Voluntary State Curriculum – Science

1.0 Skills and Processes – Students will demonstrate the thinking and acting inherent in the practice of science.

Introduction **From their very first day in school, students should be actively engaged in learning to view the world scientifically. That means encouraging them to ask questions about nature and to seek answers, collect things, count and measure things, make and record qualitative observations using simple diagrams, illustrations, and oral or written language, organize collections and observations, discuss findings, etc. Getting into the spirit of science and liking science are what count most. By the end of Grade 2, children will have had multiple experiences with applying and practicing all of the listed science skills and processes across the concept areas.**	**Introduction** **Children's strategies for finding out more and more about their surroundings improve as they gain experience in conducting simple investigations of their own and working in small groups. They should be encouraged to observe more and more carefully, measure things with increasing accuracy, record data clearly in logs and journals, and communicate their results in charts and simple graphs as well as in prose. Class discussions of the procedures and findings can provide the beginnings of scientific argument and debate. By the end of Grade 5, children will have had multiple experiences applying and practicing all of the listed science skills and processes across the concept areas.**	**Introduction** **At this level, students need to become more systematic and sophisticated in conducting their investigations, some of which may last for weeks or more. This means closing in on an understanding of what constitutes a good investigation and explicitly discussing how explanation relates to experimental design. Even though the main purpose of student investigations is to help students learn how science works, it is important to back up such experience with selected readings. Scientific explanation of the material world is built on theories and this is a good time to introduce a) an understanding of how theories are constructed and find both historical and modern examples of the theory development process; and b) an appreciation for the explanatory and predictive power of theories. By the end of Grade 8, children will have had multiple experiences applying and practicing all of the listed science skills and processes across the concept areas.**
PreKindergarten – Grade 2	Grades 3 -5	Grades 6-8
A. Constructing Knowledge 1. **Raise questions about the world around them and be willing to seek answers to some of them by making careful observations and trying things out.** a. Describe what can be learned about things by just observing those things carefully and adding information by sometimes doing something to the things and noting what happens. b. Seek information through reading, observation, exploration, and investigations. c. Use tools such as thermometers, magnifiers, rulers, or balances to extend their senses and gather data. d. Explain that when a science investigation is done the way it was done before, we expect to get a very similar result. e. Participate in multiple experiences to verify that science investigations generally work the same way in different places. f. Suggest things that you could do to find answers to questions raised by observing objects and/or phenomena (events such as, water disappearing from the classroom aquarium or a pet's water bowl). g. Use whole numbers and simple, everyday fractions in ordering, counting, identifying, measuring, and describing things and experiences.	A. Constructing Knowledge 1. **Gather and question data from many different forms of scientific investigations which include reviewing appropriate print resources, observing what things are like or what is happening somewhere, collecting specimens for analysis, and doing experiments.** a. Support investigative findings with data found in books, articles, and databases, and identify the sources used and expect others to do the same. b. Select and use appropriate tools hand lens or microscope (magnifiers), centimeter ruler (length), spring scale (weight), balance (mass), Celsius thermometer (temperature), graduated cylinder (liquid volume), and stopwatch (elapsed time) to augment observations of objects, events, and processes. c. Explain that comparisons of data might not be fair because some conditions are not kept the same. d. Recognize that the results of scientific investigations are seldom exactly the same, and when the differences are large, it is important to try to figure out why. e. Follow directions carefully and keep accurate records of one's work in order to compare data gathered. f. Identify possible reasons for differences in results from investigations including unexpected differences in the methods used or in the circumstances in which the investigation is carried out, and sometimes just because of uncertainties in observations. g. Judge whether measurements and computations of quantities are reasonable in a familiar context by comparing them to typical values when measured to the nearest: • Millimeter - length • Square centimeter - area • Milliliter - volume • Newton – weight • Gram - mass • Second - time • Degree C - temperature	A. Constructing Knowledge 1. **Design, analyze, or carry out simple investigations and formulate appropriate conclusions based on data obtained or provided.** a. Explain that scientists differ greatly in what phenomena they study and how they go about their work. b. Develop the ability to clarify questions and direct them toward objects and phenomena that can be described, explained, or predicted by scientific investigations. c. Explain and provide examples that all hypotheses are valuable, even if they turn out not to be true, if they lead to fruitful investigations. d. Locate information in reference books, back issues of newspapers, magazines and compact disks, and computer databases. e. Explain that if more than one variable changes at the same time in an investigation, the outcome of the investigation may not be clearly attributable to any one of the variables. f. Give examples of when further studies of the question being investigated may be necessary. g. Give reasons for the importance of waiting until an investigation has been repeated many times before accepting the results as correct. h. Use mathematics to interpret and communicate data. i. Explain why accurate record-keeping, openness, and replication are essential for maintaining an investigator's credibility with other scientists and society.

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PreKindergarten – Grade 2	Grades 3 -5	Grades 6 - 8
B. Applying Evidence and Reasoning 1. **People are more likely to believe your ideas if you can give good reasons for them.** a. Provide reasons for accepting or rejecting ideas examined. b. Develop reasonable explanations for observations made, investigations completed, and information gained by sharing ideas and listening to others' ideas. c. Explain why it is important to make some fresh observations when people give different descriptions of the same thing.	B. Applying Evidence and Reasoning 1. **Seek better reasons for believing something than "Everybody knows that . . ." or "I just know" and discount such reasons when given by others.** a. Develop explanations using knowledge possessed and evidence from observations, reliable print resources, and investigations. b. Offer reasons for their findings and consider reasons suggested by others. c. Review different explanations for the same set of observations and make more observations to resolve the differences. d. Keep a notebook that describes observations made, carefully distinguishes actual observations from ideas and speculations about what was observed, and is understandable weeks or months later.	B. Applying Evidence and Reasoning 1. **Review data from a simple experiment, summarize the data, and construct a logical argument about the cause-and-effect relationships in the experiment**. a. Verify the idea that there is no fixed set of steps all scientists follow, scientific investigations usually involve the collection of relevant evidence, the use of logical reasoning, and the application of imagination in devising hypotheses and explanations to make sense of the collected evidence. b. Explain that what people expect to observe often affects what they actually do observe and that scientists know about this danger to objectivity and take steps to try to avoid it when designing investigations and examining data. c. Explain that even though different explanations are given for the same evidence, it is not always possible to tell which one is correct. d. Describe the reasoning that lead to the interpretation of data and conclusions drawn. e. Question claims based on vague statements or on statements made by people outside their area of expertise.
C. Communicating Scientific Information 1. **Ask ,"How do you know?" in appropriate situations and attempt reasonable answers when others ask them the same question.** a. Describe things as accurately as possible and compare observations with those of others. b. Describe and compare things in terms of number, shape, texture, size, weight, color, and motion. c. Draw pictures that correctly portray at least some features of the thing being described and sequence events (seasons, seed growth). d. Have opportunities to work with a team, share findings with others, and recognize that all team members should reach their own conclusions about what the findings mean. e. Recognize that everybody can do science and invent things and ideas.	C. Communicating Scientific Information 1. **Recognize that clear communication is an essential part of doing science because it enables scientists to inform others about their work, expose their ideas to criticism by other scientists, and stay informed about scientific discoveries around the world.** a. Make use of and analyze models, such as tables and graphs to summarize and interpret data. b. Avoid choosing and reporting only the data that show what is expected by the person doing the choosing. c. Submit work to the critique of others which involves discussing findings, posing questions, and challenging statements to clarify ideas. d. Construct and share reasonable explanations for questions asked. e. Recognize that doing science involves many different kinds of work and engages men and women of all ages and backgrounds.	C. Communicating Scientific Information 1. **Develop explanations that explicitly link data from investigations conducted, selected readings and, when appropriate, contributions from historical discoveries.** a. Organize and present data in tables and graphs and identify relationships they reveal. b. Interpret tables and graphs produced by others and describe in words the relationships they show. c. Give examples of how scientific knowledge is subject to modification as new information challenges prevailing theories and as a new theory leads to looking at old observations in a new way. d. Criticize the reasoning in arguments in which • Fact and opinion are intermingled • Conclusions do not follow logically from the evidence given. • Existence of control groups and the relationship to experimental groups is not made obvious. • Samples are too small, biased, or not representative. e. Explain how different models can be used to represent the same thing. What kind of a model to use and how complex it should be depend on its purpose. Choosing a useful model is one of the instances in which intuition and creativity come into play in science, mathematics, and engineering f. Participate in group discussions on scientific topics by restating or summarizing accurately what others have said, asking for clarification or elaboration, and expressing alternative positions. g. Recognize that important contributions to the advancement of science, mathematics, and technology have been made by different kinds of people, in different cultures, at different times.

