E OF CALIFORNIA
COMMISSION ON TEACHER CREDENTIALING
Box 944270
Sacramento, California 94244-2700
(916) 445-7254

PETE WILSON, Governor

OFFICE OF THE EXECUTIVE DIRECTOR

95-9518

September 27, 1995

To: All Individuals and Groups Interested in the Activities of the Commission on Teacher Credentialing

From: Ruben L. Ingram, Executive Director

Subject: Science Supplementary Authorizations

Changes to California Code of Regulations Title 5 governing supplementary authorizations became effective on April 8, 1995. A part of these changes pertains to the sciences supplementary authorizations. This correspondence reviews the evaluation process for Introductory Science and the four specific science areas.

The overall requirements for supplementary authorizations have not changed. An applicant will need to complete 20 semester units (or 10 upper division semester units) of non-remedial course work in the subject, completed at a regionally accredited community college, college, or university. A grade of "C" or higher is required in every course used to meet a supplementary authorization. Education and education methodology classes will not be considered unless the applicant can obtain a letter from the chair of the subject area department stating the course in question is equivalent to one offered by that department.

An applicant can also qualify for the supplementary authorization by completing a collegiate major from a regionally accredited college or university in a subject directly related to the subject to be listed on the credential.

Introductory Science

The new Title 5 Regulations eliminate the introductory subjects of General Science, Life Science, and Physical Science on July 1, 1996. These subjects are being replaced by the Introductory Science supplementary authorization

which became effective April 8, 1995. Candidates have been able to qualify for the new authorization since that date. For the Introductory Science supplementary authorization, the requirement is course work in Biological Sciences, Chemistry, Geosciences, and Physics. In addition to completing a course in each of the four subject areas, an applicant must complete a one-year sequence of courses in at least two of the subject areas. The new regulations also require that at least one course must include a laboratory component.

A collegiate major from a regionally accredited college or university directly related to science will qualify one for the Introductory Science supplementary authorization. For example a major in Biology, Oceanography, Physics, Chemistry, Meteorology or any related science will meet the requirement.

One-Year Sequence of Courses

The Commission defines a "one-year sequence of courses" as course work that builds on ideas from the previous course in a single discipline area. The courses do not have to be taken at the same institution or in the same year. The Commission will use course numbering, prerequisites, and course descriptions as guides when evaluating for the one-year sequence.

Course numbering refers to classes taken in a sequence such as CHEM 1A, General Chemistry and Chemical Analysis, and CHEM 1B, General Chemistry and Chemical Analysis. This is recognizable as a one-year sequence of courses. However, not everyone takes courses in a 1A-1B sequence.

When courses are not in obvious sequence, the Commission will look at the prerequisite requirement for a class. For example, at California State University, Sacramento, BIOL 10, Basic Biological Concepts is a prerequisite for the following courses: BIOL 11, Animal Biology, BIOL 12, Plant Biology, BIOL 20, Biology: A Human Perspective, and BIOL 22, Introductory Human Anatomy. If an applicant takes BIOL 10 and then takes any of the courses that require BIOL 10 as a prerequisite, we will accept both courses as a one-year sequence. A course description will be required with the application at the time of the evaluation so the Commission staff can determine the course prerequisite.

The third method of evaluation is by course descriptions. If a one-year sequence is not apparent by course numbering or course prerequisites, course descriptions must then demonstrate a continuum of ideas. Course descriptions will be particularly helpful when course work is from different institutions where course numbering and prerequisites will not serve as a guide.

Specific Subjects

Several changes have been made to the specific subject science authorizations which may be added to secondary credentials. Biology and Earth Sciences were re-named Biological Sciences and Geosciences, respectively, to more accurately reflect the subject content. Also, the following components must be completed within each science area. Acceptable course work must include each of the components; however each component does not require a separate course.

a. *Biological Sciences*, including: Molecular and Cellular Biology, Biology of Organisms (characteristics of life and life forms of plants and animals), and Evolution.

b. *Chemistry*, including: Structure and Stability, and Chemical Reactions.

c. *Geosciences*, including: Astronomy, Geology, Meteorology, and Oceanography.

d. *Physics*, including: Energy - Mechanics, Energy - Heat, Energy - Electricity and Magnetism, Wave Motion, and Atomic and Nuclear Physics.

