



Energy is the capacity **to do work** or **to produce change**.

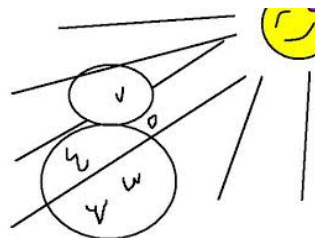
May 28-12:06 PM

## Energy!

Energy can be a difficult concept to observe and measure. It is often easier to study the effects of energy on matter and the many forms that it takes.

When a person lifts his or her arm, we can see the arm moving. Work is involved in this process. It's because of **energy** that this work gets done. **So energy can be the capacity to do work.**

When snow and ice melt, they change from a solid to a liquid phase. This change is made possible from **energy from the sun**. **Energy can also be the ability to produce change.**



May 28-12:06 PM

**Forms of energy and possible sources**

Energy from:	Energy Source:
Solar Energy	Sun
Thermal Energy	Fire
Wind Energy	Wind
Hydraulic Energy	Waterfall
Elastic Energy	Elastic Spring

May 29-9:25 AM

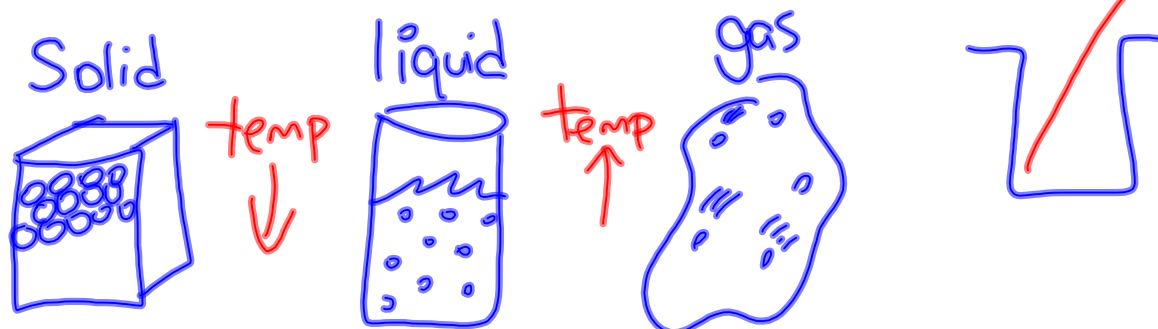
**Thermal Energy**

When we take the temperature of a substance, we are actually measuring the degree of agitation of its atoms and molecules.

*Think back to the particle model.*

Thermal energy is the energy that is associated with the movement of particles. The higher the temperature of a substance; the more thermal energy the substance contains because there is greater movement of its particles.

Thermal Energy is the energy that comes from the random motion of the particles that make up a substance.



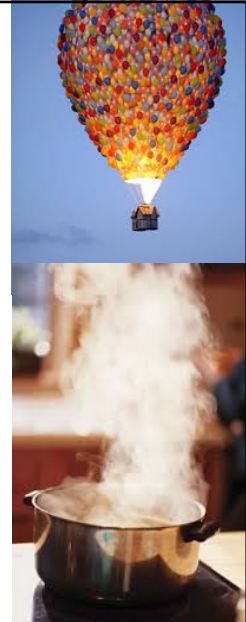
Apr 28-8:45 AM

## Thermal Energy

Thermal Energy is the energy that comes from the random motion of the particles that make up a substance.

Some examples of the work or change that can be accomplished by thermal energy:

- the melting of snow by the heat of the sun in the springtime
- the production of water vapour by the boiler of a steam engine in order to advance the train
- the lifting of a hot-air balloon into the sky by the burner's heating of air inside the balloon



Snow → liquid

Solid

temp ↑

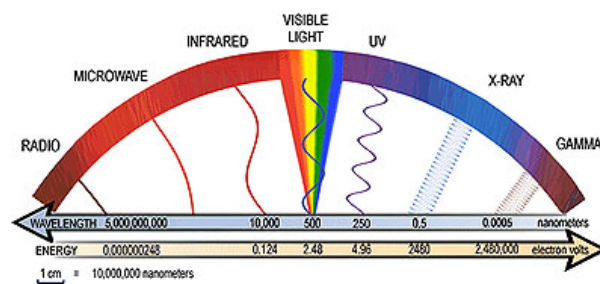
Apr 28-8:45 AM

## Radiant Energy

Radiant energy is the kind of energy that is contained in and transported by electromagnetic waves.