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PreKindergarten – Grade 2	Grades 3-5	Grades 6-8
D. Technology	D. Technology	D. Technology
Design and Systems **Design Constraints** **Children should design and make things with simple tools and a variety of materials. They should identify a need or opportunity of interest to them, and then plan, design, make, evaluate, and modify the design with appropriate help. Children may be inclined to go with their first design notion having little practice or experience in testing or revision.. Where possible, they should be encouraged to improve their ideas, but it is more important that they develop confidence in their ability to think up and carry out design projects. When their projects are complete, children can tell what they like about each other's designs.**	**Design and Systems** **Design Constraints** **As students undertake more extensive design projects, emphasis should be placed on the notion that there usually is not one best design for a product or process, but a variety of alternatives and possibilities. One way to accomplish this goal is to have several groups design and execute solutions to the same problem and then discuss the advantages and disadvantages of each solution. Ideally, the problems should be "real" and engaging for the students.**	**Design and Systems** **Design Constraints** **An idea to be developed in the middle grades is that complex systems require control mechanisms. The common thermostat for controlling room temperature is known to most students and can serve as a model for all control mechanisms. However, students should explore how controls work in various kinds of systems-machines, athletic contests, politics, the human body, learning, etc. At some point, students should try to invent control mechanisms, which need not be mechanical or electrical, that they can actually put into operation.**
1. **Design and make things with simple tools and a variety of materials.** a. Make something out of paper, cardboard, wood, plastic, metal, or existing objects that can actually be used to perform a task. b. Recognize that tools are used to do things better or more easily and to do some things that could not otherwise be done at all. c. Assemble, describe, take apart and reassemble constructions using interlocking blocks, erector sets and the like. d. Recognize that some kinds of materials are better than others for making any particular thing, for example, materials that are better in some ways (such as stronger and cheaper) may be worse in other ways (such as heavier and harder to cut). e. Explain that sometimes it is not possible to make or do everything that is designed.	1. **Develop designs and analyze the products: "Does it work?" "Could I make it work better?" "Could I have used better materials?"** a. Choose appropriate common materials for making simple mechanical constructions and repairing things. b. Realize that there is no perfect design and that usually some features have to be sacrificed to get others, for example, designs that are best in one respect (safety or ease of use) may be inferior in other ways (cost or appearance). c. Identify factors that must be considered in any technological design—cost, safety, environmental impact, and what will happen if the solution fails.	1. **Explain that complex systems require control mechanisms.** a. Explain that the choice of materials for a job depends on their properties and on how they interact with other materials. b. Demonstrate that all control systems have inputs, outputs, and feedback. c. Realize that design usually requires taking constraints into account. (Some constraints, such as gravity or the properties of the materials to be used, are unavoidable. Other constraints, including economic, political, social, ethical, and aesthetic ones also limit choices.) d. Identify reasons that systems fail—they have faulty or poorly matched parts, are used in ways that exceed what was intended by the design, or were poorly designed to begin with.
Designed Systems **Students should practice identifying the parts of things and how one part connects to and affects another. Classrooms can have available a variety of dissectible and rearrangeable objects, such as gear trains and toy vehicles and animals, as well as conventional blocks, dolls, and doll houses. Students should predict the effects of removing or changing parts.**	**Designed Systems** **Hands-on experience with a variety of mechanical systems should increase. Classrooms can have "take-apart" stations where a variety of familiar hardware devices can be taken apart (and perhaps put back together) with hand tools. Devices that are commonly purchased disassembled can be provided, along with assembly instructions, to emphasize the importance of the proper arrangement of parts (and incidentally, the importance of language-arts skills, which are needed to read and follow instructions).**	**Designed Systems** **Systems thinking can now be made explicit--suggesting analysis of parts, subsystems, interactions, and matching. Student projects should now entail analyzing, designing, assembling, and troubleshooting systems--mechanical, electrical, and biological--with easily discernable components. The idea of system should be expanded to include connections among systems. For example, a can opener and a can may each be thought of as a system, but they both--together with the person using them--form a larger system without which neither can be put to its intended use.**
1. **Practice identifying the parts of things and how one part connects to and affects another.** a. Investigate a variety of objects to identify that most things are made of parts b. Explain that something may not work if some of its parts are missing. c. Explain that when parts are put together, they can do things that they couldn't do by themselves.	1. **Investigate a variety of mechanical systems and analyze the relationship among the parts.** a. Realize that in something that consists of many parts, the parts usually influence one another. b. Explain that something may not work as well (or at all) if a part of it is missing, broken, worn out, mismatched, or misconnected.	1. **Analyze, design, assemble and troubleshoot complex systems.** a. Provide evidence that a system can include processes as well as things. b. Explain that thinking about things as systems means looking for how every part relates to others. (The output from one part of a system (which can include material, energy, or information) can become the input to other parts. Such feedback can serve to control what goes on in the system as a whole.) c. Analyze any system to determine its connection, both internally and externally to other systems and explain that a system may be thought of as containing subsystems and as being a subsystem of a larger system.

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Voluntary State Curriculum – Science

PreKindergarten – Grade 2	Grades 3-5	Grades 6-8
D. Technology	D. Technology	D. Technology
Making Models **Every opportunity should be taken to get students to talk about how the things they play with relate to real things in the world, such as toys, illustrated books, building materials, role play, picture puzzles, sculpture, etc. The more imaginative the conversation the better, for insisting upon accuracy at this level may hinder other important developments.**	**Making Models** **As students develop beyond their natural play with models, they should begin to modify them and discuss their limitations. What happens if wheels are taken off, or weight is added, if different materials are used, or if the model gets wet? Is that what would happen to the real things? Students also can begin to compare their objects, drawings, and constructions to the things they portray or resemble (real houses, airplanes, etc.). Students can begin to formulate their own models to explain things they cannot observe directly. By testing their models and changing them as more information is acquired, they begin to understand how science works.**	**Making Models** **Models and their use can now be dealt with much more explicitly than before because students have a greater general knowledge of mathematics, literature, art, and the objects and processes around them. Students should have many opportunities to learn how conceptual models can be used to suggest interesting questions, such as "What would the atmosphere be like if its molecules were to act like tiny, high-speed marshmallows instead of tiny, high-speed steel balls?" The use of physical models also can increase in sophistication. Students should discover that physical models on a reduced scale may be inadequate because of scaling effects.**
1. **Examine a variety of physical models and describe what they teach about the real things they are meant to resemble.** a. Explain that a model of something is different from the real thing but can be used to learn something about the real thing. b. Realize that one way to describe something is to say how it is like something else.	1. **Examine and modify models and discuss their limitations.** a. Explain that a model is a simplified imitation of something and that a model's value lies in suggesting how the thing modeled works. b. Investigate and describe that seeing how a model works after changes are made to it may suggest how the real thing would work if the same were done to it. c. Explain that models, such as geometric figures, number sequences, graphs, diagrams, sketches, number lines, maps, and stories can be used to represent objects, events, and processes in the real world, although such representations can never be exact in every detail. d. Realize that one way to make sense of something is to think how it is like something more familiar.	1. **Analyze the value and the limitations of different types of models in explaining real things and processes.** a. Explain that the kind of model to use and how complex it should be depends on its purpose and that it is possible to have different models used to represent the same thing. b. Explain, using examples that models are often used to think about processes that happen too slowly, too quickly, or on too small a scale to observe directly, or that are too vast to be changed deliberately, or that are potentially dangerous. c. Explain that models may sometimes mislead by suggesting characteristics that are not really shared with what is being modeled.

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2.0 Earth/Space Science – Students will use scientific skills and processes to explain the chemical and physical interactions (i.e., natural forces and cycles, transfer of energy) of the environment, Earth, and the universe that occur over time.

Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8
A. Materials and Processes That Shape A Planet	A. Materials and Processes That Shape A Planet	A. Materials and Processes That Shape A Planet	A. Materials and Processes That Shape A Planet	A. Materials and Processes That Shape A Planet	A. Materials and Processes That Shape A Planet
	2. **Recognize and explain how physical weathering and erosion cause changes to Earth's surface.** a. Investigate and describe how weathering wears down Earth's surface. • Water • Ice • Wind b. Cite evidence to show that erosion shapes and reshapes the Earth's surface as it moves Earth's materials from one location to another. • Water • Ice • Wind	2. **Cite and describe the processes that cause rapid or slow changes in Earth's surface.** a. Identify and describe events such as tornadoes, hurricanes, volcanic eruptions, earthquakes, and flooding which change surface features rapidly. b. Recognize that the natural force of gravity causes changes in Earth's surface features as it pulls things toward Earth, as in mud and rock slides, avalanches, etc. c. Cite examples that demonstrate how the natural agents of wind , water, and ice produce slow changes on the Earth's surface such as carving out deep canyons and building up sand dunes.	2. **Cite evidence to demonsrate and explain that physical weathering and chemical weathering cause changes to Earth materials.** a. Identify examples of physical weathering, such as the effect of wind, ice, etc. and describe the changes caused in each. b. Describe the changes in materials caused by each of the chemical weathering processes listed: • Rusting/tarnishing • Dissolving by acid rain c. Compare physical and chemical weathering and provide examples of changes caused in Earth materials or features by each of these processes.		

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Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8
A. Materials and Processes That Shape A Planet	A. Materials and Processes That Shape A Planet	A. Materials and Processes That Shape A Planet 3. **Explain how rock is formed from combinations of different minerals and that smaller rocks come from the breakage and weathering of bedrock (solid rock underlying soil components) and larger rocks; soil is made partly from weathered rock, partly from plant remains—and also contains many living organisms**. a. Observe and classify a collection of minerals based on their physical properties. • Color • Luster • Hardness • Streak b. Identify and compare the properties of rocks that are composed of a single mineral with those of other rocks made of several minerals using their physical properties. c. Describe ways that the following processes contribute to changes always occurring to the Earth's surface. • Weathering • Erosion • Deposition	A. Materials and Processes That Shape A Planet	A. Materials and Processes That Shape A Planet	A. Materials and Processes That Shape A Planet
			4. **Differentiate among sedimentary, igneous, and metamorphic rocks based upon the processes by which they are formed.** a. Identify and describe the processes that form sedimentary rock. • Deposition • Compaction • Cementation b. Identify and describe the processes that form igneous rocks • Volcanic eruptions • Igneous intrusions c. Identify and describe the processes that form metamophic rocks. • High temperature • Pressure d. Cite features that can be used as evidence to distinguish among the three types of rocks and relate these features to the processes that form each rock type. e. Describe the processes that change one form of rock into another (rock cycle).		

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Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8
B. Earth History	B. Earth History	B. Earth History	B. Earth History	B. Earth History	B. Earth History 1. **Explain how sedimentary rock is formed periodically, embedding plant and animal remains and leaving a record of the sequence in which the plants and animals appeared and disappeared.** a. Explain how sedimentary rock buried deep enough may be reformed by pressure and heat and these re-formed rock layers may be forced up again (uplift) to become land surface and even mountains. b. Cite evidence to confirm that thousands of layers of sedimentary rock reveal the long history of the changing surface of the Earth c. Explain why some fossils found in the top layers of sedimentary rock are older then those found beneath in lower layers. • Folding • Breaking • Uplift • Faulting • Tilting
	2. **Recognize and explain that fossils provide evidence about the plants and animals that lived long ago and about the nature of the environment at that time.** a. Recognize and explain that the remains or imprints of plants or animals can become fossils. b. Describe the physical structures of an animal or plant based on its fossil remains. c. Identify what an animal or plant fossil is able to tell about the environment in which it lived. • Water • Land				2. **Recognize and explain that fossils found in layers of sedimentary rock provide evidence of changing life forms.** a. Recognize how different types of fossils are formed, such as petrified remains, imprints, molds and casts. b. Recognize and explain that the fossil record of plants and animals describes changes in life forms over time.

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Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8
C. Plate Tectonics 1. **Gather information and provide evidence about the physical environment, becoming familiar with the details of geological features, observing and mapping locations of hills, valleys, rivers, and canyons.** a. Identify and describe some natural features of continents. • Mountains • Valleys • Rivers • Canyons b. Describe the natural features in their immediate outdoor environment, and compare the features with those of another region in Maryland. c. Identify and describe some features of the ocean floor. • Mountains • Valleys • Canyons d. Recognize and explain that an ocean floor is land covered by water.	C. Plate Tectonics	C. Plate Tectonics	C. Plate Tectonics 1. **Recognize and describe the internal and external structure of the Earth.** a. Recognize and describe that the Earth's mantle • Lies between the core and the crust • Is very hot • Has properties of both solids and liquid b. Recognize and describe that the Earth's core • Is at the center of the Earth • Is very hot • Is dense and metalllic c. Identify and describe the Earth's crust. • The solid crust consists of separate plates • The plates constantly move in different directions due to convection currents • The plates interact with one another as a result of plate motion.	C. Plate Tectonics	C. Plate Tectonics
			2. **Recognize and explain how major geologic events are a result of the movement of Earth's crustal plates.** a. Recognize and describe the evidence for plate movement. • Shape of continents • Continuity of geologic features and fossils on the continents • Ocean rifts, seafloor spreading • Global patterns of earthquakes and volcanoes b. Recognize and explain that major geologic events (earthquakes, volcanic activity, sea floor spreading) occur along crustal plate boundaries.		

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Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8
D. Astronomy	D. Astronomy 1. **Identify and describe the variety of objects in the universe through first-hand observations using the unaided eye, binoculars or telescopes or videos and/or pictures from reliable sources .** a. Observe and describe the stars and the planets as seen through a telescope, graphically in pictures or in video clips from reliable sources. b. Identify the sun as the Earth's closest star. c. Recognize that stars are like the sun, some are smaller and some larger. d. Recognize and describe that the stars are not all the same in apparent brightness. e. Recognize that the pattern of stars in the sky stays the same although their locations in the sky appear to change with the seasons.	D. Astronomy 1. **Identify and compare properties, location, and movement of celestial objects in our solar system.** a. Recognize that like all planets and stars, the Earth is spherical in shape. b. Identify the properties of the planet Earth that make it possible for the survival of life as we know it. • Temperature • Location • Presence of an atmosphere • Presence of water (solid, liquid, and gas) c. Compare the properties of at least one other planet in our solar system to those of Earth to determine if it could support life, as we know it. d. Identify and describe physical properties of comets, asteroids, and meteors. e. Provide evidence that supports the idea that our solar system is sun-centered.	D. Astronomy 1. **Recognize that objects of our solar system are interrelated.** a. Recognize that Earth and its closest star, the sun, are part of a disk-shape galaxy of stars and that our galaxy is one of billions of galaxies. b. Construct models with accurate scale that represent the position of the Earth relative to the sun and to other planets. c. Identify and describe the general pattern of movement of all objects in our solar system. d. Recognize that the pull of gravity causes the pattern of motion of celestial objects.	D. Astronomy	D. Astronomy 1. **Identify and describe the components of the universe.** a. Recognize that a galaxy contains billions of stars that cannot be distinguished by the unaided eye because of their great distance from Earth, and that there are billions of galaxies. b. Identify that our solar system is a component of the Milky Way Galaxy. c. Identify and describe the various types of galaxies d. Identify and describe the type, size, and scale, of the Milky Way Galaxy.

