Chapter19-Magnetism and Electricity

- Magnetism: attraction of a magnet for another object.
- Magnetic poles: north & south ends of a magnet, they exert the strongest forces
- Like poles repel each other, unlike poles attract each other.
- When you break a magnet in two, each smaller magnet will be complete with its own N and S poles. Within the original magnet, many N and S poles face and balance each other.
- Magnetic field: region of magnetic force around a magnet. It allows magnets to interact without touching.
- Ferromagnetic material: material that shows strong magnetic effects. Ex. Iron, Nickel, Cobalt, or some alloys of several metals.
- Temporary magnets: magnets made from materials that are easy to magnetize but lose their magnetism quickly. Ex. Steel.
- Permanent magnet: magnet made of a material that keeps its magnetism.
- Permanent magnets can become unmagnetized when you drop, strike hard, heat it.
- Earth has an immense magnetic field surrounding it. That's why the compass works as it does when the poles of the magnetized needle on the compass align themselves with Earth's magnetic field.
- Earth's magnetic poles are not the same as the geographic poles. The angle between the two north poles or the two south poles is known as magnetic declination (you need this to find directions on a map since it changes from place to place and with time).
- Electric current: flow of electric charges through a material. Unit – ampere (amp, A). The number of amperes tells the amount of charges flowing past a given point each second. The current is measured with an ammeter.
- Electric current produces a magnetic field. Magnetism is caused by the movement of charges.
- Electric circuit: complete path through which electric charges can flow. Its features are – source of electrical energy, devices run by electrical energy, and conducting wires with a switch that connect electric circuits.
- Conductor: some of the electrons are loosely bound to their atoms, are able to move throughout the conductor, and form an electric current. Ex. metals.
- Insulator: electrons are bound tightly to their atoms and do not flow easily. Ex. rubber, glass, sand, plastic, wood.
- Resistor: uses electrical energy as it interferes with, or resists, the flow of charge through a material Ex. a light bulb.
- As electrons collide with particles in a material, some of the electron's energy is converted to thermal energy (heat) or electromagnetic energy (light). The more collisions, the more electrical energy is converted.
- Electromagnet: a strong magnet that can be turned on and off. Its uses are – lifting heavy pieces of scrap metal; recording information on audiotapes, videotapes, computer discs, credit cards, or doorbell.

Chapter 20-Electric Charges and Current

- Same electric charges repel each other. Unlike ones attract.
- Unlike magnetic poles, electric charges can exist alone.
- Electric field: an electric charge exerts a force through the electric field that surrounds the charge. When a charged particle is placed in the electric field of another charged particle, it is either pushed (same charges) or pulled (different charges).
- If matter consists of charged particles that produce electric fields, we aren't attracted to or repelled by every object around us because each atom has an equal number of protons and electrons. The size (magnitude) of the charge on an electron is the same as the size on a proton. Charges cancel out. The object as a whole is neutral.
- A neutral object can become charged by gaining/losing electrons.
- Build up of charges on an object is called static electricity. Charges do not flow unlike in an electric current.
- Static electricity explains why clothes stick together in the dryer. Static electricity allows you to make copies quickly or use a plastic wrap.
- Static discharge: the loss of static electricity as electric charges move off an object. When a negatively charged object and a positively charged object are brought together, electrons move until both objects have the same charge.
- On humid days, rubbing a balloon on your clothing and then holding it next to a wall, might not have it stick to the wall. The air is filled with water molecules which carry extra electrons on an object, so charges don't have the chance to build up on the balloon.
- Sparks: shocks from touching a doorknob after walking across a carpet. This is the result of electric discharge. Electrons are rubbed off the soles of your feet, you become slightly positive, when you touch the doorknob, electrons jump from the doorknob to you, making you neutral again. Lightning is a huge spark.
- Electrons in a circuit have potential energy related to the force exerted by electric fields. The potential energy per unit of electric charge is called electrical potential. The difference in electrical potential between two places is the potential difference or voltage. This provides the force that pushes charges (current) through a circuit. Ex. a generator, a battery. Unit – volts (V). The voltage is measured with a voltmeter.
- Current also depends on resistance offered by the material through which it travels. The greater the resistance, the less current there is for a given voltage.
- Resistance of a wire depends on
  a. thickness and length of the wire – the longer and thinner has more resistance
  b. how well the material conducts current - electrons move freely though conductors
  c. temperature – the more the temperature, the more the resistance
- Current flows through the path of the least resistance. Since the bird's body offers more resistance than the high-voltage power line (wire), current continues to flow through the wire without harming the bird.

