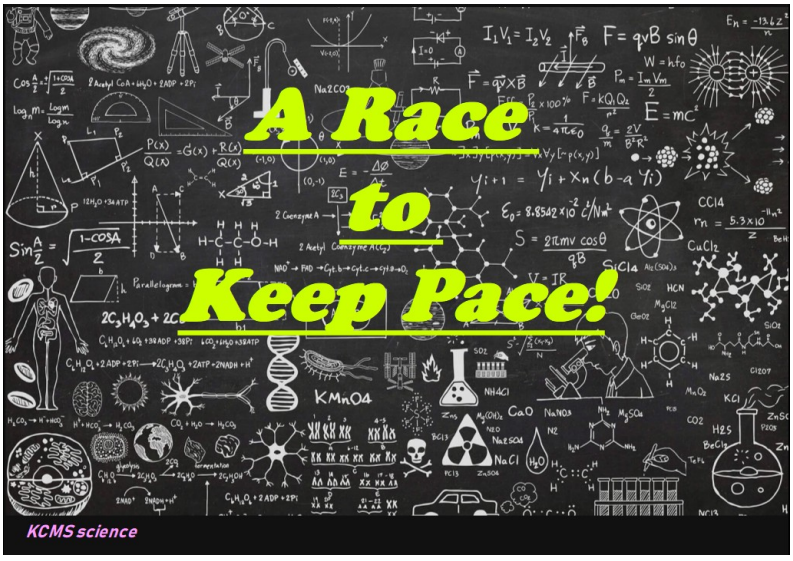
# Grade 8
# Science
# Pacing Guide

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**KCMS**

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**The initial 1-2 weeks focuses on identifying and proper use of laboratory**

**equipment. This is typically included at the start because it * minimizes teaching those skills later * when the skills are brought up later, it is a reinforcement of PS.1**

| Physical Science: Matter | 2 Weeks | Week 3 & 4 |
|---|---|---|

## Standards of Learning

**Standard PS.2**

**The student will investigate and understand the basic nature of matter. Key concepts include**

**a) the particle theory of matter;**
**b) solids, liquids, and gases;**
**d) characteristics of types of matter based on physical and chemical properties;**
**e) physical properties (shape, density, solubility, odor, melting point, boiling point, color); and**
**f) chemical properties (combustibility, reactivity).**

**PS 5a-The student will investigate and understand changes in matter and the relationship of these changes to the Law of Conservation of Matter and Energy. Key concepts will include: physical changes(effect of temp. on state, particle size on solubility, and temperature on solubility).**

PS.1 The student will plan and conduct investigations in which

- chemicals and equipment are used safely;
- length, mass, volume, density, temperature, weight, and force are accurately measured
- conversions are made among metric units, applying appropriate prefixes;
- triple beam and electronic balances, thermometers, metric rulers, graduated cylinders, probeware and spring scales are used to gather data;
- independent and dependent variables, constants, controls, and repeated trials are identified;
- data tables showing the independent and dependent variables, derived quantities, and the number of trials are constructed and interpreted;
- data tables for descriptive statistics showing specific measures of central tendency, the range of the data set, and the number of repeated trials are constructed and interpreted;
- valid conclusions are made after analyzing data;
- experimental results are presented in appropriate written form
- models & simulations are constructed and used to illustrate and explain phenomena; and
- current applications of physical science concepts are used.

