Physical Science

Core Ideas/Crosscutting Concepts:

What is science?

Scientific Method

Measurements

States of Matter

Matter's Physical and Chemical Properties

Phases of Matter and phase changes

Gas Laws

Learning Targets:

Writing Applications

Compose writings that convey a clear message and include well-chosen details.

Writing Conventions

Print legibly using appropriate spacing.

Spell grade-appropriate words correctly.

Use conventions of capitalization and punctuation in written work.

Use grammatical structures in written work.

Study of Matter

Classification of matter

Heterogeneous vs. homogeneous

Properties of matter

States of matter and its changes

Forces and Motion

Motion

Introduction to one-dimensional vectors

Displacement, velocity (constant, average and instantaneous) and acceleration

Interpreting position vs. time and velocity vs. time graphs

Forces

Force diagrams

Types of forces (gravity, friction, normal, tension)

Field model for forces at a distance

Energy and Waves

Conservation of energy

Transfer and transformation of energy (including work)

Waves

Thermal energy

Forces and Motion

Motion

Forces

Dynamics (how forces affect motion)

Core Ideas/Crosscutting Concepts:

1. List the five principles of Dalton's atomic theory

2. Describe the evidence for the existence of electrons, protons, and neutrons and describe the properties of these subatomic particles.

3. Discuss atoms of different elements in terms of their numbers of electrons, protons, and neutrons, and define the terms atomic number and mass number.

4. Define isotope, and determine the number of particles in the nucleus of an isotope.

5. Compare the Rutherford, Bohr, and quantum models of an atom.

6. Explain how the wavelengths of light emitted by an atom provide information about electron energy levels.

7. List the four quantum numbers, and describe their significance.

8. Write the electron configuration of an atom by using the Pauli exclusion principle and the aufbau principle.

9. Describe the historical development of the periodic table.

10. Describe the organization of the modern periodic table according to the periodic law.

11. Locate the different families of main-group elements on the P.T., describe their properties, and relate their properties to their E.C.

12. Locate metals on the P.T., describe their characteristic properties and relate their properties to their E.C.

13. Describe periodic trends in electronegativity, and relate them to the atomic structures of the elements.

14. Describe the naturally occurring elements form.

Learning Targets:

Writing Applications

Compose writings that convey a clear message and include well-chosen details.

Follow multi-step directions.

Speak clearly and at an appropriate pace and volume.

Deliver a variety of presentations that include relevant information and a clear sense of purpose.

Study of Matter

Atoms

Periodic trends of the elements

Chemical reactions

Nuclear reactions

Periodic trends of the elements

Models of the atom (components)

Ions (cations and anions)

Bonding and compounds

Bonding (ionic and covalent)

Nomenclature

Reactions of matter

Chemical reactions

Nuclear reactions

Core Ideas/Crosscutting Concepts:

Chemical Bonding Ionic and Covalent

Naming Compounds and Writing Formulas

Types of Reactions

Balancing Chemical Reactions

Learning Targets

Study of Matter

Ions (cations and anions)

Bonding and compounds

Bonding (ionic and covalent)

Nomenclature

Reactions of matter

Chemical reactions

Core Ideas/Crosscutting Concepts:

Formation of Solutions

Solubility and Concentration

Properties of Acids and Bases

Strengths of Acids and Bases

Learning Targets:

Classification of matter

Properties of matter

States of matter and its changes

Atoms

Ions (cations and anions)

Bonding and compounds

Bonding (ionic and covalent)

Nomenclature

Reactions of matter

Chemical reactions

Core Ideas/Crosscutting Concepts:

Compounds of Carbon

Substituted Hydrocarbons

Polymers

Reactions in Cells

Learning Targets:

Classification of matter

Properties of matter

Atoms

Ions (cations and anions)

Bonding and compounds

Bonding (ionic and covalent)

Nomenclature

Reactions of matter

Chemical reactions

Core Ideas/Crosscutting Concepts:

How are energy and work related?

What factors influence the kinetic energy of an object?

How is gravitational potential energy determined?

What are the major forms of energy?

In what direction does heat flow spontaneously?

What is affects an objects temperature?

What two variables influence thermal energy?

What causes thermal expansion?

How are changes in temperature and specific heat related?

How does a calorimeter work?

What are the three laws of Thermodynamics?

Learning Targets:

Energy and Waves

Conservation of energy

Transfer and transformation of energy (including work)

Waves

Thermal energy

Core Ideas/Crosscutting Concepts:

Distance and Displacement

Speed and Velocity

Acceleration

Universal Forces

Newton's First Law of Motion

Application of Newton's First Law to everyday phenomena to explain their behavior

Define force and state its result on objects.

Quantitatively relate force, mass, and acceleration to each other.

Newton's Second Law of Motion

Newton's Second Law involving everyday phenomena and application

Newton’s Third Law of motion

Newton's Third Law of motion involving everyday phenomena and application.

