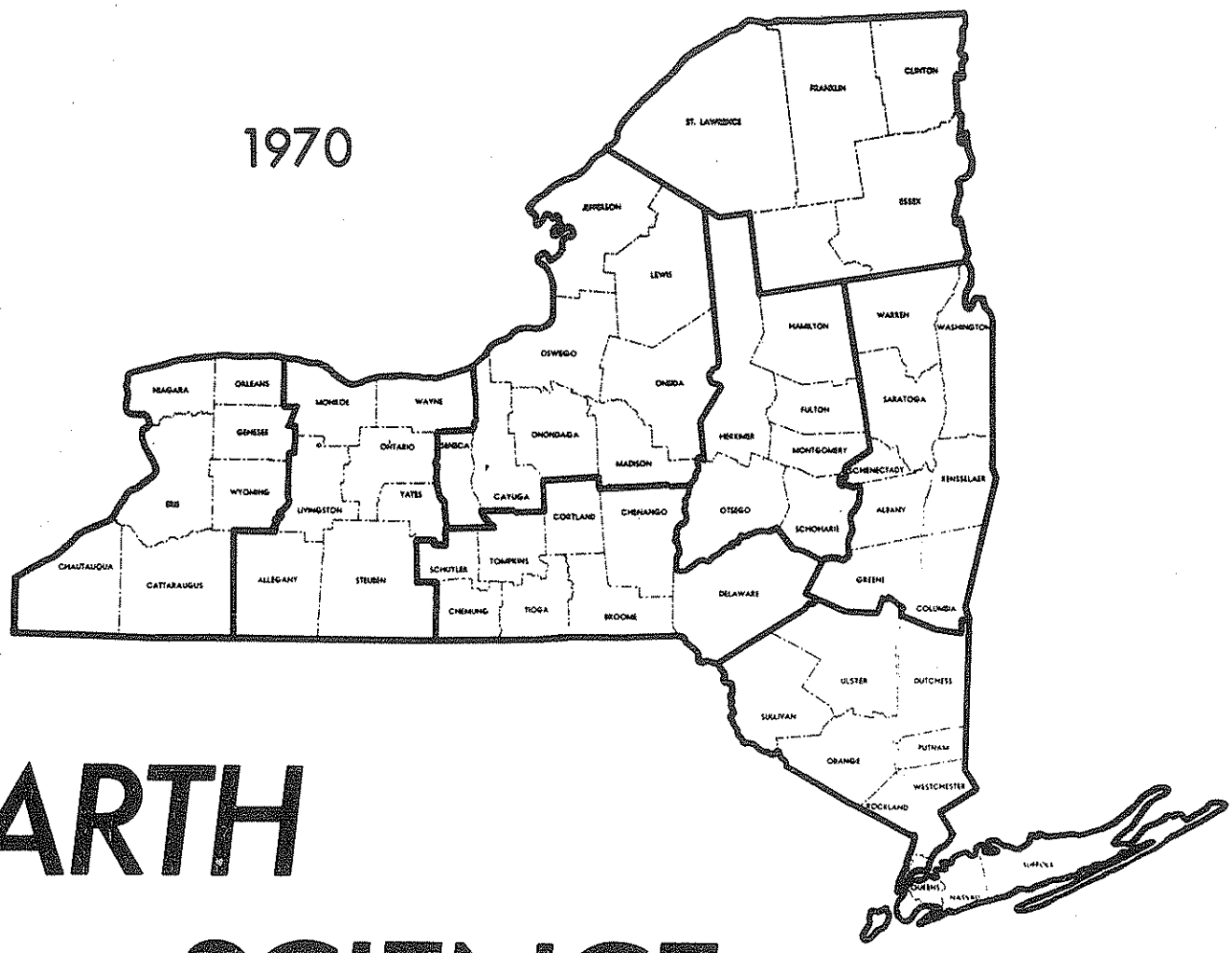
SPECIAL EDITION

1970



EARTH SCIENCE SYLLABUS

The University of the State of New York
THE STATE EDUCATION DEPARTMENT
Bureau of Secondary Curriculum Development
Albany, New York 12224

INVESTIGATIONS INVENTORY

(An asterisk indicates investigations that must have special reference materials ordered in advance. Check the "MATERIALS:" listing for these labs for specific items)

— I-A-1a Shoebox Observations
— I-A-1b Puddle Observations
— I-A-2a Classification
— I-B-1a Density
— I-B-1b Variable Density of Water
—
—
—

