SETI INSTITUTE

Mission 7
Expecting Other Planetary Systems

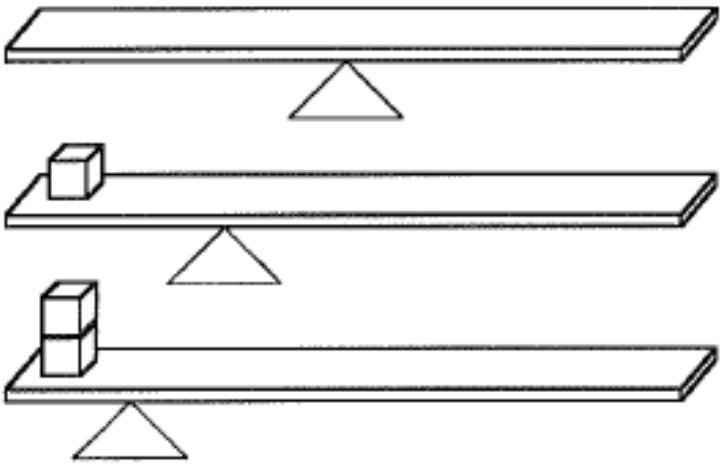
Center of Mass–Worksheet

Name: _____ Date: _____

You will use your meter stick and weights to make center of mass measurements. The center of mass is the point at which both sides of the meter stick will balance. Start by measuring the center of mass of the meter stick without any additional mass on it. The center of mass should be in the middle, at the 50 cm mark. Each side of the meter stick has equal mass. The meter stick's mass has no effect in the following measurements.

Next add one unit of mass (*e.g.*, one eraser or other object) to the meter stick as close to one end as possible and a mass unit close to the other end. Record your new center of mass measurement. Repeat this by adding to one end only one more mass unit, then another, then another.

Figure 7.6.



Center of mass:								
Measurement:	# 1		# 2		# 3		# 4	
Number of units at each end	1	1	2	1	3	1	4	1

Graph your data on the grid below. Each measurement is one data point. Put the units of mass (erasers or grams) on the x-axis, and units of distance (cm) on the y-axis.

Table 7.1.

1. On your “Data Points” worksheet, draw a diagram describing what the orbit of the two objects would look like for each of your four data points. The intersection of the two lines represents the location of the center of mass. Data point # 1 is shown as an example. Be sure to draw larger objects when you want to represent more mass. Next, draw the orbit of a single object without a companion.

2. Does the mass of the single object without a companion affect its orbit?

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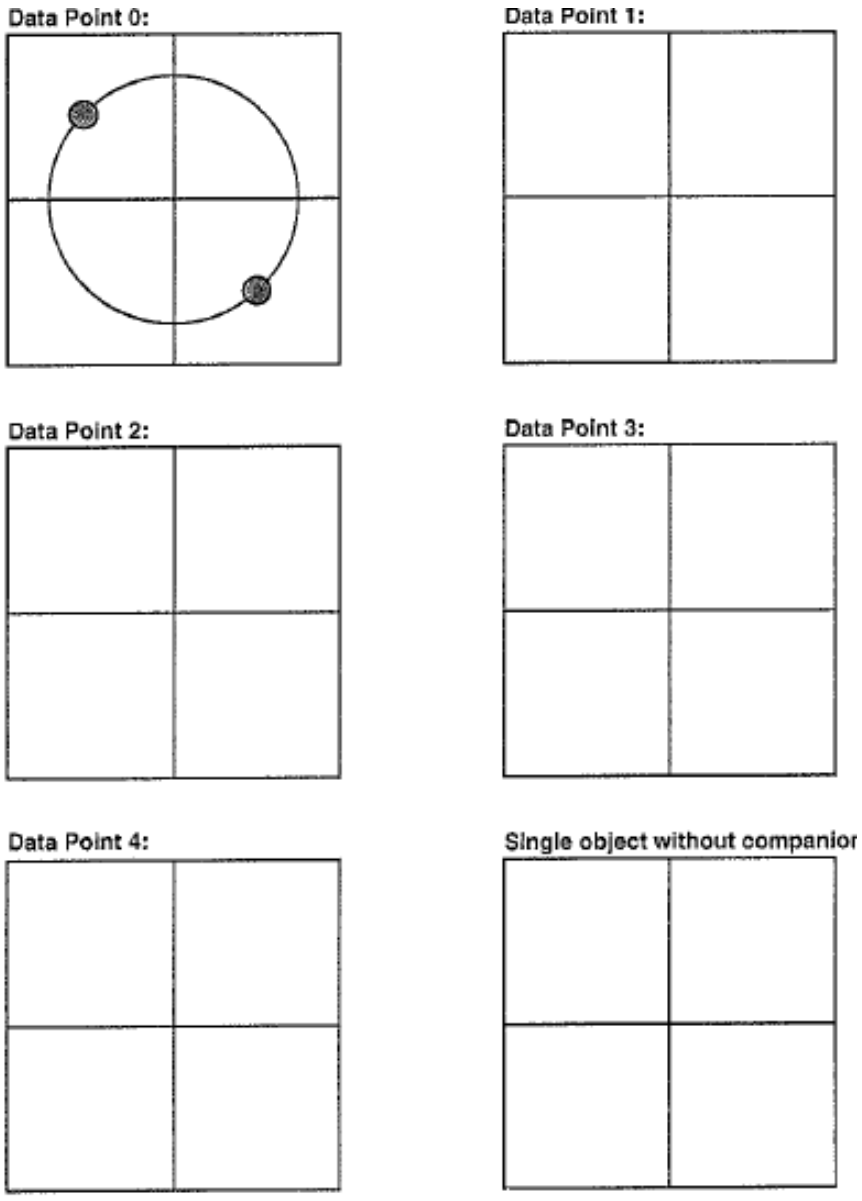
Data Points–Worksheet

