

9 Science (10FI)

Learning Opportunities

May 4 – 8

Electrical Energy

Energy is the ability to do work. Electrical energy is the energy transferred from the cell (battery) to an electric load (light bulb, radio, computer, etc.) by moving electric charges.

Symbol - E

Unit - J (joules) Electrical energy can also be measured in watt hours (W·h) or kilowatt hours (kW·h).

The formula for electrical energy is:

$$E = V \times I \times \Delta t$$

V is the voltage

I is the current

Δt is the time interval

If time is measured in seconds, then electrical energy will be in Joules (J), but if time is measured in hours then electrical energy will be in W·h or kW·h.

See Electrical energy – Sample problem

Practice Problems

1. Calculate the energy available in a single 1.5 V battery that provides 2.8 A of current for 3600 seconds.
2. Calculate the energy released from a battery in a hand vacuum cleaner that was switched on for 45s. The voltage was 6V and the current was 0.30A.
3. Calculate the energy released from a battery in an electric drill. The drill was switched on for 180 seconds. The voltage drop was 9V and the current was 1.4A.
4. Calculate the energy released from a portable radio using a 9V battery. The current was 0.5A, and it operated for 2.5 hours.
5. What three factors determine how much electrical energy is transferred to an electrical load?
6. Considering the answer to the question above, which factor is easiest to control if you want to decrease the electrical energy being used?

Electrical Power

Power is measured in watts (W). Electrical power is a measure of the rate (how quickly) electrical energy is being used. This means a 300W bulb uses up 3 times as much electrical energy as a 100W bulb in the same time period.

$$P = V \times I$$

V is the voltage

I is the current

Power can also be calculated using the formula

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

E is electrical energy in joules

Δt is time in seconds

Which formula you use depends on the information you are given in the question.

See Power – Sample problem

Practice problems

1. Find the power rating of a light bulb which draws 0.5 A of electric current when plugged into a 120 V circuit.
2. Calculate the power rating of a coffee grinder that operates on a voltage of 120V if a current of 1.7A flows in the motor.
3. Calculate the power rating of a portable electric sander that operates at a voltage of 12V. A current of 2.5A flows through the motor operating the sander.
4. What is the current that will flow through a 1000 W toaster when it is plugged into a 120 V power supply?
5. Calculate the voltage of a computer that has 600W of power and 1.9A flowing into the monitor?