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ABSTRACT

This curriculum guide, developed to establish statewide curriculum standards for the Louisiana Competency-based Education Program, contains the minimum competencies and process skills that should be included in a general science course. It consists of: (1) a rationale for an effective science program; (2) a list and description of four major goals of science; (3) a list and description of eight basic process skills (such as predicting and classifying) and five integrated processes (such as controlling variables and defining operationally); and (4) a curriculum outline organized into nine major subject areas. For each of these areas performance objectives and corresponding concepts, process skills, and suggested activities are given. The areas are: measurement; earth science; astronomy; biological sciences; energy; chemistry; ecology; space science; and technology (focusing on social implications and careers). A list of audiovisual suppliers and brief comments on evaluation techniques are also provided. (JN)

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STATE OF LOUISIANA
DEPARTMENT OF EDUCATION

GENERAL SCIENCE CURRICULUM GUIDE

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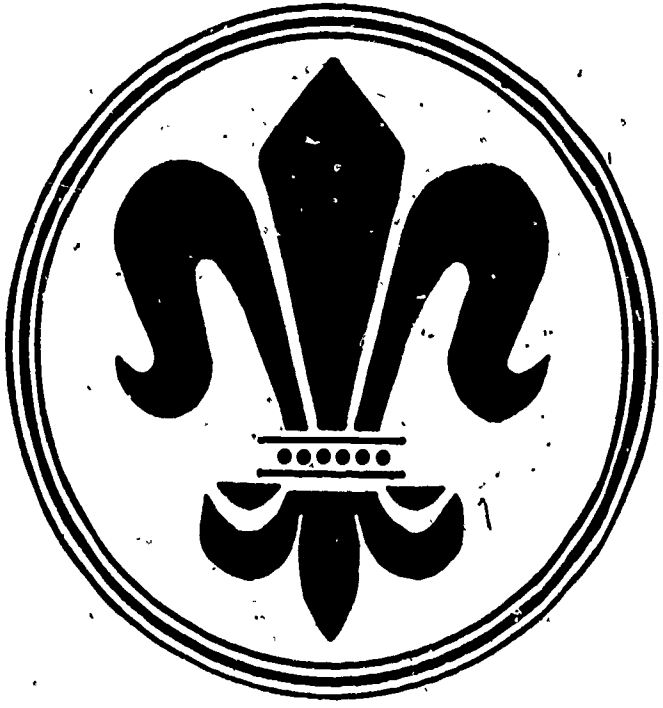

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Superintendent

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STATE OF LOUISIANA

DEPARTMENT OF EDUCATION

GENERAL SCIENCE CURRICULUM GUIDE

BULLETIN 1645

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Issued by

Office of Academic Programs

THOMAS G. CLAUSEN, Ph.D.

Superintendent

FOREWORD

Act 750 of the 1979 Louisiana Legislature (R.S. 17:24.4) established the Louisiana Competency-Based Education Program. One of the most important provisions of Act 750 is the mandated development and establishment of statewide curriculum standards for required subjects. These curriculum standards include curriculum guides which contain minimum skills, suggested activities, and suggested materials of instruction.

During the 1979-80 school year, curriculum guides were developed by advisory and writing committees representing all levels of professional education and all geographic areas across the State of Louisiana for the following Science courses: Elementary K-6, Life Science, Earth Science, Physical Science, General Science, Biology, Chemistry, and Physics.

During the 1982-83 school year, the curriculum guides were piloted by teachers in school systems representing the different geographic areas of the State as well as urban, suburban, inner-city, and rural schools. The standard populations involved in the piloting reflect also the ethnic composition of Louisiana's student population. Based upon participants' recommendations at the close of the 1982-83 pilot study, the curriculum guides were revised to ensure that they are usable, appropriate, accurate, comprehensive, relevant, and clear.

Following the mandate of Act 750, the revised curriculum guides will be implemented statewide in the 1984-85 school year. The statewide implementation is not, however, the end of the curricular development process. A continuing procedure for revising and improving curricular materials has been instituted to ensure that Louisiana students have an exemplary curriculum available to them--a curriculum that is current, relevant, and comprehensive. Such a curriculum is essential if we are to provide the best possible educational opportunities for each student in the public schools of Louisiana.

Thomas G. Clausen, Ph.D.

