Voltage & Current

Charge is bipolar → effects are positive and negative.

electric charge → 1.6022×10^{-19} C

Electrical effects attributed to both separation of charge & charges in motion.

Separation of charge creates electric force (voltage)
motion of charge creates electric fluid (current)

Voltage → energy per unit charge created by separation of charges.

$$v = \frac{dw}{dq}$$

w = energy
q = charge
v = voltage.

$$i = \frac{dq}{dt}$$

q = charge
t = time
i = current.

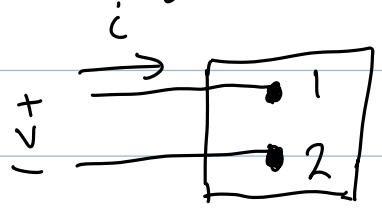
The rate of charge flow → electric current.

1.5 passive sign convention → reference direction for the current in an element is

in the direction of the reference voltage drop across the element use a positive sign in any expression that relates the voltage to the current. Otherwise use negative.

$i \rightarrow$ current

$q \rightarrow$ charge



Positive	Negative
↓v from terminal 1 to terminal 2	↓v from 2 to 1
↑v from terminal 2 to terminal 1	↑v from 1 to 2
+i flowing from 1 to 2	−i flowing from 1 to 2
−i flowing from 2 to 1	+i flowing from 2 to 1

1.6 Power & Energy

$$p = \frac{dw}{dt}$$

p = power

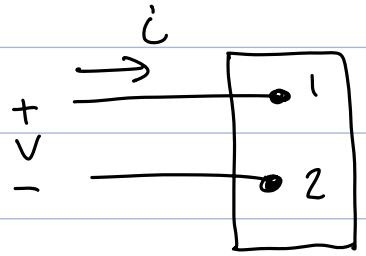
w = energy

t = time.

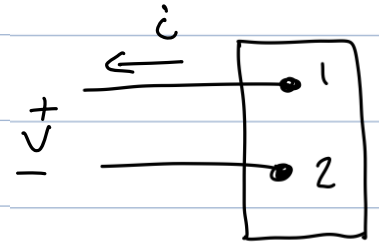
$1W = 1\ J/s$

$$p = \frac{dw}{dt} = \left(\frac{dw}{dq}\right)\left(\frac{dq}{dt}\right)$$

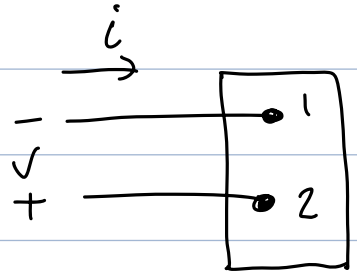
$$p = vi$$



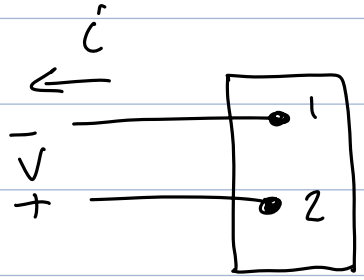
$p = vi$



$p = -vi$



$p = -vi$



$p = vi$

If $P > 0$ power is being delivered.
If $P < 0$ power is being extracted.