



## **Astronomy**

### **GRADE LEVELS:**

Grades 8th - 12th

### **OBJECTIVES:** Participants will:

- Learn about the discovery of new planets from an Ohio State University astronomer.
- Conduct experiments that reinforce gravitational force and interstellar distances.

### **ACADEMIC CONTENT STANDARDS:**

- Earth and Space science: 8.1, 8.2, 8.5, 8.6, 8.7, 8.8, 9.2, 9.3
- Scientific Inquiry: 8.1, 9.3

### **VOCABULARY WORDS:**

**Astronomy** – The study of the material universe beyond the earth’s atmosphere.

**Circumference** – The measurement of the outer boundary of a circular area.

**Doppler Effect** - The shift in frequency of acoustic or electromagnetic radiation emitted by a source moving relative to an observer as perceived by the observer.

**Gravity** - The force of attraction between objects of mass.

**Light Year** – The distance traveled by light in one mean solar year, about 5.88 trillion mi. (9.46 trillion km): used as a unit in measuring stellar distances.

**Pi** - The ratio of a circumference of a circle to its diameter. 3.141592653...

### **BUILDING CONNECTIONS:**

Space Exhibition Area-level 1

Atrium-Foucault Pendulum-level 1

Big Science Park-Giant Lever, Centripetal Generator-level 1

### **ADDITIONAL RESOURCES:**

The Globe Program

<http://www.globe.gov/>

Teacher Resources

<http://www.phy.duke.edu/~kolena/astroteach.html>

NASA resource

[http://planetquest.jpl.nasa.gov/resources/resources\\_index.cfm](http://planetquest.jpl.nasa.gov/resources/resources_index.cfm)

## SAMPLE TEST QUESTIONS:

1. Which is true about gravity
  - a. There is no gravity in deep space
  - b. Gravity causes the earth and the moon to pull each other
  - c. Gravity is the force of falling
  - d. None of the above.
  
2. If a sphere has a radius of 17,000 cm, what is its circumference?
  - a. 5414.01 cm
  - b. 53,380 cm
  - c. 106,760 cm
  - d. 53,380 cm<sup>2</sup>
  
3. Life has been identified on planets other than the earth
  - a. True
  - b. False
  
4. The shape of DNA is:
  - a. A spiral
  - b. A helix
  - c. A double helix
  - d. Parallel strands



## **Astronomy Pre Visit Activities**

### The Pulse of Gravity

**Objective:** Students will:

- Examine the effects of gravity on a person's pulse.
- Understand how gravity can differ from planet to planet

**Materials:**

- Class chart (designed by instructor for class)
- Large area to walk
- Something that can be carried that equals 5 – 10 lbs (i.e. hand weights, book bag)
- stopwatch

**Procedure:**

1. Instruct students to walk for one minute
2. Students will individually record their pulse and record it on the class chart.
3. Carrying 5 to 10 lbs of additional weight, have students walk for another minute.
4. Students will individually record their pulse and record it on the class chart.
5. Determine the class average and find the median and mode for the two columns of data.

**What Happened?**

All planets exert gravity. Smaller planets will generally exert less die to their decrease in mass over larger planets. This activity shows the difference change in gravity makes on the pulse rates of astronauts.



## Applying Math to Astronomy

**Objective:** Students will use the formula for circumference and the value of  $\pi$

**Materials:**

- Several cylindrical objects (coffee cans, soda cans, jars, cups, etc)
- Cloth measuring tapes with both English and metric measurements on them.
- Calculators

**Instructions:**

1. Have students measure the diameter of a cylindrical object.
2. Have the students use the formula to  $c = \pi \times d$
3. Record the diameter and calculated circumference on a worksheet or chart.
4. Have the students measure the circumference and record on the chart.
5. Repeat steps 1 through 4 for other objects.
6. After all objects have been used, convert them to metric/English standard depending on which unit they used initially.

**What's Going On?**

Circumference =  $\pi \times$  diameter or  $2\pi r$ .  $\pi$  is always a constant.



## **Astronomy Post Visit Activities**

### Weightless Water

**Objective:** Students will be able to witness the effects of free fall and gain better understanding of the concept of weightlessness.

**Materials:**

- Pop can
- Screwdriver or tool to make a hole
- String
- water

**Procedure:**

1. Ask students if they have ever experienced weightlessness on earth. Riding a roller coaster? Jumping off something high?
2. Take a soda can and screwdriver. Puncture the can on the side approximately  $\frac{1}{2}$  - 1" from the bottom.
3. Invert the pop tab and attach a string to the tab.
4. Lower your device into a bucket of water and quickly remove from the bucket.
5. Make observations regarding the events that follow.
6. Repeat the process. As the water begins to pour from the can, rapidly lower or drop the can.

**What is going on?**

Any object, including your body, speeds to the Earth at 9.8 meters per second for every second you fall. The falling object will do this until it reaches terminal velocity (point at which you no longer accelerate due to friction). You are falling at the same speed as everything around you. At this point, you would experience the feeling of weightlessness.

Weight is caused by the pull of gravity. When we stand, we feel the pull of gravity toward the grounds. To keep us from being pulled into the earth, the ground pushes up on our feet, opposite the pull of gravity. On the moon, there is less gravity, therefore a person would weigh less and feel less pull toward the ground.



## Planet Surfing

**Objective:** Students will be able to differentiate between two planets in the solar system using data obtained from the internet. Students will convert distances from light years to miles and back.

### **Materials:**

- Access to the internet
- Data chart
- Worksheet

### **Procedure:**

1. Students will go to Windows to the Universe website, <http://www.windows.ucar.edu>
2. Click on "Our Solar System" then on "Planetary Systems".
3. Click on a planet to explore.
4. Use the information found to complete the data chart.
5. After completing the data chart for two planets, determine the length of the day, length of the year and distances in light years to the earth and sun.

### **What's Going On?**

The solar system is made up of a number of different planets. Each planet has a different diameter, temperature range and is a different distance from the sun and earth.

## Planet Surfing Student Worksheet

Complete the data sheet for two different planets.  
Record all data in both Metric and English Units

Planet Name			Comparison to Earth			Comparison to Earth
	Metric	English		Metric	English	
Diameter						
Mass						
Density						
Minimum Distance From Sun						
Maximum Distance From Sun						
Distance From Earth						
Length of Day						
Length of Year						
Minimum/Maximum Temperature at Surface						

Of the two planets you researched, which is bigger? How can you tell?

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Which planet is closer to the sun? How much closer is it?

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Which planet has a shorter year? How much shorter is it? Can you guess why that planet has a shorter year?

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Which planet has a longer day? How much longer is it? Can you guess why that planet has a longer day?

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If you wanted to go to one of your planets from earth, how long would it take you?

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A light year is 9,500,000,000,000 km. Is the distance from your planet to the sun more or less than a light year? Can you calculate the number of light years each planet is from the sun?

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The space shuttle must reach a speed of 25,000 mph in order to escape the gravitational field. If it were to maintain this speed how long would it take to travel from earth to each of your planets?

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