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PREFACE

The General Science Curriculum Guide contains the minimum competencies and process skills that should be included in a General Science course. Each teacher should build on the foundation of these minimum competencies to establish the maximum program possible for his/her students. The teacher must take special care to incorporate all skills contained in this guide within the framework of his/her instructional program. The guide is flexible enough to be adapted to most of the commercial basal programs; and teachers may adjust the sequence of content based on the needs of their students, the available equipment, and the textbooks.

The guide contains suggested activities designed to assist the teacher in teaching each competency; however, the teacher and the students should not be limited to these activities nor bound to use all of them. There are many other activities available to the teacher which will help him/her to present each competency and process skill to the student. It is hoped that the teacher will be resourceful in using many types of experiences to teach the topics listed.

Methods of science instruction, to be most effective, must be based upon the development of process skills in critical thinking. An effort has been made to incorporate numerous process skills in the suggested activities, and the teacher should use as many of these skills as possible in daily instruction.

This curriculum guide should be of special benefit to the teacher in helping to organize the General Science course. It is suggested that additional textbooks, workbooks, and laboratory manuals be consulted for activities, demonstrations, and experiments to supplement those described in this curriculum guide.

RATIONALE

Developments in science technology have improved our way of living and have become a major influence on our culture. No one in our culture escapes the direct influence of science. Because of the impact of science on our social, economic, and political institutions, the education of every responsible citizen must include not only the basic principles of science but also the attitudes and processes of scientific thought.

The nature of science itself determines the way that it should be taught. The definition of science is a two-fold one: It is (1) an unending method or process of seeking new knowledge, and (2) the body of knowledge which results from this search. Science is an intellectual, active process which involves an investigator of any age and something to investigate. The discipline of science taught by the process approach teaches the student how to learn, and that intellectual gain is a permanent one for the student.

The process approach develops the intellectual abilities of students. Some students develop thinking skills in the normal course of growing up in a complex world, but the acquisition of useful skills and attitudes is by no means automatic. Many students succeed in school by repeating what they are told in a slightly different form or by memorizing; such strategies are of little extended value. At present, relatively few students develop persistence in and zest for dealing with new concepts because they are not aware of their intellectual capabilities. Thus, they need literally to experience application of scientific process skills in different situations.

To be most effective, methods of science instruction must be based upon the development of skills in critical thinking. Guided practice in experimenting, observing, gathering information, organizing facts, and drawing conclusions will help to develop critical thinking skills. Laboratory techniques should be employed whenever possible, and inquiry teaching/learning situations using both deductive and inductive reasoning should be the predominant method used in all classroom activities. The teacher's role in a process-oriented science classroom includes being a provider of problems, a discussion leader, a supplier of clues (when necessary), and a skillful questioner, i.e., a facilitator of learning activities. Thus, the aim of an effective science program should be to equip each child with competencies in the basic processes and concepts of science through individual participation in activities and investigations specifically designed to develop such capabilities.

GOALS

Achieving scientific literacy involves the development of attitudes, process skills, concepts, and social aspects of science and technology. Based upon this belief, the following major goals of science are stated:

1. To Foster Positive Attitudes Toward the Scientific Process

   Students will develop a deep appreciation of the role the scientific process plays in their everyday lives.

2. To Develop Process Skills

   Process skills development should be an integral part of science activities for students. Students should be given opportunities to develop those intellectual processes of inquiry and thought by which scientific phenomena are explained, measured, predicted, organized, and communicated.

   Basic Process Skills: Observing, inferring, classifying, using numbers, measuring, using space-time relationships, communicating, predicting.

   Integrated Process Skills: Controlling variables, defining operationally, formulating hypotheses, interpreting data, experimenting.

3. To Acquire Knowledge

   Included in the basic science curriculum should be those scientific facts, principles, concepts, and terms which will enable the students to understand and interpret natural phenomena.

   Areas of Knowledge: Life Science, Physical Science, Earth Science

4. To Recognize Social Aspects of Science and Technology

   The students should (a) understand the interrelationships of science, technology, and social and economic development; and (b) recognize both the limitations and the usefulness of science and technology in advancing human welfare.

