



Section II: Grades 3-4 Lessons

Lesson One: The Solar System

Introduction:

We live on planet Earth. Earth is just one member in a family of eight major planets. All of these planets orbit the Sun, which is the star at the center of the solar system. The Sun shines because it produces its own light, and this radiation from the Sun gives Earth the light and warmth needed for life. Some of the planets have moons that orbit around their parent planet. The Sun's gravity holds the planets in their orbits. From Earth we view the solar system "from the inside out," so its structure is not easy to figure out by just looking at it.

In this activity students will use **Starry Night Elementary** software and other resources to find out a few facts about the Sun and planets. They will use this information to create planet posters and then use them in a solar system dance. During the computer activity students will find and identify solar system objects in the sky and zoom in on them for a close-up view. This lesson plan also contains a special **Activity Extension: Pluto is Still Pluto** about the recent reclassification of Pluto.

Key Concepts:

- The Sun, Moon, and planets have properties, locations, and movements that can be observed and described.
- The Sun provides the light and heat necessary to maintain the temperature of the Earth.
- The Sun shines because it makes its own light.

Science Process Skills:

Observing, collecting data, investigating, classifying, building models, communicating ideas

Bridging the Curriculum:

Fine arts (drawing and painting)
Language arts (reading, writing, listening, speaking)

Materials Required:

- Access to the school or local library
- Access to the Internet
- Poster board or large sheets of paper
- Scissors, glue
- Pencils, markers, crayons, paints and brushes
- Copies of applicable log sheets, idea diagrams and/or foldables from **Section III: Resources**
- Solar System Fun Facts from **Section III: Resources**

Time Required:

Hands-on activity:
three or four 30-minute class periods
Computer exercise: 20 – 30 minutes

Procedure:

You may want to begin with a class brainstorming activity to build a solar system mind map, which will serve as a student resource for the rest of their solar system explorations. Have students use **Starry Night Elementary** software, the Internet, and books to research a few facts about the Sun and its family of planets. You may wish to divide students into small groups of three or four and assign a planet to each group. Or you may prefer them to work in pairs.

Have the students collect the information they gather into a graphic organizer. In the resources section of this binder you will find photocopy masters of graphic organizers for the Sun and the solar system, and a solar system foldable. Students can organize information in several different ways:

- By individual planet
- Sort planets by size

- Sort by distance from the Sun (near or far)
- Sort by type of planet (solid or gas)
- Sort by whether or not the planet has moons or rings

Now divide students into ten small groups: one for each of the eight planets, one for the Moon, and one for the Sun. Have each small group research a few

facts about their solar system object and then create a colorful poster for the classroom wall that displays the results of the group research. See figure 1.1 for an example.

For an additional activity on the properties of the solar system, see activity part B in **K-2 Lesson Two: How Big is it?**

