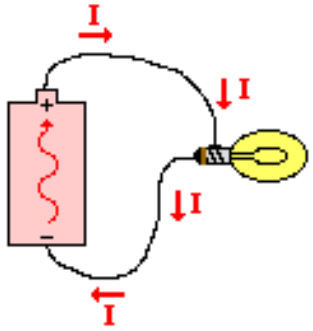
Current and Voltage

$$I = \frac{\Delta Q}{\Delta t}$$

current — charge — time



Electric current in the external circuit is directed from the positive to the negative terminal.

Voltage V is a potential energy of a unit charge. It tell you how much work the charge can do in an electric circuit. One typically measures a **Voltage difference** between two points in a circuit. It is similar to measuring height on a ski slope.

$$V = \frac{E_{potential}}{\Delta Q}$$

POWER IN ELECTRIC CIRCUIT

$$Power = \frac{Work}{time}, \qquad P = \frac{\Delta W}{\Delta t}$$

- **W** may be mechanical work, or work of a battery driving electric current.

- In this definition, ***Work*** can also be replaced with ***Heat***. That will be thermal power rather than mechanical or electric one.

- Units of power are Watts [W]: 1W=1J/s (Joule per second)

$$Power = Current \times Voltage, \qquad P = I \cdot V$$

Homework

Problem 1

A **5 kilowatt** electric boiler is plugged into a **110V** power outlet, which is connected to a circuit breaker (fuse). That circuit breaker would turn off the power if the current is larger than **40 Amp**. Will the boiler be able to operate?

Problem 2

An electric motor is used to lift a load of mass **m=5 kg** up to certain height, with speed **v=1m/s**. The voltage applied the motor is **12 V**. Find the in the electric current.

Hint: you need to find the power first. Remember that ***work=force x displacement***.