Ledyard Public Schools
Science Curriculum

Physics

Level-2

1442

Motion and Force

Suggested Time – Approximately 45 class periods (about 1/2 the course)

Essential Questions

1. What is the nature of motion?
2. How can the motion of most objects be characterized?
3. How do the laws of conservation of energy and momentum describe the motion of objects?

Focus Questions

1. What is the nature of linear motion?
   Learning Objectives - The Student will be able to:
   a. differentiate motion between distance and displacement, speed and velocity
   b. analyze acceleration as rate of change in velocity
   c. analyze graphical data to describe instantaneous velocity
   d. describe the motion of and calculate displacement, velocity and time of a freely falling body.

2. How can vectors describe the motion of projectile motion?
   Learning Objectives - The Student will be able to:
   a. distinguish between a vector and a scalar.
   b. resolve vectors using the Pythagorean theorem, the law of cosines and the law of sines.
   c. measure and calculate range, instantaneous velocity and the maximum height of projectiles.
   d. describe and calculate motion in terms of frame of reference.

3. How do Newton's Laws predict the motion of objects?
   Learning Objectives - The Student will be able to:
   a. describe how objects change their motion only when a net force is applied (1st Law)
   b. interpret and construct free body diagrams.
   c. describe, measure and calculate the relationship of force, mass and acceleration. (2nd Law)
   c. analyze and describe forces as interactions between bodies (3rd Law)

4. How are work and energy related?
   Learning Objectives - The Student will be able to:
   a. analyze and measure energy of motion and kinetic energy
   b. measure and calculate the kinetic energy of an object
   c. distinguish between kinetic and potential energy
   d. describe the scientific concept of work
   e. describe how energy is conserved in mechanical energy systems

5. How is momentum conserved in a collision?
   Learning Objectives - The Student will be able to:
   a. compare the momentum of moving objects.
   b. compare and contrast impulse and momentum
   c. analyze interactions between objects and describe how momentum is conserved
   d. assess real world applications of impulse and momentum including but not limited to sports and transportation.

6. How is rotational motion related to linear motion?
   Learning Objectives - The Student will be able to:
   a. describe the characteristics of angular displacement
   b. describe tangential and centripetal acceleration.
   c. describe the force that maintains circular motion.

Assessments

Science assessment includes: tests, which assess content knowledge and application, skill acquisition and application of knowledge at all levels of critical thinking; quizzes; formal laboratory assessments as full lab reports, parts of lab reports or quiz type lab assessments; a variety of written, oral and visual presentations; as well as a variety of other individual and group work assessments. All tests must include free response questions (or constructed response) as well as appropriate content and/or skill assessment and, except where inappropriate, must be balanced in terms of the critical thinking skills expected of students. Laboratory reports (or parts) will follow the Ledyard High School standard Laboratory format. Other Laboratory assessments should reflect CAPT Style multiple choice and / or open-ended questions.

Required Activities

The following **types** of activities are required. Titles in parentheses are suggested and procedures for these activities are available in the appendix. See the Conceptual Physics Laboratory Manual for recommended laboratory activities that will satisfy these requirements.

A One-dimensional motion/position/Acceleration laboratory activity
A Vector/Force laboratory activity
A uniformly accelerated motion laboratory activity
A force and acceleration laboratory activity
A mass and acceleration laboratory activity
A Friction laboratory activity
An Oscillation/harmonic motion laboratory activity
A Rotational Motion/Centripetal force laboratory activity
A Free Fall laboratory activity or interactive demonstration
A Projectile motion laboratory activity or interactive demonstration
A Conservation of Linear Momentum laboratory activity or interactive demonstration

****(Meets Ledyard Academic Expectation for Problem Solving)

Media Resources

Student: **Conceptual Physics,** Hewit, Paul G., Prentice Hall, 2002

Teacher: **Conceptual Physics,** Hewit, Paul G., Prentice Hall, 2002
Ancillary resources accompanying the text.

Curriculum Alignment with State of Connecticut Science Standards

All areas address State Standards for Scientific Inquiry, Literacy and Numeracy

Focus Questions	Content Standard	Supportive Concepts
1. Motion	P1	1, 2,
2. Vectors	P1	4
3. Newton's Laws	P1	3, 6
4. Work & Energy	P1, P3	2, 14
5. Momentum Conservation	P2	7, 8, 9, 10, 11, 12
6. Rotational Motion	P1	5

Electricity and Magnetism

Suggested Time - Approximately 22 class periods (about 1/4 of the course)

Essential Questions

How are electric and magnetic phenomena characterized and measured?

Focus Questions

1. What is the nature of electric force and fields?
   Learning Objectives - The Student will be able to:
   a. analyze the properties of electric charges.
   b. assess the inverse square law relationship among force, charge and distance in Coulomb's law.
   c. analyze the nature of electrical charges and the conservation of electric charge
   d. represent electric fields in diagrams
   e. analyze the relationship between moving electric charges and magnetic fields.
   f. describe the applications of electrostatics

2. What affects current in circuits?
   Learning Objectives - The Student will be able to:
   a. relate capacitance to the storage of electrical potential energy.
   b. analyze and measure the relationship among current, voltage and resistance in series and parallel circuits.
   c. analyze and measure the relationship among potential difference, current and resistance in a direct current circuit.
   d. draw, construct and analyze DC circuits.
   e. analyze and measure the nature of power in an electric circuit
   f. use Kirchhoff's rules to assist in understanding the transfer of energy through electric circuits

