Review Guide for Heat, Light and Sound Energy

Friction is associated with **EVERY** energy transformation. Therefore, every energy transformation must involve particles interacting (bumping, banging, rubbing) with each other. Because these particles are interacting with each other through **contact**, some energy is always transformed into **HEAT** energy.

Electrical appliances (toasters, lamps, hair dryers, blenders, dishwashers, etc.) are energy transformers. They change electrical energy into other forms of energy such as **HEAT**, **RADIANT**, **MECHANICAL** and **SOUND** energy. [Nuclear or Chemical will never be associated with electrical appliances….NEVER!]

The Law of Conservation of Energy (LOCOE) tells us about 3 absolute truths:
1. Energy can NOT be **CREATED**
2. Energy can NOT be **DESTROYED**
3. Energy can be **TRANSFORMED** from one form to another.

Can the amount of energy in the universe ever change? **NO !**

Do you remember what it means for **temperatures to EQUILIBRATE**? Define the word "equilibrate" in your own words: **FAST PARTICLES SLOW DOWN WHILE SLOW PARTICLES SPEED UP. THEY WILL ALL BE TRAVELING CLOSE TO THE SAME SPEED**.

If a person pours **100 ml** of water at **100 degrees Celsius** in to a container holding **100 ml** of water at **50 degrees Celsius**, what will the final temperature of the mixture become? **75° C**

Whenever **heat energy** is **added** to particles (atoms, molecules), what two things can be expected to happen?
1. **SPEED UP**
2. **SPREAD OUT**

What do you expect will happen if **heat energy** is **removed** from particles?
1. **SLOW DOWN**
2. **CONTRACT**

We have come to learn that **Potential Energy** (PE) is related to the height that an object is above the ground. PE = mass times gravity times height.

We have also learned that **Kinetic Energy** is related to motion and speed.

Think about what happens to a skater as she drops into a half pipe. As soon as she drops in what happens to her height off the ground? **DECREASES**

What begins to happen to her speed? **INCREASES**

How is her potential energy changing? **DECREASES**

How is her kinetic energy changing? **INCREASES**

As she **approaches the other side** of the half-pipe and begins to travel uphill, what happens to her height above the ground? **INCREASES**

What begins to happen to her speed? **DECREASES**

How is her potential changing? **INCREASES**

How is her kinetic energy changing? **DECREASES**

Heat is a form of energy that will ONLY flow from one object to another as long as there is a difference in **TEMPERATURES** between the two objects. Heat energy will ONLY flow from things that are **HOT** to things that are **COLD.**

When you take the **temperature** of an object, exactly what are you measuring? **KINETIC ENERGY (SPEED) OF PARTICLES**

If the temperature is "**high**", what is the **motion** of the particles like?

FAST; VERY ENERGETIC

If the temperature is "**low**", what is the **motion** of the particles like?

SLOW; NOT VERY ENERGETIC

What are the **three methods** of he**at transfer** called?

1. **CONDUCTION – DIRECT CONTACT**
2. **CONVECTION – IN FLUIDS ONLY; DUE TO CHANGING DENSITIES. HIGH HEAT = LOW DENSITY**
3. **RADIATION – ELECTROMAGNETIC WAVE CALLED INFRARED**

Look at the following list of activities and label each one as examples of **conduction**, **convection** or **radiation**:

1. feeling the heat coming from the sun **RADIATION**
2. feeling the heat above a candle that is burning **CONVECTION**
3. a spoon getting warmer as it sits in hot coffee **CONDUCTION**
4. feeling the heat from a campfire while sitting near it **RADIATION**
5. smoke goes up the chimney from your fireplace **CONVECTION**
6. a hawk circles above a farmer's field **CONVECTION**
7. water is boiling in a saucepan **CONVECTION**
8. a hamburger is cooking in a hot pan **CONDUCTION**
9. air rises above a hot parking lot **CONVECTION**
10. wax rising to the top of a lava lamp **CONVECTION**
11. a pan gets warmer as it sits on an electric stove **CONDUCTION**

We discussed the idea of **conductors** and **insulators** as they related to heat energy. Label the following articles as conductors or insulators.

