**Westbrook School Department**

**Course Blueprint**

| **Content Area / Grade Level:** **Honors Physical Science / 9th** |
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| **Course Title**Honors Physical Science |
| **Course Description**This course will provide students with opportunities to demonstrate proficiency in the Next Generation Science Standards for matter, forces and energy through the 8 Scientific Engineering Practices. Standards in technology and engineering are reflected in this course as well, making this STEM course a very engaging, hands-on, first exposure to high school science. This will engage students in physical science in a way that will give them an excellent foundation for chemistry/lab and physics/lab later on in their high school career. |
| **Westbrook K-12 Learning Standards*** Developing and Using Models
* Using Mathematics and Computational Thinking
* Constructing Explanations and Designing Solutions
 | **Guiding Principles / Vision of the Graduate*** A creative and practical problem solver
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| **Expected Outcomes -** Expectations for students upon completion of the course.Students will be able to:* Describe motion and utilize components of motion to predict and apply to real-world situations.
* Diagram forces and utilize an understanding of forces to predict and apply to real-world situations.
* Identify examples of energy and utilize an understanding of energy to predict and apply to real-world situations.
* Apply models and computational thinking to solve problems of a physical nature.
* Draw and label Bohr atomic models
* Use the periodic table to predict atomic behavior *(ionic vs covalent bonding, formula units vs. molecules)*
* Be able to use indicators (physical and chemical properties) from a lab to determine if a physical or chemical change has occurred.
* Predict changes in a system using laws of conservation of matter, momentum, and energy, as well as Newton’s laws of motion
* Understand how matter can exist as a wave and particle and the electromagnetic spectrum
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| **Core Units of Study -** Each course has 4 - 6 Core Units of Study which are required and in which all targeted learning standards are embedded.* Mathematical modeling of Motion: a, v, d, and t
* Forces and Newton’s Laws
* Inertia, momentum and impulse
* Mechanical energy and work
* Matter: structure and chemical/physical properties
* Chemical reactions & the periodic table
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| **CORE UNIT # 1****Title:** Mathematical modeling of Motion: a, v, d, and t |
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| **Westbrook Learning Standards** * Developing and Using Models
* Using Mathematics and Computational Thinking
* *A creative and practical problem solver*
 |  **Content for this Unit:*** Variables
* Graphing and Visuals
* Motion
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| **Performance Indicators (Skills)**The students will be able to:* Develop models of motion
* Use computational thinking to solve problems to find speed given distance and time (and variations of this)
 | **Essential Questions*** What are some applications for modeling motion, and how can these help us to predict, describe, and create?
* How does the use of mathematical models of motion enable us to better describe motion?
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| **Common Assessment** * [Test - Using Visuals to Depict Motion](https://docs.google.com/document/d/1J3gTlB_R9qxKQoCp281jHHkdVA10gMDBe6FM02j6z8A/edit) [(Version 2)](https://docs.google.com/document/d/1RkE-gVbvp0vUb9rOk4G4A55FUWteKutYlbrLMjHyqkE/edit)
* [Water Balloon Lab (with data)](https://docs.google.com/document/d/1kzBE0AW1VN50hl-1hYCNPVcGPBuP9eqMo6DFQ0Hib40/edit)
* Wind Tunnel Project
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| **Instructional Suggestions / Resources** - * Use multiple types of visuals to show motion, especially position-time graphs.
* Have students enact the motion shown through visuals to involve kinesthetic learning.
* Find ways to describe motion in non-numerical ways as well as numerical models.
 | **Assessment (formative) Suggestions/Resources** * [Dropping Blocks Lab](https://docs.google.com/document/d/1v6mU-eQwGQ7as63tbJHmWq5N5cg3HSHd3NcCaCh1HKY/edit)
* [Stories of Motion from Visuals](https://docs.google.com/document/d/1tGDQdVPa1shaJoZ1l9SBdP-P2BP2sr1ZZUCDvhEyves/edit)
* Labs and classwork - Modeling Motion
* Computing Time, Distance, or Speed - Worksheets
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| **CORE UNIT # 2****Title:** Forces and Newton’s Laws |
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| **Westbrook Learning Standards** * Developing and Using Models
* Using Mathematics and Computational Thinking
* Constructing Explanations and Designing Solutions
* *A creative and practical problem solver*
 | **Content for this Unit:*** Free body diagrams
* Computational modeling/Net force
* Acceleration
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| **Performance Indicators (Skills)**The students will be able to:* Diagram forces
* Utilize an understanding of forces to predict and apply to real-world situations.
