Study Guide: **Physical Science**

Lab and Lab Safety

- Follow procedures
- Use materials appropriately
- Think

Scientific Method

Purpose/Question
Research
Hypothesis
Experiment
Analysis and Conclusion

Variables- any factor in an experiment that can be changed
Constants- variables that don't change in the experiment
Independent variable- the variable being changed in the experiment
Dependent Variable- the variable that is being measured
Control- a reference for comparison in an experiment
Inference- a conclusion based on the results of the experiment

Lab, Mass, Volume, and Density

A *triple beam balance* measures mass in grams

A *graduated cylinder* measures volume in ml

A *graduated cylinder* also measures the volume of solids by liquid displacement

Ice floats in water because its density is less than liquid water

Density = $\frac{\textbf{Mass}}{\textbf{Volume}}$

Mass is the amount of matter in an object

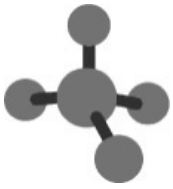
Volume is the amount of space an object occupies

Atoms, Elements, Compounds

- Matter includes all solids, liquids and gases on Earth. All matter is made of atoms.

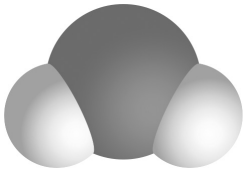
Atom

Compound



Compounds are made of two or more atoms

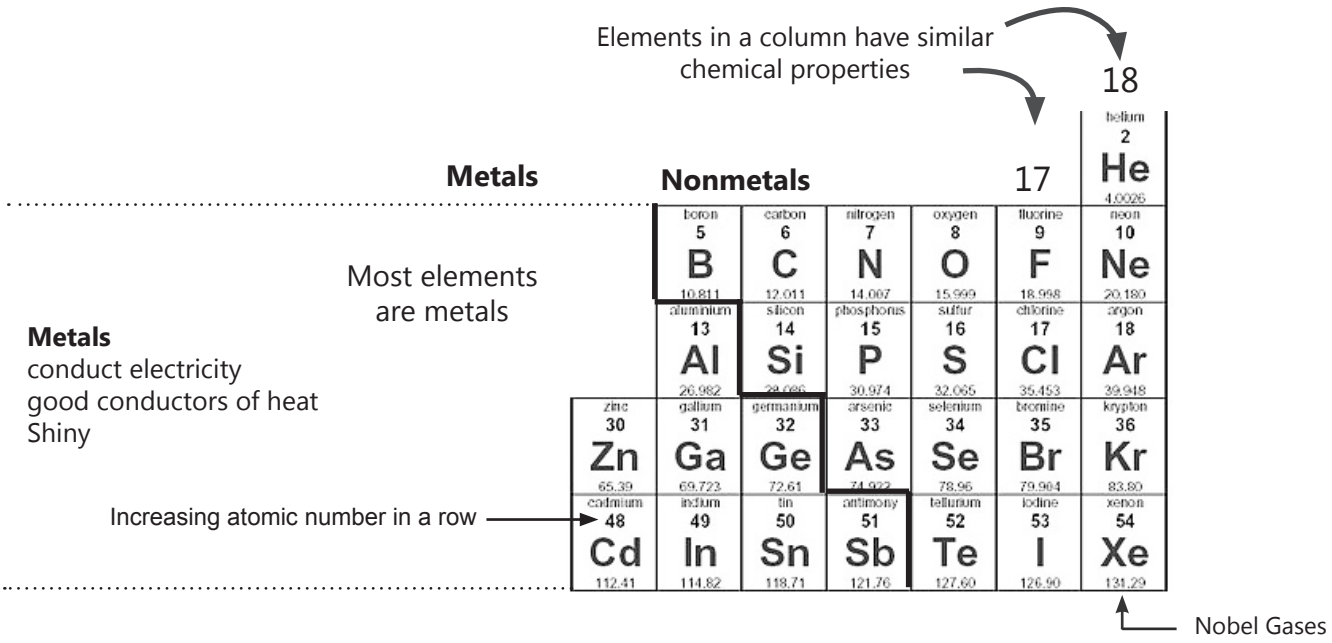
Water Molecule



H_2O

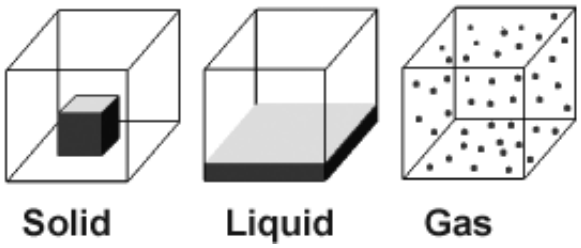
Periodic Table

- A chart that organizes the chemical elements in order of atomic number and their chemical characteristics.



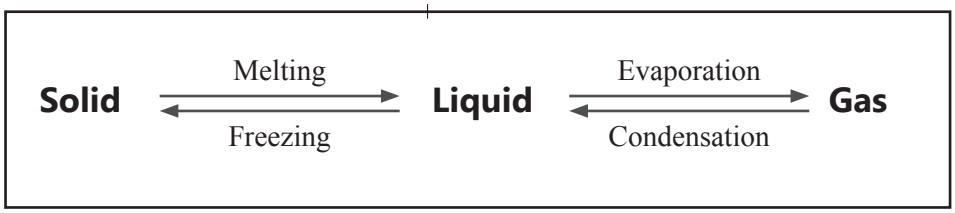
Phases of Matter

- **Atoms** in a **solid** are fixed in a crystalline pattern, **atoms** in a **liquid** can move around each other, and **atoms** in a **gas** exist independently.



