

BPS Science Department Chemistry – Unit 5

Chemistry Unit 5 – Chemical Bonding and Nomenclature

Unit Overview: In this unit students will understand how and why bonds are formed in terms of energy and stability. Students will be able to determine the oxidation states of elements and determine the formula of an ionic compound. Students will be able to determine the type of bond that forms between substances and the properties of the compound. Students will be able to use the International Union of Pure and Applied Chemistry (IUPAC) system to name compounds. Students will understand why metals are good conductors. Students will be able to determine bond and molecular polarity and use it as a basis to determine the type of intermolecular forces bound between molecules.

Essential Questions:

- How are compounds named and formulas written based on IUPAC standards?
- How are chemical bonds formed?
- What are the various types of bonds that are formed?
- What physical and chemical properties are associated with each type of bond?
- What are the atomic attributes of metals that make metals good conductors?
- What are intermolecular forces and how do they change a compounds' properties?
- How do you determine if a molecule is polar or nonpolar?

MST Standard 4 - Science

Key Idea 5: Energy and matter interact through forces that result in changes in motion.

New York State Science Learning Standards Performance Expectations:

HS-PS 2-6 Communicate scientific and technical information about why the particulate-level structure is important in the functioning of designed materials

HS-PS 3-5 Develop and use a model of two objects interacting through electric or magnetic fields to illustrate the forces between objects and the changes in energy of the objects due to the interaction.

BPS Science Department Chemistry – Unit 5

| Time Frame | Skills, Practices, or Expectations | Specific Standards / Performance Indicators | Resources | Content Vocabulary | Measurement of Student Learning |
|--|---|--|---|---|---|
| <p>11.07.2022 - 11.25.2022</p> <p>11.08.22 Election Day</p> <p>11.11.22 Veteran's Day</p> <p>11.24.22 - 11.25.22 Thanksgiving Recess</p> | <p>Nomenclature Represent a chemical compound by a chemical formula and assign chemical compounds by an IUPAC name. Use oxidation states to write the chemical formula of ionic, covalent, and polyatomic compounds.</p> <p>Bonding Understand why, how, and when atoms bond. Explain how a given element will become a cation or anion. Determine the oxidation state of an element alone or as part of a polyatomic ion or a compound. Be able to explain how the properties of ionic compounds depend on the nature of ionic bonds. Identify electron behavior in metallic bonds. Determine the polarity of a molecule based upon the shape of the molecule and distribution of the charges. Explain how intermolecular forces can change the properties of compounds.</p> | <p>MST Standard 4 Science Key Idea 3 3.1 - Explain the properties of matter in terms of the arrangement and properties of the atoms that compose them. 3.1dd - Compounds can be differentiated by their physical and chemical properties. 3.2 - Use atomic and molecular models to explain chemical reactions. 3.2i - Oxidation numbers (states) can be assigned to atoms and ions. Changes in oxidation numbers indicate that oxidation and reduction have occurred. Key Idea 5 5.2 - Explain chemical bonding in terms of the behavior of electrons. 5.2a - Chemical bonds are formed when valence electrons are:</p> <ul style="list-style-type: none"> ● Transferred from one atom to another (ionic) ● Shared between atoms (covalent) ● Mobile within a metal (metallic) <p>5.2b - Atoms attain a stable valence electron configuration by bonding with other atoms. Noble gases have stable valence configuration and tend not to bond. 5.2c - When an atom gains one or more electrons, it becomes a negative ion and its radius increases. When an atom loses one or more electrons, it becomes a positive ion and its radius decreases. 5.2d - Electron-dot diagrams (Lewis structures) can represent the valence</p> | <p>Castle Learning- Access through Clever</p> <p>BPS Science Department Recommended Virtual Labs – must be logged into BPS google document account through BPS Gmail account to access</p> <p><i>Holt NY Chemistry</i> Textbook Chapters Chapter 5, 6, 11</p> <p>Regents Chemistry Reference Tables - Table E</p> <p>Dynamic Periodic Table</p> <p>BPS Science K-12 Schoology Folder 9-12 Resources Chemistry Resources</p> <p>PhET Interactives: States of Matter</p> <ul style="list-style-type: none"> ● Interactive - View potential energy / forces between atoms in Ne & Ar <p>Atomic Interactions</p> <ul style="list-style-type: none"> ● Change distance between atoms and see effects on attractive/ repulsive forces <p>Sugar & Salt Solutions</p> <ul style="list-style-type: none"> ● At macro level check conductivity of salt & sugar; on micro level visualize ionic & covalent compounds in water <p>Molecule Shape Basics</p> <ul style="list-style-type: none"> ● Model - Add single/ double/ triple bonds to visualize shape; names of molecule geometry ● Real Molecules - See shape of various molecules & name of molecular geometry <p>Molecule Shapes</p> <ul style="list-style-type: none"> ● Model - Add single/ double/ triple bonds & lone pairs to visualize shape; name of molecule & electron geometry | <ul style="list-style-type: none"> ● anion ● asymmetrical molecule ● cation ● coordinate covalent bond ● covalent bonding ● dipole ● double covalent bonds ● hydrogen bond ● intermolecular forces ● intra-molecular forces ● ion ● ionic bond ● metallic bond ● network solid ● non-polar covalent bond ● octet ● octet rule ● polar covalent bond ● polyatomic ion ● symmetrical molecule ● triple covalent bond ● unshared pair ● Van der Waals | <ul style="list-style-type: none"> ● Ticket Out ● Think-Pair –Share ● Formative Assessment ● Weekly Quiz ● Unit Test ● Homework ● Review Questions ● DDI process using data from Edoctrina & Castle learning to generate data <p>Higher Level Questions</p> <p>Regents Exam: January 2019 Questions 61-62 June 2019 Question 66</p> |