## Essential Knowledge, Skills & Processes

**Students should be able to:**

- **find the mass and volume of substances and calculate and compare their densities.**
- **describe the properties of the states of matter (solid, liquid, and gas).**
- **distinguish between physical (i.e., shape, density, solubility, odor, melting point, boiling point, and color) and chemical (combustibility, and reactivity) properties. Some aspects of these objectives (reactivity & combustibility) will be covered in the units on chemical bonds**

**& changes and chemical reactions.**

- **conduct an investigation from a testable question related to physical and chemical properties of matter. The investigation may be a complete experimental design or may focus on systematic observation, description, measurement, and/or data collection and analysis. (Students should be able to use the inquiry skills to compose a clear hypothesis, create an organized data table, identify variables and constants, record data correctly, construct appropriate graphs, analyze data, and draw reasonable conclusions.)**
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**Suggested Assessments**

*quizzes as needed * exit passes
* tests
* lab investigation
* class work

**Suggested Instructional Methods**

*lecture *video resources *worksheets
* labs = a) mass lab weighing and graphing numbers of various objects b) graduated cylinder lab to reinforce concepts of meniscus & accurate measuring c) density lab- measure, determine and compare the densities of various objects + density of varying amounts of same object to illustrate the physical property of density d) solubility lab written up in proper shortened format and including graph of results. f) ice cream lab (phase change) time permitting(should be doable this year)

**Resources**

*lab supplies *text (as needed) *Smartboard
* powerpoint * Bill Nye Video" Matter"
*review choice: smartboard, online games, bellwork
Videos: Bill Nye Matter, Physical Science: states of matter, Physical Science: Phases of matter

**Key Questions: The key questions are the EKSP (essential knowledge & skills piece). For that information see the EKSP by objective.**

**Teacher notes:**

The concept and application of density must be reviewed throughout the course using various means and applications.
Introduction of concept of non-Newtonian fluids shows that phases aren't all static.

## Physical Science: Forces, Motion, Work, Power & Machines

**3 Weeks** **Weeks 5, 6, & 7**

## Standards of Learning

PS.10 The student will investigate and understand scientific principles of work, force, and motion. Key concepts include

a) speed, velocity, and acceleration;
b) Newton's laws of motion;
c) work, force, mechanical advantage, efficiency, and power; and
**d)** technological applications

## Essential Knowledge, Skills & Processes

Students will be able to:

- Make measurements to calculate the speed of a moving object.
- Apply the concepts of speed, velocity, and acceleration when describing motion.
- Apply the concepts of speed, velocity, and acceleration when describing motion
- Explain how force, mass, and acceleration are related.
- Differentiate between mass and weight.
- Identify situations that illustrate each Law of Motion.
- Solve basic problems given the following formulas: speed = distance/time (s = d/t) velocity= d/t, direction acceleration= vf-vi/t force = mass x acceleration (F = ma).
- Apply the concept of mechanical advantage to test and explain how a machine makes work easier
- Make measurements to calculate the work done on an object
- Make measurements to calculate the power of an object
- Explain how the concepts of work, force and motion apply to car safety technology, machines and rockets.
- Solve basic problems given the following formulas: Work= force x distance & Power= work/time

## Suggested Assessments

*quizzes as needed * exit passes
* tests * lab investigations * class work

## Suggested Instructional Methods

* lecture * videos * demonstrations of Newton's Laws of Motion (newton's cradle, cannon car, student in chair…) * worksheets
* labs include: *calculating speed, velocity and acceleration of a marble *marble rollercoasters
* simple machines {lever, pulley, inclined plane} *work & power – lifting books

## Resources

*lab supplies *text (as needed) *Smartboard
*Videos: Bill Nye- Friction & Simple Machines…other: Laws of Motion, Exploring Gravity
*review choice: smartboard, online games, bellwork

## Key Questions: The key questions are the EKSP (essential knowledge & skills piece). For that information see the EKSP by objective.

**Teacher notes:**

Rube Goldberg cartoons and the offshoot of contests etc are talked about with a bellwork video of devices people have devised. Students are asked to ID simple machines throughout the video and/or in cartoons and/or draw their own RG device (labeling the simple machines throughout).

| Physical Science: Energy & Heat | 1 Week | Week 4 |
|---|---|---|

**Standards of Learning**

PS.6 The student will investigate and understand forms of energy and how energy is

transferred and transformed. Key concepts include
a) potential and kinetic energy and
b) mechanical, chemical, electrical, thermal, radiant and nuclear energy

PS.7 The student will investigate and understand temperature scales, heat and thermal energy transfer. Key concepts include
a) Celsius and Kelvin temperature scales and absolute zero;
b) phase change, freezing point, melting point, boiling point, vaporization, and condensation;
c) conduction, convection, and radiation; and
**d)** applications of thermal energy transfer.

