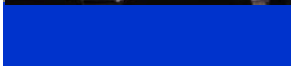
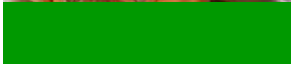




Oklahoma State Department of Education



The Parent's Guide to
**HIGH SCHOOL
SCIENCE
STANDARDS**
*Priority
Academic Student Skills
(PASS)*

Sandy Garrett, State Superintendent



<http://www.sde.state.ok.us>

(405) 521-3361

A Message from
Sandy Garrett
State Superintendent

As Oklahoma's elected education leader and advocate for children, I am committed to ensuring that all students in our state have the essential skills needed for a high quality life.



Oklahoma's *Priority Academic Student Skills (PASS)* serve as a set of specific school standards covering all areas of a student's academic growth: English language arts, mathematics, science, social studies, the arts, and world languages. Oklahoma's *PASS* documents were developed by and for educators. These detailed sets of standards guide teachers and school leaders as they plan curriculum, instruction, and assessment for your student. The complete *PASS* documents are available on the Oklahoma State Department of Education Web site <www.sde.state.ok.us>.

Your student's school needs you as a partner in building these essential skills. To help you, we have created parent guides, which summarize Oklahoma's *PASS*, explaining essential skills and concepts your student will learn at each grade level. We encourage you to use these guides as a reference in conversations with your student's teachers and principals. We also encourage you to use the guides to talk with your children every day about what they are learning in school.

All the Best!

A handwritten signature in black ink that reads "Sandy Garrett". The signature is written in a cursive, flowing style.

PHYSICAL SCIENCE

OVERVIEW OF ESSENTIAL SKILLS AND KNOWLEDGE

The science framework is what students should know, understand, and be able to do in the natural sciences. Students combine process and content as they use scientific reasoning and critical thinking to develop their understandings of science.

The science process skills are:

- ◆ Observation and Measurement
- ◆ Classification
- ◆ Experimentation
- ◆ Interpretation and Communication
- ◆ Model
- ◆ Inquiry

The science content area is:

- ◆ Physical Science—(study of nonliving things or energy, motion, light, and sound).

Science knowledge in this content area is developed through the use of the science process skills.

HIGH SCHOOL PHYSICAL SCIENCE

Observation and Measurement – Observation is the first action taken by the student to find new information about an object, organism, or event.

In Physical Science, students will:

- ◆ Observe and measure the type of change (such as temperature, mass, length, volume, position, and time) and the amount of change before, during, and after an event.
- ◆ Use tools such as metric rulers, graduated cylinders, thermometers, balances, spring scales, and stopwatches.
- ◆ Use the metric system—grams, milligrams, centigrams, kilograms, meters, millimeters, centimeters, kilometers, liters, milliliters, seconds, and degrees Celcius.



Classification is sorting objects based on similarities, differences, and relationships.

In Physical Science, students will:

- ◆ Classify (group) objects, organisms, or events based on how they are alike or different.
- ◆ Identify the properties used to classify objects, organisms, or events.

HIGH SCHOOL PHYSICAL SCIENCE

Experimentation is a method of discovering information.

In Physical Science, students will:

- ◆ Evaluate a physical science experiment for correct scientific design.
- ◆ Identify independent variables (factors that are set by the experimenter), dependent variables (what is measured) in an experiment, and controls (what stays the same) in an experiment.
- ◆ Use mathematics to show relationships.
- ◆ Identify a hypothesis (possible explanation for what will happen) in an experiment.
- ◆ Follow safety rules.

Interpretation and Communication is the process of recognizing patterns in data and sharing that information with others.

In Physical Science, students will:

- ◆ Make predictions based on patterns in evidence.
- ◆ Report data appropriately and make and interpret data tables, line bar, trend, or circle graphs to show data.
- ◆ Use the results of the experiment to show if the hypothesis was proved or disproved.
- ◆ Evaluate data from an experiment to explain what has happened, make conclusions, and predict what will happen next.

HIGH SCHOOL PHYSICAL SCIENCE

- ◆ Create a written report that describes the experiment procedure and the results of the experiment.
- ◆ Defend their scientific thinking.

Modeling is the process of forming a mental or physical representation of data, patterns or relationships.

In Physical Science, students will:

- ◆ Explain models and use models to make predictions.
- ◆ Compare models to the physical world around them.



Inquiry is defined as the skills necessary to carry out the process of scientific thinking.

