Topic 5 Energy in Earth Processes

I. Energy

Definition

_____

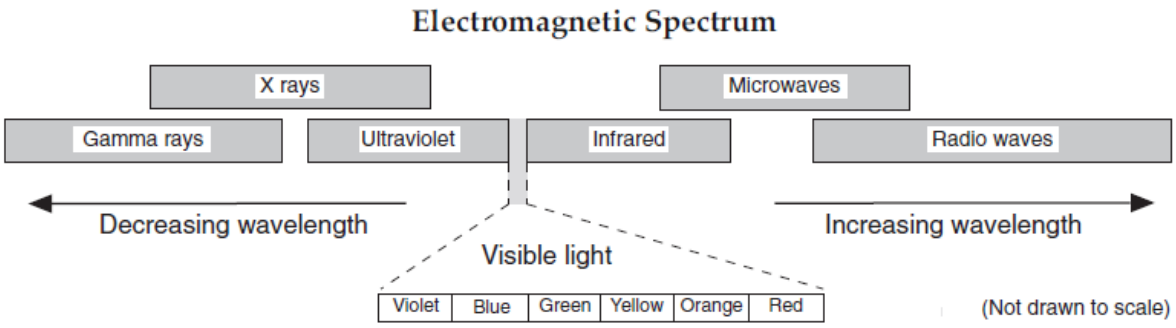
Work --

Definition

_____

Examples of different types of Energy

Electromagnetic Energy



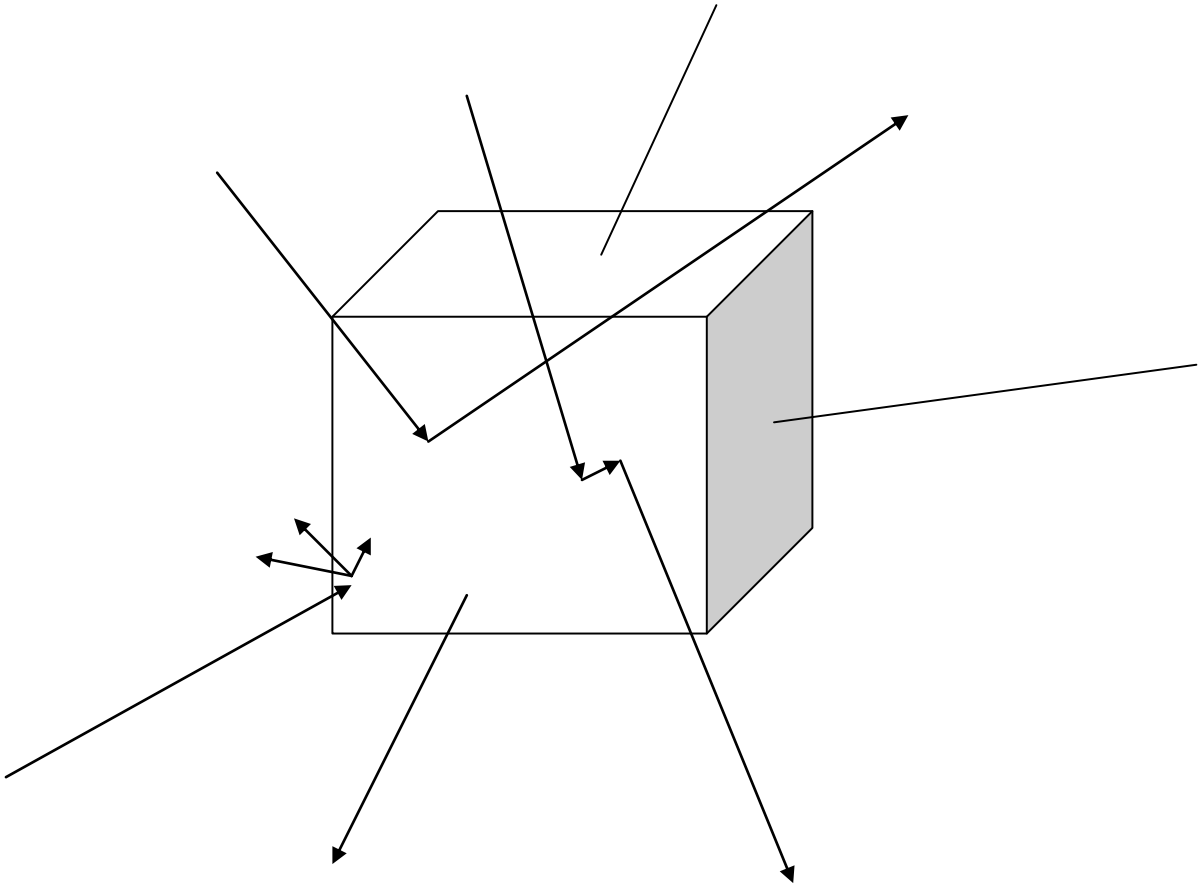
Wavelength-- _____

Frequency -- _____

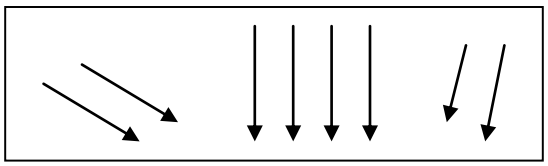
All the energy in the spectrum travels at the speed of light (c)
3.0×10^8 m/s

II. There are 5 things that can happen to energy when it comes into contact with matter

1. _____ --
2. _____--
3. _____ --
4. _____ --
5 _____--



All five happen at the same time while one will usually dominate



III. Surface Properties

Characteristics of the surface determine the amount of electromagnetic energy that can be absorbed.

1. The Angle of the Insolation-- _____

2. Texture

Rough

Smooth

3. Color

Light

Dark

IV Transfer of Energy

