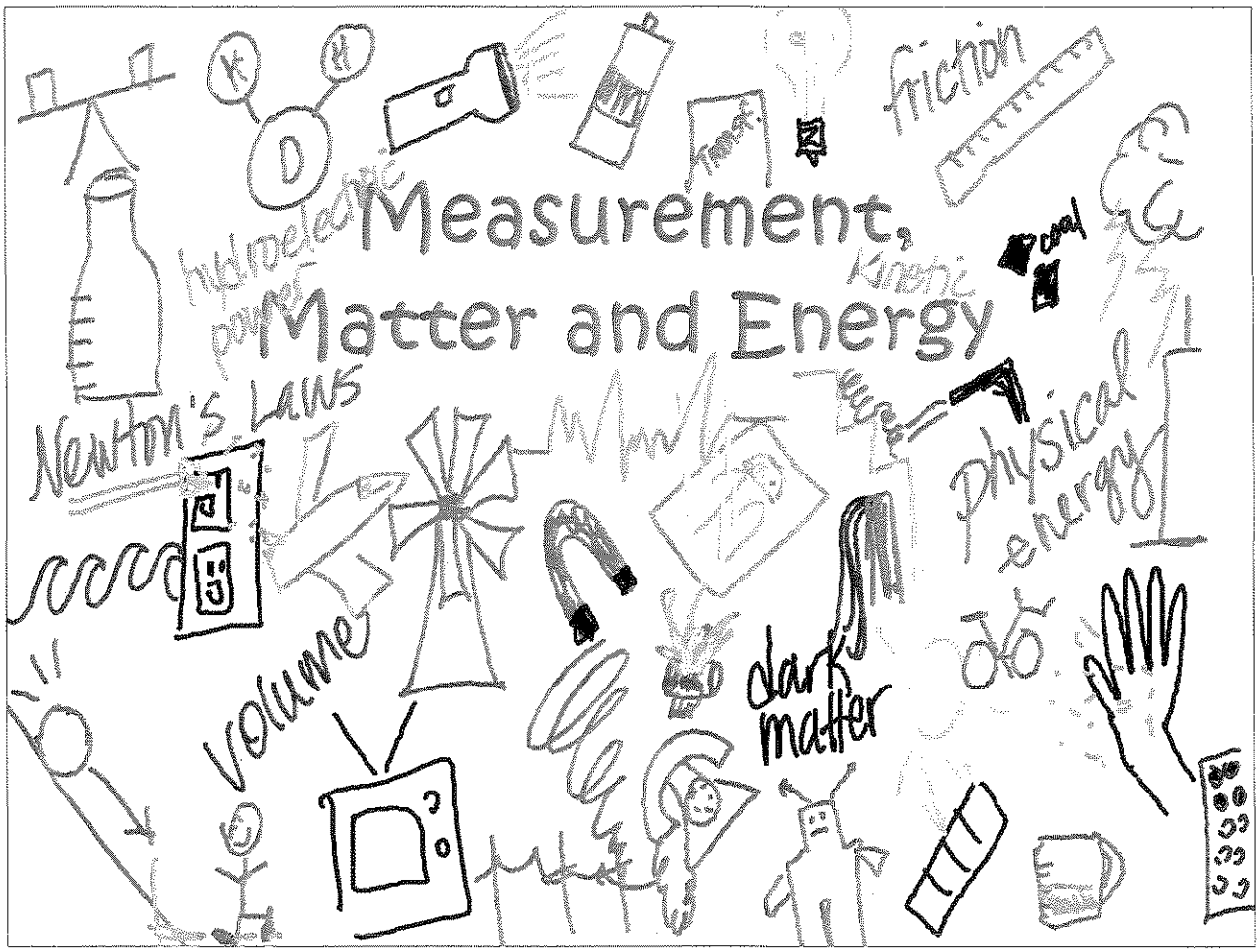
MATTER AND ENERGY

KNOW

- **matter** = makes up hard objects
- Solid - liquid - gas - plasma
- **Matter - takes up space**
- Energy = all around us
- Potential - Kinetic - Mechanical - Electric - Nuclear
- Momentum - Velocity
- Friction (heat) - Solar
- Thermal Energy - Hydrolics

WONDER

- How do you make plasma?
- Why doesn't water maintain its shape?
- How does energy work?
- How many types of matter are there?
- Solids - how are they different?
- How can matter create energy?



