Observing the Planets

Name_____

(An indoor lab for 2-3 weeks and an outdoor lab for 2-3 weeks.)

Observing Dates_____ _____ _____

Part I. - Planetary configurations *(computer/indoor)*

Where are the planets tonight? You will be finding their *elongation angle* and their *ecliptic altitude* using a planetarium program. But first some definitions:

Elongation angle = the angle of the planet away from the Sun measured in degrees along the ecliptic. (Project the planet onto the ecliptic first.) Ex) 32º E or 121º W.

Ecliptic altitude = the angle of the planet away from the ecliptic measured in degrees away from nearest point on ecliptic. Ex) 2º N or 5º S.

Part I. - Planetary configurations (cont.)

Special configurations include:

Opposition = when elongation = 180º (E or W)

Conjunction = when elongation of a superior planet = 0º

Superior conjunction = when elongation of an inferior planet is 0º and the planet is on the far side of the Sun

Inferior conjunction = when elongation of an inferior planet is 0º and the planet is on the close side of the Sun

Greatest Eastern/Western elongation = when an inferior planet reaches its greatest elongation angle

Eastern/Western quadrature = when a superior planet has an elongation of 90º E or W.

Part I. - Planetary configurations (cont.)

Find the positions of all of the planets using a planetarium program. Choose a date close to when you think you will observe the planets. Create a table below. Include the altitude above the horizon (this tells you whether the object is "up").

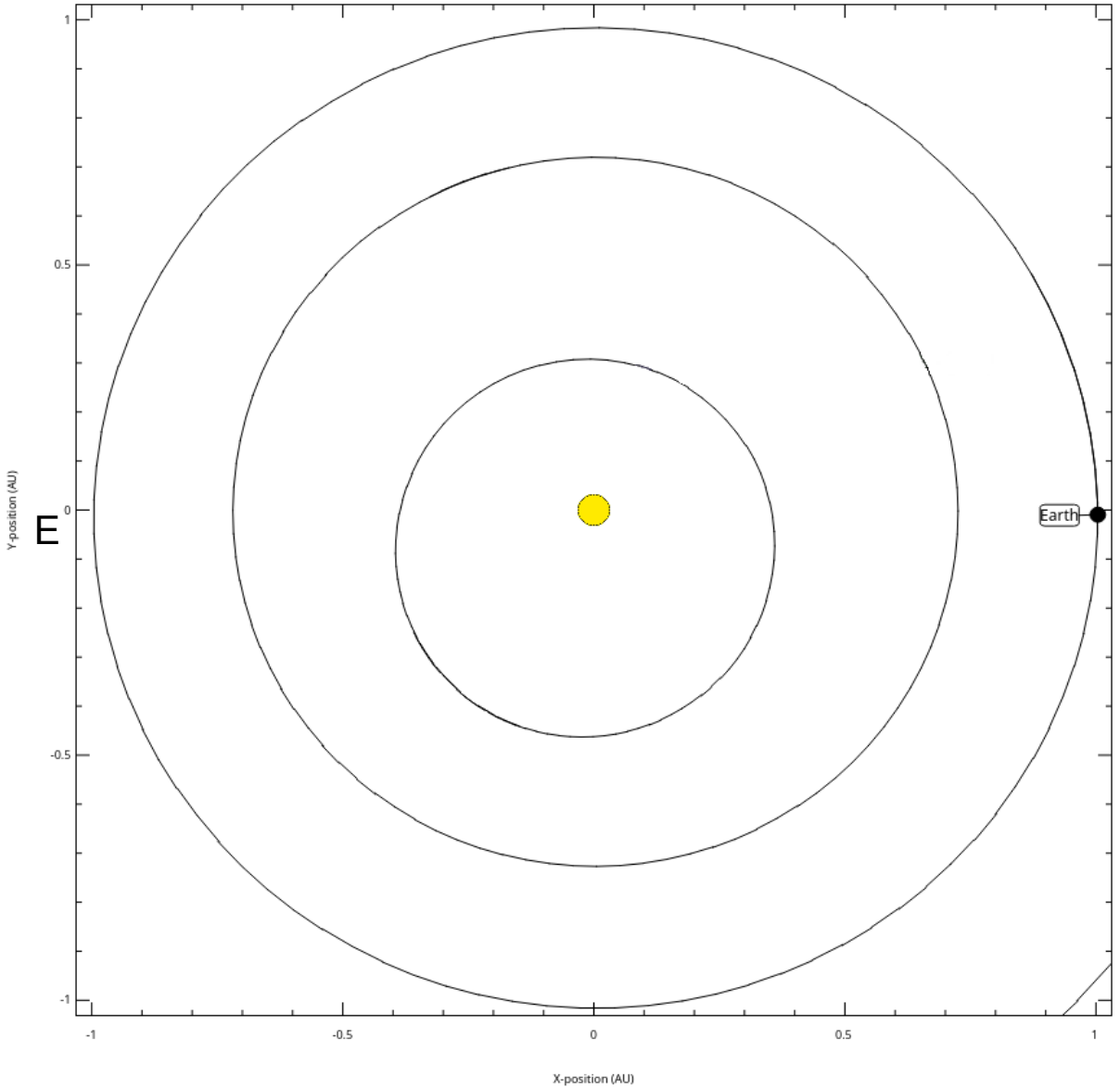
Date & Time: _____(usually 8 pm)

Planet	Elongation	Eclip Alt.	Altitude	Observed Angles?

