Mandan Public School District

Science Curriculum

Mandan Public Schools

K-12

Science Curriculum

Mandan Public Schools
Braves
"Where the Best Begin"

2011

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Preface

Mandan Public Schools' K-12 Science Curriculum Committee revised and updated the K-12 Science Curriculum. The K-12 Science Curriculum Committee included the current draft of the North Dakota K-12 Science Content Standards in the curriculum. This updated curriculum will provide Mandan Public School students with the best possible science curriculum to assist our students in learning and achieving in science.

The K-12 Science Curriculum is articulated in two ways. First, the curriculum is presented based on the current draft of the North Dakota K-12 Science Content Standards. The committee identified each benchmark specific student skill and determined the degree to which each benchmark should be addressed in each course. The following IDM coding system was used to convey this:

I – Introduce
D – Develop
M – Master.

The K-12 Science Curriculum is also articulated according to the 21st Century Skills. The committee identified which K-12 Science Curriculum benchmarks address specific 21st Century Skills. These 21st Century Skills and the match to Mandan Public Schools K-12 Science Standards can be seen in Appendices A, B and C.

The K-12 Science Curriculum IDM matrix lists all of the K-12 Science courses that are available to students in Mandan Public Schools. Please read the course descriptions to learn more about the course content.

Thanks to the K-12 Science Curriculum Committee for their time, effort, and professionalism in working on this curriculum. Mandan Public Schools is fortunate to have such dedicated hardworking professionals who teach our students Science.

Dr. Gaylynn Becker
District Curriculum/Data Director

Mandan Public Schools
2010 K-12 Science Curriculum
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Vision, Mission, Slogan and Philosophy

Mandan Public School District's vision is **"Empowering excellence."** Its mission is **"Empowering every student to lead a productive life and positively contribute to society."** Its slogan is **"Mandan Schools: Where the Best Begin."**

The principal objective of the Board shall be to provide maximum educational opportunities for their students to develop in accordance with their individual needs, abilities, and level of maturity. Teachers shall make efforts to aid students to achieve their maximum development mentally, physically, socially, spiritually, and emotionally so that they may properly adjust to our complex democratic society.

The district shall back up its educational program with supporting services necessary for students' health, safety, and personal well being.

Philosophy of the K-12 Science Curriculum is:

Students will be provided opportunities to explore their natural world and develop scientific skills through laboratory experiences, critical thinking, problem solving, discussions, and inquiry. Through these experiences students will understand the role that science plays in their lives and how it influences our society.

K-12 Science Curriculum Codes

I – Introduce
D – Develop
M – Master

Anything beyond the mastery level we assume that reinforcement will occur in the more advanced courses.

Kindergarten Science Curriculum

Standards & Benchmarks

Standard 1: **Students understand the unifying concepts and processes of science.**	**Kindergarten**
MODELS	
K.1.1 Identify models (e.g., dolls, stuffed animals, toy vehicles) that are not real	**I**
CONSTANCY AND CHANGE	
K.1.2 Identify things that can change (e.g., weather, people, water)	**I**
Standard 2: **Students use the process of science inquiry.**	**Kindergarten**
ABILITIES NECESSARY TO DO SCIENTIFIC INQUIRY	
K.2.1 Use senses (i.e., sight, hearing, touch, smell, taste) to make observations about the world around them	**I**
K.2.2 Use simple tools (e.g., hand lens, balance, funnel, strainer) to extend the senses	**I**
Standard 3: Students understand the basic concepts and principles of physical science.	**Kindergarten**
PROPERTIES OF MATTER	
K.3.1 Identify the materials that make up an object. (e.g., desk is made up of wood and metal, bike is made up of metal, rubber, and plastic)	**I**

Standard 4: Students understand the basic concepts and principles of life science.	**Kindergarten**
CHARACTERISTICS OF ORGANISMS	
K.4.1 Identify animals eat plants or other animals for food	**I**
Standard 5: Students understand the basic concepts and principles of earth and space science.	**Kindergarten**
WEATHER, SEASONS, AND CLIMATE	
K.5.1 Describe day-to-day weather changes (e.g., sunny, rainy, cloudy, snowy)	**ID**
EARTH'S SURFACE	
No benchmark expectations at this level	
OBJECTS IN THE SKY	
K.5.2 Identify objects (e.g., sun, birds, airplanes, moon) in the sky	**I**
Standard 6: Students understand relations between science and technology.	**Kindergarten**
FORMS OF TECHNOLOGY	
K.6.1 Identify natural objects that differ from those made by humans (e.g., rock-brick, sun-light bulb)	**I**
K.6.2 Identify tools (e.g., scissors, pencil, hammer) that can be helpful or harmful	**I**

Standard 7: Students understand relations between science and personal, social, and environmental issues.	**Kindergarten**
SCIENCE AND PERSONAL HEALTH	
K.7.1 Identify safety rules for school and home	**ID**
Standard 8: Students understand the history and nature of science.	**Kindergarten**
PEOPLE IN SCIENCE	
K.8.1 Explain why anyone can be a scientist	**I**

1st Grade Science Curriculum

Standards & Benchmarks

Standard 1: **Students understand the unifying concepts and processes of science.**	**1st Grade**
MODELS	
1.1.1 Identify models that represent real objects (e.g., globe represents the Earth, doll represents a real baby)	**ID**
SYSTEMS	
1.1.2 Identify objects (e.g., toy vehicles, dolls, human body, plants) that are made of parts	**ID**
CONSTANCY AND CHANGE	
1.1.3 Describe different ways that things can change (e.g., size, mass, color, movement)	**I**
Standard 2: **Students use the process of science inquiry.**	**1st Grade**
ABILITIES NECESSARY TO DO SCIENTIFIC INQUIRY	
1.2.1 Record and describe observations with pictures, numbers, or words	**I**
Standard 3: **Students understand the basic concepts and principles of physical science.**	**1st Grade**
PROPERTIES OF MATTER	
1.3.1 Identify matter that can be a liquid or solid (e.g., water)	**I**
1.3.2 Identify observable properties (e.g., size, weight, shape, color, movement) of objects	**I**
FORCE AND MOTION	

1.3.3 Identify different kinds of motion (e.g., straight, circular, back-and-forth) that objects can have	**I**
Standard 4: Students understand the basic concepts and principles of life science.	**1st Grade**
1.4.1 CHARACTERISTICS OF ORGANISMS	**I**
LIFE CYCLES	
1.4.2 Identify characteristics of living things (e.g., grow, sometimes reproduce, change, and die over time)	**I**
Standard 5: Students understand the basic concepts and principles of earth and space science.	**1st Grade**
1.5.1 Explain that short-term weather conditions can change daily, and how weather affects people's daily activities	**I**
EARTH'S SURFACE	
No benchmark expectations at this level	
OBJECTS IN THE SKY	
1.5.2 Explain why the sun can only be seen in the daytime, but the moon can be seen sometimes during the day and sometimes at night	**I**
Standard 6: Students understand relations between science and technology.	**1st Grade**
FORMS OF TECHNOLOGY	
1.6.1 Identify tools/inventions (e.g., computer, car, cell phone) that impact the way we live	**I**
TECHNOLOGICAL DESIGN	
1.6.2 Use several steps to complete a task (e.g., building blocks, art project, group investigation)	**I**

Standard 7: Students understand relations between science and personal, social, and environmental issues.	**1st Grade**
SCIENCE AND PERSONAL HEALTH	
1.7.1 Identify personal care practices (e.g., dental care, hand washing, exercise, nutrition) that contribute to a healthy life	**ID**
SCIENCE AND ENVIRONMENTAL ISSUES	
1.7.2 Describe ways that humans influence their environment (e.g., littering, recycling, car pooling)	**I**
Standard 8: Students understand the history and nature of science.	**1st Grade**
PEOPLE IN SCIENCE	
1.8.1 Identify ways (e.g., create things, ask questions, make observations, figure things out) that everybody can do science	**I**

2nd Grade Science Curriculum

Standards & Benchmarks

Standard 1: **Students understand the unifying concepts and processes of science.**	**2nd Grade**
MODELS	
2.1.1 Explain ways models are like (e.g., globe and Earth are both round) and unlike (e.g., different sizes, missing details and functions) real things	**ID**
SYSTEMS	
2.1.2 Identify some things that may not work if some of their parts are missing, broken, or assembled incorrectly (e.g., batteries are necessary for some toys to operate, wheels are necessary for a car to function)	**DM**
CONSTANCY AND CHANGE	
2.1.3 Identify changes that are slow (e.g., human development) or fast (e.g., plant growth)	**ID**
Standard 2: **Students use the process of science inquiry.**	**2nd Grade**
ABILITIES NECESSARY TO DO SCIENTIFIC INQUIRY	
2.2.1 Ask questions and seek answers about the world (e.g., Why do we have seasons)	**I**
2.2.2 Communicate (e.g., verbal written, graphic observations to others)	**D**
Standard 3: Students understand the basic concepts and principles of physical science.	**2nd Grade**
PROPERTIES OF MATTER	
2.3.1 Identify ways (e.g., mixing, heating, cooling, cutting) to make changes in matter	**D**

2.3.2 Explain why water left in an open container disappears, but water in a closed container does not disappear	**ID**
2.3.3 Sort matter by observable properties (e.g., size, shape, texture, color)	**D**
FORCE AND MOTION	
2.3.4 Describe an object's location (e.g., further than, beside, under, over) relative to another object	**I**
2.3.5 Describe how objects fall unless something holds them up (e.g., apple on a tree, coat on a hook, pencil rolling off a desk)	**I**
FORMS OF ENERGY	
2.3.6 Identify whether sources of heat and light are natural or human-made (e.g., sunlight, light bulb)	**I**
Standard 4: Students understand the basic concepts and principles of life science.	**2nd Grade**
CHARACTERISTICS OF ORGANISMS	
2.4.1 Identify how plants and animals are alike and different (e.g., in the way they look, in their behaviors)	**D**
COMPARE THE SIMILARITIES AND DIFFERENCES	
LIFE CYCLES	
No benchmark expectations at this level	
ORGANISMS AND THEIR ENVIRONMENTS	
2.4.2 Identify various things that are found in different environments (e.g., cactus, lizard – desert; shark, coral- ocean)	**I**
Standard 5: Students understand the basic concepts and principles of earth and space science.	**2nd Grade**
WEATHER, SEASONS, AND CLIMATE	
2.5.1 Describe the patterns and characteristics of the four seasons, and how these changes in weather influence plant, animal, and human activities.	**D**
EARTH'S SURFACE	
2.5.2 Identify different physical properties (e.g., size, shape, texture) of earth materials (e.g., rocks, sand, water)	**I**
2.5.3 Explain how fossils provide evidence about plants and animals and their environments that lived long ago (e.g., wooly mammoth, fern, ice age).	**I**
OBJECTS IN THE SKY	
2.5.4 Describe how the sun provides light and heat to warm the earth (e.g., land, air, and water)	**D**
2.5.5 Explain how the moon appears slightly different every day, but looks nearly the same every four weeks	**I**

Standard 6: Students understand relations between science and technology.	**2nd Grade**
FORMS OF TECHNOLOGY	
2.6.1 Identify tools (e.g., ruler, hand lens, thermometer, balance) that are used to observe, measure, and investigate things they could not otherwise see, measure and do	**D**
2.6.2 Explain how models (e.g., plastic animal figures, skeletal models) can be used to understand science	**D**
Standard 7: Students understand relations between science and personal, social, and environmental issues.	**2nd Grade**
SCIENCE AND PERSONAL HEALTH	
2.7.1 Identify personal choices (e.g., personal hygiene, nutrition, fitness, safety) that contribute to individual wellness	**D**
2.7.2 Describe some things (e.g., UV Rays, second-hand smoke, pollution) from our environment that are harmful to people	**D**
SCIENCE AND ENVIRONMENTAL ISSUES	
No benchmark expectations at this level.	
Standard 8: Students understand the history and nature of science.	**2nd Grade**
PEOPLE IN SCIENCE	
2.8.1 Identify ways scientists work together to solve problems (e.g., share results, teamwork, investigate)	**D**

3rd Grade Science Curriculum

Standards & Benchmarks

Standard 1: **Students understand the unifying concepts and processes of science.**	**3nd Grade**
MODELS	
No benchmark expectations at this level	
SYSTEMS	
No benchmark expectations at this level	
CONSTANCY AND CHANGE	
3.1.1 Identify changes that are repetitive (e.g., seasons, day and night, water cycle)	**D**
Standard 2: **Students use the process of science inquiry.**	**3nd Grade**
ABILITIES NECESSARY TO DO SCIENTIFIC INQUIRY	
3.2.1 Identify changes that are repetitive (e.g., seasons, day and night, water cycle)	**D**
3.2.2 Ask questions directly related to a scientific investigation	**I**
3.2.3 Record observations (e.g., journals, drawings, charts) based on simple investigations	**I**
Standard 3: Students understand the basic concepts and principles of physical science.	**3nd Grade**
PROPERTIES OF MATTER	
3.3.1 Identify the physical properties of solids and liquids	**ID**

FORCE AND MOTION	
3.3.2 Identify a force as push or pull	**I**
3.3.3 Describe how magnets attract iron and repel or attract other magnets	**I**
FORMS OF ENERGY	
3.3.4 Explain how sound is produced by vibration	**I**
3.3.5 Describe how the path of light tends to maintain its direction and motion until it encounters an object	**I**
Standard 4: Students understand the basic concepts and principles of life science.	**3rd Grade**
CHARACTERISTICS OF ORGANISMS	
No benchmark expectations at this level	
STRUCTURE AND FUNCTION	
3.4.1 Identify parts of an organism that have specific functions (e.g., roots absorb water, heart pumps blood)	**I**
LIFE CYCLES	
3.4.2 Describe the life cycles of plants and animals (e.g., birds, mammals, grasses, trees, insects, flowers)	**D**
ORGANISMS AND THEIR ENVIRONMENTS	
3.4.3 Identify the needs of living things (e.g., food, shelter, soil, space, water)	**I**
Standard 5: Students understand the basic concepts and principles of earth and space science.	**3rd Grade**
WEATHER, SEASONS, AND CLIMATE	
3.5.1 Identify weather conditions that can be measured (e.g., temperature, wind direction and speed, and precipitation)	**ID**
EARTH'S SURFACE	
3.5.2 Identify different uses (e.g., building materials, sources of fuel) of Earth's materials based on their properties	**D**
3.5.3 Identify ways (e.g., wind, rain, people) that larger rocks break down into smaller rocks	**I**
3.5.4 Identify the properties of soil (e.g., color, texture, ability to support plant growth, capacity to retain water)	**I**
OBJECTS IN THE SKY	
3.5.5 Explain how stars are like the Sun, but because they are at a great distance, they look like small points of light	**D**

Standard 6: Students understand relations between science and technology.	**3rd Grade**
FORMS OF TECHNOLOGY	
No benchmark expectations at this level	
TECHNOLOGICAL DESIGN	
3.6.1 Identify ways technology (e.g., zippers, Velcro, measuring instruments, computers) can be used to solve problems at home and school	**D**
Standard 7: Students understand relations between science and personal, social, and environmental issues.	**3rd Grade**
SCIENCE AND PERSONAL HEALTH	
3.7.1 Identify ways to prevent the spread of germs.	**D**
SCIENCE AND ENVIRONMENTAL ISSUES	
3.7.2 Identify the benefits of recycling, reusing, and reducing	**ID**
SCIENCE AND SOCIAL ISSUES	
No benchmark expectations at this level	
Standard 8: Students understand the history and nature of science.	**3rd Grade**
PEOPLE IN SCIENCE	
3.8.1 Identify ways people of all ages, genders, and backgrounds use science in their careers and in daily life (e.g., children check temperature conditions to decide what to wear, farmer uses genetic grains, hikers use GPS, depth-finder in boat, hearing-aides for disabilities)	**D**

4th Grade Science Curriculum

Standards & Benchmarks

Standard 1: **Students understand the unifying concepts and processes of science.**	**4th Grade**
MODELS	
4.1.1 Explain changes in the real world using a model (e.g., erosion, volcano, stream table, wing designs for airplanes)	**D**
SYSTEMS	
No benchmark expectations at this level	
CONSTANCY AND CHANGE	
4.1.2 Identify changes that can be steady or irregular (e.g., floods, earthquakes, erosion, tooth decay)	**D**
Standard 2: **Students use the process of science inquiry.**	**4th Grade**
ABILITIES NECESSARY TO DO SCIENTIFIC INQUIRY	
4.2.1 Review and ask questions about the scientific investigations of others	**D**
4.2.2 Conduct simple investigations to answer questions based on observations	**D**
4.2.3 Use scientific tools (i.e., thermometers, rulers, balances) during simple investigations	**D**
Standard 3: Students understand the basic concepts and principles of physical science.	**4th Grade**
PROPERTIES OF MATTER	
4.3.1 Identify the forms in which water appears when heated and cooled (i.e., water vapor, liquid, solid)	**M**
4.3.2 Explain the relationship between the mass of an object and the sum of its parts.	**D**
4.3.3 Explain that matter is made up of parts that are too small to see without magnification	**I**

