Emera Astronomy Center
and M. F. Jordan Planetarium

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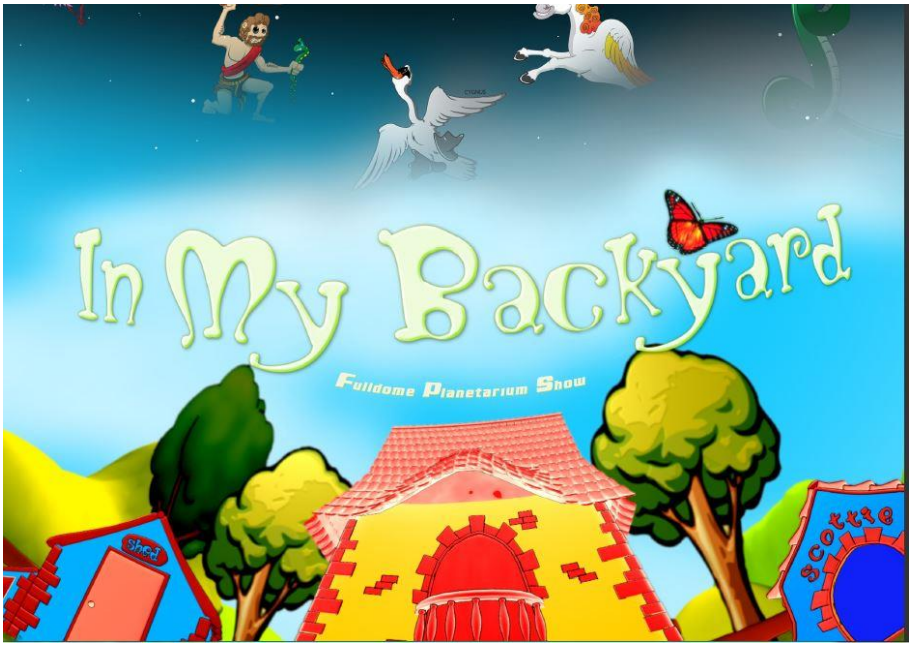
Cosmic Classroom Guide



In My Backyard

COMPILED & EDITED BY LEISA PREBLE

THE UNIVERSITY OF MAINE

A Member of the University of Maine System

Emera Astronomy Center
and M. F. Jordan Planetarium

In My Backyard

Compiled and Edited by Leisa Preble
Gr. preK-1

Mission Statement:
The mission of the Maynard F. Jordan Planetarium of the University of Maine is to provide the University and the public with educational multi-media programs and observational activities in astronomy and related subjects.

Cosmic Classroom

Looking for fun and interesting space activities? The planetarium staff has prepared a collection of materials we call the Cosmic Classroom for you to use before and/or after your visit. These materials are entirely for use at your own discretion, and are not intended to be required curricula or a prerequisite to any planetarium visit. The Cosmic Classroom is one more way that the Jordan Planetarium extends its resources to help the front line teacher and support the teaching of astronomy and space science in Maine schools.

The lessons in this Cosmic Classroom have been edited and selected for the range of ages/grades that might attend a showing of this program at the Jordan Planetarium. Those activities that are not focused at your students may be adapted up or down in level. Our staff has invested the time to key these materials to the State of Maine Learning Results in order to save you time.

The State of Maine Learning Results performance indicators have been identified and listed for the program, the Cosmic Classroom as a package, and each individual activity within the package. The guide also includes related vocabulary and a list of other available resources including links to the virtual universe. We intend to support educators, so if there are additions or changes that you think would improve, PLEASE let us know.

Thank you, and may the stars light your way.

The Maynard F. Jordan Planetarium Staff

The Program – In My Backyard

It's off to explore things large and small right in the backyard - from the colors of the rainbow to counting the ladybugs on a rose. After looking at the reasons for seasons, the stars begin to appear and we take a look at the Big and Little Dippers, and Leo the Lion. After learning about our nine planets, we take a closer look at the moon. Before we know it, the sun is rising and we're encouraged to explore the wonders and beauty of our own backyards.

We're very glad that you have chosen to visit our planetarium with your group. We hope that this guide either will help you prepare your group or help you review their experience at the University of Maine's sky theater.