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Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8
D. Astronomy	D. Astronomy	D. Astronomy 2. **Recognize and describe the causes of the repeating patterns of celestial events.** a. Describe the rotation of the planet Earth on its axis. b. Recognize and describe that the rotation of planet Earth produces observable effects • The day and night cycle. • The apparent movement of the sun, moon, planets, and stars c. Describe the revolution of the planet Earth around the sun. d. Recognize and describe that the revolution of the planet Earth produces effects. • The observable patterns of stars in the sky stay the same although different stars can be seen in different seasons. • Length of year e. Verify with models and cite evidence that the moon's apparent shape and position change.	D. Astronomy	D. Astronomy	D. Astronomy 2. **Identify and explain celestial phenomena using the regular and predictable motion of objects in the solar system.** a. Identify and describe the relationships among the period of revolution of a planet, the length of its solar year, and its distance from the sun. b. Identify and explain the relationship between the rotation of a planet or moon on its axis and the length of the solar day for that celestial object. c. Identify and explain the cause of the phases of the moon. d. Describe how lunar and solar eclipses occur. e. Identify and describe how the shape and location of the orbits of asteroids and comets affect their periods of revolution.

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Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8
D. Astronomy	D. Astronomy	D. Astronomy	D. Astronomy	D. Astronomy	D. Astronomy 3. **Recognize and explain the effects of the tilt of Earth's axis.** a. Recognize and describe that Earth's axis is tilted about 23º from vertical with respect to the plane of its orbit and points in the same direction during the year. b. Recognize and describe that as Earth orbits the sun, the tilt of Earth's axis causes • Changes in the angle of the sun in the sky during the year • Seasonal differences in the northern and southern latitudes c. Recognize and describe how the tilt of Earth's axis affects the climate in Maryland.
					4. **Recognize and explain how the force of gravity causes the tides.** a. Identify and describe the cause of high and low tides.

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Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8
E. Interactions of Hydrosphere and Atmosphere 1. **Recognize and describe that water can be found as a liquid or a solid on the Earth's surface and as a gas in the Earth's atmosphere.** a. Describe that air is a substance that surrounds us and contains such things as oxygen, water vapor (gas), pollen, dust, etc. b. Observe and explain what happens when liquid water disappears. • Turns into water vapor (gas) in the air • Can reappear as a liquid or solid when cooled, such as clouds, fog, rain, snow, etc.	E. Interactions of Hydrosphere and Atmosphere .	E. Interactions of Hydrosphere and Atmosphere 1. **Recognize and describe that the amount of water on Earth continues to stay the same even though it may change from one form to another.** a. Describe how water on Earth changes. • Condensation • Precipitation • Evaporation b. Explain that the sun is the main source of energy that causes the changes in the water on Earth. c. Describe the relationship between the amount of energy from the sun and the quantity of water that is changed. d. Describe the processes that maintain a continuous water cycle.	E. Interactions of Hydrosphere and Atmosphere	E. Interactions of Hydrosphere and Atmosphere	E. Interactions of Hydrosphere and Atmosphere 1. **Cite evidence to explain the relationship between the hydrosphere and atmosphere.** a. Describe the composition of the atmosphere and hydrosphere. b. Recognize and describe the water cycle as the distribution and circulation of Earth's water through the glaciers, surface water, groundwater, oceans, and atmosphere. c. Identify and describe how the temperature and precipitation in a geographic area are affected by surface features and changes in atmospheric and ocean content. • Relative location of mountains • Volcanic eruptions • Proximity (closeness) to large bodies of water • Heat energy of ocean currents
	2. **Recognize and describe that each season has different weather conditions.** a. Describe different seasonal weather conditions using data collected from weather instruments, models or drawings. b. Compare average daily temperatures during different seasons. c. Compare average daily wind speed and direction during different seasons. d. Compare average daily precipitation during different seasons. • Amount • Type				2. **Recognize and describe the various factors that affect climate.** a. Identify and describe how the temperature and precipitation of an area are affected by surface and ocean features. • Relative location of mountains • Proximity (closeness) to large bodies of water • Warm and cold ocean currents b. Recognize and describe the global effects of volcanic eruptions, greenhouse gases, and El Nino.

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Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8
E. Interactions of Hydrosphere and Atmosphere	E. Interactions of Hydrosphere and Atmosphere	E. Interactions of Hydrosphere and Atmosphere	E. Interactions of Hydrosphere and Atmosphere	E. Interactions of Hydrosphere and Atmosphere	E. Interactions of Hydrosphere and Atmosphere 3. **Identify and describe the atmospheric and hydrospheric conditions related to weather systems.** a. Identify and describe weather patterns associated with high and low pressure systems and the four frontal systems using appropriate data displays including weather maps. b. Identify and describe the atmospheric and hydrospheric conditions associated with the formation and development of hurricanes, tornadoes, and thunderstorms. c. Identify and describe how various tools are used to collect weather data and forecast weather conditions. • Barometer • Thermometer • Anemometer • Psychrometer

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3.0 Life Science – The students will use scientific skills and processes to explain the dynamic nature of living things, their interactions, and the results from the interactions that occur over time.

Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8
A. Diversity of Life	A. Diversity of Life 1. **Explain how animals and plants can be grouped according to observable features.** a. Observe and compile a list of a variety of animals or plants in both familiar and unfamiliar environments. b. Classify a variety of animals and plants according to their observable features and provide reasons for placing them into different groups. c. Given a list of additional animals or plants, decide whether or not they could be placed within the established groups or does a new group have to be added. d. Describe what classifying tells us about the relatedness among the animals or plants placed within any group.	A. Diversity of Life 1. **Explain the idea that in any particular environment, some kinds of plants and animals survive well, some less well, and some cannot survive at all.** a. Identify and describe features and behaviors of some of the plants and animals living in a familiar environment and explain ways that these organisms are well suited to their environment. b. Based on information about the features and behaviors of animals and plants from very different environments describe reasons that they might not survive if their environment changed or if they were moved from one environment to another. c. State reasons why certain animals such as whales, salmon, could not survive in the Chesapeake Bay. d. Research the kind of environment needed by the Maryland blue crab, the Black-eyed Susan (Maryland's state flower), or another Maryland native organism. e. Explain that the survival of individual organisms and entire populations can be affected by sudden (flood, Tsunami) or slow (global warming, air pollution) changes in the environment.	A. Diversity of Life	A. Diversity of Life 1. **Compile evidence to verify the claim of biologists that the features of organisms connect or differentiate them—these include external and internal structures (features) and processes**. a. Provide examples and explain that organisms sorted into groups share similarities in external structures as well as similarities in internal anatomical structures and processes which can be used to infer the degree of relatedness among organisms • Vascular – non-vascular plants • Closed – open circulatory systems • Asexual – sexual reproduction • Respiration (lungs-gills-skin) • Digestion b. Identify general distinctions among organisms that support classifying some things as plants, some as animals, and some that do not fit neatly into either group. • Animals consume food • Plants make food c. Use analogies, models, or drawings to represent that animals and plants have a great variety of body plans and internal structures that define the way they live, grow, survive, and reproduce.	A. Diversity of Life

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Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8
B. Cells 1. **Explore the world of minute living things to describe what they look like, how they live, and how they interact with their environment.** a. Use magnifying instruments to observe and describe using drawings or text (oral or written) minute organisms, such as brine shrimp, algae, aphids, etc. that are found in different environments. b. Describe any observable activity displayed by these organisms. c. Provide reasons that support the conclusion that these organisms are alive. d. Use information gathered about these minute organisms to compare mechanisms they have to satisfy their basic needs to those used by larger organisms.	B. Cells	B. Cells 1. **Provide evidence from observations and investigations to support the idea that some organisms consist of a single cell.** a. Use microscopes, other magnifying instruments, or video technology to observe, describe, and compare single celled organisms, such as amoeba, euglena, paramecium, etc. b. Describe the observable behaviors of single celled organisms c. Cite evidence from data gathered that supports the idea that most single celled organisms have needs similar to those of multicellular organisms.	B. Cells	B. Cells 1. **Gather and organize data to defend or argue the proposition that all living things are cellular (composed of cells) and that cells carry out the basic life functions.** a. Use microscopes or other magnifying instruments to observe, describe, and compare the cellular composition of different body tissues and organs in a variety of organisms (animals and plants). b. Based on data from readings and designed investigations, cite evidence to illustrate that the life functions of multicellular organisms (plant and animal) are carried out within complex systems of different tissues, organs and cells. • Extracting energy from food • Getting rid of wastes • Making new materials c. Based on research and examples from video technology explain that the repeated division of cells enables organisms to grow and make repairs. d. Collect data from investigations using single celled organisms, such as yeast or algae to explain that a single cell carries out all the basic life functions of a multicellular organism. • Reproducing • Extracting energy from food • Getting rid of wastes e. Based on data compiled from a number of lessons completed, take and defend a position on the statement "The way in which cells function is the same in all organisms."	B. Cells

