An Overview of 2018 Mississippi College- and Career-Readiness Standards for Science

Summer Sessions 2017

Dr. Jackie Sampsell, Science Specialist

Tanjanikia McKinney, Science Professional Development Coordinator

MISSISSIPPI DEPARTMENT OF EDUCATION

Ensuring a bright future for every child

State Board of Education

Vision and Mission

Vision

To create a world-class educational system that gives students the knowledge and skills to be successful in college and the workforce, and to flourish as parents and citizens

Mission

To provide leadership through the development of policy and accountability systems so that all students are prepared to compete in the global community

MISSISSIPPI DEPARTMENT OF EDUCATION
Ensuring a bright future for every child

State Board of Education Goals 5-Year Strategic Plan for 2016-2021

1. All Students Proficient and Showing Growth in All Assessed Areas
2. Every Student Graduates High School and is Ready for College and Career
3. Every Child Has Access to a High-Quality Early Childhood Program
4. Every School Has Effective Teachers and Leaders
5. Every Community Effectively Using a World-Class Data System to Improve Student Outcomes
6. Every School and District is Rated “C” or Higher

MISSISSIPPI DEPARTMENT OF EDUCATION
Ensuring a bright future for every child

Session Objectives:

The objectives of this session are to:

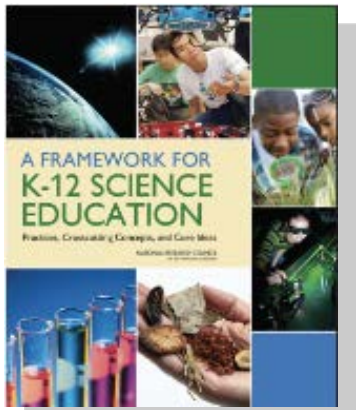
- learn answers to frequently asked questions (FAQs);
- examine the new science standards introduction;
- compare the old standards to the new standards;
- explore the major dimensions of the science standards;
- investigate a grade-band sample activity to use as a model to plan other lessons;
- use crosswalks to compare previously used teaching strategies to the new standards.

MS CCRS for Science – Research Review

Developed by a team of MS educators (K-College)

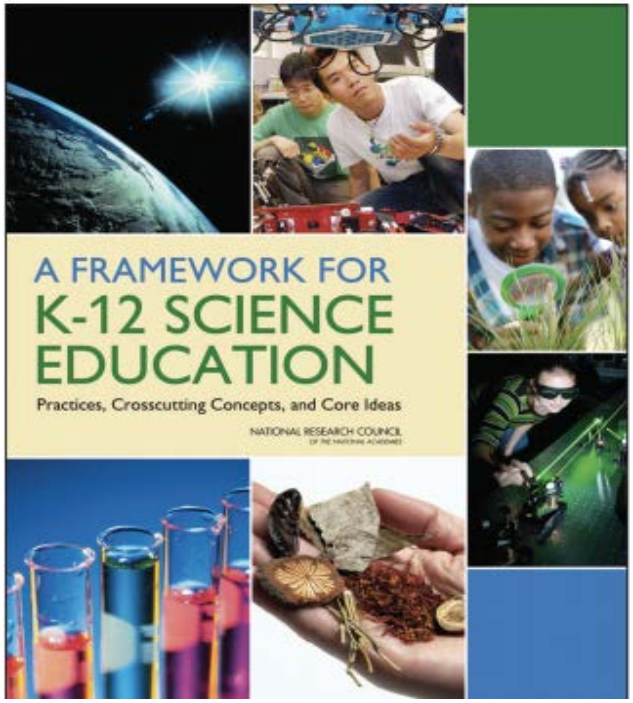
Used Resources from the following:

- State models: South Carolina (2014), Alabama (2015), Massachusetts (2016), and Virginia (2010)
- National Research Council's *A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas* (2012) (informed Next Generation Science Standards-NGSS)
- National Assessment of Educational Progress (NAEP)
- The Trends in International Mathematics and Science Study (TIMSS)
- ACT College- and Career-Readiness (CCR) Benchmarks



MS CCRS for Science – Research Review

A Framework for K-12 Science Education
Practices, Crosscutting Concepts, and Core Ideas



A New Vision for Teaching and Learning

- Science for ALL Students
- Coherent Learning

Three Dimensions

- Scientific and Engineering Practices (SEPs)
- Crosscutting Concepts (CCCs)
- Core Ideas (DCIs)

MISSISSIPPI DEPARTMENT OF EDUCATION
Ensuring a bright future for every child

Important Facts:

- The *MS CCRS for Science* are goals that reflect what a student should know and be able to do.
- This document does not dictate a manner or methods of teaching.
- The standards in this document are not sequenced for instruction and do not prescribe classroom activities, materials, or instruction strategies.
- The standards will be piloted during school year 2017-2018 with full implementation during school year 2018-2019.

MISSISSIPPI DEPARTMENT OF EDUCATION
Ensuring a bright future for every child

MS CCRS for Science – FAQs

How will new standards impact Grades 5, 8, Biology tests?

- The test questions for 2017-2018 will be based on the *2010 MS Science Framework.*
- The tests in 2017-2018 will have field-test items from the *2018 MS CCRS for Science*.
- The new assessments should be in place beginning in SY 2018-2019. This test will be based on the *2018 MS CCRS for Science*. There will be a new blueprint and new items developed.
- The Office of Student Assessment will provide more details as they become available.

MS CCRS for Science – FAQs

What about new science textbooks?

- Year of adoption for science is 2017-2018
- Meetings will begin on the state level in the early fall.
- Local Textbook Coordinators for each district will work with a local selection committee to look at the science textbooks that passes the state committee evaluation. Work with your district textbook coordinator for more information.

MISSISSIPPI DEPARTMENT OF EDUCATION
Ensuring a bright future for every child

Organization of 9-12 Courses

2010 MS Science Framework	*2018 MS CCRS for Science*
21 Science Courses	13 Science Courses

Courses Retired:
Organic Chemistry, Introduction to Biology, Biology II, Microbiology*, Biomedical Research*, Geology, Astronomy*, Aerospace Studies, Spatial Information Science*, Field Experiences

* Course with asterisk can be offer after 2017-2018 through application process

New Courses:
Foundations of Biology (replaces Introduction to Biology)
Foundations of Science Literacy (inquiry course containing objectives from *ACT College and Career Readiness Standards*)

Resources for Teachers

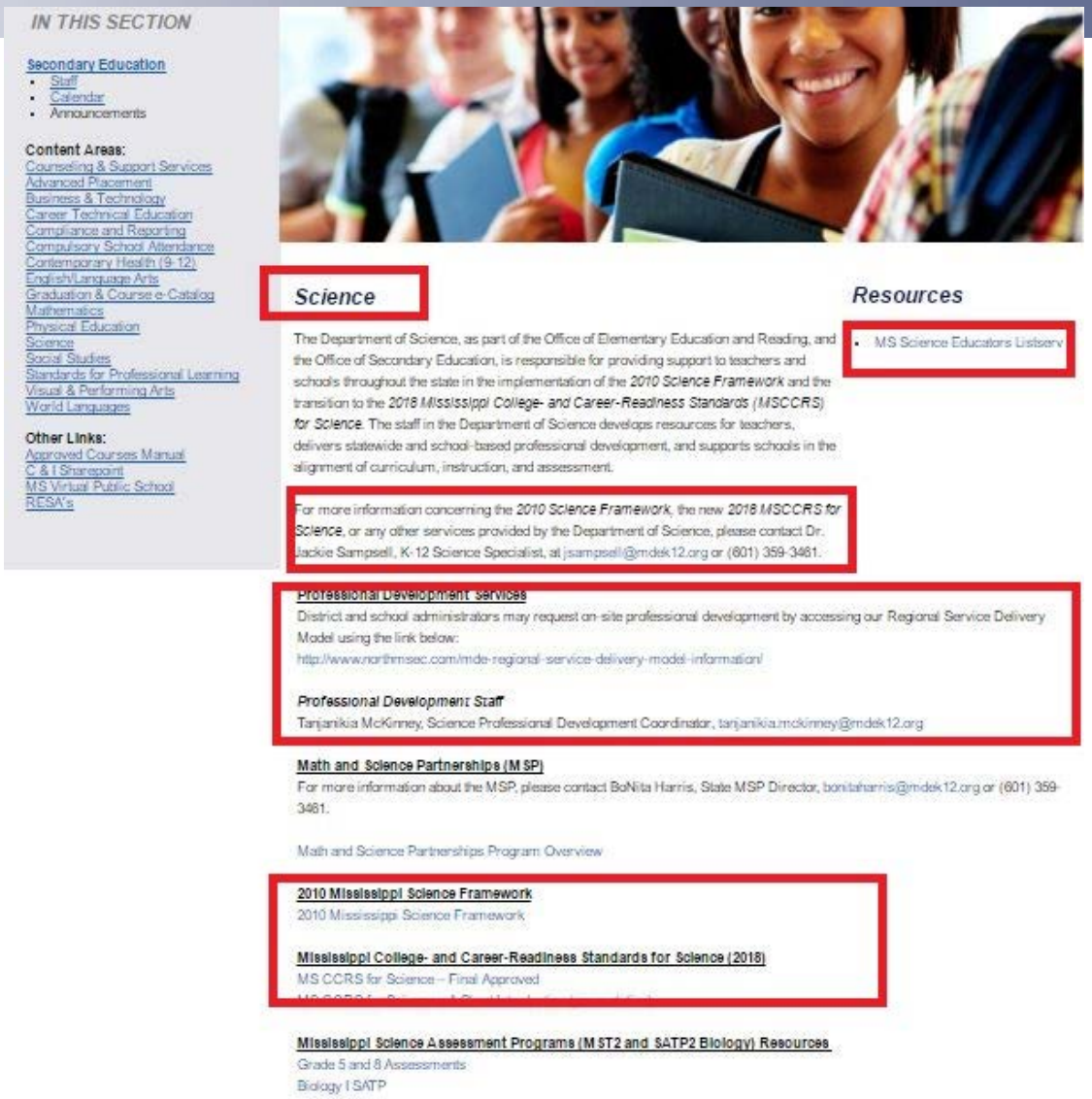
The resources below will be available for teachers in the following location:

MDE Science Homepage: http://www.mdek12.org/ESE/science

- Crosswalks for grade bands (almost ready to post)
- Materials from the summer 2017 workshops
- Resource Guides – will need YOUR help to compile great resources per grade!
- Parent Guides (being discussed)
- Webinars (being discussed for monthly after school sessions – organized by grade band groups)

Science Home Page

http://www.mdek12.org/ESE/science



IN THIS SECTION

Secondary Education
- Staff
- Calendar
- Announcements

Content Areas:
Counseling & Support Services
Advanced Placement
Business & Technology
Career Technical Education
Compliance and Reporting
Compulsory School Attendance
Contemporary Health (9-12)
English/Language Arts
Graduation & Course e-Catalog
Mathematics
Physical Education
Science
Social Studies
Standards for Professional Learning
Visual & Performing Arts
World Languages

Other Links:
Approved Courses Manual
C & I Sharepoint
MS Virtual Public School
RESA's

Science

The Department of Science, as part of the Office of Elementary Education and Reading, and the Office of Secondary Education, is responsible for providing support to teachers and schools throughout the state in the implementation of the *2010 Science Framework* and the transition to the *2018 Mississippi College- and Career-Readiness Standards (MSCCRS) for Science*. The staff in the Department of Science develops resources for teachers, delivers statewide and school-based professional development, and supports schools in the alignment of curriculum, instruction, and assessment.

