Environmental Science Institute
THE UNIVERSITY OF TEXAS AT AUSTIN

2275 Speedway, Mail Code C9000
Austin, TX 78712
(512) 471-5847
www.esi.utexas.edu

Planet Fun

Lesson Plan for Grades: Middle School
Length of Lesson: 70 min

Authored by: UT Environmental Science Institute
Date created: 12/03/2016

Subject area/course:
- Mathematics, Astronomy, and Space

Materials:
- Calculators (optional)

TEKS/SEs:

§111.26. Grade 6

(1) Mathematical process standards. The student uses mathematical processes to acquire and demonstrate mathematical understanding. The student is expected to:
- (A) apply mathematics to problems arising in everyday life, society, and the workplace;
- (B) use a problem-solving model that incorporates analyzing given information, formulating a plan or strategy, determining a solution, justifying the solution, and evaluating the problem-solving process and the reasonableness of the solution;
- (C) select tools, including real objects, manipulatives, paper and pencil, and technology as appropriate, and techniques, including mental math, estimation, and number sense as appropriate, to solve problems;
- (D) communicate mathematical ideas, reasoning, and their implications using multiple representations, including symbols, diagrams, graphs, and language as appropriate;
- (E) create and use representations to organize, record, and communicate mathematical ideas;
- (F) analyze mathematical relationships to connect and communicate mathematical ideas; and
- (G) Display, explain, and justify mathematical ideas and arguments using precise mathematical language in written or oral communication.

Lesson objective(s):
- The students will relate mathematical concepts with planet distances.
- The students will learn basic conversion factors.
- The students will learn to problem solve.

Differentiation strategies to meet diverse learner needs:
- The teacher should ask students whether they prefer to read or watch videos to learn about concepts; then have students learn in their preferred learning style. However, the teacher may assign students certain methods to improve their skills. For example, if a student prefers reading, teachers may have them watch a video and take notes to improve their listening skills.
- ELL students and students with learning disabilities should have multiple forms of instruction including visual and written instruction sheets as well as a verbal instruction and demonstration.

ENGAGEMENT (10 minutes)
- Teacher shows “The Amazing Mission to Pluto” highlight video (7:10 total time).
- Teacher discusses with the class “Why do you think it took so long for scientists to explore Pluto?” “How far away do you think Pluto is?”
- Teacher briefly mentions that astronauts, scientists and engineers use metric conversions. Teacher can also mention importance of metric conversions, using example of destroyed Mars orbiter as an example (articles.latimes.com/1999/oct/01/news/mn-17288). Scientists did not convert to metric, causing a loss of the very expensive orbiter.

EXPLORATION (20 minutes)
- Teacher passes out handout with conversion factors and conversions students need to calculate.

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- Working in teams, students should work together to solve as many problems as they can, explaining to each other what they did and why.
- Each team will select one of the problems to solve and share with the rest of the class.

EXPLANATION (10 minutes)

- Students will come up to the front of the class and work out one of the conversions with the rest of the class.
- Each team of students can share different conversions and show to the class how they got their answer.

ELABORATION (30 minutes)

- Students will draw orbits of planets while looking at a sample image that is projected on the board.
- Students will research the distances of the orbits to the sun to calculate the distance between orbits of planets, focusing on Pluto and the Earth especially.
- Students will then use conversion factor from miles to kilometers to find out how many kilometers away Pluto is from the Earth and from the sun. If needed, provide a quick overview about scientific notation.

EVALUATION (throughout entire lesson)

- The teacher will ask students some questions about conversion factors at the end of class.
- The teacher will walk around continuously during class making sure each students understands and is not confused.
- The teacher will make sure students can explain their process of thinking while using the correct vocabulary and demonstrating an understanding of the subject.
- Teacher may collect the worksheets attached to this lesson plan as an evaluation

SOURCES AND RESOURCES

- **Dr. Alan Stern's *Hot Science – Cool Talks #102, "The Amazing Mission to Pluto"***, www.hotsciencecooltalks.org
- ***Daily Astronomy News,*** www.dailyastronomynews.com/Neptune.html
- ***Mars Probe Lost Due to Simple Math Error,*** articles.latimes.com/1999/oct/01/news/mn-17288/

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EXPLORE ACTIVITY (STUDENT HANDOUT)

Name: _____ Date: _____

CONVERSIONS

Distance	
1 foot (ft) = 12 inches (in)	1 mile (mi) = 5280 feet (ft)
1 yard (yd) = 3 feet (ft)	1 mile (mi) = 1.609 kilometers (km)
1 mile (mi) = 1760 yards (yd)	
Weight	
1 pound (lb) = 16 ounces (oz)	1 pound (lb) = 0.453 kilograms (kg)

Working in teams, use the table to figure out the following conversions. Be sure to show your work. Your team needs to select one of problems below that you will showcase to the rest of the class.