Energy is always being altered

Conservation of Energy – Energy cannot be created nor destroyed, it is just transferred

All energy flows from a high concentration called a *SOURCE*

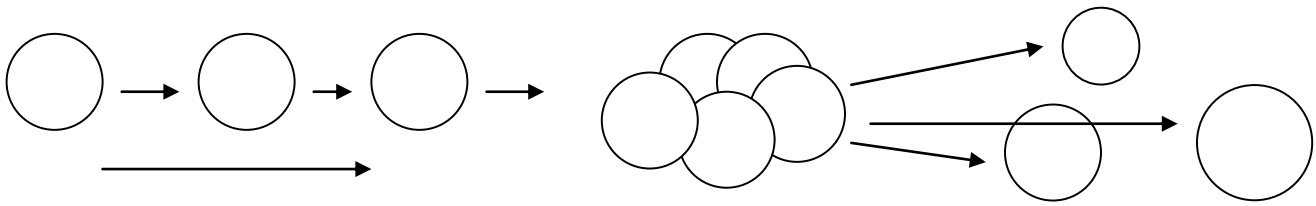
To a low concentration of energy called a *SINK*

Think

An ice cube does not give off cold it absorbs heat. It takes heat away, that is why if feels cool to the touch because it just took heat (calories) away from your finger.

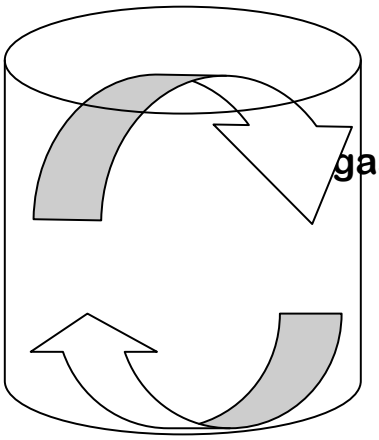
There are three methods of Transference

1. Conduction _____
_____



2. Convection -- _____
_____

This is the main way the <u>oceans</u> and <u>atmosphere</u> transfers its energy



<u>Caused by density differences</u>

Why does this only happen in liquids and gases?

3. Radiation --
_____

No medium is need to transfer this energy

What does this mean?

