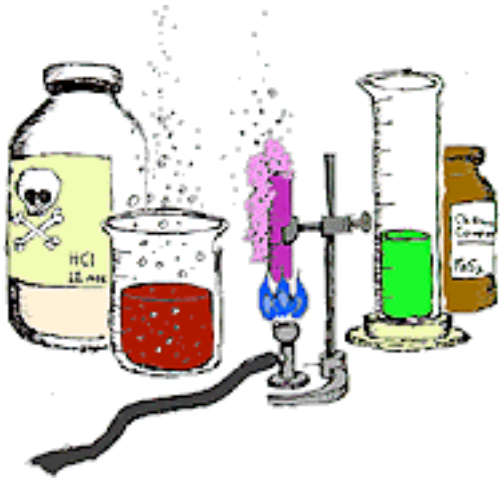
Approved by the MSAD #22 Board of Directors 6/20/2007

SCIENCE CURRICULUM

GRADES K-12
June 2007



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M.S.A.D. #22
Science Curriculum

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Introductory Pages and Overview

Science Curriculum K-12

Acknowledgments

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It is nothing short of a miracle that the modern methods of instruction have not yet entirely strangled the holy curiosity of inquiry.
- Albert Einstein, *Ideas and Opinions*

1. Learning takes place in a positive environment that promotes positive risk-taking, discussion, growth from both mistakes and successes, positive attitudes, and good study habits.

2. Inquiry learning in science involves questioning, thinking, and problem solving, especially being skeptical and willing to question common beliefs. The process leads to multiple ways of knowing.

3. Teachers encourage the viewpoint that science is a sum of the parts, not separate pieces.

4. Instruction
   - builds on a limited number of core concepts and is connected to prior knowledge by encouraging learners to apply previous knowledge to a variety of new situations
   - promotes inquiry through activities that include students identifying their own real questions about natural phenomena and students using reflection to realize concepts and processes learned
   - emphasizes more depth, less breadth
   - develops critical thinking skills
   - integrates reading, writing, and math with science
   - encourages curiosity about nature and positive attitudes toward science for all students

M.S.A.D. #22
MISSION STATEMENT

M.S.A.D. #22 is committed to the optimal learning of all students.

To achieve our mission we are further committed to...

- fostering and modeling a love of learning
- developing self-reliant, creative, and responsible citizens
- providing the necessary resources
- creating a community of respect and caring

Adopted by the M.S.A.D. #22 Board of Directors on June 5, 2002

M.S.A.D. #22
BELIEF STATEMENT

Education enables all students to learn the skills, acquire the knowledge, and develop the attitudes necessary for them to reach their potential as citizens who can meet the challenges of a changing global society.

We believe that...

- all citizens in our communities share the responsibility to educate our children and themselves
- our schools are community support systems and should welcome and encourage all members of our communities to participate
- our schools will have a supportive and empowering atmosphere for all students and community members

M.S.A.D. #22

GRADES K - 2

SCIENCE CURRICULUM

PRIMARY LEVEL

Kindergarten

A. UNIFYING THEMES - Students will be able to apply the concepts of systems of models, constancy and change and scale to further science and technological understanding.
B. THE SKILLS AND TRAITS OF SCIENTIFIC INQUIRY AND TECHNOLOGICAL DESIGN - Students will have the ability to plan, conduct, analyze data from and communicate results of in-depth scientific investigations and use a systematic process, tools, equipment, and a variety of materials to create a technological design producing a solution or product to meet a specified need.
D. THE PHYSICAL SETTING - Students will understand the universal nature of matter, energy, force and motion, and will be able to identify how these relationships are exhibited in Earth Systems, in the solar system and throughout the universe.

Content	Maine Learning Results (1997)	Revised LR (2006)	
Weather	F1	D2	D2 EARTH Students describe earth's weather and surface materials and the different ways they change.
	F2	A3	A3 CONSTANCY AND CHANGE Students will observe how things change or stay the same over time.
		B1 (a & f)	B1 SKILLS AND TRAITS OF SCIENTIFIC INQUIRY Students plan, conduct, and communicate results of simple investigations.

Kindergarten

A. UNIFYING THEMES - Students will be able to apply the concepts of systems of models, constancy and change and scale to further science and technological understanding.
B. THE SKILLS AND TRAITS OF SCIENTIFIC INQUIRY AND TECHNOLOGICAL DESIGN - Students will have the ability to plan, conduct, analyze data from and communicate results of in-depth scientific investigations and use a systematic process, tools, equipment, and a variety of materials to create a technological design producing a solution or product to meet a specified need.
E. THE LIVING ENVIRONMENT - Students will understand that cells are the basic unit of life, that all life as we know it has evolved through genetic transfer and natural selection to create a great diversity of organisms and that these organisms create an interdependent web through which matter and energy flow. They will understand their similarities and differences as humans to other organisms and their interconnections to these webs.

Content	Maine Learning Results (1997)	Revised LR (2006)	
Plants	C1	E3	E3 CELLS -Students will describe parts and wholes of living things, their basic needs, and the structures and processes that help them stay alive.
	C2	A3	A3 CONSTANCY AND CHANGE Students will observe how things change or stay the same over time.
	F3	B1 (f)	B1 SKILLS AND TRAITS OF SCIENTIFIC INQUIRY Students plan, conduct, and communicate results of simple investigations.

Kindergarten

B. THE SKILLS AND TRAITS OF SCIENTIFIC INQUIRY AND TECHNOLOGICAL DESIGN - Students will have the ability to plan, conduct, analyze data from and communicate results of in-depth scientific investigations and use a systematic process, tools, equipment, and a variety of materials to create a technological design producing a solution or product to meet a specified need.
D. THE PHYSICAL SETTING - Students will understand the universal nature of matter, energy, force and motion, and will be able to identify how these relationships are exhibited in Earth Systems, in the solar system and throughout the universe.

Content	Maine Learning Results (1997)	Revised LR (2006)	
Matter	E1	D3	D3 MATTER AND ENERGY Students will use observable characteristics to describe objects and materials and changes to physical properties of materials.
	E2	B1 (a, c & f)	B1 SKILLS AND TRAITS OF SCIENTIFIC INQUIRY Students plan, conduct, and communicate results of simple investigations.
	E3		

Grade One

A. UNIFYING THEMES - Students will be able to apply the concepts of systems of models, constancy and change and scale to further science and technological understanding.
B. THE SKILLS AND TRAITS OF SCIENTIFIC INQUIRY AND TECHNOLOGICAL DESIGN - Students will have the ability to plan, conduct, analyze data from and communicate results of in-depth scientific investigations and use a systematic process, tools, equipment, and a variety of materials to create a technological design producing a solution or product to meet a specified need.
D. THE PHYSICAL SETTING - Students will understand the universal nature of matter, energy, force and motion, and will be able to identify how these relationships are exhibited in Earth Systems, in the solar system and throughout the universe.

Content	Maine Learning Results (1997)	Revised LR (2006)	
Solar System	G1	D1	D1 UNIVERSE AND SOLAR SYSTEM Students will describe the movement of objects across the sky, as seen from the Earth.
	G2	A2	A2 MODELS - Students will use a model to describe and learn about features of things.
	G3	A3	A3 CONSTANCY AND CHANGE - Students will observe how things change or stay the same over time.
		A4	A4 SCALE - Students will observe differences in scale.
		B2	B2 SKILLS AND TRAITS OF TECHNOLOGICAL DESIGN - Students use a simple design process and basic tools and materials to solve a problem or create a product.

Grade One

A. UNIFYING THEMES - Students will be able to apply the concepts of systems of models, constancy and change and scale to further science and technological understanding.
B. THE SKILLS AND TRAITS OF SCIENTIFIC INQUIRY AND TECHNOLOGICAL DESIGN - Students will have the ability to plan, conduct, analyze data from and communicate results of in-depth scientific investigations and use a systematic process, tools, equipment, and a variety of materials to create a technological design producing a solution or product to meet a specified need.
C. SCIENTIFIC AND TECHNOLOGICAL ENTERPRISE - Students will understand the history and nature of scientific knowledge and technology, the processes of inquiry and technological design, and the impacts of science and technology have on society and the environment.
D. THE PHYSICAL SETTING - Students will understand the universal nature of matter, energy, force and motion, and will be able to identify how these relationships are exhibited in Earth Systems, in the solar system and throughout the universe.

Content	Maine Learning Results (1997)	Revised LR (2006)	
Sound	I1	D4	D4 FORCE AND MOTION Students will describe the motion of objects and ways to make objects move in different ways.
	I2	A1	A1 SYSTEMS - Identify parts and wholes objects and their relationships.
		A2	A2 MODELS - Students will use a model to describe and learn about features of things.
		B1	B1 SKILLS AND TRAITS OF SCIENTIFIC INQUIRY Students plan, conduct, and communicate results of simple investigations.
		B2	B2 SKILLS AND TRAITS OF TECHNOLOGICAL DESIGN Students use a simple design process and basic tools and materials to solve a problem or create a product.
		C2	C2 UNDERSTANDINGS ABOUT SCIENCE AND TECHNOLOGY - Students recognize that people have always engaged in science and technology and that there is a difference between the natural and designed world.

Grade One

A. UNIFYING THEMES - Students will be able to apply the concepts of systems of models, constancy and change and scale to further science and technological understanding.
B. THE SKILLS AND TRAITS OF SCIENTIFIC INQUIRY AND TECHNOLOGICAL DESIGN - Students will have the ability to plan, conduct, analyze data from and communicate results of in-depth scientific investigations and use a systematic process, tools, equipment, and a variety of materials to create a technological design producing a solution or product to meet a specified need.
C. SCIENTIFIC AND TECHNOLOGICAL ENTERPRISE - Students will understand the history and nature of scientific knowledge and technology, the processes of inquiry and technological design, and the impacts of science and technology have on society and the environment.
E. THE LIVING ENVIRONMENT -Students will understand that cells are the basic unit of life, that all life as we know it has evolved through genetic transfer and natural selection of organisms and that these organisms create an interdependent web through which matter and energy flow. They will understand their similarities and differences as humans to the other organisms and their interconnections to the web.

