

工学の資格IP

(ア) 反発力. この段階で (1), (3), (4) にたどり

(イ) $F = qE$. \therefore 必ず $E = \frac{Q}{4\pi\epsilon_0 d^2}$ の式を使う.

$F = \frac{3Q^2}{4\pi\epsilon_0 d^2}$ \therefore (1), (3) にたどり

(ウ). $T^2 = F^2 + (mg)^2$ と $\frac{F}{T} = \frac{d}{2l}$ を使う.
計算はこうしたい.

$F^2 + (mg)^2 = T^2$ の式から $\sqrt{\quad}$ を取る.

$T =$ の式にたどり.

$$\frac{F}{T} = \frac{d}{2l} \Rightarrow \frac{F^2}{T^2} = \left(\frac{d}{2l}\right)^2$$

$$\frac{F^2}{F^2 + (mg)^2} = \left(\frac{d}{2l}\right)^2$$

$$F^2 = F^2 \left(\frac{d}{2l}\right)^2 + (mg)^2 \left(\frac{d}{2l}\right)^2$$

$$F^2 - F^2 \left(\frac{d}{2l}\right)^2 = (mg)^2 \left(\frac{d}{2l}\right)^2$$

$$F^2 \left\{1 - \left(\frac{d}{2l}\right)^2\right\} = (mg)^2 \left(\frac{d}{2l}\right)^2$$

$$F \sqrt{1 - \left(\frac{d}{2l}\right)^2} = mg \left(\frac{d}{2l}\right)$$

$$\sqrt{1 - \left(\frac{d}{2l}\right)^2} = \frac{mg}{F} \left(\frac{d}{2l}\right)$$

$$= \frac{4\pi\epsilon_0 d^2 mg}{3Q^2} \left(\frac{d}{2l}\right) \times \frac{4l^2}{d^2} \left(\frac{d}{2l}\right)^2$$

$$\sqrt{1 - \left(\frac{d}{2l}\right)^2} = \frac{16\pi\epsilon_0 l^2 mg}{3Q} \left(\frac{d}{2l}\right)^3 \therefore (1) \text{ がわかる.}$$

(エ) は、この段階で、たどり着く、このとき、増加なし.

答えは、(1) とたどり

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