Some examples of radiant energy:

- producing images of the inside of the body using X-rays
- getting suntanned and sunburned from ultraviolet rays (from the sun or tanning booths)
- treating certain cancers with gamma rays



Apr 28-8:45 AM

## Chemical Energy

Chemical energy is the energy stored in the bonds of a molecule (many atoms 'stuck' together).

Some examples of chemical energy:

- the operation of a car motor by the combustion of gasoline
- the lighting of streetlights by the combustion of oil or gasoline
- photosynthesis, which occurs when the energy of the sun is transformed into chemical energy and is then stored in the bonds of a glucose molecule
- cellular respiration, which helps living organisms use the chemical energy stored in the glucose molecule so they can grow, move, and think
- chemical breakdown of food, when saliva breaks down starch from the food we eat



Apr 28-8:45 AM

## Mechanical Energy

Mechanical Energy is the energy that results from the **speed of an object**, its **mass** and its **relationship to its surroundings**.

*If we think of accidents involving vehicles, the faster the cars are going - the more damage they will do because they have more mechanical energy. **The greater the speed, the higher the mechanical energy.***

*Larger vehicles will also cause more damage than smaller vehicles because larger vehicles have a **higher mass and therefore more mechanical energy.***

*The surroundings can also play a role in mechanical energy. If someone is holding a rock and drops it on your toe, you will feel pain from the **mechanical energy within the rock.** The higher the rock falls from, the more pain you will feel.*

Examples of mechanical energy:

- the spinning of windmill blades by the wind
- the powering of a hydroelectric power station by a waterfall



Apr 28-8:45 AM

## Energy Transformation and Transfer

The transformation of energy is the changing of energy from one form to another.

For example; a burning log gives off energy. During combustion, some of the chemical energy stored in the wood molecules is transformed into radiant energy (light) and thermal energy (particle movement).



Energy is changing from one form to another.

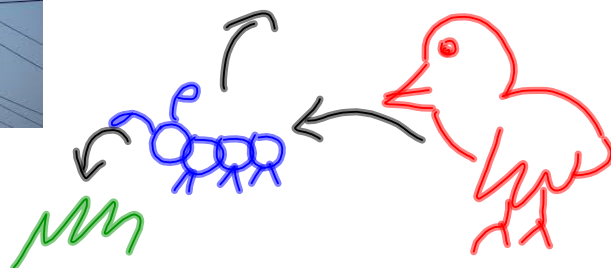
Apr 29-7:28 AM

## Energy Transformation and Transfer

**The energy transfer is the movement of energy from one place to another.**

Energy can also be transferred or moved from one location to another. Electrical energy moves along power lines from a power source to homes, and from electrical outlets to our appliances and electronics.

Heat is another good example of energy transfer. Heat is a transfer of thermal energy between two places whose temperatures are different. Thermal energy always travels from the place with the highest temperature toward the place with the lowest temperature.



Apr 29-7:28 AM

Energy can cause changes to occur in liquids, solids and gases. Two types of changes that we will be looking at is as follows:

**1) Physical Changes:** Where the shape and appearance of matter change. The change that occurs can be undone, it is reversible.

Examples: Hanging clothes out to dry in the sun, folding a piece of paper

**2) Chemical Changes:** Where one or more new substances are formed. The change that occurs cannot be undone.

Examples: Baking bread, fireworks exploding

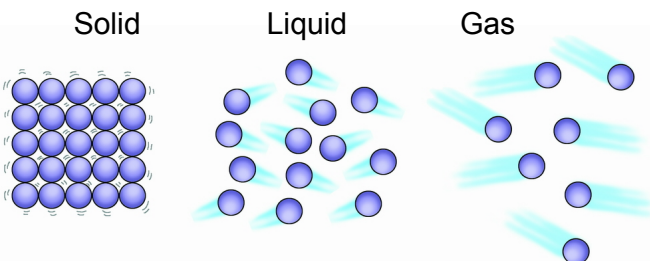
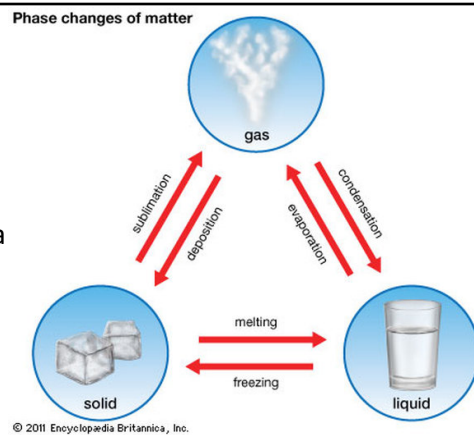
May 29-9:29 AM

**Physical Change: Changes of State**

The matter around us usually exists in three states (or phases): solid, liquid or gaseous. Matter can go from one state to another.

