

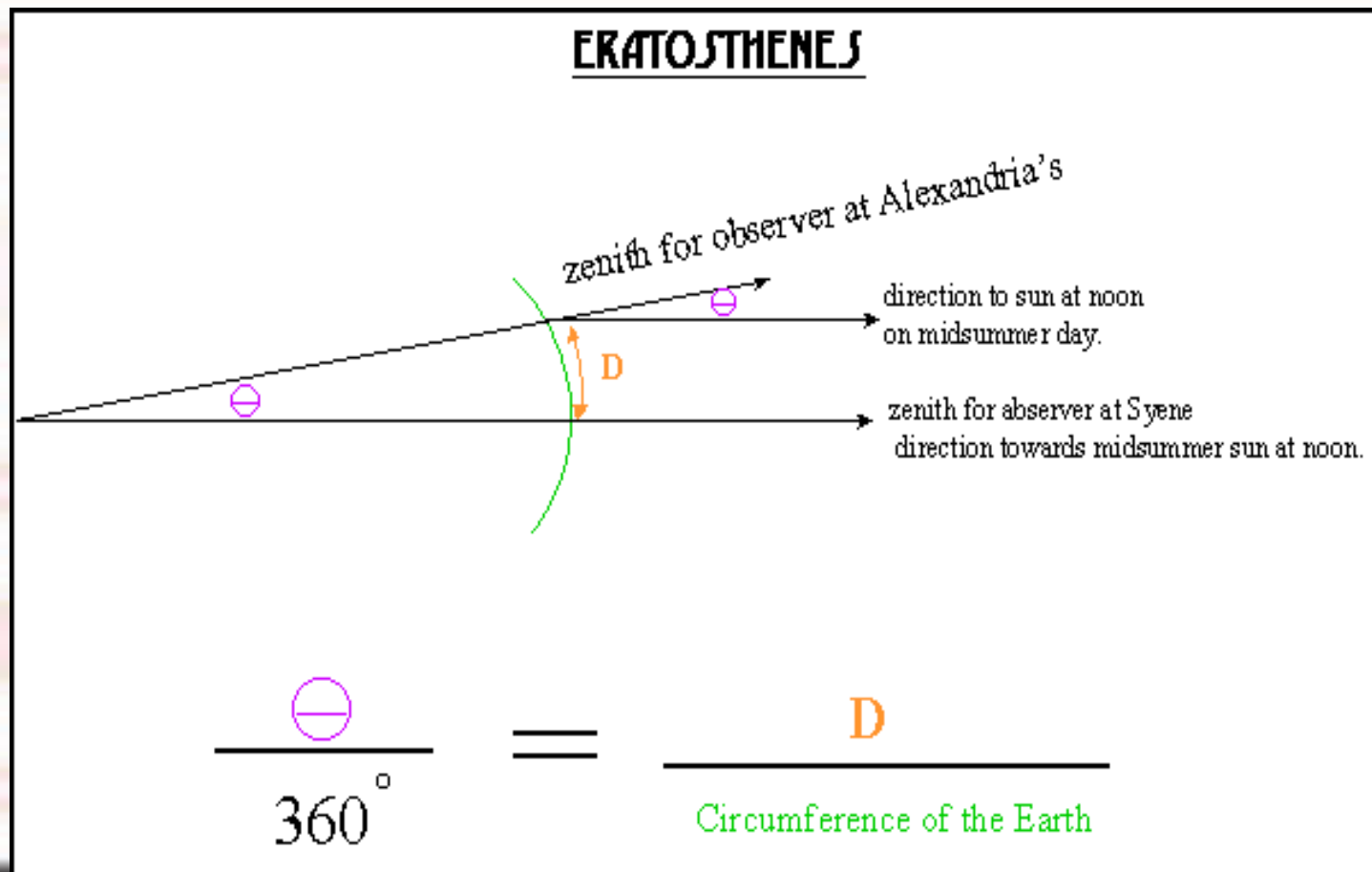
Density of
the Earth

Determining Earth's Density

- ◆ What is needed?
- ◆ Density = Mass / Volume
- ◆ Volume = $\frac{4}{3} * \pi * \text{Radius}^3$
- ◆ How do we determine these?
- ◆ Two friends for this lab:
 - ◆ $\pi = 3.14159$
 - ◆ $G = 6.67 \times 10^{-11} \text{ meter}^3 / (\text{kg} * \text{sec}^2)$

Eratosthenes' Method

- ◆ Circumference = $2 * \pi * \text{Radius}$



Measuring Earth's Mass

- ◆ Force=mass*acceleration
 - ◆ Acceleration = $G * M_{\text{earth}} / R_{\text{earth}}^2$
- ◆ Measuring Acceleration:
 - ◆ Watch an object fall from a known height
 - ◆ Distance = $1/2 * \text{acceleration} * \text{time}^2$

Our procedure

- ◆ Measure shadow length of stick
- ◆ Calculate angle
 - ◆ $\text{angle} = \arctan(\text{shadow length} / \text{stick length})$
- ◆ Calculate Earth's Circumference
 - ◆ $\text{Circumference} = (\text{Distance} / \text{Angle}) * 360$
- ◆ Calculate Earth's Radius
 - ◆ $\text{Radius} = \text{Circumference} / (2 * \pi)$
- ◆ Measure Fall time
- ◆ Calculate acceleration
 - ◆ $A = 2 * \text{distance} / \text{time}^2$

Procedure, cont'd

- ◆ Calculate Earth's Mass
 - ◆ $\text{Mass} = \text{acceleration} * \text{radius}^2 / G$
- ◆ Calculate Earth's Volume
 - ◆ $V = (4/3) * \pi * \text{radius}^3$
- ◆ Calculate Earth's Density
 - ◆ $\text{Density} = \text{Mass} / \text{Volume}$