24-ex

2022年6月21日 星期二　8:00

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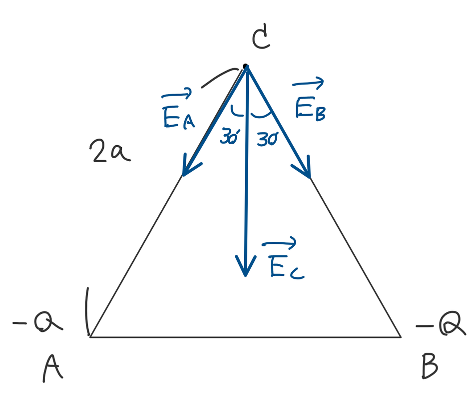


$F = k\dfrac{|q|\cdot|Q|}{r^2} = |q|E$

$\Rightarrow E = \dfrac{k|Q|}{r^2}$

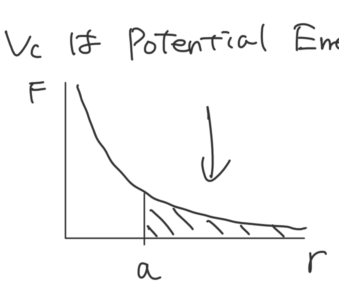
$E_A = E_B =: E$

$E_C = E\cos 30^\circ \cdot 2$

$= \dfrac{k|-Q|}{(2a)^2}\cdot\dfrac{\sqrt{3}}{2}\cdot 2$

$= \dfrac{\sqrt{3}\,kQ}{4a^2}$ [V/m]

V_C は Potential Energy U



$U = \int_a^\infty F\,dr = \int_a^\infty k\dfrac{qQ}{r^2}\,dr = \int_a^\infty kqQr^{-2}\,dr$

$= \left[-kqQr^{-1}\right]_a^\infty \quad \because (r^{-1})' = -r^{-2} \Rightarrow (-r^{-1})' = r^{-2}$

$= \left[-\dfrac{kqQ}{r}\right]_a^\infty$

$= \left(-\dfrac{kqQ}{\infty}\right) - \left(-\dfrac{kqQ}{a}\right)$

$= \dfrac{kqQ}{a}$

a を r にして

$U = \dfrac{kqQ}{r}$

$V = U/Q$ に代入

$V = \dfrac{\frac{kqQ}{r}}{Q} = \dfrac{kq}{r}$

$V_A = V_B = \dfrac{k(-Q)}{2a} =: V$

E の和：ベクトル和，V の和：代数和

$V_C = V_A + V_B = \dfrac{-kQ-kQ}{2a} = -\dfrac{kQ}{a}$ [V]

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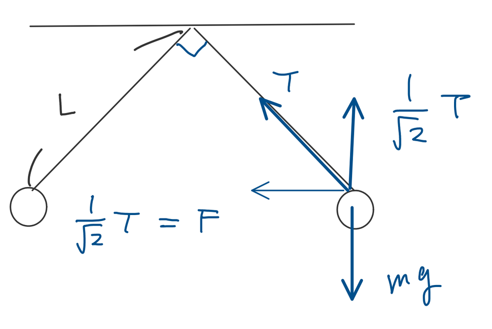


$\frac{1}{\sqrt{2}}T = mg \Rightarrow T = \sqrt{2}\,mg$

$\frac{1}{\sqrt{2}}T = F \Rightarrow$

$\frac{1}{\sqrt{2}}\cdot\sqrt{2}\,mg = k_0\dfrac{q\cdot q}{(\frac{1}{\sqrt{2}}L\cdot 2)^2}$

$q^2 = \dfrac{mg(\sqrt{2}L)^2}{k_0}$

$q = L\sqrt{\dfrac{2mg}{k_0}}$ [C]

68 (1) $\Delta V = 2.0\cdot 10^4\,\mathrm{V/m}\cdot 0.40\,\mathrm{m}$

$= 0.8\cdot 10^4$

$= 8.0\cdot 10^3\,\mathrm{V}$

(2) $\mathrm{Work}_{外力} = Fx$, $F = qE$

$\Rightarrow \mathrm{Work}_{外力} = q\boxed{Ex}$

又，$V = U/q \Leftrightarrow U = \boxed{V}q \quad \therefore V = Ex$

$\therefore \mathrm{Work}_{外力} = qV$

$= (-2.0)\cdot(-150)$

$= 3.0\cdot 10^2$ J

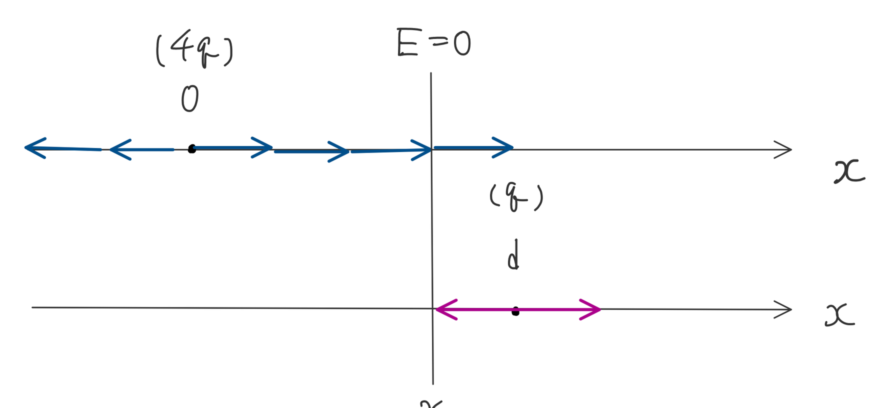
69 (1) 1, 2 は等电位面

3, 4 は电气力线

$E = k\dfrac{q}{r^2}$ がつよい ⇒ 密

∴ 4

(2)



