Lecture 26

Today: HW due by 5pm

Weds: Review

Fri: Test 2 Covers Energy / electricity + magnetism

Class 18 - 26

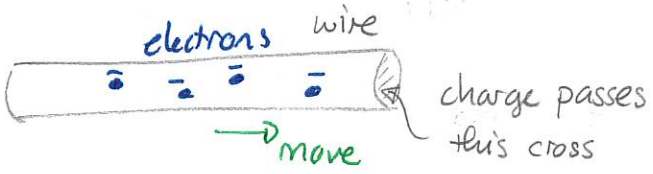
HW 5, 6, 7

2022 Test 2 - All Q

2023 Test 2 - All Q

Electric Current

Electric current describes the rate at which charge flows in any part of a circuit



$$\text{current} = \frac{\text{charge passing cross section}}{\text{time taken to pass}} \qquad I = \frac{Q}{T}$$

current: Amps ↑ ; charge passing cross section: Coulombs ↑ ; time taken to pass: seconds ↑

Thus Amperes tells us how many Coulombs of charge pass each second. One can invert this to give

$$\text{charge} = \text{current} \times \text{time}$$

Quiz 1 80% - 100%

In general we find that in typical appliances and electronic devices, huge numbers of charge pass each second since the charge of one electron is very small

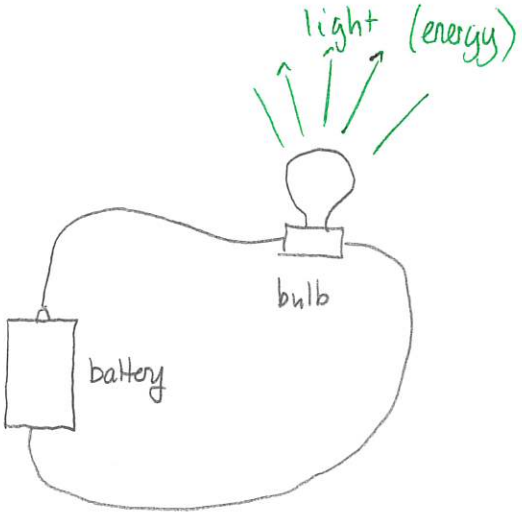
Examples of typical currents are:

* household supply 20 → 100 A
* household appliance 1A → 20A

electronic devices: milliAmps 0.001 → 0.100A

microAmps 0.000001 A

Energy in circuits



Electric circuits operate by having current flow around them. But we know that this requires a battery. When the circuit is connected the bulb produces energy in the form of light and heat.

Quiz 2 60%

The battery must be providing the energy that is eventually converted into light and heat. The amount of energy that it provides will depend on the total amount of charge that it provides. For a properly functioning battery it turns out that the total energy per charge is fixed (regardless of how much charge it provides). This aspect of a battery is described by

$$\text{Voltage (Volts V)} = \frac{\text{total energy supplied to a group of charges (Joules)}}{\text{total amount of charge in group (Coulombs)}}$$

Voltage is easily measured.

↳ energy = voltage × charge

DEMO: Construct bulb circuit and measure voltage.

Quiz 3

It is fairly easy to show that the power delivered to a circuit/device satisfies

$$\text{Power delivered} = \text{voltage} \times \text{current}$$

Recall that power = energy/time $\Rightarrow$ $\text{time} = \frac{\text{energy}}{\text{power}}$

If time permits:

Consider two current-carrying wires. Will they exert forces on each other?

DEMO: U Minnesota video
(parallel wires)

This can eventually be described using magnetic fields

Show: Oested image

DEMO: Oersted Current Loop Board.