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Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8
B. Cells	B. Cells	B. Cells 2. **Investigate and provide evidence that living things are made mostly of cells that can be seen and studied only through a microscope.** a. Use microscopes and/or other video technology to investigate and describe that some organisms are composed of a collection of similar cells working together to meet basic needs of a "colony" of cells. b. Use microscopes and pictures to investigate, describe with drawings, and compare the cells in a variety of multicellular organisms, such as cells in elodea and onions; muscle cells, nerve cells, skin cells, etc in animals. c. Select information gathered from readings that provides evidence that some organisms' cells vary greatly in appearance and perform very different roles in the organism .	B. Cells	B. Cells 2. **Recognize and provide examples that human beings, like other organisms have complex body systems of cells, tissues and organs that interact to support an organism's growth and survival.** a. Describe and explain that the complex set of systems found in multicellular organisms are made up of different kinds of tissues and organs which are themselves composed of differentiated cells. b. Select several body systems and explain the role of cells, tissues and organs that effectively carry out a vital function for the organism, such as • Obtaining food and providing energy (digestive, circulatory, respiratory) • Defense (nervous, endocrine, circulatory, muscular, skeletal, immune) • Reproduction (reproductive, endocrine, circulatory) • Waste removal (excretory, respiratory, circulatory). • Breathing (respiratory, circulatory) c. Develop a response that explains the meaning of the statement, "The specialization of cells serves the operation of the organs, and the organs serve the needs of the cells." d. Investigate ways in which the various organs and tissues function to serve the needs of cells for food, air, and waste removal.	B. Cells

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Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8
C. Genetics	C. Genetics 1. **Explain that in order for offspring to resemble their parents, there must be a reliable way to transfer information from one generation to the next.** a. Describe traits found in animals and plants, such as eye color, height, leaf shape, seed type that are passed from one generation to another b. Explain that some likenesses between parents and offspring are inherited (such as eye color in humans, nest building in birds, or flower color in plants) and other likenesses are learned (such as language in humans) c. Raise questions based on observations of a variety of parent and offspring likenesses and differences, such as "Why don't all the puppies have the same traits, such as eye color and size as their parents?" or " How do traits get transferred?" d. Develop a reasonable explanation to support the idea that information is passed from parent to offspring.	C. Genetics	C. Genetics	C. Genetics **1. Explain the ways that genetic information is passed from parent to offspring in different organisms.** a. Investigate and explain that in some kinds of organisms, all the genes come from a single parent, whereas in organisms that have sexes, typically half of the genes come from each parent. b. Investigate and explain that in sexual reproduction, a single specialized cell from a female (egg) merges with a specialized cell from a male (sperm) and the fertilized egg now has genetic information from each parent, that multiplies to form the complete organism composed of about a trillion cells, each of which contains the same genetic information.. c. Investigate organisms that reproduce asexually to identify what traits they receive from the parent. d. Use information about how the transfer of traits from parent or parents to offspring occurs, to explain how selective breeding for particular traits has resulted in new varieties of cultivated plants and domestic animals. e. Identify evidence to support the idea that there is greater variation among offspring of organisms that reproduce sexually than among those that reproduce asexually.	C. Genetics

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Voluntary State Curriculum – Science

Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8
D. Evolution	D. Evolution 1. **Explain that individuals of the same kind differ in their characteristics, and sometimes the differences give individuals an advantage in surviving and reproducing.** a. Describe ways in which organisms in one habitat differ from those in another habitat and consider how these differences help them survive and reproduce. b. Explain that the characteristics of an organism affect its ability to survive and reproduce. c. Examine individuals in a group of the same kind of animals or plants to identify differences in characteristics, such as hearing ability in rabbits or keenness of vision in hawks that might give those individuals an advantage in surviving and reproducing. d. Examine and compare fossils to one another and to living organisms as evidence that some individuals survive and reproduce.	D. Evolution	D. Evolution 1. **Explain that in any particular environment, the growth and survival of organisms and species depend on the physical conditions.** a. Cite examples and describe that small differences between parents and offspring can accumulate (through selective breeding) in successive generations so that descendants are very different from their ancestors. b. Explain that in all environments- freshwater, marine, forest, desert, grassland, mountain, and others- organisms with similar needs may compete with one another for resources, including food, space, water, air, and shelter. c. Explain that in any particular environment individual organisms with certain traits are more likely than others to survive and have offspring. d. Explain, with examples, ways that people control some characteristics of plants and animals they raise by selective breeding. e. Describe ways in which changes in environmental conditions can affect the survival of individual organisms and entire species. f. Describe how sediments of sand and smaller particles (sometimes containing the remains of organisms) are gradually buried and are cemented together by dissolved minerals to form solid rock; and describe that such fossils provide evidence for the long history of changing life forms whose remains are found in the rocks. g. Explain that the more recently deposited rock layers are likely to contain fossils resembling existing species.	D. Evolution	D. Evolution 1. **Recognize and describe that evolutionary change in species over time occurs as a result of natural variation in organisms and environmental changes.** a. Recognize and describe that gradual (climatic) and sudden (floods and fires) changes in environmental conditions affect the survival of organisms and populations. b. Recognize that adaptations may include variations in structures, behaviors, or physiology, such as spiny leaves on a cactus, birdcalls, and antibiotic resistant bacteria. c. Recognize and describe that adaptation and speciation involve the selection of natural variations in a population. d. Recognize and describe that extinction occurs when the adaptive traits of a population do not support its survival. e. Recognize that evolution accounts for the diversity of species.

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Voluntary State Curriculum – Science

Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8
E. Flow of Matter and Energy 1. **Recognize that materials continue to exist even though they change from one form to another.** a. Identify and compile a list of materials that can be recycled. b. Identify what happens to materials when they are recycled. c. Observe and record the sequence of changes that occur to plants and animals that die and decay. d. Ask and develop possible answers to questions about what happens to the materials that living things are made of when they die.	E. Flow of Matter and Energy 1**. Recognize food as the source of materials that all living things need to grow and survive.** a. Classify the things that people and animals take into their bodies as food or not food. b. Describe what happens to food in plants and animals. • Contributes to growth • Supports repair • Provides energy • Is stored for future use • Is eliminated c. Identify the things that are essential for plants to grow and survive.	E. Flow of Matter and Energy 1. **Recognize that some source of energy is needed for all organisms to grow and survive**. a. Identify the sun as the primary source of energy for all living organisms. • Plants use sunlight to make food • Plants and animals use food for energy and growth b. Cite evidence from observations and research that some insects and various other organisms depend on dead plant and animal material for food. c. Provide examples that justify the statement “Most animals’ food can be traced back to plants.”	E. Flow of Matter and Energy	E. Flow of Matter and Energy 1. **Explain that the transfer and transformation of matter and energy links organisms to one another and to their physical setting.** a. Cite evidence from research and observations that food provides molecules that serve as fuel and building materials for all organisms. b. Cite evidence from research and observations that organisms that eat plants or animals break down what they have consumed (food) to produce the materials and energy they need to survive or store for later use. c. Investigate and describe the processes that enable plants to use the energy from light to make sugars (food) from carbon dioxide and water. d. Provide evidence from research to explain how plants can use the food they make immediately for fuel or stored for later use. e. Ask and seek answers to questions about the fact that transfer of matter between organisms continues indefinitely because organisms are decomposed after death to return food materials to the environment. f. Provide evidence that supports the premise “In the flow of matter system the total amount of matter remains constant even though its form and location change.” • Carbon cycle • Nitrogen cycle • Food chains and food webs	E. Flow of Matter and Energy