FORCE AND MOTION	
4.3.4 Identify the effects forces may have when applied to objects (i.e., start, stop, change direction)	**D**
FORMS OF ENERGY	
4.3.5 Describe how the path of light changes (i.e., reflected, absorbed, or allowed to pass through) when it encounters a variety of objects	**I**
4.3.6 Explain how the pitch of a sound is related to the rate of vibrations.	**I**
4.3.7 Identify ways friction or burning produces heat (e.g., magnifying glass, carpet burn, sunburn)	**I**
Standard 4: Students understand the basic concepts and principles of life science.	**4th Grade**
STRUCTURE AND FUNCTION	
4.4.1 Classify plants and animals according to common physical characteristics	**D**
4.4.2 Identify adaptations that help plants and animals survive and grow in their environment	**D**
LIFE CYCLES	
No benchmark expectations at this level	
CHARACTERISTICS OF ORGANISMS	
4.4.3 Identify behaviors of animals as instinctive or learned	**D**
ORGANISMS AND THEIR ENVIRONMENTS	
4.4.4 Identify ways that an organism's pattern of behavior is related to the nature of the organism's environment (e.g., the availability of food, space, and resources)	**D**
Standard 5: Students understand the basic concepts and principles of earth and space science.	**4th Grade**
WEATHER, SEASONS, AND CLIMATE	
4.5.1 Describe how as water condenses small droplets of water form clouds and fog	**M**
EARTH'S SURFACE	
4.5.2 Identify slow and rapid processes (e.g., wind, water, waves, ice, volcano, earthquake) that are constantly changing Earth's surface	**D**
4.5.3 Use characteristics to classify Earth's materials (i.e. rocks, soil)	**D**
4.5.4 Compare fossil evidence to existing organisms	**D**
SOLAR SYSTEM	
4.5.5 Identify components of our solar system (e.g., planets, moons, Sun)	**M**
THE UNIVERSE	
4.5.6 Identify tools that are used to study the universe (e.g., telescopes, space probes, satellites, space craft)	**M**

Standard 6: Students understand relations between science and technology.	**4th Grade**
TECHNOLOGICAL DESIGN	
4.6.1 Evaluate the effects of technology on people and the environment (e.g., new construction, oil drilling, electric cars)	**D**
4.6.2 Explain how an invention may lead to other inventions	**D**
Standard 7: Students understand relations between science and personal, social, and environmental issues.	**4th Grade**
SCIENCE AND PERSONAL HEALTH	
No benchmark expectations at this level	
SCIENCE AND ENVIRONMENTAL ISSUES	
4.7.1 Identify consequences of natural and human-induced environmental changes (e.g., erosion, tsunami, deforestation)	**D**
SCIENCE AND SOCIAL ISSUES	
4.7.2 Identify ways in which science and technology have greatly improved human lives (e.g., food quality and quantity, transportation, health, sanitation, communication)	**D**
Standard 8: Students understand the history and nature of science.	**4th Grade**
PEOPLE IN SCIENCE	
4.8.1 Identify a variety of careers in the field of science	**D**
SCIENTIFIC KNOWLEDGE	
4.8.2 Identify scientific advances that changed popular beliefs (e.g., Earth was center of universe, world was flat, man was incapable of flight)	**D**

5th Grade Science Curriculum

Standards & Benchmarks

Standard 1: **Students understand the unifying concepts and processes of science.**	**5th Grade**
MODELS	
5.1.1 Use an appropriate model (e.g., drawing, equation, computer program, diagram, or 3-D device) to convey scientific information	**D**
SYSTEMS	
No benchmark expectations at this level	
CONSTANCY AND CHANGE	
5.1.2 Explain how changes alter the balance within a system (e.g., the effects of limited resources on populations, global climate change, flood, drought)	**IDM**
FORM AND FUNCTION	
5.1.3 Identify details of an object's form which determine its function (e.g., webbed feet for use in water, human feet for walking, shovel for scooping dirt, a rake for collecting leaves, tape measure and ruler to measure distance)	**M**
Standard 2: **Students use the process of science inquiry.**	**5th Grade**
ABILITIES NECESSARY TO DO SCIENTIFIC INQUIRY	
5.2.1 Communicate scientific procedures (e.g. visual display, graph, journal, oral presentation) that enable others to repeat the investigation	**D**
5.2.2 Formulate an explanation supported by data	**ID**
Standard 3: Students understand the basic concepts and principles of physical science.	**5th Grade**

PROPERTIES OF MATTER	
5.3.1 Identify physical properties of substances before and after they are combined	**M**
5.3.2 Identify new substances formed in a chemical change (i.e., rusting, burning)	**IDM**
5.3.3 Compare and contrast properties of solids, liquids, and gases	**DM**
FORCE AND MOTION	
5.3.4 Identify the effects force and mass have on the motion of an object	**D**
5.3.5 Explain why gravity is called an attracting force.	**D**
FORMS OF ENERGY	
5.3.6 Demonstrate a simple electrical circuit by completing a continuous loop (i.e., battery, light, wire)	**IDM**
5.3.7 Identify materials that are good conductors of heat	**IDM**
Standard 4: Students understand the basic concepts and principles of life science.	**5th Grade**
STRUCTURE AND FUNCTION	
5.4.1 Identify components of a human organ system (e.g., digestive system, respiratory system, circulatory system, muscular system, skeletal system)	**IDM**
5.4.2 Explain the function of a human organ system (e.g., digestive system, respiratory system, circulatory system, muscular system, skeletal system)	**IDM**
CHARACTERISTICS OF ORGANISMS	
No benchmark expectations at this level	
ORGANISMS AND THEIR ENVIRONMENTS	
5.4.3 Identify the producers, consumers, and decomposers in a food web.	**IDM**
Standard 5: Students understand the basic concepts and principles of earth and space science.	**5th Grade**
WEATHER, SEASONS, AND CLIMATE	
5.5.1 Measure weather conditions (i.e., temperature, wind direction and speed, and precipitation)	**DM**
5.5.2 Identify characteristics of different clouds (i.e., cumulus, stratus, cirrus	**IDM**
EARTH'S SURFACE	
5.5.3 Identify how the components of soil (e.g., plant roots, bacteria, weathered rock) influence the properties of soil (e.g., texture, fertility, capacity to hold water)	**IDM**
THE UNIVERSE	
5.5.4 Identify the characteristics of the Earth (i.e., spherical in shape, orbits the Sun, rotates on tilted axis)	**IDM**
5.5.5 Identify the objects in the sky that have predictable patterns of movement (e.g., sun, planets, moons, stars)	**IDM**

Standard 6: Students understand relations between science and technology.	**5th Grade**
TECHNOLOGICAL DESIGN	
5.6.1 Use technology to design a solution to a problem	**ID**
5.6.2 Evaluate a product or design using established criteria	**ID**
Standard 7: Students understand relations between science and personal, social, and environmental issues.	**5th Grade**
SCIENCE AND PERSONAL HEALTH	
5.7.1 Identify risks or benefits of personal health choices (e.g., tobacco, alcohol, prescription and illegal drugs, fast foods)	**ID**
SCIENCE AND ENVIRONMENTAL ISSUES	
5.7.2 Explain ways humans benefit from Earth's resources (e.g., air, water, soil, food, fuel, building materials)	**D**
SCIENCE AND SOCIAL ISSUES	
No benchmark expectations at this level	
Standard 8: Students understand the history and nature of science.	**5th Grade**
PEOPLE IN SCIENCE	
No benchmark expectations at this level	
SCIENTIFIC KNOWLEDGE	
5.8.1 Explain why results of similar scientific investigations may turn out differently (i.e., inconsistencies in methods, materials, and observations)	**ID**

6th Grade Science Curriculum

Standards & Benchmarks

Standard 1: **Students understand the unifying concepts and processes of science.**	**6th Grade**
MODELS	
6.1.1 Construct a model to represent concepts, features, or phenomena in the real world (e.g., solar system, earth's interior)	**D**
SYSTEMS	
6.1.2 Identify systems that are composed of subsystems (e.g., solar system, cell, ecosystems.)	**D**
CONSTANCY AND CHANGE	
6.1.3 Explain the connection between cause and effect in a system	**D**
FORM AND FUNCTION	
No benchmark expectations at this level	
Standard 2: **Students use the process of science inquiry.**	**6th Grade**
UNDERSTANDINGS ABOUT SCIENTIFIC INQUIRY	
6.2.1 Explain the components of a scientific investigation (e.g., hypothesis, observation, data collection, data interpretation, communication of results, replicable)	**D**
6.2.2 Select alternative methods of scientific investigations (e.g., library, internet, field work) to address different kinds of questions.	**D**
6.2.3 Identify biases that may affect data collection and analysis (e.g., gender, race, religion, economic, generational.)	**I**
ABILITIES NECESSARY TO DO SCIENTIFIC INQUIRY	
6.2.4 Use appropriate tools and techniques to gather and analyze data	**D**
6.2.5 Use data from scientific investigations to determine relationships and patterns	**D**

Standard 3: Students understand the basic concepts and principles of physical science.	**6th Grade**
PROPERTIES OF MATTER	
6.3.1 Organize materials according to similar properties (e.g., physical, chemical)	**D**
FORCE AND MOTION	
6.3.2 Use simple machines to change forces	**D**
FORMS OF ENERGY	
6.3.3 Identify different forms of energy (e.g., chemical, mechanical, heat, sound)	**I**
6.3.4 Identify sources of energy (e.g., sun, wind, moving water, nuclear, fossil fuels, food)	**I**
VIBRATIONS AND WAVES	
6.3.5 Explain how vibrations create wavelike disturbances that spread out from the source	**D**
Standard 4: Students understand the basic concepts and principles of life science.	**6th Grade**
STRUCTURE AND FUNCTION	
6.4.1 Identify single- or multi-celled organisms.	**D**
ORGANISMS AND THEIR ENVIRONMENTS	
No benchmark expectations at this level	
GENETICS AND REPRODUCTION	
6.4.2 Explain why reproduction is necessary for the continuation of the species (e.g., asexual, sexual)	**D**
Standard 5: Students understand the basic concepts and principles of earth and space science.	**6th Grade**
WEATHER, SEASONS, AND CLIMATE	
6.5.1 Identify adverse weather conditions and how humans prepare for them	**D**
CHARACTERISTICS OF THE EARTH	
6.5.2 Explain how rocks are formed (e.g., melting, cooling, metamorphism, combinations of minerals)	**D**
6.5.3 Describe the characteristics of the layers of the Earth (i.e., crust, mantle, core)	**D**
THE SOLAR SYSTEM	
6.5.4 Identify the basic characteristics (e.g., composition, rings) of objects (e.g., planets, sun, small bodies) in the solar system	**D**

Standard 6: Students understand relations between science and technology.	**6th Grade**
TECHNOLOGICAL DESIGN	
6.6.1 Identify examples of how technologies have evolved	**D**
6.6.2 Design a product or solution to a problem given constraints (e.g., limits of time, costs, materials and environmental factors)	**I**
6.6.3 Explain the relationship between science and technology	**D**
Standard 7: Students understand relations between science and personal, social, and environmental issues.	**6th Grade**
SCIENCE AND ENVIRONMENTAL ISSUES	
6.7.1 Explain how natural hazards affect populations, resources, and the environment (e.g., floods, storms, hurricanes, volcanoes, earthquakes)	**D**
6.7.2 Explain how recycling and conservation affect populations, resources, and the environment	**D**
Standard 8: Students understand the history and nature of science.	**6th Grade**
PEOPLE IN SCIENCE	
6.8.1 Identify various settings in which scientists may work alone or in a team (e.g., industries, laboratories, field work)	**D**
SCIENTIFIC KNOWLEDGE	
6.8.2 Identify scientific advances that have resulted in new ideas and further-advance	**D**

7th Grade Science Curriculum

Standards & Benchmarks

Standard 1: **Students understand the unifying concepts and processes of science.**	**7th Grade**
MODELS	
7.1.1 Explain how models can be used to illustrate scientific principles (e.g., osmosis, cell division)	**D**
SYSTEMS	
7.1.2 Identify the components (e.g., tissues, organs, living and nonliving things) within a system (e.g., body systems, ecosystems)	**D**
CONSTANCY AND CHANGE	
7.1.3 Identify examples of feedback mechanisms (e.g., hunger, perspiring)	**I**
FORM AND FUNCTION	
7.1.4 Identify the relationship between form and function (e.g., wings, fins and feet)	**D**
Standard 2: **Students use the process of science inquiry.**	**7th Grade**
UNDERSTANDINGS ABOUT SCIENTIFIC INQUIRY	
No benchmark expectations at this level	
ABILITIES NECESSARY TO DO SCIENTIFIC INQUIRY	
7.2.1 Communicate the results of scientific investigations using an appropriate format (e.g., journals, lab reports, diagrams, presentations, discussions)	**D**
Standard 3: Students understand the basic concepts and principles of physical science.	**7th Grade**

PROPERTIES OF MATTER	
No benchmark expectations at this level	
FORCE AND MOTION	
No benchmark expectations at this level	
FORMS OF ENERGY	
No benchmark expectations at this level	
ENERGY TRANSFER AND TRANSFORMATION	
7.3.1 Explain how forms of energy can be transferred. (e.g., photosynthesis, metabolism, battery)	**D**
VIBRATIONS AND WAVES	
No benchmark expectations at this level	
Standard 4: Students understand the basic concepts and principles of life science.	**7th Grade**
STRUCTURE AND FUNCTION	
7.4.1 Explain the functions of the cell (e.g., growth, metabolism, reproduction, photosynthesis, response)	**D**
7.4.2 Identify levels of organization in living systems (e.g., cells, tissues, organs, organ systems, organisms, ecosystems)	**D**
GENETICS AND REPRODUCTION	
7.4.3 Identify the characteristics of reproduction (e.g., sexual, asexual)	**D**
INTERDEPENDENCE AMONG ORGANISMS	
7.4.4 Identify interactions among organisms and their environment (e.g., competition, mutualism, predator/prey, consumers, producers)	**D**
DIVERSITY AND UNITY AMONG ORGANISMS	
7.4.5 Classify organisms (e.g., taxonomic groups)	**D**
7.4.6 Explain how different adaptations help organisms survive	**D**
Standard 5: Students understand the basic concepts and principles of earth and space science.	**7th Grade**
WEATHER, SEASONS, AND CLIMATE	
7.5.1 Identify the factors (e.g., latitude, altitude, mountains, bodies of water) that affect the Earth's climate	
7.5.2 Explain how seasons affect organisms (e.g., hibernation, photoperiodism, migration)	**D**
CHARACTERISTICS OF THE EARTH	
7.5.3 Identify the Earth's renewable and nonrenewable resources (e.g., solar, wind, fossil fuels, water, soil, metals)	**D**

Standard 6: Students understand relations between science and technology.	**7th Grade**
TECHNOLOGICAL DESIGN	
No benchmark expectations at this level	
7.6.1 Identify ways in which technology has influenced the course of history and improved the quality of life	**D**
7.6.2 Identify technologies (e.g., communication, agriculture, information processing, transportation) that are influenced by societies	**D**
7.6.3 Identify intended benefits and unintended consequences that result from the development and use of technologies	**D**
Standard 7: Students understand relations between science and personal, social, and environmental issues.	**7th Grade**
SCIENCE AND PERSONAL HEALTH	
7.7.1 Explain how science affects personal health (e.g., injury prevention, immunization, organ transplant, medical scanning devices)	**D**
7.7.2 Identify the factors (e.g., pollution, heredity, diet, virus, bacteria, parasite) that may result in disease.	**D**
SCIENCE AND ENVIRONMENTAL ISSUES	
7.7.3 Explain how overpopulation affects organisms, resources, and environments (e.g., depletion of food resources, habitat availability, increased loss due to disease, parasites and predators	**D**
SCIENCE AND SOCIAL ISSUES	
7.7.4 Explain the impact of science on food technology (e.g., preservatives, packaging, genetically modified organisms)	**I**
Standard 8: Students understand the history and nature of science.	**7th Grade**
PEOPLE IN SCIENCE	
7.8.1 Explain how science is influenced by human qualities (e.g., reasoning, insightfulness, creativity, life-long learning)	**D**
SCIENTIFIC KNOWLEDGE	
7.8.2 Explain the importance of keeping clear and accurate records of scientific investigations (e.g., Darwin's research, DaVinci's notebooks, Galileo's notes, Goodall's observations)	**D**