For more information concerning the *2010 Science Framework*, the new *2018 MSCCRS for Science*, or any other services provided by the Department of Science, please contact Dr. Jackie Sampsell, K-12 Science Specialist, at jsampsell@mdek12.org or (601) 359-3481.

Resources

- MS Science Educators Listserv

Professional Development Services

District and school administrators may request on-site professional development by accessing our Regional Service Delivery Model using the link below:
http://www.northmsec.com/mde-regional-service-delivery-model-information/

Professional Development Staff

Tanjanikia McKinney, Science Professional Development Coordinator, tanjanikia.mckinney@mdek12.org

Math and Science Partnerships (MSP)

For more information about the MSP, please contact BoNita Harris, State MSP Director, bonitaharris@mdek12.org or (601) 359-3481.

Math and Science Partnerships Program Overview

2010 Mississippi Science Framework

2010 Mississippi Science Framework

Mississippi College- and Career-Readiness Standards for Science (2018)

MS CCRS for Science – Final Approved

Mississippi Science Assessment Programs (MST2 and SATP2 Biology) Resources

Grade 5 and 8 Assessments
Biology I SATP

MDE Home Page

MISSISSIPPI DEPARTMENT OF EDUCATION
Ensuring a bright future for every child

Home | About MDE | News | MS Schools | Reports | Public Notices | Careers | Contact Us | Select MDE Office

Mississippi Department of Education Blogs

MISSISSIPPI ACHIEVES

STRONG READERS = STRONG LEADERS MISSISSIPPI

Dr. Carey M. Wright
State Superintendent of Education

For information and updates from Dr. Carey Wright, State Superintendent, click here.

MDE Hot Topics

- Charter Schools
- Early Learning Collaborative Act
- Every Student Succeeds Act (ESSA)
- Graduation Options
- Literacy-Based Promotion
- Mississippi College and Career ready Standards
- Mississippi State Board of Education Strategic Plan
- Reading and State Standards Educator Resources
- State Board of Education Policy Manual

MDE News

MDE Announces Lottery for Special Needs Scholarship Program Applications
Jul 07, 2017

Majority of Early Learning Collaborative Students Exit Pre-K Ready for Kindergarten
Jul 06, 2017

MDE Sets Community Meeting on the Mississippi Succeeds Student Achievement Plan
Jun 26, 2017

MDE Quick Links

- Mississippi State Board of Education Members
- Professional Development Calendar
- Request Professional Development
- EdUpdate
- Family Guides to Student Success
- Mississippi School Superintendents
- Mississippi Board of Education Agenda
- Mississippi Exemplar Units and Lessons
- Mississippi Virtual Public School
- Mississippi E-Learning for Educators
- APA Notification Listserv Signup
- GoSignMeUp Registration
- State, District, and School Report Cards
- 2017 Legislative Reports

Scavenger Hunt

Explore New Science Standards

MISSISSIPPI DEPARTMENT OF EDUCATION

Ensuring a bright future for every child

Scavenger Hunt Activity

Part One Directions:

- Working in groups at your table, use pages 10-16 of the new science standards (Introduction) to answer the questions in a Kahoot Quiz.
- Go to Kahoot.it. Enter the Game PIN.
- Answer each question, one at a time, as a group. You have 30 – 60 seconds per question.
- Be prepared to share and discuss findings after each question.

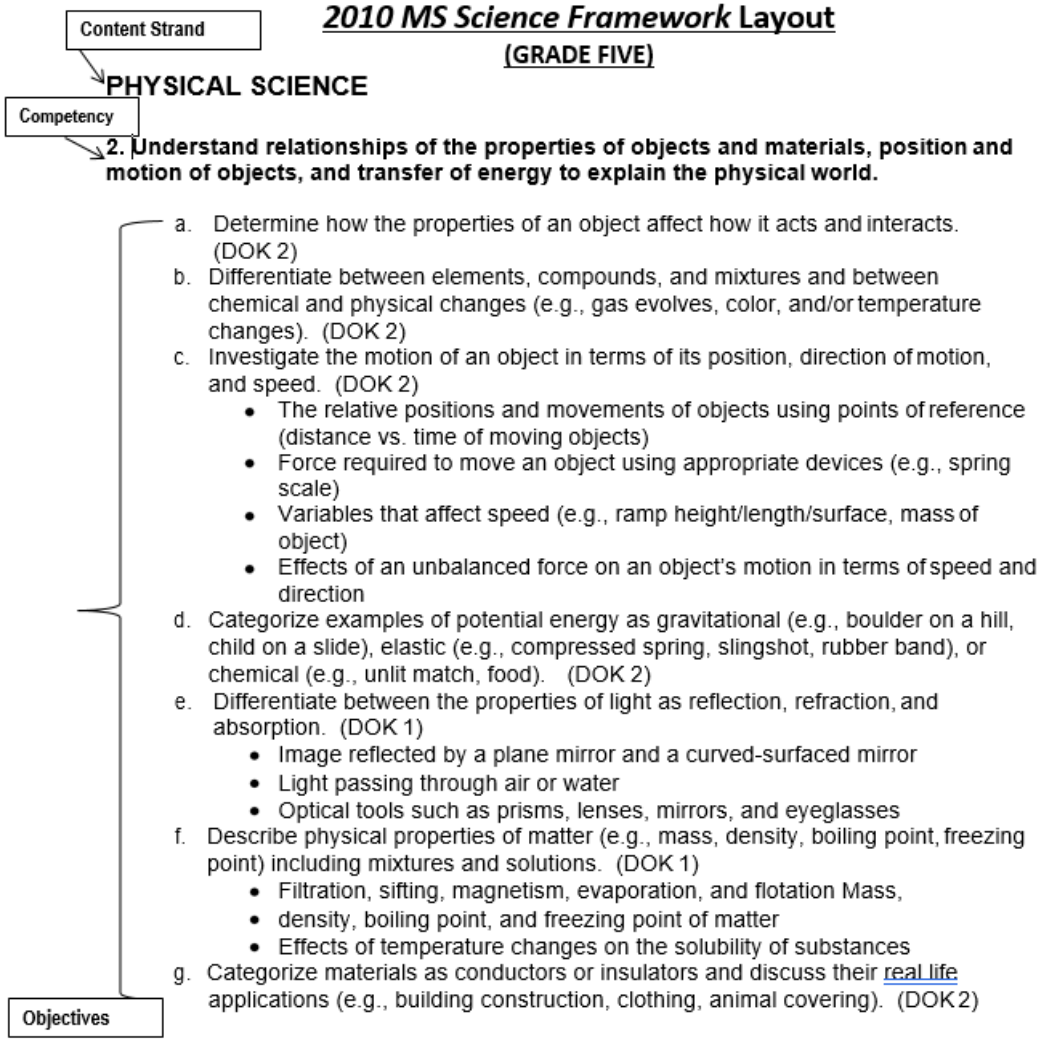
Compare Old to New!

Scavenger Hunt Activity

Part Two Directions:

- Working with your group, use the Grade 5 *2010 Science Framework* pages and the Grade 5 *2018 MS CCRS for Science* pages.
- Take 5-7 minutes to quickly compare the two documents and make a list of organizational differences on the back or bottom of the pages.
- Be prepared to share and discuss findings.

Out with the Old
2010 MS Science Framework



***2010 MS Science Framework* Layout**

(GRADE FIVE)

PHYSICAL SCIENCE

2. Understand relationships of the properties of objects and materials, position and motion of objects, and transfer of energy to explain the physical world.

a. Determine how the properties of an object affect how it acts and interacts. (DOK 2)

b. Differentiate between elements, compounds, and mixtures and between chemical and physical changes (e.g., gas evolves, color, and/or temperature changes). (DOK 2)

c. Investigate the motion of an object in terms of its position, direction of motion, and speed. (DOK 2)
- The relative positions and movements of objects using points of reference (distance vs. time of moving objects)
- Force required to move an object using appropriate devices (e.g., spring scale)
- Variables that affect speed (e.g., ramp height/length/surface, mass of object)
- Effects of an unbalanced force on an object's motion in terms of speed and direction

d. Categorize examples of potential energy as gravitational (e.g., boulder on a hill, child on a slide), elastic (e.g., compressed spring, slingshot, rubber band), or chemical (e.g., unlit match, food). (DOK 2)

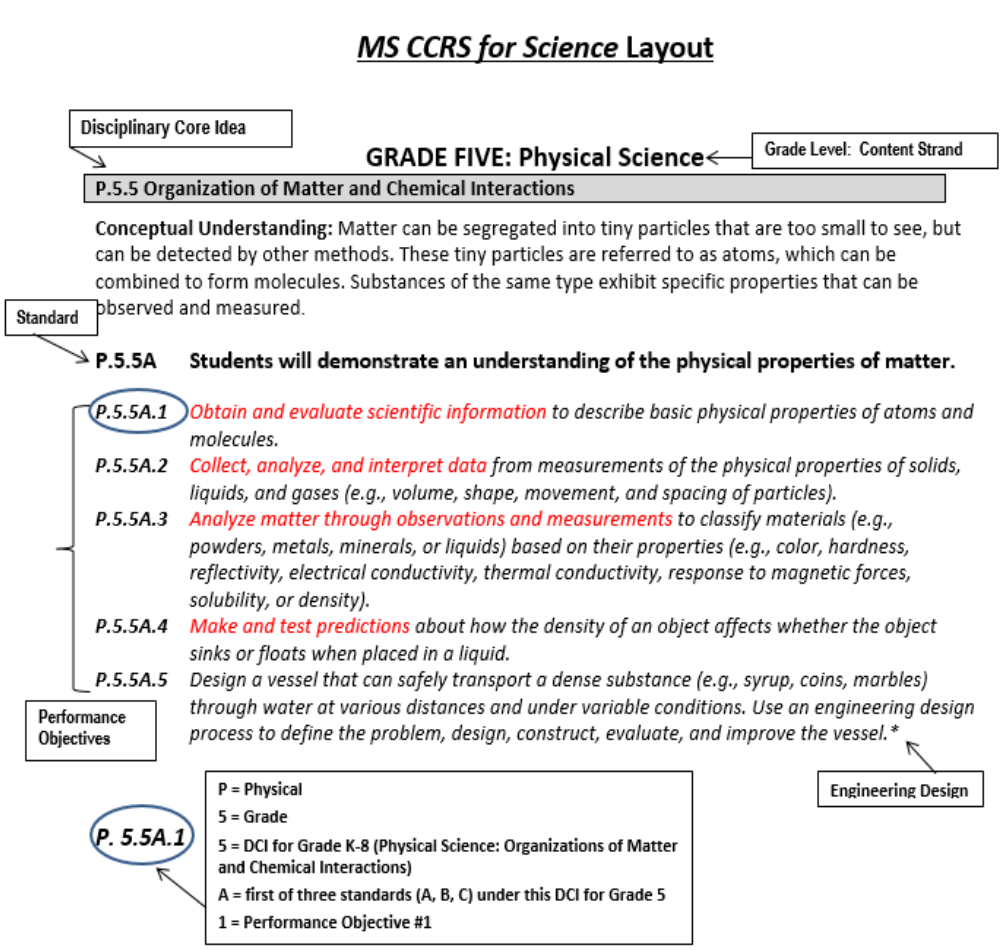
e. Differentiate between the properties of light as reflection, refraction, and absorption. (DOK 1)
- Image reflected by a plane mirror and a curved-surfaced mirror
- Light passing through air or water
- Optical tools such as prisms, lenses, mirrors, and eyeglasses