PROCESS SKILLS

Eight basic science process skills are stressed: (1) observing, (2) inferring, (3) classifying, (4) using numbers, (5) measuring, (6) using space/time relationships, (7) communicating, and (8) predicting. There is a progressive intellectual development within each process category. A brief description of each basic process skill follows:

OBSERVING: To observe is to use one or more of the five senses to perceive properties of objects or events as they are. Statements about observations should be (1) quantitative where possible, (2) descriptive regarding change(s) and rates of change(s), and (3) free of interpretations, assumptions, or inferences.

INFERRING: To infer is to explain or to interpret an observation. Inferences are statements which go beyond the evidence and attempt to interpret or to explain one or more observations. Inferences are based on (1) observations, (2) reasoning, and (3) past experiences of the observer. Inferences require evaluations and judgments, and they may or may not be accurate interpretations or explanations of the observation.

CLASSIFYING: Classifying is the grouping or ordering of phenomena according to an established scheme. Objects and events may be classified on the basis of observations. Classification schemes are based on observable similarities and differences in arbitrarily selected properties. Classification keys are used to place items within a scheme as well as to retrieve information from a scheme.

USING NUMBERS: To use numbers is to describe the measurement, properties, and relationships of quantities through the use of symbols.

MEASURING: To measure is to find out the extent, size, quantity, capacity, and other properties of a given object, especially by comparison with a standard. Once the concept of measuring is introduced and mastered in first grade, the metric and/or SI system should be used exclusively.

USING SPACE/TIME RELATIONSHIPS: Space/Time relationships is the process that develops skills in the description of spatial relationships and how they change with time. This process skill includes the study of shapes, time, direction, spatial arrangement, symmetry, motion, and rate of change.

COMMUNICATING: To communicate is to pass information along from one person to another. Communications may be verbal, nonverbal (i.e., gestures), written, or pictorial (pictures, maps, charts, and graphs). Communications should be concise, accurate, clear, precise descriptions of what is perceived.

PREDICTING: Predicting is forecasting what future observations might be; it is closely related to observing, inferring, and classifying. The reliability of predictions depends upon the accuracy of past and present observations and upon the nature of the event being predicted.

As basic progressive, intellectual development proceeds in each basic process skill, the interrelated nature of the processes is manifested in the five integrated processes: (1) controlling variables, (2) defining operationally, (3) formulating hypotheses, (4) interpreting data, and (5) experimenting. A brief description of each integrated process skill follows:

CONTROLLING VARIABLES: A variable is any factor in a situation that may change or vary. Investigators in science and other disciplines try to determine what variables influence the behavior of a system by manipulating one variable, called the manipulated (independent) variable, and measuring its effect on another variable, called the responding (dependent) variable. As this is done, all other variables are held constant. If there is a change in only one variable and an effect is produced on another variable, then the investigator can conclude that the effect has been brought about by the changes in the manipulated variable. If more than one variable changes, there can be no certainty at all about which of the changing variables causes the effect on the responding variable.

DEFINING OPERATIONALLY: To define operationally is to choose a procedure for measuring a variable. In a scientific investigation, measurements of the variables are made; however, the investigator must decide how to measure each variable. An operational definition of a variable is a definition determined by the investigator for the purpose of measuring the variable during an investigation; thus, different operational definitions of the same variable may be used by different investigators.

FORMULATING HYPOTHESES: To formulate a hypothesis is to make a guess about the relationships between variables. A hypothesis is usually stated before any sensible investigation or experiment is performed because the hypothesis provides guidance to an investigator about the data to collect. A hypothesis is an expression of what the investigator thinks will be the effect of the manipulated variable on the responding variable. A workable hypothesis is stated in such a way that, upon testing, its credibility can be established.

INTERPRETING DATA: The process of interpreting data may include many behaviors such as (1) recording data in a table, (2) constructing bar and line graphs, (3) making and interpreting frequency distributions, (4) determining the median, mode, mean, and range of a set of data, (5) using slope or analytical equations to interpret graphs, and (6) constructing number sentences describing relationships between two variables. Interpreting data requires going beyond the use of skills of tabulating, charting, and graphing to ask questions about the data which lead to the construction of inferences and hypotheses and the collecting of new data to test these inferences and hypotheses. Interpretations are always subject to revision in the light of new or more refined data.

EXPERIMENTING: (Using the scientific method): Experimenting is the process of designing a procedure that incorporates both the basic and integrated process skills. An experiment may begin as a question for the purpose of testing a hypothesis. The basic components of experimenting are as follows:

1. Constructing a hypothesis based on a set of data collected by the person from observations and/or inferences.

2. Performing a test of the hypothesis. The variables must be identified and controlled as much as possible. Data must be collected and recorded.

