



2.5.2 More on electrical power

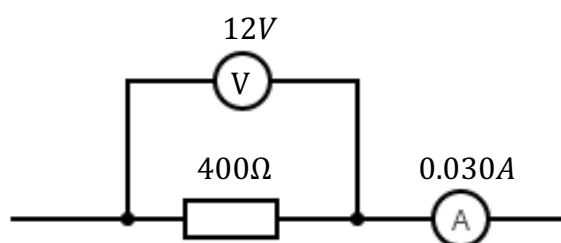
Electrical power is the energy transferred per unit time.

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

We can calculate the power transferred to a device by measuring the current flowing through the device (I), the potential difference dropped across the device (V) and multiplying the two together:

$$P = I \times V$$

Consider the following situation:



An ammeter is used to measure the current (I) flowing through a resistor and a voltmeter is used to measure the potential difference (V) dropped across the resistor.

1) *Using the formula above, calculate the electrical power transferred to the resistor.*

We can also calculate the power transferred to the device if we only know the resistance and the potential difference.

From Ohm's law we have the following relationship between current, potential difference and resistance:

$$I = \frac{V}{R}$$

Substituting this for I in our equation for power, we obtain:

$$P = I \times V$$

$$P = \left(\frac{V}{R} \right) \times V$$

$I = \frac{V}{R}$

$$\therefore P = \frac{V^2}{R}$$

2) *Use this formula to calculate the power transferred to the resistor (in the circuit above), using the values of potential difference and resistance given.*

We can also calculate the power transferred to the device if we only know the resistance and the current.

From Ohm's law we have the following relationship between current, potential difference and resistance:

$$V = I \times R$$

3) *Work out a formula for power in terms of current and resistance by substituting for V in the formula $P = I \times V$, and simplifying.*

$$P = I \times V$$

$$P = I \times (\quad)$$

$V = I \times R$

(A blue arrow points from the V in the second equation to the $V = I \times R$ text on the right.)

4) *Use this formula to calculate the power transferred to the resistor (in the circuit above), using the values of current and resistance.*

5) *In the following circuit work out the power transferred to i) the resistor and ii) the lamp. (Hint 1: Choose the appropriate power formula for the resistor. Hint 2: Work out the current flowing through the lamp and use the appropriate formula.)*