— *LTI #1 Weather Long-Term Investigation
— *LTI #2 Earthquake Long-Term Investigation
— LTI #3 Sun's Patch Watch
— LTI #4 Air pollution Long-Term Investigation
— LTI #5 - #19
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—
—

— FE #1 School Building and Grounds
— FE #2 Pit
— FE #3 Stream
— *FE #4 Cemetery
— *FE #5 Beach
—
—
—

— II-A-1a Sunspot Analysis
— II-C-1a Roadside Pollutants
— II-C-1b Air Pollution - Human Mortality
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— III-A-1a Earth's Shape
— III-A-2a Earth's Circumference
— III-A-2b Roundness and Smoothness
— III-A-3a Ocean Bottom Profile
— III-B-1a Locating Positions
— III-B-2a Temperature Field
— III-B-2b Contour Mapping
— *III-B-2c Earth's Magnetic Field
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— IV-A-1a Celestial Observations
— IV-A-1b Moon's Path
— IV-A-1c Sun's Path Analysis
— IV-D-1a Planet Phases
— IV-C-1b Heliocentric and Geocentric Models
— IV-D-1c Solar Diameter
— IV-D-2a Orbits
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— V-A-1a Electromagnetic Spectrum
— V-A-2a Heat Transfer
— V-B-1a Changes in State
— V-B-1b Energy Absorption
— V-C-1a Specific Heat
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— VI-A-1b Solar Altitude Observations
— VI-A-1c Duration of Insolation
— VI-A-1d Land Water Temperatures
— VI-B-1a Terrestrial Radiation
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— *VII-A-1a Weather Watch Analysis
— *VII-B-1a The Synoptic Weather Map
— VII-C-1a Evaporation
— VII-C-1b Vapor Pressure
— VII-C-3a Adiabatic Cooling and Cloud Formation
— VII-C-3b Dew Point-Cumulus Cloud Formation
— VII-C-4a Air-Water Interaction
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— VIII-A-1a Soil Water Movement
— VIII-A-3a Stream Pollution
— VIII-A-3b Water Purification
— VIII-B-1a The Local Water Budget
— VIII-B-2a Stream Hydrograph
— VIII-C-1a Climate of an Imaginary Continent
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— IX-A-1a Soil Formation
— IX-A-1b Reaction Rate and Particle Size
— IX-A-1c Rock Abrasion
— IX-B-1a Nature of Sand
— IX-B-2a Stream Flow
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— X-A-1a Deposition of Sediments
— X-A-1b Stream Table
— X-A-1c Density Currents
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— XI-A-1a Rock Properties
— XI-B-2a Properties of Minerals
— XI-B-2b Structure of Minerals
— XI-C-1a Formation of Sedimentary Rocks
— XI-C-2a Formation of Nonsedimentary Rocks
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— *XII-A-1a Evidence of Crustal Movement
— XII-A-2a Earthquake Watch Analysis
— *XII-A-2b James Hall's Field Trip
— XII-A-2c The spreading Sea Floor
— XII-B-2a Location of an Epicenter
— XII-D-1a Field Trip Through the Mountains
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—*XIII-A-1a Geologic History of New York State
—*XIII-A-1b Geology of the Grand Canyon
— XIII-B-1a Footprint Puzzle
— XIII-C-1a Geologic Time Line
— XIII-C-1b Correlating Rock Outcrops
— XIII-C-2a Radioactive Decay
— XIII-C-1a Variation Within A Species
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— *XIV-A-1b Regional Aerial Photo Studies
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— XIV-B-1c Exponential Population Growth
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Special Edition

1970

EARTH SCIENCE SYLLABUS

The University of the State of New York/The State Education Department
Bureau of Secondary Curriculum Development/Albany, New York 12224

THE UNIVERSITY OF THE STATE OF NEW YORK

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F O R E W O R D

Between December 1966 and June 1967, the State Education Department convened several meetings of an Earth Science Syllabus Revision Committee. The purpose of this committee was to develop guidelines that could be used as a basis for revising the New York State earth science program.

The guidelines that were developed by the committee described a philosophy and approach for a new course of study in earth science that would be:

1. student activity oriented - Students should be exposed to a learning environment in which they would be active participants. Laboratory and field experience should be the focal point of this program;
2. investigatory in approach - The learning activities should be oriented toward an inquiry approach, placing the student in the role of investigator;
3. interdisciplinary in content - The course content organization should integrate the traditional earth science subject areas. Emphasis should be placed on the analysis of the environment, and the processes affecting it.

Under the direction of Roger W. Ming, then Associate in the Bureau of Science Education now Supervisor, Education for the Gifted, and through the efforts of a writing team, a format, an outline, and implemental materials evolved which were consistent with the Revision's Committee's initial guidelines.

