Title 7: Education K-12

Part 133

Mississippi Extended Science Frameworks (MESF)

for Students with Significant Cognitive Disabilities

Elementary (Grade 5),
Middle School (Grade 8), and
High School (Biology 1)

Office of Student Assessment • Mississippi Department of Education
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Introduction

The *Mississippi Alternate Assessment of Extended Science Framework (MAAESF)* for students with significant cognitive disabilities (SCD) is designed to assess the educational performance of students with disabilities who cannot participate in the general education curriculum, even with accommodations. Students in grades 5, 8, and high school who meet the state's three SCD criteria are eligible to participate in the MAAESF. In general, eligible students are those who have a history of requiring extensive individualized instruction and have been classified as having a severe to profound cognitive disability or experience a pervasive developmental disability. (Refer to the *Teacher Resource Guide* for further information on the SCD criteria and/or the IEP form.)

The *Mississippi Extended Science Framework (MESF)* was developed with content that was prioritized and aligned with the academic grade-level content standards in science as assessed by the *Mississippi Science Test, Second Edition (MST2)* at grades—5, 8, and the *Mississippi Subject Area Test Program, Second Edition (SATP2)* for the Biology I Test. Alignment to grade-level content is required by the No Child Left Behind Act and, therefore, revisions to the extended content standards were needed to fully meet the federal requirements. During 2013, both general-and special-education teachers participated in this process to ensure that content was academic and written to be accessible to students with SCD. The *MAAESF* focuses on knowledge and skills of more limited depth and breadth than are assessed using grade-level standards, yet still sets high expectations for students with SCD.

Depth of Knowledge (DOK)

When comparing the *Mississippi Extended Science Framework (MESF)* and the *2010 Mississippi Science Framework,* it is important to note two things:

- The objectives in the *MESF* are concepts and skills that feed into the grade-level objectives shown in the *2010 Mississippi Science Framework*. Because students with significant cognitive disabilities have diverse backgrounds and needs, objective statements at different entry levels were written for many of the 2010 objectives. This variety allows teachers to choose an objective that will best assess an individual student's learning.

- Both the *Mississippi Extended Science Framework* and the *2010 Mississippi Science Framework* are coded to show the depth of knowledge (DOK) for each objective; however, depth of knowledge for a standard assessment differs from those used for the alternate assessment. Reviewing the DOK information assigned to each objective is important, but it is also important to understand that DOK is not the only factor in understanding the difficulty level of an objective. As such, difficulty does not necessarily increase as DOK level increases. A DOK2 objective can be more challenging than a DOK6 objective, depending on the concepts and information being assessed. For instance, an objective that asks students to recall a complex series of events may be more difficult than an objective that asks students to find the pattern in a simple graph. Additionally, although verbs are important in assigning DOK levels, they are not the only criterion used. Objectives with "identify" as the verb are often assigned a DOK2, but this is not always the case. For example, the grade 5 objective ***IS1C.k - Student identifies the correct summary of results for a given experiment (DOK6)*** asks the student to identify, but other skills are required before identification can take place. The DOKs used in the *MESF* are shown on page 4.

Depth of Knowledge (as adapted by UNC National Alternate Assessment Center) **Used for the *Mississippi Extended Science Framework (MESF)***	
Code	**Depth of Knowledge (verbs often associated with each level)**
1	***Attention*** (touch, look, vocalize, respond, attend)
2	***Memorize/Recall*** (list, describe [facts], identify, state, define, label, recognize, record, match, recall, state)
3	***Performance*** (perform, demonstrate, follow, count, locate, read)
4	***Comprehension*** (explain, conclude, group/categorize, restate, review, translate, describe [concepts], paraphrase, infer, summarize, illustrate)
5	***Application*** (compute, organize, collect, apply, classify, construct, solve, use, order, develop, generate, interact with text, implement)
6	***Analysis, Synthesis, Evaluation*** (pattern, analyze, compare, contrast, compose, predict, extend, plan, judge, evaluate, interpret, cause/effect, investigate, examine, distinguish, differentiate, generate)
X	*Can't score/too vague*

Source: C. Flowers, S. Wakeman, D. Browder, and M. Karvonen, *Links for academic learning: An alignment protocol for alternate assessments based on alternate achievement standards*. Charlotte, North Carolina: University of North Carolina at Charlotte, 2007.

Structure of the MESF Objectives

Throughout the *MESF* (at the objective level), some words are highlighted in gray. These words or science terms are provided at the end of this document in the **Glossary of Terms** with accompanying definitions. Not all words in the Glossary of Terms will be found in each grade cluster or content area**. It is imperative that teachers refer to the Glossary of Terms for each highlighted science term to fully understand the intent of the objective**.

For additional information regarding ***Suggested Equipment and Supplies*** (by grade or course) and ***Science Safety***, refer to the *2010 Mississippi Science Framework* and consult the science content teacher in your school or district. Note that not all the equipment, supplies, or science safety symbols listed in the *2010 Mississippi Science Framework* are needed or appropriate for the *MAAESF*.

It is highly recommended that teachers administering the *MAAESF* consult and work together with a science content teacher to gather materials and align assessment items to the *MESF*.

The chart below is provided to further assist teachers in understanding the intent of the verbs used from the DOK chart (as adapted by the UNC National Alternate Assessment Center) for the MAAESF.

Depth of Knowledge Verbs Used in the *MESF* Objectives	
Term	***Definition***
Categorize	To sort into given groups, based on one or more features, when given categories.
Choose	To select the most appropriate answer among those given.
Cite	To give evidence in support of an idea.
Classify	To group items based on one or more features. In this case, student defines the characteristics used in grouping.
Compare	To identify similarities between two or more items.
Complete	To finish a partially finished task.
Compute	To calculate using mathematical facts.
Construct	To build or describe how to build an object.
Contrast	To identify differences between two or more items.
Create	To develop an original representation of a concept or idea.
Demonstrate	To show or explain how to accomplish a task or perform a skill.
Describe	To represent or give an account of using words, pictures, writing, or characterizations that employ diagrams
Distinguish between/among	To have the student use known information to make appropriate responses within a group of two or more choices.
Explain	To relate the characteristics or attributes of an idea or process.
Follow	To complete steps of a procedure presented in words or pictures.
Identify	To give an appropriate response by showing, naming, giving, or selecting.
Infer/make inferences	To draw scientific conclusions, which are not explicitly stated, using the evidence given.
Interpolate	To estimate the value of data found between points of a graph.
Interpret	To describe the characteristics, changes or relationships displayed in a diagram or graph.
Label	To apply categories or names to the parts of an object.
Locate	To find an object using one of the five senses.
Make observations	To gain information via the student's senses.
Match	To link identical objects.
Measure	To determine an exact quantity—for example, using a ruler or balance or a small beaker that holds a known volume.
Model/use a model	To use another object to represent and demonstrate a concept or changes in an object.
Order	To sequence objects or ideas based on an increase or decrease in one characteristic.
Record	To register information.
Relate	To use knowledge to make connections between science concepts.
Select	To choose using the student's mode of communication.
Sequence	To order based on a given criterion, such as time, weight, height, or size.
Test	To use a scientific procedure to answer a question.
Trace	To follow changes physically in an object or diagram.
Use	To apply knowledge to demonstrate comprehension (understanding) of concepts.

Note: All other science terms are highlighted and are located in the **Glossary of Terms.** Teachers should refer to the glossary for each highlighted science term to fully understand the intent of the objective.

Appropriate Supports for Science

Students who are significantly cognitively disabled often need supports and adaptations to gain access to the concepts and skills being assessed. Some appropriate supports for science are

- manipulatives, objects, models, or pictures;
- computer use for data collection, data analysis, or data display;
- task-analyzed skills;
- reduced number of pictorial steps for completing data collection;
- stamps for writing numbers when recording observations;
- word problems/context read to student;
- enlarged text;
- modified text; and
- assistive technology use.

Students being assessed using the *MAAESF* may need additional setting, timing, presentation, and response accommodations. To ensure that the supports, accommodations, and assistive technology used by your student are allowable for the *MAAESF*, please refer to the current edition of the *Teacher Resource Guide*.

Data Collection Requirements

The MESF for science are aligned to the *2010 Mississippi Science Framework* and specify what students should know and be able to do at the end of each assessment grade. The competencies for assessment are organized by strand and broken down into clusters. Each cluster is contains objectives that increase in complexity from an access level to most complex to provide a variety of learning opportunities. The clusters and objectives are also organized for continuity across grade levels.

Science requires seven objectives in grades 5, 8, and high school.