8th Grade Science Curriculum

Standards & Benchmarks

Standard 1: **Students understand the unifying concepts and processes of science.**	**8th Grade**
MODELS	
No benchmark expectations at this level	
SYSTEMS	
8.1.1 Organize changes (e.g., patterns, cycles) that occur sequentially in systems	
CONSTANCY AND CHANGE	
No benchmark expectations at this level	
FORM AND FUNCTION	
No benchmark expectations at this level	
Standard 2: **Students use the process of science inquiry.**	**8th Grade**
UNDERSTANDINGS ABOUT SCIENTIFIC INQUIRY	
8.2.1 Explain how science advances through legitimate skepticism	**I**
ABILITIES NECESSARY TO DO SCIENTIFIC INQUIRY	
8.2.2 Use evidence to generate descriptions, explanations, predictions, and models	**D**
8.2.3 Use basic mathematics and statistics (e.g., operations, mean, median, mode, range, and estimation) to interpret quantitative data	**D**
8.2.4 Design and conduct a scientific investigation (e.g., making systematic observations, making accurate measurements, identifying and controlling variables)	**D**

Standard 3: Students understand the basic concepts and principles of physical science.	**8th Grade**
PROPERTIES OF MATTER	
8.3.1 Identify elements and compounds	**D**
8.3.2 Explain the relationship between phases of matter and temperature	**D**
FORCE AND MOTION	
8.3.3 Interpret the effect of balanced and unbalanced forces on the motion of an object (e.g., convection currents, orbital motion, tides)	**D**
8.3.4 Explain how all objects exert gravitational force and this force is affected by the distance between the masses of the objects	**I**
ENERGY TRANSFER AND TRANSFORMATION	
8.3.5 Identify when heat can be transferred by conduction, convection, or radiation.	**D**
VIBRATIONS AND WAVES	
8.3.6 Explain the characteristic properties (e.g., wavelength, frequency) and behaviors (e.g., reflection, refraction) of waves	**I**
Standard 4: Students understand the basic concepts and principles of life science.	**8th Grade**
STRUCTURE AND FUNCTION	
No benchmark expectations at this level	
GENETICS AND REPRODUCTION	
No benchmark expectations at this level	
INTERDEPENDENCE AMONG ORGANISMS	
No benchmark expectations at this level	
DIVERSITY AND UNITY AMONG ORGANISMS	
No benchmark expectations at this level	
NATURAL SELECTION AND BIOLOGICAL EVOLUTION	
8.4.1 Identify the evidence of biological evolution. (e.g., adaptation, radiation, extinction) as found in the fossil record	**D**
Standard 5: Students understand the basic concepts and principles of earth and space science.	**8th Grade**
WEATHER, SEASONS, AND CLIMATE	

8.5.1 Explain how factors (i.e., fronts, winds, air masses, air pressure, humidity, temperature, location) affect weather	**I**
GEOLOGIC PROCESSES	
8.5.2 Understand the rock cycle	**I**
8.5.3 Explain the water cycle	**D**
8.5.4 Explain how landforms are changed (e.g., crustal deformation, volcanic eruption, deposition, weathering, erosion)	**D**
8.5.5 Identify evidence for plate tectonics theory (e.g., fit of continents, location of earthquakes, volcanoes, mid-ocean ridge, plate boundaries)	**D**
8.5.6 Identify a variety of methods (e.g., rock sequences, fossil correlation, radiometric dating) used to determine geologic time	**I**
8.5.7 Explain the changes Earth has undergone over geologic time (e.g., fossil record, plate tectonics, climate change, glaciation)	**I**
CHARACTERISTICS OF THE EARTH	
8.5.8 Explain how phenomena on Earth (i.e., day, year, seasons, lunar phases, eclipses, tides) are related to the position and motion of the Sun, Moon, and Earth	**I**
THE UNIVERSE	
8.5.9 Identify characteristics of stars (e.g., color, size, temperature, life cycle)	**I**
8.5.10 Identify the composition (e.g., stars, galaxies) and scale of the universe	**I**
Standard 6: Students understand relations between science and technology.	**8th Grade**
TECHNOLOGY AND SOCIETY	
No benchmark expectations at this level	
Standard 7: Students understand relations between science and personal, social, and environmental issues.	**8th Grade**
SCIENCE AND SOCIAL ISSUES	
8.7.1 Explain the interaction of science and technology with social issues (e.g., mining, natural disasters)	**D**
Standard 8: Students understand the history and nature of science.	**8th Grade**
PEOPLE IN SCIENCE	
No benchmark expectations at this level	
SCIENTIFIC KNOWLEDGE	
8.8.1 Explain how many people from various cultures have made important contributions to the advancement of science and technology	**D**

9th – 10th Grade Science Curriculum

Standards & Benchmarks

Standard 1: **Students understand the unifying concepts and processes of science.**	**Ecology**	**Geology**	**Physical Science**	**Honors Physical Science**	**Biology**	**General Science**
MODELS						
9-10.1.1 Explain how models can be used to illustrate scientific principles	D	I	I	I	D	I
SYSTEMS						
9-10.1.2 Describe the interaction of components within a system (e.g., interactions between living and nonliving components of an ecosystem, interaction between organelles of a cell)	M	D	I		D	I
CONSTANCY AND CHANGE				I		
9-10.1.3 Explain how a system can be dynamic yet may remain in equilibrium (e.g., water cycle, rock cycle, population)	M	D	I	I	D	I
FORM AND FUNCTION						
9-10.1.4 Describe the relationship between form and function (e.g., solids, liquids, gases, cell specialization, simple machines, and plate tectonics)		D	DM	D	D	I
9-10.1.5 Explain how classification can be based on the relationship between form and function (e.g., elements and compounds, biological classifications, types of clouds)		D	ID	D	D	I
EVOLUTION AND EQUILIBRIUM						
9-10.1.6 Identify principles governing evolution and equilibrium within systems (e.g., cause and effect, positive and negative feedback)	D	D	I	I	D	I

Standard 2: **Students use the process of science inquiry.**	**Ecology**	**Geology**	**Physical Science**	**Honors Physical Science**	**Biology**	**General Science**
UNDERSTANDINGS ABOUT SCIENTIFIC INQUIRY						
9-10.2.1 Explain how scientific investigations can result in new ideas	D	D	D	D	D	ID
ABILITIES NECESSARY TO DO SCIENTIFIC INQUIRY						
9-10.2.2 Use appropriate safety equipment and precautions during investigations (e.g., goggles, apron, eye wash station)		M	ID	M	M	ID
9-10.2.3 Identify questions and concepts that guide scientific investigations	D	D	ID	D	D	I
9-10.2.4 Formulate a testable hypothesis for a simple investigation	D	D	ID	D	D	I
9-10.2.5 Identify the independent and dependent variables, the control, and the constants when conducting an experiment	D	I	ID	D	D	I
9-10.2.6 Design and conduct a guided investigation	D	D	ID	D	D	I
9-10.2.7 Maintain clear and accurate records of scientific investigations		M	D	D	D	ID
9-10.2.8 Analyze data found in tables, charts, and graphs to formulate conclusions	M	M	ID	D	D	ID
Standard 3: Students understand the basic concepts and principles of physical science.	**Ecology**	**Geology**	**Physical Science**	**Honors Physical Science**	**Biology**	**General Science**
PROPERTIES OF MATTER						
9-10.3.1 Classify elements according to similar properties. (e.g., metal, nonmetal, solids, liquids, gases)		I	D	D		I
9-10.3.2 Classify changes in matter as physical or chemical		I	ID	D		ID
9-10.3.3 Identify the Law of Conservation of Matter in physical and chemical changes			ID	D		I
ATOMS AND MOLECULES						
9-10.3.4 Construct a model of an atom (e.g., protons, neutrons, electrons, nucleus, electron cloud)			D	D		I
CHEMICAL REACTIONS						

9-10.3.5 Identify the reactants and products in a chemical reaction			ID	D		I
9-10.3.6 Distinguish between balanced and unbalanced chemical equations			ID	D		I
FORCE AND MOTION						
9-10.3.7 Use Newton's Laws to describe the motion of an object			ID	D		I
9-10.3.8 Describe the relationships between kinetic and potential energy in basic transformations (e.g., physical and chemical changes)			ID	D		I
VIBRATIONS AND WAVES						
9-10.3.9 Compare and contrast electromagnetic and mechanical waves (i.e. energy, energy transfer, medium)		I	ID	D		
ELECTRICITY AND MAGNETISM						
9-10.3.10 Describe the differences between series and parallel circuits			ID	D		
Standard 4: Students understand the basic concepts and principles of life science.	**Ecology**	**Geology**	**Physical Science**	**Honors Physical Science**	**Biology**	**General Science**
STRUCTURE AND FUNCTION						
9-10.4.1 Relate cell function to cell structure (i.e., cell wall, cell membrane, nucleus, mitochondria, chloroplast)					M	ID
9-10.4.2 Relate the functions of cells in multi-cellular organisms to their cell type (e.g., nerve cells, blood cells, guard cells)					D	I
9-10.4.3 Explain the relationship between protein structure and function					D	I
GENETICS AND REPRODUCTION						
9-10.4.4 Relate DNA, genes, and chromosomes					M	I
9-10.4.5 Explain the relationship between spontaneous changes in DNA and a source of genetic variation					D	I
9-10.4.6 Compare and contrast the results of mitosis and meiosis (i.e., mitosis involves a nuclear division that results in two daughter nuclei that are identical to the parent nucleus; meiosis involves two nuclear divisions that result in gametes cells containing half the number of chromosomes)					M	I
9-10.4.7 Apply the basic concepts of genetics to predict inherited traits (i.e., segregation, independent assortment, dominant and recessive traits)					D	ID
NATURAL SELECTION AND BIOLOGICAL EVOLUTION						
9-10.4.8 Relate the concept of natural selection to its evolutionary consequences	M	I			D	I
9-10.4.9 Identify evidence for evolution (e.g., fossil records, vestigial structures, similarities between organisms, and DNA)	D	D			I	I
INTERDEPENDENCE AMONG ORGANISMS						
9-10.4.10 Explain the energy and organization related to trophic pyramids	M				D	I

MATTER AND ENERGY IN LIVING SYSTEMS						
9-10.4.11 Explain how matter and energy flow through living and nonliving components in an ecosystem (e.g., carbon cycle, water cycle, nitrogen cycle)	M	D			D	I
9-10.4.12 Compare and contrast photosynthesis and cellular respiration					M	I
Standard 5: Students understand the basic concepts and principles of earth and space science.	**Ecology**	**Geology**	**Physical Science**	**Honors Physical Science**	**Biology**	**General Science**
THE UNIVERSE						
9-10.5.1 Explain the relationship between the Big Bang Theory and the origin and evolution of the universe						
EARTH'S SURFACE						
9-10.5.2 Relate the changes in the Earth's atmosphere to the evolution of photosynthetic life forms						
ENERGY IN THE EARTH SYSTEM						
9-10.5.3 Explain how energy in the Earth system is governed by convection, conduction, and radiation (e.g., heat moves in the Earth's mantle by convection, conduction occurs along the mid-oceanic ridges, energy from the Sun reaches the Earth through radiation)		M	I			I
GEOLOGIC PROCESSES, HUMAN ACTIVITIES, AND THE ENVIRONMENT						
9-10.5.4 Identify the short-term and long-term effects of physical processes (e.g., plate tectonics, extreme weather phenomenon) on the environment and society		D				
9-10.5.5 Analyze how evidence of past natural hazards and geologic events has predicted subsequent hazards and events (e.g. Gap time method to predict earthquakes and tsunamis)		D				
9-10.5.6 Explain the effects of human activities (e.g., dams, levees, farming practices, deforestation, land-use practices, land-management strategies) on the environment	D	D				
Standard 6: Students understand relations between science and technology.	**Ecology**	**Geology**	**Physical Science**	**Honors Physical Science**	**Biology**	**General Science**

TECHNOLOGICAL DESIGN						
9-10.6.1 Use appropriate technologies and techniques to solve a problem (e.g., computer-assisted tools, Internet, research skills)		D	ID	I	D	I
9-10.6.2 Explain how scientific principles have been used to create common technologies (e.g., household appliances, automotive parts, agricultural equipment, textiles, fabrics, computers, Internet resources, CD-ROMs)			ID	D		
TECHNOLOGY AND SOCIETY						
9-10.6.3 Explain how emerging technologies (e.g., genetic manipulation, biofuels, and hydrogen fuels) may impact society and the environment	D	D	ID	I	I	I
Standard 7: Students understand relations between science and personal, social, and environmental issues.	**Ecology**	**Geology**	**Physical Science**	**Honors Physical Science**	**Biology**	**General Science**
SCIENCE AND PERSONAL HEALTH						
9-10.7.1 Explain how personal health is related to fitness, substance abuse, sexual activity, and nutrition				I	I	
SCIENCE AND ENVIRONMENTAL ISSUES						
9-10.7.2 Identify factors that affect populations (e.g., food webs, carrying capacity, overpopulation, disease, food supply, algal blooms, resources, conservation practices)	M	I			M	
SCIENCE AND SOCIAL ISSUES						
No benchmark expectations at this level						
Standard 8: Students understand the history and nature of science.	**Ecology**	**Geology**	**Physical Science**	**Honors Physical Science**	**Biology**	**General Science**
PEOPLE IN SCIENCE						
9-10.8.1 Identify the role of scientists in theoretical and applied science (e.g., careers, employment possibilities)	I	I	ID	D	D	
9-10.8.2 Identify the human characteristics that influence scientific advancement (e.g.,		D	ID	I	I	

intellectual honesty, openness, objectivity, curiosity, skepticism, ethical conduct, cooperation)						
9-10.8.3 Explain how individuals and groups, from different disciplines in and outside of science, contribute to science at different levels of complexity	D	I	I	I	I	
SCIENTIFIC KNOWLEDGE						
9-10.8.4 Identify theories that have changed over time (e.g., alchemy, atomic structure, model of the solar system)		D	ID	D	D	
SCIENCE AND SOCIETY						
9-10.8.5 Explain how views and attitudes have influenced the development of science (e.g., religion, previous knowledge, cultural tradition, superstition, folklore, legends)		I	I	D	D	

11th – 12th Grade Science Curriculum

Standards & Benchmarks

Standard 1: **Students understand the unifying concepts and processes of science.**	**Ecology**	**Geology**	**Chemistry**	**Honors Chemistry**	**Advanced Chemistry**	**Physics**	**Honors Physics**	**Human A & P**
MODELS								
11-12.1.1 Explain how scientists create and use models to address scientific knowledge	D	D	D	D	D	M	M	D
SYSTEMS								
11-12.1.2 Identify the structure, organization, and dynamics of components within a system (e.g., cells, tissues, organs, organ systems, reactants and products in chemical equilibrium)		D	D	D	D M			D
CONSTANCY AND CHANGE								
11-12.1.3 Explain how a system can be dynamic yet may remain in equilibrium (e.g., balance of forces, Le Chatelier's Principle, acid base systems)		D	D	D M	D M	D	D	D
FORM AND FUNCTION								
11-12.1.4 Explain the relationship between form and function (e.g., atoms and ions, enzymes, aerodynamics)		D	D	D	M	D	D	D
11-12.1.5 Explain how classification can be based on the relationship between form and function (e.g., polar vs. nonpolar molecules, structure of periodic table , DNA vs. RNA)		D	D	D M	M			D
EVOLUTION AND EQUILIBRIUM								
No benchmark expectations at this level								

Standard 2: **Students use the process of science inquiry.**	**Ecology**	**Geology**	**Chemistry**	**Honors Chemistry**	**Advanced Chemistry**	**Physics**	**Honors Physics**	**Human A & P**
UNDERSTANDINGS ABOUT SCIENTIFIC INQUIRY								
11-12.2.1 Explain how new knowledge and methods emerge from different types of investigations and public communication among scientists	D	D	D	D	D	D	D	D
ABILITIES NECESSARY TO DO SCIENTIFIC INQUIRY								
11-12.2.2 Select and use appropriate instruments, measuring tools, and units of measure to improve scientific investigations	D	D	M	M	M	M	M	D
11-12.2.3 Use data from scientific investigations to accept or reject a hypothesis	D	I	D	M	M	M	M	M
11-12.2.4 Formulate and revise explanations based upon scientific knowledge and experimental data	D	I	D	M	M	D	M	D
11-12.2.5 Use technology and mathematics to improve investigations and communications	D	D	D	D M	M	D	M	D
11-12.2.6 Analyze data using appropriate strategies (e.g., interpolation, and extrapolation of data, significant figures, dimensional analysis)	D	M	D	D M	M	M	M	D
11-12.2.7 Design and conduct an independent investigation		D	D	D M	M	D	D	D
11-12.2.8 Communicate and defend a scientific argument	D	D	D	D M	M	D	D	D

