Ignite! Learning

Members of Our Solar System

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UNIT CHALLENGE

The unit challenges help students explore the big picture themes that tie together each unit of

hallenge presents students with an open-ended task with no single correct solution. Working in

on.

NOTE: In order to use this activity with your class for a particular Ignite! unit, you should plan on having students study the Ignite! movies from most of the topics in that unit. Otherwise, students will not have enough information to complete the challenge activity.

- 15 minutes at the start of unit to organize students into groups and review the challenge, and for the groups to discuss and record their initial thoughts and current knowledge of the issues.
- 20 minutes at the end of the unit for student groups to complete their responses to the challenge.
- *Optional*: 20-30 minutes for student groups to present their responses to the class.

_____: Before studying any of the unit's topics or movies:

1. divide your class into teams of 3 to 4 students;
2. reproduce the unit challenge worksheet and distribute to students;
3. decide whether teams will give oral presentations and/or written statements in response to their challenge;
4. read the challenge(s) out loud and make sure that all terms and concepts are understood;
5. ask groups to complete Part One of their worksheets (Getting Started). They should discuss and write down their thoughts, based on their current knowledge for how they might respond to the selected challenge.

_____: Over the next few days or weeks, as you are using the Ignite! casionally remind students to record on their worksheets any information ovies that might help them to develop or support their response to the hallenge. They should record this information in Part Two of their worksheets (Taking Notes).

_____: Give your students 20 minutes to discuss and write up their hallenge. They can use the space provided in Part Three of their worksheets (Preparing der allowing them to review some of the movies from the unit. Then, entations of their responses (2 to 3 minutes each) and/or submit their written

Members of Our Solar System

Solar System Guide

Background: So far, human beings have traveled only as far as the Moon. But as new technologies for space travel are developed, it is possible that people might someday be able to travel throughout the Solar System. What might they find along the way?

Challenge: Imagine that you are leading a tour from Earth to the outer edges of our Solar System. Describe all the planets and other types of objects you might come across.

Tips:

- Remember: you're leaving from Earth and moving away from the Sun.
- Are there any objects that you could find, and even touch, before you leave Earth?
- Be sure that you describe them in the correct order.

PART ONE – Getting Started

Directions: Based on what you already know, talk with the other members of your group about how you might respond to this challenge. Write your thoughts in the box below. You can change your mind later, after you have reviewed the Ignite! movies in this unit.

Notes:

PART TWO – Taking Notes

Directions: As you view and discuss the Ignite! movies in this unit, be on the lookout for information that will help you develop a response to your challenge. Record that information in the box below. Use additional paper if necessary.

Notes:

PART THREE – Preparing Your Response

Directions: Depending on your teacher's instructions, work with your group to create a written or oral response to your challenge. Decide on what you want to communicate, and be sure to support your statements with evidence from the Ignite! movies. Use the space below for your response. Use additional paper if necessary.

Notes:

Earth Science
Lesson Plan

unit **Members of Our Solar System**

1. Our Solar System and the Inner Planets

Class: _____ **Type Instruction:** Whole Class

Learning Objective(s): Students know the names and key characteristics of the inner planets.

Length of time: 10 Minutes

Ignite! Movies:

- Differences in Distances
- Inner Planets

Teacher Instructions: Play Ignite! movies with students and complete the following activity.
Part One: Students take notes from Ignite! movies.
Part Two: Students take notes to use in class discussion.

Target Vocabulary/Key Terms:

- *crust*
- *inner planets*
- *outer planets*
- *planet*
- *revolution*
- *rotation*

Notes:

Inner Planets

Directions: Fill in the blank portions of the following chart.

Mercury
Position from the Sun: _____ Period of Rotation: 58.6 Earth days Period of Revolution: 87.9 Earth days Temperature Range: _____ Other Features: Mercury has no atmosphere.
Venus
Position from the Sun: 2nd Period of Rotation: 243 Earth days Period of Revolution: 224.7 Earth days Temperature Range: 462ºC Other Features: _____
Earth
Position from the Sun: _____ Period of Rotation: 23.93 Earth hours Period of Revolution: 365.26 Earth days Temperature Range: _____ Other Features: Earth supports life and has liquid water.
Mars
Position from the Sun: 4th Period of Rotation: 24.6 Earth hours Period of Revolution: 686.98 Earth days Temperature Range: -133ºC to 20ºC Other Features: _____

Discussion Question

Directions: As a class, discuss the following:

- How are the inner planets similar to one another?
- What might be causing this similarity?

Use the space below to make notes before and during the discussion.

unit

Members of Our Solar System

#2. Outer Planets of Solar System

Class: _____ **Type Instruction:** Whole Class

Learning Objective(s): Students know the names and key characteristics of the outer planets.

Length of Time: 10 Minutes

Ignite! Movies:

- Touring the Outer Planets
- Outer Planets

Teacher Instructions: Play Ignite! movies with students and complete the following activity.
Part One: Students complete sequencing activity.
Part Two: Students work in a group to create an advertisement they will present to the class. Teacher may want to assign a group to each of the outer planets, to make sure all planets are covered.