## Essential Knowledge, Skills & Processes

**Students should be able to:**

- Differentiate between potential and kinetic energy.
- Use diagrams or concrete examples to compare relative amounts of potential or kinetic energy.
- Identify and give examples of common forms of energy.
- Identify the sequence of energy transformation in a given example.
- Illustrate and explain the results of the addition or subtraction of heat energy on the motion of molecules.
- Distinguish between heat and temperature.
- Compare and contrast temperature scales and describe absolute zero.
- Analyze a time/temperature graph of a phase change experiment to determine the temperature at which the phase change occurs (freezing point, melting point, or boiling point).
- Compare and contrast conduction, convection, and radiation and explain common examples.
- Explain how the principle of heat transfer applies to 4 stroke engines, thermostats, and refrigerators and heat pumps.

## Suggested Assessments

*quizzes as needed
* tests
* lab investigation
* class work

## Suggested Instructional Methods

*lecture *video resources *worksheets * demonstrations energy (pendulum, rollercoasters…) * demonstrations heat (with alcohol burner: conduction-metal in flames convection- paper snake radiation—radiometer & bimetallic strip)
* labs: a) lab stations- ID types of energy and conversions b) melting ice cube & boiling water- measure & record phase change(may also be covered in matter unit) * computer lab

## Resources

*lab supplies *text (as needed) *Smartboard
* powerpoint with embedded Unitedstreaming Videos * Bill Nye Video "Heat"
*review choice: smartboard, online games, bellwork

## Key Questions:

**The key questions are the EKSP (essential knowledge & skills piece). For that**

**information see the EKSP by objective.**

**Teacher notes:**

The area of heat transfer types must be emphasized and reemphasized.

## Physical Science: Waves, Light & Sound — 1 Week — Week 8

**Standards of Learning**

**PS.8 The student will investigate and understand characteristics of sound waves. Key concepts include**

- **a) wavelength, frequency, speed, amplitude, rarefaction and compression.**
- **b) resonance;**
- **c) the nature of compression waves; and**
- **d) technological applications of sound.**

**PS.9 The student will investigate and understand the characteristics of transverse waves. Key concepts include**

**a) wavelength, frequency, speed, amplitude, crest and trough;**
**b) the wave behavior of light ;**
**c) images formed by lenses and mirrors;**
**d) the electromagnetic spectrum; and**
**e) technological applications of light.**

## Essential Knowledge, Skills & Processes

**Students should be able to:**

- **Describe** how reflection and refraction occur.
- **Compare** and **contrast** the particle and wave theories
- **Model** a transverse wave and draw and label the basic components.
- **Compare** the various types of electromagnetic waves in terms of wavelength, frequency and energy
- **Describe** an application of each type of EM energy
- **Conduct** an investigation to illustrate the behavior of visible light via reflection & refraction.
- **Model** a compression wave; diagram, label, and describe the basic components: wavelength, compression, rarefaction, and frequency.
- **Determine** the relationship between frequency and wavelength.
- **Analyze** factors that determine the speed of sound through various materials.
- **Describe** technological applications of sound waves and how each application functions.

