Unit 6 Lessons 11 - 12 Study Guide

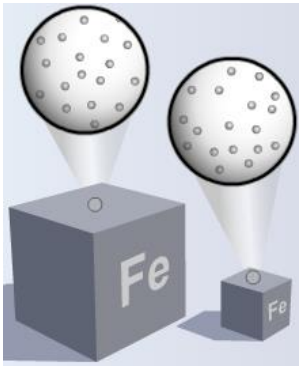
Unit 6 Lesson 11-12 Vocabulary

Lessons	Term	Definition
11	Conduction	the movement of thermal energy by bodies or fluids that are in contact
11	Convection	the transfer of heat by the circulation or movement of the heated parts of a liquid or gas
11	Heat	the transfer of thermal energy from one place to another
11	Kinetic Theory of Heat	the theory that states that heat is the result of the movement of particles in a system
11	Radiation	thermal energy transmitted as waves
11	Thermal Energy	the total energy of any closed system, including all internal kinetic and potential energy of the system
11	Thermal Equilibrium	when two or more elements of a closed physical system have the same thermal energy
11	Vibrational Motion	rapid back and forth movement of the kind found in particles that make up a substance
12	Absolute Zero	in theory, the lowest possible temperature of a substance if it were absent of all heat energy or molecular motion—equal to 0 on the Kelvin scale, -273.15°C, or -459.69°F
12	Kelvin	an SI unit of temperature

Lesson 11: Thermal Energy

REVIEW of Particles in Motion

- Vibrational Motion – atoms constantly move, vibrate back and forth
- Kinetic Energy – the energy of motion
- Potential Energy – the stored energy of position



Thermal Energy

- **Thermal Energy** - the total energy of any _____ system, including all internal kinetic and potential energy of the system
    - Thermal Energy depends partly on the _____ of an object.
        - The larger the object the more thermal energy in the object.

Thermal Energy and Temperature

- Thermal Energy also depends on the temperature of an object.
    - A cold block of iron will have _____ kinetic energy than a warm block.

Thermal Energy and Heat

- **Heat -** the _____ of thermal energy from one place to another
    - Heat flows from hotter objects to colder objects

Heat and Thermal Equilibrium

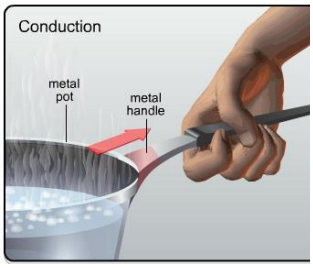
- **Thermal Equilibrium** - when two or more objects have the _____ thermal energy.
    - If you have a cold block of iron and a hot block of iron and push them together so that they touch, the temperatures will equal out as the energy transfers between them:
        - Therefore, the blocks will have the _____ temperature.

Kinetic Theory of Heat

- **Kinetic Theory of Heat** - the theory that states that _____ is the result of the movement of particles in a system; the transfer of kinetic energy
- When the two iron blocks of **different** temperatures _____:
    - The atoms of the hotter block move faster than those of the colder block.
    - The fast-moving particles of one block collide with the slower particles of the other block; causing the slower particles to **speed up** and the faster particles to **slow down**.
    - Kinetic energy is transferred between the particles until they move at the _____ rate.

Conduction

- **Conduction** is the transfer of thermal energy between objects that are _____.
    - The two iron blocks are an example of thermal energy transfer by conduction.
    - Another example is where a metal pan meets its metal handle.
        - the handle is not heated directly; heat _____ from the hot pan to the handle

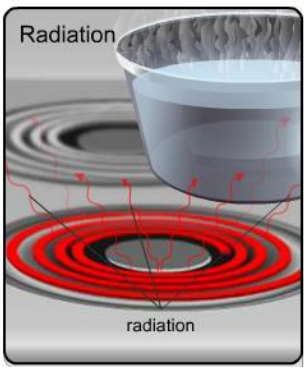


Convection

- **Convection** is the transfer of energy by the _____ of a fluid, such as air or water.
    - The transfer of energy by convection **does not** require direct contact between objects.
    - **Example:** Uneven distribution of heat in a pan causes pressure differences that allow convection currents to be set up in the pan.
        - **Warmer water rises and cooler water sinks.**
        - These convection _____ rapidly spread the liquid throughout the pan, transferring thermal energy from one place to another.
            - Winds and ocean currents are also convection currents

Radiation

- **Radiation** is the transfer of thermal energy by electromagnetic _____; is transferred between objects or across empty space.
    - **All objects emit electromagnetic radiation.**
    - Warmer objects emit _____ radiation than cooler ones.
    - **Example:** the heated coil on the stovetop: the particles in this coil are moving and emit radiation.
        - That radiation travels away from the coil to the bottom of the pan and the surrounding air.
            - The sun and camp fires transfer heat by radiation.