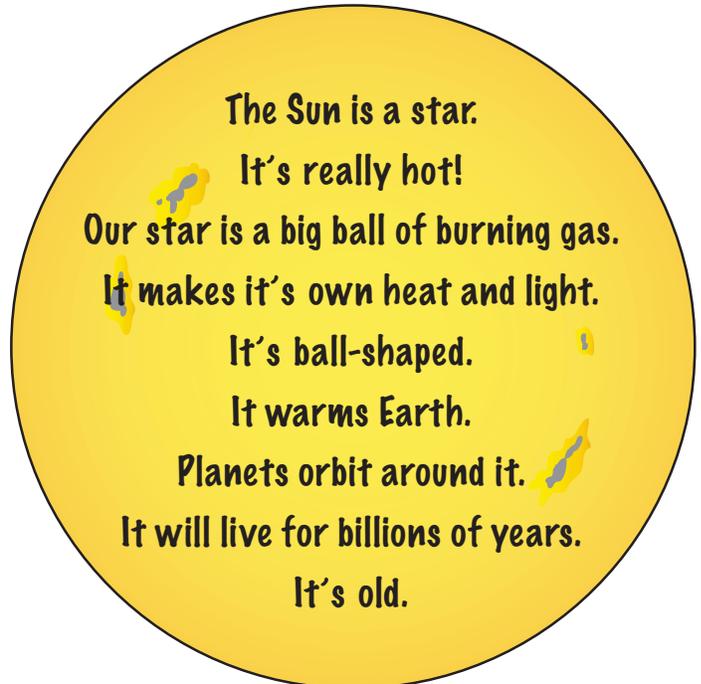
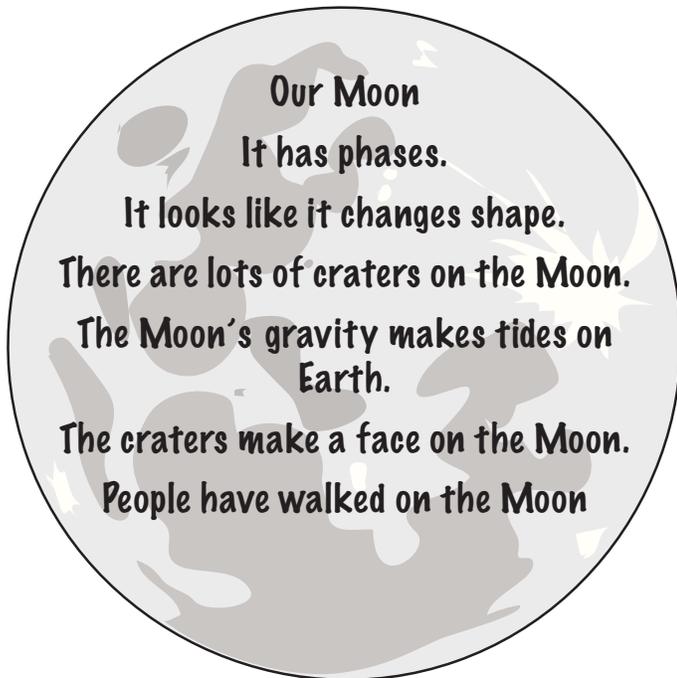
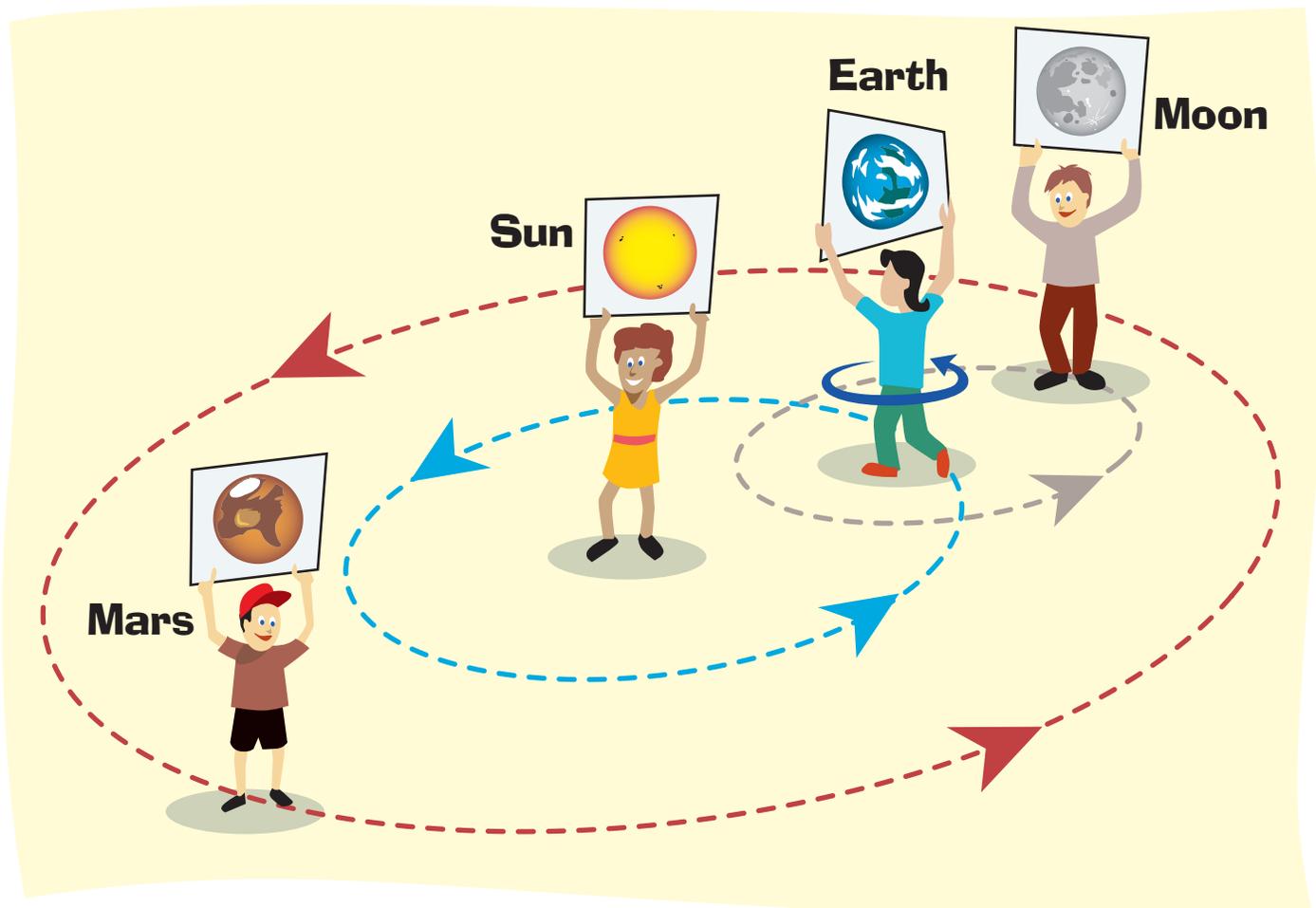