4. What is the nature of magnetism?
   Learning Objectives - The Student will be able to:
   a. represent magnetic fields in diagrams.
   b. Explain how a compass works
   c. discuss some of the similarities that exist between electricity and magnetism.
   d. describe the orientation of the earth's magnetic field
   e. describe the magnetic field produced by current
   f. determine the direction of the force and the strength of a magnetic field

Assessments

Science assessment includes: tests, which assess content knowledge and application, skill acquisition and application of knowledge at all levels of critical thinking; quizzes; formal laboratory assessments as full lab reports, parts of lab reports or quiz type lab assessments; a variety of written, oral and visual presentations; as well as a variety of other individual and group work assessments. All tests must include free response questions (or constructed response) as well as appropriate content and/or skill assessment and, except where inappropriate, must be balanced in terms of the critical thinking skills expected of students. Laboratory reports (or parts) will follow the Ledyard High School standard Laboratory format. Other Laboratory assessments should reflect CAPT Style multiple choice and / or open-ended questions.

Required Activities

The following **types** of activities are required. Titles in parentheses are suggested and procedures for these activities are available in the appendix. See the Conceptual Physics Laboratory Manual for recommnded laboratory activities that will satisfy these requirements. Use of the CASTLE electricity program is recommended.

A Magnetism measurement laboratory activity
An Electrostatics Laboratory activity
An electric field Laboratory activity
An Ohm's Law laboratory activity
A Capacitance Laboratory activity
A DC Circuits Laboratory activity
A Resistors(resistance) Parallel and Series circuit Laboratory activity
An electromagnetic induction laboratory activity

****(Meets Ledyard Academic Expectation for Problem Solving)

Media Resources

Student: **Conceptual Physics,** Hewit, Paul G., Prentice Hall, 2002

Teacher: **Conceptual Physics,** Hewit, Paul G., Prentice Hall, 2002
Ancillary resources accompanying the text.

Curriculum Alignment with State of Connecticut Science Standards

All areas address State Standards for Scientific Inquiry, Literacy and Numeracy

Focus Questions	Content Standard	Supportive Concepts
1. Electric Force & Fields	P5, 9.2	24, 27, 30
2. Current in Circuits	P5, 9.2	25, 26, D4, D5
3. Magnetism	P5, 9.2	28, D6
4. Induced Current	P5, 9.2	29

Sound and Light

Suggested Time – Approximately 23 class periods (about 1/4 of the course)

Essential Questions

1. How is sound and light based on wave behavior?
2. What is the nature, characteristics and behavior of electromagnetic radiation?

Focus Questions

1. What is the nature and characteristics of waves?
   Learning Objectives - The Student will be able to:
   a. describe the relationship among the characteristics of waves: wavelength, frequency, period and amplitude.
   b. describe the behavior of waves in various media
   c. analyze the behavior of waves at boundaries between media: reflection and refraction.
   d. analyze the diffraction of waves
   e. analyze the relationship between interference and superposition
   f. analyze the frequency and wavelength of sound produced by a moving source

2. How does light behave when passing through or reflection off media?
   Learning Objectives - The Student will be able to:
   a. analyze and describe the characteristics of visible light
   b. describe the nature and the measurement of the speed of light
   c. describe, diagram and measure the reflection of light by flat and curved mirrors
   d. describe, diagram and measure the refraction of light by flat and curved lenses
   e. Apply Snell's law to the refraction of light
   f. describe the situations in which total internal reflection would occur
   g. describe the nature of the polarization of light.
   h. describe the diffraction pattern produced by a single slit.
   i. describe and diagram the interference pattern produced by Young's experiment

3. What is the range and nature of electromagnetic radiation regions?
   Learning Objectives - The Student will be able to:
   a. analyze and describe the characteristics of the electromagnetic spectrum
   b. describe the nature of electromagnetic waves
   c. measure, analyze and describe the visible spectrum
   d. describe regions on both sides of the electromagnetic spectrum in terms of frequency, wavelength and energy possessed.

Assessments

Science assessment includes: tests, which assess content knowledge and application, skill acquisition and application of knowledge at all levels of critical thinking; quizzes; formal laboratory assessments as full lab reports, parts of lab reports or quiz type lab assessments; a variety of written, oral and visual presentations; as well as a variety of other individual and group work assessments. All tests must include free response questions (or constructed response) as well as appropriate content and/or skill assessment and, except where inappropriate, must be balanced in terms of the critical thinking skills expected of students. Laboratory reports (or parts) will follow the Ledyard High School standard Laboratory format. Other Laboratory assessments should reflect CAPT Style multiple choice and / or open-ended questions.

Required Activities

The following **types** of laboratory activities are required. Titles in parentheses are suggested and procedures for these activities are available in the appendix. See the Conceptual Physics Laboratory Manual for recommnded laboratory activities that will satisfy these requirements.

A wave properties laboratory activity (including the coil spring and the ripple tank)
A reflection laboratory activity
A refraction laboratory activity
A concave and/or convex mirror laboratory activity
A concave and/or convex lens laboratory activity

****(Meets Ledyard Academic Expectation for Problem Solving)

Media Resources

Student: **Conceptual Physics,** Hewit, Paul G., Prentice Hall, 2002

Teacher: **Conceptual Physics,** Hewit, Paul G., Prentice Hall, 2002
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Curriculum Alignment with State of Connecticut Science Standards

All areas address State Standards for Scientific Inquiry, Literacy and Numeracy

Focus Questions	Content Standard	Supportive Concepts
1. Nature of waves	P4	17, 18, 19, 20
2. Behavior of Light	P4	21, 22, 23
3. Electromagnetic Radiation	P4	21