# OAKS Review 8th Physical Science. 2016

**6.1P.1 Describe some physical and chemical properties of matter and how they can be measured.**

- **Density**: (physical) Mass/Volume. The amount of matter that fits into a certain volume. It is a characteristic property of matter. If an object is more dense than water (1g/ml) it will sink
- **Solubility:** (physical) The amount of a solute that dissolves in a certain volume of a solvent. Measured in g/L. Some substances change their solubility at different temperatures
- **Melting Point:** (physical) the temperature at which a substance changes phase from a solid to a liquid and Boiling Points: the temperature at which a substance changes from a liquid into a solid
- **Reactivity** (chemical): the tendency of a substance to have a chemical reaction with another substance (elated to the number of electrons in the outermost layer of electrons
- **Malleability**: (physical) ability to change shape Ductile: ability to be stretched into a wire.
- **Conductivity**: (physical) of heat ability to conduct heat (insulator does not conduct heat) (thermometer) and electricity (voltmeter, light bulb) POM lesson 21
- **Appearance** color, shininess etc (physical)

**6.1P.2 Compare and contrast the characteristic properties of forms of energy**

- **Kinetic Energy:** energy of movement: moving water and wind have kinetic energy (similar to mechanical energy), moving molecules (thermal, sound)
- **Potential Energy:** stored energy (gravitational potential energy is determined by position) the battery has potential chemicval energy)
- **Chemical Energy:** Energy stored inside chemical compounds that can be released during a chemical reaction; eg : food (digestion), battery, alka-seltzer and water (got cold)
- **Nuclear Energy:** energy stored inside an atom that can be released when an atom is split (fission) or two atoms are fused

(fusion reaction)

- **Electrical Energy**: Movement of electrons creates an electric current
- **Thermal Energy:** kinetic energy at the molecular level (moving particles)
- **Sound Energy:** compression waves (of potential and kinetic energy) moving through matter. Energy is transferred in a longitudinal wave
- **Mechanical Energy**: Energy of motion that does work: (work=force x distance) a push or a pull acting over a distance and moving something) Your moving solar car has mechanical energy
- **Electromagnetic Energy**: oscillating (waves) electro and magnetic fields that can travel through empty space. Have different wavelengths that determine how much energy it has. Includes visible light energy, infrared, ultraviolet, microwaves, radio waves, x-rays, gamma rays.

6.2P.1 **Describe and compare types and properties of waves and explain how they interact with matter:** look at the inspiration mind map you made on your iPad.

- **Transverse wave:** vibrations are perpendicular to the direction of transmission: LIGHT (beaded chain model) Can move through matter
- **Longitudinal:** vibrations are in the same direction as the direction as the propagation or movement (slinky model EWIT) SOUND
- **Reflection:** The throwing back of light without absorption (light box)
- **Refraction:** The bending of waves when they hit a new medium and change speed (rainbow)
- **Absorption:** when wave energy is converted to heat when it hits an object
- **Transmission:** when the wave passes through matter and comes out the other side
- **Wavelength:** Distance between two crests or two troughs or between two compressions or two rarefactions
- **Frequency**: The number of waves or cycles per second (measured in Hertz)

- **Amplitude:** The high from the center to a crest in a transverse wave, the intensity of the compressions.

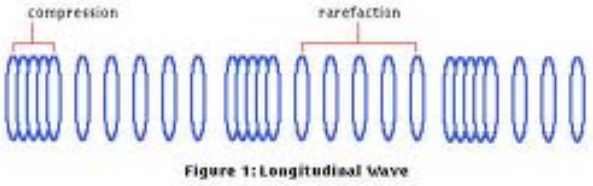


Figure 1: Longitudinal Wave

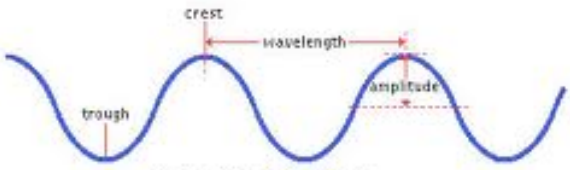
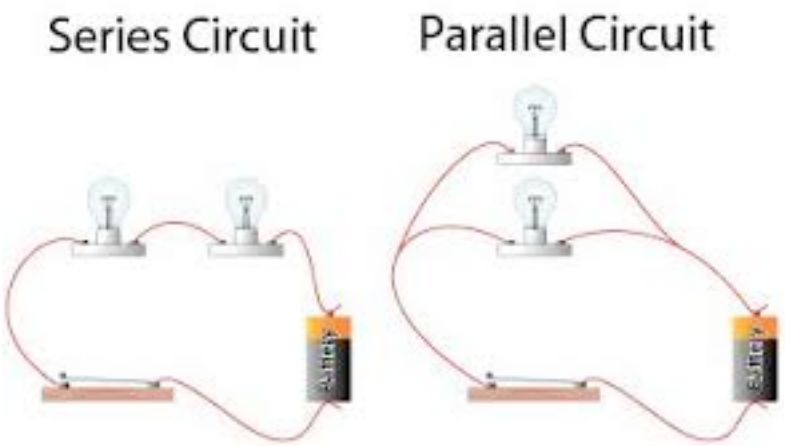


