**Course Description**: We live in a world that faces a variety of complex and ever-changing issues. A solid understanding of science concepts and scientific thinking is essential to being a good citizen who can make informed decisions. For example, combating climate change, finding alternative energy sources, providing a sustainable supply of clean water, and the development of new medicines all require knowledge of chemistry. Therefore, students will be studying the challenging yet rewarding subject of chemistry this year in 10th grade science.

**Course Goals:** Upon the completion of this class students will be able to…

* Recognize and describe the chemistry principles at work around them in everyday life
* Describe how materials are engineered at the atomic and molecular level for specific macroscopic properties
* Investigate questions and problems using the same tools, methods, and conventions as scientists
* Analyze various sources of information to make sustainable decisions for our community and planet

**Grading Policy:**

|  |  |
| --- | --- |
| **Assessments:** Tests, Quizzes, and Roundtables. Literacy Assignments (NewsELA, CER, IR etc.) | **40%** |
| **Exhibitions:** Experiments, Labs, and Rationales | **40%** |
| **Assignments:** Completing Classwork, Homework, and Exhibitions on-time.  Maintaining your science notebook with complete Do Nows and entries. | **20%** |

**UNIT 1: TALK LIKE A CHEMIST, THINK LIKE A CHEMIST**

**Objectives**: In various contexts and non-routine situations, students will be able to independently and flexibly use their learning to describe a sample or process using the appropriate descriptive scientific vocabulary related to matter, energy, and the changes they undergoes. Also, students will be able to use the mathematical language, tools, and conventions used by chemists to investigate and solve problems. Finally, students will be able to reproducibly design and safely conduct an experiment, reliably collect data, analyze and represent the results in multiple ways, draw conclusions, and communicate findings using evidence.

**Essential Questions**:

* + How do scientists observe and measure the world around them?
  + How do chemists describe matter and how it changes?
  + How do scientists ask questions, collect data, and solve problems through experimentation?

**Major Assessments**:

* *Unit 1 Test* - Chemical Safety, Types of Observations, States of Matter, Types of Matter, Types of Change, Accurate vs. Precise, Significant Figures, Conversion Factor, Density
* *Density of Pennies Experiment* – Students are given a set of pennies from different years and asked to use what they have learned about density to determine what happened to the U.S. penny and when.

**UNIT 2: THE ATOM & NUCLEUS**

**Objectives**: In various contexts and non-routine situations, students will be able to independently and flexibly use their learning to determine the basic properties of a substance based on its atomic (nuclear) structure and describe basic nuclear changes.

**Essential Questions**:

* How do we know atoms exist if we can’t see them?
* What are elements made of and where do they come from?
* How are nuclear changes different from chemical changes?
* What is the best way to model an atom?

**Major Assessments**:

* *Unit 2 Test* – History and Models of the Atom, Basic Atom Structure, Atomic Notation and Isotopes, Radioactivity and Half-life, Electron Transitions
* *Spectroscopy Lab* – Students study the connection between electronic transitions at the sub-atomic level to emission spectroscopy results as evidence of atomic structure.

**UNIT 3: THE PERIODIC TABLE & BONDING**

**Objectives**: In various contexts and non-routine situations, students will be able to independently and flexibly use their learning to determine the basic changes a substance may undergo based on its atomic (electronic) structure.

**Essential Questions**:

* What does an atom’s position on the periodic table tell chemists?
* Why are some elements so stable while others are so reactive?
* Why do atoms form chemical bonds?

**Major Assessments**:

* *Unit 3 Test* – Structure of the Periodic Table, Valence Electrons, Covalent Bonding, Ions, Ionic Bonding, and Nomenclature

**UNIT 4: ARTIST AS CHEMIST**

**Objectives**: In various contexts and non-routine situations, students will be able to independently and flexibly use their learning tosafely and reproducibly design an experiment meant to solve a problem, reliably collect data, collaborate, analyze and represent the results in multiple ways, draw conclusions, and communicate findings using evidence. Also, students will be able to express their understanding of chemical concepts and processes through explanatory writing. Finally, students will broaden their ability to relate the nanoscopic structure of a sample to its macroscale properties.

**Essential Questions**:

* How are artists like chemists?
* How can you use chemistry to construct a durable piece of artwork?
* Why do scientists design experiments and communicate results the way they do?
* How do scientists communicate how confident they are in their results and conclusions?
* Why does that kind of matter behave that way?