3. Describing or interpreting how the data support or do not support the hypothesis, i.e., deciding whether the hypothesis is to be accepted, modified, or rejected.

4. Constructing a revised hypothesis if the data do not support the original hypothesis.

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IX. Technology
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COMPETENCY/PERFORMANCE OBJECTIVE	CONCEPT	PROCESS SKILLS	SUGGESTED ACTIVITY
I. INTRODUCTION The student will be able to:			
1. Apply the main process of the scientific method (i.e., problem, hypothesis, experimentation, conclusion)	Scientific method	Observing, formulating hypotheses	Mystery box - place a few objects in a sealed box. Determine characteristics without direct observations.
2. Identify and demonstrate the use of simple laboratory equipment and basic safety procedures	Laboratory techniques and safety	Observing	Slides and filmstrip on laboratory equipment and safety
3. Identify and apply the units of metric measurement (i.e., length volume, and mass).	Measurement	Measuring, using numbers interpreting data	1. Measure regularly shaped objects with a metric ruler. 2. Measure the volume of an irregularly shaped object by displacement. 3. Use a beam balance to determine mass of various objects.
4. Define density.	Density	Defining operationally	1. Measure mass and volume/calculate density of regularly shaped and irregularly shaped objects. 2. Make liquid density column with cooking oil, glycerine, alcohol, and water. 3. Use two beakers - Place water in one and alcohol in the other. Test ice cube, cork, metal cube and paper clip in each beaker. Observe results.
5. Distinguish between the Fahrenheit and Celsius scales.	Temperature	Measuring	1. Use thermometers to measure temperature. 2. Convert Fahrenheit to Celsius.
6. Distinguish between the boiling and freezing points of water on the Fahrenheit and Celsius scales.	Temperature	Measuring, interpreting, using numbers	Use a thermometer to determine the freezing and boiling points of ice and steam.

COMPETENCY/PERFORMANCE OBJECTIVE	CONCEPT	PROCESS SKILLS	SUGGESTED ACTIVITY
II. EARTH			
7. Identify patterns of change in nature to predict the future and reconstruct the past.	Investigation	Predicting	1. Observe weathering on building. 2. Collect data on sunspot activities for the past 20 years; graph to see patterns. 3. Use free almanac to look for weather patterns.
8. Dramatize energy exchange in the atmosphere through the study of weather concepts of temperature, air pressure, humidity, and cloud formation.	Weather	Interpreting data, using space/time relationships	1. Construct simple weather instruments and chart the weather for a week. 2. Study the layers of the atmosphere. Display a poster showing the order of the layers and their relative ranges. Discuss distinctive characteristics of the areas and the kinds of incidents that might cause change. 3. Visit a local weather bureau. 4. Collect the weather information from TV, radio, and newspaper and use these to predict weather patterns. 5. Present students with hypothetical weather maps and conditions and have them draw and explain them. 6. Depending on locality and availability, hurricane tracking charts can be used to track storms.
9. Analyze the effect of water movement and weathering on the earth's surface.	Movement of water	Controlling variables, using space/time relationships.	1. Study the factors that cause soil erosion, such as wind, fire, and water, as well as human misuse of the land. Students should be able to suggest different methods of preventing soil erosion.

COMPETENCY/PERFORMANCE OBJECTIVE	CONCEPT	PROCESS SKILLS	SUGGESTED ACTIVITY
			2. Set up experiments or models illustrating erosion prevention. 3. Student groups make small stream table by titling a large flat aluminum pan filled with soil. Allow water to flow through to observe the action of the water. 4. Observe rain runoff and relate it to the three main water functions (erosion, transportation, and deposition). 5. Drop multisized particles into a tall jar of water to observe layered bedding of stream deposition.
10. Explore causes and effects of ocean salinity.	Salinity	Communicating, experimenting	1. Collect water poured through a salt-sand mixture. Evaporate the salt. 2. Use two tall jar half full of water. Make two different colored salinity solutions; pour in separately, while timing the rate of fall of each to show that both sink, but the denser solution falls faster.
11. Identify patterns of water movements in oceans, including currents, waves, and tides.	Ocean circulation	Predicting, using numbers	1. Observe the movement of cold, dyed water in a pan of hot water. 2. Blow across the top of the water to show coriolis effect. 3. Rotate a pan of water to show coriolis effect. 4. Boil a beaker of water with black pepper or sawdust to show water circulation. 5. Use rope or slinky to observe wave motion.

