

# SECONDARY SCIENCE FRAMEWORK

February 2004



*(minor revision – 4/6/05)*

*February, 2004*

## Table of Contents

Participants.....	1
Secondary Science Education Philosophy .....	2
Beliefs .....	2
Differentiation.....	3
Safety in Science Education.....	4
Animal Dissection.....	5
Millard Standards: Science .....	6
Millard Public Schools Essential Learner Outcomes.....	8
Primary Resources .....	9
Recommendations on Sequence of High School Science Courses.....	10
Course Frameworks .....	11
Sixth Grade Science.....	11
Seventh Grade Science .....	14
Eighth Grade Science.....	18
Physical Science in Action.....	22
Basic Physical Science in Action.....	27
Biology.....	32
Basic Biology.....	36
Zoology .....	40
Chemistry .....	43
Astronomy.....	46
Environmental Science .....	48
Physics .....	50
Human Physiology.....	56
Advanced Placement <sup>®</sup> Chemistry .....	60
Advanced Placement <sup>®</sup> Biology .....	63
Advanced Placement <sup>®</sup> Physics B.....	68

*February, 2004*

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## Secondary Science Education Philosophy

The purpose of science education is to prepare all students to be scientifically literate members of society. A scientifically literate person uses science knowledge and processes for meeting the challenges of a dynamic society.

### Beliefs

We believe that all students, as life-long learners, should:

1. actively experience science through inquiry while acquiring a common core of scientific knowledge by:
  - utilizing higher levels of thinking, problem solving, scientific processes and principles;
  - investigating interdisciplinary connections, those bridging diverse scientific fields as well as those linking science to other academic and artistic endeavors;
  - interpreting and communicating information; and
  - applying science to real-life situations.
2. understand the relationship between science and technology and their effects on society by:
  - using appropriate technological resources;
  - developing an ability to access, evaluate and apply scientific information;
  - recognizing scientific principles in technological applications;
  - realizing that science and technology impact the quality of life; and
  - recognizing science and technology's impact on the environment.
3. develop and maintain a curiosity about themselves and the universe in which they live.

## Differentiation

All students have the potential to become scientifically literate members of society. Regardless of their readiness, interest and learning styles, all students need to be able to apply science knowledge and skills in their daily lives. Science teachers utilize a wide range of instructional strategies and provide students with a variety of experiences, strategies and techniques that can help them develop an understanding of science.

Differentiated science instruction includes:

- Understanding students' preconceptions about science
- Experiencing science through inquiry
- Encouraging students to develop their own questions
- Utilizing thinking, problem solving and scientific processes
- Presenting science content utilizing a variety of delivery methods
- Providing multi-sensory experiences
- Investigating interdisciplinary connections
- Using appropriate technological resources
- Experiencing science in real-life situations
- Applying science to real-life situations
- Engaging students in thoughtful reflection on their learning
- Allowing students to demonstrate their learning in different ways

Science teachers will make conscious use of differentiation strategies by continuing to pursue and apply information related to readiness, interest, learning styles, multiple intelligences, cultural and ethnic differences, and physical and intellectual abilities. This will provide all students the opportunity to become scientifically literate.

## References

- Heacox, Diane. (2002) *Differentiating Instruction in the Regular Classroom: How to Reach and Teach All Learners, Grades 3-12*. Minneapolis, MN: Free Spirit Publishing.
- Krueger, Alice, and Sutton, John, eds. (2001) *EDThoughts: What We Know about Science Teaching and Learning*. Aurora, CO: Mid-continent Research for Education and Learning.
- Tomlinson, Carol Ann. (1999) *The Differentiated Classroom: Responding to the Needs of All Learners*. Alexandria, VA: Association for Supervision and Curriculum Development.

## Safety in Science Education

Providing students with opportunities to learn science through inquiry means that students will participate in a variety of hands-on learning activities. Because of this emphasis, it is imperative that science teachers are knowledgeable about science safety. *Science and Safety: Making the Connections* and Millard's *Science Safety Procedures* manual both describe the three legal responsibilities schools have regarding science safety:

- Instruction
- Supervision
- Maintenance

Millard science teachers should be familiar with the *Science Safety Procedures* manual distributed to all secondary principals and science teachers in August 2000 (reviewed 2003), and to all science teachers new to the district thereafter. All science teachers should model and follow the recommendations and procedures described in this manual.

Science teachers must provide adequate instruction prior to each laboratory experience. Safety instruction will be noted in lesson plans. In addition, science teachers must understand:

- How to keep science areas safe
- What to do in the event of an accident
- How to handle equipment
- How to label and store chemicals
- Those issues unique to biological safety
- Those issues unique to chemical safety
- Those issues unique to physical science safety

The *NSTA Guide to School Science Facilities* describes how schools should maintain appropriate class size, provide adequate classroom space, and provide and maintain adequate furnishings and functional equipment. It is important that Millard maintain appropriate class size and provide adequate classroom space and equipment to ensure that students have a safe environment in which they can participate in hands-on science activities.

### References

- Biehle, James T., LaMoine L. Motz, and Sandra S. West. (1999) *NSTA Guide to School Science Facilities*. Arlington, VA: National Science Teachers Association.
- Flinn Scientific: Safety.
- The Laboratory Safety Institute.
- Science and Safety: Making the Connections*. (n.d.) Council of State Science Supervisors.
- Science Safety Procedures*. (1999) Omaha, NE: Millard Public Schools

## Animal Dissection

Millard secondary science teachers believe all students should actively experience science through inquiry. Direct, hands-on experiences are among the best ways for students to be actively involved in scientific inquiry. Dissection provides students the opportunity to feel textures, observe and compare physical characteristics of real specimens, and understand the positions and roles of individual organs and tissues within entire systems. Life science educators believe animal dissection provides a better understanding of biological systems and functions than do alternative learning experiences.

In required courses, students who choose not to participate in dissection should be provided alternative learning experiences that may include, but are not limited to, virtual dissection via Internet or CD-ROM; other appropriate Internet, CD-ROM or video activities; working with models; and recording, interpreting and discussing data gathered by other students performing dissection.

## References

- Institute of Laboratory Animal Research. (2001) *Principles and Guidelines for the Use of Animals in Precollege Education*.
- National Association of Biology Teachers. (1995) *The Use of Animals in Biology Education*.
- National Science Teachers Association. (1991) *Guidelines for Responsible Use of Animals in the Classroom*.
- Riechard, Donald E. (1993). Teaching science: The dissection dilemma. *The Clearing House*, 67(1), pp. 4-5.

**Millard Standards: Science  
Middle School**

**Millard Outcome # 9: Students will use scientific processes to understand the unifying concepts of the natural world.**

- 8.9.1 Students will recognize and apply the unifying concepts and processes of the natural world.
- 8.9.2 Students will apply the knowledge and skills needed for scientific inquiry.

**Millard Outcome #10: Students will demonstrate understanding of life, physical, earth and space sciences.**

- 8.10.1 Students will explore and explain physical science concepts, theories and models.
- 8.10.2 Students will explore and explain life science concepts, theories and models.
- 8.10.3 Students will explore and explain earth and space science concepts, theories and models.
- 8.10.4 Students will examine the connections between science and technology.
- 8.10.5 Students will relate science to personal and social issues.
- 8.10.6 Students will evaluate the interrelationships among science, human endeavor and various cultures.

**Millard Standards: Science  
High School**

**Millard Outcome # 9: Students will use scientific processes to understand the unifying concepts of the natural world.**

11.9.1 Students will relate and apply the unifying concepts and processes to the natural world.

11.9.2 Students will apply the knowledge and process skills needed for scientific inquiry.

**Millard Outcome #10: Students will demonstrate understanding of life, physical, earth and space sciences.**

11.10.1 Students will analyze and apply physical science concepts, principles, theories and models.

11.10.2 Students will analyze and apply life science concepts, principles, theories and models.

11.10.3 Students will analyze and apply earth and space science concepts, principles, theories and models.

11.10.4 Students will analyze the connections between science and technology.

11.10.5 Students will relate science to personal and social issues.

11.10.6 Students will evaluate the interrelationships among science, human endeavor and various cultures.

**MILLARD ESSENTIAL LEARNER OUTCOMES**

- CITIZENSHIP • CONSUMER ECONOMICS • FINE AND PERFORMING ARTS • HUMAN RELATIONS
- LITERACY AND COMMUNICATION • MATHEMATICS • READINESS FOR WORK • READINESS FOR LIFE-LONG LEARNING
- SCIENCE • SOCIAL STUDIES • TECHNOLOGY • WELLNESS

<b>ACADEMIC SKILLS AND APPLICATIONS</b>	<b>LIFE SKILLS AND PERFORMANCES</b>
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Students will demonstrate proficiency on these twelve indicators by meeting established standards on district-wide assessments. This proficiency, along with the successful completion of 225 credits for the class of 2004 and beyond, is used for diploma granting or denial. Students in the Millard Public Schools will:

**LITERACY AND COMMUNICATION**

1. Demonstrate competencies in reading to understand and evaluate a variety of texts.
2. Demonstrate competencies in writing in a variety of modes.

**MATHEMATICS**

4. Represent numbers and relationships between numbers, compute fluently, and make reasonable estimates.
5. Understand and use attributes of geometric figures and systems of measurement.
6. Demonstrate knowledge of and use coordinate systems and algebraic concepts.
7. Select, organize, display and analyze data.
8. Apply appropriate mathematical strategies to solve problems.

**SCIENCE**

9. Use scientific processes to understand the unifying concepts of the natural world.
10. Demonstrate understanding of life, physical, earth and space sciences.

**SOCIAL STUDIES**

11. Demonstrate understanding of structure, operations and relationships among local, state, national and international governments.
12. Demonstrate practical knowledge of history, economics and geography.
13. Understand global interdependence.

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Course outcomes and assessments will determine program and building accountability in the areas of clarity (what is to be taught), competence (what is to be learned), consistency (among buildings), continuity (articulation) and communication (among teachers and with parents). The following indicators are not used for diploma-granting or denial.

**LITERACY AND COMMUNICATION**

3. Demonstrate appropriate speaking and listening skills for a variety of settings.

**CONSUMER ECONOMICS**

- Demonstrate skills in managing money.
- Make sound financial choices by using appropriate resources.

**HUMAN RELATIONS**

- Understand ethnic and cultural differences.
- Understand human differences.

**TECHNOLOGY**

- Obtain information electronically and organize it successfully.
- Convey information using technology.
- Use a variety of technological resources to solve problems.

**FINE AND PERFORMING ARTS**

- Experience and evaluate a variety of music, art, or drama.

**WELLNESS**

- Understand human growth and development.
- Identify the values of good nutrition and physical activity.
- Evaluate the impact of addictive substances and behaviors.

Within the school setting, students in the Millard Schools will:

**READINESS FOR WORK**

- Demonstrate the ability to manage time.
- Demonstrate the ability to follow directions.
- Solve problems by processing available information pertinent to a given situation, making decisions as appropriate.
- Develop ability to work with others to accomplish tasks/goals.
- Demonstrate essential knowledge of good work habits.
- Demonstrate responsibility.

**READINESS FOR LIFE-LONG LEARNING**

- Demonstrate ability to set and pursue short term and long term goals.
- Obtain, organize and evaluate information successfully.
- Develop the attributes of:
  - integrity,
  - self-discipline,
  - positive attitude,
  - perseverance.

**CITIZENSHIP**

- Participate in community and/or school organization.
- Acknowledge diversity of others.
- Respect the rights of others.
- Treat others in a considerate and non-demeaning manner.

Revised: Strategic Planning  
December 5, 1996  
T-Chart Approved: Millard Board of Education  
January 13, 1997

Rule Adopted: May 3, 1999  
Revised: June 18, 2001; July 21, 2003

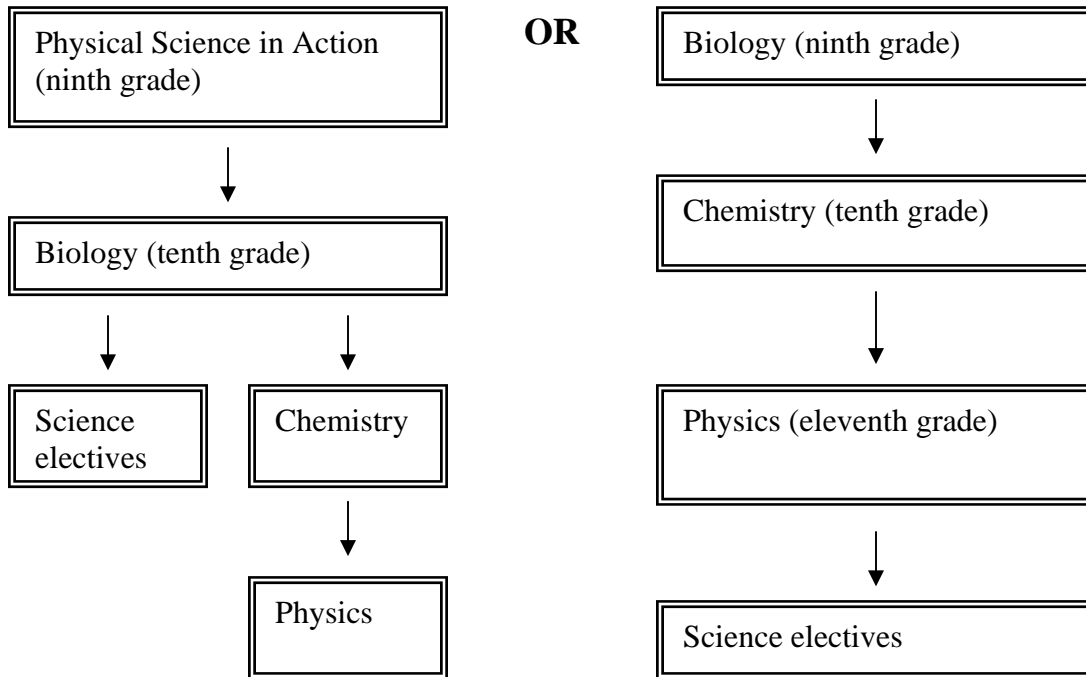
Millard Public Schools  
Omaha, NE



## Primary Resources

Course	Text
Sixth Grade Science	Holt Science & Technology Short-Course Series (2005), Holt <ul style="list-style-type: none"> <li>• Microorganisms, Fungi and Plants</li> <li>• Animals</li> <li>• Earth's Changing Surface</li> <li>• Sound and Light</li> </ul>
Seventh Grade Science	Holt Science & Technology Short-Course Series (2005), Holt <ul style="list-style-type: none"> <li>• Cells, Heredity and Classification</li> <li>• Human Body Systems and Health</li> <li>• Inside the Restless Earth</li> <li>• Forces, Motion and Energy</li> </ul>
Eighth Grade Science	Holt Science & Technology Short-Course Series (2005), Holt <ul style="list-style-type: none"> <li>• Environmental Science</li> <li>• Astronomy</li> <li>• Introduction to Matter</li> <li>• Interactions of Matter</li> <li>• Electricity and Magnetism</li> </ul>
Physical Science in Action	
Basic Physical Science in Action	
Biology	
Basic Biology	
Zoology	
Chemistry	
Astronomy	
Environmental Science	
Physics	
Human Physiology	
Advanced Placement <sup>®</sup> Chemistry	
Advanced Placement <sup>®</sup> Biology	
Advanced Placement <sup>®</sup> Physics	

## Recommendations for Sequence of High School Science Courses



Most students should take Physical Science in Action in ninth grade, followed by Biology in tenth grade. Other physical science (including Chemistry and Physics) and life science courses are available as electives to round out the student's understanding of life, physical, earth and space science.