f. Describe physical properties of matter (e.g., mass, density, boiling point, freezing point) including mixtures and solutions. (DOK 1)
- Filtration, sifting, magnetism, evaporation, and flotation Mass,
- density, boiling point, and freezing point of matter
- Effects of temperature changes on the solubility of substances

g. Categorize materials as conductors or insulators and discuss their real life applications (e.g., building construction, clothing, animal covering). (DOK 2)

- No grade level/course reference, except the first page of the competencies.
- Document was hard to use & lacked flow.
- Objectives appear as a list and are often not grouped in similar content.
- Bulleted topics under objectives were confusing for teachers.

In with the New
2018 MS CCRS for Science



- Science content is better organized.
- Conceptual understanding is featured before each standard
- Performance objectives are written in complete sentences using **SEPs** as inquiry verbs.
- Performance objectives contain clear expectations of science concepts & skills required for mastery.
- Engineering Design objectives are marked with an asterisk (*) for K-8.

More Features of the New!

MS CCRS for Science – What is different?

3-5 Grade Band Overview Example

GRADES 3-5 OVERVIEW

Upper elementary is a pivotal time to enhance students' scientific literacy and active engagement in science and engineering practices. Students use their experiences from structured investigations in kindergarten through grade two to begin planning their own investigations to answer scientific questions. Because science foundations created at this level are key in developing students for college and career readiness, the cultivation of opportunities for inquiry-based activities and experiences that emphasize problem solving and the engineering design process is critical.

The standards for Grades 3-5 have been developed around the following crosscutting concepts or themes:

- Grade 3 – Interactions Within an Environment
- Grade 4 – Energy and Change
- Grade 5 – Interdependence of Systems

Themes for Grades 3-5

In grade three, students are expected to engage in the engineering design process and conduct research and communicate their understanding of each standard in a variety of ways. In grade four, students will observe, research, and conduct investigations to discover patterns related to energy and change in the world around them. In grade five, students will model, provide evidence to support arguments, and obtain and display data about relationships among a variety of systems. As a result of this yearlong study, students will gain content knowledge and tools to provide evidence and support arguments about the ways systems across content areas are interconnected and interdependent.

The seven crosscutting concepts (patterns; cause and effect; scale, proportion, and quantity; systems and system models; energy and matter; structure and function; and stability and change) are strengthened in the appropriate context of the core science content through hands-on instruction in the classroom.

SEPs are in life science, physical science, and Earth and space science. The SEPs are designed so that students may develop skills and apply knowledge to solve real-life problems. While presented as distinct skill sets, the eight practices intentionally overlap and interconnect as students explore the science concepts. Some examples of specific skills students should develop in grades 3-5 are listed below.

1. Ask questions to predict how natural or man-made changes in a habitat cause plants and animals to respond in different ways, including hibernating, migrating, responding to light, death, or extinction (e.g., sea turtles, the dodo bird, or nocturnal species).
2. Develop and use models to explain the unique and diverse life cycles of organisms other than

MS CCRS for Science – What is different?

9-12 Grade Band Overview Example

GRADES 9-12 OVERVIEW

The high school curriculum provides essential preparation for all students in Grades 9-12. This experience should promote the development of adequate scientific knowledge to allow students to make informed, critical choices and to succeed in both the workplace and in postsecondary courses.

Content standards are integrated with scientific and engineering practices (SEPs), cross-cutting concepts, and the use of technology to connect information gathered through scientific investigations with real-world applications and engineering solutions to human problems. The nature of science and historical perspectives are critical to understanding the foundation and processes of science, regardless of the scientific discipline.

The eight SEPs should not be considered a stand-alone set of practices, as previously presented, but rather incorporated throughout the set of content objectives. The SEPs are designed so that students may develop skills and apply knowledge to solve real-life problems. While presented as distinct skill sets, the eight practices intentionally overlap and interconnect as students explore the science concepts.

The core science content utilizes hands-on classroom instruction to reinforce the seven crosscutting concepts (i.e., patterns; cause and effect; scale, portion, and quantity; systems and system models; energy and matter; structure and function; and stability and change).

The National Academies' (2012) research-based findings state that "the actual doing of science or engineering can pique students' curiosity, capture their interest and motivate their continued study..." (p. 42). Science curricula should actively engage students in learning through scientific investigations. At least 30% of the course should be dedicated to laboratory experiences, including, but not limited to:

- field studies and field trips
- manipulatives and model
- guided experimentation

MS CCRS for Science – What is different?

9-12 Statement about SEPs for Inquiry and Laboratory Extensions

Overarching (start to finish) SEPs for Inquiry Extension of Labs

Ask questions to generate hypotheses for scientific investigations based on empirical evidence and observations and/or ask questions to **clarify or refine** models, explanations, or designs.

Plan and conduct controlled scientific investigations to produce data to answer questions, test hypotheses and predictions, and develop explanations or evaluate design solutions, which require the following:

- Identify dependent and independent variables and appropriate controls.
- Select and use appropriate tools or instruments to collect data, and represent data in an appropriate form.
- Analyze and interpret various types of data sets, using appropriate mathematics, in order to verify or refute the hypothesis or determine an optimal design solution.
- Construct an explanation of observed relationships between variables.
- Communicate scientific and/or technical information in various formats.

The Three Dimensions – Very Important Info!

Major Dimensions of the *MS CCRS for Science*

Science and Engineering Practices

(These represent a more complete, holistic and accurate view of scientific activity.)

- Ask questions and define problems
- Develop and use models
- Plan and conduct investigations
- Analyze, interpret, graph, and present data
- Using mathematical and computational thinking
- Construct explanations and design solutions
- Engage in scientific argument from evidence
- Obtain, evaluate, and communicate information

Disciplinary Core Ideas

(This is the organization of the three content strands for Grades K-8.)

Life Sciences

1. Hierarchical Organization
2. Reproduction and Heredity
3. Ecology and Interdependence
4. Adaptations and Diversity

Physical Sciences

5. Organization of Matter and Chemical Interactions
6. Motions, Forces, and Energy

Earth and Space Science

7. Earth's Structure and History
8. Earth and the Universe
9. Earth Systems and Cycles
10. Earth's Resources

Crosscutting Concepts

(These are the unifying concepts across all science content strands.)

- Patterns
- Cause and effect: Mechanism and explanation
- Scale, proportion, and quantity
- Systems and system models
- Energy and matter: Flows, cycles, and conservation
- Structure and function
- Stability and change

Example of SEP from a Performance Objective

Grade 5: Physical Science
DCI: P.5.5 Organization of Matter and Chemical Interactions

P.5.5A.4 Make and test predictions about how the density of an object affects whether the object sinks or floats when placed in a liquid.

Science and Engineering Practices
(These represent a more complete, holistic and accurate view of scientific activity.)

- Ask questions and define problems
- Develop and use models
- Plan and conduct investigations
- Analyze, interpret, graph, and present data
- Using mathematical and computational thinking
- Construct explanations and design solutions
- Engage in scientific argument from evidence
- Obtain, evaluate, and communicate information

MS CCRS for Science – Crosscutting Concepts

Density of Objects – Sink or Float

- Addresses the "fragmented" approach to science lessons especially in K-8 (i.e., unit on ecosystems, then motion, then weather – What are the connections?)
- Helps the students see connections between ideas within a discipline and between different disciplines
- For the previous objective of whether objects would sink or float, students should see **Patterns** (below), and also **Cause and Effect** crosscutting concepts (there may be others).

K-2	3-5	6-8	9-12
Patterns: Observed patterns in nature guide organization and classification and prompt questions about relationships and causes underlying them.			
• Patterns in the natural and human designed world can be observed, used to describe phenomena, and used as evidence.	• Similarities and differences in patterns can be used to sort, classify, communicate and analyze simple rates of change for natural phenomena and designed products. • Patterns of change can be used to make predictions. • Patterns can be used as evidence to support an explanation.	• Macroscopic patterns are related to the nature of microscopic and atomic-level structure. • Patterns in rates of change and other numerical relationships can provide information about natural and human designed systems. • Patterns can be used to identify cause and effect relationships. • Graphs, charts, and images can be used to identify patterns in data.	• Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations of phenomena. • Classifications or explanations used at one scale may fail or need revision when information from smaller or larger scales is introduced; thus requiring improved investigations and experiments. • Patterns of performance of designed systems can be analyzed and interpreted to reengineer and improve the system. • Mathematical representations are needed to identify some patterns. • Empirical evidence is needed to identify patterns.

Challenge: Rework your lessons using SEPs

To begin piloting the new standards – we have to do several things.

(1) Take inventory of what lessons you currently have. Investigate how to rewrite or tweak to fit the new standards and objectives.

(2) Embed science and engineering practices (SEPs) into your lessons as a means of building an understanding of key concepts.

(3) Build inquiry skills into lessons – especially safety rules! Safety is first – Always!

(4) Don't forget experimental design processes! (hypothesis, controls, independent and dependent variables). Allow students to design and conduct investigations.

MISSISSIPPI DEPARTMENT OF EDUCATION
Ensuring a bright future for every child

Challenge: Rework your lessons using CCCs

As you look critically at your current lessons, don't forget the crosscutting concepts!

