Name _____ Class _____ Date _____

Chapter 20 Electricity

Summary

20.1 Electric Charge and Static Electricity

An excess or shortage of electrons produces a net electric charge.

- **Electric charge** is a property that causes subatomic particles such as protons and electrons to attract or repel each other.

Like charges repel, and opposite charges attract.

- **Electric force** is the pushing or pulling between electrically charged objects.

The strength of an electric field depends on the amount of charge that produces the field and on the distance from the charge.

- The effect an electric charge has on other charges in the space around it is the charge's **electric field.**

Charge can be transferred by friction, by contact, and by induction.

- **Static electricity** is the study of the behavior of electric charges, including the transfer of charges.
- The **law of conservation of charge** states that the total charge in an isolated system is constant.
- **Induction** is the transfer of charge without contact between materials.

Static discharge occurs when a pathway through which charges can move forms suddenly.

20.2 Electric Current and Ohm's Law

- **Electric current** is a flow of electric charges.

The two types of current are direct current and alternating current.

- **Direct current** (DC) always flows in one direction. **Alternating current** (AC) is a flow of electric charge that regularly reverses its direction.

Metals such as copper and silver are good electrical conductors. Wood, plastic, rubber, and air are good electrical insulators.

- An **electrical conductor** is a material through which charge can flow easily.
- An **electrical insulator** is a material through which charge cannot flow easily.

A material's thickness, length, and temperature affect its resistance.

- **Resistance** is opposition to the flow of charges in a material.
- A **superconductor** is a material that has almost zero resistance at low temperatures.

In order for charge to flow in a conducting wire, the wire must be connected in a complete loop that includes a source of electrical energy.

- **Potential difference** is the difference in electrical potential energy between two places in an electric field. Potential difference is also called **voltage,** because it is measured in volts.
- A **battery** is a device that converts chemical energy to electrical energy.

Increasing the voltage increases the current. Keeping the same voltage and increasing the resistance decreases the current.

- According to **Ohm's law,** the voltage in a circuit equals the product of the current and the resistance. The equation for this relationship is $V = I \times R$.

20.3 Electric Circuits

- An **electric circuit** is a complete path through which charge can flow.

Circuit diagrams use symbols to represent parts of a circuit, including a source of electrical energy and devices that are run by the electrical energy.

If one element stops functioning in a series circuit, none of the elements can operate.

- In a **series circuit,** charge has only one path through which it can flow.

If one element stops functioning in a parallel circuit, the rest of the elements still can operate.

- A **parallel circuit** is an electric circuit with two or more paths through which charges can flow.

Electric power can be calculated by multiplying voltage by current.

- The rate at which electrical energy is converted to another form of energy is **electric power.**

Correct wiring, fuses, circuit breakers, insulation, and grounded plugs help make electrical energy safe to use.

- A **fuse** prevents overload in a circuit.
- A **circuit breaker** is a switch that opens when current in a circuit is too high.
- The transfer of excess charge through a conductor to Earth is called **grounding.**

Name _____ Class _____ Date _____

20.4 Electronic Devices

Electronics conveys information with electrical patterns called analog and digital signals.

- The science of using electric current to process or transmit information is **electronics.**
- An **electric signal** is information sent as patterns in the controlled flow of electrons through a circuit.
- An **analog signal** is a smoothly varying signal produced by continuously changing the voltage or current in a circuit.
- A **digital signal** encodes information as a string of ones and zeros.

Vacuum tubes can change alternating current into direct current, increase the strength of a signal, or turn a current on or off.

In n-type semiconductors, the current is a flow of electrons. In p-type semiconductors, it appears as though positive charge flows.

- A **semiconductor** is a crystalline solid that conducts current only under certain conditions.

Most modern electronic devices are controlled by solid-state components.

- A **diode** is a solid-state component that combines an n-type and a p-type semiconductor. Current flows in only one direction, so diodes can change AC to DC.
- A **transistor** is a solid-state component with three layers of semiconductors. It can be used as a switch or an amplifier.
- An **integrated circuit** is a thin slice of silicon that contains many solid-state components.

Communication devices use microchips to make them more portable, reliable, and affordable.

- A **computer** is a programmable device that can store and process information. It usually has many microchips.