**Unit 5: Energy**/**The Transfer of Energy between the Sun, Earth’s Surface and our Atmosphere**

**Name:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Block:\_\_\_\_\_\_\_\_\_\_\_\_ Date:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Where Does Earth’s Energy Come From?**

* The temperature measured at Earth’s \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_(+6000 C) is actually inferred to be \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ than the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_(~5600 C). This heat is largely due to the initial heat created from the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_(accretion/impacts).
* MOST of Earth’s energy received at the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ is in the form of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_created by the Sun (ESRT pg. 14)
	+ Earth’s magnetosphere and atmosphere filter out most of the high energy, short wavelength radiation (x-rays, gamma rays and most UV)
	+ Energy that makes it to Earth’s surface is in the form of:
		- Visible (ROYGBV) 44%
		- Infrared (Heat) 48%
		- Ultra Violet (UV) 7%

**Radiation:** when energy is transferred through\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_; requires no \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and can be transferred through \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of matter.

**How much energy can be \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_by Earth’s surface depends on a few factors:**

1. **The Angle of Insolation** (sun’s angle): \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

(Measured from the horizon)

Because the earth’s surface is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, all latitudes receive \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ angles of insolation. The \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ the angle of insolation, the\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ energy absorbed by earth’s surface.

1. **The type of surface receiving the energy**; **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

**Color**

1. **\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**colored material will naturally absorb **\_\_\_\_\_\_\_\_** solar energy compared to lighter material, but they will also cool down \_\_\_\_\_\_\_\_\_\_\_.

Example:

**Texture**

1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_or \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of a surface affects the amount of energy absorbed. The\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ a surface, the \_\_\_\_\_\_\_\_\_\_\_energy it will absorb and the \_\_\_\_\_\_\_ it will reflect.

Example:

Color and texture combine to create differing amounts of reflectivity on Earth’s natural surfaces called \_\_\_\_\_\_\_\_\_\_\_\_\_\_.

Snow can reflect up to \_\_\_\_\_\_\_\_\_\_\_\_of incoming solar energy (and absorb 5%) while Asphalt will reflect only \_\_\_\_\_\_\_\_\_\_\_(and absorb 95%)

**Making a connection: I**f glaciers continue to melt as global temperatures rise, how may that further contribute to a global temperature change?

****iii. **The type of medium; differential heating according to specific heat (pg. 1 of ESRT)**

* **Specific Heat-**
* It takes \_\_\_\_\_\_\_\_joules of energy to increase the temperature of water by \_\_\_\_\_\_\_\_\_\_\_\_ but granitic rock (most continental crust) only \_\_\_\_\_\_\_\_\_joules
* The relationship: the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_the specific heat of a substance, the \_\_\_\_\_\_\_\_\_\_\_\_\_\_the resistance to heating

**Conduction:** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

The\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ a molecule is the\_\_\_\_\_\_\_\_\_\_\_\_ it vibrates

* \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_will only occur when two objects (or substances) have \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (different temperatures)
* Heat will always transfer from the heat \_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_to the heat \_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_
* If not all energy is gained by the “sink” it has been lost to the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (no transfer is 100% efficient!). All systems lose some heat energy during \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

Examples:

**Convection:** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

* **Warm substances:** are \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_than their cooler counterparts. This is because as a substance warms, the volume of the substance\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, due to the molecules moving \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_from one another. Lower density means the substance will\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

**Cooler substances**: are \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ than their warmer counterparts. This is because as a substance cools, the volume of the substance \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, due to the molecules moving \_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.Higher density means the substance will \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

**Draw a diagram** of the **demo** you saw in class below: Include labels such as **warm, less dense, rises, cool, denser, sinks,** with arrows to show what is going on.



Why do you feel drafts?

**Convection in the Atmosphere:**

\*On Earth, warm air \_\_\_\_\_\_\_\_\_\_\_\_\_and cool air \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

\*Warmer air is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ dense, and creates regions of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ on earth

\*Cooler air is \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_dense and creates regions of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**The Greenhouse Effect**

**Earth’s surface absorbs incoming short-waved \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ radiation as well as incoming long-wave \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ from the Sun. Once energy is absorbed, earth re-radiates this energy in the form of only long wave \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ energy. If it weren’t for greenhouse gases, the earth’s average temperature would be below \_\_\_\_\_\_\_\_\_\_\_\_\_\_. An increase in greenhouse gases will cause global temperature averages to continue to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, as \_\_\_\_\_\_\_\_\_\_ of earth’s outgoing\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ radiation becomes trapped by our atmosphere.**

**Greenhouse gases:**