StudyForge
DIGITAL CURRICULUM

Chemistry 12

Type: Online

Course Description:

A Greek philosopher once said that "there is nothing permanent except change," and Chemistry 12 will open our eyes to that continual chemical change all around us and how it leads to a fascinating and responsive state called equilibrium.
The course begins with a study of Reaction Kinetics, the factors that control the speed of a chemical reaction - from slow rusting to fast gasoline combustion - and why they have different speeds. From there we'll discover that reactions can go forwards AND backwards (reversible reactions) and learn about the interesting properties and significance of these systems in studying Dynamic Equilibrium and Solubility Equilibrium, such as how billions more people on our planet have food to eat each day!

This understanding of chemical equilibrium then extends into the Theory and Applications of Acids and Bases, including why humans are able to avoid the otherwise "lethal effects" of acidic foods like lemons and pineapples due to the acid-base equilibria in our bodies — it's true! And finally, we delve into Electrochemistry and discover how batteries actually work and why bananas turn brown (you've always wanted to know that, haven't you?!)

Thankfully, the overarching theme of equilibrium will be there to guide us through every step of the way and provide the foundation we need to help us more deeply understand the chemical phenomena of the amazing world all around us!

[1] *Attributed to Heraclitus of Ephesus: https://en.wikipedia.org/wiki/Heraclitus*

Major Units and Topics:

- Reaction Kinetics
- Dynamic Equilibria
- Solubility Equilibria
- Acids & Bases (Theory and Applications)

Assessments:

- Video Note-package
- Practice Questions
- Assignments
- Labs
- Projects
- Discussion Forums
- Unit Tests

Student Requirements:

- Scientific Calculator

Learning Standards Overview:

Content *Students are expected to know the following:*	Unit 1	Unit 2	Unit 3	Unit 4	Unit 5	Unit 6
Reaction Rate						
Heterogeneous and homogeneous reactions	✔					
Factors that affect reaction rate	✔					
Controlling reaction rate	✔					
Collision Theory						
Collision geometry	✔					
Relationship between successful collisions and reaction rate	✔					
Relationship of activated complex, reaction	✔					

intermediates, and activation energy to PE diagrams						
Energy Change						
Relationship between PE, KE, enthalpy (ΔH), and catalysis	✔					
Reaction Mechanism						
Relationship of the overall reaction to a series of steps (collisions)	✔					
Rate-determining step	✔					
Catalysts						
Applications (e.g., platinum in automobile catalytic converters, catalysis in the body, chlorine from CFCs in ozone depletion)	✔					
Dynamic Nature of Chemical Equilibrium						
Reversible nature of reactions, relationship to PE diagram		✔				
Le Châtelier's Principle and Equilibrium Shift						
Concentrations of reactants and products		✔				
Enthalpy and entropy		✔				
Presence of a catalyst		✔				
Applications (e.g., Haber process, hemoglobin and oxygen in the blood)		✔				
Equilibrium constant (Keq)						

Homogeneous and heterogeneous systems		✔				
Pure solids and liquids		✔				
Effect of changes in temperature, pressure, concentration, surface area, and a catalyst		✔				
Solubility product (Ksp)						
Ksp as a specialized Keq expression			✔			
Relative Strength						
Electrical conductivity			✔			
Table of relative acid strength				✔		
Equations of strong and weak acids and bases in water				✔		
Weak acids and weak bases						
Equilibrium systems				✔		
Titration						
The method to find an equivalence point:						
- strong acid-strong base titration					✔	
- weak acid-strong base titration					✔	
- strong acid-weak base titration					✔	
Hydrolysis of Ions in Salt Solutions						
Acidic, basic, or neutral salt solutions					✔	

Amphiprotic ions					✔	
Applications of Acid-Base Reactions						
Non-metal and metal oxides in water and associated environmental impacts					✔	
Buffers					✔	
The oxidation-reduction process						
Oxidation number						✔
Balancing redox reactions						✔
Electrochemical cells						
Half-reactions, cell voltage (E0), applications (e.g., lead-acid storage batteries, alkali cells, hydrogen-oxygen fuel cells)						✔
Electrolytic cells						
Half-reactions, minimum voltage to operate, applications including metal refining (e.g. zinc, aluminum), preventing metal corrosion (cathodic protection)						✔
Quantitative Relationships						
Quantitative problems using relationships between variables such as:						
- in equilibrium systems (e.g., Keq, initial concentrations, equilibrium concentrations)		✔				
- in solutions (e.g., Ksp, prediction of			✔			

precipitate formation, calculating the maximum allowable concentration)						
- in water as an equilibrium system (e.g., Kw, [H3O+] or [OH–], pH and pOH)				✔		
- in acid-base systems (e.g., Ka, Kb, [H3O+], [OH–], pH and pOH)				✔		
- in a titration (e.g., pH of a solution, Ka of an indicator)					✔	
- pH in hydrolysis of ions in salt solutions					✔	
- in a redox titration (e.g., grams, moles, molarity)						✔
- in an electrochemical cell (e.g., E0)						✔