V Temperature versus Heat

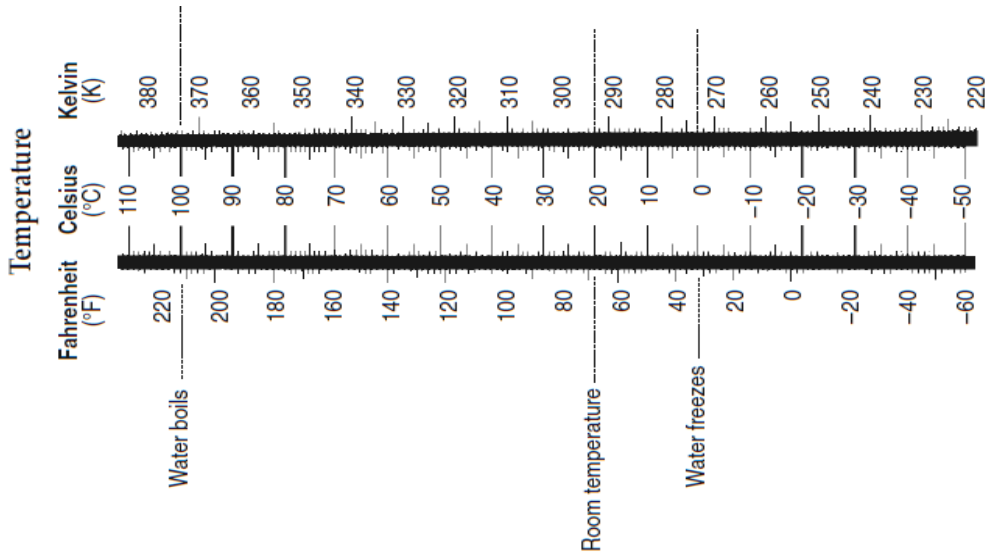
Temperature -
Definition: _____
_____

Measured with what instrument - _____

Temperature is measured with three different scales

1. _____ **2.** _____ **3.** _____

The scale below shows the three temperatures Scales



- **Mostly the U.S uses Fahrenheit.**
- **Celsius is used by science it is most used world wide**
- **Kelvin is actually used by scientist the most**

Use the scale above to make the following conversions

Fahrenheit °F	Celsius °C	Kelvin k
140	60	333
-40		
	30	
		360
	70	
		230
200		
	0	

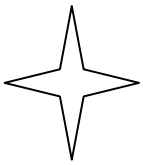
VI Specific Heat

Definition: _____

Joules: _____

All matter absorbs energy at different rates. It depends on the matter. The specific heat will tell us how good or bad it will absorb the energy. But if it absorbs energy well it will radiate or give off energy very well.

"If it is a good absorber it is also a good radiator"



Below is a chart to show certain Earth materials and their specific heats

Specific Heats of Common Materials

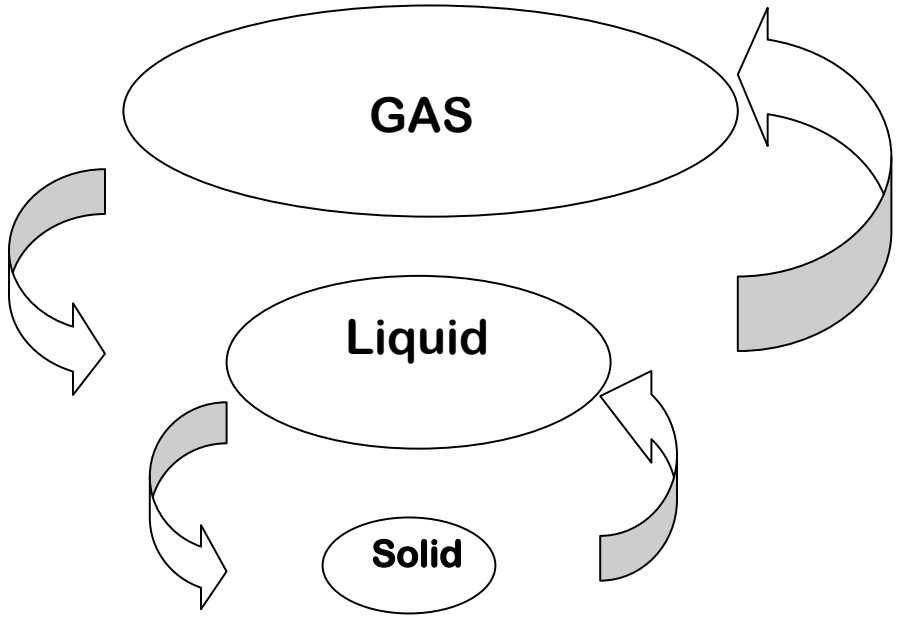
MATERIAL	SPECIFIC HEAT (Joules/gram • °C)
Liquid water	4.18
Solid water (ice)	2.11
Water vapor	2.00
Dry air	1.01
Basalt	0.84
Granite	0.79
Iron	0.45
Copper	0.38
Lead	0.13

