

## Extension Activities

Thank you for having COSI on Wheels 'Astounding Astronomy' come to your school! To enhance your students' experience, we encourage you to continue to explore astronomy in your classroom. The following activities support further investigation of this subject and can be adapted to best fit your curriculum and students' needs.

## Be Glad You're Not A Cyclops

### ACADEMIC STANDARDS:

- Earth and Space:  
8.8
- Life Science:  
2.6
- Physical Science:  
8.1
- Science and Technology:  
3.1, 4.2, 6.4
- Scientific Inquiry:  
K.4, 1.5

**OBJECTIVE:** To experience the importance of binary vision in remotely operated Vehicles.

**MATERIALS:** String, Beads

### PROCEDURE:

1. Cover or shut one eye and try putting the string through a bead.
2. Now try it with both eyes open.

### WHAT'S GOING ON?

Shut one eye and the world looks flat--2-dimensional. Keep both eyes open, and the world takes on a whole new dimension! 3-D, or stereo, vision helps us tell how far away things are.

Human stereo vision is a good thing for engineers to try to copy when making robots that can get around on their own.

Because your eyes are separated by a few centimeters (a couple of inches), each eye sees a slightly different image. Your brain, however, combines the two images into one, using the extra information to tell you how close or far away things are.

Roving robots, too, must be able to tell how far away things are. Otherwise the robot will bump into things and have a hard time reaching its target.

**EXTENSION:** With one eye closed try pouring water from one container into another. Make this even more challenging by using a container with a narrow opening.

## Pocket Solar System

### ACADEMIC STANDARDS:

- Earth and Space  
5.2, 8.1, 8.3
- Physical Science  
K.3, 1.1, 3.1, 8.1
- Science and Technology  
K.1
- Scientific Inquiry  
K.5, K.8, 1.8, 3.6

**OBJECTIVE:** To build a quick model of the solar system by folding a piece of register tape. The relative distances between the orbits of the planets will be illustrated.

### MATERIALS:

For each model:

- 1 meter length of cash register tape \*
- 10 round stickers: five large and five small \*
- Pencil or marker

\*( If you are doing this activity with a large group, you can pre-cut 1 m strips of register tape and divide out groups of stickers for each participant.)

### PROCEDURE:

1. Place a sticker on each end of the tape, a large one on one end and a small one on the other end, right at the edge. Label the large one **Sun** and the small one **Pluto**. Even though Pluto has been reclassified as a dwarf planet it serves as a useful reference point here. We can use it as the first example of such a dwarf planet ever found, just as we'll use Ceres to represent the asteroid belt later on.
2. Fold the tape in half, crease it, unfold and lay flat. Place a large sticker at the halfway point. You can ask for guesses as to which of the planets might be at this halfway point. Label the sticker **Uranus**.
3. Fold the tape back in half, then in half again. If there are mixed ages, give those with some knowledge of fractions the opportunity to show off by asking "What is half of a half?" Unfold and lay flat. Place large stickers at the quarter mark and 3/4 marks and label as **Saturn** (closer to the Sun) and **Neptune** (closer to Pluto).
4. Fold back into quarters, then in half one more time. This will give you eighths. Unfold and lay flat again. Place a large sticker for **Jupiter** at the 1/8 mark (between the Sun and Saturn), and label.

5. No need to fold the whole thing up again. If you take a look, you've got the 4 gas giants and Pluto all on there in the outer solar system. For the remaining terrestrial planets, you'll only need 1/2 of the first 1/8th! That's the inner 1/16th of your meter. Fold the Sun out to meet Jupiter to mark the 1/16th spot. A planet does not go here, but you should label this **Ceres** to represent the **Asteroid Belt**.

6. At this point, things start getting a little crowded and folding is tough to get precise distances, so fold the remaining 1/16th in half and crease at the 1/32nd spot. Place a small sticker for the **Earth** just inside this fold (between the Sun and Ceres) and a small sticker for **Mars** just outside the fold (closer to Ceres and the Asteroid Belt) and label them.

7. Place small stickers for **Mercury** and then **Venus** between the Earth and Sun, pretty much dividing the space into thirds, and label them as Mercury closest to the Sun and Venus closest to the Earth.

#### **EXTENSION:**

1. Do you know anything about the physical properties of the planets that are spread out versus the ones that are crowded in close to the Sun? All the inner planets are small and rocky and the outer ones are gaseous giants (except small, icy Pluto).
2. Given this spacing, why do you think little, rocky Venus can outshine giant Jupiter in the night sky? Both are covered with highly reflective clouds, and although it is much smaller, Venus is also much, much closer.
3. How long does it take for the **Earth** to make one trip/orbit/revolution around the Sun? **Neptune** = 164 years. **Pluto** = 248 years.
4. Does anyone know where Eris, the largest dwarf planet, would go on this model? At 97 A.U., it would more than double the size of the model. Pluto is on average 40 A.U. [A.U. stands for Astronomical Unit, roughly the mean distance from the Earth to the Sun. 1 AU = 149,597,870.691 kilometers, or about 93 million miles.]