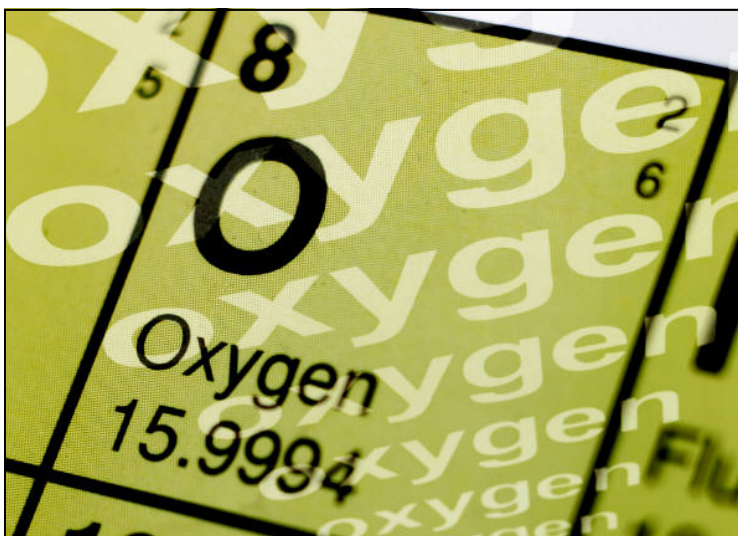
In Physical Science, students will:

- ◆ Form a testable hypothesis and design an experiment relating to the physical world.
- ◆ Design and conduct physical science experiments, identifying variables, and controls.
- ◆ Use many types of technology to collect, display, and analyze data including hand tools, measuring instruments, and computers.
- ◆ Form explanations or models based on experimental data and participate in discussions based on scientific thinking that leads to revision of explanations and continued inquiry.

HIGH SCHOOL PHYSICAL SCIENCE

In Physical Science, students will:

- ◆ Learn that matter is made of very tiny particles called atoms. Atoms are made of small particles called protons, neutrons, and electrons.
- ◆ Learn that an element is made of one type of atom. Oxygen gas is an example of an element.
- ◆ Know that the elements can be listed in order by the number of protons in the atom. The number of protons is called the atomic number of the element.



- ◆ Know that elements can be grouped into families based on similar physical or chemical characteristics.
- ◆ Learn that matter has specific properties that can be identified. Examples of these properties are boiling point, melting point, and density (the amount of matter compared to the amount of space the matter takes up).

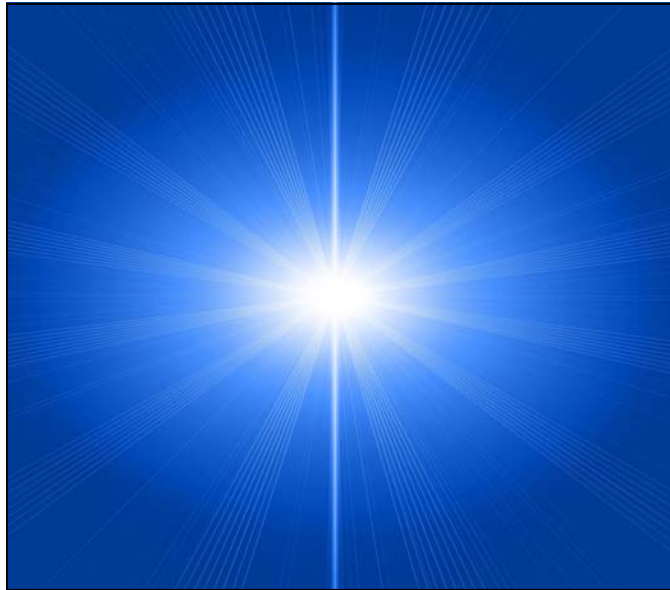
HIGH SCHOOL PHYSICAL SCIENCE

- ◆ Know that objects change motion only when a force is applied.
- ◆ Learn that The Laws of Motion are used to determine how a force will change motion.
- ◆ Understand that gravitation is a force that every mass (amount of matter) applies on any other mass.
- ◆ Learn that all energy is either kinetic energy (energy of movement), potential energy (stored energy), or field energy (such as electromagnetic waves).
- ◆ Discover that all waves have energy, including sound waves, seismic waves (waves that travel through the Earth as in an earthquake), water waves, and light waves. This energy can be transferred or moved when the waves interact with matter such as used in telescopes, solar power, or telecommunication technology.