Part I. - Planetary configurations (cont.)

Draw lines from Earth (E) to the inner planets. Use a protractor and the *elongation angles* from page 3. (There will be 2 points on the orbit for a given elongation angle, so you also need a *distance* from Stellarium.)

Show the inner planets with a dot and a label for the date of _____.

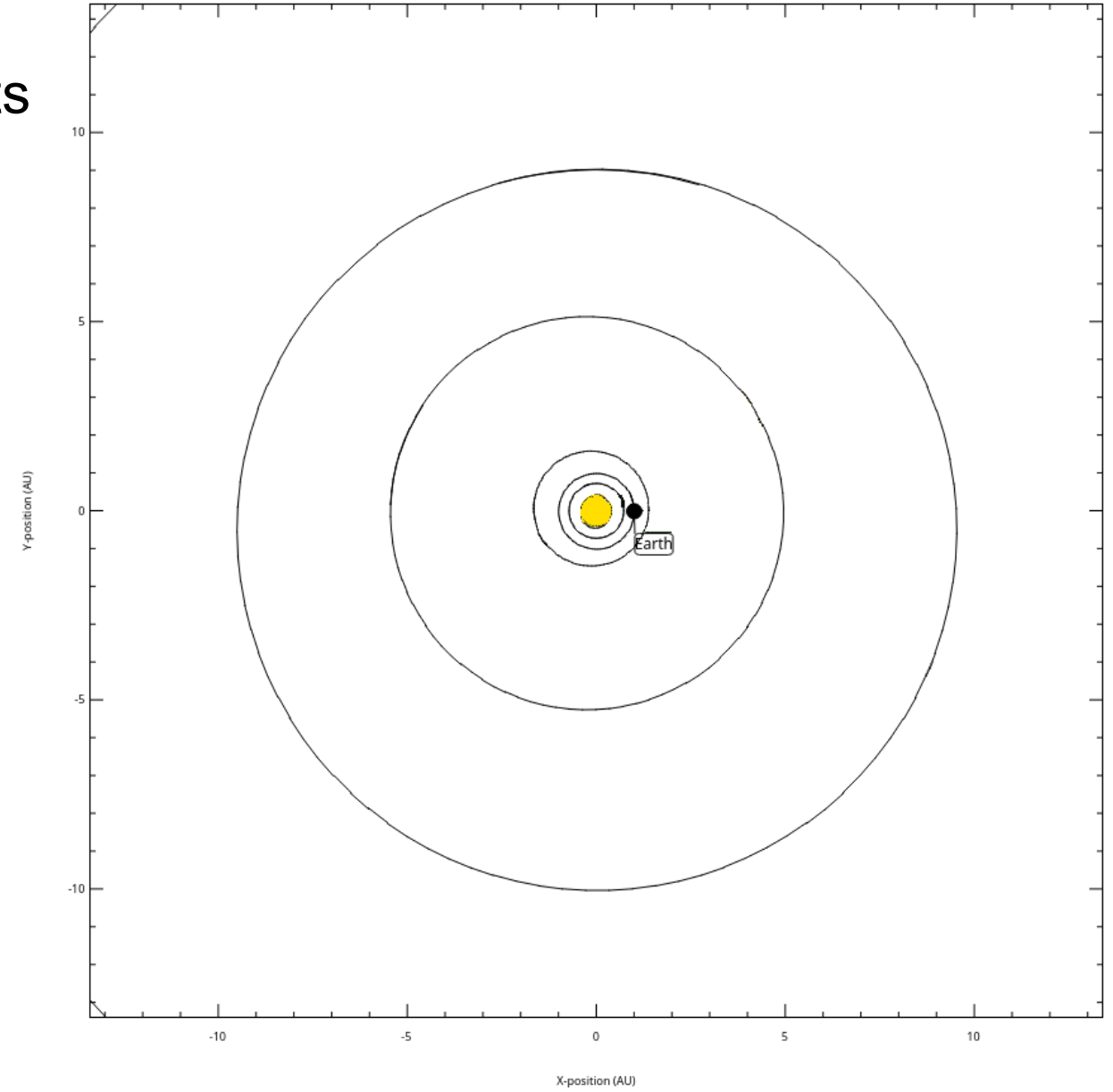


Inferior planets on 9/22/2023. *(From Kstars.)*

Part I. - Planetary configurations (cont.)

