

## 物理学Ⅱ 中間試験解答

1. 13点

(1) 3点

$$W = 4.9[\text{J}]$$

(2) 3点

$$p = 35[\text{kPa}]$$

(3) 3点

$$\Delta U = 13.5[\text{J}] \text{ or } 7.35[\text{J}]$$

(4) 4点

$$\Delta T = \frac{1.5}{R}[\text{K}] \text{ or } \frac{1.23}{R}[\text{K}] \text{ or } \frac{0.82}{R}[\text{K}]$$

2. 17点

(1) 3点

$$T_I = 250[\text{K}]$$

(2) 9点

	I	II	III
$\Delta U$ [kJ]	0	$-2.5R$	$2.5R$
$W$ [kJ]	$-1.4R$	$1.0R$	0
$Q$ [kJ]	$1.4R$	$-3.5R$	$2.5R$
$\Delta S$ [J/K]	$2.8R$	$-9.8R$	$7.0R$

(3) 2点

$$W_{\text{all}} = 0.4R[\text{kJ}]$$

(4) 3点

10%

3. 19点

(1) 6点

$$x < a \text{ の時, } \quad x = a \text{ の時, } \quad a < x < b \text{ の時,}$$

$$E = 0 \quad E = \frac{1}{8\pi\epsilon_0} \frac{Q_a}{a^2} \quad E = \frac{1}{4\pi\epsilon_0} \frac{Q_a}{x^2}$$

$$x = b \text{ の時, } \quad b < x < c \text{ の時,}$$

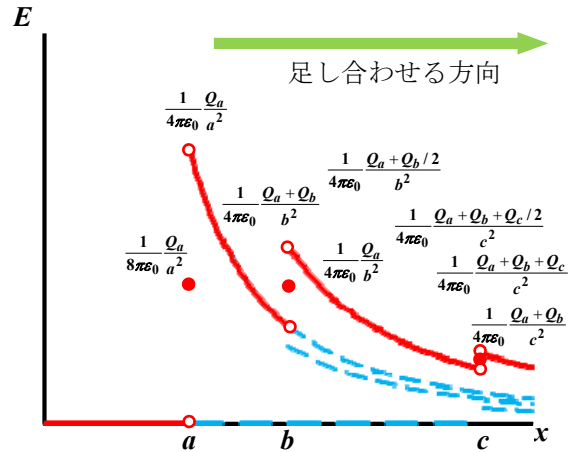
$$E = \frac{1}{4\pi\epsilon_0} \frac{Q_a + Q_b/2}{b^2} \quad E = \frac{1}{4\pi\epsilon_0} \frac{Q_a + Q_b}{x^2}$$

$$x = c \text{ の時,}$$

$$E = \frac{1}{4\pi\epsilon_0} \frac{Q_a + Q_b + Q_c/2}{c^2}$$

$$c < x \text{ の時,}$$

$$E = \frac{1}{4\pi\epsilon_0} \frac{Q_a + Q_b + Q_c}{x^2}$$



(2) 6点

$x < a$  の時,

$$V = \frac{1}{4\pi\epsilon_0} \left( \frac{Q_a}{a} + \frac{Q_b}{b} + \frac{Q_c}{c} \right)$$

$a \leq x < b$  の時,

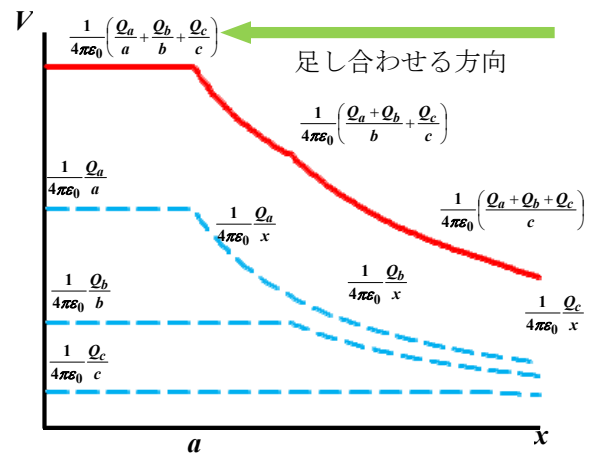
$$V = \frac{1}{4\pi\epsilon_0} \left( \frac{Q_a}{x} + \frac{Q_b}{b} + \frac{Q_c}{c} \right)$$

