Course Syllabus
Science, Integrated Science

Morgan County Curriculum 4.1 High School, Final
Morgan County School District

Students are assessed in Science through the Commonwealth Assessment Testing System (CATS).

The Kentucky Core Content Test (KCCT) in science is given in grade 11 and consists of 38 Multiple-Choice and five (5) Open Response items. The scientific content standards a the high school level are organized around seven "Big Ideas" that are important to the discipline of science. These big ideas are: Structure and Transformation of Matter, Motion and Forces, The Earth and the Universe, Unity and Diversity, Biological Change, Energy Transformations an Interdependence.

Eleventh grade students will also take the American College Test (ACT). The ACT assesses students' general educational development and their ability to complete college-level work. The Science section of the ACT contains 40 Multiple-Choice questions dealing with the following: The Science Reasoning section has seven passages, each of which is followed by five to seven questions. The passages cover material drawn from biology, chemistry, physics, and the physical sciences (including geology, astronomy, and meteorology). All of the passages fall within three basic formats: Data Representation (38%), Experimental Reasoning (45%), and Conflicting Viewpoints (17%). The questions test one's ability to interpret scientific data and fall into three categories: Understanding, Analysis, Generalization.

Tenth grade students will take the PLAN, a curriculum-based assessment program developed by the American College Testing Program (ACT) to help students plan their academic careers and prepare for entry into college or the world of work. The test consists of 30 Multiple-Choice Questions dealing with biology, chemistry, earth/space science and physics content.

Upon reviewing assessment results, the Morgan County High School will help the student and parent to determine what courses their child needs to take during their high school career, utilizing the Individual Learning Plan (ILP)

Physical Science (25%)

STRUCTURE AND TRANSFORMATION OF MATTER: A basic understanding of matter is essential to the conceptual development of other big ideas in science. By high school, students will be dealing with evidence from both direct and indirect observations (microscopic level and smaller) to consider theories related to change and conservation of matter. The use of models (and an understanding of their scales and limitations) is an effective means of learning about the structure of matter. Looking for patterns in properties is also critical to comparing and explaining differences in matter. MOTION AND FORCES: Whether observing airplanes, baseballs, planets, or people, the motion of all bodies is governed by the same basic rules. At the middle level, qualitative descriptions of the relationship between forces and motion will provide the foundation for quantitative applications of Newton's Laws. These ideas are more fully developed at the high school level along with the use of models to support evidence of motion in abstract or invisible phenomena such as electromagnetism.

- 1.1.1 (DOK 2) ASSESSED
  The learner will be able to classify or make generalizations about elements from data of observed patterns in atomic structure and/or position on the periodic table. (The periodic table is a consequence of the repeating pattern of outermost electrons.).
- 1.1.2 (DOK) Supporting
  The learner will be able to understand that the atom's nucleus is composed of protons and neutrons that are much more massive than electrons; When an element has atoms that differ in the number of neutrons, these atoms are called different isotopes of the element.
- 1.1.3 (DOK) Supporting
  The learner will be able to understand that solids, liquids, and gases differ in the distances between molecules or atoms and therefore the energy that binds them together. In solids, the structure is nearly rigid; in liquids, molecules or atoms move around each other but do not move apart; and in gases, molecules or atoms move almost independently of each other and are relatively far apart.

- 1.1.4 (DOK) Supporting
  The learner will be able to understand that in conducting materials, electrons flow easily; whereas, in insulating materials, they can hardly flow at all. Semiconducting materials have intermediate behavior. At low temperatures, some materials become superconductors and offer no resistance to the flow of electrons.

Earth/Space Science (16%)

THE EARTH AND THE UNIVERSE: The Earth system is in a constant state of change. These changes affect life on Earth in many ways. At the high school level, most of the emphasis is on why these changes occur. An understanding of systems and their interacting components will enable students to evaluate supporting theories of Earth changes. The use of models and observance of patterns to explain common phenomena is essential to building a conceptual foundation and supporting ideas with evidence at all levels Patterns play an important role as students seek to develop a conceptual understanding of gravity in their world and in the universe. High school is the time to bring all of the ideas to together to look at the universe as a whole. Students will use evidence to evaluate and analyze theories related to the origin of the universe and all components of the universe.

