

*Challenging Science Activities:
A Resource and Curriculum Guide to
Alabama Course of Study
Science*

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Appendix A Student Pages	CD-ROM
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Introduction

Challenging Science Activities: A Resource and Curriculum Guide Aligned to the Alabama Course of Study is a companion document to the *Grades K-12 Alabama Course of Study: Science* (Bulletin 2005, No. 20). The *Alabama Course of Study: Science* was developed by members of the Science State Course of Study Committee and Task Force and was adopted by the Alabama State Board of Education in February 2005. Content standards contained within the course of study document may be accessed on the Alabama Department of Education Web site at www.alsde.edu. On the home page, select Sections, and then Classroom Improvement. Click on Publications, scroll down to Courses of Study, and click on Science.

Educators are reminded that content standards indicate minimum content—what all students should know and be able to do by the end of each grade level or course. Local school systems may have additional instructional or achievement expectations and may provide instructional guidelines that address content sequence, review, remediation, and challenge.

Challenging Science Activities: A Resource and Curriculum Guide Aligned to the Alabama Course of Study provides alternate lessons for students, including those with Individual Education Plans (IEPs), who have demonstrated mastery of grade-level content, providing assignments and activities that address the mastered objective with added depth, complexity, and creativity. Student choice is often incorporated into these assignments, allowing those who learn differently to approach required content according to diverse learning styles. This allows students who are capable of working above grade level to engage in rigorous course work while addressing the required course of study standards. By pre-assessing to identify strengths, teachers may plan appropriate response to instruction (RTI) for high functioning students, while still working with all students toward achievement of the same standards. Educators are encouraged to use this document to:

- Assist in tiered lesson planning as a Response to Instruction (RtI),
- Plan for RtI Problem Solving Team meetings,
- Deliver consultative and collaborative services,
- Design professional development programs,
- Provide parent information and plan for parent conferences,
- Develop curriculum-based assessments, and
- Prepare for state assessments.

Teachers can access this document electronically by going to the Alabama State Personnel Development Grant Web site at <http://www.alspdg.org>, or the Alabama Math, Science, and Technology Initiative (AMSTI) Web site at <http://www.amsti.org/>. To locate the document on The Alabama State Department of Education Web site at www.alsde.edu, click on Sections, Special Education, and then Gifted. Scroll down to *Challenging Science Activities: A Resource and Curriculum Guide Aligned to the Alabama Course of Study*. Student pages can be downloaded and saved for interactive use on the computer or printed for paper and pencil application.

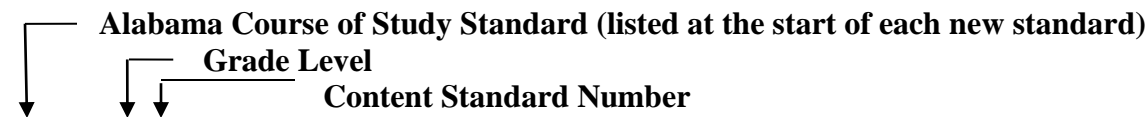
Organization of the Curriculum Guide

The organizational components of this guide include science content standards, advanced standards for those who have mastered the grade-level standards, and “going forward” standards. Also included are suggested lesson plans for each advanced standard; including vocabulary, literature and Web site resources, student pages, and suggested rubrics and graphic organizers for use with some activities.

Grade level or course is displayed at the top, right side of each page. Below is an example of the information displayed within the body of the document for Grades K-8 and directions for interpretation.

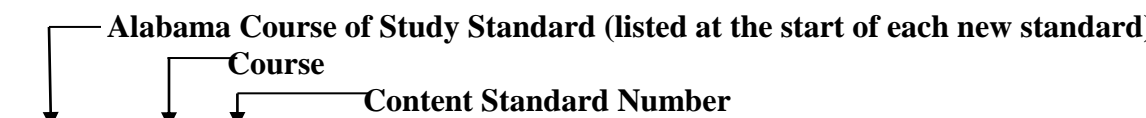
Instructional Objectives: Each new Alabama Course of Study Standard (ALCOSS) is denoted by a double bordered table. Grade level (Grades K-8) or Course (Grades 9-12) is listed next to the term, ALCOSS, followed by the standard number. Column 1 in the second row of the table, entitled, Mastered, lists the standard that students are expected to have mastered before attempting the alternate activities. Column 2, entitled Present, repeats the same standard with added depth/complexity. This is the standard for students who have demonstrated mastery are to address. Column 3, entitled Going Forward, adds further challenge and is an optional extension for students who have mastered the standard in Column 2 (Present).

Example: Standards in Grades K-8 are identified by grade level.