Note: Science is not assessed for grades 3, 4, 6, and 7.

Students must work on learning objectives for the grade in which they would be assigned if they did not have a disability. For a complete listing of the grade-level competencies (strands, clusters, and objectives), refer to the MESF document, which is available at http://www.mde.k12.ms.us/maaecf.

Elementary (Grade 5)

Elementary (Grade 5)
Extended Science Frameworks

Inquiry Strand

Competency 1: Develop and demonstrate an understanding of scientific inquiry using process skills.

- Cluster 1A. Plan safe and fair experiments
- Cluster 1B. Make and record measurements and observations
- Cluster 1C. Analyze data and draw conclusions

Physical Science Strand

Competency 2: Understand relationships of the properties of objects and materials, position and motion of objects, and transfer of energy to explain the physical world.

- Cluster 2A. Properties of matter
- Cluster 2B. Changes in matter
- Cluster 2C. Forms of energy
- Cluster 2D. Forces and motion

Life Science Strand

Competency 3: Predict characteristics, structures, life cycles, environments, evolution, and diversity of organisms.

- Cluster 3A. Diversity of life
- Cluster 3B. Structure and function of living systems
- Cluster 3C. Relationships and adaptations of life

Earth and Space Science Strand

Competency 4: Develop an understanding of the properties of Earth materials, objects in the sky, and changes in Earth and sky.

- Cluster 4A. Earth's structure
- Cluster 4B. Our solar system
- Cluster 4C. Weather

DATA COLLECTION REQUIREMENTS

MAAESF Item Competencies for Elementary School

GRADE 5

Inquiry Strand

Competency 1: Develop and demonstrate an understanding of scientific inquiry using process skills.

- *Requirements – Assess 2 objectives (safety – IS1A.a **or** IS1A.b + 1 more objective from any cluster)*

Cluster 1A. Plan safe and fair experiments
Cluster 1B. Make and record measurements and observations
Cluster 1C. Analyze data and draw conclusions

Physical Science Strand

Competency 2: Understand relationships of the properties of objects and materials, position and motion of objects, and transfer of energy to explain the physical world.

- *Requirement – Assess 1 objective*

Cluster 2A. Properties of matter
Cluster 2B. Changes in matter
Cluster 2C. Forms of energy
Cluster 2D. Forces and motion

Life Science Strand

Competency 3: Predict characteristics, structures, life cycles, environments, evolution, and diversity of organisms.

- *Requirements – Assess any 2 objectives*

Cluster 3A. Diversity of life
Cluster 3B. Structure and functions of living systems
Cluster 3C. Relationships and adaptations of life

Earth and Space Science Strand

Competency 4: Develop an understanding of the properties of Earth materials, objects in the sky, and changes in Earth and sky.

- *Requirements – Assess any 2 objectives*

Cluster 4A. Earth's structure
Cluster 4B. Our solar system
Cluster 4C. Weather

Total = 7 objectives, which always include a "safety" objective for science, with Baseline and Final evidence documented for each objective.

MAAESF Science – Elementary Grade 5		
INQUIRY STRAND		
MESF Science Competency	**Objective Code**	**MESF Objectives**
1. Develop and demonstrate an understanding of scientific inquiry using process skills.	**Cluster 1A. Plan safe and fair experiments**	
	IS1A.a	Student identifies general safety rules for experiments. (DOK2)
	IS1A.b	Student identifies safety rules for a particular experiment. (DOK2)
	IS1A.c	Student identifies tools needed for a particular experiment. (DOK3)
	IS1A.d	Student follows a simple written experimental procedure. (DOK3)
	IS1A.e	Student identifies a reasonable hypothesis that fits a given experimental procedure. (DOK4)
	IS1A.f	Student orders the steps of a simple experimental procedure. (DOK5)
	IS1A.g	Student describes a reasonable hypothesis that fits a given scientific question. (DOK6)
	Cluster 1B. Make and record measurements and observations	
	IS1B.a	Student identifies vocabulary that can be used to communicate observations. (DOK2)
	IS1B.b	Student makes observations about properties of objects. (DOK2)
	IS1B.c	Student makes observations about behavior of organisms. (DOK2)
	IS1B.d	Student chooses the appropriate tool to measure objects of differing sizes. (DOK3)
	IS1B.e	Student records raw experimental data. (DOK3)
	IS1B.f	Student describes changes over time. (DOK4)
	IS1B.g	Student completes entering data into a labeled data table using raw scientific data. (DOK5)
	IS1B.h	Student identifies data to be recorded within a given cell of a labeled, partially completed data table. (DOK5)
	Cluster 1C. Analyze data and draw conclusions	
	IS1C.a	Student identifies data found in a cell of table. (DOK2)
	IS1C.b	Student identifies parts of graphs. (DOK2)
	IS1C.c	Student identifies data found in a graph. (DOK2)
	IS1C.d	Student traces the trend seen in a bar graph of discrete data. (DOK3)
	IS1C.e	Student describes the trend seen in a bar graph of discrete data. (DOK4)
	IS1C.f	Student classifies statements about data as either inferences or observations. (DOK5)
	IS1C.g	Student completes a bar graph using a given set of discrete data from a table. (DOK5)
	IS1C.h	Student interprets a pictograph to answer a question. (DOK6)
	IS1C.i	Student uses a bar graph to draw a conclusion. (DOK6)
	IS1C.j	Student answers questions posed in an investigation, citing data to support those answers. (DOK6)
	IS1C.k	Student identifies the correct summary of results for a given experiment. (DOK6)
	IS1C.l	Student makes inferences from completed data tables and graphs. (DOK6)

MAAESF Science – Elementary Grade 5		
PHYSICAL SCIENCE STRAND		
MESF Science Competency	**Objective Code**	**MESF Objectives**
2. Understand relationships of the properties of objects and materials, position and motion of objects, and transfer of energy to explain the physical world.	**Cluster 2A. Properties of matter**	
	PS2A.a	Student identifies solids, liquids, and gases. (DOK2)
	PS2A.b	Student identifies how a particular solid, liquid, or gas will behave when placed in containers. (DOK2)
	PS2A.c	Student identifies characteristics of matter. (DOK2)
	PS2A.d	Student models the behavior of the molecules making up solids, liquids, and gases. (DOK3)
	PS2A.e	Student describes how solids, liquids, and gases will behave when placed in a container. (DOK4)
	PS2A.f	Student describes characteristics of matter. (DOK4)
	Cluster 2B. Changes in matter	
	PS2B.a	Student identifies activities that produce physical changes in matter. (DOK2)
	PS2B.b	Student identifies activities that produce chemical changes in matter. (DOK2)
	PS2B.c	Student explains how changing the volume of an object affects whether that object will sink or float. (DOK3)
	PS2B.d	Student describes how changes in temperature affect how well substances dissolve. (DOK4)
	PS2B.e	Student classifies observed changes in matter using the categories physical change and chemical change. (DOK5)
	PS2B.f	Student contrasts physical and chemical changes. (DOK6)
	PS2B.g	Student tests accuracy of predictions about whether objects will sink or float. (DOK6)
	Cluster 2C. Forms of energy	
	PS2C.a	Student identifies different forms of energy. (DOK2)
	PS2C.b	Student identifies examples of gravitational potential energy. (DOK2)
	PS2C.c	Student identifies examples of elastic potential energy. (DOK2)
	PS2C.d	Student identifies examples of chemical potential energy. (DOK2)
	PS2C.e	Student locates the correct tool to refract, reflect or absorb light. (DOK3)
	PS2C.f	Student identifies examples of reflection, refraction, and absorption of light. (DOK4)
	PS2C.g	Student identifies examples of insulators and conductors of heat energy. (DOK4)
	PS2C.h	Student classifies examples of potential energy using the terms elastic, chemical, and gravitational. (DOK4)
	PS2C.i	Student identifies real life uses for insulators and conductors of heat energy. (DOK5)
	PS2C.j	Student tests how light will behave when it interacts with different surfaces. (DOK6)

MAAESF Science – Elementary Grade 5		
PHYSICAL SCIENCE STRAND		
MESF Science Competency	**Objective Code**	**MESF Objectives**
2. Understand relationships of the properties of objects and materials, position and motion of objects, and transfer of energy to explain the physical world. (Cont.)	**Cluster 2D. Forces and motion**	
	PS2D.a	Student identifies examples of force. (DOK2)
	PS2D.b	Student identifies variables that affect the speed of moving objects. (DOK2)
	PS2D.c	Student demonstrates how to change the speed of an object by changing variables. (DOK3)
	PS2D.d	Student describes the movement of objects using points of reference. (DOK4)
	PS2D.e	Student describes the position of objects using points of reference. (DOK4)
	PS2D.f	Student tests how an outside force will change a moving object's speed and direction. (DOK6)

