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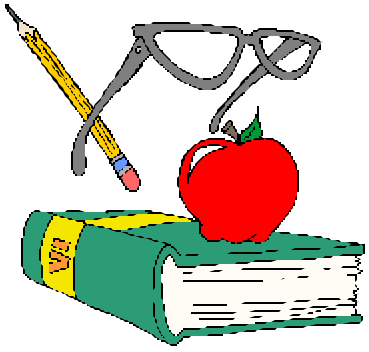
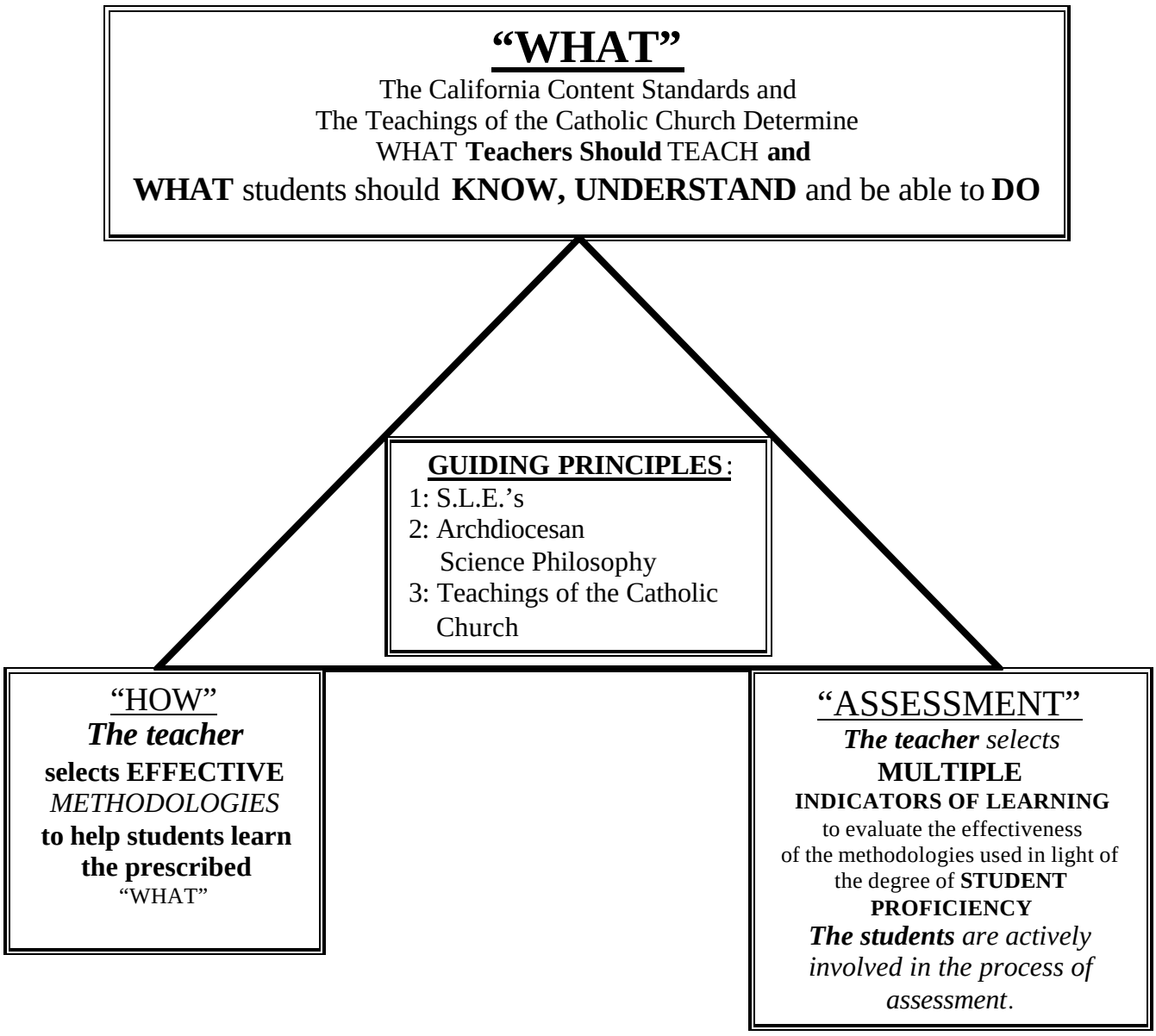


Student Centered Curriculum Model for SCIENCE



Faith and Science
A Catholic Perspective

Science and technology have given us great insight into the workings of our world. These insights lead us to see the hand of God behind the principles and processes that sustain our natural world. By examining nature's scope, complexity, and balance, it brings us face to face with the power, the splendor, and the wisdom of our loving God.

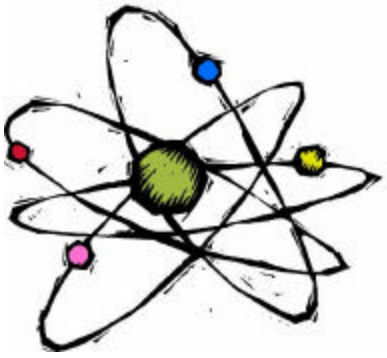
"Science springs from the gift of intellect, one of the divine traits that God gave humanity." Since all truth comes from God, there cannot be a conflict between reason and faith; thus the truths revealed by science spring from God.

Yet, at times, troubling questions arise. One of these questions deals with the Church's teaching of the origin of life. The Catholic Church clearly states that there is no conflict between the Catholic faith and the scientific theory of evolution. Pope John Paul II states that, while the Church does not espouse that theory, neither does it exclude that theory as a possible explanation of the way life began. He affirmed the belief that God is the Creator and left the explanation of the process to scientists.

Far from being incompatible, science and religion have much to offer each other. Einstein wrote: "Science without religion is folly, religion without science is blind." Ongoing scientific discoveries affirm our faith in God's plan for humankind. They lead us to praise him for his wondrous deeds.

"ALL CREATION PRAISES GOD" (Psalm 148, Daniel 3: 52)

Vice versa, our faith challenges scientists to use their understanding and knowledge to safeguard the environment, to alleviate suffering, and to enhance the dignity and quality of life for all. Working together, religion and science will bring us closer to the reality of "God's kingdom on earth."



