SCHOOL DISTRICT OF THE CHATHAMS

Honors Chemistry
Grade 10
Full Year

Course Overview

This course provides students with a deeper understanding of key concepts along with a rigorous laboratory experience that provides an in-depth comprehension of the physical sciences. The concepts in chemistry include the structure and properties of matter, chemical reactions, and nuclear processes. In addition, students explore conservation of energy and energy transfer, energy in chemical processes and everyday life. These performance expectations blend the core ideas with scientific and engineering practices and crosscutting concepts to support students in developing usable knowledge to explain ideas across the science disciplines. In the physical science performance expectations at the high school level, there is a focus on several scientific practices. These include developing and using models, planning and conducting investigations, analyzing and interpreting data, using mathematical and computational thinking, and constructing explanations; and to use these practices to demonstrate an understanding of the core ideas. Students are also expected to demonstrate an understanding of several engineering practices, including design and evaluation.

New Jersey Student Learning Standards
The New Jersey Student Learning Standards (NJSLS) can be located at www.nj.gov/education/cccs/2020/.

Physical Science:
HS-PS1-1 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-PS1-2 Construct and revise an explanation for the outcome of a simple chemical reaction based on the outermost electron states of atoms, trends in the periodic table, and knowledge of the patterns of chemical properties.
HS-PS1-3 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-PS1-4 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-PS1-5 Apply scientific principles and evidence to provide an explanation about the effects of changing the temperature or concentration of the reacting particles on the rate at which a reaction occurs.
HS-PS1-6 Refine the design of a chemical system by specifying a change in conditions that would produce increased amounts of products at equilibrium.
HS-PS1-7 Use mathematical representations to support the claim that atoms, and therefore mass, are conserved during a chemical reaction.
HS-PS1-8 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-PS2-6 Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials.

HS-PS3-4 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).

Earth and Space Science
HS-ESS1-1 Develop a model based on evidence to illustrate the life span of the sun and the role of nuclear fusion in the sun's core to release energy that eventually reaches Earth in the form of radiation.
HS-ESS1-3 Communicate scientific ideas about the way stars, over their life cycle, produce elements.

Technology Standards
9.4.12.IML.7: Develop an argument to support a claim regarding a current workplace or societal/ethical issue such as climate change (e.g., NJSLSA.W1, 7.1.AL.PRSNT.4).
9.4.12.TL.2: Generate data using formula-based calculations in a spreadsheet and draw conclusions about the data.
9.4.12.TL.3: Analyze the effectiveness of the process and quality of collaborative environments.

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9.3.12.AG-NR.4 Demonstrate responsible management procedures and techniques to protect or maintain natural resources.

Career Ready Practices
CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.
CRP2. Apply appropriate academic and technical skills.
CRP4. Communicate clearly and effectively and with reason.

Interdisciplinary Connections
English Language Arts:
Reading
- RST.9-10.7 Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.
- RST.11-12.1 Cite specific textual evidence to support analysis of science and technical texts, attending to important distinctions the author makes and to any gaps or inconsistencies in the account.

Writing
- WHST.9-12.2 Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.
- WHST.9-12.5 Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience.
- WHST.9-12.7 Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.
- WHST.11-12.8 Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation.
- WHST.9-12.9 Draw evidence from informational texts to support analysis, reflection, and research.

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Speaking and Listening

- SL.11-12.4 Present claims and findings, emphasizing salient points in a focused, coherent manner with relevant evidence, sound valid reasoning, and well-chosen details; use appropriate eye contact, adequate volume, and clear pronunciation.

Mathematics:

- HSN-Q.A.1 Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.
- HSN-Q.A.2 Define appropriate quantities for the purpose of descriptive modeling.
- HSN-Q.A.3 Choose a level of accuracy appropriate to limitations on measurement when reporting quantities.
- HSA-SSE.A.1 Interpret expressions that represent a quantity in terms of its context.
- HSA-CED.A.2 Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.
- HSA-CED.A.4 Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving equations.

Units of Study

Unit 1: Introduction to Chemistry *(~ 16 days)*

- How do charges affect the force between objects on an atomic scale?
- How does the force between electric charges at the atomic scale explain the structure, property and transformation of matter?

Unit 2: Nuclear Chemistry *(~ 16 days)*

- Is the lifespan of a star predictable?
- How do stars produce elements?
- What causes the production of energy in the sun?