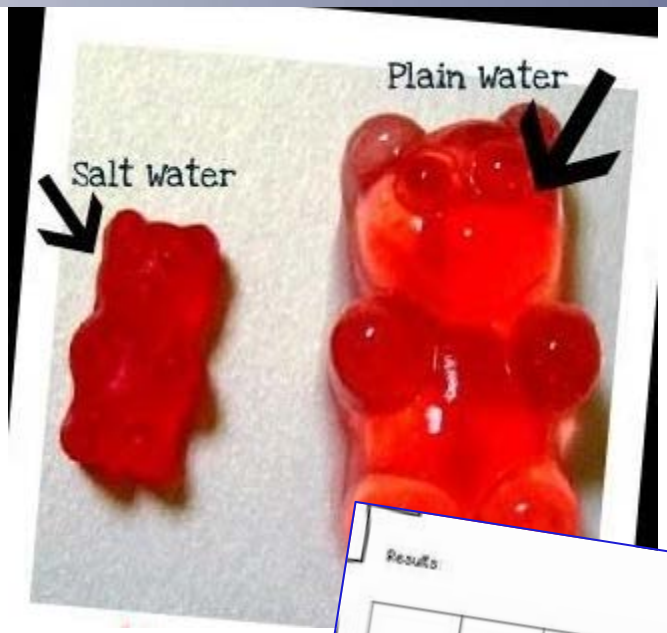
- Support students in making connections to the Cross Cutting Concepts.
- Put descriptions of Crosscutting Concepts on bulletin boards in grade friendly language.
- Encourage students to reflect at the end of class in notebooks.
- Exit Slip – "My connection today"
  Ask students to provide evidence of a Crosscutting Concept that they used in the day's lesson (does not have to be every day but you get the idea…)

Science and Engineering Practices Quiz

Science and Engineering Practices An Activity

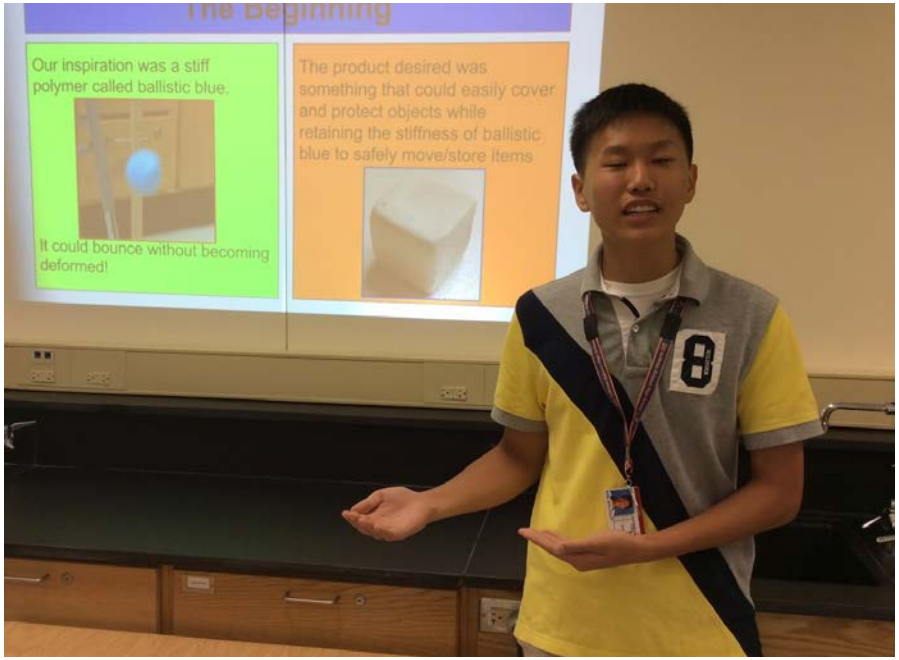
Directions:

- Each person has a handout with the eight (8) science and engineering practices (SEPs).
- You will be shown a picture and given a brief description (if needed).
- Select one practice that immediately comes to mind.
- Remember: More than one SEP may go with a picture.



Results

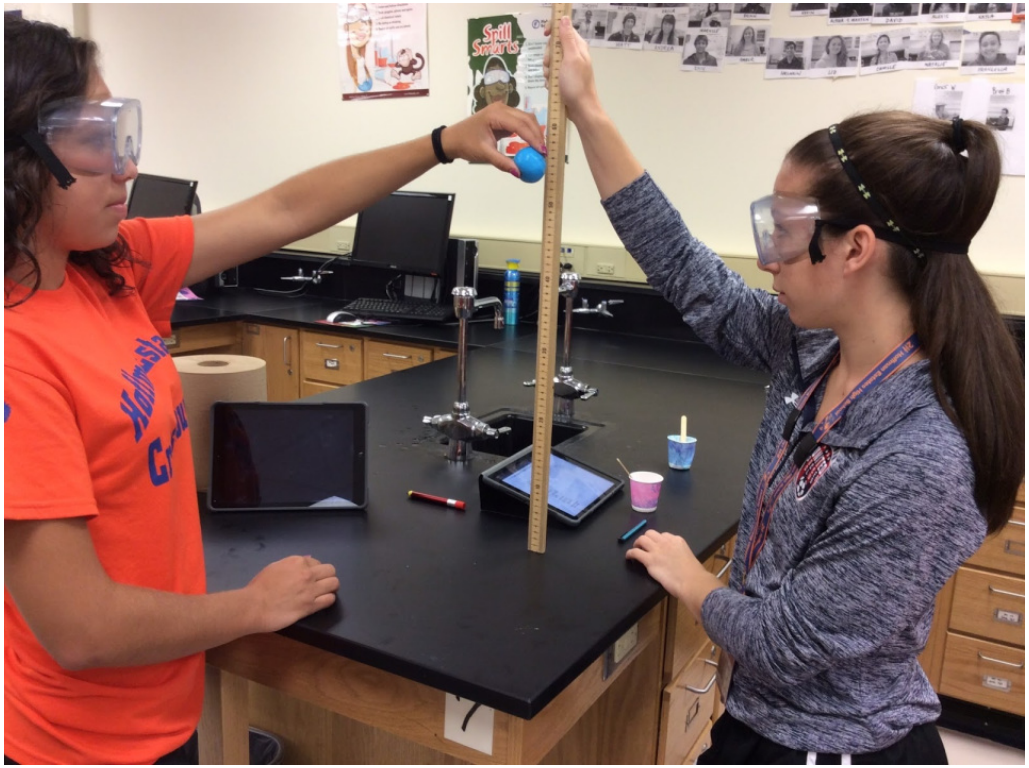
	Original Length	Day 2 Length	Change in Length	Physical Description
$+H_2O$	2 cm	4 cm	+2 cm	Huge! No color change
+Salt H_2O	2 cm	2.5 cm	+0.5 cm	Slightly larger, firm, so soft, no color change
+Vinegar	2 cm	4.5 cm	+2.5 cm	Grew the most! Extremely fragile and soft, no color change
+Baking Soda	2 cm	3 cm	+1 cm	Slightly larger, lost color


The Beginning
Our inspiration was a stiff polymer called ballistic blue.
It could bounce without becoming deformed!
The product desired was something that could easily cover and protect objects while retaining the stiffness of ballistic blue to safely move/store items

Write a statement summarizing the relationship between temperature and germination of pumpkin seeds. Predict the rate of germination of pumpkin seeds at 50 degrees Celsius.

Effect of Soil Temperature on the Germination Rate of Pumpkin Seeds

Soil Temperature (°C)	Germination Rate (%)			Average Germination Rate (%)
	X	X	X	
20	60	64	70	65
24	75	78	82	78
28	86	84	83	84
32	69	65	63	66



Engineering Design Process

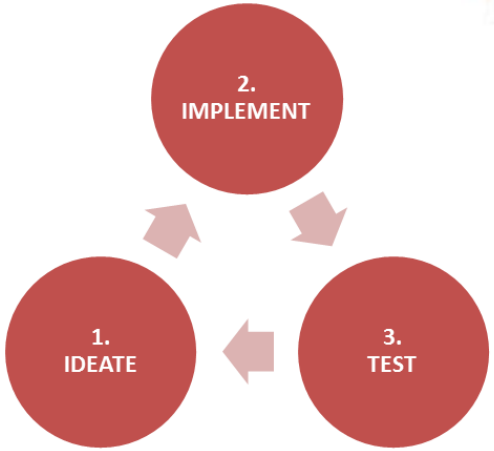
The asterisk performance objectives*

MISSISSIPPI
DEPARTMENT OF
EDUCATION

Ensuring a bright future for every child

Engineering Design Process

- A series of steps that engineers use to guide them as they solve problems.



MISSISSIPPI DEPARTMENT OF EDUCATION
Ensuring a bright future for every child

Engineering Design Process

Engineering Design Process

- A series of steps that engineers use to guide them as they solve problems.

Writing Process

- A series of steps that authors use to guide them as they create pieces of writing.

Example of Engineering Design

Example:

E.K.8B.3 *Develop a device (i.e., umbrella, shade structure, or hat) which would reduce heat from the sun (temperature) using an engineering design process to define the problem, design, construct, evaluate, and improve the device.**

Planning

Building Model

Example of Engineering Design

Testing Structure and Collecting Data

Communicating Results

Example of Engineering Design

Video clip:

https://betterlesson.com/lesson/resource/3292580/a-place-in-the-shade-3-mp4?from=resource_title

Physical Science Activities

K-2, 3-5, 6-8, Biology

Physical Science Activity

Our focus today will be physical sciences.

- You will play the role of the students and will conduct simple investigations that matches at least one objective in the grade-band.
- (Sorry we don't have an activity for every grade/course! You can get ideas (we hope) by working with your group. Think about how you can adapt the teaching strategies for your own lessons/topics.)

MISSISSIPPI DEPARTMENT OF EDUCATION
Ensuring a bright future for every child

Physical Science Activity

For the K-2 Group:

P.K.5A Students will demonstrate an understanding of the solid and liquid states of matter.

P.K.5A.2 *Describe and compare the properties of different materials (e.g., wood, plastic, metal, cloth, paper) and classify these materials by their observable characteristics (visual, aural, or natural textural) and by their physical properties (weight, volume, solid or liquid, and sink or float).*

Physical Science Activity
K-2 Group

For the K-2 Group:

P.2.5 Students will demonstrate an understanding of the properties of matter.

