Solutions

Each answer shows the steps, then the **result**.

2.1

- the **charge stored per unit potential difference** ($C = Q/V$)

2.2

- the **farad** (F)

2.3

- $C = Q/V$

$$C = \frac{60 \times 10^{-6}\ \text{C}}{12\ \text{V}} = \mathbf{5.0}\ \mu\text{F}$$

2.4

- $C = C_1 + C_2 + \ldots$

3.1 B

- the SI unit of capacitance is the **farad**

3.2

- $Q = CV$

$$Q = (100 \times 10^{-6}\ \text{F})(9.0\ \text{V}) = \mathbf{9.0 \times 10^{-4}}\ \text{C}$$

3.3

- series: $1/C = 1/C_1 + 1/C_2$

$$\frac{1}{C} = \frac{1}{4.0\ \mu\text{F}} + \frac{1}{2.0\ \mu\text{F}} = \frac{3}{4.0\ \mu\text{F}}$$

- $C = \mathbf{1.3}\ \mu\text{F}$

3.4

- $1/C = 1/C_1 + 1/C_2 + \ldots$

3.5

(a) charges: $Q_1 = Q_2 = Q_\text{S}$ — the same charge passes through every capacitor in a series chain

- p.d.s: $V_1 + V_2 = V_\text{S}$

(b) $1/C = 1/120 + 1/180$

$$C = \frac{(120\ \mu\text{F})(180\ \mu\text{F})}{300\ \mu\text{F}} = \mathbf{72}\ \mu\text{F}$$

(c) $Q = CV$

$$Q = (72 \times 10^{-6}\ \text{F})(12\ \text{V}) = \mathbf{8.6 \times 10^{-4}}\ \text{C}$$

$$V_1 = \frac{Q}{C_1} = \frac{8.64 \times 10^{-4}\ \text{C}}{120 \times 10^{-6}\ \text{F}} = \mathbf{7.2}\ \text{V}$$

- the **smaller** capacitor takes the larger share of the p.d.

(d) capacitors in parallel add: $C_\text{total} = 72\ \mu\text{F} + 220\ \mu\text{F} = \mathbf{292}\ \mu\text{F}$

$$Q_\text{total} = (292 \times 10^{-6}\ \text{F})(12\ \text{V}) = \mathbf{3.5 \times 10^{-3}}\ \text{C}$$

(e) C_3

- it has the full 12 V across it and the largest capacitance, so $Q = CV$ is largest; the series pair shares the same p.d. and behaves as only 72 μF