

Power Problems

Name _____ Date _____ Block _____

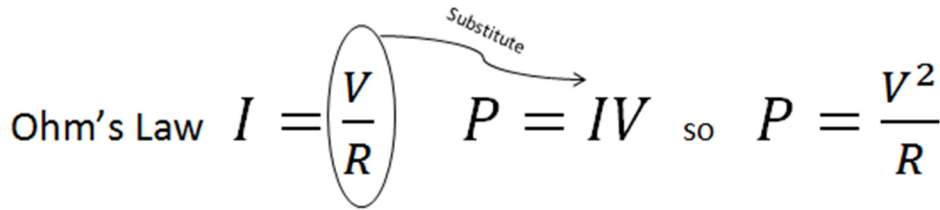
The electric power (in Watts) represents the rate at which energy is converted from the electrical energy of the moving charges to some other form in an electric circuit or a circuit component. (For example, the electricity may be converted into heat, mechanical energy, or energy stored in electric or magnetic fields.)

The Power in a circuit or circuit component can be found with the formula:

$$P = IV$$

Since you may not know the current every time, you can substitute Ohm's law ($I=V/R$) in for the current above.

Ohm's Law $I = \frac{V}{R}$ $P = IV$ so $P = \frac{V^2}{R}$



You will have to select which formula based on the information you know from the problem.

Remember that P is Power in Watts, V is voltage in volts, I is current in Amps, and R is resistance in Ohms (Ω)

Show your work (**G.U.E.S.S.**) for full credit and make sure your answer has correct units.

1. How much current is used by a 150-W light bulb that is connected to a 120-volt circuit?

2. What is the power rating of an appliance that is plugged into a 240-volt socket and has 90Ω of resistance?

3. What current does a 240 Watt light fixture (four 60 W bulbs) operate if it is connected to a 120-volt circuit?

4. How much power is used by a calculator that operates on 8 volts and 0.1 ampere?

5. Will a 1200-Watt hair dryer operate on a 120-volt circuit if the current in the circuit is limited to 15 amps by a safety fuse? (Hint: Solve for current, if it is higher than 15A, it will shut off the circuit)

I=

Circle one: Yes you can use the hair dryer safely **OR** No the fuse will activate shutting off the circuit.

6. Calculate the current in a 140-Watt electric blanket connected to a 120-volt outlet.

Calculating Electrical Energy Costs:

Electric company charge electricity consumers based on how much electricity they use. The quantity they sell electricity in is the kilowatt-hour (kWh). One kilowatt-hour is 1000 Watts used for one hour of time.

Example: A coffee pot operates on 2 amperes of current on a 110-volt circuit for 3 hours. Calculate the total kWh used.

- Determine power: $P = V \times I$
 $= 110 \text{ volts} \times 2 \text{ amps}$
 $= 220 \text{ watts}$
kWh = P x hours
kWh = $\frac{V \times I \times \text{hours}}{1,000}$
- Convert watts to kilowatts:
 $220 \text{ watts} \times \frac{1 \text{ kilowatt}}{1,000 \text{ watts}} = 0.22 \text{ kW}$
- Multiply by the hours given in the problem:
 $0.22 \text{ kW} \times 3 \text{ hrs} = 0.66 \text{ kWh}$

1. A microwave oven operates on 5 amps of current on a 110-volt circuit for one hour. Calculate the total kilowatt hours used.

2. How much would it cost to run the microwave in problem # 1 if the cost of energy is \$0.12 per kWh?

3. An electric stove operates on 20 amps of current on a 220-volt circuit for one hour. Calculate the total kilowatt hours used.

4. What is the cost of using the stove in problem # 3 if the cost of energy is \$0.10 per kWh?

5. A refrigerator operates on 15 amps of current on a 220-v circuit for 18 hours per day. How many kWh are used per day?

6. If the electricity costs \$0.13 per kWh, how much does it cost to run the refrigerator in problem # 5 per day?

7. The electric company had a "meter-reader" read your electric meter on June 1st. The reading was 84,502 kWh. On July 1st your meter read 87,489 kWh. How many kWh did you use in the month of June?

8. Using the information from problem # 7 how much was your June electric bill if electricity costs you \$0.12 per kWh.

9. A room in your house has a light fixture with three 100-Watt light bulbs which are on for an average of 5 hours per day. How much does it cost to have this light fixture on for a year? (365 days in a year)
Electricity costs \$0.13 per kWh # 15 & 16.

10. You replace the 100-Watt bulbs from problem # 15 with energy efficient bulbs which use 40 Watts each. How much will it cost to have these on for an average of 5 hours per day for the year?

11. How much money did you save per year by switching to energy efficient bulbs in this one light fixture?