10. The equivalent capacitance is

$$C_{eq} = C_3 + \frac{C_1C_2}{C_1+C_2} = 4.00\,\mu\text{F} + \frac{(10.0\,\mu\text{F})(5.00\,\mu\text{F})}{10.0\,\mu\text{F}+5.00\,\mu\text{F}} = 7.33\,\mu\text{F}.$$

11. The equivalent capacitance is

$$C_{eq} = \frac{(C_1+C_2)C_3}{C_1+C_2+C_3} = \frac{(10.0\,\mu\text{F}+5.00\,\mu\text{F})(4.00\,\mu\text{F})}{10.0\,\mu\text{F}+5.00\,\mu\text{F}+4.00\,\mu\text{F}} = 3.16\,\mu\text{F}.$$

14. (a) The potential difference across C_1 is V_1 = 10.0 V. Thus,

$$q_1 = C_1V_1 = (10.0\ \mu\text{F})(10.0\ \text{V}) = 1.00 \times 10^{-4}\ \text{C}.$$

(b) Let C = 10.0 μF. We first consider the three-capacitor combination consisting of C_2 and its two closest neighbors, each of capacitance C. The equivalent capacitance of this combination is

$$C_{eq} = C + \frac{C_2C}{C+C_2} = 1.50\ C.$$

Also, the voltage drop across this combination is

$$V = \frac{CV_1}{C+C_{eq}} = \frac{CV_1}{C+1.50\ C} = 0.40V_1.$$

Since this voltage difference is divided equally between C_2 and the one connected in series with it, the voltage difference across C_2 satisfies $V_2 = V/2 = V_1/5$. Thus

$$q_2 = C_2V_2 = (10.0\,\mu\text{F})\left(\frac{10.0\,\text{V}}{5}\right) = 2.00\times10^{-5}\,\text{C}.$$

19. (a) and (b) We note that the charge on C_3 is q_3 = 12 μC – 8.0 μC = 4.0 μC. Since the charge on C_4 is q_4 = 8.0 μC, then the voltage across it is q_4/C_4 = 2.0 V. Consequently, the voltage V_3 across C_3 is 2.0 V $\Rightarrow$ $C_3 = q_3/V_3$ = 2.0 μF.

Now C_3 and C_4 are in parallel and are thus equivalent to 6 μF capacitor which would then be in series with C_2; thus, Eq 25-20 leads to an equivalence of 2.0 μF which is to be thought of as being in series with the unknown C_1. We know that the total effective capacitance of the circuit (in the sense of what the battery "sees" when it is hooked up) is (12 μC)/$V_{battery}$ = 4 μF/3. Using Eq 25-20 again, we find

$$\frac{1}{2\ \mu\text{F}} + \frac{1}{C_1} = \frac{3}{4\ \mu\text{F}} \quad \Rightarrow \quad C_1 = 4.0\ \mu\text{F}\ .$$

57. The pair C_3 and C_4 are in parallel and consequently equivalent to 30 μF. Since this numerical value is identical to that of the others (with which it is in series, with the battery), we observe that each has one-third the battery voltage across it. Hence, 3.0 V is across C_4, producing a charge

$$q_4 = C_4 V_4 = (15\ \mu\text{F})(3.0\ \text{V}) = 45\ \mu\text{C}.$$