ALCOSS: 4.1		
Describe how electrical circuits can be used to produce light, heat, sound, and magnetic fields.		
Mastered: Students can describe how electrical circuits can be used to produce light, heat, sound, and magnetic fields.	Present: Students will further develop their understanding of electricity, energy conservation and how it relates to their daily lives.	Going Forward: Students will develop an energy conservation plan for a city, county and/or state.
What students already know and can do ↑	Standard with added depth/complexity ↑	Optional extension ↑

Example: Standards in Grades 9-12, are identified by course name rather than grade level.



ALCOSS: Biology 1		
Select appropriate laboratory glassware, balances, time measuring equipment, and optical instruments to conduct an experiment.		
Mastered: Students will select appropriate laboratory glassware, balances, time measuring equipment, and optical instruments to conduct an experiment.	Present: Students will demonstrate and expand the concept of scientific processes using their imagination and understanding.	Going Forward: Students will modify their experiment to conduct it as a science fair project.
What students already know and can do ↑	Standard with added depth/complexity ↑	Optional extension ↑

Each standard component contains the following elements: Career connections, Present and Going Forward Vocabulary, one or more Alternate Activities aligned to the standard, and Literature/Resources Connections.

Career Connections: Careers listed in the boxes are aligned to each standard. We encourage teachers to emphasize these or other connected careers both to spark student interest in further investigation and to assist students in making real-world connections.



Career Connections:
Biologist, Research Scientist

Vocabulary: Present and Going Forward Vocabulary words are specialized terms used by practicing professionals or those studying the discipline/s in which this standard would be integral.

Present and Going Forward Vocabulary:

Abstract, double-blind study, clinical trials, in vitro, in vivo, multiple parameters, therapeutic level

Advanced Understanding & Activity (Alternate activity):

Students will design an imaginary experiment step by step with all of the necessary laboratory equipment and safety precautions. Plan your experiment using a graphic organizer. Consider the following questions:

- What will you test?
- How much time will the experiment take?
- Even though you are only testing one variable at a time how many experimental groups will you need?
- What will your experimental organism be?
- Why are you using this model organism?
- What safety precautions should you use?
- What things need to be held constant while the experiment is being conducted?
- What are your independent and dependent variables?
- What are sources of error to take into consideration?
- How will you collect your data and once you have how are you going to analyze the data?
- What is your hypothesis and do the results obtained support your hypothesis?

Once you have the experiment complete you will select your audience and write an illustrated story, comic book, instruction manual, or screen play about the experiment. Use your imagination to create supporting characters and situations. Your goal is to highlight the experiment and all of the things that go along with it such as safety rules, lab equipment, experimental design, data collection and analysis, conclusion and adherence to basic scientific methods while keeping your audience interested to the very end. You can use illustrations to convey information or if you choose the screenplay your vivid descriptions of the stage directions will supplement the dialogue to convey the material. It is essential that you use the associated vocabulary to convey understanding of the terms and processes.

Length is not limited, there is no minimum or maximum but the experiment must be described from conception to conclusion. Refer to the rubric for details (Appendix A).

Advanced Understanding & Activity (Alternate Activity): Alternate activities are specifically defined, with accompanying, full size, printable student sheets found in Appendix A. In addition, student activity sheets are available on the CD Rom version of this document. They can be saved to a computer and completed electronically or printed.

Literature Connections/Resources: Web sites listed in this document are also found on the CD Rom version, where they are in clickable format. Simply click on the Web address or copy and paste into the address bar to go to the selected site. All sites have been previewed by the ALSDE and are safe and appropriate for student access. A separate page found in Appendix D also lists these resources.

<p>Literature Connections/Resources:</p> <ul style="list-style-type: none"> • Basic Lab Equipment: http://staff.tuhsd.k12.az.us/gfoster/standard/labeq.htm • Safe Handling of Equipment: http://mdk12.org/instruction/curriculum/science/safety/handling.html

Types of Alternate Activities: Many formats are used to differentiate the lessons in this document, most of which will be familiar to the user. Explanations and examples of some which may not be familiar, such as RAFT, Tic-Tac-Toe Choice Boards, ThinkFast, Kaplan’s Depth & Complexity, I can..., and Thinker Keys follow.

Roll, Audience, Format, Topic (RAFT)

Students are required to research a given topic and answer study questions to assist them in gaining the necessary understanding to complete the RAFT assignment. Then they assume the **role** (Column 1) of an animate or inanimate object or character from the unit of study. They choose an **audience** (Column 2) from the universe of anyone/anything that would be interested in the topic. The **format** (Column 3) can be any suitable method of communication, including verbal, musical, kinesthetic, artistic, etc. The **topic** is often adapted from a clever saying, a song, or a cliché (Column 4), and serves as the title for the RAFT. For example, in the set of RAFTs below, a student might choose to be a balance, talking to blocks through a comic strip, debating the topic, “To be balanced, or not to be balanced.”

