What is universe?

Universe is the totality of all space, time, matter and energy.

In our Calendars days, months and year are representation of what?

What is a constellation?

A constellation is an imagined pattern of naked-eye stars typically associated with common objects, mythological beings and animals etc.

Do constellations have same meaning today also?

Although most of the constellations originated in antiquity, the constellations are now used to officially designate specific sections of the sky.
The sky has been divided into how many constellations?

88

Name three well known constellations of winters?

Name three well known constellations of summers?

Give four names of this constellation as given by different cultures.

- Ursa Major
- Big Dipper (North America)
- The Great Bear (Greeks)
- Wagon or Plough (western Europe)
- Leg of an ox (Egyptians)
- Stag (Siberians)
- Funeral procession (Native Americans)
- Seven Rishis (Indians)
What is celestial sphere?

This is an imaginary sphere or dish surrounding the earth onto which the planets, stars, sun, moon and all other heavenly bodies seem to be attached or projected.

Define celestial north pole, south pole and equator and draw them on the writing board.

What do you mean by angular sizes of heavenly objects? What are the units of angular measurements.

The apparent angular separation between any two points on the celestial sphere/sky.

A full circle contains = 360 degree
1 degree = 60 arc min
1 arc min = 60 arc sec

Is angular size by itself enough to determine the actual sizes of an object? If yes, how and if no, then what else is needed and why?

- Angular size by itself is not enough to determine the actual diameter of an object -- the distance must also be known.
• Draw the coordinates which are used to determine the positions of stars on celestial sphere/sky?

• Draw it on the writing board their reference circles and units.

• Name one of the motion of the earth and its two consequences.

• Name rest of the motions of the earth.

• How many times in your life have you orbited the Sun?

• Why all stars and other heavenly objects rise in the East and set in the West?

Explain the following with the help of volunteers.

• Why do you see different constellations or stars at different times of a year?

• Why are there seasons on the earth.

• Equinoxes and solstices.

• A day measured by the Sun is called _____ and a day measured by stars is called_____. These are differ by _____.

• Which one is longer and why?

Moon

• Does moon have its own light? Why does it shine?

• Different moon phases.

• Setting and rising time of moon

• Explain eclipses.

• What is umbra and penumbra?

• Lunar months.
• What is parallax, give at least two examples. It is used to determine what and why?

• Why we need longer baseline to determine parallax? What is the longest base line on earth.

Identify these two structures.

Stonehenge:
• Britain, Construction period (2800 B.C - 1100 B.C.)
• Largest stone weigh up to 50 tons.
• Three-dimensional calendar or almanac.

Identify these two observatories.

The Big Horn Medicine Wheel (Wyoming, USA). This was built by Plains Indians.

Observatory at Denmark named Uraniborg made by Tycho Brahe (1546--1601).

• What were the general observations of ancient astronomers about stars, sky, sun, moon.

• How many planets were known to them and how they distinguished them from the stars.

• Why the name of planet is planet? What strange behavior of planets they noticed?

• Name the two Greek astronomers who gave geocentric model
• What was the geocentric model. Explain it on the writing board.
• How many circles Ptolemy used to describe the motions of Sun, moon and 5 planets.
• Name the astronomers (in series) who believed and proved that it’s not Earth but Sun is at the center.
• Who made the first telescope for observing the sky and what he observed (mention at least 4 observations)

• How many laws of planetary motion were given by Kepler. Whose data he had used?
• What do you mean by accuracy of a data? What was the accuracy of Tycho’s data.
• Why Kepler’s laws are called empirical laws?

What is Kepler’s first law of planetary motion?
• All planets follow elliptical orbits, with the Sun located at one focus.

★ What is an ellipse, draw it on the writing board and show its major and, semi-major and position of sun.
★ What is Perihelion and Aphelion, show it on the diagram.
★ What are the two numbers needed to describe the path of a planet around Sun?
★ What is eccentricity and how much is the eccentricity of a circle?
**Description of an ellipse**

- Major axis
- Semi-major axis
- Perihelion
- Aphelion

eccentricity = \frac{\text{distance between foci}}{\text{major - axis}}

**What is Kepler’s second laws? Explain it on the board and what do you infer from this.**

2. Every planet sweeps out equal areas in equal times as it orbits the Sun.

[In other words, planets move fastest when closest to the Sun (near perihelion) and slowest when furthest away (aphelion).]

**NEWTON' S LAWS OF MOTION**

**First law:**

An object at rest remains at rest and an moving object will move forever at the same speed and in the same direction unless some external force acts on it to stop or change its direction. This tendency is called Inertia.

