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

Summer Sessions 2017

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The new science standards were created and developed to correlate with the vision and mission mandated by the State Board of Education.

The *Mississippi College- and Career-Readiness Standards for Science* also correlates with numbers 1, 2, 3, 4, and 6 of the State Board of Education's goals.

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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.

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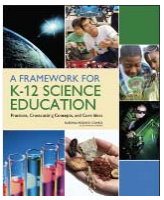
MS CCRS for Science – Research Review

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

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The major document used was the National Research Council's (NRC) Framework for K-12 Science Education. This document was the major reference for the Next Generation Science Standards (NGSS) but the task force used this document to write specific MS standards. Some overlap with NGSS but the MS standards are unique for Mississippi. The writing task force also used state standards that used the NRC document and are rated high in the Fordham's State Standard rating.
The Writing Task Force used the NAEP Framework for Science and the NAEP Framework for Technology and Engineering as a resource. **MS Standards are aligned with NAEP standards.**
The Trends in International Mathematics and Science Study (TIMSS) is an international comparative study of student achievement. These were used as a reference.
The ACT CCR Benchmarks were used for science and reading skills needed per grade level and high school courses. This document's objectives and skills were the basis of the new 0.5 credit course, Foundations of Science Literacy, that is new for high school students.

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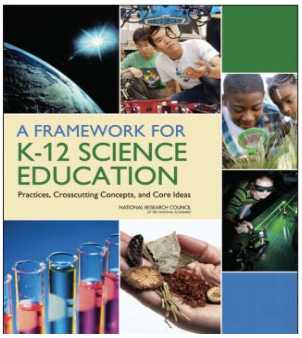
MS CCRS for Science – Research Review

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)

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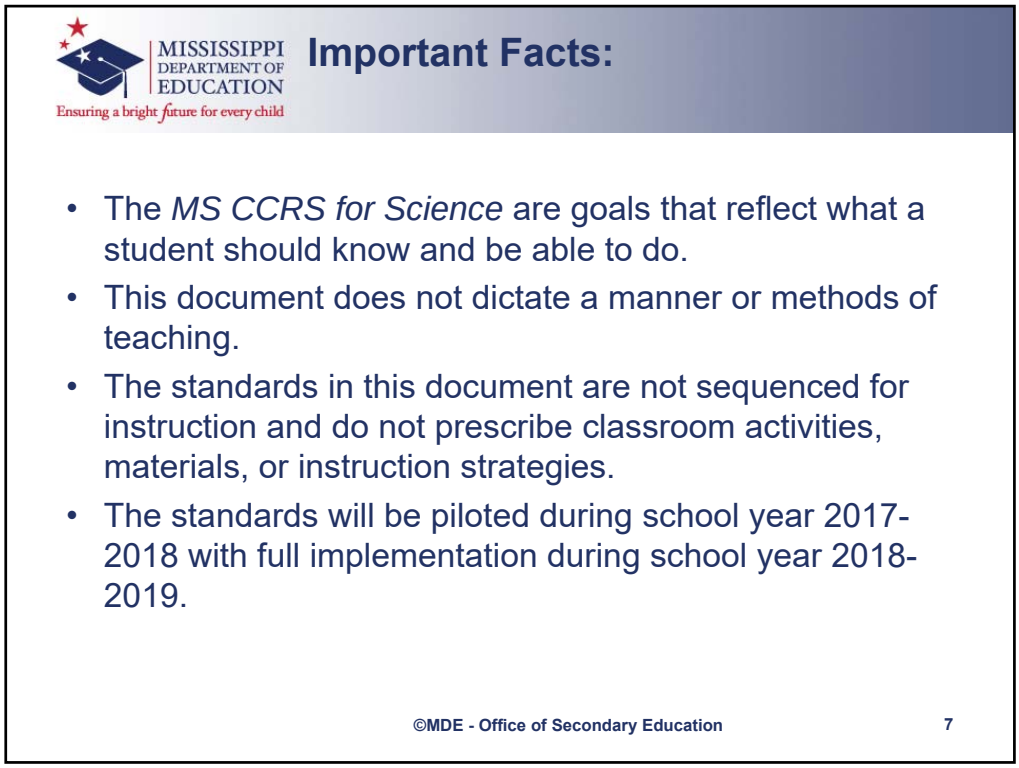
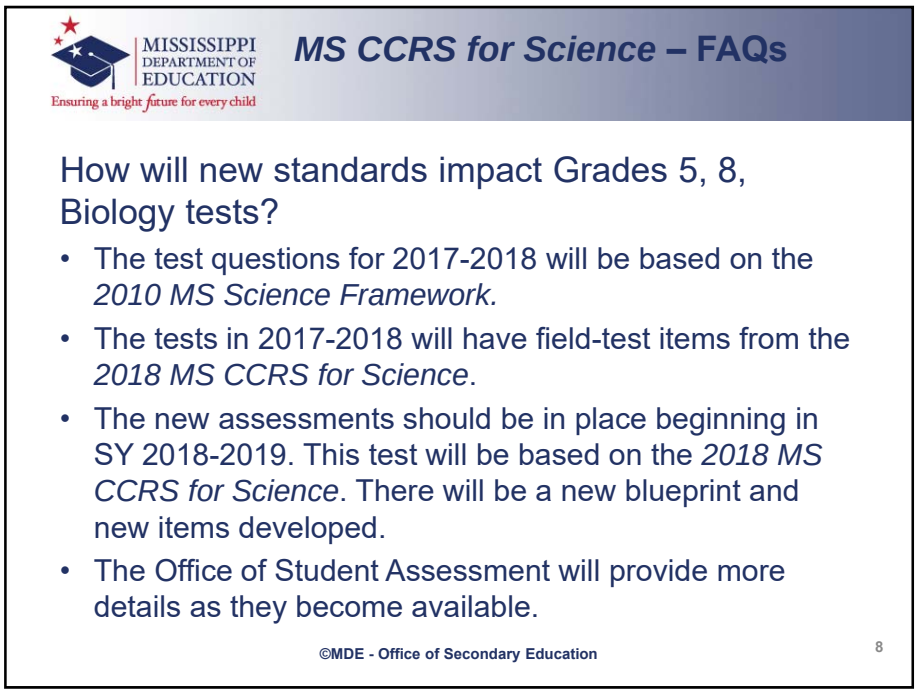
The National Research Council's research has been used to formulate most of the MS Science Frameworks from 1996 forward.

Using their research is not new to Mississippi but the 2012 book introduces methods for teaching science that are very different from all of our other science frameworks.



This is from the introduction on page 11.



Additional info – For the 2019 new tests, Grade 5 will be based on Grade 5 standards and performance objectives. This will be the same for Grade 8 and Biology. There will not be a grade band (3-5, 6-8) assessment.

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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.

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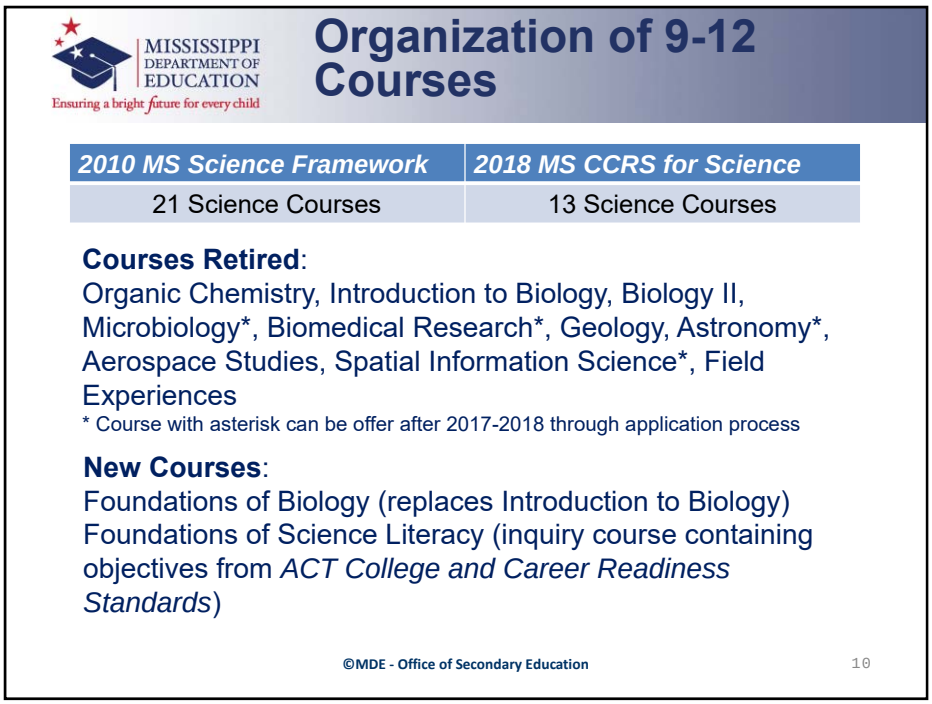


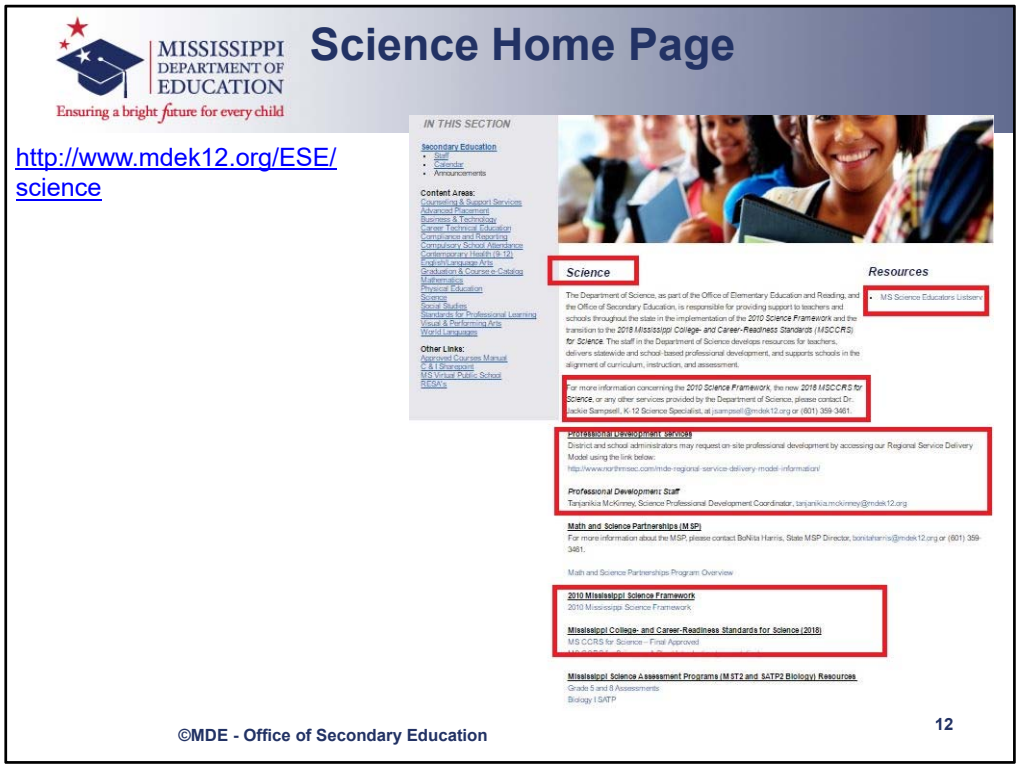
For High School: We have reduced the number of course offerings from 21 to 13. Some of the courses are totally retired but many have been reformatted or are being offered through another venue such as, Dual Enrollment Courses, Dual Credit Courses, AP Courses, the Project Lead the Way Initiative, and Career and Technical Education (CTE) courses.

(CTE Curriculum Courses (Polymer Science, Horticulture, Engineering, Forestry, Health Sciences, various Agriscience courses); We are working on a process to allow districts to submit a yearly application requesting permission to offer Advanced Topics in Science for the courses of Microbiology, Biomedical Research, Astronomy, Spatial Information Science. More information to follow.

New Courses: Foundations of Biology replaces Introduction to Biology and has increased rigor with research and reading woven into biological topics

Foundations of Science Literacy will require the students to research, plan, and conduct experiments while improving scientific literacy and thinking skills by using sample ACT science passages to analyze and interpret data, graphics, and experimental designs.

We are working to change the MDE webpage in the fall.



The MDE science homepage will be updated frequently with new resources for the new standards. To keep up-to-date on science, join the MS Science Educators Listserv (under Resources).

Information can be found for the K-12 Science Specialist, the Professional Development Coordinator, as well as the new standards, professional organization, Math and Science Partnerships, Instructional Resources including a link to Safety policies and documents.

Note the location of the Professional Development Calendar, the “Request Professional Development”, and EdUpdate links. Your district can request professional development on science by the Professional Development Coordinator for science.

Scavenger Hunt

Explore New Science Standards

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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.

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Compare Old to New!

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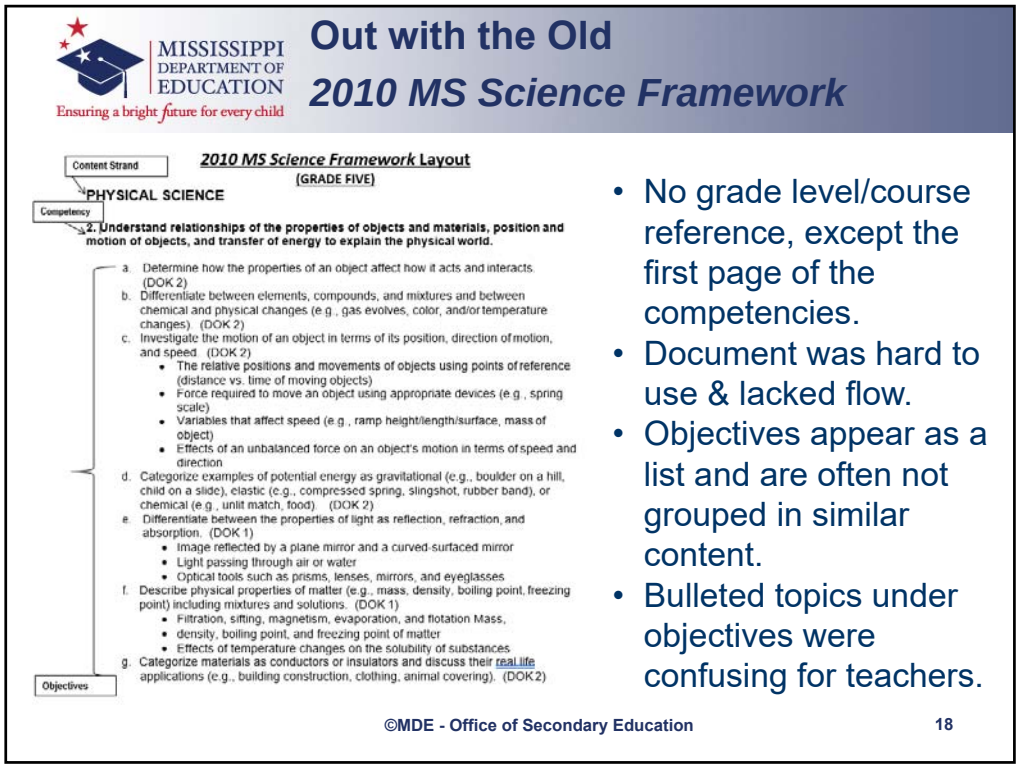
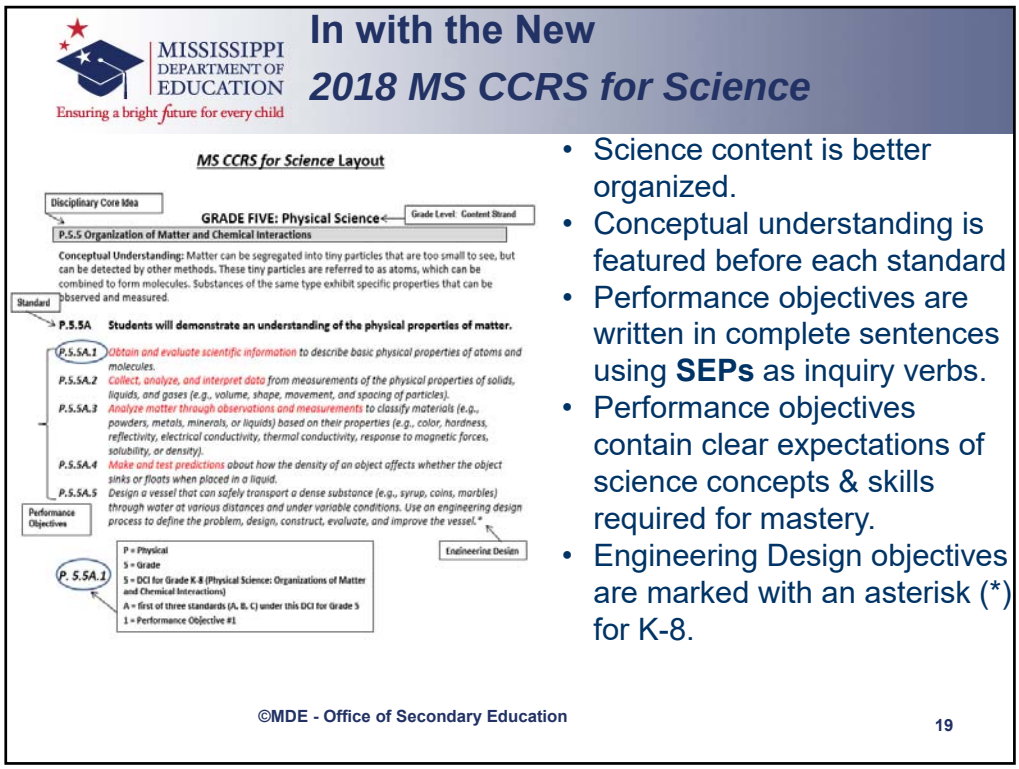
Scavenger Hunt Activity

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.



2. B and f objective reference is matter. (They are not grouped together. If a school/district does not have a pacing guide, the teaching of objectives may not flow and make sense to the students.)



The identification numbers for the grouping, the standards, and the performance objectives seem difficult to understand at first, but these are specific and more organized than any previous science framework. Conceptual Understandings are general information about each standard and performance objective. The SEP language is highlighted in red text in this view- teachers should encourage students to use any of the eight practices needed to explore and investigate each concept. Ex: P.5.5A.2, students may need to plan and conduct an experiment prior to analysis of measurements to determine physical properties of matter.

Bullet 5: Engineering design process is a series of steps that the student engineers will follow to come up with a solution to a problem.

More Features of the New!