Draw the outer planets on their orbits for the date of:

_____



Superior Planets on 9/22/2021.

Part I. - Planetary configurations (cont.)

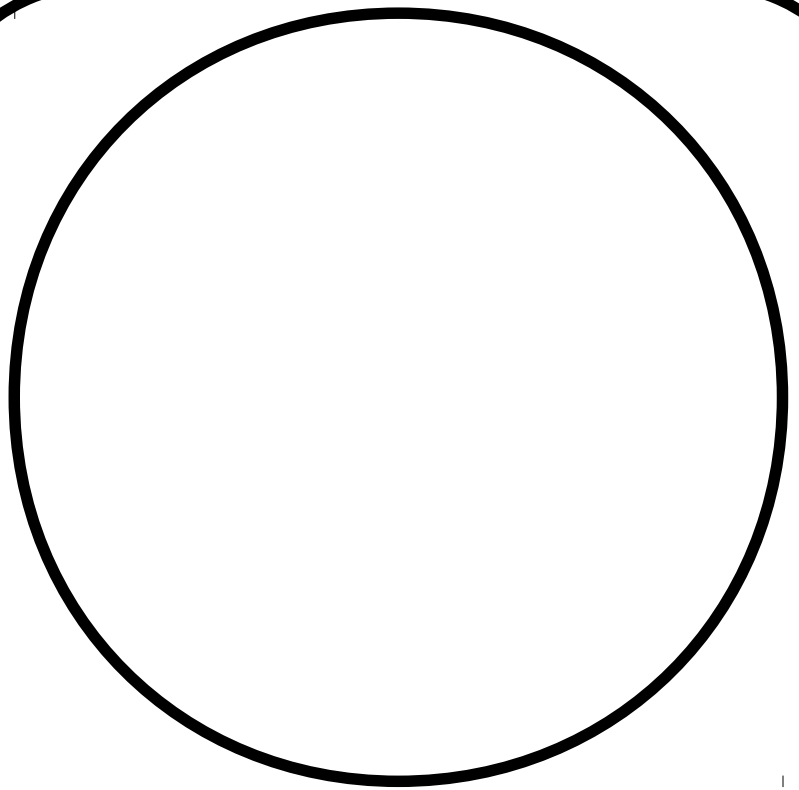
Using the configurations defined previously, show which configuration each planet is closest to.
The choices for inferior planets are:
Inferior conjunction, Superior conjunction, Greatest Eastern Elongation (GEE), Greatest Western Elongation (GWE).
For superior planets choose from:
Conjunction, Opposition, Western Quadrature, Eastern Quadrature.

Mercury _____
Venus _____
Mars _____
Jupiter _____
Saturn _____

Part II. Sketching the planets *(outdoor)*

•Turn on a telescope.
•Find a planet that is up using “goto” capabilities.
•Take out a sketch page (with circular field of view) and clip to clipboard.
•Obtain a reticle eyepiece, if possible, or at least view under high magnification.
•Move the telescope E-W and align the reticle with the E-W direction.
•Draw the planet and the reticle tickmarks in the circle. Use pencil and eraser.
•If needed, inset a blown-up picture of the planet to show surface detail.
•Fill out the other information near the circle. You will need to obtain the reticle scale in arcseconds/tickmark.

Part 2. Sketching the planets (cont.)