<u>ROLE</u>	<u>AUDIENCE</u>	<u>FORMAT</u>	<u>TOPIC</u>
Balance	Blocks	Comic Strip	To be balanced or not to be balanced

Tic-Tac-Toe Choice Board

The Tic-Tac-Toe menu provides students with choices of activities that address different learning styles or different levels of complexity. Students contract with the teacher to complete three, moving across, down, or diagonally. For example, in the Tic-Tac-Toe menu below, a student might choose to complete Activities 2, 5, and 8 to complete the Tic-Tac-Toe contract.

ACTIVITY 1	ACTIVITY 2	ACTIVITY 3
ACTIVITY 4	ACTIVITY 5 STUDENT CHOICE (with teacher approval)	ACTIVITY 6
ACTIVITY 7	ACTIVITY 8	ACTIVITY 9


Think Fast

Students are asked to answer a series of questions concerning a major topical concept (spelled out vertically in Column 1). Answers should begin with the corresponding letter of each row. For example, in row one, students are asked to list three ways to use their muscles, and all answers must begin with the letter “M.”

M	List three ways you use your muscles.
U	Name five voluntary muscles that you contract or relax to control the way your body moves.
S	List three ways to care for your muscular system.
C	Name three muscles in your leg that allow you to kick a ball.
L	List three involuntary muscles that power the body without you thinking about them.
E	Identify two examples of how muscles work in pairs.
S	Name five tendons that connect muscles to the skeletal system.



Kaplan’s Depth & Complexity

In this activity, students think about a given topic in one of a possible 11 different contexts, each of which adds depth or complexity to their topical study. First, they choose one of 11 possible elements (Column 1). After answering questions and/or participating in an activity to facilitate understanding (Column 2), students culminate with an authentic product (Column 3). The 11 possible elements are Details, Language of the Discipline, Patterns, Trends, Unanswered Questions, Big Ideas, Rules, Ethics, Change over Time, Multiple Points of View, and Interdisciplinary Relationships.

ELEMENT	QUESTION/ACTIVITY	PRODUCT(S)
 LANGUAGE OF THE DISCIPLINE		

Thinker Keys

Thinker Keys offer students choices in ways to think about a given topic in 20 different ways, based on questions, activities, and research opportunities that encourage creativity and abstract thought, while strengthening higher order thinking skills. The keys consist of What If?; Reverse Listing; Disadvantages; Combination; BAR-Bigger, Add, Replace; Alphabet; Variations; Picture Transformations; Prediction; Different Uses; Ridiculous; Commonality; Brainstorming; Inventions; Brick Wall; Construction; Forced Relationships; Alternatives; and Interpretation. Students choose one or more of the keys from Column 1 and complete the activities from Column 2. See the example below.

 What If?	What if there was no electricity? What would your life be like? Create a list and use this list to create a story of your life without electricity.
 Reverse Listing	Name ten things that do not require electricity.

How Can Teachers Most Effectively Use This Document?

- Become familiar with the *Alabama Course of Study: Science* (Bulletin 2005, No. 20).
- Pre-assess students to determine mastery of each objective.
- Pre-assess all students at first. Later in the year, pre-assess those whom you strongly believe might have already mastered the material as well as any student who requests it.
- Use advanced activities **in place of** not in addition to the “regular” or grade-level lessons and assignments. The length of time to complete alternate assignments should be comparable to the length of time allotted to complete the regular assignment.
- Emphasize the importance of students taking ownership of their learning.
- Establish clear rules for behavior so that students know what is expected of them in all work situations. Be consistent in enforcing rules and follow through with consequences for rule infractions. (Behavior contracts may be a useful tool.)
- Best practices suggest awarding students a letter grade of “A” for each of the “regular” or grade-level activities. Evaluation of the alternate activities should be in the form of extra points, teacher narrative reports, rubrics, or shared student and teacher evaluations.
- Prior to beginning a new objective, browse through Resource and Curriculum Guides in order to obtain necessary literature, classroom materials, etc.
- Prepare sufficient student pages and materials for lessons in Resource and Curriculum Guide ahead of time to be ready for students who show mastery of grade-level material. (The number of students who need these materials may be reduced as the year progresses, especially during the second semester.)
- Organize student pages and materials needed to complete advanced lessons for easy access by students.
- Prepare all students for the probability that all may not be working on the same content at the same time nor in the same way. Help them to understand that each is unique and; therefore, may need to learn differently.
- Use graphic organizers and student planners when suggested in the Resource and Curriculum Guide or when otherwise necessary.
- Ask for collaborative or consultative assistance from the gifted specialist when necessary.

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Inside front cover of the guide:

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