$$E_n = \sigma_{e^n}/2 = \left\{egin{array}{l} 6*10^{-5} \ 1*10^{-5} \ 5.5*10^{-5} \end{array}
ight.$$

以 σ_{e^2} 为零电势面

$$\begin{cases} V_A = +5 * 10^{-6} \\ V_B = -7 * 10^{-7} \end{cases} \Rightarrow U_{AB} = -2 * 10^{-7}$$

(2)

$$W = -U_{AB} \cdot q_0 = -2 * 10^{-15} J$$

1 - 34

(1)

$$V=rac{1}{4\piarepsilon_0 r}.rac{4}{3}
ho_e\pi R^3=rac{
ho_e R^3}{3arepsilon_0 r}$$

(2)

$$V = \frac{\rho_e R^2}{3\varepsilon_0}$$

(3)

$$\vec{E} = \frac{4}{3}\rho_e \pi r^3 \frac{1}{4\pi\varepsilon_0 r^2} = \frac{\rho_e r}{3\varepsilon_0}$$

$$V = \frac{\rho_e R^2}{3\varepsilon_0} - \int_R^r \frac{\rho_e r'}{3\varepsilon_0} dr' = \frac{\rho_e R^2}{3\varepsilon_0} - \left(\frac{\rho_e r^2}{6\varepsilon_0} - \frac{\rho_e R^2}{6\varepsilon_0}\right) = \frac{\rho_e R^2}{2\varepsilon_0} - \frac{\rho_e r^2}{6\varepsilon_0}$$

1 - 36

(1)令内部圆柱面电荷线密度为 σ

$$\begin{split} E\left(r\right) &= \frac{1}{2\pi r \varepsilon_0} \sigma\left(R_1 < r < R_2\right) \\ &- \int_{R_1}^{R_2} E\left(r\right) = 450 \mathrm{V} \\ &\Rightarrow \frac{\sigma}{2\pi \varepsilon_0} \ln\left(\frac{R_1}{R_2}\right) = 450 \mathrm{V} \\ &\Rightarrow \sigma = \frac{900\pi \varepsilon_0}{\ln\left(0.3\right)} \mathrm{C} \cdot \mathrm{m}^{-1} \end{split}$$

(2)

$$E\left(r
ight) = rac{1}{2\pi r arepsilon_0} \sigma = rac{450}{\ln\left(0.3
ight)r}(V)\left(R_1 < r < R_2
ight)$$

1.37

$$\vec{E} = \begin{cases} \frac{\rho_e r}{2\varepsilon_0} & r \leqslant R \\ \frac{\rho_e R^2}{2\varepsilon_0 r} & r > R \end{cases}$$

$$V = -\int_0^r \vec{E} \cdot d\vec{r} = \begin{cases} \frac{\rho_e r^2}{4\varepsilon_0} \\ \frac{\rho_e R^2}{4\varepsilon_0} + \frac{\rho_e R^2}{2\varepsilon_0} \ln \frac{r}{R} \end{cases}$$

1 - 43

$$egin{align*} V_B &= \int_{-rac{l}{2}}^{rac{l}{2}} rac{1}{4\piarepsilon_0} rac{l_e \mathrm{d}x}{\sqrt{\left(rac{x}{2}
ight)^2 + b^2}} \ &= \int_{-rctanrac{l}{4b}}^{rctanrac{l}{4b}} rac{1}{2\piarepsilon_0} rac{l_e}{\cos heta} \mathrm{d} heta \ &= -\int_{-rctanrac{l}{4b}}^{rctanrac{l}{4b}} rac{1}{2\piarepsilon_0} rac{l_e}{1-\sin^2 heta} \mathrm{d}\sin heta \ &= -rac{1}{2\piarepsilon_0} rac{l_e}{2} \mathrm{ln} \left(rac{1+x}{1-x}
ight)igg|_{x=-rac{l}{\sqrt{16b^2+l^2}}}^{x=rac{l}{\sqrt{16b^2+l^2}}} \ &= -rac{l_e}{2\piarepsilon_0} \mathrm{ln} \left(rac{1+x}{1-x}
ight)igg|_{x=-rac{l}{\sqrt{16b^2+l^2}}}^{x=-rac{l}{\sqrt{16b^2+l^2}}} \ &= -rac{l_e}{\sqrt{16b^2+l^2}} \mathrm{ln} \left(rac{1-x}{1-x}
ight)igg|_{x=-rac{l}{\sqrt{16b^2+l^2}}}^{x=-rac{l}{\sqrt{16b^2+l^2}}} \ \end{split}$$

1 - 49

(1)

$$egin{aligned} \mathbf{V}_P &= \int_{R_1}^{R_2} \left(rac{1}{4\piarepsilon_0} \cdot rac{2\pi r \sigma_e \mathrm{d}r}{\sqrt{r^2 + x^2}}
ight) \ &= \int_{R_1}^{R_2} \left(rac{r \sigma_e \mathrm{d}r}{2arepsilon_0 \sqrt{r^2 + x^2}}
ight) \ &= rac{\sigma_e}{2arepsilon_0} \left(\sqrt{R_2^2 + x^2} - \sqrt{R_1^2 + x^2}
ight) \end{aligned}$$

(2)

令原点 O 的电势为

$$V = \frac{\sigma_e}{2\varepsilon_0} (R_2 - R_1)$$

则无穷远处电势为

$$egin{align} V &= rac{\sigma_e}{2arepsilon_0} igg(\sqrt{R_2^2 + x^2} - \sqrt{R_1^2 + x^2}igg) \ &= rac{\sigma_e}{2arepsilon_0} igg(\sqrt{1 + \left(rac{R_2}{x}
ight)^2} - \sqrt{1 + \left(rac{R_1}{x}
ight)^2}igg) \ &pprox rac{\sigma_e\left(R_2^2 - R_1^2
ight)}{4xarepsilon_0} pprox 0 \end{array}$$

因而得到

$$\frac{1}{2}mv_{min}^2 = \frac{\sigma_e}{2\varepsilon_0}(R_2 - R_1)$$

$$\Rightarrow v_{min} = \sqrt{\frac{\sigma_e}{m\varepsilon_0}(R_2 - R_1)}$$

(不是,这计算就是以无穷远点为势能零点算的啊,我还再算一次干嘛)

1 - 51

作法类似上一题 (懒得算了)

$$V = rac{\sigma_e}{2arepsilon_0} \sqrt{R_2^2 + \left(rac{R_2}{ an heta}
ight)^2} + rac{\sigma_e}{2arepsilon_0} \sqrt{R_1^2 + \left(rac{R_1}{ an heta}
ight)^2}$$

1 - 55

$$egin{align} V &= rac{\sigma_e}{2arepsilon_0}igg(\sqrt{R_2^2+x^2}-\sqrt{R_1^2+x^2}igg) \ E &= -rac{\partial V}{\partial x} = -rac{\sigma_e}{2arepsilon_0}igg(rac{x}{\sqrt{R_2^2+x^2}}-rac{x}{\sqrt{R_1^2+x^2}}igg) \ \end{array}$$