

# 作业纸

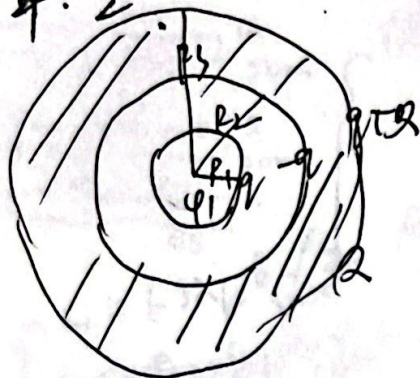
课程名称: 大物

班级: 6302216

教学班级: 08012204 姓名: 俞乐博

学号: 112024303 第 1 页

第 2 题



①  $r < R_1$   $\varphi = \varphi_1$   $E = 0$

$$\varphi_1 = \frac{1}{4\pi\epsilon_0} \left( \frac{q}{R_1} + \frac{-q}{R_2} + \frac{q}{R_3} \right)$$

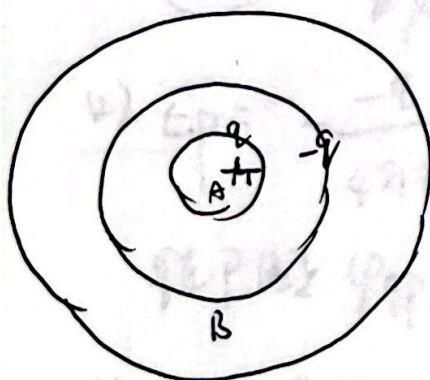
$$\Rightarrow q = \frac{4\pi\epsilon_0 R_1 R_2 R_3 \varphi_1 - R_2 R_3 Q}{R_2 R_3 - R_2 R_3 + R_1 R_2}$$

②  $R_1 < r < R_2$   $\varphi = \frac{1}{4\pi\epsilon_0} \left( \frac{q}{r} + \frac{-q}{R_2} + \frac{q}{R_3} \right)$   $E = \frac{q}{4\pi\epsilon_0 r^2}$

③  $R_2 < r < R_3$   $\varphi = \frac{q+Q}{4\pi\epsilon_0 R_3}$   $E = 0$

④  $r > R_3$   $\varphi = \frac{Q+Q}{4\pi\epsilon_0 r}$   $E = \frac{q+Q}{4\pi\epsilon_0 r^2}$

3.  $q_1$  均分布在 A 外表面. B 内表面  $-q_1$  外表面  $q_2 - q_1$



$$\varphi = \begin{cases} \frac{q_1}{4\pi\epsilon_0 R_1} - \frac{q_1}{4\pi\epsilon_0 R_2} + \frac{q_1 + q_2}{4\pi\epsilon_0 R_3} & (r \leq R_1) \\ \frac{q_1}{4\pi\epsilon_0 r} - \frac{q_1}{4\pi\epsilon_0 R_2} + \frac{q_1 + q_2}{4\pi\epsilon_0 R_3} & (R_1 < r \leq R_2) \\ \frac{q_1 + q_2}{4\pi\epsilon_0 R_3} & (R_2 < r \leq R_3) \\ \frac{q_1 + q_2}{4\pi\epsilon_0 r} & (r > R_3) \end{cases}$$

联系方式: \_\_\_\_\_



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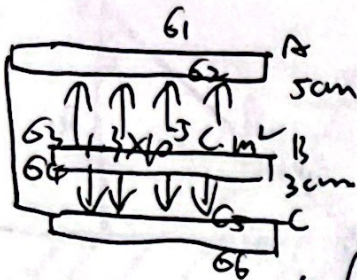
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6.



