Intro Thermochemistry Assignment

Chemistry 12

1. Define the following terms
   a) Calorimeter

      A device used to measure the absorption or release of heat

   b) Endothermic

      A process that requires heat

      Heat is being added and the temperature of the surroundings decreases, the sign of ΔH is positive

   c) Energy

      The capacity to do work

   d) Enthalpy

      The total kinetic and potential energy of a system under constant pressure

   e) Exothermic

      A process that releases heat
      Heat is being removed or lost and the temperature of the surroundings increases, the sign of ΔH is negative

   f) First Law of Thermodynamics

      Energy is neither created no destroyed, only transferred from one substance to another (except in nuclear reactions)

   g) Heat

      A form of energy

      Thermal energy based on the motion of the molecules in the substance

h) Heat of combustion

ΔH°_{comb} The amount of heat released during the combustion of one mole of a substance

i) Heat of condensation

ΔH°_{cond} The amount of heat released when one mole of a substance changes from a gas to a liquid at its boiling point

j) Heat of formation

ΔH°_{f} The amount of heat absorbed or released when one mole of a compound forms from its free elements in their standard states.

k) Heat of fusion

ΔH°_{fus} The amount of heat absorbed when one mole of a substance changes from a solid to a liquid at its melting point

l) Heat of reaction

ΔH°_{rxn} The amount of heat absorbed or released during a chemical reaction

m) Heat of solidification

ΔH°_{solid} The amount of heat released when one mole of a substance changes from a liquid to a solid at its freezing point

n) Heat of solution

ΔH°_{soln} The amount of heat absorbed or released as a substance dissolves

o) Heat of vaporization

ΔH°_{vap} The amount of heat absorbed by one mole of a substance when it changes from a liquid to a gas at its boiling point

p) Kinetic energy

E_k The energy of motion

q) Phase change

- A change in the state of matter without any change in the chemical composition of the system.
- Phase changes always involve energy changes but they never involve temperature changes.
- Phase changes involve changes in potential energy

r) Potential energy

E_p The energy of position, or stored energy

s) Specific heat capacity

The amount of heat energy required to change the temperature of one gram of a substance one degree Celsius

t) Temperature

A measure of the average kinetic energy of the particles that make up a substance

u) Thermochemistry

The study of heat changes that occur during chemical reactions or phase changes

v) Thermodynamics

The study of the flow of heat

2. Explain the relationship between temperature and heat.

When heat is transferred between substance, a change in temperature occurs. Heat is a form of energy, temperature is a measurement of how hot something is.

3. Provide examples of ways in which you rely on energy from chemical reactions.

   - Combustion of natural gas, coal, oil, propane, and/or wood to heat buildings, cook meals, heat water, etc.
   - Combustion of gasoline or diesel fuel to power cars and trucks
   - Reaction of carbohydrates in the body to maintain body temperature

4. Our society depends primarily on energy from chemical sources such as fossil fuels. What are some alternative energy sources?

   - Geothermal
   - Solar
   - Nuclear
   - Wind
   - Hydroelectric
   - Biomass
   - Tidal

5. a) List two energy-consuming devices that you use every day that are essential; two that are practical, efficient, or convenient; and two that are non-essential.

   Essential: furnace, refrigerator
   Practical: calculator Efficient: watch Convenient: car
   Non-essential: CD player, electric toothbrush

   b) For each example in part (a), identify the form of the energy (e.g., electrical energy, heat, light, sound, mechanical energy, etc.)

   furnace - heat
   refrigerator - heat
   calculator - electrical
   watch - mechanical
   car - mechanical
   CD player - sound
   Electric toothbrush - mechanical

   c) For each example in part (a), identify the source from which the energy was obtained (e.g., chemical, nuclear, solar, geothermal, etc.).

   furnace - chemical energy – burning of fossil fuels directly
   refrigerator - chemical energy – burning of fossil fuels in power plant
   calculator - chemical energy – reactions in the battery
   watch - chemical energy – reactions in the battery
   car - chemical energy – burning of fossil fuels
   CD player - chemical energy – burning of fossil fuels on power plant
   Electric toothbrush - chemical energy – reactions in the battery

6. Many different technologies, including chemical, nuclear, hydro, geothermal, solar, wind, tidal, and ocean thermal, are used to produce electrical energy. The choice of technology always involves trade-offs of competing values; for example, considerations of safety, cost, and environmental factors. List four different kinds of electric power generating plants and list two (or more) advantages and two (or more) disadvantages for each.

Technology	Advantages	Disadvantages
Chemical	• The technology is already developed • Economically viable	• Greenhouse gasses • Polluting gases • Depletion of fossil fuels
Nuclear	• high energy output for small quantity of fuel • fossil fuels are conserved	• waste is extremely hazardous • societal fears
Hydro	• little pollution • fossil fuels are conserved	• ecological disruptions from dam building • social disruptions from dam building
Geothermal	• little pollution • fossil fuels are conserved	• not easy to develop in all areas
Solar	• little pollution • fossil fuels are conserved • "free"	• source not continuous (clouds, etc.)
Tidal	• little pollution • fossil fuels are conserved • "free"	• technology developed only in coastal areas
Ocean thermal	• little pollution • fossil fuels are conserved	• technology developed only in coastal areas