**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 |
| **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 | |

| **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 |
| **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? |
| **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 | |
| **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 |

| **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 |
| **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? |
| **Common Assessment**   * [Egg Drop Project (Parachute)](https://docs.google.com/document/d/1AbXtxVDtLruzsCpyFacmDXWAH2u_d8Dx-E3PlNc9BJY/edit) * Friction lab * Test - Forces and Acceleration | |
| * **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) |

| **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 |
| **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? |
| **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 | |
| **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 |

| **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 |
| **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) |

| **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 |
| **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? |
| **Common Assessment**   * Test - Matter and Atomic Structure * [Lab - Separation of a Mixture](https://docs.google.com/document/u/0/d/1PIQZHMcr-SD-38nSgRMtzghOpPT8JNyIcoknIxe2npI/edit) | |
| **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 |

| **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 |
| **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? |
| **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) | |
| **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 |