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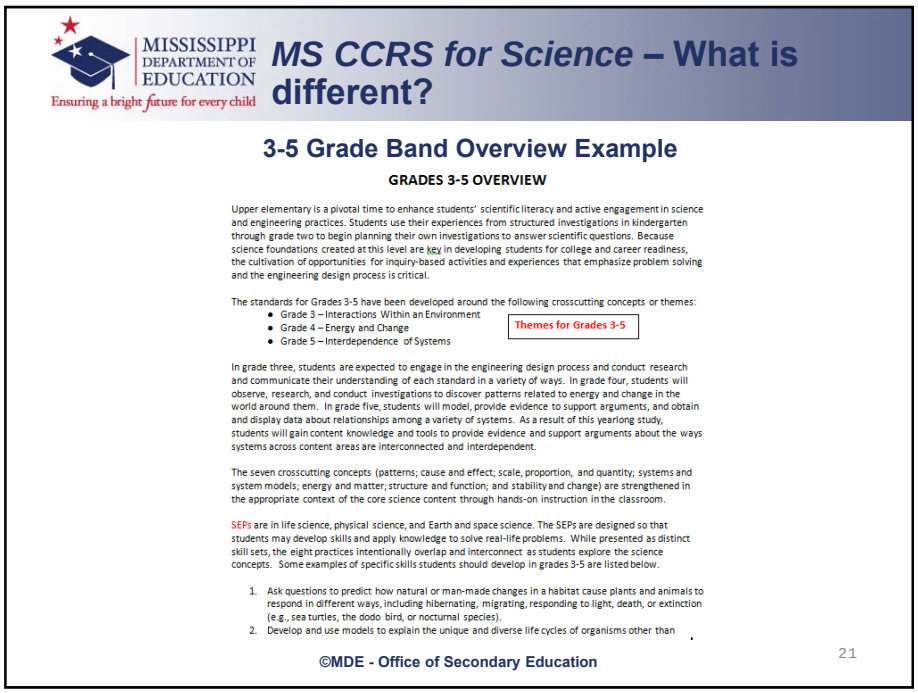


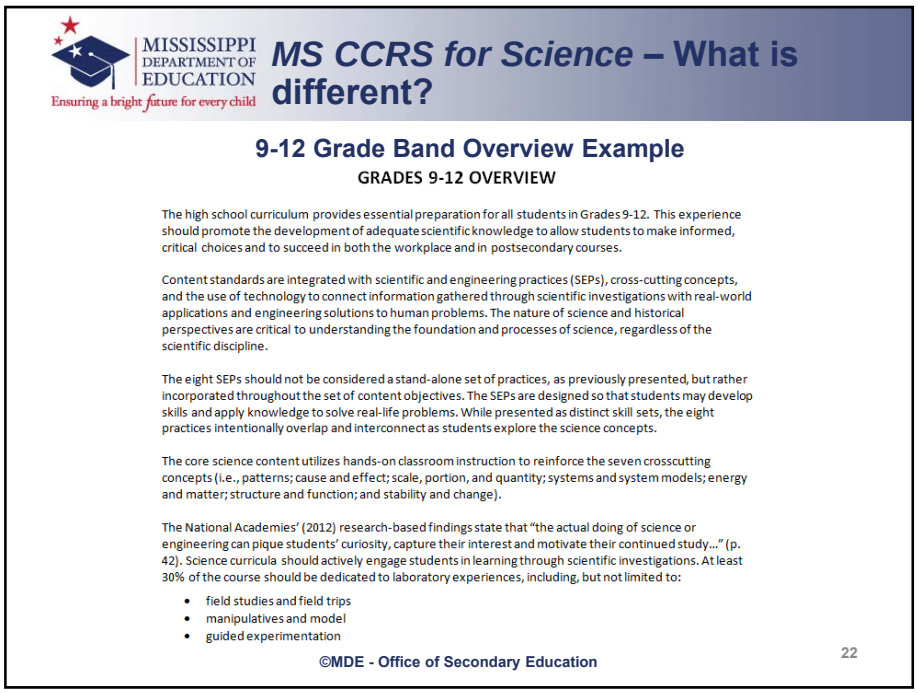
Example of 3-5 Grade Band Overview

We have grade band overviews for K-2, 3-5, 6-8, and 9-12.

The grade band overviews contains specific, grade-appropriate explanations for content, crosscutting concepts, science and engineering practices, and engineering design.

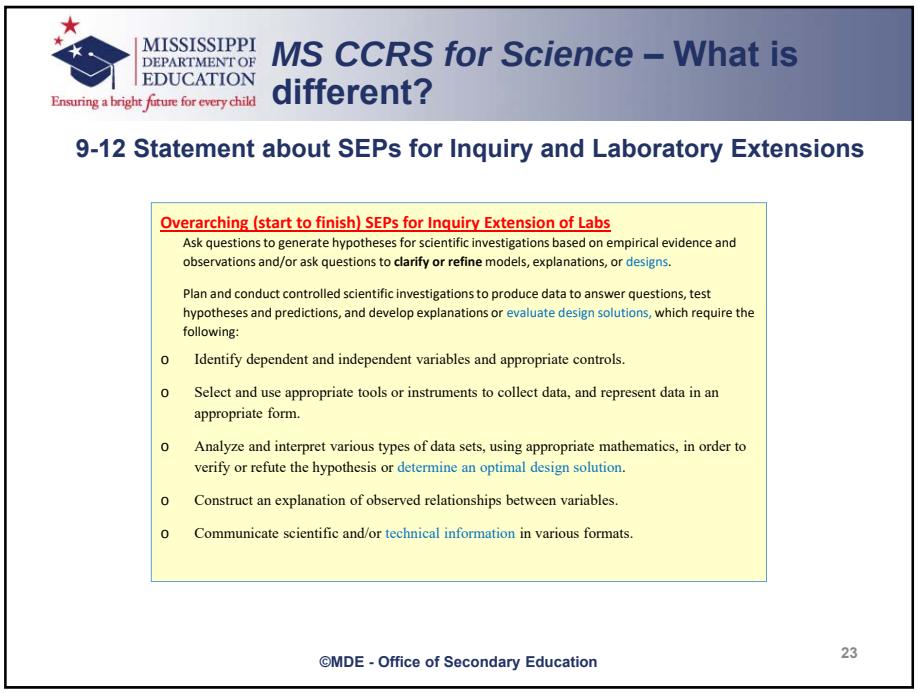
Note that each grade content for K-8 is developed around a theme.

Grade Five's Theme is "Interdependence of Systems"



Here is an example of 9-12 Grade Band Overview.

There are no themes here because each course is built around the content. The Disciplinary Core Ideas, (DEIs) are different from K-8 and based around course content. SEPs and crosscutting concepts should be used in 9-12 courses.

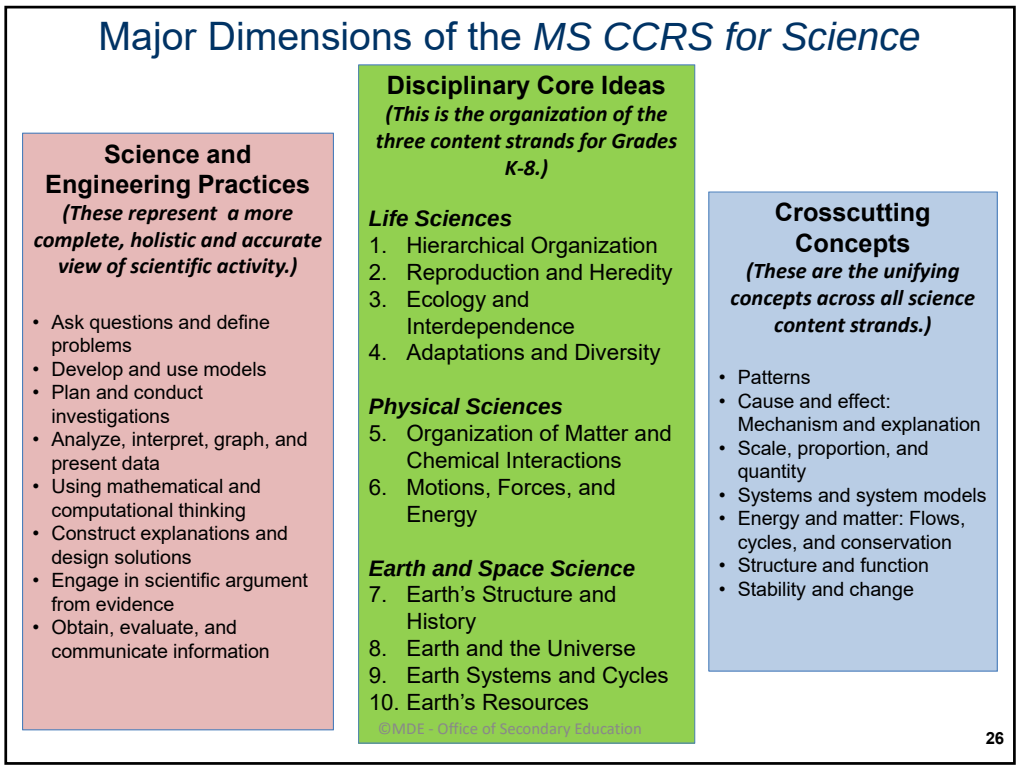


Each course in high school has this box at the end of the standards – Overarching SEPs for Inquiry Extension of Labs

This explains how the student should use the SEPs in designing and conducting an experiment.

Teachers are encouraged to utilize SEPs in all high school courses with experiments and other types of classroom activities.

The Three Dimensions – Very Important Info!



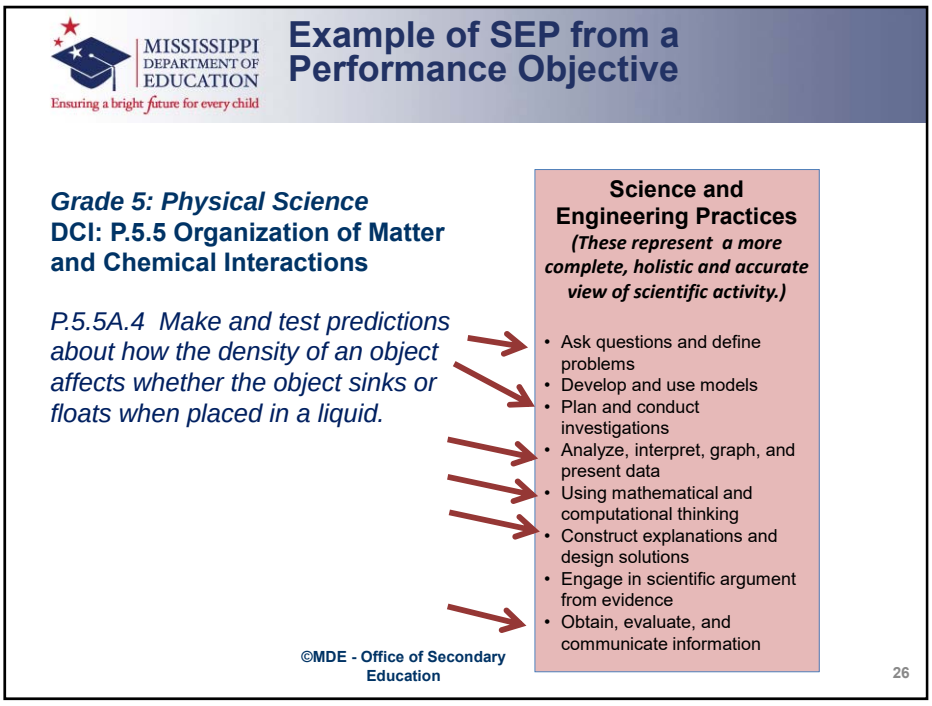
This slide is a review of the 3 Major Dimensions of the new standards.

Middle Green Section: Disciplinary core ideas This is the basic content for K-8 that is subdivided into the 3 content strands. Under each Disciplinary Core Idea, the document contains specific content standards with corresponding performance objectives. Grouping content in this way allows for vertical alignment of competencies and objectives to better organize content distribution. All content strands (life, physical and earth/space) will be found in each grade level, but all disciplinary core ideas will not be found in every grade level in K-8 due to the spiral arrangement of content.

Content strands are not included in the Grades 9-12 course organization, which allows for a more logical, sequential placement and flow of content.

Left Pink Section: Science and Engineering Practices (SEPs) The SEPs replaces the Inquiry Strand included in the *2010 Mississippi Science Framework*. The 8 practices describe the behaviors that scientists and engineers engage in as they investigate and explore the natural world. These practices work together (overlap and interconnect) and are not separated in the study and investigation of science concepts. Many will be used by students as they work through each performance objective for each grade and course in K-12.

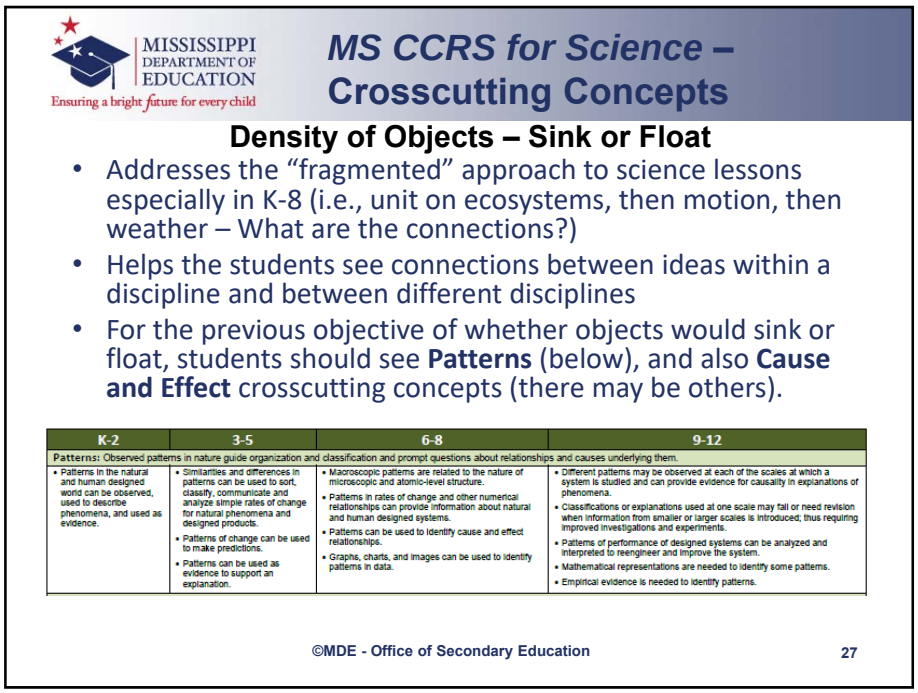
Right Blue Section: Crosscutting Concepts These are seven concepts that were adopted directly from the National Research Council's *A Framework for K-12 Science Education: Practices, Crosscutting Concepts, and Core Ideas* (2012). Crosscutting concepts are designed to help students see the unity of the sciences. For example, in Grade 5 the theme is "Interdependence of Systems" – Crosscutting concept #4 is Systems and System Models – you can see that life science focuses on ecosystems, physical science focuses on matter and its changes, and focuses on the universe systems and how the earth is impacted. The teacher will learn to look at these concepts and show/explain the connections to the students within each discipline and between each discipline.



The performance objective above states for the students to *Make and test predictions* – Which SEP would this relate? Yes, they will probably have to form a plan to conduct an investigation to test the predictions.

To completely study how density impacts the sinking or floating, the students may also have to use other SEPs.

For example: In the course of the investigation, the students may have to *collect, analyze and interpret data* which is another SEP; after collecting data, they may have to *using mathematical and computational thinking* to compare the density of the objects that floats or sinks. They may take the results and construct a chart, visual or a graph which would be *develop and use models*, and at the end they may *evaluate and communicate information*. This gives an illustration that even though the performance objective contain only one SEP, teachers should encourage students to use all SEPs as needed to learn and experience science though each performance objective.



Crosscutting Concepts for previous slide. Think back to the previous standard and objective. To expand on crosscutting concepts, students often see science as individual units with no connections. They lose the nature of science and view as a collection of facts that can be memorized. The crosscutting concepts help the students see connections between concepts and how to study the concepts within a discipline and between different disciplines. Students will begin to see the whole picture when learning science.

This example shows **Patterns**. Patterns can be found in all three sciences. They are often related and have similar trends. In this example, the students

Types of Patterns • **Classification** • Distributions • Relationships among variables • Changes and rates of change;

Students can classify organisms (life science); matter/density of objects – sink or float (physical sciences), types of rocks or seasonal weather (earth science).

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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.

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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

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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.

Left: **Developing and Using Models** – they also could be:

Asking Questions

Obtaining, Evaluating and Communicating Information

Right: **Analyzing and Interpreting Data**,

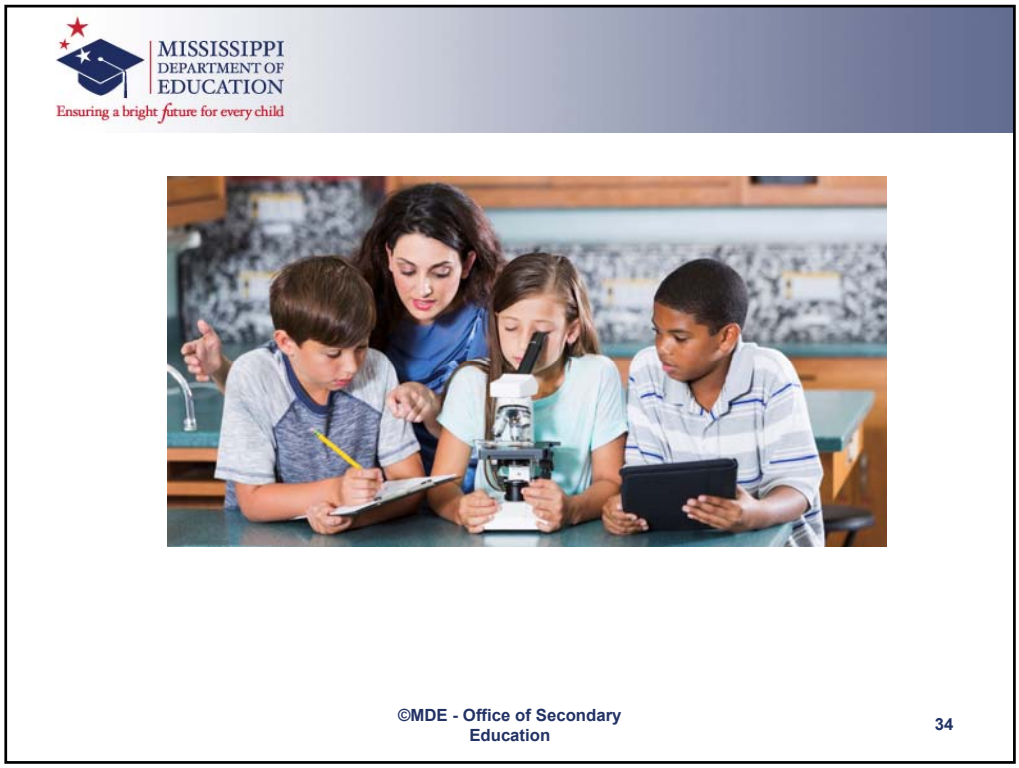
Using Mathematics and Computational Thinking,

Obtaining, Evaluating, and Communicating Information

Left: **Obtaining, Evaluating, and Communicating Information** (presentation to explain experiment) is the best here but other SEPs apply – what about Engaging in Scientific Argument? He could be expressing his point of view from his experiment.

Right**: Engaging in Scientific Argument** – this only means expressing your point of view – not a true argument.

These students could also be using others, such as, **Constructing Explanations and Designing Solutions** or **Planning an Experiment** to conduct.

