# 10 Electric potential and capacitors – Part 2

Name: _____ Class: _____ Date: _____

## Vocabulary

*Write each word three times.*

| **English** | **Write it 3 times** (English) | | |
|---|---|---|---|
| Electric potential | | | |
| voltage | | | |
| capacitor | | | |
| capacitance | | | |

## Recall

In Part A you met electric charge, force, and field. Now two ideas you use every day without noticing:

- **Voltage** is written on every battery (1.5 V, 9 V). It is really "electric potential."
- A **capacitor** stores charge – it is inside phones, cameras, and flashes.

Each idea has a worked example before the Practice.

## New ideas

### 1 Electric potential

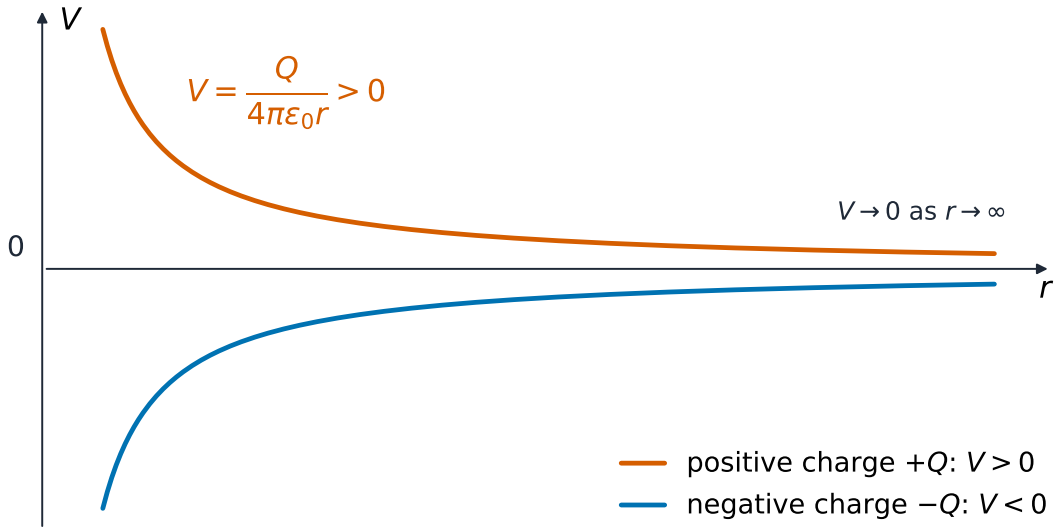
**Electric potential** $V$ is the electric potential energy per unit charge, measured in volts:

$$V = \frac{U}{q}.$$

Unlike the field (a vector), potential is a simple number (a scalar), so it is easier to work with.



exercises.lol exercises.com.cn




## 2 Voltage

The **voltage** (potential difference) between two points is the work done per unit charge to move a charge between them: $U = qV$. A positive charge moves from high to low potential on its own – like a ball rolling downhill.

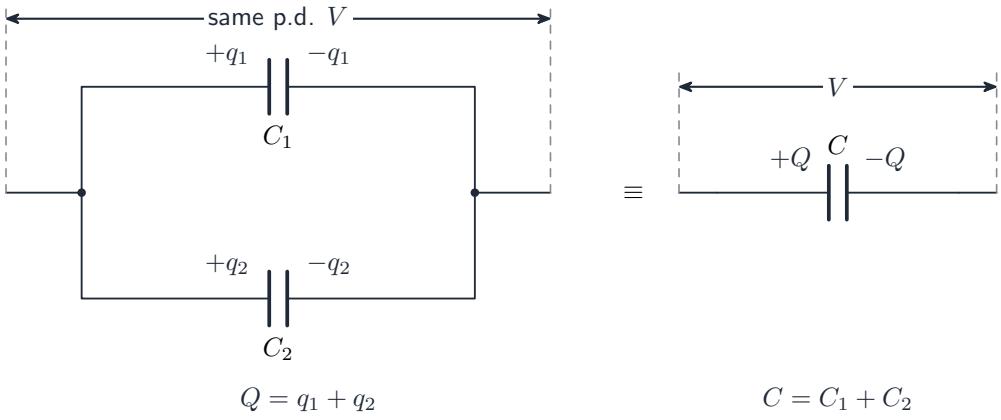
*Worked example.* Moving a charge of 2.0 C through a potential difference of 6.0 V transfers $U = qV = 2.0 \times 6.0 = 12$ J of energy.

## 3 Capacitors

A **capacitor** stores charge on two plates. Its **capacitance** links charge to voltage:

$$C = \frac{Q}{V},$$

and it stores energy $U = \frac{1}{2}CV^2$.




*Worked example.* A 100 $\mu$F capacitor charged to 12 V holds $Q = CV = 100 \times 10^{-6} \times 12 = 1.2 \times 10^{-3}$ C and stores $U = \frac{1}{2}CV^2 = \frac{1}{2} \times 100 \times 10^{-6} \times 12^2 = 7.2 \times 10^{-3}$ J.

### ■ 4 Charges gain energy from voltage

A charge released across a voltage speeds up, turning electric energy into kinetic energy:

$$qV = \tfrac{1}{2}mv^2.$$

**Watch out:** electric potential $V$ is a **scalar** (just a number), so potentials from several charges simply **add** – much easier than adding field arrows, which are vectors.

## Practice

Try these in order. The methods are all above.

**2.1** State what electric potential (voltage) measures, in words. [1]

**2.2** Moving a 3.0 C charge through a potential difference of 4.0 V – find the energy transferred. [2]

**2.3** A 50 $\mu$F capacitor is charged to 10 V. Find the charge it stores. [2]

**2.4** For the capacitor in 2.3, find the energy stored ($U = \tfrac{1}{2}CV^2$). [3]



exercises.lol exercises.com.cn

**2.5** Explain why electric potential is easier to add up than the electric field, when several charges are present. [2]