MAAESF Science – Elementary Grade 5		
LIFE SCIENCE STRAND		
MESF Science Competency	**Objective Code**	**MESF Objectives**
3. Predict characteristics, structures, life cycles, environments, evolution, and diversity of organisms.	**Cluster 3A. Diversity of life**	
	LS3A.a	Student identifies plants and animals. (DOK2)
	LS3A.b	Student identifies differences between plants and animals. (DOK2)
	LS3A.c	Student identifies examples of life cycles of plants. (DOK2)
	LS3A.d	Student identifies examples of life cycles of animals. (DOK2)
	LS3A.e	Student matches microbiologists Jonas Salk, Louis Pasteur, and Alexander Fleming to their key discoveries. (DOK2)
***For these objective entries only, items may be repeated within and across the Baseline and Final assessments. The items must be presented in a different format.**	***LS3A.f**	Student locates the parts of a plant. (DOK3)
	LS3A.g	Student classifies plants using given scientific criteria. (DOK5)
	LS3A.h	Student classifies animals using given scientific criteria. (DOK5)
	LS3A.i	Student classifies organisms using scientific criteria. (DOK5)
	LS3A.j	Student orders the life cycle stages of animals. (DOK5)
	LS3A.k	Student classifies objects as either living or non-living. (DOK5)
	LS3A.l	Student compares the life cycles of animals. (DOK6)
	Cluster 3B. Structure and function of living systems	
	***LS3B.a**	Student identifies the functions of the parts of a flower. (DOK2)
	LS3B.b	Student identifies the organs of the digestive system. (DOK2)
	LS3B.c	Student identifies plant and animal cells. (DOK2)
	LS3B.d	Student matches organs to their functions. (DOK2)
	LS3B.e	Student matches specific functions to human body systems: nervous, circulatory, respiratory, digestive, skeletal, muscular. (DOK2)
	LS3B.f	Student locates specific organs of the human digestive system. (DOK3)
	LS3B.g	Student locates specific organs of a plant. (DOK3)
	LS3B.h	Student describes the function of plant organs. (DOK4)
	LS3B.i	Student describes the function of animal organs. (DOK4)
	LS3B.j	Student classifies organs by body system. (DOK5)
	LS3B.k	Student orders diagrams of the organs of a system to show their location within the human body. (DOK5)
	LS3B.l	Student compares the functions of different organs. (DOK6)

MAAESF Science – Elementary Grade 5		
LIFE SCIENCE STRAND		
MESF Science Competency	**Objective Code**	**MESF Objectives**
3. Predict characteristics, structures, life cycles, environments, evolution, and diversity of organisms. (Cont.)	**Cluster 3C. Relationships and adaptations of life**	
	LS3C.a	Student identifies fossils as preserved remains of past organisms. (DOK2)
	LS3C.b	Student identifies that the Sun is the major source of energy for living things. (DOK2)
	LS3C.c	Student identifies the basic needs of plants and animals. (DOK2)
	LS3C.d	Student identifies adaptations of organisms to a particular environment. (DOK2)
For these objective entries only*, *items may be repeated within and across the Baseline and Final assessments. The items must be presented in a different format.	**LS3C.e**	Student identifies adaptations that increase survival in a given habitat. (DOK2)
	LS3C.f	Student identifies organisms that may become endangered due to changes in the environment. (DOK2)
	***LS3C.g**	Student identifies how fossils are formed. (DOK2)
	LS3C.h	Student locates the components within a food chain. (DOK3)
	LS3C.i	Student describes the role of each organism in a food chain. (DOK4)
	LS3C.j	Student classifies consumers as carnivores, herbivores, and omnivores. (DOK4)
	LS3C.k	Student describes differences among organisms that help some survive when the environment changes. (DOK4)
	LS3C.l	Student sequences pictures of plants and animals into a food chain. (DOK5)

MAAESF Science – Elementary Grade 5		
EARTH AND SPACE SCIENCE STRAND		
MESF Science Competency	**Objective Code**	**MESF Objectives**
4. Develop an understanding of the properties of Earth's materials, objects in the sky, and changes in Earth and sky.	**Cluster 4A. Earth's structure**	
	ES4A.a	Student identifies examples of constructive forces. (DOK2)
	ES4A.b	Student identifies examples of destructive forces. (DOK2)
	ES4A.c	Student identifies examples of natural resources. (DOK2)
	ES4A.d	Student identifies changes to the environment caused by humans. (DOK2)
	ES4A.e	Student locates the layers of the atmosphere, hydrosphere, and lithosphere. (DOK3)
	ES4A.f	Student demonstrates how to use a scratch test to characterize rocks. (DOK3)
	ES4A.g	Student describes ways to conserve natural resources. (DOK4)
	ES4A.h	Student describes how sedimentary, igneous, and metamorphic rocks are created. (DOK4)
	ES4A.i	Student classifies rock samples as sedimentary, igneous, and metamorphic. (DOK5)
	ES4A.j	Student contrasts properties of sedimentary, igneous, and metamorphic rocks. (DOK6)
	Cluster 4B. Our solar system	
** For these objective entries only, items may be repeated within and across the Baseline and Final assessments. The items must be presented in a different format.*	**ES4B.a**	Student identifies heavenly objects in the sky. (DOK2)
	***ES4B.b**	Student identifies the relative position of the Earth, Sun, and Moon. (DOK2)
	ES4B.c	Student classifies heavenly objects as either reflecting or radiating light. (DOK2)
	***ES4B.d**	Student identifies planets other than Earth. (DOK2)
	ES4B.e	Student describes the relative position and movement patterns of the Earth, Sun, and Moon in the solar system. (DOK4)
	ES4B.f	Student classifies heavenly objects, including the Sun and Earth, as stars and planets. (DOK5)
	ES4B.g	Student compares the physical characteristics of planets. (DOK6)
	Cluster 4C. Weather	
	ES4C.a	Student identifies weather instruments. (DOK2)
	ES4C.b	Student identifies characteristics of different forms of precipitation. (DOK2)
	ES4C.c	Student describes day to day changes in the weather. (DOK2)
	ES4C.d	Student identifies seasonal changes in the weather. (DOK2)
	ES4C.e	Student demonstrates how to use weather instruments. (DOK3)
	ES4C.f	Student describes ways humans change the environment. (DOK4)
	ES4C.g	Student compares Mississippi's weather with the weather of other regions of the country. (DOK6)
	ES4C.h	Student compares the seasons. (DOK6)

Middle School (Grade 8)

Middle School (Grade 8)
Extended Science Frameworks

Inquiry Strand

Competency 1: Draw conclusions from scientific investigations, including controlled experiments.

- Cluster 1A. Plan and conduct safe and fair experiments
- Cluster 1B. Make and record measurements and observations
- Cluster 1C. Analyze data and draw conclusions

Physical Science Strand

Competency 2: Apply concepts relating to an understanding of chemical and physical changes, interactions involving energy, and forces that affect the motion of objects.

- Cluster 2A. Properties of matter
- Cluster 2B. Changes in matter
- Cluster 2C. Energy
- Cluster 2D. Forces and motion

Life Science Strand

Competency 3: Compare and contrast the structure and functions of the cell, levels of organization of living things, basis of heredity, and adaptations that explain variations in populations.

- Cluster 3A. Relationships and adaptations of living things
- Cluster 3B. Disease
- Cluster 3C. Organization of cells and tissues
- Cluster 3D. Inheritance

Earth and Space Science Strand

Competency 4: Describe the Earth's system in terms of its position in relation to objects in the universe, structure and composition, climate, and renewable and nonrenewable resources.

- Cluster 4A. Earth's structure
- Cluster 4B. Planets, the solar system, and beyond
- Cluster 4C. Factors affecting the environment

DATA COLLECTION REQUIREMENTS

MAAESF Item Competencies for Middle School

GRADE 8

Inquiry Strand

Competency 1: Draw conclusions from scientific investigations, including controlled experiments.

- *Requirements – Assess 2 objectives (safety – IS1A.a, IS1A.b, IS1A.c, **or** IS1A.d + 1 more objective from any cluster)*

Cluster 1A. Plan safe and conduct fair and safe experiments
Cluster 1B. Make and record measurements and observations
Cluster 1C. Analyze data and draw conclusions

Physical Science Strand

Competency 2: Apply concepts relating to an understanding of chemical and physical changes, interactions involving energy, and forces that affect the motion of objects.