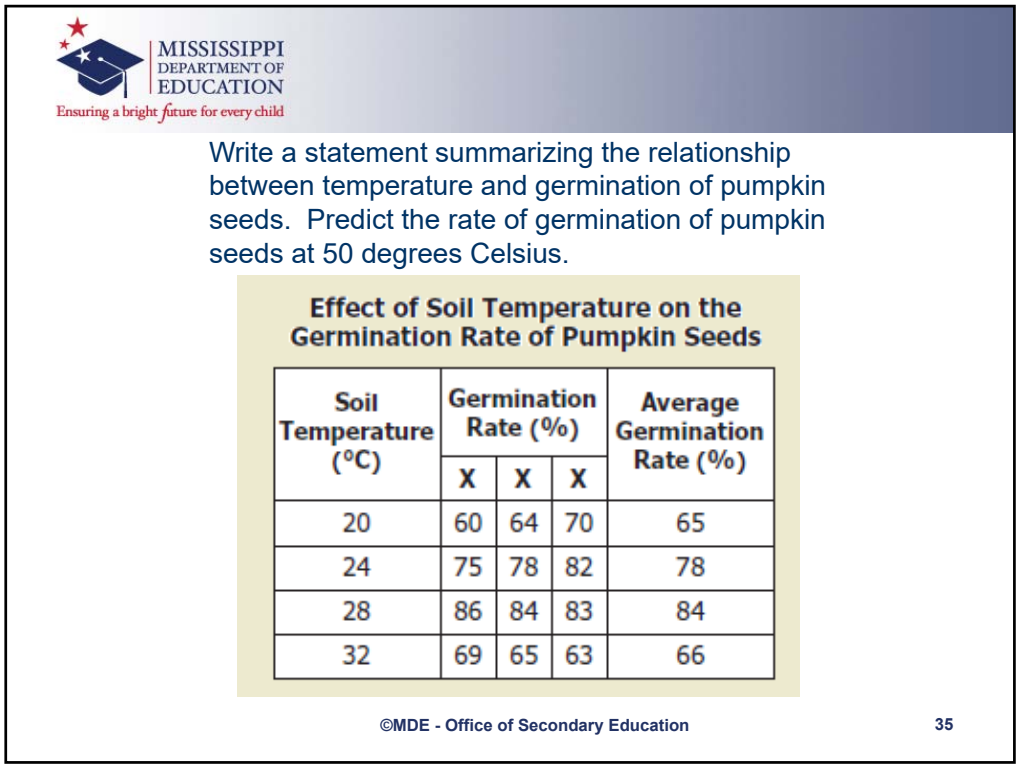


Obtaining, Evaluating and Communicating Information

Developing and Using Models – if drawing a sketch of a slide

Asking Questions and Defining Problems

Others could be used here -



Using Mathematics and Computational Thinking,

Analyzing and Interpreting Data,

Obtaining, Evaluating, and Communicating Information

Others could be used here -

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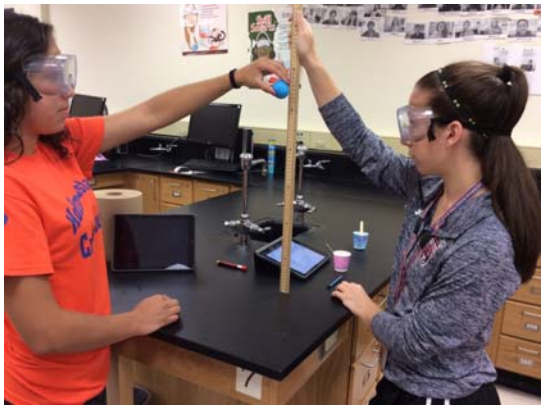

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Planning and Conducting an Investigation – maybe not showing the plan but they had to plan before doing

Obtaining, Evaluating and Communicating Information

Asking questions

Others could be used here -

Engineering Design Process

The asterisk performance objectives*

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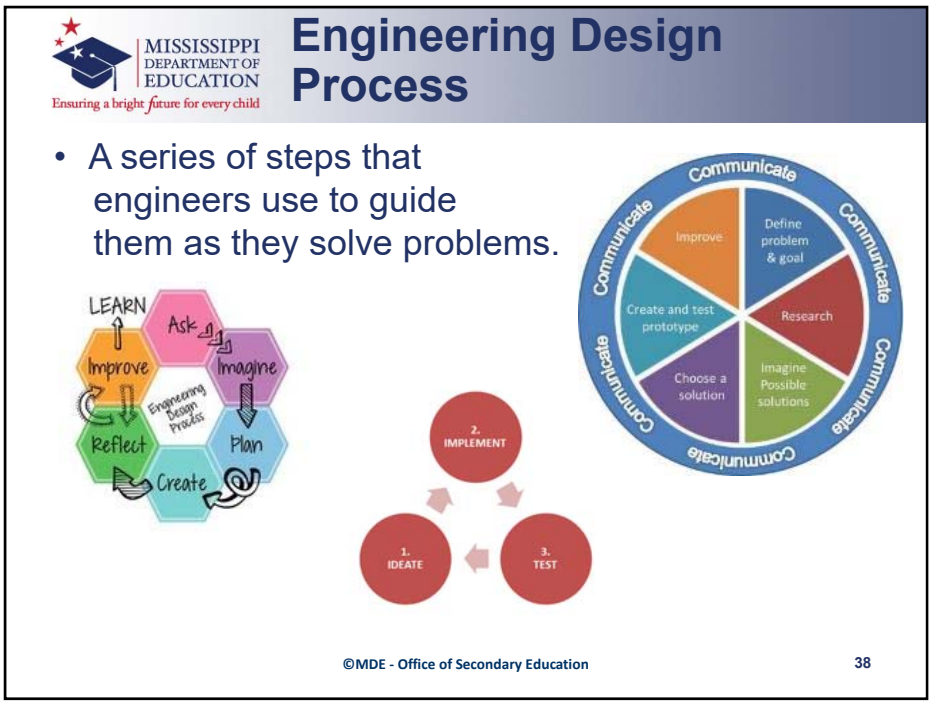
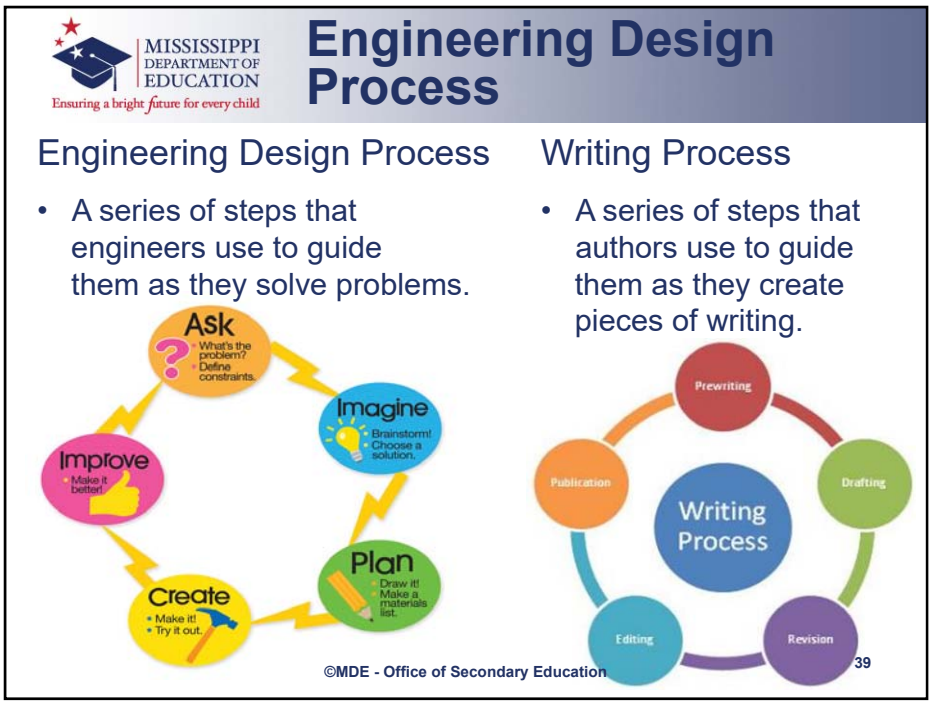
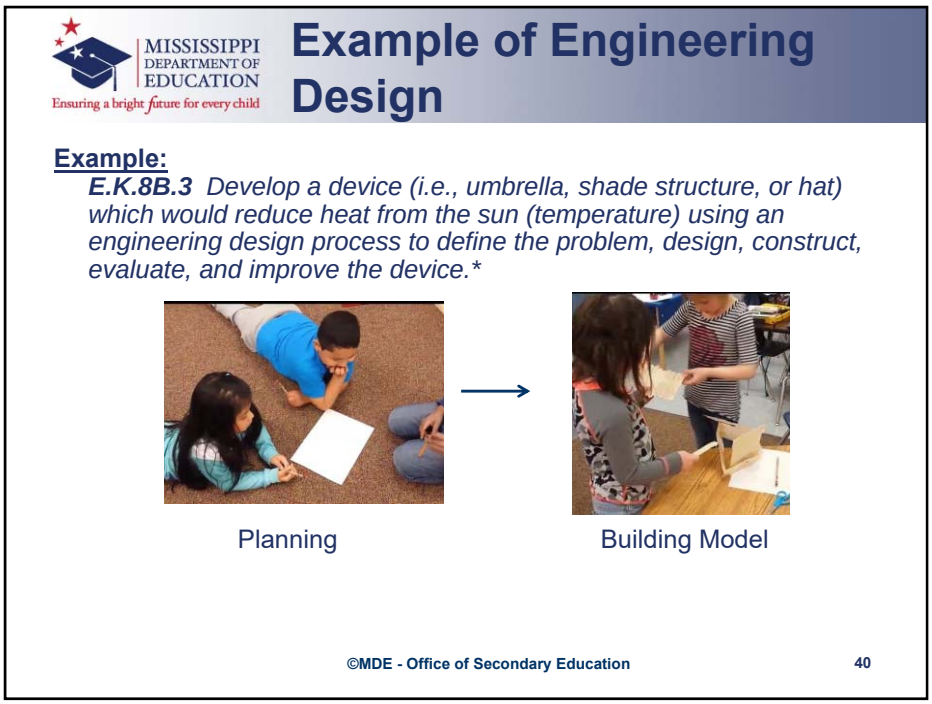


Our last NEW component is the Engineering Design Process. Engineering design standards are represented in some performance objectives with grade-banded, specific wording that prompts educators to approach learning and exploration using the engineering process. These performance objectives are marked with an *. For high school courses, these objectives are also marked as "Enrichment."

Engineering design process (EDP) is the method of devising a system, component, or process to meet desired needs. It is important to note that the EDP is flexible and can be approached in a variety of ways. This slide shows a variety of methods that can be used by students for an Engineering Design process.



The engineering design process is a series of steps with a similar process to writing an essay. Writing involves a great deal of planning, prewriting, reviewing/revision, and editing before the final product is finished. The engineering design process is very similar. Students can stop and rework each step and can back up and rework.



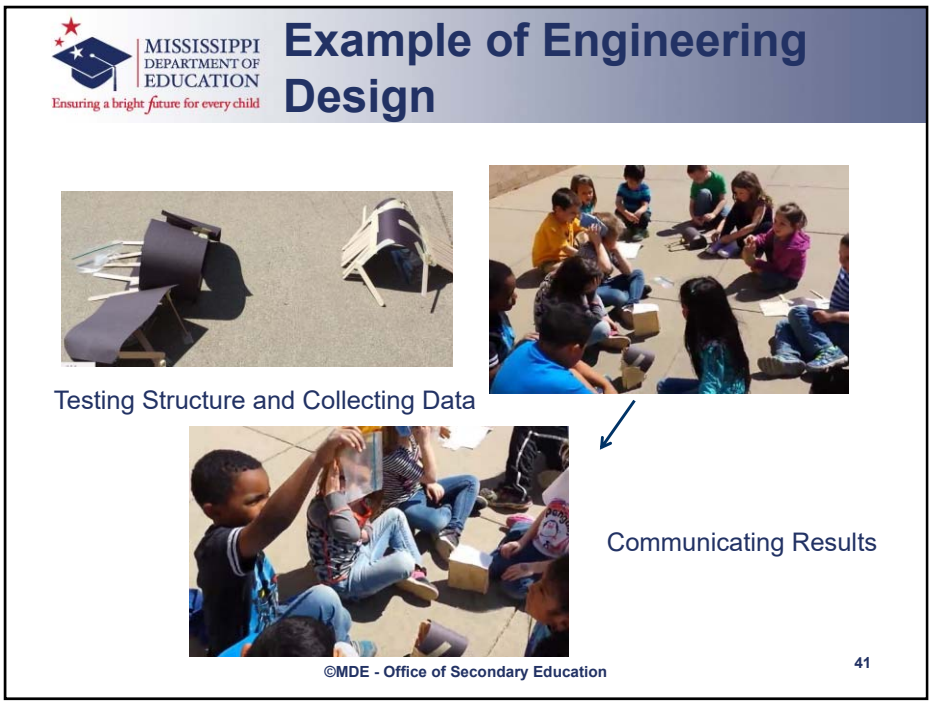
E.K.8B.3: *"Develop a device (i.e., umbrella, shade structure, or hat) which would reduce heat from the sun (temperature) using an engineering design process to define the problem, design, construct, evaluate, and improve the device.*"*

For this lesson, students will be asking questions, designing and using models, planning and carryout an investigation, analyzing and interpreting data, and constructing explanations. This lesson could start by asking students what it means to be shaded when it is hot outside. What types of objects provide shade? (trees, hats with brims, buildings, canopies, buildings).

Next the teacher at this level may have to provide an actual design task instead of leaving it open for the student to interpret.

In this example the teacher gave students a focus task: To protect ice cubes placed in the sun from melting

The pictures show the planning stage and the construction stage.



The pictures show the testing of the various structures, students collecting data, and lastly communicating results.

After the results are shared with all of the students the teacher will lead the students to compare all results and identify the characteristics of the more effective structures.

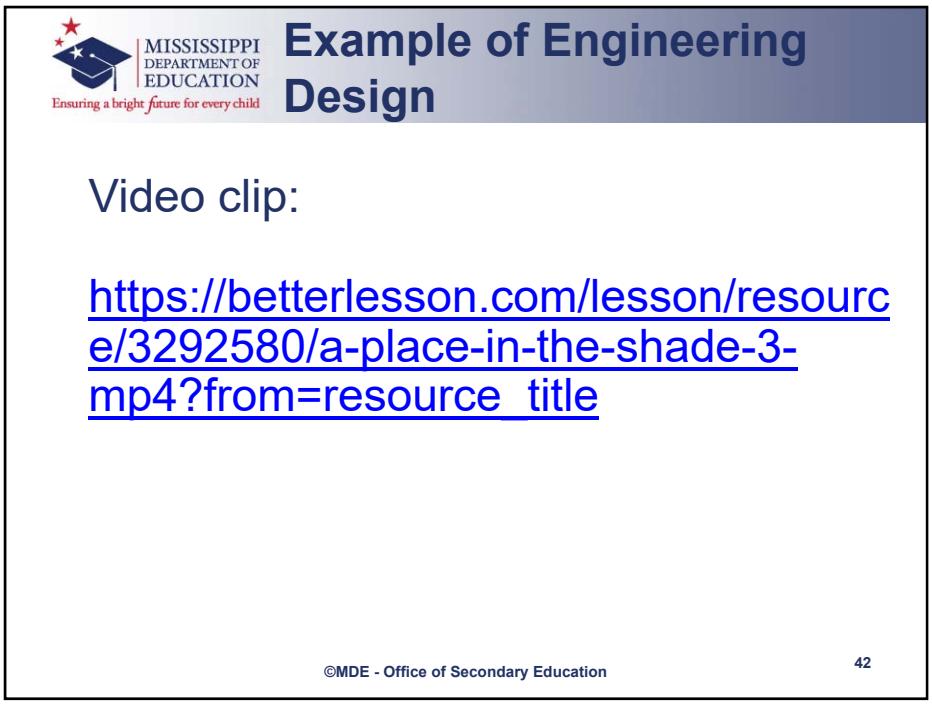
Teacher questions could include:

What things helped the structures protect the ice cube?

What things were probably missing from the structures that did not protect the ice cube as well?

Did the color of the paper make a difference? Why do you think that is?

Students could then plan improvements for the structure for future testing.



This video clip shows the Obtaining, Evaluating, and Communication Information SEP in this engineering design activity.