Figure 2: Transverse Wave

6.2P.2 **Describe the relationship between: electricity and magnetism, static and current electricity, and series and parallel electrical circuits**

- **Electrical Current** can induce a magnetic field detected by a magnet (EWIT)
- **Moving magnets** can induce electric current, moving the shaft of the motor lit a lightbulb. (EWIT, turbine)
- **Series circuit:** is when all the wires are in one “circle” so if there is a break in the circuit (switch) electricity does not flow, whereas in a **parallel circuit** there is more than one pathway for the electricity to flow, so if a switch is open in part of it, electricity can still flow in the other part.
- **Static electricity**: when electric charges stay on the surface of a substance until it can be discharged and move away. (rubbing a balloon on your head and your hair standing on end, laundry out if the dryer clinging together,
- **Current Electricity**: electric charges that flow through a medium like a wire.




7.1P.1 **Explain the relationship between atoms, elements and compounds**

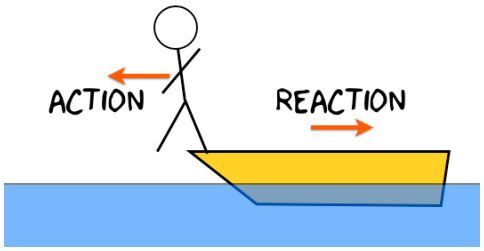
- **Atoms:** all matter is made of atoms: an atom is the smallest particle of an element that has the properties of the element
- **Elements:** are pure substances that are composed of a single kind of atom, and have a distinct set of characteristic properties
- **Compounds:** are a pure substance composed of two or more different elements that are chemically combined (with chemical bonds) and have a distinct set of characteristic properties
- **Mixture**: is two or more pure substances mixed together but not chemically combined and the properties of the mixture changes depending on the amount of each substance in the mixture (eg salt and ice temperature: POM lesson 18)

**7.2P.1 Identify and describe types of motion and forces and relate forces qualitatively to the laws of motion and gravitation.**

- **Unbalanced vs balanced forces**: If forces are balanced the object will not move or will move at a constant speed.
- **Effect of a constant force** on motion: a constant force causes an increase in speed. This increase in speed is called **acceleration.** A skydiver experiences this constant force due to gravity until they reach **terminal velocity** because the forces of air resistance is equal to the force of gravity and they fall at a constant speed
- **Inertia**: the tendency of an object to maintain its movement or lack of movement. **Newton's first Law** is called the law of inertia. An object at rest tends to stay at rest unless acted upon by an unbalanced force, while an object in motion tends to stay

in motion at the same speed and direction unless acted upon by an outside force. Example: A person riding in a car that takes a curve in the road at high speed will find themselves thrown into the side of the car in the direction they were moving.

- **Newton's second law of motion** describes the relationship between Force mass and acceleration. F=ma. If the Force increases and the mass stays the same, the acceleration will increase. If the mass increases and the force is kept the same,, the acceleration will decrease. **Example**: A full truck (more mass) with the same motor (force) as an empty truck will accelerate more slowly.
- **Newton's Third Law of Motion:** For every action there is an equal and opposite reaction. When you are standing on the floor the floor is pushing back up on you with the same force (normal) as the force of gravity. When you step out of a canoe the canoe moves away with the same force that you step off.




- **Friction** (air, rolling, sliding): the force opposing motion
- **Normal Force:** the force opposing gravity
- **Gravitational Force**: The force between any two objects and is directly related to their masses inversely related to their distance apart
- **Speed**= Distance/Time or m/s, acceleration is the change in speed over time of m/s/s meters per second change per second. The acceleration due to gravity is about 10 m/s/s, velocity: speed in a certain direction.

