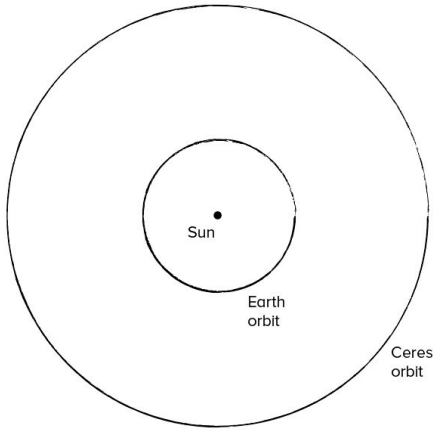
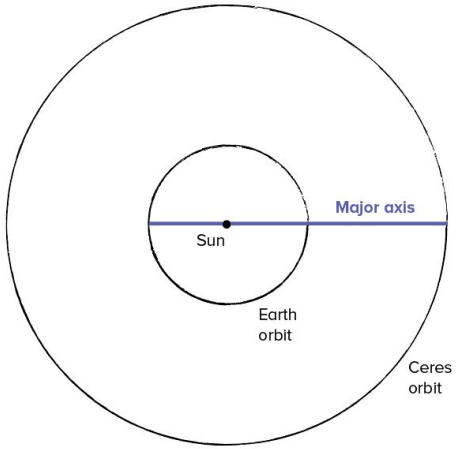
Plan A Hohmann Orbit Transfer

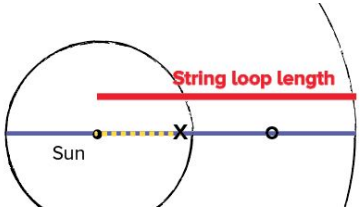
1. Draw Scale Orbits Of Two Objects Orbiting The Sun That You Want To Travel Between *Just like you did in the first half of this activity. Choose two orbits, calculate their scaled size, and draw them, making sure to label the sun, each orbit, and note the size of each orbital radius.*		**Object 1:_____** **Object 1 orbital radius: _____ AU** **Object 2:_____** **Object 2 orbital radius: _____AU**
2. Draw The Major Axis Of Your Hohmann Ellipse *Use a ruler to draw a horizontal line through your solar system illustration, from the far side of one orbit through the sun, to the opposite side of the other orbit. This line spans what will be the widest part of your finished Hohmann ellipse, called the "major axis."*		**The "major" axis is the longer axis across the center of an ellipse, and the "minor" axis is the shorter axis. Why do you think the two axes are given these two different names?**

3. Measure And Label The Features You Need In Order To Draw Your Hohmann Ellipse

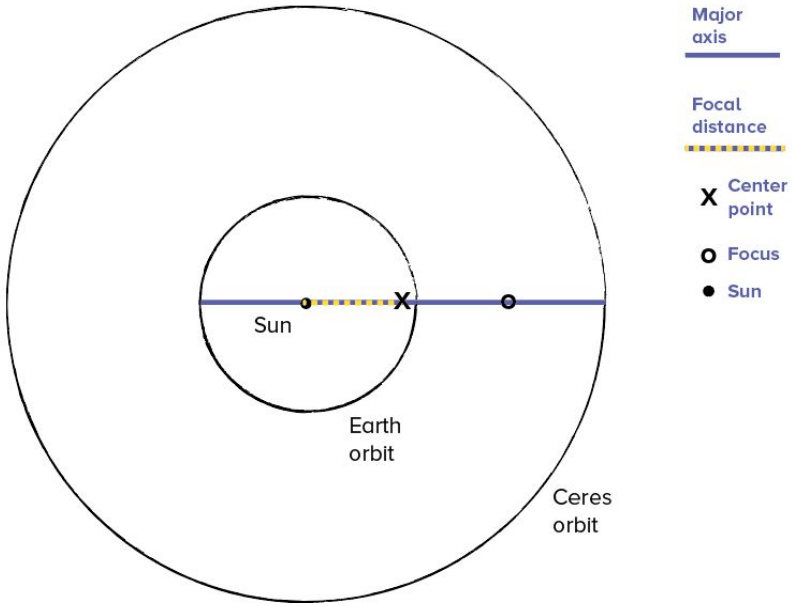
- *Length of the major axis (one orbital radius + the other orbital radius) in AU*
- *Place an "X" at the middle of the major axis*
- *Color and measure the focal distance (distance from the sun to the center point)*
- *Place an "o" at the position of the second focus, located on the opposite side of the center point from the sun, one focal distance from the center point.*

4. Draw The Hohmann Ellipse

Measure a loop of string that when taped or tied reaches from one focus, past the center, to the opposite side of the Hohmann ellipse



Place a pin at the position of the two foci (the sun and the second focus), place your loop over both pins, then draw the ellipse. When you are done, erase or recolor the second half of your Hohmann transfer ellipse—a Hohmann transfer only goes halfway around the sun.



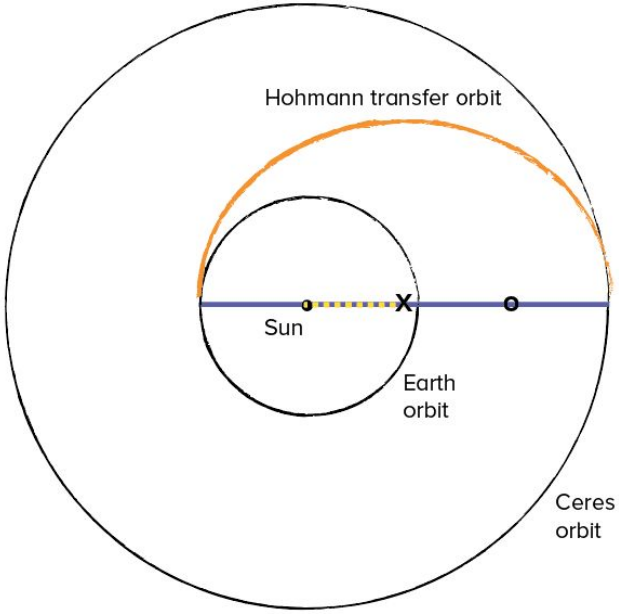
Convert all of the distances in your Hohmann transfer illustration to AU by dividing each distance (in cm) by the scale factor (in cm/AU) of your illustration that you calculated.

Drawing scale: _____cm/AU

Length of major axis: _____cm
Length of major axis: _____AU (= length of major axis / scale)

Focal distance: _____cm
Focal distance: _____AU

Reflection Questions:



1. The Hohmann transfer you just planned was between two different objects orbiting the sun. What do you think would happen if another object, like a planet, came near the path during your planned mission? What could go wrong, and why?

2. Both your starting object (usually Earth) and your destination object are moving around the sun constantly. How would that impact *when* you launched your mission? What would happen to your mission if your destination object weren't in the right place at the right time when you arrived to enter its orbit?

3. Why is the Hohmann transfer orbit only half an ellipse? What would happen if you traveled a full ellipse?

4. Research challenge: The Hohmann transfer is very useful for moving between two different orbits around the sun (called "heliocentric orbits"), but it can also be used to transfer between earth orbits of different altitudes, such as low-earth orbit, and medium earth orbit. Research the orbital radii of different earth orbits, then plan a Hohmann transfer for a satellite moving between them!