The planet Mars has a satellite, Phobos , which travels in a circular orbit of radius 9.40*10**6 m , with a period of 2.754*10**4 s. Calculate the mass of Mars from this information.

A. 4.56*10**26 kg
B. 6.48*10**23 kg
C. 3.95*10**23 kg
D. 5.90*10**26 kg
E. Data incomplete. Mass of Phobos is not given.

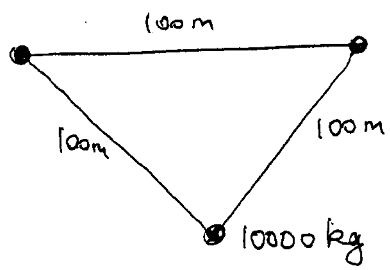
Use : $$T^2 = \left(\frac{4\pi^2}{GM}\right) r^3$$

$$(2.754\times10^4)^2 = \left(\frac{4\pi^2}{6.67\times10^{-11} M}\right)(9.4\times10^6)^3$$

$$\Rightarrow \boxed{M = 6.48\times10^{23}\ kg}$$

Three particles each of mass 10000 kg each are placed at the corners of an equilateral triangle with each side 100 m long. Calculate the potential energy of the system.

A. -2.00*(10**-4) J
B. -4.50*(10**-4) J
C. -3.18*(10**-4) J
D. -6.97*(10**-4) J
E. -8.00*(10**-4) J

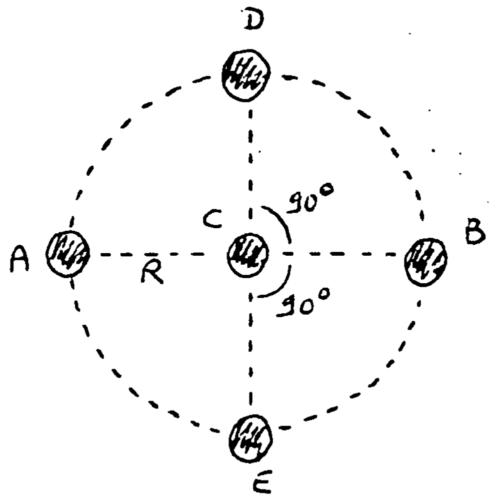


$$U = -\frac{G m_1 m_2}{r_{12}} - \frac{G m_1 m_3}{r_{13}} - \frac{G m_2 m_3}{r_{23}}$$

$$= -G\left(\frac{3m^2}{r}\right) = -6.67\times10^{-11}\left(3\times\frac{10000^2}{100}\right)$$

$$\boxed{U = -2\times10^{-4}\ J}$$

Four stars (A, B, D, E), of equal mass, rotate in the same direction around a fifth star C of the same mass located at their common center of mass (see figure). The radius of the common orbit is R. What minimum speed would star A need in order to depart from its companions for good? (express your answer in terms of G, M, R).



A. 1.23 * (G*M/R)**1/4
B. (G*M/R)**1/3
C. 5.32 * (G*M/R**3)**1/3
D. 2.41 * (G*M/R)**1/2
E. 3.21 * (G*M/R**2)**1/2

$$K_i + U_i = \underbrace{\cancel{K_f}^{\,0} + \cancel{U_f}^{\,0}}_{\text{depart for good}}$$

$$\frac{1}{2} m v_i^2 - G\left(\frac{m^2}{R} + \frac{m^2}{2R} + \frac{m^2}{R\sqrt{2}} + \frac{m^2}{R\sqrt{2}}\right) = 0$$

$$\frac{1}{2} m v_i^2 = \frac{G m^2}{R}\left(1 + \frac{1}{2} + \frac{2}{\sqrt{2}}\right)$$

$$v_i = \sqrt{\frac{5.8\, Gm}{R}} = 2.41\sqrt{\frac{Gm}{R}}$$