More massive is the body, the more is the inertia.

(Aristotle’s view was that the natural state of an object was to be at rest and forces were needed merely to keep something moving at a constant speed, but Newton realized friction or air resistance were forces that slowed things down; Galileo had already understood and realized this.)

**Third law?**

3. The square of a planet’s orbital period is proportional to the cube of its semi-major axis.

\[ P^2 = a^3 \]

(in earth years) (in astronomical units)

1 Astronomical unit (AU) = 1.5 x 10^8 Km
The rate of change of velocity of an object — speeding up, slowing down or simply changing direction — is called its **acceleration**.

**Second law:**

*Acceleration of an object is directly proportional to the applied force and inversely proportional to its mass.*

\[ a = \frac{F}{m} \]

1 Newton is the force required to cause a mass of 1 kilogram to accelerate at a rate of 1 meter per second.

**Third law:**

*Every action (force) has an equal and opposite reaction.*

---

**GRAVITY**

- Newton hypothesized that any object having mass always exerts an attractive force on all other massive objects. This attractive force is called **gravitational force or gravity**.
  - *This is directly proportional to the product of masses of objects and inversely proportional to the square of the distance between them.*

\[ F = G \frac{m_1 \times m_2}{r^2} \]

- Planetary Motion

The unending competition between Sun’s gravity and planet’s inertia results in a **stable orbit**, despite planet’s continuous rapid motion through space.

- **Kepler’s laws reconsidered**

  **First law:**
  
The orbit of a planet around the Sun is an ellipse, with the center of mass of the planet-Sun system at one focus.

  **Third law:**
  
  \[ P^2 = \frac{a^3}{M_{\text{total}}} \]

  In earth years

  Combined mass of two objects in solar units
# Constellations Sorted by Month

This is a list of all 88 constellations split up into the months when they are best seen in the sky. The months listed assume that you are looking at the sky at 9:00 PM. For every hour later than 9:00, add half a month. For every hour before 9:00, subtract half a month. The constellations are typically visible for more than just one month, depending on where you are on the Earth. If you need to know exactly when a constellation is visible, check in a star atlas or on a planetarium.