Catholic School Science Educators

"Humanity's exploration of space has given us an entirely new perspective from which to reflect on the beauty and complexity of the Universe. It provides us with new insights into God's work of creation."

Rev. Donal Wuerl

Science educators in the elementary Catholic Schools of the Archdiocese of Los Angeles …

- Acknowledge that science is a core subject of the curriculum. Therefore, they teach to the standards and benchmarks as outlined in the Archdiocesan Guidelines for Science.

- Believe that scientific progress will be made through the process of asking meaningful questions, conducting careful investigation, and experimentation. Therefore, they encourage scientific inquiry and enthusiasm for science by motivating students to investigate the world of nature and technology in an atmosphere of curiosity, open mindedness, honesty, and patience.

- Evaluate student work using a variety of methods aligned with the guidelines. Therefore, in addition to chapter tests and quizzes, teachers use rubrics to evaluate projects and performance tasks, and they actively involve the students in the process of assessment.

- Expect a basic level of scientific literacy from all students, which enables students to exercise good judgment in dealing with challenging social issues.

- Help students reflect on the ethical dimensions of scientific advances in light of the Church's 2000 years of experience, guided by the inspiration of the Holy Spirit.

- Accept responsibility to instill in students a moral obligation to become stewards of our global environment.

Science Time Allotments (per week)

SUBJECTS	GRADES							
	1	2	3	4	5	6	7	8
Religion	150	150	150	150	150	200	200	200
Language Arts (Total)	(890)	(890)	(775)	(725)	(625)	(575)	(575)	(575)
Reading/literature								
English /Grammar								
Spelling								
Handwriting								
Mathematics	300	300	300	300	300	300	300	300
Science	**60**	**60**	**100**	**100**	**100**	**150**	**150**	**150**
Social Studies	80	80	125	175	225	225	225	225
Fine Arts (Total)	(120)	(120)	(120)	(120)	(120)	(120)	(120)	(120)
Art	60	60	60	60	60	60	60	60
Music	60	60	60	60	60	60	60	60
Physical Education	50	50	50	50	50	50	50	50
Additional instructional minutes to be allocated by each staff			30	30	30	30	30	30
Opening/Closing/Recess/Lunch	300	300	300	300	300	300	300	300
Total Weekly Instructional Minutes	**1950**	**1950**	**1950**	**1950**	**1950**	**1950**	**1950**	**1950**
Faculty Meeting Minutes Total	90	90	90	90	90	90	90	90
Curriculum Planning/Articulation	45	45	45	45	45	45	45	45
Other Administrative Planning	45	45	45	45	45	45	45	45
TOTAL WEEKLY MINUTES	**2040**	**2040**	**2040**	**2040**	**2040**	**2040**	**2040**	**2040**

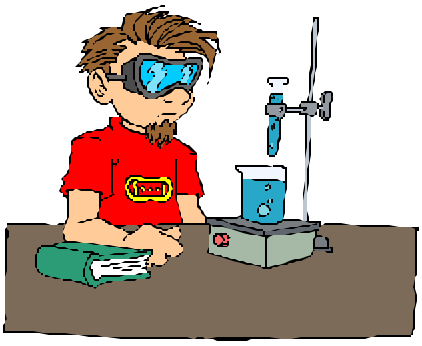
Please note: A call to integration.

The above minimum time allotments may not be sufficient to teach all standards and benchmark proficiencies at all grade levels. It is recommended that time allotments for science be increased, especially at the junior high level. Many schools have already lengthened the school day to accommodate more minutes for math, science, and foreign language. The currently prescribed minimum time allotments will be reviewed by an archdiocesan curriculum committee during the 2003-2004 school year.

The teaching of science takes place not in isolation from other core subjects, but in conjunction with them. To maximize learning, teachers should integrate appropriate elements of the science program with other subjects, such as mathematics, technology, language arts, family life, and religion. Special attention must be given to the teaching of science vocabulary. A standards based vocabulary list is included in this packet.

Additional Provisions:

1. Science instruction is mandatory at all levels. Every teacher should have a copy of the ***Science Curriculum Guidelines for their grade***, published by The Department of Catholic Schools, Archdiocese of Los Angeles.
2. It is recommended that the same science program be used in grades K-5 or K-6. By the same token, grades 6-8 or grades 7-8 need to adopt the same series.
3. Hands-on experiences with scientific phenomena (laboratory experiments done by students, as well as field studies) should be an integral part of the instructional program.
4. The skills and student outcomes at each level should be discussed at faculty and level meetings in order to provide articulation about the science program.
5. The three basic scientific fields of study---physical, earth, and life sciences---are addressed each year in K-5 and the connections among them are developed. In grade six the focus is earth science, in grade seven the focus is life science, and in grade eight the focus is physical science.
6. In order to promote inquiry, scientific method should be taught and developed at each grade level. Refer to "Scientific Method: Investigations and Experimentation" which is found at the end of each grade level in the *Science Student Outcomes, Grades K-8.*
7. Connections should be made between science and the real world in order to show its implications on society.
8. Science should be presented in connection with students' own experiences and interests.
9. Instructional strategies and materials should allow several levels of access so that all students can experience both challenge and success.
10. Printed materials should be presented in an interesting and engaging narrative.



Role of the Science Curriculum Coordinator

In consultation with the principal, the Science Curriculum Coordinator will…

1: Spearhead the science in-depth study and the yearly update of its plan of action and actively engage all teachers in the process.

2: Map out the faculty science meetings (times, places, and content) for the upcoming school year.

3: In-service science teachers on the use of the archdiocesan science curriculum guidelines.

4: Promote the integration of science into the other curricular areas.

5: Share and discuss a variety of teaching methods and assessment tools with teachers.

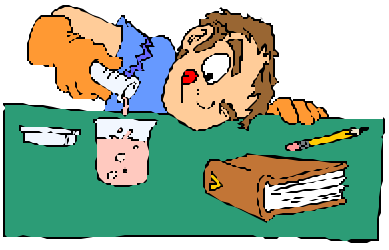
6: Encourage faculty and students to participate in archdiocesan and state science fairs and contests.

7: Keep inventory and inform teachers of existing supplementary teaching resources.

8: Each spring, after consulting with teachers, draft a list of needed additional resources.

9: Keep teachers informed about new trends and developments in the field of science.

10: Alert teachers to pertinent research and encourage them to participate in professional growth opportunities.



