

(1)

$$Q_{1\text{左}} = 0$$

$$Q_{1\text{右}} = -Q_{2\text{左}}$$

$$Q_{2\text{左}} = -Q_{2\text{右}}$$

$$Q_{3\text{右}} = Q_{2\text{右}}$$

$$Q_{4\text{左}} = -Q_{2\text{右}}$$

$$Q_{4\text{右}} = 0$$

(2)

(i) 1-2 間

ガウスの定理より

$$\int E_{12} ds = \frac{Q_{2\text{左}}}{\epsilon_0}$$

$$E_{12} = -\frac{Q_{2\text{左}}}{\epsilon_0 s} \hat{x}$$

(ii) 2-3 間

(i) と同様にして

$$E_{23} = \frac{Q_{2\text{右}}}{\epsilon_0 s} \hat{x}$$

(iii) 3-4 間

(i) と同様にして

$$E_{34} = \frac{Q_{3\text{右}}}{\epsilon_0 s} \hat{x}$$

(B)

(i) 1-2 間

$$\begin{aligned} V_{12} &= -\int_0^d E_{12} dx \\ &= \frac{Q_{2\text{左}}}{\epsilon_0 s} d \end{aligned}$$

(ii) 2-3 間

$$\begin{aligned} V_{23} &= -\int_{2d}^{3d} E_{23} dx \\ &= \frac{Q_{2\text{右}}}{\epsilon_0 s} d \end{aligned}$$

(iii) 3-4 間

$$\begin{aligned} V_{34} &= -\int_{3d}^{4d} E_{34} dx \\ &= \frac{Q_{3\text{右}}}{\epsilon_0 s} d \end{aligned}$$

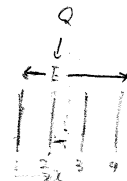
$$(4) \quad \begin{cases} Q = Q_{2\text{左}} + Q_{2\text{右}} \\ V_{12} = V_{23} + V_{34} \end{cases}$$

$$\frac{Q_{2\text{左}}}{\epsilon_0 s} d = \frac{Q_{2\text{右}}}{\epsilon_0 s} d + \frac{Q_{3\text{右}}}{\epsilon_0 s} d$$

$$Q_{2\text{左}} = Q_{2\text{右}} + \frac{\epsilon_0}{\epsilon} Q_{2\text{右}} = \left(1 + \frac{\epsilon_0}{\epsilon}\right) Q_{2\text{右}}$$

$$Q_{2\text{右}} = \frac{\epsilon}{2\epsilon + \epsilon_0} Q$$

$$Q_{2\text{左}} = \frac{\epsilon + \epsilon_0}{2\epsilon + \epsilon_0} Q$$



(5)

$$V = V_{12} - V_{34}$$

$$\begin{aligned} V_{34} &= -\int_x^d E_{23} dx \\ &= \frac{Q_{2\text{右}}}{\epsilon_0 s} (x-d) \end{aligned}$$

$$V = \frac{Q_{2\text{左}}}{\epsilon_0 s} d - \frac{Q_{2\text{右}}}{\epsilon_0 s} (x-d)$$

$$= \frac{\epsilon + \epsilon_0}{2\epsilon + \epsilon_0} \cdot \frac{Q}{\epsilon_0 s} d - \frac{\epsilon}{2\epsilon + \epsilon_0} \cdot \frac{Q}{\epsilon_0 s} (x-d)$$

$$= \frac{Q}{s} \left( \frac{d(\epsilon + \epsilon_0)}{(2\epsilon + \epsilon_0)\epsilon_0} - \frac{x-d}{\epsilon_0 + 2\epsilon} \right)$$

