M6 Additional Chemistry 5

Course Syllabus - 2025 Term 2

Teacher: Kru Michael Nguyen

Department: Science **Subject Code**: ST33205

Periods per week: 3 **Credits**: 1.5

Course Description

This course provides an in-depth study of advanced chemical concepts, focusing on electron transfer reactions and an introduction to the chemistry of carbon. The curriculum begins with redox reactions, where students will study oxidation and reduction and learn techniques for balancing redox equations, along with identifying oxidizing and reducing agents. Next, the Electrochemistry unit offers an introduction to electrochemistry by detailing the function and operation of electrochemical cells, specifically comparing voltaic cells (which produce electrical energy) and electrolytic cells (which require electrical energy). The course transitions to the Introduction to Organic Chemistry, exploring the diversity of organic compounds and focusing on hydrocarbons, including alkanes, alkenes, and alkynes and aromatic hydrocarbons. The organic unit concludes with an introduction to other functional groups like alcohols, ethers, and carboxylic acids. Finally, (If time permits), the course offers an introduction to nuclear chemistry, covering the nucleus, radioactive decay, nuclear radiation, and the concepts of nuclear fission and nuclear fusion. As with any PHS science course, each unit will also include lab-based work.

Course Content

1. Redox Reactions
    1.1. Oxidation and reduction
    1.2. Balancing redox equations
    1.3. Oxidizing and reducing agents

2. Electrochemistry
    2.1. Introduction to electrochemistry
    2.2. Voltaic Cells
    2.3. Electrolytic Cells

3. Introduction to Organic Chemistry
    3.1. Organic compounds
    3.2. Hydrocarbons
    3.3. Alkanes, Alkenes, and Alkynes
    3.4. Isomers of hydrocarbons
    3.5. Aromatic hydrocarbons
    3.6. Other functional groups
        3.6.1. Alcohols
        3.6.2. Ethers
        3.6.3. Carboxylic acids

4. (If time permits) Introduction to nuclear chemistry
    4.1. The nucleus
    4.2. Radioactive Decay
    4.3. Nuclear Radiation
    4.4. Nuclear Fission and Nuclear Fusion

Learning Outcomes

1. Redox Reactions
    - Understand that oxidation and reduction can be considered in terms of electron transfer or change in oxidation number.
    - Understand that an oxidizing agent is reduced and a reducing agent is oxidized during a redox reaction.
    - Deduce the oxidation states of an atom in an ion or a compound.
    - Identify the species oxidized and reduced and the oxidizing and
    - reducing agents, in redox reactions.
    - Balance redox equations by using the half-reaction method.
    - Relate chemical activity to oxidizing and reducing strength.

2. Electrochemistry
    - Identify parts of an electrochemical cell and their functions.
    - Write electrode half reactions for cathodes and anodes.
    - Describe the operation of voltaic cells, including dry cells, lead-acid batteries, and fuel cells.
    - Identify conditions that lead to corrosion and ways to prevent it.

- Describe the relationship between voltage and the movement of electrons.
- Calculate cell voltage/potentials from a table of standard electrode potentials.
- Describe the nature of electrolytic cells.
- Describe the process of electrolysis in the decomposition of water and in production of metals.
- Explain the process of electroplating.
- Describe the chemistry of a rechargeable cell.

3. Organic Chemistry
    - Explain how the structure and bonding of carbon lead to the diversity and number of organic compounds.
    - Understand that a homologous series is a series of compounds of the same family, with the same general formula, which differ from each other by a common structural unit.
    - Compare the use of molecular and structural formulas to represent organic compounds.
    - Understand that saturated compounds contain single bonds only and unsaturated compounds contain double or triple bonds.
    - Compare structural and geometric isomers of organic compounds.
    - Distinguish among the structures of alkanes, alkenes, alkynes, and aromatic hydrocarbons.
    - Write structural formulas and names for alkanes, alkenes, and alkynes using IUPAC rules
    - Explain the trends in boiling points of members of a homologous series.
    - Define “functional group” and explain why functional groups are important.
    - Identify alcohols, alkyl halides, ethers, aldehydes, ketones, carboxylic acids, esters, and amines based on the functional group present in each.
    - Explain the relationships between the properties and structures of compounds with various functional groups.

4. Nuclear chemistry
    - Identify the forces that affect the stability of the nucleus of atoms
    - Write balanced nuclear equations
    - Describe different types of radioactive decay (alpha, beta, and gamma)
    - Complete calculations involving half-life
    - Describe different methods for detecting radiation

- Describe different applications of nuclear radiation
- Compare fission and fusion and describe common applications of each.

Learning Resources

Textbook: HMH Modern Chemistry (ISBN 9780544817845)

Lesson slides, lesson notes, worksheets, and lab handouts (all will be available in Google Classroom)

Virtual experiment from Explorelearning.com (Gizmos)

Other online learning resources (PHeT, EdPuzzle, Wayground, CK12, Simbucket, and others.)

Assessment Methods

Assignments and in class quizzes will be used to assess students' skills and understanding of basic concepts within each unit. Assignments will not be graded based on accuracy, but will instead be graded for completion and submission by assigned deadlines. The quizzes will typically be short in duration and will be open-note in order to assess students' ability to complete basic problems without the need to memorize formulas or the steps required to finish problems.

Students' lab work will be assessed on preparation and planning, attention to detail, ability to draw conclusions and depth of evaluation. Each semester students will also have to choose a project to demonstrate their level of understanding of a particular topic. Details will be provided at the appropriate time.

Unit tests and a formal final exam will include a range of problems. About 50% of the exam will consist of problems that will cover the fundamental skills. About 30% of the exam will consist of problems that will require a deeper understanding of each topic and will require students to combine skills from several topics. About 20% of the final exam will consist of real-world application problems.

Homework Policy

An assignment that is complete and submitted on-time will receive 100% of the points.

Any complete assignment that is submitted up to 1 week late will receive 75% of the points. Any complete assignment that is submitted up to 3 weeks late will receive 50%.

Over three weeks after the due date, assignments will not be accepted and a grade of 0 will be given.

If students are absent when assignments are assigned or on an assignment due date, then it is the responsibility of the student to contact the teacher to make arrangements for submission.

Information on all assignments can be found in Google Classroom. Students should read instructions carefully to know how assignments should be submitted (either attached to Google Classroom or handed in during class) and the due date.

Evaluation Breakdown

Assessments 30%

- Unit Tests
- Short Quizzes
- Lab Quizzes

Student Work 40%

- Online Practice
- Homework/Classwork
- Labs
- Projects

Final Exam 30%