Three Critical Questions

What?

- What do I want my students to know, understand, and be able to do at the end of each lesson, each unit, each quarter/trimester, and at the end of each school year?

Assessment?

- How will I know if my students have mastered the proposed standards and benchmark proficiencies?
- How good is good enough?

How?

- Which methodologies, resources, and procedures will I employ to help students reach the appropriate level of proficiency?

The Archdiocesan Science Guidelines

The primary purpose of this document is to assist the teacher in determining the ***"WHAT"*** of the curriculum.

The *Science Content Standards for California Public Schools, Kindergarten Through Grade Twelve* represents the content of science education and includes the essential skills and knowledge students will need to be scientifically literate citizens in the twenty-first century. By adopting these standards, the State Board of Education affirms its commitment to provide a world-class science education for all California students. These standards reflect the diligent work and commitment of the Commission for the Establishment of Academic Content and Performance Standards (Academic Standards Commission) and the Commission's Science Committee to define the common academic content of science education at every grade level.

A few general guidelines and resources are included to help teachers address the "***Assessment***" and the "***How"*** of the curriculum. Ongoing professional development opportunities will be offered to further strengthen the curriculum.

The HOW and the ASSESSMENT of the science curriculum

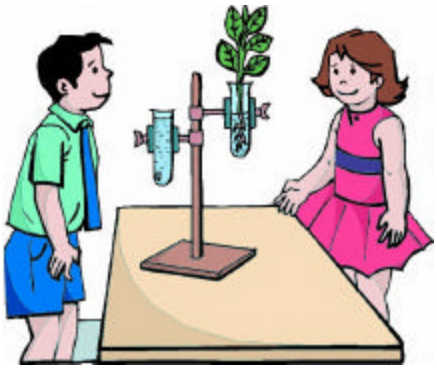
To assist teachers in implementation of the curriculum, the California Department of Education has published a curriculum framework for science. This 2003 framework edition builds on the California Science Content Standards. It gives guidance for science instruction in the elementary, middle, and high school grades.

Each year, in kindergarten through grade five, students receive basic knowledge in physical, life, and earth sciences, as well as develop skills in investigation and experimentation. By combining physical, life, and earth science content with investigation and experimentation standards at each grade level, the framework helps students to develop solid foundation of science knowledge, along with the abilities to observe, describe, compare, inquire, and evaluate.

Science instruction increases in complexity and depth in the middle school grades, where students focus on one science strand each year. In grade six, students focus on earth sciences, in grade seven, on life sciences, and in grade eight, on physical sciences. The investigation and experimentation standards increase in sophistication in the middle grades and require students to formulate a hypothesis for the first time, communicate the logical connections among hypotheses, and apply their knowledge of mathematics to analyze and report on data from their experiments.

It is highly recommended that each school purchase a copy of the 2003 Curriculum Framework for Science. The framework can be downloaded from the internet, free of charge. To do so, go to http://www.cde.ca.gov/ You may also order a hard copy at the address below.

Curriculum Frameworks and Instructional Resources Office
California Department of Education
721 Capitol Mall, Third Floor
Sacramento, CA 95814
(916) 657-3023



Instructional Materials

Instructional materials must give teachers what they need in order to teach to all the science standards and affiliated benchmarks. Textbook series published prior to the publication of the California Content Standards for Science may not meet that criterion, and if so must be supplemented by the missing components. Thus, administrators and teachers must take the time to check the series used at the school and must take the necessary steps to assure full alignment with the standards and benchmarks. The State of California has already approved several series. These series meet the following stringent criteria.

1. **Science Content/Alignment with Standards**; the content as specified in the California Science Standards.
2. **Program Organization**; the sequence and organization of the science program.
3. **Assessment**; the strategies presented in the instructional materials for measuring what students know and are able to do.
4. **Universal Access**; the information and ideas that address the needs of special student populations, including students eligible for special education, advanced students, students whose English language proficiency is significantly lower than that typical of the class or grade level, and students whose achievement is either significantly below or significantly above that typical of the class or grade level.
5. **Instructional Planning and Support**; the instructional planning and support information and materials, typically including a separate edition specially designed for use by the teacher, that assist teachers in the implementation of the science program

PUBLISHERS	
Glencoe/McGraw-Hill **Grades 6-8** *Glencoe Science Voyager* P.O. Box 543 Blacklick, OH 43004-0543 800.334.7344	**Harcourt Brace School Publishers** **Grades K-2** *Harcourt Ciencias* **Grades K-5** *Harcourt Science* 6277 Sea Harbor Drive Orlando, Florida 32887 800.225.5425
Holt, Rinehart and Winston **Grades 6-8** *Holt Science and Technology* **Grades 6-8** *Holt Ciencias Y Technologia* 6277 Sea Harbor Drive Orlando, Florida 32887 800.225.5425	**Houghton Mifflin Company** **Grades K-5** *Discovery Works* *Discovery Works* **(Spanish)** 1900 South Batavia Avenue Geneva, IL 60134 630.208.5830
McGraw-Hill **Grades K-6** *McGraw-Hill Science* *McGraw-Hill Ciencias* 220 East Danieldale Road DeSoto, TX 75115-8815 972.224.1111	**Prentice Hall, Inc.** **Grades 6-8** *Prentice Hall Science Explorer* P.O. Box 2500 Lebanon, IN 46052-3009 800.848.9500
For more information, contact: Curriculum Frameworks and Instructional Resources Division California Department of Education 1430 N Street, Suite 1201 Sacramento, CA 95814 916.319.0881 Office 916.319.0172 Fax	

How Students Learn

Criteria

The professional staff designs and implements a variety of learning and formational experiences which use research-based knowledge about teaching and learning, actively engage all students, and are consistent with the schoolwide learning expectations and the overall mission of the school.

Science Learning Involves Process Learning

The teaching of science involves more than teaching science facts and concepts; it is dependent upon a process approach. Students need to be equipped with the same process skills and tools that scientists use to discover the facts and concepts about the world in which they live.

A curriculum designed to promote the "doing" of science through inquiry and hands-on activities will provide the environment for the development of process skills and critical thinking skills, and will develop science literacy in students.

Development of critical thinking skills will help students learn to think and make informed decisions based on reason and evidence.

