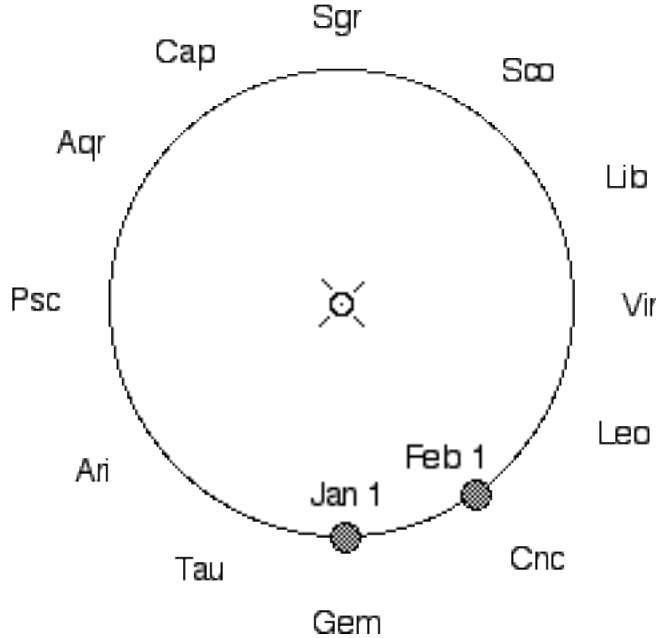


NAME(S) \_\_\_\_\_

SECTION DAY/TIME \_\_\_\_\_

PROBLEM SET #1 ASTRONOMY 20 (LLOYD)

PART I: ANNUAL MOTION OF THE SUN



In the diagram, you are looking down on the north pole of the Sun. Notice the Earth in its orbit.

1. Mark the position of the Earth on the 1st of every month.
2. Is the Earth going around the Sun clockwise or counter-clockwise? \_\_\_\_\_

Beyond the Earth's orbit are the constellations of the zodiac:

- |                 |              |
|-----------------|--------------|
| Sgr Sagittarius | Gem Gemini   |
| Cap Capricornus | Cnc Cancer   |
| Aqr Aquarius    | Leo Leo      |
| Psc Pisces      | Vir Virgo    |
| Ari Aries       | Lib Libra    |
| Tau Taurus      | Sco Scorpius |

3. On January 1, then the Earth (as seen from Sun) is in Gemini.  
 On February 1... \_\_\_\_\_  
 On March 1... \_\_\_\_\_  
 On July 1... \_\_\_\_\_  
 On December 1... \_\_\_\_\_

4. On January 1, then the Sun (as seen from Earth) is in Sagittarius.  
On February 1... \_\_\_\_\_  
On March 1... \_\_\_\_\_  
On July 1... \_\_\_\_\_  
On December 1... \_\_\_\_\_

5. If the Sun is in Leo today then:  
tomorrow it will probably be in \_\_\_\_\_  
in 1 month \_\_\_\_\_  
in 6 months \_\_\_\_\_

6. The Sun is in Capricornus at 6 am on February 1.  
It is in \_\_\_\_\_ at 12 noon on February 1.  
\_\_\_\_\_ at 6 pm on February 1.  
\_\_\_\_\_ at 12 midnight on February 2.  
\_\_\_\_\_ at 12 midnight on March 2.

7. **Carefully explain** your answer to question 6 in a complete sentence or two.

## PART II. INFERIOR PLANETS

The diagram on the previous page shows the Earth and "Venus" every 30 days. The Sun is in the center. "Venus" is the inner planet (this "Venus" is a planet similar to the real Venus, but somewhat simplified for this exercise.) Earth is the outer planet.

Use a protractor to measure the Sun–Earth–Venus angle on each date. Note that on Jan. 1 of the first year, "Venus" is exactly between the Earth and the Sun (inferior conjunction) so the angle is  $0^\circ$ .

1) Start by drawing a line from the Earth (on Feb. 1) to the Sun, and then a line from the Earth to "Venus" on Feb 1. Measure the angle between the lines with a protractor and write it near the Earth. *Hint:* the angle will never be greater than  $45^\circ$ . **Be sure to connect the Earth with the right Venus.**

2) Repeat for Mar. 1. thru the following Feb. 1. Record in the table below.

Jan 1	$0^\circ$	Aug 1	
Feb 1	$25^\circ$	Sep 1	
Mar 1		Oct 1	
Apr 1		Nov 1	
May 1		Dec 1	
Jun 1		Jan 1	
Jul 1		Feb 1	

1a. On what date is the angle between "Venus" and the Sun (as seen from Earth) the greatest? Label this date **maximum elongation**.

1b. On this date is "Venus" to the east (left) or the west (right) of the Sun?

1c. Will it rise before or after the Sun? That is, will you be able to see it in the morning sky before dawn or the evening sky after sunset?

2. On what date will the Sun be EXACTLY between "Venus" and the Earth? Label this date **superior conjunction**.

3a. How many months is it from inferior conjunction to superior conjunction?

3b. How many months is it from *superior* conjunction to the next *inferior* conjunction?

3c. How many months is it from one inferior conjunction to the next inferior conjunction?

This number is the **synodic period** of "Venus", the time from inferior conjunction to the next inferior conjunction.

4. How many months does it take "Venus" to go around the Sun? (This is the **sidereal period** of "Venus", the Venus "year".) *Hint: count the months.*

5a. Which planet is faster, "Venus" or Earth?

5b. After inferior conjunction, which planet will catch up with the other?

6. In a paragraph, explain why "Venus" takes longer to catch up with the Earth than it does to go around the Sun. In other words, why is the time from inferior conjunction to the next inferior conjunction more than its "year"?

(29 September 2017)