Anoka-Hennepin Secondary Curriculum Unit Plan

Department:	Science	Course:	IB Chemistry 12 (H)	Unit Title:	Equilibrium	Grade Level(s):	12
Assessed Trimester:	Trimester A	Pacing:	Trimester A	Date Created:	6/24/2014	Last Revision Date:	

Course Understandings: *Students will understand that:*

- Problems can be solved and knowledge gained in a systematic way: solutions to one problem can create new questions and problems.
- Chemistry is recognized as significant in its application to other disciplines and the world.
- Ideas are expressed symbolically, numerically, and graphically.
- Behavior and properties of materials are organized, classified, and predicted utilizing periodic trends.
- Mathematical relationships are interpreted and manipulated to model the real world.
- The basic building blocks combine and recombine in a variety of ways to make all matter from the simple to the complex.
- The laws of chemistry predict outcomes that impact and apply to daily life.

DESIRED RESULTS (Stage 1) - WHAT WE WANT STUDENT TO KNOW AND BE ABLE TO DO?

Established Goals

- Students will know that many reactions are reversible. These reactions will reach a state of equilibrium when the rates of the forward and reverse reaction are equal. The position of equilibrium can be controlled by changing the conditions.(IB 7.1)
- The position of equilibrium can be quantified by the equilibrium law. The equilibrium constant for a particular reaction only depends on the temperature . (IB 17.1)

Transfer

Students will be able to independently use their learning to: (product, high order reasoning)

- Understand the Haber process. This process has been described as the most important chemical reaction on Earth as it has revolutionized global food production. However, it also had a large impact on weaponry in both world wars. Investigate the pros and cons of the Haber process and describe how your life could be different today without this process.

Meaning

Unit Understanding(s):

Students will understand that:

- A state of equilibrium is reached in a closed system when the rates of the forward and reverse reactions are equal.
- The equilibrium law describes how the equilibrium constant (K_c) can be determined for a particular chemical reaction.
- The position of the equilibrium changes with changes in concentration, pressure, and temperature.
- The position of equilibrium corresponds to a maximum value of entropy and a minimum in the value of the Gibbs free energy.
- The Gibbs free energy change of a reaction and the equilibrium constant can both be used to measure the position of an equilibrium reaction and are related by the equation, $\Delta G = -RT\ln K$.

Essential Question(s):

Students will keep considering:

- Scientists investigate the world at different scales; the macroscopic and microscopic. Which ways of knowing allow us to move from the macroscopic to the microscopic?
- Chemistry uses a specialized vocabulary: a closed system is one in which no matter is exchanged with the surroundings. Does our vocabulary simply communicate our knowledge; or does it shape what we can know?
- The career of Fritz Haber coincided with the political upheavals of two world wars. He supervised the release of chlorine on the battlefield in World War I and worked on the production of explosives. How does the social context of scientific work affect the methods and findings of science? Should scientists be held morally responsible for the applications of their discoveries?
- We can use mathematics successfully to model equilibrium systems. Is this because we create mathematics to mirror reality or because the reality is intrinsically mathematical?
- Many problems in science can only be solved when assumptions are made which simplify the mathematics. What is the role of intuition in problem solving?

Acquisition

Knowledge - Students will:

- Know reactions can occur in both the forward and reverse directions.
- Know that when the rate of the forward reaction equals the rate of the reverse reaction chemical equilibrium is established.
- Know the reaction quotient (*Q*) measures the relative amount of products and reactants present during a reaction at a particular point in time. *Q* is the equilibrium expression with non-equilibrium concentrations
- Know the magnitude of the equilibrium constant indicates the extent of a reaction at equilibrium and is temperature dependent.
- Know a catalyst has no effect on the position of equilibrium or the equilibrium constant.
- Know square brackets [ ] indicate molarity

Reasoning - Students will:

- Deduce the equilibrium constant expression (K_c) from an equation for a homogeneous reaction.
- Apply Le Châtelier's principle to predict the qualitative effects of changes of temperature, pressure and concentration on the position of equilibrium and on the value of the equilibrium constant.
- Explain the relationship between ΔG and the equilibrium constant.

Skills - Students will:

- Calculate the equilibrium constant (K_c) for a given reaction.
- Calculate free energy using the equation - ln

Common Misunderstandings

- It is possible for mathematics to get in the way of some students' understanding of the chemistry of this chapter.
- Students falsely assume equilibrium constants are constant under all conditions.
- Students falsely assume that once equilibrium is established reactions stop
- Students falsely assume that once equilibrium is established the concentrations of reactants equal the concentrations of products.

Essential new vocabulary

- Forward reaction
- Reverse reaction
- Equilibrium
- Equilibrium constant
- Free energy
- Magnitude
- Catalyst
- LeChatelier's Principle
- Equilibrium Position