66 ft = ____ yd ___ ft	**15 ft. 6 in = _____ in**	**14,848 yd = ___ mi _____ yd**
125 oz = ____ lb ____ oz	**20 lb = _____ kg**	**9 lb 8 oz = _____ oz**
6 mi 3,228 ft = _____ ft	**3253 miles = _____ km**	**52, 133 ft = ___ mi ____ ft**

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EXPLORE ACTIVITY (TEACHER HANDOUT)

Name: _____ **Date:** _____

CONVERSIONS

Distance	
1 foot (ft) = 12 inches (in)	1 mile (mi) = 5280 feet (ft)
1 yard (yd) = 3 feet (ft)	1 mile (mi) = 1.609 kilometers (km)
1 mile (mi) = 1760 yards (yd)	
Weight	
1 pound (lb) = 16 ounces (oz)	1 pound (lb) = 0.453 kilograms (kg)

Working in teams, use the table to figure out the following conversions. Be sure to show your work. Your team needs to select one of problems below that you will showcase to the rest of the class.

66 ft = ____ yd ___ ft **1 yd = 3 ft** **66/3** **Answer = 22 yd 0 ft**	**15 ft. 6 in = _____ in** **1 ft = 12 in** **(15 x 12) + 6** **Answer = 186 in**	**14,848 yd = ___ mi _____ yd** **1 mi = 1760 yards** **14,848/1760** **Answer = 8 mi 768 yd**
125 oz = ____ lb ____ oz **1 lb = 16 oz** **125/16** **Answer = 7 lb 13 oz**	**20 lb = _____ kg** **1 lb = 0.453 kg** **20 x 0.453** **Answer = 9.06 kg**	**9 lb 8 oz = _____ oz** **1 lb = 16 oz** **(9 x 16) + 8** **Answer = 152 oz.**
6 mi 3,228 ft = _____ ft **1 mi = 5280 ft** **(6 x 5280) + 3228** **Answer = 34, 908 ft**	**3253 miles = _____ km** **1 mi = 1.609 km** **3253 x 1.609** **Answer = 5234 km**	**52, 133 ft = ___ mi ____ ft** **1 mi = 5280 ft** **52,133/5280** **Answer = 9 mi 4613 ft**

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ELABORATE ACTIVITY

Purpose: Learn about orbits and planet distances.

Materials: Paper and pencils.

Safety Information: N/A

Procedure:

- Display the image below showing the orbits of different planets and moons. Have students draw orbits of planets and dwarf planets (Jupiter, Saturn, Uranus, Neptune, Pluto).
- Have students search online for the distances for (a) Sun to Pluto (b) Sun to Earth. Students must then calculate the distance from Earth to Pluto. Why does the distance from the Sun to Pluto vary?
- Have students learn about conversion factors to figure out how many kilometers away Pluto and the Earth are from the Sun. You may need to have a quick overview of scientific notation.

