24-24. (a) $V = Q/C = 2.55 \times 10^{-6}/920 \times 10^{-12} = 2770$ V

(b) Since $C = \epsilon_0 A/d$, doubling d halves C which doubles $V = Q/C$. Alternatively since the charge and area of the plates in unchanged $E = \sigma/\epsilon_0$ is also unchanged. But $V = Ed$, so doubling d doubles V.

(c) The work required to move the plates is $+\Delta U = \frac{1}{2}Q^2(1/C_f - 1/C_i) = \frac{1}{2}Q^2(2/C_i - 1/C_i) = \frac{1}{2}Q^2/C_i = \frac{1}{2}(2.55 \times 10^{-6})^2/(920 \times 10^{-12}) = 3.53 \times 10^{-3}$ J

24-29. (a) $U = \frac{1}{2}\,Q^2/C = \frac{1}{2}\,xQ^2/\epsilon_0 A$

(b) $dU = \frac{1}{2}\,dx\;Q^2/\epsilon_0 A = \frac{1}{2}\,dx\;Q(\sigma/\epsilon_0) = \frac{1}{2}\,dx\;QE$

(c) $F = \frac{1}{2}\,QE$

(d) You can't push yourself: half of E is due to this plate; half to the other.

24-39. (b) Using Eq. 24-14:

$$K = \frac{E_0}{E} = \frac{3.2}{2.5} = 1.28$$

(a) The free charge (which remains remains unchanged) was: $\sigma = \epsilon_0 E$
Using Eq. 24-16:

$$\sigma_i = \epsilon_0 E\left(1 - \frac{1}{K}\right) = 8.85 \times 10^{-12} \cdot 3.2 \times 10^5 \left(1 - \frac{1}{1.28}\right) = 6.20 \times 10^{-7}\ \text{C/m}^2$$

11. (old exam)

A.

$$\begin{aligned} C &= K\,\frac{\epsilon_0 A}{d} \\ d &= K\,\frac{\epsilon_0 A}{C} \\ &= 10\,\frac{8.8542 \times 10^{-12} \cdot (.01)^2}{0.01 \times 10^{-6}} \\ &= 8.85 \times 10^{-7}\ \text{m} \end{aligned}$$

B.

$$\begin{aligned} \sigma &= \epsilon_0 K E \\ Q &= \sigma A = \epsilon_0 K E A \\ &= 8.8542 \times 10^{-12} \cdot 10 \cdot 10^7 \cdot (.01)^2 \\ &= 8.85 \times 10^{-8}\ \text{C} \end{aligned}$$