Which material would be the best absorber of Energy? _____

Which material would be the worst absorber of Energy? _____

The Higher the specific heat number the harder it is to warm up but that also means it is harder it is to cool off

Heat energy is transferred in changes of state



Melting:

Solidification (crystallization):

Evaporation:

Condensation:

Sublimation:

Phase Change in water

The amount of energy that it takes to change the phase of water changes

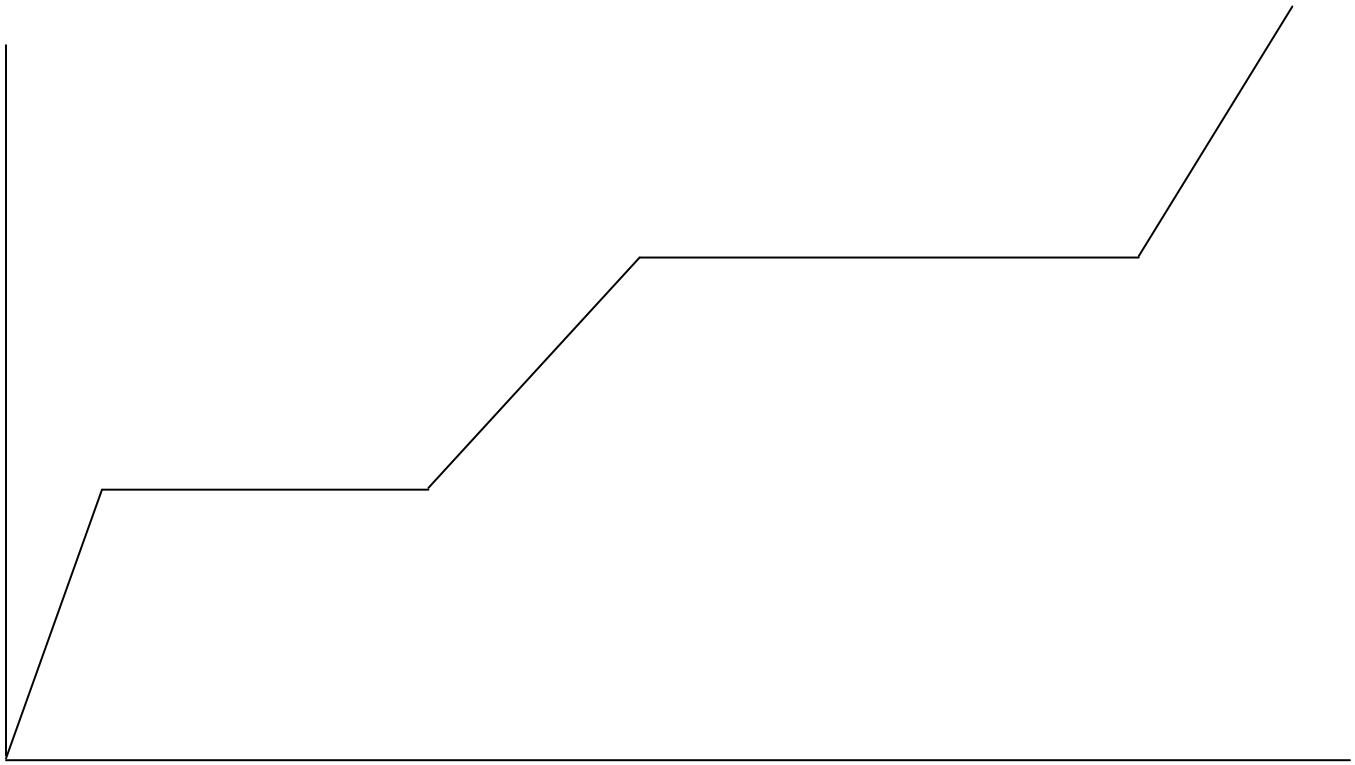
Properties of Water

Heat energy gained during melting	334 J/g
Heat energy released during freezing	334 J/g
Heat energy gained during vaporization	2260 J/g
Heat energy released during condensation	2260 J/g
Density at 3.98°C	1.0 g/mL

It takes more energy to make liquid water into water vapor (vaporization) than it takes solid water into liquid water (Freezing)

To calculate the amount of energy you need to use three formulas

- **Mass X change in temperature ( ) X specific Heat = Joules**
- **Mass X heat of fusion = Joules**
- **Mass X the heat of vaporization = Joules**



