

〔 1 〕

$$\text{問 1 } F_{\min} = \underline{\underline{\mu g (M + m)}}$$

$$\text{問 2 } V_1 = \frac{F_1 - \mu' mg}{M} T_1, \quad v_1 = \underline{\underline{\mu' g T_1}}$$

$$\text{問 3 } v_0 = 0, \quad T_2 = \frac{M V_0}{\underline{\underline{F_2}}}$$

$$\text{問 4 } v_2 = \frac{M}{M + m} V_0$$

$$\text{問 5 } V_n' = \frac{(-e)^n m + M}{M + m} V_0, \quad v_n' = \frac{\{1 - (-e)^n\} M}{M + m} V_0$$

$$\text{問 6 } v_3 = \frac{M}{M + m} V_0$$

$$\text{問 7 } \frac{1}{2\mu' mg} \left\{ \frac{mM}{M + m} V_0^2 - k(L - d)^2 \right\}$$

$$\text{問 8 } a = -\frac{M + m}{Mm} k \left(D - d - \frac{\mu' mg}{k} \right)$$

$$\text{問 9 } d_1 = d + \frac{\mu' mg}{k} - \sqrt{\frac{MmV_0^2}{k(M + m)} + \left(\frac{\mu' mg}{k} \right)^2}$$

$$\text{問 10 } L = d + (-1)^n \left\{ \sqrt{\frac{MmV_0^2}{k(M + m)} + \left(\frac{\mu' mg}{k} \right)^2} - (2n - 1) \frac{\mu' mg}{k} \right\}$$

[2]

問 1 (イ)

問 2 $W_1 = \hbar\nu - eV_0$

問 3 $v_1 = \sqrt{\frac{2eV_1}{m}}$

問 4 $v_x = \frac{eE\ell}{mv_1}$

問 5 $\frac{eB}{m}$

問 6 $v_0 = \sqrt{\frac{2w}{m}}$

問 7 $\frac{1}{\sqrt{3}}$ 倍

問 8 (せ)

問 9 $Y = \frac{1}{B} \sqrt{\frac{2mEX}{e}}$

問 10 (ち), (て)

〔 3 〕

問 1
$$\frac{2x_0 D_0}{L}$$

問 2
$$D_0 = \frac{\lambda_0 L}{2\Delta x}$$

問 3
$$k = \frac{nF_0}{(n-1)D_0}$$

問 4
$$\lambda_1 = 5.6 \times 10^{-7} \text{ m}$$

問 5
$$D_2 = 2.7 \times 10^{-7} \text{ m} \quad , \quad D_3 = 1.9 \times 10^{-7} \text{ m}$$

問 6
$$1.6 \times 10^{-13} \text{ J}$$

問 7 (オ)

問 8 (あ)
$$\frac{1}{m_Z} \left(\sqrt{2m_X E_X} - m_n v_n \right)$$

(い)
$$\frac{1}{2} m_n v_n^2 + \frac{1}{2} m_Z v_Z^2 - E_X - Q$$

(う)
$$\geq$$

(え)
$$\frac{m_Z + m_n}{m_X - m_Z - m_n} Q$$

問 9 (ス), (セ), (ソ), (タ)