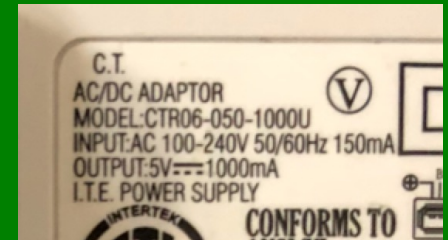


Motors and Generators

- The Motor Principle
- The Right-Hand Rule
- AC Motors and Applications
- DC Motors
- Generators
- Electricity Generation
- Step-up and Step-down Transformers
- Conservation of Energy
- The Transformer Equation



SAMPLE FILE

Thank you for your interest in my lesson.

The following slides will give you a good idea of how this lesson is structured although, much of the information has been removed.

For instance, when you see, that represent text that has been removed.

Note: This sample was created from the student version of the PowerPoint therefore, you will see _____ which are placeholders for the teacher version text which your students will fill in. Furthermore, the videos have also been removed.

If you have any questions, please send me an email – devon@teachwithfergy.com

Motors

With the person beside you...

1. List 4 things that you use every day that have a motor.
2. Come up with a definition of a motor.

Electric Motors

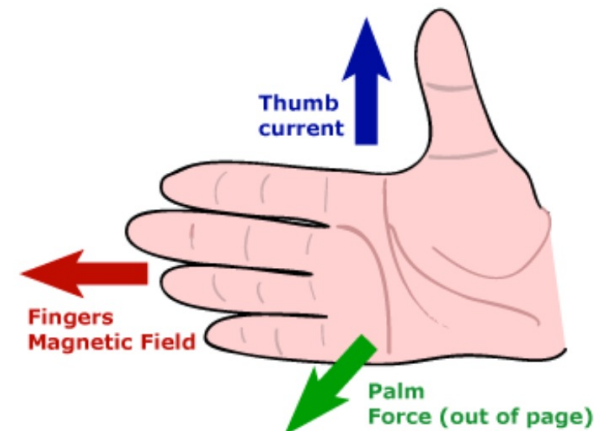


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The Right-Hand Rule for the Motor Principle

- We can use the motor right-hand rule to figure out the direction of force on a current-carrying conductor like a copper wire

- _____
- Your fingers point in the direction of the magnetic field and your thumb points in the direction of the current
- Your thumb points in the direction of the force on the conductor



AC Motors

- AC motors operate by applying alternating current to the motor
 - If the power source is direct like from a battery, the power must be converted into AC before it can be used
- AC and DC motors also have different structures
- AC motors have two basic parts: the stator and the rotor.
 - The stator has coils which produces a magnetic field
 - The rotor then spins inside the stator's coils to produce the required torque

- ---

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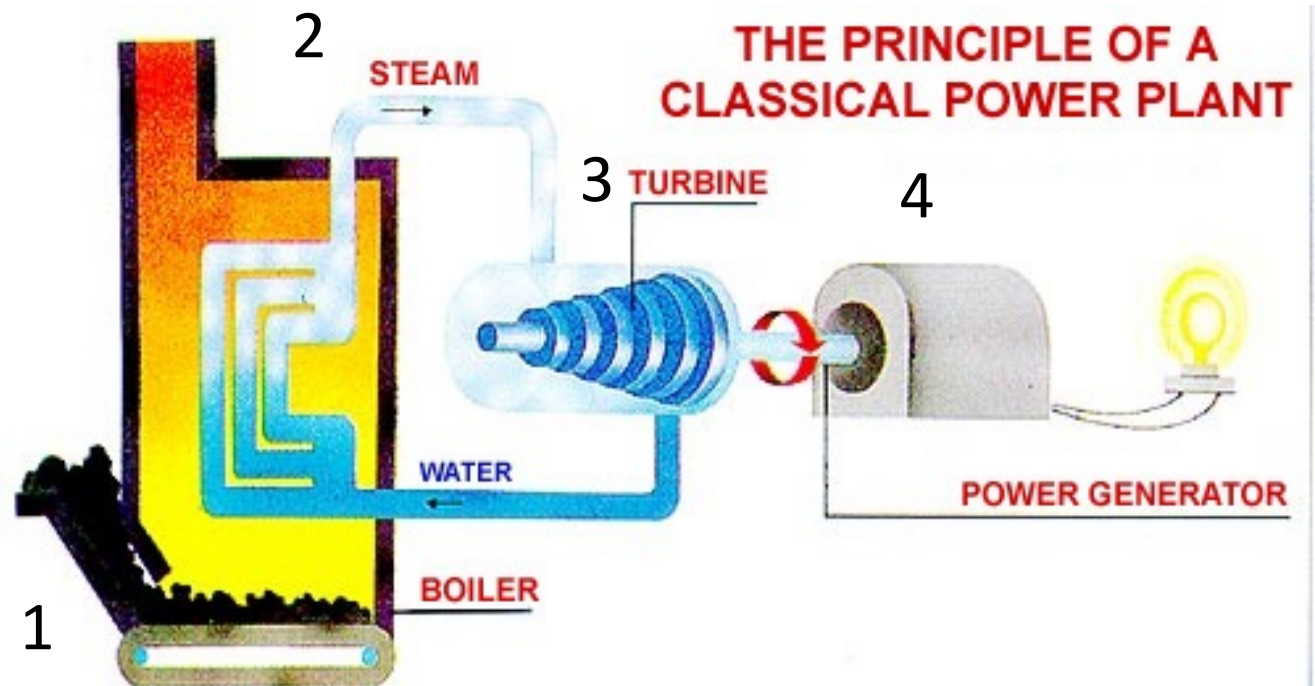
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Generators