State of Maine Learning Results Guiding Principles

The lessons in this guide, in combination with *In My Backyard*, help students to work towards some of the Guiding Principles set forth by the State of Maine Learning Results. By the simple act of visiting the planetarium, students of all ages open an avenue for self-directed lifelong learning. A field trip encourages students to think about learning from all environments including those beyond the schoolyard. A Jordan Planetarium visit also introduces visitors to the campus of the largest post-secondary school in Maine and encourages them to think of this as a place which holds opportunities for their future education, enjoyment and success.

Other sites on the University campus, including three museums, explore a variety of subjects, and the Visitors Center is always willing to arrange tours of the campus. A field trip can contribute to many different disciplines of the school curriculum and demonstrate that science is not separate from art, from mathematics, from history, etc. The world is not segregated into neat little boxes with labels such as social studies and science. A field trip is an opportunity for learning in an interdisciplinary setting, to bring it all together and to start the process of thinking. For a more complete discussion of field trips, please visit the Jordan Planetarium web site at http://www.GalaxyMaine.com.

If used in its entirety and accompanied by the Planetarium visit this guide will help students to:

Become **a clear and effective communicator** through

A. oral expression such as class discussions, and written presentations

B. listening to classmates while doing group work, cooperation, and record keeping.

Become **a self-directed and life long learner** by

A. introducing students to career and educational opportunities at the University of Maine and the Maynard F. Jordan Planetarium.
B. encouraging students to go further into the study of the subject at hand, and explore the question of "what if?"
C. giving students a chance to use a variety of resources for gathering information

Become **a creative and practical problem solver** by

A. asking students to observe phenomena and problems, and present solutions
B. urging students to ask extending questions and find answers to those questions
C. developing and applying problem solving techniques
D. encouraging alternative outcomes and solutions to presented problems

Become **a collaborative and quality worker** through

A. an understanding of the teamwork necessary to complete tasks
B. applying that understanding and working effectively in assigned groups
C. demonstrating a concern for the quality and accuracy needed to complete an activity

Become **an integrative and informed thinker** by

A. applying concepts learned in one subject area to solve problems and answer questions in another
B. participating in class discussion

State of Maine Learning Results Performance Indicators

In conjunction with the Maynard F. Jordan Planetarium show *In My Backyard,* this guide will help you meet the following State of Maine Learning Results Performance Indicators in your classroom.

Maine Learning Results

Grades Pre-K – 2

A2 Models

b. Use a model as a tool to describe the motion of objects or features of the planets.

A3 Constancy and Change

a. Describe the size, weight, color, or movement of things over varying lengths of time and note qualities that change or remain the same.

D1 Universe and Solar System.

a. Identify objects that are in the daytime and nighttime sky.

D3 Matter and Energy

a. Describe objects in the universe and determine what they are made of and their physical properties.

Next Gen Science Standards

1-ESS1. Earth's Place in the Universe

1-ESS1-1. Use observations of the sun, moon, and stars to describe patterns that can be predicted.
ESS1.A: *The Universe and its Stars* – Patterns of the motion of the sun, moon, and stars in the sky can be observed described, and predicted.

1-ESS1-2. Make observations at different times of year to relate the amount of daylight to the time of year.
ESS1.B: *Earth and the Solar System* – Seasonal patterns of sunrise and sunset can be observed, described, and predicted.

2-PS1. Matter and its Interactions

2-PS1-1. Plan and conduct an investigation to describe and classify different kinds of materials by their observable properties.
PS1.A: *Structure and Properties of Matter* – Different kinds of matter exist and many of them can be either solid or liquid, depending on temperature. Matter can be described and classified by its observable properties.

K-PS3-1. Energy

K-PS3-1. Make observations to determine the effect of sunlight on Earth's surface.
PS3.B: *Conservation of Energy and Energy Transfer* – Sunlight warms the Earth's surface.

Performance Indicators Snapshot

The Guide

MLRs:

Grades Pre-K – 2
Science and Technology
A2.b
A3.a
D1.a
D3.a

NGSS:

1-ESS1-1. Earth's Place in the Universe.
1-ESS1-1; ESS1.A
1-ESS1-2; ESS1.B

2-PS1. Matter and its Interactions
2-PS1-1; PS1.A

K-PS3-1. Energy
K-PS3.1; PS3.B

The Sun Is a Star

Based on The Sun is a daytime star. by Susan Reynolds and Onondaga-Cortland-Madison Board of Cooperative Educational Services Math, Science and Technology.

