Planetary Astronomy Lab

Orbital Positions of the Planets

As we continue our study of the planets of the solar system it will be useful to become familiar with how astronomers keep track of the positions of these objects in the sky. From our moving vantage point on the Earth, we see the planets apparently moving one way and the other across the heavens. Occasionally, These planets come into special alignments with the Sun. In this lab exercise, you will plotting the positions of the planets for the current date to reinforce the concepts of planetary alignment To do this, you will be given the heliocentric longitude of each of the planets, including Earth

First,. an introduction to the various names of the possible planetary alignments

Inferior conjunction - is that alignment for an inferior planet such as Mercury or Venus. Where the planet moves into a position between the Earth and the Sun

Superior conjunction - is that alignment when the inferior planet is exactly on the opposite side of the Sun. That is to say that the Earth, Sun, and Planet are in line, in that order.

Conjunction - Is the term usually reserved for superior planets such as Mars and Jupiter when they pass on the far side the Sun It is technically a superior conjunction. but since it is the only kind of conjunction possible for a superior planet, we just say "conjunction".

Opposition - may only happen with superior planets. It is that situation where the planet such as Saturn, Is seen to be 180 degrees away from the Sun in the sky. Note that a superior planet is closest to the Sun at the time of opposition.

Elongation is a general term meaning the number of degrees between a Line drawn from the Earth to the Sun, and a line drawn from the Earth to the planet When a planet is in conjunction with the Sun, its elongation is said to be equal to zero degrees. When a planet is in opposition, its elongation is said to be equal to one hundred eighty degrees.

The heliocentric coordinate system which you will be using is centered on the Sun In it, planets travel around the Sun in their orbits, sweeping out a certain number of degrees from the starting point That starting point of measurements is in the direction of the good old vernal equinox Objects in the direction off a, the right in your diagrams then, have heliocentric longitudes of zero degrees. By the way. there is another measure in the heliocentric coordinate system which we will not pre in this

lab. It is the heliocentric latitude of an object This it a measure of bow far above or below the plane of the ecliptic an object may be found since most of the planets' orbits we tilted with respect to the ecliptic by a fairly small angle we will ignore the heliocentric latitude of the planets.

Now you are ready to place the positions of the planets on your diagrams. You have two diagrams included in this lab exercise The first one shows the orbits of the inner planets including Mercury, Venus, Earth and Mars The other diagram shows the orbits of the outer planets. Note that the overlying coordinate system is centered on the Sun. Notice rise that the direction to the right is marked as zero degrees and has the little symbol for the vernal equinox.