Physical Science Activities

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

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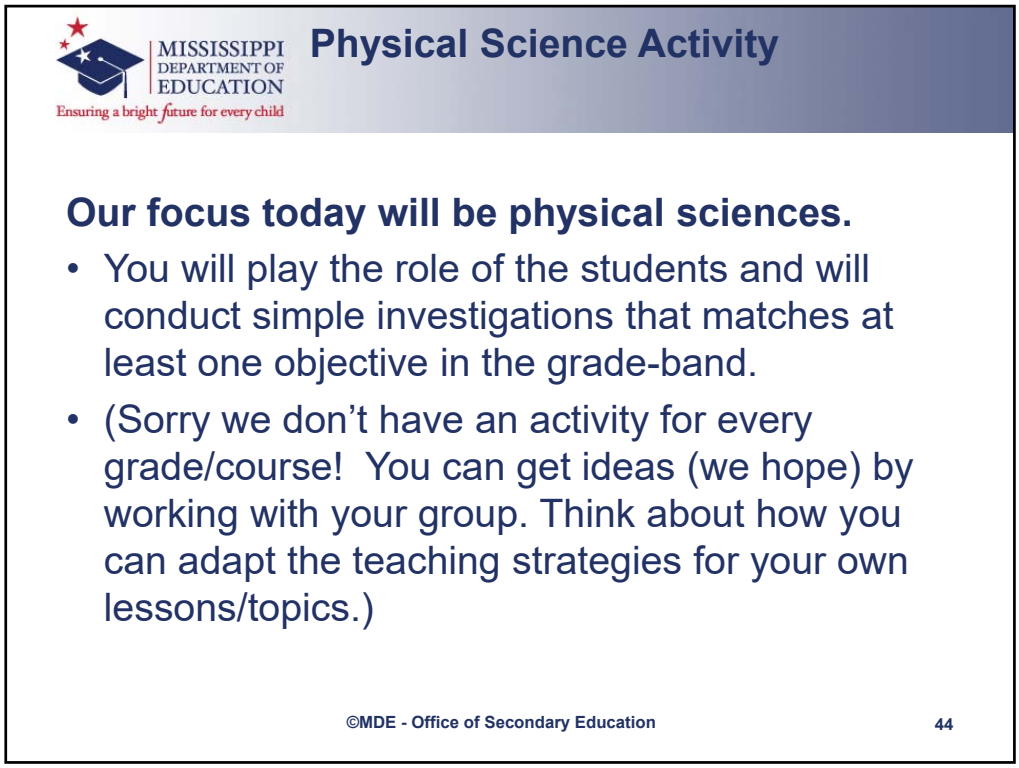
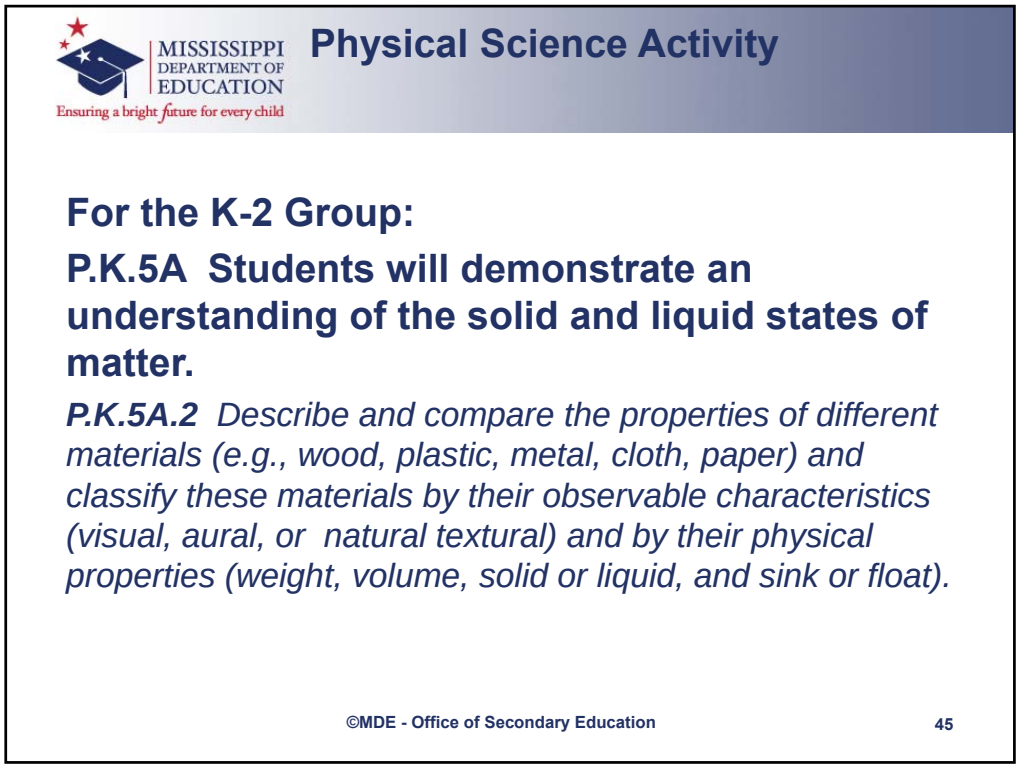


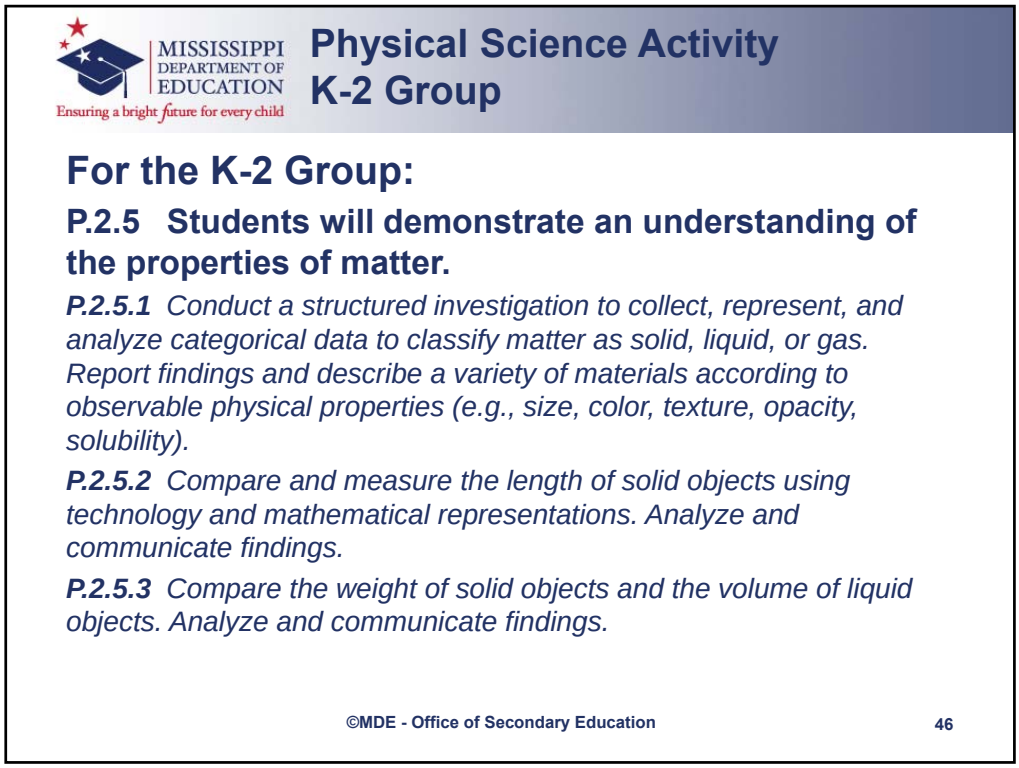
Reasons for the choice of physical science topics:

Physical science was an area that many teachers have said they need additional help.

Materials were easy to transport and use in this one room K-12 mobile workshop.



Standard and Objectives for K.



Additional Standard and Objectives for Grade 2.

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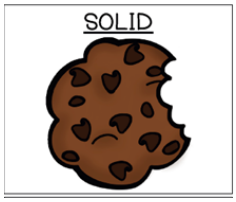
Physical Science Activity
K – 2 Group

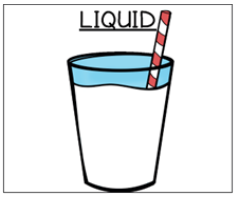
K-2 could start the lesson with something like:

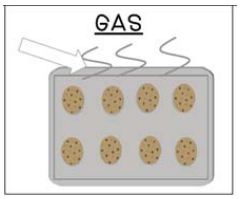
Look around the room and write down 5 items that take up space and have mass.

What is matter?

What are our three states of matter?







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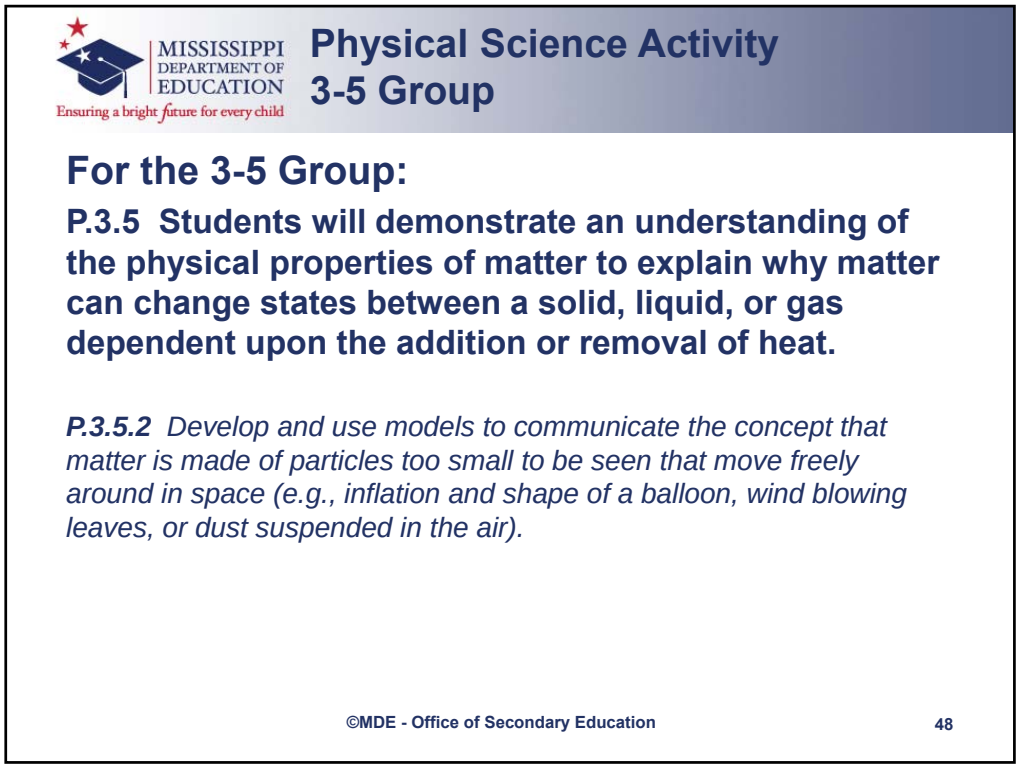
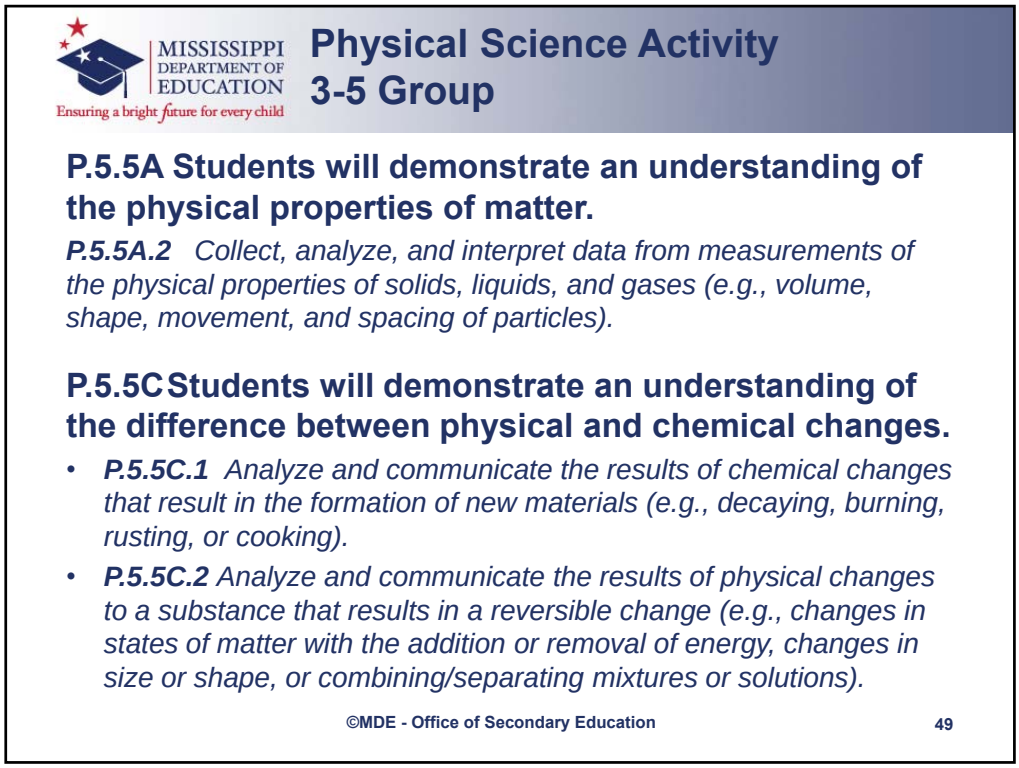
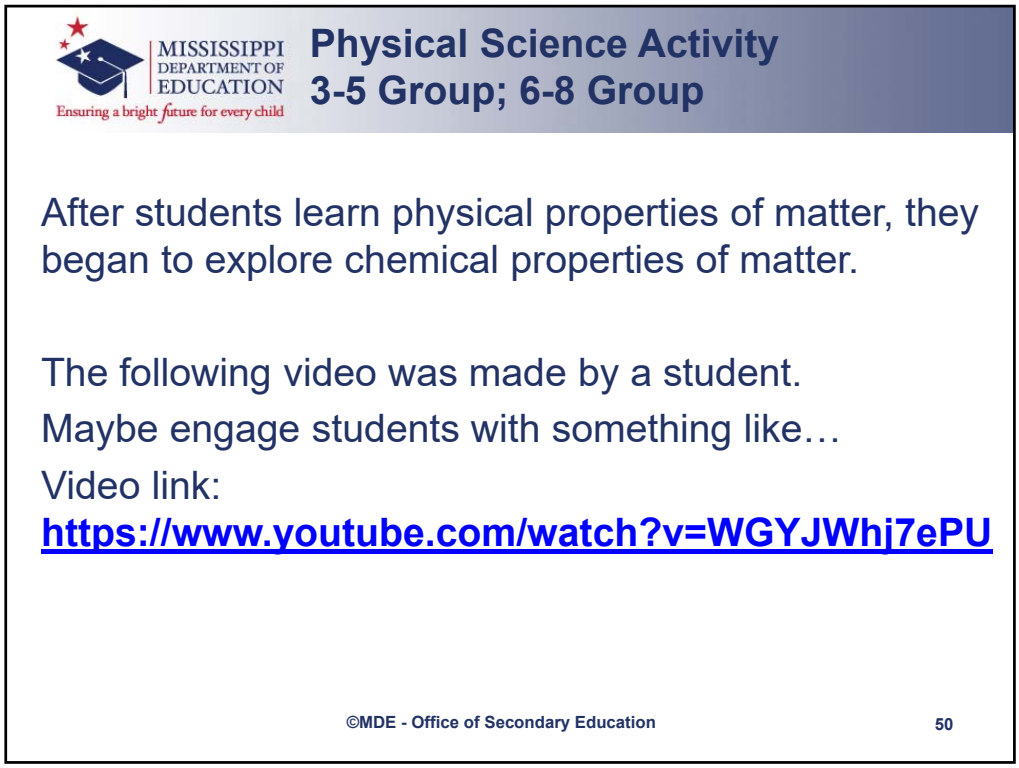
Discussion of how to introduce lessons



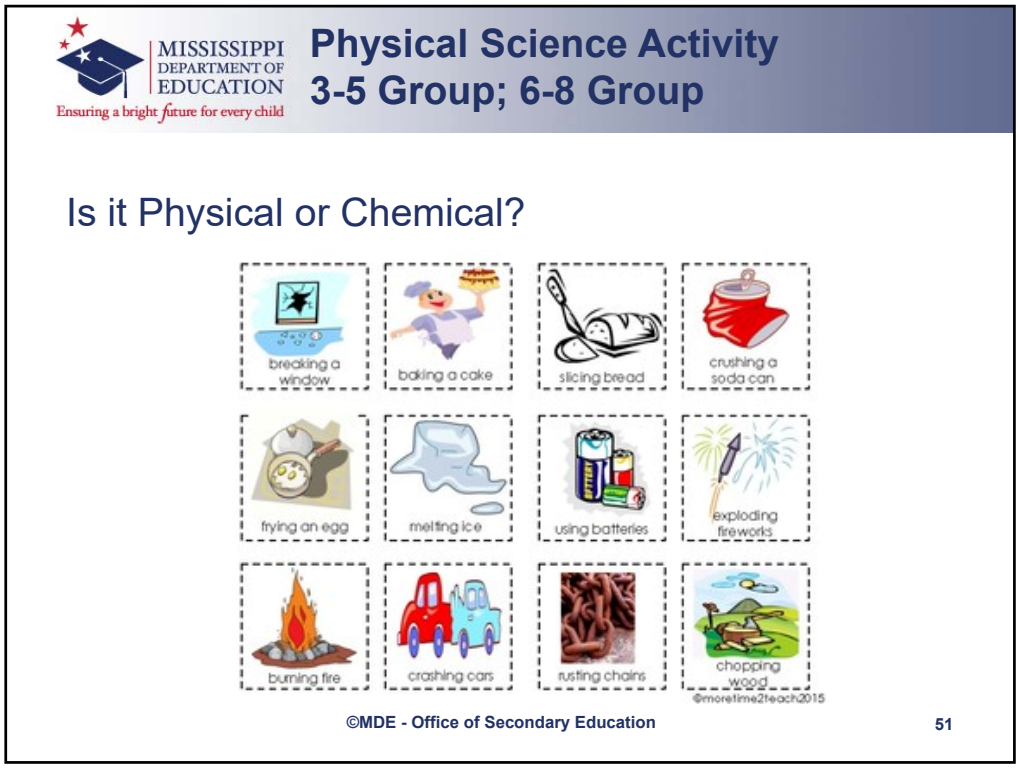
Standard and Objectives for Grade 3.