- *Requirements – Assess any 2 objectives*

Cluster 2A. Properties of matter
Cluster 2B. Changes in matter
Cluster 2C. Energy
Cluster 2D. Forces and motion

Life Science Strand

Competency 3: Compare and contrast the structure and functions of the cell, levels of organization of living things, basis of heredity, and adaptations that explain variations in populations.

- *Requirement – Assess 1 objective*

Cluster 3A. Relationships and adaptations of living things
Cluster 3B. Disease
Cluster 3C. Organization of cells and tissues
Cluster 3D. Inheritance

Earth and Space Science Strand

Competency 4: Describe the Earth's system in terms of its position in relation to objects in the universe, structure and composition, climate, and renewable and nonrenewable resources.

- *Requirements – Assess any 2 objectives*

Cluster 4A. Earth's structure
Cluster 4B. Planets, the solar system, and beyond
Cluster 4C. Factors affecting the environment

Total = 7 objectives, which always include a "safety" objective for science, with Baseline and Final evidence documented for each objective.

MAAESF Science – Middle School Grade 8		
INQUIRY STRAND		
MESF Science Competency	**Objective Code**	**MESF Objectives**
1. Draw conclusions from scientific investigations, including controlled experiments.	**Cluster 1A. Plan and conduct safe and fair experiments**	
	IS1A.a	Student identifies unsafe conditions in a given illustration or diagram of a laboratory. (DOK2)
	IS1A.b	Student identifies ways to improve the safety for a given laboratory setup. (DOK2)
	IS1A.c	Student demonstrates proper disposal methods for materials used in an experimental procedure. (DOK4)
	IS1A.d	Student classifies laboratory procedures as either safe or unsafe. (DOK5)
	IS1A.e	Student identifies the variable being tested in an experimental procedure. (DOK6)
	IS1A.f	Student identifies the data to be collected in an experimental procedure. (DOK6)
	Cluster 1B. Make and record measurements and observations	
	IS1B.a	Student identifies the correct tools to make quantitative observations with measurements. (DOK2)
	IS1B.b	Student identifies the correct tools to make qualitative observations. (DOK2)
	IS1B.c	Student demonstrates how to use laboratory measuring tools accurately. (DOK3)
	IS1B.d	Student classifies examples of observations as either qualitative or quantitative. (DOK5)
	IS1B.e	Student completes entering data into a labeled data table using a given set of raw data. (DOK5)
	Cluster 1C. Analyze data and draw conclusions	
	IS1C.a	Student identifies examples of trends that can be shown in graphs. (DOK2)
	IS1C.b	Student identifies different types of graphs. (DOK2)
	IS1C.c	Student locates a point corresponding to a particular cell in a data table. (DOK3)
	IS1C.d	Student identifies a graph that shows a given trend. (DOK4)
	IS1C.e	Student describes the trend seen in a line graph containing a single line and showing a single trend. (DOK4)
	IS1C.f	Student infers a reasonable conclusion from data shown in a table. (DOK4)
	IS1C.g	Student infers a reasonable conclusion from data shown in a graph. (DOK4)
	IS1C.h	Student completes graphing data into a labeled bar graph using data supplied in a table. (DOK5)
	IS1C.i	Student explains whether a given conclusion is supported by the data in a table or graph. (DOK6)
	IS1C.j	Student identifies an improvement to an experimental procedure. (DOK6)

MAAESF Science – Middle School Grade 8		
PHYSICAL SCIENCE STRAND		
MESF Science Competency	**Objective Code**	**MESF Objectives**
2. Apply concepts relating to an understanding of chemical and physical changes, interactions involving energy, and forces that affect the motion of objects.	**Cluster 2A. Properties of matter**	
	PS2A.a	Student identifies elements, compounds, and mixtures. (DOK2)
	PS2A.b	Student identifies the chemical formulas for simple compounds. (DOK2)
	***PS2A.c**	Student describes ways to separate mixtures. (DOK3)
	PS2A.d	Student describes properties of metals and non-metals. (DOK4)
	PS2A.e	Student classifies elements as either metals or non-metals based on their properties. (DOK5)
	PS2A.f	Student distinguishes between examples of compounds and elements based on the type of atoms each contains. (DOK6)
	Cluster 2B. Changes in matter	
	PS2B.a	Student identifies examples of oxidation. (DOK2)
***** *For these objective entries only, items may be repeated within and across the Baseline and Final assessments. The items must be presented in a different format.*	**PS2B.b**	Student uses a model to show that the number of atoms shown in a chemical reaction is the same for reactants and products. (DOK4)
	PS2B.c	Student determines that the mass of chemicals before and after a chemical change remains the same. (DOK6)
	Cluster 2C. Energy	
	PS2C.a	Student identifies parts of a simple electrical circuit. (DOK2)
	PS2C.b	Student identifies different types of energy found in the electromagnetic spectrum. (DOK2)
	PS2C.c	Student labels a diagram of the electromagnetic spectrum to show the relative locations of different forms of electromagnetic radiation. (DOK2)
	PS2C.d	Student completes a given electrical circuit. (DOK3)
	PS2C.e	Student describes effects of high energy on living organisms. (DOK4)
	PS2C.f	Student constructs an electrical circuit. (DOK5)
	PS2C.g	Student tests how an electrical circuit will behave when components are added, subtracted, and rearranged. (DOK6)

MAAESF Science – Middle School Grade 8		
PHYSICAL SCIENCE STRAND		
MESF Science Competency	**Objective Code**	**MESF Objectives**
2. Apply concepts relating to an understanding of chemical and physical changes, interactions involving energy, and forces that affect the motion of objects. (Cont.)	**Cluster 2D. Forces and motion**	
	PS2D.a	Student identifies examples of Newton's three laws of motion when given these laws. (DOK2)
	PS2D.b	Student identifies examples of acceleration. (DOK2)
	PS2D.c	Student demonstrates concepts related to Newton's laws of motion, when given these laws. (DOK3)
	PS2D.d	Student measures the motion of an object. (DOK3)
	PS2D.e	Student explains how different forces affect objects. (DOK4)
	PS2D.f	Student describes the effect of friction on an object's movement. (DOK4)
	PS2D.g	Student relates the amount of force needed to move an object to the object's mass. (DOK4)
	PS2D.h	Student computes the speed of objects using time and distance traveled. (DOK5)
	PS2D.i	Student completes a graph showing changes in either the speed, direction, or position of an object. (DOK5)
	PS2D.j	Student tests the effect of changing the mass of a moving object. (DOK6)

MAAESF Science – Middle School Grade 8		
LIFE SCIENCE STRAND		
MESF Science Competency	**Objective Code**	**MESF Objectives**
3. Compare and contrast the structure and functions of the cell, levels of organization of living things, basis of heredity, and adaptations that explain variations in populations.	**Cluster 3A. Relationships and adaptations of living things**	
	LS3A.a	Student identifies different ecosystems. (DOK2)
	LS3A.b	Student locates a food chain within a food web. (DOK3)
	LS3A.c	Student describes changes in the environment that may change a given ecological niche. (DOK4)
	LS3A.d	Student traces the flow of matter through a food chain. (DOK4)
	LS3A.e	Student describes an example of an ecological niche occupied by an organism. (DOK4)
	LS3A.f	Student classifies the organisms in a food web using the terms producers, consumers, and decomposers. (DOK5)
	Cluster 3B. Disease	
	LS3B.a	Student identifies various causes of infectious human diseases. (DOK2)
	LS3B.b	Student identifies different diseases associated with various body systems. (DOK2)
	LS3B.c	Student models prevention of infectious disease. (DOK3)
	LS3B.d	Student explains how a disease interferes with normal body function. (DOK4)
	Cluster 3C. Organization of cells and tissues	
	LS3C.a	Student identifies organisms that convert the Sun's energy into food. (DOK2)
	LS3C.b	Student identifies organisms that can only obtain their energy by breaking down food. (DOK2)
	LS3C.c	Student identifies plant and animal cell structures: nucleus, cytoplasm, cell membrane, cell wall, mitochondrion, nuclear membrane. (DOK2)
	LS3C.d	Student describes the composition of human organs. (DOK4)
	LS3C.e	Student compares plant and animal cells. (DOK6)
	Cluster 3D. Inheritance	
	LS3D.a	Student identifies the offspring of an adult organism. (DOK2)
	LS3D.b	Student identifies traits that are inherited. (DOK2)
	LS3D.c	Student completes a Punnett square. (DOK3)
	LS3D.d	Student describes the phenotype of a given organism. (DOK4)
	LS3D.e	Student orders different diagrams of DNA, genes, and chromosomes to show the levels of organization among them. (DOK5)
	LS3D.f	Student distinguishes between dominant and recessive traits. (DOK6)