Orbital Positions of the Planets

Name _____

1. Which planet will be in opposition next?

_____

2. In what planetary alignment is Mercury seen on the first day of October of this year?

_____

3. Will Mercury be in the morning or evening sky in one month?

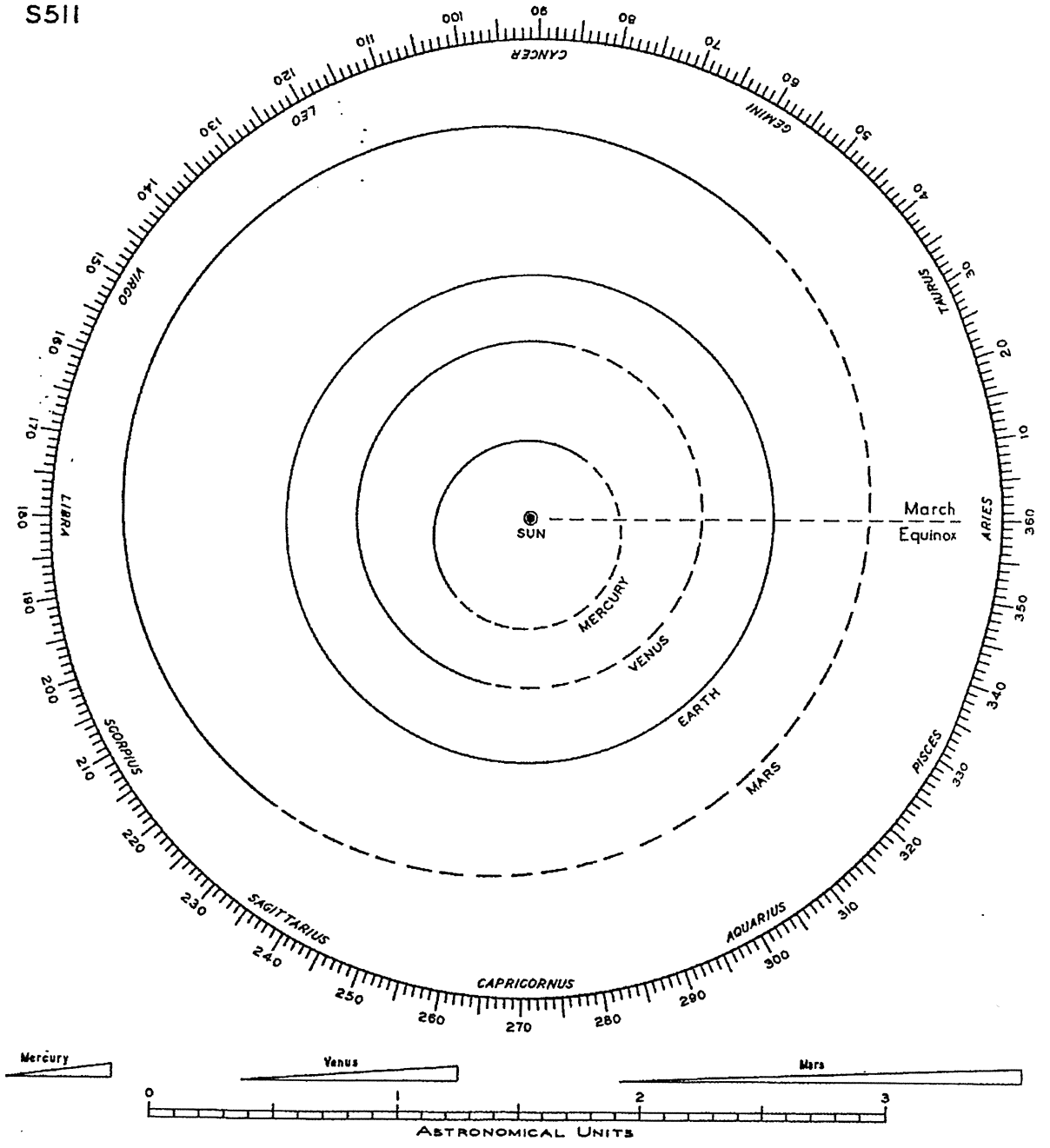
4. How many degrees away from the Sun do we see Venus in early October?