<table>
<thead>
<tr>
<th>January</th>
<th>February</th>
<th>March</th>
<th>April</th>
<th>May</th>
<th>June</th>
<th>July</th>
<th>August</th>
<th>September</th>
<th>October</th>
<th>November</th>
<th>December</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cassiopeia</td>
<td>Camelopardalis</td>
<td>Canis Major</td>
<td>Cepheus</td>
<td>Lyra</td>
<td>Leo</td>
<td>Libra</td>
<td>Lepus</td>
<td>Lynx</td>
<td>Aql</td>
<td>Aquarius</td>
<td>Aries</td>
</tr>
<tr>
<td>Perseus</td>
<td>Ursa Major</td>
<td>Ursa Minor</td>
<td>Draco</td>
<td>Hercules</td>
<td>Hydra</td>
<td>Lyra</td>
<td>Lyra Major</td>
<td>Lyra Minor</td>
<td>Lyra Major</td>
<td>Lyra Minor</td>
<td>Lyra Major</td>
</tr>
<tr>
<td>Pegasus</td>
<td>Andromeda</td>
<td>Aries</td>
<td>Aries Major</td>
<td>Aries Minor</td>
<td>Aries Major</td>
<td>Aries Minor</td>
<td>Aries Minor</td>
<td>Aries Major</td>
<td>Aries Minor</td>
<td>Aries Minor</td>
<td>Aries Minor</td>
</tr>
<tr>
<td>Orion</td>
<td>Orion</td>
<td>Orion</td>
<td>Orion</td>
<td>Orion</td>
<td>Orion</td>
<td>Orion</td>
<td>Orion</td>
<td>Orion</td>
<td>Orion</td>
<td>Orion</td>
<td>Orion</td>
</tr>
<tr>
<td>Taurus</td>
<td>Taurus</td>
<td>Taurus</td>
<td>Taurus</td>
<td>Taurus</td>
<td>Taurus</td>
<td>Taurus</td>
<td>Taurus</td>
<td>Taurus</td>
<td>Taurus</td>
<td>Taurus</td>
<td>Taurus</td>
</tr>
<tr>
<td>Gemini</td>
<td>Gemini</td>
<td>Gemini</td>
<td>Gemini</td>
<td>Gemini</td>
<td>Gemini</td>
<td>Gemini</td>
<td>Gemini</td>
<td>Gemini</td>
<td>Gemini</td>
<td>Gemini</td>
<td>Gemini</td>
</tr>
<tr>
<td>Leo Minor</td>
<td>Leo Minor</td>
<td>Leo Minor</td>
<td>Leo Minor</td>
<td>Leo Minor</td>
<td>Leo Minor</td>
<td>Leo Minor</td>
<td>Leo Minor</td>
<td>Leo Minor</td>
<td>Leo Minor</td>
<td>Leo Minor</td>
<td>Leo Minor</td>
</tr>
<tr>
<td>Leo Major</td>
<td>Leo Major</td>
<td>Leo Major</td>
<td>Leo Major</td>
<td>Leo Major</td>
<td>Leo Major</td>
<td>Leo Major</td>
<td>Leo Major</td>
<td>Leo Major</td>
<td>Leo Major</td>
<td>Leo Major</td>
<td>Leo Major</td>
</tr>
<tr>
<td>Orion</td>
<td>Orion</td>
<td>Orion</td>
<td>Orion</td>
<td>Orion</td>
<td>Orion</td>
<td>Orion</td>
<td>Orion</td>
<td>Orion</td>
<td>Orion</td>
<td>Orion</td>
<td>Orion</td>
</tr>
<tr>
<td>Lyra</td>
<td>Lyra</td>
<td>Lyra</td>
<td>Lyra</td>
<td>Lyra</td>
<td>Lyra</td>
<td>Lyra</td>
<td>Lyra</td>
<td>Lyra</td>
<td>Lyra</td>
<td>Lyra</td>
<td>Lyra</td>
</tr>
<tr>
<td>Aquarius</td>
<td>Aquarius</td>
<td>Aquarius</td>
<td>Aquarius</td>
<td>Aquarius</td>
<td>Aquarius</td>
<td>Aquarius</td>
<td>Aquarius</td>
<td>Aquarius</td>
<td>Aquarius</td>
<td>Aquarius</td>
<td>Aquarius</td>
</tr>
<tr>
<td>Pisces</td>
<td>Pisces</td>
<td>Pisces</td>
<td>Pisces</td>
<td>Pisces</td>
<td>Pisces</td>
<td>Pisces</td>
<td>Pisces</td>
<td>Pisces</td>
<td>Pisces</td>
<td>Pisces</td>
<td>Pisces</td>
</tr>
<tr>
<td>Gemini</td>
<td>Gemini</td>
<td>Gemini</td>
<td>Gemini</td>
<td>Gemini</td>
<td>Gemini</td>
<td>Gemini</td>
<td>Gemini</td>
<td>Gemini</td>
<td>Gemini</td>
<td>Gemini</td>
<td>Gemini</td>