Work and Power

Work and Machines

Mechanical Advantage and Efficiency

Simple Machine

Learning Targets:

Forces and Motion

Motion

Introduction to one-dimensional vectors

Displacement, velocity (constant, average and instantaneous) and acceleration

Interpreting position vs. time and velocity vs. time graphs

Forces

Force diagrams

Types of forces (gravity, friction, normal, tension)

Field model for forces at a distance

Dynamics (how forces affect motion)

Objects at rest

Objects moving with constant velocity

Accelerating objects

Core Ideas/Crosscutting Concepts:

The Electromagnetic Spectrum and Light

ELECTROMAGNETIC WAVES

How are electromagnetic waves different from mechanical waves?

What is the maximum speed of light?

How do electromagnetic waves differ from one another?

What is the dual nature of electromagnetic radiation?

What happens as light travels farther from its source?

THE ELECTROMAGNETIC SPECTRUM
What waves are included in the electromagnetic spectrum?

How is each type of electromagnetic wave used?

BEHAVIOR OF LIGHT
What three types of materials affect the behavior of light?

How does light behave when it enters a new medium?

COLOR
How does a prism separate white light?

What determines the color of an object?

What are the primary colors of light?

What are the primary colors of pigments?

SOURCES OF LIGHT
What are the six sources of light?

How does each type of light source generate light?

Optics

MIRRORS
What is the law of reflection?

What type of image is produced by each of the three types of mirrors

LENSES
What causes light to refract?

What type of images do concave and convex lenses form?

In what types of materials is total internal reflection likely to occur?

OPTICAL INSTRUMENTS
What are the two types of telescopes?

How does a camera an image on film?

What type of lenses does a compound microscope use to form an image?

THE EYE AND VISION
What are the main parts of the eye?

What are some common vision problems?

Learning Targets:
Energy and Waves

Waves

Refraction, reflection, diffraction, absorption, superposition

Radiant energy and the electromagnetic spectrum

Doppler shift

Core Ideas/Crosscutting Concepts:
Newton's Laws of Motion

What causes objects to move?

What factors influence the motion of an object?

How can the motion of an object be predicted?

The learner will define inertia and state Newton's First Law of Motion.

The learner will apply Newton's First Law to everyday phenomena to explain their behavior.

The learner will define force and state its result on objects.

The learner will quantitatively relate force, mass, and acceleration to each other.

The learner will state Newton's Second Law of Motion.

The learner will give examples of the consequences of Newton's Second Law involving everyday phenomena.

The learner will apply Newton's Second Law to explain why objects fall at identical rates.

The learner will state Newton’s Third Law of motion

The learner will explain why equal and opposite forces do not cancel each other out

The learner will explain the difference between equal forces and equal effects

The learner will express a force vector in terms of its components.

The learner will calculate the resultant force when 2 or more forces act concurrently.

The learner will differentiate between kinetic and static friction.

The learner will calculate the frictional force acting on an object.

The learner will calculate the net force acting on an object.

The learner will calculate the acceleration and all kinematic quantities in a real-life problem.

Core Ideas/Crosscutting Concepts:

Momentum

What is momentum?

How is momentum measured?

What does it mean to say that momentum is conserved?

The learner will be able to define impulse and momentum.

The learner will be able to explain different means of achieving a change in momentum.

The learner will be able to give examples of impulses and change in momentum over short and long time intervals.

The learner will be able to calculate momentum and velocity for masses involved in elastic collisions.

The learner will be able to show that momentum and kinetic energy are conserved in elastic collisions.

The learner will be able to make systematic observations of mass and velocity in inelastic collisions.

The learner will be able to calculate momentum and velocity for masses in inelastic collisions using conservation of momentum.

The learner will be able to calculate momentum and velocity for masses involved in explosion using conservation of momentum.

The learner will be able to define angular momentum and explain the consequences of conservation of angular momentum in real-life situations.

Core Ideas/Crosscutting Concepts:

Sun, Earth, and Moon

What is gravity?

What are the different theories of gravity?

What variables determine the amount of gravitational force?

Why are there seasons?

Why are there different phases of the moon?

How are solar and lunar eclipses explained?

The learner will describe the direction of force and acceleration on an object moving in a circle.

The learner will differentiate between centripetal and centrifugal force.

The learner will calculate centripetal acceleration and force.

The learner will identify the cause/source of a centripetal force.

The learner will state Newton's Law of Universal Gravitation.

The learner will calculate the weight of an object using Newton's Law of Universal Gravitation.

The learner will calculate the acceleration due to gravity using Newton's Law of Universal Gravitation.

The learner will explain weightlessness.

The learner will explain Einstein's theory of gravitation and compare it to Newton's Law of Universal Gravitation.

The learner will explain how tides are formed

The learner will explain lunar and solar eclipses

The learner will use the axial tilt of the earth to explain the seasons

The learner will use the period of orbit and rotation of the earth to explain day/night and years

Learning Targets:

Strand PS Physical Science