HIGH SCHOOL PHYSICAL SCIENCE

- ◆ Learn that observation of rock sequence or the study of fossils can be used to estimate geologic time (the age of the Earth).



- ◆ Know that the solid crust of the earth is made of separate plates that move very slowly and press against each other or pull apart from each other. This movement creates volcanoes and earthquakes, and builds mountains.
- ◆ Learn that matter and energy of the universe is always changing. Stars are different in size, temperature, and age. They seem to be made up of the same elements that are found on Earth.
- ◆ Learn that all stars have a life cycle involving the birth of the star, growth of the star, and death of the star. Fusion reactions in stars release very large amounts of energy and matter over millions of years.

BIOLOGY I

OVERVIEW OF ESSENTIAL SKILLS AND KNOWLEDGE

The science framework is what students should know, understand, and be able to do in the natural sciences. Students combine process and content as they use scientific reasoning and critical thinking to develop their understandings of science.

The science process skills are:

- ◆ Observation and Measurement
- ◆ Classification
- ◆ Experimentation
- ◆ Interpretation and Communication
- ◆ Model
- ◆ Inquiry

The science content area is:

- ◆ Biology—study of living things

Science knowledge in this content area is developed through the use of the science process skills.

HIGH SCHOOL BIOLOGY I

Observation and Measurement—Observation is the first action taken by the student to find new information about an object, organism, or event.

In Biology I, students will:

- ◆ Observe and measure the type of change (such as temperature, mass, length, volume, position, and time) and the amount of change before, during, and after an event.
- ◆ Use tools such as metric rulers, graduated cylinders, thermometers, balances, spring scales, and stopwatches.
- ◆ Use the metric system—grams, milligrams, centigrams, kilograms, meters, millimeters, centimeters, kilometers, liters, milliliters, seconds, and degrees Celcius.

Classification is sorting objects based on similarities, differences, and relationships.

In Biology I, students will:

- ◆ Classify (group) objects, organisms, or events based on how they are alike or different.
- ◆ Identify the properties used to classify objects, organisms, or events.



HIGH SCHOOL BIOLOGY I

Experimentation is a method of discovering information.

In Biology I, students will:

- ◆ Evaluate a physical science experiment for correct scientific design.
- ◆ Identify independent variables (factors that are set by the experimenter), dependent variables (what is measured) in an experiment, and controls (what stays the same) in an experiment.
- ◆ Use mathematics to show relationships.
- ◆ Identify a hypothesis (possible explanation for what will happen) in an experiment.
- ◆ Follow safety rules.

Interpretation and Communication is the process of recognizing patterns in data and sharing that information with others.

In Biology I, students will:

- ◆ Make predictions based on patterns in evidence.
- ◆ Report data appropriately and make and interpret data tables, line bar, trend, or circle graphs to show data.
- ◆ Use the results of the experiment to show if the hypothesis was proved or disproved.
- ◆ Evaluate data from an experiment to explain what has happened, make conclusions, and predict what will happen next.

HIGH SCHOOL BIOLOGY I

- ◆ Create a written report that describes the experiment procedure and the results of the experiment.
- ◆ Defend their scientific thinking.

Modeling is the process of forming a mental or physical representation of data, patterns, or relationships.

In Biology I, students will:

- ◆ Explain models and use models to make predictions.
- ◆ Compare models to the physical world around them.

Inquiry is defined as the skills necessary to carry out the process of scientific thinking.

In Biology I, students will:

- ◆ Form a testable hypothesis and design an experiment relating to the physical world.
- ◆ Design and conduct physical science experiments, identifying variables and controls.
- ◆ Use many types of technology to collect, display, and analyze data including hand tools, measuring instruments, and computers.
- ◆ Form explanations or models based on experimental data and participate in discussions based on scientific thinking that leads to revision of explanations and continued inquiry.

HIGH SCHOOL BIOLOGY I

In Biology I, students will:

- ◆ Learn that cells are the basic unit of life. Cells are made of different structures that do specific jobs necessary for life.
- ◆ Learn that cells can develop in different ways and may develop into organisms (living things) that have many types of cells that work together (cells - tissues - organs - organ systems - organisms).
- ◆ Know that cells act from instructions that come from DNA in the cell. These instructions are the master code for the cell and control everything about the cell.