Target Vocabulary/Key Terms:

NA

Notes:

Outer Planets

Directions: Finish placing the outer planets in their correct sequence from the Sun (closest to the left, farthest to the right), and state one important fact about each.

- **Neptune**
- **Saturn**
- **Uranus**

Name of Planet	**Jupiter**				**Pluto**
Important Fact	Jupiter has at least 16 moons.				Pluto has an elliptical orbit.

Galactic Tour

Directions: The Outer Planet Tourism Bureau (O.P.T.B.) has asked you and your group to write a short radio advertisement urging people to take a Galactic Tour to one of the outer planets. What fascinating features will you emphasize to get people to visit? Be prepared to present your advertisement to the class.

Earth Science
Lesson Plan

unit

Members of Our Solar System

#3. Pluto and Dwarf Planets

Class: _____ **Type Instruction:** Whole Class

Learning Objective(s): Students understand how and why Pluto was redefined as a dwarf planet.

Length of Time: 10 Minutes

Ignite! Movies:

- Change Some Definitions
- Dwarf Planet Pluto

Teacher Instructions: Play Ignite! movies with students and complete the following activity.
Part One: Students describe the new defining criteria for planets.
Part Two: Students write a persuasive argument for Pluto's reclassification.

Target Vocabulary/Key Terms:

- *classification*
- *dwarf planet*
- *gravity*
- *mass*
- *orbit*
- *outer planets*
- *planet*
- *satellite*
- *solar system*

Notes:

Change Some Definitions

Directions: List and describe the three criteria for a celestial body to be a planet.

1._____

_____

_____

2._____

_____

_____

3._____

_____

_____

Arguing for Reclassification

Directions: Incorporating scientific vocabulary, write a brief persuasive argument to the scientific community about why Pluto should be reclassified as a dwarf planet.

_____

_____

_____

_____

_____

Earth Science
Lesson Plan

unit

Members of Our Solar System

#4. Origin of Solar System

Class: _____ **Type Instruction:** Whole Class

Learning Objective(s): Students understand two theories of how our solar system was created: the planetesimal theory and the nebular theory.

Length of Time: 10 Minutes

Ignite! Movies:

- Formation of the Solar System
- The Nebular Theory

Teacher Instructions: Play Ignite! movies with students and complete the following activity.
Part One: Students create a caption explaining how the solar system began according to the nebular theory.
Part Two: Class discussion question about the nebular theory.

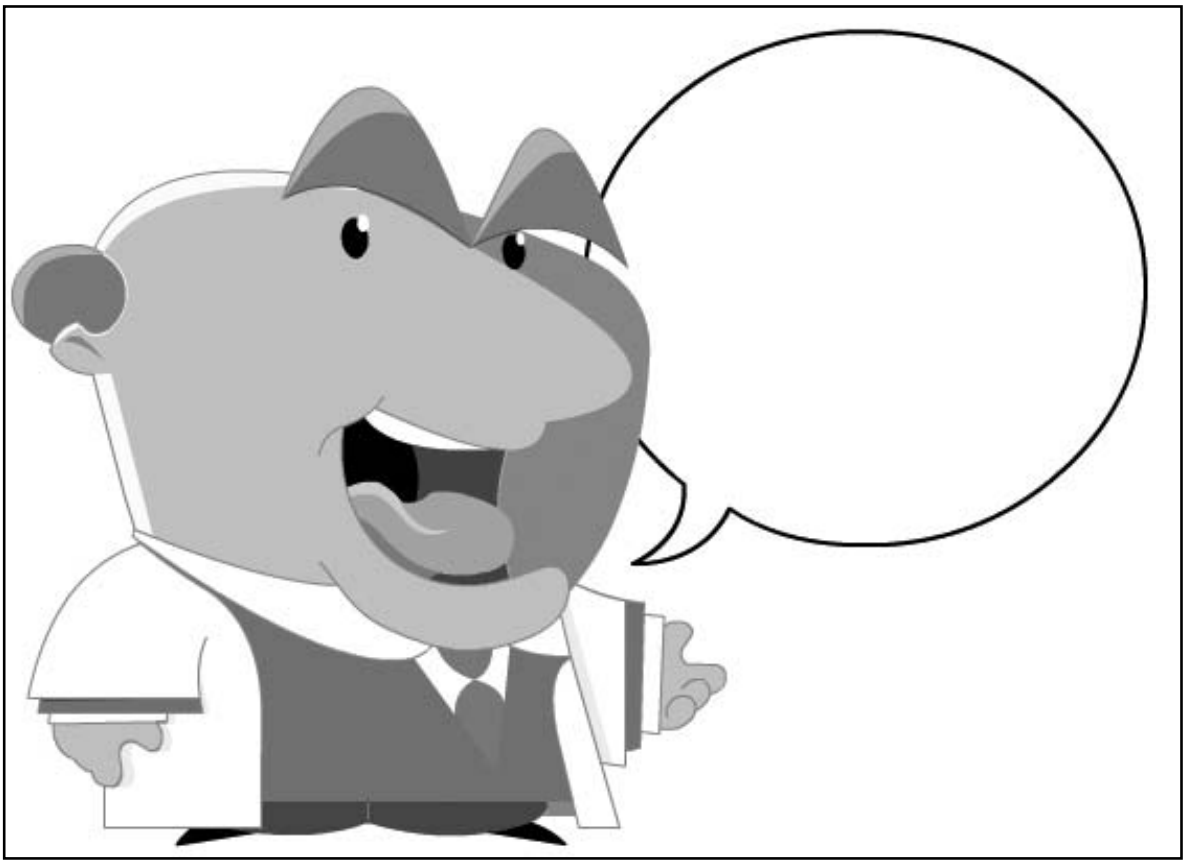
Target Vocabulary/Key Terms:

- *gravity*
- *nebula*
- *nebular theory*
- *planetesimal*
- *planetesimal theory*
- *solar system*

Notes:

The Nebular Theory

Directions: Fill in the caption so that Mister Bighead, as Mike Methodical, explains how the solar system began according to the nebular theory. Do not try to explain the whole theory, just select one part of it that you think is important.



The Nebular Theory

Directions: As a class, discuss the following:

- According to the nebular theory, what role did gravity play in forming our solar system?

Use the space below to make notes before and during the discussion.

unit Members of Our Solar System

#5. Sun

Class: _____ **Type Instruction:** Whole Class

Learning Objective(s): Students understand layers and key characteristics of the Sun.

Length of Time: 10 Minutes

Ignite! Movies:

- Layers of the Sun
- Solar Storms

Teacher Instructions: Play Ignite! movies with students and complete the following activity.
Part One: Note taking activity.
Part Two: Class discussion questions.

Target Vocabulary/Key Terms:

- *chromosphere*
- *core*
- *corona*
- *photosphere*
- *solar flare*
- *solar prominence*
- *solar wind*
- *sunspot*

Notes:

The Sun

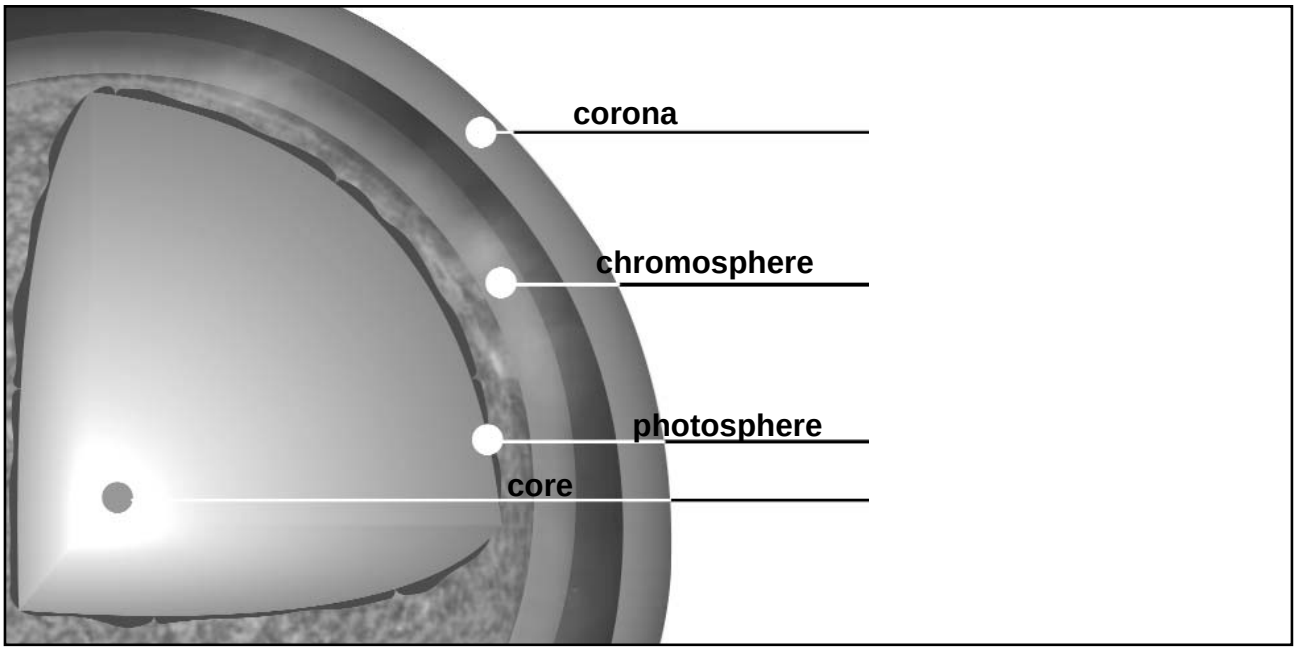
Directions: List one key fact for each of the four layers of the Sun in the diagram below.