P.2.5.1 *Conduct a structured investigation to collect, represent, and analyze categorical data to classify matter as solid, liquid, or gas. Report findings and describe a variety of materials according to observable physical properties (e.g., size, color, texture, opacity, solubility).*

P.2.5.2 *Compare and measure the length of solid objects using technology and mathematical representations. Analyze and communicate findings.*

P.2.5.3 *Compare the weight of solid objects and the volume of liquid objects. Analyze and communicate findings.*

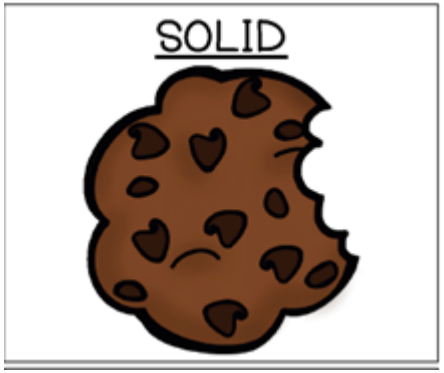
Physical Science Activity
K – 2 Group

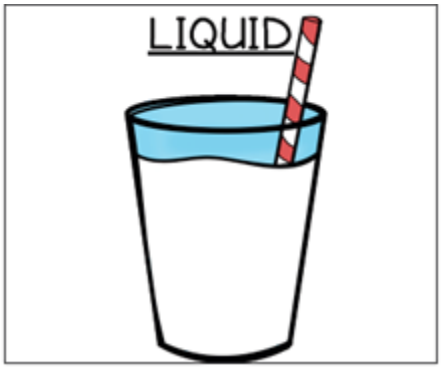
K-2 could start the lesson with something like:

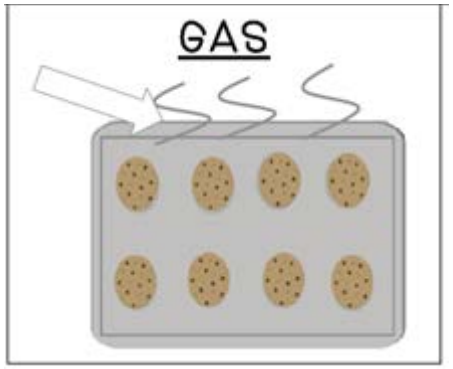
Look around the room and write down 5 items that take up space and have mass.

What is matter?

What are our three states of matter?







Physical Science Activity
3-5 Group

For the 3-5 Group:

P.3.5 Students will demonstrate an understanding of the physical properties of matter to explain why matter can change states between a solid, liquid, or gas dependent upon the addition or removal of heat.

P.3.5.2 *Develop and use models to communicate the concept that matter is made of particles too small to be seen that move freely around in space (e.g., inflation and shape of a balloon, wind blowing leaves, or dust suspended in the air).*

MISSISSIPPI DEPARTMENT OF EDUCATION
Ensuring a bright future for every child

Physical Science Activity
3-5 Group

P.5.5A Students will demonstrate an understanding of the physical properties of matter.

P.5.5A.2 *Collect, analyze, and interpret data from measurements of the physical properties of solids, liquids, and gases (e.g., volume, shape, movement, and spacing of particles).*

P.5.5C Students will demonstrate an understanding of the difference between physical and chemical changes.

- ***P.5.5C.1*** *Analyze and communicate the results of chemical changes that result in the formation of new materials (e.g., decaying, burning, rusting, or cooking).*
- ***P.5.5C.2*** *Analyze and communicate the results of physical changes to a substance that results in a reversible change (e.g., changes in states of matter with the addition or removal of energy, changes in size or shape, or combining/separating mixtures or solutions).*

Physical Science Activity
3-5 Group; 6-8 Group

After students learn physical properties of matter, they began to explore chemical properties of matter.

The following video was made by a student.

Maybe engage students with something like…

Video link:
https://www.youtube.com/watch?v=WGYJWhj7ePU

Physical Science Activity
3-5 Group; 6-8 Group

Is it Physical or Chemical?

Physical Science Activity
6-8 Group

For the 6-8 Group:

P.7.5A Students will demonstrate an understanding of the physical and chemical properties of matter.

P.7.5A.3 *Compare and contrast chemical and physical properties (e.g., combustion, oxidation, pH, solubility, reaction with water).*

Physical Science Activity
6-8 Group

For the 6-8 Group:

P.7.5D Students will demonstrate an understanding of chemical formulas and common chemical substances to predict the types of reactions and possible outcomes of the reactions.

- ***P.7.5D.1*** *Analyze evidence from scientific investigations to predict likely outcomes of chemical reactions.*
- ***P.7.5D.2*** *Design and conduct scientific investigations to support evidence that chemical reactions (e.g., cooking, combustion, rusting, decomposition, photosynthesis, and cellular respiration) have occurred.*
- ***P.7.5D.3*** *Collect, organize, and interpret data using various tools (e.g., litmus paper, pH paper, cabbage juice) regarding neutralization of acids and bases using common substances.*

Physical Science Activity
3-5 Group; 6-8 Group

Student will begin to study chemical reactions by Grade 7.

Maybe introduce these lessons with something like this…

Video link:
https://www.youtube.com/watch?v=aKPoQYevoLs

Physical Science Activity
Biology

For the Biology Group:

BIO.1B Students will analyze the structure and function of the macromolecules that make up cells.

- ***BIO.1B.1*** *Develop and use models to compare and contrast the structure and function of carbohydrates, lipids, proteins, and nucleic acids (DNA and RNA) in organisms.*
- ***BIO.1B.2*** *Design and conduct an experiment to determine how enzymes react given various environmental conditions (i.e., pH, temperature, and concentration). Analyze, interpret, graph, and present data to explain how those changing conditions affect the enzyme activity and the rate of the reactions that take place in biological organisms.*

Physical Science Activity
Biology

Biomolecules from Amoeba Sisters

https://www.youtube.com/watch?v=YO244P1e9QM

A short video made by a student about enzyme activity.

Video link:
https://www.youtube.com/watch?v=9mr1g7xhILc

Physical Science Activities

Physical Science Activity

K-2 Group – Physical Properties

Bag of Matter, Cup of Water, Bag of Tools to Investigate the matter on the table by using the bag of tools; Record observations on your sheet.

- How could you change this activity to better teach your grade lessons?

Physical Science Activity

3-5 Group – 3 activities:

(1) Matter and Tool bags – Investigate physical properties; 3 states of matter; find volume of a solid and irregular solid

(2) Investigate physical properties of unknown substances

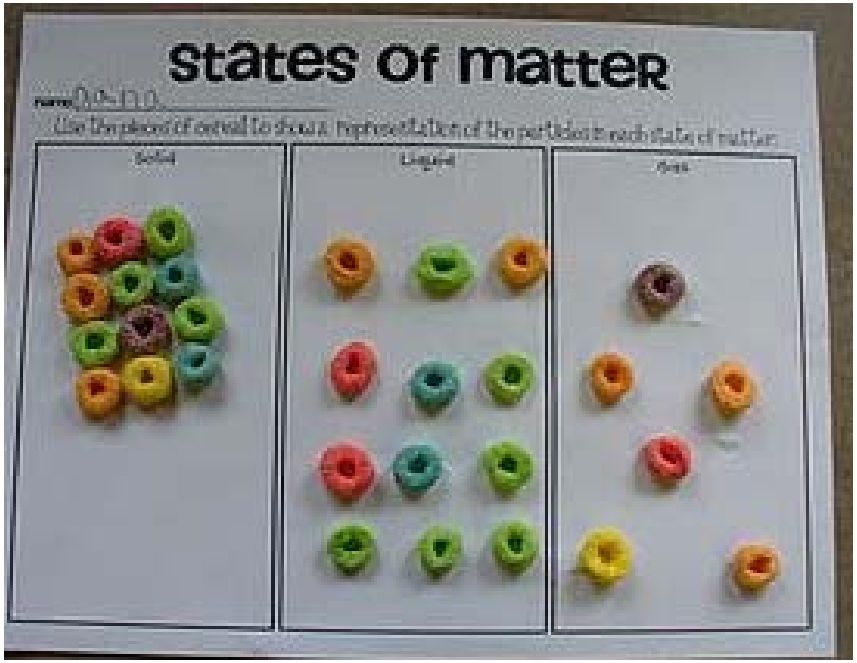
(3) Investigate chemical properties - gas production

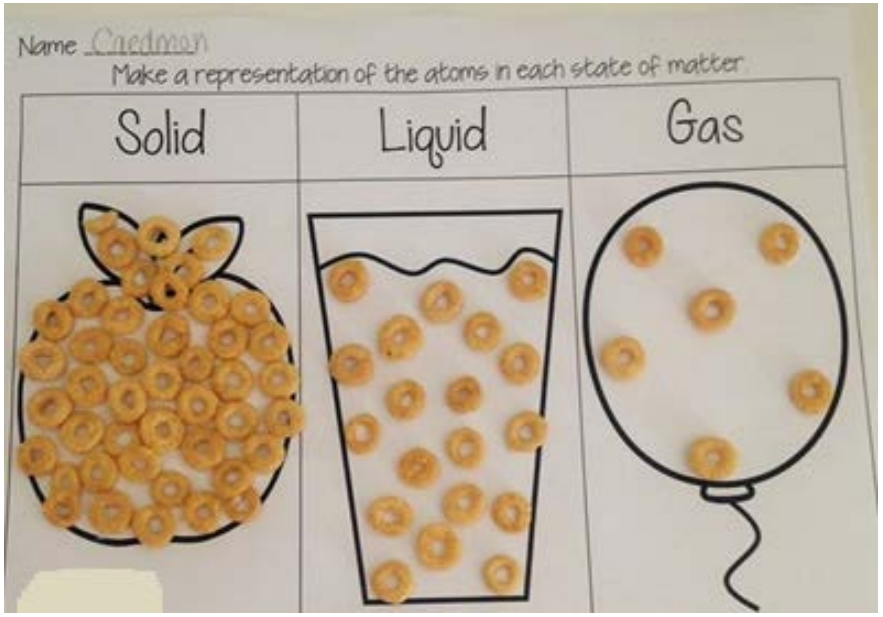
[Unknowns: 1 = cane sugar; 2 = baking powder; 3 = sand; 4 = sea salt]

- How could you change this activity to better teach your grade lessons?