## Suggested Assessments

*quizzes as needed
* tests
* lab investigation
* class work

## Suggested Instructional Methods

*lecture *video(waves, light&elec spec) *demos- waves w/ slinky and long spring
labs= [ refraction of light through concave and convex lenses + distinction of images formed by each] [ mirrors- labs emphasize the characteristics of reflection from concave, plane and convex mirrors] [ diffraction is illustrated by use of diffraction grating + interference is illustrated on the overhead projector] Interference is illustrated via video clips and by use of the Smartboard. [sound-making and using simple musical instruments (w/straw, ruler, bottles of water, rubber bands), use of tuning forks]

**Resources**

- lab supplies
- text (as needed)
- Smartboard
- powerpoint with embedded Unitedstreaming Videos
- Bill Nye Video "Waves" & "Light" & "Sound"
- review choice: smartboard, online games, bellwork
- SOUND – Prentice Hall Chapter resources
- *Teaching and Learning the Basic Skills* videotape teacher training series and site guide: http://www.pen.k12.va.us/VDOE/Instruction/sol.html
- http://www.pen.k12.va.us/VDOE/Instruction/OurLivingEnvironment.doc
- Teacher generated test
- lab supplies

**Key Questions:**

**The key questions are the EKSP (essential knowledge & skills piece). For that information see the EKSP by objective.**

**Teacher notes:**

This unit is typically cut short and has a vast amount of material pertaining to light, lenses and mirrors…that time prevents us from covering thoroughly. But, it should be covered in HS physics.

| Electricity and magnetism | 2-3 days | Week 9 |
|---|---|---|

**Standards of Learning**

**PS.11 The student will investigate and understand basic principles of electricity and magnetism. Key concepts include:**

**a) static, current, current electricity and circuits;**
**b) relationship between magnetic fields and an electric current.**
**c) Electromagnets, motors, and generators and their uses; and**
**d) Conductors, semiconductors and insulators.**

**Essential Knowledge Skills and Processes**

In order to meet this standard, it is expected that students should be able to

- **explain** the relationship between a magnetic field and an electric current
- **create and identify** series and parallel circuits
- **create** an electromagnet and explain its operation
- **use** units **and read** a meter to measure electrical usage in a house
- **conduct** an experiment that illustrates the effects of static electricity
- **create** a motor from simple materials and **explain** its operation
- **map** a magnetic field
- **map** a magnetic field between 2 magnets( like & unlike poles facing)
- **identify** those materials that are not attracted to magnets

## Primary Resources

Electricity and Magnetism Prentice Hall Chapter Resources
*TOPs modules for electricity and magnetism * text * worksheets
*unitedstreaming video site
*Smartboard manipulatives

## Suggested Assessments

- video, lecture
- this unit covered through the use of the TOPS modules for electricity and magnetism as these labs cover the majority of the objectives
- demonstration: static electricity balloon rubbing on hair
- demonstration/explanation of generator
- vandeGraff generator
- build simple motors or demonstrate

## Teacher Notes

Bloom's: Synthesis

It has been noted that most students at this age understand magnetic attraction and repulsion. Thus, we decided toward the end of the year to move through those areas w/o the accompanying labs and focus on electromagnets. The concepts of magnetic interaction can be illustrated and reviewed with demos and the use of visual aides.

# Atoms and Atomic Theory 3 days Week 10

## Standards of Learning

**P.S. 2aThe student will investigate and understand the nature of matter. Key concepts include:**

- **the particle theory of matter;**

**P.S. 3 a , b The student will investigate and understand the modern and historical models of atomic structure. Key concepts include**

- **the contributions of Dalton, Thomson, Rutherford, and Bohr in understanding the atom; and**
- **the modern model of atomic structure.**

## Essential Knowledge Skills and Processes

In order to meet this standard, it is expected that students should be able to

- **describe** the particle theory of matter
- **describe** the historical development of the concept of the atom and the contributions of Dalton, Thomson, Rutherford, and Bohr.
- **use** the Bohr model to differentiate among the three basic particles in the atom (proton, neutron, and electron) and their charges, relative masses, and locations.
- **compare** the Bohr atomic model to the electron cloud model with respect to their ability to represent accurately the three-dimensional structure of the atom.