1. **chromosphere:**

2. **photosphere:**

3. **corona:**

4. **core:**



Sizing Up the Sun

Directions: As a class, discuss the following: the Sun is a million times the size of Earth!

- What does it mean to be a million of something?
- How much money is a million pennies?

Use the space below to make notes before and during the discussion.

unit Members of Our Solar System

#6. Comets

Class: _____ **Type Instruction:** Whole Class

Learning Objective(s): Students understand key characteristics of comets.

Length of Time: 10 Minutes

Ignite! Movies:

- Comets Flying By
- Characteristics of Comets

Teacher Instructions: Play Ignite! movies with students and complete the following activity.
Part One: Students create a caption explaining comets.
Part Two: Class discussion questions.

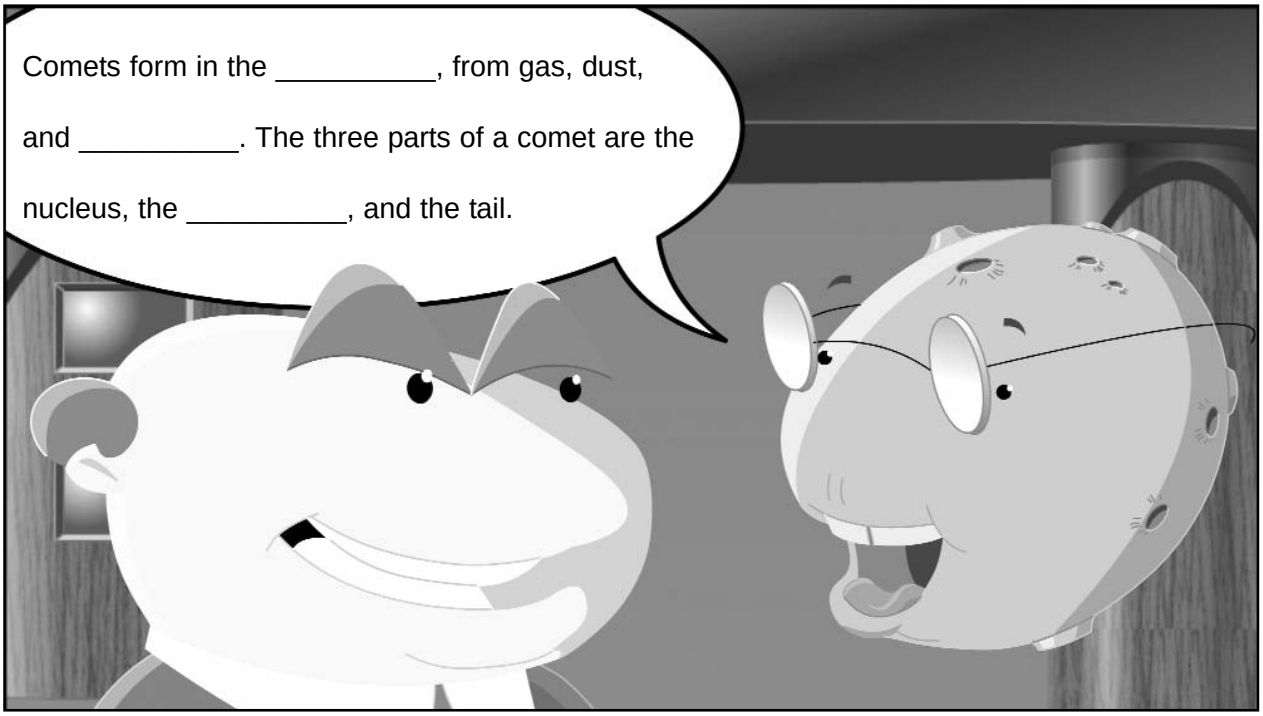
Target Vocabulary/Key Terms:

- *coma*
- *comet*
- *elliptical*
- *nucleus*
- *orbit*
- *Oort cloud*
- *tail*

Notes:

Comets

Directions: Fill in the word balloon so that Hubble explains comets to Mr. Bighead.



Talking about Comets

Directions: As a class, discuss the following questions:

- When a comet swings by Earth, which part of the comet makes it visible to us?
- Why do you think so?

Use the space below to make notes before and during the discussion.

unit

Members of Our Solar System

#7. Meteors and Asteroids

Class: _____ **Type Instruction:** Whole Class

Learning Objective(s): Students understand the key characteristics and motions of meteors and asteroids.

Length of Time: 10 Minutes

Ignite! Movies:

- Asteroids and Meteoroids
- Asteroids and Meteoroids Song

Teacher Instructions: Play Ignite! movies with students and complete the following activity.
Part One: Students use information from Ignite! movies to complete the chart.
Part Two: Students use information from Part One to fill in the rhyming words to complete the phrases.

