

Exercise walk-through

10.6

Capacitors

AP Physics 2

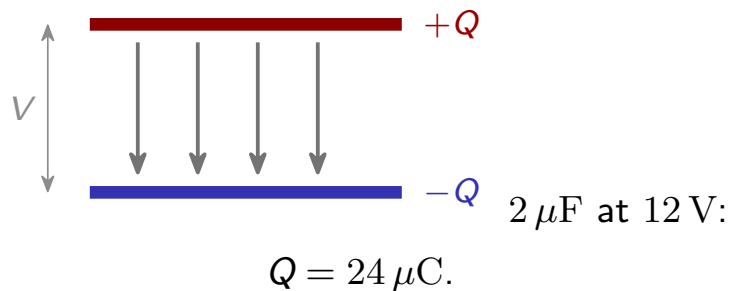
Capacitors

A **capacitor** stores charge on two plates ($+Q$ and $-Q$).

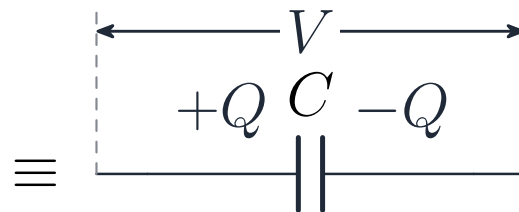
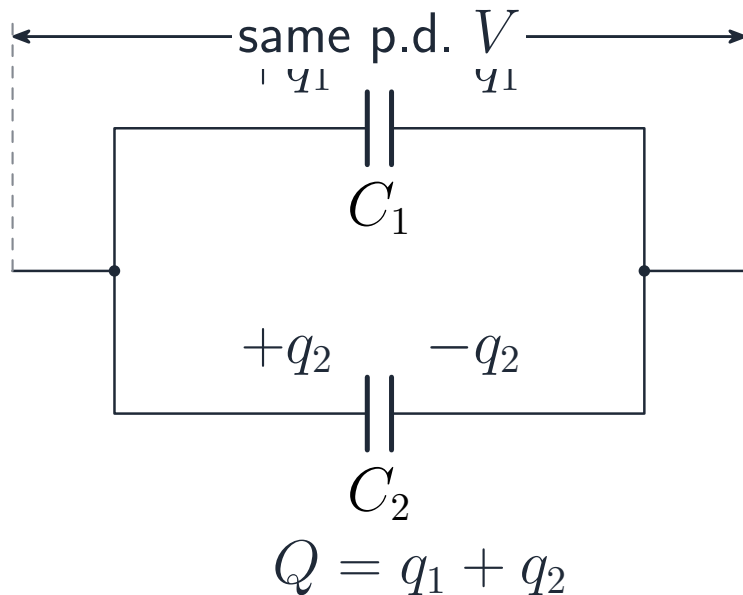
Capacitance and stored energy

$$C = \frac{Q}{V} = \frac{\epsilon_0 A}{d}, \quad U = \frac{1}{2} CV^2$$

Bigger plates or a smaller gap $\Rightarrow$ more capacitance. Energy $\propto V^2$.



Capacitors in parallel share the same p.d



$$C = C_1 + C_2$$

Capacitors in parallel share the same p.d., and their charges add

Exercises 2.1-2.3

2.1 A capacitor stores 6.0×10^{-4} C at 12 V. Find its capacitance. [2]

2.2 State how the capacitance changes if the plates are moved closer together. [1]

2.3 Find the energy stored in a $5.0 \mu\text{F}$ capacitor at 20 V. [2]

Exercises 2.1-2.3

2.1 A capacitor stores 6.0×10^{-4} C at 12 V. Find its capacitance. [2]

2.1

- $$C = \frac{Q}{V} = \frac{6.0 \times 10^{-4}}{12} = 5.0 \times 10^{-5} \text{ F}$$

2.2 State how the capacitance changes if the plates are moved closer together. [1]

2.2

- it increases (smaller separation gives larger capacitance)
-

2.3 Find the energy stored in a $5.0 \mu\text{F}$ capacitor at 20 V. [2]

2.3

- $$U = \frac{1}{2}CV^2 = \frac{1}{2}(5.0 \times 10^{-6})(20)^2 = 1.0 \times 10^{-3} \text{ J}$$

Exercises 3.1-3.2

3.1 Capacitance is defined as

[1]

☐

A QV

B Q/V

C V/Q

D $\frac{1}{2}QV$

☐

A CV

B $\frac{1}{2}CV^2$

C Q/V

D QV^2

Exercises 3.1-3.2

3.1 Capacitance is defined as

[1]

☐

A QV

B Q/V

C V/Q

D $\frac{1}{2}QV$

3.1 B

- Q/V .

3.2 The energy stored in a capacitor is

[1]

☐

A CV

B $\frac{1}{2}CV^2$

C Q/V

D QV^2

3.2 B

- $\frac{1}{2}CV^2$.

Exercise 3.3 (a)

3.3 A $100\ \mu\text{F}$ capacitor is charged to $50\ \text{V}$.

(a) Find the charge stored.

[2]

Exercise 3.3 (a)

3.3 A $100\ \mu\text{F}$ capacitor is charged to $50\ \text{V}$.

(a) Find the charge stored.

[2]

(a)

- $Q = CV = (100 \times 10^{-6})(50) = 5.0 \times 10^{-3}\ \text{C}$

Exercise 3.3 (b)

3.3 A $100\ \mu\text{F}$ capacitor is charged to $50\ \text{V}$.

(b) Find the energy stored.

[2]

Exercise 3.3 (b)

3.3 A $100\ \mu\text{F}$ capacitor is charged to $50\ \text{V}$.

(b) Find the energy stored.

[2]

(b)

- $U = \frac{1}{2}CV^2 = \frac{1}{2}(100 \times 10^{-6})(50)^2 = 0.125\ \text{J}$