(図の d は気にしないでください ><

点.x =: x (0 < x < d)　E=0 の場所が知りたいだけです)

$E_0 = E_d$

$k_0\dfrac{4q}{x^2} = k_0\dfrac{q}{(d-x)^2}$

$\dfrac{4}{x^2} = \dfrac{1}{(d-x)^2}$

$\dfrac{x^2}{4} = (d-x)^2$

$x^2 = 4(d-x)^2$

$= 4d^2 - 8dx + 4x^2$

$0 = 3x^2 - 8dx + 4d^2$

$= (3x-2d)(x-2d)$

$x\ (0<x<d) = \dfrac{2}{3}d$

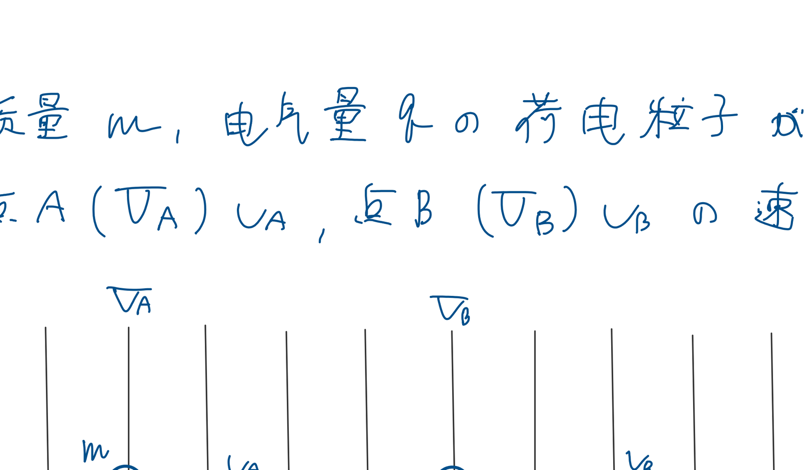
(3) 荷电粒子の运动

电界中に荷电粒子をおくと

荷电粒子は电气力を受け移动.

质量 m，电气量 q の荷电粒子が

点 A (V_A) v_A，点 B (V_B) v_B の速さで通过



エネルギー保存则がはたらく.

< 力学的エネルギー保则の法则 >

$K_i + U_i = K_f + U_f$

$(K = \frac{1}{2}mv^2,\ U = mgh)$

电位 $V = \dfrac{\text{Potential-energy 电气力 } U}{\text{电气量 } q}$

$\Leftrightarrow U = Vq$ より

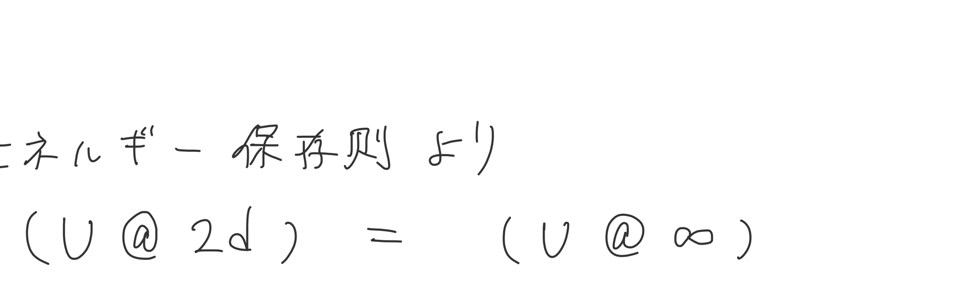
$$\frac{1}{2}mv_A^2 + V_A q = \frac{1}{2}mv_B^2 + V_B q$$

エネルギー保存则より

$(U @ 2d) = (U @ \infty)$

$\frac{1}{2}m\cdot 0^2 + V_{2d}Q = \frac{1}{2}mv^2 + V_\infty q \quad \cdots ①$

V_{2d} は，无限远点基準で



Q があることは无关系

V は「その地点での」

$V_{2d} = V_0 + V_d$

$= k_0\dfrac{4q}{2d} + k_0\dfrac{q}{(2d-d)}$

$= k_0\dfrac{q}{d}\left(\dfrac{4}{2} + \dfrac{1}{1}\right)$

$= k_0\dfrac{3q}{d}$

$① \Rightarrow k_0\dfrac{3q}{d}Q = \dfrac{1}{2}mv^2 + V_\infty q$

V_∞ は，

$V_\infty = \dfrac{k_0 q}{\infty} = 0$

$① \Rightarrow k_0\dfrac{3q}{d}Q = \dfrac{1}{2}mv^2$

$v^2 = k_0\dfrac{3q}{d}Q\cdot\dfrac{2}{m}$

$v = \sqrt{\dfrac{6k_0 qQ}{md}}$