Target Vocabulary/Key Terms:

- *asteroid*
- *asteroid belt*
- *meteor*
- *meteorite*
- *meteoroid*

Notes:

Meteors and Asteroids

Directions: Define each of the terms listed below:

1. **asteroid:** a chunk of rock and metal that orbits the Sun and is smaller than _____
2. **meteoroid:** the name given to an asteroid which breaks free of the _____ and fly through space
3. **meteor:** a meteorite that enter Earth's _____
4. **meteorite:** a meteor that hits Earth's surface, leaving a hole called a _____

Guess the Rhyming Word!

Directions: Fill in the blanks with the rhyming word you think explains the following terms. Then, as a class, say the following rhyme several times as a mnemonic device for the differences between asteroids, meteoroids, meteors, and meteorites.

When an asteroid leaves the asteroid belt
"meteoroid" is its new name,

we call it "meteor" when it enters Earth's atmosphere,
lighting the sky like _____,

and when a meteor hits Earth's surface,
crashing and ending its flight,

the name we give to the part
that lands here is _____.

unit Members of Our Solar System

#8. Comets, Meteors, and Asteroids

Class: _____ **Type Instruction:** Whole Class

Learning Objective(s): Students understand the key characteristics and motions of comets, meteors, and asteroids.

Length of time: 10 Minutes

Ignite! Movies:

- Objects in our Solar System
- Celestial Objects

Teacher Instructions: Play Ignite! movies with students and complete the following activity.
Part One: Students create a caption for the illustration
Part Two: Students complete statements with rhyming words.

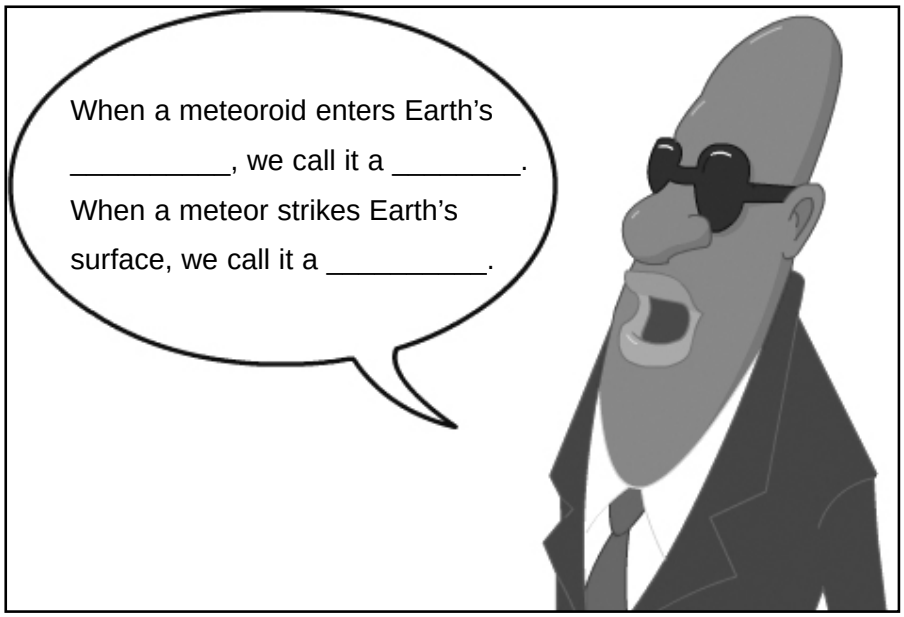
Target Vocabulary/Key Terms:

NA

Notes:

Comets, Meteors, and Asteroids

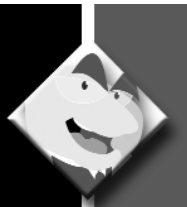
Directions: Fill in the blanks in the word balloon below.



Guess the Rhyming Word!

Directions: Fill in the blanks with the rhyming word you think explains the following terms. Then, as a class, say the following rhyme several times as a mnemonic device for the differences between comets and asteroids.

Comets orbit the sun
in a long elliptical _____,
but asteroids are less elliptical
and orbit together in a group.



unit **Members of Our Solar System**

#9. Space Exploration

Class: _____ **Type Instruction:** Whole Class

Learning Objective(s): Students understand key developments and missions in the history of space exploration.

Length of time: 10 Minutes

Ignite! Movies:

- Exploring Space
- Super Spacecraft

Teacher Instructions: Play Ignite! movies with students and complete the following activity.
Part One: Students complete a timeline.
Part Two: Students use their opinions and facts from Ignite! movies for discussion.

Target Vocabulary/Key Terms:

- *artificial satellite*
- *space shuttle*
- *space station*

Notes:

Space Exploration

Directions: Fill in the blanks to complete the timeline below on how different spacecraft advanced space exploration.

Year	Spacecraft	Advancement in Space Exploration
1957	_____	First artificial satellite
1969	_____	Neil Armstrong and Buzz Aldrin became the first humans to walk on the moon.
1973	Skylab	This _____ allowed astronauts to live for months at a time in space.
1986	_____	This Soviet space station was used by American astronauts as well as Russian _____.