Standard 3: Students understand the basic concepts and principles of physical science.	**Ecology**	**Geology**	**Chemistry**	**Honors Chemistry**	**Advanced Chemistry**	**Physics**	**Honors Physics**	**Human A & P**
PROPERTIES OF MATTER								
No benchmark expectations at this level								
ATOMIC STRUCTURE AND PROPERTIES								
11-12.3.1 Explain how the structure of an atom, isotope, or ion relates to its properties			D	M	M			D
11-12.3.2 Identify the basic organization of the periodic table (e.g., elements are listed according to the number of protons [atomic number]; repeating patterns of physical and chemical properties			D	D M	M			D
ATOMS AND MOLECULES								
11-12.3.3 Compare and contrast the role of electrons in ionic and covalent bonding			D	D M	M			D
11-12.3.4 Identify the basic bonding characteristics of carbon which lead to a large variety of structures			D	D	M			D
11-12.3.5 Identify the effect of concentration, temperature, surface area, pressure, and catalysts on reaction rates as it relates to the Kinetic Theory.			D	D	D			D
11-12.3.6 Write the chemical formula and name for compounds using a table of element names, symbols, and oxidation numbers			D	M	M			
11-12.3.7 Balance chemical equations			D	M	M			
FORCE AND MOTION								
11.12.3.8 Identify the principles and relationships influencing forces and motion (e.g., gravitational force, vectors, velocity, friction)			I	D	D	M	M	
FORMS OF ENERGY								
11-12.3.9 Explain the relationship among thermal energy, temperature, and the motion of particles			D	D M	D M	D	D	
ENERGY TRANSFER AND TRANSFORMATION								
11-12.3.10 Apply the law of conservation of energy to a variety of situations			D	M	M	M	M	
11-12.3.11 Explain how energy is related to physical changes of matter (e.g., phase changes, temperature changes)			D M	M	M	D	M	
VIBRATIONS AND WAVES								
11-12.3.12 Relate wave energy to wavelength and frequency		D	I	D		M	M	
ELECTRICITY AND MAGNETISM								
11-12.3.13 Explain how magnetic forces relate to electric forces						D	M	

Standard 4: Students understand the basic concepts and principles of life science.	**Ecology**	**Geology**	**Chemistry**	**Honors Chemistry**	**Advanced Chemistry**	**Physics**	**Honors Physics**	**Human A & P**
STRUCTURE AND FUNCTION								
11-12.4.1 Explain the importance of cell differentiation in the development of tissues, organs, organ systems, and multi-cellular organisms.								M
GENETICS AND REPRODUCTION								
11-12.4.2 Explain how types of DNA technology (e.g., genetic engineering, forensic science, cloning) may impact society now and in the future.								D
NATURAL SELECTION AND BIOLOGICAL EVOLUTION								
11-12.4.3 Explain how change through time has ensured adaptation to changing environments	D	D						M
INTERDEPENDENCE AMONG ORGANISMS								
No benchmark expectations at this level								
MATTER AND ENERGY IN LIVING SYSTEMS								
No benchmark expectations at this level								
Standard 5: Students understand the basic concepts and principles of earth and space science.	**Ecology**	**Geology**	**Chemistry**	**Honors Chemistry**	**Advanced Chemistry**	**Physics**	**Honors Physics**	**Human A & P**
THE UNIVERSE								
11-12.5.1 Explain how the Sun and other stars are powered by nuclear reactions (e.g., the fusion of hydrogen to form helium, formation of elements)			I	I	D			
EARTH'S HISTORY								
No benchmark expectations at this level								
ENERGY IN THE EARTH SYSTEM								
11-12.5.2 Explain how Earth systems are in dynamic equilibrium (e.g., cycling of energy and matter through the atmosphere, hydrosphere, and lithosphere)	M	D						
CYCLES IN THE EARTH SYSTEM								
No benchmark expectations at this level								

GEOLOGIC PROCESSES, HUMAN ACTIVITIES, AND THE ENVIRONMENT								
11-12.5.3 Explain the short-term and long-term effects of chemical processes (e.g., acid rain, CO2 emissions, ozone depletion, run-off) on the environment and society	M	D	I	D	D			
Standard 6: Students understand relations between science and technology.	**Ecology**	**Geology**	**Chemistry**	**Honors Chemistry**	**Advanced Chemistry**	**Physics**	**Honors Physics**	**Human A & P**
TECHNOLOGICAL DESIGN								
11-12.6.1 Select and use appropriate technologies, tools, and techniques to solve a problem (e.g., computer-assisted tools, Internet, research skills, CBL, graphing calculators)	D	D	D M	M	M	D	M	D
11-12.6.2 Identify examples of how new technologies advance science –	I	M	I	D	D	D	D	D
TECHNOLOGY AND SOCIETY								
11-12.6.3 Explain how designing and implementing technology requires weighing trade-offs between positive and negative impacts on humans and the environment	D	D				D	D	D
Standard 7: Students understand relations between science and personal, social, and environmental issues.	**Ecology**	**Geology**	**Chemistry**	**Honors Chemistry**	**Advanced Chemistry**	**Physics**	**Honors Physics**	**Human A & P**
SCIENCE AND PERSONAL HEALTH								
No benchmark expectations at this level								
SCIENCE AND ENVIRONMENTAL ISSUES								
11-12.7.1 Explain the impact of environmental laws and policies on the environment and society (e.g., waste/pollutants from industry, carbon dioxide emissions, location and number of animals in a feedlot versus water supply)	D	I						
11-12.7.2 Explain ways renewable and nonrenewable resources are managed (e.g., land reclamation, forest management, CRP, hunting licenses, energy –conserving technologies)	D	D						
11-12.7.3 Explain the economic and social impact of using alternative energy resources	D	D				D	D	
SCIENCE AND SOCIAL ISSUES								
11-12.7.4 Explain how science and technology can influence personal, industrial, and cultural decision-making (e.g., organ transplants, cloning, stem cell research, genetic manipulation, use of genetic profile, archeological discoveries, land management, resource management)	D	I	I	I	I		D	D

Standard 8: Students understand the history and nature of science.	**Ecology**	**Geology**	**Chemistry**	**Honors Chemistry**	**Advanced Chemistry**	**Physics**	**Honors Physics**	**Human A & P**
PEOPLE IN SCIENCE								
No benchmark expectations at this level								
SCIENTIFIC KNOWLEDGE								
11-12.8.1 Identify the criteria that scientific explanations must meet to be considered valid (e.g., must be based on consistent and repeatable data, be consistent with experimental and observational evidence about nature, make accurate predictions about systems being studied, be logical, report methods and results, be open to question and reexamination, respect rules of evidence)	D	D	D	D	D	D	D	D
SCIENCE AND SOCIETY								
No benchmark expectations at this level								

Course Descriptions and Course Outlines

Life Science – Grade 6

Course Description

Sixth grade Science covers a briefing sampling of Life Science, Earth Science, and Physical Science. This sampling is to give students a preview of what Science areas they will be covering as they advance through their academic careers.

Course Outline

I. LIFE SCIENCE:
- KINGDOMS
  - Classification of living organisms
  - Plant Kingdom
  - Animal Kingdom
  - Invertebrates
  - Vertebrates
- ECOSYSTEMS
  - Biomes

II. PHYSICAL SCIENCE:
- MATTER
  - Properties
  - Atoms and Elements
  - Chemical changes
- HEAT ENERGY
  - Temperature and Heat
  - Heats affect on matter
  - Sources of energy
- ELECTRICITY/MAGNETISM
  - Static electricity
  - Circuits
  - Electromagnets
  - Using electricity
- MOTION
  - Speed and distance
  - Forces and motion
  - Acceleration and momentum
- WORK AND MACHINES
  - Energy and work
  - Levers
  - Inclined planes

III. EARTH SCIENCE
- EARTH AND MOON
  - Astronomy
  - Earth and sun
  - Moon in motion
- SOLAR SYSTEM
  - Inner solar system
  - Outer solar system
  - Stars
  - Galaxies
- EARTH'S CRUST
  - Plates
  - Earthquakes
  - Volcanoes
- EARTH'S CHANGES
  - Mountain formation
  - Erosion and deposition
  - Rock cycle
  - Geologic time

Life Science – Grade 7

Course Description

Life Science – 7th grade science class - The purpose of Life Science is for students to reinforce and build upon their understanding of the living world around them. Students begin the year by learning about the basic components of life and the characteristics that all living things share. As the year progresses, students learn about genetics, body systems, human health, animals, plants, fungi, and the classification of living things. By the end of the year when the focus shifts to ecology, students pull previous concepts together to learn about the interrelationships of all things in nature and the impact of our decisions/actions. Along with global concepts of life science, students also learn about the richness and diversity of nature in North Dakota as we explore the various habitats of ND and the future of our state.

Science is an active, adapting academic field of study. Our goal is to help students construct a deeper understanding of Life Science concepts throughout the entire year. To meet this goal students will be engaged in/with lab experiments, demonstrations, guest presenters, discussions, small group activities, inquiry based learning, dissections, etc.

Course Outline

I. Exploring Life
   a. Scientific Method
   b. Measurement – Metric System
   c. Observations
   d. Graphing and Data Analysis
   e. Classification
   f. Inquiry
   g. Characteristics of Living Things

II. Cells
   a. Organelles
   b. Animal vs. Plant Cells
   c. Cellular Organization
   d. Microbes
   e. Eukaryotic vs. Prokaryotic
   f. Mitosis
   g. Cellular Energy
      i. Photosynthesis
      ii. Cellular Respiration
      iii. Fermentation
   h. Human Health
      i. Viruses and Disease
      ii. Cancer
   i. Cellular Transport
      i. Active Transport (endocytosis, exocytosis, etc.)
      ii. Passive Transport (diffusion, osmosis, etc.)

III. Genetics

- a. DNA
- b. Reproduction
    - i. Sexual vs. Asexual
- c. Heredity
    - i. Gregor Mendel
    - ii. Probability
- d. Genes and Alleles
    - i. Punnett Squares
    - ii. Heterozygous vs. Homozygous
    - iii. Dominant alleles and Recessive alleles
    - iv. Incomplete Dominance
- e. Meiosis
- f. Genetic Disorders
- g. Mutations
- h. Current Issues

IV. Anatomy/Body Systems
- a. Body Systems (Digestive, Respiratory, Muscular, Skeletal, etc.)
- b. Interrelationships
- c. Dissections
- d. Closed vs. Open Circulatory Systems
- e. Human Health

V. Animals and Survival
- a. Classification
- b. Invertebrate vs. Vertebrate characteristics
- c. Mutations
- d. Adaptations
- e. Natural Selection
- f. Innate vs. Learned Behaviors
    - i. Seasonal Behaviors
    - ii. Survival Behaviors
- g. Symbiosis

VI. Ecology, Plants, Fungi
- a. Plant Anatomy
    - i. Adaptations
    - ii. Tropisms
- b. Plant Classification
    - i. Herbaceous vs. Woody
    - ii. Angiosperms vs. Gymnosperms
- c. Life Cycles
- d. Fungi (General Characteristics)
- e. Interrelationships
    - i. Predator/Prey
    - ii. Mutualism
    - iii. Commensalism
    - iv. Parasitism
    - v. Competition

f. Abiotic vs. Biotic
g. Classification
h. Food Energy Transfer
    i. Food webs
    ii. Trophic Pyramids
    iii. Food Chains
i. Biomes
j. ND Habitats
    i. Prairies
    ii. Wetlands
    iii. Woodlands
    iv. Riparian
    v. Badlands
k. Renewable and Non-renewable Energy
    i. Fossil Fuels
    ii. Solar
    iii. Wind
    iv. Hydro
    v. Bio
l. Conservation
m. Current Issues

VII. Final Review and Test
a. Cumulative

Earth Science – Grade 8

Course Description

Earth Science – 8th grade science class - The main objective of this course is to give the student a basic understanding of science in general and the earth sciences in particular. The course will focus upon the fundamental concepts of terrestrial systems and then look more specifically at geology, meteorology, oceanography, and astronomy. Together, these branches will help students understand our physical home within the universe. Such understanding will help us make wise decisions, both now and in the future.

Course Outline

I. GEOLOGY
- A. What is Earth Science
  1. Branches of Earth Science
  2. Scientific method
  3. Measurement
  4. Theory and Law
- B. Earth chemistry
  1. Atoms and elements
  2. How atoms combine
  3. Properties of matter
- C. Minerals
  1. Characteristics of minerals
  2. Mineral identification by physical properties
  3. Uses of minerals
  4. Mineral resources
- D. Rocks
  1. The rock cycle
  2. Igneous rock origin
  3. Igneous rock classification
  4. Sedimentary rock formation
  5. Types of sedimentary rock
  6. Metamorphic rock origin
  7. Metamorphic rock classification
  8. Uses of rocks
- E. Earth Views
  1. Landforms; plains, plateaus, mountains
  2. Latitude and longitude
  3. Types of maps
  4. Time zones
- F. Weathering and Soil
  1. Types of weathering
  2. Formation of soil
  3. Soil erosion

4. Land use and soil loss

G. Erosion Forces
   1. Mass movements by gravity
   2. Wind
   3. Glaciers

H. Running Water
   1. Surface water movement and deposition
   2. Stream development
   3. Ground water movement
   4. Ground water erosion and deposition
   5. Ocean shoreline

I. Earthquakes
   1. Forces inside earth
   2. Seismic Waves and earth's interior
   3. Measuring and locating earth quakes
   4. People and earth quakes

J. Volcanoes
   1. Volcanoes and plate movement
   2. Types of volcanoes
   3. Igneous rock features

K. Plate Tectonics
   1. Continental drift
   2. Sea floor spreading
   3. Theory of plate tectonics
   4. Cause of plate motion

L. Earth's Past
   1. Fossil formation
   2. Index fossils
   3. Relative – age dating of rocks
   4. Absolute – age dating of rocks

M. Geologic Time
   1. Geologic time scale
   2. Early earth history
   3. Middle and recent earth history

N. Energy Resources
   1. Natural resources
   2. Nonrenewable resources
   3. Renewable resources
   4. Alternative energy resources
   5. Conserving resources

O. Human impact on Earth resources
   1. Population impact on the environment
   2. Human impact on land resources
   3. Human impact on water resources
   4. Human impact on air resources

II. METEOROLOGY

A. Atmosphere
   1. Earth's atmosphere
   2. Air pressure
   3. Energy transfer in the atmosphere
   4. Air movement
B. Weather
   1. Causes of weather
   2. Cloud formation and classification
   3. Pressure systems
   4. Weather patterns
   5. Weather forecasts
C. Climate
   1. What is Climate
   2. Climate classification
   3. Climatic changes
   4. Human factors

III. OCEANOGRAPHY
A. Waves, Tides, and Currents
   1. Ocean water
   2. Ocean currents
   3. Ocean waves and tides
B. Seafloor and Life in the Ocean
   1. The seafloor
   2. Life in the ocean
   3. Ocean pollution

IV. ASTRONOMY
A. Space Exploration
   1. Radiation from space
   2. Tools from astronomy
   3. Early space missions
   4. Current and future space missions
B. Sun, Moon, Earth Systems
   1. Earth facts, data, and characteristics
   2. The moon- formation, phases, and features
   3. Motions and eclipses
C. Solar System
   1. Overview of our solar system
   2. The inner planets
   3. The outer planets
   4. Other objects in the Solar System
D. Stars, Galaxies, and Universe
   1. The Sun
   2. Stars
   3. Evolution of stars
   4. The Milky Way Galaxy
   5. Other galaxies and the universe

Physical Science

Course Description

Physical Science – Required: Grades 9-10 – 1 Unit of credit -- 2 semester course. This course introduces the student to basic topics in physics and chemistry, and includes: laboratory equipment and procedures, measurement, kinetic theory, chemistry, forces, machines and power, sound, light, electricity, and magnetism.