Temperature determines phase

Atoms have more kinetic energy as temperature increases



Changing from one state to another is an example of a **Physical Change** (not a chemical change)

Physical Changes

No new substances created

e.g. ripping paper
making a mixture
melting copper
changing shape

Chemical Changes

new substances created

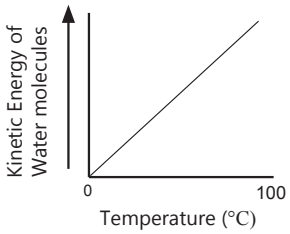
e.g. formation of rust
burning of fuels
photosynthesis
baking cookies

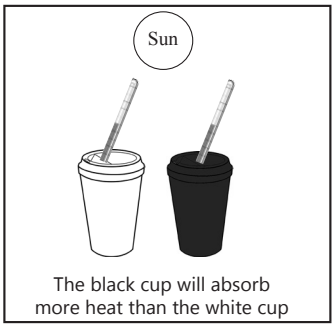
Mixture- a combination of substances (e.g. sand and salt in water) that can separated from each other

Solubility- sugar can dissolve in water. Heating and stirring increase solubility

Thermal Energy

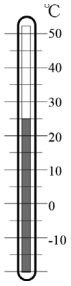
• Also called heat. As temperature increases, the atoms and molecules move faster and thermal energy increases.





The black cup will absorb more heat than the white cup

Thermometer



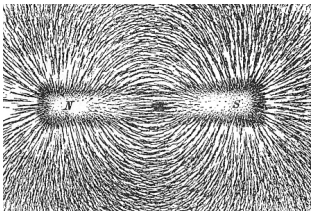
The liquid expands when heated and contracts when cooled.

Convection currents occur in the mantle of the Earth

Magnets

Repel

Attract

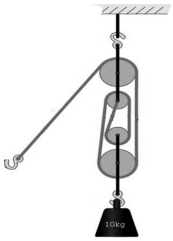


The field is strongest at the poles

Simple Machines

Lever

Pulley



Inclined Plane

Screw and **Wedge** are types of inclined planes

Wheel and Axle

Pulleys and levers can *change the direction* of the force

Motion and Energy

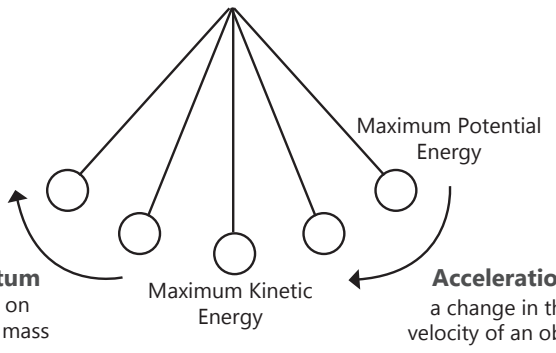
Potential Energy- stored energy **Kinetic Energy** - the energy of motion

• Machines use **Mechanical Energy**

• Energy can be converted from one form into another
(solar energy, photosynthesis)

Chemical Potential Energy → Electricity → moving electrons through a closed circuit

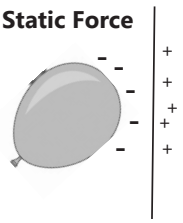
Pendulum



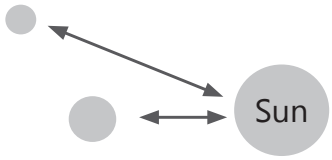
Forces

- a push or pull on an object. A force usually changes the motion of an object
- every action has an equal and opposite reaction.

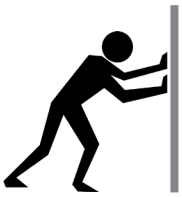
Static Force



Gravity- an attractive force between two objects



mass and *distance* determine the strength of the gravitational field between two objects



The wall pushes back with an equal force

Friction — a force that opposes motion (air resistance, drag)
friction usually produces thermal energy

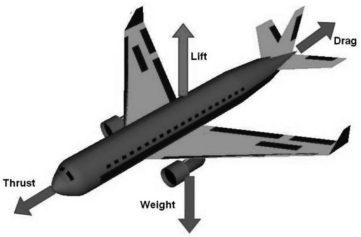
Lift an upwards force that affects objects in motion in a fluid

Thrust - a force that propels rockets and airplanes

Drag- a force that opposes thrust, a type of friction

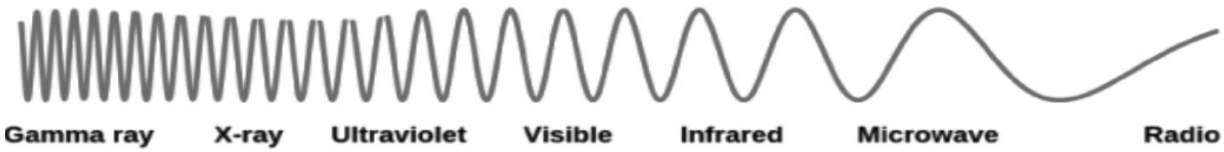
Weight- the pull of gravity

Forces involved in Flight



Spring Scale measures force

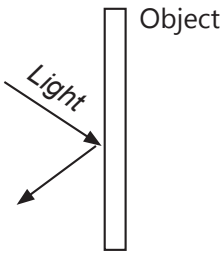
Electromagnetic Waves



Short Wavelengths → **Long Wavelengths**

- The shorter the wavelength, the more energy carried by the waves
- Visible light is the portion of the EM spectrum that can be detected by the human eye

Light Waves



Reflection

Refraction

Refraction

Sound Waves

- Sound waves are produced by ***mechanical vibrations***
- Sound waves need a solid, liquid or gas to travel through and cannot travel through space (a vacuum)

Lightning - light waves, arrive first

Thunder - sound waves, arrive second