Benefits of Space Exploration

Directions: As a class, discuss the following: the media pieces discuss specific benefits humans gain from space exploration, such as the improvements satellites have brought to weather forecasts and communication technology.

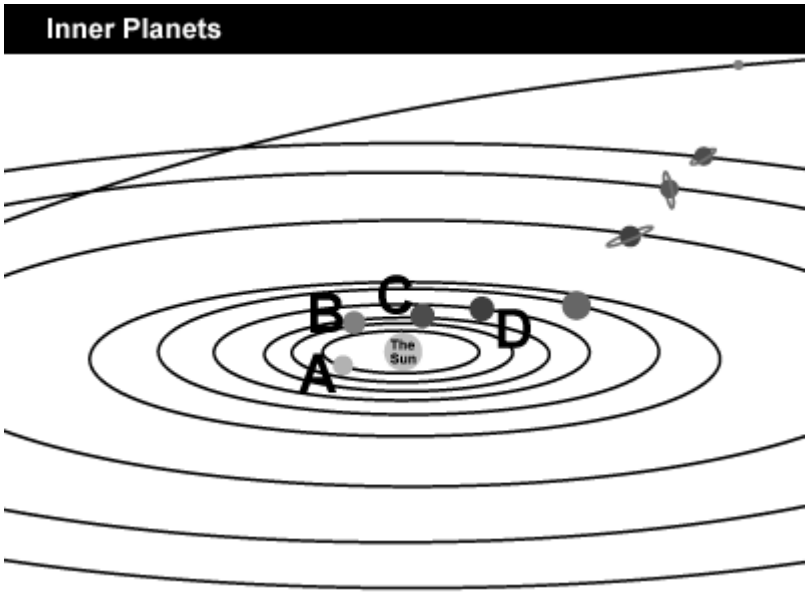
- Besides specific technological benefits, do you think space exploration benefits humans?
- How so?

Use the space below to make notes before and during the discussion.

Name: _____

"Members of Our Solar System" Unit Test

1. Use the image below AND your science knowledge to answer the following question.



Which planet on this diagram is Mercury?

A. A
B. B
C. C
D. D

2. Why are the inner planets hard and rocky while the outer planets tend to be gas giants?

F. The Sun burned off most of the gaseous atmospheres on the inner planets.
G. The density of the inner planets drew them closer to the Sun.
H. The gaseous nature of the outer planets allows them to float more freely in the solar system.
J. The outer planets are still forming and are not yet a part of the Sun's gravitational pull.

3. Why is Mercury the most heavily cratered planet in the solar system?

A. It is closest to the Sun.
B. It has no atmosphere to burn up meteoroids.
C. Its gravity attracts more comets than other planets.
D. It is near the asteroid belt.

4. Starting with the planet closest to the Sun, what is the correct order of the outer planets?

   F. Jupiter, Saturn, Uranus, Neptune, Pluto
   G. Pluto, Neptune, Saturn, Jupiter, Uranus
   H. Saturn, Pluto, Neptune, Uranus, Jupiter
   J. Uranus, Jupiter, Pluto, Saturn, Neptune

5. Looking from above, most planets rotate --

   A. clockwise
   B. around the Sun
   C. counterclockwise
   D. around their moons

6. Which planet has the longest period of revolution?

   F. Pluto
   G. Jupiter
   H. Neptune
   J. Saturn

7. Pierre-Simon Laplace was the French mathematician who proposed the theory that our solar system began as a giant cloud of gas and dust that collapsed, pulling material into its center and flattening into a disk. This theory is known as the --

   A. law of cross-cutting relationships
   B. law of inertia
   C. nebular theory
   D. planetesimal theory

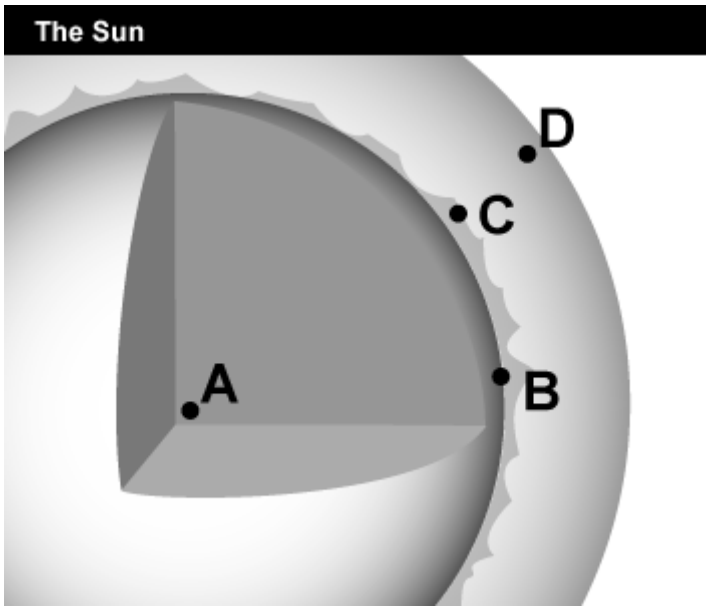
8. How does the central part of a nebula become a star?

