how long. They should discover that the hard-boiled egg spins well while the raw egg wobbles and stops much sooner. Have the students guess why this might happen.
4. Explain to the class that one egg is solid (hard-boiled) and the other has a liquid centre (raw). The raw egg represents the Earth and its rotational behaviour because the Earth has a liquid mantle and outer core

What happened:

Explain to the class that the material inside the shell affects the way it spins. Egg number one has a solid content that spins with the shell. The raw liquid in egg number two does not start spinning with the movement of its shell. The outer shell motion does cause the liquid to move, but slowly. The sluggish movement of the liquid causes the egg to wobble and stop more quickly. Part of the Earth's mantle and outer core are liquid. Because the Earth's interior is not solid, just like the egg it wobbles during its rotation. Unlike the egg's wobbling, the Earth's wobbling is very slight and takes many years for a noticeable change. This wobble is called precession.

Activity Three – Day and Night (adapted with permission from [Earth Science for Every Kid](#) by Janice Van Cleave)

Objective: Students will be able to understand what causes night and day on the Earth.

Materials: table
light bulb
dark shirt or smock (1 per student)
small hand mirror (1 per pair of students)
darkened room

What to do:

1. Place the light bulb on the table and turn it on. This light should be the only light source in the room. Tell the students that this light represents the Sun.
2. Have the students spread out around the light, each wearing a dark shirt. Tell them that they each represent the Earth. The lit areas of their shirt (facing the light) represent daytime, and the dark areas of their shirt (facing away from the light) represents nighttime on the Earth.
3. Tell the students that their noses represent their home on the Earth. Ask the students to turn to their left to imitate the rotation of the Earth on its axis. As the Earth turns towards the east (left), the light from the Sun moves across the rotating Earth.
4. Have the students turn in a complete circle and discuss what happens (where is sunset occurring? sunrise?).

Going further:

Have the students work in pairs to see how the Moon reflects light from the Sun at night.

1. One student from each pair should represent the Earth and face the Sun. The other student should take a hand mirror, stand behind their partner off to one side, and hold the mirror at an angle so that it reflects light onto the back of the dark shirt of their partner.
2. Tell the students that the mirror represents the Moon. As daytime is experienced by the people on the side of the Earth facing the Sun, the reflected light from the Moon brightens the side of the Earth turned away from the Sun. The reflected light from the Moon is not as bright as the direct light from the Sun. The nighttime is very dark when the Moon is not in position to reflect the Sun's light onto the Earth.

Glossary

Inner core: 1.7% of the Earth's mass; depth of 5150-6370 km. The inner core is solid and unattached to the mantle, suspended in the molten outer core.

Outer core: 30.8% of the Earth's mass; depth of 2890-5150 km. The outer core is a hot, electrically conducting liquid within which convective motion occurs.

Lower mantle: 49.2% of the Earth's mass; depth of 650-2890 km. The lower mantle is probably composed mainly of silicon, magnesium, and oxygen.

Transition region: 7.5% of the Earth's mass; depth of 400-650 km. The transition region or mesosphere (for middle mantle), sometimes called the fertile layer contains calcium, aluminum, and garnet.

Upper mantle: 10.3% of the Earth's mass; depth of 10-400 km. Fragments have been excavated for our observation by eroded mountain belts and volcanic eruptions. Olivine and pyroxene have been the primary materials found in this way.

Oceanic crust: 0.099% of the Earth's mass; depth of 1-10 km. The majority of the Earth's crust was made through volcanic activity. The oceanic ridge system, a 40,000 k. network of volcanoes, generates new oceanic crust at the rate of 17 kilometres per year, covering the ocean floor with basalt.

Continental crust: 0.374% of the Earth's mass; depth of 0-50 km. This is the outer part of the Earth composed essentially of crystalline rocks. These are low-density buoyant minerals dominated mostly by quartz and feldspars.

Day/night: Caused by the rotation of the Earth on its axis every 24 hours, and affected by the tilt of the Earth on its axis.

Precession: The wobbling of the Earth on its axis, caused by the partially molten interior of the Earth.

Revolution: Movement of a body in orbit, such as the Earth revolving around the Sun.

Rotation: The spinning motion of a body on its axis, such as the spinning of the Earth causing night and day.

Resources

Canadian Space Agency <http://www.space.gc.ca>, 1-800-511-3500

H.R. MacMillan Space Centre (astronomical information)
<http://hrmacmillanspacecentre.com> or 604-738-7827 ext. 228