内部电荷为0.

$$\sigma_1 - \sigma_2 - \sigma_3 - \sigma_4 + \sigma_5 + \sigma_6 = 0$$

$$\sigma_1 + \sigma_2 + \sigma_3 - \sigma_4 - \sigma_5 - \sigma_6 = 0$$

$$\sigma_1 + \sigma_2 + \sigma_3 + \sigma_4 + \sigma_5 - \sigma_6 = 0$$

AC 导体:  $U_{AB} = U_{CB}$

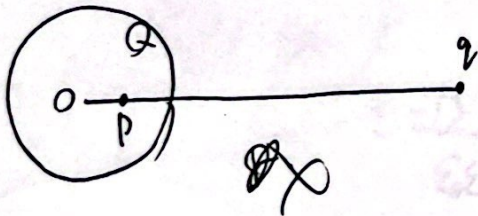
$$\Rightarrow (\sigma_1 + \sigma_2 - \sigma_3 - \sigma_4 + \sigma_5 - \sigma_6) d_{AB} =$$

$$(\sigma_5 + \sigma_6 - \sigma_1 - \sigma_2 - \sigma_3 - \sigma_4) d_{CB}$$

$$\sigma_4 = -5.8 \times 10^{-6} \text{ C/m}^2 \quad \sigma_3 + \sigma_4 = 1.3 \times 10^{-5}$$

$$\sigma_6 = 6.5 \times 10^{-6} \text{ C/m}^2 \quad \text{AC 导体} \quad \sigma_1 + \sigma_2 + \sigma_3 + \sigma_4 = 0$$

7.



(1).  $\vec{E}_0 = 0$

$$\varphi_0 = \frac{Q}{4\pi\epsilon_0 R} + \frac{q}{4\pi\epsilon_0 r}$$

(2).  $\vec{E}_P = \frac{-q}{4\pi\epsilon_0 (x - \frac{R}{2})^2}$

在 P 点  $\varphi_{qp} = \frac{q}{4\pi\epsilon_0 (x - \frac{R}{2})}$

$\varphi_{总} = \varphi_P - \varphi_{qp} = \varphi_P - \frac{q}{4\pi\epsilon_0 (x - \frac{R}{2})}$

$\varphi_P = \varphi_0 = \frac{Q}{4\pi\epsilon_0 R} + \frac{q}{4\pi\epsilon_0 x}$

$\therefore \varphi_{总} = \frac{Q}{4\pi\epsilon_0 R} + \frac{q}{4\pi\epsilon_0 x} - \frac{q}{4\pi\epsilon_0 (x - \frac{R}{2})}$

联系方式: \_\_\_\_\_



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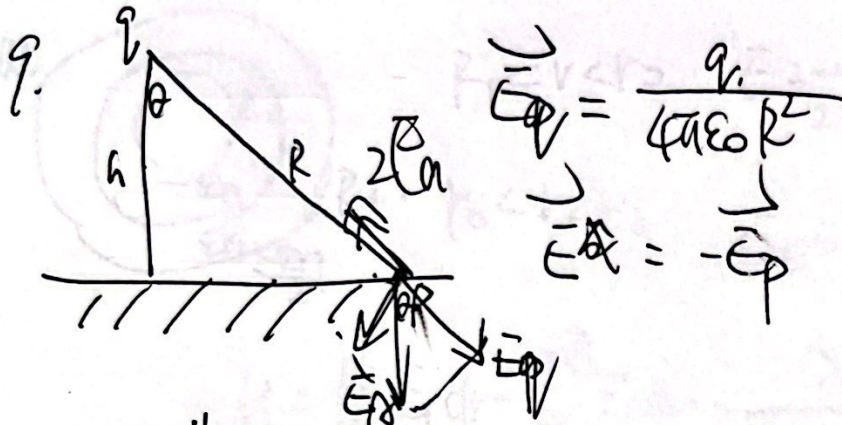
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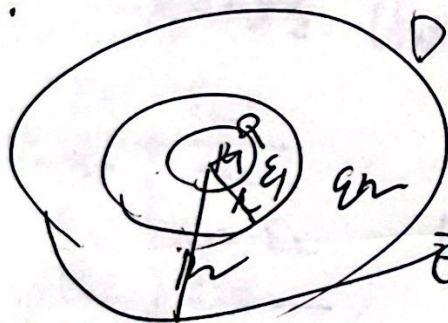
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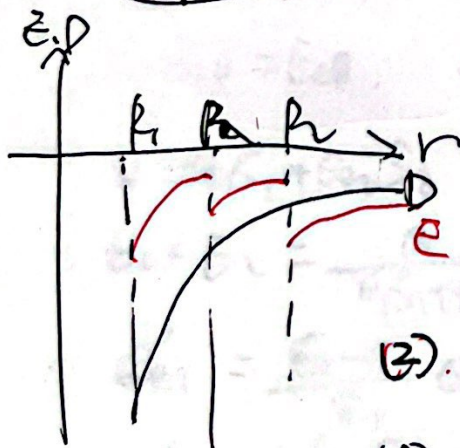
其它电荷都在垂直平面.  $\therefore \vec{E}_A = 2\vec{E}' \cos\theta = \frac{2qh}{4\pi\epsilon_0 R^3}$