Content	Maine Learning Results (1997)	Revised LR (2006)	
Ecology	B1	E1	E1 BIODIVERSITY - Students point out similarities and differences in the observable behaviors, features, and needs of plants and animals.
	B3	E2	E2 ECOSYSTEMS Students will describe how plants and animals depend on each other and the environment they live in.
	B4	E3	E3 CELLS Students will describe parts and wholes of living things, their basic needs, and the structures and processes that help them stay alive.
		A2	A2 MODELS - Students will use a model to describe and learn about features of things.
		A3	A3 CONSTANCY AND CHANGE - Students will observe how things change or stay the same over time.
		B1	B1 SKILLS AND TRAITS OF SCIENTIFIC INQUIRY Students plan, conduct, and communicate results of simple investigations.
		C1	C1 UNDERSTANDINGS OF INQUIRY Students describe the use of questions, tools, observations, prior knowledge, and accurate communication in scientists.

Grade Two

B. THE SKILLS AND TRAITS OF SCIENTIFIC INQUIRY AND TECHNOLOGICAL DESIGN - Students will have the ability to plan, conduct, analyze data from and communicate results of in-depth scientific investigations and use a systematic process, tools, equipment, and a variety of materials to create a technological design producing a solution or product to meet a specified need.
E. THE LIVING ENVIRONMENT - Students will understand that cells are the basic unit of life, that all life as we know it has evolved through genetic transfer and natural selection to create a great diversity of organisms and that these organisms create an interdependent web through which matter and energy flow. They will understand their similarities and differences as humans to other organisms and their interconnections to these webs.

Content	Maine Learning Results (1997)	Revised LR (2006)	
Animals	A1	E1	E1 BIODIVERSITY - Students point out similarities and differences in the observable behaviors, features, and needs of plants and animals.
	D2	E2	E2 ECOSYSTEMS -Students will describe how plants and animals depend on each other and the environment they live in.
	D4	E3	E3 CELLS -Students will describe parts and wholes of living things, their basic needs, and the structures and processes that help them stay alive.
		B1	B1 SKILLS AND TRAITS OF SCIENTIFIC INQUIRY- Students plan, conduct, and communicate results of simple investigations.

Grade Two

A. UNIFYING THEMES - Students will be able to apply the concepts of systems of models, constancy and change and scale to further science and technological understanding.
B. THE SKILLS AND TRAITS OF SCIENTIFIC INQUIRY AND TECHNOLOGICAL DESIGN - Students will have the ability to plan, conduct, analyze data from and communicate results of in-depth scientific investigations and use a systematic process, tools, equipment, and a variety of materials to create a technological design producing a solution or product to meet a specified need.
D. THE PHYSICAL SETTING - Students will understand the universal nature of matter, energy, force and motion, and will be able to identify how these relationships are exhibited in Earth Systems, in the solar system and throughout the universe.

Content	Maine Learning Results (1997)	Revised LR (2006)	
Motion and Forces	I1	D4	D4 FORCE AND MOTION Students will describe the motion of objects and ways to make objects move in different ways.
	I2	A2	A2 MODELS - Students will use a model to describe and learn about features of things.
		B2	B2 SKILLS AND TRAITS OF TECHNOLOGICAL DESIGN - Students use a simple design process and basic tools and materials to solve a problem or create a product.

Grade Two

A. UNIFYING THEMES - Students will be able to apply the concepts of systems of models, constancy and change and scale to further science and technological understanding.
B. THE SKILLS AND TRAITS OF SCIENTIFIC INQUIRY AND TECHNOLOGICAL DESIGN - Students will have the ability to plan, conduct, analyze data from and communicate results of in-depth scientific investigations and use a systematic process, tools, equipment, and a variety of materials to create a technological design producing a solution or product to meet a specified need.
E. THE LIVING ENVIRONMENT - Students will understand that cells are the basic unit of life, that all life as we know it has evolved through genetic transfer and natural selection to create a great diversity of organisms and that these organisms create an interdependent web through which matter and energy flow. They will understand their similarities and differences as humans to other organisms and their interconnections to these webs.

Content	Maine Learning Results (1997)	Revised LR (2006)	
Dinosaurs	D1	E5	E5 EVOLUTION Describe similarities and differences among and between present day and past organisms that helped them live in their environment.
	D2	A3	A3 CONSTANCY AND CHANGE - Students will observe how things change or stay the same over time.
		A4	A4 SCALE - Students will observe differences in scale.
		B1	B1 SKILLS AND TRAITS OF SCIENTIFIC INQUIRY Students plan, conduct, and communicate results of simple investigations.

M.S.A.D. #22

GRADES 3 - 5

SCIENCE CURRICULUM

ELEMENTARY LEVEL

Grade Three

E. THE LIVING ENVIRONMENT -Students will understand that cells are the basic unit of life, that all life as we know it has evolved through genetic transfer and natural selection of organisms and that these organisms create an interdependent web through which matter and energy flow. They will understand their similarities and differences as humans to the other organisms and their interconnections to the web.

Content	Maine Learning Results (1997)	Revised LR (2006)	
Biomes	A3	E2	E2 ECOSYSTEMS - Students will describe ways organisms depend upon, interact within, and change the living and nonliving environment as well as ways the environment affects organisms, biomes and ecosystems.
	B1		
	B3		

Grade Three

A. UNIFYING THEMES - Students will be able to apply the concepts of systems of models, constancy and change and scale to further science and technological understanding.
C. SCIENTIFIC AND TECHNOLOGICAL ENTERPRISE - Students will understand the history and nature of scientific knowledge and technology, the processes of inquiry and technological design, and the impacts of science and technology have on society and the environment.
D. THE PHYSICAL SETTING - Students will understand the universal nature of matter, energy, force and motion, and will be able to identify how these relationships are exhibited in Earth Systems, in the solar system and throughout the universe.

Content	Maine Learning Results (1997)	Revised LR (2006)	
Solar System	G1	D1	D1 UNIVERSE AND SOLAR SYSTEM Students will describe the positions and motions of different objects in and beyond our solar system and how they can be viewed from Earth.
	G3	D4	D4 FORCE AND MOTION Students will describe the properties of earth's materials, the processes that change them and the cycles that affect the earth.
	G4	A1	A1 SYSTEMS Explain interactions between parts and wholes of familiar things.
		A3	A3 CONSTANCY AND CHANGE Students will identify basic patterns of change.
		A4	A4 SCALE Students will use mathematics to describe scale.
		C1	C1 UNDERSTANDINGS OF INQUIRY Students describe how scientists conduct investigations, develop explanations, and communicate with other scientists.
		C4	C4 HISTORY AND NATURE OF SCIENCE Students examine how science helps us understand the natural world and describe the different types of men and women who have contributed to science.

Grade Three

B. THE SKILLS AND TRAITS OF SCIENTIFIC INQUIRY AND TECHNOLOGICAL DESIGN - Students will have the ability to plan, conduct, analyze data from and communicate results of in-depth scientific investigations and use a systematic process, tools, equipment, and a variety of materials to create a technological design producing a solution or product to meet a specified need.
D. THE PHYSICAL SETTING - Students will understand the universal nature of matter, energy, force and motion, and will be able to identify how these relationships are exhibited in Earth Systems, in the solar system and throughout the universe.

Content	Maine Learning Results (1997)	Revised LR (2006)	
Matter	E1	D3	D3 MATTER AND ENERGY Students will describe properties of objects and materials before and after they undergo a change or interaction.
	E2	D4	D4 FORCE AND MOTION Students will describe the properties of earth's materials, the processes that change them and the cycles that affect the earth.
		B1	B1 SKILLS AND TRAITS OF SCIENTIFIC INQUIRY - Students plan, conduct, analyze data from and communicate results of investigations, including fair tests.

Grade Four

Revised Learning Results(2006) that can be applied to either/or weather, cells, or forces units: B1, C1, C3.
A. UNIFYING THEMES - Students will be able to apply the concepts of systems of models, constancy and change and scale to further science and technological understanding.
D. THE PHYSICAL SETTING - Students will understand the universal nature of matter, energy, force and motion, and will be able to identify how these relationships are exhibited in Earth Systems, in the solar system and throughout the universe.

Content	Maine Learning Results (1997)	Revised LR (2006)	
Weather and climate	F2	D2	D2 EARTH Students will describe the properties of earth's materials, the processes that change them, and cycles that affect the earth.
	F4	A1	A1 SYSTEMS Explain interactions between parts and wholes of familiar things.
		A2	A2 MODELS Students will use models to represent and understand objects, processes, and events in the real world.
		A3	A3 CONSTANCY AND CHANGE Students will identify basic patterns of change.

Grade Four

A. UNIFYING THEMES - Students will be able to apply the concepts of systems of models, constancy and change and scale to further science and technological understanding.
D. THE PHYSICAL SETTING - Students will understand the universal nature of matter, energy, force and motion, and will be able to identify how these relationships are exhibited in Earth Systems, in the solar system and throughout the universe.

Content	Maine Learning Results (1997)	Revised LR (2006)	
Motion and Forces	I2	D4	D4 FORCE AND MOTION Students will summarize how various forces affect the motion of objects.
	I3	A1	A1 SYSTEMS Explain interactions between parts and wholes of familiar things.
		A4	A4 SCALE Students will use mathematics to describe scale.

Grade Four

A. UNIFYING THEMES - Students will be able to apply the concepts of systems of models, constancy and change and scale to further science and technological understanding.
E. THE LIVING ENVIRONMENT -Students will understand that cells are the basic unit of life, that all life as we know it has evolved through genetic transfer and natural selection of organisms and that these organisms create an interdependent web through which matter and energy flow. They will understand their similarities and differences as humans to the other organisms and their interconnections to the web.

Content	Maine Learning Results (1997)	Revised LR (2006)	
Cells	C1	E3	E3 CELLS Students will describe parts and wholes of living things, their basic needs, and the structures and processes that help them stay alive.
	C2	A1	A1 SYSTEMS Explain interactions between parts and wholes of familiar things.
	C3	A4	A4 SCALE Students will use mathematics to describe scale.

Grade Five

A. UNIFYING THEMES - Students will be able to apply the concepts of systems of models, constancy and change and scale to further science and technological understanding.
B. THE SKILLS AND TRAITS OF SCIENTIFIC INQUIRY AND TECHNOLOGICAL DESIGN - Students will have the ability to plan, conduct, analyze data from and communicate results of in-depth scientific investigations and use a systematic process, tools, equipment, and a variety of materials to create a technological design producing a solution or product to meet a specified need.
C. SCIENTIFIC AND TECHNOLOGICAL ENTERPRISE - Students will understand the history and nature of scientific knowledge and technology, the processes of inquiry and technological design, and the impacts of science and technology have on society and the environment.
D. THE PHYSICAL SETTING - Students will understand the universal nature of matter, energy, force and motion, and will be able to identify how these relationships are exhibited in Earth Systems, in the solar system and throughout the universe.