Objectives and State of Maine Learning Results Performance Indicators:

1. Learners will be able to identify objects that are in the daytime and nighttime sky. (MLR - PreK-2. Science and Technology. D1.a)
2. Learners will be able to identify objects that are in the daytime and nighttime sky. (NGSS - Earth's Place in the Universe. 1-ESS1-1.)
3. Learners will be able to identify the Sun as the only star visible during the day. (NGSS - Earth's Place in the Universe. 1-ESS1-1.)
4. Learners will be able to recognize that the sun is a star and is similar to other stars in the universe. (NGSS - Earth's Place in the Universe. 1-ESS1-1.)

The General Idea:

When discussing astronomy we often mention the Sun, moons, stars and planets, but for many young students this may inadvertently cause them to believe that the Sun is not a star. The following activity is designed to help students remember that the Sun is a star we can see during the day.

Getting Ready:

Ask the students to think about, and discuss, when the Sun can be seen.

What You Need:

- Paper
- Crayons
- Markers
- Sunny day

What To Do:

1. Take the students outside on a sunny day to observe the daytime sky (before going outside, emphasize to the students that they should never look directly at the Sun because it could hurt their eyes).
2. Write down for your students, what they see outside during the day
3. Talk to the students about what they think the Sun is, what it's made of, etc.
4. Explain that stars are made of the same things that the Sun is made of; that the Sun is the same as many of the stars we see at night. In fact, the Sun is a star that is closer to us than all other stars and that's why it looks so much bigger.
5. Help your students make a list of what they see at night and have a class discussion about the differences between this list and the list of things they see during the day.
6. Have each student fold a piece of paper in half
7. Have students draw the daytime sky on one side of the piece of paper and the nighttime sky on the other side. Students can use these drawings to remember the differences in the daytime and nighttime sky as well as remembering that the Sun is a star.

What To Discuss:

1. What did you observe in the daytime sky?
2. What did you observe in the nighttime sky?
3. What can be seen in both the daytime and nighttime sky?

The Sun Appears to Rise and Set

Based on The Sun Appears To Rise in the East and Set in the West by Susan Reynolds and Onondaga-Cortland-Madison Board of Cooperative Educational Services math, Science and Technology.

Objectives and State of Maine Learning Results Performance Indicators:

1. Learners will be able to use a model to represent the Sun rising. (MLR - Pre. K-2. Science and Technology. A2.b.)
2. Learners will be able to observe that the Sun appears to be in different places in the sky at different times of the day. (NGSS - Earth's Place in the Universe. 1-ESS1-1.)
3. Learners will be able to demonstrate that the above occurs because the Earth is rotating. (NGSS - Earth's Place in the Universe.)
4. Learners will be able to use a model to represent the Sun rising (NGSS - Earth's Place in the Universe. 1-ESS1.1.)

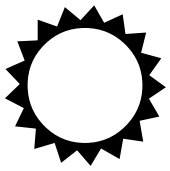
The General Idea:

This activity is designed to disprove the geocentric idea that many young students have, the idea that the Sun must be going around us because of how it rises and sets. Through observations of the Sun (please make sure that all you students know that it is dangerous to look directly at the Sun!) and its path through the sky and through teacher demonstration, students will learn how day and night are the result of the Earth rotating rather then the Sun revolving.

Getting Ready: Set up a light for the demonstration, a bare bulb works well

What To Do:

1. Take the students outside at a set time (9am is good to start) and discuss where the Sun is (again, warn students to ***never*** to look at the Sun because it will harm their eyes).
2. Repeat step one at least twice more (11 am and 2pm for instance).



What To Discuss:

1. Was the Sun in the same place each time we looked at it?
2. Why or why not?
3. Did the Sun move or did the Earth move?

