



Teacher Notes- “Comets And Asteroids-What They Are, Where They Are, They And Us”

Comets and asteroids are as mysterious as they are beautiful. They capture our imagination with their unbelievable size (did you say a 50-mile-wide flying ice cube?!?!), and terrify us with the thought of what would happen should we (earth) and they meet, which we do with regularity.

This lesson dissects comets and asteroids using 3 criteria: What they are, Where they are, and They and us. It’s all packaged in a note sheet that students fill in as they listen and learn.

	<i>What they are</i>	<i>Where they are</i>	<i>They and us</i>
 <p>Comets</p>	<ul style="list-style-type: none"> A huge ball of mostly _____ Their size ranges between _____ and _____ miles wide. There are _____ in our solar system. 	<ul style="list-style-type: none"> Most comets are found in the _____ Cloud, which is about _____ further out than the earth is from the sun. A few orbit among the 9 _____ A _____ or _____ is what sends some into the inner solar system among the planets. 	<ul style="list-style-type: none"> A comet too close to the sun will begin to die as it sheds small fragments due to _____ passing over it. This is how the _____ forms. If the Earth had passed through this, a phenomenon we call _____ occurs. There are _____ major meteor showers that occur throughout the year.
 <p>Asteroids</p>	<ul style="list-style-type: none"> Asteroids are mostly _____ 	<ul style="list-style-type: none"> Most asteroids hang loosely _____ the sun between _____ and _____ They will never gather into a planet because of Jupiter's _____ A few have been nudged _____ 	<ul style="list-style-type: none"> There are _____ asteroids that cross earth's orbiting plane that are at least 10 meters across or larger. A _____ sized asteroid collides with earth about every _____ year. Asteroid _____, some _____ miles wide, is thought to be what caused the _____ extinction.

Materials per student:

1-Student Note Sheet (see p. 5)

Additional Teacher Materials...

- All optional* {
- PowerPoint-Comets And Asteroids (see page 5)
 - Ice Cubes
 - 1-Roll-Toilet Paper
 - 1-Screwdriver
 - 1-Home-made mini comet (optional)- see Beforehand #3
 - 1-Fan

Beforehand:

- Beginning about a week before these notes, start [reading about comets and asteroids](#). You need to be able to speak knowledgeably and be up to date on the most recent research and discoveries. The day before is too late to begin your research.
- If you’re using PowerPoint, it is set up to look just like the student handout, but it needs pictures of comets and asteroids inserted into it (for copyright reasons we could not include any). *1

Insert the following kinds of pictures on these slides*²: If you're inserting onto slides with student notes and they overlap, then right-click the picture → select "Order" and "Send to Back".

- Slide #1- Leave as-is with the title, or add a stunning comet and asteroid picture to the side/behind
- Slide #2- Close-up of a comet nucleus, without a tail (drawing or photograph)
- Slide #3- The [Oort Cloud](#)
- Slide #4- Comet with a tail
- Slide #5- Close-up of an asteroid
- Slide #6- The [solar system](#) (at least through Jupiter)
- Slide #7- A [crater](#) somewhere on earth (like Barringer)


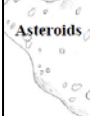
You'll find more pictures than you can possibly use, so remember that less is more. Too many images would crowd the you're trying to present. Just use 1 or 2 of the best, and keep applying the information on the handout to them.

If you're not using a PowerPoint, look through the appropriate chapter in your book for pictures to refer to.

3. And speaking of picking and choosing, the note sheet that students will be filling out represents the most basic and essential information about comets and asteroids. It was intentionally designed that way for 3 reasons:
 - 1.) It gives a reasonable amount of information that students are expected to be accountable for knowing
 - 2.) Depending on the information you come across in your preparation and are most interested in sharing, plus the student questions you get, there is room for you to expand and elaborate on anything. The idea here is "flexibility".
 - 3.) The amount of information on the sheet will comfortably take you about 45 minutes to share.

So, think of the statements and blanks on the note sheet as discussion starters.

4. Consider making some home-made mini comets to let students see. Put dirt, ammonia (-based household cleaner), and then water in an ice cube tray, freeze it, and you've got mini-comets. They're not perfect (missing are methane, carbon dioxide, and carbon monoxide), but they help.
5. Write yourself notes reminding yourself when to do a demo, change PowerPoint slides, or make a comment.
6. Check a [list of meteor showers](#) so you can pass this

	What they are	Where they are	They and us
Comets 	<ul style="list-style-type: none"> • A large ball of mostly FROZEN WATER • Their size ranges between 1 and 200 miles wide • There are TRILLIONS in our solar system. 	<ul style="list-style-type: none"> • Most comets are found in the OORT Cloud, which is about 75,000X further out than the earth is from the sun. • A few orbit among the PLANETS • GRAVITATIONAL TUG or COLLISION what sends some into the inner solar system causing the planets. 	<ul style="list-style-type: none"> • A comet that close to the sun will begin to die as WIND peeling away it. This is how the TAIL is "blown". • If the Earth's orbit passes through this, a phenomenon we call METEOR SHOWER occurs. • There are 14 major meteor showers that occur throughout the year.
Asteroids 	<ul style="list-style-type: none"> • A much smaller body IRON ROCK 	<ul style="list-style-type: none"> • Most asteroids have the ORBIT the sun between MARS and JUPITER • They will never gather into a planet because of Jupiter's GRAVITY • A few have been nudged 	<ul style="list-style-type: none"> • There are 10 MILLION asteroids that cross earth's orbiting zone that are at least 10 meters across or larger. • A FOOTBALL FIELD 1,000 meters wide with about 100,000 asteroids. • Asteroid KT was 6 miles wide, is thought to be what caused the DINOSAUR extinction.