- _____
- This is typically done by generating heat through the burning of fossil fuels or a nuclear reaction
- Recall the Law of Electromagnetic Induction – The creation of
- We can create an ever-changing magnetic field by rotating a magnet
 - All we need is a means of spinning the magnet inside a generator

Fossil Fuel Electricity Production

- Fossil Fuels are burned (1) in order to heat water which creates steam (2)
- Steam pressure causes a turbine to spin (3) which causes the generator to create electricity (4)



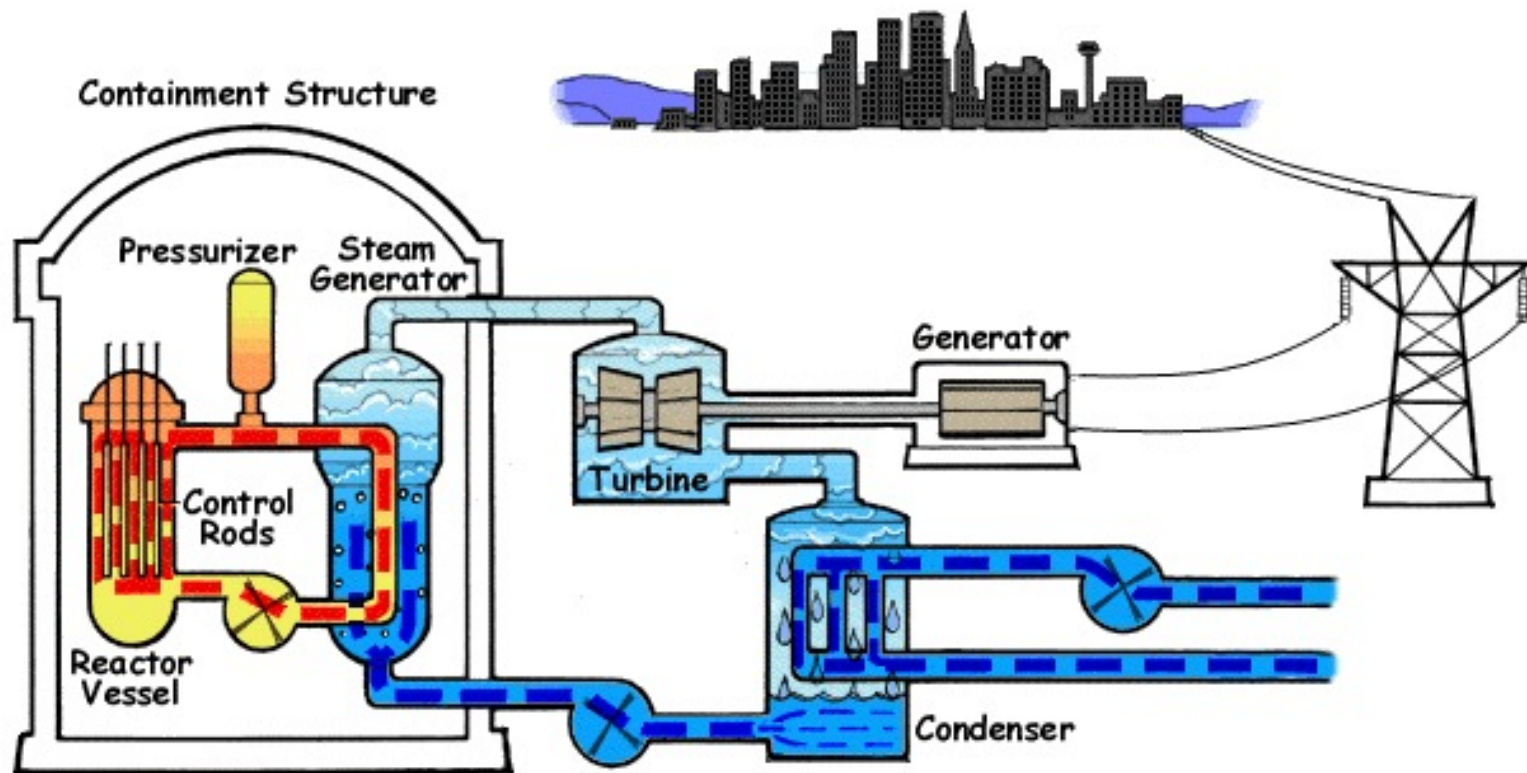
Generators

- _____