Putting It All Together

- Why does the sand on a sunny beach burn your feet?
  - Sand is made of particles that have thermal energy.
  - On a sunny day, heat is transferred to the sand from the sun by _____.
  - When you walk on the beach, your feet are colder than the sand.
    - Therefore, thermal energy flows as heat by _____ from the hot sand to your colder feet.
- What about the air around you?
  - In the morning the air is cool, the sun heats the sand, currents of _____ warm the air from the heat of the sand.

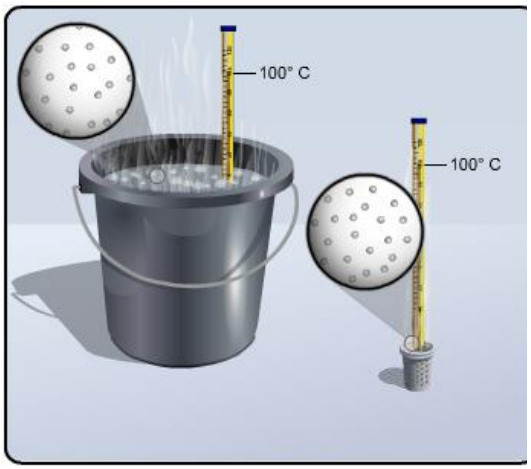
Lesson 12: Temperature

Review: Thermal Energy

- **Thermal Energy** - the total energy in a system, includes all internal kinetic and potential energy
  - Thermal Energy depends partly on the **size** of an object.
  - Thermal Energy also depends on the **temperature** of an object.

How are Temperature and Thermal Energy Different?

- Remember, **thermal energy** is the *total* kinetic and potential energy of the particles in a substance.
- **Temperature** for any substance will _____ when the *average* kinetic energy of a substance increases.
  - If you have two iron blocks of different sizes. The blocks are at the same temperature:
    Do they have the same amount of thermal energy?
    - _____. The larger block has more mass and more atoms than the smaller block.
      - Therefore, the larger block has more thermal energy than the smaller block.



Temperature vs. Thermal Energy

- Remember, **energy** is the ability to do work. Thermal energy is a form of energy.
  - The more thermal energy in a substance, the more _____ it can accomplish.

Temperature and Expansion

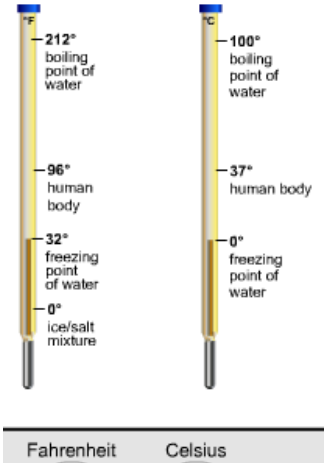
- Remember, the temperature of a substance increases, the **kinetic energy** of its particles also _____.
  - When kinetic energy increases, the particles move faster and farther apart.
  - When particles move farther away from each other, their **potential energy** _____.
    - And, as a result of the particles spreading out, the substance **expands in size**.
    - **Example:** Have you ever tried to open a jar with a tight lid?
      - You can loosen the jar top by running hot water over the lid.
      - Why does this work?
        - **When hot water heats the lid, the higher temperature of the lid causes it to expand slightly, making the lid easier to come off.**

Temperature and Contraction

- When temperature increases, objects expand or get larger.
- What do you think happens with a decrease in temperature?
  - A **lower temperature** will cause most objects to _____.
  - When the temperature of an object decreases, the **kinetic energy** of its particles _____.
  - As the particles move closer to each other, the **potential energy** _____.
    - **Example:** Most car tires need more air in the winter than in the summer. Why?
      - When the temperature of the inside air decreases, the air contracts, making the tire slightly flat.

Fahrenheit and Celsius Scales

- Temperature is measured with different scales. Two common scales are **Fahrenheit** and **Celsius**.
  - Most countries use the **Celsius scale** to measure temperature.
    - With this scale:
      - the freezing point of water is set at ____°
      - the boiling point is set at 100°
      - room temperature in Celsius is about 24°
  - In the United States, the **Fahrenheit scale** is used for temperature.
    - With this scale:
      - the freezing point of water is set at 32°
      - the boiling point is set at _____°
      - room temperature in Fahrenheit is about 75°



Converting Fahrenheit and Celsius

- You can use the following equations to _____ Fahrenheit and Celsius:
  - To convert Fahrenheit to Celsius: **°C = (5/9) (°F – 32)**
  - To convert Celsius to Fahrenheit: **°F = (9/5) (°C) + 32**

Kelvin Scale

- One unit on the Kelvin scale, called a _____ (K), is the SI unit of temperature.
- The Kelvin system is based on the temperature at which the motion of particles is at its lowest possible level. At this temperature, the _____energy of the particles is as small as it can be.
- The lowest temperature that a molecule could possibly be is called **absolute zero**.
  - The value of _____ **zero** is **0 K or –273°C**.