BPS Science Department Chemistry – Unit 5

| | | | | |
|--|--|--|--|--|
| | <p>electron arrangement in elements, compounds, and ions.</p> <p>5.2e - In a multiple covalent bond, more than one pair of electrons are shared between two atoms. Unsaturated organic compounds contain at least one double or triple bond.</p> <p>5.2g - Two major categories of compounds are ionic and molecular (covalent) compounds.</p> <p>5.2h - Metals tend to react with nonmetals to form ionic compounds. Nonmetals tend to react with other nonmetals to form molecular (covalent) compounds. Ionic compounds containing polyatomic ions have both ionic and covalent bonding.</p> <p>5.2i - When a bond is broken energy is absorbed. When a bond is formed, energy is released.</p> <p>5.2j - Electronegativity indicates how strongly an atom of an element attracts electrons in a chemical bond. Electronegativity values are assigned according to arbitrary scales.</p> <p>5.2k - The electronegativity differences between two bonded atoms is used to assess the degree of polarity in the bond.</p> <p>5.2l - Molecular polarity can be determined by the shape of the molecule and distribution of charge. Symmetrical (nonpolar) molecules include CO₂, CH₄, and diatomic elements. Asymmetrical (polar) molecules include HCl, NH₃, and H₂O.</p> <p>5.2m - Intermolecular forces created by the unequal distribution of charge result in varying degrees of attraction</p> | <ul style="list-style-type: none"> ● Real Molecules - See shape of various molecules & name of molecular and electron geometry <p>Build a Molecule (once the molecule is built, the name appears & atoms move to proper shape)</p> <ul style="list-style-type: none"> ● Single - Drag atoms up to build molecules ● Multiple - Drag atoms up to build multiples ● Playground - Drag atoms up to build a variety of molecules <p>Virtual PPTs:</p> <ul style="list-style-type: none"> ● Ionic Bonding - Forming ionic bonds, properties, naming ionic compounds ● Ionic Formulas - Charges on periodic table, writing and naming ionic compounds with examples ● Metallic Bonding - Properties of metals and metallic bonding ● Covalent Compounds - Prefixes, writing and naming binary covalent compounds with examples <p>CK12</p> <p>Soap – Simulation - Observe how soap removes stains; recognize relationship between polarity and ability to form a solution; real world connections</p> <p>Dripping Droplets – Simulation - Illustrate types of intermolecular forces and their relationship to surface tension; observe hydrogen bonds; real world connections</p> <p>PBS Learning Media</p> <p>Covalent Bonding - Interactive Tutorial - Covalent bonding</p> <p>Ionic bonding - Interactive Tutorial - Ionic bonding</p> <p>Molecular Shapes – Interactive Tutorial - Molecular shapes; VSEPR theory</p> <p>Water molecules – Simulation - Observe water molecules as temperature increases or decreases</p> | | |
|--|--|--|--|--|