Physical Science Activity K-5

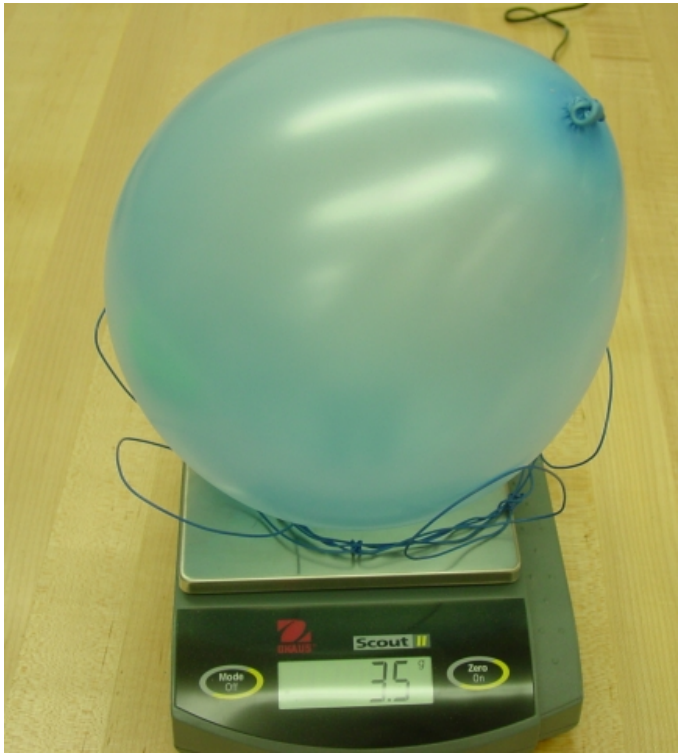
What SEP would this represent?

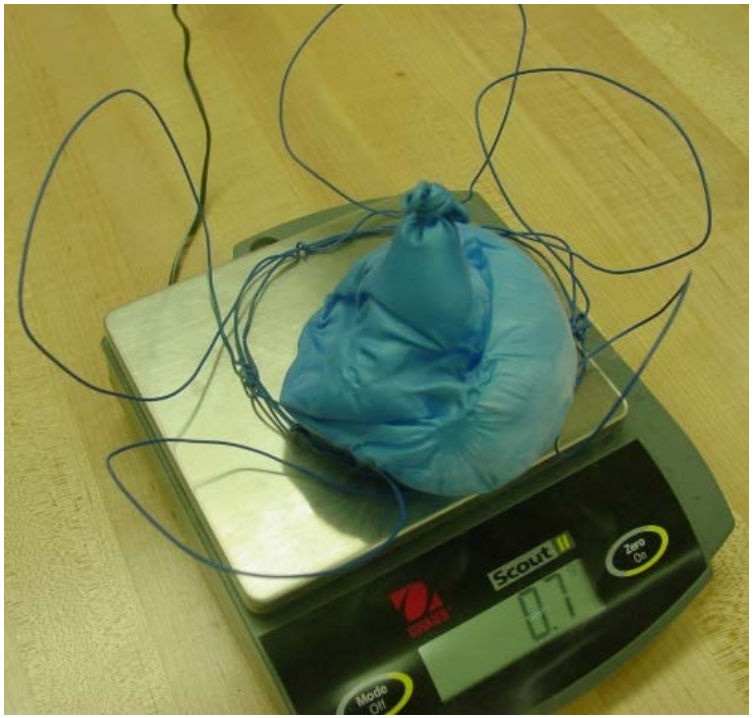




Physical Science Activity K-5

Gases take up space and have mass!



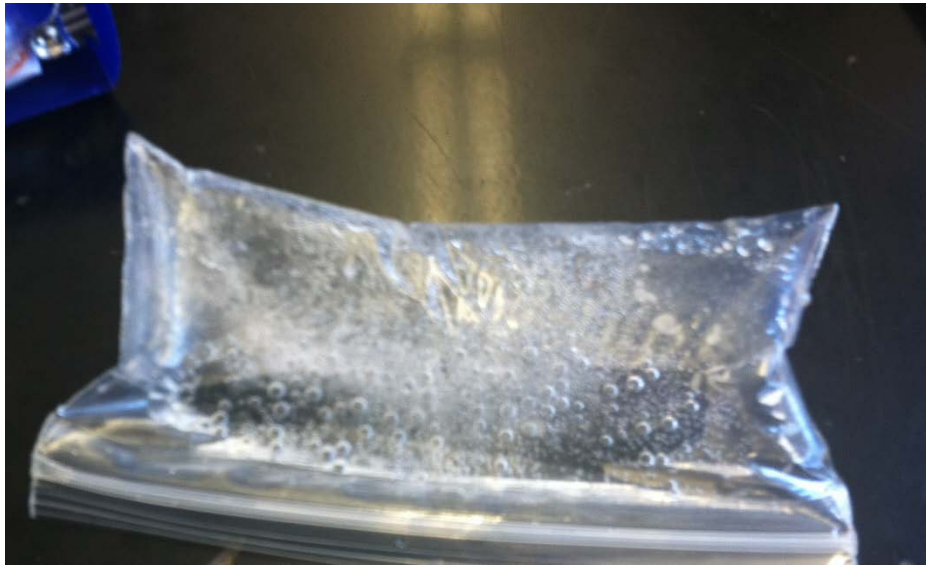


Physical Science Activity K-5

Can you find three phases of matter?

Physical Science Activity 3-5

Is this physical or chemical?



Physical Science Activity Grades 6-8

6-8, HS Physical Science Group: 2 Activities

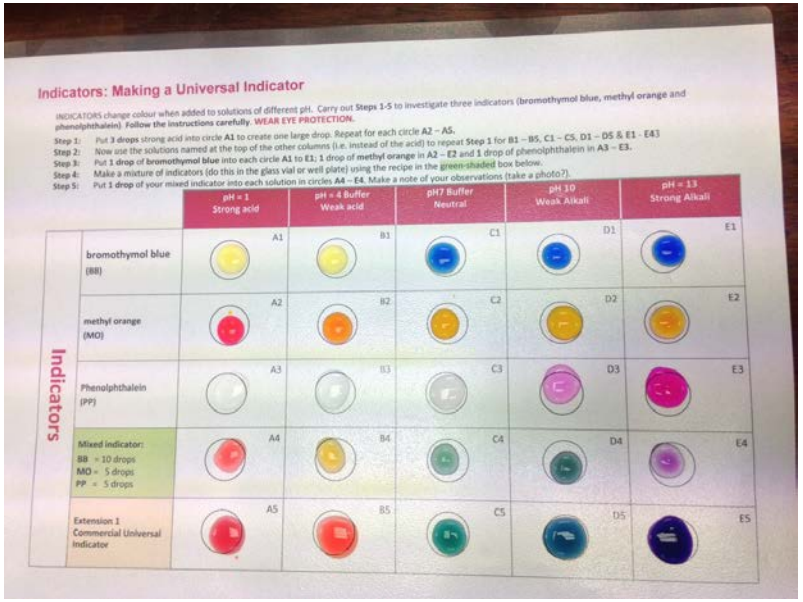
(1) Chemical and physical changes - Physical – dissolving only; Chemical – color change, bubbles

(2) Neutralization– Red cabbage indicator was the control – add cream of tartar to one plate and detergent to another

- How are acid, base, and pH concepts used in this activity?
- How could you change this activity to better teach your grade lessons?

Physical Science Activity Group Reports

6-8 and High School Chemistry, Physics Group



Physical Science Activity
Biology

Biology – 2 Activities:

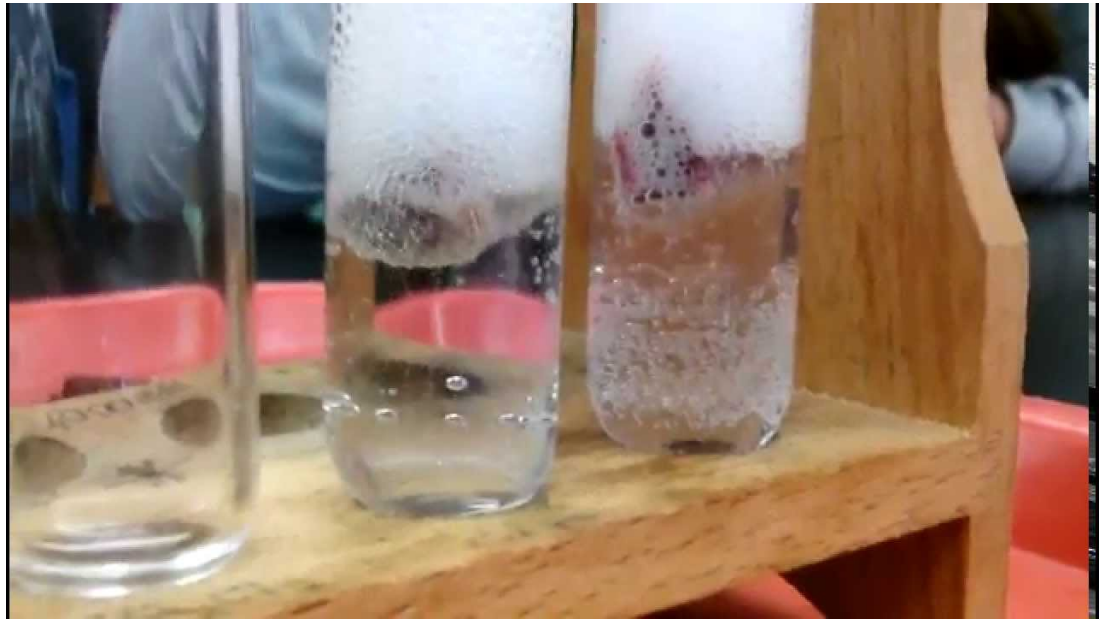
(1) Organic molecules – Construct simple models and answer questions about 4 types (proteins, carbohydrates, nucleic acids, lipids)

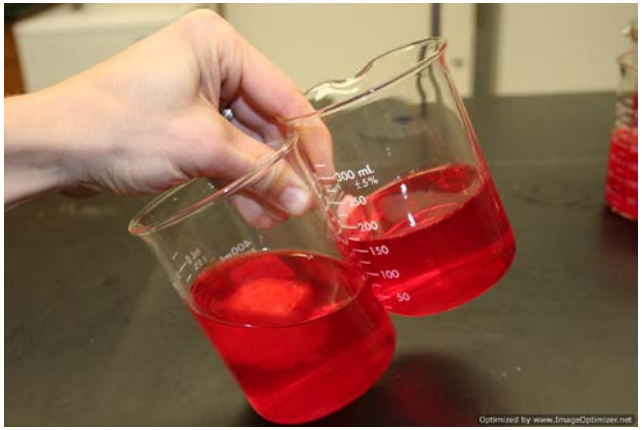
(2) Enzyme activity - Pineapple (raw, canned) with Jello; Liver (cooked, raw) with hydrogen peroxide (H_2O_2) plus water – Purpose of raw + water? Purpose of repeating cups 1 and 4?

What is the enzyme and substrate in each?

Physical Science Activity Group Reports

High School Biology Group





Physical Science Activity K-12

Reflection for ALL Groups:

- Did the activity match the objective?
- What **SEP(s)** did you use while performing the activities?
- What would students need to know prior to the activity (tools, content, safety)?
- Brainstorm! What other ideas did you come up with?

Science and Engineering Practices

(These represent a more complete, holistic and accurate view of scientific activity.)