* Utilize computational thinking to solve for force given mass and acceleration (and variations of this)
* Demonstrate an understanding of acceleration, including the acceleration due to gravity
* Utilize engineering practices to solve a problem related to force and motion
 | **Essential Questions*** How is force involved in the motion and changes in motion of objects?
* How can concepts of force and acceleration be modeled and used to solve problems?
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| **Common Assessment** * [Egg Drop Project (Parachute)](https://docs.google.com/document/d/1AbXtxVDtLruzsCpyFacmDXWAH2u_d8Dx-E3PlNc9BJY/edit)
* Friction lab
* Test - Forces and Acceleration
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| * **Instructional Suggestions / Resources** -
* Utilize interactive programs such as PhET and Rocket Sled to help students model the effect of force on motion
* Videos to show the effects of gravity on falling objects, especially in fluid-free environments
 | **Assessment (formative) Suggestions/Resources** - * Cartoon forces
* Diagramming forces worksheets
* Parachute worksheet
* [Rocket Sled](https://docs.google.com/document/u/0/d/1cM1yhVimxhIePjx_hpXOOgUuZVaUlKGOiifvcpGhzRQ/edit)
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| **CORE UNIT # 3****Title:** Inertia, momentum and impulse |
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| **Westbrook Learning Standards** * Using Mathematics and Computational Thinking
* Constructing Explanations and Designing Solutions
* *A creative and practical problem solver*
 |  **Content for this Unit:*** Inertia
* Momentum
* Impulse
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| **Performance Indicators (Skills)**The students will be able to:* Utilize computational thinking to solve for impulse given time and acceleration (and variations of this) or momentum given velocity and mass
* Demonstrate an understanding of the role of mass in momentum
* Utilize engineering practices to solve a problem related to force and motion
 | **Essential Questions*** How are the concepts of inertia, momentum, and impulse linked to safety and technological advances in safety?
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| **Common Assessment** - * [Egg Drop Project (Impulse Egg Drop)](https://docs.google.com/document/u/0/d/1POgpfzfkYCDl60vq7ZedTfpdXT_TCJ7m7CMZW-Xo0wU/edit)
* Test - Inertia, Momentum, and Impulse
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| **Instructional Suggestions / Resources** - * Utilize videos of safety (especially from the automobile industry) to help students visualize how the concepts are embedded in real world situations
* Find ways to explore these concepts in non-numerical ways as well as numerical models.
 | **Assessment (formative) Suggestions/Resources** - * [Inertia Activities](https://docs.google.com/document/u/0/d/1CRzn2HeuDYv9NDS7wAfR0yomNg-cZ0LAqANLmhi7a4c/edit)
* Lab - Relationship between Mass and Momentum
* Lab - Relationship between Velocity and Momentum
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| **CORE UNIT # 4****Title:** Mechanical energy and work |
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| **Westbrook Learning Standards** * Using Mathematics and Computational Thinking
* Constructing Explanations and Designing Solutions
* *A creative and practical problem solver*
 |  **Content for this Unit:*** Kinetic and Potential Energy
* Conservation of Energy
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| **Performance Indicators (Skills)**The students will be able to:* Utilize computational thinking to solve for amount of energy given variables such as velocity, mass, and/or height (and variations of this)
* Demonstrate an understanding of how energy is transferred yet conserved as an object moves
 | **Essential Questions**How does an understanding of the conservation of energy help us describe, analyze, and predict the interactions between objects? |
| **Common Assessment** -Test - Conservation of Energy[Energy of a Catapult](https://docs.google.com/document/u/0/d/198-AuN4yGJA0GvYC4gf6vdXhrEQM3FufPnh7TvMuV5o/edit) |
| **Instructional Suggestions / Resources** - * Utilize labs that involve kinesthetics, such as investigating the energy of human movement (climbing stairs, jumping, etc.)
* Provide visuals when possible. Students can draw diagrams to show transfers of energy.