- They rely on a changing magnetic field to produce an electrical current
 - To create a changing magnetic field, you can spin a permanent magnet inside
 - Power plants utilize a energy source to spin a coiled

Nuclear Reactors

- The same principle is applied

- _____



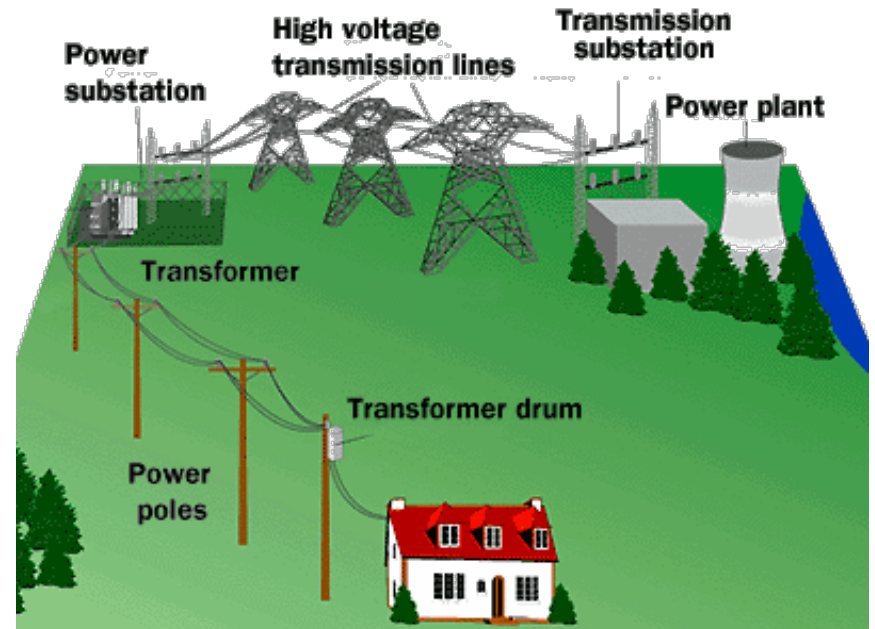
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Step-up and Step-down Transformers

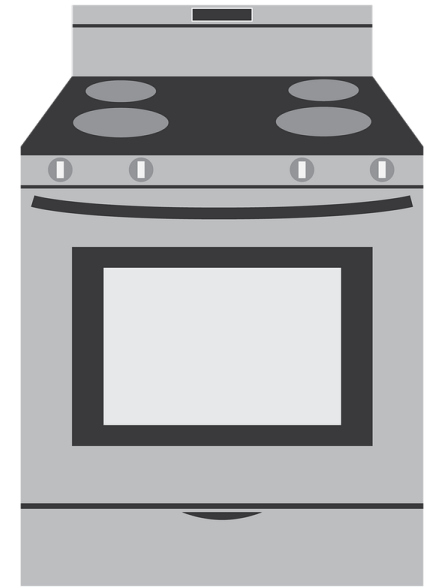
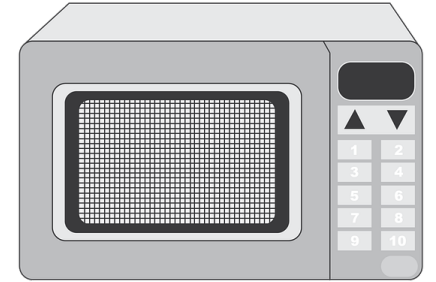
- Transformers are electromagnetic devices that raise and lower voltage
- Power plants typically produce voltages around 10,000 to 20,000 V