MAAESF Science – Middle School Grade 8		
EARTH AND SPACE SCIENCE STRAND		
MESF Science Competency	**Objective Code**	**MESF Objectives**
4. Describe the Earth's system in terms of its position in relation to objects in the universe, structure and composition, climate, and renewable and nonrenewable resources.	**Cluster 4A. Earth's structure**	
	ES4A.a	Student identifies characteristics of the layers of the Earth. (DOK2)
	ES4A.b	Student demonstrates the movement of tectonic plates. (DOK3)
	ES4A.c	Student explains ways that tectonic plates interact. (DOK4)
	ES4A.d	Student classifies resources as either renewable or nonrenewable. (DOK5)
	ES4A.e	Student compares characteristics of the lithosphere and asthenosphere. (DOK6)
	ES4A.f	Student analyzes how two moving tectonic plates will interact. (DOK6)
	Cluster 4B. Planets, the solar system, and beyond	
	ES4B.a	Student identifies characteristics of stars, clusters, galaxies, and galactic clusters. (DOK2)
	ES4B.b	Student identifies components of the solar system. (DOK2)
	ES4B.c	Student identifies heavenly objects in the nighttime and daytime skies. (DOK2)
	ES4B.d	Student uses a model to demonstrate the daily rotation and yearly revolution of Earth in relation to the Sun. (DOK3)
	ES4B.e	Student uses a model to demonstrate the Moon's orbit around the Earth. (DOK3)
	ES4B.f	Student describes characteristics of the universe. (DOK4)
	ES4B.g	Student sequences pictures to describe the levels of organization of the universe. (DOK5)
	ES4B.h	Student contrasts stars, clusters, galaxies, and galactic clusters. (DOK6)
	Cluster 4C. Factors affecting the environment	
	ES4C.a	Student identifies measurements used in weather prediction. (DOK2)
	ES4C.b	Student describes methods that may be used to decrease global warming. (DOK4)
	ES4C.c	Student describes ways to conserve renewable and non-renewable resources in and outside of Mississippi. (DOK4)
	ES4C.d	Student labels a diagram of the water cycle. (DOK4)
	ES4C.e	Student uses a model to describe how Earth's tilt and position affects climate, seasons, and the day's length. (DOK4)
	ES4C.f	Student uses data to track the progress of an imaginary hurricane. (DOK5)

High School (Biology I)

High School (Biology I)
Extended Science Frameworks

Inquiry Strand

Competency 1: Apply inquiry-based and problem-solving processes and skills to scientific investigations.

- Cluster 1A. Plan and conduct safe and fair experiments
- Cluster 1B. Make and record measurements and observations
- Cluster 1C. Analyze data and draw conclusions

Physical Science Strand

Competency 2: Describe the biochemical basis of life and explain how energy flows within and between the living systems.

- Cluster 2A. Biochemicals
- Cluster 2B. Flow of energy in photosynthesis and ecosystems

Life Science Strand

Competency 3: Investigate and evaluate the interaction between living organisms and their environment.

- Cluster 3A. Interactions and adaptations of plants and animals within biomes
- Cluster 3B. Ecosystem structure

Competency 4: Analyze and explain the structures and function of the levels of biological organization.

- Cluster 4A. Structure and function of cells and organelles
- Cluster 4B. Levels of organization from organelle to system

Competency 5: Demonstrate an understanding of the molecular basis of heredity.

- Cluster 5A. Inherited versus non-inherited traits
- Cluster 5B. DNA and mutations

Competency 6: Demonstrate an understanding of principles that explain the diversity of life and biological evolution.

- Cluster 6A. Classification of organisms
- Cluster 6B. Natural selection

DATA COLLECTION REQUIREMENTS

MAAESF Item Competencies for High School

(The focus of science for high school is Biology I concepts.)

Inquiry Strand
Competency 1: Apply inquiry-based and problem-solving processes and skills to scientific investigations.
➢ *Requirements – Assess 2 objectives (safety – IS1A.a, IS1A.b, **or** IS1A.c + 1 more objective from any cluster)* **Cluster 1A.** Plan and conduct safe and fair experiments **Cluster 1B.** Make and record measurements and observations **Cluster 1C.** Analyze data and draw conclusions
Physical Science Strand
Competency 2: Describe the biochemical basis of life and explain how energy flows within and between the living systems.
➢ *Requirement – Assess 1 objective* **Cluster 2A.** Biochemicals **Cluster 2B.** Flow of energy in photosynthesis and ecosystems
Life Science Strand
Competency 3: Investigate and evaluate the interaction between living organisms and their environment.
➢ *Requirement – Assess 1 objective* **Cluster 3A.** Interactions and adaptation of plants and animals within biomes **Cluster 3B.** Succession
Competency 4: Analyze and explain structures and function of the levels of biological organization.
➢ *Requirement – Assess 1 objective* **Cluster 4A.** Structure and function of cells and organelles **Cluster 4B.** Levels of organization from organelle to system
Competency 5: Demonstrate an understanding of the molecular basis of heredity.
➢ *Requirement – Assess 1 objective* **Cluster 5A.** Inherited versus non-inherited traits **Cluster 5B.** DNA and mutations
Competency 6: Demonstrate an understanding of principles that explain the diversity of life and biological evolution.
➢ *Requirement – Assess 1 objective* **Cluster 6A.** Classification of organisms **Cluster 6B.** Natural selections
Total = 7 objectives, which always include a "safety" objective for science, with Baseline and Final evidence documented for each objective.

MAAESF Science – High School (Biology I)		
INQUIRY STRAND		
MESF Science Competency	**Objective Code**	**MESF Objectives**
1. Apply inquiry-based and problem-solving processes and skills to scientific investigations.	**Cluster 1A. Plan and conduct safe and fair experiments**	
	IS1A.a	Student identifies safety procedures used after laboratory accidents. (DOK2)
	IS1A.b	Student demonstrates safe methods used to clean up after an experiment. (DOK3)
	IS1A.c	Student locates lab safety equipment shown in a picture. (DOK3)
	IS1A.d	Student demonstrates the steps of using a microscope. (DOK3)
	IS1A.e	Student categorizes given questions as either testable or non-testable. (DOK4)
	IS1A.f	Student identifies the independent variable in an experimental design. (DOK6)
	IS1A.g	Student identifies the dependent variable in an experimental design. (DOK6)
	Cluster 1B. Make and record measurements and observations	
	IS1B.a	Student identifies different types of data tables to organize a given set of data. (DOK2)
	IS1B.b	Student creates a data table to organize raw data. (DOK3)
	IS1B.c	Student categorizes data to fit a data table. (DOK4)
	IS1B.d	Student selects the more precise of two measuring tools. (DOK5)
	IS1B.e	Student identifies the cell(s) in a data table in which to record particular data. (DOK5)
	IS1B.f	Student selects the appropriate units for a given type of data. (DOK5)
	IS1B.g	Student identifies appropriate labels for a data table organizing a given set of data. (DOK5)
	Cluster 1C. Analyze data and draw conclusions	
	IS1C.a	Student identifies the graph corresponding to data in a table. (DOK2)
	IS1C.b	Student locates the data cell corresponding to a data point. (DOK3)
	IS1C.c	Student traces trends in a multiple-line graph. (DOK3)
	IS1C.d	Student identifies trends seen in a multiple-line graph showing two lines that do not intersect. (DOK4)
	IS1C.e	Student identifies a data point corresponding to given values on the *x*- and *y*-axes of a graph of experimental data. (DOK5)
	IS1C.f	Student interpolates from a line graph. (DOK5)
	IS1C.g	Student identifies a descriptive title that relates the *x*- and *y*-axes of a given graph. (DOK6)

