TREYNOR COMMUNITY SCHOOL DISTRICT
CURRICULUM FRAMEWORK

Subject: **Science**
Course: **Chemistry**
Grade Level(s): **9 - 12**
Prerequisites: **Algebra II or concurrent enrollment (Exceptions only with instructor approval)**

Course Description: Chemistry is a two-semester course designed to meet the needs of the student who wants to go on to a four-year university. Chemistry focuses on the modern concepts of chemistry and on using problem solving effectively. Topics investigated include atomic structure, periodic law, chemical bonds, chemical composition, chemical equations, gas laws, solution process, acid and bases, and science/society issues pertaining to chemistry.

Students will use scientific principles and evidence to define and classify matter, using mathematical representations to describe the properties and structure of matter. They will also design demonstrations to compare and contrast physical properties and changes with chemical properties and changes. They will perform measurements and other laboratory activities safely and with appropriate equipment and techniques.

(Note: a student must pass the first semester to enroll in the second semester.)

Chemistry may be taken in place of Semester 1 of Physical Science.

Examples of Students' Work at School:

- Represent and explain phenomena with multiple types of models – for example, represent molecules with 3-D models or with bond diagrams.
- Use subatomic and subcellular explanations in describing phenomena in the physical sciences.
- Plan experimental or field-research procedures, identifying relevant independent and dependent variables, recognizing that it is not always possible to control variables and that other methods can be used in such cases.
- Ask probing questions that seek to identify the premises of an argument, request further elaboration, refine a research question or engineering problem, or challenge the interpretation of a data set – for example, How do you know? What evidence supports that argument?
- Explain how claims to knowledge are judged by the scientific community today and articulate the merits and limitations of peer review and the need for independent replication of critical investigations.
- Engage in critical reading of primary scientific literature (adapted for classroom use) or of media reports of science in order to communicate understanding, ask questions, and discuss the validity and reliability of data, hypotheses, and conclusions using appropriate scientific vocabulary, tables, diagrams, graphs, and mathematical expressions.

Content Standards: In order that our students may achieve the maximum benefit from their talents and abilities, the students of the Treynor Community School who demonstrate understanding of chemistry can . . .

I. Physical Science

1. Matter and Its Interactions

1) Use the periodic table as a model to predict the relative properties of elements based on the patterns of electrons in the outermost energy level of atoms. (HS - PS1-1)
2) Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron state of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties. (HS – PS1-2)
3) Plan and conduct an investigation to gather evidence to compare the structure of substances at the bulk scale to infer the strength of electrical forces between particles (HS – PS1-3)
4) Develop a model to illustrate that the release or absorption of energy from a chemical reaction system depends upon the changes in total bond energy. (HS – PS1-4)
5) Apply scientific principles and evidence to provide an explanation about the effects of changing temperature or concentration of the reacting particles on the rate at which a reaction occurs. (HS – PS1-5)
6) Refine the design of a chemical system by specifying a change in conditions that would produce increased amounts of products at equilibrium (HS – PS1-6)
7) Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction. (HS – PS1-7)
8) Develop models to illustrate the changes in the composition of the nucleus of the atom and the energy released during the processes of fission, fusion, and radioactive decay (HS – PS1-8)

2. Motion and Stability: Forces and Interactions

1) Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials. (HS – PS2-6)

3. Energy

1) Create a computational model to calculate the change in the energy of one component in a system when the change in energy of the other component(s) and energy flows in and out of the system are known. (HS – PS3-1)
2) Develop and use models to illustrate that energy at the macroscopic scale can be accounted for as a combination of energy associated with the motions of particles (objects and energy associated with the relative position of particles (objects). (HS – PS3-2)

3) Design, build, and refine a device that works within given constraints to convert one form of energy into another form of energy. (HS – PS3-3)

Plan and conduct an investigation to provide evidence that the transfer of thermal energy when two components of different temperature are combined within a closed system results in a more uniform energy distribution among the components in the system (second law of thermodynamics). (HS – PS3-4)

4. Waves and Their Applications in Technologies for Information Transfer

1) Use mathematical representations to support a claim regarding relationships among the frequency, wavelength, and speed of waves traveling in various media. (HS – PS4-1)
2) Evaluate the claims, evidence, and reasoning behind the idea that electromagnetic radiation can be described either by a wave model or a particle model, and that for some situations one model is more useful than the other. (HS – PS4-3)
3) Evaluate the validity and reliability of claims in published materials of the effects that different frequencies of electromagnetic radiation have when absorbed by matter. (HS – PS4-4)
4) Communicate technical information about how some technological devices use the principles of wave behavior and wave interactions with matter to transmit and capture information and energy. (HS – PS4-5)

II. Engineering, Technology, and Application of Science

1. Engineering Design

1) Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants (HS – ETS1-1)
2) Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering. (HS – ETS1-2)
3) Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts. (HS - ETS1-3)