

Chapter 12: Electrical Energy and Power

Electrical Energy

The amount of electrical energy consumed (transformed either usefully or wasted) by an electrical device can be easily calculated from the current, voltage and time.

$$W = V I t \quad \text{where:}$$

W = energy supplied (in joules)

V = the potential difference across the device i.e. the voltage (in volts)

t = time (in seconds)

Electrical Power

$$\text{Power} = \frac{\text{work done}}{\text{time}} \quad \text{or} \quad \frac{\text{energy transformed}}{\text{time}}$$

so $P = \frac{VIt}{t}$ but the times cancel giving...

$$P = V I \quad \text{where:}$$

P = power (in watts)

Questions

1. A 67W television is supplied at a mains voltage of 230V.
 - a) Calculate the current flowing.
 - b) Calculate the energy used in 35 minutes
2. A heater is connected to a 12 V supply and a current of 2.7 A flows.
 - a) Calculate the power of the heater.
 - b) Calculate how much electrical energy it transforms per hour.
3. An X-ray tube has a power of 1200 W. It operates at a potential difference of 30 kV.
 - a) Calculate the current.
 - b) The tube has a beam of electrons flowing through it. Using your knowledge from Chapter 10 calculate how many electrons pass per second.