Nature of Science

Nature of Science Slide 1

Scientific Measurements

"No amount of experimentation can ever prove me right; a single experiment can prove me wrong."
~Albert Einstein

Nature of Science: Slide 2

Size of Earth

- Eratosthenes measured the size of the earth in 235 BC
- Calculated the circumference of earth by comparing shadows at local noon

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Eratosthenes' Method

- Determine angle between sun's rays and vertical
- This angle is equal to the angle between the two radius vectors
- $7.1^{o}/360^{o} = 1/50$
- Distance between Syene and Alexandria known to be 800 km
- 50*800 km = 40,000 km

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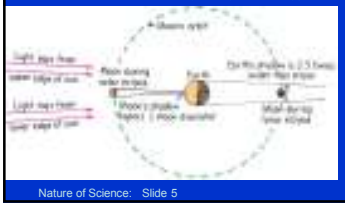
Size of the Moon

- Aristarchus determined the size of the moon in 240 BC
- Eclipse of moon
- Shadow of earth at moon's distance has tapered by 1 moon diameter
- Shadow was 2.5 X the moon's diameter



- Earth's diameter is therefore 3.5 X moon's diameter
- Moon diameter = 2*6,370 km/3.5 =
- 3640 km

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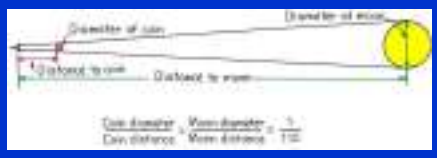
Distance to Moon



- Once Aristarchus had estimated the diameter of the moon (to within 5% of the present accepted value)
- the above technique was used to calculate the distance to the moon
- 110*3640 km = 400,400 km

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Distance to Sun

- Once earth-moon distance is known
- Right triangle trigonometry allows the determination of the earth-sun distance
- Aristarchus measured the angle X to be 87°
- Actual value is 89.8° (difficult to measure)
- Sun is 400 X farther than moon
- Aristarchus estimated 20 X earth-moon distance

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Size of the Sun

- Pinhole camera
- Sun's diameter is
- 150,000,000 km/110
- = 1,360,000 km

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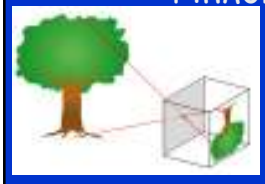
Pinhole Camera



- Pinhole camera can be used to safely view a partial eclipse
- Spaces between leaves act as pinholes during eclipse

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Science Terms

- Fact – a close agreement by competent observers – facts can change
- Hypothesis – must be stated in a way that it can be disproved
- Theory – a synthesis of a large body of information encompassing well-tested and verified hypotheses

Scientific Hypotheses

- Scientific Hypothesis
  - Must be testable
  - Must be falsifiable
- Our universe is surrounded by another, larger universe, with which we can have absolutely no contact.
  - Not testable
- There are other inhabited planets in the universe.
  - Not falsifiable
- The moon is made of green cheese.
  - Testable & Falsifiable

Scientific Method

- There are many scientific methods – but generally
  - Recognize a question
  - Form a testable hypothesis
  - Make predictions
  - Test predictions
  - Formulate simplest general rule