**Electricity & Energy**

**Electrical Power**

**Summary**

**Electrical power** is the rate at which electrical energy is converted into other forms.

Electrical power is measured in watts (W).

Electrical power is also equal to the current (charge per second) multiplied by the voltage (energy per charge).

**Power, Energy & Time**

$$power=\frac{energy}{time}$$

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

$$E=Pt$$

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

J

W

s

*P*

*E*

*t*

**Power, Current & Voltage**

$$power=current × voltage$$

$$P=IV$$

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

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

*I*

*P*

*V*

W

A

V

When there is a current in a component with resistance electrical energy is converted into heat (or other forms of energy such as light).

It can be useful to combine the power equation with Ohm’s Law to establish relationships between power, current and resistance or between power, voltage and resistance,

**Power, Voltage & Resistance**

$$power=\frac{voltage^{2}}{resistance}$$

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

$$V^{2}=PR$$

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

V

W

Ω

*P*

*V2*

*R*

**Power, Current & Resistance**

$$power=current^{2} × resistance$$

$$ P=I^{2}R$$

$$I^{2}=\frac{P}{R}$$

$$R=\frac{P}{I^{2}}$$

*I2*

*P*

*R*

W

A

Ω