- Ohm's Law: R=V/I where R is the resistance in ohms, V is the voltage in volts, and I is the current in amps. As the V increases, the I increases. As the R increases, the I decreases.
- Sometimes we need to increase the resistance to prevent too much current from flowing, for example in TV's and radios.
- Some resistors don't obey Ohm's Law. The resistance of a light bulb increases when the bulb is turned on and the filament heats up. The cold filament conducts the most current. Therefore the bulb most often burns out the instant you switch it on.
- Series circuit: if all parts of an electric circuit are connected one after another. There is only one path for the current to take.
  Disadvantages –
  One light goes out, all go out.
  As more bulbs are added, the light bulbs become dimmer (R more, I less)
- Parallel circuit: the different parts of the circuit are on separate branches. There are several paths for the current to take.
  Advantages –
  If one bulb is out, others work.
  More current will flow since we have more than one path (total R decreases). The increased current will not affect the original branches, the brightness of a light bulb does not change if another branch is added.
- Short circuit: connection that allows current to take an unintended path (less R, more I). The result is a fatal shock.
- If you touch an exposed wire (insulation worn off), you become part of the circuit. The result is a shock.
- Water and electricity don't mix.
- Grounding: if a short circuit occurs, current will directly go into Earth through the low resistance grounding wire. This protects the person.
- Lightning rods: metal rods mounted on the roof of a building to protect it.
- Fuses: contain a thin strip of metal that melts and opens the circuit if too much current flows through it (breaks the circuit). Ex. during an overload.
- Circuit breaker: uses an electromagnet to shut off the circuit when the current gets to high. Pulling back a switch you can reset the circuit breaker after turning off some of the appliances that are causing high current.
- The human body depends on electrical signals (beating of the heart, breathing, muscle movement). If your body receives an electric current from a source outside of it, the current will interfere with the normal processes within your body. This depends on the amount of the current, the length of exposure, and the body part.

Grade 8 Science
Chapter 21 & 22 Notes

1. Galvanometer – measures small currents using an electromagnet.
2. Electric motor – converts electrical energy to mechanical energy when a loop of current-carrying wire spins continuously.
3. Generator – converts mechanical energy to electrical energy
   - AC (alternating current) – current consisting of charges that move back and forth in a circuit, ex. in a house
   - DC (direct current) – charges flow in one direction, ex. from one end of a battery, around the circuit, to the other end
     - a battery starts with chemical energy
     - wet cell (liquid electrolyte): auto battery
     - dry cell (dry electrolyte): flashlight
     - a rechargeable battery: when useless products are changed back into valuable reactants
4. Turbine – a circular device made up of many blades to generate electricity from mechanical energy. Flowing water from a dam, wind, steam from the burning of fuels, and even the ocean's tides can be used to turn turbines.
5. Generating electricity: table, page 688
   Some sources of energy are
   - Renewable: can be replaced in nature at a rate close to the rate at which it is used, ex. water, wind energy, tidal energy, geothermal energy, and solar energy.
   - Non-renewable: limited, can't be replaced once used up, ex. fossil fuels.

   Eventually, even the largest deposits will be used up. For this reason, and to reduce the risk of global warming caused by the carbon dioxide released by burning fossil fuels, the world's energy sources will probably shift away from fossil fuels.
6. Power – rate at which energy is converted from one form to another. It is expressed in units called Watts (W).
   A light bulb with 100 W is brighter, uses electrical energy at a faster rate than a light bulb with 60 W.
   Power (Watts,W) = Voltage (Volts,V) x Current (Amps, A)
   $P = V \times I$
7. Energy (Kilowatt hours, kWh) = Power (Kilowatts, kW) x Time (Hours, h)
   $E = P \times T$
   A meter measures the electrical energy in a home. As more lights/appliances are turned on, the meter turns more rapidly.
8. Transformer – increases or decreases voltage.
   Step-up: The voltage must be increased before it is sent out over wires from a generating plant since it is more efficient (less energy loss).
   Step-down: Then it is reduced again before it is distributed to customers (it is safer).

9. Electronics - use of electricity to control, communicate, and process information.