Answer on Question 73123, Physics, Astronomy, Astrophysics

Question:

The planet Mars takes 1.88 years to complete on revolution around the Sun. The mean distance of the Earth from the Sun is $1.5 \cdot 10^8 km$. Calculate that distance of planet of Mars.

Solution:

We can find the mean distance of the Mars from the Sun from the third Kepler's law of planetary motion. It states that the square of the orbital period of a planet is proportional to the cube of the semi-major axis (mean distance) of its orbit:

$$\frac{P_M^2}{a_M^3} = \frac{P_E^2}{a_E^3}$$

here, P_M is the orbital period of the Mars, P_E is the orbital period of the Earth, a_M is the mean distance of the Mars from the Sun, a_E is the mean distance of the Earth from the Sun.

Then, from this formula we can find the mean distance of the Mars from the Sun:

$$a_M^3 = a_E^3 \frac{P_M^2}{P_E^2},$$

$$a_{M} = \sqrt[3]{a_{E}^{3} \frac{P_{M}^{2}}{P_{E}^{2}}} = \sqrt[3]{(1.5 \cdot 10^{8} \ km)^{3} \cdot \frac{(1.88 \ year)^{2}}{(1.0 \ year)^{2}}} = 2.28 \cdot 10^{8} \ km.$$

Answer:

 $a_M = 2.28 \cdot 10^8 \, km.$

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