Measurement, Matter and Energy

pg. 488 - Matter

MATTER = anything that has mass and volume

MASS = the amount of "stuff" inside something

WEIGHT = the measurement that the pull of gravity has on an object

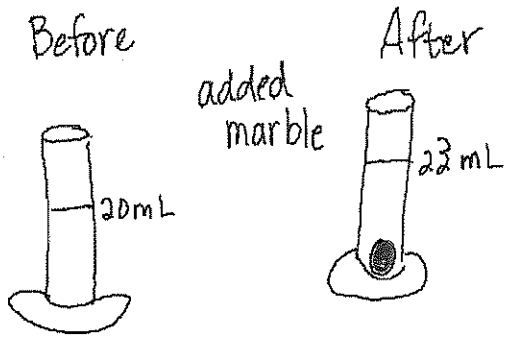
VOLUME = the amount of space that matter takes up

VOLUME can be measured three ways:

1. For regular solids: Multiply ---- Length x Width x Height (used with solid objects) - answer given in cubic measurements (ex: cm^3 or m^3)
2. For liquids: Pour into a graduated cylinder - measured in milliliters (mL)
3. For irregular shapes: Water displacement

$1\ cm^3 = 1\ ml$

Water Displacement



Volume of marble = $3\ cm^3$

$$\text{Density } (g/cm^3) = \frac{\text{Mass (g)}}{\text{Volume } (cm^3)}$$

Density is the measurement of how much mass fits in a certain volume of space

Density of water = $1\ g/cm^3$

SINK or FLOAT???

If something sinks in water, it must have a density higher than 1 g/cm^3

If something floats in water, it must have a density less than 1 g/cm^3

Buoyancy - the ability to float in a gas or a liquid

Archemedes' Principle: The buoyant force of an object is equal to the weight of the water that is displaced.

States of Matter

- **Solid** - definite shape and takes up a definite amt. of space -- molecules are scrunched together
- **Liquid** - takes shape of a container, and space is definite -- molecules have some movement between them
- **Gas** - no definite shape or space - takes the shape of containers --- molecules are moving quickly apart in all directions
- **Plasma** - molecules move VERY quickly apart; rarely exists on Earth

PHYSICAL PROPERTY = properties that can be observed without changing the identity of that substance

Examples:

- color
- hardness
- density
- boiling point
- texture
- magnetism
- odor
- conductivity

Conductor: allows heat and electricity to flow easily through
ex: copper, gold, silver, steel

Insulator: blocks electricity from flowing through an object
ex: rubber, glass, plastic, wood

ELEMENT: pure substances that can't be broken down into any simpler substance

- represented by 1 or 2 letter abbreviations (symbols)
  - Example: H = Hydrogen, Cu= Copper, He = Helium
- Elements rarely exist by themselves - most combine with something else to make a compound

ATOM: the smallest particle of an element that still has the same chemical properties of that element

9,030,000,000,000,000,000,000,000

atoms in one teaspoon of water!

PARTS OF AN ATOM:

- Nucleus: located at the center of an atom contains most of its mass
  - Protons: located in nucleus; positive in charge
  - Neutrons: located in nucleus; neutral charge (not +/not -)
- Electron: moving around the nucleus; has a negative charge

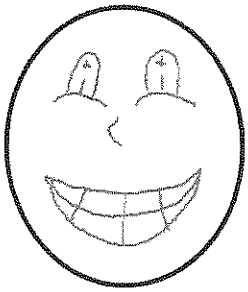
- ATOMIC NUMBER = based on the # of protons in that atom

- ATOMIC MASS = # of protons plus the # of neutrons

The Atoms Family

Name: Perky Patty Proton

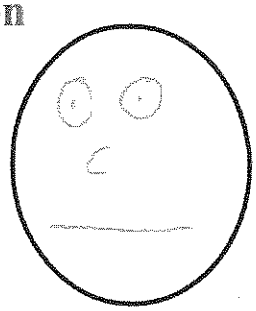
Description



Favorite Activity:

Name: Nerdy Nelda Neutron

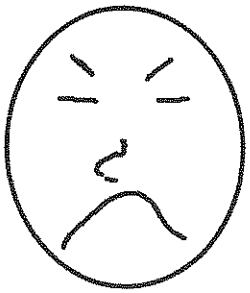
Description



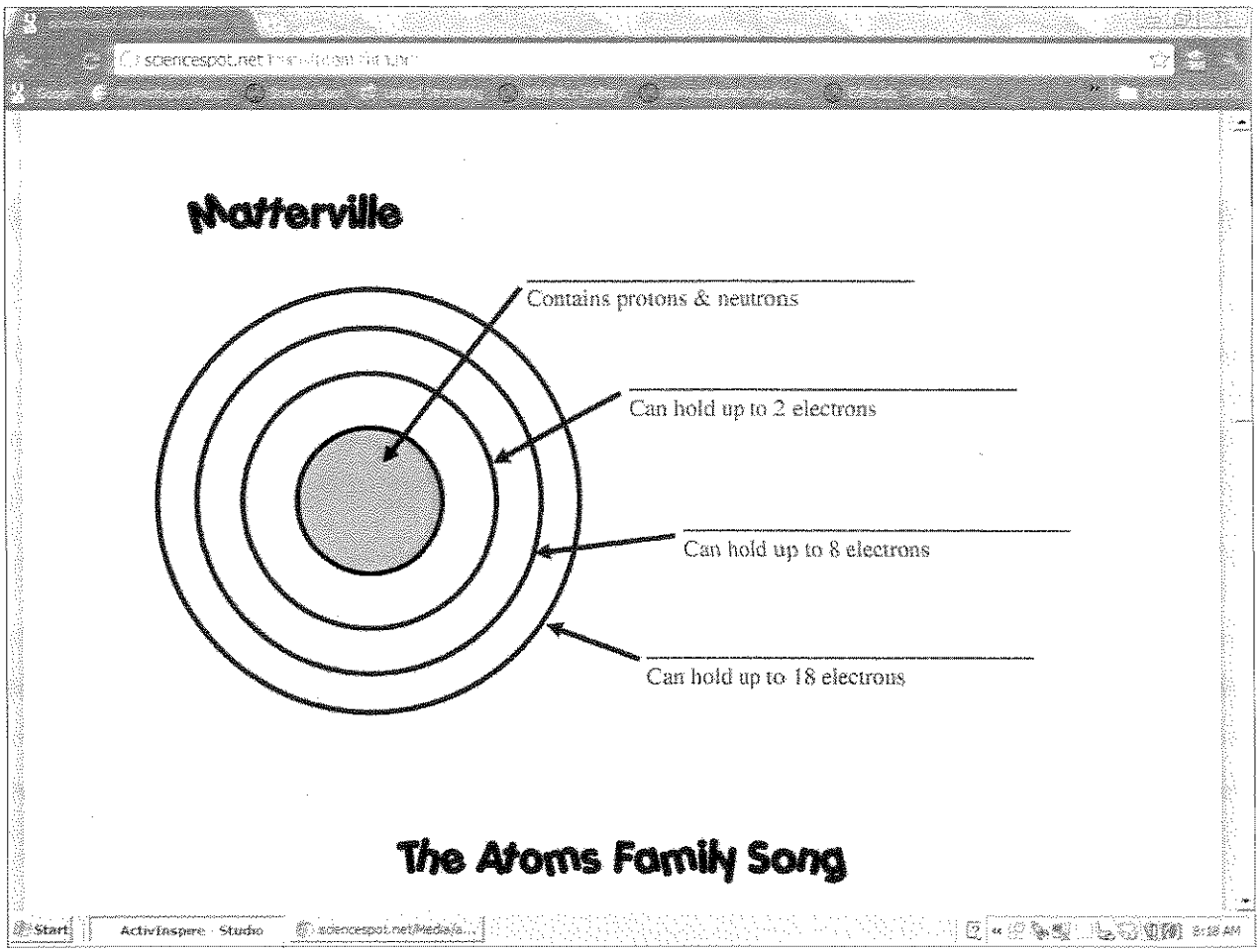
Favorite Activity:

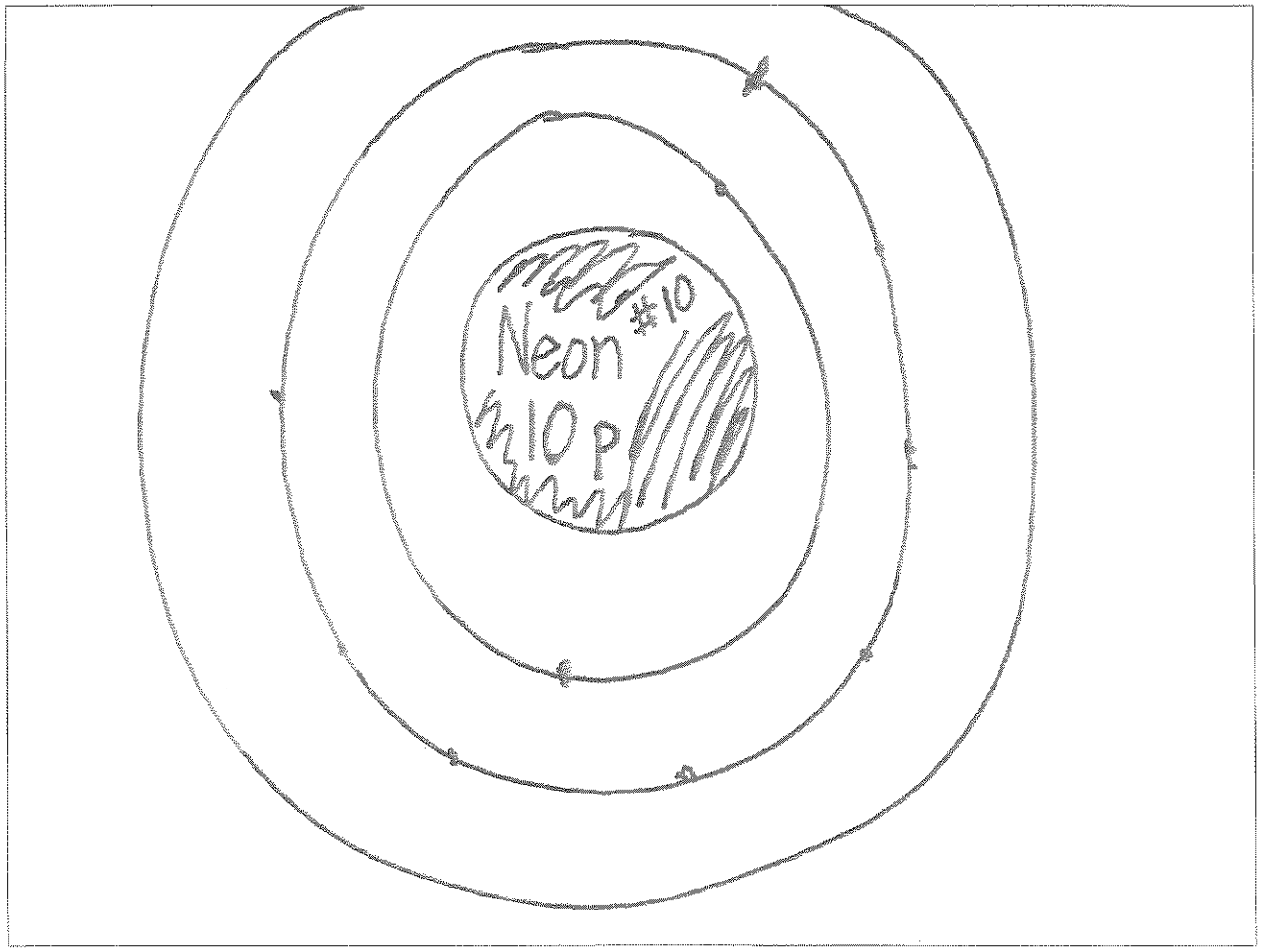
Name: Enraged Elliot Electron

Description

