Chapter **26** (Benson)

E03 $C = 240\,\text{pF}$, $Q = 40\,\text{nC}$, $d = 0.2\,\text{mm}$. (**a**) $A = Cd/\epsilon_0 = 54.2\,\text{cm}^2$; (**b**) $V = Q/C = 167\,\text{V}$; (**c**) $E = V/d = 8.33\times10^5\,\text{V/m}$.

E07 Effective area is $4A$, so $C = 4\epsilon_0 A/d$.

E18 $C_{eq} = 15/41\,\mu\text{F} = 0.366\,\mu\text{F}$.

E25 $A = 40\,\text{cm}^2$, $d = 2.5\,\text{mm}$, $\mathcal{E} = 24\,\text{V}$. (**a**) $C = 14.2\,\text{pF}$; (**b**) $U = 4.08\,\text{nJ}$; (**c**) $E = 9.6\,\text{kV/m}$; (**d**) $u_E = 408\,\mu\text{J/m}^3$.

E33 (**a**) $C = \epsilon_0 A/(d-l)$; (**b**) No change.

E34 $Q = CV$, $C = \epsilon_0 A/d$; $d' = 2d$, $C' = C/2$. (**a**) $V' = V$; (**b**) $Q' = C'V' = (C/2)V = Q/2$; (**c**) $U' = C'V^2/2 = CV^2/4 = U/2$.

E35 $Q = CV$, $C = \epsilon_0 A/d$; $d' = 2d$, $C' = C/2$.
(**a**) $V' = 2V$; (**b**) $Q' = Q$; (**c**) $U' = C'V^2/2 = 2U$.

E36 $U = CV^2/2$, $U_5 = 200\,\text{mJ}$. (**a**) $U_4 = (4/5)U_5 = 160\,\text{mJ}$; (**b**) $C_{36} = 2\,\mu\text{F}$, $U_{36} = (2/5)U_5 = 80\,\text{mJ}$, $U_3 = (2/3)U_{36} = 53.3\,\text{mJ}$.

E41 $C = C_0(\kappa_1 + \kappa_2)/2$.

E42 $C = 2\kappa_1\kappa_2 C_0/(\kappa_1 + \kappa_2)$.

E43 $d = 1\,\text{cm}$, $l = 0.3\,\text{cm}$, $\sigma = 2\,\text{nC/m}^3$, $\kappa = 5$, $A = 40\,\text{cm}^2$. (**a**) $V = V_0[1 - (\kappa-1)l/\kappa d] = 1.72\,\text{V}$; (**b**) $C = C_0/[1 - (\kappa-1)l/\kappa d] = 4.66\,\text{pF}$.

E55 (**a**) $C = \kappa\epsilon_0 A/d = 1.65\,\text{nF}$; (**b**) From Table 26.1, $V_{max} = 1600\,\text{V}$.

E63 $C_0 = \epsilon_0 A/d = 3.2\,\text{nF}$, $C = \kappa\epsilon_0 A/2d = (\kappa/2)C_0 = 8.0\,\text{nF}$, thus $\kappa = 5.0$.

P01 $U = CV^2/2 = \kappa C_0(Ed)^2/2 = \kappa\epsilon_0 E^2(Ad)/2$. Thus, $u = U/(Ad) = \kappa\epsilon_0 E^2/2$.

P02 $U_i = \epsilon_0 AV^2/2(d-l)$; $U_f = \epsilon_0 AV^2/2d$. $W = \Delta U = -\epsilon_0 AlV^2/2d(d-l)$.

P03 $Q_f = Q_i$; $U_i = \epsilon_0 AV^2/2(d-l)$; $V_f = dV/(d-l)$, $U_f = C_f V_f^2/2 = \epsilon_0 AdV^2/2(d-l)^2$. $\Delta U = \epsilon_0 AlV^2/2(d-l)^2$. (Teacher: Jyh-Shinn Yang, 90.05.07)

P05 $1/C_{eq} = 2/C + 1/(C_{eq} + C)$, so $2C_{eq}^2 + 2CC_{eq} - C^2 = 0$. Find $C_{eq} = 0.366C$.

P08 $Q_D = Q$, $C_D = kC$, $V_D = V/k$, $U = C_D V_D^2/2 = (\kappa C)(V/k^2)/2 = CV^2/2\kappa$.

P09 $V_D = V$, $C_D = kC$, $U = C_D V_D^2/2 = (\kappa C)(V^2)/2 = \kappa CV^2/2$.

P10 $C = 2\pi\epsilon_0 L/\ln(b/a) \sim \epsilon_0(2\pi La)/(b-a) = \epsilon_0 A/d$.

P11 $C = 4\pi\epsilon_0 R_1 R_2/(R_2 - R_1) \sim 4\pi\epsilon_0 R_1^2/(R_2 - R_1) = \epsilon_0 A/d$.

P13 $E_D = E_0 - E_i = E_0/\kappa$, $E_i = E_0(1 - 1/\kappa)$, $\sigma \propto E$, $\sigma_b = \sigma_f(1 - 1/\kappa)$.