Content	Maine Learning Results (1997)	Revised LR (2006)	
Motion and forces	I1	D4	D4 FORCE AND MOTION Students will summarize how various forces affect the motion of objects.
		A1	A1 SYSTEMS Explain interactions between parts and wholes of familiar things.
		A2	A2 MODELS Students will use models to represent and understand objects, processes, and events in the real world.
		A4	A4 SCALE Students will use mathematics to describe scale.
		B1	B1 SKILLS AND TRAITS OF SCIENTIFIC INQUIRY Students plan, conduct, analyze data from and communicate results of investigations, including fair tests.
		B2	B2 SKILLS AND TRAITS OF TECHNOLOGICAL DESIGN Students use a design process, simple tools, and a variety of materials to solve a problem or create a product, recognizing the constraints that need to be considered.
		C1	C1 UNDERSTANDINGS OF INQUIRY Students describe how scientists conduct investigations, develop explanations, and communicate with other scientists.

Grade Five

A. UNIFYING THEMES - Students will be able to apply the concepts of systems of models, constancy and change and scale to further science and technological understanding.
B. THE SKILLS AND TRAITS OF SCIENTIFIC INQUIRY AND TECHNOLOGICAL DESIGN - Students will have the ability to plan, conduct, analyze data from and communicate results of in-depth scientific investigations and use a systematic process, tools, equipment, and a variety of materials to create a technological design producing a solution or product to meet a specified need.
C. SCIENTIFIC AND TECHNOLOGICAL ENTERPRISE - Students will understand the history and nature of scientific knowledge and technology, the processes of inquiry and technological design, and the impacts of science and technology have on society and the environment.
D. THE PHYSICAL SETTING - Students will understand the universal nature of matter, energy, force and motion, and will be able to identify how these relationships are exhibited in Earth Systems, in the solar system and throughout the universe.

Content	Maine Learning Results (1997)	Revised LR (2006)	
Sound	H3	D4	D4 FORCE AND MOTION Students will summarize how various forces affect the motion of objects.
		A1	A1 SYSTEMS Explain interactions between parts and wholes of familiar things.
		A4	A4 SCALE Students will use mathematics to describe scale.
		B1	B1 SKILLS AND TRAITS OF SCIENTIFIC INQUIRY Students plan, conduct, analyze data from and communicate results of investigations, including fair tests.
		B2	B2 SKILLS AND TRAITS OF TECHNOLOGICAL DESIGN Students use a design process, simple tools, and a variety of materials to solve a problem or create a product, recognizing the constraints that need to be considered.
		C1	C1 UNDERSTANDINGS OF INQUIRY Students describe how scientists conduct investigations, develop explanations, and communicate with other scientists.

Grade Five

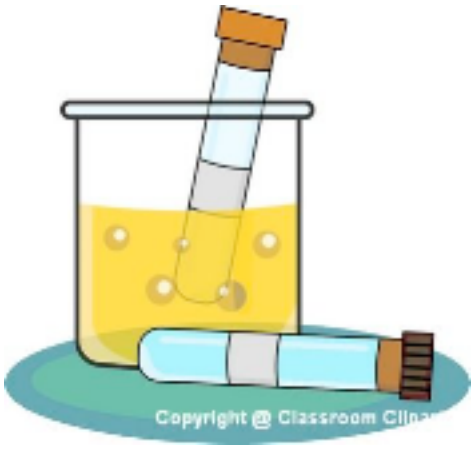
C. SCIENTIFIC AND TECHNOLOGICAL ENTERPRISE - Students will understand the history and nature of scientific knowledge and technology, the processes of inquiry and technological design, and the impacts of science and technology have on society and the environment.
E. THE LIVING ENVIRONMENT -Students will understand that cells are the basic unit of life, that all life as we know it has evolved through genetic transfer and natural selection of organisms and that these organisms create an interdependent web through which matter and energy flow. They will understand their similarities and differences as humans to the other organisms and their interconnections to the web.

Content	Maine Learning Results (1997)	Revised LR (2006)	
Animals	A1	E1	E1 BIODIVERSITY - Students compare living things based on their behaviors, external features, and environmental needs.
	A3	E2	E2 ECOSYSTEMS - Students will describe ways organisms depend upon, interact within, and change the living and nonliving environment as well as ways the environment affects organisms, biomes and ecosystems.
		C1	C1 UNDERSTANDINGS OF INQUIRY Students describe how scientists conduct investigations, develop explanations, and communicate with other scientists.
		C3	C3 SCIENCE, TECHNOLOGY, AND SOCIETY Students describe how people, science, and technology affect personal health, human populations, environments, and quality of life.

M.S.A.D. #22

GRADES 6 - 8

SCIENCE CURRICULUM



MIDDLE LEVEL

Grade Six

A. UNIFYING THEMES - Students will be able to apply the concepts of systems of models, constancy and change and scale to further science and technological understanding.
C. SCIENTIFIC AND TECHNOLOGICAL ENTERPRISE - Students will understand the history and nature of scientific knowledge and technology, the processes of inquiry and technological design, and the impacts of science and technology have on society and the environment.
D. THE PHYSICAL SETTING - Students will understand the universal nature of matter, energy, force and motion, and will be able to identify how these relationships are exhibited in Earth Systems, in the solar system and throughout the universe.

Content	Maine Learning Results (1997)	Revised LR (2006)	
Astronomy	G1	D1	D1 UNIVERSE AND SOLAR SYSTEM Students will explain the movements, and describe the location, composition and characteristics of our solar system and vast universe, including planets, the sun, and galaxies.
	G2	A1	A1 SYSTEMS Use systems to describe natural and manmade things and processes.
	G4	A2	A2 MODELS Students will choose different types of models to represent real world phenomena.
	G5	C1	C1 UNDERSTANDINGS OF INQUIRY Students describe how scientists' investigations are determined and guided by questions, prior knowledge, careful use of procedures and tools; rely on evidence and explanation; and advance through legitimate skepticism; often leading to new investigations.
	F1	C2	C2 UNDERSTANDINGS OF INQUIRY Students describe the relationship between the nature of science and technology and the tradeoffs, constraints, and consequences associated with the designed world.

Grade Six

A. UNIFYING THEMES - Students will be able to apply the concepts of systems of models, constancy and change and scale to further science and technological understanding.
D. THE PHYSICAL SETTING - Students will understand the universal nature of matter, energy, force and motion, and will be able to identify how these relationships are exhibited in Earth Systems, in the solar system and throughout the universe.

Content	Maine Learning Results (1997)	Revised LR (2006)	
Weather	F4	D2	D2 EARTH Students will discuss the various cycles, physical and biological forces and processes, position in space, and human actions that affect short and long term changes to the earth.
		A2	A2 MODELS Students will choose different types of models to represent real world phenomena.
		A4	A4 SCALE Students will use notions of scale to describe objects, events, and processes.

Grade Six

A. UNIFYING THEMES - Students will be able to apply the concepts of systems of models, constancy and change and scale to further science and technological understanding.
C. SCIENTIFIC AND TECHNOLOGICAL ENTERPRISE - Students will understand the history and nature of scientific knowledge and technology, the processes of inquiry and technological design, and the impacts of science and technology have on society and the environment.
D. THE PHYSICAL SETTING - Students will understand the universal nature of matter, energy, force and motion, and will be able to identify how these relationships are exhibited in Earth Systems, in the solar system and throughout the universe.
E. THE LIVING ENVIRONMENT -Students will understand that cells are the basic unit of life, that all life as we know it has evolved through genetic transfer and natural selection of organisms and that these organisms create an interdependent web through which matter and energy flow. They will understand their similarities and differences as humans to the other organisms and their interconnections to the web.

Content	Maine Learning Results (1997)	Revised LR (2006)	
Geology	F2	D2	D2 EARTH Students will discuss the various cycles, physical and biological forces and processes, position in space, and human actions that affect short and long term changes to the earth.
	F3	E5	E5 EVOLUTION Describe the evidence that supports the explanation that evolution occurs over many generations, allowing species to acquire many of their unique characteristics or adaptations.
	F4	A1	A1 SYSTEMS Use systems to describe natural and manmade things and processes.
		A3	A3 CONSTANCY AND CHANGE Students will recognize patterns of change that can be used to describe physical and biological systems.
		C1	C1 UNDERSTANDINGS OF INQUIRY Students describe how scientists' investigations are determined and guided by questions, prior knowledge, careful use of procedures and tools; rely on evidence and explanation; and advance through legitimate skepticism; often leading to new investigations.

Grade Seven

A. UNIFYING THEMES - Students will be able to apply the concepts of systems of models, constancy and change and scale to further science and technological understanding.
B. THE SKILLS AND TRAITS OF SCIENTIFIC INQUIRY AND TECHNOLOGICAL DESIGN - Students will have the ability to plan, conduct, analyze data from and communicate results of in-depth scientific investigations and use a systematic process, tools, equipment, and a variety of materials to create a technological design producing a solution or product to meet a specified need.
E. THE LIVING ENVIRONMENT -Students will understand that cells are the basic unit of life, that all life as we know it has evolved through genetic transfer and natural selection of organisms and that these organisms create an interdependent web through which matter and energy flow. They will understand their similarities and differences as humans to the other organisms and their interconnections to the web.

Content	Maine Learning Results (1997)	Revised LR (2006)	
Cells	C2	E3	E3 CELLS Students will describe structure and function of cells at the intracellular and molecular level, the interactions between cells and their environment, and the impact of cellular processes and changes on individuals.
	J 1	A1	A1 SYSTEMS Use systems to describe natural and manmade things and processes.
	L4	A2	A2 MODELS Students will choose different types of models to represent real world phenomena.
	L5	B1	B1 SKILLS AND TRAITS OF SCIENTIFIC INQUIRY Students plan, conduct, analyze data from, and communicate results of investigations, including simple experiments.

Grade Seven

A. UNIFYING THEMES - Students will be able to apply the concepts of systems of models, constancy and change and scale to further science and technological understanding.
B. THE SKILLS AND TRAITS OF SCIENTIFIC INQUIRY AND TECHNOLOGICAL DESIGN - Students will have the ability to plan, conduct, analyze data from and communicate results of in-depth scientific investigations and use a systematic process, tools, equipment, and a variety of materials to create a technological design producing a solution or product to meet a specified need.
E. THE LIVING ENVIRONMENT -Students will understand that cells are the basic unit of life, that all life as we know it has evolved through genetic transfer and natural selection of organisms and that these organisms create an interdependent web through which matter and energy flow. They will understand their similarities and differences as humans to the other organisms and their interconnections to the web.

