Q 02 . The planet Mars has two moons, Phobos and Deimos.

a. Phobos has a period 7h, 39 min and an orbital radius of 9.4×10^3 km. Calculate the mass of mars.

b. Assume that earth and mars move in circular orbits around the sun with the Martian orbit being 1.52 times the orbital radius of the earth. What is the length of the Martian year in days?

Sol.

a. $T = 7h\ 39min = 459 \times 60s$, orbital radius is given by R and

$R = 9.4 \times 10^3 km = 9.4 \times 10^6 m,\ M_m = ?$

$\therefore$ Mass of mars is given by, $M_m = \frac{4\pi^2}{G} \cdot \frac{R^3}{T^2}$

$= \frac{4 \times (3.14)^2 \times (9.4 \times 10^6)^3}{6.67 \times 10^{-11} \times (459 \times 60)^2}$

$= 6.48 \times 10^{23} kg$

b. Using Kepler's third law, $\frac{T_m^2}{T^2} = \frac{R_{MS}^3}{R_{ES}^3}$

where R_{MS} is the mass-sun distance R_{ES} is the earth-sun distance

$\therefore T_m = (1.52)^{3/2} \times 365 = 684\ days$