#946 SCIENCE 10B SMALL GROUP

GRADE: 10

LEVEL: Small Group

CREDITS: 2.5

PREREQUISITES: An Individualized Educational Plan with this component

BASIC TEXT(S): Prentice Hall, Science Explorer Book M, Motion, Forces, and Energy
or
Prentice Hall**, Conceptual Physics,** by Paul Hewitt, (Proposed)

SUPPLEMENTAL READINGS:

REQUIRED MATERIALS:
Pen/Pencil
Notebook
Calculator
Agenda book

COURSE DESCRIPTION: Students in Science 10B will receive small group instruction which addresses concepts and factual information in a manner consistent with their identified special needs. This course will engage students in designing technological solutions to real world challenges in physics. Students will engage in four phases of inquiry; investigation (student poses a question, becomes aware of a need or problem), invention (students plan and design alternative ways to address the challenge), implementation (students test and modify their original design) and evaluation (students evaluate both the product they developed and process they used).

MISSION RELATED GOALS:
- Promote academic excellence
- Promote intellectual curiosity
- Promote respect for others
- Promote self-confidence
- Foster development of communication skills
- Foster development of problem-solving skills

Students will communicate effectively and work towards a common goal while developing appropriate problem solving skills. The students will respect the rights of others while promoting personal growth in accepting responsibility and working individually within a group setting.

STUDENT EXPECTATIONS ADDRESSED:

- Communicate effectively – In their classroom discussions and other oral and written presentations, students will obtain information and present ideas in a clear, articulate manner.
- Solve complex problems – In their labs and projects, students will use higher order thinking skills to assess and solve multi-step problems.
- Work with others towards a common goal – Again, in their labs and projects, students will accept personal responsibility and work interdependently in a group setting.
- Contribute to the community and the global society – Students will understand that scientific knowledge will enable them as citizens to better promote the welfare of the local and global society.
- Respect the rights of others – In the classroom setting students will be led to establish appropriate rules and then to follow those rules for the benefit of all the members of the class.
- Exercise life skills that promote personal growth – Students will recognize the role that science education may play in achieving their future goals.

GENERAL PERFORMANCE OBJECTIVES: The students will be able to:

- Distinguish between vector quantities (e.g., velocity, acceleration, and force) and scalar quantities (e.g., speed and mass).
- Create and interpret graphs of motion (position vs. time, speed vs. time, velocity vs. time, constant acceleration vs. time).
- Explain the relationship between mass and inertia.
- Interpret and apply Newton's first law of motion.
- Interpret and apply Newton's second law of motion to show how an object's motion will change only when a net force is applied.
- Use a free body diagram with only co-linear forces to show forces acting on an object, and determine the net force on it.
- Qualitatively distinguish between static and kinetic friction, what they depend on, and their effects on the motion of objects.
- Interpret and apply Newton's third law of motion.
- Understand conceptually Newton's law of universal gravitation.
- Identify appropriate standard international units of measurement for force, mass, distance, speed, acceleration, and time, and explain how they are measured.
- Interpret and provide examples that illustrate the law of conservation of energy.
- Provide examples of how energy can be transformed from kinetic to potential and vice versa.
- Describe the relationship among energy, work, and power both conceptually and quantitatively.
- Interpret the law of conservation of momentum and provide examples that illustrate it.
- Calculate the momentum of an object.
- Identify appropriate standard international units of measurement for energy, work, power, and momentum.
- Relate thermal energy to molecular motion.
- Differentiate between specific heat and heat capacity.
- 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.

MASSACHUSETTS FRAMEWORKS STRAND(S):
From the Massachusetts Science and Technology/Engineering Curriculum Framework, May 2001, Physics, Grade 9 or 10:

Strand 3: Physical Sciences (Chemistry and Physics)

CURRICULUM FRAMEWORK LEARNING STANDARDS (# and description):
From the Massachusetts Science and Technology/Engineering Curriculum Framework, May 2001, Physics, Grade 9 or 10:

1. Motion and Forces
   - 1.1. Distinguish between vector quantities (velocity, acceleration, and force) and scalar quantities (speed and mass).
   - 1.4. Create and interpret graphs of motion (position vs. time, speed vs. time, velocity vs. time, constant acceleration vs. time).
   - 1.5. Explain the relationship between mass and inertia.
   - 1.6. Interpret and apply Newton's first law of motion.
   - 1.7. Interpret and apply Newton's second law of motion to show how an object's motion.
   - 1.8. 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.
   - 1.9. Qualitatively distinguish between static and kinetic friction, what they depend on and their effects on the motion of objects.
   - 1.10. Interpret and apply Newton's third law of motion.
   - 1.11. Understand conceptually Newton's law of universal gravitation.
   - 1.12. Identify appropriate standard international units of measurements for force, mass, distance, speed, acceleration, and time, and explain how they are measured.