Object: Mercury

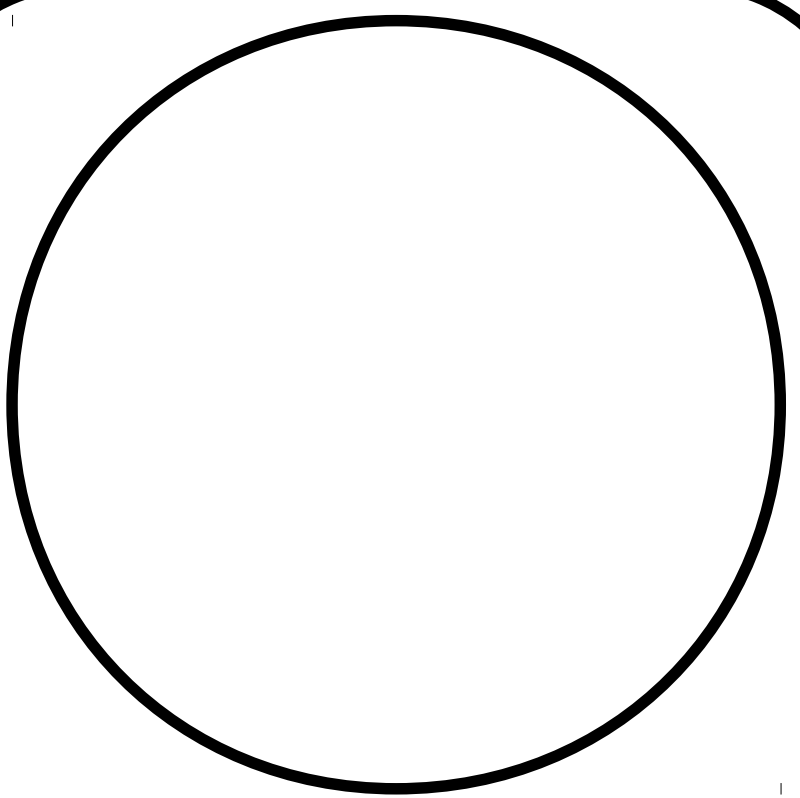
Time: _____

Telescope:_____

Eyepiece:_____

Magnif:___X Diam:_____"

Remarks:



Object: Venus

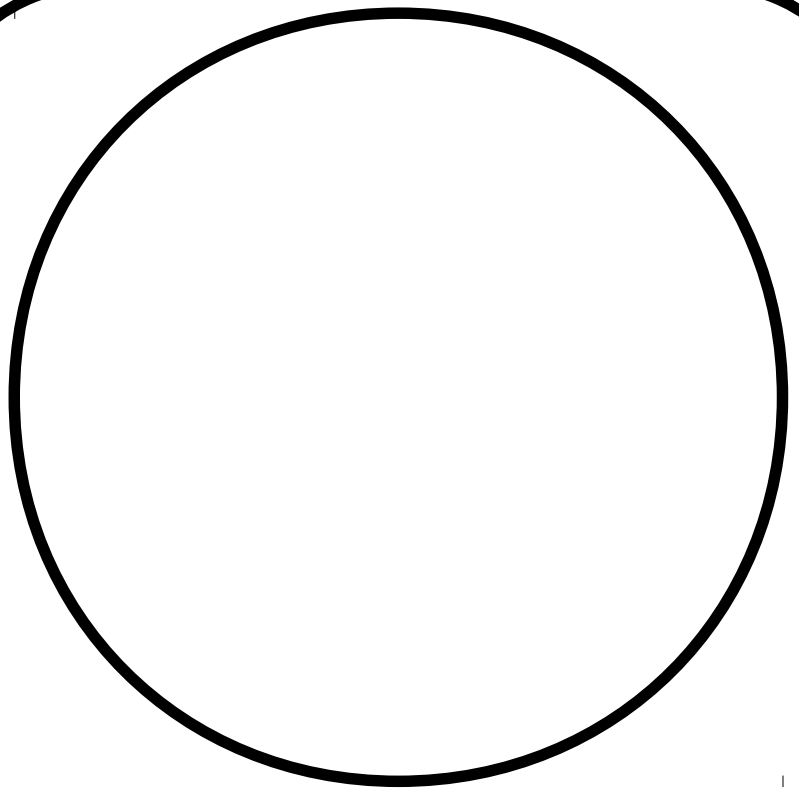
Time: _____

Telescope:_____

Eyepiece:_____

Magnif:_____X Diam:_____"

Remarks:



Object: Mars

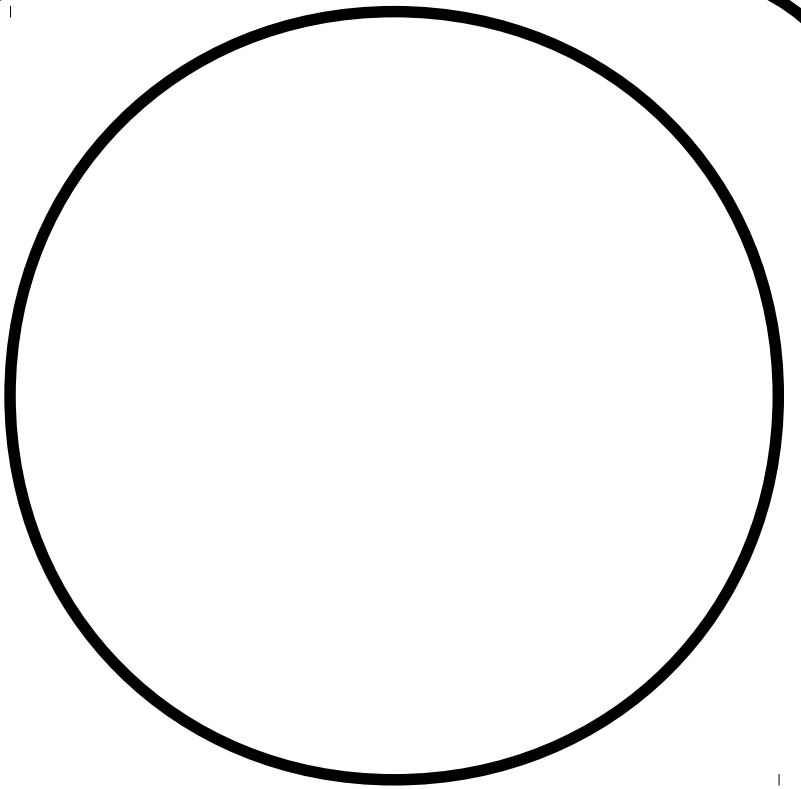
Time: _____

Telescope:_____

Eyepiece:_____

Magnif:____X Diam:_____"

Remarks:



Object:

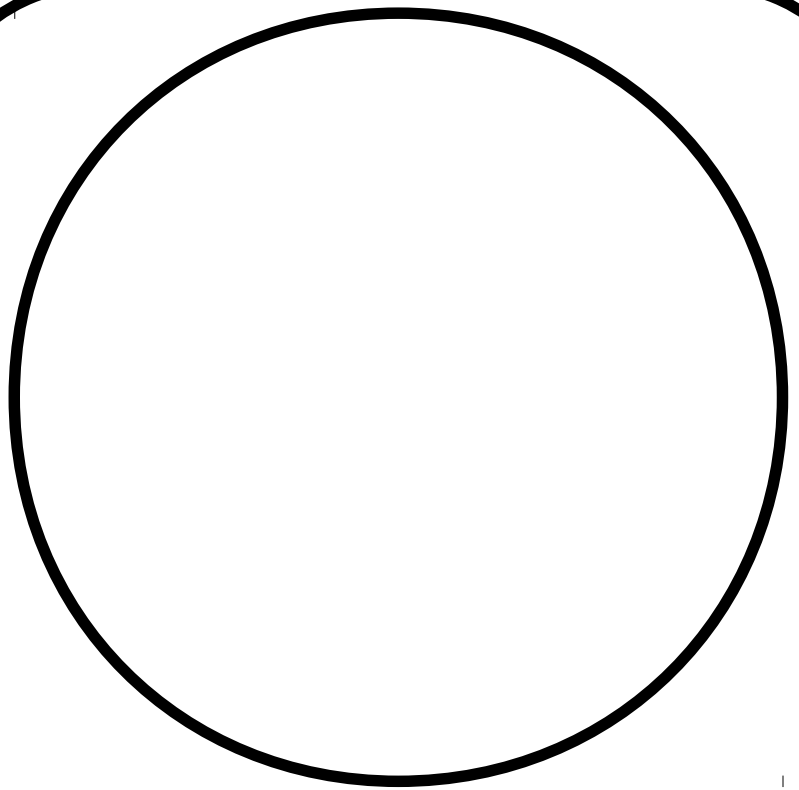
Time: _____

Telescope:_____

Eyepiece:_____

Magnif:____X Diam:_____"

Remarks:



Object: Jupiter

Time: _____

Telescope:_____

Eyepiece:_____

Magnif:_____X Diam:_____"

Remarks:

Object:

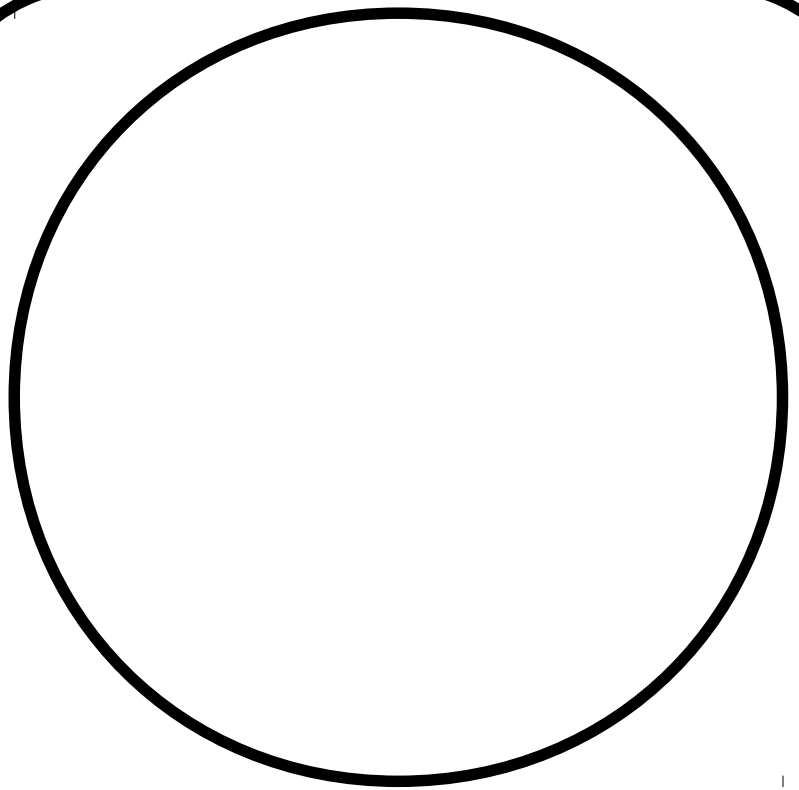
Time: _____

Telescope:_____

Eyepiece:_____

Magnif:____X Diam:_____"