Students wanting to accelerate their science curriculum may take Biology in ninth grade. It is recommended that they take Chemistry in tenth grade, followed by Physics in eleventh grade. The purpose of starting with Biology in ninth grade is to provide students who have a strong interest in science the opportunity to take more than two and a half years of science in high school, including Advanced Placement<sup>®</sup> science courses.

Success as an eighth grader is the criteria for placement in Biology in ninth grade. In order to take Biology as a ninth grader, students should be recommended by their eighth grade team with that recommendation based on:

- Strong math ability and skills
- Strong reading ability and skills
- Strong science ability, skills and interest
- Interest in taking more than the required high school science courses.

## SIXTH GRADE SCIENCE

Sixth Grade Science

6

Year

**Course Description:** Students will use scientific inquiry to investigate the natural world and understand the connections among physical, life and earth sciences. Students will also explore the role of science in society. Concepts included in sixth grade science are light and sound, the structure of earth, diversity and adaptation of organisms, and the structure and function of living systems including plants.

### Outcome 1

Students will use scientific inquiry and technology to recognize and apply the unifying concepts and processes of the natural world.

#### Academic ELOs

- Use scientific processes to understand the unifying concepts of the natural world.
- Demonstrate understanding of life, physical, earth and space sciences.

#### Life Skills ELOs

- Use a variety of technological resources to solve problems.
- Demonstrate the ability to follow directions.
- Solve problems by processing available information pertinent to a given situation, making decisions as appropriate.
- Develop the ability to work with others to accomplish tasks/goals.
- Obtain, organize and evaluate information successfully.

#### Millard Standards

- Recognize and apply the unifying concepts and processes of the natural world.
- Apply the knowledge and skills needed for scientific inquiry.

### **Objectives:**

- Recognize and describe key parts and functions of any system.
- Analyze and predict the interactions within a system and between systems.
- Create and use classification schemes.
- Interpret cause and effect relationships within and between systems.
- Collect, manipulate and analyze data from an experiment.
- Observe and develop models (physical, mathematical, mental and computer simulations).
- Interpret and explain results of experimentation.
- Select and use appropriate measurement units.
- Demonstrate how the design of an object makes it possible for that object to perform a specialized task.
- Identify questions and form hypotheses that can be examined through scientific investigations.
- Conduct a scientific investigation.
- Use appropriate tools and techniques to gather, analyze and interpret data. (Introduce and

use computer software and presentations, electronic data collection devices, microscopes, balances and metric rulers.)

- Given evidence, develop descriptions, explanations and models.
- Communicate scientific procedures and explanations.
- Use mathematics in scientific inquiry.

**Assessment:** Performance: Demonstrate acquisition of process skills (checklist).

## **Outcome 2**

Students will explore and explain the concepts, theories and models of physical, life and earth sciences.

### **Academic ELOs**

- Use scientific processes to understand the unifying concepts of the natural world.
- Demonstrate understanding of life, physical, earth and space sciences.

### **Life Skills ELOs**

- Use a variety of technological resources to solve problems.
- Demonstrate the ability to follow directions.
- Solve problems by processing available information pertinent to a given situation, making decisions as appropriate.
- Develop the ability to work with others to accomplish tasks/goals.
- Obtain, organize and evaluate information successfully.

### **Millard Standards**

- Explore and explain physical science concepts, theories and models.
- Explore and explain life science concepts, theories and models.
- Explore and explain earth and space science concepts, theories and models.

### **Objectives:**

- Compare and contrast reflection and refraction.
- Investigate and describe the properties of the visible light spectrum.
- Investigate and describe sound waves and the properties of sound (wave length, frequency, pitch, resonance and Doppler effect).
- Describe the characteristics of life.
- Investigate and describe population and ecosystems
- Describe an organism by the function it serves in an ecosystem (producers, consumers and decomposers).
- Explore plant and animal behavior.
- Investigate and describe characteristics of the six kingdoms.
- Explain plant reproduction.
- Explain how erosion and weathering have impacted land forms.
- Investigate and describe the water cycle.

**Assessment:** Selected response test

### **Outcome 3**

Students will evaluate the interrelationships among science, human endeavor and various cultures; relate science to personal and social issues; and examine the connections between science and technology.

#### **Academic ELOs**

- Use scientific processes to understand the unifying concepts of the natural world.
- Demonstrate understanding of life, physical, earth and space sciences.

#### **Life Skills ELOs**

- Use a variety of technological resources to solve problems.
- Demonstrate the ability to follow directions.
- Solve problems by processing available information pertinent to a given situation, making decisions as appropriate.
- Develop the ability to work with others to accomplish tasks/goals.
- Obtain, organize and evaluate information successfully.

#### **Millard Standards**

- Examine the connections between science and technology.
- Relate science to personal and social issues.
- Evaluate the interrelationships among science, human endeavor and various cultures.

#### **Objectives:**

- Interpret the effects of population on local and global environmental resources.
- Interpret the effects of natural hazards on the environment.
- Analyze a type of hazard (natural, chemical or biological) to evaluate the options for reducing or eliminating human risk.
- Explain that the effect of science on society is neither entirely beneficial nor entirely detrimental.
- Explain how people of various social and ethnic backgrounds engage in the activities of science, engineering and related fields.
- Explore the process of technological design.

**Assessment:** Personal communication or essay

#### **Primary Text:**

Holt Science & Technology Short-Course Series (2005), Holt

- Microorganisms, Fungi and Plants
- Animals
- Earth's Changing Surface
- Sound and Light

## SEVENTH GRADE SCIENCE

Seventh Grade Science

7

Year

**Course Description:** Students will use scientific inquiry and technology to demonstrate an understanding of the unifying concepts and processes of the natural world. Students will identify the relationships among the personal, social and historical aspects of science. Concepts included in seventh grade science are motion and forces, energy and energy transfer, geological processes, and the structure and function of living systems with emphasis on cells and human body systems.

### Outcome 1

Students will use scientific inquiry and technology to recognize and apply the unifying concepts and processes of the natural world.

#### Academic ELOs

- Use scientific processes to understand the unifying concepts of the natural world.
- Demonstrate understanding of life, physical, earth and space sciences.

#### Life Skills ELOs

- Use a variety of technological resources to solve problems.
- Demonstrate the ability to follow directions.
- Solve problems by processing available information pertinent to a given situation, making decisions as appropriate.
- Develop the ability to work with others to accomplish tasks/goals.
- Obtain, organize and evaluate information successfully.

#### Millard Standards

- Recognize and apply the unifying concepts and processes of the natural world.
- Apply the knowledge and skills needed for scientific inquiry.

### **Objectives:**

- Recognize and describe key parts and functions of any system.
- Analyze and predict the interactions within a system and between systems.
- Create and use classification schemes.
- Interpret cause and effect relationships within and between systems.
- Collect, manipulate and analyze data from an experiment.
- Observe and develop models (physical, mathematical, mental and computer simulations).
- Interpret and explain results of experimentation.
- Select and use appropriate measurement units.
- Demonstrate how the design of an object makes it possible for that object to perform a specialized task.
- Identify questions and form hypotheses that can be examined through scientific investigations.
- Conduct a scientific investigation.
- Use appropriate tools and techniques to gather, analyze and interpret data.

(Review and use computer software and presentations, electronic data collection, microscopes, balances and metric rulers.)

- Given evidence, develop descriptions, explanations and models.
- Show the relationship between evidence and explanations.
- Communicate scientific procedures and explanations.
- Use mathematics in scientific inquiry.

**Assessment:** Performance: Demonstrate acquisition of process skills (checklist).

## **Outcome 2**

Students will explore and explain the concepts, theories and models of physical, life and earth sciences.

### **Academic ELOs**

- Use scientific processes to understand the unifying concepts of the natural world.
- Demonstrate understanding of life, physical, earth and space sciences.

### **Life Skills ELOs**

- Use a variety of technological resources to solve problems.
- Demonstrate the ability to follow directions.
- Solve problems by processing available information pertinent to a given situation, making decisions as appropriate.
- Develop the ability to work with others to accomplish tasks/goals.
- Obtain, organize and evaluate information successfully.

### **Millard Standards**

- Explore and explain physical science concepts, theories and models.
- Explore and explain life science concepts, theories and models.
- Explore and explain earth and space science concepts, theories and models.

## **Objectives:**

- Investigate and apply Newton's laws.
- Describe forces.
- Identify simple machines and explain how they work.
- Compare and contrast compression and transverse waves.
- Compare and contrast conduction, convection and radiation.
- Describe basic plant and animal cell structure.
- Explain the relationship between cell structure and function.
- Describe levels of organization of living things.
- Investigate and describe human body systems and how they interact (urinary, respiratory, circulatory, nervous, digestive and endocrine).
- Investigate the impact of disease on human body systems at an introductory level.
- Compare and contrast mitosis and meiosis.
- Explain the relationships between chromosomes and genes.
- Investigate and describe hereditary traits.

- Investigate and describe how earth processes that occur today are similar to those that occurred in the past.
- Illustrate and explain geological processes (plate tectonics, earthquakes and volcanoes).
- Investigate and describe the crust, mantle and core of the earth.

**Assessment:** Selected response test

### **Outcome 3**

Students will evaluate the interrelationships among science, human endeavor and various cultures; relate science to personal and social issues; and examine the connections between science and technology.

#### **Academic ELOs**

- Use scientific processes to understand the unifying concepts of the natural world.
- Demonstrate understanding of life, physical, earth and space sciences.

#### **Life Skills ELOs**

- Use a variety of technological resources to solve problems.
- Demonstrate the ability to follow directions.
- Solve problems by processing available information pertinent to a given situation, making decisions as appropriate.
- Develop the ability to work with others to accomplish tasks/goals.
- Obtain, organize and evaluate information successfully.

#### **Millard Standards**

- Examine the connections between science and technology.
- Relate science to personal and social issues.
- Evaluate the interrelationships among science, human endeavor and various cultures.

### **Objectives:**

- Explain the effects of natural hazards on the environment.
- Explain the effects of human activities and interventions on the environment.
- Analyze a type of hazard (natural, chemical or biological) to evaluate the options for reducing or eliminating human risk.
- Explain that the effect of science on society is neither entirely beneficial nor entirely detrimental.
- Explain how people of various social and ethnic backgrounds engage in the activities of science, engineering and related fields.
- Explain the need for ethical codes followed by scientists.
- Evaluate completed technological designs or products.

**Assessment:** Essay

**Primary Text:**

Holt Science & Technology Short-Course Series (2005), Holt

- Cells, Heredity and Classification
- Human Body Systems and Health
- Inside the Restless Earth
- Forces, Motion, and Energy

## EIGHTH GRADE SCIENCE

**Eighth Grade Science**

**8**

**Year**

**Course Description:** Eighth grade science explains the connections among physical, earth and space sciences. Students will explore the concepts of electricity and magnetism, the solar system, and properties and changes in properties of matter. Students will demonstrate their understanding of these concepts through scientific inquiry and the use of technology.

### Outcome 1

Students will use scientific inquiry and technology to recognize and apply the unifying concepts and processes of the natural world.

#### Academic ELOs

- Use scientific processes to understand the unifying concepts of the natural world.
- Demonstrate understanding of life, physical, earth and space sciences.

#### Life Skills ELOs

- Use a variety of technological resources to solve problems.
- Demonstrate the ability to follow directions.
- Solve problems by processing available information pertinent to a given situation, making decisions as appropriate.
- Develop the ability to work with others to accomplish tasks/goals.
- Obtain, organize and evaluate information successfully.

#### Millard Standards

- Recognize and apply the unifying concepts and processes of the natural world.
- Apply the knowledge and skills needed for scientific inquiry.

### **Objectives:**

- Recognize and describe key parts and functions of any system.
- Analyze and predict the interactions within a system and between systems.
- Create and use classification schemes.
- Interpret cause and effect relationships within and between systems.
- Collect, manipulate and analyze data from an experiment.
- Observe and develop models (physical, mathematical, mental and computer simulations).
- Interpret and explain results of experimentation.
- Select and use appropriate measurement units.
- Demonstrate how the design of an object makes it possible for that object to perform a specialized task.
- Identify questions and form hypotheses that can be examined through scientific investigations.
- Conduct a scientific investigation.
- Use appropriate tools and techniques to gather, analyze and interpret data.  
(Review and use computer software and presentations, electronic data collection,

microscopes, balances and metric rulers.)