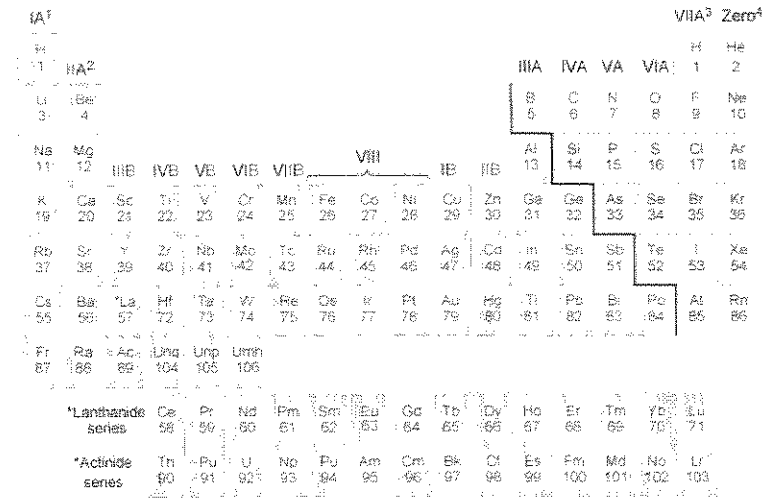


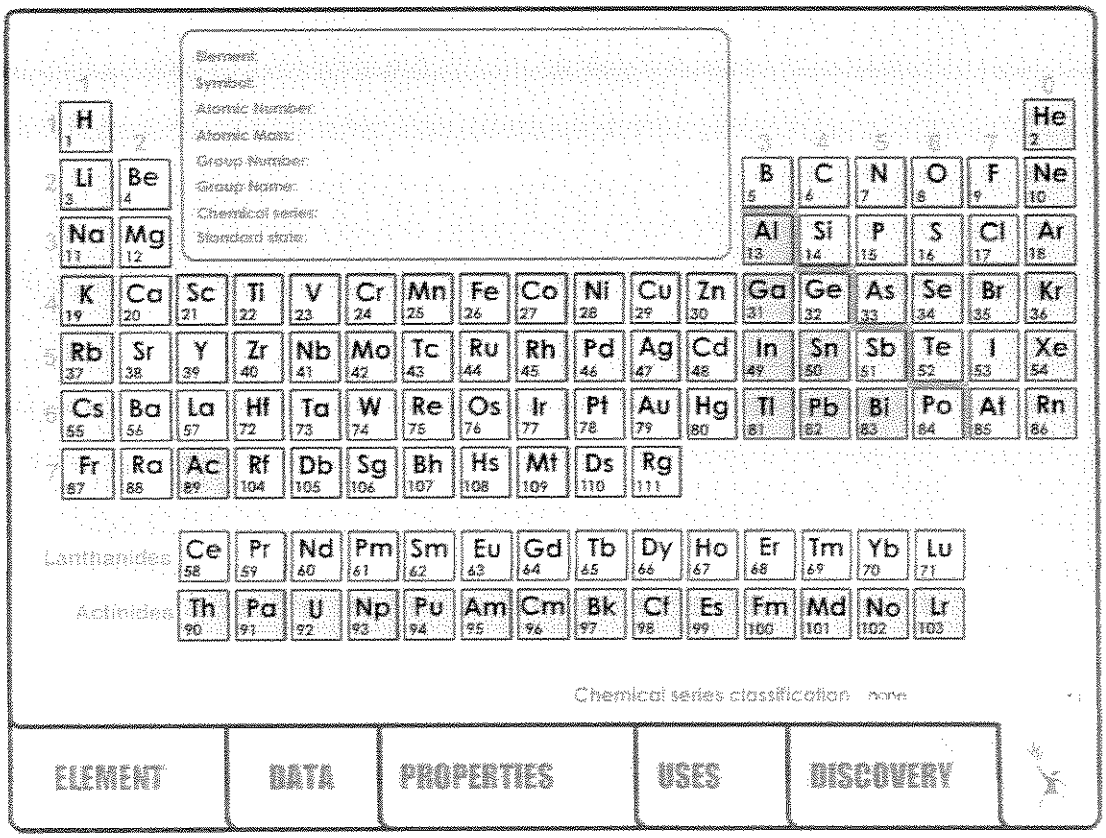
Favorite Activity:


Matterville
Contains protons & neutrons
Can hold up to 2 electrons
Can hold up to 8 electrons
Can hold up to 18 electrons
The Atoms Family Song


Neon
#10
10 p

Periodic Table = organizes the elements according to their atomic # (# of protons it has)





Few elements exist by themselves. Most combine with others to make COMPOUNDS

EX: NaCl = salt (sodium + chlorine)

MOLECULE = the smallest part of a compound that has all the same properties of that compound

TEMPERATURE:

- measurement of how hot or cold something is
- average amount of kinetic energy that the atoms have

Changing the state of matter involves changing the amount of ENERGY it has

- Solids have the least amount of energy
- Gases have the most energy

SUBLIMATION - when something changes from a solid directly to a gas (skips liquid stage)

ex: vanishing ice cube in freezer, dry ice

Most substances exist in solid, liquid or gas form on earth.

4th state - PLASMA -- more energetic than gas state due to its extremely high temp.

Melting Point: the temp. at which a solid turns from a solid to a liquid

- different substances have different melting points, etc.

Condensation: when a gas changes to a liquid

Freezing Point - temp. at which a liquid freezes to a solid

A substance's MELTING point and FREEZING point are the SAME temperature!!!

Water, unlike most liquids, EXPANDS when frozen and takes up more space

- When a liquid is heated, the molecules move faster because it gets more energetic.
- Eventually the liquid turns to a gas = BOILING POINT

Boiling Point for water = 100 °C
Freezing Point for water = 0 °C

- When a liquid turns to a gas, it turns to a vapor = VAPORIZATION (it eVAPORates!)

PRESSURE - force exerted by a gas

- Putting more pressure on a gas decreases its volume
- Ex: pushing on a balloon with more pressure will make the size of the balloon shrink

Cooling a gas will cause the molecules to slow down and will also decrease its volume

ex: putting the balloon outside and it shrunk considerably

However, heating a gas will increase the volume once again

ex: bringing the balloon back inside to warmth and watching it get bigger again

- PHYSICAL CHANGE - when you alter the size, shape or state of a substance without forming something new

NO CHEMICAL CHANGES HAVE TAKEN PLACE!

Physical or Chemical?

- Can something be brought back to its original state? If so, it's a physical change!
- Ex: sugar water - if you let it sit, it will leave sugar behind when the water evaporates

Dissolving: process that occurs when the molecules of a solid move apart and are separated by the molucules of a liquid

- **Heat speeds up the dissolving process because the molucules move around faster**
- **Ex: boiling water dissolves sugar quickly**

HEAT - p.682

Heat = the flow of energy from one substance to another

-- always moves from the hot object to the colder object

Calorie -- the amt. of energy needed to raise the temp of 1g. of water 1 degree Celsius

As temperature increases, the kinetic energy of the molecules gets faster.

Molecules move faster, which increases its volume -- THERMAL EXPANSION

Thermal energy depends on:

- Temperature
- Mass

Three Forms of Heat Transfer:

1. Conduction
2. Convection
3. Radiation

Conduction: movement of energy through direct contact (touching)

- moves from the hot thing to the cold thing
- MUST touch!

