静电场（二）参考答案

一、选择题

题号	1	2	3	4	5
答案	A	B	D	C	B

二、填空题

1. $\dfrac{Q}{4\pi\varepsilon_0 R}$

2. $U = \dfrac{Q}{4\pi\varepsilon_0 R}$

3. $\dfrac{\lambda}{2\pi\varepsilon_0}\ln\dfrac{r_0}{r}$

4. 0

5. $\vec{E} = (-4+10xy)\vec{i} + 5x^2\vec{j}$

三、计算题

1.

取杆左端为原点，x 轴向右为正

在带电细杆任意位置 x 处取一小段线元，其电量 $dq = \lambda dx = \dfrac{q}{l}dx$

它在点 P 产生的电势 $dU = \dfrac{\lambda dx}{4\pi\varepsilon_0(l+d-x)} = \dfrac{qdx}{4\pi\varepsilon_0 l(l+d-x)}$

$$U = \int dU = \int_0^l \frac{qdx}{4\pi\varepsilon_0 l(l+d-x)} = \frac{q}{4\pi\varepsilon_0 l}\ln\frac{l+d}{d}$$

2.

$$\oint_S \vec{E}\cdot d\vec{S} = \frac{1}{\varepsilon_0}\sum_{内} q_i$$

(1) $r < R$

$$E4\pi r^2 = \frac{1}{\varepsilon_0}\int_0^r kr4\pi r^2 dr$$

$$E = \frac{\pi kr^4}{4\varepsilon_0}$$

(2) $r \geq R$

$$E4\pi r^2 = \frac{1}{\varepsilon_0}\int_0^R kr4\pi r^2 dr$$

$$E = \frac{\pi kR^4}{4\varepsilon_0 r^2}$$

$$U_r = \int_R^\infty \vec{E}\cdot d\vec{l}$$

$$= \int_R^\infty \frac{kR^4}{4\varepsilon_0 r^2}dr$$

$$= \frac{kR^3}{4\varepsilon_0}$$