   F. Colliding planetesimals make the particles denser.
   G. Radiation from nearby stars ignites the dust particles.
   H. Packing atoms into an extremely small volume creates nuclear fusion.
   J. The gravity of nearby planets pulls at the atoms, creating nuclear fission.

9. What is the most popular theory of the origin of the solar system among scientists today?

   A. Kantian theory
   B. Nebular theory
   C. Laplacian theory
   D. Planetesimal theory

10. Use the image below AND your science knowledge to answer the following question.



Where is the Sun's chromosphere in this diagram?

F. A
G. B
H. C
J. D

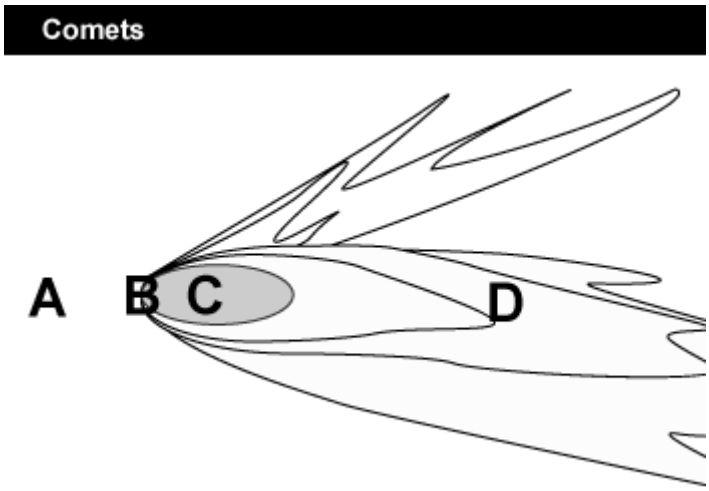
11. Solar winds can impact life on Earth by --

A. interfering with radio signals
B. making the days appear longer
C. lowering the global temperature
D. increasing the force of hurricanes

12. The _____ is the part of the Sun we see from Earth.

F. chromosphere
G. core
H. corona
J. photosphere

13. Use the image below AND your science knowledge to answer the following question.



Where is the comet's tail in this diagram?

A. A
B. B
C. C
D. D

14. Comets orbit the Sun in _____ path.

F. a circular
G. an elliptical
H. a random
J. a straight

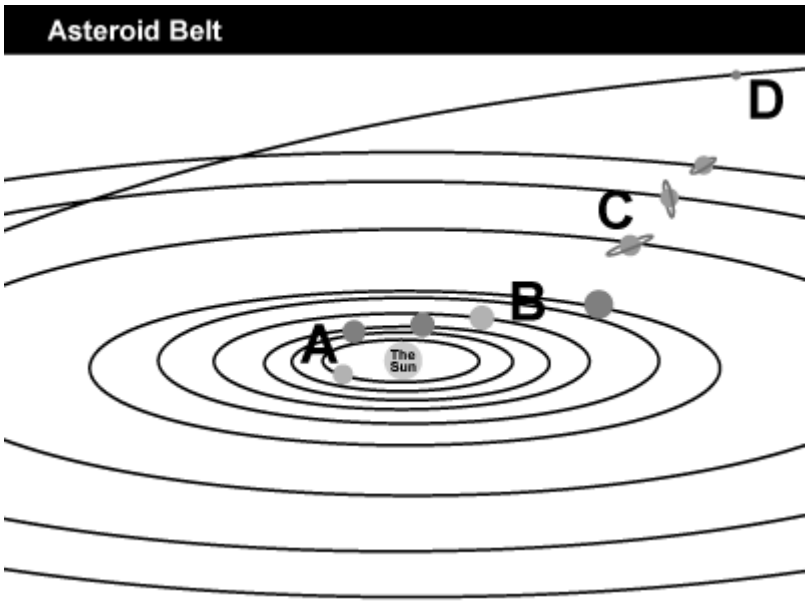
15. Where do many comets come from?

A. Asteroid belt
B. Coma
C. Inner planets
D. Oort cloud

16. What usually happens to a meteoroid that passes through Earth's atmosphere but does not strike Earth's surface?

F. It continues toward the Sun.
G. It burns up.
H. It eventually returns to the asteroid belt.
J. It goes into orbit around Earth.

17. Use the image below AND your science knowledge to answer the following question.



Where is the asteroid belt located?