- 2.3.1 (DOK 3) ASSESSED
  The learner will be able to explain phenomena (falling objects, planetary motion, satellite motion) related to gravity; Describe the factors that affect gravitational force. (Gravity is a universal force that each mass exerts on every other mass.).
- 2.3.2 (DOK 2) ASSESSED
  The learner will be able to describe the current scientific theory of the formation of the universe (Big Bang) and its evidence; Explain the role of gravity in the formation of the universe and its components. (The big bang theory and observational measurements that support it place the origin of the universe at a time between 10 and 20 billion years ago, when the universe began in a hot dense state. According to this theory, the universe has been expanding since then. Early in the history of the universe, the first atoms to form were mainly hydrogen and helium. Over time, these elements clump together by gravitational attraction to form trillions of stars.
- 2.3.3 (DOK 2) ASSESSED
  The learner will be able to explain the origin of the heavy elements in planetary objects (planets, stars). (Some stars explode at the end of their lives, and the heavy elements they have created are blasted out into space to form the next generation of stars and planets.).
- 2.3.4 (DOK) Supporting
  The learner will be able to understand that stars have life cycles of birth through death that are analogous to those of living organisms. During their lifetimes, stars generate energy from nuclear fusion reactions that create successively heavier chemical elements.
- 2.3.5 (DOK 2) ASSESSED
  The learner will be able to explain the difference between alpha and beta decay, fission, and fusion; Identify the relationship between nuclear reactions and energy. (Nuclear reactions convert a fraction of the mass of interacting particles into energy, and they can release much greater amounts of energy than atomic interactions. Fission (alpha and beta decay) is the splitting of a large nucleus into smaller pieces. Fusion is the joining of two nuclei at extremely high temperature and pressure. Fusion is the process responsible for the energy of the Sun and other stars.).
- 2.3.6 (DOK) Supporting
  The learner will be able to understand that the forces that hold the nucleus together, at nuclear distances, are usually stronger than the forces that would make it fly apart.
- 2.3.7 (DOK) Supporting
  The learner will be able to understand that the Sun, Earth, and the rest of the solar system formed approximately 4.6 billion years ago from a nebular cloud of dust and gas.
- 2.3.8 (DOK 3) ASSESSED
  The learner will be able to compare the limitations/benefits of various techniques (radioactive dating, observing rock sequences, and comparing fossils) for estimating geological; Justify deductions

about age of geologic features. (Techniques used to estimate geological time include using radioactive dating, observing rock sequences, and comparing fossils to correlate the rock sequences at various locations.).

Unifying Ideas (34%)

ENERGY TRANSFORMATIONS are inherent in almost every system in the universe--from tangible examples at the elementary level, such as heat production in simple Earth and physical systems to more abstract ideas beginning at middle school, such as those transformations involved in the growth, dying and decay of living systems. The use of models to illustrate the often invisible and abstract notions of energy transfer of living systems. The use of models to illustrate the often invisible and abstract notions of energy transfer will aid in conceptualization, especially as students move from the macroscopic level of observation and evidence (primarily elementary school) to the microscopic interactions at the atomic level (middle and high school levels). Students in high school expand their understanding of constancy through the study of a variety of phenomena. Conceptual understanding and application of the laws of thermodynamics connect ideas about matter with energy transformations within all living, physical and Earth systems. INTERDEPENDENCE: It is not difficult for students to grasp the general notion that species depend on one another and on the environment for survival. But their awareness must be supported by knowledge of the kinds of relationships that exist among organisms, the kinds of physical conditions that organisms must cope with, the kinds of environments created by the interaction of organisms with one another and their physical surroundings, and the complexity of such systems. At the high school level, the concept of an ecosystem should bring coherence to the complex array of relationships among organisms and environments that students have encountered. Students growing understanding of systems in general will reinforce the concept of ecosystems. organisms and change in ecosystems can be considered in terms of variables such as population size, number of kinds of species, productivity and the effect of human intervention.