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Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8
F. Ecology	F. Ecology 1. **Explain ways that individuals and groups of organisms interact with each other and their environment.** a. Identify and describe the interactions of organisms present in a habitat. • Competition for space, food, and water • Beneficial interactions: nesting, pollination, seed dispersal, oysters filtering as in the Chesapeake Bay, etc. • Roles within food chains and webs: scavengers, decomposers, producers, consumers. b. Explain that changes in an organism's habitat are sometimes beneficial to it and sometimes harmful.	F. Ecology	F. Ecology 1. **Give reasons supporting the fact that the number of organisms an environment can support depends on the physical conditions and resources available.** a. Explain that populations increase or decrease relative to the availability of resources and the conditions of the environment. b. Identify and describe factors that could limit populations within any environment, such as disease, introduction of a nonnative species, depletion of resources, etc. c. Explain that within any environment organisms with similar needs may compete with one another for resources. d. Cite examples to illustrate that competition is reduced when organisms use different sets of resources, such as birds in a forest eat different kinds and sizes of seeds.	F. Ecology	F. Ecology

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4.0 Chemistry – Students will use scientific skills and processes to explain the composition, structure, and interactions of matter in order to support the predictability of structure and energy transformations

Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8
A. Structure of Matter 1. **Identify ways to classify objects using supporting evidence from investigations of observable properties.** a. Classify objects based on their observable properties. b. Provide reasons for placing the objects into groups. c. Compare classifications with those of others.	A. Structure of Matter 1. **Provide evidence to support the fact that matter has observable and measurable properties** a. Identify examples of matter. b. Describe and compare the physical properties of samples of matter. • Strength • Hardness • Flexibility • Ability to conduct heat • Ability to conduct electricity • Ability to be attracted by magnets c. Compare samples of like materials using appropriate tools to measure, estimate, and calculate size, capacities, masses and weights. d. Cite evidence that supports the statement, "All matter takes up space and contains a certain amount of material."	A. Structure of Matter	A. Structure of Matter	A. Structure of Matter 1. **Cite evidence to support the fact that all matter is made up of atoms, which are far too small to see directly through a microscope.** a. Recognize and describe that the atoms of each element are alike but different from atoms of other elements. b. Recognize and describe that different arrangements of atoms into groups compose all substances. c. Provide evidence from the periodic table, investigations and research to demonstrate that elements in the following groups have similar properties. • Highly reactive metals, such as magnesium and sodium • Less-reactive metals, such as gold and silver • Highly reactive non-metals, such as chlorine, fluorine, and oxygen • Almost non-reactive gases, such as helium and neon d. Provide examples to illustrate that elements are substances that do not breakdown into smaller parts during normal investigations involving heating, exposure to electric current or reactions with acids. e. Cite evidence to explain that all living and non-living things can be broken down into elements.	A. Structure of Matter 1. **Provide evidence to explain how compounds are produced. (No electron transfer)** a. Describe how elements form compounds and molecules. b. Investigate and describe what happens to the properties of elements when they react chemically with other elements. c. Based on data from investigations and research compare the properties of compounds with those of the elements from which they are made.
2. **Identify and describe structures of objects too small to be seen clearly with the unaided eye.** a. Identify and describe minute objects, such as grains of sand and crystals of salt after examining them with a magnifying instrument. b. Identify and describe the minute features of objects, such as the lines (grain) in a piece of wood and the fibers in a paper napkin after examining with a magnifying instrument.					

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Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8
B. Conservation of Matter	B. Conservation of Matter	B. Conservation of Matter 1. **Cite evidence to support the statement that, "No matter how many parts of an object are assembled, the mass of the whole object made is always the same as the sum of the parts."** a. Use magnifying instruments to investigate samples of matter, such as a leaf, sugar cube, color photograph, and granite to describe the minute parts from which they are made. b. Use evidence from investigations with a variety of materials, such as water to describe how matter can change from one form to another without the loss of any mass. c. Describe the relationship between the masses of whole objects to the sum of the mass of their parts using appropriate tools to gather supporting data.	B. Conservation of Matter	B. Conservation of Matter	B. Conservation of Matter 1. **Provide evidence to support the fact that the idea of atoms explains conservation of matter.** a. Use appropriate tools to gather data and provide evidence that equal volumes of different substances usually have different masses. b. Cite evidence from investigations that the total mass of a system remains the same throughout a chemical reaction because the number of atoms of each element remains the same. c. Give reasons to justify the statement, "If the number of atoms stays the same no matter how the same atoms are rearranged, then their total mass stays the same."

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Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8
C. States of Matter 1. **Provide evidence from investigations to describe the effect that changes in temperature have on the properties of materials.** a. Based on data gathered from investigations, identify and describe the changes that occur to the observable properties of materials when different degrees of heat is applied to them, such as melting chocolate pieces, boiling an egg. b. Observe and describe the changes cooling causes to the observable properties of materials when they are cooled, such as freezing water in a straw, milk in an ice cream maker. c. Cite examples of similar changes that heating and cooling have on the observable properties of various other materials.	C. States of Matter	C. States of Matter 1. **Provide evidence from investigations to identify the processes that can be used to change materials from one state of matter to another.** a. Observe and describe the changes heating and cooling cause to the different states in which water exists. • Heating causes: ice (solid) to melt forming liquid water; liquid water to evaporate forming water vapor (gas). • Cooling causes: liquid water to freeze forming ice (solid); water vapor (gas) to form liquid water. b. Based on data explain the importance of water's ability to exist in all three states within the temperatures normally found on Earth. c. Analyze data from observations to support the idea that when materials change from one state to another the amount of material stays the same.	C. States of Matter 1. **Provide evidence and examples illustrating that many substances can exist as a solid, liquid, or gas depending on temperature.** a. Use evidence from investigations to describe the effect that adding heat energy to different types of matter has on changing matter from one state to another. b. Based on data from investigations describe the effect that removing heat energy from different types of matter has on changing matter from one state to another. c. Analyze data gathered and formulate a conclusion on the effects of temperature change on most substances.	C. States of Matter	C. States of Matter 1. **Describe how the motion of atoms and molecules in solids, liquids, and gases changes as heat energy is increased or decreased**. a. Based on data from investigations and video technology, describe and give reasons for what happens to a sample of matter when heat energy is added to it (most substances expand). b. Describe what the temperature of a solid, or a liquid, or a gas reveals about the motion of its atoms and molecules. c. Formulate an explanation for the different characterisctics and behaviors of solids, liquids, and gases using an analysis of the data gathered on the motion and arrangement of atoms and molecules.

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Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8
D. Physical and Chemical Changes	D. Physical and Chemical Changes	D. Physical and Chemical Changes 1. **Provide evidence to illustrate that when a new material is made by combining two or more materials, its properties are different from the original materials.** a. Investigate and describe what happens to the properties of materials when several materials are combined to make a mixture, such as table salt and pepper; various kinds of nuts, chocolate pieces, and coconut; sugar dissolved in milk b. Based on observations from investigations and video technology, describe what happens to the observable properties of materials when several materials are combined to make a new material, such as baking soda combined with vinegar c. Share data gathered and construct a reasonable explanation of the results.	D. Physical and Chemical Changes 1. **Cite evidence to support the fact that some substances can be separated into the original substances from which they were made.** a. Investigate and identify ways to describe and classify mixtures using the observable and measurable properties of their components. • Magnetism • Boiling point • Solubility in water. b. Based on data gathered, identify and describe various processes used to separate mixtures. • Filtration • Evaporation • Paper chromatography c. Use data gathered to provide a reasonable explanation for the idea that the mass of a mixture is equal to the sum of the masses of its components.	D. Physical and Chemical Changes	D. Physical and Chemical Changes 1. **Compare compounds and mixtures based on data from investigations and research.** a. Cite evidence from investigations to explain how the components of mixtures can be separated. b. Use evidence from data gathered to explain why the components of compounds cannot be separated using physical properties. c. Analyze the results of research completed to develop a comparison of compounds and mixtures.
					2. **Cite evidence and give examples of chemical properties of substances.** a. Based on data from investigations and research, identify and describe chemical properties of common substances. • Reacts with oxygen (rusting/tarnishing and burning) • Reacts with acids (dissolves metal) • Reacts with bases (forms soap) b. Use information gathered from investigations using indicators and the pH scale to classify materials as acidic, basic, or neutral.

