物理基礎・物理

工学部、理学部、農学部、医学部、情報学部（自然情報学科、コンピュータ科学科）

問題　I

(1) [答]
$$V_1 = \sqrt{\frac{kd^2}{m} - 2gd\sin\phi}$$

(2) [答]
$$\tan\phi = \frac{V_{2y}}{V_{2x} + V_3}$$

(3) [答]
$$0 = mV_{2x} + M \times (-V_3)$$

(4) [答]
$$\tan\phi' = \frac{V_{2y}}{V_{2x}} \quad (2) \text{の} \tan\phi = \frac{V_{2y}}{V_{2x}+V_3} \text{と比べて}$$

$$\tan\phi' > \tan\phi \text{ なので } \phi' > \phi$$

(5) [答]
$$t_1 = \frac{v_0 \sin\theta}{g}$$

[答]
$$h = \frac{v_0^2 \sin^2\theta}{2g}$$

(6) [答]
$$\ell = \frac{v_0^2 \sin\theta\cos\theta}{g}$$

(7) [答]
$$E_0 = m_1 g \frac{L^2 + 4H^2}{4H} \quad \text{※重力の位置エネルギーの基準を床とする。}$$

(8) [答]
$$m_1 v_0 \cos\theta = m_1 \times (-v_1) + m_2 v_2$$

(9) [答]
$$v_1 = \frac{em_2 - m_1}{m_1 + m_2} v_0 \cos\theta$$

[答]
$$v_2 = \frac{(1+e)m_1}{m_1 + m_2} v_0 \cos\theta$$

(10) [答]
$$1 - e^2$$

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問題　Ⅱ

(1) [答]
$$S_1(x) = \frac{1}{2}(\ell - x)^2$$

(2) [答]
$$C_1(x) = \frac{3\varepsilon_0}{5d}(\ell - x)^2$$

(3) [答]
$$C_0(x) = \frac{\varepsilon_0}{2d}x(2\ell - x)$$

(4) [答]
$$C(x) = \frac{\varepsilon_0}{10d}(x^2 - 2\ell x + 6\ell^2)$$

(5) [答]
$$U(x) = \frac{\varepsilon_0 V^2}{20d}(x^2 - 2\ell x + 6\ell^2)$$

(6) [答]
$$U(x+\varDelta) - U(x) = \frac{\varepsilon_0 V^2}{20d}\varDelta\{\varDelta - 2(\ell - x)\}$$

(7) [答]
$$W_I(x) = 2\{U(x+\varDelta) - U(x)\}$$

(8) [答]
$$W_F(x) = -\{U(x+\varDelta) - U(x)\}$$

(9) [答]
$$F_p(x) = \frac{\varepsilon_0 V^2}{10d}(x - \ell)$$

(10) [答]

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問題　Ⅲ

(1) [答] $\lambda = \dfrac{V}{f}$

(2) [答] $X^2 + Y^2 = (Vt)^2$

(3) [答] $X_A = (V+W)t$ | [答] $X_B = -(V-W)t$

(4)
[答] $\varDelta X_A = \dfrac{V+W}{f}$ | [答] $f_1 = f$

[答] $\varDelta X_B = \dfrac{V-W}{f}$ | [答] $f_2 = f$

(5) [答] $(X-Wt)^2 + Y^2 = (Vt)^2$

(6) [答] $\varDelta Y = \dfrac{\sqrt{V^2-W^2}}{f}$ | [答] $f_3 = f$

(7) [答] $f_4 = \dfrac{V+W-U}{V+W}f$ | [答] $f_5 = \dfrac{\sqrt{V^2-W^2}+U}{\sqrt{V^2-W^2}}f$

(8) [答] $L = \dfrac{V^2 W_0^2}{4fW_0}$

(9) [答] $d = \dfrac{V^2 W_0^2}{4fV}$