COMPETENCY/PERFORMANCE OBJECTIVE	CONCEPT	PROCESS SKILLS	SUGGESTED ACTIVITY
			6. Graph a series of tides from a tide table. These can be obtained from weather reports depending on locality.
12. Name the three basic types of rocks and tell how they are formed by the rock cycle. A. Igneous B. Sedimentary C. Metamorphic	Rock cycle	Communicating	1. Examine various rocks and identify igneous, sedimentary, and metamorphic types. 2. Examine whole and crushed rock to note rocks are made of different minerals.
13. Demonstrate the basic points of reference of longitude and latitude.	Longitude and latitude	Defining operationally	1. Use globe or flat map to visualize latitude and longitude. 2. Correlate latitude and longitude and longitude to distances.
14. Locate specific locations on a map/globe and define rotation.	Maps	Defining operationally	1. Locate specific points on globes and maps. 2. Use globe and flashlight to show sweep of sunlight across the earth.
15. Identify the various time zones and their purpose.	Time zones	Using space/ time relationships	1. Examine a chart of the United States' time zones and compare. 2. Have students use TV programs and sports events to explain time zones.
III. ASTRONOMY			
16. Recognize that the Earth is one of the nine planets orbiting the sun.	Solar system	Inferring	1. Teacher presentation: films and filmstrip 2. Construct or draw a model of the solar system.
17. Identify the sun as a major source of the earth's energy.	Solar energy	Observing, experimenting	1. Use a radiometer. 2. Take two plants; place one in the sun and one in the dark. Observe results.

COMPETENCY/PERFORMANCE OBJECTIVE	CONCEPT	PROCESS SKILLS	SUGGESTED ACTIVITY
			3. Investigate current projects and uses of solar energy along with the advantages and disadvantages of each. 4. Observe temperature differences in direct sunlight and shade. 5. Ignite floating paper boats with magnifying glass.
18. Identify the solar system's relationship to the universe.	Universe	Using space/time relationships ships	1. Talk about planets and constellations. Students can learn the location of some formations and the shape they take. Consult an almanac to see which seasonal constellations can be seen on a forthcoming date. Visit a planetarium. 2. Use a tripenese planetarium. 3. Use zodiac constellations as references.
IV. BIOLOGICAL			
19. Demonstrate the proper procedure for preparing slides and using the microscope.	Laboratory techniques	Observing, experimenting	1. Locate and give functions and parts of the microscope. 2. Have students prepare wet mounts.
20. Generalize the characteristics of living things: A. Respiration B. Movement C. Reproduction D. Response to change E. Growth F. Utilization of food	Life processes	Observing, inferring, formulating hypotheses	1. Contrast various living and nonliving things as to their characteristic properties. 2. Discuss how various organisms respire. 3. Contrast size and weight due to water absorption of seeds versus pebbles. 4. Compare your present height and mass with birth measurements. 5. Construct a bar graph of class results from data in No. 4. 6. Germinate seeds.

COMPETENCY/PERFORMANCE OBJECTIVE	CONCEPT	PROCESS SKILLS	SUGGESTED ACTIVITY
21. Identify the nucleus and cytoplasm as the main parts of the cell and understand their functions.	Cell structure	Observing	1. Examine under the microscope various prepared slides of cells or student cheek cells. 2. Construct or draw and label a model of a cell.
22. Distinguish between plant and animal cells.	Cell structure	Inferring	Examine and compare plant and animal cells using prepared slides or cheek cells and onion skin with a microscope.
23. Identify the levels of cellular organization.	Levels of organization	Defining operationally	Use a plant or pictoral representation to show development from cells to tissue to organs to systems.
24. Distinguish between the three kingdoms* on the basis of physical characteristics. *(Some texts may use four or five kingdoms.)	Classification	Classifying	1. Compare a living plant to a goldfish or frog, fungus, and various protists. 2. Set up an aquarium. 3. Set up a vivarium with animals and plants.
25. Describe the basic functions of the 10 human body systems: digestive, circulatory, excretory, respiratory, reproductive, skeletal, muscular, skin, nerve, and endocrine.	Body systems	Classifying	1. Make up a set of cards on systems and functions. Match system with function. 2. Have students color in and label various illustrations of different systems.
26. Create a basic health plan for maintaining a healthy body.	Body maintenance	Inferring, measuring	1. Keep a chart of your personal diet for a day/week. Evaluate as to nutrition and calorie count. 2. Bring in articles related to a healthy body. 3. Bring in and discuss/evaluate articles and ads on health products.