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Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8
D. Physical and Chemical Changes	D. Physical and Chemical Changes	D. Physical and Chemical Changes	D. Physical and Chemical Changes	D. Physical and Chemical Changes	D. Physical and Chemical Changes 3. **Provide evidence to support the fact that common substances have the ability to change into new substances.** a. Investigate and describe the occurrence of chemical reactions using the following evidence: • Color change • Formation of a precipitate or gas • Release of heat or light b. Use evidence from observations to identify and describe factors that influence reaction rates. • Change in temperature • Acidity c. Identify the reactants and products involved in a chemical reaction given a symbolic equation, a word equation, or a description of the reaction. d. Provide data from investigations to support the fact that energy is transformed during chemical reactions. e. Provide examples to explain the difference between a physical change and a chemical change.

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5.0 Physics – Students will use scientific skills and processes to explain the interactions of matter and energy and the energy transformations that occur.

Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8
A. Mechanics 1. **Cite evidence from observations to describe the motion of an object using position and speed.** a. Describe the position of an object by locating it relative to another object or to its background. b. Using information from multiple trials, compare the speeds (faster or slower) of objects that travel the same distance in different amounts of time. c. Using information from multiple trials, compare the distances that objects moving at different speeds travel in the same amount of time.	A. Mechanics	A. Mechanics 1. **Describe the motion of objects using distance traveled, time, direction, and speed.** a. Observe, describe, and compare types of motion. • Uniform motion as equal distances traveled in equal times, such as escalators, conveyor belts. • Variable motion as different distances traveled in equal times, such as an accelerating car, falling objects. • Periodic motion as motion that repeats itself, such as a child on a swing, a person on a pogo stick. b. Use measurements to describe the distance traveled as the change in position. c. Based on data describe speed as the distance traveled per unit of time.	A. Mechanics	A. Mechanics	A. Mechanics 1. **Develop an explanation of motion using the relationships among time, distance, velocity, and acceleration.** a. Observe, describe, and compare the motions of objects using position, speed, velocity, and the direction. b. Based on data given or collected, graph and calculate average speed using distance and time. c. Compare accelerated and constant motions using time, distance, and velocity. d. Describe and calculate acceleration using change in the speed and time.

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Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8
A. Mechanics 2. **Explain that changes in the ways objects move are caused by forces.** a. Observe and describe the way an object's motion changes in a variety of situations (rolling a ball, bouncing a ball, dropping a yo-yo, winding up a toy, etc.) and identify what may have caused the change. b. Describe changes in the motion of objects as they move across different textured surfaces and suggest possible causes for the change. c. Observe and describe that objects fall to the ground unless something holds them up (gravity).	A. Mechanics	A. Mechanics 2. **Explain that the changes in the motion of objects are determined by the mass of an object and the amount (size) of the force applied to it.** a. Observe and give examples that show changes in speed or direction of motion are caused by an interaction of forces acting on an object: • Friction • Gravity. b. Observe and explain the changes in selected motion patterns using the relationship between force and mass.	A. Mechanics	A. Mechanics	A. Mechanics 2. **Identify and relate formal ideas (Newton's Laws) about the interaction of force and motion to real world experiences**. a. Investigate and explain the interaction of force and motion that causes objects that are at rest to move. b. Demonstrate and explain, through a variety of examples, that moving objects will stay in motion at the same speed and in the same direction unless acted on by an unbalanced force. c. Investigate and collect data from multiple trials, about the motion that explain the motion that results when the same force acts on objects of different mass; and when different amounts of force act on objects of the same mass. d. Based on data collected and organized, explain qualitatively the relationship between net force applied to an object and its mass for a given acceleration. e. Calculate the net force given the mass and acceleration.

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Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8
A. Mechanics	A. Mechanics	A. Mechanics	A. Mechanics	A. Mechanics	A. Mechanics 3. **Recognize and explain that every object exerts gravitational force on every other object.** a. Explain the difference between mass and weight. • Mass is a measure of inertia • Weight is a measure of the force of gravity**.** b. Describe the relationship between the gravitational force and the masses of the attracting objects. c. Describe the relationship between the gravitational force and the distance between the attracting objects. d. Recognize and cite examples showing that mass remains the same in all locations while weight may vary with a change in location (weight on Earth compared to weight on moon). e. Recognize that gravity is the force that holds planets, moons, and satellites in their orbits.

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Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8
A. Mechanics	A. Mechanics	A. Mechanics 4. **Cite evidence that energy in various forms exists in mechanical systems.** a. Identify ways of storing energy (potential) in an object. • Raising an object above the ground • Putting it on the end of a compressed or extended spring or rubber band b. Identify that an object has energy (kinetic) related to its motion. • The greater the mass, the greater the energy • The greater the speed, the greater the energy c. Observe and cite examples showing that stored energy may be converted to energy of motion and vice versa.	A. Mechanics	A. Mechanics	A. Mechanics 4. **Recognize and explain that energy can neither be created nor destroyed; rather it changes form or is transferred through the action of forces.** a. Observe and describe the relationship between the distance an object is moved by a force and the change in its potential energy or kinetic energy, such as in a slingshot, in mechanical toys, the position of an object and its potential energy.. b. Identify the relationship between the amount of energy transferred (work) to the product of the applied force and the distance moved in the direction of that force. c. Identify and describe that simple machines (levers and inclined planes) may reduce the amount of effort required to do work. • Calculate input and output work using force and distance • Demonstrate that input work is always greater than output work

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Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8
B. Thermodynamics 1. **Recognize and describe that heat is transferred between objects that are at different temperatures.** a. Recognize and describe that the temperature of an object increases when heat is added and decreases when heat is removed. b. Recognize and describe that heat will flow between object at different temperatures until they reach the same temperature.	B. Thermodynamics 1. **Provide evidence that heat can be transferred in different ways.** a. Recognize and explain that heat can be transferred either by direct contact between objects at different temperatures or without direct contact. • A spoon in hot water • Heat from a flame b. Observe, describe, and compare materials that readily conduct heat and those that do not conduct heat very well. c. Classify materials as conductors or insulators based on how easily heat flows through them.	B. Thermodynamics	B. Thermodynamics		B. Thermodynamics 1. **Describe and cite evidence that heat can be transferred by conduction, convection and radiation.** a. Based on observable phenomena, identify and describe examples of heat being transferred through conduction and through convection. b. Based on observable phenomena, identify examples to illustrate that radiation does not require matter to transfer heat energy. c. Research and identify the types of insulators that best reduce heat loss through conduction, convection, or radiation.
					2. **Identify and explain that heat energy is a product of the conversion of one form of energy to another.** a. Identify and describe the various forms of energy that are transformed in order for systems (living and non-living) to operate. • Chemical - Flashlight battery-Light • Mechanical – Pulleys-Motion • Solar/Radiant - Solar calculator • Chemical - Plant cells b. Explain that some heat energy is always lost from a system during energy transformations.

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Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8
C. Electricity and Magnetism	C. Electricity and Magnetism 1. **Recognize and describe the effects of static electric charges**. a. Observe and describe how to produce static charges by friction between two surfaces. b. Observe the phenomena produced by the static charges. • Light • Sound • Feeling a shock • Attracting lightweight materials over a distance without making contact	C. Electricity and Magnetism	C. Electricity and Magnetism	C. Electricity and Magnetism	C. Electricity and Magnetism
	2. **Investigate and provide evidence that electricity requires a closed loop in order to produce measurable effects.** a. Identify the source of electricity needed to produce various effects: • Light – flashlight (battery) • Heat – hot plate, hairdryer (outlet, battery) • Sound – Ipod (battery) , doorbell(electrical wiring) • Movement – mechanical toys (battery, outlet) b. Investigate and describe (orally or with diagrams) how to light a light bulb or sound a buzzer given a battery, wires, and light bulb or buzzer. c. Describe and compare the path of electricity (circuit) within this system that caused the light to light or the buzzer to sound to those that do not affect the light or buzzer. d. Observe, describe and compare materials that readily conduct electricity and those that do not conduct electricity. e. Provide evidence from observations and investigations that electrical circuits require a complete loop through which electricity can pass.		2. **Cite evidence supporting that electrical energy can be produced from a variety of energy sources and can itself be transformed into almost any other form of energy.** a. Research and identify various energy sources and the energy transforming devices used to produce electrical energy • Wind (generators, wind mills) • Sun (solar cells) • Water(turbines) • Fossil fuels (engines) b. Cite examples that demonstrate the transformation of electrical energy into other forms of energy. c. Investigate and describe that some materials allow the quick, convenient, and safe transfer of electricity (conductors), while others prevent the transfer of electricity (insulators). d. Identify and describe the energy transformations in simple electric circuits.		