- Given evidence, develop descriptions, explanations and models.
- Show the relationship between evidence and explanations.
- Communicate scientific procedures and explanations.
- Use mathematics in scientific inquiry.

**Assessment:** Performance: Demonstrate acquisition of process skills (checklist or rubric).

## **Outcome 2**

Students will explore and explain the concepts, theories and models of physical, earth and space sciences.

### Academic ELOs

- Use scientific processes to understand the unifying concepts of the natural world.
- Demonstrate understanding of life, physical, earth and space sciences.

### Life Skills ELOs

- Use a variety of technological resources to solve problems.
- Demonstrate the ability to follow directions.
- Solve problems by processing available information pertinent to a given situation, making decisions as appropriate.
- Develop the ability to work with others to accomplish tasks/goals.
- Obtain, organize and evaluate information successfully.

### Millard Standards

- Explore and explain physical science concepts, theories and models.
- Explore and explain life science concepts, theories and models.
- Explore and explain earth and space science concepts, theories and models.

## **Objectives:**

- Investigate and describe properties and changes in properties of matter (phase change, density and solubility).
- Compare chemical reactions by identifying their products and reactants.
- Summarize the conservation of matter.
- Compare and contrast chemical energy (endothermic and exothermic).
- Show relationships among atoms, molecules, elements and compounds.
- Investigate and use the Periodic Table at an introductory level.
- Identify forms of energy and explain how energy is transferred.
- Investigate static electricity.
- Explain the relationship among current, voltage and resistance (ohm).
- Compare and contrast conductors and insulators.
- Explain and construct circuits.
- Investigate and describe magnetic domains.
- Compare and contrast temporary and permanent magnets.

- Identify and categorize components of the solar system.
- Compare and contrast the effects of rotation and revolution.
- Investigate and explain moon phases and eclipses.
- Investigate and describe the influence of gravity on objects in the solar system.

**Assessment:** Selected response test

### **Outcome 3**

Students will evaluate the interrelationships among science, human endeavor and various cultures; relate science to personal and social issues; and examine the connections between science and technology.

#### **Academic ELOs**

- Use scientific processes to understand the unifying concepts of the natural world.
- Demonstrate understanding of life, physical, earth and space sciences.

#### **Life Skills ELOs**

- Use a variety of technological resources to solve problems.
- Demonstrate the ability to follow directions.
- Solve problems by processing available information pertinent to a given situation, making decisions as appropriate.
- Develop the ability to work with others to accomplish tasks/goals.
- Obtain, organize and evaluate information successfully.

#### **Millard Standards**

- Examine the connections between science and technology.
- Relate science to personal and social issues.
- Evaluate the interrelationships among science, human endeavor and various cultures.

#### **Objectives:**

- Analyze a type of hazard (natural, chemical or biological) to evaluate the options for reducing or eliminating human risk.
- Explain that the effect of science on society is neither entirely beneficial nor entirely detrimental.
- Explain how people of various social and ethnic backgrounds engage in the activities of science, engineering and related fields.
- Identify and describe the difficulties experienced by past scientists who overcame commonly held beliefs of their era.
- Describe how science and technology are reciprocal.

**Assessment:** Performance/product

#### **Primary Text:**

- Holt Science & Technology Short-Course Series (2005), Holt
  - Environmental Science

- Astronomy
- Introduction to Matter
- Interactions of Matter
- Electricity and Magnetism

## PHYSICAL SCIENCE IN ACTION

Physical Science in Action

9

Year

10 Credits

**Course Description:** Students will use a hands-on, problem-solving approach to explore the interconnections among the physical sciences. Students will develop scientific reasoning skills and utilize technology in order to draw conclusions about the world around them.

### Outcome 1

Students will use scientific inquiry and technology to show the relationships among the unifying concepts and processes of the physical world.

### Academic ELOs

- Demonstrate competencies in reading to understand and evaluate a variety of texts.
- Demonstrate competencies in writing in a variety of modes.
- Select, organize, display and analyze data.
- Use scientific processes to understand the unifying concepts of the natural world.
- Demonstrate understanding of life, physical, earth and space sciences.
- Convey information using technology.

### Life Skills ELOs

- Demonstrates the ability to manage time.
- Demonstrate the ability to follow directions.
- Solve problems by processing available information pertinent to a given situation, making decisions as appropriate.
- Develop ability to work with others to accomplish tasks/goals.
- Demonstrate essential knowledge of good work habits.
- Demonstrate responsibility.
- Obtain, organize and evaluate information successfully.
- Respect the rights of others.

### Millard Standards

- Relate and apply the unifying concepts and processes to the natural world.
- Apply the knowledge and process skills needed for scientific inquiry.
- Analyze the connections between science and technology.

### **Objectives:**

- Summarize the relationships between systems and order.
  - Predict and evaluate how change within a system affects that system.
  - Recognize the organization of the parts of a system and the way they interconnect and interact with each other.
- Interpret evidence and create models to develop an explanation.
  - Create a physical or mental model to show how objects and processes are connected.
  - Test the usefulness of a model by comparing its predictions to actual observations.
  - Analyze evidence using graphs, charts, and/or organizers.
  - Interpret and explain results from experimentation.
  - Evaluate whether or not results are reasonable.

- Explain the cause/effect relationship between two or more variables in an experiment.
- Use scientific measurement to explore change and constancy.
  - Select and use appropriate measurement units.
  - Use averages and ranges of values to compare data from groups.
  - Describe how measurement errors may affect results of calculations.
  - Describe rate of change by comparing one measured quantity to another measured quantity.
  - Describe how physical phenomena occur in predictable ways.
- Explain how the structure of a system impacts how that system works.
- Explain how a system is affected by change.
- Use inquiry skills to explore science.
  - Formulate questions and identify concepts that guide scientific investigations.
  - Design and conduct scientific investigations.
  - Use technology and mathematics to design and conduct investigations.
  - Use technology to communicate problems, solutions and results of investigations.
  - Formulate and revise scientific explanations and models using logic and evidence.
  - Recognize alternative explanations and models.
- Recognize science as one way of answering questions and explaining the natural world.
- Explore and create scientific explanations consistent with experimental and observational evidence, make accurate predictions, strive to be logical, and report the methods and procedures used.
- Explain how science and technology both create and help solve local, national and global challenges.

**Assessment:** Develop, apply, evaluate and draw conclusions from a scientific experiment.

## **Outcome 2**

Students will apply the fundamental concepts and theories of physics.

### **Academic ELOs**

- Select, organize, display and analyze data.
- Use scientific processes to understand the unifying concepts of the natural world.
- Demonstrate understanding of life, physical, earth and space sciences.
- Convey information using technology.
- Use a variety of technological resources to solve problems.

### **Life Skills ELOs**

- Demonstrates the ability to manage time.
- Demonstrate the ability to follow directions.
- Solve problems by processing available information pertinent to a given situation, making decisions as appropriate.
- Develop ability to work with others to accomplish tasks/goals.
- Demonstrate essential knowledge of good work habits.
- Demonstrate responsibility.
- Obtain, organize and evaluate information successfully.
- Treat others in a considerate and non-demeaning manner.

## Millard Standards

- Relate and apply the unifying concepts and processes to the natural world.
- Apply the knowledge and process skills needed for scientific inquiry.
- Analyze and apply physical science concepts, principles, theories and models.
- Analyze the connections between science and technology.
- Evaluate the interrelationships among science, human endeavor and various cultures.

## **Objectives:**

- Investigate the motion and forces of the physical world.
  - Investigate and explain the effect of forces on the motion of objects.
  - Investigate and explain gravity as an attractive force that each mass exerts on any other mass.
  - Investigate and explain electrical force as a force that exists between any two charged objects.
- Explain the conservation of energy in the physical world.
  - Explain that the total energy in the universe is constant and can never be destroyed.
  - Investigate and distinguish between kinetic energy and potential energy.
  - Investigate and describe heat transfer in terms of conduction, convection and radiation.
- Investigate basic interactions of energy and matter.
  - Investigate and understand that all waves possess and transfer energy.
  - Investigate and illustrate how wavelength and frequency of waves are inversely related.
  - Investigate and explain that the energy of waves can be changed into other forms of energy, just as other forms of energy can be transformed into wave energy.

**Assessment:** Selected response test

## **Outcome 3**

Students will evaluate the fundamental concepts, theories and models of chemistry.

### Academic ELOs

- Demonstrate competencies in reading to understand and evaluate a variety of texts.
- Select, organize, display and analyze data.
- Use scientific processes to understand the unifying concepts of the natural world.
- Demonstrate understanding of life, physical, earth and space sciences.
- Demonstrate practical knowledge of history, economics and geography.
- Convey information using technology.

### Life Skills ELOs

- Demonstrates the ability to manage time.
- Demonstrate the ability to follow directions.
- Solve problems by processing available information pertinent to a given situation, making decisions as appropriate.
- Develop ability to work with others to accomplish tasks/goals.
- Demonstrate essential knowledge of good work habits.
- Demonstrate responsibility.
- Obtain, organize and evaluate information successfully.
- Respect the rights of others.

## Millard Standards

- Relate and apply the unifying concepts and processes to the natural world.
- Apply the knowledge and process skills needed for scientific inquiry.
- Analyze and apply physical science concepts, principles, theories and models.
- Analyze the connections between science and technology.

## **Objectives:**

- Explore the structure and properties of matter.
  - Investigate and explain that atoms interact with one another by transferring or sharing electrons.
  - Investigate and explain the Periodic Table of elements in terms of repeating patterns of physical and chemical properties.
  - Investigate and describe how the structure of an atom determines the chemical properties of an element.
  - Investigate and explain how the interactions among the molecules of a compound determine its physical and chemical properties.
  - Investigate the physical property of density and how it relates to the different states of matter.
  - Investigate and use changes in energy to explain the differences among the states of matter.
- Explain the structure of the atom.
  - Investigate and describe the structure of atoms, focusing on properties of subatomic particles.
  - Investigate and explain the types of nuclear reactions.
  - Investigate and describe the effect of electrical and nuclear forces that hold atoms together.
- Explain basic chemical reactions and recognize that matter is conserved.
  - Investigate and describe common chemical reactions.
  - Investigate and describe how electrons are involved in bond formation during chemical reactions.
- Explain that changes in atomic structure theory evolve over time and almost always build on earlier knowledge.

**Assessment:** Multiple objects density lab.

## **Outcome 4**

Students will explore the fundamental concepts, theories, and models of earth systems.

## Academic ELOs

- Demonstrate competencies in reading to understand and evaluate a variety of texts.
- Select, organize, display and analyze data.
- Use scientific processes to understand the unifying concepts of the natural world.
- Demonstrate understanding of life, physical, earth and space sciences.
- Demonstrate practical knowledge of history, economics and geography.
- Obtain information electronically and organize it successfully.

- Convey information using technology.
- Use a variety of technological resources to solve problems.

### Life Skills ELOs

- Demonstrates the ability to manage time.
- Demonstrate the ability to follow directions.
- Solve problems by processing available information pertinent to a given situation, making decisions as appropriate.
- Develop ability to work with others to accomplish tasks/goals.
- Demonstrate essential knowledge of good work habits.
- Demonstrate responsibility.
- Obtain, organize and evaluate information successfully.
- Treat others in a considerate and non-demeaning manner.

### Millard Standards

- Relate and apply the unifying concepts and processes to the natural world.
- Apply the knowledge and process skills needed for scientific inquiry.
- Analyze and apply earth and space science concepts, principles, theories and models.
- Relate science to personal and social issues.

### **Objectives:**

- Investigate energy in the earth system.
  - Investigate and distinguish between internal sources of energy (radioactive decay and gravitational energy) and external sources of energy (the sun) and explain how both provide energy to the earth systems.
  - Investigate and explain how the outward transfer of earth's internal heat drives convection in the mantle that propels the plates comprising the earth's surface.
  - Investigate and explain how global climate is determined by energy transfer from the sun and is influenced by dynamic processes (cloud formation and the earth's rotation) and static conditions (the position of mountain ranges and oceans).
- Investigate and diagram how elements and compounds on earth move among reservoirs in the solid earth, oceans, atmosphere, and organisms as part of geochemical cycles.
- Develop a scientific understanding of the origin of the earth system and the universe.
  - Contrast the early earth with the planet we live on today.
  - Investigate and relate how the interactions among the solid earth, oceans, atmosphere, and organisms affect the ongoing evolution of the earth.
  - Investigate the scientific theory of the origin of the universe.
- Investigate and explain that the earth has renewable and finite resources.

**Assessment:** Selected response test

**Primary Text:**

## BASIC PHYSICAL SCIENCE IN ACTION

**Basic Physical Science in Action**                      **9**                      **Year**                      **10 Credits**

**Course Description:** Students will use a hands-on, problem-solving approach to explore the interconnections among the physical sciences. Students will develop scientific reasoning skills and utilize technology in order to draw conclusions about the world around them. Emphasis will be placed on reading and writing strategies to help students gain a better understanding of physical and earth sciences.

### **Outcome 1**

Students will use scientific inquiry and technology to show the relationships among the unifying concepts and processes of the physical world.

#### **Academic ELOs**

- Demonstrate competencies in reading to understand and evaluate a variety of texts.
- Demonstrate competencies in writing in a variety of modes.
- Select, organize, display and analyze data.
- Use scientific processes to understand the unifying concepts of the natural world.
- Demonstrate understanding of life, physical, earth and space sciences.
- Convey information using technology.

#### **Life Skills ELOs**

- Demonstrates the ability to manage time.
- Demonstrate the ability to follow directions.
- Solve problems by processing available information pertinent to a given situation, making decisions as appropriate.
- Develop ability to work with others to accomplish tasks/goals.
- Demonstrate essential knowledge of good work habits.
- Demonstrate responsibility.
- Obtain, organize and evaluate information successfully.
- Respect the rights of others.

#### **Millard Standards**

- Relate and apply the unifying concepts and processes to the natural world.
- Apply the knowledge and process skills needed for scientific inquiry.
- Analyze the connections between science and technology.

