

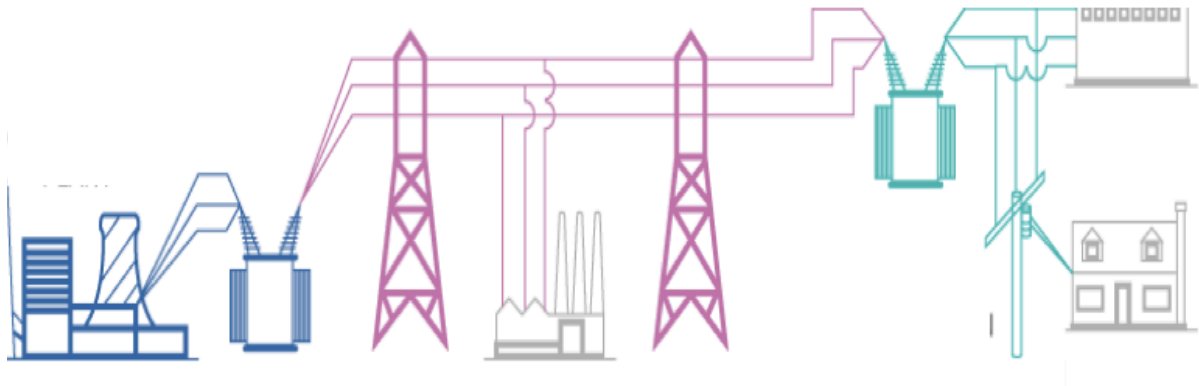
Topic 7: From the Grid to Your Home

What is a transformer/what does it do?

What does the circuit breaker or fuse box do?

Label the diagram with:

- a. High-voltage transmission lines
- b. Low-voltage transmission lines
- c. Generating plant
- d. Industrial buildings/customers
- e. Sub-station
- f. Step up transformer
- g. Step down transformer
- h. Distribution station
- i. Residential homes/customers



Transistor Video:

<https://www.youtube.com/watch?v=IcrBqCFLHIY>

What is a transistor?

What are the two binary positions of a transistor or switch?

What is an n-type transistor?

What is a p-type transistor?

Practice Problems Page 324

1. What is the power (in watts and kilowatts) of a hair dryer that requires 10 A of current to operate on a 120 V circuit?
2. The maximum current that a 68.5 cm television can withstand is 2 A. If the television is connected to a 120V circuit, how much power is the television using?
3. A 900W microwave oven requires 7.5A of current to run. What is the voltage of the circuit to which the microwave is connected?
4. A flashlight using two 1.5V D-cells contains a bulb that can withstand up to 0.5A of current. What would be the maximum power of the bulb?

Practice Problems Page 325

1. a) If a refrigerator requires 700W of power to function, how many kilowatt hours of power will it require in a 30 day period?

b) If electricity costs 11 cents per kilowatt hour, how much would the refrigerator cost to operate in that period?
2. A home-owner finds that she has a total of 42 light bulbs (100 W) in use in her home.
 - a. If all of the bulbs are on for an average of 5 hours per day, how many kilowatt hours of electricity will be consumed in a 30 day period?
 - b. At 11 cents per kilowatt hour, how much will operating these lights cost the home-owner during that period?
 - c. How much money would the home-owner save if she switched all of the bulbs to energy-saving 52 W light bulbs?
3. Bob has a stereo that operates at 120 V, using 2.5 A.
 - a. How much power does Bob's stereo need to operate? (Hint: Think back to the previous power-calculation)
 - b. If Bob plays his stereo for an average of 5 hours each day, how much electricity will he use in a 30 day period?

Practice Problems Page 329

1. Find the efficiency of a 23W fluorescent tube that is used 4.0 hours per day and in that time produces 6.624×10^4 J of useful light energy.
2. A 100W incandescent bulb also produces about 6.624×10^4 J over a 4.0 hour period. What is the efficiency of this bulb?
3. Based on your answers to questions 1 and 2, how much money would you save in a 30-day month if you replaced 25 of the 100W incandescent bulbs with 23 W fluorescent bulbs? Assume that the bulbs operate 4 hours a day, and that electricity costs 11 cents per kilowatt hour.

Topic 7 Review

1. What is a short circuit and how can it be caused?
2. Which type of light bulb is more efficient and why: incandescent or fluorescent?
3. What part of the electricity panel in your home acts as a safety switch that can cut off power? How does it do it?
4. Describe three ways in which electric energy could be conserved with respect to home lighting.

Math Problems:

5. If a refrigerator requires 700W of power to function, how many kilowatt-hours of power will it require in 30 days?
700 W = _____ kW (kilowatts)
30days = _____ h (hours)
6. A flashlight using two 1.5 V D-cells contains a bulb that can withstand up to 0.5A of current. What would be the maximum power of the bulb? $P = IV = \text{current} \times \text{voltage}$

Use the following words to fill in the blanks (more than once or not at all)

| | | | |
|------------------|--------------|---------------|----------------------|
| Neutral wire | Power | Hot wire | Fuse |
| Ground wire | Domains | Short circuit | Transformers |
| Circuit breakers | Watts | Efficiency | Breaker |
| Kilowatt hour | Power rating | Energy | Electric shock |
| Power Grid | Step-up | Step-down | Distribution station |

- The _____ is a complex network to transfer electrical energy from a generating station. The power company uses a _____ to distribute electricity from the plant to different energy consumers.
- _____ is equal to the energy per unit time, in Watts, which is a Joule per second. ($P = E/t$)
- A step-up _____ is used to increase the voltage of an alternating current travelling over long distances.
- The technology that channels the power entering a home to different circuits is called a _____ box or a _____ box.
- A _____ is a metallic conductor with a lower melting point than that of the conducting wires. It will melt if too much current flows through it.
- _____ flip the switch off and cut electricity to a circuit when too much current flows through them.
- No electronic device can be 100% _____.
- The useful _____ output divided by the total _____ input multiplied by 100% is the calculation used to find efficiency.
- When you pay for power, the power company measures your electrical usage in _____ (kWh).
- An un-insulated copper wire is called a _____.
- _____ is the power number, measured in Watts, that is stamped onto your electronic device.
- _____ occurs when an electrical current flows through the body.
- A _____ happens when bare wires touch and electricity travels on an unintended path by the most direct route of contact.
- $P = I \times V$ is an equation that means _____ (in Watts) is equal to the current (in Amps) multiplied by the voltage (in Volts).

Calculating Power and Efficiency Open-Book Quiz

Individual Topic 7 Assignment. Show all work including formulas.

Marks will be given for each question's formula, work shown for unit conversions, plugged in values for each variable, and correct answer with proper units.

Formulas: $E = Pt$

$P = IV$

$efficiency = (\text{output/input}) \times 100\%$

1. What is the energy of a 400W device that runs for 6 minutes?
2. A laptop charger has a power rating of 60 W. If the laptop takes 3.5 hours to charge, how many kilowatt hours of power will be used?
3. An electric outlet has a potential difference of 120 V. If a device requires 200W of power, what is the amount of current that flows through its cord?
4. What is the efficiency of an 80W light bulb that produces 50 000J of light energy over 6 hours?