Course Outline

I. Semester One: Chemistry
- A. Introduction- The of Science
  - i. The Scientific Method
  - ii. Metric Measurement
  - iii. Graphing Basics
- B. Classification of Matter
  - i. Physical and Chemical Properties
  - ii. Physical and Chemical Changes
  - iii. Elements, Compounds, and Mixtures
- C. Solids, Liquids, and Gases
  - i. Phases of Matter
  - ii. Phase Changes
  - iii. Fluid Principles
  - iv. Gas Laws
- D. Elements and the Periodic Table
  - i. Make-up of atoms
  - ii. Metals, Nonmetals, & Noble Gases
  - iii. Bonding Basics
- E. Chemical Reactions
- F. Acids and Bases

II. Semester Two: Physics
- A. Motion
  - i.
- B. Forces
- C. Work and Machines
- D. Energy
- E. Electricity
- F. Waves

Honors Physical Science

Course Description

Honors Physical Science – Elective: Grades 9-10 – 1 Unit of credit -- 2 semester course. Students should be excellent in the fields of math and science in previous years. The class covers what regular physical science covers but with more emphasis on inquiry and problem based learning. Students will explore the nature of matter and energy. The course will cover basic topics of chemistry including the use of laboratory equipment, measuring, safety, the naming of compounds, balancing of reactions, and study of the atom. Also included will be a broad overview of physics including fluid and gas laws, motion, forces, machines, electrical energy, magnetism, waves, optics, and light. Honors Science will provide for open ended learning while still covering essential skills required for future science classes. Students may take honors physical science in lieu of physical science and meet the physical science requirement. Students may not take both physical science and honors physical science.

Course Outline

I. Semester One: Chemistry
- G. Introduction- The Nature of Science
  - i. The Scientific Method
  - ii. Metric Measurement
  - iii. Graphing Basics
  - iv. Conversion of Metric and English units
- H. Classification of Matter
  - i. Physical and Chemical Properties
  - ii. Physical and Chemical Changes
  - iii. Elements, Compounds, and Mixtures
- I. Solids, Liquids, and Gases
  - i. Phases of Matter
  - ii. Phase Changes
  - iii. Fluid Principles
  - iv. Gas Laws
- J. Elements and the Periodic Table
  - i. Make-up of atoms
  - ii. Metals, Nonmetals, & Noble Gases
  - iii. Evolution of atomic theory
  - iv. Bonding Basics
  - v. Naming ionic and covalent compounds
  - vi. Organic compounds
  - vii. Molar mass

K. Chemical Reactions
   i. Types of chemical reactions
   ii. Balancing equations
   iii. Identifying products and reactants

L. Acids and Bases
   i. pH
   ii. Common uses and products
   iii. Molarity

II. Semester Two: Physics

G. Motion
   i. Speed
   ii. Velocity
   iii. Acceleration
   iv. Momentum

H. Forces
   i. Inertia
   ii. Centripetal acceleration
   iii. Friction
   iv. Gravitation

I. Work and Machines
   i. Forces applied to machines
   ii. Efficiency of machines
   iii. Inclined planes
   iv. Pulleys

J. Energy
   i. Thermal energy and its sources
   ii. Conduction, Convection, Radiation
   iii. Alternative energy sources and "Green energy"
   iv. Internal combustion engine
   v. Steam engine
   vi. Specific heat

K. Electrical energy and Magnetism
   i. Conductors vs. Insulators
   ii. Relationship between Magnetism and Electrical fields
   iii. Generation of Electrical energy
   iv. Building of Circuits

L. Waves
    i. Compression waves
    ii. Transverse waves
    iii. Doppler effect
    iv. Parts of a wave (period, frequency, wavelength, amplitude)
M. Optics
    i. Convex and concave lenses
    ii. Convex and Concave mirrors
N. Light
    i. Wavelength and Frequency
    ii. Color
    iii. EM spectrum

Biology

Course Description

Biology – Required: Grade 10 – 1 Unit of credit -- 2 semester course. This course is essentially the study of living things, from simple single-celled organisms to complex multicellular plants and animals. Emphasis is also placed on learning principles of genetics, ecology, and cellular processes. Insect and leaf collections are requirements of this course. Additional projects will be assigned to provide students an opportunity to gain a deeper understanding of biological concepts and develop a greater appreciation for the nature of science.

Course Outline

1st Quarter

Unit 1- Introducing Biology

Biology in the 21st Century
Classification of Organisms

Unit 2 – Cells

Cell structure and cellular transport
Cells and Energy-Photosynthesis and Cellular Respiration
Cell Growth and Division (Mitosis)

2nd Quarter

Unit 3-Genetics

Meiosis and Sexual Reproduction
Extending Mendelian Genetics
From DNA to Proteins
Frontiers of Biotechnology

3rd Quarter

Unit 4-Classification and Diversity

Viruses and Prokaryotes
Protists & Fungi

Unit 5 Plants

Plant Diversity
Plant Structure and Function
Plant Growth Reproduction and Response

4th Quarter

Unit 6- Animals

Arthropods
Vertebrate Diversity
Animal Behavior

Unit 7 - Ecology

Principles of Ecology
Interactions of Ecosystem

ECOLOGY

Course Description

Ecology – Elective: grades 11-12 – 1 unit of credit – 2 semester course. Prerequisites: Physical Science and Biology. Throughout the year, we will explore the interactions of living organisms with one another and with their environment. Environmental issues and conservation of our natural resources will also be important topics for discussion. Several activities from Project WET (Water Education for Teachers), Project WILD, the North Dakota Game & Fish Dept., along with the U.S. Fish & Wildlife Service will be incorporated into this course. A major group project will be required during each quarter such as a Powerpoint presentation, model, poster, research paper, or science experiment.

Course Outline

I. Introduction – The Nature of Ecology
II. The Physical Environment
    a. Climate
    b. The aquatic environment
    c. The terrestrial environment
III. Organisms
    a. Ecological genetics: adaptation and natural selection
    b. Plant and animal adaptations to the environment
IV. Populations
    a. Properties of populations
    b. Population growth
    c. Metapopulations
V. Species Interactions
    a. Competition
    b. Dynamics of consumer – resource interactions
    c. Evolution of species interactions
VI. Communities
    a. Community structure
    b. Ecological succession and community development
    c. Biodiversity
VII. Ecosystems
    a. Energy in the ecosystem
    b. Nutrient and biogeochemical cycles
VIII. Ecological Applications
    a. Biodiversity, extinction, and conservation
    b. Economic development and global ecology

GEOLOGY

Course Description

Geology – Elective: Grades 10-12 – 1 Unit of credit — 2 semester course. The purpose of this course is to offer an opportunity for students to explore aspects of geology as it relates to the real world. Students will be exposed to activities related to mineral/rock identification, plate tectonics, oil/coal exploration, ground water quality, geologic history and mapping techniques. Several projects will be assigned as requirements for this course, some examples are: completion of a microfossil collection, maintenance of a geologic field book, analysis of an exposed stratigraphic section and mapping the school grounds to scale with proper orientation on a mapped surface. Several lengthy field trips are required for data collection and project completion.

Course Outline

I. Semester one Summer Geology-3 weeks
   A. Lab (chapter) one- Observing and Measuring Earth Materials and Processes.
      i. Field Book project. Required project of curriculum.
      ii. Understanding processes of change through time.
      iii. Understanding scale-spatial scale and geologic time scale.
      iv. Understanding how geology in the field is different and/or related to geology in the lab.
      v. Technological advances as used in geology today.
      vi. Basic use of the metric system within the lab.
      vii. Exploration of global isostacy.
   B. Lab (chapter) two- Plate Tectonics and the Origin of Magma.
      i. Continental Drift Hypothesis VS. current day Plate Tectonics Hypothesis.
      ii. Understanding types of Plate Boundaries.
      iii. Understanding stress and resulting types of faults.
      iv. Understanding the driving mechanism of plate tectonics.
      v. Lab application of measuring and understanding plate tectonics.
   C. Lab (chapter) three- Mineral Properties, Uses, and Identification.
      i. Understanding mineral concepts.
      ii. Understanding the physical properties of minerals.
      iii. Mineral identification lab project. Required project of curriculum.
   D. Lab (chapter) four- Rock-Forming Processes and the Rock Cycle.
      i. Understanding the three main groups of rocks and their subgroups.
      ii. Understanding the rock cycle.
      iii. Rock identification lab project.
   E. Lab (chapter) six- Sedimentary Rocks, Processes, and Environments.
      i. Understanding types of weathering.

ii. Understanding textural features and compositional classification of sedimentary rocks.
iii. Understanding the formation of sedimentary rocks.
iv. Grain analysis of exposed stratigraphic section in the North Dakota badlands. Required field project of curriculum.
v. Understanding of sedimentary environments and structures.

F. Lab (chapter) eight- Dating of Rocks, Fossils, and Geologic Events.
i. Relative dating VS. absolute dating.
ii. Understanding relative ages of rocks based on their physical relationships.
iii. Understanding the different types of unconformities and how they apply to the geologic record.
iv. Determine geologic history based on block diagrams- lab project.
v. Use of fossils and radiometric dating to determine age relationships.
vi. Use of well logs to analyze subsurface features.
vii. Microfossil mounting techniques. Required lab project for curriculum. (Grade applied to second semester.)

II. **Semester two Summer Geology- 3 weeks**.

A. Lab (chapter) nine- Topographic Maps, Aerial Photographs, and Satellite Images.
i. Field Book project. Required project of curriculum.
ii. Introduction to topographic maps.
iii. Understanding relief and gradient.
iv. Understanding map scales.
v. Understanding Public Land Survey System.
vi. Understanding compass bearings.
vii. School to scale. Required field project for curriculum.
viii. Use of interpolation and extrapolation to construct topographic maps.
ix. Understanding topographic profiles and vertical exaggeration.

B. Lab (chapter) ten- Geologic Structures, Maps and Block Diagrams.
i. Introduction to structural geology.
ii. Understanding geologic map symbols
iii. Making block diagrams to understand subsurface features.
iv. Production of geologic cross section. Required lab project for curriculum.

C. Lab (chapter) eleven- Stream processes, Landscapes, Mass Wastage, and Flood Hazards.
i. Understanding stream patterns, characteristics and processes.
ii. Interpreting stream behaviors from topographic maps.
iii. Understanding flood hazards and risk assessments.

D. Lab (chapter) twelve- Groundwater processes, Resources, and Risks.
i. Understanding ground water movement.
ii. Understanding land subsidence hazards and risk assessments.

iii. Understanding water quality as it relates to human and livestock needs.
iv. Understanding overpopulation and its effects on water quality and availability.

E. Lab (chapter) thirteen (optional) - Glacial Processes, Landforms, and Indicators of Climate Change.
   i. Understanding glacial processes and landforms.
   ii. Understanding of mountain glaciation and continental glaciation.
   iii. Identification of glacial features on topographic maps.
   iv. Analysis of climate change and its affects on mountain glaciers in the Cascade mountain range.

F. Lab (chapter) fourteen (optional) - Dryland Landforms, Hazards, and Risks.
   i. Understanding eolian processes and landforms.
   ii. Exploring hazards of desertification and other dryland hazards.

G. Lab (chapter) sixteen (optional) - Earthquake Hazards and Human Risks.
   i. Simulating earthquakes and estimating risks lab.
   ii. Understanding types of earthquake waves.
   iii. Using aerial photos to analyze active faults.
   iv. Tracking earthquake hazards in real time and assessing their impact.

Breakdown of projects per semester

Semester One-

**Mineral Identification lab project
**Analysis of exposed stratigraphic section field project
**Field book (containing lab and field data)

Semester Two-

**Microfossil mounting lab project
**School to scale field project
**Field book (containing lab and field data)

General Science

Course Description

General Science (Applied Biology and Chemistry) - Elective: Grade 9-10 – 1 Unit of credit -- 2 semester course. This course will introduce students to the basic units of study in biology and physical science. Topics to be covered but not limited to are: History & Nature of Science, Properties of matter and energy transfer, Characteristics of various biological kingdoms, Ecological succession, Uses of technology in science. This course is designed for students that have had difficulty in the Junior High Sciences. This course will help prepare students to take physical science or biology after successful completion. This course is not designed to prepare students for advanced/upper level high school science courses. Students that have successfully completed physical science and/or biology may not take this course. A major report/project is required each semester.

Course Outline

General Science is designed to help students with the transition into high school Physical Science and Biology. It is designed for students who are in need of building the basic knowledge of the areas to allow for success in the Physical Science and Biology classroom.

Semester One: Physical Introduction

- Metric System
- Introduction to Lab Equipment and Measurements
- Introduction to Matter
- Introduction to Characteristics of Solids, Liquids and Gases
- Introduction to the Periodic Table
- Introduction to the Characteristics of the different Families
- Introduction to Atomic Structure
- Introduction to Naming Binary Compounds
- Introduction to Counting Atoms
- Introduction to Balancing Equations
- Introduction to Force, Velocity, Speed
- Introduction to Energy and Conversions
- Introduction to Power
- Introduction to Specific Heat

Semester Two: Biology Introduction

- Introduction to the Characteristics of Living Things
- Structure and Function of Organelles of the Cell
- Introduction to Genetics
- Introduction to Ecology
- Introduction to Classification of Organisms
- Introduction to the Characteristics of Organisms in different Kingdoms and Orders
- Introduction to Photosynthesis and Cell Respiration

Course Descriptions and Course Outlines

Chemistry

Course Description

Chemistry – Elective: Grades 10, 11, 12 – 1 Unit of credit -- 2 semester course. Prerequisite: Physical Science and Algebra I. Geometry must be completed or taken at the same time. This course deals with the structure and composition of materials and the changes in composition of these materials. Topics included are structure of the atom; periodic law; chemical formulas; states of matter and their properties; solutions including acids, bases, salts; types of chemical reactions and balancing; problem solving techniques including dimensional analysis; ionic, covalent and metallic bonding; and laboratory investigations utilizing computer based data collection.

Course Outline

I – Intro to Chemistry
- state of matter
- physical and chemical changes
- elements, compounds, and mixtures

II – Matter and Energy
- measurements in science
- significant figures
- matter and energy
- calculating error of measurements

III – Atoms and Moles
- structure of atoms
- electron configuration
- number of atoms
- Avogadro's number

IV – Periodic Table
- organization of periodic table
- trends of periodic table
- origin of elements

V – Ionic Bonding and Compounds

- formation of ions
- ionic salts
- naming and formula writing

VI – Covalently Bonded Compounds
- covalent bonds
- shape and structure of molecules
- naming molecules

VII – Chemical Composition and calculations
- Conversions
- Atomic masses
- Formulas and percentage composition

VIII – Chemical Equations and Reactions
- identify types of reactions
- balance different types of reactions
- write ionic and net ionic equations

IX – Stoichiometry
- stoichiometric calculations
- limiting reagent determinations
- percent yield calculations

X – Causes of Change
- energy transfer
- understanding enthalpy
- understanding entropy

XI – States of Matter and Intermolecular forces
- properties of solids
- properties of liquids
- properties of gases
- phase changes and energy relationships
- intermolecular forces

XII – Gases
- gas law concepts and calculations
- Boyle's, Charles', Dalton's, Gay-Lussac's, Ideal
- comparison of ideal and real gases
- molecular composition of gases

XIII – Solutions
- properties of solutions

- calculations involving concentrations
- freezing and boiling point change calculations
- solubility

XIV – Acids and Bases

- properties of acids and bases
- naming acids and bases
- formula writing for acids and bases
- calculating hydronium/hydroxide ion concentration
- calculating pH
- various definitions of acids and bases
- neutralization reactions
- titration of acids and bases

Honors Chemistry

Course Description

Honors Chemistry – Elective: Grades 10, 11, 12 – 1 Unit of credit -- 2 semester course. Prerequisite: Physical Science, Algebra I, and Geometry. The purpose of this course is to offer an opportunity for students who excel in science and/or for those interested in pursuing a science career. Honors Chemistry would be taken instead of Chemistry as it will cover the same material but at a more in-depth analysis. This course deals with the structure and composition of materials and the changes in composition of these materials. Topics included are structure of the atom; periodic law; chemical formulas; states of matter and their properties; solutions including acids, bases, salts; types of chemical reactions and balancing; problem solving techniques including dimensional analysis; ionic, covalent and metallic bonding; and laboratory investigations utilizing computer based data collection as well as extensive inquiry investigations.

Course Outline

I – Foundations of Chemistry
- scientific method
- measurements
- significant figures
- dimensional analysis
- state of matter
  - physical and chemical changes
  - elements, compounds, and mixtures

II – Atomic Structure
- theory of atom
- structure of atom
- properties of atoms
- electron configuration
- quantum mechanics

III – Periodic Table
- organization of periodic table
- trends of periodic table
- origin of elements

IV – Ionic Bonding and Compounds
- formation of ions
- ionic salts
- naming and formula writing

V – Covalently Bonded Compounds
- covalent bonds
- shape and structure of molecules
- naming molecules

VI – The Mole and Chemical Composition
- Atomic mass, mole and particle determinations
- Formulas and percentage composition

VII – Chemical Equations and Reactions
- identify and balance different types of reactions
- write ionic and net ionic equations

VIII – Stoichiometry
- stoichiometric calculations
- limiting reagent determinations
- percent yield calculations

IX – Gases
- gas law concepts and calculations
- Boyle's, Charles', Dalton's, Gay-Lussac's, Ideal
- comparison of ideal and real gases
- molecular composition of gases

X – States of Matter and Intermolecular forces
- properties of solids
- properties of liquids
- properties of gases
- phase changes and energy relationships
- intermolecular forces

XI – Solutions
- properties of solutions
- calculations involving concentrations
- freezing and boiling point change calculations
- solubility

XII – Acids and Bases
- properties of acids and bases
- naming and fomula writing of acids and bases
- calculating hydronium/hydroxide ion concentration
- calculating pH
- various definitions of acids and bases
- titration of acids and bases

Advanced Chemistry

Course Description

Advanced Chemistry – Elective: Grade 11-12 – ½ Unit of credit -- 1 semester course. Prerequisite: Chemistry or Honors Chemistry. This course covers equilibrium systems; reaction mechanisms; oxidation-reduction reactions; reaction rates; thermochemistry and entropy; organic structures, properties, reactions and their derivatives; nuclear chemistry; and electrochemistry.

