

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

- $C = Q/V$

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

2.4

- $C = C_1 + C_2 + \dots$

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

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

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

3.4

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

3.5

(a) charges: $Q_1 = Q_2 = Q_S$ — the same charge passes through every capacitor in a series chain

- p.d.s: $V_1 + V_2 = V_S$

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

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

(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 $72 \mu\text{F}$