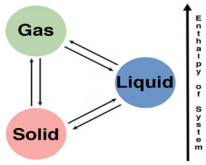
Ch 22 (Heat Transfer), Ch 23 (Phase Change), Ch 24 (Thermodynamics) Test Review

Review your Ch 21-24 Guided Readings and all assignments from these chapters. Also make sure you have watched the videos for this unit.

READING THIS ANSWER KEY IS NOT THE BEST WAY TO STUDY. PLEASE WORK THROUGH YOUR REVIEW AND CHECK YOUR ANSWERS HERE.

Chapter 22 - Heat Transfer

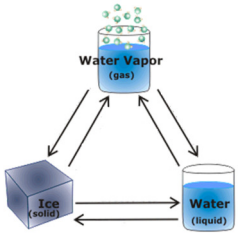
1. List and describe the characteristics of the 3 methods of heat transfer. Make sure you can classify examples by type. **Conduction is heat transferred through particle motion. The particles with the most kinetic energy (AKA temperature) collide with slower moving (AKA cooler) particles and transfer the energy to them. This continues until the substance is at thermal equilibrium. Convection is the transfer of heat through convection currents in a fluid (AKA liquid or gas). The warmer particles rise and force the cooler particles towards a heat source where they are heated then rise. Radiation is the transfer of heat through electromagnetic waves. Radiation can travel through empty space (AKA a vacuum) so radiation is the only heat transfer that does not require a medium of particles to travel through.**
2. In conduction, what subatomic particles are transferring the energy? **The atoms transfer the energy; specifically the electrons in a metal transfer much of the kinetic and thermal energy.**
3. Why does the metal part of your desk feel cooler than the top if they are really the same temperature? **The metal feels cooler because it is a better conductor and is faster to transfer the heat out of your foot.**
4. What type of matter can transfer energy by convection? **Fluids (gases and liquids)**
5. As air warms it (**expands**, contracts) and (**rises** or sinks).
6. Wood is a very poor **conductor** of heat. This is one of the reasons it is possible for people to walk on coals.
7. A black glass and a white glass are set outside in the sun. Which will warm up faster? Why? **The darker colored (black) glass will warm faster because darker colors absorb more radiant heat.**
8. The planet Earth gains and loses heat primarily through **radiation**.
9. Light colored clothes help keep you cool because they **reflect** radiant energy. **Dark (black)** colored clothes make you warm up faster because they absorb radiant energy.
10. Which would be a better insulator and feel warmer….a **rug** or tile?
11. Dark colors are good **absorbers** of radiation (absorbers, emitters, reflectors)



Chapter 23 – Phase Change

You will see a phase diagram picture. Study yours from the packet! Know what areas represent phase changes.

1. What is heat of fusion and heat of vaporization? **H_f and H_v are the specific amounts of heat required for phase changes. While these amounts of heat are added the phase changes but the temperature remains the same.**
2. Does vaporization of water release or absorb energy? **In order for water to vaporize to a gas, it must absorb energy.**
3. Does the freezing of water release or absorb energy? **In order for water to cool off and freeze, it will release energy.**
4. What are the names of the following phase changes: solid → liquid **(melting)**, liquid → solid**(freezing)**, gas → liquid**(condensing)**, liquid → gas**(vaporization, AKA boil or evaporate)**, solid → gas **(sublimation)**, gas → solid**(deposition)**.
5. Condensation is a **warming** process (warming or cooling). **Evaporation is a cooling process**
6. When water condenses, does the surrounding air warm or cool? **When water condenses, the cooler molecules change phase, leaving the remaining molecules warmer.**
7. List examples of good insulators (give at least 3). **Adobe brick (like in desert homes), Styrofoam (like in cups or to go boxes), sleeping bags, air.**
8. Heat transfer in a metal would be through **conduction**.
9. Which phase changes release heat? **Colling off – condensing, freezing, or deposition.**
10. What is the difference between evaporation and boiling? **Evaporation happens slowly over time when the highest energy molecules escape, and boiling is forced to happen**



quickly by a heat source and boiling starts from the bottom of the substance (where the heat is).

11. Dew is the result of which phase change? **Condensation.**

Chapter 24 - Thermodynamics:

1. Doing work on a system without adding heat, does what to the temperature? **Increases the temperature.**
2. Systems left alone tend to become **more** ~~**or less**~~ **disordered**? What is the term for this? **Entropy**
3. List the 2 Laws of Thermodynamics. **1st Law: the internal energy of a system can either be increased by adding heat or doing work. 2nd Law: Heat will travel from hot too cold on its own and never from cold to hot.**
4. List some places that adiabatic processes occur. **Steam engines, internal combustion engines, weather.**
5. What helps determine the efficiency of a heat engine (Relate to input and output reservoir). **The amount of heat converted to useful work.**
6. Work that is done on a system increases both internal **energy** and **temperature.**
7. Heat can only flow from **hot** objects to **cool** objects.
8. What is the lowest possible temperature in nature? **Absolute Zero.**
9. The first law of thermodynamics is related to which law that we have already talked about. **Law of Conservation of energy.**
10. What does entropy measure? **Disorder.**

Can you explain the greenhouse effect and list pros and cons for / against it? **Greenhouse effect is when radiation from the sun becomes trapped (or reradiated from the earth) and heats our atmosphere. We need the greenhouse effect to keep the Earth at a comfortable warm temperature, but too much greenhouse gases can overheat the earth causing global warming.**

PROBLEMS – Heat transfer (heat of fusion, heat of vaporization etc.)

c of water = 4.186 J/g°C,
c of ice = 2.108 J/g°C,
c of steam 1.996 J/g°C
H_f water = 334 J/g
H_v = 2,260 J/g

Solid to solid
Liquid to liquid
Steam to steam } $Q = mc\Delta T$

Freezing to melting $Q = mH_f$

Boiling to condensation $Q = mH_v$

} **Provided on test**

1. A 100 g sample of 80°C water is heated to 102°C. What heat is required to change it to steam at 102°C?
   $step\ 1 - heat\ the\ 80°C\ water\ to\ 100\ °C \quad Q = mc\Delta T = 100g \bullet 4.186 \bullet 20°C = 8,372\ J$
   $step\ 2 - phase\ change\ the\ water\ to\ steam\ Q = mH_v = 100g \bullet 2,260\ {}^{J}/_{g} = 226,000\ J$
   $step\ 3 - heat\ the\ 100°C\ water\ to\ 102\ °C \quad Q = mc\Delta T = 100g \bullet 1.996J\ /\ (g \cdot °C) \bullet 2°C = 399.2\ J$
   $step\ 4 - add\ up\ the\ steps = 234,771.2\ J$
2. A 50 gram sample of 60°C water is heated to 90°C. How much heat is required for this temperature change?
   $Q = mc\Delta T = 50g \bullet 4.186 \bullet 30°C = 6,279\ J$
3. How much heat is required to change 400g of ice to water? (at 0°C)
   $Q = mH_f = 400g \bullet 334\ {}^{J}/_{g} = 133,600\ J$
4. How much heat is required to change 210 g of water to steam? (at 100°C)
   $Q = mH_V = 210 \bullet 2,260\ {}^{J}/_{g} = 474,600\ J$