College Physics Solutions
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Chapter 16

92. (a) $\frac{1}{C_s} = \frac{1}{C_1} + \frac{1}{C_2}$, ☛ $C_s = \frac{C_1 C_2}{C_1 + C_2} = \frac{(0.40\ \mu\text{F})(0.60\ \mu\text{F})}{0.40\ \mu\text{F} + 0.60\ \mu\text{F}} = \boxed{0.24\ \mu\text{F}}$.

(b) $C_p = C_1 + C_2 = 0.40\ \mu\text{F} + 0.60\ \mu\text{F} = \boxed{1.0\ \mu\text{F}}$.

94. All three are in parallel. So $C_p = C_1 + C_2 + C_3 = 1.7\ \mu\text{F}$.

Therefore $C_1 = 1.7\ \mu\text{F} - 0.20\ \mu\text{F} - 0.30\ \mu\text{F} = \boxed{1.2\ \mu\text{F}}$.

96. (a) You can obtain (3) seven different capacitance values.

(b) Three in series: $\frac{1}{C_s} = \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_2} = \frac{3}{1.0\ \mu\text{F}}$, so $C_s = \boxed{0.33\ \mu\text{F}}$.

Two in series: $\frac{1}{C_s} = \frac{1}{C_1} + \frac{1}{C_2} = \frac{2}{1.0\ \mu\text{F}}$, so $C_s = \boxed{0.50\ \mu\text{F}}$.

Two in parallel, then series: $C_p = C_1 + C_2 = 2.0\ \mu\text{F}$.

So $C_s = \frac{C_p C_3}{C_p + C_3} = \frac{(2.0\ \mu\text{F})(1.0\ \mu\text{F})}{2.0\ \mu\text{F} + 1.0\ \mu\text{F}} = \boxed{0.67\ \mu\text{F}}$.

Just one: $C = \boxed{1.0\ \mu\text{F}}$.

Two in series, then parallel: $C_p = 0.50\ \mu\text{F} + 1.0\ \mu\text{F} = \boxed{1.5\ \mu\text{F}}$.

Two in parallel: $C_p = 1.0\ \mu\text{F} + 1.0\ \mu\text{F} = \boxed{2.0\ \mu\text{F}}$.

Three in parallel: $C_p = 1.0\ \mu\text{F} + 1.0\ \mu\text{F} + 1.0\ \mu\text{F} = \boxed{3.0\ \mu\text{F}}$.

97. Parallel combination gives maximum. $C_p = C_1 + C_2 + C_3 = 1.5\ \mu\text{F} + 2.0\ \mu\text{F} + 3.0\ \mu\text{F} = \boxed{6.5\ \mu\text{F}}$.

Series combination gives minimum.

$\frac{1}{C_s} = \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3} = \frac{1}{1.5\ \mu\text{F}} + \frac{1}{2.0\ \mu\text{F}} + \frac{1}{3.0\ \mu\text{F}} = \frac{1}{1.5\ \mu\text{F}}$. So $C_s = \boxed{0.67\ \mu\text{F}}$.

98. The voltage is the same for all capacitors in parallel. $Q_1 = C_1 V = (0.10\ \mu\text{F})(6.0\ \text{V}) = \boxed{0.60\ \mu\text{C}}$,

$Q_2 = (0.20\ \mu\text{F})(6.0\ \text{V}) = \boxed{1.2\ \mu\text{C}}$, $Q_3 = (0.30\ \mu\text{F})(6.0\ \text{V}) = \boxed{1.8\ \mu\text{C}}$.