What To Do:

1. Have the students stand in a circle around the lamp (while it is turned off).
2. Explain how scientists use models to discover how things happen and how you are going to use a model to discover how the Sun appeared to move in the sky.
3. Tell the students that they are the Earth and that the lamp is the Sun.
4. Have the students turn so that their left side is in the light
5. Tell the students to pretend that it is Sunrise.
6. While staying in the same spot, have the students turn ***slowly*** to their left until their backs are bathed in light.

What To Discuss:

1. Even though it's nighttime on their faces, is it nighttime on the students backs?
2. Did they all see how the "Sun" came up on one side of their face and went down on the other?

Continuations/Extensions:

1. Do the above activity with a globe. You may also want to mark your state with a bit of clay so that the students can watch as it goes from day to night.

The Maynard F. Jordan Planetarium - Cosmic Classroom Activity

What's in My Backyard

2002-2003 School Year

Objectives and State of Maine Learning Results Performance Indicators:

1. Learners will be able to explain that the sun warms the air, water, and land. (MLR - Science and Technology. D2.a)
2. Learners will be able to recognize the Sun's contribution of energy to cycles on Earth. (NGSS - Energy. K-PS3-1.)
3. Learners will be able to identify ways the Sun affects their daily lives. (NGSS - Conservation of Energy and Energy Transfer. K-PS3.B.)

The General Idea:

Students will observe and identify interactions of some components in the world around them. They will identify ways the Sun influences their day-to-day lives.

What You Need:

- Open area/outside for students to spread out
- Paper to draw on

What To Do:

1. Explain to students that they will be considering how the Sun affects them and their environment over a period of 3–5 days. Have students consider the Sun's effect on their health, mood or choices they make during their day.
2. Brainstorm a list of activities they have already done during their day in which the Sun influenced their decision. For example, students should be able to identify that the clothes they are wearing were chosen because of their or their parents' observations of weather, which is affected by the Sun.
3. Have students identify the components of the environment they are in. You may choose to take students outside so that younger students are better able to identify things in the natural world around them. Brainstorm a list of things like plants, animals, or weather to fully describe the environment they are in.
4. Explain that for the next few days students will be asked to record their observations of the environment they live in, by drawing in their journals. They will need to use their senses of seeing, hearing and smelling to make their observations. They will need to explain/describe what is happening around them. For example, the leaves of the trees might be falling, or it may be snowing.
5. Allow students to draw, in their journals the first or last ten minutes of class for 3–5 days. Younger students may be more likely to draw what is around them in the classroom. If you would like students to make observations of other environments, it is recommended to put them in it.

What To Discuss:

At the beginning of each class, have the class brainstorm a list of questions they may want to consider while making their observations. This will create an ongoing list of questions over the course of the allotted time, so list them in a place they are going to be accessible. For students just learning to form questions here are some to guide the discussion:

- What can I see?
- What can I smell?
- What do I hear?
- Where does what I hear come from?

Assessment:

Host a class discussion answering some of questions they were keeping in mind. Discuss if there were similarities and differences in their observations. Ask students to think about how the objects/things they observed in their environments may be influenced by the Sun. Record their ideas.

Journal Activity/Real Life Connection
Have students to write a poem about how they think their lives and environment would be affected if there were no Sun.

For pre- and emergent readers/writers*:* Have students create a collage of their home environments.

The Maynard F. Jordan Planetarium - Cosmic Classroom Activity

Matching Game

Written by Kim Small

Objectives and State of Maine Learning Results Performance Indicators:

1. Learners will be able to compare two objects in the universe and determine whether they are the same type of object. (MLR - Pre. K-2. Science and Technology. D3.a.)
2. Learners will be able to describe the physical properties of celestial bodies and group them based on those properties. (MLR - Pre. K-2. Science and Technology. A3.a., D3.a.)
3. Learners will be able to compare two objects in the universe and determine whether they are the same type of object. (NGSS - Matter and its Interactions. 2.PS1.1.)
4. Learners will be able to describe the physical properties of celestial bodies and group them based on those properties. (NGSS - Matter and its Interactions. 2.PS1.1.)

The General Idea:

This activity exercises recognition skills by matching objects in the sky that students may not realize are very similar. An example of this is Sun/star, Earth/planet, and different phases of the Moon. Emphasis can be placed on the idea that even though objects don't always look the same, as a whole they may not be all that different.

