I. Apparent Motion

- **Geocentric Universe** - 

  - Starts all rotate around the Earth on a single sphere at _________ °/hour
  - Planets travel on smaller spheres around their own large sphere in ____________

- Problems with the Geocentric Model:
  - Locations of ______________________ could not accurately be predicted
  - Changes in the apparent diameter of the ___________________ and ____________________ could not be explained
• Celestial Object - ____________________________

• Apparent Motion - ____________________________

• Celestial Sphere - ____________________________

• Horizon - ____________________________

• Zenith - ____________________________

• All objects (except Polaris) appear to move across the celestial sphere from _______________ to _______________ at 15 °/hour or 360 °/24 hour
Class Notes: Astronomy

- **Star Trails**
- **Circumpolar Stars**
- **Polar Stars**

Locating positions on the celestial sphere uses angular coordinates:

- **Altitude**
- **Azimuth**
The Sun’s path changed both its position and length with the season

- The ____________________ the Sun’s path the ____________________ amount of daylight hours an area receives
- The ____________________ the Sun’s path the ____________________ amount of daylight hours an area receives
II. Actual Motions

- **Heliocentric Model**

- **Rotation**

- **Period of Rotation**

- **Example**: Earth rotates 360° in ________ hours
  
  Earth’s axis of rotation is ____________________

- **Evidence of Rotation**:
  - **Foucault Pendulum** - large pendulum that allowed to swing freely changes its path due to Earth’s rotation
  - **Coriolis Effect** - the tendency of all particles on Earth surface to be deflected from a straight line
    - N. Hemisphere to the right
    - S. Hemisphere to the left
Class Notes: Astronomy

- Revolution - 
- Period of Revolution - 
  - Example: Earth orbits the Sun in ________ days
- Evidence of Revolution:
  - Parallelism of Earth's Axis - 
- Winter Solstice - 
- Summer Solstice - 
- Vernal Equinox - 
- Autumnal Equinox - 

![Diagram of Earth's revolution around the Sun with key dates: Winter Solstice (December 21), Summer Solstice (June 21), Vernal Equinox (March 21), Autumnal Equinox (September 21).]
Class Notes: Astronomy

- **Ellipse**
- **Eccentricity**
- **Foci**
- **Major Axis**
- **Minor Axis**

III. The Solar System

- **Solar System**
- **Terrestrial Planets**
- **Jovian Planets**
- **Asteroids**

- The Sun accounts for ________ of the mass in the solar system
- Examples: Mercury, Venus, Earth, Mars
- Examples: Jupiter, Saturn, Uranus, Neptune
- A large percent of the thousands of known asteroids are between Mars and Jupiter
• **Moon -**

• There are _______ known moons in our solar system

• **Earth’s Moon**
  • After an impact with a large asteroid a portion of the Earth created the moon
  • The Moon orbits the Earth in an ________________________ orbit once every _________ days while it appears to change shape

• **Crescent Moon -**

• **Full Moon -**

• **Gibbous Moon -**

• **New Moon -**

• **Waxing Moon -**

• **Waning Moon -**

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[Images of moon phases: New, Crescent, Half, Gibbous, Full Moon, Gibbous, Half, Crescent]
Class Notes: Astronomy

- Comet - 

- As the solids melt they leave a trail behind known as a comet's tail

- Meteoroid - 

- Meteorites - 

- Evolution
  - 5 billion years ago a large dust cloud left over from an exploded star started to condense
  - Most of the mass was concentrated to the center and formed the ________________
  - The other concentration formed the ________________
  - When the Sun became too massive it ignited under its own mass in a violent explosion
  - The explosion blew most of the gases off the inner planets and pushed most of the debris between ________________ and ________________