</tr>
<tr>
<td>Orion</td>
<td>Orion</td>
<td>Orion</td>
<td>Orion</td>
<td>Orion</td>
<td>Orion</td>
<td>Orion</td>
<td>Orion</td>
<td>Orion</td>
<td>Orion</td>
<td>Orion</td>
<td>Orion</td>
</tr>
<tr>
<td>Lyra</td>
<td>Lyra</td>
<td>Lyra</td>
<td>Lyra</td>
<td>Lyra</td>
<td>Lyra</td>
<td>Lyra</td>
<td>Lyra</td>
<td>Lyra</td>
<td>Lyra</td>
<td>Lyra</td>
<td>Lyra</td>
</tr>
<tr>
<td>Aquarius</td>
<td>Aquarius</td>
<td>Aquarius</td>
<td>Aquarius</td>
<td>Aquarius</td>
<td>Aquarius</td>
<td>Aquarius</td>
<td>Aquarius</td>
<td>Aquarius</td>
<td>Aquarius</td>
<td>Aquarius</td>
<td>Aquarius</td>
</tr>
<tr>
<td>Pisces</td>
<td>Pisces</td>
<td>Pisces</td>
<td>Pisces</td>
<td>Pisces</td>
<td>Pisces</td>
<td>Pisces</td>
<td>Pisces</td>
<td>Pisces</td>
<td>Pisces</td>
<td>Pisces</td>
<td>Pisces</td>
</tr>
<tr>
<td>Gemini</td>
<td>Gemini</td>
<td>Gemini</td>
<td>Gemini</td>
<td>Gemini</td>
<td>Gemini</td>
<td>Gemini</td>
<td>Gemini</td>
<td>Gemini</td>
<td>Gemini</td>
<td>Gemini</td>
<td>Gemini</td>
</tr>
<tr>
<td>Orion</td>
<td>Orion</td>
<td>Orion</td>
<td>Orion</td>
<td>Orion</td>
<td>Orion</td>
<td>Orion</td>
<td>Orion</td>
<td>Orion</td>
<td>Orion</td>
<td>Orion</td>
<td>Orion</td>
</tr>
<tr>
<td>Lyra</td>
<td>Lyra</td>
<td>Lyra</td>
<td>Lyra</td>
<td>Lyra</td>
<td>Lyra</td>
<td>Lyra</td>
<td>Lyra</td>
<td>Lyra</td>
<td>Lyra</td>
<td>Lyra</td>
<td>Lyra</td>
</tr>
<tr>
<td>Aquarius</td>
<td>Aquarius</td>
<td>Aquarius</td>
<td>Aquarius</td>
<td>Aquarius</td>
<td>Aquarius</td>
<td>Aquarius</td>
<td>Aquarius</td>
<td>Aquarius</td>
<td>Aquarius</td>
<td>Aquarius</td>
<td>Aquarius</td>
</tr>
<tr>
<td>Pisces</td>
<td>Pisces</td>
<td>Pisces</td>
<td>Pisces</td>
<td>Pisces</td>
<td>Pisces</td>
<td>Pisces</td>
<td>Pisces</td>
<td>Pisces</td>
<td>Pisces</td>
<td>Pisces</td>
<td>Pisces</td>
</tr>
<tr>
<td>Gemini</td>
<td>Gemini</td>
<td>Gemini</td>
<td>Gemini</td>
<td>Gemini</td>
<td>Gemini</td>
<td>Gemini</td>
<td>Gemini</td>
<td>Gemini</td>
<td>Gemini</td>
<td>Gemini</td>
<td>Gemini</td>
</tr>
<tr>
<td>Orion</td>
<td>Orion</td>
<td>Orion</td>
<td>Orion</td>
<td>Orion</td>
<td>Orion</td>
<td>Orion</td>
<td>Orion</td>
<td>Orion</td>
<td>Orion</td>
<td>Orion</td>
<td>Orion</td>
</tr>
<tr>
<td>Lyra</td>
<td>Lyra</td>
<td>Lyra</td>
<td>Lyra</td>
<td>Lyra</td>
<td>Lyra</td>
<td>Lyra</td>
<td>Lyra</td>
<td>Lyra</td>
<td>Lyra</td>
<td>Lyra</td>
<td>Lyra</td>
</tr>
<tr>
<td>Aquarius</td>
<td>Aquarius</td>
<td>Aquarius</td>
<td>Aquarius</td>
<td>Aquarius</td>
<td>Aquarius</td>
<td>Aquarius</td>
<td>Aquarius</td>
<td>Aquarius</td>
<td>Aquarius</td>
<td>Aquarius</td>
<td>Aquarius</td>
</tr>
<tr>
<td>Pisces</td>
<td>Pisces</td>
<td>Pisces</td>
<td>Pisces</td>
<td>Pisces</td>
<td>Pisces</td>
<td>Pisces</td>
<td>Pisces</td>
<td>Pisces</td>
<td>Pisces</td>
<td>Pisces</td>
<td>Pisces</td>
</tr>
<tr>
<td>Gemini</td>
<td>Gemini</td>
<td>Gemini</td>
<td>Gemini</td>
<td>Gemini</td>
<td>Gemini</td>
<td>Gemini</td>
<td>Gemini</td>
<td>Gemini</td>
<td>Gemini</td>
<td>Gemini</td>
<td>Gemini</td>
</tr>
<tr>
