

**MEDFORD HIGH SCHOOL
COURSE SYLLABUS**

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| Department: | Science |
| Course Title: | Introductory Physics |
| Level and/or Grade: | Standard; Grade 9 |
| Prerequisite: | Passing grade in grade 8 Mathematics; Grade 8 Integrated Science |

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.

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.....*

Motion and Forces:

- Distinguish between vector quantities and scalar quantities; represent vectors in diagrams and graphically.
- Distinguish between, and solve problems involving velocity, speed, and constant acceleration.
- Solve problems involving displacement and distance.
- Create, interpret, and solve problems involving graphs of motion; describe relationships among time, distance, and speed.
- Understand, interpret, and apply Newton's three Laws of Motion: Inertia; Force and Acceleration; Action and Reaction.
- Use a free body force diagram with only co-linear forces to show forces acting on an object, and determine the net force on it.
- Quantitatively distinguish between static and kinetic friction, what they depend on and their effects on the motion of objects.
- Describe and locate the center of gravity; describe the center of mass.
- Understand conceptually Newton's Law of Universal Gravitation.
- Distinguish between rotate and revolve; describe rotational speed; give examples of centripetal and centrifugal forces.

Conservation of Energy and Momentum:

- Define work, power, mechanical energy, potential energy, and kinetic energy; understand, interpret, and provide examples for the law of conservation of energy.
- Provide examples of how energy can be transformed from kinetic to potential and vice versa.

- Apply quantitatively the law of conservation of mechanical energy to simple systems.
- Describe the relationship among energy, work, and power both conceptually and quantitatively.
- Define and calculate momentum; understand, interpret, and provide examples that illustrate the law of conservation of momentum.

Heat and Heat Transfer:

- Explain conduction and its effects; distinguish between conduction and convection; explain how heat is transferred by radiation.
- Explain how heat energy will move from a higher temperature to a lower temperature until equilibrium is reached.
- Describe solid, liquid, gaseous, and plasma stages of matter; explain what happens during a phase change.
- Explain why evaporation is a cooling process and why condensation is a warming process.
- Explain the relationship among temperature change in a substance for a given amount of heat transferred, the amount (mass) of the substance, and the specific heat of the substance.

Waves:

- Describe the properties and characteristics of waves; describe wave motion.
- Distinguish between mechanical and electromagnetic waves.
- Distinguish between transverse waves and longitudinal waves.
- Describe the basic principles of reflection and refraction of waves.
- Describe factors that affect the speed of a wave; explain the relationship between the speed of a wave and the medium it travels through.
- Describe the Doppler effect for sound.

Electromagnetism:

- Recognize the characteristics of static charge, and explain how a static charge is generated.
- Develop a qualitative and quantitative understanding of current, voltage, resistance, and the connection between them
- Analyze circuits using Kirchoff's and Ohm's Laws.
- Interpret and apply Coulomb's Law
- Explain how electric current is a flow of charge caused by a potential difference (voltage) and how power is equal to current multiplied by voltage.
- Explain the difference in concept between electric forces and electric fields.
- Recognize that moving electric charges produce magnetic forces and moving magnets produce electric forces. Recognize that the interplay of electric and magnetic forces is the basis for electric motors, generators, and other technologies.

Electromagnetic Radiation:

- Recognize that electromagnetic waves are transverse waves and travel at the speed of light through a vacuum.
- Describe the electromagnetic spectrum for wavelength and energy; be able to identify specific regions such as visible light; recognize ways in which direction of visible light can be changed.
- Explain how the various wavelengths in the electromagnetic spectrum have many useful applications such as radio, TV, microwaves, and cellular phones.
- Calculate the frequency and energy of an electromagnetic wave from the wavelength.

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; cite specific textual evidence when writing or speaking to support conclusions drawn from text.
2. Determine central ideas or themes of a text and analyze their development; summarize the key supporting details and ideas.
3. Analyze how and why individuals, events, or ideas develop and interact over the course of a text.

Craft and Structure

4. Interpret words and phrases as they are used in a text, including determining technical, connotative, and figurative meanings, and analyze how specific word choices shape meaning or tone.
5. Analyze the structure of texts, including how specific sentences, paragraphs, and larger portions of the text (e.g., a section, chapter, scene, or stanza) relate to each other and the whole.
6. Assess how point of view or purpose shapes the content and style of a text.

Integration of Knowledge and Ideas

7. Integrate and evaluate content presented in diverse formats and media, including visually and quantitatively, as well as in words.
8. Delineate and evaluate the argument and specific claims in a text, including the validity of the reasoning as well as the relevance and sufficiency of the evidence.
9. Analyze how two or more texts address similar themes or topics in order to build knowledge or to compare the approaches the authors take.

Range of Reading and Level of Text Complexity

10. Read and comprehend complex literary and 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.
3. Write narratives to develop real or imagined experiences or events using effective technique, well-chosen details and well-structured event sequences.

Production and Distribution of Writing

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

Research to Build and Present Knowledge

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

Range of Writing

10. Write routinely over extended time frames (time for research, reflection, and revision) and

shorter time frames (a single sitting or a day or two) for a range of tasks, purposes, and audiences.

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.