MAAESF Science – High School (Biology I)		
PHYSICAL SCIENCE STRAND		
MESF Science Competency	**Objective Code**	**MESF Objectives**
2. Describe the biochemical basis of life and explain how energy flows within and between the living systems.	**Cluster 2A. Biochemicals**	
	PS2A.a	Student identifies enzymes. (DOK2)
	PS2A.b	Student identifies examples of household chemicals as either acid, base, or neutral. (DOK2)
	PS2A.c	Student identifies characteristics of subatomic particles. (DOK2)
	PS2A.d	Student locates the parts of an atom on a model. (DOK3)
	PS2A.e	Student measures the pH of household chemicals. (DOK3)
	PS2A.f	Student categorizes a job done by a class of biomolecules. (DOK4)
	PS2A.g	Student classifies liquids as either acid, base, or neutral using a pH scale. (DOK5)
***** *For these objective entries only, items may be repeated within and across the Baseline and Final assessments. The items must be presented in a different format.*	**PS2A.h**	Student compares properties of acids, bases, and neutral solutions. (DOK6)
	Cluster 2B. Flow of energy in photosynthesis and ecosystems	
	PS2B.a	Student identifies organisms that photosynthesize. (DOK2)
	PS2B.b	Student identifies organisms that respire. (DOK2)
	PS2B.c	Student traces the flow of energy through a food chain within a food web. (DOK4)
	PS2B.d	Student identifies the relative amount of energy available in each level of an energy pyramid. (DOK4)
	PS2B.e	Student describes the basic process used by organisms to release the energy stored in food. (DOK4)
	PS2B.f	Student describes the basic process used by plants to store energy as food. (DOK4)
	PS2B.g	Student sequences organelles, cells, tissues, and organs to show the pathways used by the body to release energy from food. (DOK5)
	***PS2B.h**	Student contrasts photosynthesis and respiration. (DOK6)

MAAESF Science – High School (Biology I)		
LIFE SCIENCE STRAND		
MESF Science Competency	**Objective Code**	**MESF Objectives**
3. Investigate and evaluate the interaction between living organisms and their environment.	**Cluster 3A. Interactions and adaptations of plants and animals within biomes**	
	***LS3A.a**	Student identifies land biomes: desert, tundra, taiga, grassland, temperate forest, tropical rainforest. (DOK2)
	LS3A.b	Student identifies characteristics of biomes. (DOK2)
	LS3A.c	Student matches animals to biomes. (DOK2)
	LS3A.d	Student locates biomes on a map. (DOK3)
	LS3A.e	Student describes examples of interdependence within an ecosystem. (DOK4)
	LS3A.f	Student describes examples of symbiosis, including the concepts of parasitism, mutualism, and commensalism. (DOK4)
****** *For these objective entries only, items may be repeated within and across the Baseline and Final assessments. The items must be presented in a different format.*	**LS3A.g**	Student classifies plants according to biome. (DOK5)
	LS3A.h	Student compares adaptations of plants in different ecosystems. (DOK6)
	LS3A.i	Student compares adaptations of animals in different ecosystems. (DOK6)
	Cluster 3B. Ecosystem structure	
	LS3B.a	Student identifies biotic and abiotic factors in an ecosystem. (DOK2)
	LS3B.b	Student identifies a non-native species. (DOK2)
	LS3B.c	Student describes human activities that may affect major ecosystems. (DOK4)
	LS3B.d	Student describes how natural events may affect major ecosystems. (DOK4)
	LS3B.e	Student creates a representation of a biome. (DOK6)
4. Analyze and explain the structures and function of the levels of biological organization.	**Cluster 4A. Structure and function of cells and organelles**	
	LS4A.a	Student identifies organelles: nucleus, mitochondrion, rough ER, ribosomes, Golgi bodies, lysosomes, vacuoles, chloroplast, nucleolus, chromosomes, nuclear membrane, cell wall, cell membrane. (DOK2)
	LS4A.b	Student identifies an organelle used for movement by single-celled organisms. (DOK2)
	***LS4A.c**	Student labels structures found within plant cells. (DOK2)
	***LS4A.d**	Student labels structures found within animal cells. (DOK2)
	LS4A.e	Student identifies a structure found within both a plant and animal cell. (DOK2)
	LS4A.f	Student locates organelles within a cell diagram. (DOK3)
	LS4A.g	Student uses models to demonstrate cellular processes. (DOK3)
	LS4A.h	Student describes the function of cell organelles and structures found within the cell. (DOK4)
	LS4A.i	Student compares the structures of plant and animal cells. (DOK6)

MAAESF Science – High School (Biology I)		
LIFE SCIENCE STRAND		
MESF Science Competency	**Objective Code**	**MESF Objectives**
4. Analyze and explain the structures and function of the levels of biological organization. (Cont.)	**Cluster 4B. Levels of organization from organelle to system**	
	LS4B.a	Student identifies examples of tissues found in plants. (DOK2)
	LS4B.b	Student identifies examples of organs found in plants. (DOK2)
	LS4B.c	Student locates plant organs within diagrams, pictures, or samples. (DOK3)
	LS4B.d	Student describes how cells interact within a tissue. (DOK4)
	LS4B.e	Student describes how tissues interact within an organ. (DOK4)
	LS4B.f	Student orders diagrams of a cell, tissue, organ, and body system to show the levels of organization within that system. (DOK5)
	LS4B.g	Student compares the function of organs in plants and animals. (DOK6)
5. Demonstrate an understanding of the molecular basis of heredity.	**Cluster 5A. Inherited versus non-inherited traits**	
	LS5A.a	Student identifies components of the cell involved with inheritance. (DOK2)
	LS5A.b	Student locates males and females in a pedigree. (DOK3)
	LS5A.c	Student locates relatives of an individual in a pedigree. (DOK3)
	LS5A.d	Student describes examples of phenotypes and genotypes. (DOK4)
	LS5A.e	Student organizes data into a pedigree. (DOK5)
	LS5A.f	Student describes the genotypes of individuals represented in a Punnett square. (DOK6)
	Cluster 5B. DNA and mutations	
	LS5B.a	Student identifies examples of mutations in DNA. (DOK2)
	LS5B.b	Student demonstrates DNA replication using a model. (DOK3)
	LS5B.c	Student describes genetic changes in plants and animals. (DOK4)
	LS5B.d	Student sequences the stages of mitosis using models or diagrams. (DOK5)

MAAESF Science – High School (Biology I)		
LIFE SCIENCE STRAND		
MESF Science Competency	**Objective Code**	**MESF Objectives**
6. Demonstrate an understanding of principles that explain the diversity of life and biological evolution.	**Cluster 6A. Classification of organisms**	
	***LS6A.a**	Student identifies the six kingdoms of life. (DOK2)
	LS6A.b	Student identifies characteristics of the six kingdoms of life. (DOK2)
	LS6A.c	Student follows a simple dichotomous key. (DOK3)
	LS6A.d	Student describes characteristics of different animal phyla. (DOK4)
	LS6A.e	Student classifies a given organism into one of the six kingdoms of life. (DOK5)
	LS6A.f	Student classifies an animal by phylum when given characteristics of different phyla. (DOK5)
***** *For these objective entries only, items may be repeated within and across the Baseline and Final assessments. The items must be presented in a different format.*	**LS6A.g**	Student compares characteristics of organisms within the same phylum. (DOK6)
	Cluster 6B. Natural selection	
	LS6B.a	Student identifies animals by their body plan. (DOK2)
	LS6B.b	Student identifies examples of sexual and asexual reproduction. (DOK2)
	LS6B.c	Student describes examples of extinct species. (DOK4)
	LS6B.d	Student describes factors that may lead to extinction of a species. (DOK4)
	LS6B.e	Student classifies examples of reproduction as either sexual or asexual. (DOK5)
	LS6B.f	Student infers the relatedness of different organisms based on body structures. (DOK6)

Glossary of Terms

Glossary of Terms

The Glossary of Terms is designed to serve as a tool for the MESF document (Elementary School, Middle School, and High School). These words are highlighted throughout the MESF document. Not all words are used at each level.

Term	Definition
Abiotic factors	The non-living parts of an ecosystem, such as soil, rocks, and water.
Absorb/Absorption	The taking in and storing of energy.
Acceleration	Change in the position or speed of an object.
Acid	A chemical with a pH less than 7.
Adaptation(s)	Changes in an organism to become better suited to an environment.
Asexual (reproduction)	Reproduction that does not use sex cells, including the production of spores, cell division, and budding.
Asthenosphere	The portion of Earth's mantle that is just below the lithosphere and that moves by flowing.
Atmosphere	The blanket of gases surrounding Earth.
Atom(s)	The smallest particle of a substance that retains properties of that substance.
Bar graph	A graph in which variables are represented as rectangles, with the height of each rectangle corresponding to the value of each variable.
Base	A chemical with a pH greater than 7.
Biome(s)	A community of organisms adapted to live in a particular climate in a particular geographic area.
Biomolecule(s)	A molecule used by living organisms, including fats, carbohydrates, proteins, and nucleic acids.
Biotic factors	The living parts of an ecosystem, such as plants, animals, and bacteria.
Body plan	The basic body features shared by members of a phylum.
Body system(s)	A group of organs that work together to perform a certain function. For fifth grade, examples include the circulatory, respiratory, skeletal, muscular, and digestive systems.
Carnivore(s)	An animal that obtains its energy from eating the flesh of other animals.
Cell(s)	The smallest unit of organization of living things; a compartment within a data table.
Cellular processes	The chemical and physical changes that occur inside the cell.
Change/Changes/Changing	The process of becoming different.
Chemical(s)	A form of matter that is made from a particular type of atom and has a specific set of properties.
Chemical change	A change that forms a new substance with new properties.
Chemical equation	A representation of a chemical reaction using numbers and symbols for elements to show the type and amount of reactants and products.
Chemical formula(s)	A way to show the type and number of atoms in a compound.
Chemical potential energy	Energy stored within the chemical bonds of a compound.

