

[1]

問1

$$\omega_s = 7 \times 10^{-5} \text{ rad/s}$$

問2

$$R_s = \left( \frac{GM}{\omega_s^2} \right)^{\frac{1}{3}}$$

問3

張力の  
大きさ

$$m R_1 \omega_s^2 - \frac{GMm}{R_1^2}$$

問4

最小の  $r'$

$$\left( \frac{2GM}{\omega_s^2} \right)^{\frac{1}{3}}$$

問5

(a)  $F_i = \frac{GM \Delta m}{r_i^2} - \Delta m r_i \omega_s^2$

(b)  $\Delta m = \lambda \Delta r$

(c)  $\sum_{i=1}^N F_i = GM \lambda \left( \frac{1}{R_0} - \frac{1}{R_2} \right) - \frac{1}{2} \omega_s^2 \lambda (R_2^2 - R_0^2)$

(d)  $F = 0$

問6

$$\frac{R_2}{R_0} = \frac{1}{2} \left( \sqrt{1 + \frac{8R_s^3}{R_0^3}} - 1 \right)$$

記号

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[2]

問1  $P_A(t) = \frac{V^2}{R} \sin^2 \omega t$

問2  $I_r = \frac{2\bar{P}_A}{V}$

問3  $I_C = \omega C V$

問4  $I_R = \sqrt{\left(\frac{2\bar{P}_A}{V}\right)^2 + (\omega C V)^2}$

問5  $\bar{P}_B = R \left\{ \left(\frac{2\bar{P}_A}{V}\right)^2 + (\omega C V)^2 \right\}$

問6  $V_{\min} = \sqrt{\frac{2\bar{P}_A}{\omega C}}$

$\bar{P}_B = 4R\omega C \bar{P}_A$

問7 記号  $\epsilon$

[3]

問1

$$\Delta Q = \frac{3}{2} nR\Delta T$$

問2

$$x = \sqrt{\frac{mRT}{k}}$$

問3

$$\Delta Q = 2nR\Delta T$$

$$c = 2nR$$

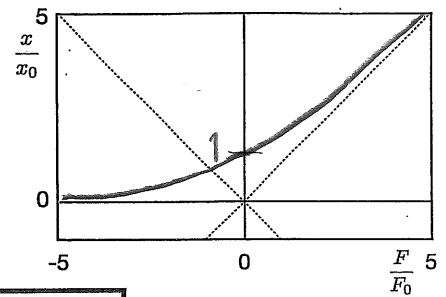
問4

$$x = \frac{1}{2k} (F + \sqrt{F^2 + 4kmRT})$$

問5

$$\frac{x}{x_0} = \frac{1}{2} \left\{ \frac{F}{F_0} + \sqrt{\left(\frac{F}{F_0}\right)^2 + 4} \right\}$$

問5 グラフ



問6

(a)  $\frac{k_{\text{eff}}}{k} = 1$

(b)  $\frac{k_{\text{eff}}}{k} = 2$

問7

(a)  $U = \frac{1}{2} kr^2$

(b)  $\frac{Mv^2}{r} = kr$

(c)  $E = kr^2$

(d)  $\lambda_B = \frac{h}{r\sqrt{kM}}$

(e)  $r_n = \sqrt{\frac{nh}{2\pi\sqrt{kM}}}$

(f)  $E_n = \frac{nh}{2\pi} \sqrt{\frac{k}{M}}$

(g)  $\Delta E_{ln} = \frac{(l-n)h}{2\pi} \sqrt{\frac{k}{M}}$

(h)  $\lambda_{ln} = \frac{2\pi c}{l-n} \sqrt{\frac{M}{k}}$