info. along to students. Even if there are no major meteor showers happening, you could watch for stray meteors, which are not uncommon. These are more frequent in the morning than evening, and in the early fall than spring.

Procedure:

1. A nice way to welcome students to your room today and get them instantly curious is to have the [Stellarium](#) star program running, with meteors shooting through the sky (press the “9” key to toggle rates).
2. Introduce the lesson:

“Students, we’re going to spend today discussing comets and asteroids. They’re as mysterious and they are beautiful. Using the note sheet you’ve been given, we’ll cover 3 things about each: What they are, Where they are, and They and us.

Now, the information on the sheet represents just the most *basic* and *essential* information about them. There is a lot more besides this that we do know. So here’s what I need you to do- as we talk today, if a question suddenly pops into your head, I want you to raise your hand and ask it. Any question you want. There is lots of room for all kinds of questions, so please ask. I will keep my responses brief so we can answer lots of questions. Let’s begin.

3. Advance to PowerPoint slide #2 and go through the information on the note sheet related to comets using the 3 guiding statements- *What* they are, *Where* they are, and *They and Us*. Encourage students to ask questions, which will give you the opportunity to elaborate.

And don’t just feed them answers- as you lead up to a blank, ask them what goes there.

(end of Teacher Notes preview)

Come back and visit InteractiveScienceTeacher.com and for just .99¢ you can download the entire set of Teacher Notes right now, along with:

◆ PowerPoint (7 slides) Don't have PowerPoint? Download it FREE: [Mac / PC](#)

Comets & Asteroids

What they are
Where they are
They and us

COMETS-WHAT THEY ARE

- A huge ball of mostly **FROZEN WATER**
- Their size ranges between **1** and **200** miles wide.
- There are **TRILLIONS** in our solar system.

COMETS-WHERE THEY ARE

- Most comets are found in the **OORT** Cloud, which is about **75,000x** further out than the earth is from the sun.
- A few orbit among the **8 PLANETS**
- A **GRAVITATIONAL TUG** or **COLLISION** is what sends some into the inner solar system among the planets.

COMETS-THEY AND US

- A comet too close to the sun will begin to die as it sheds small fragments due to **SOLAR WIND** passing over it. This is how the **TAIL** forms.
- If the Earth later passes through this, a phenomenon we call **METEOR SHOWER** occurs.
- There are **14** major meteor showers that occur throughout the year.

ASTEROIDS-WHAT THEY ARE

- Asteroids are mostly **IRON ROCK**

ASTEROIDS-THEY AND US

- There are **10,000,000** asteroids that cross earth's orbiting route that are at least 10 meters across or larger.
- A **FOOTBALL FIELD** sized asteroid collides with earth about every **1,000** years.
- Asteroid **KT**, some **6** miles wide, is thought to be what caused the **DINOSAUR** extinction.

◆ Student Handout

Comets	What they are	Where they are	They and us
	<ul style="list-style-type: none"> A large ball of mostly FROZEN WATER Their size ranges between 1 and 200 miles wide. There are TRILLIONS in our solar system. 	<ul style="list-style-type: none"> Most comets are found in the OORT Cloud, which is about 75,000x further out than the earth is from the sun. A few orbit among the 8 PLANETS A GRAVITATIONAL TUG or COLLISION is what sends some into the inner solar system among the planets. 	<ul style="list-style-type: none"> A comet too close to the sun will begin to die as it sheds small fragments due to SOLAR WIND passing over it. This is how the TAIL forms. If the Earth later passes through this, a phenomenon we call METEOR SHOWER occurs. There are 14 major meteor showers that occur throughout the year.
Asteroids	<ul style="list-style-type: none"> Asteroids are mostly IRON ROCK 	<ul style="list-style-type: none"> There are 10,000,000 asteroids that cross earth's orbiting route that are at least 10 meters across or larger. A FOOTBALL FIELD sized asteroid collides with earth about every 1,000 years. Asteroid KT, some 6 miles wide, is thought to be what caused the DINOSAUR extinction. 	