- ◆ Know that genes are small sections of DNA that give instructions to the cell for how the cell acts or how an organism looks. When an organism creates offspring, the genes are sorted and put together in different ways.
- ◆ Learn that the offspring receive information from each parent, so the way the genes are combined causes the offspring to look a certain way or the organism's cells to act a certain way.

HIGH SCHOOL BIOLOGY I

- ◆ Know that charts called Punnett Squares and Pedigrees allow us to predict how the genes will combine to form offspring.
- ◆ Learn that different species may look different, but the unity and similarity of organisms is seen when the internal structures and the chemical processes are studied.
- ◆ Learn that evidence of common ancestors is seen in the structures that are analogous (common to different species).
- ◆ Understand that species get many of their special characteristics through biological adaptation (a process which may include changes in structures, behaviors, or the way the organism moves).



- ◆ Discover that organisms depend on each other and on the environment around them.
- ◆ Learn that matter on Earth cycles through the living and nonliving parts of the biosphere (the part of the Earth, including air, land, surface rocks, and water where life is found).
- ◆ Learn that organisms cooperate (symbiosis) and compete to survive in an ecosystem.

HIGH SCHOOL BIOLOGY I

- ◆ Know that organisms have the ability to produce populations of unlimited size, but the environment and the amount of resources around them (food, water, shelter, etc.) limits the size of the population.
- ◆ Know that living systems must have continuing input of energy in order to support life.
- ◆ Learn that organisms must obtain, change, move, release, and eliminate matter and energy in order to survive.



- ◆ Learn that matter and energy can flow through different levels of living systems and between living systems and the environment (sun energy - grass - deer - mountain lion). When this energy is transferred, chemical elements are changed.

HIGH SCHOOL BIOLOGY I

- ◆ Learn that matter and energy are conserved (not lost) in each change. Examples include the water cycle, carbon cycle, nitrogen cycle, food webs, and energy pyramids.
- ◆ Special cells allow an organism to know what is going on in the world around them. Examples include special cells called sense organs and cells that detect light, sound, and gravity.



- ◆ Discover that organisms can respond to a stimulus from the environment around them or from their species or other species. These responses can either be an innate response (the organism is born with this response) or a learned response.
- ◆ Know that patterns of change over time have allowed organisms to have more success in reproduction and survival.

CHEMISTRY

OVERVIEW OF ESSENTIAL SKILLS AND KNOWLEDGE

The science framework is what students should know, understand, and be able to do in the natural sciences. Students combine process and content as they use scientific reasoning and critical thinking to develop their understandings of science.

The science process skills are:

- ◆ Observation and Measurement
- ◆ Classification
- ◆ Experimentation
- ◆ Interpretation and Communication
- ◆ Model
- ◆ Inquiry

The science content area is:

- ◆ Chemistry—study of nonliving things or the study of energy, motion, light, and sound.

Science knowledge in this content area is developed through the use of the science process skills.

HIGH SCHOOL CHEMISTRY

Observation and Measurement – Observation is the first action taken by the student to find new information about an object, organism, or event.

In Chemistry, students will:

- ◆ Observe and measure the type of change (such as temperature, mass, length, volume, position, and time) and the amount of change before, during, and after an event.
- ◆ Use tools such as metric rulers, graduated cylinders, thermometers, balances, spring scales, and stopwatches.
- ◆ Use the metric system—grams, milligrams, centigrams, kilograms, meters, millimeters, centimeters, kilometers, liters, milliliters, seconds, and degrees Celcius.



Classification is sorting objects based on similarities, differences, and relationships.

In Chemistry, students will:

- ◆ Classify (group) objects, organisms, or events based on how they are alike or different.
- ◆ Identify the properties used to classify objects, organisms, or events.

HIGH SCHOOL CHEMISTRY

Experimentation is a method of discovering information.

In Chemistry, students will:

- ◆ Evaluate a physical science experiment for correct scientific design.
- ◆ Identify independent variables (factors that are set by the experimenter), dependent variables (what is measured) in an experiment, and controls (what stays the same) in an experiment.
- ◆ Use mathematics to show relationships.
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Interpretation and Communication is the process of recognizing patterns in data and sharing that information with others.