$b \leq x < c$  の時

$$V = \frac{1}{4\pi\epsilon_0} \left( \frac{Q_a + Q_b}{x} + \frac{Q_c}{c} \right)$$

$c \leq x$  の時

$$V = \frac{1}{4\pi\epsilon_0} \left( \frac{Q_a + Q_b + Q_c}{x} \right)$$



(3) 3点

$$V_a = \frac{1}{4\pi\epsilon_0} \left( \frac{Q_a}{a} + \frac{Q_b}{b} + \frac{Q_c}{c} \right)$$

$$V_b = \frac{1}{4\pi\epsilon_0} \left( \frac{Q_a + Q_b}{b} + \frac{Q_c}{c} \right)$$

$$V_c = \frac{1}{4\pi\epsilon_0} \left( \frac{Q_a + Q_b + Q_c}{c} \right)$$

(4) 4点

$$V_c - V_c' = \frac{1}{4\pi\epsilon_0} \cdot \frac{a}{c} \cdot \left( \frac{Q_a}{a} + \frac{Q_b}{b} + \frac{Q_c}{c} \right)$$

4. 19点

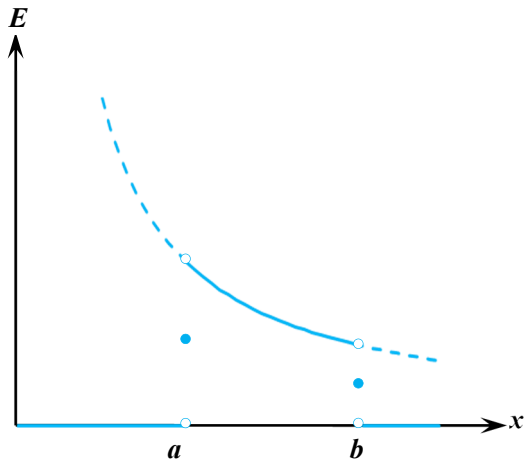
(1) 3点

$$E = \frac{\lambda}{2\pi\epsilon_0 x}$$

(2) 5点

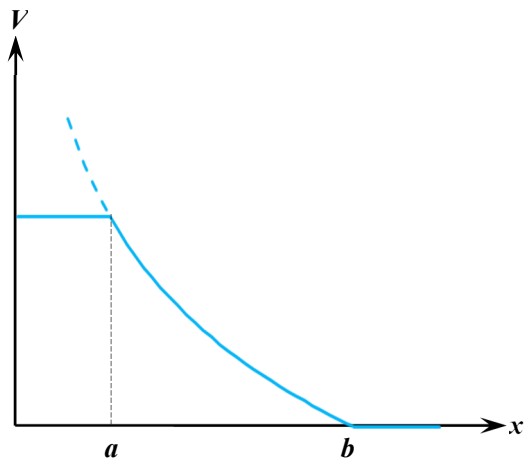
$x < a$ の時,	$x = a$ の時,	$a < x < b$ の時,
$E = 0$	$E = \frac{\lambda}{4\pi\epsilon_0 a}$	$E = \frac{\lambda}{2\pi\epsilon_0 x}$

$x = b$ の時,	$x < b$ の時,
$E = \frac{\lambda}{4\pi\epsilon_0 b}$	$E = 0$



(3) 5点

$x \leq a$ の時,	$a < x \leq b$ の時,	$b < x$ の時,
$V = \frac{\lambda}{2\pi\epsilon_0} \ln \frac{b}{a}$	$V = \frac{\lambda}{2\pi\epsilon_0} \ln \frac{b}{x}$	$V = 0$



(4) 3点

$$V = \frac{\lambda}{2\pi\epsilon_0} \ln \frac{b}{a}$$

(5) 3点

$$C = 2\pi\epsilon_0 \ln \frac{b}{a}$$

5. 16点

(1) 2点

$$I_1 = \frac{V}{2r}$$

(2) 2点

$$Q_1 = CV$$

$$U_1 = \frac{1}{2} CV^2$$

(3) 3点

$$W_1 = \frac{1}{2} CV^2$$

(4) 2点

$$I_2 = \frac{V}{5r}$$

(5) 3点

$$Q_2 = \frac{2CV}{3}$$

$$U_2 = \frac{1}{9} CV^2$$

(6) 4点

$$W_2 = \frac{1}{5} CV^2$$

6. 16点

(1) 8点

$$R = 150[\Omega]$$

(2) 8点

$$V_{DB} = 5[V], \quad V_{CB} = 9[V].$$