◆ Answer Key

Comets	What they are	Where they are	They and us
	<ul style="list-style-type: none"> A large ball of mostly FROZEN WATER Their size ranges between 1 and 200 miles wide. There are TRILLIONS in our solar system. 	<ul style="list-style-type: none"> Most comets are found in the OORT Cloud, which is about 75,000x further out than the earth is from the sun. A few orbit among the 8 PLANETS A GRAVITATIONAL TUG or COLLISION is what sends some into the inner solar system among the planets. 	<ul style="list-style-type: none"> A comet too close to the sun will begin to die as it sheds small fragments due to SOLAR WIND passing over it. This is how the TAIL forms. If the Earth later passes through this, a phenomenon we call METEOR SHOWER occurs. There are 14 major meteor showers that occur throughout the year.
Asteroids	<ul style="list-style-type: none"> Asteroids are mostly IRON ROCK 	<ul style="list-style-type: none"> There are 10,000,000 asteroids that cross earth's orbiting route that are at least 10 meters across or larger. A FOOTBALL FIELD sized asteroid collides with earth about every 1,000 years. Asteroid KT, some 6 miles wide, is thought to be what caused the DINOSAUR extinction. 	

◆ Quick Notes

Teacher Quick Notes- "Comets And Asteroids"

Materials:

- 1-Student Note Sheet
- PowerPoint-Comets And Asteroids

Procedure:

1. Introduce the lesson with the PowerPoint slideshow started.
2. Move through the note sheet deliberately and purposefully. Use your slideshow, the demonstration, and information you've picked up from your studying to supplement the note sheet.

◆ Drawings & Pictures

◆ Document- background info. on Comets & Asteroids



Drawing-Asteroid Ida



Drawing-Comet



Pic-Student Note Sheet

The following provides you a general background on comets & asteroids. It's not information you have to (or may want to) share with students, but you may find it helps you be prepared for some common questions, and provides a rich supplement to the core information represented on the new sheet.

Comets

Comets are mostly frozen water, but they also contain varying amounts of dirt/dust, ammonia, carbon dioxide, carbon monoxide, and methane. No one is sure how many there are in the Oort cloud (a region in our solar system 75,000x further than the sun-earth distance, or AU), since they are far too small to be seen or measured in any meaningful way. They can survive indefinitely, spanning billions of years, in the Oort cloud, because the sun's radiation that far out is very weak, barely even holding them in orbit. Some long-period comets take 30 million years for one revolution!



We don't know for sure how many comets there are roaming among the planets in the inner solar system. But we do know they don't belong here. So how'd they get here? Two things can disturb their orbit in the Oort Cloud and send them among the planets - collisions with each other and a push or pull from a nearby star. And once comets are closer than where Jupiter orbits, the solar wind (sun's radiation) becomes strong enough to chip away at them, forming the tail that can go millions of miles into space. Cracks form and pockets of trapped gas burst free. So a comet that was billions of years old until it was bumped out of the Oort Cloud will now be gone in just a few thousand years.

Asteroids

Asteroids wander our entire solar system, but most are concentrated in the asteroid belt, which is located between Mars and Jupiter. Most of us assume that the asteroid belt is packed full of tumbling rocks in close proximity to each other. It's not. Most asteroids are half a million miles away from their nearest neighbor.

Jupiter will always come up in any discussion of asteroids. Not only is Jupiter useful in helping us remember where the asteroid belt is, it is also the reason there even IS an asteroid belt. Jupiter has enormous mass - 12 times that of earth. And being that big means it can exert enough of a tug to keep all those rocks from collecting into another planet. Jupiter will occasionally even steal an asteroid for a moon. That's why it has so many.

Jupiter's enormous mass leads us to believe that it had a double life. It is, technically, a planet, but it also carries the designation "brown dwarf", meaning it's a star that failed



Copyright © 2007 by Interactive Science Teacher™

to ignite. It was originally intended to be a companion star for our sun (it's estimated that about half of all stars are "binary", or have a companion), but Jupiter couldn't reach the critical core temperature of 11,000,000° Fahrenheit needed to squeeze hydrogen in to helium and perform nuclear fusion.

Boole's Law is another rabbit trail you can chase if time permits. Developed some time in the early 1700's, it's a mathematical anomaly that predicted accurately the distances of the planets, even ones that weren't yet discovered, except for Neptune.

Here's how it works- start with a value of "0" for Mercury, "2" for Venus and then double thereafter, adding "4" and then dividing by "10". That number tells you exactly where that body revolves around the sun. All orbit distances are based on Earth's, which has a value of "1". Pretty cool, huh?

	Formula	Value Orbit	Accurate*
Mercury	0 + 4 / 10 =	4	✓
Venus	3 + 4 / 10 =	7	✓
Earth	6 + 4 / 10 =	10	✓
Mars	12 + 4 / 10 =	16	✓
J1†	24 + 4 / 10 =	28	✓
Jupiter	48 + 4 / 10 =	52	✓
Saturn	96 + 4 / 10 =	100	✓
Uranus	192 + 4 / 10 =	196	✓
Neptune	384 + 4 / 10 =	388	X (400)

In 1801, Piazzi, using the formula, was looking everywhere in the 2.8 region, searching for the lost planet and hoping to become famous for doing so. But all he found was Ceres, an impressive rock at over 600 miles across, that was later disproved to be a planet.

Other asteroids have impressive sizes- Ida has it's own moon named Dactyl. Some have basalt flows on them, and that's only produced by volcanoes.

Every day some 25,000 tons of rock comes at our earth.

Copyright © 2007 by Interactive Science Teacher™