Teachers who engage in inquiry and process learning help students extend their curiosity and discovery of why things are as they are and behave as they do. Promoting inquiry, these teachers organize the students, the environment, and the materials so that all learners actively participate in the processes of exploration, discovery, and learning.

The Science Processes

The processes of science are skills that develop knowledge, concepts, and application across the curriculum. The processes are often referred to as the "hands-on" approach to science and must be used through the program. Each of the terms has been adapted from Elementary Science Studies, American Association for the Advancement of Science, and Science Curriculum Improvement Studies, and implies active student participation.

Observing: using the senses to gather information about objects and events in the environment. This skill includes using scientific instruments to extend the range of the human senses and the ability to differentiate relevant data from non-relevant.

Classifying: A method for establishing order in collections of objects or events. Students use classification systems to identify objects or events, to show similarities, differences and interrelationships. It is important to realize that all classification systems are subjective and may change as criteria change. The test for a good classification system is whether others can use it.

Measuring: A procedure for using instruments to determine the length, area, volume, mass or other physical properties of an unknown quantity. It requires the proper use of instruments and the ability to calculate the measured results.

Using Numbers: The skill includes: number sense, computation, estimation, spatial sense, and whole number operation.

Communicating: Transmitting the results of observations and experimental procedures to others through the use of such devices as graphs, charts, and tables.

Questioning: The formulating of original questions based on observations and experiences with an event in such a way that one can experiment to seek the answers.

Relating: In the sciences, information about relationships can be descriptive or experimental. Relationships are based on logical arguments that encompass all data. Hypothetical reasoning, deductive reasoning, coordinate graphing, the managing of variables, and the comparison of effects of one variable upon another contribute to understanding the "big" ideas of science.

Inferring: An inference is a tentative explanation that is based on partial observations. Available data is gathered and an evaluation made based on the observed data. These judgments are never absolute and reflect what appears to be the most probable explanation at the time and are subject to change as new data is accumulated.

Predicting: Using previously observed information to make possible decisions about future events.

Formulating Hypotheses: Stating a probable outcome for some occurrence based on many observations and inferences. These validity of the hypothesis is determined by testing by one or more experiments.

Identifying and Controlling Variables: Determining what elements in a given investigation will vary or change and what will remain constant. Ideally, scientists will attempt to identify all the variables before an investigation is conducted. By manipulating one variable at a time they can determine how that variable will affect the outcome.

Experimenting: the process is the culmination of all the science process skills. Experimentation often begins with observations that lead to questions that need answers. The steps for proceeding may include forming a hypothesis, identifying and controlling variables, designing the procedure for conducting tests, implementing tests, collecting and interpreting the data and sometimes changing the hypothesis being tested.

Applying: The process of inventing, creating, problem solving, and determining probabilities are applications of using knowledge to discover further information.

Constructing Models: Developing physical or mental representations to explain an idea, object, or event. Models are usually developed on the basis of acceptable hypothesis.

Current Thinking on How We Learn

- ***Intelligence is not fixed***
  (factors – life experiences – expectations – motivation)

- ***There is no single general intelligence***
  The right question is "How are you smart?" Not "How smart are you?
  Author: Howard Gardner: Frames of Mind (1993)
  Implication: discovering our strengths, playing into these and compensating for weaknesses.

- ***Emotions are a powerful influence on learning***
  Emotional intelligence: being able to motivate oneself and persist in the face of frustrations: to control impulse and delay gratification, to regulate one's moods and keep distress from swamping the ability to think, to empathize and to hope.
  Daniel Goleman/Emotional Intelligence/Why it can matter more than IQ (1996)

- ***Motivation*** is the driving force of learning and is closely linked to achievement

- ***Learning requires thinking things through for ourselves***.
  It involves making sense out of new information and requires integration and problem solving (long term memory)

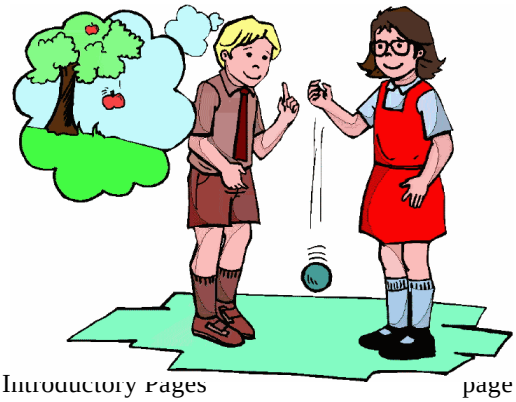
- ***Learning is messy: Beware of the right answer approach***
  Children do not proceed in easy linear steps

- ***Working cooperatively,*** a risk free climate that invites expression of opinions and sharing of ideas, develops a sense of responsibility for self and others

- ***Most children learn by doing – active learning***

- ***All children develop a preferred learning style.***
  Do you know yours? Do we teach to the preferred learning styles of all our students? Individuals learn in different ways, at different paces, and benefit from different kinds of support.

- ***Most learning takes place outside of the school walls***, but schools help students become creative thinkers and problem solvers.



GROUPING STUDENTS FOR INSTRUCTION:
The Flexible and Dynamic Model

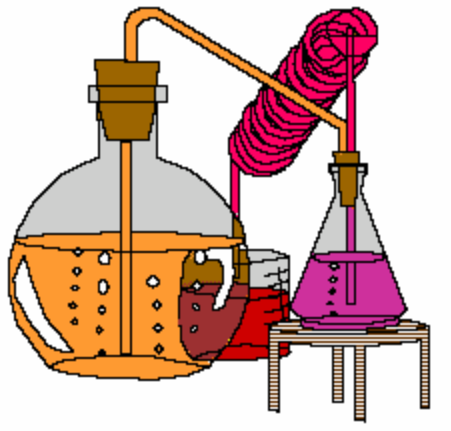
Why group students?
To optimize learning for all students.

When to group students
When the objectives of a lesson, or the sequence and pacing of that lesson, are not appropriate for the full range of students in a class, grouping is recommended.

How to group students
The dynamic grouping model avoids grouping students into a lower curriculum strand and higher curriculum strand, often referred to as "tracking of students." Since all students work toward the same high standards, students will move in and out of groups based on the lesson objectives of the day or week, and the needs of specific students in the class as these relate to the set objectives.