Remarks:



Object: Saturn

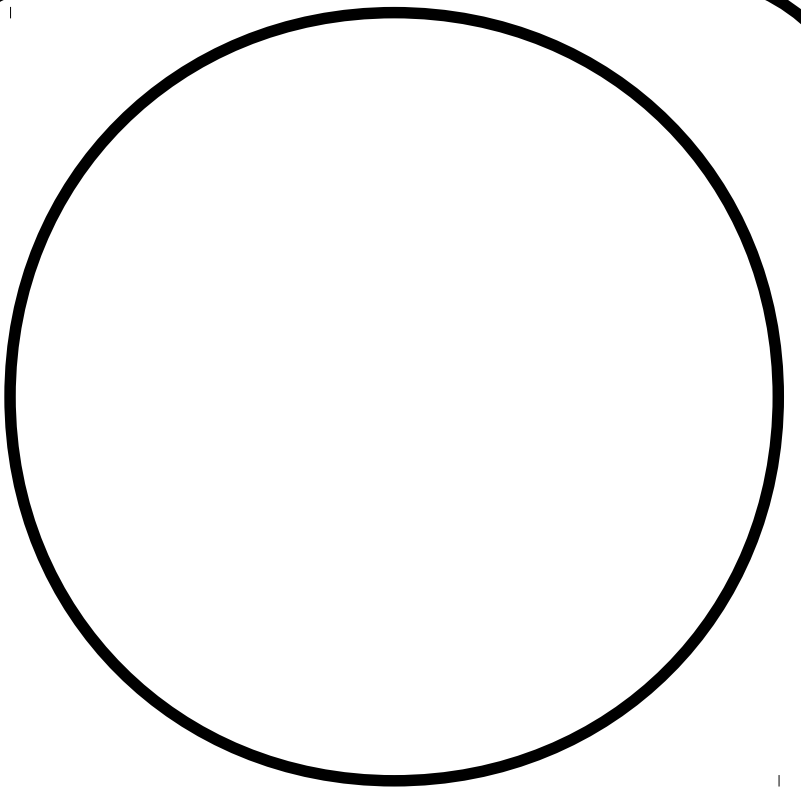
Time: _____

Telescope:_____

Eyepiece:_____

Magnif:____X Diam:_____"

Remarks:



Object:

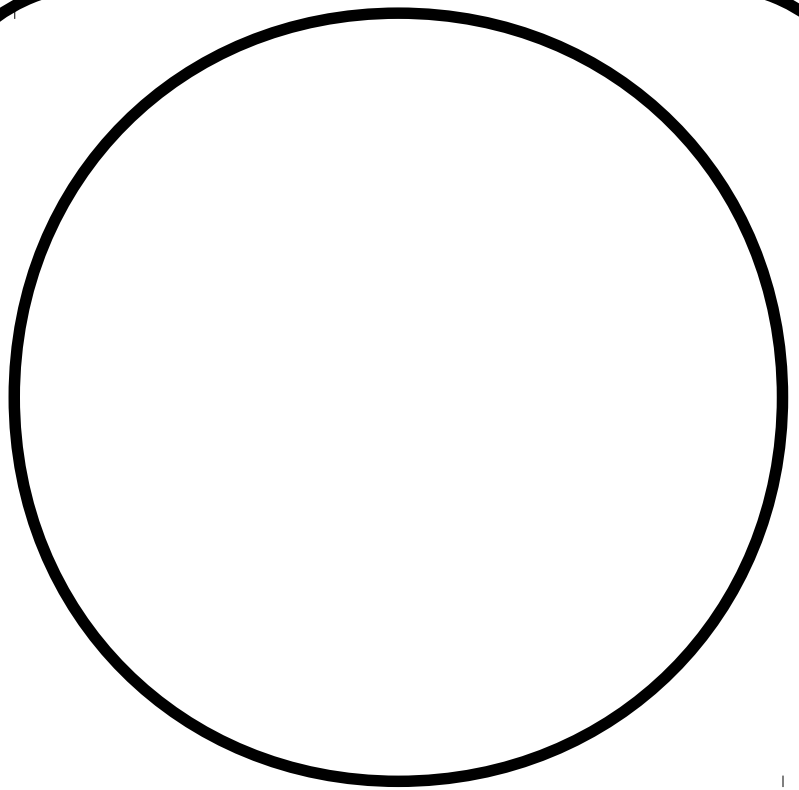
Time: _____

Telescope:_____

Eyepiece:_____

Magnif:____X Diam:_____"