Figure 1.1. Shown here are examples of two possible solar system posters that students might create. Note that some of the answers students provide may not be strictly correct. For example, it is the Mare (large impact basins), not the craters, that creates the impression of the “Man in the Moon”.

Students can now use their completed posters to help them perform a solar system dance. You may want each group to elect one student to represent their planet. Or you may want to do the dance two or three times so everyone has a chance to perform. Have the dancers arrange themselves as the planets around the Sun, and move in orbits around the Sun. Earth should spin on its axis as it orbits the Sun, and the Moon should orbit around Earth as Earth orbits around the Sun. See figure 1.2.

If you wish to include the dwarf planet Pluto in your dance, the student representing this newly reclassified object will have to find a way to represent its unusual orbit. Standing up on a table in the farthest corner of the classroom would be a good approximation for Pluto.

Figure 1.2. The solar system dance.



Questions for Discussion:

As students research the solar system, make posters, and prepare to perform the solar system dance, ask them to consider these questions:

1. Which object is at the center of the solar system?
2. What object do the planets orbit around?
3. What objects do moons orbit around?

4. From what object do the planets receive light and warmth?
5. Can you think of anything that behaves like the solar system? (A merry-go-round.)

When your students have completed their solar system adventures, hang the posters on the classroom wall, in the correct order from the Sun outwards.

