C:\Users\Schuler\AppData\Local\Microsoft\Windows\Temporary Internet Files\Content.IE5\GFY5X1GB\MCj03519550000[1].wmfChemistry Name:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Chemical Equilibrium**

**Part A: Key Terms***:* Watch the YouTube video “Crash Course: Equilibrium” or use your book (pages 214-222) to define the following terms.

* **Products:**
* **Reactants:**
* **Reversible Reaction:**
* **Equilibrium:**
* **Dynamic Equilibrium:**
* **Le Chatelier’s Principle:**

**Part B: True/False:** Classify each of these statements as true or false.

\_\_\_\_\_\_\_1. The overall concentrations of reactants and products in a system at dynamic equilibrium are always changing.

\_\_\_\_\_\_\_2. A change in the pressure on a system can cause a shift in the equilibrium.

\_\_\_\_\_\_\_3. For a chemical equilibrium to be established, the chemical reaction must be irreversible.

\_\_\_\_\_\_\_4. When equilibrium is reached, the forward and reverse reactions take place at equal rates.

**Part C: Matching:** Match each description in Column B to the correct term in Column A.

**Column A**

5. Reversible reactions \_\_\_\_\_\_\_\_\_

6. Chemical Equilibrium \_\_\_\_\_\_\_\_

7. Equilibrium position\_\_\_\_\_\_\_\_\_

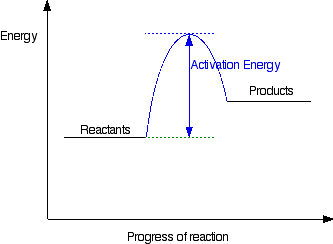
8. Le Chatelier’s Principle \_\_\_\_\_\_

9. Concentration \_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Column B**

1. State of balance in which forward and reverse reactions take place at the same rate.
2. Measurement of the amount of solute that is dissolved in a given quantity of solvent
3. When stress is applied to a system at equilibrium, the system changes to relieve the stress.
4. Reaction in which conversion of reactants to products and products to reactants occur simultaneously
5. Ratio of product concentrations to reactant concentration when a system is at equilibrium

**Part D: Endothermic or Exothermic (review):** Label each as being endothermic or exothermic. (∆G = ∆H)

10. A reaction produces light. 13.

11. H2(g) + CO2(g) ↔ CO(g) + H2O(g) ∆H = +40kJ

12. N2 (g) + 3H2 (g) ↔ 2NH3 (g) + Energy

**Part E: Le Chatelier’s Principle**

Le Chatelier’s Principle states that if a stress is applied to a system at equilibrium, the system will adjust, to partially offset or correct for the stress and will reach a new state of equilibrium.

The “stresses” that can be applied to the system include changes in **concentration, pressure, volume and temperature.**

1. **Changes in concentration** of either reactants or products will change the equilibrium position.

**\*Adding more reactant will drive (favor) the forward reaction.**

**\*Adding more product will drive (favor) the reverse reaction.**

Removal of reactants or products will shift the equilibrium in the direction needed to produce more of the substance that was removed.

1. **Changes in pressure and volume** will affect the equilibriumof reactions **involving gases.**

**\*Increasing** the **volume** of the system (**lowering the pressure**) drives the equilibrium toward a state with the larger number of moles of gas.

**\*Increasing** the **pressure** of the system (**decreasing the volume**) drives the equilibrium towards a state with the fewest number of moles of gas.

1. **Changes in temperature:**

**\***Heat can be treated as a **product in exothermic** reactions and as a **reactant in endothermic** reactions.

\*Raising the temperature of a reaction can be thought of as adding heat. In endothermic reactions (heat = reactant) adding heat will drive the forward reaction. In exothermic reactions (heat = product), raising the temperature or adding heat will drive the reverse reaction.

1. **Catalysts** are chemicals that speed up the rate of a reaction. However, they speed up both the forward and reverse reactions and do **NOT** affect the equilibrium position.

**Part E: Practice Problems:**

1. For the balanced **exothermic** reaction below, predict the effect of each of the following changes on this system at equilibrium (drive forward reaction, drive reverse reaction, no effect).

**2NO2 (g) ↔ N2O4 (g)**

1. Add N2O4
2. Increase the volume (decrease pressure)
3. Add C2H4
4. Remove NO2
5. Decrease the temperature
6. For the **endothermic** reaction listed below, predict the effect of each of the following changes on this system at equilibrium (drive forward reaction, drive reverse reaction, no effect).

**N2 (g) + 3H2 (g) ↔ 2NH3 (g)**

1. Add hydrogen gas
2. Remove ammonia (NH3)
3. Decrease the pressure
4. Increase the temperature (add heat)
5. Decrease the volume