In Chemistry, students will:

- ◆ Make predictions based on patterns in evidence.
- ◆ Report data appropriately and make and interpret data tables, line bar, trend, or circle graphs to show data.
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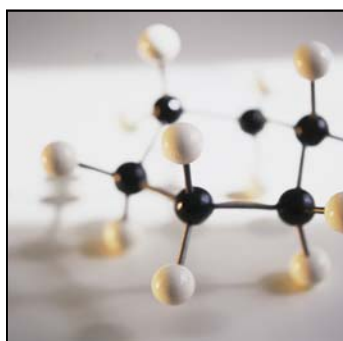
HIGH SCHOOL CHEMISTRY

- ◆ Create a written report that describes the experiment procedure and the results of the experiment.
- ◆ Defend their scientific thinking.

Modeling is the process of forming a mental or physical representation of data, patterns, or relationships.

In Chemistry, students will:

- ◆ Explain models and use models to make predictions.
- ◆ Compare models to the physical world around them.



Inquiry is defined as the skills necessary to carry out the process of scientific thinking.

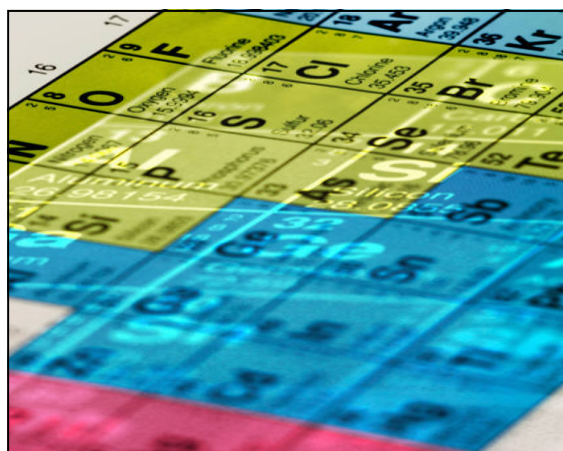
In Chemistry, students will:

- ◆ Form a testable hypothesis and design an experiment relating to the physical world.
- ◆ Design and conduct physical science experiments, identifying variables and controls.
- ◆ Use many types of technology to collect, display, and analyze data including hand tools, measuring instruments, and computers.
- ◆ Form explanations or models based on experimental data and participate in discussions based on scientific thinking that leads to revision of explanations and continued inquiry.

HIGH SCHOOL CHEMISTRY

In Chemistry, students will:

- ◆ Learn that matter is made of very tiny particles called atoms. Atoms are made of small particles called protons, neutrons, and electrons.
- ◆ Learn that an element is made of one type of atom. Oxygen gas is an example of an element.
- ◆ Know that the elements can be listed in order by the number of protons in the atom. The number of protons is called the atomic number of the element.



- ◆ Know that elements can be grouped into families based on similar physical or chemical characteristics.
- ◆ Learn that matter has specific properties that can be identified. Examples of these properties are boiling point, melting point, and density (the amount of matter compared to the amount of space the matter takes up).

HIGH SCHOOL CHEMISTRY

- ◆ Know that matter is made of atoms and that atoms are made of even smaller components called protons, neutrons, and electrons.
- ◆ Know that atoms interact with each other by either transferring or sharing the electrons that are farthest from the nucleus in the center of the atom. These outer electrons determine the chemical properties of the element.
- ◆ Know that an element is a single type of atom. Elements can be grouped into families based on physical and chemical characteristics that are similar.
- ◆ Learn that a compound is made when two or more kinds of atoms are chemically joined together.
- ◆ Learn that each compound has special chemical and physical properties.
- ◆ Discover that in a chemical reaction, one or more substances are changed into a different substance.



HIGH SCHOOL CHEMISTRY

- ◆ Learn that in many important reactions, either electrons or hydrogen ions are transferred.
- ◆ Know that the rate or speed of chemical reactions depends on the concentration and temperature of the materials used in the reaction. A catalyst is a substance that speeds up a chemical reaction.
- ◆ Learn that chemical substances react in specific molar weight proportions.
- ◆ Learn that mass (amount of matter in a substance) is conserved (not lost) in chemical reactions and this is demonstrated in balancing of equations. This is the Law of Conservation of Matter.



PHYSICS

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- ◆ Classification
- ◆ Experimentation
- ◆ Interpretation and Communication
- ◆ Model
- ◆ Inquiry

The science content area is:

- ◆ Physics—study of nonliving things or the study of energy, motion, light, and sound.

