

Heat Energy Vocabulary

1. **Energy**: The ability to do work. Measured in Joules.
2. **Joules**: The units for energy and work. One Joule is equal to one Newton meter.
3. **Work**: A force acting over a distance to move something. Work has only been done if an object moves. Measured in Joules.
Formula: $\text{Work} = \text{force} * \text{distance}$
4. **Force**: A push or pull. You know that a force is present if there is a change in shape or a change in motion. Force is measured in Newtons.
5. **Potential Energy / Gravitational Potential Energy**: Stored energy or energy of position. The higher up an object is the more gravitational potential energy it has.
Formula: $\text{GPE} = \text{mass} * \text{elevation} * \text{acceleration due to gravity}$
6. **Kinetic Energy**: The energy of motion. The faster something is moving, the more kinetic energy it has
7. **Matter**: Anything that has mass and takes up space. Matter is made up of atoms.
8. **Atoms**: Make up matter. An atom is the smallest piece of an element that you can have and still have the same element. Atoms are made up of three different types of particles: protons (+) , electrons (-), and neutrons (neutral).
9. **Mass**: the amount of matter in an object; measured with a balance in grams.
10. **The three phases of matter**:
 - a. **Solids**: have a definite shape and volume. Molecules are tightly packed with lots of bonds holding the molecules together. Molecules move by vibrating back and forth. Solids have a low level of energy.
 - b. **Liquids**: Take on the shape of their container, so they do not have a definite shape. Liquids do have a definite volume. Molecules are packed more loosely than solids and have fewer bonds holding them together than solids. Molecules move by rotating around each other. Liquids have more energy than solids.
 - c. **Gases**: will spread out to fill any container- they do not have a definite volume. The molecules of a gas are the most loosely packed of the three phases of matter and have the fewest bonds holding them together. The molecules move all over the place like crazy. Gases have more energy than liquids.
11. **Phase Changes**: When an object is going through a phase change, its temperature remains the same; any energy being added is being used to either rip apart bonds or build new bonds.
 - a. **Melting**: when a solid changes into a liquid. Energy is absorbed during this process.
 - b. **Freezing**: when a liquid changes into a solid. Energy is released during this process.
 - c. **Vaporization / Evaporation**: when a liquid changes into a gas. Energy is absorbed during this process.

- d. **Condensation**: when a gas turns into a liquid. Energy is released during this process.
 - e. **Sublimation**: when a solid turns directly into a gas without going through the liquid phase first. Energy is released during this process.
12. **Heat**: the kinetic and potential energy of molecules within a substance. The amount of heat an object has depends on the temperature of the object and the object's mass. If two objects have the same temperature, the object with more mass has more heat. If two objects have the same mass, the object with the higher temperature has more heat.
13. **Temperature**: the measurement of the amount of heat in an object. Temperature is measured with a thermometer in degrees Celsius.
14. **Heat Transfer**: the movement of heat from an area of high concentration (where there is a lot of heat) to an area of low concentration (an area where there is only a small amount of heat). There are three methods of heat transfer:
- a. **Conduction**: heat transfer that involves the direct contact of molecules. In conduction, molecules with more heat energy (which are faster moving) collide with molecules with less heat energy (slower molecules). When the molecules collide, the warmer molecules share some of their heat energy with the cooler molecules. The entire process repeats over and over again until the entire substance is the same temperature. Conduction works in all three phases of matter, but works best in solids because the molecules are closer together.
 - b. **Convection**: this method of heat transfer occurs only in liquids and gases. As a liquid is heated, the molecules gain heat energy and speed up. As the molecules speed up, they tend to move apart, making the substance less dense. The less dense fluid rises. When the fluid is away from its heat source, it starts to cool down, making the molecules slow down and move closer together. This makes the fluid more dense, so it sinks. The cycle repeats, creating convection currents.
 - c. **Radiation**: heat transfer through empty space. Radiation can happen only in gases, and can occur through a vacuum.
15. **Conductors**: materials that allow heat to travel through them easily. Metals are good conductors; copper and silver are the best.
16. **Insulators**: materials that do not allow heat to travel through them easily. Ex: wood, glass, plastic, rubber, air.
17. **Physical Change**: when a substance changes from one form into another without a change in its composition (ingredients). Examples: phase changes, crushing, grinding, tearing
18. **Chemical Change**: when a substance has a change in its chemical properties (composition) so that a new substance is formed. This can happen when one substance gets broken down into two or more substances, or can happen when two or more substances combine to form one new substance. Ex: rusting, burning, cooking

19. **Forms of Energy:**

- a. **Chemical energy:** Energy stored in chemical bonds. When the bonds are broken, chemical energy is released.
- b. **Mechanical energy:** energy associated with movement
- c. **Nuclear energy:** energy stored in the nucleus of an atom. There are two types:
 - i. **Nuclear Fission:** when one nucleus splits into two or more nuclei. This is the type of nuclear energy we get from nuclear power plants. It produces hazardous wastes.
 - ii. **Nuclear Fusion:** when two or more nuclei join together to form one larger nucleus. This is the type of nuclear reaction that happens on the sun.
- d. **Heat energy:** thermal energy. Caused by friction.

20. **Energy Sources:**

- a. **Geothermal:** heat from hot rocks deep under ground
- b. **Nuclear:** energy from the nucleus of an atom
- c. **Solar:** energy from the sun
- d. **Wind:** energy from wind is harnessed when a wind mill powers a turbine which is used to power a generator.
- e. **Hydroelectric:** energy from moving water
- f. **Fossil fuels:** coal, oil, and natural gas. Formed by the decaying remains of plants and animals from millions of years ago.

21. **Law of Conservation of Energy:** Energy cannot be created or destroyed, but it can change forms.

22. **Momentum:** all moving objects have momentum. The more momentum an object has, the harder it is to stop.

Formula: $\text{momentum} = \text{Mass} * \text{Velocity}$

23. **The Law of Conservation of Momentum:** The total momentum of any group of objects will remain constant unless they are acted on by an outside force.