### **Objectives:**

- Summarize the relationships between systems and order, and the way parts of a system interconnect and interact.
- Interpret evidence and create models to develop an explanation.
  - Create a physical or mental model to show how objects and processes are connected.
  - Test the usefulness of a model by comparing its predictions to actual observations.
  - Analyze evidence using graphs, charts, and/or organizers.
  - Interpret and explain results from experimentation.

- Evaluate whether or not results are reasonable.
- Explain the cause/effect relationship between two or more variables in an experiment.
- Use scientific measurement to explore change and constancy.
  - Select and use appropriate measurement units.
  - Use averages and ranges of values to compare data from groups.
  - Describe how measurement errors may affect results of calculations.
- Explain how the structure of a system impacts how that system works.
- Explain how a system is affected by change.
- Use inquiry skills to explore science.
  - Formulate questions and identify concepts that guide scientific investigations.
  - Design and conduct scientific investigations that utilize technology.
  - Use technology to communicate results of investigations.
  - Analyze results of, and draw conclusions from, scientific investigations.
- Explain how science and technology both create and help solve local, national and global challenges.

**Assessment:** Design and conduct a scientific experiment and communicate the results of that experiment.

## **Outcome 2**

Students will apply the fundamental concepts and theories of physics.

### **Academic ELOs**

- Select, organize, display and analyze data.
- Use scientific processes to understand the unifying concepts of the natural world.
- Demonstrate understanding of life, physical, earth and space sciences.
- Convey information using technology.
- Use a variety of technological resources to solve problems.

### **Life Skills ELOs**

- Demonstrates the ability to manage time.
- Demonstrate the ability to follow directions.
- Solve problems by processing available information pertinent to a given situation, making decisions as appropriate.
- Develop ability to work with others to accomplish tasks/goals.
- Demonstrate essential knowledge of good work habits.
- Demonstrate responsibility.
- Obtain, organize and evaluate information successfully.
- Treat others in a considerate and non-demeaning manner.

### **Millard Standards**

- Relate and apply the unifying concepts and processes to the natural world.
- Apply the knowledge and process skills needed for scientific inquiry.
- Analyze and apply physical science concepts, principles, theories and models.
- Analyze the connections between science and technology.
- Evaluate the interrelationships among science, human endeavor and various cultures.

## Objectives:

- Investigate the motion and forces of the physical world.
  - Investigate and explain the effect of forces on the motion of objects.
  - Investigate and explain gravity as an attractive force that each mass exerts on any other mass.
  - Investigate and explain electrical force as a force that exists between any two charged objects.
- Explain the conservation of energy in the physical world.
  - Explain that the total energy in the universe is constant and can never be destroyed.
  - Investigate and distinguish between kinetic energy and potential energy.
  - Investigate and describe heat transfer in terms of conduction, convection and radiation.
- Investigate basic interactions of energy and matter.
  - Investigate and explain that all waves possess and transfer energy.
  - Investigate and illustrate how wavelength and frequency of waves are inversely related.
  - Investigate and explain that the energy of waves can be changed into other forms of energy, just as other forms of energy can be transformed into wave energy.

**Assessment:** Create a model of a selected physics concept.

## Outcome 3

Students will evaluate the fundamental concepts, theories and models of chemistry.

### Academic ELOs

- Demonstrate competencies in reading to understand and evaluate a variety of texts.
- Select, organize, display and analyze data.
- Use scientific processes to understand the unifying concepts of the natural world.
- Demonstrate understanding of life, physical, earth and space sciences.
- Demonstrate practical knowledge of history, economics and geography.
- Convey information using technology.

### Life Skills ELOs

- Demonstrates the ability to manage time.
- Demonstrate the ability to follow directions.
- Solve problems by processing available information pertinent to a given situation, making decisions as appropriate.
- Develop ability to work with others to accomplish tasks/goals.
- Demonstrate essential knowledge of good work habits.
- Demonstrate responsibility.
- Obtain, organize and evaluate information successfully.
- Respect the rights of others.

### Millard Standards

- Relate and apply the unifying concepts and processes to the natural world.
- Apply the knowledge and process skills needed for scientific inquiry.
- Analyze and apply physical science concepts, principles, theories and models.
- Analyze the connections between science and technology.

## Objectives:

- Explore the structure and properties of matter.
  - Investigate and explain that atoms interact with one another by transferring or sharing electrons.
  - Investigate and explain the Periodic Table of elements in terms of repeating patterns of physical and chemical properties.
  - Investigate the physical property of density and how it relates to the different states of matter.
  - Investigate and use changes in energy to explain the differences among the states of matter.
- Investigate and describe the structure of atoms, focusing on properties of subatomic particles.
- Explain basic chemical reactions and recognize that matter is conserved.
- Explain that changes in atomic structure theory evolve over time and almost always build on earlier knowledge.

**Assessment:** Multiple objects density lab.

## Outcome 4

Students will explore the fundamental concepts, theories, and models of earth systems.

### Academic ELOs

- Demonstrate competencies in reading to understand and evaluate a variety of texts.
- Select, organize, display and analyze data.
- Use scientific processes to understand the unifying concepts of the natural world.
- Demonstrate understanding of life, physical, earth and space sciences.
- Demonstrate practical knowledge of history, economics and geography.
- Obtain information electronically and organize it successfully.
- Convey information using technology.
- Use a variety of technological resources to solve problems.

### Life Skills ELOs

- Demonstrates the ability to manage time.
- Demonstrate the ability to follow directions.
- Solve problems by processing available information pertinent to a given situation, making decisions as appropriate.
- Develop ability to work with others to accomplish tasks/goals.
- Demonstrate essential knowledge of good work habits.
- Demonstrate responsibility.
- Obtain, organize and evaluate information successfully.
- Treat others in a considerate and non-demeaning manner.

### Millard Standards

- Relate and apply the unifying concepts and processes to the natural world.
- Apply the knowledge and process skills needed for scientific inquiry.
- Analyze and apply earth and space science concepts, principles, theories and models.
- Relate science to personal and social issues.

**Objectives:**

- Investigate energy in the earth system.
  - Compare and contrast internal sources of energy with external sources of energy, including how they provide energy to the earth system.
  - Investigate and explain the theory of plate tectonics.
  - Investigate and explain factors that affect global climate.
- Investigate and diagram geologic processes (water cycle, erosion, weathering, mountain formation).
- Develop a scientific understanding of the origin of the earth system and the universe.
  - Contrast the early earth with the planet we live on today.
  - Investigate and relate how the interactions among the solid earth, oceans, atmosphere, and organisms affect the ongoing evolution of the earth.
  - Investigate the scientific theory of the origin of the universe.
- Investigate and explain that the earth has renewable and finite resources.

**Assessment:** Selected response test

**Primary Text:**

# BIOLOGY

**Biology**

**9/10**

**Year**

**10 Credits**

**Course Description:** Biology offers an opportunity to explore diversity and interdependence in our living world. This course provides a general overview of major biological topics including the cell, genetics, biochemistry and interdependence of organisms, and their relevance to human body systems. Students will develop a conceptual understanding of biology as they acquire important information and refine their laboratory skills.

## **Outcome 1**

Students will identify, compare and analyze relationships and adaptations of organisms to various environments.

### **Academic ELOs**

- Use scientific processes to understand the unifying concepts of the natural world.
- Demonstrate understanding of life, physical, earth and space sciences.

### **Life Skills ELOs**

- Solve problems by processing available information pertinent to a given situation, making decisions as appropriate.
- Obtain, organize and evaluate information successfully.

### **Millard Standards**

- Relate and apply the unifying concepts and processes to the natural world.
- Analyze and apply life science concepts, principles, theories and models.
- Relate science to personal and social issues.
- Evaluate the interrelationships among science, human endeavor and various cultures.

## **Objectives:**

- **Classification:** Differentiate between the six kingdoms using form/function, unique characteristics, and ecological and economical importance.
- Explain the purpose of the levels of taxonomy.
- Explain the hierarchy and interrelationships of the levels of biological organization (biosphere, ecosystem, population, etc.).
- Relate an energy pyramid to food chains and energy flow.
- Relate how the abiotic factors of biomes affect living organisms and their adaptations.
- Analyze food chains and food webs.
- Identify and relate an organism's niche as a heterotroph, autotroph, predator, prey, etc.
- Compare and contrast symbiotic relationships between organisms.
- Explain how limiting factors affect population growth and carrying capacity.
- Recognize man's impact on the environment.
- Research pathogens as to their type and effects on living organisms and the environment (including viruses and organisms associated with the six kingdoms).

**Assessment:** Selected response exam

## **Outcome 2**

Students will identify, discuss and apply the fundamentals of molecular biology and genetics as they relate to history, current research, evolutionary theory and human ethics.

### **Academic ELOs**

- Use scientific processes to understand the unifying concepts of the natural world.
- Demonstrate understanding of life, physical, earth and space sciences.
- Understand ethnic and cultural differences.
- Understand human differences.
- Understand human growth and development.
- Evaluate the impact of addictive substances and behaviors.

### **Life Skills ELOs**

- Solve problems by processing available information pertinent to a given situation, making decisions as appropriate.
- Obtain, organize and evaluate information successfully.
- Acknowledge diversity of others.
- Respect the rights of others.

### **Millard Standards**

- Relate and apply the unifying concepts and processes to the natural world.
- Analyze and apply life science concepts, principles, theories and models.
- Analyze the connections between science and technology.
- Relate science to personal and social issues.
- Evaluate the interrelationships among science, human endeavor and various cultures.

### **Objectives:**

- Draw Punnett squares and use them to predict genetic probability.
- Examine possible causes and effects of mutations.
- Recognize molecular differences, processes and the importance of DNA and RNA.
- Explore the connection between natural selection and adaptation.
- Describe several types of scientific evidence used to support the theory of biological evolution.
- Summarize recent advancements in biotechnology, including the human genome project and advancements in agriculture and medicine.
- Study the inheritance patterns of genetic disorders.
- Debate the ethics of current issues in genetics.
- Examine the accomplishments of biologists, including Gregor Mendel and Charles Darwin.

**Assessment:** Selected response exam

### **Outcome 3**

Students will identify and analyze form and function, cell differentiation, biochemistry and cellular processes.

#### **Academic ELOs**

- Use scientific processes to understand the unifying concepts of the natural world.
- Demonstrate understanding of life, physical, earth and space sciences.
- Use a variety of technological resources to solve problems.
- Identify the values of good nutrition and physical activity.

#### **Life Skills ELOs**

- Solve problems by processing available information pertinent to a given situation, making decisions as appropriate.
- Obtain, organize and evaluate information successfully.

#### **Millard Standards**

- Relate and apply the unifying concepts and processes to the natural world.
- Apply the knowledge and process skills needed for scientific inquiry.
- Analyze and apply physical science concepts, principles, theories and models.
- Analyze and apply life science concepts, principles, theories and models.
- Analyze the connections between science and technology.
- Relate science to personal and social issues.
- Evaluate the interrelationships among science, human endeavor and various cultures.

#### **Objectives:**

- Explain the hierarchy and interrelationships of levels of cellular organization, including cell, tissue and organ.
- Use models to analyze cycles of nature (nitrogen, carbon and water).
- Identify and relate form to function of eukaryotic cell organelles, specifically the nucleus, mitochondria, cytoplasm, chloroplast, ribosome, vacuole, plasma membrane and cell wall.
- Use inquiry to explore major components of biochemistry, e.g., enzymes, water or macromolecules.
- Differentiate the properties of acids, bases and water and relate them to living systems.
- Identify the structure of organic compounds and relate their importance to the human body.
- Explain how the Law of Conservation of Matter is exhibited in chemical reactions.
- Explain the importance and results of the following cellular processes: photosynthesis, respiration, transport, mitosis/meiosis and cell cycle.
- Summarize the relationship of inquiry to advancements in biological technology.

**Assessment:** Selected response exam

### **Outcome 4**

Students will use scientific inquiry and technology to recognize and apply the unifying concepts and processes of the natural world.

### Academic ELOs

- Use scientific processes to understand the unifying concepts of the natural world.
- Demonstrate understanding of life, physical, earth and space sciences.
- Obtain information electronically and organize it successfully.
- Convey information using technology.
- Use a variety of technological resources to solve problems.

### Life Skills ELOs

- Demonstrate the ability to manage time.
- Demonstrate the ability to follow directions.
- Solve problems by processing available information pertinent to a given situation, making decisions as appropriate.
- Develop the ability to work with others to accomplish tasks/goals.
- Demonstrate essential knowledge of good work habits.
- Demonstrate responsibility.
- Obtain, organize and evaluate information successfully.

### Millard Standards

- Relate and apply the unifying concepts and processes to the natural world.
- Apply the knowledge and process skills needed for scientific inquiry.
- Analyze and apply life science concepts, principles, theories and models.
- Analyze the connections between science and technology.
- Evaluate the interrelationships among science, human endeavor and various cultures.

### **Objectives:**

- Use appropriate laboratory equipment to collect and graph data.
- Differentiate between observation and inference.
- Identify and utilize components of scientific inquiry.
  - Develop hypothesis based on an identified problem.
  - Conduct controlled experiment with independent and dependent variables.
  - Organize and analyze data.
  - Form conclusions based upon evidence.
  - Identify sources of error.

**Assessment:** Conduct a controlled experiment

### **Primary Text:**

## BASIC BIOLOGY

**Basic Biology**

**10**

**Year**

**10 Credits**

**Course Description:** Basic Biology offers an opportunity to explore diversity and interdependence in our living world. This course provides a general overview of major biological topics including the cell, genetics, biochemistry and ecology, and their relevance to human body systems. Utilizing technology, students will develop a conceptual understanding of biology as they acquire important information and refine their laboratory skills. Emphasis will be placed on reading and writing strategies to help students gain a better understanding of life science.

### Outcome 1

Students will identify, compare and analyze relationships and adaptations of organisms to various environments.

### Academic ELOs

- Use scientific processes to understand the unifying concepts of the natural world.
- Demonstrate understanding of life, physical, earth and space sciences.

