

## Notes-History Of Orbiting Theories

A fascinating look back and how some of the greatest minds wrestled with the concept of the earth's place in the universe. Your students will also appreciate some of the greatest minds in history who performed astounding astronomical calculations with little more than their minds.

<p style="text-align: center;"><b>Proof That The Earth Is Round</b></p> <p><b>Direct Evidence:</b></p> <ul style="list-style-type: none"><li>• earth's curved shadow on the moon during eclipse</li><li>• ships disappear slowly as they sail away</li><li>• southern and northern hemisphere have different sky</li></ul> <p><b>Indirect Evidence:</b></p> <ul style="list-style-type: none"><li>• Everything else is round: sun, moon, planets, stars, comets, asteroids; this is because...</li><li>• Gravity pulls inward</li><li>• the gods created a round world since they are perfect and a circle is also perfect</li><li>• The seasons: flat earth would mean equal directness of sunlight for all earth</li></ul>
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### Direct Evidence:

- earth's curved shadow on the moon during eclipse (Aristotle)
- ships disappear slowly as they sail away (Aristotle)
- southern and northern hemisphere have different sky (Aristotle)

1. To get students in the right frame of mind, start with a tease by having them prove to you the world is round. Oh, and they can't claim any satellite photos.

Have them copy the points shown. Feel free to change and add to the list (listen to students- they might come up with a new one).

This is available as a Student Handout (see last page).

### Indirect Evidence:

- Everything else is round: sun, moon, planets, stars, comets, asteroids; this is because...
- Gravity pulls inward (Newton)
- the gods created a round world since they are perfect and a circle is also perfect(Pythagoras, 500 B.C.)
- The seasons: flat earth would mean equal directness of sunlight for all earth



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## The Constellations

5. The study of stars gets into constellation,

- humans must have order
- Stars with unusual patterns were thought to resemble animals
- These constellations helped civilizations recognize seasons easier (the appearance of Pisces and Aquarius, 2 water constellations, foretold stormy weather too hard for sailing)

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6. This is a screenshot from my PowerPoint showing a typical night sky (shown with the Stellarium program, which is a free download by the way).

When talking about constellations, I like to put up a shot of the night sky and then ask students to simply look at it and notice that their minds are noticing the unusual ones and looking for patterns, without being told to do any of this.



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## Major Events

7. Now we'll start talking about people and events that would lead directly to what Copernicus would say in 1543.

- Aristotle (350 BC)- argued that the Earth was round
- And that we had a GEO-CENTRIC solar system, which translates “earth-centered”
  - Why can't you blame them for thinking that everything revolves around earth?
- Fatal flaw (thank goodness!)- Venus and Mercury did not appear to revolve around earth (*retrograde motion*)

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### More Contributions

8. More names and contributions.

- Eratosthenes (200 BC) used the sun's shadow to calculate earth's circumference (and was only 400 meters off)
- Hipparchus (150 BC)- successfully used a technique called "triangulation" to accurately measure the distance between the earth and the moon
- The Arabs- gave us star names like Betelgeuse and Aldebaran
- The Chinese- kept incredibly detailed records
  - thanks to them we know when the Crab Nebula first novaed (1054)

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### More contributions

9. What the PowerPoint looks like with a picture of the Crab Nebula inserted.

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10. ...and finally the major breakthrough in 1543.

These notes remind us of the importance of working with a correct model. As long as you're using a wrong model, there will always be something wrong. Little things that nag will linger and not go away (like the orbits of Mercury and

### GEO-Centric Model In Trouble

- 1543 Copernicus proposed the first HELIO-CENTRIC model of our solar system
  - translates "sun-centered"
- Galileo (1600)- observed the phases of

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Venus). When you finally accept the true model, it's like you've taken a breath of fresh air, and now things just simply click. And now look what that lead to- Kepler and Brahe's advance, now that the issue is no longer what orbits around what.