Term	Definition
Chemical reaction(s)	A change that results in the formation of new substances.
Chromosome(s)	A long strand of DNA and proteins that carries genes.
Class	A classification category that divides phyla into smaller groups.
Classify/Classifies	To apply or indicate a label or description related to each grouping. For plants, grouping criteria include: seed-bearing vs. non-seed bearing, flowering vs. non-flowering, compound leaves vs. simple leaves, and coniferous vs. deciduous. For animals, criteria include: vertebrate vs. invertebrate, mammalian vs. non-mammalian, amphibian vs. fish vs. reptile, and warm-blooded vs. cold-blooded.
Climate	The weather of a location over time.
Cluster	A group of stars held together by gravity.
Commensalism	A type of symbiosis where one member benefits and the other is not affected.
Communicate	The transmission of observable data; examples include spoken or written words, graphs, drawings, diagrams, maps, and mathematical equations; skills such as asking questions, discussing, explaining, reporting, and outlining can aid in the development of communication skills.
Compound(s)	A substance containing two or more elements, with properties different than those elements.
Compound leaves	Leaves that have a blade divided into more than one leaflet attached to a single petiole (leaf stalk).
Concept(s)	An abstract, universal idea of phenomena or relationships between phenomena in the natural world.
Conclusion	A statement that makes sense of data.
Conductor(s)	Material that allows heat or electrical energy to be transmitted.
Constructive forces	Processes that build up the Earth's crust by depositing materials.
Consumer(s)	A member of a food chain that gets its energy by eating producers, consumers, or both.
Control/Control group(s)	The variables in an experiment that stay the same; the process of designing an experiment to keep non-tested variables the same.
Data	Numerical information, such as measurements, and observations that are collected during an experiment. "Raw" data is disorganized and has not been analyzed.
Data table	A tool for arranging information in rows and columns to make patterns and trends easier to recognize.
Decomposer(s)	A member of a food chain that breaks down dead organisms.
Dependent variable	The variable that changes as the result of an experimental procedure.
Descriptive	Uses appropriate language (more than "*x*" or "*y*") to label a graph.
Destructive forces	Processes that break down or carry away materials in the Earth's crust.
Dichotomous key	A strategy used in classification that involves placing objects in groups (or eliminating them) based on certain characteristics.
Discrete data	Data which contains only a set number of values. Discrete data will have gaps between values (for example, days of the week).
Disease(s)	A condition that prevents an organism's cells, tissues, organs, or systems from working properly. (Sexually transmitted diseases do not fall within this topic.)

Term	Definition
DNA	A molecule found within cells that stores genetic information and is made of smaller components called nucleotides.
DNA replication	The process used by the cell to copy DNA.
Dominant (trait)	A trait that is always seen in an organism when the gene coding for it is present.
Ecological niche	An organism's job within an ecosystem.
Ecosystem(s)	A community of interacting organisms and the environment they live in.
Elastic	Ability to stretch, then return to the original state.
Elastic potential energy	Potential energy that results from stretching or compressing an object.
Electrical circuit	A path through which electricity can flow. A simple electrical circuit contains a material that can conduct electricity in a path (such as wire), a source of potential energy that will cause electrons to flow (such as a battery), and a resistor that will cause electricity to do work (such as a light bulb, buzzer, or fan).
Electricity	Energy that results from charged particles.
Electromagnetic radiation	A form of energy that has both magnetic and electrical properties; this includes visible light, radio waves, x-rays, and ultraviolet light.
Electromagnetic spectrum	The range of wavelengths of all known forms of electromagnetic radiation.
Element(s)	A substance that cannot be broken down into simpler substances by ordinary methods.
Endangered	When a species is likely to go extinct unless steps are taken to protect its ecosystem.
Energy	The capacity of a system to do work.
Energy pyramid	A diagram showing the movement of energy within a community.
Environment	All external conditions and factors, living and non-living, that affect an organism during its lifetime.
Enzyme(s)	A protein molecule that assists in chemical reactions in organisms.
Experiment	Testing a hypothesis under controlled conditions. Basic to the total scientific process and uses all process skills.
Experimental data	Numerical information or observations collected during the course of an experiment. Scientific data always has the context of an experiment.
Experimental design	A way to determine the cause and effect relationship between variables. An experimental design can be inferred by analyzing an experimental procedure, data, or the results of an experiment.
Experimental procedure	Set of instructions to be followed in an experiment. A written procedure may take the form of words or pictures.
Explanation	Includes a rich scientific knowledge base, evidence of logic, higher levels of analysis, greater tolerance of criticism and uncertainty, and a clear demonstration of the relationship between logic, evidence, and current knowledge.
Extinct/Extinction	When a species no longer exists on Earth; the loss of a species.
Fairness	The controlling of an experiment to ensure that both the treatment group and control group are handled the same. Can be used to introduce the idea of controlling variables in experiments.

Term	Definition
Fleming, Alexander	A scientist who discovered the antibiotic penicillin.
Food chain	A linear diagram showing the flow of energy among producers and consumers.
Food web	A diagram showing the interrelationships among food chains.
Force(s)	A push or pull.
Galactic cluster	A group of hundreds to thousands of galaxies bound together by gravity.
Galaxies	Groups of millions to billions of stars, bound together by gravity.
Gas/Gases	A form of matter that has no definite shape, and which changes its volume to fill a container.
Gene(s)	A piece of DNA containing the instructions to build a protein.
Genotype(s)	The specific genes of an organism.
Global warming	A gradual increase in the overall temperature of Earth.
Gravitational	Related to gravity.
Gravitational potential energy	Potential energy that results from the position of an object within a gravitational field.
Heavenly objects/bodies	Non-living natural/celestial (non-man-made) objects associated with the solar system that can be seen in the sky during the day or night (for example: Sun, stars, the Moon, planets, etc.). This does not include clouds, birds, or man-made objects such as planes or satellites. The terms “natural” and “celestial” are interchangeable.
Herbivore	An animal that obtains its energy from eating only plants.
High energy	Forms of energy that are damaging to life, such as x-rays and ultraviolet light.
Hydrosphere	All water found on, under, and above Earth’s surface.
Hypothesis	Forming a generalization and/or question based on observations. Involves asking questions, making inferences, and making predictions. Must be testable or tested to establish credibility. Note that a hypothesis does not have to be correct.
Igneous rock	Rock formed by the cooling of magma or lava.
Independent variable	The variable that is changed by an experimenter during an experimental procedure.
Infectious (disease)	A disease that is caused by a virus, bacteria, fungus, or other organism, which can be spread among organisms. (Sexually transmitted diseases are not a part of this topic.)
Infer	Using logic to draw conclusions from observations. Suggests explanations, reasons, and/or causes for events. Based on judgments and may not always be valid.
Inference(s)	A conclusion drawn from the data collected in an experiment.
Inheritance/Inherited (trait(s))	When a characteristic is passed from parent to child through genetics; a characteristic that is passed on from parent to child through the genetics.
Insulator(s)	A material that prevents heat or electrical energy from transferring away from an object.
Interpolate(s)	To read between the data points of a graph. In a graph where data points are connected by a line, the line shows interpolations. *Extrapolation* is reading beyond the data points of a graph (before the first data point or after the last data point) and is less accurate than interpolation.