_____

5. What planet is closest to Earth on December 1st, and how many A.U.'s is that distance?

_____

INNER PLANETS
CURTATE ORBITS
S511



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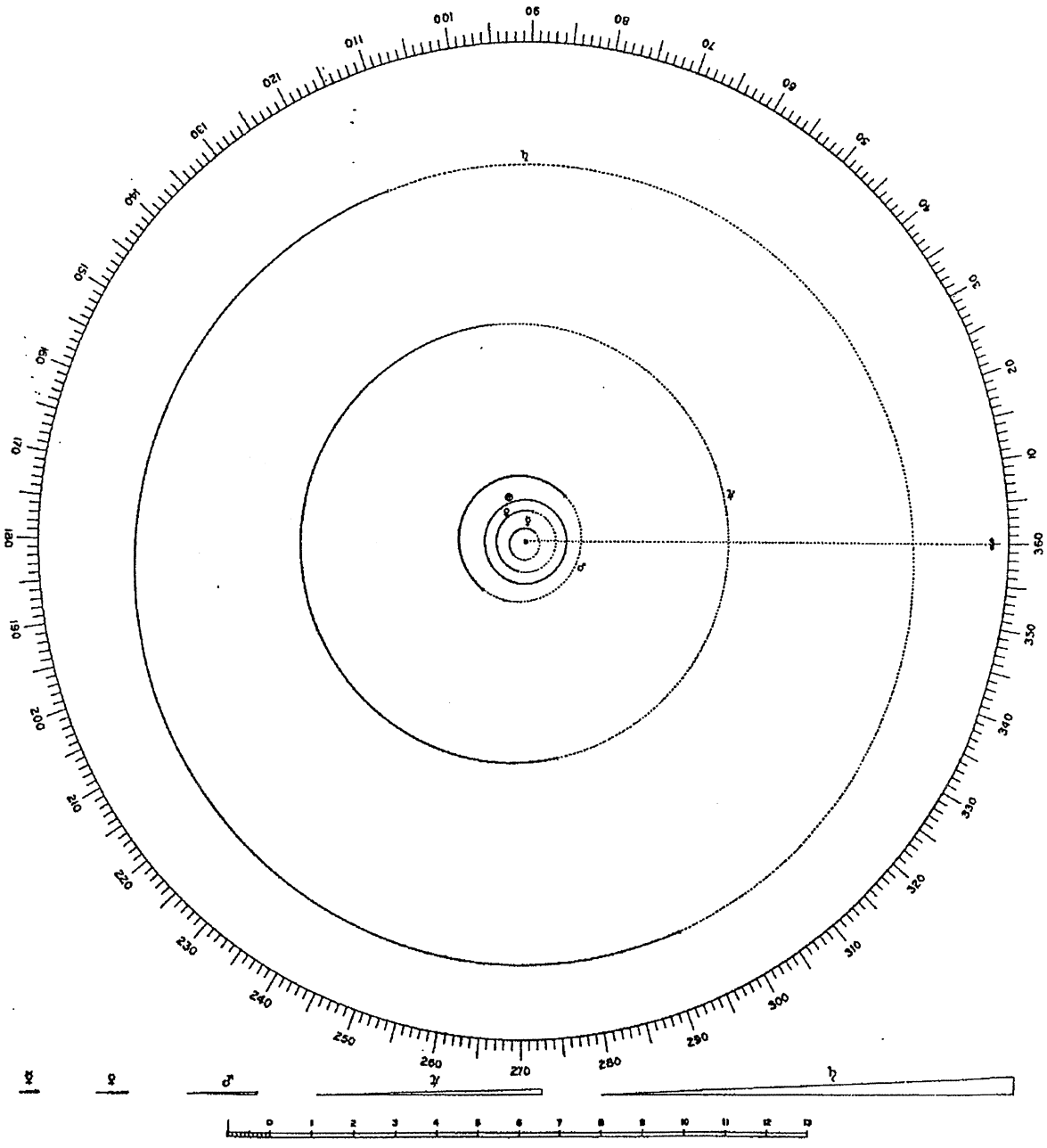
S512 OUTER PLANET CHART

CURTATE ORBITS—OUTER PLANETS



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PLANETARY HELIOCENTRIC LONGITUDES
2017

The **heliocentric longitude** of a planet is the angle between the vernal equinox and the planet, as seen from the Sun. It is measured in the ecliptic plane, in the direction of the orbital motion of the planet (counterclockwise as viewed from the north side of the ecliptic plane). Knowing the heliocentric longitudes and the distances of the planets from the Sun, one can construct a diagram or model showing the relative orientations of the Sun and planets on any date.

Universal Time	Mercury	Venus	Earth	Mars	Jupiter	Saturn	Uranus	Neptune	Pluto
Jan. 1.0	117°	050°	101°	016°	191°	260°	023°	341°	287°
Feb. 1.0	239°	100°	132°	035°	193°	260°	024°	342°	287°
Mar. 1.0	323°	145°	161°	051°	195°	261°	024°	342°	287°
Apr. 1.0	129°	196°	191°	068°	198°	262°	024°	342°	288°
May 1.0	242°	244°	221°	083°	200°	263°	025°	342°	288°
June 1.0	338°	293°	251°	098°	202°	264°	025°	342°	288°
July 1.0	145°	340°	279°	112°	205°	265°	025°	342°	288°
Aug. 1.0	253°	030°	309°	126°	207°	266°	026°	343°	288°
Sept. 1.0	356°	079°	339°	140°	209°	267°	026°	343°	288°
Oct. 1.0	164°	128°	008°	153°	212°	268°	026°	343°	289°
Nov. 1.0	264°	178°	039°	167°	214°	269°	027°	343°	289°
Dec. 1.0	010°	227°	069°	180°	216°	270°	027°	343°	289°
Jan. 1.0	181°	276°	100°	194°	219°	271°	027°	344°	289°