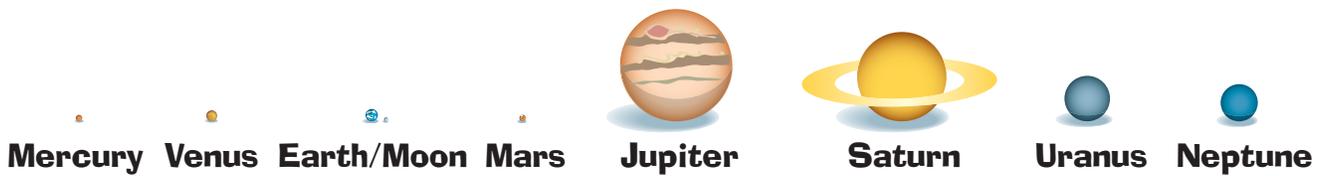
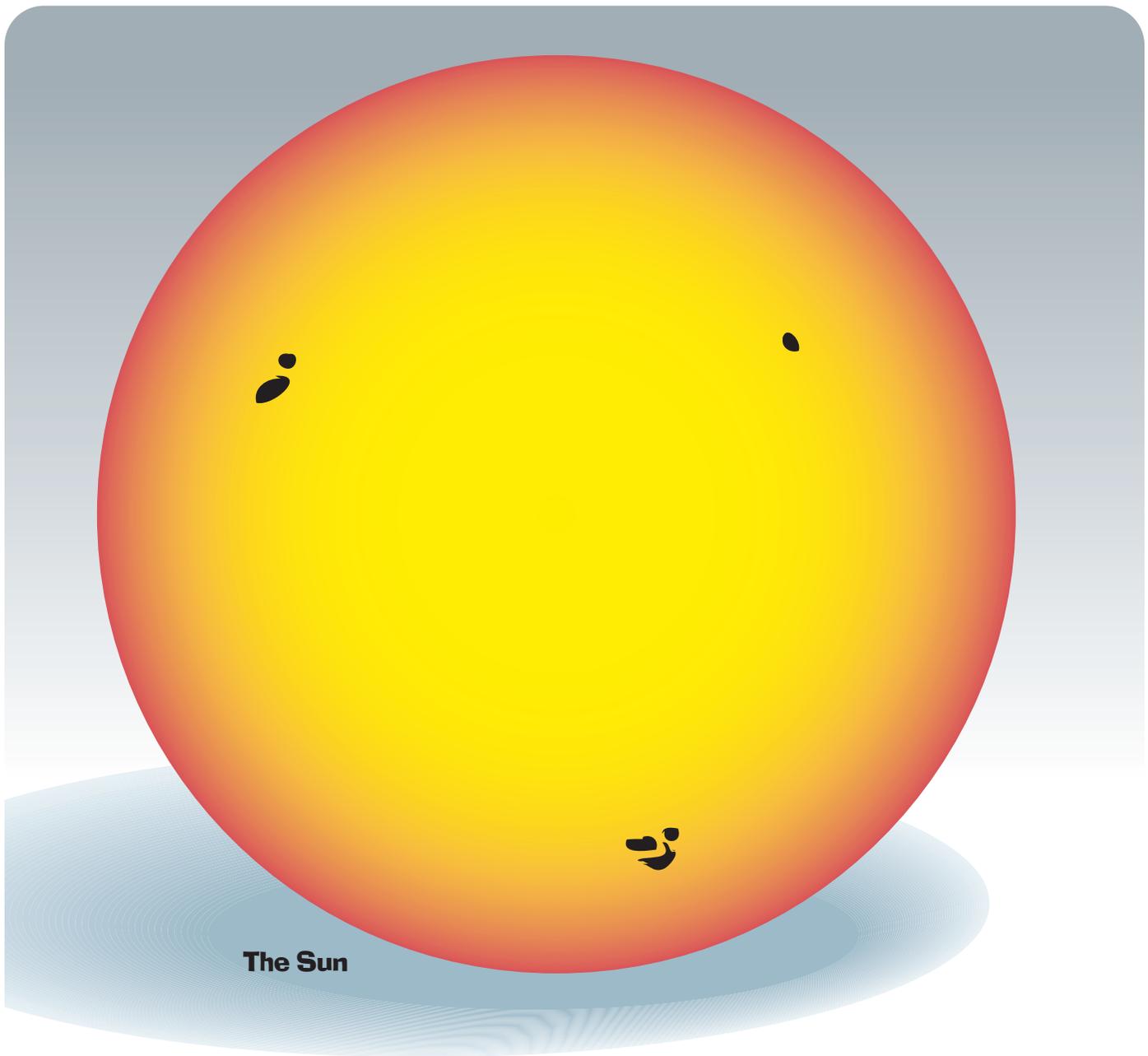


Figure 1.3. This illustration shows the correct relative sizes of the Sun and eight major planets. It does not show correct distances.



