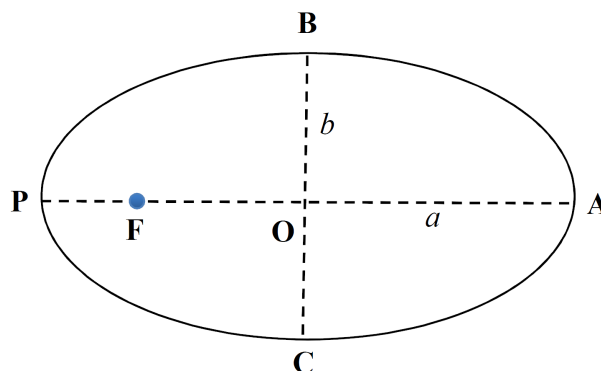


Important Constants

Constant	Symbol	Value
Speed of light	c	$3.00 \times 10^8 \text{ m s}^{-1}$
Earth's rotation period	1 day	24 hours
Earth's orbital period	1 year	365.25 days
parsec	pc	$3.09 \times 10^{16} \text{ m}$
Astronomical Unit	au	$1.50 \times 10^{11} \text{ m}$
Radius of the Earth	R_E	$6.37 \times 10^6 \text{ m}$
Semi-major axis of the Earth's orbit		1 au
Radius of the Sun	R_\odot	$6.96 \times 10^8 \text{ m}$
Mass of the Sun	M_\odot	$1.99 \times 10^{30} \text{ kg}$
Mass of the Earth	M_E	$5.97 \times 10^{24} \text{ kg}$
Luminosity of the Sun	L_\odot	$3.85 \times 10^{26} \text{ W}$
Gravitational constant	G	$6.67 \times 10^{-11} \text{ m}^3 \text{ kg}^{-1} \text{ s}^{-2}$

You might find the diagram of an elliptical orbit below useful in solving some of the questions:



Elements of an elliptic orbit:

- $a = \text{OA} (= \text{OP})$ semi-major axis
- $b = \text{OB} (= \text{OC})$ semi-minor axis
- $e = \sqrt{1 - \frac{b^2}{a^2}}$ eccentricity
- F** focus
- PF** = $a(1 - e)$ perihelion distance (shortest distance from **F**)
- AF** = $a(1 + e)$ aphelion distance (longest distance from **F**)

Kepler's Third Law: For an elliptical orbit, the square of the period, T , of an object about the focus is proportional to the cube of the semi-major axis, a (as defined above), such that

$$T^2 = \frac{4\pi^2}{GM} a^3,$$

where M is the total mass of the system (typically dominated by the central object) and G is the universal gravitational constant.

Magnitudes: The apparent magnitudes of two objects, m_1 and m_0 , are related to their apparent brightnesses, b_1 and b_0 , via the formula:

$$\frac{b_1}{b_0} = 10^{-0.4(m_1 - m_0)}$$