Course Outline

I. Oxidation-Reduction Reactions
- redox reactions
- balance redox reactions

II. Thermochemistry
- thermochemical processes
- thermochemical equations
- calculations involving enthalpy and entropy of substances, reactions, and phase changes

III. Reaction Rates and Equilibrium
- reaction rates
- equilibrium processes
- Le Chatlier's principle
- reaction mechanisms

IV. Hydrocarbon Compounds
- intro to organic chemistry
- hydrocarbon compound naming and reactions
- -anes, -enes, -ynes, cyclics, aromatics
- isomers

V. Functional Groups and Organic Reactions
- hydrocarbon functional groups
- aldehydes, ethers, alcohols, ketones,
- carboxylic acids, esters, amines
- polymerization

VI. Nuclear Chemistry
- radioactivity
- nuclear reactions
- measurements involving radiation

VII. Electrochemistry
- electrochemical processes
- voltaic cells
- electrolytic cells
- calculate cellular potentials

Human Anatomy & Physiology

Course Description

Human Anatomy & Physiology – Elective: grades 11-12 – 1 unit of credit – 2 semester course. Prerequisite: Physical Science and Biology. Although chemistry is not a prerequisite, it is highly recommended that students take it prior to this course. Human Anatomy & Physiology is designed for students that have a special interest in the biological sciences or those planning a career in medicine and health. Through lecture, discussions, dissections, physiology labs, and projects students will learn the intricate anatomy and physiology of the human body. A Powerpoint presentation of a human disease and an interview of a medical professional are requirements of this course. Field trips and quest speakers are also possibilities. Students may not take the second semester without having successfully completed the first semester.

Course Outline

I. Semester One

A. Introduction to Human A & P
B. Chemical Basis of Life
C. Cells
D. Cellular Metabolism
E. Tissues
F. Skin & the Integumentary System
G. Skeletal System
H. Muscular System
I. Nervous System
J. Somatic & Special Senses

II. Semester Two

A. Endocrine System
B. Blood
C. Cardiovascular System
D. Lymphatic System
E. Digestion & Nutrition
F. Respiratory System
G. Urinary System
H. Reproductive System

Physics

Course Description

Physics – Elective: Grades 11-12 – 1 Unit of credit -- 2 semester course. Prerequisite: Algebra II – You must have taken it previously or you are currently enrolled in it. Physics presents a complex study in the areas of force and motion, energy transformations, wave phenomena and the electromagnetic spectrum, light, electricity, fields, and non-Newtonian physics. The use of mathematics, including algebra and trigonometry, is important, but conceptual understanding of physical systems remains a primary concern. Laboratory experiments will be conducted so that students can experience the principles of physics in action.

Course Outline

1st 9 weeks

1. Motion

A. Units & Measurements

(a) Metric Units: Fundamental and Derived
(b) Metric Prefixes
(c) Significant Digits: Data and Arithmetic
(d) Mass, Weight, and Density

B. Vectors and Graphing

(a) Vectors vs. Scalars
i. Vector Addition: Perpendicular Component Method
ii. Vector Multiplication: scalar and Vector Product
iii. Basic Graphing: Scales, Slopes, Direct and Indirect Proportions
(b) One- Dimension and Two- Dimensions Kinematics
i. Kinematic Vectors: Displacement, Velocity, Acceleration
ii. Average vs. Instantaneous Quantities
iii. Equations of Motion and their Application: Constant Acceleration
iv. Graphical Analysis of Motion in Time

C. Forces and Equilibrium

(a) The Laws of Newton
i. The Law of Galileo in contrast to Aristotle
ii. Force and Acceleration
iii. Action-Reaction Forces
(b) Friction and Normal Forces
(c) Mechanical Equilibrium: Force Diagrams or Free-Body Diagrams
i. Resultant Force on Point Masses
ii. The Inclined Plane
iii. Static vs. Dynamic Equilibrium
Large Project Marble Roller Coaster

2nd 9 weeks

2. Motion and Forces in Two-Dimensions

A. Projectile Motion

B. Circular Motion

(i) Uniform Circular Motion

(ii) Centripetal Forces

3. Gravitation

A. Gravitational Force

(a) Universal Gravitation: The Inverse-Square Law

(b) Orbiting Objects as Falling

(c) Planetary Motion: Laws of Kepler

(d) Satellite and Planetary Motion, Escape Velocity

(e) Calculation of Acceleration of Gravity in terms of Universal Gravitational Constant

4. Torque and Rotational equilibrium

(a) Different Units for Rotational Speed

(b) Rotational Kinematics

(c) Resultant torque on rigid body

(d) Rotational Equilibrium

(e) Angular Momentum and Conservation

5. Momentum:

(a) Classical and Newtonian Definitions of Linear Momentum

(b) Linear Momentum Conservation & Collisions

(c) Impulse

End of 1st Semester

Large Project Widgets or Rube Goldberg

3rd 9 weeks

6. Energy

A. Work & Energy

(a)Work

(b)Power

(c) Kinetic Energy

(d)Potential Energy

(e)Elastic and Gravitational Energy

B. Conservation of Mechanical Energy

(a) Energy Transformation for Freely Falling Object

(b) Energy transformation When an Object Moves Along an Inclined Plane (with/without friction)

(c) Work-Energy Theorem

7. Gas Laws & Thermodynamics

A. Gas Laws
(a) Relation between Pressure, Volume, and Temperature
(b) Ideal Gas Laws
(c) Kinetic-Molecular Theory-Interpretation of Temperature
B. Heat
(a) Mechanical Equivalent of Heat
(b) Phase Transformation and Phase Diagrams
(c) Heat Transfer Processes: Conduction, Convection, & Radiation
(d) Thermal Expansion
C. Thermodynamics
(a) First Law
(b) Types of Thermodynamic Processes
i. Adiabatic
ii. Isothermal
iii. Isochoric
(c) Pressure -Volume Work of a Gas
(d) Second Law of Thermodynamics: Entropy
i. Entropy: Disorder
ii Efficiency of Heat Pumps

8. Fluids

A. Hydrostatic Pressure
B. Buoyancy
C. Fluid Flow Continuity
D. Bernoulli's Equation

9. Waves and Oscillations

A. Simple Harmonic Motion (SHM)
(a) Hooke's Law
(b) Comparison of SHM with Uniform Circular Motion
(c) SHM: Period of oscillation
(d) Time-dependent Position, Velocity, and Acceleration of an Oscillator
(e) Elastic Potential Energy and Energy Conservation
(f) The Simple Pendulum
(g) Resonance: The Swing
B. Waves
(a) Longitudinal and Transverse waves
(b) Relationship between wavelength, frequency, and speed
(c) Sound Wave: Medium-dependent Speed
(d) Intensity, Pitch, Loudness & Doppler Effect
(e) Standing Waves & Musical Instruments
Large Project Instrument Build
4th 9 weeks

10. Light

A. What is Light?

(a) Light as Electromagnetic Wave
(b) The Electromagnetic Spectrum

B. Geometrical Optics

(a) Plane Mirrors
(b) Concave & Convex Mirrors
(c) Laws of Reflection & Refraction
(d) Total Internal Reflection, Critical Angle
(e) Dispersion and Rainbow
(g) Lenses
(i) Concave Lens
(ii) Convex Lens

C. Physical Optics

(a)Diffraction Through Slits
(b) Interference
(c)Thin Films
(d) Polarization

D. Image Formation in Lenses and Mirrors

11. Electromagnetism

A. Electrostatics

(a) Electric Charge
(b) Electrostatic Forces (Coulomb's Law)
(c) Electric Lines of Force
(d) Conductors & Insulators
(e) Induced Charge
(f) Parallel Plate Capacitor

B. Electric Fields & Potential

(a) Electric fields & Electrical Work
(b) Electric Potential Energy
(c) Equi-potential surfaces Grounded Conductors
(d) Particle Dynamics within a Capacitor
(i) Cathode Ray Tube
(ii) Milikan Oil Drop Experiment

C. Direct Circuits

(a) Mechanical Analogy of a Circuit: EMF, Current, Resistance
(b) Current, Electrical Work, and Electric Power
(c) Ohm's Law
(d) Heat Dissipated in a Resistor: Calorimetry Connection
(e) Energy Stored in a Capacitor
(f) Resistors and Capacitors in Series and Parallel
(g) Kirchhoff's Two Laws
(h) Home Consideration, Parallel Circuits and
i. Circuit Breakers
ii. Multi-loop circuits
iii. Connecting Ammeters, Voltmeters, and Cells

D. Magnetism

(a) Sources of Magnetic Field Lines: Moving Charges
(b) Field Lines about Bar Magnets, Horseshoe Magnets and the Earth
(c) Field lines about a Wire and a Coil: Biot-Savart Law
(d) Electromagnets
(e) Atomic Theory of Magnetism: Electron Spins and Domains
(f) Magnetic Forces
i Point Charges: Lorentz Law
ii Forces between Parallel Wires
(g) Magnetic Torque on a Current Loop
(h) Magnetic Devices
i. Electromagnetic Motor
ii. Mass Spectrometer

E. Electromagnetic Induction

(a) Generation of Electromotive Force
(b) Faraday's Law
(c)Electric Generator & Motor
(d) Transformers

12. Atomic & Nuclear Structure

A. Atomic Theory & Quantum Mechanics

(a) Radioactivity: alpha, beta, and gamma radiation
(b) Cathode Ray Tubes and The Raisin Cake Model of the At
(c) Rutherford: The Gold Foil Experiment
(d) Bohr: Postulates of Atomic Structure
i Electrons are confined to certain quantized orbits
ii Contrary to Maxwell, electrons do not emit energy
while in stationary orbits
iii These orbits are of quantized angular momentum
(e) Bohr: Conclusions
i. Interpretation of Line Spectra (qualitative)
ii. Derivation of Quantized Electron Energy Values
iii. Agreement with Line Spectra (quantitative)

B. Quantum Theory: Physical Laws at Atomic Scale

(a) Experimental Evidence suggesting the need for a
new theory
i. Line Spectra
ii The Photoelectric Effect
(b) Early Theoretical Work
i. Einstein and Planck: Quantization of EMR
ii. de Broglie: Photon Momentum, Matter Waves, &
Wave- Particle Duality
iii Heisenberg: The Uncertainty Principle
(c) Current Quantum-Mechanical Model of The Atom
(d) Electronic Energy Level Diagrams

C. Nuclear Reactions

(a) Balancing Nuclear Reactions

(b) Alpha, Beta, & Gamma Decay
(c) First-Order Decay Processes: Half-Lives and Decay Sequences
(d) Power Sources: Fission & Fusion

13. Electronics and Nanotechnology

A. Miniaturization and Nanotechnology
Large Project Rube Goldberg or Portfolios

List Of Labs:

Lab # 1: Acceleration due to Gravity
Lab # 2: Constant Acceleration down an Incline
Lab # 3: Newton's Second Law
Lab # 4: Atwood's Machine
Lab # 5: Conservation of Momentum
Lab # 6: Heat Transfer
Lab # 7: Simple Harmonic Motion
Lab # 8: Sound Waves
Lab # 9: Light Intensity vs. Position
Lab # 10: Optical Bench
Lab # 11: Ohm's Law
Lab # 12: Kirchhoff's Laws with Multimeters and Circuit Boards
Lab # 13: Circuit
Lab # 14: Magnetic Field

Other Suggested Experiments
- Determine Density
- Determine g.
- Coefficient of Friction
- Centripetal Force
- Conservation of Energy
- Specific Heat
- Period of a Pendulum
- Resistor Addition

Honors Physics

Course Description

Honors Physics – Elective: Grades 11 – 12 – 1 Unit of credit – **students are required to take both semesters!** Prerequisite: Algebra II and you must be currently enrolled in Trigonometry, or Precalculus, or Calculus. Physics presents a complex study in the areas of force and motion, energy transformations, wave phenomena and the electromagnetic spectrum, light, electricity, fields, and non-Newtonian physics. The use of mathematics, including algebra and trigonometry, is important, but conceptual understanding of physical systems remains a primary concern. Laboratory experiments will be conducted so that students can experience the principles of physics in action. The Honors Class at Mandan High School will be focusing more on the trigonometry level and instills many aspects of beginning engineering concept of design and construction.

Course Outline

1st 9 weeks

1. Motion

A. Units & Measurements

(a) Metric Units: Fundamental and Derived
(b) Metric Prefixes
(c) Significant Digits: Data and Arithmetic
(d) Mass, Weight, and Density

B. Vectors and Graphing

(a) Vectors vs. Scalars
i. Vector Addition: Perpendicular Component Method
ii. Vector Multiplication: scalar and Vector Product
iii. Basic Graphing: Scales, Slopes, Direct and Indirect Proportions
(b) One- Dimension and Two- Dimensions Kinematics
i. Kinematic Vectors: Displacement, Velocity, Acceleration
ii. Average vs. Instantaneous Quantities
iii. Equations of Motion and their Application: Constant Acceleration
iv. Graphical Analysis of Motion in Time

C. Forces and Equilibrium

(a) The Laws of Newton
i. The Law of Galileo in contrast to Aristotle
ii. Force and Acceleration
iii. Action-Reaction Forces
(b) Friction and Normal Forces
(c) Mechanical Equilibrium: Force Diagrams or Free-Body Diagrams
i. Resultant Force on Point Masses
ii. The Inclined Plane
iii. Static vs. Dynamic Equilibrium
Large Project Marble Roller Coaster

2nd 9 weeks

2. Motion and Forces in Two-Dimensions

A. Projectile Motion

B. Circular Motion

(i) Uniform Circular Motion

(ii) Centripetal Forces

3. Gravitation

A. Gravitational Force

(a) Universal Gravitation: The Inverse-Square Law

(b) Orbiting Objects as Falling

(c) Planetary Motion: Laws of Kepler

(d) Satellite and Planetary Motion, Escape Velocity

(e) Calculation of Acceleration of Gravity in terms of Universal Gravitational Constant

4. Torque and Rotational equilibrium

(a) Different Units for Rotational Speed

(b) Rotational Kinematics

(c) Resultant torque on rigid body

(d) Rotational Equilibrium

(e) Angular Momentum and Conservation

5. Momentum:

(a) Classical and Newtonian Definitions of Linear Momentum

(b) Linear Momentum Conservation & Collisions

(c) Impulse

End of 1st Semester

Large Project Widgets or Rube Goldberg

3rd 9 weeks

6. Energy

A. Work & Energy

(a)Work

(b)Power

(c) Kinetic Energy

(d)Potential Energy

(e)Elastic and Gravitational Energy

B. Conservation of Mechanical Energy

(a) Energy Transformation for Freely Falling Object

(b) Energy transformation When an Object Moves Along an Inclined Plane (with/without friction)

(c) Work-Energy Theorem

7. Gas Laws & Thermodynamics

A. Gas Laws

(a) Relation between Pressure, Volume, and Temperature

(b) Ideal Gas Laws
(c) Kinetic-Molecular Theory-Interpretation of Temperature

B. Heat

(a) Mechanical Equivalent of Heat
(b) Phase Transformation and Phase Diagrams
(c) Heat Transfer Processes: Conduction, Convection, & Radiation
(d) Thermal Expansion

C. Thermodynamics

(a) First Law
(b) Types of Thermodynamic Processes
i. Adiabatic
ii. Isothermal
iii. Isochoric
(c) Pressure -Volume Work of a Gas
(d) Second Law of Thermodynamics: Entropy
i. Entropy: Disorder
ii Efficiency of Heat Pumps

8. Fluids

A. Hydrostatic Pressure
B. Buoyancy
C. Fluid Flow Continuity
D. Bernoulli's Equation

9. Waves and Oscillations

A. Simple Harmonic Motion (SHM)

(a) Hooke's Law
(b) Comparison of SHM with Uniform Circular Motion
(c) SHM: Period of oscillation
(d) Time-dependent Position, Velocity, and Acceleration of an Oscillator
(e) Elastic Potential Energy and Energy Conservation
(f) The Simple Pendulum
(g) Resonance: The Swing