- _____



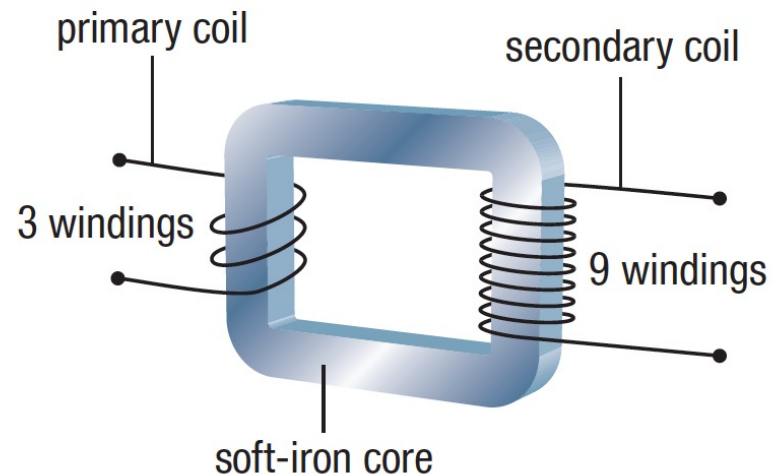
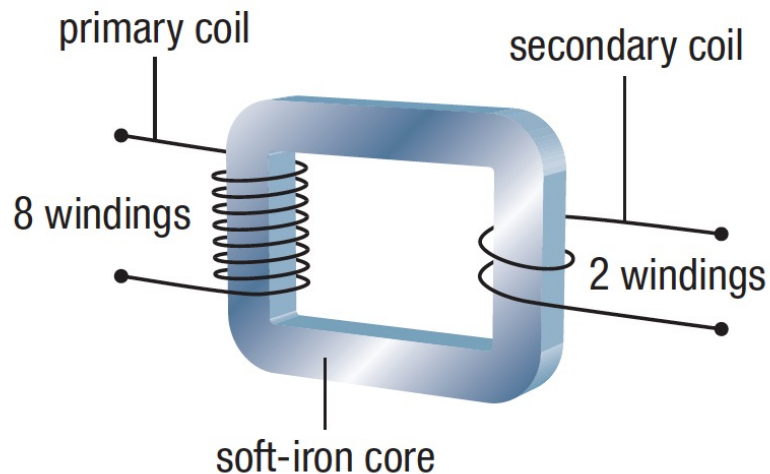
Step-up and Step-down Transformers

- _____
- Most major appliances in your home will utilize 120 volts but more power-hungry ones like your stove and dryer will utilize 240 V



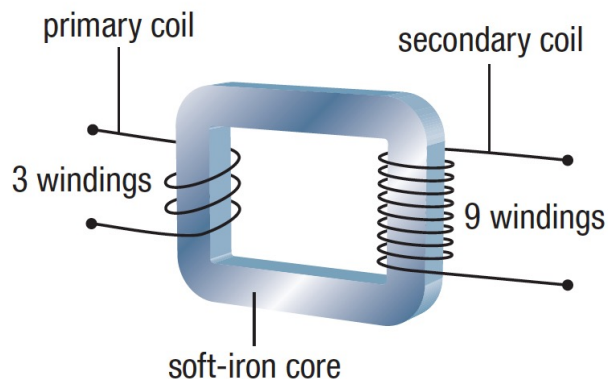
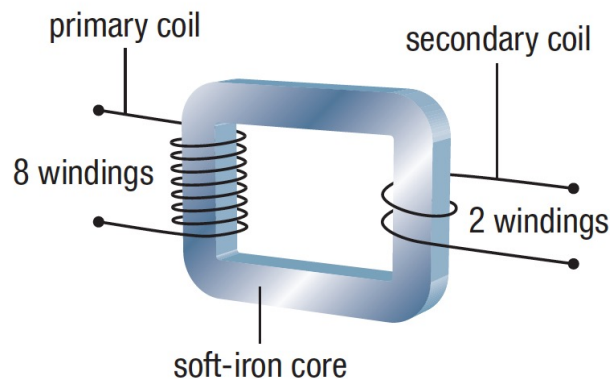
Step-up and Step-down Transformers