Content	Maine Learning Results (1997)	Revised LR (2006)	
Animals	A1	E1	E1 BIODIVERSITY Students differentiate among organisms based on biological characteristics and look for patterns of similarity.
	A2	E2	E2 ECOSYSTEMS Students will examine how the physical characteristics of an environment, the types and behaviors of organisms, and the flow of matter and energy affect organisms and the ecosystem of which they are a part.
	A3	A1	A1 SYSTEMS Use systems to describe natural and manmade things and processes.
		B1	B1 SKILLS AND TRAITS OF SCIENTIFIC INQUIRY Students plan, conduct, analyze data from, and communicate results of investigations, including simple experiments.

Grade Seven

A. UNIFYING THEMES - Students will be able to apply the concepts of systems of models, constancy and change and scale to further science and technological understanding.
B. THE SKILLS AND TRAITS OF SCIENTIFIC INQUIRY AND TECHNOLOGICAL DESIGN - Students will have the ability to plan, conduct, analyze data from and communicate results of in-depth scientific investigations and use a systematic process, tools, equipment, and a variety of materials to create a technological design producing a solution or product to meet a specified need.
E. THE LIVING ENVIRONMENT -Students will understand that cells are the basic unit of life, that all life as we know it has evolved through genetic transfer and natural selection of organisms and that these organisms create an interdependent web through which matter and energy flow. They will understand their similarities and differences as humans to the other organisms and their interconnections to the web.

Content	Maine Learning Results (1997)	Revised LR (2006)	
Human body	C1	E1	E1 BIODIVERSITY Students differentiate among organisms based on biological characteristics and look for patterns of similarity.
	C3	E3	similarities
		E4	E4 HEREDITY AND REPRODUCTION Students will describe the general characteristics and mechanisms of reproduction and heredity in organisms, including humans, and ways in which organisms are affected by their genetic traits.
	C4	A1	A1 SYSTEMS Use systems to describe natural and manmade things and processes.
	C5	A2	A2 MODELS Students will choose different types of model to represent real world phenomena.
		A3	A3 CONSTANCY AND CHANGE Students will recognize patterns of change that can be used to describe physical and biological systems.
		B1	B1 SKILLS AND TRAITS OF SCIENTIFIC INQUIRY Students plan, conduct, analyze data from, and communicate results of investigations, including simple experiments.

Grade Seven

A. UNIFYING THEMES - Students will be able to apply the concepts of systems of models, constancy and change and scale to further science and technological understanding.
B. THE SKILLS AND TRAITS OF SCIENTIFIC INQUIRY AND TECHNOLOGICAL DESIGN - Students will have the ability to plan, conduct, analyze data from and communicate results of in-depth scientific investigations and use a systematic process, tools, equipment, and a variety of materials to create a technological design producing a solution or product to meet a specified need.
C. SCIENTIFIC AND TECHNOLOGICAL ENTERPRISE - Students will understand the history and nature of scientific knowledge and technology, the processes of inquiry and technological design, and the impacts of science and technology have on society and the environment.
E. THE LIVING ENVIRONMENT -Students will understand that cells are the basic unit of life, that all life as we know it has evolved through genetic transfer and natural selection of organisms and that these organisms create an interdependent web through which matter and energy flow. They will understand their similarities and differences as humans to the other organisms and their interconnections to the web.

Content	Maine Learning Results (1997)	Revised LR (2006)	
Ecology	B3	E2	E2 ECOSYSTEMS Students will examine how the physical characteristics of an environment, the types and behaviors of organisms, and the flow of matter and energy affect organisms and the ecosystem of which they are part.
	M3	A3	A3 CONSTANCY AND CHANGE Students will recognize patterns of change that can be used to describe physical and biological systems.
	M4	B1	B1 SKILLS AND TRAITS OF SCIENTIFIC INQUIRY Students plan, conduct, analyze data from, and communicate results of investigations, including simple experiments.
		C3	C3 ECOLOGY Students describe the relationship of science and technology for personal and societal challenges.

Grade Eight

A. UNIFYING THEMES - Students will be able to apply the concepts of systems of models, constancy and change and scale to further science and technological understanding.
D. THE PHYSICAL SETTING - Students will understand the universal nature of matter, energy, force and motion, and will be able to identify how these relationships are exhibited in Earth Systems, in the solar system and throughout the universe.

Content	Maine Learning Results (1997)	Revised LR (2006)	
Motion and forces	I1	D4	D4 FORCE AND MOTION Students will describe the nature of light, the motion of waves and the force of gravity.
	I2	A2	A2 MODELS Students will choose different types of models to represent real world phenomena.
	M6		

A. UNIFYING THEMES - Students will be able to apply the concepts of systems of models, constancy and change and scale to further science and technological understanding.
C. SCIENTIFIC AND TECHNOLOGICAL ENTERPRISE - Students will understand the history and nature of scientific knowledge and technology, the processes of inquiry and technological design, and the impacts of science and technology have on society and the environment.
D. THE PHYSICAL SETTING - Students will understand the universal nature of matter, energy, force and motion, and will be able to identify how these relationships are exhibited in Earth Systems, in the solar system and throughout the universe.

Content	Maine Learning Results (1997)	Revised LR (2006)	
Matter	E1	D3	D3 MATTER AND ENERGY Students will describe physical and chemical properties of matter, interactions and changes in matter, and transfer of energy through matter.
	J1	A2	A2 MODELS Students will choose different types of models to represent real world phenomena.
		C1	C1 UNDERSTANDINGS OF INQUIRY Students describe how scientists' investigations are determined and guided by questions, prior knowledge, careful use of procedures and tools; rely on evidence and explanations; and advance through legitimate skepticism; often leading to new investigations.
		C4	C4 HISTORY AND NATURE OF SCIENCE - Students describe how science advances knowledge through the people involved, the ways scientists think about their work and the work of others and through cultural and historical examples.

Grade Eight

B. THE SKILLS AND TRAITS OF SCIENTIFIC INQUIRY AND TECHNOLOGICAL DESIGN - Students will have the ability to plan, conduct, analyze data from and communicate results of in-depth scientific investigations and use a systematic process, tools, equipment, and a variety of materials to create a technological design producing a solution or product to meet a specified need.
D. THE PHYSICAL SETTING - Students will understand the universal nature of matter, energy, force and motion, and will be able to identify how these relationships are exhibited in Earth Systems, in the solar system and throughout the universe.

Content	Maine Learning Results (1997)	Revised LR (2006)	
Energy	H1	D3	D3 MATTER AND ENERGY Students will describe physical and chemical properties of matter, interactions and changes in matter, and transfer of energy through matter.
	H2	D4	D4 FORCE AND MOTION Students will describe the nature of light, the motion of waves and the force of gravity.
	J 2	B1	B1 SKILLS AND TRAITS OF SCIENTIFIC INQUIRY Students plan, conduct, analyze data from, and communicate results of investigations, including simple experiments.
	J 6	B2	B2 SKILLS AND TRAITS OF TECHNOLOGICAL DESIGN Students use a systematic process, tools, equipment, and a variety of materials to design and produce a solution or product to meet a specified need and using established criteria.

M.S.A.D. #22

GRADES 9 - 12

SCIENCE CURRICULUM

SECONDARY LEVEL

COURSE DESCRIPTION

524 SCIENCE 9 Required of 9

This ninth grade course is required of all incoming freshmen. The course will explore Earth science and physical science. In the Earth science portion of the course, students will gain knowledge about the process that change the Earth and how humans have come to understand it. Students will also gain knowledge about the universe and the principles upon which it operates. In the physical science portion of the course, students will study the concepts of energy and its forms as well as the motion of objects and forces acting upon those objects.

MAINE LEARNING RESULTS

E. Structure of Matter
F. The Earth
G. The Universe
H. Energy
I. Motion
J. Inquiry and Problem Solving
K. Scientific Reasoning
L. Communication

COURSE OBJECTIVES

1. To understand the concepts in scientific methodology and to apply them to solving scientific problems
2. To understand the concept of scale and to apply that understanding in analyzing relationships between/among components of various scientific units
3. To understand characteristics of cycles and to apply that understanding to analyzing the roles of the components in a system
4. To make accurate predictions about the functioning of systems
5. To communicate understanding of scientific methodology in written, visual, and oral forms

COURSE CONTENT

I. Study skills
   A. Learning styles inventory
   B. Examination of textbook format and identifying reading clues
   C. Notetaking
      1. Notetaking from reading assignments
      2. Notetaking from lectures
   D. Scientific explanation format
   E. Organization of required notebook
      1. Notes
      2. Handouts
      3. Reading journals
      4. Returned work
      5. Researching

II. Introductory units: Scientific methodology
   A. Types of observations
   B. Formation of hypothesis
   C. Elements of an experiment
   D. Data collection
      1. Units in the metric system
      2. Measuring in metric
   E. Forming conclusions
   F. Designing an experiment and carrying it out

III. Astronomy
A. Electromagnetic spectrum
B. Organization of the universe including:
1. The star cycle
2. Our solar system and its relative scale
C. Astronomy as a model of scientific inquiry

IV. The Earth system
A. Structure of the Earth
B. Geologic time
C. Plate tectonics
D. Rocks and minerals: the rock cycle
E. Climate change

V. Chemistry
A. Properties of matter
1. Weight/Mass
2. Density
3. Temperature
4. Volume
B. Introduction to the periodic table and the structure of the atom

VI. Physics
A. Forces and Motion
1. Speed, velocity, and acceleration
a. Linear measurement of speed
b. Linear measurement of velocity
c. Linear measurement of acceleration
2. Newton's Three Laws of Motion
a. Describe qualitatively
b. Describe quantitatively
B. Energy: Analyzing relationship between potential and kinetic energy

SUGGESTED INSTRUCTIONAL STRATEGIES

(See "Best Practices in Science" at the beginning of the K-12 written curriculum document)

TYPICAL ASSESSMENT TOOLS

Homework assignments
Quizzes
Tests
Oral presentations
Projects, including use of technology
Lab reports
Common assessments (see below)

SCHOOL-WIDE RUBRICS USED IN THIS COURSE

Writing
Presentation

MAINE LEARNING RESULTS COMMON ASSESSMENTS ADMINISTERED IN THIS COURSE

Below are the names of the common assessments which are part of MSAD #22's local assessment system.

