Chapter **22** (Benson)

E03 $q_1 = 2\mu C$, $q_2 = -4\mu C$, $q_3 = 6\mu C$, $L = 3\,\text{cm}$. **(a)** $F_{3x} = F_{31} - F_{32x} = 3kq_1^2/L^2 - 6kq_1^2\cos 60^0/L^2 = 0$, $F_{3y} = F_{32}\sin 60^0 = k(2\mu)(3\mu)(\sqrt{3}/2)/(0.03)^2 = 208\,\text{N}$; **(b)** $F_{2x} = (F_{23} - F_{21})\cos 60^0 = 80\,\text{N}$, $F_{2y} = -(F_{23} + F_{21})\sin 60^0 = -277\,\text{N}$.

E04 $a = 4\,\text{cm}$, $b = 3\,\text{cm}$. $q_1 = Q$, $q_2 = 2Q$, $q_3 = -3Q$, $q_4 = -2Q$, where $Q = 4\,\text{nC}$. **(a)** $F_{4x} = F_{42}\,a/r + F_{41} = 0.364\times 10^{-3}\,\text{N}$, $F_{4y} = F_{43} - F_{42}\,b/r = 0.822\times 10^{-3}\,\text{N}$; **(b)** $F_{3x} = (F_{32} + F_{31})\,a/r = 0.678\times 10^{-3}\,\text{N}$, $F_{3y} = -F_{32} + F_{31}\,b/r = -0.857\times 10^{-3}\,\text{N}$.

E12 $T\cos\theta = mg$, $T\sin\theta = kQ^2/d^2$, where $d = 2L\sin\theta \Rightarrow Q^2 = mgd^2\tan\theta/k$, $Q = 0.395\mu C$.

P02 **(a)** $F_y = 0$, $F_x = 2kqQ\cos\theta/r^2 = 2kqQx/(a^2 + x^2)^{3/2}$; **(b)** Set $dF/dx = 0$ to find $x = \pm a/\sqrt{2}$; **(c)** $F_x = 2kqQ/x^2$. (Teacher: Jyh-Shinn Yang, 90.04.06)

P03 **(a)** $F_x = 0$, $F_y = -2kqQ\sin\theta/r^2 = -2kqQa/(a^2 + x^2)^{3/2}$; **(b)** $x = 0$.

P04 **(a)** $F_x = 0$, $F_y = kqQ/(y-a)^2 - kqQ/(y+a)^2 = 4kqQay/(y^2 - a^2)^2$; **(b)** $F_y = 4kqQa/y^3$.

P09 **(a)** $F_e = F_c$, $ke^2/r^2 = mv^2/r$, so $v = (ke^2/mr)^{1/2}$; **(b)** $L = mrv = nh/2\pi$, leads to $r = (nh/2\pi)^2/mke^2$; **(c)** $n = 1$, $r_1 = 0.53\times 10^{-10}\,\text{m}$; $n = 2$, $r_2 = 2.12\times 10^{-10}\,\text{m}$; $n = 3$, $r_3 = 4.77\times 10^{-10}\,\text{m}$.