Starry Night Computer Exercise

In this exercise, your students will become acquainted with some features of the solar system. The activity begins with a view of Earth and Moon from a satellite orbiting 1000 km above the surface of the Earth.

Open the **SkyGuide** pane, and navigate to **Lessons > Grades 3-4 > Lesson One: The Solar System** and follow the instructions given.

Conclusion:

This lesson plan is an introduction to the solar system. Once completed, students should know that the Sun lies at the center of the solar system, the planets move in orbit around the Sun, and some planets (like Earth) have moons in orbit around them. Students should know that the Sun shines by making its own light, and that it provides light and warmth to Earth and the other planets.

Extension Activity: Pluto is Still Pluto

Any discussion of the solar system will naturally involve Pluto and its recent reclassification from planet to dwarf planet. Pluto seems to have a place in everyone's heart. Maybe this is because it shares its name with a certain cartoon dog, and because it seems also to be the solar system's planetary underdog.

In August 2006, the International Astronomical Union changed Pluto's status from planet to dwarf planet. But this is not the first time the solar system has been revised. It has happened several times in the history of astronomical science. Such events are part of the normal process of science.

The scientists' job is to question and explore. They are constantly re-evaluating ideas in the light of new information. New technologies, space probes, and advances in computing and remote sensing have allowed us to study the solar system in greater detail. New discoveries made it plain that some of our previously held ideas were incorrect. A review was in order.

Scientists looked at all the known characteristics of planets, asteroids, comets and other objects in the solar system. They considered behavior in addition to physical properties. In the end, they knew they had to reclassify things to make sense of the new and better information about the solar system.

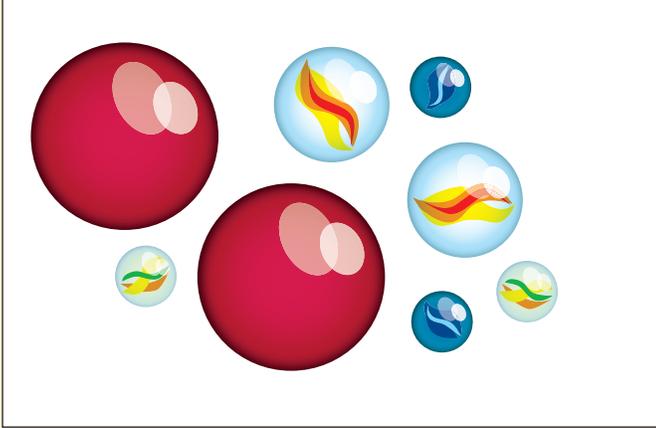
Pluto has been reclassified. It has not been "demoted." It is now one of the largest members of a new class of solar system objects: the dwarf planets. Pluto itself has not changed. It is still the same distant, small, cold, rocky and icy lump of which we are so fond.