BPS Science Department Chemistry – Unit 5

| | | | | | |
|--|--|---|---|--|--|
| | | <p>between molecules. Hydrogen bonding is an example of a strong intermolecular force.</p> <p>5.2n - Physical properties of substances can be explained in terms of chemical bonds and intermolecular forces. These properties include conductivity, malleability, solubility, hardness, melting point, and boiling point.</p> | <p><u>Gautam Desiraju: Follow Your Convictions*</u></p> <ul style="list-style-type: none">• Article: Professor Gautam Radhakrishna Desiraju, Indian Institute of Science, Bangalore, has played a major role in the development and growth of crystal engineering and the study of the structural aspects of the weak hydrogen bond. He is one of the most highly cited Indian chemists. <p>Z Space Activities (code) The Properties of Water (A145) Identify and explain the properties of water, determine how the properties of water impact life on Earth and the environment Teacher Resources pdf Student Resource pdf</p> | | |
|--|--|---|---|--|--|

Resources

<http://ngss.nsta.org/Classroom-Resources.aspx> - Searchable NYSSLS/NGSS aligned resources curated by NSTA

[Buffalo Public Schools Science Department Chemistry Webpage](#) – BPS chemistry curriculum resource hub

[BPS Science Department Recommended Virtual Labs](#) – Virtual lab resources with embedded links to virtual labs and student sheets. Must be logged into BPS google document account through BPS Gmail account to access.

[NYS Regents Chemistry Exams 2012-2020](#) NYSED's Office of State Assessment webpage for released Regents Chemistry Examinations

[NYS MST Science Learning Standards Physical Setting/Chemistry](#) – Current NYS Physical Setting/Chemistry Standards

[NYS P-12 Science Learning Standards \(HS\)](#) – NYSSLS High School Standards

[Regents Chemistry Reference Tables](#) – Reference Tables for Regents Chemistry

BPS Science Department Chemistry – Unit 5

| | | | | | |
|--|--|--|---|--|--|
| <p>ELL Enhancements To access hyperlinked material, you must be logged into your BPS Google Drive</p> | <p>Listening</p> <ul style="list-style-type: none"> ● <u>Cross- Linguistic Practices:</u> Gives students opportunities to make connections between what they hear and their home language (For example, allow students to listen to a passage and identify cognates.) ● <u>Build background knowledge</u> ● <u>Activating Prior Knowledge</u> Activating prior knowledge means both eliciting from students what they already know and building initial knowledge that they need in order to access upcoming content ● <u>Activating Prior Knowledge</u> ● <u>Visuals</u> - GIFs, pictures- will assist students in understanding what they are listening to. Use visual thinking strategies to set the lens for learning. ● Video to review or introduce a topic – use closed captioning to help students see the words and pronunciations while they listen to the content. ● <u>Word stretching / Vowel stretching</u> when instructing allows student to listen closely to the pronunciation of the word ● <u>Performance Level Descriptors</u> this document provides teachers with a description of what output they can expect from students based on earned NYSESLAT levels in the modality of listening Scroll for grades 9-12. | <p>Speaking</p> <ul style="list-style-type: none"> ● <u>Sentence Frames</u> - to begin a sentence - such as <i>Evolution is...</i> or <i>I think that evolution is...</i> ● <u>Academic Conversation Starters:</u> Have a visual of a list of academic sentence starters that students can refer to in a discussion. Examples include- I expect ____ to happen. My data shows that... This helps students have a more science focused dialogue. ● <u>Choral Reading</u> - To build fluency, self-confidence and motivation with reading/speaking ● Create movement to go with the word. Movement can be a motivating factor, as well as a kinesthetic tool for conceptualizing the rhythm and flow of fluent reading while triggering brain function for optimal learning ● <u>Performance Level Descriptors</u> This document provides teachers with a description of what output they can expect from students based on earned NYSESLAT levels in the modality of speaking. Scroll for grades 9-12 | <p>Reading</p> <ul style="list-style-type: none"> ● <u>Supplementary Text</u> to help reinforce concepts. If necessarily, use lower Lexile levels to ensure comprehension. ● <u>Visual Aids</u> - Pictures or models to support vocabulary words and concepts ● Video to review or introduce a topic - use closed captioning to help students read along while they listen to the content ● <u>4 Square / Frayer models</u> to help students gain a deeper understanding of vocabulary. ● <u>Highlighting</u> important text to assist students in answering questions after the reading. ● <u>Chunking</u>-Break reading of text into chunks or paragraphs ● <u>Vocabulary Morphology-</u> Morphology relates to the segmenting of words into affixes (prefixes and suffixes) and roots or base words, and the origins of words. Understanding that words connected by meaning can be connected by spelling can be critical to expanding a student’s vocabulary ● <u>Performance Level Descriptors</u> this document provides teachers with a description of what output they can expect from students based on earned NYSESLAT levels in the modality of reading. Scroll for grades 9-12. | <p>Writing</p> <ul style="list-style-type: none"> ● <u>Sentence Frames</u> - to begin a sentence- such as <i>Biodiversity is...</i> or <i>An example of competition is...</i> ● <u>Cloze passages</u> with word banks ● <u>Word banks</u> ● <u>Graphic Organizers</u> to help break down the writing process and organize thoughts ● <u>Standards-based sentence stems</u> ● <u>Performance Level Descriptors</u> this document provides teachers with a description of what output they can expect from students based on earned NYSESLAT levels in the modality of writing. Scroll for grades 9-12. | <p>Instructional Accommodations (depending on the student’s needs)</p> <ul style="list-style-type: none"> ● <u>Extended time</u> for tests in class, projects and assignments ● <u>Directions read.</u> Broken down as necessary ● <u>Model</u> how to complete the activity in the lesson ● <u>Oral simplification</u> of directions or questions ● <u>Translated version</u> of test when available. Student may have both version English and native language version ● Use of approved bilingual glossaries from NYS in each subject |
|--|--|--|---|--|--|

