Davison Community Schools
ADVISORY CURRICULUM COUNCIL
Phase I/II, *May 14, 2018*

Sixth Grade Science

Phase I: Course Essential Questions

1. What is energy and how is energy transferred?
2. What is the relationship between force, motion, and energy?
3. How do living things interact with each other and their nonliving environment?
4. How are traits passed from parent organisms to offspring?

Phase II Curriculum

Unit 1: Energy

Essential Questions:	Essential Understanding:
1. What is energy? 2. What happens when energy is transferred?	1. Energy is the ability to do work and comes in different forms.

Curriculum Standards- DOK noted where applicable with Standards

UNIT STANDARDS

PS3-1 Construct and interpret graphical displays of data to describe the relationships of kinetic energy to the mass of an object and to the speed of an object**.**

PS3-2 Develop a model to describe that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system.

PS3-3 Apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer.

PS3-4 Plan an investigation to determine the relationships among the energy transferred, the type of matter, the mass, and the change in the average kinetic energy of the particles as measured by the temperature of the sample.

PS3-5 Construct, use, and present arguments to support the claim that when the kinetic energy of an object changes, energy is transferred to or from the object.

EVERY UNIT STANDARDS

MS-ETS1-1 Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and natural environment that may limit possible solutions.

MS-ETS1-2 Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.

MS-ETS1-3 Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.

Knowledge/Content **I Know** …(includes academic vocabulary)	**Skills/Processes** **I Can** …
• energy is the ability to do work and comes in different forms (heat, light, motion, electrical, chemical, nuclear energy and gravitational). • kinetic energy is motion energy; it is proportional to the mass of the moving object and grows with the square of its speed. • potential energy is stored energy. • mass is the amount of matter in an object. • temperature is a measure of the average kinetic energy of particles of matter; the relationship between the temperature and the total energy of a system depends on the types, states, and amounts of matter present. • thermometers are used to read temperatures. • thermal energy is the energy of molecules in a substance due to its temperature. • the amount of energy needed to change the temperature of matter depends on the nature of the matter, the size of the sample, and the environment. • energy is spontaneously transferred out of the hotter regions or objects and into colder ones. • when two objects interact, each one exerts a force on the other that can cause energy to be transferred to or from the object. **<u>Academic Vocabulary</u>** energy kinetic energy potential energy mass speed thermal energy	• give examples of different forms of energy. • explain how kinetic and potential energy are related. • explain the relationship between energy mass and speed. • construct and interpret graphical displays of data to describe the relationship of kinetic energy to the mass and speed of an object. • develop a model to describe that when the arrangement of objects interacting at a distance changes, different amounts of potential energy are stored in the system. • create tables and graphs of data to show the relationships between data sets. • explain the relationship between temperature and the total energy of a system. • accurately use and read a thermometer. • apply scientific principles to design, construct, and test a device that either minimizes or maximizes thermal energy transfer. • plan an investigation to determine the relationship among the energy transferred, the type of matter, the mass, and the change in the average kinetic energy of the particles as measured by the temperatures of the sample. • construct, use, and present arguments to support the claims that when the kinetic energy of an object changes, energy is transferred to or from the object. • explain how energy is transferred.

Phase II Curriculum
Unit II : Motion and Stability: Forces and Interactions

Essential Questions:

1. What is force and how do forces interact to cause motion? (Newton's three (3) Laws)

2. What are the different types of forces?

Essential Understanding:

1. Force causes motion (Newton's 1st law). When forces are equal and opposite, no motion occurs. When forces are not equal, movement occurs in the direction of the greater force.

2. Forces can be attractive or repulsive.

3. For every action there is an equal and opposite reaction (Newton's 3rd law).

4. Three types of forces are:
   gravitational
   electrical
   magnetic

UNIT STANDARDS:

PS2-1 Apply Newton's Third Law to design a solution to a problem involving the motion of two colliding objects.

PS2-2 Plan an investigation to provide evidence that the change in an object's motion depends on the sum of the forces on the object and the mass of the object.

PS2-3 Ask questions about data to determine the factors that affect the strength of electric and magnetic forces.

