Question

A double star system consists of two stars A and B which have time periods T_A and T_B. Radius R_A and R_B and mass M_A and M_B, choose the correct answer,_____

A $(T_A/T_B)^2 = (R_A/R_B)^3$

B If $T_A > T_B$ then $R_A > R_B$

C $T_A = T_B$

D $T_A > T_B$ then $M_A > M_B$

Solution

Correct option is C)

$$M_1 R_1 = M_2 R_2 \quad \text{-(1)}$$

Force acting on both stars,i.e, gravitational force and centripital forces are balanced.

$$\therefore \frac{GM_1 M_2}{R^2} = \frac{M_1 V_1^2}{R_1} = \frac{M_2 V_2^2}{R_2} - (2)$$

Now substitute, $V_1 = \frac{2\pi R_1}{T_1}$, $V_2 = \frac{2\pi R_2}{T_2}$ in

equation(2) after simplification we get $\therefore$

$$\frac{M_1 R_1}{T_1^2} = \frac{M_2 R_2}{T_2^2}$$

$$\Rightarrow T_1 = T_2$$