Unit 3: Chemical Reactions & Stoichiometry *(~ 8 days)*

- What factors dictate whether a reaction will occur or not?
- How does the periodic table of elements reflect the regular patterns of chemical behavior exhibited by the elements it depicts?
- How do the chemical names and formulas of compounds relate to their physical and chemical properties?
- Why are mathematics and laboratory investigations used to show the relationships between the amounts of reactants and products in a chemical reaction?
- Why is it important to be able to predict the outcome of a reaction?

Unit 4: Thermochemistry *(~18 days)*

- How does the transformation of energy occur in a chemical reaction?
- How is the change in the amount of energy determined?
- How does the flow of energy into or out of matter change its behavior?
- How does the physical arrangement of matter depend upon the properties of particles within matter?

Unit 5: Periodicity and Bonding *(~ 20 days)*

- How does the periodic table of elements reflect the regular patterns of chemical behavior exhibited by the elements it depicts?
- How can scientists & students use the periodic table as a tool in the experimental science of chemistry?
- What are some of the unique chemical and physical properties of the various elements on the periodic table?

Unit 6: States of Matter *(~ 16 days)*

- How does the strength of electrical forces between particles affect the measurable properties of a substance?

Unit 7: Equilibrium *(~ 16 days)*

- Why do chemical reactions occur at different rates?
- How can a chemical system be changed to produce an increased amount of product at equilibrium?

Learning Objectives/Discipline Standards of Practice

Lesson Objectives

- Predict the charges of ions that will form from the common groups of elements using the periodic table
- Distinguish between the chemical and physical properties of ionic, covalent and metallic compounds.
- Write an equation representing a chemical reaction using chemical formulas for the species involved.
- Develop a balanced chemical equation from a word equation, experimental evidence, or a description of a chemical reaction taking place.
- Predict the products of a reaction based on the reactants and the type of reaction.
- Analyze data from a given experiment
- Design a solution to a problem using scientific principles
- Explain a scientific phenomena using evidence from experimentation
- Refine a solution to a problem based on the outcome of scientific knowledge, experimentation and desired results
- Obtain information about a scientific phenomena
- Evaluate scientific information for its factual content
- Communicate information regarding a phenomena in various formats
- Develop a model based on evidence
- Illustrate the relationships between systems
- Obtain and evaluate information
- Communicate scientific ideas
- Identify trends in the periodic table of elements
- Use the periodic table of an element as a tool to investigate problems in chemistry
- Predict properties of elements based upon their location on the periodic table
- Plan out an investigation to study interactions of matter
- Take specific measurements
- Create particulate models (i.e., particle spacing, and explain the motion and orientation of atoms in a substance
- Carry out an investigation to determine the specific heat of a substance
- Carry out an investigation to calculate the heat generated from or absorbed in a pure substance

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- Convert between units of energy

Discipline Standards of Practice

Science and Engineering Practices

- Plan and Carryout and Investigation
- Ask questions and define problems
- Develop and use models
- Obtain, evaluate and communicate information
- Analyze and interpret data
- Construct explanations and design solutions
- Engage in argument from evidence
- Use mathematics and computational thinking

Crosscutting Concepts

- Cause and Effect
- Scale, Proportion and Quantity
- Structure and Function
- Patterns
- Energy and Matter
- Systems and System Models
- Stability and Change

Instructional Resources and Materials
Whole class resources have been identified with an asterisk.

Resources

Zumdahl, Steven S., and Donald J. DeCoste. Introductory Chemistry: A Foundation. 7th ed. Bellmont, CA: Brooks/Cole, CENGAGE Learning, 2011. Print.

Materials

- Types of Reactions Lab kit
- Single Replacement Reaction Lab
- 4 Solutions Lab Kit
- Mole-Mole Lab Kit
- Stoichiometry Lab
- Limiting Reactant Lab Kit
- PASCO Spectrometers probes
- Equilibrium Constant Lab Kit
- LeChatelier Lab Kit
- Uncertainties in Measurements Lab Kit
- Density Lab Kit
- Atomic Mass of Element Lab Kit
- Molecular Modeling Kit
- Types of Bonding Lab Kit
- PASCO Temperature probes
- Alkaline Earth Metals Lab Kit
- Intermolecular Forces Lab Kit
- Phase Change Lab Kit
- Temperature Probes
- Calorimetry Lab Kit
- Specific Heat Lab Kit
- Enthalpy Lab Kit

Assessment Strategies
Assessment is designed to measure a student's mastery of a course standard and learning objective. Assessment can be used for both instructional purposes (formative assessment) and for evaluative purposes (summative assessment).

The following is a general list of the many forms assessment may take in learning.

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- Tests
- Quizzes
- Projects
- Unit Assessments
- Labs

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