**Major Assessments**:

* *Durability Experiment –* Students are challenged to design an experiment that will test which material will be durable in constructing a piece of artwork. This is the first 10th grade opportunity to practice the full range of skills required for the 11th grade PBAT.
* *Artwork & Placard –* Students’ study of cross-over artwork and chemistry techniques culminates in the construction of a piece of artwork. Clay, Copper, electroplating, steel alloy making, and making pigments for paint are examples of the chemistry studied through the lens of artwork. Students write an art Placard description of the inspiration, design, and chemical principles behind their artwork.
* *Semester 1 Roundtables* – As with all East Side science classes, students must prepare a three part Roundtable presentation. Semester 1 Roundtables in chemistry require students to present their artwork with a demo and mini-teach of a specific chemistry technique that was used. There is also a cooperative group presentation of a lab from the semester. Finally, students participate in a thirty minute live question and answer final in which they must defend the chemistry knowledge they have gained throughout the semester.

**UNIT 5: MOLECULES AND REACTIONS**

**Objectives**: In various contexts and non-routine situations, students will be able to independently and flexibly use their learning to analyze the properties of and describe (qualitatively, write symbolically, and quantitatively calculate amount of) the reactants and products in a chemical reaction.

**Essential Questions**:

* How do elements achieve stability?
* How does the type of bonding explain the properties of substances?
* Why is there such a diversity of organic molecules?
* How and why does matter change?
* How do we know a chemical reaction is occurring?
* Why do chemists use symbols and mathematics to describe chemical equations?
* How do chemists manipulate reactions to produce substances important in my life and our society?

**Major Assessments**:

* *Molecular Modeling Lab* – Students use their knowledge of covalent bonding and VSEPR theory to build and describe the molecular structure of over 25 molecules with connections to their lives (i.e. medicines, toxins, polymers, and biological molecules).
* *Reactions Lab* – Students are challenged to identify the “signs and type of reaction” for six reactions. Then they must analyze and balance the chemical equation for the reactions.
* *Stoichiometry Experiment* – Students use gravimetric analysis to determine the balanced equation, % yield, and confirm the stoichiometric ratios for the reaction of Aluminum with Copper (II) Chloride.
* *Unit 5 Test* - Covalent Bonding, VSEPR Theory, Signs of Reactions, Types of Reactions, Balancing Reactions, Mole Conversions, Stoichiometry

**UNIT 6: WATER SUSTAINABILITY**

**Objectives**: In various contexts and non-routine situations, students will be able to independently and flexibly use their learning to apply chemistry concepts and engineering design principles to solve real and socially relevant issues. Also, students will use dynamic multimedia methods of research and presentation to inform others about solutions to local and global sustainability issues.

**Essential Questions**:

* Why is water a unique molecule and how do the unique properties of water make life on earth possible?
* If water is an economic, environmental, and social equity issue, how are we responsible for it as a sustainable resource?
* How do chemical engineers design solutions to real problems?
* How does knowing some science help me, my family, or my community?
* How can I educate and inspire others to make sustainable choices?

**Major Assessments**:

* *Unit 6 Test Water Chemistry Test* – Sustainability & the 3E’s, Polarity, Hydrogen Bonding, Universal Solvent, Solubility, Surface Tension, Capillary Action, Specific Heat
* *Water Treatment Exhibition* ¬– Students must test a sample of contaminated to develop and appropriate action plan for treatment to make the water potable.
* *Water Treatment Engineering Extension* – Students are challenged to evaluate the effectiveness of an alternative water treatment method for use in New York City.
* *Water PSA Video Exhibition* – Students research and create a short Public Service Announcement video designed to teach their younger MS peers about a Water Sustainability issue, the related 3 E impacts, how chemistry connects, and a message/solution to the issue. The PSA’s are published at a joint 6th & 10th grade movie screening!

**UNIT 7: GAS LAWS**

**Objectives**: In various contexts and non-routine situations, students will be able to independently and flexibly use their learning to effectively describe, accurately draw at the nanoscopic level, and demonstrate a macroscale gas law demo .

**Essential Questions**:

* How do we know what is happening to atoms and molecules if we cannot see them?
* How is what I am seeing related to what is happening on a molecular level?
* How do I represent or model the behavior or particles on a nanoscopic level?

**Major Assessments**:

* *Challenge Problem* – After working through many in-class examples of gas law demos students are challenged (timed) to get a hardboiled egg inside a glass bottle using their knowledge of gas laws without breaking the egg.
* *Semester 2 Roundtables* – Students choose one gas law demo to thoroughly explain and execute live for their evaluator at Roundtables. There is also a cooperative on-demand sustainability discussion for Unit 5’s water chemistry content. Finally, students participate in a thirty minute live question and answer final in which they must defend the chemistry knowledge they have gained throughout the semester.