2. Conservation of Energy and Momentum
   - 2.1. Interpret and provide examples that illustrate the law of conservation of energy.
   - 2.2. Provide examples of how energy can be transformed from kinetic to potential and vice versa.
   - 2.4. Describe the relationship among energy, work, and power both conceptually and quantitatively.
   - 2.5. Interpret the law of conservation of momentum and provide examples that illustrate it. Calculate the momentum of an object.
   - 2.6. Identify appropriate standard international units of measurement for energy, work, power, and momentum.

3. Heat and Heat Transfer
   - 3.1. Relate thermal energy to molecular motion .
   - 3.2. Differentiate between specific heat and heat capacity.
   - 3.3. 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.
   - 3.4. Recognize that matter exists in four phases, and explain what happens during a phase change.

4. Waves
   - 4.1. Differentiate between wave motion (simple harmonic nonlinear motion) and the motion of objects (nonharmonic).
   - 4.2. Recognize the measurable properties of waves and explain the relationships among them.
   - 4.4. Distinguish between mechanical and electromagnetic waves.

UNITS AND THEMES (Topical Outline including duration of unit) STANDARD # COVERED:

• Metric System	1.12
• Measurement	1.12
• Graphing	1.1 - 1.4
• Friction	1.5 – 1.9
• Momentum	2.5 – 2.6
• Centripetal Force	1.7, 1.10 – 1.12
• Pendulum	1.7, 2.1 – 2.2
• Work, Power, Energy	2.4, 2.6
• Waves	4.1, 4.2, 4.4

COURSE OUTLINE:

- Laboratory safety, scientific method, standard lab reporting, metric system, significant figures (common segment to be taught in all integrated science courses at beginning of year).
- Motion – describing, measuring and graphing motion and acceleration.
- Forces – the nature of force and Newton's three laws. Friction, momentum, centripetal force, and pendulum motion. Forces in fluids.
- Work – describing work and understanding simple machines.
- Energy and Power – the nature of energy and power. Energy conversion and conservation.
- Thermal energy and heat – describing temperature and thermal energy. The nature and uses of heat.

I. Metric System

II. Measurement
- a) Fundamental & Derived Units
- b) Metric Tools (Rulers & Calipers)
- c) % Error Analysis
- d) % Difference Analysis

III. Graphing
- a) Formatting
- b) Slope
- c) Diameter/Circumference
- d) Diameter/Area
- e) Hooke's Law

f) Distance/Time

IV. Friction

a) Normal Force
b) Angle of Repose
c) Coefficient of Friction
d) Friction Force vs. Gravitational Force
e) Friction Force vs. Surface Area

V. Momentum

a) Conservation of Momentum
b) Impulse/Change in Momentum Relationship

VI. Centripetal Force

a) Force vs. Velocity
b) Force vs. Mass
c) Force vs. Radius

VII. Pendulum

Period vs. Mass
a) Period vs. Amplitude
b) Period vs. Length

VIII. Work, Power, Energy

a) Definition of Work & Power
b) Various units for Work & Power
c) Potential & Kinetic Energy
d) Use and Measurement in electrical appliances

IX. Waves

a) Sound Waves/Longitudinal Waves
b) E&M Waves/Transverse Waves
c) Electromagnetic Spectrum

X. Review, Final

SUGGESTED INSTRUCTIONAL STRATEGIES:

- Small group instruction
- Lab exercises
- Lecture
- Worksheets
- Demonstrations
- As specified by Individual Education Plan

SUGGESTED INTEGRATION:
A variety of integrated science activities may be introduced; e.g., tectonic plate motion and satellite motion (earth and space science), machines in the human body (biology), and thermal energy and states of matter (chemistry).

USE OF TOOLS/TECHNOLOGY: (Used by student and teacher)

- Video programs, publisher web sites, web research.
- Classroom computer(s) with data collection peripherals
- Calculators and CBL units
- Overhead projectors

ASSESSMENT TECHNIQUES:

- Homework will be checked.
- Laboratory exercises/reports
- Projects
- Unit tests and a final exam.
- School wide rubric will be utilized where appropriate.