8.1P.1 **Describe the atomic model and explain how the types and arrangements of atoms determine the physical and chemical properties of elements and compounds**

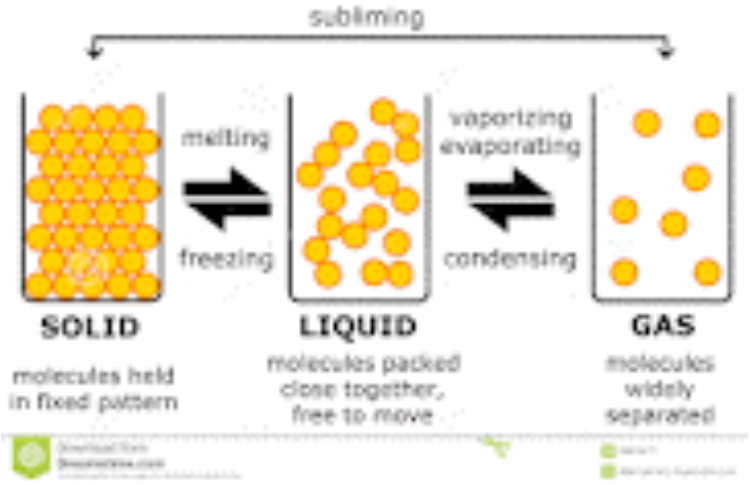
- **Electrons:** negatively charged subatomic particles found in an electron cloud around the nucleus: very tiny
- **Protons:** positively charged subatomic particles, larger particles found in the nucleus
- **Neutrons:** Neutral subatomic particles found in the nucleus: same size as the protons (1amu)
- **Nucleus:** Center of the atom containing protons and neutrons
- **Electron Cloud model:** electrons are not found in circular pathways as initially modeled, but are constantly moving in a cloud like region where the electron is likely to be found.
- **Atomic number:** number of protons (periodic table is in order of atomic number.
- **Atomic Mass:** mass of one atom
- **Solid, Liquid, Gas**: phases of matter: most elements are solid at room temp, two are liquid and about 10 are gases.
- **Crystalline structure:** shape of crystals formed by a pure substance like salt sodium chloride or copper sulfate
- Reactivity: based on electrons

8.1P.2 **Explain how the Periodic Table is an organization of elements based on their physical and chemical properties**

- **Group/ Families**: vertical columns: have common properties, like how reactive they are and which other families they most likely will interact with. Alkali metals, Alkaline Earth Metals, Halogens, Noble gasses.
- **Metals/Non-Metals**: Metals are on the left non-metals on right
- **Reactivity**: If an atom has missing electron or wants to get rid of an electron or two, that is what makes elements very reactive
- Noble Gases far right/un-reactive don't form compounds
- **Valence electrons**: outermost electrons
- **The periodic table rows** are in order of atomic number which is the number of protons in an atom and the number of electrons in a neutral atom

8.1P.3 **Explain how the motion and spacing of particles determines states of matter.**

- Solid: particles are slow moving and close together
- Liquid: some movement and particles are a little farther apart
- Gas: assume shape and volume of container




8.2P.1 **Compare and contrast physical and chemical changes and describe how the law of conservation of mass applies to these changes**

- **Physical changes:** dissolving, phase changes such as melting, freezing, boiling, condensation, evaporation, and errosion. There is a change in form but it does not change into a new substance
- **Chemical Changes:** When a new substance is produced through a chemical reaction which can be detected by a change in color, a new phase of matter without heating an cooling, smoke, fire, change in texture, particle size.
- **Mass is conserved** during physical (dissolving, phase changes) and chemical changes (chemical reactions as long as the change takes place in a closed system and matter is not allowed to escape

8.2P.2 **Explain how energy is transferred, transformed, and conserved**

- **Potential Energy** (stored energy) is often converted to **kinetic energy** (energy of movement). When a roller coaster car is at the top of the hill it has the greatest potential energy but as it

rolls down due to gravity the potential gravitational energy is converted into kinetic energy. The faster it is moving the greater the kinetic energy.

- It may seem like the car slows down and loses energy but if you feel the rails you know it transferred the moving energy into heat which then radiates into the air
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Energy is always conserved but can change from one type to another. **Energy Transformations**

- Potential to Kinetic (roller coaster)
- Chemical (batteries in a flashlight) to electrical to light
- Kinetic energy (movement) to heat energy
- Mechanical (generator/turbine) converted into electrical to sound light and heat etc.

## Engineering Standards:

8.4 Engineering design is a process of identifying needs, defining problems, identifying design criteria and constraints, developing solutions, and evaluating proposed solutions.

**The Solar Car Project as an engineering design project:**
**Needs:** What is needed (a solar Car to race in the solar challenge)
**Problem to be solved**: How will we design, build and test the fastest car so we win

**Design Criteria**: size of car (less than 60 in long and 30 inches wide) 2 AAA batteries in case of rain, same type of solar panel, distance traveled 20 meter, must use the same motor

**Constraints**: Time, materials, money, knowlege

**Solutions:** Make it aerodynamic, reduce friction by aligning parts and using graphite lubricant, make it light to reduce friction

**Evaluating Solutions:** Test the car and make modifications as needed