## Mission to Mars – Mars Rover Landing

### ACADEMIC STANDARDS:

- Physical Science
  - K.1, K.2, K.5, 1.6, 3.2, 3.3, 3.4, 8.2, 8.3,
- Science and Technology
  - 1.1, 1.7, 1.8, 2.4, 3.4, 3.5, 4.3, 5.2, 6.5, 7.4, 8.3, 8.4

**OBJECTIVE:** Students will learn about the challenges that come with planning a mission to Mars, and about the difficulty of designing a safe spacecraft for any mission, by completing the following objectives: 1) To design a vehicle to carry a raw egg from the 2<sup>nd</sup> floor to the 1<sup>st</sup> floor. 2) To design a scientific investigation and communicate the results. 3) To use a simple design process to solve a problem.

### MATERIALS:

Per Group:

- Paper
- Cardstock
- Balloons
- Packing Peanuts
- Masking Tape
- Eggs
- String
- Kitchen Garbage bags
- Straws
- Rulers
- Protractors
- Compasses
- Tape Measures

### PROCEDURE:

Give students access to markers, pencils, crayons, and paper. Tell them their mission: To create a landing device that will allow a raw egg to land safely from a specific height. Before they can build they must draw or write out their design and have it approved by a “NASA Consultant” (a teacher). Designers will not receive their egg until their design is approved. When their design is approved and they begin to build they must follow the posted rules and regulations.

### Rules:

1. You may not utilize any lowering device.
2. You may not utilize any padding on the ground.

3. Your egg drop device can weigh no more than 1.25 kilograms (including egg).
4. You may not utilize a parachute.
5. Your egg must complete the drop still intact with no cracks.
6. All eggs must be placed in a zip lock bag before dropping.

Each participant may use the following amount of materials:

- Paper: 6 pieces (8.5x11)
- Cardstock: 4 pieces
- Balloons: 3
- Packing peanuts: 8 cups (by volume)
- Masking Tape: 2 Meters
- String: 2 Meters
- Kitchen Garbage Bags: 1
- Straws: 6
- Ziploc Bags: 2

After the design is approved and the lander has been constructed, participants can go to the “Drop Zone” where a teacher will show them where to launch their lander.

**EXTENSION:**

After the first drop, redesign the landers. What can be done to improve the effectiveness of the landers?

# Areology

## ACADEMIC STANDARDS:

- Earth and Space  
3.1, 3.2, 3.5, 3.6, 8.8
- Physical Science  
K.2, 1.1
- Scientific Inquiry  
K.4, K.10, 1.6, 2.5, 2.7, 3.2, 3.6, 5.3, 8.2

## OBJECTIVE:

Students will learn about the process of core sampling by examining core samples from candy bars, and then relate this scenario with real life core sampling of planets.

## MATERIALS:

- “Fun” or “Bite Size” Candy Bars (Snickers, Milky Way, Mounds, Reese’s Peanut Butter Cup, etc.)
- Large Straws (Sections 3” Long)
- Paper Plate
- Plastic Knife
- Wet Wipes (optional)

## PROCEDURE:

Invite each participant to take one candy bar (use candy at room temperature, or a bit warmer). Encourage participants to select a brand that has not already been selected.

Go ahead and unwrap your bar and make observations about its surface: color, texture, composition, etc. Is it wavy, bumpy or smooth? Compare your candy to someone else’s. Is yours darker or lighter?

Now take a “core sample” by carefully and steadily drilling a straw into their candy bar. Please notice the number and thickness of layers, as well as color and texture of layers. What are the layers made of? Any repeated layers?

Now, using knives cut the candy in half so the layers can be viewed more easily in a cross-section. Discuss which layers were made first. How were the layers made?

Finally, allow the participants to consume the samples.

Core sampling is one method that scientists use to learn more about the history and geology of an area. Do you think core sampling might help us learn more about Mars?

## **WHAT'S GOING ON?**

Until now, most of our science observations have been of surface features. To have a better understanding of the processes that formed the Martian features, seeing below the subsurface is very important. There are many unanswered questions that scientists have: Is there water in the subsurface of Mars that a mission to Mars could access? How many layers are there and how thick are the layers in the subsurface? Are there different rocks underground on Mars than there are on Earth? What can we tell about the climatic history of Mars from these layers?

## **EXTENSION:**

Try a variety of candies. Are certain candies harder to sample? Why? What do the harder layers simulate for a real world experience? (Different rock layers.)