Remarks:



Object: Uranus

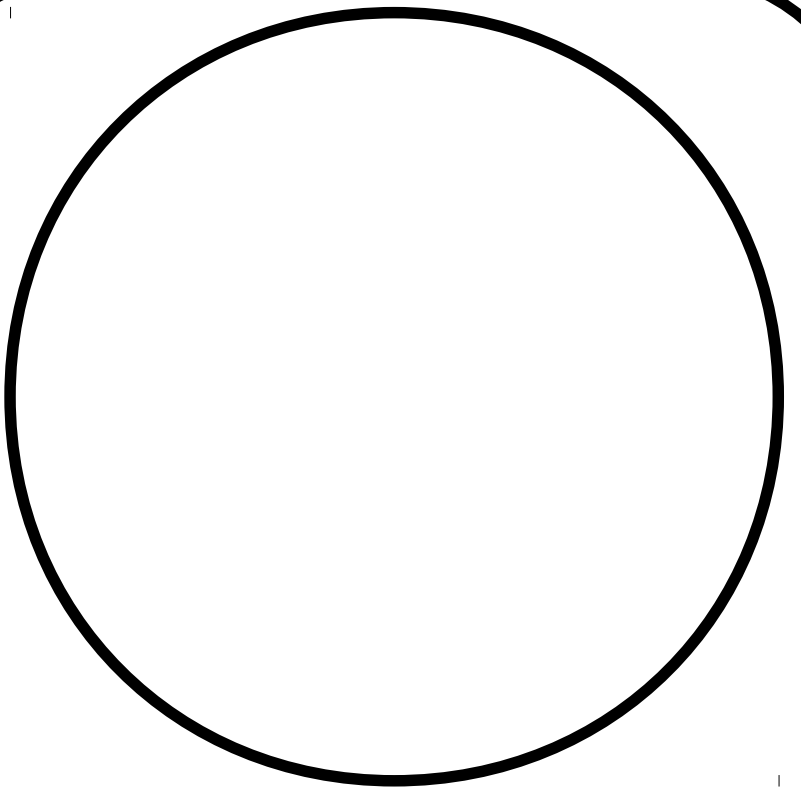
Time: _____

Telescope:_____

Eyepiece:_____

Magnif:_____X Diam:_____"

Remarks:



Object:

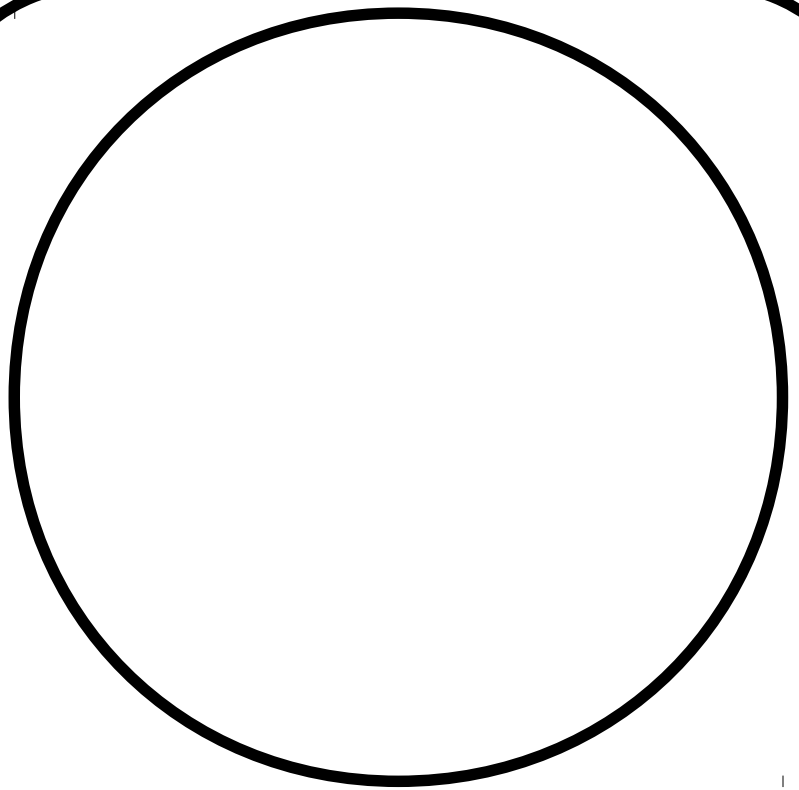
Time: _____

Telescope:_____

Eyepiece:_____

Magnif:____X Diam:_____"

