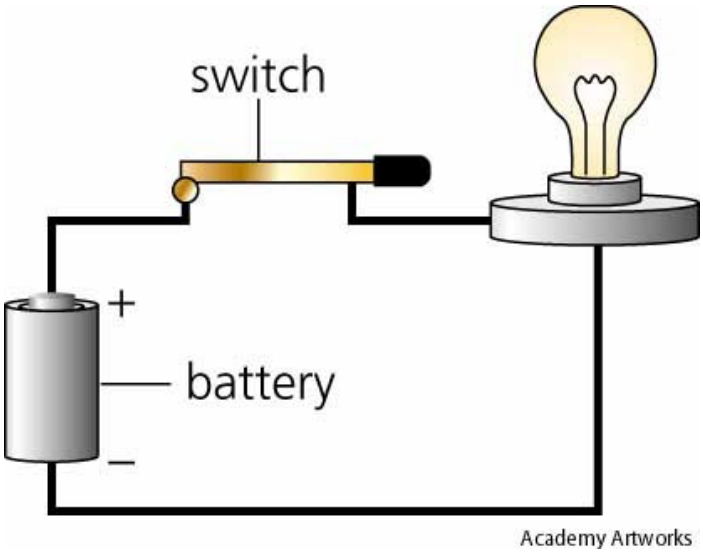
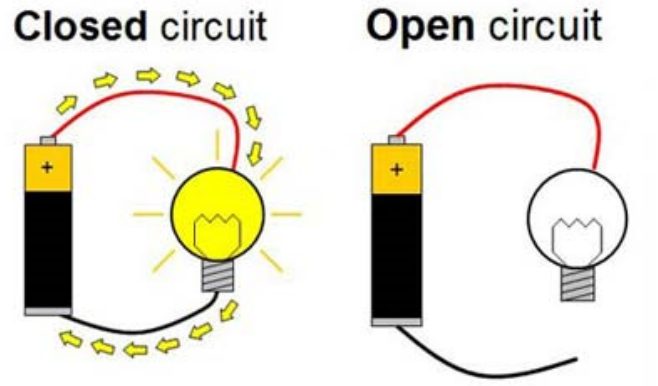
# Electricity Formulas

**Circuit def**: Movement of electrons through a closed pathway.



## Variables

| | Definition | Symbol | Unit |
|---|---|---|---|
| Current intensity | Electron flow in a circuit | I | A amps |
| Potential Difference Voltage | Provides the push given to electrons to travel in the circuit. | V | V volts |
| Resistance | Opposes current flow | R | Ω ohms |
| Power | The amount of work an electrical device can perform in one second | P | W watt |
| Energy | The power an electrical appliance uses and the amount of time it is used for | E | J joule |
| Time | The amount of time a device is being used for | t | s seconds |

Conversions:

Minutes to seconds x 60

Seconds to minutes ÷ 60

Hours to seconds x 3600

Seconds to hours ÷ 3600

W to kW ÷ 1000

kW to W x 1000

J to kJ ÷ 1000

J to kWh ÷ 3600000

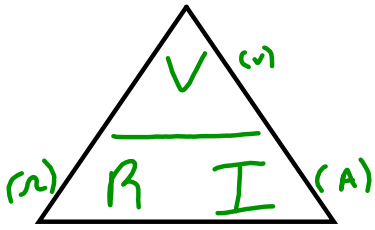
Formulas given on tests and exams:

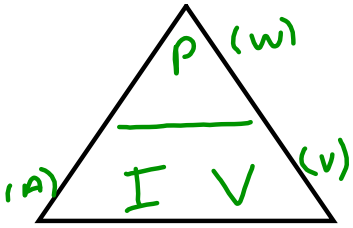
V= RI P=IV E=Pt

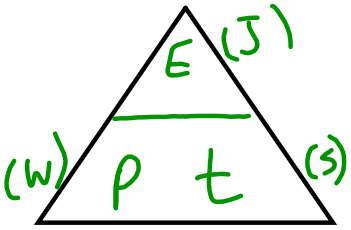
Formula not given:

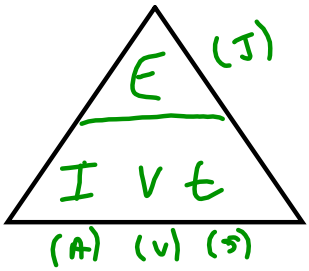
E= IVt


Triangles used for the formulas:



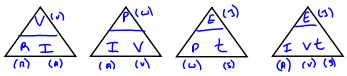




**Rating plates**: Information given on electrical appliances that allows its power and energy to be calculated


P (W)
V (V)
I (A)