COMPETENCY/PERFORMANCE OBJECTIVE	CONCEPT	PROCESS SKILLS	SUGGESTED ACTIVITY
V. ENERGY			
27. Define energy in its states and forms.	Energy	Defining operationally	Demonstrate simple forms of energy (thermal, chemical, electromagnetic, sound, mechanical, nuclear).
28. Describe how heat energy is transferred, measured, and utilized. a. transfer: conduction convention radiation b. measurement: calorie B.T.U. c. utilization: home industry	Heat energy	Experimenting, measuring, using numbers, communicating	1. Use light bulbs, silver and and black cans, and thermometers to measure heat absorption as affected by colors and/or distance. 2. Use styrofoam cups with covers, U-shaped metal bar, two thermometers, hot and cold water to show conduction. 3. Use bimetallic strip. 4. Use a calorimeter to measure heat content of common substances. 5. Contact local utilities for information on heat pumps, heat loss from homes, and insulation.
29. Demonstrate properties of light: A. Reflection B. Refraction C. Spectrum D. Path	Light	Experimenting, observing, inferring	1. Use simple radiometer. 2. Demonstrate how light travels in a straight line by aligning holes in several pieces of cardboard. 3. Use plane and curved mirrors to demonstrate reflection. 4. Use a simple prism. 5. Demonstrate a color spectrum.
30. Identify relationship between electricity and magnetism.	Electricity	Inferring	1. Construct a series and parallel circuit. 2. Use a compass to show magnetic effect on electric current. 3. Construct a simple voltaic cell.

COMPETENCY/PERFORMANCE OBJECTIVE	CONCEPT	PROCESS SKILLS	SUGGESTED ACTIVITY
			4. Make a simple electromagnet. 5. Construct/demonstrate electric motor or generator. 6. Investigate how electricity is generated in your community. If possible, arrange a field trip to a power plant or whatever power source serves your area. 7. Provided the basic material to build an electrical circuit (battery, light bulb, wire), allow the students to set up different patterns of electrical connections to complete a circuit. The bulb will light up if the circuit is completed.
31. Define Ohms, amperes, volts, and watts as unit measurements of electricity.	Measuring and recording electrical units	Measuring, using numbers	1. Use various available instruments which measure electrical units. 2. Relate Ohm's Law to a closed water system using a pipe as a wire, water as a current and a person standing on the pipe as a resistance.
32. Identify sound production and properties with simple devices.	Sound	Experimenting	1. Obtain an instrument to measure noise, voices, telephone ringing, machines and cars running, or the overall noise levels in sections of the school or neighborhood. Compare noise levels. 2. Using a cylinder, attach a membrane and small mirror to one end. Reflect light onto the other end; vibrations on the membrane cause the light to flicker. 3. Construct a test tube xylophone. 4. Place a vibrating tuning fork in H_2O.

COMPETENCY/PERFORMANCE OBJECTIVE	CONCEPT	PROCESS SKILLS	SUGGESTED ACTIVITY
33. Define force, work, speed, and acceleration. Distinguish between kinetic and potential energy.	Force, work, kinetic and potential energy	Defining operationally	1. Roll a ball down the center of a ruler which acts as an inclined plane. Use a stop watch to determine time. Calculate the speed and acceleration of the ball. 2. Demonstrate force and work using common illustrations.
34. Distinguish cause and effect relationship with simple machines.	Simple machine	Controlling variables	1. Construct and operate different types of simple machines. 2. Calculate the mechanical advantage of simple machines.
35. Define nuclear energy.	Nuclear energy	Inferring	1. Use available printed material and filmstrips from the Nuclear Regulatory Commission. 2. Obtain materials from Local Power Companies.
36. Distinguish between fission and fusion; also among alpha, beta, and gamma rays.	Nuclear energy	Inferring	Use balls and mousetraps to illustrate chain reactions and fission.
37. Identify methods of detecting and shielding from nuclear energy.	Nuclear energy	Experimenting, communicating	If a Geiger counter is available or can be borrowed, use it to measure the level of radiation around the school grounds and in the surrounding neighborhood. Record all readings and compare the results. Note where the highest readings occurred and what factors seemed to be to be involved. Information for this activity can be obtain from: Office of Emergency Preparedness Post Office Box 66536 Baton Rouge, La. 70896 Phone: 504-342-5470