The reclassification of Pluto highlights a few key concepts regarding the nature of science itself. They are:

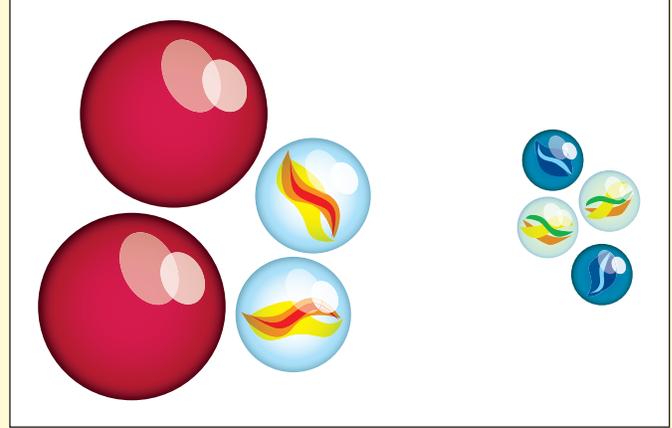
- Science is not a static body of facts, but an ongoing process subject to constant revision.
- The history of astronomy is a history of changing worldviews as a result of new and better data.
- Refining the classification of solar system objects does not change the nature of Pluto.

Be an Astronomer: Play “Sort the Planets”

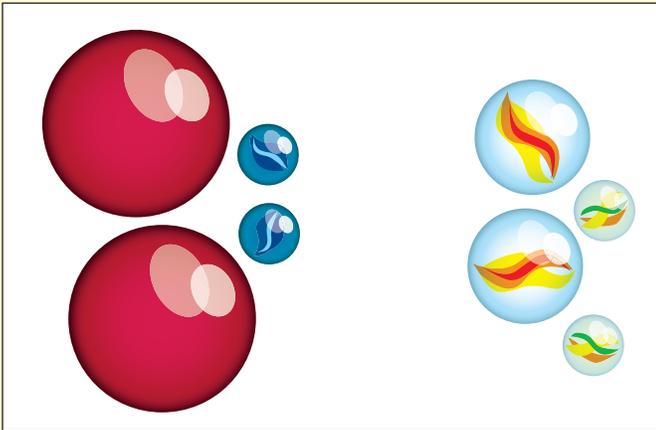
By reclassifying Pluto, scientists were engaging in a type of solar system sorting game. They needed to find a better way to sort the planets so they could make more sense of the solar system. You can mimic the situation with your students by playing a sorting game using marbles.



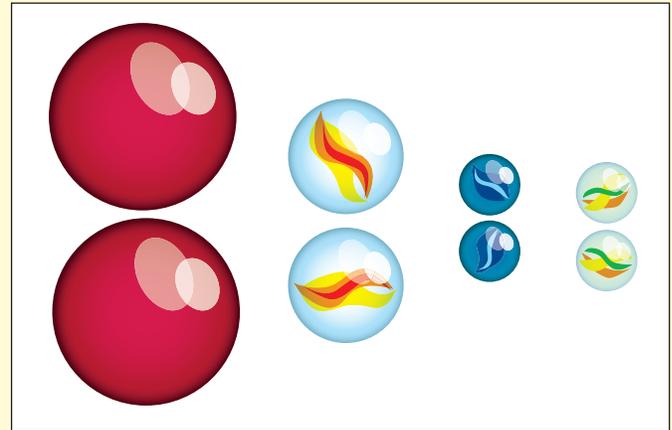
Suppose you have a number of marbles of different types: large, small, single-colored and multi-colored. How can they be sorted?



They can be sorted as large and small. Both groups contain marbles that are similar and marbles that are different.



Or they can be sorted as single-color and multi-colored marbles. But each group still contains more than one type of marble.



Or you can create new categories and sort them with much greater clarity, as large single-color, large multi-color, small multi-color, and small single-color. Now each group contains only one type of object and the distinction between the four categories is clear.