**Practice**

1. What is the resistance of a circuit if the potential difference is 25 V and the current is 3 A?

$R = \frac{V}{I}$ $\frac{25}{3} = 8.3\Omega$

2. A radio is on for 2 hours and has 700 W of power. How much energy was used in J?

$E = Pt$ $700 \times 2 \times 3600$ 5 040 000 J

3. A radio is on for 2 hours and has 700 W of power. What is the energy in kJ and kWh?

$E = P \times t$ kJ: $\frac{2 \times 700 \times 3600}{1000}$ 5040 kJ

$E = Pt$ kWh: $\frac{2 \times 700 \times 3600}{3\,600\,000}$ 1.4 kWh

4. How much power did it take to use a microwave for 90 seconds and consumed 70 000 J of energy?

$P = \frac{E}{t}$ $\frac{70000}{90} = 777.8$ W

5. A hairdryer is used for 20 minutes a day. It runs on 190 V and 3 A. How much energy is used in J?

$E = IVt$ $3 \times 190 \times 20 \times 60$ 684 000 J

6. What is the current intensity of a circuit if the voltage is at 20 V and the resistor is a 40 Ω resistor?

$I = \frac{V}{R}$ $\frac{20}{40} = .5$ A

7. How much energy in kJ does a computer use if it is on for 3 hours and uses 200 V and 2.0 A.

$E = IVt$ $\frac{2 \times 200 \times 3 \times 3600}{1000} = 4320$ kJ

8. If a computer used 950 000 J of energy and 100 W of power. How long did you use the computer for?

$t = \frac{E}{P}$ $\frac{950000}{100} = 9500$ s

9. What is the potential difference of a circuit if the resistance of the resistor is 100 Ω and the current is 0.5 A?

$V = RI$ $100 \times .5 = 50$ V

10. If a TV used 950 000 J of energy and 90 W of power. How many hours did you watch TV for?

$t = \frac{E}{P}$ $\frac{950000}{90} = 10555.6$ s $\frac{10555.6}{3600} = 2.9$ hrs

11. How much power did it take when a dishwasher ran for 55 minutes and consumed 50 000 J of energy?

$P = \frac{E}{t}$ $\frac{50000}{(55 \times 60)} = 15.2$ W

12. A hairdryer uses 220 V and 7 A. If the hairdryer used 525 000 J of energy, how much time did you use it for in minutes?

$t = \frac{E}{IV}$ $\frac{525000}{(220 \times 7)} = 340.9$ s $\frac{340.9}{60} = 5.7$ min

13. A computer is on for 160 minutes and needs 220 V to work. If the computer used 925 000 J of energy, what was the current intensity for the computer?

$I = \frac{E}{Vt}$ $\frac{925000}{(220 \times 160 \times 60)} = .44$ A

**Past exam questions**

1. Some characteristics of appliances are listed in the table below:

P=IV

| Appliance | Characteristic |
|---|---|
| 1 | 120 V x 10 A 1200W |
| 2 | 240 V x 6 A 1440W |
| 3 | 120 V, 1500 W 1500W |
| 4 | 240 V, 1.8 kW 1800W |

If each appliance is used for the same amount of time, which appliance uses the most electric energy?

A) 1 B) 2 C) 3 (D) 4

2. Shown below is the rating plate for a lamp that consumed 3 000 J of energy when it was last used.

| |
|---|
| 100 W |
| 60 Hz |
| 120 V |

$t = \frac{E}{P}$ $\frac{3000}{100}$ = 30s

For how much time was this lamp used?

A) 25 s (B) 30 s C) 25 min D) 30 min

3. Jeremy assembled an electrical circuit using a 6 V battery and a resistor. He measured a current intensity of 0.05 A in this circuit.

a) What is the resistance of this circuit?

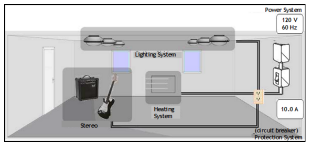
$R = \frac{V}{I}$ $\frac{6}{.05}$ = 120Ω

b) If the 6 V battery is replaced with a battery with a greater potential difference (voltage), and the same resistor is used, what will happen to the electric current intensity in this circuit?

(1)- The electric current intensity will increase
2- The electric current intensity will decrease
3- The electric current intensity will remain the same

4. Eric wants to convert a room in his house into a music studio. Below is the layout of the electric installations and the rating plates on the appliances in the room.

Layout of Electrical Appliances in the Music Studio




Here is the information on the rating plates for the heating system and the stereo system in the room:

| Heating system | Stereo |
|---|---|
| 120 V 60 Hz 720 W | 120 V 60 Hz 360 W |

Here is the information on the rating plates for the two lighting systems available:

| Incandescent lighting system | Compact fluorescent lighting system |
|---|---|
| 120 V 60 Hz 480 W | 120 V 60 Hz 110 W |

a- Calculate the maximum electrical power that can be attributed to the lighting system.

P=IV
10×120 = 1200W

b- Which lighting system should be installed in the electrical circuit of the music studio? Justify your choice using mathematical reasoning.

1200 - 720 - 360 = 120W left
Must choose compact lights because it needs 110W ∴ have enough. Incandescent lights need 480W to work.