Transformers
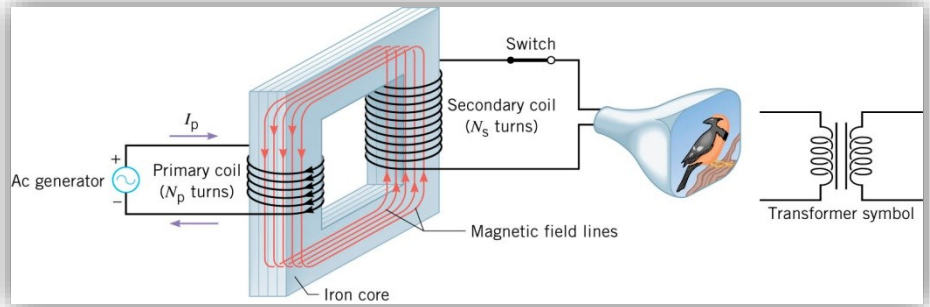
- The _____ in a wall outlet is approximately _____.
- Many electrical appliances _____ handle that many _____.
    - Computer speakers
      _____
    - Projection TV
      _____
- A _____ changes the voltage for the _____.

- The _____ coil creates a _____ field in the _____ core.
- Since the _____ in the coil is _____, the *B*-field is always _____.
- The _____ makes the *B*-field go through the _____ coil.
- The _____ *B*-field means the _____ in the _____ coil is also _____ and thus _____ a *emf*.

Transformer equation

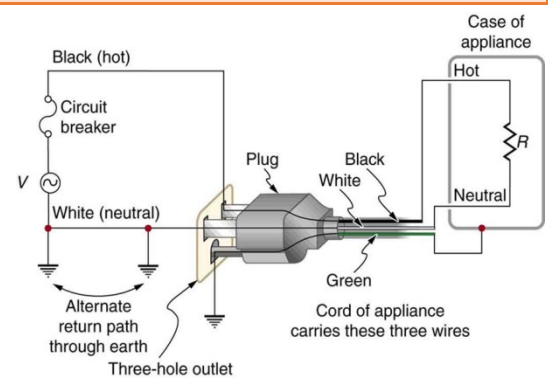$$\frac{I_P}{I_S} = \frac{V_S}{V_P} = \frac{N_S}{N_P}$$

- A transformer that steps _____ the _____, steps _____ the _____ and vise versa.
- To keep electrical lines from getting _____, electrical companies use transformers to step _____ the voltage to up to _____. The box on electrical pole is a _____ that steps the voltage down to _____.

A TV requires 15000V and 0.01 A to accelerate the electron beam. The outlet in the house supplies 120V. The primary coil of the transformer in the TV has 100 turns. How many turns should the secondary coil have?

How much current does the TV draw from the outlet?

Safety

- Two _____
    - _____ wire
        - _____ prong
        - _____ through ground
    - _____ wire
        - _____ prong
        - Grounds the _____
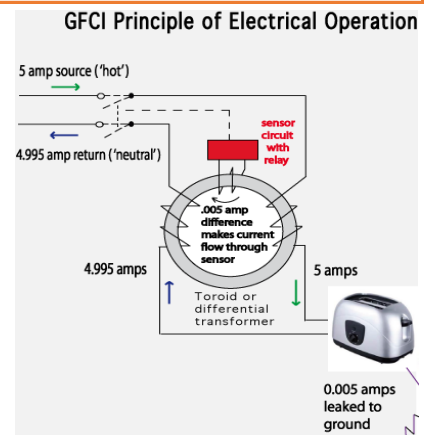- _____ wire
    - _____
    - Carries the _____ voltage

Circuit Breaker

- If the current load gets too _____, an _____ pulls a _____ to stop the current
- Stops wires from getting _____ in _____ circuits

Ground Fault Interrupter

- Both sides (hot and neutral) are wrapped around a metal _____ like a _____, but the number of loops are _____
- Normally the induced current is _____ since the two sides _____
- If an _____ occurs (like current going through a person to the ground), an _____ pulls a _____

Practice Work

1. Explain what causes physical vibrations in transformers at twice the frequency of the AC power involved.

2. Does plastic insulation on live/hot wires prevent shock hazards, thermal hazards, or both?

3. Why are ordinary circuit breakers and fuses ineffective in preventing shocks?

4. A plug-in transformer supplies 9.00 V to a video game system. (a) How many turns are in its secondary coil, if its input voltage is 120 V and the primary coil has 400 turns? (b) What is its input current when its output is 1.30 A? (OpenStax 23.44) **$30.0, 9.75 \times 10^{-2}$ A**

5. An American traveler in New Zealand carries a transformer to convert New Zealand's standard 240 V to 120 V so that she can use some small appliances on her trip. (a) What is the ratio of turns in the primary and secondary coils of her transformer? (b) What is the ratio of input to output current? (c) How could a New Zealander traveling in the United States use this same transformer to power her 240 V appliances from 120 V? (OpenStax 23.45) **2.00, 0.500**

6. A cassette recorder uses a plug-in transformer to convert 120 V to 12.0 V, with a maximum current output of 200 mA. (a) What is the current input? (b) What is the power input? (c) Is this amount of power reasonable for a small appliance? (OpenStax 23.46) **20.0 mA, 2.40 W, yes**

7. (a) What is the voltage output of a transformer used for rechargeable flashlight batteries, if its primary has 500 turns, its secondary 4 turns, and the input voltage is 120 V? (b) What input current is required to produce a 4.00 A output? (c) What is the power input? (OpenStax 23.47) **0.96 V, 32.0 mA, 3.84 W**

8. (a) The plug-in transformer for a laptop computer puts out 7.50 V and can supply a maximum current of 2.00 A. What is the maximum input current if the input voltage is 240 V? Assume 100% efficiency. (b) If the actual efficiency is less than 100%, would the input current need to be greater or smaller? Explain. (OpenStax 23.48) **0.063 A, greater**