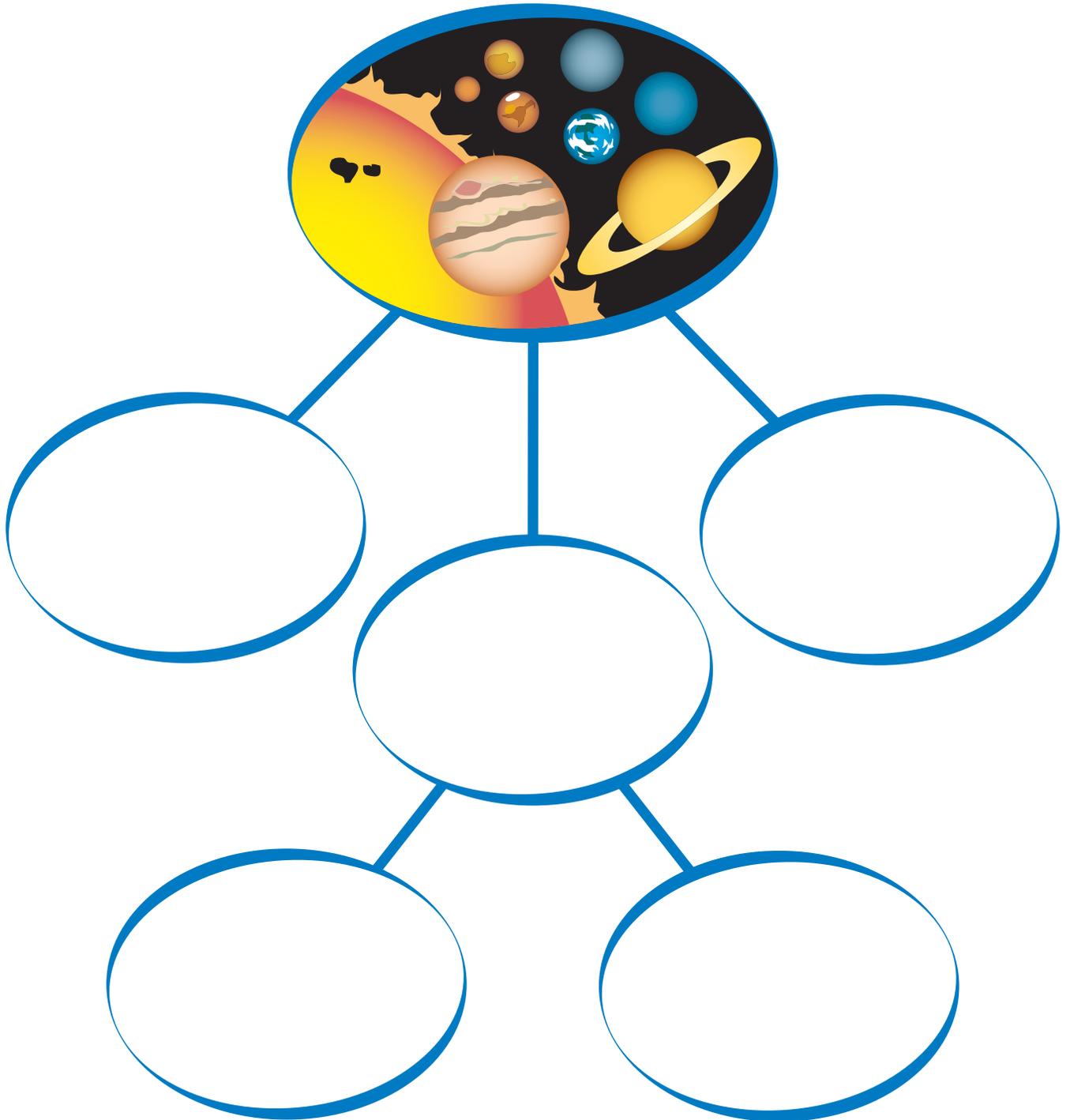
This is analogous to what astronomers have done with a new solar system classification. The new sorting scheme helps us understand the solar system in greater depth.

Idea Diagram

Name: _____

Class: _____

Lesson One: the Solar System





Computer Exercise Log Sheet

Name: _____

Class: _____

Lesson One: the Solar System

Instructions for the student

Open the SkyGuide pane, and navigate to Lessons > Grades 3-4 > Lesson One: The Solar System and follow the instructions given.