BPS Science Department Chemistry – Unit 5

| | | | |
|--|---|--|--|
| <p>Special Education Modifications</p> <p>Special Education students must have accommodations as per Individual Educational Plan (IEP)</p> | <p><u>Instructional</u></p> <ul style="list-style-type: none"> ● Pre-teach vocabulary ● Use picture vocabulary ● Scaffold Depth of Knowledge questions ● Provide copy of notes/notes in “cloze” form ● Use of Think, Pair, and Share strategy to help process information ● Scaffold written assignments with the use of graphic organizers ● Allow for multiple ways to respond (verbal, written, response board) ● Provide model of performance task ● Modify informational text to fit the needs of the students ● Provide a digital or paper interactive notebook ● Present complex tasks in multiple ways ● Provide mnemonic strategies for Chemistry concepts | <p><u>Technology:</u></p> <ul style="list-style-type: none"> ● Audio reading of text ● Text to type functions ● Videos to clarify/visualize Chemistry concepts ● Record class lecture/discussions and make accessible to student ● Nearpod- interactive presentations of notes ● Playposit - show a video clip about the topic and add your own questions for them to answer as they watch ● Allow students to type answers in chat on Teams <p><u>Other:</u></p> <ul style="list-style-type: none"> ● Arrange seating for maximum engagement and minimum distraction ● Accessible lab space (counter level) | <p><u>In Class Assessments</u></p> <ul style="list-style-type: none"> ● Provide review packet or review sheet of concepts covered on the test ● Practice similar questions prior to the test ● Provide multiple options for projects ● Give a timeline of when things are due and remind them of the process often. ● Use of timer in class ● Break all complex tasks into chunks |
| <p>Step Up to Writing</p> <p>Step Up to Writing materials can be found in BPS Science K-12 Schoology Folder 9-12 Resources Chemistry Resources Curriculum Materials</p> | <p><u>SUTW Strategy</u></p> <ul style="list-style-type: none"> ● Informal Outline ● Color-Coding – Informative/Explanatory Text ● Two-column notes ● I-V-F Topic Sentence progressing to Four Step Summary Paragraph ● CUPS – Capitalization, Usage, Punctuation, Spelling ● Transitions | | |
| <p>Culturally and Linguistically Responsive Teaching (CLRT) in the Science Classroom</p> | <p>Materials, resources, and/or discussions address diverse cultural backgrounds and real-world applications</p> <ul style="list-style-type: none"> ● Artifacts (posters, charts, etc.) in the science classroom are representative of the cultures of the student population ● All students are given an opportunity to engage in science discourse ● Teacher demonstrates high expectations for all students <p>CLRT resources which align to Science content are denoted with a *</p> | | |