MEDFORD HIGH SCHOOL  
COURSE SYLLABUS

<table>
<thead>
<tr>
<th>Department:</th>
<th>Science</th>
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<tbody>
<tr>
<td>Course Title:</td>
<td>Introductory Physics</td>
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<tr>
<td>Level and/or Grade:</td>
<td>College Prep; Grade 9</td>
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<tr>
<td>Prerequisite:</td>
<td>Passing grade in grade 8 Mathematics; Grade 8 Integrated Science</td>
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**Course Description:**

The Introductory Physics course helps students recognize the nature and scope of physics and its relationship to the other sciences. Students will learn about basic topics such as motion, forces, energy, momentum, heat and heat transfer, waves, electricity, and magnetism. Students will be engaged in scientific inquiry, investigations, and labs so that they develop a conceptual understanding and basic scientific skills. Students are expected to apply a variety of science and engineering practices to three core ideas of physics:

- **Motion and stability: forces and interactions**
- **Energy**
- **Waves and their applications in technologies for information transfer**

Across the set of high school introductory physics standards, particular emphasis is placed on science and engineering practices of developing and using models, analyzing and interpreting data, using mathematics, and engaging in argument from evidence.

Students are expected to use mathematical and graphical representations and models to quantitatively and qualitatively describe, evaluate, and make predictions of a variety of phenomena such as motion, energy, and waves. The mathematics prerequisite skills are based on middle school mathematics topics such as data analysis, measurement, scientific notation, ratio and proportion, and algebraic expressions.

**Learning Standards:** Through inquiry, experimentation, labs, use of tools, discussion, presentation, and composition, students will be able to.....

<table>
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<th>Motion and stability - forces and interactions:</th>
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<td><strong>Analyze data to support the claim that Newton’s second law of motion is a mathematical model describing change in motion (the acceleration) of objects when acted on by a net force.</strong></td>
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<tr>
<td><strong>Use mathematical representations to show that the total momentum of a system of interacting objects is conserved when there is no net force on the system.</strong></td>
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<tr>
<td><strong>Apply scientific principles of motion and momentum to design, evaluate, and refine a device that minimizes the force on a macroscopic object during a collision.</strong></td>
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<tr>
<td><strong>Use mathematical representations of Newton’s law of gravitation and Coulomb’s law to both qualitatively and quantitatively describe and predict the effects of gravitational and electrostatic forces between objects.</strong></td>
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<tr>
<td><strong>Provide evidence that an electric current can produce a magnetic field and that a changing magnetic</strong></td>
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field can produce an electric current.

- Evaluate simple series and parallel circuits to predict changes to voltage, current, or resistance when simple changes are made to a circuit.
- Use free-body force diagrams, algebraic expressions, and Newton’s laws of motion to predict changes to velocity and acceleration for an object moving in one dimension in various situations.

**Energy:**

- Use algebraic expressions and the principle of energy conservation to calculate the change in energy of one component of a system when the change in energy of the other component(s) of the system, as well as the total energy of the system including any energy entering or leaving the system, is known. Identify any transformations from one form of energy to another, including thermal, kinetic, gravitational, magnetic, or electrical energy, in the system.
- Develop and use a model to illustrate that energy at the macroscopic scale can be accounted for as either motions of particles and objects or energy stored in fields.
- Design and evaluate a device that works within given constraints to convert one form of energy into another form of energy.*
- Provide evidence that when two objects of different temperature are in thermal contact within a closed system, the transfer of thermal energy from higher-temperature objects to lower-temperature objects results in thermal equilibrium, or a more uniform energy distribution among the objects and that temperature changes necessary to achieve thermal equilibrium depend on the specific heat values of the two substances.
- Develop and use a model of magnetic or electric fields to illustrate the forces and changes in energy between two magnetically or electrically charged objects changing relative position in a magnetic or electric field, respectively.

**Waves and Their Applications in Technologies for Information Transfer:**

- Use mathematical representations to support a claim regarding relationships among the frequency, wavelength, and speed of waves traveling within various media. Recognize that electromagnetic waves can travel through empty space (without a medium) as compared to mechanical waves that require a medium.
- Evaluate the claims, evidence, and reasoning behind the idea that electromagnetic radiation can be described by either a wave model or a particle model, and that for some situations involving resonance, interference, diffraction, refraction, or the photoelectric effect, one model is more useful than the other.
- Communicate technical information about how some technological devices use the principles of wave behavior and wave interactions with matter to transmit and capture information and energy.*

**Matter and Its Interactions**

- Develop a model to illustrate the energy released or absorbed during the processes of fission, fusion, and radioactive decay.

**Standards for Literacy in History/Social Studies, Science, and Technical Subjects:**

**Key Ideas and Details**

1. Read closely to determine what the text says explicitly and to make logical inferences from it.

**Craft and Structure**

2. Interpret words and phrases as they are used in a text, including determining technical, connotative, and figurative meanings.
Integration of Knowledge and Ideas
3. Integrate and evaluate content presented in diverse formats and media, including visually and quantitatively, as well as in words.

Range of Reading and Level of Text Complexity
4. Read and comprehend informational texts independently and proficiently.

Standards for Writing in History/Social Studies, Science, and Technical Subject:

Text Types and Purposes
1. Write arguments to support claims in an analysis of substantive topics or texts using valid reasoning and relevant and sufficient evidence.
2. Write informative/explanatory texts to examine and convey complex ideas and information clearly and accurately through the effective selection, organization, and analysis of content.

Production and Distribution of Writing
3. Produce clear and coherent writing in which the development organization and style are appropriate to task, purpose, and audience.
4. Develop and strengthen writing as needed by planning, revising, editing, rewriting, and trying a new approach.
5. Use technology to produce and publish writing and to interact and collaborate with others.

Research to Build and Present Knowledge
6. Conduct short as well as more sustained research projects based on focused questions, demonstrating understanding of the subject under investigation.
7. Gather relevant information from multiple print and digital sources, assess the credibility and accuracy of each source, and integrate the information while avoiding plagiarism.
8. Draw evidence from literary and informational texts to support analysis, reflection, and research.

Course Alignment with 21st Century Learning Expectations:

Students will…
- Become self-directed learners.
- Communicate effectively.
- Apply problem-solving skills and critical and creative thinking.
- Use technology appropriately as a tool for learning, collaboration, presentation, research, and design.
- Act with integrity, respect and responsibility toward themselves, others and the environment.
- Exhibit flexibility and adaptability.
- Collaborate in diverse groups to share knowledge, build consensus, and achieve goals.
- Practice leadership in and service to their community.
- Become contributing citizens in a global society.

Assessment:
- See grading policy attached.