B. Waves

(a) Longitudinal and Transverse waves
(b) Relationship between wavelength, frequency, and speed
(c) Sound Wave: Medium-dependent Speed
(d) Intensity, Pitch, Loudness & Doppler Effect
(e) Standing Waves & Musical Instruments

Large Project Instrument Build
4th 9 weeks

10. Light

A. What is Light?

(a) Light as Electromagnetic Wave
(b) The Electromagnetic Spectrum

B. Geometrical Optics
(a) Plane Mirrors
(b) Concave & Convex Mirrors
(c) Laws of Reflection & Refraction
(d) Total Internal Reflection, Critical Angle
(e) Dispersion and Rainbow
(g) Lenses
(i) Concave Lens
(ii) Convex Lens
C. Physical Optics
(a)Diffraction Through Slits
(b) Interference
(c)Thin Films
(d) Polarization
D. Image Formation in Lenses and Mirrors

11. Electromagnetism

A. Electrostatics
(a) Electric Charge
(b) Electrostatic Forces (Coulomb's Law)
(c) Electric Lines of Force
(d) Conductors & Insulators
(e) Induced Charge
(f) Parallel Plate Capacitor
B. Electric Fields & Potential
(a) Electric fields & Electrical Work
(b) Electric Potential Energy
(c) Equi-potential surfaces Grounded Conductors
(d) Particle Dynamics within a Capacitor
(i) Cathode Ray Tube
(ii) Milikan Oil Drop Experiment
C. Direct Circuits
(a) Mechanical Analogy of a Circuit: EMF, Current, Resistance
(b) Current, Electrical Work, and Electric Power
(c) Ohm's Law
(d) Heat Dissipated in a Resistor: Calorimetry Connection
(e) Energy Stored in a Capacitor
(f) Resistors and Capacitors in Series and Parallel
(g) Kirchhoff's Two Laws
(h) Home Consideration, Parallel Circuits and
i. Circuit Breakers
ii. Multi-loop circuits
iii. Connecting Ammeters, Voltmeters, and Cells
D. Magnetism
(a) Sources of Magnetic Field Lines: Moving Charges
(b) Field Lines about Bar Magnets, Horseshoe Magnets and the Earth

(c) Field lines about a Wire and a Coil: Biot-Savart Law
(d) Electromagnets
(e) Atomic Theory of Magnetism: Electron Spins and Domains
(f) Magnetic Forces
i Point Charges: Lorentz Law
ii Forces between Parallel Wires
(g) Magnetic Torque on a Current Loop
(h) Magnetic Devices
i. Electromagnetic Motor
ii. Mass Spectrometer

E. Electromagnetic Induction

(a) Generation of Electromotive Force
(b) Faraday's Law
(c)Electric Generator & Motor
(d) Transformers

12. Atomic & Nuclear Structure

A. Atomic Theory & Quantum Mechanics

(a) Radioactivity: alpha, beta, and gamma radiation
(b) Cathode Ray Tubes and The Raisin Cake Model of the At
(c) Rutherford: The Gold Foil Experiment
(d) Bohr: Postulates of Atomic Structure
i Electrons are confined to certain quantized orbits
ii Contrary to Maxwell, electrons do not emit energy
while in stationary orbits
iii These orbits are of quantized angular momentum
(e) Bohr: Conclusions
i. Interpretation of Line Spectra (qualitative)
ii. Derivation of Quantized Electron Energy Values
iii. Agreement with Line Spectra (quantitative)

B. Quantum Theory: Physical Laws at Atomic Scale

(a) Experimental Evidence suggesting the need for a
new theory
i. Line Spectra
ii The Photoelectric Effect
(b) Early Theoretical Work
i. Einstein and Planck: Quantization of EMR
ii. de Broglie: Photon Momentum, Matter Waves, &
Wave- Particle Duality
iii Heisenberg: The Uncertainty Principle
(c) Current Quantum-Mechanical Model of The Atom
(d) Electronic Energy Level Diagrams

C. Nuclear Reactions

(a) Balancing Nuclear Reactions
(b) Alpha, Beta, & Gamma Decay
(c) First-Order Decay Processes: Half-Lives and Decay

Sequences
(d) Power Sources: Fission & Fusion

13. Electronics and Nanotechnology

A. Miniaturization and Nanotechnology
Large Project Rube Goldberg or Portfolios

List Of Labs:

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Lab # 6: Heat Transfer
Lab # 7: Simple Harmonic Motion
Lab # 8: Sound Waves
Lab # 9: Light Intensity vs. Position
Lab # 10: Optical Bench
Lab # 11: Ohm's Law
Lab # 12: Kirchhoff's Laws with Multimeters and Circuit Boards
Lab # 13: Circuit
Lab # 14: Magnetic Field
Lab # 15 : Magnetic Induction

Other Suggested Experiments
- Determine Density
- Determine g.
- Coefficient of Friction
- Centripetal Force
- Conservation of Energy
- Specific Heat
- Period of a Pendulum
- Resistor Addition

APPENDIX A

21st Century Skills – 4th Grade

The Partnership for 21st Century Skills organization in cooperation with the National Council of Teachers of English developed a 21st Century Skills Map. The 21st Century Skills Map has so far been developed at grades 4, 8, and 12.

We did an alignment between the 21st Century Skills and Mandan Public Schools' Science Curriculum Standards and Benchmarks. Each science benchmark addresses at least one the 21st Century Skills. However, not all of the 21st Century Skills are addressed by Mandan Public Schools' Science Curriculum. Some of the 21st Century Skills may be addressed by other curriculums in Mandan Public Schools. This match is a guide to assist us in the identification of which 21st Century Skills align to specific benchmarks in each grade. If someone else did the match, we would expect slightly different results.

We numbered the 12 broad 21st Century Skills 1-12. In front of each 21st Century Skill is a digit which indicates the grade level at which the 21st Century Skill was developed. Each of these 12 skills has 1 or more sub-skills. We numbered the sub-skills with a decimal point followed by another digit in numerical sequence.

The numbers in parenthesis below the 21st Century sub-skills refer to Mandan Public Schools' Science Curriculum. The first digit in parenthesis refers to the grade level. The second digit in the parenthesis refers to the standard. The third digit in parenthesis refers to the benchmark.

It is important that these 21st Century Skills be addressed by the various components of the school curriculum. As new state standards and benchmarks are developed, we hope that they will address the 21st Century Skills.

4.1 Creativity and Innovation

4.1.1 Demonstrate originality and inventiveness in work

4.1.2 Communicate new ideas to others

(1.1.3; 1.2.1)
(2.1.1; 2.2.2)
(3.2.1)
(4.1.1)

4.1.3 Develop, implement and communicate new ideas to others

(1.1.3; 1.2.1)
(2.1.1; 2.2.2)
(3.2.1)
(4.3.2; 4.3.3)

4.2 Critical Thinking & Problem Solving

4.2.1 Identify and ask significant questions that clarify various points of view
(2.2.1)
(3.2.2)
(4.2.1)

4.2.2 Frame, analyze and synthesize information in order to solve problems and answer questions
(K.5.2; K.6.1; K.6.2; K.8.1)
(1.1.3; 1.4.2; 1.5.1; 1.5.2; 1.6.1; 1.6.2; 1.7.1; 1.7.2; 1.8.1)
(2.1.1; 2.1.2; 2.1.3; 2.3.1; 2.3.2; 2.3.3; 2.3.4; 2.3.5; 2.3.6; 2.4.1; 2.4.2; 2.5.1-5; 2.6.1; 2.6.2; 2.7.1; 2.7.2; 2.8.1;)
(3.3.1; 3.3.2; 3.3.3; 3.3.4; 3.3.5; 3.4.2; 3.4.3; 3.5.5; 3.6.1; 3.7.1; 3.7.2; 3.8.1)
(4.1.1; 4.1.2; 4.2.1; 4.3.2; 4.3.3; 4.3.5; 4.3.6; 4.3.7; 4.5.3; 4.5.4; 4.6.1; 4.6.2; 4.7.1; 4.7.2; 4.8.1; 4.8.2)

4.3 Communication

4.3.1 Articulate thoughts clearly and effectively through writing, speaking, and visuals
(K.5.2; K.6.1; K.6.2; K.8.1)
(1.1.3; 1.4.2; 1.5.1; 1.5.2; 1.6.1; 1.6.2; 1.7.1; 1.7.2; 1.8.1)
(2.1.1; 2.1.2; 2.1.3; 2.3.1; 2.3.2; 2.3.3; 2.3.4; 2.3.5; 2.3.6; 2.4.1; 2.4.2; 2.5.1-5; 2.6.1; 2.6.2; 2.7.1; 2.7.2; 2.8.1;)
(3.3.1; 3.3.2; 3.3.3; 3.3.4; 3.3.5; 3.4.2; 3.4.3; 3.5.5; 3.6.1; 3.7.1; 3.7.2; 3.8.1)
(4.1.1; 4.1.2; 4.2.1; 4.3.2; 4.3.3; 4.3.5; 4.3.6; 4.3.7; 4.5.3; 4.5.4; 4.6.1; 4.6.2; 4.7.1; 4.7.2; 4.8.1; 4.8.2)

4.4 Collaboration

4.4.1 Demonstrate the ability to work effectively with diverse teams

4.4.2 Assume shared responsibility for collaborative work

4.5 Information Literacy

4.5.1 Access and critically evaluate information and use information accurately to solve problems

4.5.2 Access and critically evaluate information and use information creatively

4.5.3 Evaluate information critically and competently

4.5.3 Evaluate information critically and competently and use information accurately and creatively for the problem at hand

4.5.4 Access information efficiently and effectively, evaluate information critically and competently and use information accurately and creatively

4.6 Media Literacy

4.6.1 Understand how media messages are constructed, for what purposes and using which characteristics and conventions

4.6.2 Examine how values and points of view are included or excluded and how media can influence beliefs and behaviors

4.7 ICT Literacy

4.7.1 Use technology as a tool to research, organize, evaluate and communicate information

4.7.2 Use digital technology and communication tools appropriately to access, evaluate, and create information

4.8 Flexibility & Adaptability

4.8.1 Adapt to varied roles and responsibilities

4.9 Initiative & Self-Direction

4.9.1 Define, prioritize and complete tasks without direct oversight

4.9.2 Monitor one's own understanding and learning needs

4. 10 Social & Cross-Cultural Skills

4.10.1. Bridge cultural differences and use differing perspectives to increase innovation and the quality of work

4. 10.2 Leverage the collective intelligence of groups when appropriate

4.11 Productivity & Accountability

4.11.1 Demonstrate diligence and a positive work ethic (e.g., being punctual and reliable)

4.12 Leadership & Responsibility

4.12.1 Leverage strengths of others to accomplish a common goal

APPENDIX B

21st Century Skills – 8th Grade

The Partnership for 21st Century Skills organization in cooperation with the National Council of Teachers of English developed a 21st Century Skills Map. The 21st Century Skills Map has so far been developed at grades 4, 8, and 12.

We did an alignment between the 21st Century Skills and Mandan Public Schools' Science Curriculum Standards and Benchmarks. Each science benchmark addresses at least one the 21st Century Skills. However, not all of the 21st Century Skills are addressed by Mandan Public Schools' Science Curriculum. Some of the 21st Century Skills may be addressed by other curriculums in Mandan Public Schools. This match is a guide to assist us in the identification of which 21st Century Skills align to specific benchmarks in each grade. If someone else did the match, we would expect slightly different results.

We numbered the 12 broad 21st Century Skills 1-12. In front of each 21st Century Skill is a digit which indicates the grade level at which the 21st Century Skill was developed. Each of these 12 skills has 1 or more sub-skills. We numbered the sub-skills with a decimal point followed by another digit in numerical sequence.

The numbers in parenthesis below the 21st Century sub-skills refer to Mandan Public Schools' Science Curriculum. The first digit in parenthesis refers to the grade level. The second digit in the parenthesis refers to the standard. The third digit in parenthesis refers to the benchmark.

It is important that these 21st Century Skills be addressed by the various components of the school curriculum. As new state standards and benchmarks are developed, we hope that they will address the 21st Century Skills.

8.1 Creativity and Innovation

8.1.1 Demonstrate originality and inventiveness in work
(5.1.1; 5.6.1)
(6.1.1; 6.6.2)
(7.1.1)
(8.2.1)

8.1.2 Be open and responsive to new and diverse perspectives
(5.6.2)

8.1.3 Develop and communicate new ideas to others
(5.1.2; 5.2.1)
(6.1.2)
(7.1.2; 7.1.3; 7.4.6; 7.6.3; 7l7.1; 7.7.3)

8.2 Critical Thinking & Problem Solving

8.2.1 Frame, analyze and synthesize information in order to solve problems and answer questions
(5.6.1; 5.6.2)
(6.2.1; 6.2.3; 6.3.1; 6.3.3; 6.3.5; 6.4.2; 6.5.2; 6.6.3; 6.7.1; 6.7.2)
(7.1.4; 7.2.1; 7.3.1; 7.4.1; 7.4.l; 7.4.5; 7.4.6; 7.5.2; 7.6.3; 7.7.1; 7.7.3; 7.7.4; 7.8.1; 7.8.2; 8.1.1; 8.2.1; 8.2.2; 8.2.3; 8.2.4; 8.3.2; 8.3.3; 8.3.4; 8.3.5; 8.3.6; 8.4.1; 8.5.1; 8.5.3; 8.5.4; 8.5.7; 8.5.8; 8.7.1; 8.8.1)

8.2.2 Make complex choices and decisions
(5.1.1; 5.6.1; 5.6.2)

8.2.3 Identify and ask significant questions that clarify various points of view

8.3 Communication

8.3.1 Articulate thoughts and ideas clearly and effectively
(5.1.2; 5.6.1)
(6.1.3; 6.2.1; 6.3.5; 6.4.2; 6.6.3; 6.7.1; 6.7.2)
(7.3.1; 7.4.1; 7.4.5; 7.4.6; 7.5.2; 7.6.3; 7.7.1; 7.7.3; 7.7.4; 7.8.1; 7.8.2)
(8.2.1; 8.2.2; 8.2.3; 8.2.4; 8.3.2; 8.3.3; 8.3.4; 8.3.6; 8.4.1; 8.5.1; 8.5.3; 8.5.4; 8.5.7; 8.5.8; 8.7.1; 8.8.1)

8.3.2 Articulate thoughts and ideas clearly and effectively through writing
(5.2.1)

8.4 Collaboration

8.4.1 Assume shared responsibility for collaborative work

8.4.2 Exercise flexibility and willingness to be helpful in making necessary compromises to accomplish a common goal

8.4.3 Demonstrate the ability to work effectively with diverse teams

8.5 Information Literacy

8.5.1 Use information accurately and creatively for the issue or problem at hand
(5.1.1; 5.6.1; 5.6.2)

8.5.2 Use information accurately and creatively to generate new knowledge
(5.1.1; 5.6.1)

8.5.3 Evaluate information critically and competently

(5.1.1; 5.6.1)

8.5.4 Possess a fundamental understanding of the ethical/legal issues surrounding the access and use of information

8.6 Media Literacy

8.6.1 Examine how values and points of view are included or excluded and how media can influence beliefs and behaviors

8.6.2 Examine how individuals interpret messages differently, how values and points of view are included or excluded and how media can influence beliefs and behaviors

8.7 ICT Literacy

8.7.1 Use technology as a tool to research, organize, evaluate and communicate information, and possess a fundamental understanding of the ethical/legal issues surrounding the access and use of information
(5.6.1)

8.7.2 Use digital technology and communication tools appropriately to access, evaluate, and create information
(5.6.1)

8.7.3 Demonstrate an understanding of legal, ethical, and safe online behavior
(5.6.1)

8.8 Flexibility & Adaptability

8.8.1 Adapt to varied roles and responsibilities

8.9 Initiative & Self-Direction

8.9.1 Utilize time efficiently and manage workload

8.9.2 Monitor one's own understanding and learning needs

8.10 Social & Cross-Cultural Skills

8.10.1 Bridge cultural differences and use differing perspectives to increase innovation and the quality of work

8.11 Productivity & Accountability

8.11.1 Set and meet high standards and goals for delivering quality work on time

8.12 Leadership & Responsibility

8.12.1 Demonstrate integrity and ethical behavior

Appendix C

21st Century Skills – 12th Grade

The Partnership for 21st Century Skills organization in cooperation with the National Council of Teachers of English developed a 21st Century Skills Map. The 21st Century Skills Map has so far been developed at grades 4, 8, and 12.

