Curriculum Guide

Course 542: Enriched Physics **Level:** Grades 11 & 12

1. Course Structure

This full-year course meets daily. There are no supplementary laboratory periods because investigations are incorporated into regular class periods.

2. Intended Audience

Enriched Physics is an elective course intended for junior/senior students who have completed two years of CPI or II level math or its equivalent, or have obtained teacher recommendation and completed the departmental math evaluation.

3. Course Goals

Students in this course will develop the following: a solid understanding of many of the physical principles which govern our world, a proficiency in solving the mathematical problems which model the aforementioned physical principles, and the skills necessary to effectively collect and analyze laboratory data to form meaningful conclusions.

4. Course Objectives

Content:

I. The Tools of Physics
II. Kinematics
III. Dynamics
IV. Work and Energy
V. Momentum
VI. Circular Motion and Gravity
VII. Simple Harmonic Motion and Waves
VIII. Sound

Skills:

- Students will demonstrate habits of mind characteristic of physicists, including the constant questioning of how and why things happen in the physical world around them.
- Students will demonstrate an ability to solve physics problems in an ordered, logical fashion using a learned problem solving strategy.
- Students will become proficient in observing, recording, analyzing, and effectively reporting data collected in the laboratory.
- Students will be able to design and conduct meaningful investigations; they will recognize inherent limitations in experimentation, and they will design

procedures that minimize sources of error.
- Students will demonstrate an ability to relate everyday experiences to the laws of physics. For example, students will be able to use Newton's three laws of motion to explain why seatbelts and airbags are necessary safety features in automobiles.

5. Essential Questions

I. The Tools of Physics
- What is the "language" through which physicists communicate?
- How are physical quantities reported and manipulated?

II. Kinematics
- What mathematical models are used to describe the motion of objects?
- How can graphical models be used to better describe motion?
- What concepts are involved in accelerated motion?

III. Dynamics
- What are the causes of motion?
- What are Newton's three laws and how do you apply them?

IV. Work and Energy
- How are work and energy related?
- What is momentum and how do you cause a change in momentum?
- What physical concepts explain collisions and explosions?

V. Circular Motion and Gravity
- What causes things to move along a curvilinear path?
- How does circular motion differ from linear motion?
- What is Gravity?

VI. Momentum
- What is momentum and how do you cause a change in momentum?
- What physical concepts explain collisions and explosions?

VII. Simple Harmonic Motion and Waves
- What factors affect the motion of pendulums and springs?
- How are waves described and how do they behave?

VIII. Sound
- What determines the speed of sound?
- How is the loudness of sound measured?
- How does motion affect the frequency of sound?

6. Course Outline/ Curriculum Map

Quarter 1

I. The Tools of Physics
- Scientific Notation
- Significant Figures
- Accuracy and Precision
- Graphing

II. Kinematics
- One-Dimensional Linear Motion
  - Horizontal
  - Vertical
  - Graphical Model of Motion
- Vector Analysis
  - Graphical Method
  - Component Method
- Projectile Motion
  - Projectiles Launched Horizontally
  - Projectiles Launched at an Angle (symmetrical only)

Quarter 2

III. Dynamics
- Newton's Laws as an Explanation of Motion
  - The Law of Inertia
  - F = ma
  - Action-Reaction
- Solving Force and Motion Problems (with and without friction)
  - Horizontal Motion
  - Vertical Motion
  - Inclined Plane Motion

IV. Work and Energy
- Work
- Energy
  - Potential Energy (Gravitational and Elastic)
  - Kinetic Energy
- Work-Energy Theorem
- Conservation of Mechanical energy

Quarter 3

V. Momentum
- Momentum in two dimensions
- Impulse
- Impulse-Momentum Theorem

- Conservation of Momentum
  - Collisions
  - Explosions

VI. Circular Motion
- Centripetal Force
- Circular Motion on the Surface of the Earth
  - Horizontal Circles
  - Vertical Circles
- Universal Gravitation and Satellite Motion
- Kepler's Laws of Planetary Motion

Quarter 4

VII. Simple Harmonic Motion and Waves
- Simple Harmonic Motion
  - The Motion of Springs
  - The Motion of Pendulums
- Wave Motion
  - Wave Characteristics (Amplitude, Wavelength, Velocity, and Frequency)
  - The Wave Equation
  - Wave Behaviors (Reflection, Refraction, Interference, and Diffraction)

VIII. Sound
- Speed of Sound
- Intensity
- Intensity Level or Relative Intensity(decibel scale)
- Doppler Effect
- Beats

7. Course Text and Other Materials

The text for this course is:
- Cutnell and Johnson: **Physics Sixth Edition (**2004)

8. Instructional Methods and Course Activities

Content will be conveyed through:
- Class dialogue and discussion
- Interactive lecture demonstrations
- Instructor-designed laboratory investigations
- Student-designed laboratory investigations

9. Learning Strategies

- Class discussion and problem-solving, accompanied by laboratory experiences, are designed to illustrate and reinforce physical principles learned in class.
- Computer-assisted instruction (interactive lecture demonstrations, microcomputer based laboratories) will be used to increase learning and to support a variety of learning styles.
- The development and effective use of a problem solving strategy will also be used.

10. Assessment

The assessment of students will occur through:

- Evaluation of class preparation and participation
- Laboratory performance including observations, analysis, and reporting of data
- Formal testing and quizzing

11. Course Evaluation

The assessment of this course will occur through:

- Feedback from current students and graduates
- A formal student questionnaire