

# Energy and electricity

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Voltage is a pressure charges feel by being exposed to other charges measured in volts

$V$  in formulas units = volts (V)

Current is a flow of charges past a point measured in Amps

$I$  in formulas units = Amps (A)

Electrical Energy is the product of voltage, current and time or

$E = V I t$

And the change in energy using electricity is  $\Delta E = \Delta V I t$

Since Power = work / time and work =  $\Delta E$

$P = \frac{W}{t} \leftarrow \Delta E$

Then

$P = \frac{\Delta E}{t} = \frac{\Delta V I t}{t}$

$P = \Delta V I$

The power to run an LED lightbulb is 12 W and is connected to 120 V household supply.

Find the current flowing in the bulb.

$P = \Delta V I$   
 $12 = 120 I$   
 $I = 0.100 A$

If the same light is left on for 24 hours find the energy used in the light.

$P = \frac{\Delta E}{t}$   
 $P t = \Delta E = (12) (86400) = 1.04 \times 10^6 J$   
*Change to seconds*  
 $24 h \times \frac{3600 s}{h} = 86400 s$

If your house is billed  $\$2.77 \times 10^{-7}$  per Joule how much does this cost?  
this is actual BC hydro rate

Cost =  $E \times \text{rate} = 1.04 \times 10^6 J \times \frac{\$2.77 \times 10^{-7}}{\text{Joule}} = \$0.29$   
*to leave light on ALL DAY*

Fun fact, electricity is billed in kWh which are big units of energy,  $J \times 3600000 =$

kWh

Find the power used if a 10 A circular saw is running on household supply voltage.

$$P = \Delta V I$$
$$(120) 10 = 1200 \text{ W}$$

The saw runs for 2 hours cutting cats, what energy in Joules is used?

↑  
change to  
seconds

$$2 \text{ h} \times \frac{3600 \text{ s}}{\text{h}} = 7200 \text{ s}$$

$$P = \frac{\Delta E}{t}$$

$$Pt = \Delta E \quad (1200)(7200) = 8.64 \times 10^6 \text{ W}$$