Getting Ready:

1. Explain to students that the Sun and stars are shaped like balls, but are often represented with points. This is a good time to show them some drawings of stars and some actual photographs of stars.
2. Explain to students that even though the shape of the Moon doesn't look round all the time, it is always shaped like a ball. A demonstration about moon phases may be helpful here for very young students.
3. Planets look different from one another and are made of different substances, but they are all planets.

What You Need:

- Pictures of the Sun, stars, Earth, planets, and Moon phases.
- Crayons, markers or colored pencils
- Scissors
- 3x5 index cards

What To Do:

1. Have students look at the different pictures and show them how they are the same.
2. Have students color their own versions of the pictures you showed them on the 3x5 cards.
3. You may organize "Match Game" for a class activity, small group, or one-on-one using the cards that the students have constructed. For young students, the pictures themselves may be used and you can do away with step 2 altogether.
4. Arrange a mixed group of cards on a table and ask student(s) to pick out which is the Sun/star, Moon or Earth/planet.
5. Arrange a mixed group of cards/pictures and ask student(s) to pick out which is not the Sun/star, Moon or Earth/planet. OR have students make groups of one, excluding all others. (i.e. all planets or all phases of the moon)
6. Repeat as desired with as many cards/pictures as appropriate for the age of your students.

What To Discuss:

1. The Sun is a star, and like all stars, is shaped like a ball. Even though they are sometimes drawn with points, stars are not pointed.

2. The Moon doesn't always look the same, but the different shapes we see repeat again and again over time.
3. Earth is not the only planet, but each of the eight planets is different.

Vocabulary List

Arc	Any unbroken part of the circumference of a circle or other curved line.
Binoculars	An optical device, providing good depth effect for use with both eyes, consisting of two small telescopes fitted together side by side, each telescope having two prisms between the eyepiece and objective for erecting the image.
Constellation	Any group of stars to which definite names have been given (as Orion, Ursa Major, etc.)
Elliptical Galaxy	A spherical or ovoid (oval) mass of stars, starved of star-making gases.
Moon	The earth's natural satellite, or any planetary satellite.
Orbit	The curved path, usually elliptical, described by a planet, satellite, spaceship, etc., around a celestial body, as the sun.
Phases	One of the recurring appearances or states of the moon or a planet in respect to the form, or the absence, of its illuminated disk.
Planet	Any of the eight large heavenly bodies revolving about the sun and shining by reflected light.
Rainbow	An arc of prismatic colors appearing in the heavens opposite the sun and caused by the refraction and reflection of the sun's rays in drops of rain.
Reflection	An image, or representation in a mirror, water, or other reflective surface
Revolve	To move in a circular or curving course or orbit.
Rotate	To cause to turn around an axis or center point.
Satellite	A natural body that revolves around a planet (ie: the Moon)
Seasons	One of the four periods of the year beginning astronomically at an equinox or solstice.
Star	Any of the large, self-luminous heavenly bodies, except the moon, appear as fixed points in the sky at night.
Sun	The star that is the central body of the solar system, around which the planets evolve and from which they receive light and heat.
Telescope	An optical instrument for making distant objects appear larger, and therefore nearer.

Some good books to use with *In My Backyard*

Science project ideas about the moon.
Gardner, Robert. 1997, Enslow Publishers.
Introduces the phases and other characteristics of the moon.

I Didn't Know The Sun is a Star
Petty, Kate. 1997, Copper Beech Books.

The Planets in Our Solar System
Branley, Franklyn and Kevin O'Malley. 1998, HarperCollins.
From the Let's Read and Find Out Science 2 Series

What Makes Day and Night
Branley, Franklyn and Arthur Dorros. 1999, HarperCollins.
From the Let's Read and Find Out Science 2 Series

Sunshine Makes the Seasons (reillustrated)
Branley, Franklyn and Michael Rex. 2005, HarperCollins.
From the Let's Read and Find Out Science 2 Series

Some good web sites to use with *In My Backyard*

tycho.usno.navy.mil/vphase.html
What do you see when you look at the moon?