### Life Skills ELOs

- Solve problems by processing available information pertinent to a given situation, making decisions as appropriate.
- Obtain, organize and evaluate information successfully.

### Millard Standards

- Relate and apply the unifying concepts and processes to the natural world.
- Analyze and apply life science concepts, principles, theories and models.
- Relate science to personal and social issues.
- Evaluate the interrelationships among science, human endeavor and various cultures.

### **Objectives:**

- **Classification:** Differentiate between the six kingdoms using form/function, unique characteristics, and ecological and economical importance.
- Explain the purpose of the levels of taxonomy.
- Explain the hierarchy and interrelationships of the levels of biological organization (biosphere, ecosystem, population, etc.).
- Relate an energy pyramid to food chains and energy flow.
- Relate how the abiotic factors of biomes affect living organisms and their adaptations.
- Analyze food chains and food webs.
- Identify and relate an organism's niche as a heterotroph, autotroph, predator, prey, etc.
- Compare and contrast relationships between organisms.
- Explain how limiting factors affect population growth and carrying capacity.
- Recognize man's impact on the environment.

**Assessment:** Selected response exam

## **Outcome 2**

Students will identify, discuss and apply the fundamentals of molecular biology and genetics as they relate to history, current research, evolutionary theory and human ethics.

### **Academic ELOs**

- Use scientific processes to understand the unifying concepts of the natural world.
- Demonstrate understanding of life, physical, earth and space sciences.
- Understand ethnic and cultural differences.
- Understand human differences.
- Understand human growth and development.
- Evaluate the impact of addictive substances and behaviors.

### **Life Skills ELOs**

- Solve problems by processing available information pertinent to a given situation, making decisions as appropriate.
- Obtain, organize and evaluate information successfully.
- Acknowledge diversity of others.
- Respect the rights of others.

### **Millard Standards**

- Relate and apply the unifying concepts and processes to the natural world.
- Analyze and apply life science concepts, principles, theories and models.
- Analyze the connections between science and technology.
- Relate science to personal and social issues.
- Evaluate the interrelationships among science, human endeavor and various cultures.

### **Objectives:**

- Draw Punnett squares and use them to predict genetic probability.
- Examine possible causes and effects of mutations.
- Recognize molecular differences, processes and the importance of DNA and RNA.
- Explore the connection between natural selection and adaptation.
- Describe several types of scientific evidence used to support the theory of biological evolution.
- Develop an awareness of the ethics of current genetics issues.
- Examine the accomplishments of biologists, including Gregor Mendel and Charles Darwin.

**Assessment:** Selected response exam

## **Outcome 3**

Students will identify and analyze form and function, cell differentiation, biochemistry and cellular processes.

### Academic ELOs

- Use scientific processes to understand the unifying concepts of the natural world.
- Demonstrate understanding of life, physical, earth and space sciences.
- Use a variety of technological resources to solve problems.
- Identify the values of good nutrition and physical activity.

### Life Skills ELOs

- Solve problems by processing available information pertinent to a given situation, making decisions as appropriate.
- Obtain, organize and evaluate information successfully.

### Millard Standards

- Relate and apply the unifying concepts and processes to the natural world.
- Apply the knowledge and process skills needed for scientific inquiry.
- Analyze and apply physical science concepts, principles, theories and models.
- Analyze and apply life science concepts, principles, theories and models.
- Analyze the connections between science and technology.
- Relate science to personal and social issues.
- Evaluate the interrelationships among science, human endeavor and various cultures.

### **Objectives:**

- Explain the hierarchy and interrelationships of levels of cellular organization, including cell, tissue and organ.
- Use models to analyze cycles of nature (nitrogen, carbon and water).
- Identify and relate form to function of eukaryotic cell organelles, specifically the nucleus, mitochondria, cytoplasm, chloroplast, ribosome, vacuole, plasma membrane and cell wall.
- Differentiate the properties of acids, bases and water and relate them to living systems.
- Identify the structure of organic and inorganic compounds and relate their importance to the human body.
- Explain how the Law of Conservation of Matter is exhibited in chemical reactions.
- Explain the importance and results of the following cellular processes: photosynthesis, respiration, transport, mitosis/meiosis and cell cycle.
- Summarize the relationship of inquiry to advancements in biological technology.

**Assessment:** Create a model showing cellular structure, function and processes.

### **Outcome 4**

Students will use scientific inquiry and technology to recognize and apply the unifying concepts and processes of the natural world.

### Academic ELOs

- Use scientific processes to understand the unifying concepts of the natural world.
- Demonstrate understanding of life, physical, earth and space sciences.
- Obtain information electronically and organize it successfully.
- Convey information using technology.
- Use a variety of technological resources to solve problems.

### Life Skills ELOs

- Demonstrate the ability to manage time.
- Demonstrate the ability to follow directions.
- Solve problems by processing available information pertinent to a given situation, making decisions as appropriate.
- Develop the ability to work with others to accomplish tasks/goals.
- Demonstrate essential knowledge of good work habits.
- Demonstrate responsibility.
- Obtain, organize and evaluate information successfully.

### Millard Standards

- Relate and apply the unifying concepts and processes to the natural world.
- Apply the knowledge and process skills needed for scientific inquiry.
- Analyze and apply life science concepts, principles, theories and models.
- Analyze the connections between science and technology.]
- Evaluate the interrelationships among science, human endeavor and various cultures.

### **Objectives:**

- Use appropriate laboratory equipment to collect and graph data.
- Differentiate between observation and inference.
- Identify and utilize components of scientific inquiry.
  - Develop hypothesis based on an identified problem.
  - Conduct controlled experiment with independent and dependent variables.
  - Organize and analyze data.
  - Form conclusions based upon evidence.
  - Identify sources of error.
- Use technology to conduct and/or simulate a scientific investigation.

**Assessment:** Conduct a controlled experiment

**Primary Text:**

# ZOOLOGY

**Zoology**

**10/12**

**Semester**

**5 Credits**

**Course Description:** This course offers an in-depth exploration of animal life. In a laboratory setting, students investigate the physical structure of animals in order to understand its function based on the morphological, physiological and behavioral characteristics. Students also examine the relationship of animals to their environment and to each other. Emphasis is placed on the understanding and use of biological classification.

## **Outcome 1**

Students will identify and explain how individuals or groups of animals adapt to and interact with their environments.

### **Academic ELOs**

- Use scientific processes to understand the unifying concepts of the natural world.
- Demonstrate understanding of life, physical, earth and space sciences.
- Obtain information electronically and organize it successfully.

### **Life Skills ELOs**

- Demonstrate the ability to follow directions.

### **Millard Standards**

- Relate and apply the unifying concepts and processes to the natural world.
- Apply the knowledge and process skills needed for scientific inquiry.
- Analyze and apply life science concepts, principles, theories and models.
- Analyze the connections between science and technology.

## **Objectives:**

- Discuss and examine various body systems, which may include:
  - Respiration
  - Skeletal/support
  - Muscular
  - Digestion/nutrition
  - Reproduction
  - Excretion
  - Circulation
- Compare and contrast structural and behavioral variations among animal groups.
- Examine and discuss interactions among various animal groups regarding:
  - Abiotic environment
  - Biotic environment
  - Life cycle/history
  - Communications

**Assessment:** Multiple choice exam.

## **Outcome 2**

Students will identify and compare selected animal groups based on morphological, physiological and behavioral characteristics.

### **Academic ELOs**

- Use scientific processes to understand the unifying concepts of the natural world.
- Demonstrate understanding of life, physical, earth and space sciences.
- Obtain information electronically and organize it successfully.

### **Life Skills ELOs**

- Demonstrate the ability to follow directions.

### **Millard Standards**

- Relate and apply the unifying concepts and processes to the natural world.
- Apply the knowledge and process skills needed for scientific inquiry.
- Analyze and apply life science concepts, principles, theories and models.
- Analyze the connections between science and technology.

### **Objectives:**

- Explore and examine the following animal phyla:
  - Porifera
    - Structure/function
    - Cell specialization
  - Cnidarians
    - Structure/function
    - Germ layers
  - Simple worms
    - Acoelomate
    - Pseudocoelomate
    - Symbiosis
  - Mollusks
    - Coelomate
    - Adaptive radiation
  - Annelids
    - Segmentation
  - Arthropods
    - Metamorphosis
  - Echinodermata
    - Deuterostome
    - Protostome
  - Chordates:
    - Vertebrates
    - Fish and amphibians
    - Reptiles and birds
    - Mammals

The objectives (concepts) listed under outcome 1 are taught simultaneously with the objectives (phyla) listed under outcome 2.

**Assessment:** Exam consisting of diagrams to be labeled and explained

**Primary Text:**

## CHEMISTRY

**Chemistry**                      **10/12**                      **Year**                      **10 Credits**

**Course Description:** This course emphasizes the impact of chemistry on a global society. The course is designed to stimulate and challenge students by presenting a broad view of chemistry. Students will develop a strong conceptual understanding of chemical principles and enhance problems-solving skills through laboratory experience and the application of acquired information.

### **Outcome 1**

Based on their understanding of chemistry, students will make informed decisions about issues involving science and the applications of technology.

#### Academic ELOs

- Use scientific process to understand the unifying concepts of the natural world
- Demonstrate understanding of life, physical, earth, and space science
- Select, organize, display and analyze data.
- Use a variety of technological resources to solve problems

#### Life Skills ELOs

- Solve problems by processing available information pertinent to a given situation, making decisions as appropriate.

#### Millard Standards

- Relate and apply the unifying concepts and processes to the natural world.
- Apply the knowledge and process skills needed for scientific inquiry.
- Analyze and apply physical science concepts, principles, theories and models.
- Analyze the connections between science and technology.
- Relate science to personal and social issues.
- Evaluate the interrelationships among science, human endeavor and various cultures.

### **Objectives:**

- Utilize knowledge of chemistry and apply critical thinking skills to biochemistry, environmental chemistry, industrial chemistry, and nuclear radiation and energy.
- Relate the unifying concepts and processes inherent in chemistry.
- Integrate the history and nature of science with ethical, personal, cultural and societal issues.
- Use current technology to investigate and communicate chemistry concepts.

### **Assessment:**

Exam consisting of multiple choice and short response items

### **Outcome 2**

Students will explain the composition, structure, organization and interactions of matter.

### Academic ELOs

- Use scientific process to understand the unifying concepts of the natural world
- Demonstrate understanding of life, physical, earth, and space science
- Select, organize, display and analyze data.
- Use a variety of technological resources to solve problems

### Life Skills ELOs

- Solve problems by processing available information pertinent to a given situation, making decisions as appropriate.

### Millard Standards

- Relate and apply the unifying concepts and processes to the natural world.
- Apply the knowledge and process skills needed for scientific inquiry.
- Analyze and apply physical science concepts, principles, theories and models.
- Relate science to personal and social issues.
- Evaluate the interrelationships among science, human endeavor and various cultures.

### **Objectives:**

- Explain and apply concepts of physical properties and changes, including states of matter, phase changes, gas laws, kinetic molecular theory, and solutions and solubility.
- Explain and apply concepts of chemical properties and changes, including reaction types; nomenclature; oxidation/reduction reactions; factors that affect reactions; formulas; balancing equations; acids, bases and pH; stoichiometry and mole concept.
- Explain and apply geochemical cycles.
- Explain and apply atomic structure and periodicity.
- Classify matter, including elements, compounds and mixtures.
- Explain and apply chemical bonding and resulting properties. Relate chemical changes to local, national and global challenges.

### **Assessment:**

Exam consisting of multiple choice and short response items

### **Outcome 3**

Students will explain the role of energy in physical, chemical and nuclear reactions.

### Academic ELOs

- Use scientific process to understand the unifying concepts of the natural world
- Demonstrate understanding of life, physical, earth, and space science
- Select, organize, display and analyze data.
- Use a variety of technological resources to solve problems

### Life Skills ELOs

- Solve problems by processing available information pertinent to a given situation, making decisions as appropriate.

### Millard Standards

- Relate and apply the unifying concepts and processes to the natural world.
- Apply the knowledge and process skills needed for scientific inquiry.
- Analyze and apply physical science concepts, principles, theories and models.

### **Objectives:**

- Explore energy changes as they relate to physical processes associated with states of matter, gas laws, kinetic molecular theory and geochemical cycles.
- Explore energy changes as they relate to chemical processes such as combustion of organic and inorganic compounds.
- Explore energy changes as they relate to nuclear processes such as fission, fusion and nuclear radiation.

**Assessment:** Exam consisting of multiple choice and short response items

### Outcome 4

Students will design and conduct scientific investigations, analyze data and explain related scientific concepts.

### Academic ELOs

- Use scientific process to understand the unifying concepts of the natural world
- Demonstrate understanding of life, physical, earth, and space science
- Select, organize, display and analyze data.
- Use a variety of technological resources to solve problems

### Life Skills ELOs

- Solve problems by processing available information pertinent to a given situation, making decisions as appropriate.

### Millard Standards

- Relate and apply the unifying concepts and processes to the natural world.
- Apply the knowledge and process skills needed for scientific inquiry.
- Analyze and apply physical science concepts, principles, theories and models.
- Analyze the connections between science and technology.

### **Objectives:**

- Incorporate accurate and precise metric measurements in all scientific investigations.
- Use chemical concepts and processes to identify unknown ionic compounds.
- Conduct experiments to synthesize various compounds.
- Use scientific processes to effectively communicate an understanding of scientific concepts.

**Assessment:** Qualitative analysis lab

### **Primary Text:**

# ASTRONOMY

**Astronomy**

**10/12**

**Semester**

**5 Credits**

**Course Description:** This course offers an opportunity to explore various topics in astronomy. Students examine the development of the universe, galaxies, moons and the earth. Emphasis is placed on the exploration of the universe and its development through time.

## **Outcome 1**

Students will examine astronomy concepts and explain how scientific perceptions of the universe evolve.