Metals -- good conductors ~ energy flows through really well when it's touching something

Insulators --- STOP the energy from flowing through something (wood, rubber, plastic)

Examples of Conduction:

- chocolate melting in a pan or your hand
- hot fudge on ice cream
- bacon on a frying pan
- thermometer in your mouth when sick
- pot touching stovetop
- person in a bed
- hands in a glove
- marshmallow touching a flame
- wood touching fire
- hot water on your hands
- snow in your warm hands
- metal spoon in your hand

Examples of conduction:

- Your hand on a cookie sheet
- Your foot and your sock
- Touching hot handle of woodstove
- Hand on hot pot
- Wire in a cord touching an outlet
- Person touching warm water
- Feet on a hot deck
- Magma touching ground

examples of conduction:

- pan touching burner
- marshmallow touching flame
- burning hand on stove
- hand touching heater
- handwarmers on your hand
- flame on wood
- hair straightener on hair
- hot sand on your feet at beach
- touching a lightbulb

Convection = transfer of energy by a flow of liquid or gas

- MOVING air or liquid makes something warmer
- Heat is less dense and rises; cold things are more dense and sink --- this creates currents

Examples of Convection:

- hot air balloons
- steam room / sauna
- air conditioning
- water boiling
- furnace warming your house
- soup boiling
- cold air in freezer escaping
- ocean currents

Examples of Convection:

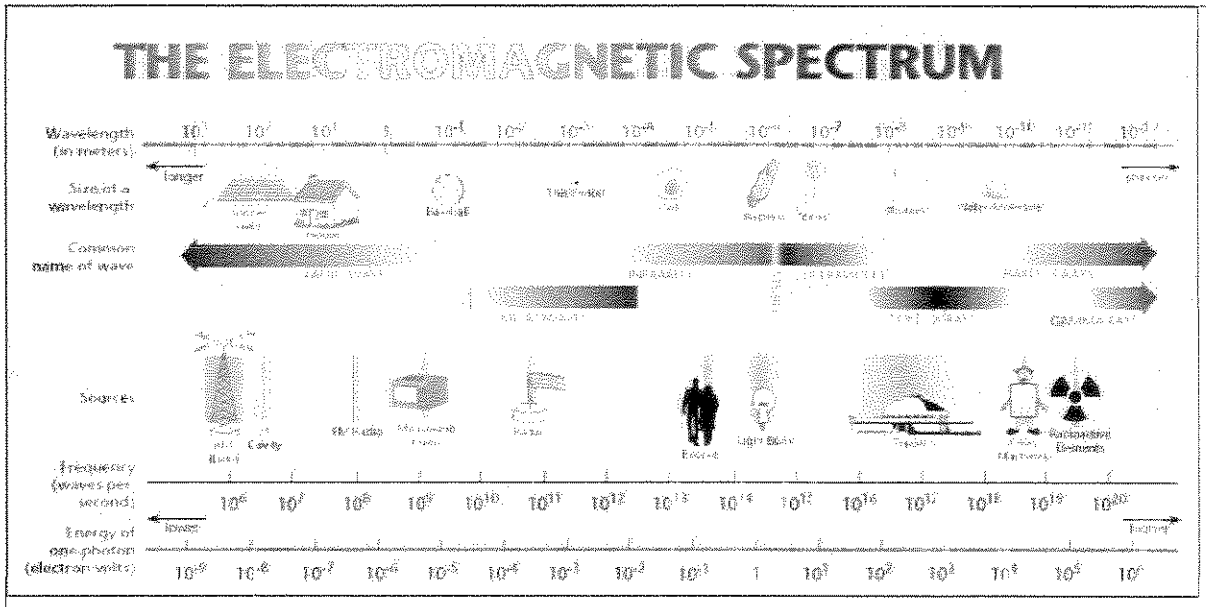
- boiling water
- steam room / sauna
- blowdryer
- furnace in your house
- fans in a room
- bubbling oil