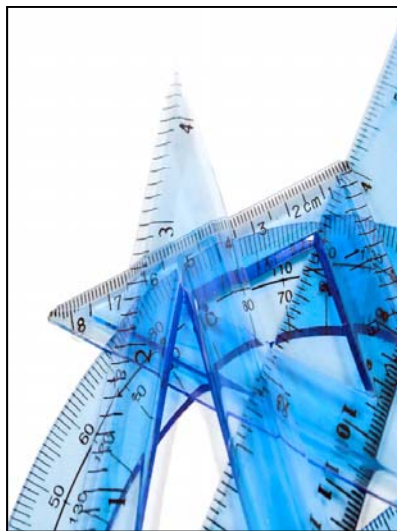
Science knowledge in this content area is developed through the use of the science process skills.

HIGH SCHOOL PHYSICS

Observation and Measurement – Observation is the first action taken by the student to find new information about an object, organism, or event.

In Physics, students will:

- ◆ Observe and measure the type of change (such as temperature, mass, length, volume, position, and time) and the amount of change before, during, and after an event.
- ◆ Use tools such as metric rulers, graduated cylinders, thermometers, balances, spring scales, and stopwatches.
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Classification is sorting objects based on similarities, differences and relationships.

In Physics, students will:

- ◆ Classify (group) objects, organisms, or events based on how they are alike or different.
- ◆ Identify the properties used to classify objects, organisms, or events.

HIGH SCHOOL PHYSICS

Experimentation is a method of discovering information.

In Physics, students will:

- ◆ Evaluate a physical science experiment for correct scientific design.
- ◆ Identify independent variables (factors that are set by the experimenter), dependent variables (what is measured) in an experiment, and controls (what stays the same) in an experiment.
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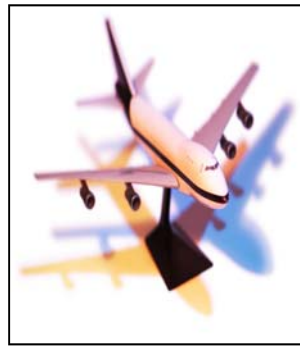
HIGH SCHOOL PHYSICS

- ◆ Evaluate data from an experiment to explain what has happened, make conclusions, and predict what will happen next.
- ◆ Create a written report that describes the experiment procedure and the results of the experiment.
- ◆ Defend their scientific thinking.

Modeling is the process of forming a mental or physical representation of data, patterns, or relationships.

In Physics, students will:

- ◆ Explain models and use models to make predictions.
- ◆ Compare models to the physical world around them.



Inquiry is defined as the skills necessary to carry out the process of scientific thinking.

In Physics, students will:

- ◆ Form a testable hypothesis and design an experiment relating to the physical world.
- ◆ Design and conduct physical science experiments, identifying variables and controls.
- ◆ Form explanations or models based on experimental data and participate in discussions based on scientific thinking that leads to revision of explanations and continued inquiry.

HIGH SCHOOL PHYSICS

In Physics, students will:

- ◆ Use many types of technology to collect, display, and analyze data including hand tools, measuring instruments, and computers.
- ◆ Learn that objects change motion only when a net force (overall force) is applied to the object. A force is what causes a mass to accelerate (speed up). The force may be a lift, a push, or a pull.
- ◆ Know that Newton's Laws of Motion are used to find how a force affects the motion of an object.



HIGH SCHOOL PHYSICS

- ◆ Learn that gravitation is a universal force that every mass (amount of matter) applies on any other mass. The strength of the gravitational force between two masses can be calculated.
- ◆ Learn that all energy can be kinetic (energy of motion), potential energy (stored energy), or field energy.
- ◆ Know that heat is made by random motion and by vibrations of atoms, molecules, and ions (atoms and molecules that have a charge). As the temperature goes higher, the motion of the atoms or molecules increases.
- ◆ Learn that waves have energy and can transfer that energy to matter. Sound waves and electromagnetic waves are fundamentally different.
- ◆ Learn that electromagnetic waves happen when an object with a charge is accelerated (speeds up) or decelerates (slows down).



HELPFUL NUMBERS

Curriculum

Assistant State Superintendent, (405) 521-4514

Team Leader, (405) 522-3521

Director, Arts in Education, (405) 521-3034

Director, Reading and Literacy, (405) 521-2537

Director, Language Arts, (405) 522-3522

Director, World Languages, (405) 521-3035

Director, Mathematics, (405) 522-3525

Director, Social Studies, (405) 522-3523

Director, Science, (405) 522-3524



NOTES

OKLAHOMA STATE DEPARTMENT OF EDUCATION

SANDY GARRETT
STATE SUPERINTENDENT
OF PUBLIC INSTRUCTION