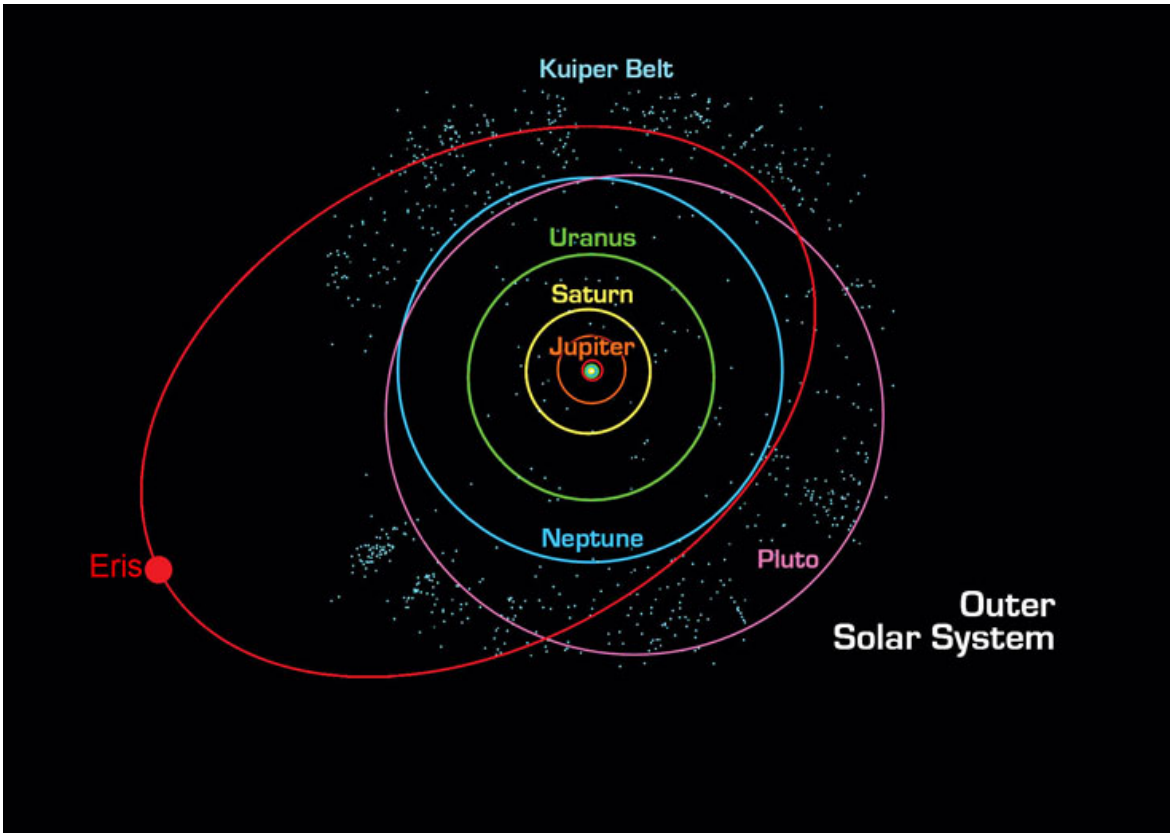

***Image Source**: Daily Astronomy News*, www.dailyastronomynews.com/Neptune.html

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ELABORATE ACTIVITY (STUDENT HANDOUT)

Name: _____ Date: _____

1. In the space below, draw out the orbits of the following outer planets and dwarf planet: **Jupiter Saturn Uranus Neptune Pluto**
2. Go online and find the average distance from the Sun for the following:
Earth: _____ miles Pluto: _____ miles
3. Now, calculate the distance from Earth to Pluto. Why do the distances from the Sun vary?
4. Use conversion to figure out how many kilometers away, the following are from the Sun:
Sun to Pluto: _____ kilometers Earth to Pluto: _____ kilometers

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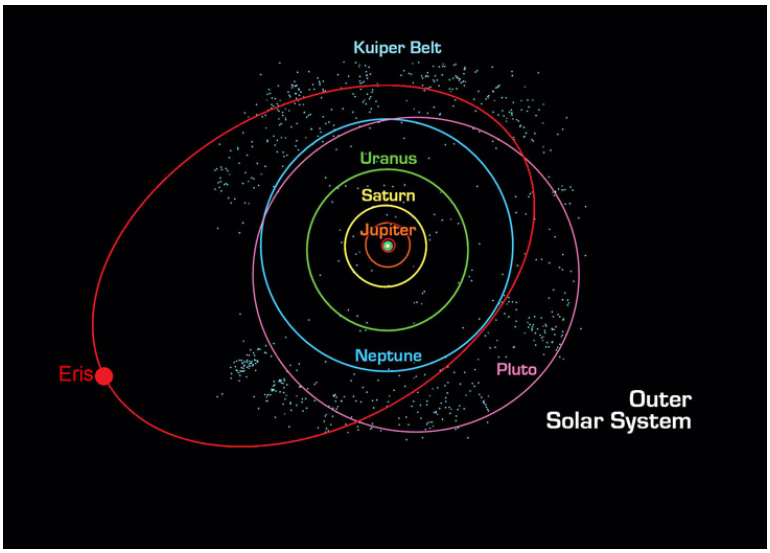
ELABORATE ACTIVITY (TEACHER HANDOUT)

Name: _____ **Date:** _____

1. **In the space below, draw out the orbits of the following outer planets and dwarf planet:**

   Jupiter Saturn Uranus Neptune Pluto



2. **Go online and find the average distance from the Sun for the following:**

   Earth: **~ 93,000,000 miles** **Pluto:** **~3,670,100,000 miles**

3. **Now, calculate the distance from Earth to Pluto. Why do the distances from the Sun vary?**

   Distance from Earth to Pluto is approximately 3,577,100,000 or 3.6 billion miles away. The orbits for the different planets and dwarf planets are elliptical not perfect circles.

4. **Use conversion to figure out how many kilometers away, the following are from the Sun:**

   Sun to Pluto: **5,905,190,900 kilometers**

   3,670.100,000 x 1.609

   Earth to Pluto: **5,755,553,900 kilometers**

   3,577,100,000 x 1.609