Another change to the specific subject science authorizations is the requirement that one course include a laboratory section. This can be within any of the courses used to add the specific science area or be a separate course. Once a candidate has met the required component areas, he or she can use elective units taken from related subject areas. No more than 50% of the total required units can come from related areas.

Attached to this correspondence is the *"Specific Subject Science Supplementary Authorization Evaluation Guide."* This guide has been developed to help in the evaluation process for the specific subject science supplementary authorizations. The guide lists each of the component areas that must be covered, with key words or phrases that need to appear in course descriptions, sample course titles that cover the component area, and notes about each component. General notes appear at the bottom of each chart. The sample course titles mentioned on the guide are not an exhaustive list, but rather a sampling of those offered at colleges and universities.

Unacceptable Course Work

The new science standards specifically exclude Health Science course work as acceptable units toward the science authorizations.

Previous Commission policy allowed the use of Physical Geography to meet the Earth Science requirement; under the new state standards the Commission will no longer be able to continue this policy. Therefore, Physical Geography will not be acceptable toward the Introductory Science or Geosciences supplementary authorizations. The Commission will continue to accept Physical Geography toward Earth Science, Introductory General Science, and Introductory Physical Science until July 1, 1996.

Physiology of Exercise and Kinesiology will no longer be accepted as Biological Sciences course work and therefore cannot be used toward Introductory Science or specific subject Biological Sciences. However, the Commission will continue to accept these courses for Introductory General Science, Introductory Life Science and specific subject Biology until July 1, 1996.

Science course work which focuses on methods or science education will not be considered for the science supplementary authorizations, even if the course is offered by a science department. For example, a California university offers a course in the Geoscience department entitled "Planning/Implementing K-6 Science Program." The course content is planning, implementing, and managing science programs. The focus of the course is science education which is not acceptable for the supplementary authorizations. A course that is predominately science in content with some attention to teaching models is acceptable.

Implementation of Regulations

As stated above, the introductory subjects of General Science, Life Science, and Physical Science supplementary authorizations will be eliminated July 1, 1996. During this transition period the Commission will evaluate for the Introductory Science authorization when any of the above subjects have been requested. If an applicant qualifies for the Introductory Science authorization, the Commission will grant the new authorization because it has a broader authorization than the other supplementary authorizations.

The Introductory Science authorization authorizes the holder to teach Biology, Earth Science or Geoscience, Integrated Science (7-9), Introductory General Science, Introductory Life Science, and Introductory Physical Science, in grades 9 and below.

Specific Subject Science Supplementary Authorization
Evaluation Guide

This chart has been developed to assist in the evaluation of the specific subject science supplementary authorizations.

SUPPLEMENTARY AUTHORIZATION

Requirements: 20 semester units (or 10 upper division semester units) of non-remedial course work in the subject area. An applicants course of study must include each of the components for that area as shown below. At least one of the courses must include a laboratory component.

Biological Sciences, including: Molecular and Cellular Biology, Biology of Organisms (characteristics of life and life forms of plants and animals), and Evolution.

Chemistry, including: Structure and Stability, and Chemical Reactions.

Geosciences, including: Astronomy, Geology, Meteorology, and Oceanography.

Physics, including: Energy - Mechanics, Energy - Heat, Energy - Electricity and Magnetism, Wave Motion, and Atomic and Nuclear Physics.

or

A collegiate major from a regionally accredited college or univeristy directly related to one of the above subjects.

Electives: Electives may be taken in the specific science area or in related areas as stated in the general notes on the Evaluation Guide. Health Science, Physiology of Exercise, and Kinesiology are not acceptable for any of the science supplementary authorizations.