Heterogeneous instruction, the optimum setting for learning, should be used whenever the objectives are appropriate for all students in the class and homogeneous instruction when called to meet the learning needs of a specific group of students for a specific purpose and time. Students should be invited back to join the heterogeneous group as soon as they are ready for it.

Pull-out or tutoring programs must be appropriately used to "supplement," not "supplant" teacher delivered instruction and must always be aligned with the instructional goals for all students.



Science Safety

It is imperative that safety is practiced in all science classes. The safety of the children is not only a legal responsibility, it is also a moral obligation. All activities involving student participation or observation should be planned according to established safety procedures and guidelines.

Suggested Minimum Safety Equipment For Science Classes

- Latex, vinyl or nitrile gloves (beware of possible allergies)
- Chemical splash goggles
- Impact goggles
- Fire extinguisher
- Sand to be used as a fire extinguisher/fire blanket
- Protective aprons or an old shirt from home to protect clothes from spills
- First aid kit
- Eye wash station
- First aid book
- Knowledge of locations of circuit breakers and the school's emergency plan

It is also recommended that science teachers be certified in First Aid by an accredited agency. The committee recommends Red Cross certification.

Science Safety Contracts & Rules

Before students participate in any science experiment or demonstration they must be familiar with safe laboratory practices. They must take and pass a laboratory safety test with a score of 100% before being allowed to participate in any science experiment or demonstration. The school must also draw up a safety contract. The parent and the student must sign the contract before the student is allowed to participate in any science experiment or demonstration. The school must keep the contracts and safety tests on file for a minimum of three years.

Examples of safety tests and contracts are included in most science textbooks. An excellent additional resource is the **Science Safety Handbook of California Public Schools, 1999 Edition.** It can be accessed from the web: http://www.cde.ca.gob/ci/science.html Additional resources are listed on the next page.

> The California Science Safety Handbook states:
> "Specific safety instruction and testing are highly recommended as an integral part of every science classroom procedure. This handbook includes suggested safety procedures and a student safety test that may be adapted for use in the teaching of various scientific disciplines." (p.4)

Science Safety Workshops

It is recommended that Science teachers attend a Science Safety Workshop sponsored by the Los Angeles County Office of Education. Workshops are offered yearly at various locations throughout the region. Teachers completing the workshop will receive a certification in laboratory safety.

ADDITIONAL SCIENCE SAFETY RESOURCES

The Science Safety Handbook for California Public Schools, 1999 Edition, can now be accessed from the CDE Science web page at http://www.cde.ca.gov/ci/science.html.

Science Safety Monitor - http://www.ipso.asn.au/
"Dr. Science": Promoting Safety in Science Education: http://www.rci.rutgers.edu/~jefkatz/
or http://www.drscience.org

Safety Issues: http://www.links2go.com/toic/Safety
BHS Science Safety Internet Resources:
http://www.bhs.berkeley.k12.ca.us/departments/science/labsafety.html

Total Science Safety System:
http://www.bhs.berkeley.k12.ca.us/departments/science/labsafety.html

Excite Education: Science Safety:
http://www.bhs.berkeley.k12.ca.us/departments/science/labsafety.html

University of Nebraska, Lincoln Chemical Safety Resources: http://wwitch.unl.edu/safety

Up to date MSDS chemical information on-line: http://www.msdonline.com/

Flinn safety materials and guidance: http://www.flinnsci.com/homepage/sindex.html

Science Safety issues and links from the National Science Supervisors Assoc.:
http://www.enc.org/csss.safety/html

Safety software for elementary and secondary:
http://www.netins.net/showcase/jakel/safety.htm

OSHA home page: http://www.osha.gov/index.html
Current information and access to resources: http://www.safetyonline.com/

NSTA's Position Paper on Lab Science: http://www.nsta.org/handbook/labsci.htm

The Texas state guidance on lab and field safety:
http://www.tenet.edu/teks/science/stacks/safety/safetymain.html

NABT position statement: http://www.nabt.org/Laboratory.html

University of Virginia's extensive safety resources: http://keats.admin.virginia.edu/

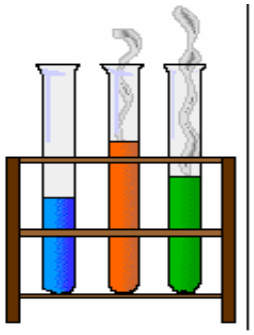
Science Fairs

The California Content Standards for Science stress the importance of including an investigation and experimentation component to all science standards. A set of progressively more complex scientific inquiries are suggested for each one of the grade levels, starting in Kindergarten. When students are given the opportunity to experiment and investigate early on, they will be ready to tackle a science project by the time they reach the sixth grade. This means that sixth grade students understand the meaning of a hypothesis, can formulate one, and use proper processes to prove the hypothesis correct or incorrect. It is highly recommended that all seventh and eighth grade students participate in a school science fair to give them an opportunity to apply these important skills.

The Los Angeles County Office of Education has published a Science Fair Handbook for the Los Angeles County Science Fair preparation. This document begins by pointing out the benefits a science fair brings to the classroom, the curriculum, the students and their schools. It supports the idea that a science fair does not only focus on the attainment of greater science knowledge, as it "integrates science with other curriculum areas including mathematics, computers, and language arts," and also "provides opportunities for interdisciplinary development in reading, writing, and library research skills." Through motivation, creativity and critical thinking, students may produce a product that not only increases a positive attitude toward science, but also strengthens other necessary academic skills.

For more information on how to plan and schedule a school science fair, refer to the LACOE web page, www.LACOE.edu and type in the search words “science fair.”
You will be given a list of downloadable publications that will give step-by-step guidance. The bonus to following these guidelines is that students’ projects will also be eligible for the Los Angeles County Science Fair.

Another reliable source for information is the California State Science Fair web page at www.usc.edu/CSSF, which also contains many useful links to other resources, including an Experimental Science Fair Project Guide.



Literature for Science and Mathematics: Kindergarten Through Grade Twelve

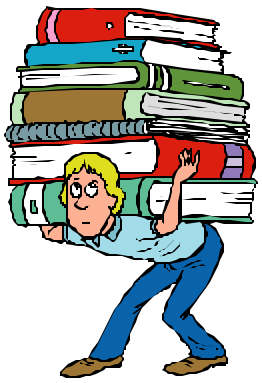
California Department of Education: http://www.cde.ca.gov

Literature for Science and Mathematics is a resource to help districts in the selection of supplemental instructional materials. School officials and teachers are encouraged to use this list as an aid in designing their standards-based instructional programs. Selections from this list may be used to instruct or extend students' understanding of a wide range of science and mathematics standards.