For example, when ice melts it changes from a solid to a liquid.

Looking at the particle model can help us to understand why a phase change does not affect the characteristic properties of a substance.



From one phase to another, only the forces of attraction change. The particles themselves don't change.

May 6-10:11 AM

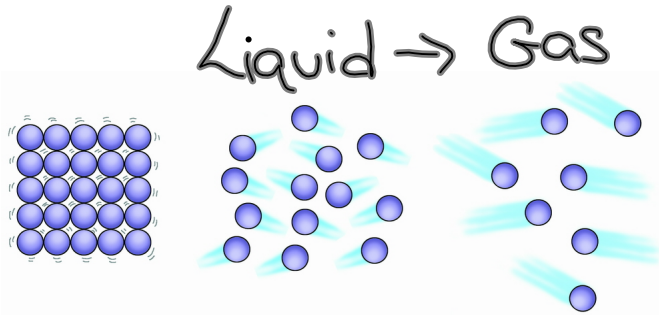
### Physical Change: The role of energy in phase changes

#### How does liquid water change to vapour (a gas?)

When we heat a liquid, thermal energy is transferred from a heating element to a liquid. The water particles absorb the energy, which makes them move faster and faster until they have enough energy to change the forces of attraction between them.



liquid water + energy --> water vapour



May 6-10:11 AM

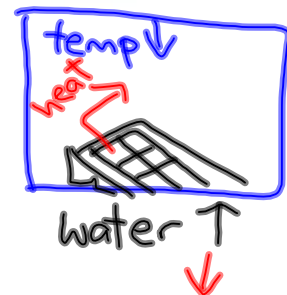
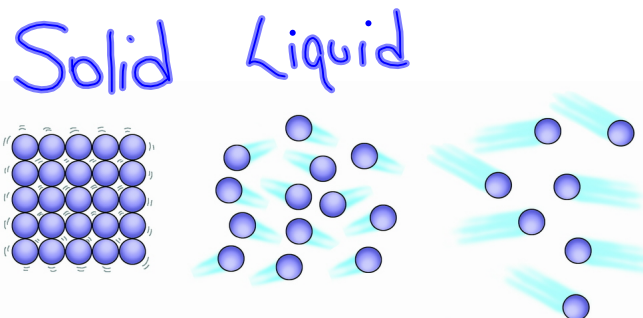
### Physical Change: The role of energy in phase changes

#### How does liquid water change to ice (a solid?)

The temperature of air in a freezer is lower than the temperature of the water. The heat passes from the water to the cold air which lowers the temperature of the water, slowing down its particles. As the water reaches its freezing point, its particles reorganize themselves.



liquid water --> ice + energy



May 6-10:11 AM

## Physical Change: The role of energy in phase changes

How does liquid water change to vapour (a gas?)

liquid water + energy  $\rightarrow$  water vapour

How does liquid water change to ice (a solid?)

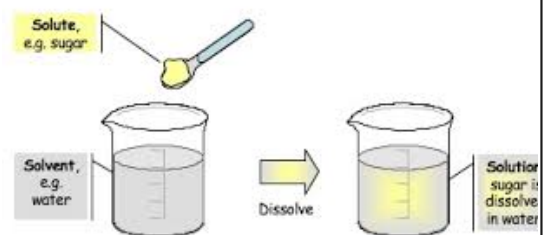
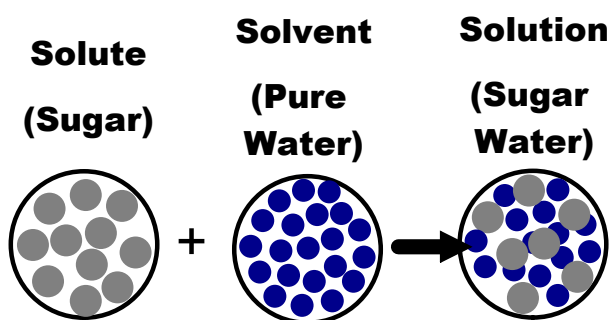
liquid water  $\rightarrow$  ice + energy

May 6-10:11 AM

## Physical Change: Dissolution

Many substances can be dissolved in other substances. For example, salt dissolves in water to make salt water.