<td>Orion</td>
<td>Orion</td>
<td>Orion</td>
<td>Orion</td>
<td>Orion</td>
<td>Orion</td>
<td>Orion</td>
<td>Orion</td>
<td>Orion</td>
<td>Orion</td>
<td>Orion</td>
<td>Orion</td>
</tr>
<tr>
<td>Lyra</td>
<td>Lyra</td>
<td>Lyra</td>
<td>Lyra</td>
<td>Lyra</td>
<td>Lyra</td>
<td>Lyra</td>
<td>Lyra</td>
<td>Lyra</td>
<td>Lyra</td>
<td>Lyra</td>
<td>Lyra</td>
</tr>
<tr>
<td>Aquarius</td>
<td>Aquarius</td>
<td>Aquarius</td>
<td>Aquarius</td>
<td>Aquarius</td>
<td>Aquarius</td>
<td>Aquarius</td>
<td>Aquarius</td>
<td>Aquarius</td>
<td>Aquarius</td>
<td>Aquarius</td>
<td>Aquarius</td>
</tr>
<tr>
<td>Pisces</td>
<td>Pisces</td>
<td>Pisces</td>
<td>Pisces</td>
<td>Pisces</td>
<td>Pisces</td>
<td>Pisces</td>
<td>Pisces</td>
<td>Pisces</td>
<td>Pisces</td>
<td>Pisces</td>
<td>Pisces</td>
</tr>
<tr>
<td>Gemini</td>
<td>Gemini</td>
<td>Gemini</td>
<td>Gemini</td>
<td>Gemini</td>
<td>Gemini</td>
<td>Gemini</td>
<td>Gemini</td>
<td>Gemini</td>
<td>Gemini</td>
<td>Gemini</td>
<td>Gemini</td>
</tr>
<tr>
<td>Orion</td>
<td>Orion</td>
<td>Orion</td>
<td>Orion</td>
<td>Orion</td>
<td>Orion</td>
<td>Orion</td>
<td>Orion</td>
<td>Orion</td>
<td>Orion</td>
<td>Orion</td>
<td>Orion</td>
</tr>
<tr>
<td>Lyra</td>
<td>Lyra</td>
<td>Lyra</td>
<td>Lyra</td>
<td>Lyra</td>
<td>Lyra</td>
<td>Lyra</td>
<td>Lyra</td>
<td>Lyra</td>
<td>Lyra</td>
<td>Lyra</td>
<td>Lyra</td>
</tr>
<tr>
<td>Aquarius</td>
<td>Aquarius</td>
<td>Aquarius</td>
<td>Aquarius</td>
<td>Aquarius</td>
<td>Aquarius</td>
<td>Aquarius</td>
<td>Aquarius</td>
<td>Aquarius</td>
<td>Aquarius</td>
<td>Aquarius</td>
<td>Aquarius</td>
</tr>
<tr>
<td>Pisces</td>
<td>Pisces</td>
<td>Pisces</td>
<td>Pisces</td>
<td>Pisces</td>
<td>Pisces</td>
<td>Pisces</td>
<td>Pisces</td>
<td>Pisces</td>
<td>Pisces</td>
<td>Pisces</td>
<td>Pisces</td>
</tr>
<tr>
<td>Gemini</td>
<td>Gemini</td>
<td>Gemini</td>
<td>Gemini</td>
<td>Gemini</td>
<td>Gemini</td>
<td>Gemini</td>
<td>Gemini</td>
<td>Gemini</td>
<td>Gemini</td>
<td>Gemini</td>
<td>Gemini</td>
</tr>
<tr>
<td>Orion</td>
<td>Orion</td>
<td>Orion</td>
<td>Orion</td>
<td>Orion</td>
<td>Orion</td>
<td>Orion</td>
<td>Orion</td>
<td>Orion</td>
<td>Orion</td>
<td>Orion</td>
<td>Orion</td>
</tr>
<tr>
<td>Lyra</td>
<td>Lyra</td>
<td>Lyra</td>
<td>Lyra</td>
<td>Lyra</td>
<td>Lyra</td>
<td>Lyra</td>
<td>Lyra</td>
<td>Lyra</td>
<td>Lyra</td>
<td>Lyra</td>
<td>Lyra</td>
</tr>
<tr>
<td>Aquarius</td>
<td>Aquarius</td>
<td>Aquarius</td>
<td>Aquarius</td>
<td>Aquarius</td>
<td>Aquarius</td>
<td>Aquarius</td>
<td>Aquarius</td>
<td>Aquarius</td>
<td>Aquarius</td>
<td>Aquarius</td>
<td>Aquarius</td>
</tr>
<tr>
<td>Pisces</td>
<td>Pisces</td>
<td>Pisces</td>
<td>Pisces</td>
<td>Pisces</td>
<td>Pisces</td>
<td>Pisces</td>
<td>Pisces</td>
<td>Pisces</td>
<td>Pisces</td>
<td>Pisces</td>
<td>Pisces</td>
</tr>
<tr>
<td>Gemini</td>
<td>Gemini</td>
<td>Gemini</td>
<td>Gemini</td>
<td>Gemini</td>
<td>Gemini</td>
<td>Gemini</td>
<td>Gemini</td>
<td>Gemini</td>
<td>Gemini</td>
<td>Gemini</td>
<td>Gemini</td>
</tr>
</tbody>
</table>