KEY TO EVALUATION GUIDE

Component Areas: All component areas must be covered to obtain the specific subject area, however each component does not require a separate course. One course may cover all of the component areas listed under a specific subject.

Course Content: Key words that may appear in a course description to meet the component area. One or more of the key words or phrases needs to appear in the course description for it to be acceptable.

Course Titles: A sample of course titles that cover the component area. This is not a definitive list of courses. Catalog descriptions should be submitted when the course title does not clearly describe the component area.

BIOLOGICAL SCIENCES			
Component Areas	**Course Content**	**Sample Course Titles**	**Notes**
Molecular and Cellular Biology	Molecular and cellular biology, structure and function of cells, cellular bioenergetics, or molecular biology of genes	General Biology	
Biology of Organisms	Organ systems, characteristics of life, plants and animals, or principles of Mendelian genetics	Microbiology, Genetics, Marine Biology, or Anatomy	Courses offered in the Botany or Zoology Departments will meet this component
Evolution	Origins of life, history of life, Darwinism, evolutionary mechanisms or evolutionary patterns	Genetics, Molecular Biology, or any class with Evolution in the title	Anthropology classes may meet this area, check the course description. Creationism is not acceptable for this component.

Biological Sciences General Notes: A General Biology course may cover all of the specific components, check the course description To meet the unit requirement, we will accept up to 50% of the total required units from related subject areas, i.e. Agriculture, Anthropology, Ecology, Environmental Science, Forestry, and Physiology.

CHEMISTRY			
Component Areas	**Course Content**	**Sample Course Titles**	**Notes**
Structure & Stability	Chemical bonds, molecular shapes, states of matter: models of atomic, molecular, and ionic structures, polarity, simple nuclear chemistry, or simple models for chemical bonds	Inorganic or Physical Chemistry	
Chemical Reactions	Types of reactions (phase changes, acid base and organic functional group reactions), stoichiometry, solutions, rates or energy changes	Physical, General, Introductory, or Inorganic Chemistry	

GEOSCIENCES			
Component Areas	**Course Content**	**Sample Course Titles**	**Notes**
Astronomy	The Solar System, stars, or cosmology		May be offered in the Physics Department
Geology	Earth materials, geomorphic and internal processes, natural hazards, the Earth's interior, or the history of the Earth	Earth Science, Physical, Soil Science, Historical, General or Introductory Geology	Courses offered in the Geology Department
Meteorology	Atmospheric composition, atmospheric transport, or weather and climate		May be offered in Geography Department
Oceanography	Physical, chemical, biological, or geological characteristics of the ocean		Marine Biology does not meet this component

Geosciences General Notes: Earth Science may cover all component areas, check a course description. Physical Geography is not acceptable as an Earth Science unless the department chair of the Earth Science/Geology department states in a letter that this course is equivalent to one offered by the Earth Science/Geology department. To meet the unit requirement we will accept up to 50% of the total required units from related subject areas, i.e. Forestry, Paleontology, and Mineralogy.

PHYSICS			
Component Areas	**Course Content**	**Sample Course Titles**	**Notes**
Energy-Mechanics	Motion, dynamics, and gravity		See General Notes below
Energy-Heat	Mechanical equivalence, temperature and thermal energy, transfer mechanisms, or effects on materials		See General Notes below
Energy-Electricity/Magnetism	Static electricity and DC circuits and magnetism		See General Notes below
Wave Motion	Reflections, vibrations in matter (sound), electromagnetic radiation, or optics including geometric ray diagrams		See General Notes below
Atomic & Nuclear	Common subatomic particles, strong and weak interactions, or effects of ionizing radiation	Modern Physics	See General Notes below

Physics General Notes: One year or three quarters of general physics course work will meet all of the component areas. To meet the unit requirement we will accept up to 50% of the total required units from related subject areas, i.e. Engineering.