Standard and Objectives for Grade 5



Video to introduce topic of chemical and physical changes



Break a window – physical

Baking a cake – chemical

Slicing bread – physical

Crushing a soda can – physical

Frying an egg – chemical

Ice melting – physical

Using batteries – chemical

Fireworks – chemical

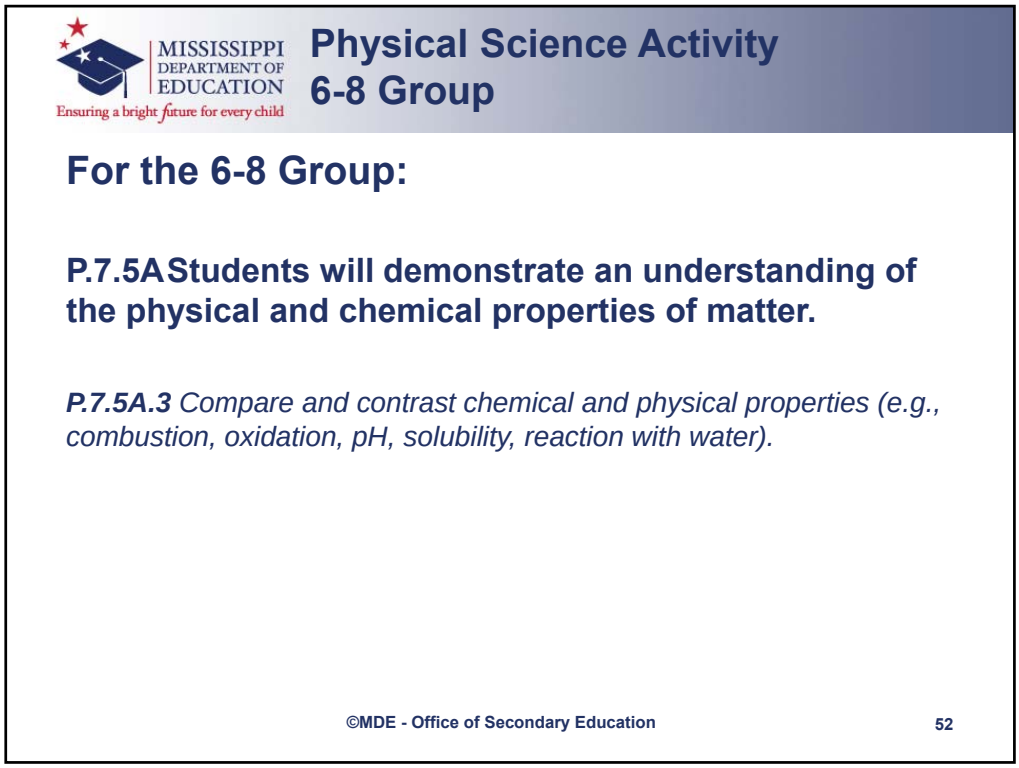
Fire – chemical

Car crash – physical

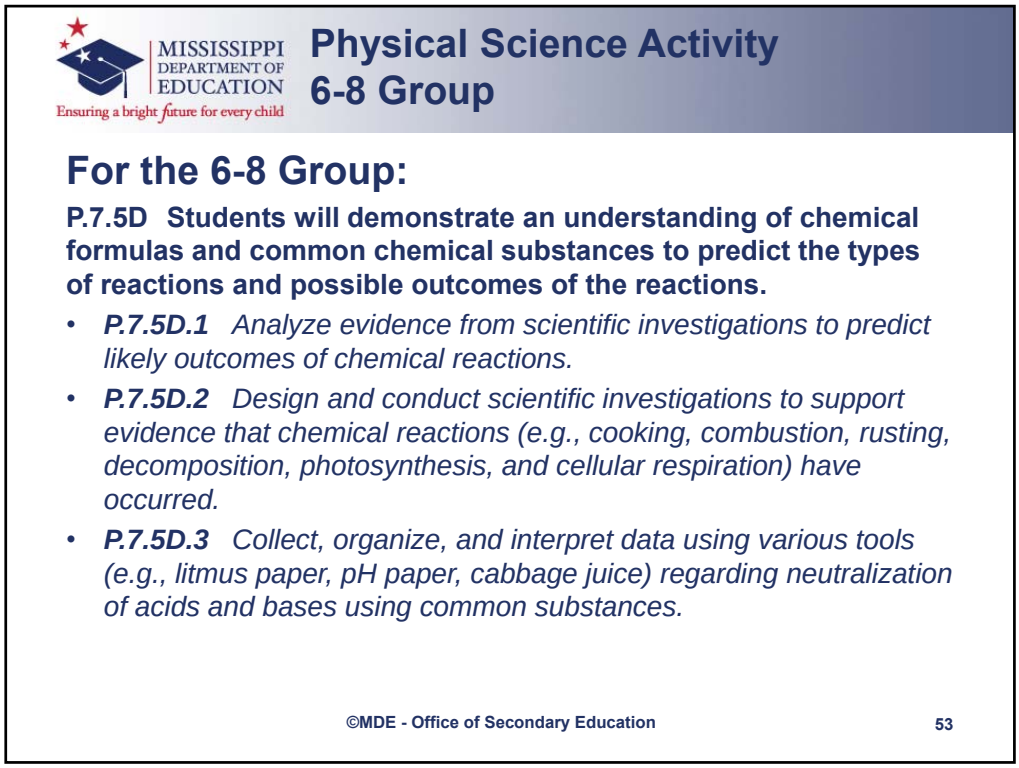
Rusting Chains - chemical

Chop wood - physical

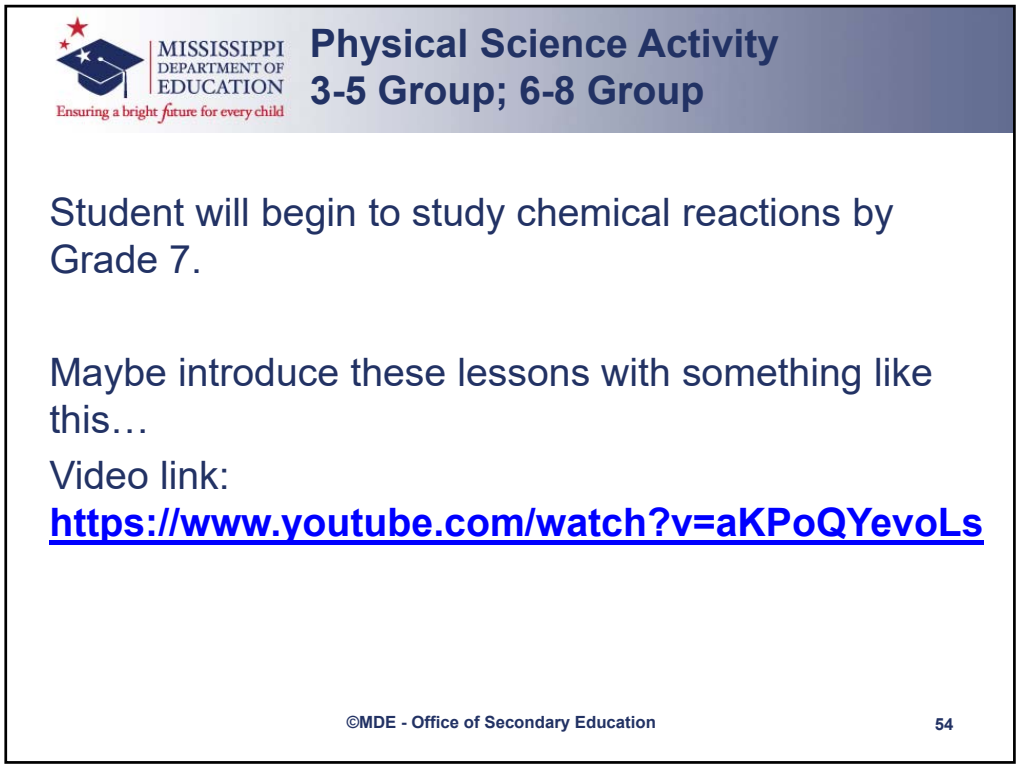
What is Making popcorn – physical (water inside corn kernel expands the starch inside)



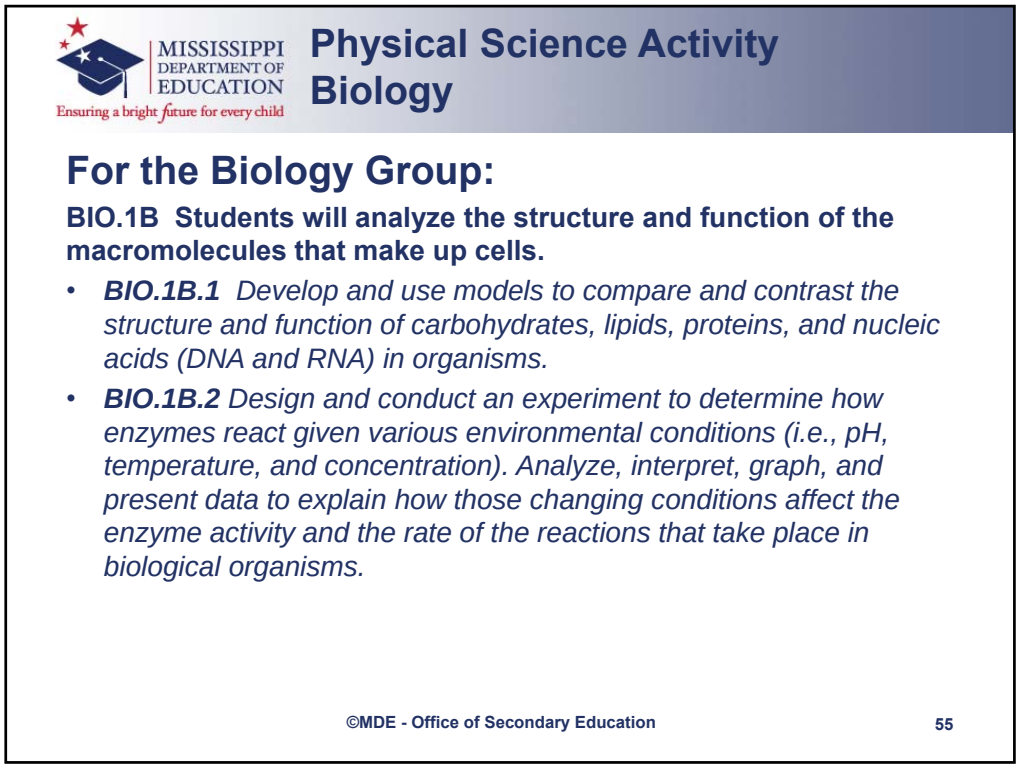
Standard and Objectives for Grade 7



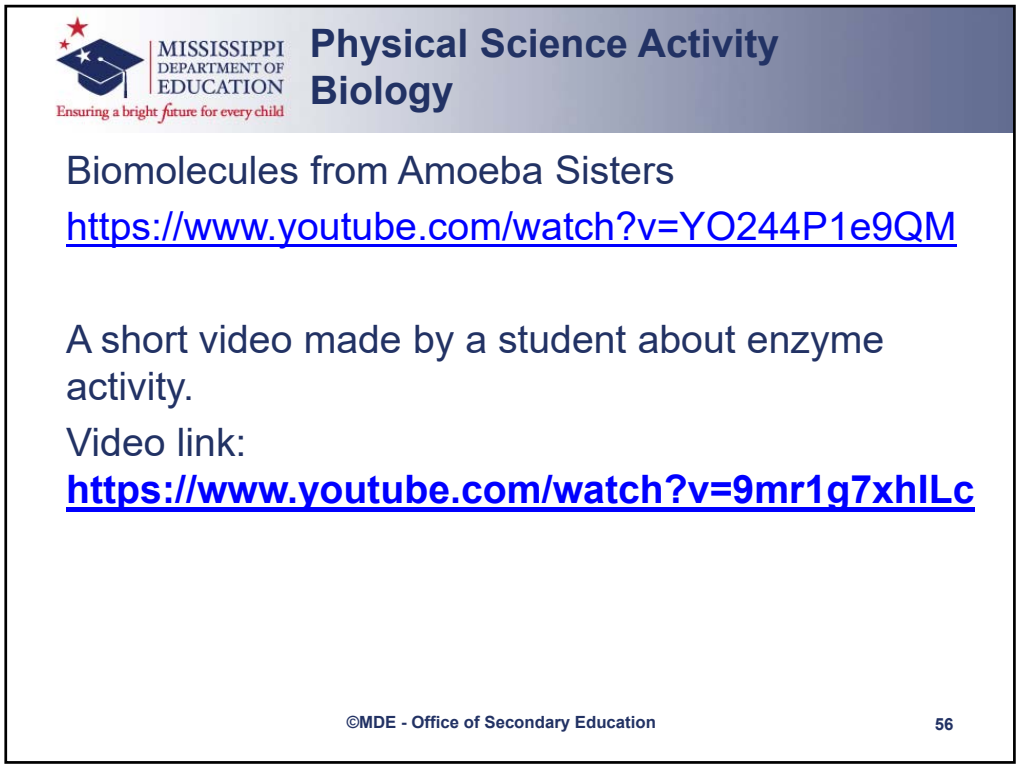
Standard and Objectives for Grade 7



The five indicators that a chemical change has occurred: gas production (bubbles), color change, temperature change, precipitate formation, or light production.



Standard and Objectives for Biology – these tie into chemical reactions and changes within the living organisms



Suggestions for engaging students prior to lesson

Physical Science Activities

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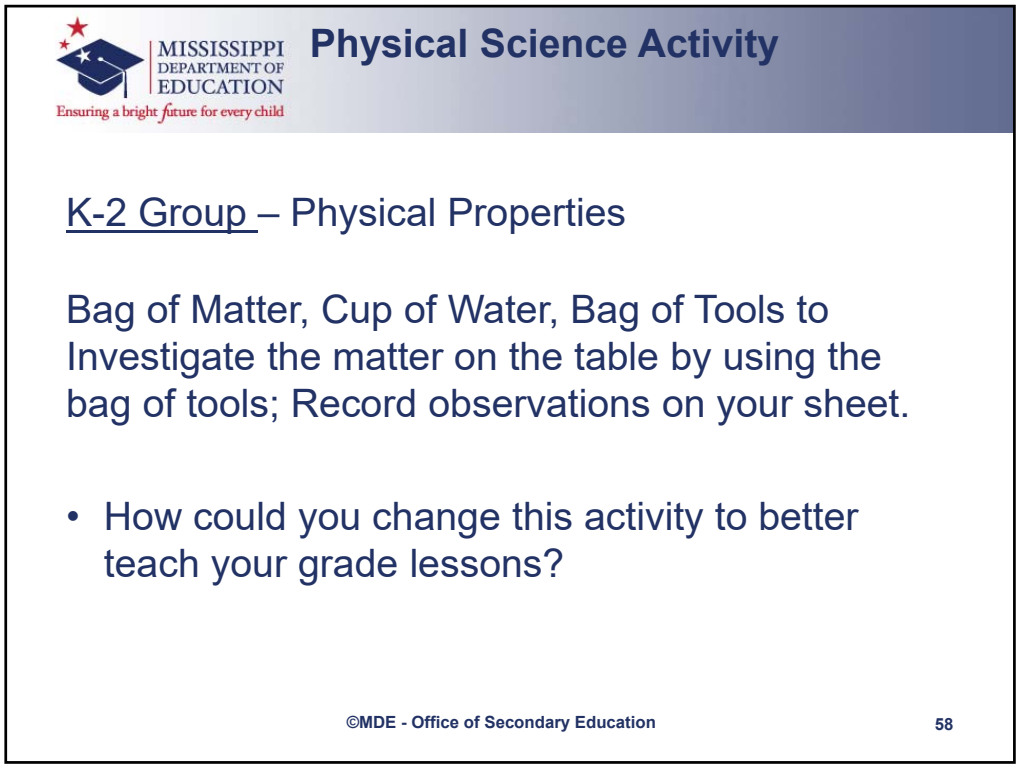


The K-2 group was given a bag of matter and a bag of tools. A cup of water was placed on the table in a clear cup.

The bag of matter contains buttons, dry noodles, marbles, wood craft stick, metal washers (screws), hair pins, rubber bands, small portion of sandpaper, soft fabric (fake fur), wooden block, cotton ball, small ball of playdough (in plastic clear bag as not to dry out), small bottle of bubbles (like at wedding section at dollar store); balloons. [Many other objects can be used if these are not available.] The tool bag contained graduated cylinder, ruler, and small clear containers.

The teachers were asked to explore the bag of matter and the water using the tool bag and to discuss how they could teach the objectives for their grade using these materials. All teachers, including the grade one teachers, were asked to explore other objectives to discuss strategies for using these techniques to teach students science concepts.

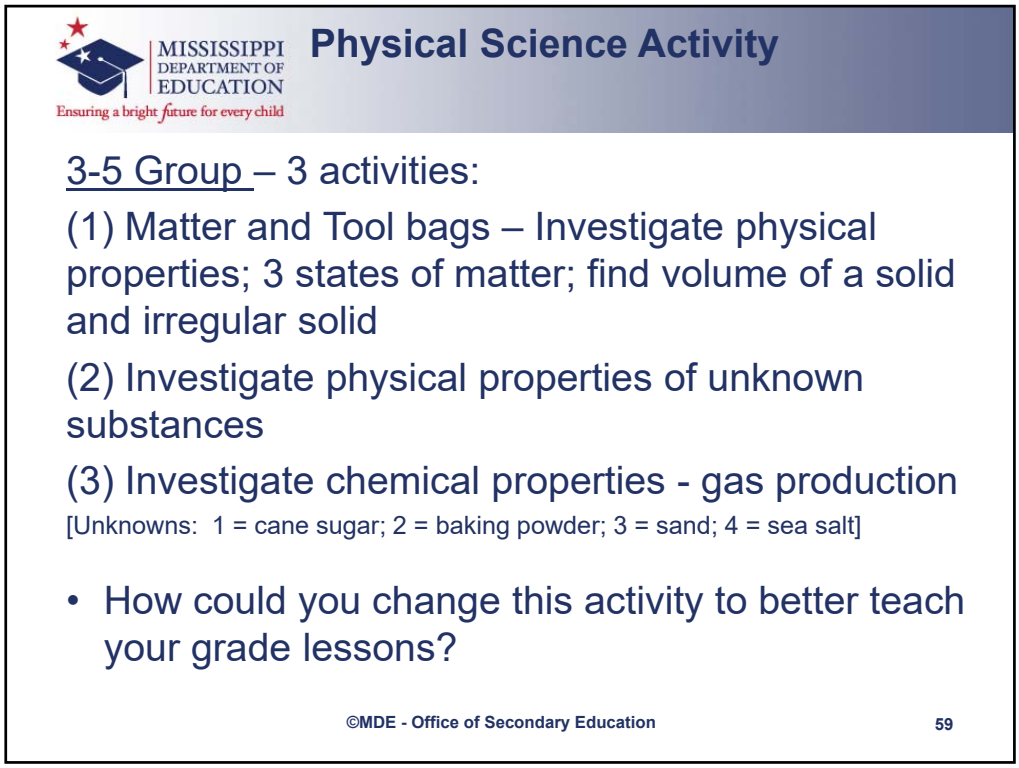
[Hint: the small clear containers were added to the tool bag so teachers could explore the concept that water takes the shape of the container. An appropriate ruler and graduated cylinder for K-2 is needed.]

References:

https://www.lernerbooks.com/SiteCollectionDocuments/TeachingGuides/9780822553489.pdf

http://rpsec.usca.edu/Workshops/SISSI/LessonPlans/PropertiesSolids_LessonPlan.pdf

http://www.mccracken.kyschools.us/Downloads/2%20NGSS%20UNIT%20Matter.pdf



Activity 1: The 3-5 group was given a bag of matter and a bag of tools. A cup of water was placed on the table in a clear cup.

The bag of matter contains a wooden block, cotton ball, rock, balloon, small bottle of bubbles (like at wedding section at dollar store); The tool bag contained graduated cylinder, ruler, small clear containers. The teachers were asked to explore the bag of matter and the water using the tool bag and to discuss how they could teach the objectives for their grade using these materials. All teachers, including the grade four teachers, were asked to explore other objectives to discuss strategies for using these techniques to teach students science concepts.

Activity 2: The 2nd bag contained four containers marked 1, 2, 3, 4, four tiny 1 oz. containers, toothpicks, and a 2nd bag with a white tablet and a small cup. **Part 1:** Teachers were asked to observe the solids inside the container using a magnifying glass or the photo app on their cell phone to see the structure of the solids. Teachers were asked to place a small amount of each substance inside the tiny cups, add water, and stir with toothpicks. Record observations. **Part 2**: Teachers were asked to take a ziplock© bag and place a small amount of water using your paper cup in the bag. Add the solid tablet and quickly remove air and seal the bag. Observe what happens and write a description. How is this different from Part 1? [Hint: part one shows dissolving -physical change- for 1, 2, and 4; part two is a chemical change]

References:

https://www.lernerbooks.com/SiteCollectionDocuments/TeachingGuides/9780822553489.pdf

http://rpsec.usca.edu/Workshops/SISSI/LessonPlans/PropertiesSolids_LessonPlan.pdf

www.inquiryinaction.org/pdf/InquiryinAction.pdf

http://www.chem4kids.com/files/matter_changes.html

https://www.alkaseltzer.com/science-experiments/

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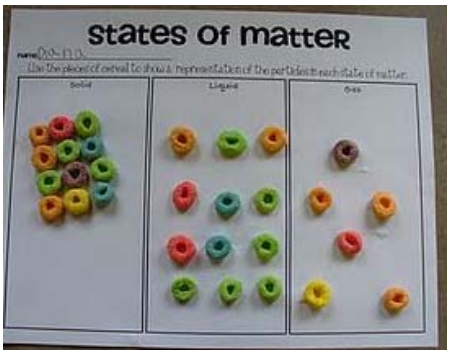
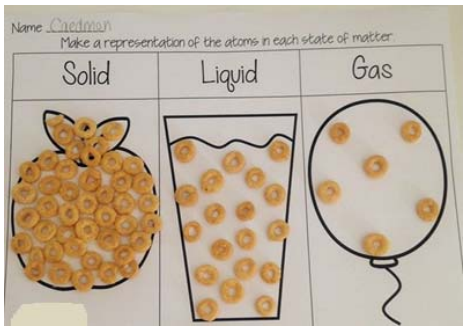
Physical Science Activity K-5

What SEP would this represent?