- Ask questions and define problems
- Develop and use models
- Plan and conduct investigations
- Analyze, interpret, graph, and present data
- Using mathematical and computational thinking
- Construct explanations and design solutions
- Engage in scientific argument from evidence
- Obtain, evaluate, and communicate information

MS CCRS for Science– Progression from K-12 Physical Science

Progression for Disciplinary Core Idea: Organization of Matter

Ideas build through the grade levels to become successively more sophisticated.

Highest level

By the end of Physical Science or Chemistry	Atomic Structure Model – investigate atomic structure using periodic table and predict bonding through reactions
By the end of 7th grade	Atomic/Molecular Model – explore the physical and chemical properties through changes using reactions
By the end of 5th grade	Particle Model –investigate physical properties of matter (volume, shape, movement, spacing of particles)
By the end of 2nd grade	Macroscopic Model – classify matter as solid, liquid, or gas

Lowest level

MS CCRS for Science– What is different?

Progression for Life Science – Grades 6, 7, 8

Topics in Grade 6 Life Science

Cell Structure and Function

Interactions of Organisms with Environment

Classification tools/Characteristics of major kingdoms

Topics in Grade 7 Life Science

Cycling of matter through living systems

Photosynthesis and aerobic and anaerobic respiration

Topics in Grade 8 Life Science

Mitosis and Meiosis

Genetics and principles of heredity

DNA and Chromosomes

Ideas for Lesson Planning

K-12

Ideas for Lesson Planning

Content:

Which is more effective – provide information (notes) prior to activity or after?

Does it make a difference?

Student take and make notes during activity – report out and clarify misunderstandings

MISSISSIPPI DEPARTMENT OF EDUCATION
Ensuring a bright future for every child

Ideas for Lesson Planning

What is a 5E Lesson Plan?

- Supports inquiry/SEP-based instruction
- Allows students to make discoveries and to process new skills in an engaging way
- Students are learning and more knowledgeable about their own metacognition because they are coached along and not just listening to teachers lecturing.
- Teacher's role is to facilitate and support students as they build new knowledge.

Ideas for Lesson Planning

Let’s watch a clip explaining using 5E lesson planning techniques.

https://www.youtube.com/watch?v=lQzQumJmJv8

The information in this video is copyrighted and has restrictions – you can use lessons in your classroom or teacher training but can’t be used, posted, or used in money making ventures!

How to plan innovative lessons

Let's watch a clip with younger students showing the teacher checking for understanding, a 5E concept – Explain.

https://betterlesson.com/lesson/resource/3256830/conferencing-with-students-mov

The information in this video is copyrighted and has restrictions – you can use lessons in your classroom or teacher training but can't be used, posted, or used in money making ventures!

Ideas for Lesson Planning

The Five E's are:

- **Engage**
- **Explore**
- **Explain**
- **Elaborate**
- **Evaluate**

Challenge: Research science lessons that utilize 5Es.

Try to begin incorporating these proven techniques when you plan for next year.

MS CCRS for Science – Crosscutting Concepts

Physical Properties

- Addresses the "fragmented" approach to science lessons especially in K-8 (i.e., unit on ecosystems, then matter, then types of rocks – What are the connections?)
- Helps the students see connections between ideas within a discipline and between different disciplines

K-2	3-5	6-8	9-12
Patterns: Observed patterns in nature guide organization and classification and prompt questions about relationships and causes underlying them.			
• Patterns in the natural and human designed world can be observed, used to describe phenomena, and used as evidence.	• Similarities and differences in patterns can be used to sort, classify, communicate and analyze simple rates of change for natural phenomena and designed products. • Patterns of change can be used to make predictions. • Patterns can be used as evidence to support an explanation.	• Macroscopic patterns are related to the nature of microscopic and atomic-level structure. • Patterns in rates of change and other numerical relationships can provide information about natural and human designed systems. • Patterns can be used to identify cause and effect relationships. • Graphs, charts, and images can be used to identify patterns in data.	• Different patterns may be observed at each of the scales at which a system is studied and can provide evidence for causality in explanations of phenomena. • Classifications or explanations used at one scale may fall or need revision when information from smaller or larger scales is introduced; thus requiring improved investigations and experiments. • Patterns of performance of designed systems can be analyzed and interpreted to reengineer and improve the system. • Mathematical representations are needed to identify some patterns. • Empirical evidence is needed to identify patterns.

MS CCRS for Science – Crosscutting Concepts

Physical and Chemical Changes

- Cause and Effect relationships may be used to predict phenomena in natural or designed systems.
- A change to the molecular or compound structure has a cause that could effect the substance by forming a new substance.

K-2	3-5	6-8	9-12
Cause and Effect: Mechanism and Prediction: Events have causes, sometimes simple, sometimes multifaceted. Deciphering causal relationships, and the mechanisms by which they are mediated, is a major activity of science and engineering.			
• Events have causes that generate observable patterns. • Simple tests can be designed to gather evidence to support or refute student ideas about causes.	• Cause and effect relationships are routinely identified, tested, and used to explain change. • Events that occur together with regularity might or might not be a cause and effect relationship.	• Relationships can be classified as causal or correlational, and correlation does not necessarily imply causation. • Cause and effect relationships may be used to predict phenomena in natural or designed systems. • Phenomena may have more than one cause, and some cause and effect relationships in systems can only be described using probability.	• Empirical evidence is required to differentiate between cause and correlation and make claims about specific causes and effects. • Cause and effect relationships can be suggested and predicted for complex natural and human designed systems by examining what is known about smaller scale mechanisms within the system. • Systems can be designed to cause a desired effect. • Changes in systems may have various causes that may not have equal effects.

MS CCRS for Science – Crosscutting Concepts

Organic Molecules and Enzymes

- Structure and Function and Stability and Change

K-2	3-5	6-8	9-12
Structure and Function: The way an object is shaped or structured determines many of its properties and functions.			
• The shape and stability of structures of natural and designed objects are related to their function(s).	• Different materials have different substructures, which can sometimes be observed. • Substructures have shapes and parts that serve functions	• Complex and microscopic structures and systems can be visualized, modeled, and used to describe how their function depends on the shapes, composition, and relationships among its parts; therefore, complex natural and designed structures/systems can be analyzed to determine how they function. • Structures can be designed to serve particular functions by taking into account properties of different materials, and how materials can be shaped and used.	• Investigating or designing new systems or structures requires a detailed examination of the properties of different materials, the structures of different components, and connections of components to reveal its function and/or solve a problem. • The functions and properties of natural and designed objects and systems can be inferred from their overall structure, the way their components are shaped and used, and the molecular substructures of its various materials.
Stability and Change: For both designed and natural systems, conditions that affect stability and factors that control rates of change are critical elements to consider and understand.			
• Some things stay the same while other things change. • Things may change slowly or rapidly.	• Change is measured in terms of differences over time and may occur at different rates. • Some systems appear stable, but over long periods of time will eventually change.	• Explanations of stability and change in natural or designed systems can be constructed by examining the changes over time and forces at different scales, including the atomic scale. • Small changes in one part of a system might cause large changes in another part. • Stability might be disturbed either by sudden events or gradual changes that accumulate over time. • Systems in dynamic equilibrium are stable due to a balance of feedback mechanisms.	• Much of science deals with constructing explanations of how things change and how they remain stable. • Change and rates of change can be quantified and modeled over very short or very long periods of time. Some system changes are irreversible. • Feedback (negative or positive) can stabilize or destabilize a system. • Systems can be designed for greater or lesser stability.

Physical Science Activity

Name: _____

Why Does Matter Matter?

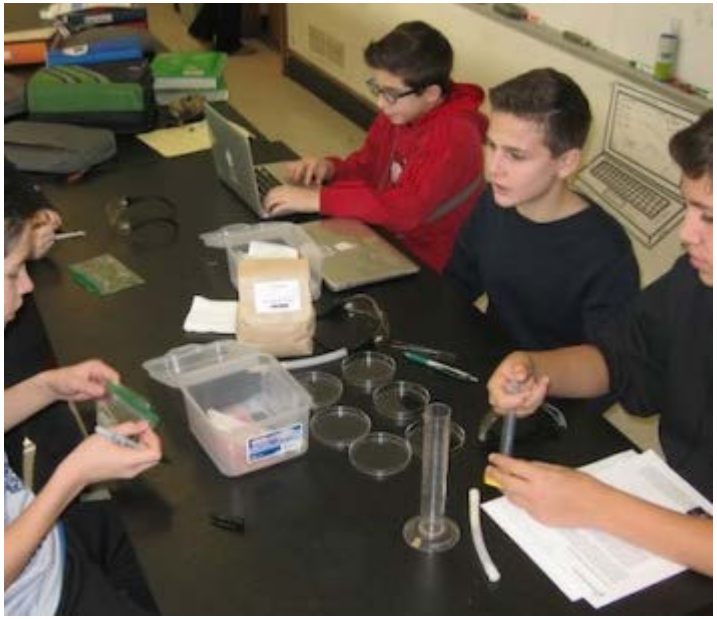
by Kelly Hashway

solids	volume	container	matter	ice	juice
gases	mass	atoms	chair	oxygen	melting
liquids	shape	space	milk	helium	

Choose a word from the box to complete each sentence.

1. The three basic properties of matter are _____, _____, and _____.
2. All matter is made up of tiny particles called _____.
3. Volume is the amount of _____ that matter takes up.
4. Mass is the amount of _____ an object has.
5. Liquids take the shape of their _____.
6. _____ do not have a definite shape or volume.
7. _____ do not have a definite shape, but they do have a definite volume.
8. _____ have a definite shape and volume.
9. A _____ and _____ are examples of solids.
10. _____ and _____ are examples of liquids.
11. _____ and _____ are examples of gas.
12. Solid ice is _____ when it is changing into a liquid.

OR



Physical Science Activity

PHYSICAL AND CHEMICAL PROPERTIES AND CHANGES

Name _____Key_____

PHYSICAL PROPERTY	CHEMICAL PROPERTY
1. observed with senses 2. determined without destroying matter	1. indicates how a substance reacts with something else 2. matter will be changed into a new substance after the reaction

Identify the following as a chemical (C) or physical property (P):

_____1. blue color
_____2. density
_____3. flammability (burns)
_____4. solubility (dissolves)
_____5. reacts with acid
_____6. supports combustion
_____7. sour taste
_____8. melting point
_____9. reacts with water
_____10. hardness
_____11. boiling point
_____12. luster
_____13. odor
_____14. reacts with air

PHYSICAL CHANGE	CHEMICAL CHANGE
1. a change in size, shape, or state 2. no new substance is formed	1. a change in the physical and chemical properties 2. a new substance is formed

Identify the following as physical *(P)* or chemical *(C)* changes.