### **Academic ELOs**

- Understand and use attributes of geometric figures and systems of measurement.
- Demonstrate knowledge of and use coordinate systems and algebraic concepts.
- Select, organize, display and analyze data.
- Apply appropriate mathematical strategies to solve problems.
- Use scientific processes to understand the unifying concepts of the natural world.
- Demonstrate understanding of life, physical, earth and space sciences.
- Obtain information electronically and organize it successfully.
- Convey information using technology.
- Use a variety of technological resources to solve problems.

### **Life Skills ELOs**

- Demonstrate the ability to follow directions.
- Solve problems by processing available information pertinent to a given situation, making decisions as appropriate.
- Obtain, organize and evaluate information successfully.

### **Millard Standards**

- Relate and apply the unifying concepts and processes to the natural world.
- Apply the knowledge and process skills needed for scientific inquiry.
- Analyze and apply physical science concepts, principles, theories and models.
- Analyze and apply earth and space science concepts, principles, theories and models.
- Analyze the connections between science and technology.
- Evaluate the interrelationships among science, human endeavor and various cultures.

### **Objectives:**

- Compare and contrast different celestial models and their origins.
- Explain the evolution of stellar bodies.
- Identify man's role in exploring the Universe.

**Assessment:** Exam in which students will write short-answer responses to questions about astronomy theories and models.

## **Outcome 2**

Students will examine the components of the universe and the Earth's place in space.

### **Academic ELOs**

- Understand and use attributes of geometric figures and systems of measurement.
- Demonstrate knowledge of and use coordinate systems and algebraic concepts.
- Select, organize, display and analyze data.
- Apply appropriate mathematical strategies to solve problems.
- Use scientific processes to understand the unifying concepts of the natural world.
- Demonstrate understanding of life, physical, earth and space sciences.
- Obtain information electronically and organize it successfully.
- Convey information using technology.
- Use a variety of technological resources to solve problems.

### **Life Skills ELOs**

- Demonstrate the ability to follow directions.
- Solve problems by processing available information pertinent to a given situation, making decisions as appropriate.
- Obtain, organize and evaluate information successfully.

### **Millard Standards**

- Relate and apply the unifying concepts and processes to the natural world.
- Apply the knowledge and process skills needed for scientific inquiry.
- Analyze and apply physical science concepts, principles, theories and models.
- Analyze and apply earth and space science concepts, principles, theories and models.
- Analyze the connections between science and technology.
- Evaluate the interrelationships among science, human endeavor and various cultures.

### **Objectives:**

- Categorize stellar bodies.
- Identify relationships between the Earth and other celestial bodies.
- Explain the structure and make-up of the solar system.

**Assessment:** Multiple choice exam on celestial systems.

### **Primary Text:**

## ENVIRONMENTAL SCIENCE

**Environmental Science**

**10/12**

**Semester**

**5 Credits**

**Course Description:** This course is designed to help students gain a better awareness of how they fit into the delicate balance of their environment. The interaction of living things as well as their impact on the non-living will be explored.

### **Outcome 1**

Students will identify, explain and apply the principles underlying the support and maintenance of all ecosystems.

### **Academic ELOs**

- Select, organize, display and analyze data.
- Use scientific processes to understand the unifying concepts of the natural world.
- Demonstrate understanding of life, physical, earth and space sciences.
- Understand human differences.
- Obtain information electronically and organize it successfully.
- Use a variety of technological resources to solve problems.

### **Life Skills ELOs**

- Demonstrate the ability to follow directions.
- Solve problems by processing available information pertinent to a given situation, making decisions as appropriate.
- Develop ability to work with others to accomplish tasks/goals.
- Demonstrate responsibility.
- Obtain, organize and evaluate information successfully.

### **Millard Standards**

- Relate and apply the unifying concepts and processes to the natural world.
- Apply the knowledge and process skills needed for scientific inquiry.
- Analyze and apply physical science concepts, principles, theories and models.
- Analyze and apply life science concepts, principles, theories and models.
- Analyze the connections between science and technology.
- Relate science to personal and social issues.
- Evaluate the interrelationships among science, human endeavor and various cultures.

### **Objectives:**

- Identify and explain the components of an ecosystem and how species interact and adapt to their changing environment.
- Describe and differentiate the cycles and energy flow in ecosystems and the changes they create.
- Define, compare and describe the different ecosystems and biomes.

**Assessment:** Multiple choice exam on interactions within ecosystems.

## **Outcome 2**

Students will explain, examine and predict how human beings interact with and impact their ecosystem as well as other natural ecosystems.

### **Academic ELOs**

- Demonstrate appropriate speaking and listening skills for a variety of settings.
- Select, organize, display and analyze data.
- Apply appropriate mathematical strategies to solve problems.
- Use scientific processes to understand the unifying concepts of the natural world.
- Demonstrate understanding of life, physical, earth and space sciences.
- Understand global interdependence.
- Understand human differences.
- Use a variety of technological resources to solve problems.

### **Life Skills ELOs**

- Demonstrate the ability to follow directions.
- Solve problems by processing available information pertinent to a given situation, making decisions as appropriate.
- Develop ability to work with others to accomplish tasks/goals.
- Demonstrate responsibility.
- Obtain, organize and evaluate information successfully.

### **Millard Standards**

- Relate and apply the unifying concepts and processes to the natural world.
- Apply the knowledge and process skills needed for scientific inquiry.
- Analyze and apply physical science concepts, principles, theories and models.
- Analyze and apply life science concepts, principles, theories and models.
- Analyze the connections between science and technology.
- Relate science to personal and social issues.
- Evaluate the interrelationships among science, human endeavor and various cultures.

### **Objectives:**

- Define and describe water resources and the sources and effects of pollution.
- Identify, explain and predict the causes and effects of air pollution on human beings.
- Describe how the atmosphere and climate affect life on Earth.
- Discuss the use of land and predict the effect of land use on human population.
- Explain how human beings affect biodiversity.
- Compare and contrast renewable and nonrenewable resources.
- Define waste and explain its implications in today's society.
- Explain and predict population patterns in different ecosystems.

**Assessment:** Inquiry based, group activity to develop solutions for human-induced threats on the ecosystem.

### **Primary Text:**

# PHYSICS

**Physics**

**10/12**

**Year**

**10 Credits**

**Course Description:** Physics is a strong college preparatory class that develops critical thinking skills and problem solving techniques. This class would be beneficial for all students going to college, not just students planning to major in science. Students use technology-based laboratory equipment to explore and verify the way the physical world works. Traditional concepts of motion, forces, energy, heat, sound, light, electricity, magnetism, and nuclear physics are emphasized.

In the development of the physics curriculum, we recognize that there are overlying aspects in science education: unifying concepts and processes, knowledge and skills needed for scientific inquiry, human aspects of science and technology, and social perspectives. Although not specifically stated as independent objectives, these aspects will be integrated into the following two physics outcomes.

## Outcome 1

Students will explain and apply concepts and theories of mechanics.

### Academic ELOs

- Represent numbers and relationships between numbers, compute fluently, and make reasonable estimates.
- Understand and use attributes of geometric figures and systems of measurement.
- Demonstrate knowledge of and use coordinate systems and algebraic concepts.
- Select, organize, display and analyze data.
- Apply appropriate mathematical strategies to solve problems.
- Use scientific processes to understand the unifying concepts of the natural world.
- Demonstrate understanding of life, physical, earth and space sciences.
- Obtain information electronically and organize it successfully.
- Convey information using technology.
- Use a variety of technological resources to solve problems.

### Life Skills ELOs

- Demonstrate the ability to follow directions.
- Solve problems by processing available information pertinent to a given situation, making decisions as appropriate.
- Develop ability to work with others to accomplish tasks/goals.
- Demonstrate essential knowledge of good work habits.
- Demonstrate responsibility.
- Obtain, organize and evaluate information successfully.
- Respect the rights of others.

### Millard Standards

- Relate and apply the unifying concepts and processes to the natural world.
- Apply the knowledge and process skills needed for scientific inquiry.
- Analyze and apply physical science concepts, principles, theories and models.
- Analyze and apply earth and space science concepts, principles, theories and models.
- Analyze the connections between science and technology.

- Relate science to personal and social issues.
- Evaluate the interrelationships among science, human endeavor and various cultures.

## Objectives:

### Measurement

- Measure motion and forces.
- Use sensors connected to a computer to gather reliable data and/or be able to manipulate images to collect data.
- Use collected data to make a proper graph including:
  - Labels on each axis.
  - Units for each label on each axis.
  - Convenient choice of scale on each axis.
  - Best fit line of the data points.
  - A correctly formatted title placed at the top of the graph.
- Know the difference between accuracy and precision and use each correctly in context.
- Know how and when to use significant figures when computing.
- Calculate the percent error for the result of an experiment.
- Use computer software to graph data and write about your conclusions to experiments.
- Use computer software to find the mathematical relationships for a set of data.

### Vectors, Scalars, Equilibrium and Torque, Motion and Forces

- Explain the difference between vectors and scalars and give examples of each
- Add vectors graphically and mathematically.
- Use the Pythagorean theorem to find the resultant vector when vectors are added at right angles.
- Calculate the components of any vector given an angle and magnitude.
- Use computer simulation software to solve vector problems.
- Give the conditions required for an object to be in static equilibrium.
- Draw free body force diagrams for objects in static equilibrium.
- Determine the forces on any object in static equilibrium.
- Calculate the torque exerted on an object, and determine the direction of the torque vector.
- Locate an object's center of mass.
- Calculate whether or not forces applied to an object will cause the object to rotate.
- Solve number problems involving the coefficient of friction.

### Kinematics

- Investigate and describe motion.
- Relate energies in the earth system.
- Define the difference between speed and velocity.
- Collect displacement vs. time for any moving object and from this data calculate average and instantaneous speed.
- Define acceleration in terms of velocity and time.
- Construct and calculate the instantaneous value of the slope on any motion-related graph.
- Use a velocity vs. time graph to construct a distance vs. time graph or an acceleration vs. time graph.
- Measure the value of  $g$ , the acceleration due to gravity.
- Solve simple story problems involving distance velocity, acceleration and time.
- Sketch vector diagrams for the vertical and horizontal velocity during projectile motion.

- Solve simple story problems involving the range, maximum height and velocity for projectile motion.

#### Dynamics

- Study and relate motion and forces.
- Describe interactions of energy and matter.
- Relate energy and force in the earth system.
- Investigate the Law of Inertia
- Explain when the Law of Inertia is valid.
- Investigate Newton's Second Law.
- Investigate Newton's Third Law.
- Work story problems involving kinematics equations and Newton's Second Law.
- Investigate circular motion.
- Apply the Law of Universal Gravitation and solve problems.

#### Momentum and Impulse

- Calculate the momentum involved with motion and forces.
- Describe interactions of energy and matter.
- Give examples of elastic and inelastic collisions.
- Define momentum verbally and mathematically.
- Define impulse verbally and mathematically.
- Explain the circumstances under which momentum is conserved.
- Describe what is required to change the momentum of any object.
- Solve number problems related to collisions.

**Assessment:** Performance assessment on forces.

### Outcome 2

Students will explain and apply of concepts and theories of energy.

#### Academic ELOs

- Represent numbers and relationships between numbers, compute fluently, and make reasonable estimates.
- Understand and use attributes of geometric figures and systems of measurement.
- Demonstrate knowledge of and use coordinate systems and algebraic concepts.
- Select, organize, display and analyze data.
- Apply appropriate mathematical strategies to solve problems.
- Use scientific processes to understand the unifying concepts of the natural world.
- Demonstrate understanding of life, physical, earth and space sciences.
- Obtain information electronically and organize it successfully.
- Convey information using technology.
- Use a variety of technological resources to solve problems.

#### Life Skills ELOs

- Demonstrate the ability to follow directions.
- Solve problems by processing available information pertinent to a given situation, making decisions as appropriate.
- Develop ability to work with others to accomplish tasks/goals.
- Demonstrate essential knowledge of good work habits.
- Demonstrate responsibility.

- Obtain, organize and evaluate information successfully.
- Respect the rights of others.

### Millard Standards

- Relate and apply the unifying concepts and processes to the natural world.
- Apply the knowledge and process skills needed for scientific inquiry.
- Analyze and apply physical science concepts, principles, theories and models.
- Analyze and apply earth and space science concepts, principles, theories and models.
- Analyze the connections between science and technology.
- Relate science to personal and social issues.
- Evaluate the interrelationships among science, human endeavor and various cultures.

### **Objectives:**

#### Work, Power, and Energy

- Relate motion and forces to work, power and energy.
- Investigate conservation of energy and increase in disorder
- Discuss interactions of energy and matter related to work, power and energy.
- Energy in the earth system
- Define kinetic energy mathematically.
- Define gravitational potential energy mathematically.
- Write a mathematical definition for work.
- Calculate, in joules, the work done on an object.
- Define power mathematically and explain how power is different than work.
- Solve number problems involving work and power.
- Find experimentally the time equation for a simple pendulum and calculate the amount of kinetic and potential energy available for any time during the swing.
- Calculate the area under a curve and apply the concept to other situations.
- Use Hooke's Law to calculate the energy stored in a spring.

#### Heat, Calorimetry and Phase Changes

- Relate structure and properties of matter.
- Describe conservation of energy and increase in disorder.
- Investigate the interactions of energy and matter.
- Discuss energies in the earth system.
- Define energy units in terms of heating a specific amount of water.
- Explain the difference between heat and temperature without resorting to memorized definitions.
- Experimentally calculate the heat capacity of an object.
- Calculate the specific heat capacity of an object and use its specific heat to help identify the material.
- Solve number problems involving heat loss and gain.
- On a temperature vs. time phase change graph, identify the following specific points: heat of fusion, heat of crystallization, heat of vaporization and heat of condensation.
- Solve number problems associated with phase changes.

#### Nuclear Physics

- Investigate the structure and components of the atom.
- Describe the structure and properties of matter.

- Discuss the role of science and technology in local, national and global challenges.
- Investigate interactions of energy and matter.
- Discuss nuclear energies in the earth system.
- Relate radioisotopes to the origin of the earth system.
- Rank types of radiation according to their penetration ability.
- Calculate the half-life of a radioisotope.
- Calculate how the dose rate varies with distance from a radioactive source.

