Chapter 24.

1. $p = (-1\hat{i} - 2\hat{j} + 4\hat{k})$.

$\vec{E} = \vec{\nabla} V = -(2yz^2\hat{i} + 2xz^2\hat{j} + 4xyz\hat{k})$

$\vec{E} = 64\hat{i} + 32\hat{j} - 32\hat{k}$ $E = 78.4\ N/C$

31. $q = 7.5\times10^{-15}\ C$.

$V = \frac{1}{4\pi\varepsilon_0}\sum\frac{q_i}{r_i} = \frac{1}{4\pi\varepsilon_0}\left(+\frac{q}{2d}\right)$.

$\therefore V = 2.11\times10^{-3}\ V$.

3. (a) $m_A = 5\times10^{-3}\ kg$ $m_B = 10^{-2}\ kg$ $q = 5\times10^{-6}\ C$.

$E = \frac{1}{4\pi\varepsilon_0}\frac{q_1 q_2}{r^2} = 74.9\times10^{-3}\ J$.

(b) $F = \frac{1}{4\pi\varepsilon_0}\frac{q^2}{d^2} = 0.025\ N$.

$a_1 = \frac{F}{m_1} = 5\ m/s^2$ $a_2 = 2.5\ m/s^2$

(c). $m_1 v_1 = m_2 v_2$.

$E = \frac{m_1 v_1^2}{2} + \frac{m_2\left(\frac{m_1}{m_2}v_1\right)^2}{2} = 24.9\ J$

$\therefore v_2 = 2.24\ m/s$.

9. (a) $d = 3\times10^{-2}\ m$. $V = \frac{1}{4\pi\varepsilon_0}\left(\frac{q_1}{\frac{r}{2}} + \frac{q_2}{\frac{r}{2}}\right)$ $V = -630\ V$.

(b) $V = \frac{1}{4\pi\varepsilon_0}\left(\frac{q_1}{R} + \frac{q_2}{r-R}\right) = 263\ pV$

(c) $V = \frac{1}{4\pi\varepsilon_0}\left(\frac{q_1}{r-R} + \frac{q_2}{R}\right) = -2295\ pV$

6.

(a) $E = \frac{\sigma}{2\varepsilon_0} = 0.33\,N/C$

$W = \int_{r_1}^{r_2} \bar{E} q\,dx$ 代入 $E = 3.22\times10^{-21}\,J$

$\Delta V = -\int_{r_1}^{r_2} \bar{E}\,dx = -2.03\times10^{-2}\,V$.

$\therefore V_p = V + \Delta V = -2.03\times10^{-2}\,V$.

7. $V = \frac{1}{4\pi\varepsilon_0}\int \frac{\sigma}{r'}\,da$ $\sigma = 7.73\times10^{-15}\,C/m^2$

$da = r\,dr\,d\phi$ 代入 $\int_0^R 2\pi r\cdot dr\cdot\sigma$ $dq = \sigma\cdot 2\pi r\,dr$

代入 $V = \frac{1}{4\pi\varepsilon_0}\int_0^R \frac{\sigma}{2\varepsilon_0}\frac{r\,dr}{\sqrt{D^2+r^2}} = \frac{\sigma}{8\varepsilon_0}\left(\sqrt{D^2+r^2} - D\right)$. $dV = \frac{1}{4\pi\varepsilon_0}\frac{\sigma(2\pi r)\,dr}{\sqrt{D^2+r^2}}$

代入 $V = 3.63\times10^{-5}\,V$.