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A final activity would be to have the students make a model of the arrangement of particles in a solid, liquid, gas. Materials would be a glue stick and fruit loop cereal.

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Physical Science Activity K-5

Gases take up space and have mass!

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Even if you don't have a balance for this experiment, you can allow students to explore air and mass (weight).

Simply blow up a small balloon and tie to the end of a clothes hanger. Tie an identical balloon to the other end. Hold up the hanger and the end holding the inflated balloon will hang lower.

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Physical Science Activity K-5

Can you find three phases of matter?

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Ice – solid

Soft drink – liquid

Bubbles – filled with gas

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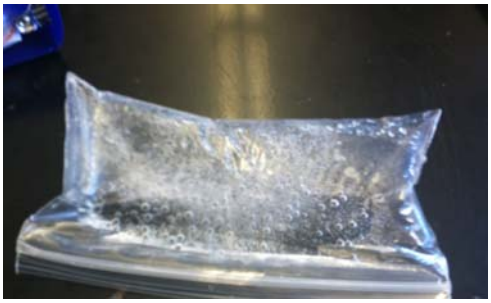
Physical Science Activity 3-5

Is this physical or chemical?



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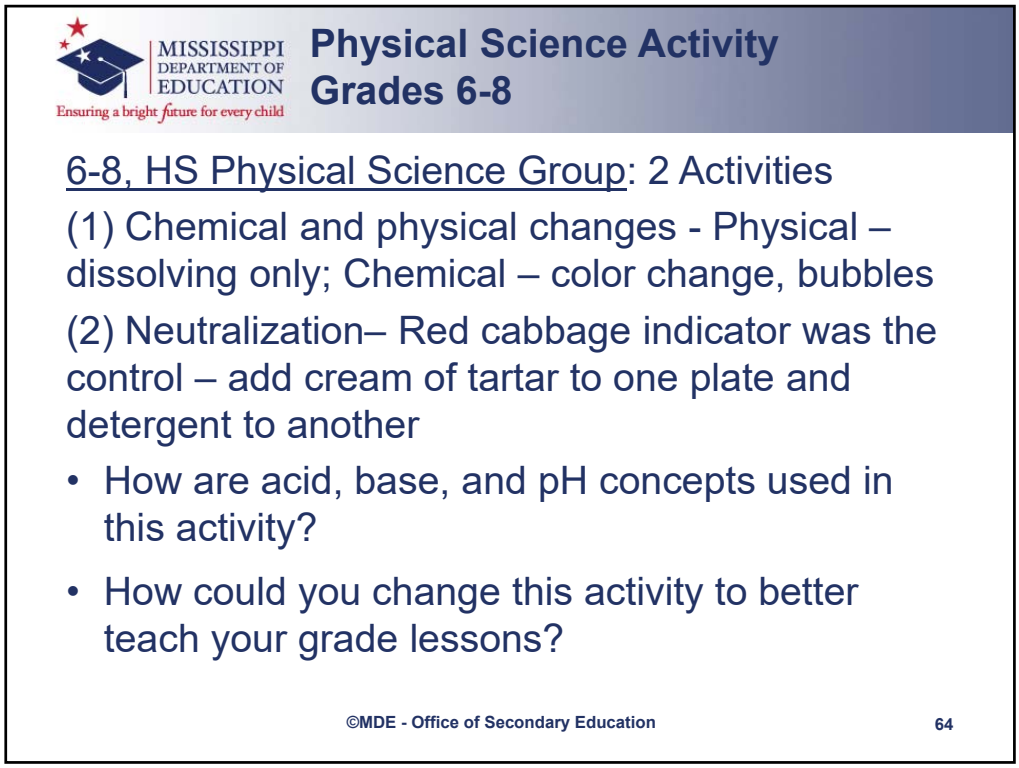
Chemical – unlike the dissolving for the unknown solutions in cups 1, 2, 3, 4 (except 3), this is a chemical change – note the gas release in the bag where you placed the small amount of water and the antacid tablet.



Activity 1: Take a cardstock grid showing solids across the top (baking powder, baking soda, detergent, cream of tartar, cornstarch) and along the side are the solutions (water, vinegar, iodine, indicator – red cabbage juice). Teachers will place a small amount of each powder on the grid and use pipets to put the solutions into the powders and stir with toothpick. Record results. Determine if physical or chemical change has occurred. An unknown will be placed on the last column of the grid and the teachers will use the solutions to determine the identity of the unknown powder.

Activity 2: Teachers have three shallow cups and will place two-three pipets of red cabbage juice. To one cup, add a tiny amount of detergent and stir with toothpick. Repeat until the solution changes color. To a 2nd cup, add a tiny amount of cream of tartar and stir with toothpick. Repeat until the solution changes color. Challenge: Make the detergent solution and the cream of tartar solution go back to the original color. Use the third small plate of only red cabbage juice as the control.

References:

http://www.inquiryinaction.org/classroomactivities/activity.php?id=22

http://funsci.com/fun3_en/acids/acids.htm#1

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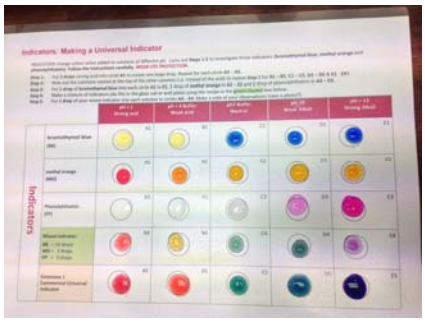
Physical Science Activity Group Reports

6-8 and High School Chemistry, Physics Group

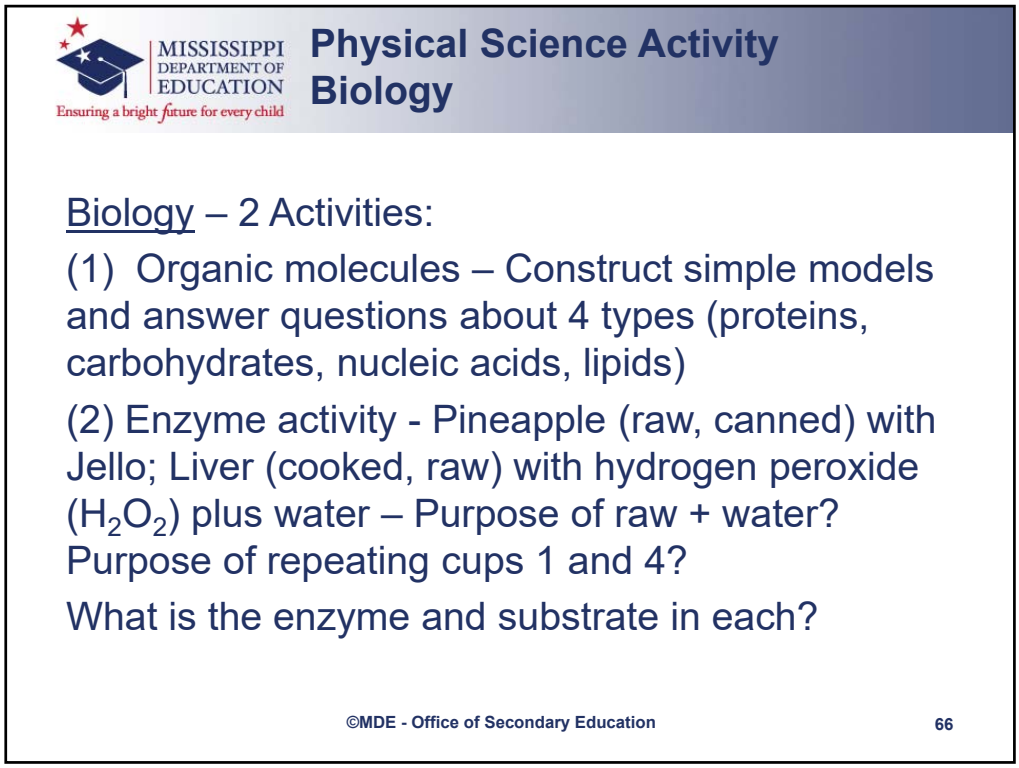


 65

What skills will students need? Tools would be for use of pipets; Students will also need to know characteristics of chemical changes.

How to conduct experiment?
What about safety?

Discuss each of these points by collecting responses and discussing with follow up questions as needed.



Activity 1: The teachers were given a large plastic bag containing 4 cardstock sheets with proteins, carbohydrates, lipids, nucleic acids printed. A smaller plastic bag contained cutouts of various organic molecule "pieces" (ribose sugar, amino acid, glucose, nitrogen base, fatty acid, phosphate group, glycerol). Teachers were asked to assemble a model of each organic molecule.

Activity 2: The teachers were given three 2 oz. cups of gelatin (red). They were given a tiny cup containing a canned pineapple piece and another cup containing a raw pineapple piece. Teachers placed the pineapple on the gelatin. The third cup was a control. For the second part, teachers placed three pipets of hydrogen peroxide into three small cups. A fourth cup had the same amount of water added. The temperature was taken for each cup and recorded. A tiny piece of raw liver was added to three cups (2 with hydrogen peroxide and one with water) and the temperature was taken. Observations were recorded. The cooked liver was placed in the final cup of hydrogen peroxide and the temperature taken. Observations were recorded.

Pineapple reference:

http://mdk12.msde.maryland.gov/instruction/curriculum/hsa/biology/enzyme_activity/teachers_guide_engagement2.html

http://practicalbio.blogspot.com/2012/01/in-two-beakers-of-gelatin-above-fresh.html

Enzyme reference:

https://www.biologycorner.com/worksheets/enzyme_lab.html

www.biologyjunction.com/Catalase Enzyme Lab revised.doc

http://spooksinmay.weebly.com/chicken-liver-enzyme-lab.html

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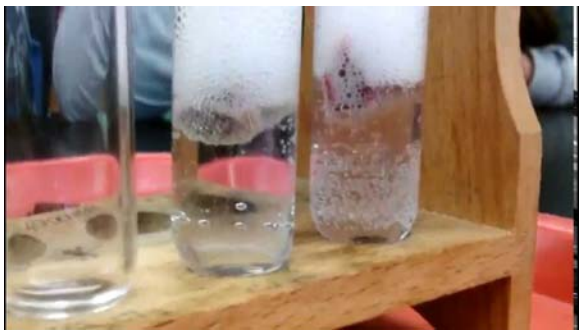
Physical Science Activity Group Reports

High School Biology Group



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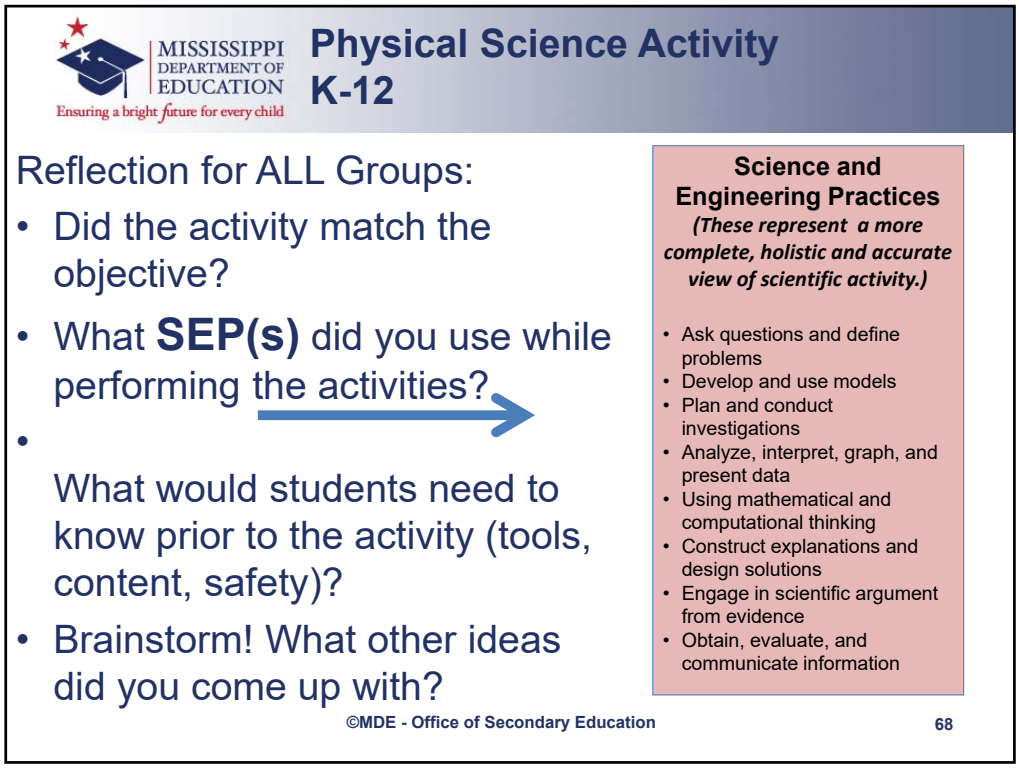
What skills will students need? Tools would be for use of pipets; Students will also need to know characteristics of chemical changes.

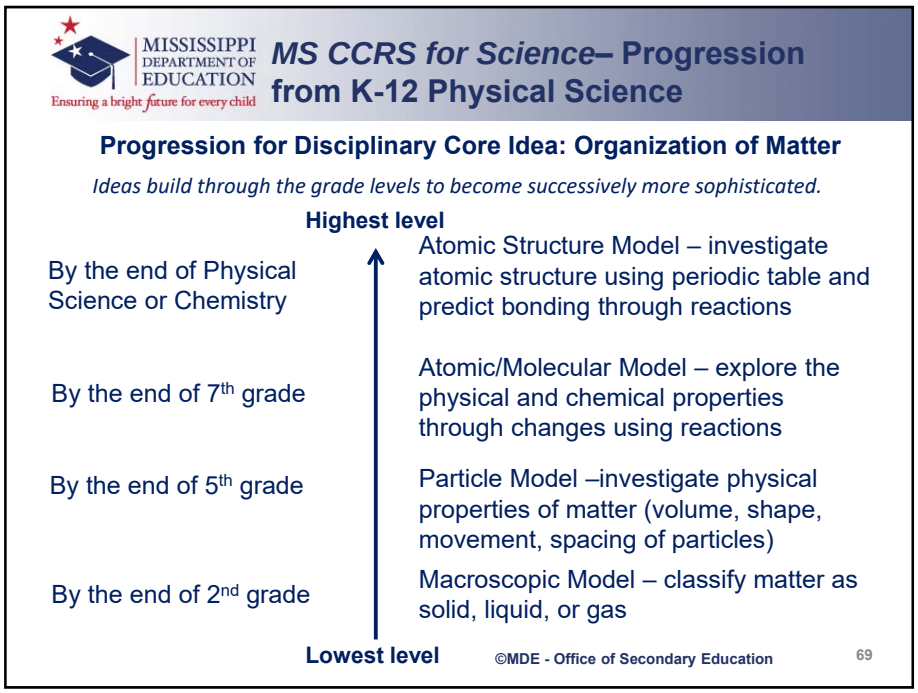
How to conduct experiment?
What about safety?

Discuss each of these points by collecting responses and discussing with follow up questions as needed. Diagrams show results of liver reactions and pineapple reactions.



Each group will use these reflection questions to evaluate the activity.

Group discussions will be conducted.



The new science standards are built around a spiral progression. We do not repeat the same exact content in every grade from K-8 but the content is enhanced in the appropriate grade band. This example shows the spiraled progression for a physical science disciplinary core idea: Organization of Matter.

2nd grade students will be able to classify matter;

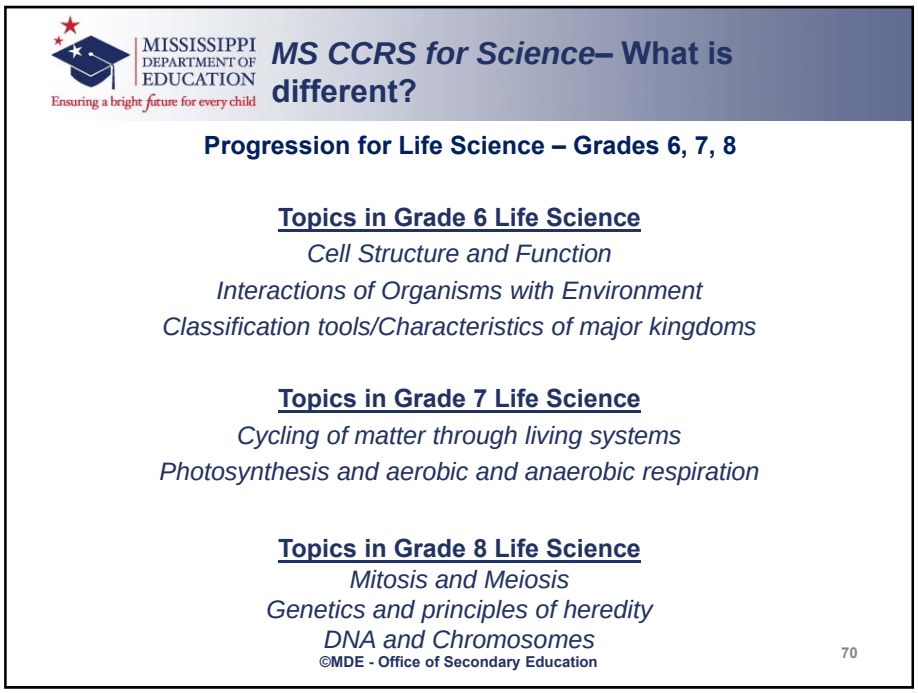
5th grade students will investigate unique properties of matter;

7th grade students will explore the physical and chemical properties through changes using reactions

Physical Science or Chemistry students will investigate the atomic structure using the periodic table and predict bonding through reactions

Biology teachers – what did the student have to know prior to your organic molecule lessons and enzyme activity? Answer: covalent bonding, pH, chemical reactions from grade 7;

You can see that this concept is not taught in every grade level but is taught at least once in each grade band. Did you see this TODAY in your experiments?



As mention in the previous slide, the new standards are arranged differently from the 2010 Science Framework. The 2010 document taught very similar concepts in Life, Earth and Physical sciences at each grade level in a straight progression. The 2018 MS CCRS for Science are spiraled in content design. Each grade does not teach a repeat of the same content with a "little extra added in."

Look at this slide for life science progression in grades 6-8

As you can see all of these topics are unique per grade – no content is repeated. The content in each grade provides necessary introductory material for the successful completion of biology at the high school level. If only Grade 8 life science standards were taught in grades 6, 7, and 8, would the students be fully prepared for Biology?