www.spaceplace.nasa.gov/
NASA's Space Place for kids

www.thursdaysclassroom.com
Thursday's classroom from NASA

www.KidsAstronomy.com
Kid's Astronomy page

www.wbplanetarium.org/field-trip-calendar-and-teacher-s-guide/preschool-elementary/in-my-backyard
More activity materials for In My Backyard from the Ward Beecher Planetarium (see bottom of page)

btc.montana.edu/ceres/html/birthdayphases.html
More moon phases

www.harcourtschool.com/activity/moon_phases/
An interactive guide for moon phases

www.astronomyinyourhands.com/activities/activities.html
Astronomy in your Hands activities

Lessons From The World Wide Web

Also, a wide variety of lesson plans and activities can be found on the World Wide Web. These sites are dedicated to lesson planning in a variety of subjects.

btc.montana.edu/ceres
Maintained by the Burns Telecommunications Center, this page links to educational activities and classroom resources

spaceplace.jpl.nasa.gov/spacepl.htm
This California Institute of Technology and NASA Jet Propulsion Laboratory site for kids offers information and activities

school.discoveryeducation.com/
This Discovery Channel education site allows teachers to search for lesson plans by grade and subjects

www.eduref.org/cgi-bin/lessons.cgi/Science/Astronomy
Lesson plans based of the popular PBS series, Newton's Apple

www.thegateway.org
Sponsored by The U.S. Department of Education's National Library of Education and ERIC Clearinghouse on Information & Technology, this site offers lesson plans for all subjects and all grades

Astronomy Web Sites Worth a Visit

Galaxymaine.com
The Maynard F. Jordan Planetarium and Observatory home page

Galaxymaine.com/SA/SA2.htm
The teacher resources and bibliography page on the Maynard F. Jordan Planetarium web site

space.jpl.nasa.gov
NASA's Jet Propulsion Laboratory web site

ssd.jpl.nasa.gov
A site about our solar system maintained by the Solar System Dynamics Group of the Jet Propulsion Laboratory

hawastsoc.org
The Hawaiian Astronomical Society's home page

www.nss.org
The National Space Society web site

stardate.org
Learn what's going on TODAY in astronomy on the "Star Date" web page, maintained by the University of Texas' McDonald Observatory

The Maynard F. Jordan Planetarium does not guarantee that the information given on the above web sites to be accurate, accessible, or appropriate for students.

Additional Activities

Solar System Rap
In My Backyard Crossword Puzzle

Solar System Rap

Performed by Fred Penner
Produced by the Calgary Science Centre
Calgary, Alberta, Canada
From the planetarium program "In My Backyard"

Close to the Sun, the Moon it is not,
This planet is Mercury, rocky and hot.

Hotter than Mercury, second from the Sun,
To live on cloudy Venus wouldn't be fun.

We live on this planet, with grass that needs mowing,
On Earth we drive cars to get where we're going.

This planet is red, and it has no cars,
Fourth from the Sun, this planet is Mars.

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This world is huge, opposite of small,
Jupiter is fifth, and the largest of all.