The titles in *Literature for Science and Mathematics* illustrate the quality and complexity of the literature related to science and mathematics. Works of fiction, nonfiction, poetry, and drama have been included on this list to accommodate a variety of tastes, interests, and abilities. For children who can read in Spanish, selections written in Spanish or a bilingual combination of Spanish and English are included.

Literature as Part of Science and Mathematics Instruction:
Reading and the use of literature are of great benefit beyond the boundaries of the language arts classroom. Teachers can enrich their students' understanding through the integration of quality literature selections into the science and mathematics lessons. Discussions stemming from the literature coupled with hands-on activities can create an atmosphere for inquiry. Whether students read literature independently or it is read to them, students who are engaged with quality texts will have the opportunity to develop a deeper understanding of the subject matter and specific concepts.

Literature for Independent Content Reading:
This collection of literature is intended for use by teachers, library media teachers, parents, and students as a guide to the kinds of books that children should read independently both at school and outside of class. At every grade level, the reading comprehension strand of the English-language arts content standards calls for students to read and understand grade-level-appropriate material and, by the end of high school, to read two million words annually on their own.



Assessment of Student Learning

Criteria

Assessment results are the basis for:

- ***Measurement of progress toward the student learning expectations***
- ***Regular evaluation and improvement of curriculum and instruction***
- ***Allocation of resources***

The faculty:

- ***uses a professionally acceptable process to collect, disaggregate, and analyze student performance and assessment data.***
- ***frequently involves students in the use of assessment results in the teaching and learning process.***

Assessment Terminology

Alignment
The process of strengthening the linkage among objectives, instructional materials, instructional methods and assessments.

Alternative Assessment
Any type of assessment in which students create a response to a question (as opposed to assessments in which students choose a response from a given list, such as multiple-choice, true/false, or matching.) Alternative assessments can include short-answer questions, essays, performance assessments, oral presentations, demonstrations, exhibitions, and portfolios

Authentic Assessment
Assessment tasks that elicit demonstrations of knowledge and skills in ways that resemble "real life" as closely as possible. An authentic assessment also engages students in the activity and reflects best instructional activities. Thus, teaching to the authentic assessment is desirable.

Belief or Value Statement
Direct statement of commonly held beliefs about students, staffs, schools and other important aspects in the schooling process. Such statements answer the question "What do we believe about people, conditions, and control in the schooling process?"

Benchmark
An interpretation of a performance standard according to age, grade, or developmental levels. In this document it refers to adequate or reachable targets at the various grade levels.

Interdisciplinary or Integrated Assessment
Tasks that assess students' ability to apply concepts, principles, and processes from two or more subject disciplines to a central question, theme, issue, or problems.

Norm-Referenced Assessment
Comparing a student's or a group of students' performance or test result to the performance of other students in a norming population. (e.g.,. Standardized testing, such as the SAT9). This type of assessment is frequently contrasted with criterion- referenced assessment.

Open-ended Task
A performance task having no single correct response. For example: "Below you see a bar graph without any labels. Of what might this be a graph?" or "Here is an aquarium. You have $25 to buy fish, plants, rocks, etc. Use the attached information to plan what you will put in your aquarium. Justify or explain your choices. Open–ended tasks are usually used when the goal is to assess reasoning, critical thinking, and group process skills rather than specific knowledge.

Performance Assessment
Direct observation of student performance or student work and professional judgment of the quality of that performance. Good-quality performance assessment has pre-established performance criteria.

Performance Standard
An established level of achievement, quality of performance, or degree of proficiency.

Portfolio
A purposeful, integrated collection of students' work showing effort, progress, or achievement in one or more areas. Usefulness for interaction and assessment is enhanced when students select items for their portfolios, self-reflection is encouraged, and the criteria for success are clear.

Proficiency
Having or demonstrating solid understanding of concepts and skills taught. A student is considered proficient if he/she is well prepared to handle the next level of learning.

Prompt
An assignment or directions asking the student(s) undertake a task or series of tasks. Complete prompts present the context of the situation, the problem(s) to be solved, and criteria of standards by which responses will be evaluated.

Rubric
An established set of criteria for scoring or rating students' performance on tasks. Good rubrics consist of a fixed measurement scale (e.g., 4-point), a description of the characteristics of products or performances being measured for each score point, and sample responses (anchors) that illustrate the various levels of performance.

Scale
The range of scores possible on a task. Performance assessment items are typically scored on a four-to six-point scale compared with a scale of two (right/wrong) on multiple-choice measures.

Summative Assessment
Culminating assessment for a unit, grade level, or course of study providing a status report on mastery of degree of proficiency according to identified learning goals (outcomes).

Guidelines for Developing a Rubric

The information below has been provided by
Donna Szpyrka and Ellyn B. Smith of Florida's Statewide Systemic Initiative.

- Determine which concepts, skills, or performance standards you are assessing.
- List the concepts and rewrite them into statements which reflect both cognitive and performance components.
- Identify the most important concepts or skills being assessed in the task.
- On the basis of the purpose of the task, determine the number of points to be used for the rubric (example: 4-point scale or 6-point scale).
- Starting with the desired performance, determine the description for each score, remembering to use the importance of each element of the task or performance to determine the score or level of the rubric.
- Compare student work to the rubric. Record the elements that caused you to assign a given rating to the work.
- Revise the rubric descriptions based on performance elements reflected by the student work that you did not capture in your draft rubric.
- Rethink your scale: Does a point scale differentiate enough between types of student work to satisfy you?
- Adjust the scale if necessary. Reassess student work and score it against the developing rubric.