Ideas for Lesson Planning

K-12

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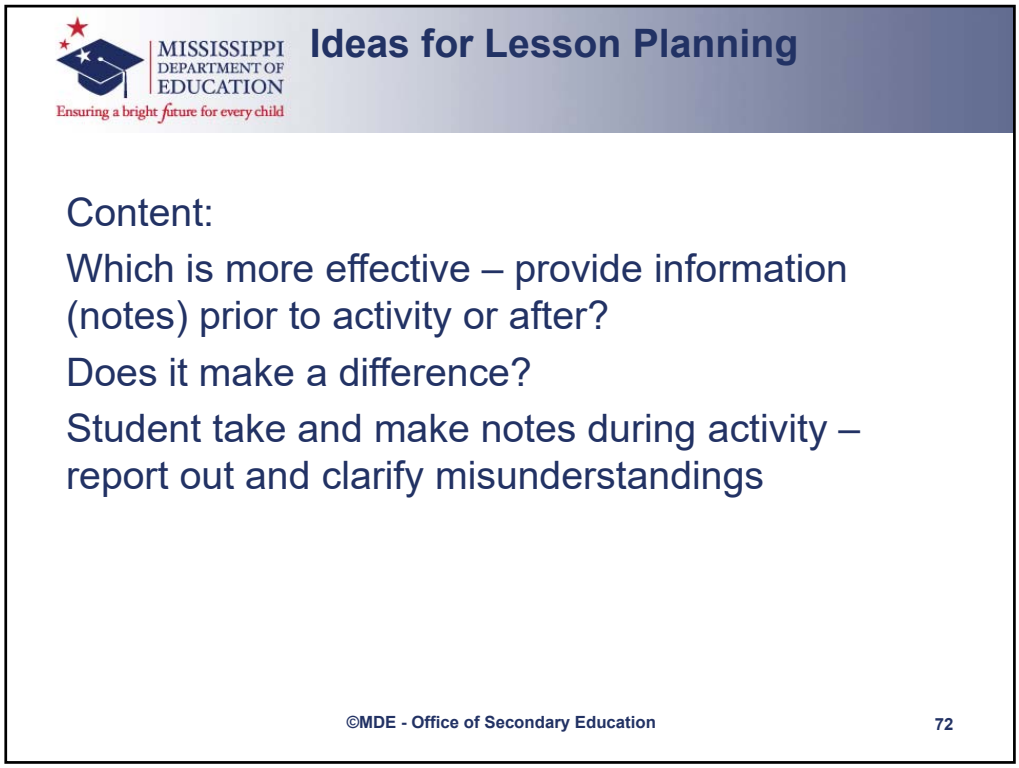
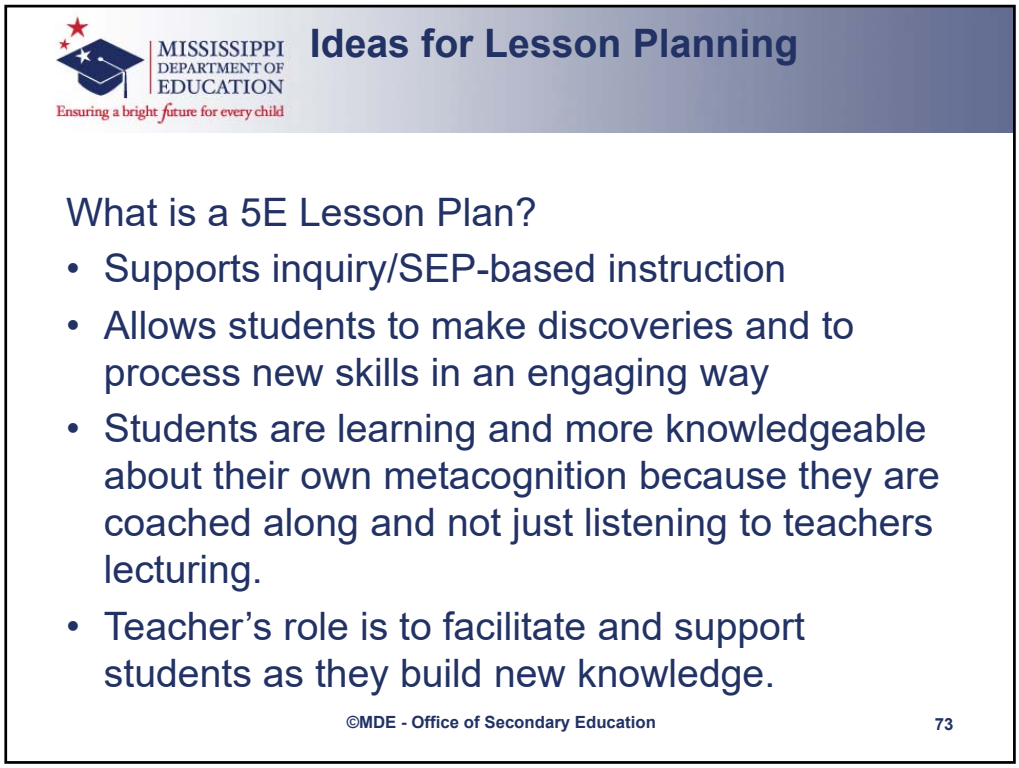


Think about what you are doing today? What if you were copying notes and completing a worksheet?



A video series for K-5 teachers using 5E from Primary Connections:

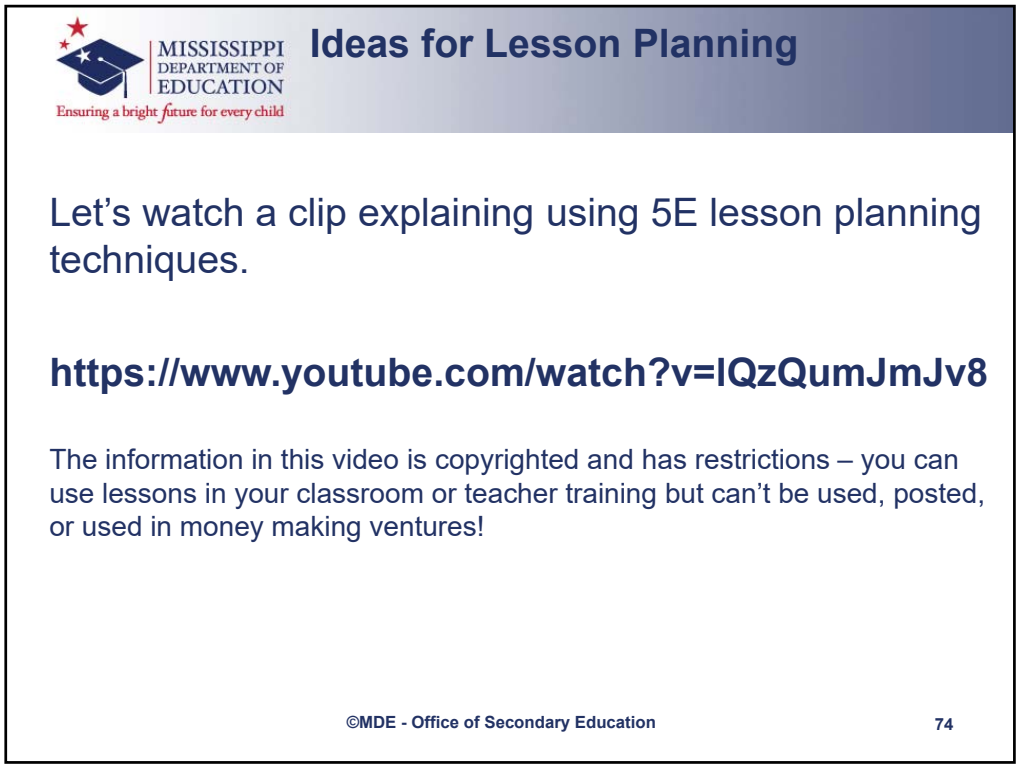
https://www.youtube.com/watch?v=OSo5R3sDXAc

https://www.youtube.com/watch?v=j-wkE7V-Vxw

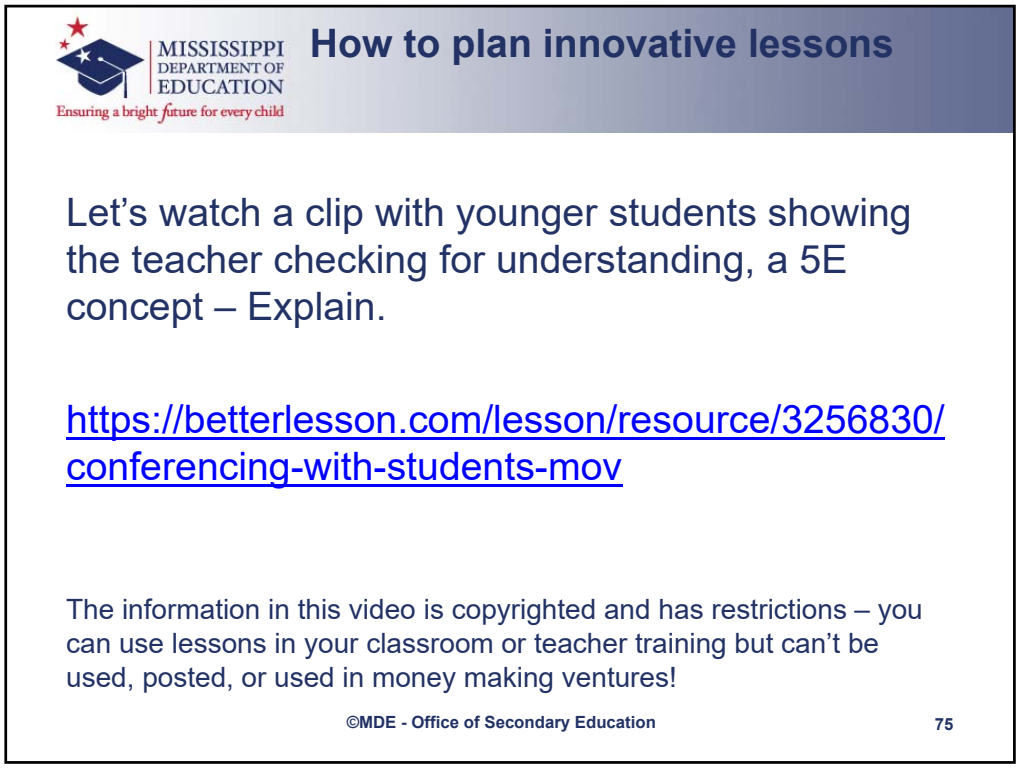
https://www.youtube.com/watch?v=aFM4GsyR-EE

https://www.youtube.com/watch?v=foNqMIFU5Ts

https://www.youtube.com/watch?v=qsLi1hs65OY



This video is designed for teachers of 6-12 students.

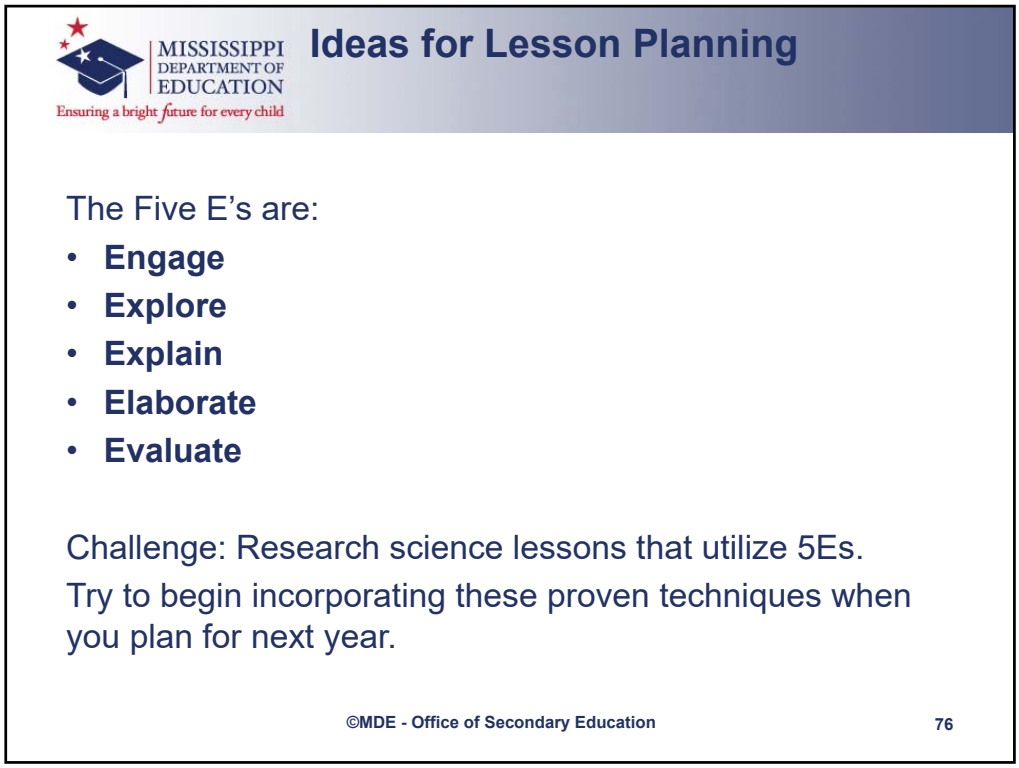


This is a more structured way of using 5E Explore and Evaluation for K-5 students.

Monitoring Student Understanding

Once students begin discussing and recording observations, conference with every group. Support students by asking guiding questions (listed below). Encourage students to engage in Science & Engineering Practice: Engaging in Argument from Evidence.

1. What have you noticed?
2. Why do you suppose ____?
3. What have you found so far?
4. Has your thinking changed?
5. What evidence do you have?
6. How did you decide _____?
7. What conclusion can you draw about ____?



See video links referenced for teachers in a previous slide.

Engage: To engage means to excite and to draw the student's curiosity

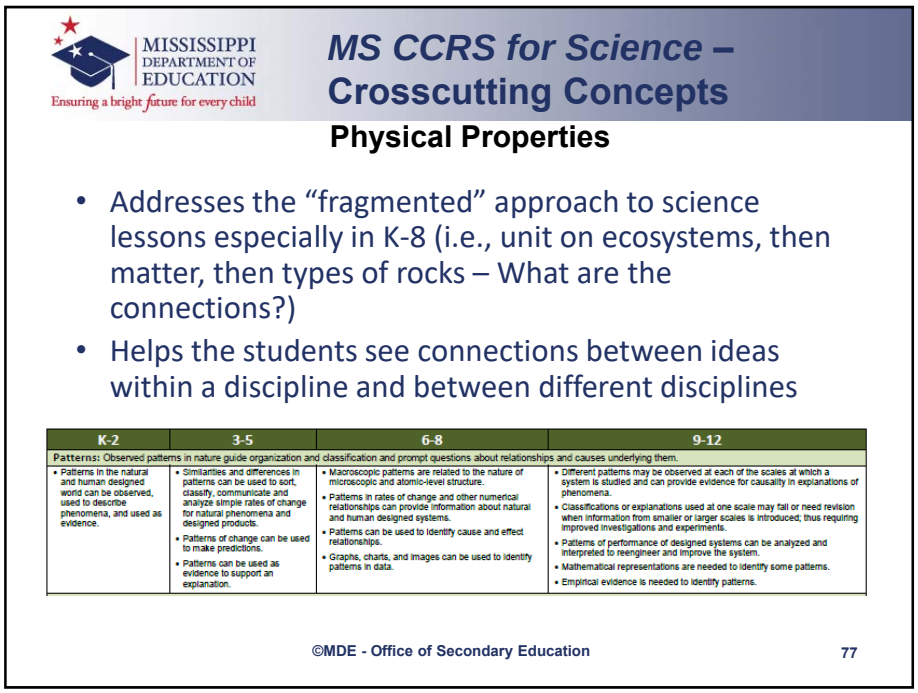
Explore: Students will explore by using manipulatives, watch a short video, conduct a short practice or work in groups to discuss a concept

Explain: Teachers use questions to explain concepts

Elaborate: Teachers can use what students have learned by extending or expanding the concept or allow students to explore more to test out a different idea; if students did not learn what was intended – this could be a reteach opportunity

Evaluate: reflection, writing activity, presentation, video, model (mini book with drawing); rubric can be used to grade – it could be the dreaded test -----

Many veteran teachers find the 5E lesson plan just more to do. I think that it makes teaching the lesson easier in that the students are more willing to learn, the activities are set up, the lesson sequence is well thought out and the objective is thoroughly explored.

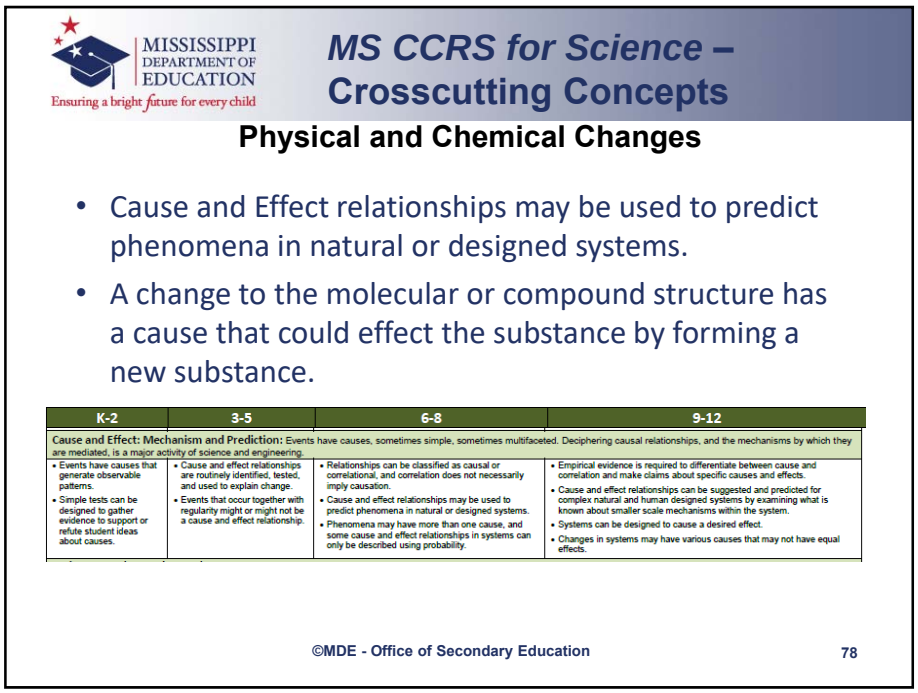


Classifying matter using physical properties ties into the crosscutting concept of **Patterns**.

Patterns can be found in all three sciences. They are often related and have similar trends.