_____1. NaCl (Table Salt) dissolves in water.
_____2. Ag (Silver) tarnishes.
_____3. An apple is cut.
_____4. Heat changes H_2O to steam.
_____5. Baking soda reacts to vinegar.
_____6. Fe (Iron) rusts.
_____7. Alcohol evaporates .
_____8. Ice melts.
_____9. Milk sours.
_____10. Sugar dissolves in water.
_____11. Wood rots.
_____12. Pancakes cook.
_____13. Grass grows.
_____14. A tire is inflated.
_____15. Food is digested.
_____16. Paper towel absorbs water.

Physical and Chemical Changes

Part A

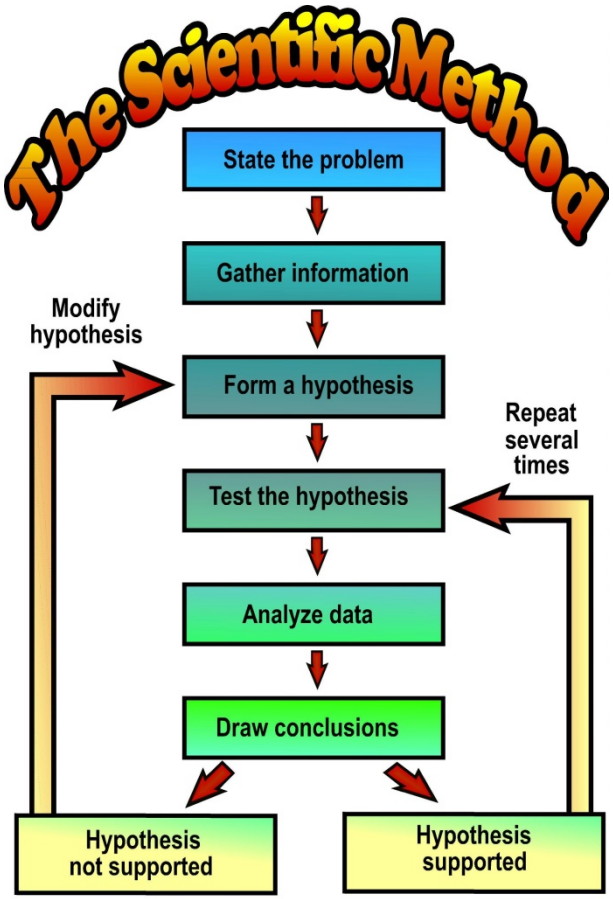
Can you recognize the chemical and physical changes that happen all around us? If you change the way something looks, but haven't made a new substance, a **physical change** (P) has occurred. If the substance has been changed into another substance, a **chemical change** (C) has occurred.

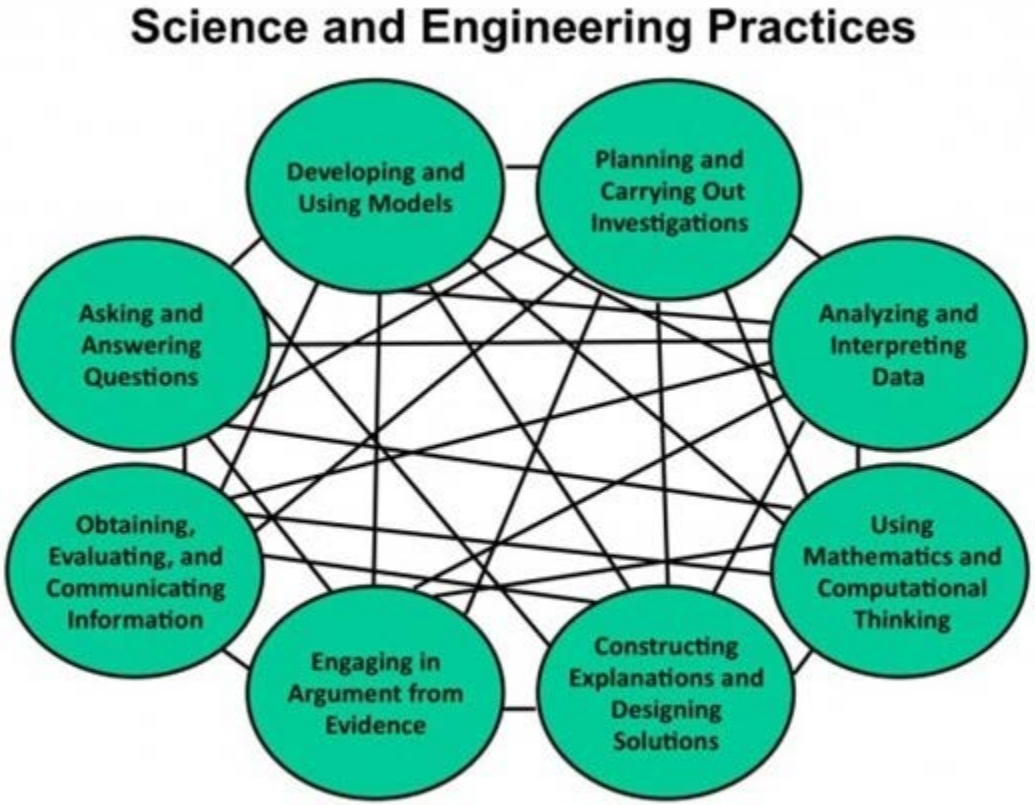
1.		An ice cube is placed in the sun. Later there is a puddle of water. Later still the puddle is gone.
2.		Two chemical are mixed together and a gas is produce.
3.		A bicycle changes color as it rusts.
4.		A solid is crushed to a powder.
5.		Two substances are mixed and light is produced.
6.		A piece of ice melts and reacts with sodium.
7.		Mixing salt and pepper.
8.		Chocolate syrup is dissolved in milk.
9.		A marshmallow is toasted over a campfire.
10.		A marshmallow is cut in half.

OR

MISSISSIPPI DEPARTMENT OF EDUCATION
Ensuring a bright future for every child

New Approaches to Scientific Methods





Mississippi CCRS for Science An Analogy

An Analogy MS CCR for Science: Making a Cake

Final Cake

(Student Knowledge and Understanding)

Tools & Techniques (Science & Engineering Practices)

Ingredients (Core Ideas - Content)

Frosting (Icing) (Crosscutting Concepts)

Work in Grade Bands

Planning by Using the Crosswalks

Crosswalk Inquiry Strand

Crosswalk 2010 MS Science - 2018 MS CCRS for Science
Inquiry Strand Grade 5

2010 MS Framework G5 - Inquiry	2018 MS CCRS for Science - all grades and courses
Competency 1. 1. Develop and demonstrate an understanding of scientific inquiry using process skills.	All Inquiry skills will be taught in the appropriate performance objectives in the new standards. Students will use various Science and Engineering Practices (SEPs) to learn the content. All science skills should be included as needed.
1a.Form a hypothesis, predict outcomes, and conduct a fair investigation that includes manipulating variables and using experimental controls.	
1b.Distinguish between observations and inferences.	
1c. Use precise measurement in conjunction with simple tools and technology to perform tests and collect data. • Tools (English rulers [to the nearest one-sixteenth of an inch], metric rulers [to the nearest millimeter], thermometers, scales, hand lenses, microscopes, balances, clocks, calculators, anemometers, rain gauges, barometers, hygrometers) • Types of data (height, mass, volume, temperature, length, time, distance, volume, perimeter, area)	
1d. Organize and interpret data in tables and graphs to construct explanations and draw conclusions.	
1e.Use drawings, tables, graphs, and written and oral language to describe objects and explain ideas and actions.	
1f.Make and compare different proposals when designing a solution or product.	
1g.Evaluate results of different data (whether trivial or significant).	
1h. Infer and describe alternate explanations and predictions.	

Crosswalks – K-8, Biology

Crosswalk 2010 MS Science - 2018 MS CCRS for Science
Physical Science Grade 5

2010 MS Framework G5 – Physical Science	2018 MS CCRS for Science G5 – Physical Science Topics
Competency 2. Understand relationships of the properties of objects and materials, position and motion of objects, and transfer of energy to explain the physical world.	Standard statements are in bold font below.
2a. Determine how the properties of an object affect how it acts and interacts.	*See P.5.5A below*
2b. Differentiate between elements, compounds, and mixtures and between chemical and physical changes (e.g., gas evolves, color, and/or temperature changes).	P.5.5C Students will demonstrate an understanding of the difference between physical and chemical changes. P.5.5C.1 Analyze and communicate the results of chemical changes that result in the formation of new materials (e.g., decaying, burning, rusting, or cooking). P.5.5C.2 Analyze and communicate the results of physical changes to a substance that results in a reversible change (e.g., changes in states of matter with the addition or removal of energy, changes in size or shape, or combining/separating mixtures or solutions). P.5.5C.3 Analyze and interpret data to support claims that when two substances are mixed, the total weight of matter is conserved.
2c. Investigate the motion of an object in terms of its position, direction of motion, and speed. • The relative positions and movements of objects using points of reference (distance vs. time of moving objects) • Force required to move an object using appropriate devices (e.g., spring scale) • Variables that affect speed (e.g., ramp height/length/surface, mass of object) • Effects of an unbalanced force on an object's motion in terms of speed and direction)	P.5.6 Students will demonstrate an understanding of the factors that affect the motion of an object through a study of Newton's Laws of Motion. P.5.6.1 Obtain and communicate information describing gravity's effect on an object. P.5.6.2 Predict the future motion of various objects based on past observation and measurement of position, direction, and speed. P.5.6.3 Develop and use models to explain how the amount or type of force, both contact and non-contact, affects the motion of an object. P. 5.6.4 Plan and conduct scientific investigations to test the effects of balanced and unbalanced forces on the speed and/or direction of objects in motion. P. 5.6.5 Predict how a change of force, mass, and/or friction affects the motion of an object to convert potential energy into kinetic energy. P. 5.6.6 Design a system to increase the effects of friction on the motion of an object (e.g., non-slip surfaces or vehicle braking systems or flaps on aircraft wings). Use an engineering design process to define the problem, design, construct, evaluate, and improve the system.*

Crosswalk for Inquiry Strand

Challenge 1:

- Students' science skills are very important [e.g., use of tools, experimental design (variables of experiments), collecting and organizing data, graphing, reading data and graphs]
- How do we incorporate the concepts into the K-12 lessons for the new standards?

Crosswalk Challenge K-12

Challenge 2:

- Spend time with fellow grade band teachers and discuss the crosswalks
- Write down major changes for your grade/courses
- Brainstorm with others ideas on how to teach at least one standard (or at least a couple of performance objectives).
- Share Ideas with entire group

Contact Information

For more Information:

Jackie Sampsell, Ed.D.
K-12 Science Specialist
Office of Secondary Education
jsampsell@mdek12.org
601-359-2605

Tanjanikia McKinney
Professional Development Coordinator
Office of Professional Development, Science
tanjanikia.mckinney@mdek12.org
601-421-7585