Term	Definition
Inertia	Tendency of a moving object to continue moving or a non-moving object to stay at rest.
Land biomes	Habitats on land with particular communities of plants and animals, including desert, taiga, tundra, grassland, temperate forest, and tropical rainforest.
Layers of the Earth	Divisions of the Earth based on chemical properties: crust, mantle, and core or asthenosphere, lithosphere.
Levels of organization	The arrangement of objects into systems, which in turn interact within larger systems.
Life cycle	The changes in the life of an organism.
Line graph	A graph that uses points connected by a line to show how a variable changes.
Liquid(s)	A form of matter that has a definite volume, but that takes the shape of its container.
Lithosphere	The layer of rigid rock that sits atop the asthenosphere and moves as a result of stress.
Magnetism	Attractive force between an object and a magnet.
Mass	The amount of matter in a substance.
Matter	Anything that has mass and takes up space.
Measurement	Numbers used to quantify capacity, volume, dimensions, or other characteristics of an object. Scientists generally use the International System of Measurement (SI) or metric system.
Meiosis	The process used by the cell to systematically reduce the number of chromosomes during sex cell production.
Metal(s)	Elements found on the left side of the periodic table that are shiny, malleable, ductile, and good conductors of electricity.
Metamorphic rock	Rock that has been transformed by heat or pressure.
Microbiologist	A scientist who studies single-celled organisms.
Mitosis	The process used by the cell to systematically divide copied chromosomes before the division of body cells.
Mixture(s)	A combination of compounds and/or elements that does not have properties different from the compounds and elements of which it is made.
Model	Tentative schemes or structures that correspond to real objects, concepts, events, or classes of events and have explanatory power. Models help scientists and engineers understand how things work.
Multiple-line graph	A graph that contains more than one line plotted using the same *x*- and *y*- axes.
Mutation	A change in a DNA sequence.
Mutualism	A type of symbiosis where both organisms benefit from the relationship.
Natural resources	Naturally occurring materials, such as land, water, minerals, and forests that can be used by humans.
Neutral	A substance with a pH of 7.

Term	Definition
Newton's (three) laws of motion	Laws that describe the movement of objects. First law states that unless acted upon by an outside force, an object that is resting will keep on resting, and an object that is moving will keep on moving. Second law states that when a force acts on an object, the object will accelerate (change its speed or direction of movement). The larger the force, the greater the acceleration. When comparing the same amount of force applied to two objects, the larger the mass of the object, the smaller the acceleration. Third law states that whenever an object is pushed or pulled, the object pushes or pulls in the opposite direction with an equal amount of force.
Non-metal(s)	Elements found on the right side of the periodic table, typically gases or brittle solids. They are poor conductors of electricity and heat.
Non-native species	A species that has been introduced into an area. Also known as introduced species or invasive species. In Mississippi, examples are zebra mussels, fire ants, water hyacinths, and Dutch Elm fungus.
Non-testable	A question or hypothesis that cannot be answered using an experiment that collects measurable data.
Nonrenewable (resources)	A resource of which there is a limited supply (for example, fuels such as gasoline, coal, natural gas, and diesel, as well as materials such as glass, copper, aluminum, and plastics).
Observation	Perception of properties, similarities, and differences in objects and events; can be made directly with the senses or indirectly through the use of simple or complex instruments; influenced by the previous experience of the observer.
Omnivore(s)	An animal that obtains its energy from eating both plants and animals.
Organ(s)	A structure made of different types of tissues that work together to do a specific job.
Organelle(s)	A specialized structure within the cell that does a specific job.
Organisms	Any form of life.
Outside force	A force applied to an object.
Oxidation	The reaction of oxygen with another element or compound. Can be slow, such as rust, or quick, such as burning.
Parasitism	A type of symbiosis where one organism benefits and the other is harmed.
Pasteur, Louis	A scientist who studied microorganisms and developed techniques to reduce the spoiling of milk by bacteria.
Pedigree	A genetic family tree that uses symbols to show the relationships within a family and to trace traits within that family.
pH/pH scale	The measure of the acidity or basicity of a substance; a diagram showing the relative strengths of acids, bases, and neutral substances.
Phenotype(s)	The physical characteristics of an organism.
Photosynthesize/Photosynthesis	A process used by plants, algae, and some bacteria to store the Sun's energy within the chemical bonds of food. Converts carbon dioxide and water into sugars and oxygen.

Term	Definition
Phylum/Phyla	A classification category that divides kingdoms into smaller groups.
Physical change(s)	A change in the properties of a substance that does not change the identity of the substance.
Pictograph	A graph that uses symbols or shapes to represent the amount of each variable.
Plant organs	Plant structures containing tissues that work together. Examples include leaves, roots, petals, stems, stamens, and pistils.
Point(s) of reference	A point in space that stays still and which is used to determine the position of an object.
Potential energy	Energy stored in an object due to its position, or energy stored within chemical bonds.
Precipitation	Water that falls to the ground as rain, snow, sleet, hail, etc.
Precise	Being more precise means that the results of an experiment will more closely and more likely agree when the experiment is repeated.
Producer(s)	An organism in a food chain that harvests energy directly from an energy source, usually from the Sun.
Product(s)	Materials formed as the result of a chemical reaction.
Property/Properties	A measurable or observable characteristic of objects and organisms.
Punnett square	A tool used in genetics to predict the possible offspring from a genetic cross.
Qualitative	Describes data that cannot be measured.
Quantitative	Describes data that is numerical and measurable.
Radiate/Radiation	The spreading out of energy from a source; the emission of energy as waves or high-energy particles.
Reactant(s)	Materials to be converted by a chemical reaction. Interchangeable with raw materials.
Recessive trait	A trait that is only seen when dominant forms of the gene coding for the trait are absent.
Reflect/Reflection	The bouncing of a wave after striking a surface.
Refract/Refraction	The bending of a wave moving from one medium into another.
Renewable resources	A natural resource that can continually be replenished with the passage of time through a naturally recurring process (for example, sunlight, wind, rain, tides, waves, geothermal energy, wood [fiber crops], biofuels, etc.).
Reproduction	Production of a new organism.
Respire/Respiration	A process used by plants, animals, and many other living things to convert the energy stored within the chemical bonds of food into forms more easily used by their cells. Converts sugars and oxygen into carbon dioxide and water.
Resources	Living and non-living Earth materials that can be used by humans.
Results	The portion of an experiment where data is analyzed and graphed.
Revolution of Earth	The yearly movement of the Earth around the Sun.
Rotation of Earth	The daily turning of Earth on its axis, which produces night and day.
Safety symbols	Pictures used as reminders and warnings about lab safety.
Salk, Jonas	A scientist who studied viruses and developed the polio vaccine.

Term	Definition
Scientific criteria	Categories used for sorting or analysis that are scientific in nature.
Scientific question	Question about the material world that can be tested using an experimental procedure.
Scratch test	A test used to determine the relative softness or hardness of a mineral.
Sedimentary rock	Rock formed by the buildup of eroded materials.
Sexual reproduction	Reproduction involving sex cells.
Short	In a science experiment, describes a procedure of five or fewer steps.
Simple experimental procedure	A simple experiment is one where only one variable is changed.
Single-celled organism(s)	An organism made up of only one cell.
Six kingdoms of life	Categories used to sort organisms into six major groups: plants, animals, fungi, protists, eubacteria, and archaebacteria.
Solar system	The Sun and the planets, moons, and asteroids surrounding it.
Solid(s)	A form of matter that has a definite shape and volume.
Species	A group of organisms that can mate with each other to produce fertile offspring.
Speed	The rate at which an object moves.
(Cellular) Structures	Organelles and components found within the cell. At eighth grade, these include nucleus, cytoplasm, cell membrane, cell wall, mitochondrion, nuclear membrane. At high school, these include nucleus, mitochondrion, rough ER, ribosomes, Golgi bodies, lysosomes, vacuoles, chloroplast, nucleolus, chromosomes, nuclear membrane, cell wall, cell membrane.
Subatomic particles	Particles found within the atom, such as electrons, protons, and neutrons.
Succession	The gradual replacement of one biological community with another until a stable community results.
Symbiosis	A close relationship between two organisms of different species where at least one member of the pair benefits.
System	An organized group of related objects or components that form a whole.
Tectonic plates	A slab of lithospheric rock that floats on the asthenosphere.
Testable	Able to be supported or refuted using experimental data. Testable questions and hypotheses deal with the material world and measurable, observable phenomena only.
Tissue(s)	A group of cells working together to do certain jobs.
Tool(s)	An object used to achieve a goal, make an observation, or extend the senses.
Trait(s)	A characteristic shown by an organism.
Trend	A pattern shown in data or a graph.
Units	A quantity chosen as a standard for measuring.
Universe	All existing matter and energy and the space they occupy.
Water cycle	The movement of water above, below, and on Earth's surface.
Weather	The state of the atmosphere at a particular time.

Term	Definition
***x*-axis**	In a graph, the horizontal axis. The variable manipulated in the experiment (independent variable) is measured here. The axis is labeled descriptively, so that a reader can easily determine the relationship shown in the graph.
***y*-axis**	In a graph, the vertical axis. The variable responding during the experiment (dependent variable) is measured here. The axis is labeled descriptively so that a reader can easily determine the relationship shown in the graph.