Question 1: The Earth and Moon

Can you describe the motion of the Earth and the Moon?

Question 2: The Earth in Orbit

Can you describe the two different motions the Earth has?

Question 3: The Inner Solar System

What other planets can you see circling the Sun?

Question 4: The Outer Solar System

What are the rest of the planets in the solar system called?



Answer Key for Starry Night Computer Exercise

Lesson One: The Solar System

Question 1: The Earth and Moon

Can you describe the motion of the Earth and the Moon?

Possible Answer: The Earth is rotating on its axis. The Moon goes (or orbits) around the Earth.

Teaching Tips

- Students should be able to clearly see the rotation of the Earth as well as the motion of the Moon along its orbit.
- If you allow the simulation to run long enough, you will see a beautiful “moonset.”
- Remember you can always stop or reset the simulation as required.

Question 2: The Earth in Orbit

Can you describe the two different motions the Earth has?

Possible Answer: The Earth rotates and orbits the Sun.

Teaching Tips

- The Earth’s orbit appears oval shaped because it is viewed from an angle. Seen face-on, it would be close to a perfect circle.
- Students may need to be reminded that the Earth has been greatly magnified to show its rotation.
- All stars have been removed from the screen. The other two (moving) points are planets. Stop the motion and use the cursor to identify them.

Question 3: The Inner Solar System

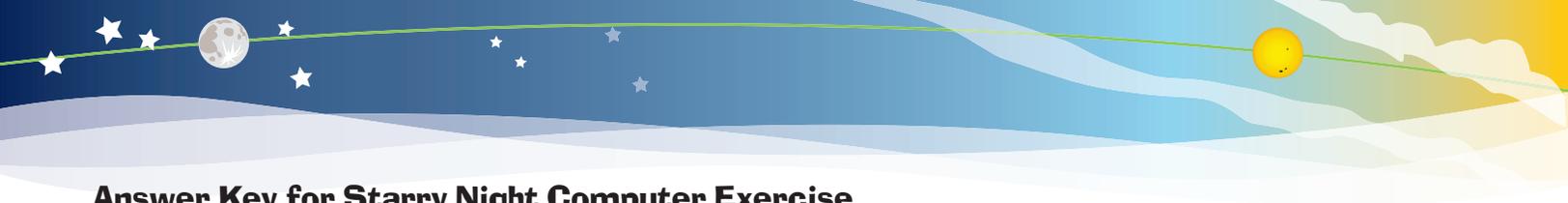
What other planets can you see circling the Sun?

Possible Answer: Mercury, Venus and Mars.

Teaching Tips

- The animation shows the relative distances and speed of the inner planets.
- You may wish to stop the animation on December 31, 2006 to show the appearance of the very bright comet McNaught. Advancing time stepwise until January 24, 2007, shows the comet’s motion around the Sun as well as the changes in its tail.
- Choosing the larger-image simulation allows students to see some surface detail on each of the planets. Simply stop the animation when the chosen planet is well illuminated.

Continued on next page



Answer Key for Starry Night Computer Exercise Lesson One: The Solar System

Question 4: The Outer Solar System

What are the rest of the planets in the solar system called?

Possible Answer: Jupiter, Saturn, Uranus and Neptune.

Teaching Tips

- Students may need to be reminded that Pluto is no longer a major planet and does not show up here.
- If you prefer to see all planets at once, see the bottom of the SkyGuide screen.
- Choosing the larger-image simulation allows students to see some surface detail on each of the planets. Simply stop the animation when the chosen planet is well illuminated.

Extension

Planets rise and set just like the stars. But they also move in a different way. **Starry Night Elementary** software can show you how the planets move against the background of the stars.

Teaching Tips

- The animation clearly shows that some planets move faster than others.
- The direction of each planet's motion is the combination of that planet's and Earth's orbital motion. Detailed discussion of this effect is probably not appropriate for this level.