- _____
- This AC induces a magnetic field which travels along the soft-iron core and induces an AC current in the secondary coil



Step-up and Step-down Transformers

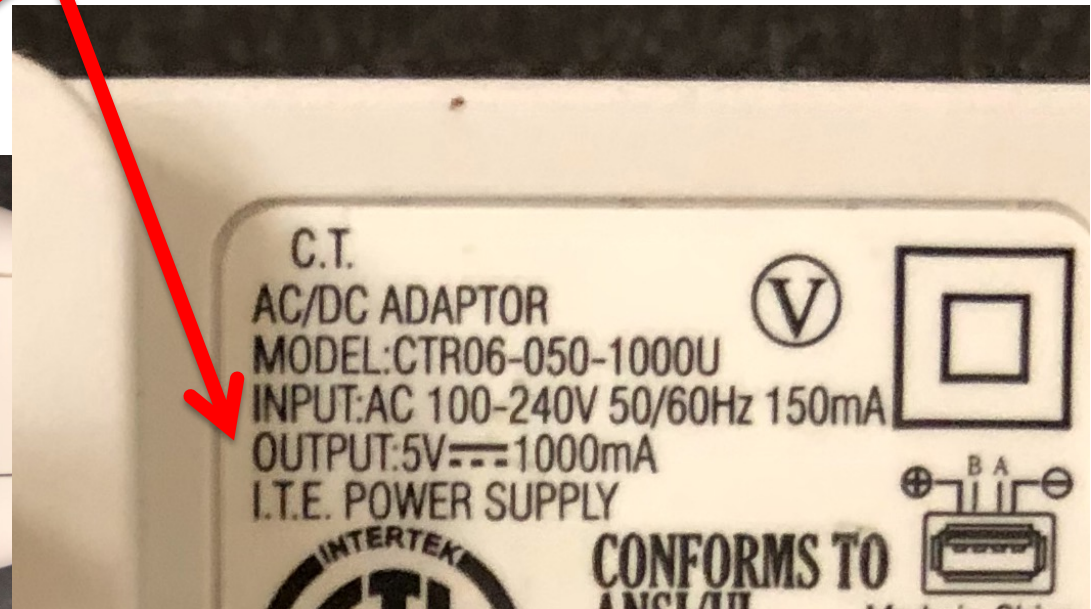
- _____
- Step-down transformers have fewer windings on the secondary coil which results in less voltage compared to the primary side
 - The amount the voltage is lowered depends on the how many less coils there are on the secondary coil



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Step-up and Step-down Transformers

- Most electronics need to have the
- You'll have seen these input/output values on your cell phones charging cord



Conservation of Energy

- Since the voltage is changed, does that mean that we've lost energy? Does this violate the conservation of energy?

- _____

Conservation of Energy

- $\Delta E = P\Delta t$ and $P = IV$
 - Note: p = primary coil, s = secondary coil
- $\Delta E_p = \Delta E_s$ therefore, $P_p = P_s$ as the times cancel
- Since $P = IV$, $I_p V_p = I_s V_s$
- ---
- Note: Transformers are not 100% efficient. Like everything, some energy is lost as heat, sound, etc. Transformers are typically better than 90 % efficient.

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The Transformer Equations

- We can also express current in a transformer with respect to the number of windings

$$\frac{I_s}{I_p} = \frac{N_p}{N_s}$$

- This gives us three transformers equations

$$\frac{I_s}{I_p} = \frac{V_p}{V_s} \quad \frac{I_s}{I_p} = \frac{N_p}{N_s} \quad \frac{V_s}{V_p} = \frac{N_s}{N_p}$$

Check Your Understanding

A step-down transformer used in an adapter for a phone has a primary voltage of 120 V.

$$\frac{V_s}{V_p} = \frac{N_s}{N_p}$$

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Check Your Understanding

A step-down transformer used in the adapter for a cellphone charger has a primary voltage of 120 V and a secondary voltage of

$$I_p V_p = I_s V_s$$