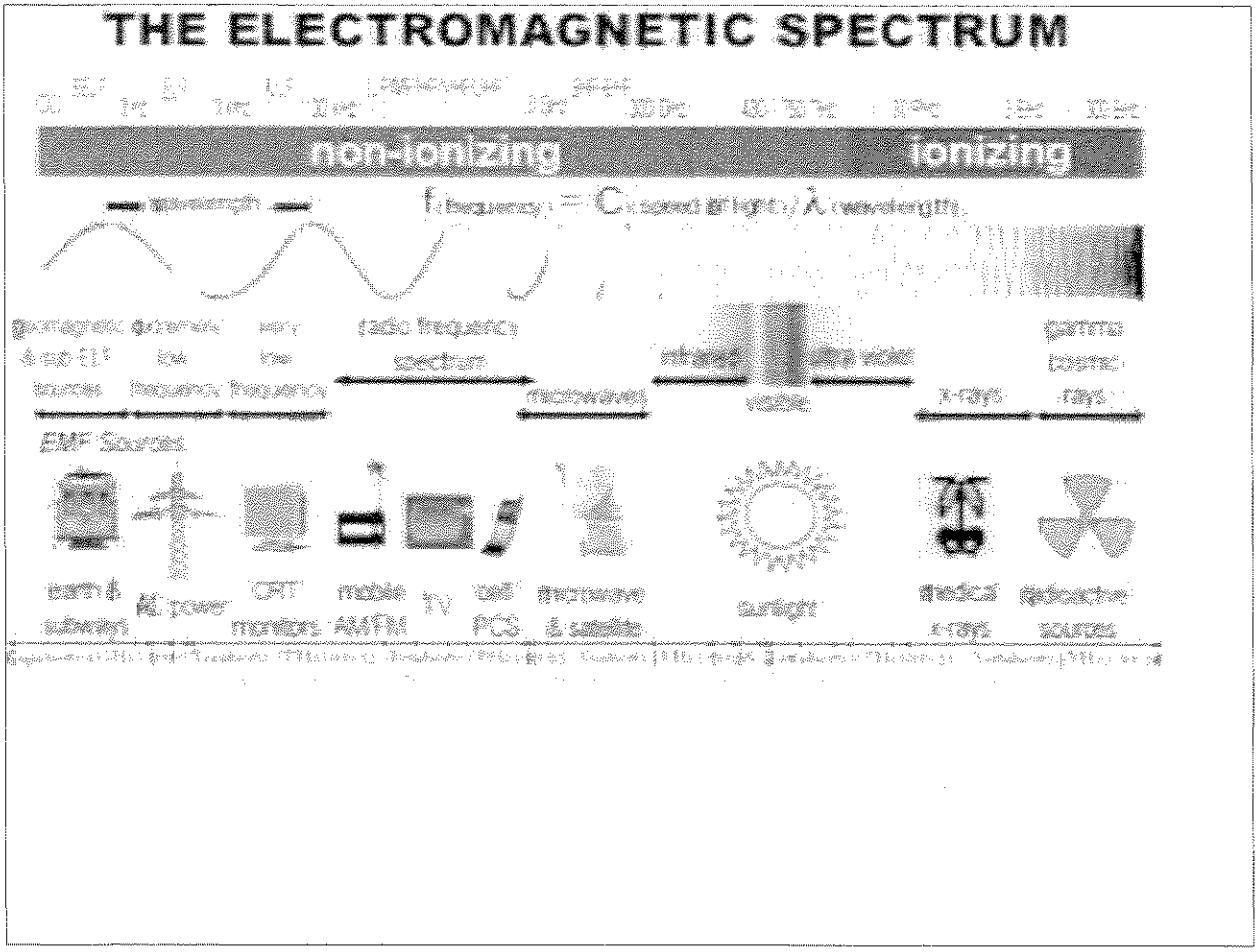
Examples of Convection:

- Boiling water
- Fan moving air through room
- Furnace warming your home
- Warm air cooking food in the oven
- Air currents moving in atmosphere
- Dryer warming your clothes
- Hot water moving in a hottub
- Heating a pot of soup
- Swimming pool currents warming up

RADIATION -- transfer of energy through electromagnetic waves

You can't see the waves warming something up usually, but you feel it as energy





Examples of Radiation:

- Sun's rays (infrared rays=heat and visible light =light and UV rays (sunburn))
- X-Rays - see bones
- Infrared rays - heat lamp, toaster
- Radio waves - radio, TV, radar,
- Microwaves - cell phones, microwave oven
- Gamma rays - zap away cancer
- Visible Light - light you can see
- Ultraviolet radiation - tanning beds

Examples of Heat Transfer:

	6 ex. of each	