* There are good interactives online, such as pHet (skate park).
 | **Assessment (formative) Suggestions/Resources** - * Lab - Energy of a Rolling Ball
* [Energy Skate Park (interactive)](https://docs.google.com/document/u/0/d/1zd1NAuTz5CmSEGVZjDWOuJ9irDtL0ry0OwiNnzAtvAc/edit)
* [Investigation - Energy of a Spring Toy](https://docs.google.com/document/u/0/d/1tnvF7m6pHfSbmFGExw1ncRM-oV8DJYseYBBIYM5Cp-g/edit)
* [Pendulum Demo](https://docs.google.com/document/u/0/d/19npCeofByVfVCwOd9GjsN88faTQw33iot-UQdWqx_xE/edit)
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| **CORE UNIT # 5****Title:** Matter: structure and chemical/physical properties |
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| **Westbrook Learning Standards** * Developing and Using Models
* *A creative and practical problem solver*
 |  **Content for this Unit:*** Classification and Properties of Matter
* Atomic Structure
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| **Performance Indicators (Skills)**The students will be able to:* Develop models to depict atomic structure
* Differentiate between different ways of classifying matter, recognizing that the atomic makeup and behavior is the key to this differentiation
 | **Essential Questions*** What does the classification of matter tell us about the substances that make up the world around us?
* What are some applications for atomic modeling, and how can these help us to predict atomic behavior?
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| **Common Assessment** * Test - Matter and Atomic Structure
* [Lab - Separation of a Mixture](https://docs.google.com/document/u/0/d/1PIQZHMcr-SD-38nSgRMtzghOpPT8JNyIcoknIxe2npI/edit)
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| **Instructional Suggestions / Resources** - * Use models such as Bohr Models and Lewis Dot structures, as well as three-dimensional modeling kits, to help students visualize the atom.
* Interactives such as pHet are useful for modeling.
* Get hands-on with as many materials as possible. Have students investigate through measurement labs
 | **Assessment (formative) Suggestions/Resources** * Various measurement labs
* Build an Atom interactive
* Lab - Graphing Mass vs. Volume
* Visualizing Elements, Compounds, and Mixtures
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| **CORE UNIT # 6****Title:** Chemical reactions & the periodic table |
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| **Westbrook Learning Standards** * Developing and Using Models
* Using Mathematics and Computational Thinking
* *A creative and practical problem solver*
 |  **Content for this Unit:*** Periodic Table and Trends
* Chemical Bonding
* Chemical Reactions
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| **Performance Indicators (Skills)**The students will be able to:* Develop models to predict atomic behavior
* Use computational thinking to predict bonding tendencies for given elements
* Utilize the trends seen in the Periodic Table of the Elements to predict atomic behavior
 | **Essential Questions*** How and why do elements react to one another?
* How can patterns seen in chemistry help us describe and use basic tendencies of substances to our advantage?
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| **Common Assessment** * [Test - Periodic Trends and Chemical Reactions](https://docs.google.com/document/d/1wuPieXPZARTyRTpGXizMYcXdzlFA21_3PiY0U8DWVaw/edit)
* [Lab - Chemical Reactions (Hydrolysis)](https://docs.google.com/document/d/18JY9WUx-XEeRTljkSDDXAYa_efYXW6AUaPCOpjnVVEI/edit)
* [Element Narrative Poster](https://docs.google.com/document/d/11hHiXoUq0ZxZLsH8xvc6FSb-VAqWc4-e4vmq0uz7pj8/edit)
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| **Instructional Suggestions / Resources** - * Use multiple types of visuals to show bonding and periodic trends, including interactives
* Get hands-on with low-risk chemical reactions
* Work on the concepts of patterns, starting with simple patterns and building to more complex
* Utilize three-dimensional models
 | **Assessment (formative) Suggestions/Resources** * [Milk Lab](https://docs.google.com/document/d/17bpZ5ZCjZCiOJbr1zVCV6w1ofkthzX7a9LPofdTsLzU/edit)
* [Elephant Toothpaste](https://docs.google.com/document/u/0/d/1gk5OmV2bWsM91SCsOMSwkJnyoxq_Fw6hJYmZraa9Wss/edit)
* Visualizing Physical and Chemical Changes
* Bonding worksheets
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