Remarks:



Object: Neptune

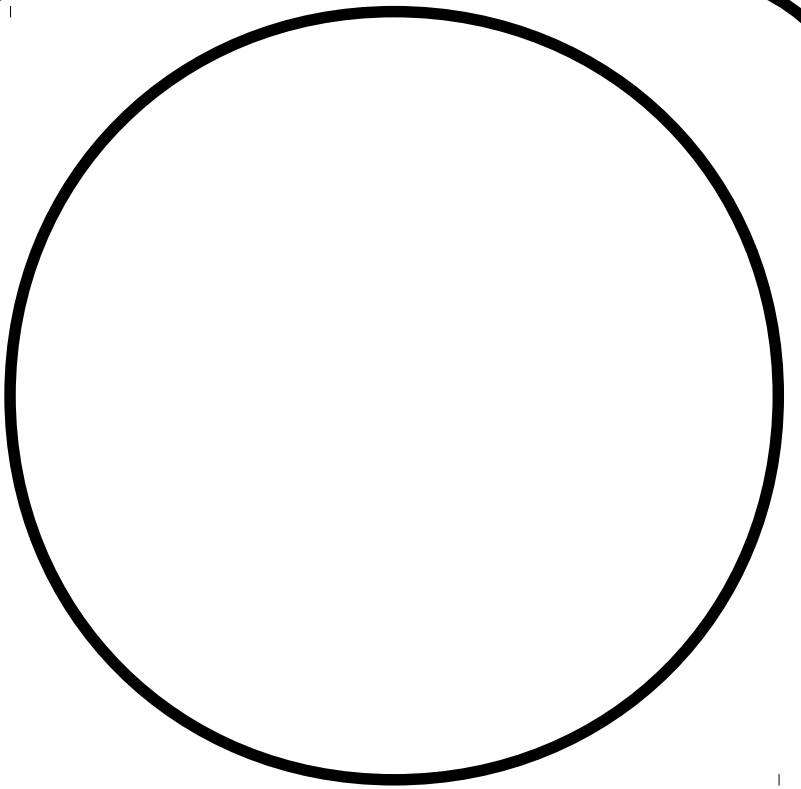
Time: _____

Telescope:_____

Eyepiece:_____

Magnif:____X Diam:_____"

Remarks:



Object:

Time: _____

Telescope:_____

Eyepiece:_____

Magnif:____X Diam:_____"

Remarks:

Part III. Calculations. *(computer/indoor)*

1) Estimate distances to the planets from the Earth using the orbital positions on page 4 and 5. First, figure out the scales in cm/AU on pages 4 and 5. (Use the fact that the Earth's orbit is 1 AU.)

Page 4 scale = _____

Distance to Mercury = _____cm _____ AU
Distance to Venus = _____cm_____ AU

Page 5 scale =_____

Distance to Mars = _____cm_____ AU
Distance to Jupiter = _____cm_____AU
Distance to Saturn = _____cm_____AU

All of these distances are for the date of _____.

Part III. Calculations (cont.) *(computer/indoor)*

The diameters and magnitudes of the planets

2) Fill out the table on p. 16. Leave blank only the values for which you made no measurements. (Everything in the "Look up in text..." columns should be done.)

3) How closely do your angular diameters (θ(″)) compare with the "Looked up" values? (Try to be quantitative.)

4) How closely do your planet diameters (Diam(km)) measured from θ(″) compare with the "Looked up" values? Your Diam(km) will be off if either your measured θ(″) OR your measured Dist(km) is off. Which causes the biggest error? Could it be that your distances are off for Venus or Merc because you choose the wrong point on p. 4?

5) Measure the magnitudes of the inner planets using Stellarium for the night you observed. Run the time forward until the planet has the same elongation, but is located on the opposite side (e.g., if it was on the near side, move it to the far side). Now measure the magnitudes again. How does the brightness of the far away position compare to the brightness of the close position? Try to explain what you find.

Part III. Calculations (cont.) *(computer/indoor)*

Planet	From your measurements				Look up in text, magazine, etc. GIVE THE SOURCE next to "Src".		
	Dist(AU)	Dist(km) (from Earth)	θ(″)	Diam(km)	Dist(km) (from Earth)	θ(″)	Diam(km)
Source:	P. 4,5	=Dist(AU)*1.5e10^8 km/AU	Sketch notes	=θ(″)Dist(km) / 206265	Src:_____ _____	_____ _____	_____ _____
Mercury							
Venus							
Mars							
Jupiter							
Saturn							
Uranus							
Neptune							

Planet	m_V (mag)	$m_{V\_Opposite}$	Is planet brighter when closer?
Source:	Stellarium	Stellarium	
Mercury			
Venus			