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Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8
C. Electricity and Magnetism	C. Electricity and Magnetism 3. **Cite evidence supporting that forces can act on objects without touching them.** a. Investigate and describe the effect that two magnets have on each other. • Like poles repel • Opposite poles attract b. Based on observations, describe the effect of a magnet on a variety of objects including those that are metallic or non-metallic; those made with iron or made with other metals**;** and on other magnets. c. Compare a compass to a magnet based on observations of the effect a variety of objects (metallic or non-metallic; those made with iron or other metals; and magnets) have on a compass. d. Provide examples to demonstrate the different ways a magnet acts on objects and how the objects respond. e. Investigate and describe how electricity in a wire affects the needle of a compass. f. Describe how to make a simple electromagnet with a battery, a nail, and wire. g. Cite examples showing that magnetic, electrical, and gravitational forces can act at a distance.	C. Electricity and Magnetism	C. Electricity and Magnetism 3. **Identify and describe magnetic fields and their relationship to electric current.** a. Investigate and describe the magnetic fields surrounding various types of magnets using materials, such as iron filings and small comapasses. • A single bar magnet • Two bar magnets with like poles facing • Two bar magnets with opposite poles facing • A horseshoe magnet b. Investigate and explain ways to change the strength of a simple electromagnet by varying the number of coils wrapped, the amount of electricity in the wire, the number of batteries used, and whether or not an iron core is used. c. Describe how the electromagnet demonstrates the relationship of magnetism and electricity and identify common devices that demonstrate application of this relationship. • Electric motors (fans, hair dryers, can openers) • Electrical generators (turbine) d. Based on investigations describe that electricity moving through a wire produces a magnetic force on materials placed near the wire. • Iron filings • Compasses	C. Electricity and Magnetism	C. Electricity and Magnetism

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Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8
D. Wave Interactions	D. Wave Interactions	D. Wave Interactions	D. Wave Interactions 1. **Identify and describe the relationships among the various properties of waves.** a. Cite examples to show that waves transfer energy from one place to another. • Light • Sound • Earthquake waves b. Measure and describe the wavelength, frequency, and amplitude of waves using: • Water • Ropes • Springs. c. Measure and describe the relationship between the frequency and the wavelength of a wave.	D. Wave Interactions	D. Wave Interactions
2. **Identify and describe the relationship between a sound and the vibrations that produce it.** a. Based on observations of objects that produce sound, relate vibration to the back and forth motion of parts of the object. b. Pose questions concerning the relationship between loudness or pitch and the vibration of an object.			2. **Provide evidence to demonstrate the relationship among the properties of waves using sound.** a. Investigate and describe that the pitch of sounds can be varied by changing the rate of vibration. b. Identify and describe the relationship among frequency, wavelength, and pitch. c. Observe and describe the relationship between amplitude and loudness. d. Cite evidence that sound waves transfer energy using observation of sympathetic tuning forks, tuned guitar strings, etc.		

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Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8
D. Wave Interactions	D. Wave Interactions	D. Wave Interactions 3. **Provide evidence to show that light travels in a straight line until it is reflected or refracted.** a. Observe and describe the images formed by a plane mirror. • Size of the image • Apparent distance of the image from the mirror • Front-to-back reversal in the image. b. Based on observations trace the path of a ray of light before and after it is reflected (bounces) off a plane mirror. c. Observe and describe that a ray of light changes direction when it crosses the boundary between two materials such as air and water or air to glass.	D. Wave Interactions 3. **Investigate and cite the rules that govern behaviors of light.** a. Based on data generalize the law of reflection. b. Cite evidence from observations and research to support the fact that something can be "seen" when light waves emitted or reflected by it enter the eye. c. Based on observations predict the change in the direction (refraction) of light as it travels from one material to another. d. Cite evidence that the amount of light energy absorbed or reflected depends on the color of the object illuminated.	D. Wave Interactions	D. Wave Interactions
		4. **Recognize and describe how light interacts with different materials.** a. Classify materials as translucent, transparent or opaque. b. Explain that shadows are formed when objects block light. c. Observe and describe that prisms separate white light into its component colors. d. Pose questions about why objects appear to be different colors.			

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6.0 Environmental Science – Students will use scientific skills and processes to explain the interactions of environmental factors (living and nonliving) and analyze their impact from a local to a global perspective.

Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8
A. Natural Resources and Human Needs	A. Natural Resources and Human Needs	A. Natural Resources and Human Needs 1. **Recognize and explain how renewable and nonrenewable natural resources are used by humans in Maryland to meet basic needs.** a. Identify and compare Maryland's renewable resources and nonrenewable resources. b. Describe how humans use renewable natural resources, such as plants, soil, water, animals. c. Describe how humans use nonrenewable natural resources, such as oil, coal, natural gas, minerals, including metals	A. Natural Resources and Human Needs 1. **Recognize and compare how different parts of the world have varying amounts and types of natural resources and how the use of those resources impacts environmental quality.** a. Identify and describe natural resources as • Land • Fossil fuels • Forests • Water • Wind • Minerals • Wildlife b. Identify and describe the distribution of natural resources around the Earth c. Identify and describe how the natural change processes may be affected by human activities. • Agriculture • Beach preservation • Mining • Development/construction • Stream/river alteration. d. Identify and describe problems associated with obtaining, using, and distributing natural resources. e. Identify possible solutions to problems associated with obtaining, using, and distributing natural resources.	A. Natural Resources and Human Needs 1. **Recognize and explain the impact of a changing human population on the use of natural resources and on environmental quality.** a. Based on data identify and describe the positive and negative impacts of an increasing human population on the use of natural resources b. Recognize and describe the decreasing dependence on local resources due to the impact of available transportation.	A. Natural Resources and Human Needs

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Grade 3	Grade 4	Grade 5	Grade 6	Grade 7	Grade 8
B. Environmental Issues	B. Environmental Issues 1 **Recognize and describe that people in Maryland depend on, change, and are affected by the environment**. a. Identify and describe that human activities in a community or region are affected by environmental factors • Presence and quality of water • Soil type • Temperature • Precipitation.	B. Environmental Issues 1. **Recognize and explain that decisions influencing the use of natural resources may have benefits, drawbacks, unexpected consequences, and tradeoffs.** a. Identify and describe personal and community behaviors that waste natural resources and/or cause environmental harm and those behaviors that maintain or improve the environment. b. Identify and describe that individuals and groups assess and manage risk to the environment differently.	B. Environmental Issues 1. **Recognize and explain that human-caused changes have consequences for Maryland's environment as well as for other places and future times.** a. Identify and describe a range of local issues that have an impact on people in other places. b. Recognize and describe how environmental change in one part of the world can have consequences for other parts of the world. c. Identify and describe that ecosystems can be impacted by human activities. • Protection of the Chesapeake Bay watershed • Resource acquisition and use • Land use decisions (agriculture, mining, and development) • Recycling • Use and disposal of toxic substances	B. Environmental Issues 1. **Recognize and describe that environmental changes can have local, regional, and global consequences.** a. Identify and describe a local, regional, or global environmental issue. b. Identify and describe that different individual people or groups of people are affected by an issue in different ways.	B. Environmental Issues 1. **Recognize and explain how human activities can accelerate or magnify many naturally occurring changes.** a. Based on data from research identify and describe how natural processes change the environment. • Cyclic climate change • Sedimentation in watersheds • Population cycles • Extinction b. Identify and describe how human activities produce changes in natural processes: • Climate change • Loss of habitat due to construction • Hunting and fishing • Introduction of nonnative species • Cycling of matter
		2. **Recognize and describe that consequences may occur when Earth's natural resources are used.** a. Explain how human activities may have positive consequences on the natural environment. • Recycling centers • Native plantings • Good farming practice b. Explain how human activities may have a negative consequence on the natural environment. • Damage or destruction done to habitats • Air, water, and land pollution c. Identify and describe that an environmental issue affects individual people and groups of people differently.			

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