Sample Rubric: Drawing Conclusions

1. **Draws a conclusion that is supported by the data and gives supporting evidence for the conclusion.**
2. **Draws a conclusion that is supported by data, but fails to show any evidence for the conclusion.**
3. **Draws a conclusion that is not supported by data.**
4. **Fails to reach a conclusion.**

Sample Rubric: Cooperative Learning

1. **The student actively listens to and values the opinion of others.**
2. **The student actively listens to but it is not evident that he/she values the opinion of others.**
3. **The student listens to but does not value the opinion of others. OR The student values the opinion of others but does not listen to them.**
4. **The student does not listen to and does not value the opinion of others.**

Sample Rubric: A Product

1 **The product shows evidence that the student reached valid conclusions based on data analysis and displayed the results of the analysis in appropriate formats.**

2 **The product shows evidence that the student reached valid conclusions based on data analysis but displayed the results of the analysis in inappropriate formats.**

3 **The product shows evidence that the student reached conclusions not based on data analysis and displayed the results of the analysis in appropriate formats - OR - the product shows evidence that the student reached valid conclusions based on data analysis but lacked evidence of the analysis.**

4 **The product shows no evidence of analysis.**

Websites

General Science -- For Teachers

NSTA's Science Store online - over 300 items specially selected for science teachers, students and parents. Books, posters, software, CD-ROMs and more. Browse at your leisure, order at your convenience. www.nsta.org/scistore

Funded by the NSF, the **Virtual River** is part of Geology Labs On-Line from the California State University at Los Angeles. Geared toward middle school to introductory college level, this site uses flash animation and interactive testing to depict discharge, flooding, and flood frequency. Each activity requires students to make careful observations and measurements, do simple calculations, and answer questions. vcourseware.sonoma.edu/VirtualRiver/Flooding/

Visit www.actionbioscience.org for lessons for high school and undergraduate levels to accompany peer-reviewed articles examining bioscience issues. Lessons are written by educators and correlated to NSES standards. Articles and lessons focus on issues in **biodiversity, environment, genomics, biotechnology, evolution, new frontiers in the sciences, and education.**

NASA's K-12 Home Page is at quest.arc.nasa.gov/

The USGS Rocky Mountain Mapping Center maintains USGS topographic maps illustrating physiographic features which indexes the names and locations of topographic maps that illustrate landforms associated with coasts, escarpments, glaciation (alpine and continental), tectonics, solution, rivers, volcanic, wind and more. The index is also organized by state. If needing the name of a topographic map that illustrates process and landform, then this is the site to visit: rockyweb.cr.usgs.gov/public/outreach/featureindex.html

Space science, the solar system, the sun, and Earth are subject areas covered on this website. Lessons are listed with their grade-level ranges and their ties to the National Science Education Standards. Each lesson plan allows users to create a custom reference page. Pages about each lesson contain summaries, time and materials required, teaching tips, and technical information. cse.ssl.berkeley.edu/SEGway

Periodic Table of the Elements online . You can click on an element and get a description of it. Go to www.dayah.com/periodic

Science Education Resource WWW Links are available at www.eskimo.com/~billb/edu.html

This highly interactive site launched by the **Natural Resources Defense Council** offers a fun environment for kids to learn about serious issues, namely health and conservation. It gives kids the tools and skills they need to help locate -- and solve -- environmental and health problems in their schools. The Green Squad is available in Spanish and English.
http://www.nrdc.org/greensquad

This NASA-related site contains a collection of K-12 science education **materials for teaching astronomy**. The collection was developed by faculty from Montana State University, with help from teachers from across the country. NASA provided financial support. Lesson plans and activities are organized by grade level and estimated time requirements. The site includes links to NASA resources, data, and images. btc.montana.edu/ceres

Space Explorers develops space education curriculum and activities, which are internet based and fully interactive. Partners with NASA, Johns Hopkins University, and Jet Propulsion Laboratories. For more information, www.space-explorers.com

The CSUN Chemistry Teacher Support Group strives to provide an environment of easily accessed, teacher-driven staff development with a focus on the sharing of the best practices and collaborative development of standards-based teaching materials, benchmark assignments, laboratory experiments, demonstrations and assessment tools. This website provides resources for all high school chemistry teachers. www.csun.edu/chemteach

ENSI Lessons for teaching the nature of science and evolution. Freely downloadable ready-to-use classroom-tested lessons for any science teacher, especially for Life Science, Biology, and Earth Science teachers, 5-12. Also online support for science teachers for using these lessons with unit plan ideas. Visit their award-winning website. www.indiana.edu/~ensiweb

The Space Place Classroom! - Specifically developed for the educational community, the Classroom is dedicated to supporting teachers interested in integrating real-life space science and technology activities into their classroom curriculum. With easy downloadable activities in Adobe Acrobat (.pdf) format, teachers can share the Space Place program with their students directly in their classroom. One activity allows students to learn how ions are used to accelerate spacecraft on long missions exploring the solar system. Yet another lets students learn how engineers strive to make spacecraft smaller and smaller, yet more and more capable. The activities are multi-disciplinary and include such themes as math, biology, physics, the visual and language arts. spaceplace.jpl.nasa.gov/teachers_page.htm

Resource Area for Teachers (RAFT) - 408-451-1423, www.raft.net, rat@raft.net.

As part of our new on-line teacher's resource, Bio-Rad will upload a featured **"Explorer Teacher of the Month"** each month in order to highlight how he or she integrates biotechnology into the biology curricula. Many educators are actively adapting and integrating new biotechnology topics into their courses. This is a way of sharing what they have created. Check out their new site at: www.explorer.bio-rad.com

"**Resources for Earth Science and Geography Instruction**" at www.cmich.edu/~franc1m/homepage.htm

For intriguing news on topics like battling blindness or a gene that can boost brain power, visit the **Science Updates** section at Access Excellence - www.accessexcellence.org/WN/SU. The site was created by the National Health Museum to provide scientific updates for teachers.

The Eisenhower National Clearinghouse for Math & Science Education is at www.enc.org/

Physics Lessons : www.physicslessons.com

WhaleNet is an award-winning educational website focusing on whales and marine animals. The site is interactive and includes a world of information, pictures and movies for students of all ages. whale.wheelock.edu/whalenet-stuff/awards/

Crocodile Clips are offering a free electricity simulator program suitable for grades 3 to 7 called Crocodile Clips Elementary. Visit the website at www.crocodile-clips.com to download. Demos of science simulation products for high schools are also available on the website. Experiment freely in the on-screen laboratory, make measurements using the graphing facilities and create your own on-screen activities. If you have questions or comments, visit the website or e-mail feedback@crocodile-clips.com.

