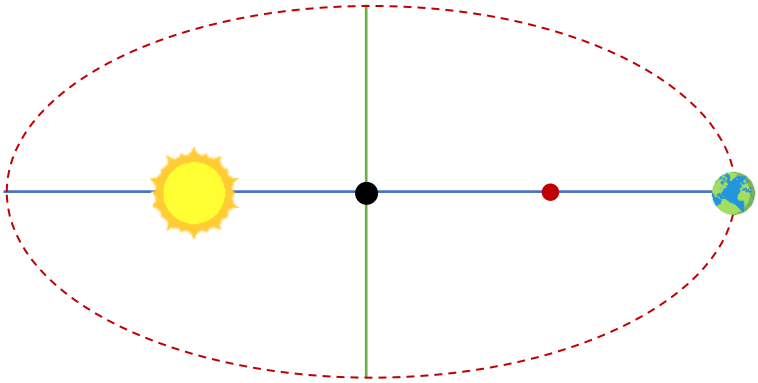
CONCEPT: Kepler's First Law

● All orbits are _____ (even circular ones!) with the Sun at one focus. Nothing physical at other focus.



● Major axis → _____ axis (Length:)

- Closest distance: Perihelion/periapsis
- Farthest distance: Aphelion/apoapsis
- Semi-major axis: $\mathbf{a} =$ _____

● Minor axis → _____ axis (Length:)

● Eccentricity of orbit (e) → # between 0 and 1, measures how _____ the orbit is.

- Lower #s (near 0) are *nearly* **[CIRCULAR | ELLIPTICAL]**
- Higher #s (near 1) are *very* **[CIRCULAR | ELLIPTICAL]**
- Eccentricity relates the aphelion & perihelion with the semi-major axis:

R_a = _____ R_p = _____

EXAMPLE: Earth's closest distance to the Sun is 1.471×10^{11}m, while its farthest distance is 1.521×10^{11}m. Calculate **a)** Earth's semi-major axis and **b)** orbital eccentricity.

ELLIPTICAL ORBITS

$$\mathbf{a} = \frac{\mathbf{R_a}+\mathbf{R_p}}{2}$$
$$\mathbf{R_a} = \mathbf{a}(\mathbf{1}+\mathbf{e})$$
$$\mathbf{R_p} = \mathbf{a}(\mathbf{1}-\mathbf{e})$$

PRACTICE: Pluto's orbit is the most eccentric of the 9 large objects in our solar system, with e = 0.25. The total distance from Pluto's closest to farthest point from the Sun is 1.18×10^{13}m. a) How close does it get to the Sun? b) How far does it get from the Sun?

ELLIPTICAL ORBITS

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