We did an alignment between the 21st Century Skills and Mandan Public Schools' Science Curriculum Standards and Benchmarks. Each science benchmark addresses at least one the 21st Century Skills. However, not all of the 21st Century Skills are addressed by Mandan Public Schools' Science Curriculum. Some of the 21st Century Skills may be addressed by other curriculums in Mandan Public Schools. This match is a guide to assist us in the identification of which 21st Century Skills align to specific benchmarks in each grade. If someone else did the match, we would expect slightly different results.

We numbered the 12 broad 21st Century Skills 1-12. In front of each 21st Century Skill is a digit which indicates the grade level at which the 21st Century Skill was developed. Each of these 12 skills has 1 or more sub-skills. We numbered the sub-skills with a decimal point followed by another digit in numerical sequence.

The numbers in parenthesis below the 21st Century sub-skills refer to Mandan Public Schools' Science Curriculum. The first digit in parenthesis refers to the grade level. The second digit in the parenthesis refers to the standard. The third digit in parenthesis refers to the benchmark.

It is important that these 21st Century Skills be addressed by the various components of the school curriculum. As new state standards and benchmarks are developed, we hope that they will address the 21st Century Skills.

12.1 Creativity and Innovation

12.1.1 Develop and communicate new ideas to others
(9-10.2.1)
12.1.2 Demonstrate originality and inventiveness in work
(9-10.2.6)
(11-12.2.7)
12.1.3 Act on creative ideas to make a tangible and useful contribution to the domain in which the innovation occurs
(9-10.3.4; 9-10.4.7)
(11-12.1.1; 11-12.3.10)

12.2 Critical Thinking & Problem Solving

12.2.1 Frame, analyze and synthesize information in order to solve problems and answer questions
(9-10.1.5; 9-10.2.4; 9-10.2.5; 9-10.2.8; 9-10.3.1; 9-10.3.2; 9-10.3.9; 9-10.5.5; 9-10.5.6)
(11-12.2.3; 11-12.2.6; 11-12.8.1)
12.2.2 Identify and ask significant questions that clarify various points of view
(9-10.2.3; 9-10.3.3; 9-10.3.5; 9-10.4.9; 9-10.5.4)
(11-12.2.4; 11-12.3.4)

12.2.3 Exercise sound reasoning in understanding
(9-10.1.3; 9-10.1.6; 9-10.3.6; 9-10.4.1; 9-10.4.2; 9-10.4.3; 9-10.4.6; 9-10.4.8; 9-10.4.11; 9-10.5.1;
9-10.5.2)
(11-12.1.5; 11-12.3.5; 11-12.3.8; 11-12.3.12; 11-12.3.13)

12.3 Communication

12.3.1 Articulate thoughts clearly and effectively through writing, speaking, and multimedia
(9-10.1.1; 9-10.1.2; 9-10.1.4; 9-10.3.7; 9-10.3.8; 9-10.3.10; 9-10.4.4; 9-10.4.5; 9-10.4.10; 9-10.4.12;
9-10.5.3)
(11-12.1.2; 11-12.1.3; 11-12.1.4; 11-12.2.8; 11-12.3.1; 11-12.3.2; 11-12.3.3; 11-12.3.7; 11-12.3.9;
11-12.3.11; 11-12.4.1; 11-12.5.1; 11-12.5.2)

12.3.2 Articulate thoughts clearly and effectively through writing
(9-10.2.7; 11-12.3.6)

12.4 Collaboration

12.4.1 Exercise flexibility and willingness to be helpful in making necessary compromises to accomplish a common goal

12.4.2 Assume shared responsibility for collaborative work

12.4.3 Demonstrate the ability to work effectively with diverse teams

12.5 Information Literacy

12.5.1 Possess and share a fundamental understanding of the ethical/legal issues surrounding the access and use of information

12.5.2 Use information accurately and creatively for the issue or problem at hand

12.6 Media Literacy

12.6.1 Understand how media messages are constructed, for what purposes and using which tools, characteristics and conventions
(11-12.2.2)

12.7 ICT Literacy

12.7.1 Use technology as a tool to research, organize, evaluate and communicate information, and possess a fundamental understanding of the ethical/legal issues surrounding the access and use of information
(9-10.6.1; 9-10.6.3)
(11-12.4.2)

12.7.2 Use technology as a tool to communicate information
(11-12.2.5)
12.7.3 Use digital technology, communication tools and/or networks appropriately to integrate, evaluate, and create information
(9-10.6.2)
(11-12.2.1; 11-12.6.1; 11-12.6.2)

12.8 Flexibility & Adaptability

12.8.1 Work effectively in a climate of ambiguity and changing priorities
(9-10.8.4)
(11-12.4.3)

12.9 Initiative & Self-Direction

12.9.1 Go beyond basic mastery of skills and/or curriculum to explore and expand one's own learning and opportunities to gain expertise
(9-10.8.1)
12.9.2 Demonstrate commitment to learning as a lifelong process

12.10 Social & Cross-Cultural Skills

12.10.1 Bridge cultural differences and use differing perspectives to increase innovation and the quality of work
(9-10.8.5)

12.10.2 Leverage the collective intelligence of groups when appropriate
(9-10.8.3)

12.11 Productivity & Accountability

12.11.1 Demonstrate diligence and a positive work ethic (e.g., being punctual and reliable)
(9-10.2.2; 9-10.8.2)

12.12 Leadership & Responsibility

12.12.1 Act responsibly with the interests of the larger community in mind
(9-10.7.1; 9-10.7.2)
(11-12.5.3; 11-12.6.3; 11-12.7.1; 11-12.7.2; 11-12.7.3; 11-12.7.4)

Appendix D

6th Grade Essential Skills

Sixth grade teachers at Mandan Middle School in Mandan Public Schools have determined that in order to be successful in science students entering 6th grade need specific science knowledge and skills.

Science

Upon entering 6th Grade students need to be able to:

- Take notes from the Promethean Board
- Answer questions in a complete sentence
- Be able to think for themselves and use available resources to find answers and information they need.

Upon leaving 6th Grade students will be able to:

- Take notes from the Promethean Board
- Answer questions in a complete sentence
- Think for themselves and use available resources to find answers and information they need
- Will be familiar with an overview of Physical, Life, and Earth Science
- Use technology and other resources to find science information.

Appendix E

7th Grade Essential Skills

Seventh grade teachers at Mandan Middle School in Mandan Public Schools have determined that in order to be successful in science students entering 7th grade need specific science knowledge and skills.

Science

Upon entering 7th Grade students need to be able to:

- ✓ Attend to the task at hand.
- ✓ Ask appropriate questions.
- ✓ Participate in science based discussion.
- ✓ Apply what they've learned to their life (reason and think critically.
- ✓ Have basic knowledge of the following concepts:
  - Scientific method (make observations, summarize and analyze data)
  - Measurement (volume, length, mass)
  - Cells (organelle structure and function, mitosis, meiosis)
  - Genetics (asexual reproduction, sexual reproduction, alleles, traits, heredity)
  - Vertebrate and Invertebrate characteristics (body structure and function)
  - Systems of the human body (Circulatory, Nervous, Skeletal, Digestive, Respiratory)
  - Biomes (Interactions of living and non-living components within ecosystems)

Upon leaving the 7th Grade students will be able to:

- ✓ Attend to the task at hand.
- ✓ Ask appropriate questions.
- ✓ Participate in science based discussion.
- ✓ Apply what they've learned to their life (reason and think critically)
- ✓ Have basic knowledge of the following concepts:
  - Scientific inquiry (problem solving, cooperative learning, critical thinking)
  - Microscopes (wet mount slide preparation, coarse and fine focus, using appropriate stage lens)
  - Characteristics of living things (reproduce to create fertile offspring, have cells, have DNA, respond to change, grow and develop, obtain and use energy)
  - Classification (levels, dichotomous keys)
  - Organization of living things (domains, kingdoms, binomial nomenclature)
  - Types of cells (total body, sex cells, cell specialization)

- Structure and function of cells (organelles, active transport, passive transport, repair, growth, development)
- Cell division (mitosis, meiosis, health aspects of cancer)
- Cellular Energy (Photosynthesis, Cellular Respiration, Fermentation)
- Disease (Communicable and Non-communicable)
- Adaptation and Mutations (natural selection, artificial selection, physical adaptations, behavioral adaptations, and structural adaptations)
- Characteristics of animal groups (vertebrate, invertebrate, and sub groups)
- Heredity (alleles, dominant traits, recessive traits, genetic disorders)
- Alleles and traits (heterozygous, homozygous, dominant, recessive)
- Predicting traits (punnett square and pedigree)
- Systems of the human body and the systems' interrelationships (integumentary system, respiratory system, skeletal system, muscular system, cardiovascular system, digestive system, lymphatic system, endocrine system, nervous system, urinary/excretory, reproductive system)
- Importance of healthy living (disease prevention and treatment)
- Abiotic and Biotic factors, and their interrelationships (pollution, ecology, environmental change and response)
- Relationships between organisms (symbiosis – mutualism, commensalism, parasitism, predator-prey)
- Feeding relationships and trophic levels (food webs, energy pyramids, food chains)
- Habitats (Global habitats, biomes, local habitats of North Dakota)
- Species survival (natural selection, respond to change, adaptation, seasonal behaviors, social behaviors, survival behaviors)
- Plant processes and structures, and their roles in the environment (germination, tropisms, seed dispersal, food and nutrient storage, adaptations)
- Forms of energy (renewable and non-renewable resources)

✓ Have deeper knowledge of the following concepts:

- Scientific method (make observations, summarize and analyze data)
- Measurement (collect data from experiments and analyze data to communicate results)
- Vertebrate and Invertebrate characteristics (body systems, structure, development, environmental roles)
- Biomes (interrelationships between biotic/abiotic factors, environmental change over time, seasonal effects, effects of human action)

Appendix F

8th Grade Essential Skills

Eighth grade teachers at Mandan Middle School in Mandan Public Schools have determined that in order to be successful in science students entering 8th grade need specific science knowledge and skills.

Upon entering 8th Grade students need to be able to:

- ✓ Attend to the task at hand.
- ✓ Ask appropriate questions.
- ✓ Participate in science based discussion.
- ✓ Apply what they've learned to their life (reason and think critically.)
- ✓ Have basic knowledge of the following concepts:
    - Scientific method (make observations, summarize and analyze data)
    - Metric Measurement (area, volume, density, mass, temp. scale)
    - Photosynthesis (interaction of sunlight with plants and carbon dioxide)
    - Elements/symbols(periodic table of elements, names of common elements and their symbols)
    - Classes of matter (elements, compounds, mixtures)
    - Latitude/longitude (prime meridian, equator, coordinates, international date line)
    - Classification (levels of organization, dichotomous key)
    - Use of a balance (operation of triple beam balance)
    - States of matter (solids, liquids, gases)
    - Basic structure of the Solar System (Sun, planets, asteroids, comets and organization of the solar system)
    - Use of a globe and map. (rotation and revolution, coordinates, finding locations on Earth, Earth motions)

Upon leaving the 8th Grade students will be able to:

- ✓ Attend to the task at hand.
- ✓ Ask appropriate questions.
- ✓ Participate in science based discussion.
- ✓ Apply what they've learned to their life (reason and think critically.
- ✓ Have basic knowledge of the following concepts:

    - Scientific inquiry (problem solving, cooperative learning, critical thinking)
    - Basic concepts of chemistry (atoms, elements, compounds, molecules, atomic structure, atomic number, atomic weight)
    - Knowledge of minerals (mineral criteria, physical property tests, uses for minerals, gems)

- Identify classes of rocks (igneous, sedimentary, metamorphic rocks)
- Rock cycle (processes of change- weathering, erosion, deposition compaction, cementation, melting and cooling
- Energy resources (renewable resources, nonrenewable resources advantages and disadvantage of each, conservation methods)
- Weather patterns (air masses, pressure systems, severe weather, clouds, types of precipitation)
- Plate tectonic theory (continental drift, Pangaea, plate boundaries, evidence to support it)
- Characteristics of Earth (size, shape, age, temperature, features of it, etc..)
- Earth's place in space (location of Earth in the solar system, the Milky Way, and the scale of the universe)
- Erosional forces on the surface of Earth (Effects of wind, running water, glaciers, and gravity)
- Structure of the Universe (scale of universe, galaxies, solar system)
- Human impact on Earth (pollution effects on air, water, and land, the role of conservation of resources, and methods of recycling)
- Greenhouse Effect (global warming, role of carbon dioxide, causes)
- Seasons (causes of seasons, earths tilt and revolution, solstice, equinox)
- Earth Motions (rotation, revolution, tilt, seasons)
- Atmosphere makeup (layers, gases present, characteristics)
- Sun (structure, layers, characteristics, effect on Earth)
- Stars and galaxies (life cycle of stars, types of stars and galaxies)
- Moon –features and phases(,characteristics, origin)
- Ocean water, currents, and tides (salinity levels, shoreline features created by waves)
- Earthquakes- faults, seismic waves,(earthquake belts of the world, locating epicenters, famous earthquakes in history)
- Volcanoes- types, and where they form (structure, famous eruptions in history)
- Soil profiles (horizons, characteristics of each horizon, prevention of erosion)
- Space exploration history (space race with Russia, rocketry development, people in space, moon missions, space shuttle program, space station program)
- Tools of astronomy (telescopes land based and space)
- Climate. (classification of climates, climate zones of the world, characteristics of specific climates of the world, adaptations of living things in specific climates)

Appendix G

9th Grade Essential Skills

Ninth grade teachers at Mandan High School in Mandan Public Schools have determined that in order to be successful in science students entering 9th grade need specific science knowledge and skills.

Science

Upon entering 9th Grade students need to be able to:

1. Name all of the parts of a microscope and their functions
2. Focus specimens under high power using a microscope
3. Prepare a wet mount slide
4. Read a thermometer
5. Read a ruler and measure distances
6. Know the names of various dissecting instruments and know when to use them
7. Record observations in complete sentences
8. Calculate area and volume in metric units
9. Estimate distance, volume and mass of objects within a reasonable range of acceptance
10. Manipulate a formula with a single variable
11. Add, subtract, and multiply single digit values without a calculator
12. Follow the order of operations when simplifying mathematical expressions
13. Understand scientific notation and be able to multiply a value by 10 without a calculator
14. Read and follow instructions involving multiple steps
15. Measure and record empirical data in a data table
16. Plot experimental data in various types of graphs
17. Perform a simple controlled experiment to test a hypothesis
18. Demonstrate basic safe laboratory procedures
19. Prepare a simple Powerpoint presentation with text and graphics
20. Generate a graph using a computer
21. Follow computer instructions and conduct virtual investigations.

Appendix H

6th Grade Science Plan

Chapter 1	Kingdoms
4 lessons	August 31-September 24
Chapter 2	Ecosystems
2 lessons	September 26-October 8

Chapters 3 and 4 are covered in 6th grade Health.

Chapter 9	Matter
3 lessons	October 11-October 25
Chapter 10	Heat Energy
3 lessons	November 1-November 24
Chapter 11	Electricity/Magnetism
4 lessons	November 29-December 22
Chapter 12	Motion
3 lessons	January 3-January 21
Chapter 13	Work/Machine
3 lessons	January 24-February 17
Chapter 5	Earth-Moon
3 lessons	February 22-March 9
Chapter 6	Solar System
4 lessons	March 14-April 8
Chapter 7	Earth's Crust
3 lessons	April 11-April 29
Chapter 8	Earth Changes
4 lessons	May 2-May 20

Appendix I

7th Grade Science Plan

Content/Topic	Duration of Time	Chapters
Exploring Life	4 weeks	1, 2, 9,
Cells	6 weeks	3, 4, 10
Genetics	6 weeks	5, 6, 7, 8, 28
Anatomy/Body Systems	6 weeks	22-28
Animals and Survival	6 weeks	9, 14-17
Ecology, Plants, Fungi	7 weeks	9, 11-13, 18-21
Final Review and Text	1 week	All

Appendix J

8th Grade Science Plan

Geology 18 weeks

What is Earth Science 1wk

Earth Chemistry 1.5 wk

Minerals 1 wk

Rocks 1.5 wk

Earth Views 1.5 wk

Weathering and Soil 1 wk

Erosion Forces 1 wk

Running Water 1wk

Earthquakes 1.5 wk

Volcanoes 1.5 wk

Plate Tectonics 1.5 wk

Earths Past 1 wk

Geologic Time 1 wk

Energy Resources 1wk

Astronomy 10 weeks

Space Exploration 2.5 wk
Sun, Moon, Earth Systems 2.5 wk
The Solar System 2.5 wk
Stars, Galaxies and Universe 2.5 wk

Human Impact on Earth Resources 1wk

Meteorology 5 weeks
Atmosphere 1.5 wk
Weather 2wk
Climate 1.5 wk

Oceanography 3 weeks
Waves, Tides, and Currents 1.5 wk
Seafloor and Life in the Ocean 1.5 wk