Continental Drift	F6
Nothn' but Net	K3 and H4

TEXTS AVAILABLE

Conceptual Physical Science Explorations, Addison Wesley, 2003

SUPPLEMENTAL RESOURCES

Supplemental resources for the text
Assorted videos
Reading Around the Clock notetaking format
Explanation Scaffold writing format

COURSE DESCRIPTION

SCIENCE 9/10 (9,10)

(Not written up in course directory as students are placed in this class by case managers or middle school guidance and high school guidance collaboration)

Science 9/10 is a two year looping course that meets all the science requirements for high school graduation. The course is designed to meet the needs of each learner and incorporates labs and lecture in each class.

MAINE LEARNING RESULTS

PHYSICAL SCIENCE YEAR

E. Structure of Matter
F. The Earth
G. The Universe
H. Energy
I. Motion
J. Inquiry and Problem Solving
K. Scientific Reasoning
L. Communication

BIOLOGICAL SCIENCE YEAR

A. Classifying life forms
B. Ecology
C. Cells
D. Continuity and Change
J. Inquiry and Problem Solving
K. Scientific Reasoning
L. Communication

COURSE OBJECTIVES

1. To understand and apply scientific principals in lab and real life situations
2. To make science relevant to student's everyday life
3. To understand the link between science and technology and the influence each exerts on the other
4. Encourage curiosity and positive attitudes to learning
5. To make accurate predictions about situations in lab and real life
6. To communicate understanding of scientific methodology in written, visual and oral forms

COURSE CONTENT

SCIENCE KNOWLEDGE

I. What is science and how do we make discoveries in science?
   A. The branches of science
   B. The scientific method
   C. Science of classification - making and using a key
   D. Constructing an insect collection

LIFE SCIENCE

II. The Study of Life
   A. What are the characteristics of life?
   B. What are the biological molecules?
   C. What are the basic units of life?
   D. Understanding cells

III. The Kingdoms of Life
   A. How do we differentiate between life forms?
   B. From Simple to Complex
   C. Animal and Plant Kingdoms
   D. The cycle of Life - photosynthesis and cellular respiration

GENETICS

IV. DNA - The Code of Life
  A. Mendel and heredity
  B. Methods of identifying heredity
  C. Controlling heredity

EVOLUTION

V. Measuring Time and Change
  A. Theories of evolution
  B. Natural selection and human intervention

HUMAN ANATOMY

VI. From Cells to Systems
  A. Human body systems
  B. Nutrition, immunology and health

ECOLOGY

VII. Populations and Communities
  A. Cycles in nature
  B. Ecosystems and food chains

ALTERNATE YEAR SEQUENCE

PHYSICAL SCIENCE

VIII. The Properties of Matter
  A. Molecules, matter
  B. Physical and chemical changes

IX. Energy and Matter
  A. Forms of matter
  B. Energy conversions

X. Force and Motion
  A. Motion, force and inertia
  B. Types of machines

XI. Heat, Light and Sound
  A. Heat and kinetic changes in matter
  B. Light and sound movement

XII. Electricity and Magnetism
  A. Currents, circuits
  B. Insulators and conductors
  C. Using electricity

XIII. Planet Earth
  A. Earth as a spaceship
  B. Physical features
  C. Maps

XIV. The Earth's Crust
  A. Plate tectonics
  B. Rocks and minerals

XV. The Earth's Atmosphere
    A. The properties of air
    B. Water and air
    C. Weather and climate

XVI. The Earth's History
    A. Rocks and geological time

XVII. The Earth's Ocean
    A. Physical features
    B. Waves and tides
    C. Ocean resources

XVIII. Exploring Space
    A. Telescopes and space exploration
    B. The solar system

TYPICAL ASSESSMENT TOOLS

Homework
Quizzes
Tests
Lab reports
Projects using technology

SCHOOL-WIDE RUBRICS USED IN THIS COURSE

Writing
Presentation

MAINE LEARNING RESULTS COMMON ASSESSMENTS ADMINISTERED IN THIS COURSE

Below are the names of the common assessments which are part of MSAD #22's local assessment system.

Mutations	D1
Origin of Eukaryotic Cells	D6
Continental Drift	F6
Nothn' but Net	K3 and H4

TEXTS AVAILABLE

Pacemaker General Science, Globe Fearon, 2001

SUPPLEMENTAL RESOURCES

Supplemental resources for the text
Assorted video

COURSE DESCRIPTION

530 SCIENCE 10 10

This tenth grade course is designed to help students who have chosen not to take College Biology. This course, along with Science 9, will provide the opportunity for students to complete their learning results assessments. Using a laboratory-based approach, the course will primarily focus on content standards (A) Classifying Life Forms, (B) Ecology, (C) Cells, and (D) Continuity and Change from the State of Maine Learning Results.

MAINE LEARNING RESULTS

A. Classifying life forms
B. Ecology
C. Cells
D. Continuity and Change
J. Inquiry and Problem Solving
K. Scientific Reasoning
L. Communication
M. Implications of Science and Technology

COURSE OBJECTIVES

1. To understand and apply knowledge of biological principles to personal / relevant situations / scenarios
2. To understand the link between biology and technology, and the influence each exerts on the other
3. Develop critical thinking skills by emphasizing questioning, problem solving, skepticism, and research
4. Encourage curiosity and positive attitudes surrounding biology, the environment, and science in general

COURSE CONTENT

I. Introduction to Biology
   A. Characteristics of living things
   B. Classification
   C. Levels of organization
   D. Scientific method

II. Cells
   A. Equipment and techniques
      1. Units of measurement
      2. Microscopes
   B. Cell structure and function
      1. Prokaryotic cells
      2. Eukaryotic cells
      3. Exchange of materials between cell and environment
      4. Cell cycle
      5. DNA replication
      6. Mutations

III. Genetics - The Science of Heredity
   A. Meiosis and gametogenesis
      1. Embryonic development
   B. Mendelian genetics
      1. Definitions
      2. Laws of genetics
      3. Monohybrid and dihybrid crosses
   C. Chromosomal abnormalities
      1. Karyotype
      2. Nondisjunction

IV. Genetic Engineering and Biotechnology

V. Evolution
   A. Evidence for evolution
      1. Historical development of the theory of evolution
   B. Mechanisms of evolution
      1. Mechanisms of speciation
      2. Evolutionary patterns
   C. Origin of life
      1. Geologic time

VI. Survey of Viruses, Bacteria, Protists, and Fungi
   A. Viruses
   B. Diversity and characteristics of kingdoms
      1. Archaebacteria and Eubacteria
      2. Protista
      3. Fungi
   C. Human immune system

VII. Survey of Plants
   A. Diversity, classification, and phylogeny of the plant kingdom
      1. Adaptations to land
   B. Reproduction of flowering plants

VIII. Survey of Animals
   A. Diversity, classification, and phylogeny
      1. Survey of major invertebrate phyla
      2. Survey of major classes in phylum chordata

IX. Reproduction and Development
   A. Types of reproduction
   B. Stages of embryonic development

X. Digestive System
   A. The human digestive system
      1. Carbohydrates
      2. Fats
      3. Proteins

XI. Muscular System
   A. Functions
   B. Structure of a skeletal muscle

XII. Ecology
   A. Population interactions
   B. Communities and ecosystems
      1. Energy flow through ecosystems (photosynthesis and cellular respiration)
   C. Biochemical cycles
   D. Human influences on ecosystems

TYPICAL ASSESSMENT TOOLS

Homework
Quizzes
Tests
Presentations
Projects
Lab reports
Homework

SCHOOL-WIDE RUBRICS USED IN THIS COURSE

Writing
Presentation

MAINE LEARNING RESULTS COMMON ASSESSMENTS ADMINISTERED IN THIS COURSE

Below are the names of the common assessments which are part of MSAD #22's local assessment system.

Mutations	D1
Origin of Eukaryotic Cells	D6

TEXTS AVAILABLE

Biology Exploring Life, Campbell, Williamson, and Heyden, Prentice Hall, 2004

SUPPLEMENTAL RESOURCES

Supplemental resources for the text
Assorted videos

COURSE DESCRIPTION

544 COLLEGE PREPARATORY BIOLOGY 10, (11)

This laboratory-oriented course is designed for the student who plans to continue studies after high school. Emphasis is on life processes, structure and function, heredity, behavior, and interrelationships of selected plant and animal types. Students are expected to integrate class and lab activities in order to understand the various concepts developed in the course.

MAINE LEARNING RESULTS

A. Classifying life forms
B. Ecology
C. Cells
D. Continuity and Change
J. Inquiry and Problem Solving
K. Scientific Reasoning
L. Communication
M. Implications of Science and Technology

COURSE OBJECTIVES

1. To understand how living things depend on one another and on non-living aspects of the environment
2. To understand the basis for all life and that all living things change over time
3. To understand how structure is related to function from molecules all the way to whole organisms
4. To develop critical thinking skills and problem solving abilities
5. To improve laboratory skills and science process skills

COURSE CONTENT

I. Introduction to Biology
   A. Characteristics of living things
   B. Classification
   C. Levels of organization
   D. Scientific method

II. Chemistry of Life
   A. General chemistry
      1. Atoms, molecules, compounds, and bonding
      2. Organic molecules in organisms (proteins, lipids, carbohydrates, nucleic acids)
      3. Chemical reactions
      4. Enzymes
   B. Biochemical pathways
      1. Photosynthesis
      2. Cellular respiration
      3. ATP

III. Cells
   A. Equipment and techniques
      1. Units of measurement
      2. Microscopes

B. Cell structure and function
    1. Prokaryotic cells
    2. Eukaryotic cells
    3. Exchange of materials between cell and environment
    4. Cell cycle
        a. cancer
        b. stem cells

IV. Genetics - The Science of Heredity
A. Meiosis and gametogenesis
    1. Embryonic development
B. Mendelian genetics
    1. Definitions
    2. Laws of genetics
    3. Monohybrid and dihybrid crosses
C. Other patterns of inheritance
    1. Incomplete dominance
    2. Co-dominance
    3. Multiple alleles
    4. Sex-linked
    5. Polygenic
D. Chromosomal abnormalities
    1. Karyotype
    2. Nondisjunction

V. Molecular Genetics
A. RNA and DNA structure and function
B. DNA replication
C. Protein synthesis
D. Mutations
E. Genetic engineering
F. Biotechnology

VI. Evolution
A. Evidence for evolution
    1. Historical development of the theory of evolution
B. Mechanisms of evolution
    1. Mechanisms of speciation
    2. Evolutionary patterns
C. Origin of life
    1. Geologic time

VII. Survey of Viruses, Bacteria, Protists, and Fungi
A. Viruses
B. Diversity and characteristics of kingdoms
    1. Archaebacteria and eubacteria
    2. Protista
    3. Fungi
C. Human immune system response to pathogens

VIII. Survey of Plants
A. Diversity, classification, and phylogeny of the plant kingdom
    1. Adaptations to land
B. The life cycle: alternation of generations
C. Reproduction of flowering plants

IX. Survey of Animals
    A. Diversity, classification, and phylogeny
        1. Survey of major invertebrate phyla
        2. Survey of major classes in phylum chordata

X. Ecology
    A. Populations
    B. Communities and ecosystems
        1. Energy flow through ecosystems
    C. Biochemical cycles
    D. Human influences on ecosystems

TYPICAL ASSESSMENT TOOLS

Homework
Quizzes
Tests
Presentations
Projects
Lab reports

SCHOOL-WIDE RUBRICS USED IN THIS COURSE

Writing
Presentation

MAINE LEARNING RESULTS COMMON ASSESSMENTS ADMINISTERED IN THIS COURSE

Below are the names of the common assessments which are part of MSAD #22's local assessment system.