PS2-4 Construct and present arguments using evidence to support the claim that gravitational interactions are attractive and depend on the masses of interacting objects.

PS2-5 Conduct an investigation and evaluate the experiment design to provide evidence that fields exist between objects exerting forces on each other even though the objects are not in contact.

EVERY UNIT STANDARDS:

MS-ETS1-1 Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and natural environment that may limit possible solutions.

MS-ETS1-2 Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.

MS-ETS1-3 Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.

Knowledge/Content **I Know** …(includes academic vocabulary)	**Skills/Processes** **I Can** …
• force is a push or pull on an object. • the motion of an object is the result of the forces acting upon it. When forces are equal and opposite, no movement occurs. When forces are not equal, movement occurs in the direction of the greater force. • mass is the amount of matter in an object. • the force necessary to move an object is directly dependent on the object's mass (Newton's 2nd Law). • when a force acts on an object (action force), there will be an equal and opposite reaction force (Newton's 3rd Law). • gravity is an attractive force that exists between two or more objects. • three different types of forces are: Physical Electrical Magnetic • magnetic forces can be attractive or repulsive. • when an object gains or loses electrons, electrical charges occur. • electrical current (electricity) is the movement of electrons from a negatively charged area or object to a positively charged area or object. • lightening is the result of electrically charged particles to a positively charged area or object. **Academic Vocabulary** force Newton's 1st Law Newton's 2nd Law Newton's 3rd Law gravity	• identify the forces acting on an object. • analyze the forces acting on an object and predict the movement of an object when external unbalanced forces act upon it. • design and conduct an experiment to illustrate Newton's laws of motion. • use Newton's third law to analyze the collision of two objects and offer a solution explaining your observations. • give examples of attractive and repulsive forces. • construct a model to illustrate attractive and repulsive forces. • explain the relationship between force and mass. • calculate speed given force and mass • design and conduct an experiment to demonstrate how magnetic forces can be either attractive or repulsive. • identify different types of forces. • construct a simple circuit to demonstrate the flow of electrical current. • explain how lightening occurs.

Phase II Curriculum
Unit III: Ecosystems: Interactions, Energy, and Dynamics

Essential Questions:	Essential Understanding:
1. How do living things interact with each other and their non-living environment? 2. How is energy transferred through an ecosystem?	1. Living things interact with one another and with non-living factors in the environment in a variety of ways. 2. Living organisms in an ecosystem are interdependent on one another and the non-living factors within their environment. 3. Energy is transferred through an ecosystem from producers to consumers.

UNIT STANDARDS:

MS LS 2-1 Analyze and interpret data to provide evidence for the effects of resource availability on organisms and populations of organisms in an ecosystem.

MS LS 2-2 Construct an explanation that predicts patterns of interactions among organisms across multiple ecosystems.

MS LS 2-3 Develop a model to describe the cycling of matter and flow of energy among living and nonliving parts of an ecosystem.

MS LS 2-4 Construct an argument supported by empirical evidence that changes to physical or biological components of an ecosystem affect populations.

MS LS 2-5 Evaluate competing design solutions for maintaining biodiversity and ecosystem services.

EVERY UNIT STANDARDS

MS-ETS1-1 Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and natural environment that may limit possible solutions.

MS-ETS1-2 Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.

MS-ETS1-3 Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.

Knowledge/Content **I Know** …(includes academic vocabulary)	Skills/Processes **I Can** …
• living organisms are referred to as biotic factors. • non-living things are abiotic factors. • a population is the number of a specific species within an ecosystem.	• identify the biotic and abiotic factors in an ecosystem. • analyze data and calculate population density. • identify limiting factors in an ecosystem.