COMPETENCY/PERFORMANCE OBJECTIVE	CONCEPT	PROCESS SKILLS	SUGGESTED ACTIVITY
38. Compare nuclear energy's positive and negative effects on living things.	Nuclear energy	Formulating hypothesis, inferring, predicting	Explore legislative mandates and regulations and discuss the industrial and environmental effects.
VI. CHEMISTRY			
39. Define matter.	Matter	Inferring	1. "Empty" bottle experiment--Use a wide mouth bottle with a one-hole stopper and funnel. Pour colored water into the funnel to show that air is matter. Repeat using a two-hole stopper and funnel. 2. Try to get liquid out of a can with one small hole.
40. Distinguish among states of matter (solid, liquid, gas).	States of matter	Defining operationally	Collect matter in different states. Use water to demonstrate change of state.
41. Categorize matter into elements, compounds, and mixtures.	Classification of matter	Classifying	Collect and classify various items into elements, compounds, and mixtures.
42. Identify common elements by means of symbols (O, H, C, Na, Cl, Fe, I, N, Pb, S, U) on the periodic chart.	Elements and symbols	Observing	1. Construct models of elements. 2. Make a home inventory of common objects to identify common elements. 3. Assemble flashcards of the most common elements with their appropriate symbols.
43. Identify common compounds by means of chemical formulas (H_2O, Nacl, CO_2, CO, Fe_2O_3, H_2SO_4, CH_4, NaOH).	Compounds and formulas	Observing	1. Construct models of compounds. 2. Make a home inventory of common substances to identify compounds and their constituent elements. 3. Prepare and separate mixtures and compounds.

COMPETENCY/PERFORMANCE OBJECTIVE	CONCEPT	PROCESS SKILLS	SUGGESTED ACTIVITY
44. Name and describe the two structural parts of atoms and three main particles (nucleus and energy levels and protons, neutrons, and electrons).	Atomic structure	Formulating hypotheses	Draw a Bohr model of an atom.
45. Recognize simple physical and chemical changes.	Changes in matter	Observing, classifying	1. Melt ice. 2. Dissolve and recover sugar or salt in water. 3. Burn wood or paper. 4. Combine an acid and a metal. 5. Observe the rusting of steel wool.
VII. ECOLOGY			
46. Define ecology, biosphere, and levels of organization of a community.	Ecology	Inferring, observing	1. Make a hay infusion. 2. Schedule field trips to local nature areas. 3. Study various food webs, chains, and cycles.
47. Determine man's impact on his environment.	Ecology	Predicting, formulating hypotheses	1. Collect news articles on environmental problems. 2. Explore legislative mandates and discuss industrial impact. 3. Use speakers from local environmental agencies. 4. Develop a personal plan to prevent misuse of the environment.
VIII. SPACE SCIENCE			
48. Assess the programs of applied science since the launching of the first satellite.	Scientific progress/ change	Observing	Research and presentation of technological advances in the last 25 years

COMPETENCY/PERFORMANCE OBJECTIVE	CONCEPT	PROCESS SKILLS	SUGGESTED ACTIVITY
49. Evaluate the United States' space program and its benefits to mankind.	Space exploration	Communicating, interpreting data	1. Use current films and filmstrips. 2. Research and debate the space program (pros-cons). 3. Research a prepared list of benefits. 4. Use NASA as a primary resource.
IX. TECHNOLOGY			
50. Compare the changes that have occurred in the quality of living because of technology, e.g.: Communication Transportation Advances in the home environment Medicine Food production Computers and microcomputers NOTE: This area should be incorporated into each topic covered throughout the year.	Scientific progress	Inferring	1. Consult reader's guide to current periodicals about new developments in applied technology. 2. Have students survey own home/school and determine the effects brought about by technology. 3. Survey different types of microcomputers.
51. Identify various career opportunities in science and related fields. (optional)	Careers	Observing, investigating	Consult government agencies investigating for information regarding career opportunities.

