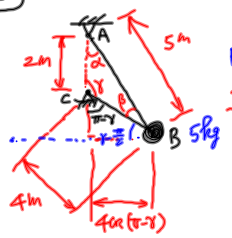
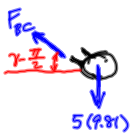
12.38



To find v_{max}

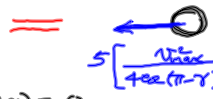


Law of cosines:

$\overline{AB}^2 = \overline{AC}^2 + \overline{BC}^2 - 2\overline{AC}\,\overline{BC}\cos\gamma$

$\therefore \gamma = \square$

$\frac{\pi}{2} - (\pi - \gamma) = \gamma - \frac{\pi}{2}$



$+\uparrow \Sigma F_y: \quad F_{BC}\sin(\gamma - \frac{\pi}{2}) - 5(9.81) = 0$

$\xrightarrow{+} \Sigma F_x: \quad F_{BC}\cos(\gamma - \frac{\pi}{2}) = 5\left[\frac{v_{max}^2}{4\cos(\pi-\gamma)}\right]$

$\therefore F_{BC} = \square \qquad v_{max} = \square$

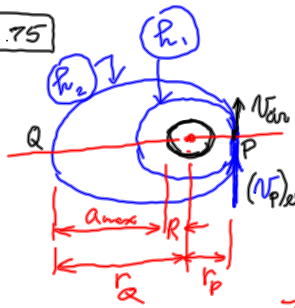
To find v_{min}

$+\uparrow \Sigma F_y: \quad \cdots\cdots$

$\xrightarrow{+} \Sigma F_x: \quad \cdots\cdots \quad \Big\} \quad F_{AB} = \square \qquad v_{min} = \square$

$$\boxed{v_{min} < v < v_{max}}$$

12.75



$R = 6.37 \times 10^3$ km

km s

$(v_P)_{ell} = v_{cir} + 1$ km/s $= \square$

$r_P = 12\,M_m = 12 \times 10^3$ km

$\frac{1}{r_P} + \frac{1}{r_Q} = \frac{2GM}{h_1^2} \qquad h = r v_\theta$

$\frac{1}{r_P} + \frac{1}{r_P} = \frac{2gR^2}{r_P^2 v_{cir}^2} \qquad g = 9.81 \times 10^{-3}$ km/s^2

$\therefore v_{cir} = \square$ km/s

In elliptic orbit

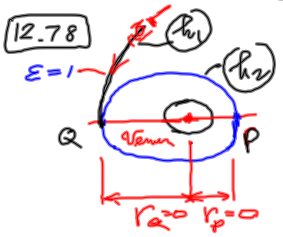
$\frac{1}{r_P} + \frac{1}{r_Q} = \frac{2GM}{h_2^2} = \frac{2gR^2}{r_P^2 (v_P)_{ell}^2} \qquad \therefore r_Q = \square$

$a_{max} = r_Q - R = \square \qquad \boxed{a_{max} = \square \text{ km}}$

Period of orbit around the elliptic orbit

$\tau = \frac{\pi(r_P + r_Q)\sqrt{r_P r_Q}}{h_2} = \square$ s $\qquad \boxed{\tau = \square \text{ h}}$

12.78



$\frac{m_{Venus}}{m_{earth}} = 0.8144$

$(v_Q)_{par} = ? \qquad (v_Q)_{ell} = ?$

$(v_P)_{ell} = ?$

$$\boxed{\frac{1}{r} = \frac{GM}{h^2}(1 + \varepsilon\cos\theta)}$$ to find $(v_Q)_{par}$

$\frac{1}{r_Q} = \frac{gR^2(0.8144)}{h_1^2}(1 + 1\cos 0) \qquad g = 9.81 \times 10^3$ km/s^2, $R = 6.37 \times 10^3$ km

$\therefore h_1 = \square = r_Q (v_Q)_{par} \qquad \therefore \boxed{(v_Q)_{par} = \square \text{ km/s}}$

$\frac{1}{r_P} + \frac{1}{r_Q} = \frac{2gR^2(0.8144)}{h_2^2}, \quad h_2 = \square = r_Q (v_Q)_{ell} = r_P (v_P)_{ell}$