


## Rotating Earth

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### How do we know that the Earth is Round-ish?

- Besides going up into outer space and taking a look... how do we know the shape of the Earth?


**Show me your best guess on your whiteboards!**



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### Sinking Ships

- When ships sailed away they were observed to disappear over the horizon



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### Review Question

- Is our Earth a perfect sphere?
  - **NO!**
- What is the shape of Earth called?
  - **Oblate Spheroid**

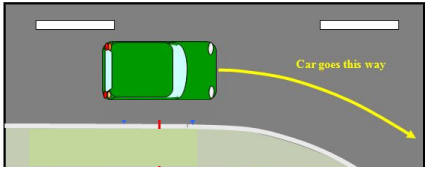


Spherical Earth                      Oblate Spheroid

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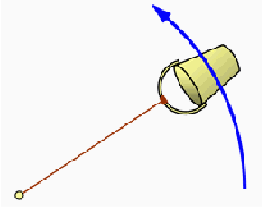
### Let's Think About It....

- What happens when you take a turn too quickly in a car?
  - Slide/lean in the direction away from the turn
- Why?



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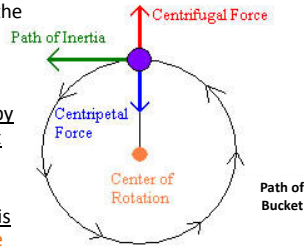
### Water in a Bucket Demonstration



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### Why is the Earth a Oblate Spheroid?

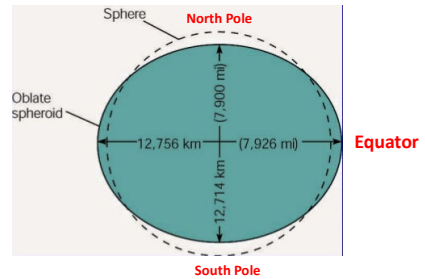
- Centrifugal force is the apparent force that draws a rotating body away from the center of rotation.
- The Earth bulges due to centrifugal force created by rotating at speed of about 1,000 miles per hour
- In the Earth's case, water is drawn away from the core creating the equatorial bulge.



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### Earth's Bulge

- The bulge only adds about 26 miles to the equator.



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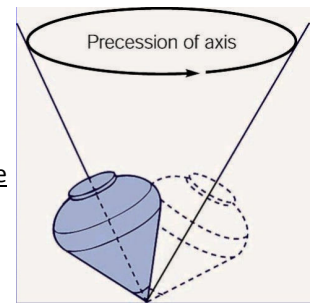
### Review Question

- How long does it take the Earth to rotate on its axis once?
  - **Whiteboards!**
  - **23 hours, 56 minutes (and 4.1 seconds)**

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### Precession of an Axis

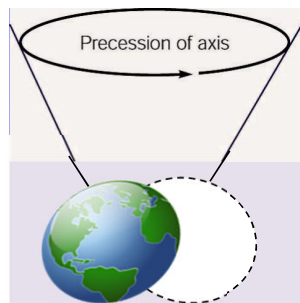
- A spinning top wobbles as it spins, and the axis of the top traces out a small circle.
- The wobbling of the axis is called precession.



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### Precession of the Earth

- Precession caused by the equatorial bulge of the Earth
- Takes 26,000 years to make one precession circle
- SLOW PROCESS!!!!!!
- VERY SLOW!!!!!!

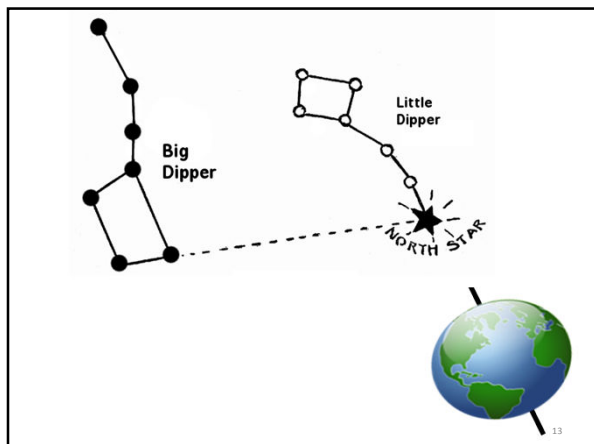


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### The North Star

- What do you know about the North Star?
  - **Whiteboards!**

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### The North Star

- Currently our North Star is Polaris
- In the year 14,000 AD our North Star will be Vega

To Polaris

Earth's rotation axis now

Earth's orbit

Toward Vega

Earth's rotation axis in approximately AD 14,000

Earth's orbit

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### Quick Facts on Precession

- Change in direction of the Earth's axis
- **DOES NOT** change the tilt (23.5°)
- **DOES NOT** affect the seasons
- Changes the stars we see at the Pole (North Star)

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### Nutation

- **R = Rotation**
- **P = Precession**
- **N = Nutation**

- Nutation is a nodding motion on the precession circle

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### What Causes Nutation?

- Gravitational pull from the moon and sun causes nutation

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### Quick Facts on Nutation

- Change in Earth's axis angle by a ½ degree
- 18 year "nod" period due to the moon's pull
- Very slight increases or decreases seasonal effects

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### What's the Difference?

- What is the difference between **precession** and **nutation** of the Earth?

**Show me on your whiteboards!**

#### Today's Main Idea:

Precession is the slow, top-like wobbling of the spinning Earth. Nutation is a small nod within the precession circle.

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### What Would Happen if the Earth Stopped Spinning?

- Video!  
<https://www.youtube.com/watch?v=nH3bmG-KjvU>

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