#### Electricity and Magnetism

- Describe electrical structure and properties of matter.
- Describe motion and forces.
- Demonstrate how to give a neutral object either a positive or negative charge, using conduction or induction.
- Draw pictures of neutral and charged objects, showing the relative amount of charge as well as where the charges are concentrated.
- Calculate the charge on an object in coulombs.
- Use Coulomb's Law to solve simple number problems.
- Explain the concept of an electric field.
- Define electrical resistance in terms of voltage and current.
- Create an analogy to clarify the voltage, current and resistance in an electric circuit.
- Use volt-ohm meter to measure voltage, current and resistance in operating electrical circuits.
- Calculate the value of resistor networks.
- Calculate the theoretical voltage drop across any two points in a simple resistor circuit.
- Calculate the power consumed by an electrical device, given the operating voltage and the current.

#### Wave Behavior

- Describe the interactions of energy and matter.
- Investigate the Law of Reflection for light.
- Experimentally investigate the Law of Refraction for light.
- Perform experiments on light optics.
- Use the behavior of light to investigate the particulate and wave theory of light.
- Identify the amplitude, wavelength, frequency and period of a wave pattern.
- Calculate the velocity of any wave given its wavelength and its frequency.
- Explain the difference between a transverse wave and a longitudinal wave and give an example of each.
- Measure the speed of sound experimentally at normal atmospheric conditions and compare the experimental value to the accepted value.
- Calculate the speed of sound at any temperature within the normal range of temperatures on earth.
- Calculate the wavelength of any wave given its frequency or calculate any frequency given its wavelength.
- Use the superposition principle to add any two wave patterns.
- Draw the harmonics of a fundamental pitch given the wavelength of the fundamental pitch.
- Solve number problems involving the Doppler effect.
- Define resonance and give common examples.
- Relate energy content and amplitude in a wave.
- Define a decibel mathematically and solve number problems involving decibels.

**Assessment:** Performance assessment on energy.

**Primary Text:**

## HUMAN PHYSIOLOGY

**Human Physiology**                      **10/12**                      **Year**                      **10 Credits**

**Course Description:** This course is an in-depth study of the structure and function of human body systems. It is recommended for students interested in learning about the structure and function of the human body, exploring current health topics such as causation and prevention of disease, acquiring health occupational skills and gaining insight into various health and medical careers.

### **Outcome 1**

Students will understand that the human body is a dynamic entity controlled by homeostatic mechanisms.

#### Academic ELOs

- Use scientific processes to understand the unifying concepts of the natural world.
- Demonstrate understanding of life, physical, earth and space sciences.
- Understand human differences.
- Use a variety of technological resources to solve problems.
- Identify the values of good nutrition and physical activity.
- Evaluate the impact of addictive substances and behavior.

#### Life Skills ELOs

- Demonstrate the ability to follow directions.
- Solve problems by processing available information pertinent to a given situation, making decisions as appropriate.
- Develop ability to work with others to accomplish tasks/goals.
- Demonstrate responsibility.
- Obtain, organize and evaluate information successfully.

#### Millard Standards

- Relate and apply the unifying concepts and processes to the natural world.
- Apply the knowledge and process skills needed for scientific inquiry.
- Analyze and apply life science concepts, principles, theories and models.
- Analyze the connections between science and technology.
- Relate science to personal and social issues.

### **Objectives:**

- Identify the basic anatomy of body systems and explain the role of homeostasis in regulating body function.
  - Integumentary system
  - Skeletal system
  - Muscular system
  - Nervous system
  - Endocrine system
  - Circulatory system

- Lymphatic system
- Respiratory system
- Digestive system
- Nutrition and metabolism
- Urinary system
- Reproductive system
- Illustrate how the mechanisms of disease disrupt homeostasis.
- Apply the basic chemical processes of physiology, such as nutrition, metabolism, pH and fluid balance.

**Assessment:** Multiple choice exam on human body systems and homeostasis

## **Outcome 2**

Students will analyze the relationship between form and function of anatomical structures.

### **Academic ELOs**

- Use scientific processes to understand the unifying concepts of the natural world.
- Demonstrate understanding of life, physical, earth and space sciences.

### **Life Skills ELOs**

- Demonstrate the ability to follow directions.
- Solve problems by processing available information pertinent to a given situation, making decisions as appropriate.
- Develop ability to work with others to accomplish tasks/goals.
- Demonstrate responsibility.
- Obtain, organize and evaluate information successfully.

### **Millard Standards**

- Relate and apply the unifying concepts and processes to the natural world.
- Apply the knowledge and process skills needed for scientific inquiry.
- Analyze and apply life science concepts, principles, theories and models.
- Analyze the connections between science and technology.
- Relate science to personal and social issues.

### **Objectives:**

- Identify how structures and functions of major organs of the body systems are related.
  - Integumentary system
  - Skeletal system
  - Muscular system
  - Nervous system
  - Endocrine system
  - Circulatory system
  - Lymphatic system
  - Respiratory system
  - Digestive system
  - Nutrition and metabolism

- Urinary system
- Reproductive system

**Assessment:** Students will write an analysis of the relationship between form and function of a given anatomical part.

### **Outcome 3**

Students will demonstrate how individual body systems are interrelated.

#### **Academic ELOs**

- Use scientific processes to understand the unifying concepts of the natural world.
- Demonstrate understanding of life, physical, earth and space sciences.
- Understand human differences.
- Use a variety of technological resources to solve problems.
- Identify the values of good nutrition and physical activity.
- Evaluate the impact of addictive substances and behavior.

#### **Life Skills ELOs**

- Demonstrate the ability to follow directions.
- Solve problems by processing available information pertinent to a given situation, making decisions as appropriate.
- Develop ability to work with others to accomplish tasks/goals.
- Demonstrate responsibility.
- Obtain, organize and evaluate information successfully.

#### **Millard Standards**

- Relate and apply the unifying concepts and processes to the natural world.
- Apply the knowledge and process skills needed for scientific inquiry.
- Analyze and apply life science concepts, principles, theories and models.

#### **Objectives:**

- Examine basic functions of each body system.
- Compare and contrast these basic functions.
- Explain how functions in one system are dependent on functions in other systems.
  - Integumentary system
  - Skeletal system
  - Muscular system
  - Nervous system
  - Endocrine system
  - Circulatory system
  - Lymphatic system
  - Respiratory system
  - Digestive system
  - Nutrition and metabolism
  - Urinary system
  - Reproductive system



## ADVANCED PLACEMENT<sup>®</sup> CHEMISTRY

**Advanced Placement<sup>®</sup> Chemistry                      11/12                      Year                      10 Credits**

**Course Description:** This course provides a rigorous, in-depth study of the structure of matter (atomic theory, atomic structure, chemical bonding, nuclear chemistry), states of matter (gases, liquids, solids, solutions), and reactions (reaction types, stoichiometry, equilibrium, kinetics, thermodynamics). AP<sup>®</sup> Chemistry is designed to be equivalent to college-level introductory general chemistry courses; therefore, student expectations and outcomes will be similar. In addition to the traditional classroom format, students participate in an intensive laboratory experience and become familiar with current scientific literature. Completion of this course will prepare students to take the College Board AP<sup>®</sup> Chemistry exam.

Because this course is aligned with the College Board AP<sup>®</sup> Chemistry curriculum, course content is subject to changes made by the College Board and will be adjusted accordingly.

### **Outcome 1**

Students will examine, compare and categorize matter according to atomic structure and chemical bonding.

#### **Academic ELOs**

- Use scientific processes to understand the unifying concepts of the natural world.
- Demonstrate understanding of life, physical, earth and space sciences.

#### **Life Skills ELOs**

- Solve problems by processing available information pertinent to a given situation, making decisions as appropriate.
- Obtain, organize and evaluate information successfully.

#### **Millard Standards**

- Relate and apply the unifying concepts and processes to the natural world.
- Apply the knowledge and process skills needed for scientific inquiry.
- Analyze and apply physical science concepts, principles, theories and models.
- Evaluate the interrelationships among science, human endeavor and various cultures.

### **Objectives:**

- Analyze and describe concepts of atomic theory, atomic structure and periodic relationships.
- Analyze and describe concepts of intra- and inter-molecular bonding and molecular structure.

**Assessment:** Multiple choice questions from released AP<sup>®</sup> Chemistry exam: atomic theory and structure, binding forces and molecular models, and the geometry of molecules.

## **Outcome 2**

Students will differentiate between the properties and characteristics of the states of matter as related to the kinetic molecular theory.

### **Academic ELOs**

- Use scientific processes to understand the unifying concepts of the natural world.
- Demonstrate understanding of life, physical, earth and space sciences.

### **Life Skills ELOs**

- Solve problems by processing available information pertinent to a given situation, making decisions as appropriate.
- Obtain, organize and evaluate information successfully.

### **Millard Standards**

- Relate and apply the unifying concepts and processes to the natural world.
- Apply the knowledge and process skills needed for scientific inquiry.
- Analyze and apply physical science concepts, principles, theories and models.
- Evaluate the interrelationships among science, human endeavor and various cultures.

### **Objectives:**

- Explain and apply concepts of gas laws and applications of kinetic molecular theory.
- Utilize and explain properties of liquids, solids and solutions.

**Assessments:** Multiple choice questions from released AP<sup>®</sup> Chemistry exam: laws of ideal gases, kinetic-molecular energy, liquids and solids, and solutions.

## **Outcome 3**

Students will analyze the dynamic interactions of chemical reactions and explore the mathematical relationships of these reactions.

### **Academic ELOs**

- Select, organize, display and analyze data.
- Apply appropriate mathematical strategies to solve problems.
- Use scientific processes to understand the unifying concepts of the natural world.
- Demonstrate understanding of life, physical, earth and space sciences.
- Use a variety of technological resources to solve problems.

### **Life Skills ELOs**

- Solve problems by processing available information pertinent to a given situation, making decisions as appropriate.

### **Millard Standards**

- Relate and apply the unifying concepts and processes to the natural world.
- Apply the knowledge and process skills needed for scientific inquiry.
- Analyze and apply physical science concepts, principles, theories and models.

## Objectives:

- Describe the concepts of and solve problems using gas laws, solutions, stoichiometry, equilibrium, kinetics, thermodynamics and electrochemistry.
- Describe the concepts of and solve problems involving the following reaction types: acid/base, precipitation, oxidation/reduction and nuclear.

**Assessments:** Multiple choice questions from released AP<sup>®</sup> Chemistry exam: reaction types, stoichiometry, equilibrium, kinetics and thermodynamics.

## Outcome 4

Students will identify, explain, participate and use technology in activities that demonstrate key principles and concepts of chemistry.

### Academic ELOs

- Select, organize, display and analyze data.
- Apply appropriate mathematical strategies to solve problems.
- Use scientific processes to understand the unifying concepts of the natural world.
- Demonstrate understanding of life, physical, earth and space sciences.
- Obtain information electronically and organize it successfully.
- Convey information using technology.
- Use a variety of technological resources to solve problems.

### Life Skills ELOs

- Solve problems by processing available information pertinent to a given situation, making decisions as appropriate.
- Develop ability to work with others to accomplish tasks/goals.

### Millard Standards

- Relate and apply the unifying concepts and processes to the natural world.
- Apply the knowledge and process skills needed for scientific inquiry.
- Analyze and apply physical science concepts, principles, theories and models.
- Analyze the connections between science and technology.

## Objectives:

- Describe the concepts of and solve problems utilizing gas laws, solutions, stoichiometry, equilibrium, kinetics, thermodynamics and electrochemistry.
- Describe the concepts of and solve problems involving the following reaction types: acid/base, precipitation, oxidation/reduction and nuclear.
- Describe chemical interactions based on lab experiences.
- Manipulate and use a variety of technologically advanced laboratory equipment.

**Assessments:** Multiple choice questions from released AP<sup>®</sup> Chemistry exam: chemical reactivity and the products of chemical reactions, relationships in the periodic table.

## Primary Text:

## ADVANCED PLACEMENT<sup>®</sup> BIOLOGY

**Advanced Placement<sup>®</sup> Biology**      **11/12**      **Year**      **10 Credits**

**Course Description:** AP<sup>®</sup> Biology provides an in-depth study of the rigorous components of the life sciences. Emphasis is placed on traditional concepts as well as current topics in biology and related subjects. This course is designed to be the equivalent to a college-level introductory biology course with the intent of providing a strong preparation for post-high school science. Completion of this course will prepare students to take the College Board AP<sup>®</sup> Biology exam. An AP<sup>®</sup> Biology student should possess strong writing, reading and analytical skills.

Because this course is aligned with the College Board AP<sup>®</sup> Biology curriculum, course content is subject to changes made by the College Board and will be adjusted accordingly.

### Outcome 1

Students will examine and discuss the inter-relationships between biomolecules, the cell and the cyclic nature of energy and its transformations.

#### Academic ELOs

- Use scientific processes to understand the unifying concepts of the natural world.
- Demonstrate understanding of life, physical, earth and space sciences.
- Obtain information electronically and organize it successfully.
- Convey information using technology.
- Use a variety of technological resources to solve problems.

#### Life Skills ELOs

- Demonstrate the ability to manage time.
- Demonstrate the ability to follow directions.
- Solve problems by processing available information pertinent to a given situation, making decisions as appropriate.
- Develop ability to work with others to accomplish tasks/goals.
- Demonstrate essential knowledge of good work habits.
- Demonstrate responsibility.

#### Millard Standards

- Relate and apply the unifying concepts and processes to the natural world.
- Apply the knowledge and process skills needed for scientific inquiry.
- Analyze and apply life science concepts, principles, theories and models.
- Analyze the connections between science and technology.
- Evaluate the interrelationships among science, human endeavor and various cultures.