Types of Patterns • **Classification** • Distributions • Relationships among variables • Changes and rates of change;

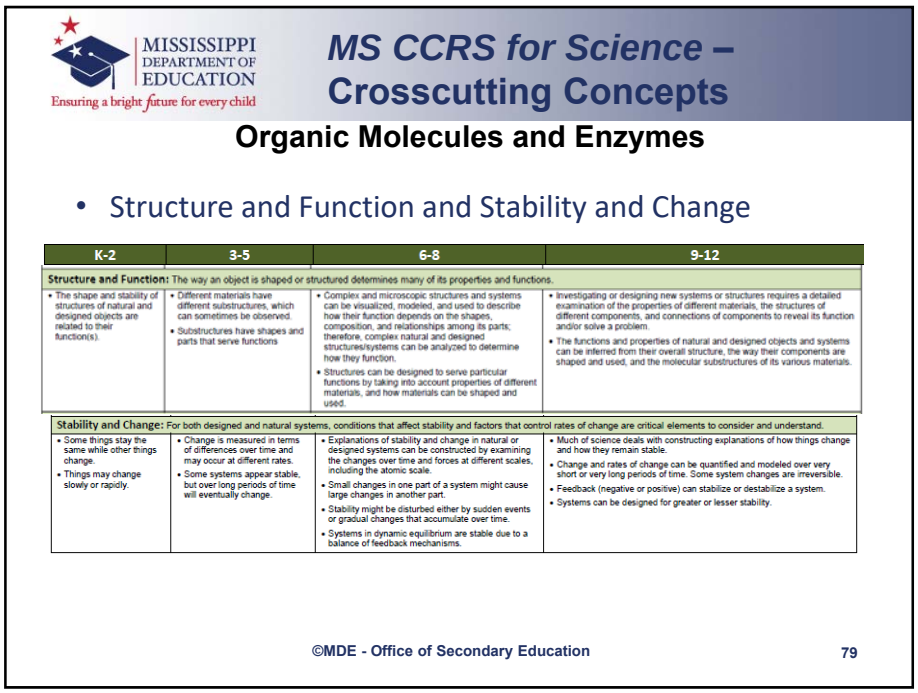
Students can classify organisms (life science); matter (physical sciences), types of rocks or seasonal weather (earth science).



Studying physical and chemical changes shows **Cause and Effect**. A change to the molecular or compound structure has a cause that could effect the substance by forming a new substance.

Changes to the structure may result in a new substance with matter being conserved.

Cause and effect relationships may be used to predict phenomena in natural or designed systems.



For the Biology Activities showing Organic Molecules including Enzymes: What are the crosscutting concepts?

This example shows **Structure and Function**.

The functions and properties of natural and designed objects and systems can be inferred from the chemical structure, the way their components are shaped and used, and the molecular substructures of its various materials

Organic Molecules and Enzymes both have structures that determine the function of the molecules.

Another crosscutting concept is **Stability and Change**: For a natural system like enzyme activity, conditions that affect stability and factors that control rates of change are critical elements to consider and understand.

Small changes can have a huge impact. If enzymes cannot digest food, then larger problems can occur to the organism.

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Physical Science Activity

Name: _____

Why Does Matter Matter?

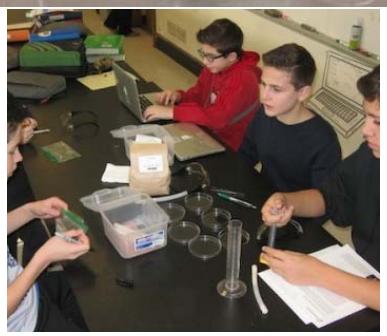
by Kelly Hashway

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



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What is the best way to learn about matter?

Method on left or method on right?

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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 have'nt 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

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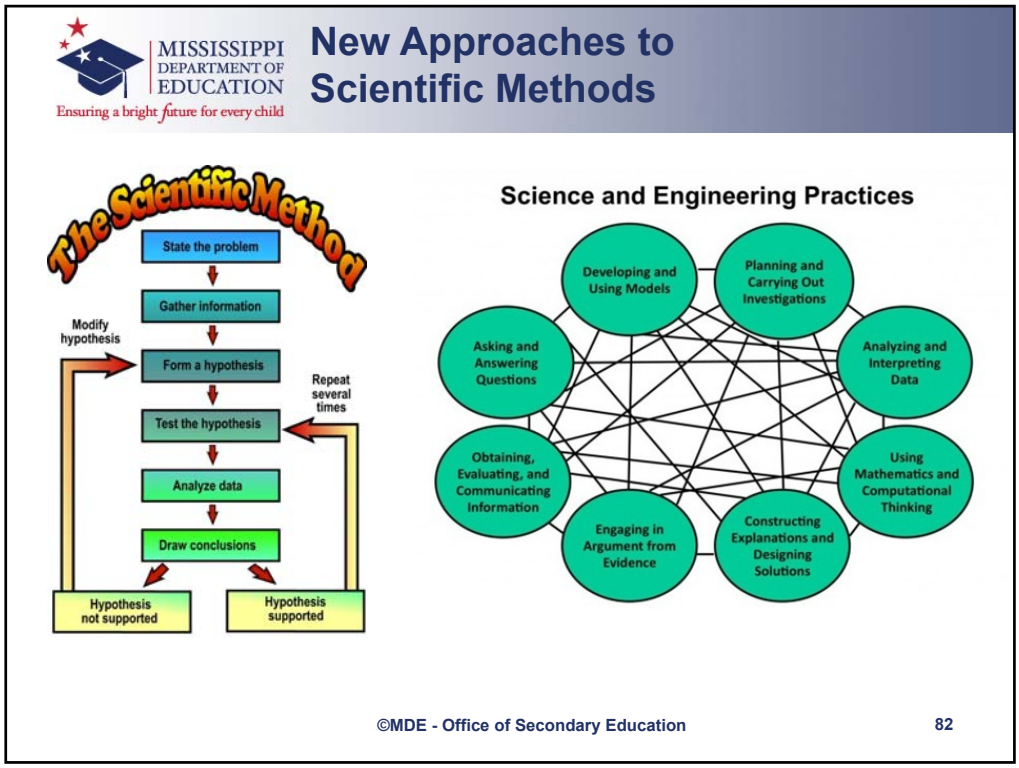
What is the best way to learn about physical and chemical properties?

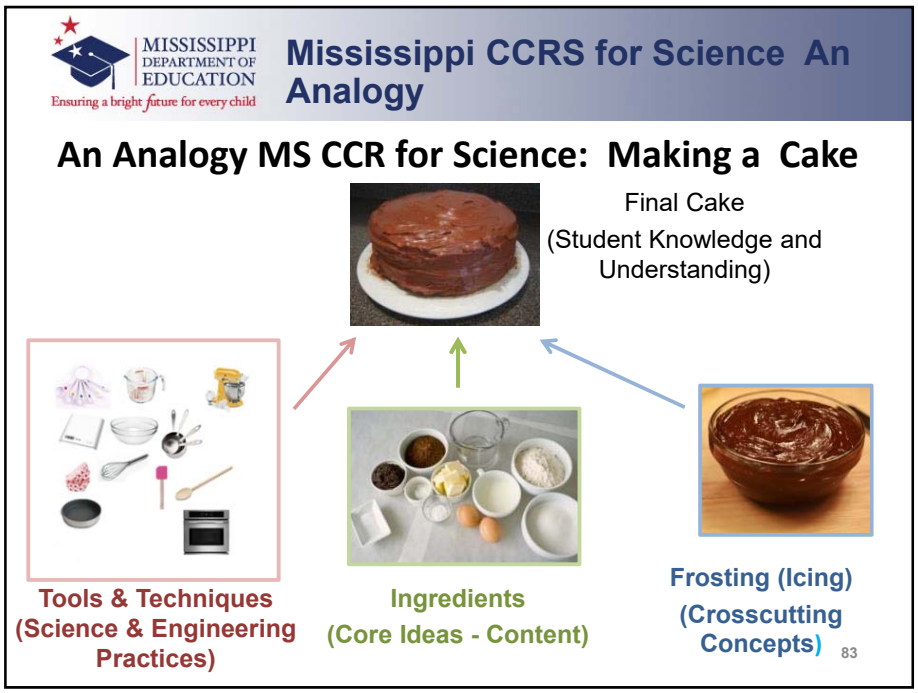
Method on left or method on right?



Many teachers introduced science by showing students the scientific method, the step-by-step method to "doing science".

It's time to change how we teach students to be scientists.

It turns out, that the scientific method as we have known it, no longer exists. Actually, it really never existed! Real scientists and engineers do not follow a linear approach. They use multiple methods. Should we feel bad that we used the linear scientific method with students? No. However, we are now armed with new knowledge and we understand that there is a new and better way of doing things – SEPs.



Let's tie the 3 Major Dimensions of our new standards by using a simple analogy. Let's think about making a cake.

Can you make a cake with just ingredients? Can you make a cake without ingredients?

Cake ingredients are our science content knowledge.

SEPs are the tools and techniques to use to study science just as mixing, measuring and baking tools are needed to put the cake ingredients together for baking;

Crosscutting concepts are needed to make the final connection to the unity of the sciences. Icing helps unite the layers of the cake together and makes the cake taste better!

Remember, we can memorize a recipe without actually making it just like we can memorize science facts without using anything other than a textbook. If we take the science content ingredients and go through the SEP practices of making the cake, we will gain and enhance skills and techniques that we can apply in many situations. The crosscutting concept icing makes the cake even better and adds to our student's knowledge of how science works in the world.

Work in Grade Bands

Planning by Using the Crosswalks

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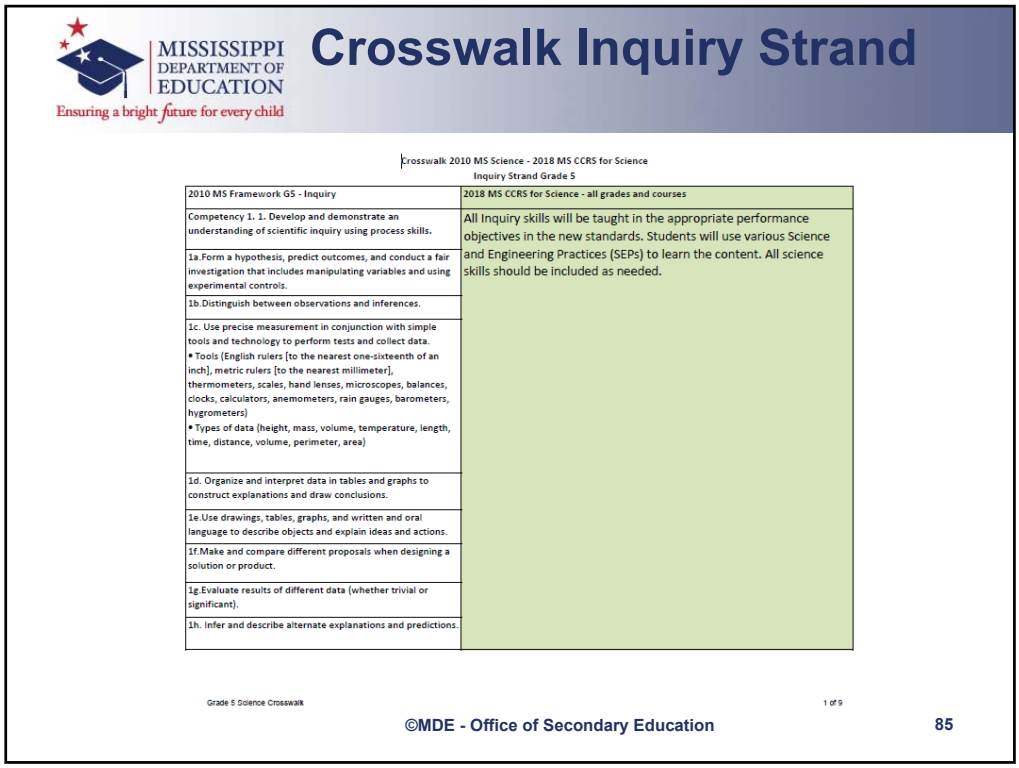
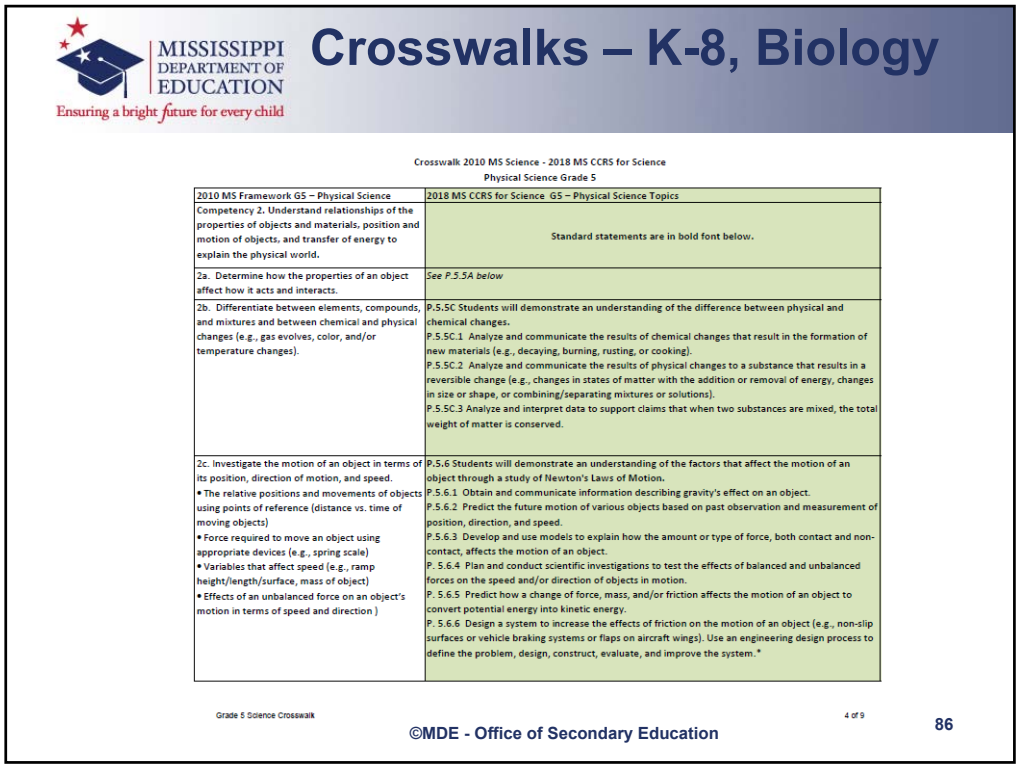


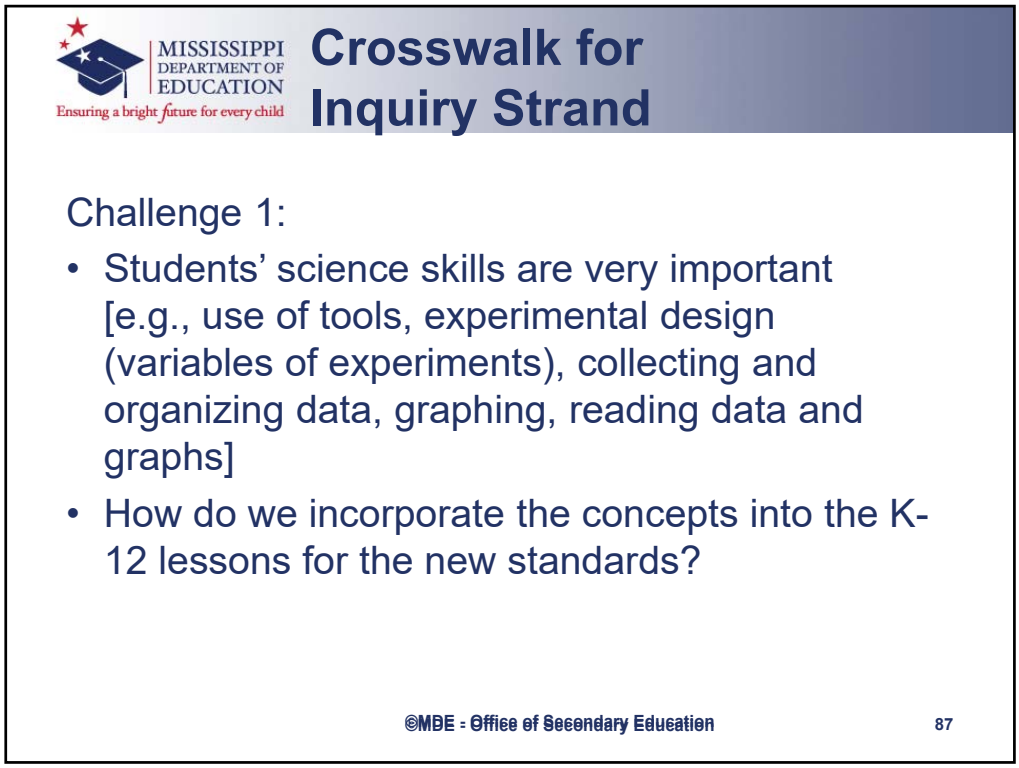
A challenge will be to put the necessary inquiry skills including safety into the new standards. How would this be done?

Did the students really remember the proper use of equipment and the techniques when this was taught at the beginning of school? How effective was teaching the Inquiry strand as stand-alone material and often not incorporating the concepts into the actual teaching of the Life, Earth, and Physical strands?

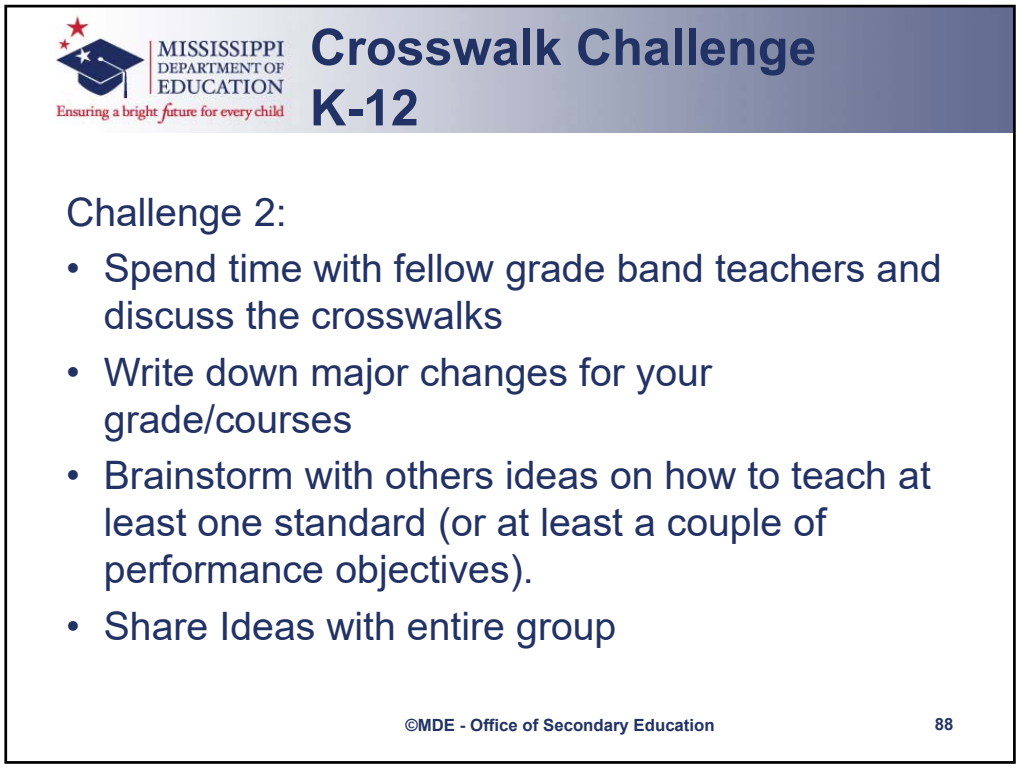


Crosswalks are now available for K-8, Biology. Physical Science, Chemistry, and Physics will be developed this fall.

All resources will be linked to the new standards on the MDE science homepage.



Let participants discuss these at table.



Let participants discuss these at table. Each group will use chart paper and place on a gallery walk. Presentations will be the exit ticket for the workshop.

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