## Primary Resources

Text
charts
models
Bill Nye Video #403-- Atoms and Molecules
use movement of parts on SMARTBOARD
use SMARTBOARD notebook pages
see this web page: http://www. colorado.edu/physics/2000/applets/ a2.html

## Suggested Assessments

lecture, notes, video, history of discovery of atomic structure
modeling atoms
exit slips
computer lab review, practice tests, worksheet :review of history Democritus (not on SOL's)`
Activity: when periodic table has been introduced and students are familiar with basics-- build atom model with beads

## Teacher Notes

Bloom's: analysis
apply the PS.1 science skills in the context of the content of this topic where applicable.

# Investigating the Periodic Table 1 week Week 11

## Standards of Learning

**PS.4 The student will investigate and understand the organization and use of the periodic table of elements to obtain information. Key concepts include:**

a.) symbols, atomic number, atomic mass, chemical families (groups), and periods
b.) classification of elements as metals, metalloids, and nonmetals;

## Essential Knowledge Skills and Processes

**use** the periodic table to obtain the following information about the atom of an element:

- symbol
- atomic number

- atomic mass
- state of matter at room temperature
- number of outer energy level (valence) electrons
- recognize that an atom's identity is related to the number of protons in its nucleus

**describe** the organization of the periodic table in terms of:

- atomic number
- metals, metalloids, and nonmetals;
- groups/families vs. periods.
- categorize a given element as metal, non-metal, or metalloid

## Primary Resources

- periodic table,
- text (as needed)
- unitedstreaming videos
- slide pictures of Mendeleev and Henry Moseley
- parts of periodic symbols
- smart board notebook page
- use of interactive elements website: http://www.colorado.edu/physics/2000/applets/a2.html

## Suggested Assessments

- student demonstrations,
- lecture
- drill,
- element research project (Mac Lab)
- notes
- computer lab, test review

## Teacher Notes

apply ps.1 science skills in the context of the content of this topic
Bloom's: synthesis
We have found it imperative to spend time in this unit as it is key to understanding future unit in chemistry. We have also reinforced the concepts of where various elements (metals-nonmetals-metalloids) are located on the PTE.

# Investigating Chemical Bonds and Changes 1 week Week 13

## Standards of Learning

P.S.4c The student will investigate and understand how to use the periodic table of elements to obtain information. Key concept includes:

- **formation of compounds through ionic and covalent bonding.**

## Essential Knowledge Skills and Processes

Students should be able to

- given a chemical formula of a compound, **identify** the elements and the number of atoms of each that comprise the compound.

- **recognize** that the number of electrons in the outermost energy level determines an element's chemical properties or chemical reactivity.
- **predict** what kind of bond (ionic or covalent) will likely form when metals and nonmetals combined chemically.
- **describe** the difference between ionic and covalent bonding.
- **recognize** that an atom's identity is related to the number of protons in its nucleus.

## Primary Resources

- periodic table
- text (as needed)
- unitedstreaming videos, see unitedstreaming for understanding of parts of equation
- parts of periodic symbols
- smart board notebook page
- powerpoint with embedded videos

## Suggested Assessments

- student demonstrations
- lecture, drill
- use of smartboard for understanding of parts of equation
  **critical--located in notebook--called chem.. eq.
- element research project (Mac Lab)
- notes
- computer lab, test review

## Teacher Notes

apply ps.1 science skills in the context of the content of this topic
Bloom's: synthesis
Key concepts: distinction between types of bonds and the role of valence electrons in the process.

## Investigating Chemical Reactions and Families  1 week  Week 14-15

### Standards of Learning

PS.2b,e The student will investigate and understand the nature of matter.
Key concepts include:
b.) elements, compounds, mixtures, acids, bases, salts
e) chemical properties.

PS.5 a,b The student will investigate:
a) physical changes ; and
b) chemical changes.

.