#### **Objectives:**

- Explain the chemistry that supports cellular activity.
  - Elements essentials to biological life
  - Molecular bonding
  - Properties of water and its importance to life

- Organic molecules essential to life
- Identify energy changes that support cellular metabolic activities.
  - Endergonic and exergonic reactions
  - Metabolic pathways
  - Enzymatic activity and influence
  - Coupled reactions
- Compare and contrast structure and function of eukaryotic and prokaryotic cells.
  - Cell organelles
  - Organelle structure and function
  - Reproduction
  - Cellular metabolism
- Explain the anatomy and physiology the plasma membrane.
  - Transport processes
  - Structure of membrane
  - Electrochemical gradients
  - Tonicity
  - Turgor pressure
  - Cell recognition and communication
- Describe the oxidation of glucose to produce cellular energy.
  - Glycolysis
  - Krebs Cycle
  - Electron transport
  - Aerobic and anaerobic respiration
  - Fermentative processes
  - Chemiosmosis
- Explain the importance of the cell cycle and list the events that complete the process.
  - Mitosis
  - DNA replication
  - Interphase
  - Cytokinesis
- Describe the process of autotrophic metabolism and the synthesis of carbohydrates. This includes topics on:
  - Photosynthetic light reactions
  - Photosynthetic carbon-fixing reactions
  - Leaf anatomy
  - Chloroplasts

**Assessments:** Selected response exam

## **Outcome 2**

Students will apply fundamentals of genetics as they relate to inheritance, gene expression, biotechnology and evolutionary theory.

### Academic ELOs

- Use scientific processes to understand the unifying concepts of the natural world.
- Demonstrate understanding of life, physical, earth and space sciences.
- Obtain information electronically and organize it successfully.
- Convey information using technology.
- Use a variety of technological resources to solve problems.

### Life Skills ELOs

- Demonstrate the ability to manage time.
- Demonstrate the ability to follow directions.
- Solve problems by processing available information pertinent to a given situation, making decisions as appropriate.
- Develop ability to work with others to accomplish tasks/goals.
- Demonstrate essential knowledge of good work habits.
- Demonstrate responsibility.

### Millard Standards

- Relate and apply the unifying concepts and processes to the natural world.
- Apply the knowledge and process skills needed for scientific inquiry.
- Analyze and apply life science concepts, principles, theories and models.
- Analyze the connections between science and technology.
- Evaluate the interrelationships among science, human endeavor and various cultures.

### **Objectives:**

- Explain the importance of meiosis and identify those events that determine the proper formation of sex cells.
  - Reduction of chromosome of number
  - Gametogenesis,
  - Various life cycles
- Identify historical research that establishes genetic theory and apply it to explaining human genetics.
  - Mendelian genetics
  - Sex-linked traits
  - Gene linkage
- Compare and contrast the structure and function DNA and RNA and identify their importance in cell function.
  - Replication
  - Transcription
  - Translation
  - Protein synthesis
- List the various components involved in molecular genetics and relate advancements in gene regulation and biotechnology
  - Biotechnology- genetic engineering
  - Recombinant DNA technology
- Sequence events that established the theory of biological evolution and analyze current evidence that supports it.
  - Evidence of evolutionary theory

- Mechanism of evolution
- Micro- and macro-evolution
- Patterns of evolution

**Assessments:** Selected response exam

### **Outcome 3**

Students will examine relationships of structure to function of organisms and how those organisms interact with their environment.

#### **Academic ELOs**

- Use scientific processes to understand the unifying concepts of the natural world.
- Demonstrate understanding of life, physical, earth and space sciences.
- Obtain information electronically and organize it successfully.
- Convey information using technology.
- Use a variety of technological resources to solve problems.

#### **Life Skills ELOs**

- Demonstrate the ability to manage time.
- Demonstrate the ability to follow directions.
- Solve problems by processing available information pertinent to a given situation, making decisions as appropriate.
- Develop ability to work with others to accomplish tasks/goals.
- Demonstrate essential knowledge of good work habits.
- Demonstrate responsibility.

#### **Millard Standards**

- Relate and apply the unifying concepts and processes to the natural world.
- Apply the knowledge and process skills needed for scientific inquiry.
- Analyze and apply life science concepts, principles, theories and models.
- Analyze the connections between science and technology.
- Evaluate the interrelationships among science, human endeavor and various cultures.

### **Objectives:**

- Identify the taxonomy system used to classify organisms and the criteria used to create the classification of the six kingdom system
  - Eubacteria
  - Archaeobacteria
  - Protista
  - Fungi
  - Plantae
  - Animalia
- Identify those systems within the animal kingdom that create homeostatic physiology for the organism.
  - Digestion
  - Circulation

- Respiration
- Nervous
- Excretion
- Immune
- Reproduction
- Compare and contrast plant tissue systems that drive normal homeostatic physiology for plants.
  - Dermal System
  - Ground System
  - Vascular System
  - Reproduction
- Identify components of various ecosystems and describe how interactions within those ecosystems influences balance of them.
  - Populations
  - Communities
  - Ecosystems
  - Cycling of nutrients

**Assessments:** Selected response exam

**Primary Text:**

## ADVANCED PLACEMENT<sup>®</sup> PHYSICS B

**Advanced Placement Physics B**    **11/12**                      **Year**                      **10 Credits**

**Course Description:** This course is for students with a very strong interest in science and mathematics. A college physics textbook will be the basis for covering both traditional and modern topics in physics with emphasis on mechanics, thermodynamics, electricity, magnetism, light, optics, quantum physics and atomic/nuclear physics. The rigor of this course will prepare students for the AP<sup>®</sup> Physics B exam. Previously released AP<sup>®</sup> Physics B exam questions will be utilized for assessment throughout the course.

The AP<sup>®</sup> Physics B curriculum, developed by The College Board, is a dynamic document and subject to change periodically.

Within the AP<sup>®</sup> Physics B, curriculum there are overlying aspects in science education: unifying concepts and processes, knowledge and skills needed for scientific inquiry, human aspects of science and technology, and social perspectives. Although not specifically stated as independent objectives, these aspects will be integrated into the following outcomes.

### Outcome 1

Students will analyze and verify principles of Newtonian mechanics.

### Academic ELOs

- Represent numbers and relationships between numbers, compute fluently, and make reasonable estimates.
- Understand and use attributes of geometric figures and systems of measurement.
- Demonstrate knowledge of and use coordinate systems and algebraic concepts.
- Select, organize, display and analyze data.
- Apply appropriate mathematical strategies to solve problems.
- Use scientific processes to understand the unifying concepts of the natural world.
- Demonstrate understanding of life, physical, earth and space sciences.
- Obtain information electronically and organize it successfully.
- Convey information using technology.
- Use a variety of technological resources to solve problems.

### Life Skills ELOs

- Demonstrate the ability to follow directions.
- Solve problems by processing available information pertinent to a given situation, making decisions as appropriate.
- Develop ability to work with others to accomplish tasks/goals.
- Demonstrate essential knowledge of good work habits.
- Demonstrate responsibility.
- Obtain, organize and evaluate information successfully.
- Respect the rights of others.

### Millard Standards

- Relate and apply the unifying concepts and processes to the natural world.
- Apply the knowledge and process skills needed for scientific inquiry.
- Analyze and apply physical science concepts, principles, theories and models.

- Analyze the connections between science and technology.

### **Objectives:**

- Kinematics: Mathematically analyze and describe motion.
- Newton's laws of motion: Relate forces and motion.
- Work, energy and power: Mathematically relate through the Law of Conservation of Energy.
- Systems of particles, linear momentum: Describe and analyze collisions through conservation of momentum.
- Circular motion and rotation: Mathematically describe and analyze rotational motion and equilibrium.
- Oscillations and gravitation: Describe simple harmonic motion in pendulum, spring, and circular systems.

**Assessment:** Previously released AP<sup>®</sup> Physics B exam questions Assessment:

### **Outcome 2**

Students will analyze and verify principles of fluid mechanics and thermal physics.

#### Academic ELOs

- Represent numbers and relationships between numbers, compute fluently, and make reasonable estimates.
- Understand and use attributes of geometric figures and systems of measurement.
- Demonstrate knowledge of and use coordinate systems and algebraic concepts.
- Select, organize, display and analyze data.
- Apply appropriate mathematical strategies to solve problems.
- Use scientific processes to understand the unifying concepts of the natural world.
- Demonstrate understanding of life, physical, earth and space sciences.
- Obtain information electronically and organize it successfully.
- Convey information using technology.
- Use a variety of technological resources to solve problems.

#### Life Skills ELOs

- Demonstrate the ability to follow directions.
- Solve problems by processing available information pertinent to a given situation, making decisions as appropriate.
- Develop ability to work with others to accomplish tasks/goals.
- Demonstrate essential knowledge of good work habits.
- Demonstrate responsibility.
- Obtain, organize and evaluate information successfully.
- Respect the rights of others.

#### Millard Standards

- Relate and apply the unifying concepts and processes to the natural world.
- Apply the knowledge and process skills needed for scientific inquiry.
- Analyze and apply physical science concepts, principles, theories and models.
- Analyze the connections between science and technology.

## Objectives:

- Temperature and heat: Analyze and describe mechanical equivalence, calorimetry, and heat transfer.
- Kinetic Theory: Qualitatively and quantitatively describe an ideal gas and its relationship to energy.
- Thermodynamics: Apply the laws of thermodynamics to conservation of energy and heat transfer.

**Assessment:** Previously released AP<sup>®</sup> Physics B exam questions

## Outcome 3

Students will analyze and verify principles of electricity and magnetism.

### Academic ELOs

- Represent numbers and relationships between numbers, compute fluently, and make reasonable estimates.
- Understand and use attributes of geometric figures and systems of measurement.
- Demonstrate knowledge of and use coordinate systems and algebraic concepts.
- Select, organize, display and analyze data.
- Apply appropriate mathematical strategies to solve problems.
- Use scientific processes to understand the unifying concepts of the natural world.
- Demonstrate understanding of life, physical, earth and space sciences.
- Obtain information electronically and organize it successfully.
- Convey information using technology.
- Use a variety of technological resources to solve problems.

### Life Skills ELOs

- Demonstrate the ability to follow directions.
- Solve problems by processing available information pertinent to a given situation, making decisions as appropriate.
- Develop ability to work with others to accomplish tasks/goals.
- Demonstrate essential knowledge of good work habits.
- Demonstrate responsibility.
- Obtain, organize and evaluate information successfully.
- Respect the rights of others.

### Millard Standards

- Relate and apply the unifying concepts and processes to the natural world.
- Apply the knowledge and process skills needed for scientific inquiry.
- Analyze and apply physical science concepts, principles, theories and models.
- Analyze the connections between science and technology.

## Objectives:

- Electrostatics: Describe electric fields and electric potential.
- Conductors and capacitors: Describe characteristics of conductors and capacitors.
- Electric circuits: Relate voltage, current, resistance, and capacitance in an electric circuit.
- Magnetostatics: Describe forces in a magnetic field.

- Electromagnetism: Relate Faraday's Law and Lenz's Law

**Assessment:** Previously released AP<sup>®</sup> Physics B exam questions

### **Outcome 4**

Students will analyze and verify principles of waves and optics.

#### Academic ELOs

- Represent numbers and relationships between numbers, compute fluently, and make reasonable estimates.
- Understand and use attributes of geometric figures and systems of measurement.
- Demonstrate knowledge of and use coordinate systems and algebraic concepts.
- Select, organize, display and analyze data.
- Apply appropriate mathematical strategies to solve problems.
- Use scientific processes to understand the unifying concepts of the natural world.
- Demonstrate understanding of life, physical, earth and space sciences.
- Obtain information electronically and organize it successfully.
- Convey information using technology.
- Use a variety of technological resources to solve problems.

#### Life Skills ELOs

- Demonstrate the ability to follow directions.
- Solve problems by processing available information pertinent to a given situation, making decisions as appropriate.
- Develop ability to work with others to accomplish tasks/goals.
- Demonstrate essential knowledge of good work habits.
- Demonstrate responsibility.
- Obtain, organize and evaluate information successfully.
- Respect the rights of others.

#### Millard Standards

- Relate and apply the unifying concepts and processes to the natural world.
- Apply the knowledge and process skills needed for scientific inquiry.
- Analyze and apply physical science concepts, principles, theories and models.
- Analyze the connections between science and technology.

### **Objectives:**

- Wave motion (including sound): Describe and analyze wave properties.
- Physical optics: Analyze and calculate interference and diffraction of waves.
- Geometrical optics: Analyze and apply principles of reflection and refraction of light.

**Assessment:** Previously released AP<sup>®</sup> Physics B exam questions

### **Outcome 5**

Students will analyze and verify principles of modern physics.

### Academic ELOs

- Represent numbers and relationships between numbers, compute fluently, and make reasonable estimates.
- Understand and use attributes of geometric figures and systems of measurement.
- Demonstrate knowledge of and use coordinate systems and algebraic concepts.
- Select, organize, display and analyze data.
- Apply appropriate mathematical strategies to solve problems.
- Use scientific processes to understand the unifying concepts of the natural world.
- Demonstrate understanding of life, physical, earth and space sciences.
- Obtain information electronically and organize it successfully.
- Convey information using technology.
- Use a variety of technological resources to solve problems.

### Life Skills ELOs

- Demonstrate the ability to follow directions.
- Solve problems by processing available information pertinent to a given situation, making decisions as appropriate.
- Develop ability to work with others to accomplish tasks/goals.
- Demonstrate essential knowledge of good work habits.
- Demonstrate responsibility.
- Obtain, organize and evaluate information successfully.
- Respect the rights of others.

### Millard Standards

- Relate and apply the unifying concepts and processes to the natural world.
- Apply the knowledge and process skills needed for scientific inquiry.
- Analyze and apply physical science concepts, principles, theories and models.
- Analyze the connections between science and technology.

### **Objectives:**

- Atomic physics and quantum effects: Describe properties and behaviors of photons.
- Nuclear physics: Relate mass number, energy, and charge in nuclear phenomena.

**Assessment:** Previously released AP<sup>®</sup> Physics B exam questions

### **Primary Text:**