Mutations	D1
Origin of Eukaryotic Cells	D6

TEXTS AVAILABLE

Biology, Miller and Levine, Prentice Hall, 2002

SUPPLEMENTAL RESOURCES

Supplemental resources for the text
Assorted videos

COURSE DESCRIPTION

548 ADVANCED PLACEMENT BIOLOGY 11, (12)

The AP Biology course is designed to be taken by students after successful completion of college preparatory biology and chemistry (chemistry may be taken concurrently). It aims to provide students with the conceptual framework, factual knowledge, and analytical skills necessary to deal critically with the rapidly changing science of biology. AP Biology is a college course taught in the high school setting. The Advanced Placement Biology Exam is a mandatory part of the course and is given by the Educational Testing Service (ETS) of New Jersey. A student who receives a score of 3 or higher on the AP Exam may get college credit from many colleges. Students will be required to complete a summer assignment before class starts in the fall.

MAINE LEARNING RESULTS

A. Classifying Life
B. Ecology
C. Cells
D. Continuity and Change
J. Inquiry and Problem Solving
K. Scientific Reasoning
L. Communication
M. Implications of Science and Technology

COURSE OBJECTIVES

1. To provide students with the conceptual framework, factual knowledge, and analytical skills necessary to deal critically with the rapidly changing science of biology
2. To help students gain an appreciation of science as a process
3. To develop an understanding of concepts rather than on memorizing terms and technical details
4. To provide the students with the skills necessary to score well on the Advanced Placement Biology Test

COURSE CONTENT

I. Molecules and Cells
   A. Chemistry of Life
      1. Water
      2. Organic molecules in organisms
      3. Free energy changes
   B. Cells
      1. Prokaryotic and eukaryotic cells
      2. Membranes
      3. Subcellular organization
      4. Cell cycle and its regulation
   C. Cellular Energetic
      1. Coupled reactions
      2. Fermentation and cellular respiration
      3. Photosynthesis

II. Heredity and Evolution
   A. Heredity
      1. Meiosis and gametogenesis
      2. Eukaryotic chromosomes
      3. Inheritance patterns

B. Molecular Genetics
    1. RNA and DNA structure and function
    2. Gene regulation
    3. Mutation
    4. Viral structure and replication
    5. Nucleic acid technology and applications
C. Evolutionary Biology
    1. Early evolution of life
    2. Evidence for evolution
    3. Mechanisms of evolution

III. Organisms and Populations
A. Diversity of Organisms
    1. Evolutionary patterns
    2. Survey of the diversity of life
    3. Phylogenetic classification
    4. Evolutionary relationships
B. Structure and Function of Plants and Animals
    1. Reproduction, growth, and development
    2. Structural, physiological, and behavioral adaptations
    3. Response to the environment
C. Ecology
    1. Population dynamics
    2. Communities and ecosystems
    3. Global issues

TYPICAL ASSESSMENT TOOLS

Homework
Quizzes
Unit exams
Written lab reports
Group projects and presentations
Class participation

SCHOOL-WIDE RUBRICS USED IN THIS COURSE

Writing
Presentation

MAINE LEARNING RESULTS COMMON ASSESSMENTS ADMINISTERED IN THIS COURSE

None

TEXTS AVAILABLE

Biology 8th edition, Sylvia Mader, McGraw Hill, 2004

SUPPLEMENTAL RESOURCES

*AP Biology Lab Manual for Students (*revised 2001*)*
Assorted videos

COURSE DESCRIPTION

552 ANATOMY AND PHYSIOLOGY (11,)12

The course begins with the organization of the human body and descriptive terminology relating to the various segments of the body. The study of tissues leads to the study of organ systems. Systems included in this course are included in the course content. Students are expected to integrate class and lab activities in order to understand concepts developed in the course.

MAINE LEARNING RESULTS

C. Cells
E. Structure of Matter
J. Inquiry and Problem Solving
K. Scientific Reasoning
L. Communication

COURSE OBJECTIVES

1. To understand and apply how body structures determine function from the molecular to the individual level
2. To communicate verbally and in writing the language of anatomy
3. To improve lab skills
4. To apply content knowledge to practical situations
5. To integrate class content with laboratory experience

COURSE CONTENT

I. Introduction to the Human Body: includes microscopes
   A. Overview of anatomy and physiology
   B. Homeostasis
   C. The language of anatomy

II. Tissues
   A. Microscope parts, use, and function
   B. Epithelial tissue
   C. Connective tissue
   D. Muscle
   E. Nervous tissue

III. Integumentary System
   A. Classification of body membranes
   B. Basic skin functions
   C. Structure of the skin: epidermis and dermis
   D. Homeostatic imbalances of skin

IV. Skeletal System
   A. Overview of skeletal system
   B. Bone growth and remodeling
   C. Bone fractures
   D. Axial Skeleton
   E. Appdendicular skeleton
   F. Joints

V. Nervous System
   A. Nervous system overview
   B. Neurophysiology
   C. Central nervous system
   D. Peripheral nervous system

VI. Muscles
- A. Overview of muscles
- B. Skeletal muscle activity
- C. Muscle movements, types, and names
- D. Gross anatomy of skeletal muscles

VII. Special Senses
- A. Overview of special senses
- B. The eye and vision
- C. The ear: hearing and balance

VIII. Blood and Immunity
- A. Overview of blood
- B. Blood cells
- C. Immunity
- D. Blood typing
- E. Introduction to hemostasis

IX. Cardiovascular System
- A. Overview of the heart
- B. Physiology of the heart
- C. Blood vessels

X. Respiratory System
- A. Overview of the respiratory system
- B. Anatomy of the respiratory system
- C. Respiratory physiology

XI. Digestive System
- A. Overview of the digestive system
- B. Anatomy of the digestive system
- C. Functions of the digestive system

XII. Excretory/Urinary System
- A. Overview of the urinary system
- B. Structures of the urinary system
- C. Functions of the urinary system

XIII. Endocrine System
- A. Overview of the endocrine system and hormone function
- B. Major endocrine glands
- C. Other hormones - producing tissues and organs

XIV. Reproductive Systems: Male and Female
- A. Male reproductive system
- B. Female reproductive system
- C. Survey of pregnancy and embryonic development

<u>TYPICAL ASSESSMENT TOOLS</u>

Homework
Class work: includes labs and lab simulations
Quizzes
Exams: includes unit exams; midterm exam (comprehensive for first semester; final exam (comprehensive for second semester)
Notebook

SCHOOL-WIDE RUBRICS USED IN THIS COURSE

Writing
Presentation

MAINE LEARNING RESULTS COMMON ASSESSMENTS ADMINISTERED IN THIS COURSE

None

TEXTS AVAILABLE

Essentials of Human Anatomy & Physiology, Marie, Pearson, 2006

SUPPLEMENTAL RESOURCES

Supplemental sources for the text
Assorted videos
Portaportal

COURSE DESCRIPTION

556 COLLEGE PREPARATORY CHEMISTRY 11, (12)

This class is generally taken by those in the junior class. Chemistry is a course that is useful to all students planning further education beyond high school and especially for those that plan careers or further studies in the health occupations, engineering, or any branch of science. The important principles of chemistry are developed and reinforced both in the classroom and in the laboratory.

MAINE LEARNING RESULTS

E. Structure of Matter
G. The Universe
H. Energy
I. Motion
J. Inquiry and Problem Solving
K. Scientific Reasoning
L. Communication

COURSE OBJECTIVES

1. To develop and practice safety skills in the laboratory setting
2. To demonstrate proper use of appropriate laboratory equipment and technology
3. To understand and be able to explain how atoms interact with each other
4. To explain how chemistry is related to the world
5. To communicate results of investigative activities to others through lab reports, graphs, and oral presentations

COURSE CONTENT

I. Introduction to chemistry
   A. Branches of chemistry
   B. Impact of chemistry (materials, energy, medicine, space, agriculture, environment)

II. Laboratory
   A. Equipment
   B. Skills and methodology
   C. Safety

III. Matter and Change
   A. Substances: elements and compounds
   B. Mixtures: homogeneous and heterogeneous
   C. Solid liquid and gas

IV. Scientific Measurement
   A. Quantitative vs. qualitative
   B. Uncertainty in: significant figures
   C. SI units: (metric system) dimensional analysis, conversion factors, scientific notation
   D. Density, specific gravity
   E. Temperature: Fahrenheit, Celsius, Kelvin scales

V. Atomic Structure
   A. History of the model of the atom
   B. Model development: Democritus, Dalton, Thomson, Rutherford, Bohr, Schrodinger
   C. Subatomic particles: electrons, nucleons
   D. Structure: nucleus, orbitals, atomic number, mass number, atomic mass, isotopes, charge, size

VI. Quantum Mechanical Model
   A. Electron configuration: Aufbau, Hund, Pauli Exclusion
   B. Light: electromagnetic spectrum, atomic spectral analysis
   C. Quantum mechanics and photoelectric effect
   D. DeBroglie equation, Heisenberg uncertainty principle

VII. Periodic Trends of Elements
   A. By electron configuration
   B. Size: atoms and ions
   C. Ionization energy
   D. Electronegativities

VIII. Bonding
   A. Energy and energy changes
   B. Ionic: electron configurations
   C. Covalent: polar, non polar
   D. Van der Waals forces: dipoles, dispersion

IX. Chemical Names and Formulas
   A. Representing chemical compounds
   B. Ionic charges: monatomic, poly atomic
   C. Formula unit predictions

X. Acids and bases
   A. Acids and the pH scale
   B. Bases and the pH scale
   C. Acids in the environment

TYPICAL ASSESSMENT TOOLS

Homework
Quizzes
Tests
Presentations
Projects
Lab reports

SCHOOL-WIDE RUBRICS USED IN THIS COURSE

Writing
Presentation

MAINE LEARNING RESULTS COMMON ASSESSMENTS ADMINISTERED IN THIS COURSE

None

TEXTS AVAILABLE

Chemistry Addison-Wesley/Prentice Hall 2000

SUPPLEMENTAL RESOURCES

A Demo a Day Gross, Bilash, Koob, Flinn Scientific , 1995
Chem lab topics Flinn Scientific 2004
Hands on Chemistry Activities Herr, Cunningham, Center for applied research in education 1999

COURSE DESCRIPTION

558 ADVANCED PLACEMENT CHEMISTRY 12

The AP Chemistry course is a full year college level course in chemistry taught in the high school setting. It is designed to be taken by students after successful completion of college chemistry. The Advanced Placement Chemistry Exam is a mandatory part of the course and is given by the Education Testing Service (ETS) of New Jersey. A student who receives a score of 3 or higher on the AP Exam may get college credit from many colleges. Students will be required to complete a summer assignment before class starts in the fall.