Name: _____ Date: _____

Figure 7.7.



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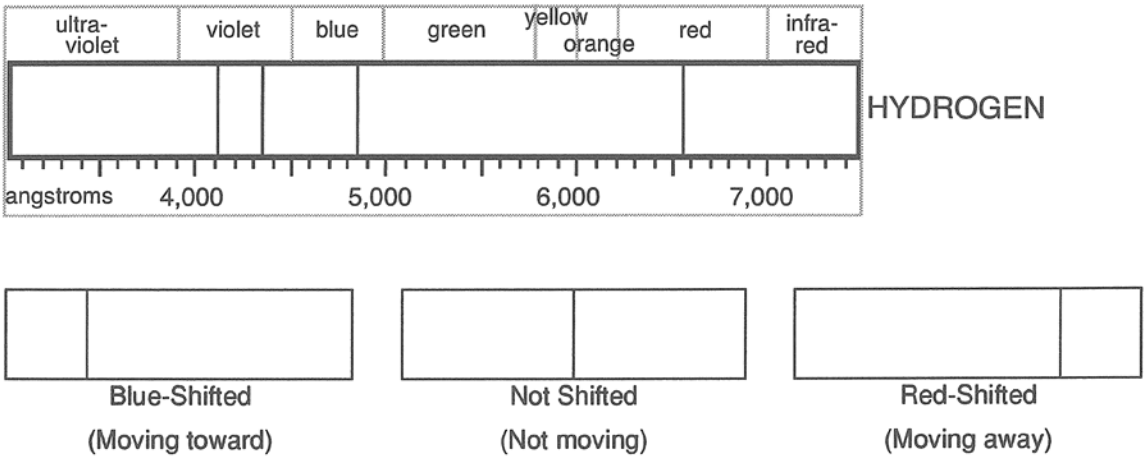
Red Shift, Blue Shift–Worksheet

Name: _____ Date: _____

If we measure the wavelength of a single line of the hydrogen spectrum very carefully, we can tell if it has a Doppler shift caused by a planetary companion. This measurement requires a precision of 10^{-4} Angstroms! If a star is moving away from us, the waves will stretch out and become longer so its light will be "red shifted"; if a star is moving toward us, the waves will compress and become shorter so its light will be "blue shifted." What would a star with a wobble look like to us on Earth?

Figure 7.8a.



The following spectral lines are from three different stars. There are four sets of spectral data for each star, representing four observations taken at different times. Using these data, fill out the table and answer the following questions.

Figure 7.8b. (Lines must be drawn inside of boxes.)

	Star 1	Star 2	Star 3
Observation 1			
Observation 2			
Observation 3			
Observation 4			

Table 7.2.

Star #1	Doppler Shift	Movement of Star
Observation 1		
Observation 2		
Observation 3		
Observation 4		

Star #2	Doppler Shift	Movement of Star
Observation 1		
Observation 2		
Observation 3		
Observation 4		

Star #3	Doppler Shift	Movement of Star
Observation 1		
Observation 2		
Observation 3		
Observation 4		

Logbook

1. Make a general comment about the movement of star # 1:

2. Make a general comment about the movement of star # 2:

3. Make a general comment about the movement of star # 3:

4. Which of these three stars is most likely to have a planet? Why?