The Southeastern Michigan Math-Science Learning Coalition has assembled an impressive set of science lesson plans and science activities at "Science Lessons by Subject". The site is quick loading, easy to follow, and differentiates lesson plans from activities, the latter typically being a demonstration that will perk student interest before a lecture. www.eecs.umich.edu/~coalitn/sciedoutreach/funexperiments/agesubject/subject.html

Visit www.bio12.com as a resource for both students and teachers of **senior biology, in particular human physiology and biochemistry**. All materials -- study guides, tutorials, quizzes and more, offer interactive content, instant audio and text feedbacks as well as scoring.

Advice and Connections at kidsgardening.com. The nonprofit **National Gardening Association** website for educators and parents offers more than "how-to" advice, classroom stories, grant information and other resources to help kids grow. It is also a great place for learning from and with other educators who use plants and gardens to delight, engage and enrich learning. Through the Garden in Every School Registry, you can learn what's happening in nearly 1,000 school gardens, greenhouses and habitats, and swap ideas, seeds and more with those who share your interests. Our ambitious goal is to document and feature every school garden and habitat project in the country and beyond. What's your story? Be sure your program is counted by registering at www.kidsgardening.com/School/register.asp

Science Associations, Organizations, and Publications

Founded in 1944, the **National Science Teachers Association (NSTA**)is the world's largest organization dedicated to promoting excellence and innovation in science teaching and learning for all. The association's current membership of more than 53,000 includes science teachers and supervisors, administrators, scientists, business and industry representatives and others involved in science education. Check out NSTA's website at www.nsta.org.

The Forest Foundation - www.calforests.org/foundation

Several **forest education information sites**: California Foundation for Agriculture in the Classroom - Forest Institute for Teachers - Project Learning Tree.

Sign up for **New Scientist Newsletter** at www.newscientist.com.

Look for a **Popular Science** magazine article, search for further information on an article, write a letter to the editor, ask questions, or submit an article idea at www.popsci.com -- The official website of Popular Science Magazine.

Visit the **New Jersey Earth Science Teachers Association** at www.njesta.org.

Activities of Modesto Area Partners in Science - virtual.yosemite.cc.ca.us/smurov/sched.html.

The National Teacher Recruitment Clearinghouse: www.recruitingteachers.org

The Dairy Council of California helps us make healthy food choices. Visit their website at www.dairycouncilofca.org

The Association for Environmental and Outdoor Education: www.aeoe.org

Visit **American Institute of Biological Sciences** on the web! At www.aibs.org you'll find BioScience online, including tables of contents of upcoming issues and full-text versions of selected articles. There is also information about the career field of biology and AIBS membership, programs and services.

Future Scientists and Engineers of America (FSEA) is a nonprofit whose mission is to motivate and excite students in grades 4-12 about science, engineering, mathematics and technology via hands-on projects. They manufacture 46 projects for sale in their on-line store to individuals or as turn-key after school clubs. For more information, contact Elaine Warford at ehw@fsea.org or (714) 22-2223, fax (714) 229-2228.

Parks and Museums

University of California Museum of Paleontology: www.ucmp.berkeley.edu

The Exploratorium: www.exploratorium.edu

National Parks Service-related websites: "Parks as Classrooms" engages K-12 students in dynamic curriculum-based science programs in National Parks. Click on www.nps.gov/interp/curriculum.htm for a complete list of programs and resources.

Several National Parks in California are also participating in **"Parks as Resources for Knowledge in Science"**, a special partnership between the National Science Teachers Assn., National Park Foundation, Exxon Corp. and the National Park Service. Check out "Scientists in Training at Channel Islands" at www.nps.gov/chis. "Wheels Across the Desert: Creating Inquiries in Science at Joshua Tree" at www.nps.gov/jotr. "Here's the Dirt: Science at Native Plant Nurseries at Golden Gate NRA" at www.nps.gov/goga. "Creating Coastal Stewardship Through Science at Point Reyes National Seashore" at www.nps/gov/pore. "Bridges - Connecting Classrooms with Redwood National and State Parks" at www.nps.gov/redw. "Nature's Laboratories at Santa Monica Mountains NRA" at www.nps.gov/samo.

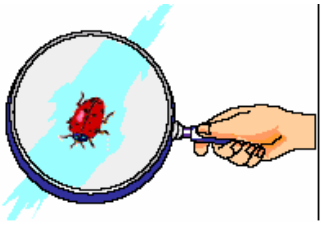
American Museum of Natural History is a top-notch virtual science museum. Packed with educational activities, photos, videos and more on a range of topics. www.amnh.org

Boston Museum of Science: www.mos.org

Museum of Science and Industry in Chicago. www.msichicago.org

Questacon, the Australian science and technology museum, is full of educational and entertaining features. www.questacon.edu.au

The Franklin Institute Science Museum: sln.fi.edu



Aligning the Instructional Program with the Grade Level Standards and Benchmarks

In order to align the instructional program with the prescribed content standards for the grade, it is critical that the standards and their affiliated benchmarks are reviewed regularly so that we become very familiar with them. At the outset of each quarter/trimester an initial decision must be made as to which standards and benchmark proficiencies will be included in the instructional program. At the end of each quarter/trimester the teacher should fill out the **response section next to each benchmark**. This activity will serve as a checkpoint and will help gauge what still needs to be taught or what should be re-taught.

Complete the Response Section

ST/B = Standard and Benchmark **P:** Priority benchmark **Q:** Quarter 1 or 2 or 3 or 4

At the start of the quarter/trimester, select the benchmarks you consider to be your "priority benchmarks." Mark the box under the "P" code.

At the end of each quarter/trimester complete the response section of the standard/benchmark listings, indicating to what extent students have mastered the benchmark.

A:75% or more of the students of the students are proficient | **B: About *half* (50%) of the students are proficient** | **C: *Fewer than 25%* of the students are proficient**

Sample Recording of the Response Form

GRADE 2

I. PHYSICAL SCIENCE

The motion of objects can be observed and measured. As a basis for understanding this concept, students in the SECOND GRADE will …

ST/B	P	ST/B: Standard/Benchmark P: Priority Benchmark Degree of Mastery: % of students at end of each Q: Quarter A= 75% or more B=about half C=fewer than 25%	Q 1	Q 2	Q 3	Q 4
ST1.A	P	*know* that the position of an object can be described by locating it in relation to another object or to the background.	A	B	B	C
ST1.B		*know* that an object's motion can be described by recording the change in position of the object over time.	A	A	B	B