NOTE: All students are required to take the AP Exam. The cost of the AP Exam is $82 to the student. This cost, however, should not be a determining factor in taking this course. Financial aid is available for qualifying students.

MAINE LEARNING RESULTS

E. Structure of Matter
G. The Universe
H. Energy
I. Motion
J. Inquiry and Problem Solving
K. Scientific Reasoning
L. Communication

COURSE OBJECTIVES

1. To provide students with the conceptual framework, factual knowledge, and analytical skills necessary to deal critically modern chemistry

2. To help students gain an appreciation of science as a process

3. To develop the laboratory skills needed to help understand the underlying concepts of chemistry, as well as the background to maintain safe laboratory practice

4. To provide the students with the skills necessary to score well on the Advanced Placement Chemistry Test

COURSE CONTENT

I. Structure of matter
   A. Atomic theory and atomic structure
      1. Evidence for the atomic theory
      2. Atomic masses: by chemical and physical means
      3. Atomic number, mass number, isotopes
      4. Electron energy levels atomic spectra, quantum numbers, orbitals
   B. Chemical bonding
      1. Binding forces
         a. Types: ionic, covalent, metallic, hydrogen bonding, van der Waals including london dispersion forces
         b. Relationship to state, structure and properties of matter
         c. Polarity of bonds, electronegativities
      2. Molecular models
         a. Lewis structure
         b. Valence bond: hybridization of orbitals, resonance,sigma and pi
         c. VESPR
      3. Geometry of molecules and ions, isomerism, coordination complexes, dipoles

C. Nuclear chemistry
    1. equations
    2. half lives
    3. radioactivity

II. States of matter
A. Gases
    1. Ideal gases laws and partial pressures
B. Kinetic molecular theory
    1. Basis of ideal gas law
    2. Avogadro's hypothesis and the mole
    3. Kinetic energy and temperature
    4. Real gases
C. Liquids and solids
    1. Liquids and solids from the kinetic molecular viewpoints
    2. Phase diagrams
    3. Change of state
    4. Structure of solids: Lattice energy
D. Solutions
    1. Molarity and molality
    2. Solubility

III. Reactions
A. Reaction types
    1. Acid/ base
    2. Precipitation reactions
    3. Redox reactions
        a. Oxidation number
        b. Role of the electron
        c. Electrochemistry: electrolytic and galvanic cells; Faraday's law half cells, Nernst equation
B. Stoichiometry
    1. Balancing all reactions
    2. Mass and volume relations with emphasis on the mole
C. Equilibrium
    1. Dynamic equilibrium, Le Chatelier's principle equilibrium constants
    2. Quantitative
        a. Equilibrium constants gases and solutions
        b. Equilibrium constants for solutions
D. Kinetics
    1. Rates of reaction
    2. Determining rate constants and rate laws
    3. Effect of temperature
    4. Activation energy
    5. Rate determining step and mechanism

IV. Descriptive Chemistry
A. Chemical reactivity and products
B. Relationships on the periodic table such as ionic radius, electronegativities, ionic charge
C. Introduction to organic chemistry

V. Laboratory
A. Safety
B. Basic lab procedures
C. Quantitative and qualitative analysis
D. Making observations
E. Communicating lab results through lab reports

TYPICAL ASSESSMENT TOOLS

Homework
Quizzes
Unit exams
Written lab reports and questions
Group presentations
Class participation
Released AP free response questions

SCHOOL-WIDE RUBRICS USED IN THIS COURSE

Writing
Presentation

MAINE LEARNING RESULTS COMMON ASSESSMENTS ADMINISTERED IN THIS COURSE

None

TEXTS AVAILABLE

Chemistry The Central Science tenth edition, Brown, Lemay, Bursten, Pearson Prentice/ Hall 2006

SUPPLEMENTAL RESOURCES

AP Chemistry course description (Acorn Book) updated yearly
General Chemistry, Umland and Bellama 3rd edition Brooks /Cole publishing 1999
Laboratory Experiments Nelson and Kemp Chemistry The Central Science, seventh edition, Prentice Hall 1997
Laboratory experiments for Advanced Placement Chemistry Vonderbrink Flinn Scientific 1995

COURSE DESCRIPTION

560 COLLEGE PREPARATORY PHYSICS 11, 12

Physics is recommended for those students planning further study in any field of science, medicine, engineering or technology. Topics considered include the study of motion, energy, wave theory, magnetism, electricity and nuclear physics. A math proficiency test will be taken at the beginning of the school year.

MAINE LEARNING RESULTS

G. The Universe
H. Energy
I. Motion
J. Problem Solving
K. Scientific Reasoning
M. Implications of Science

COURSE OBJECTIVES

1. To introduce high school students to the basics in classical (Mechanics, Optics, Sound, Electricity and Magnetism, and Thermodynamics) and modern (Atomic, Special Relativity, and Time Analysis) physics
2. To improve the quantitative (mathematical) capabilities of students
3. To enhance the problem solving skills of upper level high school students in real world scenarios
4. To improve the cooperative (group dynamic) abilities of students
5. To offer to highly motivated students a challenging and at times very difficult mathematic based science course just prior to entering college

COURSE CONTENT

I. Review of the algebra, geometry, and trigonometric skills essential to success in physics
   A. Signed numbers
   B. Algebraic equations and fractions
   C. Isolating unknowns in terms of other variables
   D. Functions
   E. Right and nonright trig

II. Vector analysis
   A. Colinear Vectors
   B. Perpendicular vectors
   C. Multiple vectors
   D. Noncolinear, nonperpendicular vectors

III. Exponential and linear graphing
   A. Direct relationships
   B. Inverse relationships

IV. Problem solving practice for dealing with purely quantitative real life experiences using scientific graphing calculators
   A. Outline of the problem solving approach we will use during the entire school year
   B. Basic review with examples involved in using a graphing scientific calculator

V. Motion in 1 Dimension
   A. Uniform linear motion
   B. Uniform accelerated motion

VI. Projectile Motion
   A. Uniform linear motion
   B. Uniform accelerated motion

VII. Forces
- A. Newton's 3 Laws of motion
- B. Friction and the coefficient of static and kinetic friction
- C. Universal Gravitation
- D. Inclined planes
- E. The Normal Force

VIII. Work, Power, and Energy
- A. Potential Energy
- B. Kinetic Energy
- C. Power (The rate at which work is accomplished)
- D. The Work-Energy Theorem

IX. Momentum
- A. Force Impulses and their relationship to changes in momentum
- B. The Law of the Conservation of Momentum
- C, Elastic vs. Inelastic collisions

X. Circular Motion
- A. Centripetal Force and Acceleration
- B. Tangential velocity
- C. The Radian Concept

XI. Rotational Statics and Dynamics
- A. Torque
- B. "Bridge Problems"

XII. Fluids
- A. Hydrostatics
  1. Mass Density
  2. Buoyancy Force
  3. Pressure: Atmospheric and fluidic
  4. Pascal's Principle
  5. Archimede's Principle
- B. Hydrodynamics
  1. Bernoulli's Principle
  2. Flow continuity
  3. Ideal vs. Real Fluids

XIII. Thermal Physics
- A. Temperature Scale Conversion Methods
- B. Gas Laws
- C. Expansion and Contractions Rates in Solid, Liquid, and Gaseous Materials
- D. Using Young's, Bulk, and Shearing Moduli Equations
- E. The Laws of Thermodynamics

XIV. Simple Harmonic Motion
- A. Amplitude, Acceleration, Velocity, and Displacement in SHM
- B Mass vs. Simple Pendulums

XV. Wave Characteristics
- A. Transverse vs. Longitudinal Waves
- B. Electromagnetic vs. Mechanical Waves
- C. Wave Velocities in Different Media
- D. Wave Velocities in Relationship to Frequency and Wavelength

XVI. Sound
- A. Sound Intensity (watts/m^2) vs. Sound Intensity Level (Db)
- B. Doppler Effect
- C. Frequency Response
- D. Interference, Diffraction, and Superposition's in waves

XVII. Electricity
- A. Electric Charges, Fields, and Forces
- B. Work as it relates to charges
- C. Electric current
- D. Series and parallel circuits

XVIII. Magnetism
- A. Magnetic Fields
- B. Magnetic Force
- C. Three Right Hand Rules
- D. Electricity
- E. Electromagnetic Induction

XIX. Modern Physics
- A. Quantum Mechanics
- B. The Nucleus
- C. The Atom
- D. Radioactivity

TYPICAL ASSESSMENT TOOLS

Exams, Quizzes, Lab Reports, Homework, and Laboratories

SCHOOL-WIDE RUBRICS USED IN THIS COURSE

Presentation and Writing Rubrics

MAINE LEARNING RESULTS COMMON ASSESSMENTS ADMINISTERED IN THIS COURSE

None

TEXTS AVAILABLE

Holt Physics (2006 Edition); Serway and Faughn; Holt Publishers

SUPPLEMENTAL RESOURCES

The Laboratory Equipment in Room 10

COURSE DESCRIPTION

576 AP PHYSICS 12

AP Physics is a full-year college level, non-calculus based course in college physics addressing the issues of Newtonian Mechanics, Electricity, Magnetism, and Energy (including wave theory). A student who receives a score of 3 or higher on the final examination given by Educational Testing Service (ETS) of New Jersey can expect to obtain college credit for one year of general physics. A list of colleges which give credit is in the guidance office. Students will be required to complete a summer assignment before class starts in the fall.