Venus

- Kepler uses Brahe's (1600) data to figure that the planets orbit the sun not in perfect circles but in ELLIPSES

Come back and visit [InteractiveScienceTeacher.com](http://InteractiveScienceTeacher.com) to upgrade this lesson with:

**PowerPoint-** lead your students through the lesson click-by-click  
-includes links to several images you can insert

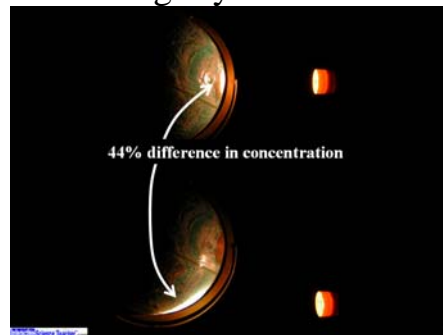
### Proof That The Earth Is Round

#### Direct Evidence:

- earth's curved shadow on the moon during eclipse
- ships disappear slowly as they sail away
- southern and northern hemisphere have different sky

#### Indirect Evidence:

- Everything else is round: sun, moon, planets, stars, comets, asteroids; this is because...
- Gravity pulls inward
- the gods created a round world since they are perfect and a circle is also perfect
- The seasons: flat earth would mean equal directness of sunlight for all earth



### Major Events

- Aristotle (350 BC)- argued that the Earth was round
- And that we had a **GEO-CENTRIC** solar system, which translates "earth-centered"
  - Why can't you blame them for thinking that everything revolves around earth?
- Fatal flaw (thank goodness!)- Venus and Mercury did not appear to revolve around earth (*retrograde motion*)

## Student Handout

### Notes: History Of Orbiting Theories

#### Proof The Earth Is Round

##### Direct Evidence:

- earth's \_\_\_\_\_ on the moon during \_\_\_\_\_ (Aristotle)
- ships \_\_\_\_\_ as they sail away (Aristotle)
- southern and northern hemisphere have \_\_\_\_\_ (Aristotle)

##### Indirect Evidence:

- Everything else is \_\_\_\_\_
- \_\_\_\_\_ pull inward (Newton)
- the gods created a round world since they are perfect and a \_\_\_\_\_ is also perfect (Pythagoras, 500 B.C.)
- The \_\_\_\_\_ for earth would mean equal directness of sunlight for all earth

#### What's the big deal?

- nearly everything is \_\_\_\_\_, repeating day after day, year after year
- which served as a way of \_\_\_\_\_
- past cultures could then predict when to \_\_\_\_\_ and have \_\_\_\_\_
- The appearance of the "dog star", \_\_\_\_\_, meant there were 2 weeks until the \_\_\_\_\_
- Today we have \_\_\_\_\_ so we don't need the stars to tell us the season or anything else

#### The constellations

- humans can't have \_\_\_\_\_
- Stars with unusual patterns were thought to resemble \_\_\_\_\_
- These constellations helped civilizations recognize \_\_\_\_\_ and \_\_\_\_\_ (water constellations, forecast stormy weather too hard for sailing)

#### Major Events:

- Aristotle (350 BC)- argued that the Earth was \_\_\_\_\_ solar system, which translates \_\_\_\_\_
- Why can't you blame them for thinking that everything revolves around earth?
- Fatal flaw (thank goodness!)- \_\_\_\_\_ and \_\_\_\_\_ did not appear to revolve around earth \_\_\_\_\_ motion

#### More contributions

- Eratosthenes (200 BC) used the sun's \_\_\_\_\_ to calculate earth's circumference (and was only \_\_\_\_\_ meters off)
- Hipparchus (150 BC) successfully used a technique called \_\_\_\_\_ to accurately measure the distance between the earth and the \_\_\_\_\_
- The Arabic gave us star names like Betelgeuse and \_\_\_\_\_
- The Chinese kept incredibly detailed records \_\_\_\_\_ thanks to them we know when the \_\_\_\_\_ first occurred

#### Geocentric model in trouble

- 1543 Copernicus proposed the first \_\_\_\_\_ model of our solar system
- retrograde
- Galileo (1600)- observed the phases of \_\_\_\_\_
- Kepler uses Brahe's (1600) data to figure that the planets orbit the sun not in perfect circles but in \_\_\_\_\_