

Exercise walk-through

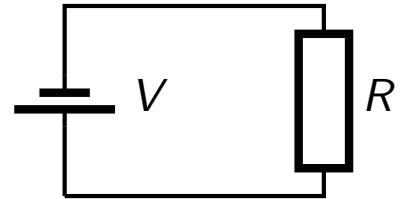
11.8

RC Circuits

AP Physics 2

What we will cover

- 1 Electric current
- 2 Simple circuits and Ohm's law
- 3 Electric power
- 4 Series and parallel resistors
- 5 Kirchhoff's rules
- 6 RC circuits



Simple circuits and Ohm's law

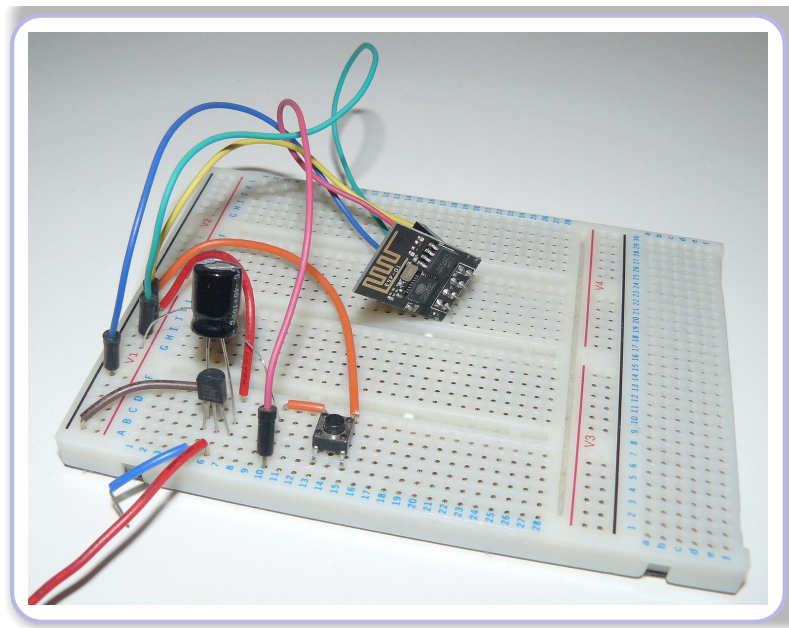
A **battery** pushes current around a complete loop – break it anywhere and current stops everywhere.

Ohm's law

$$V = IR, \quad R = \frac{\rho \ell}{A}$$

A device is **ohmic** if its I - V graph is a straight line.

12 V across $4\ \Omega$: $I = 3\ \text{A}$.



Circuits route charge through components

Exercises 2.1-2.3

2.1 Find the time constant of a $2000\ \Omega$ resistor and a $50\ \mu\text{F}$ capacitor. [2]

2.2 State the current through the capacitor a long time after charging begins. [1]

2.3 State what happens to the charging rate if the resistance is increased. [1]

Exercises 2.1-2.3

2.1 Find the time constant of a $2000\ \Omega$ resistor and a $50\ \mu\text{F}$ capacitor. [2]

2.1

- $\tau = RC = 2000 \times 50 \times 10^{-6} = 0.10\ \text{s}$
-

2.2 State the current through the capacitor a long time after charging begins. [1]

2.2

- zero (the capacitor is fully charged)
-

2.3 State what happens to the charging rate if the resistance is increased. [1]

2.3

- it slows down (a larger $\tau = RC$)

Exercises 3.1-3.2

3.1 The time constant of an RC circuit is

[1]

☐

A R/C

B RC

C $R + C$

D C/R

3.2 A long time after charging begins, the current in an RC circuit is

[1]

☐

A at its maximum

B zero

C constant and large

D negative

Exercises 3.1-3.2

3.1 The time constant of an RC circuit is

[1]

☐

A R/C

B RC

C $R + C$

D C/R

3.1 B

- RC .

3.2 A long time after charging begins, the current in an RC circuit is

[1]

☐

A at its maximum

B zero

C constant and large

D negative

3.2 B

- zero.

Exercise 3.3 (a)

3.3 A $10\text{ k}\Omega$ resistor charges a $100\text{ }\mu\text{F}$ capacitor from a 9.0 V supply.

(a) Find the time constant.

[2]

Exercise 3.3 (a)

3.3 A $10\text{ k}\Omega$ resistor charges a $100\text{ }\mu\text{F}$ capacitor from a 9.0 V supply.

(a) Find the time constant.

[2]

(a)

- $\tau = RC = (10 \times 10^3)(100 \times 10^{-6}) = 1.0\text{ s}$

Exercise 3.3 (b)

3.3 A $10\text{ k}\Omega$ resistor charges a $100\text{ }\mu\text{F}$ capacitor from a 9.0 V supply.

(b) State the final voltage across the capacitor.

[1]

Exercise 3.3 (b)

3.3 A $10\text{ k}\Omega$ resistor charges a $100\text{ }\mu\text{F}$ capacitor from a 9.0 V supply.

(b) State the final voltage across the capacitor.

[1]

(b)

- 9.0 V (the supply voltage)