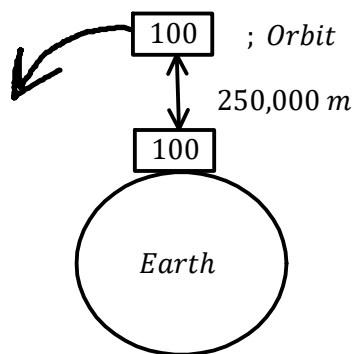


# P12 - 7.3 - Velocity in/Work to Orbit Notes



$$F_g = F_c \quad \boxed{F_c = F_g} \quad ; \text{Orbit}$$

$$\frac{GMm}{r^2} = ma_c \quad a_c = \frac{v^2}{r}$$

$$\frac{GMm}{r^2} = m \frac{v^2}{r}$$

$$\frac{GM}{r} = v^2 \quad ; \text{mass of object is irrelevant}$$

$$v = \sqrt{\frac{GM}{r}}$$

$$v = \sqrt{\frac{6.67E-11 \times 5.98E24}{(6.38E6 + 250000)}}$$

$$v = 7756.338 \frac{m}{s}$$

Earth

$$E_p = -\frac{GMm}{r}$$

$$E_p = -\frac{6.67E-11(5.98E24)(100)}{6.38E6}$$

$$E_p = -6.25E9 J$$

$$E_k = \frac{1}{2} mv^2$$

$$E_k = 0 \quad \text{To Change Orbit } v = \#$$

Orbit

$$E_p = -\frac{GMm}{r}$$

$$E_p = -\frac{6.67E-11(5.98E24)(100)}{6.38E6 + 250000}$$

$$E_p = -6.01E9 J$$

$$E_k = \frac{1}{2} mv^2$$

$$E_k = \frac{1}{2} (100)(7756.338)^2$$

$$E_k = 3.01E9 J$$

$$E_{pi} + E_{ki} + W = E_{pf} + E_{kf}$$

$$-6.25E9 + 0 + W = -6.01E9 + 3.01E9$$

$$W = \dots$$

Or

$$W = \Delta E$$

$$W = \Delta E_p + \Delta E_k \quad \boxed{E_{ki} = 0}$$

$$W = (E_{pf} - E_{pi}) + (E_{kf} - E_{ki})$$

$$W = (-6.01E9 - (-6.25E9)) + (3.01E9 - 0)$$

$$W = 3.26E9 J$$

$$W = GMm \left( \frac{1}{r_i} - \frac{1}{r_f} \right) + \left( \frac{1}{2} mv_f^2 - \frac{1}{2} mv_i^2 \right)$$

$$W = \frac{GMm}{2} \left( \left( \frac{2}{r_i} - \frac{2}{r_f} \right) + (v_f^2 - v_i^2) \right)$$

...