- 4.6.1 (DOK 3) ASSESSED
  The learner will be able to explain the relationships and connections between matter, energy, living systems, and the physical environment; Give examples of conservation of matter and energy. (As matter and energy flow through different organizational levels (e.g., cells, organs, organisms, communities) and between living systems and the physical environment, chemical elements are recombined in different ways. Each recombination results in storage and dissipation of energy into the environment as heat. Matter and energy are conserved in each change.
- 4.6.2 (DOK 3)
  The learner will be able to predict wave behavior and energy transfer: Apply knowledge of waves to real life phenomena/investigations. (Waves, including sound and seismic waves, waves on water, and electromagnetic waves, can transfer energy when they interact with matter. Apparent changes in frequency can provide information about relative motion.
- 4.6.3 (DOK) Supporting
  The learner will be able to understand that electromagnetic waves, including radio waves, microwaves, infrared radiation, visible light, ultraviolet radiation, x-rays, and gamma rays, result when a charged object is accelerated.
- 4.6.4 (DOK 3) Assessed
  The learner will be able to describe the components and reservoirs involved in biogeochemical cycles (water, nitrogen, carbon dioxide, and oxygen); Explain the movement of matter and energy in biogeochemical cycles and related phenomena. (The total energy of the universe is constant. Energy can change forms and/or be transferred in many ways, but it can neither be created nor destroyed. Movement of matter between reservoirs is driven by Earth's internal and external sources of energy. These movements are often accompanied by a change in physical and chemical properties o f the matter. Carbon, for example, occurs in carbonate rocks such as limestone, in the atmosphere as carbon dioxide gas, in water as dissolved carbon dioxide, an in all organisms as complex molecules that control the chemistry of life.

- 4.6.6 (DOK) Supporting
  The learner will be able to understand that heat is the manifestation of the random motion and vibrations of atoms.
- 4.6.7 (DOK 2) ASSESSED
  The learner will be able to explain real world applications of energy using information/data; Evaluate explanations of mechanical systems using current scientific knowledge about energy. (The universe becomes less orderly and less organized over time. Thus, the overall effect is that the energy is spread out uniformly. For example, in the operation of mechanical systems, the useful energy output is always less than the energy input; the difference appears as heat.).
- 4.6.8 (DOK 3) ASSESSED
  The learner will be able to describe the connections between the functioning of the Earth system and its sources of energy (internal and external); Predict the consequences of changes to any component of the Earth system. (Earth systems have sources of energy that are internal and external to the Earth. The Sun is the major external source of energy. Two primary sources of internal energy are the decay of radioactive isotopes and the gravitational energy from Earth's original formation.
- 4.6.9 (DOK 3) ASSESSED
  The learner will be able to explain the cause and effect relationship between global climate and weather patterns and energy transfer (cloud cover, location of mountain ranges, oceans); Predict the consequences of changes to the global climate and weather patterns. (Global climate is determined by energy transfer from the Sun at and near Earth's surface. This energy transfer is influenced by dynamic processes such as cloud cover and the Earth's rotation and static conditions such as the position of mountain ranges and oceans.).
- 4.7.2 (DOK 3) ASSESSED
  The learner will be able to evaluate proposed solutions from multiple perspectives to environmental problems caused by human interaction; Justify positions using evidence/data. (Human beings live within the world's ecosystems. Human activities can deliberately or inadvertently alter the dynamics in ecosystems. These activities can threaten current and future global stability and, if not addressed, stability can be irreversibly affected.
- 4.7.3 (DOK 3) ASSESSED
  The learner will be able to predict the consequences of changes to any component (atmosphere, solid Earth, oceans, living things) of the Earth System; Propose justifiable solutions to global problems. (Interactions among the solid Earth, the oceans, the atmosphere, and living things have resulted in the atmosphere, and living things have resulted in the ongoing development of a changing Earth system.).