Closed and Open Systems

Closed System

Definition

Examples	**Non-examples**

Open System

Definition:

Examples	**Non- examples**

Topic five
Specific Heat

1. **A piece of Iron is heated from 2000 to 3000 Degrees Celsius. It has a mass of 80 grams. How much energy was absorbed?**

2. **Water as a gas is heated from 150 to 200 degrees Celsius to produce hot steam. If you started with 300 grams of steam, how much heat energy will be produced?**

3. **A piece of 2000gram piece of granite was measured at 3 p.m. to be 90 degrees Celsius. At midnight it had a temp of 50 degrees Celsius. How much energy did the granite release?**

4. **The temperature of a chunk of ice was zero. The mass of the Ice was 200grams. How much energy will it absorb to become totally liquid?**

5. **An 800-gram sample of water is at zero degrees Celsius. How much more energy must it release to become a total solid?**

6. **A 40-gram piece of lead is at 100 degrees. As it cools to 20 degrees Celsius. How much energy will it release into the environment?**

7. **How much energy will a 50 gram sample of water vapor release as it turns from a vapor into a liquid?**

8. **How much energy needs to be absorbed for 88grams of liquid water at 100 degrees to turn totally into a gas?**

9. **Basalt is a volcanic rock that forms when lava hits ocean water and cools. How much energy is released when 900, 000, 000 grams of basalt cools from 3000 degrees to 35 degrees**

10. **Copper heats up quickly. How much heat does it take to have a 50-gram piece of copper go from 20 degrees to 70 degrees Celsius?**

Review exercise

I. For the following sentences circle the source and place a block around the sink.

1. An iceberg floating in the North Atlantic Ocean.
2. Lava flowing on top of solid rock.
3. A tree is hit by lightning.
4. A glacier on a summer day.
5. A hot piece of Iron is placed in a water bath.

II. For the following, are the process described gaining or losing energy, and list if it is going to a higher or lower phase of energy.

	gaining or losing energy	Higher or lower phase of energy.		gaining or losing energy	Higher or lower phase of energy.
Water freezing			A snowflake forming		
Water Boiling			Lava cooling		
Water condensing			Lead solidifying		
Water Evaporating			Iodine vaporizing		
Going from solid to a liquid			Pool of water evaporating		
Going from gas to solid			Going from liquid to solid		

III. What would be the dominate form of energy transfer:

- Radiation
- Convection
- Conduction

1. A light from a flashlight is casted on to a house.
2. A heater in an aquarium.
3. Burn your foot on the blacktop driveway.
4. Electricity travels through a wire.
5. Heating up your living room.
6. Warming up French fries at Burger King
7. Using a tanning bed
8. Sticking a metal fork in a fire.
9. Electromagnetic energy from the Sun.
10. A Lava lamp

Review exercise number 2

1. **Finish the statement**

"A good absorber is a good _____"

2 if an ice cube is placed in liquid water explain the heat exchange between the ice and the water.

3. **Liquid water increases in latent heat, what phase will it turn into? And what is the change called?**

4. **What temperature gives off the most energy?**

10°C 0°C -60°C 293 K

5. **If water crystallizes (snowflake) is it gaining or losing energy?**

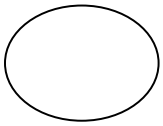
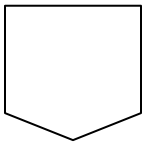
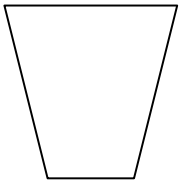
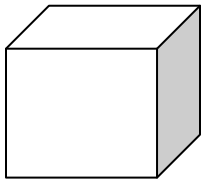
6. **Define Convection (look in your notes)**

7. **Which loses energy and which gain energy label each**

1. Liquid to solid 2. Solid to liquid 3. Liquid to gas 4. Solid to gas

8. **For a surface to absorb energy what color and texture should it have?**

Granite 10 °C **iron 22 °C** **liquid water 30 °C** **dry air 40 °C**

9. **Which sample will heat up the fastest?**

10. **Convection currents may be produced in which samples?**

11. **Name the heat source and sink**
    Granite to dry air **liquid water to iron** **liquid water to granite**

12. **Q= m x change in temp x Cp**

a. If the granite sample is heated to 50 °C and the mass is 10 grams how much energy is absorbed by the granite?

b. If the dry air is cooled to 15 °C and the mass is 10 grams how much energy is released?