### Essential Knowledge Skills and Processes

Students should be able to:

- **design** an investigation to determine whether a substance is an element, compound, or mixture.
- **analyze** the pH of a solution and classify it as acidic, basic, or neutral.
- **describe** what a salt is and explain how salts form.
- **compare and contrast** physical (and) chemical changes given chemical formulas
- **identify** reactants, products in a chemical equation
- **conduct** experiments that **demonstrate** the types of chemical reactions and understand the relationship between chemical formulas and specific types of chemical reactions.
- **analyze** chemical equations to determine whether they represent the Law of Conservation of Mass
- **identify** simple chemical reactions as balanced or unbalanced

### Primary Resources

- periodic table
- text (as needed)
- lab supplies
- Smartboard
- use of videos from united streaming and see TRC for Bill Nye Video #124 (#2067) Chemical Reactions or the video "Kaboom"

## Suggested Assessments

- lecture,
- notes
- demonstration
- video

labs:

- pH determination
- neutralization reactions
- conduct tests to illustrate the different types of chem reactions & balance equations
- experiment to determine effects of temp or particle size on solubility).
- review of balancing equations use of smartboard for this in=out
- demonstration plates: NaOH+HCl --> salt + water & phenolphthalein and NaOH --> pink
- sample tray and 15 household items to be tested for pH

## Teacher Notes

apply ps.1 science skills in the context of the content of this topic
Bloom's: evaluation and analysis
Note: This area is usually divided into two units and, thus, takes more than a week to complete. Typically it takes two weeks. As such, we have to shave off time in other areas to accomplish that.

## Investigating Nuclear Reaction 1 week Week 16

### Standards of Learning

PS.5c The student will investigate and understand changes in matter and the relationship of these changes to the Law of Conservation of Matter and Energy.

- nuclear reactions .

### Essential Knowledge Skills and Processes

Students should be able to

- **compare and contrast** physical, chemical, and nuclear changes.
- **describe**, in simple terms, the processes that release nuclear energy (i.e., nuclear fission and nuclear fusion).
- **create** a simple diagram to summarize and compare and contrast these two types of nuclear energy.
- **evaluate** the positive and negative effects of using nuclear energy.

### Primary Resources

- powerpoint text
- unitedstreaming Videos -- Fission and Fusion
- video "Marie Curie" when expedient

### Suggested Assessments

- test
- classwork
- half-life lab -- chain reaction lab w/ popsicle sticks (typically we don't have the time or we substitute the use of 100 pennies in a tray to simulate the process of decay)

### Teacher Notes

apply ps.1 science skills in the context of the content of this topic
Bloom's: analysis and evaluation
Primary concepts emphasized are outlined in the EKSP

*Special Note: If you notice that the first two week period of classes is absent, that is because that time is spent reviewing and introducing the various pieces of lab equipment and their proper use. In addition, time is spent reviewing the scientific method. Each of those is a unit in itself.*

*Addendum: It should be noted that these times and schedules are not strictly adhered to as (1) responsibilities are constantly changing from month to month and semester to semester (2) days within semesters are not equally distributed (there tends to be more time in the first semester than the second…due to snow days and the fact that SOL's are begun in early to mid-May and these interruptions*

*prevent a continuous flow of academic time (3) needs and demands of students require more time in certain areas than others as determined by assessments (4) we are transitioning back to shorter year-long classes and have to make the mindset adjustments from blocks. Hence, the times on the above document have NOT been adjusted.*

*This link is one of the possible timelines for this class. Note that we have included 6th/7th grade days to review those concepts AND have included STEM activity days. The STEM days are a grand blend of science, math and other subjects (as they acronym suggests). The process does use the engineering framework which closely, but not exactly, aligns with the scientific method. We have not "fleshed out" those STEM activities, though some ideas may include (frictional forces and hockey pucks, catapult competition, hydraulics and electromagnets, spaghetti towers and/or bridges, electric motors, ooblecks, crime chemistry AND , of course, time allowing at the end, activities correlating with 6th & 7th grade sciences).*