<table>
<thead>
<tr>
<th>Celestial Object</th>
<th>Mean Distance from Sun (million km)</th>
<th>Period of Revolution (d=days, y=years)</th>
<th>Period of Rotation at Equator</th>
<th>Eccentricity of Orbit</th>
<th>Equatorial Diameter (km)</th>
<th>Mass (Earth = 1)</th>
<th>Density (g/cm³)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SUN</td>
<td>—</td>
<td>—</td>
<td>27 d</td>
<td>—</td>
<td>1,392,000</td>
<td>333,000.00</td>
<td>1.4</td>
</tr>
<tr>
<td>MERCURY</td>
<td>57.9</td>
<td>88 d</td>
<td>59 d</td>
<td>0.206</td>
<td>4,879</td>
<td>0.06</td>
<td>5.4</td>
</tr>
<tr>
<td>VENUS</td>
<td>108.2</td>
<td>224.7 d</td>
<td>243 d</td>
<td>0.007</td>
<td>12,104</td>
<td>0.82</td>
<td>5.2</td>
</tr>
<tr>
<td>EARTH</td>
<td>149.6</td>
<td>365.26 d</td>
<td>23 h 56 min 4 s</td>
<td>0.017</td>
<td>12,756</td>
<td>1.00</td>
<td>5.5</td>
</tr>
<tr>
<td>MARS</td>
<td>227.9</td>
<td>687 d</td>
<td>24 h 37 min 23 s</td>
<td>0.093</td>
<td>6,794</td>
<td>0.11</td>
<td>3.9</td>
</tr>
<tr>
<td>JUPITER</td>
<td>778.4</td>
<td>11.9 y</td>
<td>9 h 50 min 30 s</td>
<td>0.048</td>
<td>142,984</td>
<td>317.83</td>
<td>1.3</td>
</tr>
<tr>
<td>SATURN</td>
<td>1,426.7</td>
<td>29.5 y</td>
<td>10 h 14 min</td>
<td>0.054</td>
<td>120,536</td>
<td>95.16</td>
<td>0.7</td>
</tr>
<tr>
<td>URANUS</td>
<td>2,871.0</td>
<td>84.0 y</td>
<td>17 h 14 min</td>
<td>0.047</td>
<td>51,118</td>
<td>14.54</td>
<td>1.3</td>
</tr>
<tr>
<td>NEPTUNE</td>
<td>4,498.3</td>
<td>164.8 y</td>
<td>16 h</td>
<td>0.009</td>
<td>49,528</td>
<td>17.15</td>
<td>1.8</td>
</tr>
<tr>
<td>EARTH’S MOON</td>
<td>149.6 (0.386 from Earth)</td>
<td>27.3 d</td>
<td>27.3 d</td>
<td>0.055</td>
<td>3,476</td>
<td>0.01</td>
<td>3.3</td>
</tr>
</tbody>
</table>
IV. Galaxies and Stars

- Galaxy - ____________________________________________________________
  
  - Average galaxies have around ____________ billion stars
  
  - Galaxies have been classified by the following shapes:
    - ________________________, ________________________, ______________________
  
  - Milky Way Galaxy - ____________________________________________________
  
  - Star - _______________________________________________________________

  - Make up the majority of known matter in the galaxy
  
  - Nuclear Fusion - ______________________________________________________

    - The Sun converts hydrogen nuclei into helium nuclei
  
  - Luminosity - __________________________________________________________________

    - Luminosity and temp. are used in classifying the different types of stars on a H-R diagram

![Diagram of a H-R diagram showing different types of stars and their luminosity and surface temperature relationships.](image)
• Stars have a life cycle and undergo stellar evolution
  • Stars originate from a cloud of ________________ and ________________
  • Gravity causes them to clump together and form larger balls of dust and gases
  • When gravitational contraction creates enough heat they ignite and start nuclear fusion

• Main Sequence Star - ____________________________
  • ________________ of the known stars spend their life on the main sequence
  • The ________________ is apart of the main sequence

• Red Giant Stars - a luminous easily seen star that is in a late phase of stellar evolution
• Super Giant Stars - star with an extremely high temperatures in the late phase of stellar evolution
• White Dwarf Stars - Earth sized star with a low luminosity and a hot surface

V. The Universe

• Universe - ____________________________
  • Scientists all agree that the universe is extremely vast and between 10-17 billion years ago came to creation with the big bang

• Big Bang - ____________________________

• Electromagnetic Energy - ____________________________

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(Not drawn to scale)
Evidence of the Big Bang

1. **Background Radiation** -

   - Scientists have found evidence of long wave radiation (microwaves) that come from all directions in the universe.

2. **Doppler Effect** -

   - Each element gives off an electromagnetic spectral line and when scientists study energy coming off a celestial object they can infer which elements are in these objects as well as its direction of movement.

   - Positions of colored lines shifted as they studies stars and galaxies
     - **Blue Shift** -
     - **Red Shift** -

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