MAINE LEARNING RESULTS CONTENT

G. The Universe
H. Energy
I. Motion
J. Problem solving
K. Scientific Reasoning
M. Implications of Science

COURSE OBJECTIVES

1. To introduce high school students to the basics in classical (Mechanics, Optics, Sound, Electricity and Magnetism, and Thermodynamics) and modern (Atomic, Special Relativity, and Time Analysis) physics
2. To improve the quantitative (mathematical) capabilities of students
3. To enhance the problem solving skills of upper level high school students in real world scenarios
4. To improve the cooperative (group dynamic) abilities of students
5. To offer to highly motivated students a challenging and at times very difficult mathematic based science course just prior to entering college

COURSE CONTENT

I. The mathematics and related requirements as the course begins:
   A. Review of algebra skills
   B. Basics of right and non-right triangle trig
   C. Using significant digits
   D. Working with vectors (addition, subtraction, and resolution)
   E. Working with the metric system
   F. Mass density

Laboratory Unit: Determining the mass of the air in our classroom

II. Motion Kinematics:
   A. Motion defined and the terms associated with it (velocity, displacement, time, and acceleration)
   B. Vector vs. Scalar quantities including the concept of vector independence
   C. Motion in one dimension
   D. Motion in more then one dimension
   E. Deriving appropriate equations

Laboratory Units: 1. Measuring the acceleration due to gravity
2. Viewing the acceleration of a free falling object with a strobe light

III. Newton's 3 Laws of Motion:
   A. The concept of inertia
   B. Introduction to net forces as the creators of motion (F = ma)
   C. The Action-Reaction Law
   D. The friction force and its relationship to the normal and weight forces
   E. The coefficient of static and kinetic friction

F. The tension force
G. Vector related apparent weight and "elevator" problem applications
H. Hooke's Law and springs
I. Translational equilibrium
J. Atwood's machine
K. Circular motion addressing the concepts of centripetal force and acceleration
L. The inclined plane

Laboratory Units: 1. Conservation of Energy: Potential into kinetic
2. Exploring the Potential Energy in a stretched rubber band
3. Masses and Springs
4. Centripetal Force as it balances with the weight force
5. Hooke's Law
6. The Coefficient of Static and Kinetic Friction

IV. Work, Power, and Energy:
A. What is and what isn't work?
B. Kinetic and gravitational and elastic potential energy
C. The Work-Energy Theorem
D. Measuring the rate at which work is done (Power)
E. Conservation of Mechanical Energy
F. Work accomplished by non conservative forces

Laboratory Unit: Work and the Inclined Plane

V. Linear Momentum and Elastic vs Inelastic Collisions:
A. Momentum defined
B. Changing linear momentum with force impulses (Ft)
C. Conservation of linear momentum
D. Elastic and Inelastic collisions
E. Center of gravity (or mass) calculations in single objects with uniform mass distribution, nonuniform mass distribution, and in multiple objects

Laboratory Units: 1. Conservation of linear momentum using collision carts
2. Predicting the center of gravity for a multiple object structure

VI. Rotational Kinematics and Dynamics:
A. Angular motion (displacement, velocity, and acceleration)
B. Rotational Kinematics
C. Rotational and linear motion relationships
D. Tangential acceleration and velocity
E. Using radian measures
F. Rotational work, kinetic energy, power, and momentum
G. Revisiting the total mechanical energy with the addition of the rotational components
H. The moment of inertia (I)
I. Torque, angular acceleration, and
J. The condition requirements for rotational equilibrium

Laboratory Units: 1. Conservation of Energy in bicycles (gravitational PE to Rotational KE transitions)
2. Torque and diving boards

VII. Universal Gravitation:
A. Newton's law of universal gravitation and the discovery of the universal gravitational constant (G)
B. The acceleration due to gravity and how it relates to the mass and radius of a given planet
C. Determining the required orbital velocity for satellites

D. Escape velocity
E. Kepler's 3 laws of planetary motion
F. Gravitational potential energy and its relationship to weight
G. Mass vs weight

Laboratory Units: 1. The pathway taken for horizontally directed projectiles
2. What would you weigh on the surface of....?

VIII. Simple Harmonic Motion:
A. Vibrational Oscillations in terms of frequency (f) and period (T)
B. Simple Harmonic Motion in springs
C. Calculating displacement, acceleration, and velocity in SHM and any given moment in its oscillation
D. Simple and Mass Pendulums

Laboratory Units: 1. Determine the factors that do and do not affect the period of a simple and mass pendulum
2. The inertial pendulum

IX. Wave Basics:
A. Transverse vs Longitudinal waves
B. Waves terms: Period, frequency, amplitude, wavelength, and speed
C. Waves on strings considering their linear density, and force
D. Wave reflection rules
E. Sound: It's characteristics, and human capabilities and capacities
F. Sound intensity in w/m^2
G. Sound intensity level in decibels
H. Doppler Effect
I. Superposition and Interference
J. Standing Waves, Nodes, and Antinodes
K. Harmonics
L. Beat frequencies
M. Resonance frequencies

Laboratory Units: 1. Determine the speed of sound in our classroom
2. Resonance in pipes
3. Waves in strings
4. Using echoes to determine the speed of sound

X. Hydrostatic and Hydrodynamic Fluids:
A. Pressure (Force/Area): Atmospheric vs Gauge
B. Pressure as it relates to fluid immersion depth
C. Pascal's Principle and Hydraulic lifts
D. Archimedes Principle and Buoyancy Force
E. The role of a fluid's density in force buoyancy
F. Fluid Flow continuity equation for mass and volume flow rates
G. Bernoulli's principle and equation
H. The role of fluid viscosity and surface tension in flow rates

Laboratory Unit: Aluminum foil ship design contest for maximum cargo capacity per unit mass

XI. Thermal Physics:
A. Temperature scales and conversions, and a discussion of the meaning of absolute zero
B. Thermal equilibrium through conduction, convection, and radiation

C. The 4 Laws of Thermodynamics including Heat vs Work changes in the Internal Energy (U) of a system, Isochoric, Isothermal, Isobaric, and Adiabatic processes, Specific Heat and Molar Heat Capacities, The Theoretical Carnot engine and the reversible process, Calculating engine efficiency, Refrigerators, Combustion Engines and Heat Pumps, and The Concept of Entropy, Disorder and Randomness on a Universal Basis
D. Thermal expansion: Linear, Area, and Volumetric
E. Thermal Changes in and during Phase Changes: Latent heat of Fusion, Vaporization, and Sublimation
F. The Ideal Gas law
G. The Kinetic Theory
H. Elastic Deformation of matter
I. Evaporation vs Condensation

Laboratory Units: 1. Identification of matter using its Specific Heat
2. Linear and volumetric expansion

XII. Electromagnetic Waves:
A. The Electromagnetic Spectrum
B. How EM waves are produced
C. The speed of light (c) and its relationship to the index of refraction
D. Visible light: A narrow band, its polarization, and illuminance
E. The Law of Reflection and the normal perpendicular angle (NPA)
F. Visible light: Is it a wave (transverse and electromagnetic) or particles (Photons)
G. Mirrored vs diffuse surfaces
H. The characteristics of flat and curved mirrors (both concave and convex)
I. Snell's Law of Refraction and the index of refraction
J. The mirror/lens and magnification equations
K. Total internal reflection requirements
L. Ray diagrams in thin lenses (convex and concave types)
M. The problems with spherical and chromatic aberration in mirrors and lenses
N. Interference and diffraction of light
O. Young's double slit experiment and bright and dark fringes
P. Diffraction gratings

Laboratory Units: 1. Using optic benches and convex lenses; determining the focal length of an assortment of convex lenses and using those lenses to project an image with clarity at a particular distance
2. Ray Diagrams with thin convex and concave lenses and mirrors to develop reasoning strategies for determining real vs virtual images, and orientation of images with respect to the object
3. Snell's Law

XIII. Electric Charges, Forces, and Fields:
A. Defining the electric charge in terms of its magnitude and polarity (+ or -)
B. Separating static charges including charge distribution on spheres
C. Coulomb's Law and "point" charges
D. Electric field lines
E. The parallel plate capacitor
F. Electrostatic shielding
G. Gauss's law and charging by induction
H. Electric potential vs electric potential energy
I. Electric potential and point charges
J. Conductors and insulators
K. The use of dielectrics
L. Capacitance

Laboratory Units: 1. Creating static charges
2. Drawing field lines
3. Building an electroscope
4. Balloons and Coulomb's law

XIV. Electric Current and DC Circuits
A. Electric current, its units, and ways to measure it (ammeters)
B. How batteries work and measuring their potential (voltmeters)
C. Basic electric circuits (DC) nomenclature and reading schematics
D. Resistance and Ohm's law
E. Resistively in different forms of matter and the role of temperature on conductivity
F. Electric power and energy
G. Series, parallel, and combined circuits
H. Kirchoff's Rules: The Junction and Loop rule
I. Resistance/Capacitor (RC) circuits

Laboratory Units: 1. Building and analyzing series and parallel circuits using ammeters and voltmeters to monitor results
2. The Wheatstone Bridge

XV. Magnetism:
A. Magnetic vs electric fields
B. Magnetic field lines and directions
C. Magnetic force on moving charges
D. The right hand rules for analyzing the direction of current, field, and forces
E. Magnetic force exerted on a current carrying wire
F. Current loops and magnetic field related torque's
G. Ampere's law
H. Transformers (Step up and step down types)

Laboratory Units: 1. Drawing magnetic field lines using bar magnets
2. Assemble an electric motor kit

XVI. Modern Physics:
A. Special relativity, time dilution, and length contraction
B. Quantum physics
C. Photons and the photoelectric effect
D. The Compton Effect
E. The deBroglie Wavelength
F. The Heisenberg Uncertainty Principle
G. The popular and historic models of the atom (Thompson, Rutherford, and Bohr)
H. Nuclear Physics, nuclear decay, radioactivity (alpha, beta, and gamma), half-life, and radioactive dating
I. Nuclear fission and fusion

Laboratory Units: 1. A Decay Series
2. Radioactive Decay
3. Spectrum of Hydrogen and Plank's Constant

TYPICAL ASSESSMENT TOOLS

Exams, Quizzes, Lab Reports, Homework, and Laboratories

SCHOOL-WIDE RUBRICS USED IN THIS COURSE

Presentation and Writing Rubrics

MAINE LEARNING RESULTS COMMON ASSESSMENTS ADMINISTERED IN THIS COURSE

None

TEXTS AVAILABLE

Physics AP Edition (2007 Edition); Walker; Pearson Publishers

SUPPLEMENTAL RESOURCES

The Laboratory Equipment in Room 10