1. a bathroom rug **INSULATOR**
2. a metal spatula **CONDUCTOR**
3. the rubber handle on a metal spatula **INSULATOR**
4. a tile floor **CONDUCTOR**
5. a piece of wood **INSULATOR**

When we think about the **color** of different objects, why is a white object white? **ALL WAVELENGTHS OF COLOR HIT THE OBJECT AND REFLECT OFF TO OUR EYES**

Why is a black object black? **ALL WAVELENGTHS OF COLOR HIT THE OBJECT AND ARE ABSORBED**

Why is a red object red? **ALL WAVELENGTHS OF COLOR ARE ABSORBED BY THE OBJECT BUT RED LIGHT IS REFLECTED TO OUR EYES**

List the colors that make up white light: **RED, ORANGE, YELLOW, GREEN, BLUE, INDIGO, VIOLET**

All light is an electromagnetic wave. How does all light **begin**? **VIBRATING CHARGED PARTICLE**

At what speed does all light travel? **SPEED OF LIGHT**

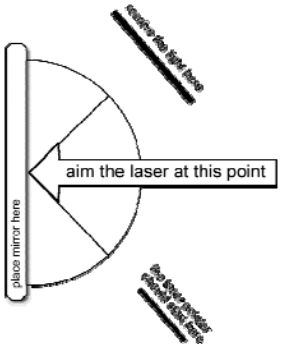
What happens to an EM wave's **frequency** as its wavelength decreases?
SHORTER WAVES HAVE A HIGHER FREQUENCY

What happens to an EM wave's **energy** as its wavelength decreases?
SHORTER WAVES HAVE HIGHER ENERGY

A **vacuum is nothing but empty space!** That means that there are no particles present…anywhere in the vacuum. Can light travel through a vacuum? **YES !!!!!**
What is the **speed of light** through a **vacuum**? **300,000,000 $^{m}/_{s}$**
Does one type of light travel faster than another in a vacuum? **NO**
List as many types of light found on the EMS that you can: **RADIO, TV, MICROWAVE, INFRARED, VISIBLE LIGHT, ULTRAVIOLET, X-RAY, GAMMA RAY**

When light **reflects** off a mirror, the angle of incidence is always equal to the angle of **REFLECTION.**

Draw a sketch of light reflecting off of a mirror:



Why can you see your **reflection** in a mirror but NOT in a wall? _
LIGHT REFLECTS IN MANY DIRECTIONS OFF OF A WALL (DIFFUSE REFLECTION) AND REFLECTS EVENLY OFF OF A MIRROR

A **convex** lens can be a glass rod or a magnifying lens. What always happens to the **image of an object** when looking through a convex lens?
THE IMAGE IS FLIPPED UPSIDE-DOWN

Light **changes speed and changes direction (bends)** when it travels through different objects or substances. The closer the particles that make up a substance, the slower light is able to travel through that substance. The farther apart the particles, the faster light can travel. Predict what happens to light in the following examples. **Does it speed up or slow down**?

1. light traveling through air into glass **SLOWS DOWN**
2. light traveling through water into air **SPEEDS UP**
3. light traveling through water into glass **SLOWS DOWN**
4. light traveling through glass into water **SPEEDS UP**

Sound always begins whenever **PARTICLES** vibrate. Sound will only travel if particles are present. No particles….no sound!
Will sound travel through solids? **YES, VERY FAST**
Will sound travel through liquids? **YES, SOMEWHAT FAST**
Will sound travel through gasses? **YES**
Will sound travel through a vacuum? **NO !!!!!!**

Sound totally depends on particles to travel. No particles…no travel! This is because the vibrating particles must pass their vibrations on to their neighbor particles. Sound moves from particle to particle! If the particles are close together, sound can travel faster. If the particles are farther apart, sound travels slower. Does sound travel faster in solids, liquids or gasses? **SOLID = FASTEST**
LIQUID = MEDIUM SPEED
GAS = MUCH SLOWER THAN THE OTHERS

All **foods** that we eat (protein, carbohydrate, and fat) and **fuels** that we burn (gasoline, diesel, butane, propane, alcohol, wood) contain what form of **stored energy**? **CHEMICAL ENERGY**

What are the **two types** of energy? **POTENTIAL** and **KINETIC**

What are the **seven forms** of energy?
CHEMICAL, HEAT, ELECTRIC, MECHANICAL, NUCLEAR, RADIANT, SOUND

Where does **all the food that we eat** get its energy from? **THE SUN**
Where do **all the fuels that we burn** get their energy from? **THE SUN**