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(11-3) $F_g = G\frac{Mm}{r^2}$ 공식을 사용한다

$$F_g = 6.674\times10^{-11}\times\frac{1.5\times15\times10^{-3}}{(4.5\times10^{-2})^2} = \frac{6.674\times10^{-11}\times1.5\times15\times10^{-3}}{20.25\times10^{-4}}$$

$$= 10^{-10}\times7.415\ \mathrm{N}$$

(11-6)

(a) $\vec{F_g} = m_0\vec{g} = G\frac{m_1 m_0}{r^2}$

$$m_0\vec{g} = G\frac{m_1 m_0}{r^2} \Rightarrow \vec{g} = G\frac{m_1}{r^2}$$

$$\therefore 6.674\times10^{-11}\times\frac{6.68\times10^{19}}{(242\times10^3)^2}$$

$$= \frac{6.674\times10^{-11}\times6.68\times10^{19}}{58564\times10^6} = 7.612\times10^{-2}$$

$$= 0.07612\ \mathrm{m/s^2}$$

(b)

$y_f = y_i + V_{yi} + \frac{1}{2}a_y t^2$을 이용하면

$$-5000 = 0 + 0 - \frac{1}{2}(0.07612)t^2$$

$$10000 = 0.07612t^2 \quad \therefore t = 362.45\ \mathrm{s}$$

(c) $x_f = x_i + V_{xi}t + \frac{1}{2}a_x t^2$을 이용하면

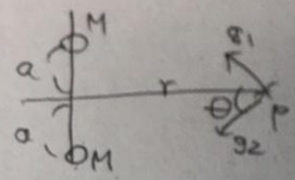
$$= 0 + 8.5\times362.45 = 3080\mathrm{m}$$

(d) $V_{yf} = V_{yi} + a_y t = 0 - 0.07612\times362.45 = -27.589\ \mathrm{m/s}$

$$\therefore \vec{V_f} = 8.5\vec{x} - 27.589\vec{y} = \underline{28.86\ \mathrm{m/s}}\ //$$

11-9)

(a) $g_1 = g_2 = \frac{MG}{a^2+r^2}$



$g_{1x} = g_{2x} = g_2 \cos\theta$

$\cos\theta = \frac{r}{\sqrt{a^2+r^2}}$ ∴

$g_{2x} = \frac{MG}{a^2+r^2} \times \frac{r}{\sqrt{a^2+r^2}} = \frac{rMG}{(a^2+r^2)^{\frac{3}{2}}}$

∴ $\vec{g} = \frac{2rMG}{(a^2+r^2)^{\frac{3}{2}}}$

(b) $r \rightarrow 0$ 이면 $\vec{g}$의 수식이 0으로 가기 때문에

(c) $\lim_{r\to 0} \frac{2rMG}{(a^2+r^2)^{\frac{3}{2}}} = \frac{2\times 0 \times MG}{a^3} = 0$

(d) r이 크면 θ가 작아져서 축과 평행

(e) $\lim_{r\to\infty} \frac{2rMG}{(a^2+r^2)^{\frac{3}{2}}} = \frac{2MG}{r^2}$

(11-17) $\tau^2 = ka^3$

$$(75.6)^2 = \left(\frac{0.57+y}{2}\right)^3$$

$$5715 = \frac{(0.57+y)^3}{8} \Rightarrow 45720 = (0.57+y)^3$$

$$\therefore y = 35.2\ AU.$$

(11-22)

(a) $v_i^2 = 2GM_E\left(\frac{1}{R_E} - \frac{1}{R_E+h}\right)$

$$\frac{2GM_E}{h+R_E} = \frac{2GM_E}{R_E} - v_i^2$$

$$\frac{2GM_E}{h+R_E} = \frac{2GM_E - R_Ev_i^2}{R_E} \Rightarrow \frac{h+R_E}{2GM_E} = \frac{R_E}{2GM_E - R_Ev_i^2}$$

$$h = \frac{2GM_ER_E}{2GM_E - R_Ev_i^2} - R_E$$

// $v_{esc} = \sqrt{\frac{2GM_E}{R_E}}$

$v_{esc}^2 = \frac{2GM_E}{R_E}$

$\therefore \boxed{2GM_E = R_Ev_{esc}^2}$

$$= \frac{R_E^2v_{esc}^2 - R_E(R_Ev_{esc}^2 - R_Ev_i^2)}{R_Ev_{esc}^2 - R_Ev_i^2}$$

$$h = \frac{R_Ev_i^2}{R_Ev_{esc}^2 - R_Ev_i^2} = \frac{R_Ev_i^2}{v_{esc}^2 - v_i^2}$$

$$\therefore h = \frac{6.37\times10^6\times(8.76)^2}{(11.2)^2-(8.76)^2} = 1.00\times10^7\,m$$

11-22)

(b) $V_i^2 = R_E V_{esc}^2 \left(\frac{1}{R_E} - \frac{1}{h+R_E} \right)$

$$= V_{esc}^2 - \frac{R_E V_{esc}^2}{h+R_E}$$

$$= \frac{hV_{esc}^2 + R_E V_{esc}^2 - R_E V_{esc}^2}{h+R_E}$$

$$V_i^2 = \frac{hV_{esc}^2}{h+R_E} = V_{esc}^2 \left(\frac{h}{h+R_E} \right)$$

$$= (11.2 \times 10^3)^2 \times \frac{2.51 \times 10^7}{2.51 \times 10^7 + 6.31 \times 10^6}$$

$$= 1.00 \times 10^8 \ m/s$$

$$\therefore V_i = 1.00 \times 10^4 \ m/s$$