$$\phi_e = -\epsilon_0 \vec{E}_A = -\frac{qh}{2\pi R^3}$$

11.



$$D = \begin{cases} r < R_1 \\ r > R_1 \end{cases} \quad D = \begin{cases} r < R \\ r > R \end{cases} \quad D = \frac{Q}{4\pi r^2}$$



$$(2) \quad U = \int_{R_1}^R \vec{E} dr + \int_R^{\infty} \vec{E} dr = -2.8 \times 10^3 \text{ V}$$

$$(3) \quad \sigma = \vec{P} \cdot \vec{e}_n = \vec{P} \cdot \vec{e}_n = -\epsilon_0 \epsilon_1 \nabla \cdot \vec{E} = 9.9 \times 10^{-6} \text{ C/m}^2$$

联系方式: \_\_\_\_\_

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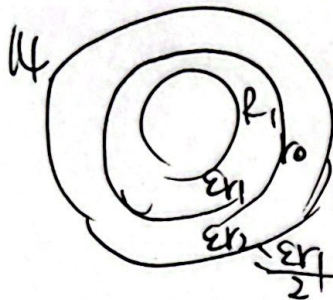
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$$R_1 < r < b. \quad \bar{E} = \frac{\lambda e}{2\pi b \epsilon_1 r}$$

$$b < r < R_2. \quad \bar{E}_2 = \frac{\lambda e}{2\pi \epsilon_2 r} - \frac{\lambda e}{\pi \epsilon_2 R_2 r}$$

$$U = \int_{R_1}^b \bar{E}_1 dr + \int_b^{R_2} \bar{E}_2 dr = \frac{\lambda e}{2\pi \epsilon_0 \epsilon_1} \ln \frac{R_2^2}{R_1 R_0}$$

$$\therefore \bar{E}_1 = \frac{U}{R_1 \ln \frac{R_2^2}{R_1 R_0}} \quad \bar{E}_2 = \frac{2U}{R_0 \ln \frac{R_2^2}{R_1 R_0}}$$

$$\therefore \text{电势差}. U_{\max} = \frac{\bar{E}_1 R_0}{2} \ln \frac{R_2^2}{R_1 R_0}$$

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$S_1$	$S_2$
$-\sigma_{e1}$	$-\sigma_{e2}$
$\epsilon_1$	$\epsilon_2$
$+\sigma_{e1}$	$+\sigma_{e2}$

$$D_1 = \sigma_{e1}. \quad \bar{E}_1 = \frac{\sigma_{e1}}{\epsilon_1}$$

$$D_2 = \sigma_{e2}. \quad \bar{E}_2 = \frac{\sigma_{e2}}{\epsilon_2}$$

$$\bar{E}_1 = \bar{E}_2. \quad \bar{E}_1 = \bar{E}_2 = \frac{\sigma_{e1}}{\epsilon_1} = \frac{\sigma_{e2}}{\epsilon_2}$$

$$Q = \sigma_{e1} S_1 + \sigma_{e2} S_2$$

$$\therefore \bar{E}_1 = \bar{E}_2 = \frac{Q}{\epsilon_1 S_1 + \epsilon_2 S_2}$$

$$\therefore \sigma_{e1}' = \frac{\epsilon_2 - \epsilon_1}{\epsilon_1} \sigma_{e1}$$

$$\sigma_{e2}' = \frac{\epsilon_1 - \epsilon_2}{\epsilon_2} \sigma_{e2}$$

联系方式: \_\_\_\_\_