# **Make Your Own Constellation**

## **ACADEMIC STANDARDS:**

- Earth and Space:  
5.4
- Scientific Ways of Knowing:  
K.4, 3.3, 5.5, 6.5, 7.3

## **OBJECTIVE:**

Although the most commonly known constellations are based on Greek mythology, other civilizations also named constellations. Native Americans, Indians, Chinese and Aborigines all have different constellations. After learning about these constellations, make up your own constellation and create a mythological story about your constellation.

## **MATERIALS:**

- Work sheet with the map of the stars
- Colored pencils, crayon, or markers
- A pencil

## **PROCEDURE:**

Have students look at the map of the stars in the sky (see the following page). Using their imaginations the students should try to see an object within the stars. This will simulate how throughout history civilizations looked up at the stars and saw images.

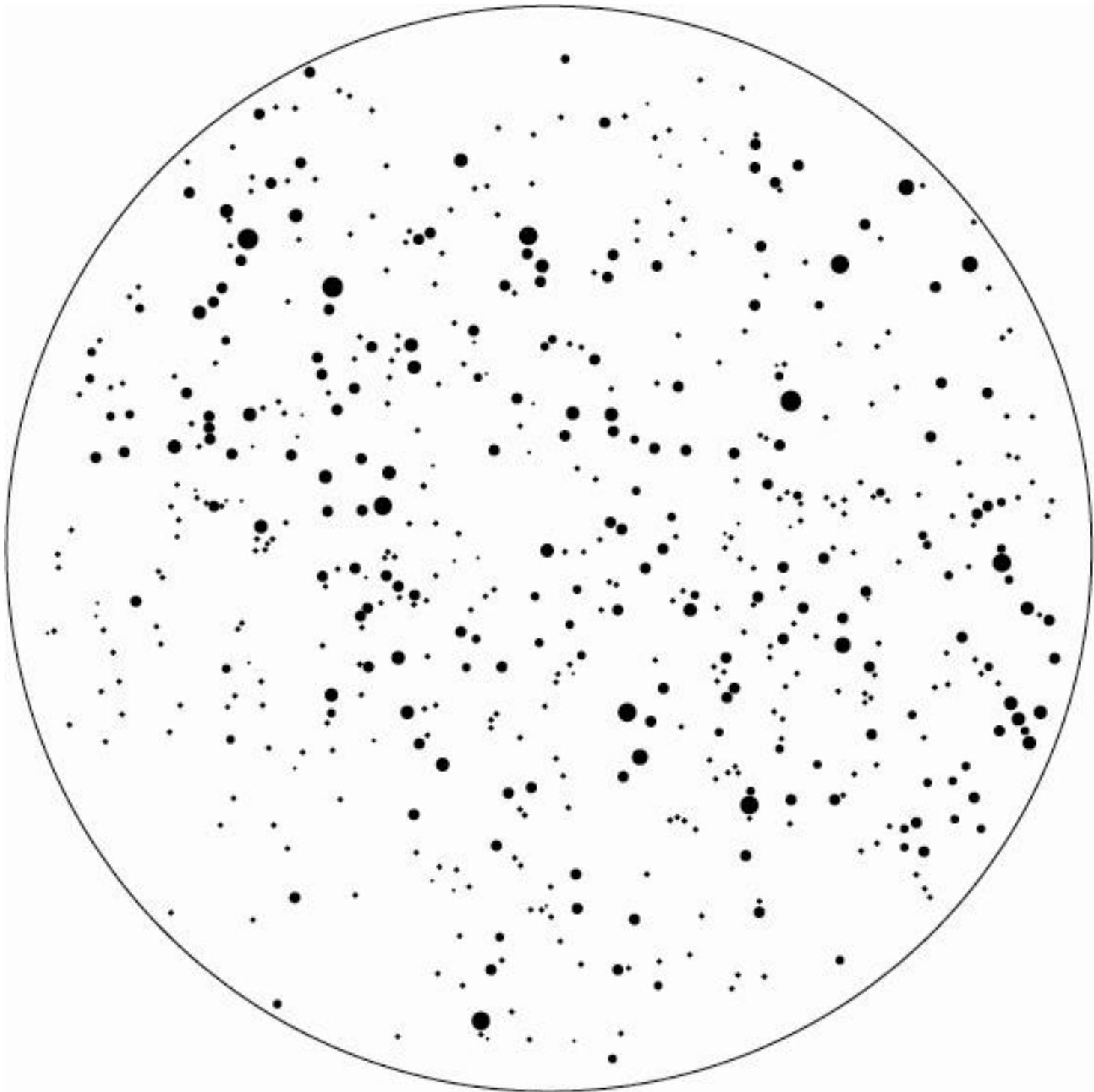
Using colored pencils, crayons, or makers, students should draw the object they see.

Students can then develop a story about their constellation and how the constellation ended up in the sky.

## **EXTENSION:**

Research different civilizations constellations' and compare and contrast them.

Attach the students' constellations to the ceiling of the classroom. Have the students lie on their backs and look up at the "stars" as students share their constellation's story.



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