REFERENCE MATERIAL

Textbook Reference List:

1. Agresta, J.; Ochs, D.; Sulcoski, J.; and Swartney, J. General Science. Morristown, New Jersey: Silver Burdett, 1981.

2. Burkman, E.; Darrow, S.; Redfield, D.; and Synder, W. The Natural World. Morristown, New Jersey: Silver Burdett, 1981.

3. Heimber, C., and Neal, C. Principles of Science. Columbus: Chas. E. Merrill, 1979.

4. Oxenhorn, J. Pathways in Science Series. New York: Globe, 1982.

5. Ramsey, W., et al. Holt General Science. New York: Holt, 1983.

6. Smallwood, W., and Brown, C. General Science: For Tomorrow's World. New York: Webster, 1980.

AUDIOVISUAL SUPPLIERS

The audiovisual materials suggested in the curriculum guide can be obtained from the following suppliers:

Association Instructional Materials
347 Madison Avenue (Department DC)
New York, New York 10017

BFA-Ealing Corporation
2211 Michigan Avenue
Post Office Box 1795
Santa Monica, California 90406

BFA-Educational Media
2211 Michigan Avenue
Post Office Box 1795
Santa Monica, California 90406

Beckman Instruments Inc.
Attention: New Dimensions
2500 Harbor Boulevard
Fullerton, California 92634

Coronet Films
65 East South Water Street
Chicago, Illinois 60601

Education Audio-Visual Inc.
Pleasantville, New York 10570

Encyclopaedia Britannica
Educational Corp.
425 North Michigan Avenue
Chicago, Illinois 60611

Inquiry Audio Visuals
1754 West Farragut Avenue
Chicago, Illinois 60640

International Communication Films
1371 Reynolds Avenue
Santa Ana, California 92705

John Wiley and Sons, Inc.
605 Third Avenue
New York, New York 10016

Kalmia
Department C1
Concord, Massachusetts 01742

Lansford Publishing Co.
Post Office Box 8711
1088 Lincoln Avenue
San Jose, California 95155

McGraw-Hill Films
CRM/McGraw-Hill
110 15th Street
Del Mar, California 92014

Modern Learning Aids
1212 Avenue of the Americas
New York, New York 10036

Harper and Row Media
10 East 53rd Street
New York, New York 10022

Holt, Rinehart, and Winston, Inc.
383 Madison Avenue
New York, New York 10017

Indiana University
Audio-Visual Center
Office for Learning Resources
Bloomington, Indiana 47401

Prentice Hall Media
Servode HC236.
150 White Plains Road
Terrytown, New York 10591

Scholarly Audio-Visuals Inc.
5 Beekman Street
New York, New York 10038

Science Software Systems Inc.
11899 West Pico Boulevard
West Los Angeles, California 90064

Shell Oil Film Library
1433 Sadlier Circle W. Drive
Indianapolis, Indiana 46239

Modern Talking Picture Service
2323 New Hyde Park Road
New Hyde Park, New York 11040

Peter M. Robeck and Company
230 Park Avenue
New York, New York, 10017

James J. Ruhl and Association
Post Office Box 4301
Fullerton, California 92631

Thorne Films
1229 University Avenue
Boulder, Colorado 80302

Universal Education and Visual Arts
100 Universal City Plaza
Universal City, California 91608

Westwood Educational Productions
701 Westport Road
Kansas City, Missouri 64111

Sutherland Educational Films
201 North Occidental Boulevard
Los Angeles, California 90026

Since these materials vary from quite simple to complex, teachers are urged to preview materials before presenting them to the class.

EVALUATION TECHNIQUES

Methods for evaluating pupils' achievement and progress are an integral part of the instructional program. Evaluation techniques must reflect (1) the objectives to be reached, and (2) the activities employed to reach those objectives. Since the objectives are stated clearly, the method of evaluation is indicated within the objective. The objectives are stated in behavioral terms, the process skills are identified, and suggested activities are listed. Thus, it is clear what the student is expected to be able to do after successful completion of a learning activity. The successful attainment of an objective can be demonstrated by having the student do specific things which can be observed.

Therefore, evaluation should consist of more than just paper and pencil tests on recall of factual knowledge. A variety of evaluation activities should be used.