Inner and Outer Planets

Background Information
This lesson focuses on comparing and contrasting the four inner planets with the four outer planets and one dwarf planet. The students will first explore the differences using Venn diagrams to establish the groupings in the Solar System. Then students will express these differences in size, temperature and composition artistically through dance and movement. Then, they will create a dance based on information gained from this lesson.

Objectives
By the end of this activity, students will be able to:
- order the planets of our solar system.
- identify the four inner planets and the five outer planets,
- explain the contrasting qualities of the inner planet and the outer planets.

Instruction Time
30 Minutes (Venn Diagram)
30 Minutes (Interpretive Dance)

Materials
- Astronomer Journal pages 12-13
- Music
- Colorful scarves
- Books
- Posters and charts on the solar system.
- CD/cassette player

Procedure – Venn Diagrams
1. Discussion: How many planets are in our solar system? Name them. Explain that Pluto had been considered a planet, but in August 2006 it was demoted to a dwarf planet.
2. Use the bulletin board, classroom books, and research from previous lessons to complete the Venn diagrams on pages 11-12 of the Astronomer Journal. Students should place the name of each planet in its appropriate location on the Venn diagram.
3. *The Terrestrial Planets (or INNER PLANETS) have compact and rocky surfaces and the Gaseous Planets (or OUTER PLANETS) have a gaseous composition.* Look at and discuss the differences between the four inner planets, the four outer planets and dwarf planet.
    a. Size: Inner - small Outer - big (excluding Pluto)
    b. Temperature: Inner - hot Outer – cold
    c. Composition: Inner - rocky Outer – gaseous (excluding Pluto)

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Procedure – Interpretive Dance

1. Students remain sitting after discussion and demonstrate a small movement with their hand, then a big movement with their hand. Repeat with head, then shoulders, foot, elbow, etc. staying in their own personal/self space.
2. Next have the students move with small and big movements while travelling around the room in general/shared space. Emphasize NO TOUCHING OR BUMPING!!! Encourage movement on different levels (high, middle, low). Teacher calls out, "Inner Planets" and the dancers respond by dancing with SMALL movements. Then, Teacher calls out, "Outer Planets" and the dancers respond with BIG movements. Teacher continues to alternate between "Inner and Outer Planets".
3. BIG/SMALL DANCE - Divide the class into small groups so they can watch each other. One group at a time dances while the other groups watch as audience members. Dancers begin in a frozen shape and begin moving when the music starts. Dancers should move either small or big in correspondance to what the teacher calls out (alternating between "Inner" and "Outer" Planets). When music stops, students freeze in a SMALL or BIG shape.
4. Across the Floor Exercise - Identify one wall as the SUN and the opposite wall as PLUTO. Review the order of the planets. Divide class into groups (size dependent on size of dance space). With music, one group at a time begins on one side of the room and moves to the other side of the room, changing the size of their movement (SMALL or BIG) representing the size of each planet they pass through along the way. Repeat travelling the other way. Try again, this time incorporating temperature changes that correspond with the planets.
5. ROCKY vs GASEOUS - Two groups dance at a time. Group One - OUTER PLANETS - dances with light, flowing movement, demonstrating the composition of the outer planets, using scarves as a prop. Group Two - INNER PLANETS - dances with strong, hard, rocky, abrupt movement, demonstrating the composition of the inner planets. Drums or rhythm sticks may be used by the dancers as a prop.
6. Culminating Activity - Divide the class into small groups. Based on the previous activities, each group must work together to create their own dance about the Solar System's Inner and Outer Planets. Each group must display a clear beginning, middle and end to their dance and must contain at least one or two elements from the lesson. After working for 10-15 minutes in small groups, have each group perform their dance for the other groups. Remind the groups who are watching to be a good, respectful audience by sitting quietly without talking, laughing or playing around and to be encouraging to their classmates.

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Expected Results & Explanations

Upon completion of this activity, students should understand that the 8 planets can be categorized into 2 groups quite easily. Students should notice that Pluto does not fall into neither of these categories. Instead, Pluto may be the first of many dwarf planets.

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	Mercury	Venus	Earth	Mars	Jupiter	Saturn	Uranus	Neptune	Pluto
Mean Distance From Sun (Astronomical Units)	0.387	0.723	1.000	1.524	5.204	9.582	19.201	30.047	39.236
Mass (Earth masses)	0.055	0.815	1.000	0.107	318	95.2	14.5	17.1	0.0021
Orbital period; or length of one of planet's years	88 days	225 days	365.3 days	687 days	11.86 years	29.46 years	84.01 years	164.79 years	247.68 years
Diameter (kilometers)	4,880	12,100	12,800	6,790	143,000	121,000	51,100	49,500	2,390
Atmosphere (main components)	Virtually a vacuum	Carbon Dioxide	Nitrogen, Oxygen	Carbon Dioxide	Hydrogen, Helium	Hydrogen, Helium	Hydrogen, Helium, Methane	Hydrogen, Helium, Methane	Methane, Nitrogen
Moons	0	0	1	2	61	31	25	13	1
Rotation Period	59 days	244 days retrograde*	23 hours 56 min	24 hours 37 min	9 hours 56 min	10 hours 39 min	17 hours 14 min retrograde*	16 hours 7 min	6 days 9 hours 18 min retrograde*

Numbers in the table are valid as of February 2004.

*One can imagine looking down on the solar system from high above the Sun's north pole. From this vantage point all the planets revolve counterclockwise around the Sun. Also from this vantage point, most of the planets are seen to rotate on their axes counterclockwise. However, Venus, Uranus, and Pluto are seen to rotate clockwise and are said to be rotating 'retrograde'. On the surface of a planet with retrograde rotation, the Sun would appear to rise from the west and set in the east.