- limiting factors are things that limit the size of a population.
- producers are organisms that produce or make their own food.
- plants are producers.
- consumers eat other living things for food.
- herbivores are consumers that eat only plants.
- carnivores are consumers that eat animals.
- omnivores are consumers that eat both plants and animals.
- food chains, food webs and food pyramids are models that show how energy is transferred through an ecosystem.
- food pyramids show the relationship between the energy needs and the number of different types of organisms in an ecosystem.
- predator/prey relationships and symbiosis are examples of the way organisms interact in a ecosystem.
- examples of symbiotic relationships are:
    - Mutualism – when both organisms benefit from the relationship
    - Commensalism – when one organism benefits and the other is not affected
    - Parasitism – when one organism benefits and is harmed

Academic Vocabulary
organisms
biotic
abiotic
population
limiting factors
producers
consumers

- design an experiment to show how resources limit the population of an organism
- differentiate between herbivores, carnivores and omnivores.
- develop models (food chains, food web) to show the relationships that exist within an ecosystem (producers/consumers, predator/prey).
- construct a prediction on the impact of the elimination of a predator or prey species from the environment.
- construct graphs to demonstrate predator/prey relationships and their interdependence on one another.
- develop models (energy pyramid) to show the relationships between the number of each type of organism and their energy needs in an ecosystem.
- explain the different types of symbiotic relationships and give examples of each.
- analyze and evaluate different proposals to manage an ecosystem and construct an argument on which proposal to implement

herbivores carnivores omnivores food chains food webs food pyramids predator prey symbiosis mutualism commensalism parasitism	

Phase II Curriculum
Unit IV: Heredity: Inheritance and Variation of Traits

Essential Questions:	Essential Understanding:
1. How are traits passed from parents to offspring? 2. How do changes (variations) in a species occur over time?	1. Traits are passed from parents to offspring. 2. Asexual reproduction results in clones, identical copies of the parent. 3. Sexual reproduction results in organisms that are similar yet different from their parent organism. 4. Species can change over time due to changes in genes known as mutations.

Curriculum Standards- DOK noted where applicable with Standards

UNIT STANDARDS

LS3-1 Develop and use a model to describe why structural changes to genes (mutations) located on chromosomes may affect proteins and may result in harmful, beneficial, or neutral effects to the structure and function of the organism.

LS3-2 Develop and use a model to describe why asexual reproduction results in offspring with identical genetic information and sexual reproduction results in offspring with genetic variation.

EVERY UNIT STANDARDS

MS-ETS1-1 Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and natural environment that may limit possible solutions.

MS-ETS1-2 Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.

MS-ETS1-3 Analyze data from tests to determine similarities and differences among several design solutions to identify the best characteristics of each that can be combined into a new solution to better meet the criteria for success.

Knowledge/Content **I Know** …(includes academic vocabulary)	**Skills/Processes** **I Can** …
• genetic information is passed from parents to offspring through chromosomes. • chromosomes are composed of DNA (deoxyribonucleic acid). • segments of chromosomes (DNA) that control traits are called genes. • genes can change over time through mutation. • mutation can occur when genes (DNA) replicates. • Mutations can be helpful, harmful or neutral • replication of DNA occurs prior to the formation of gametes or sex cells (sperm and egg). • asexual reproduction produces identical offspring. • sexual reproduction requires two parents, a male and a female, and produces offspring that are different than the parents. • sex cells (sperm and egg) carry genes from parents to offspring during fertilization. • sperm are male sex cells; eggs are female sex cells. • offspring from sexual reproduction have genes from both parents. • offspring can have the same or different traits than their parents. • some genes are dominant and are always expressed. • some genes are recessive and are only expressed when no dominant gene is present. • the actual genes an organism has is its genotype.	• explain how traits are passed from parents to offspring. • develop a model of the DNA molecule. • use a model of the DNA molecule to demonstrate how replication occurs and how structural changes can result in mutations • explain how genes determine traits. • construct a Punnett square to show the possible genotype and phenotypes for offspring when the genotypes of the parents are known. • Develop a model to show how asexual reproduction results in identical offspring and sexual reproduction results in offspring with genetic variation.

• the traits an organism has is its phenotype. • phenotype is determined by genotype. **Academic Vocabulary** chromosomes DNA (deoxyribonucleic acid) genes mutation replication gametes asexual reproduction sexual reproduction fertilization dominant recessive genotype phenotype	

**An estimated budget needs to be submitted along with a Phase II report.