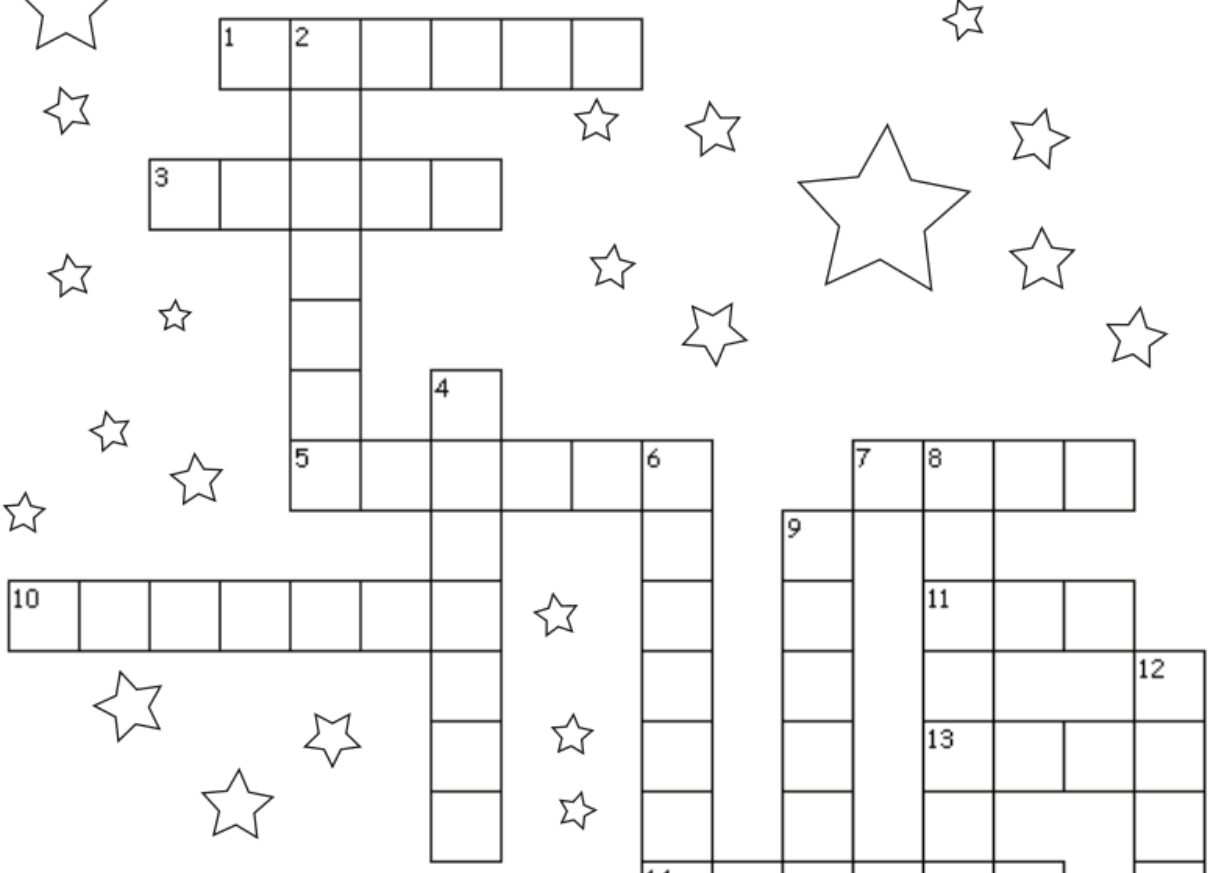
This planet's big, too, but you'll notice its rings,
Saturn's very pretty, fit for a king.

Far beyond Saturn, it spins on its side,
With thin, rocky rings, Uranus is wide.

The most distant planet, an icy cool blue,
Neptune is special and it has rings, too.

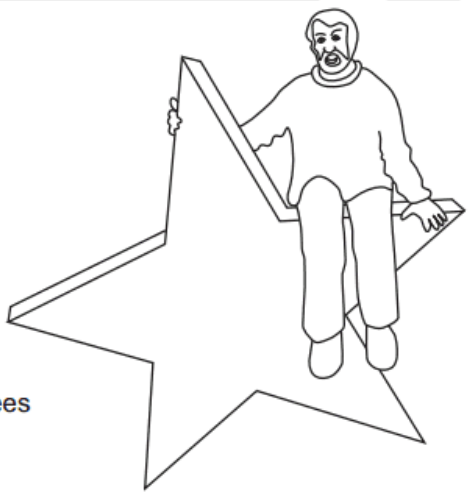
Now it's a dwarf planet, so far out in space,
Lonely small Pluto, is a frozen dark place.

In My Backyard



Across
1. the season when new plants grow and bloom
3. balls of hot gas and light, our Sun is one of them
5. the season with hot weather
7. it's in the sky at night and it orbits the Earth
10. a small, red bug with black spots
11. it's in the sky during the day and it gives us heat and light
13. water that falls from the sky
14. the season when it snows

Down
2. they orbit the Sun, Earth is one of them
4. to make believe
6. an arc of colors that sometimes appears in the sky
8. to see, watch, or notice
9. the season when the leaves change color and fall off the trees
12. frozen water that falls from the sky, usually in winterAAt



From the Classroom Activity Materials developed by Sharon Shanks at the Ward Beecher Planetarium at Youngstown State University. 330-941-3616 – www.wbplanetarium.org