Once again, we can look at the particle model to help us understand the properties of dissolution.



The sugar and water molecules don't change, the sugar breaks apart until it is uniformly distributed throughout the water.

May 6-10:11 AM



### Physical Change: The role of energy in Dissolution

Some substances release energy when they are dissolved in a solvent which makes the temperature of the solution increase.

When dissolution releases energy --> Temperature Increases

Other substances need to absorb energy in order to dissolve, this lowering the temperature of the solution.

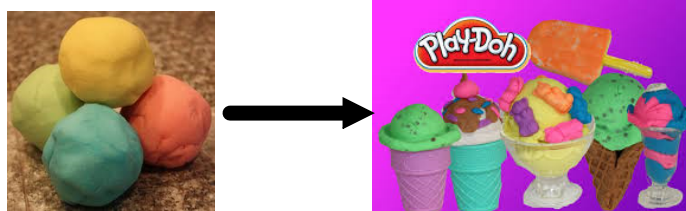
When dissolution absorbs energy --> Temperature Decreases

May 6-10:11 AM

### Physical Change: Deformation

A lump of clay can be moulded and sculpted into an infinite array of different shapes. A wire spring can be stretched, and then released, allowing it to regain its original shape. A metal sheet can be folded, bent, cut or torn. All of these objects can undergo deformation.

Deformation means changing the shape of a material.

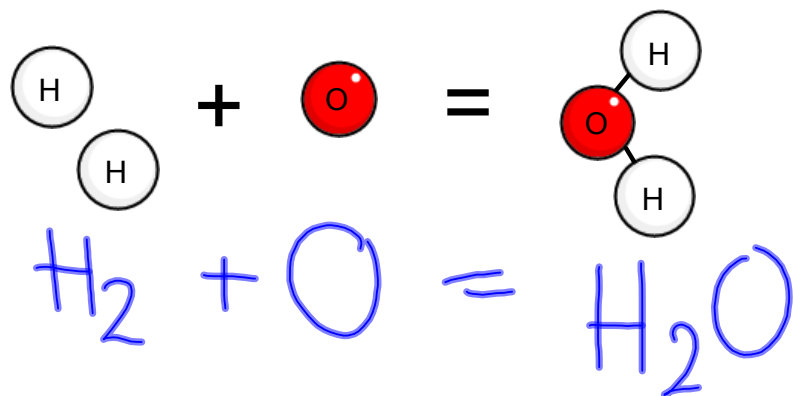


May 30-2:39 PM

## Chemical Change: Synthesis

Synthesis is the formation of a complex molecule from atoms or simpler molecules.

For example; two hydrogen atoms can react with an oxygen atom to form a water molecule. We call this synthesis of water.



May 30-2:39 PM

## Chemical Change: Decomposition

Decomposition is the transformation of complex molecules into simpler molecules or into atoms.



May 30-2:39 PM

## Chemical Change: Oxidation

Oxidation is a chemical reaction involving oxygen or a substance that has similar properties to oxygen.

The best known oxidation process is the formation of rust.

Oxidized bananas are less appetizing.



May 30-2:39 PM

## Chemical Change: Precipitation

When we mix two solutions, the dissolved substances sometimes react to form a new substance.

The addition of enzymes or other acidic substances to milk or cream produces precipitation, in this case called curdling. This is how cheese is made.



May 30-2:39 PM

**How do you know a chemical change has occurred?**

Clues that help us tell whether a chemical change has taken place (as opposed to a physical change):

- the release of a gas
- greater changes of heat
- the generation of light
- a change of colour
- the formation of a precipitate



Apr 29-7:41 AM

**What about an egg?**

**What type of change occurs when we crack it open?**

**Mix it in a bowl?**

**Cook it in the frying pan?**



<http://www.brainpop.com/science/matterandchemistry/matterchangingstates/>

<http://www.brainpop.com/science/matter/propertychanges>

May 29-9:43 AM

Are the following examples of physical or chemical change?

	Physical	Chemical
1. A person making clouds with their breath		
2. A cut apple turning brown		
3. A person digesting a meal		
4. A crumpled piece of paper		
5. A person cleaning a grease spot with soap		
6. Limewater that becomes milky when exposed to carbon dioxide		
7. Wood burning		
8. Chopping wood		
9. Iron rusting		
10. Melting an ice cube		
11. Mixing sand and water		

May 29-9:48 AM

May 13-10:55 AM