

Thermochemistry

FINDING THE RIGHT WORD

Using your text book (Chapter 17) fill the blanks in the following sentences with the correct thermodynamics term:

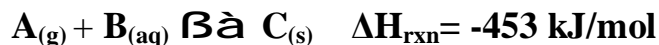
- 1) A(n) **catalyst** is used to lower the energy required to make a reaction take place. It makes chemical reactions go faster without being consumed.
- 2) Another word for freezing is **fusion**.
- 3) The thing we measure when we want to determine the average kinetic energy of random motion in the particles of a substance is **temperature**.
- 4) The **specific heat capacity (or “heat capacity” or “specific heat”)** is the energy needed to raise the temperature of a substance by one degree Celsius.
- 5) A(n) **exothermic** reaction is one where the products have lower energy than the reactants.
- 6) **Endothermic** reactions require energy in order to take place.
- 7) **Spontaneous** changes take place by themselves, without any help.
- 8) The **heat of vaporization** is the energy required to boil one mole of a substance, and its symbol is **DH_{vap}**
- 9) The measure of randomness in a system is called **entropy**.
- 10) The **heat of reaction (or “enthalpy of reaction”)** is used to describe how much energy is produced or used during a chemical change.
- 11) **Activation energy** is the amount of energy which a system has to have in order for a chemical change to take place.
- 12) **DG** is the symbol which stands for the value equal to the enthalpy minus the temperature times entropy. It can be used to determine if a reaction will take place **spontaneously**.

PHASE CHANGE

- 1) A 12 oz. can of soda weighs about 450 grams. How many joules are released when a can of soda is cooled from 25 degrees Celsius (room temperature) to 4 degrees Celsius (the temperature of a refrigerator). **The heat capacity of liquid water is 4.18 J / gram x °C. 39.5 kJ**
- 2) How many joules are required to heat 250 grams of liquid water from 0° to 100° C ? **104.5 kJ**
- 3) How many joules are required to melt 100 grams of water? **The heat of fusion of water is 6.01 kJ / mole. 33.4 kJ**
- 4) How many joules are required to boil 150 grams of water? **The heat of vaporization of water is 40.67 kJ / mole. 338.8 kJ**
- 5) How many joules are required to heat 200 grams of water from 25 °C to 125 °C? **The heat capacity of steam is 1.84 J / g · °C 523.9 kJ**
- 6) How many joules are given off when 120 grams of water are cooled from 25 °C to -25°C? **The heat capacity of ice is 2.09 J / g · °C. 58.9 kJ**
- 7) How many joules are required to heat 75 grams of water from -85 °C to 185°C? **The heat capacity of steam is 1.84 J / g · °C. 250.9 kJ**
- 8) How many joules are required to heat a frozen can of juice (360 grams) from -5 °C (the temperature of an overcooled refrigerator) to 110 °C (the highest practical temperature within a microwave oven)? **1094.46 kJ**
- 9) How many joules are released when 450 grams of water are cooled from 4×10^7 °C (the hottest temperature ever achieved by man) to 1×10^{-9} °C (the coldest temperature achieved by man). **3.31×10^{10} J**
- 10) How many joules are required to raise the temperature of 100 grams of water from -269 °C (the current temperature of space) to 1.6×10^{15} °C (the estimated temperature of space immediately after the big bang)? **2.94×10^{17} J**

Le Châtelier's Principle

Explain how the following changes in reaction conditions will affect the position of the equilibrium below, and explain your reasoning.



- 1) The pressure of A in the reaction chamber is increased.
The reaction is pushed toward products.
- 2) The temperature of the reaction is increased by 20⁰ C.
Because heat can be thought of as being a product, the reaction will be pushed toward reactants.
- 3) A catalyst is added to the system.
No change. A catalyst doesn't change the equilibrium position, it only changes how quickly equilibrium is reached.
- 4) As the reaction progresses, more of compound B is steadily added to the reaction chamber.
The reaction is pushed toward products.
- 5) An inhibitor is added to the reaction chamber.
No change, though the reaction will move more slowly.
- 6) Argon gas is added to the reaction chamber, doubling the pressure.
No change. If the partial pressure of gaseous compounds is changed, the equilibrium will shift position. However, adding argon gas doesn't change the partial pressures of A, so the equilibrium position is unaffected.