

**MEDFORD HIGH SCHOOL  
COURSE SYLLABUS**

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| <b>Department:</b>         | Science  |
| <b>Course Title:</b>       | Introductory Physics   |
| <b>Level and/or Grade:</b> | Standard; Grade 9  |
| <b>Prerequisite:</b>       | 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.

***Course Alignment with High School Expectations for Student Learning:***

Students will...

1. Analyze, interpret, evaluate and use logical reasoning to solve problems using a variety of resources and strategies.
  - Make observations, raise questions, and formulate hypotheses.
  - Read, interpret, and examine the credibility and validity of scientific claims in different sources of information.
  - Design and conduct scientific investigations - identify purpose, select appropriate tools and conditions; identify variables; write clear procedures; measure accurately and collect data in organized ways; follow safety guidelines.
  - Analyze and interpret results of scientific investigations.
2. Communicate effectively to a variety of audiences.
  - Communicate orally and in writing, and apply the results of scientific investigations.
  - Explain diagrams and charts and prepare lab reports,
  - Use language and vocabulary appropriately, speak clearly, and use appropriate technology.
3. Create works using a variety of communication forms.
  - Present arguments through writing; solve problems through projects, homework, tests, and lab experiences; use technology; make oral presentations.
4. Develop skills and knowledge to reach personal and career goals.
  - Develop 'habits of mind': work beyond center of competence; gain attitude of persistence; seek feedback; develop confidence.
  - Become familiar with careers related to science.
5. Work cooperatively to achieve objectives.
  - Work in pairs, small groups, and part of the whole class to solve problems.
  - Analyze and evaluate the mathematical thinking and strategies of others.

***Assessment:***

- See grading policy attached.