A. A
B. B
C. C
D. D

18. The bright light given off by an object when it enters Earth's atmosphere is called --

F. an asteroid
G. a meteor
H. a meteorite
J. a meteoroid

19. An asteroid that escapes from the asteroid belt but is beyond a celestial body's atmosphere is a --

A. comet
B. crater
C. meteor
D. meteoroid

20. One difference between an asteroid and a comet is that --

F. asteroids do not orbit the Sun
G. asteroids do not have elliptical paths
H. comets are never visible from Earth's surface
J. comets do not have bodies made of rock and metal

21. Craters are caused by the impact of --

A. asteroids
B. meteors
C. comets
D. meteorites

22. Which device controls the direction of motion of an artificial object?

F. Artificial satellite
G. Guidance system
H. Space shuttle
J. Space station

23. Which of the following achievements in the history of space exploration came first?

A. *Apollo 11*
B. Hubble
C. *Skylab CX*
D. *Sputnik 1*

24. When did humans first land on the Moon?

F. 1957
G. 1965
H. 1969
J. 1973

Members of Our Solar System

Topic One:
Part One:
Mercury: position from the Sun is 1st.
Mercury: temperature range is -180ºC to 430ºC.
Venus: other features include a retrograde rotation.
Earth: temperature range is -90ºC to 58ºC.
Earth: position from the Sun is 3rd.
Mars: other features include red soil, polar ice caps, and the largest known volcano in the solar system.

Part Two:
The inner planets are similar in that they have rocky surfaces, as opposed to the outer planets, most of which are gas giants. This is because they're so close to the Sun, which has burned off most of their gases.

Topic Two:
Part One:
The outer planets in order from left to right are: Jupiter, Saturn, Uranus, Neptune, and Pluto.

Important facts for Saturn, Uranus, and Neptune include:
Saturn: most moons and rings of any planet, and had such low density that it would float on water.
Uranus: has a retrograde rotation.
Neptune: unlike other planets, it fives off more heat than it receives from the Sun.

Part Two:
The outer planets are similar in some respects (for instance, most are gas giants, or have moons and/or rings). Good answers to this discussion question will emphasize a particular planet's unique features, for instance Pluto's elliptical orbit, or the many rings and moons of Saturn.

Topic Three:
Part One:
Answers may vary.
1. A planet is a celestial body that is in orbit around a star.
2. A planet must have enough mass to become nearly round in shape.
3. A planet must be so large that its gravity influences other objects in its orbital path, either pushing them out of the way or attracting them to gain more mass. This is referred to as "clearing the neighborhood."

Topic Three:
Part Two:
Answers will vary.
Students should try to incorporate the vocabulary, explain the definitional criteria for a planet, and where Pluto fails to meet that definitional criteria.
Example: I believe that Pluto, one of the **outer planets**, should be **reclassified** from a **planet** to a **dwarf planet**. While it meets two of the three criteria to be a planet, in that 1) it is in **orbit** around a star and 2) it has enough **mass** to be nearly round in shape, it does not clear its neighborhood. Pluto is not large enough for its **gravity** to influence other objects in its orbital path. If Pluto is allowed to be classified as a planet even though it does not clear its orbit it opens the door to other celestial objects in our **solar system**, like moons and other satellites, being reclassified as planets.

Topic Four:
Part One:
Good answers might focus on what a nebula is, or what happened when it began to contract, or that clumps attracted more matter and grew into larger clumps, which later evolved into planets.

Part Two:
Gravity was what caused clumps of matter to form and then attract more matter, becoming the large clumps of matter that evolved into planets. The intense gravity at the center of the nebula started the process of nuclear fusion from which our Sun was formed.

Topic Five:
Part One:
Some key facts for these layers include:
chromosphere: surrounds the photosphere
photosphere: this is the part of the Sun we see from Earth
corona: is the outer layer, and is the hottest layer of the Sun
core: this is the source of the Sun's energy

Part Two:
The concept of a million may start to sink in when students realize that a million pennies equals 10,000 dollars! A million minutes is almost two years! A million hours is around 114 years!

Topic Six:
Part One:
Comets form in the Oort cloud, from gas, dust, and ice. The three parts of a comet are the nucleus, the coma, and the tail.

Part Two:
The part of a comet we see is mostly the tail, which can stretch for millions of kilometers and glows when it's near the Sun.

Topic Seven:
Part One:
An asteroids is smaller than a moon.
A meteoroids is an asteroid that has broken free of the asteroid belt.
When a meteorite hits Earth's surface, it leaves a crater.

Part Two:
Rhyming words are "flame" and "meteorite."

Topic Eight:
Part One:
Meteoroids that enter Earth's atmosphere are called meteors.
Meteors that strike Earth's surface are called meteorites.

Part Two:
Rhyming words are "flame," and "meteorite.".

Topic Nine:
Part One:
Sputnik (1957) was the first artificial satellite.
Apollo 11 (1969) resulted in the Armstrong's and Aldrin's walking on the moon.
Skylab (1973) was a space station.
Mir (1986) was used by astronauts and cosmonauts.

Part Two:
Good answers may discuss, among other issues, how human accomplishment is driven by challenge, the move from Cold War competition to cooperation in space exploration, or the fact that pure science often results in later benefits undreamed of at the time.

Unit 21: Members of Our Solar System

1. A
2. F
3. B
4. F
5. C
6. F
7. C
8. H
9. B
10. H
11. A
12. J
13. D
14. G
15. D
16. G
17. B
18. G
19. D
20. J
21. D
22. G
23. D
24. H