During the summer of 1967, a first edition of the experimental syllabus was written. A supplement containing suggested learning activities and separate test items for a terminal examination were developed concurrently. During the 1967-68 school year, 75 teachers used the first edition. These teachers were organized into regional centers which held frequent meetings to assemble feedback on the course of study. The centers also provided training for their members and prepared inservice programs for teachers who were not yet using the experimental materials.

During the summer of 1968, second editions of the experimental syllabus and supplement were developed incorporating changes suggested in the feedback from the participating teachers. A second terminal examination was also prepared. During the 1968-69 school year, 110 teachers used the second edition of the syllabus. The regional centers were expanded in number and more specific functions and responsibilities were assumed by the center teachers.

A third edition of the refined syllabus materials and an examination were prepared during the summer of 1969. This edition was tested by 110 teachers in the 1969-70 school year.

The final editions of the new earth science syllabus and supplement were prepared during the summer of 1970.

A total of 155 teachers representing 96 school districts throughout New York State were directly involved in the process of developing and evaluating the new course of study. These, along with others who contributed, are listed on page vi.

The overall project was developed under the general direction of Hugh B. Templeton, Chief, Bureau of Science Education. During the 1967-69 period of development and field-testing, Mr. Ming was mainly responsible for the steps taken that resulted in the extensive involvement of teachers across the State. Robert F. Zimmerman, Associate in Secondary Curriculum, was the curriculum liaison person during the total period.

The final edition of this syllabus was prepared under the direction of Douglas S. Reynolds, Associate in Science Education. A special acknowledgment is made to the leadership role on the writing teams played by W. John Higham, Vestal Central School, and to the special services that his school performed in publishing experimental editions of the syllabus and supplement.

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Chief, Bureau of Secondary Curriculum Development

William E. Young
Director, Curriculum Development Center

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Student Scheduling

Earth science is most frequently offered to selected and able ninth grade students who display an interest in science.

Some schools have found that success in earth science can be achieved by very high ability students in the eighth grade, and by Regents caliber senior high school students. In the 11th or 12th year some students with a strong science interest and high ability that did not have this course in junior high school may elect to enroll in two sciences simultaneously.

Time Requirement

The *minimum* time required for this course is six 45-minute periods per week, although seven periods are recommended. The time allotment should include at least one double period for laboratory work each week.

Laboratory

One of the requirements of this course is that the pupil shall have successfully completed at least 30 periods performing laboratory work, and shall have prepared a written record verifying this work.

State Diploma Credit

This course may be used as one unit of the group II major science sequence or for group III credit as an elective toward a State Diploma.

Changes in Syllabus

Corrections or changes in the syllabus that become necessary will be brought to the attention of school principals by means of supervisory letters from the Department.

Topic Sequence

Recommendations from the participating teachers in the experimental program have resulted in the development of the sequence of topics presented in this syllabus that leads to a successful completion of the course objectives.

Earth Science

INSTRUCTIONAL OBJECTIVES

If the objectives of any course of study are not clearly defined, it will be difficult to evaluate what has been learned. Without such clearly defined objectives, there can be no sound basis for selecting appropriate course content or instructional methods and materials. Clearly defined objectives should provide the student with a means to evaluate his own progress at any time and to help him organize his efforts into relevant activities.

In this syllabus, the focus is upon the identification and formulation of appropriate objectives which have been *behavioralized.* These are classified into two groups: those related to the process of inquiry (PIO's), and those related to subject matter or course content (CCO's). Both groups of objectives have been specifically related to the understandings in each topic.

Process-of-Inquiry Objectives (PIO)

At the completion of the course, the student should be able to:

1. demonstrate the following skills in mathematics:
   a. determine relative error in percent,
   b. use scientific notation correctly,
   c. solve for unknowns in simple algebraic equations (e.g., $D = \frac{M}{V}$)
   d. use proportions in establishing scale,
   e. measure dimensions using metric system and convert from one metric unit to another metric unit;
2. a) read the scales on standard measuring apparatus, such as rulers, protractors, balances, graduated cylinders, barometers, or compasses, to an accuracy of 1/2 of the smallest scale calibration of the apparatus;
   b) demonstrate a degree of precision with standard measuring apparatus by collecting 3 trial measurements that vary no more than $\pm$1/2 of the smallest scale calibrations of the apparatus;
   c) demonstrate an ability to determine map measurements, such as directions, locations, distances, and other quantities designated on special maps, which are appropriate to the limitations of the map;
3. a) devise a classification system that can be used to interpret natural phenomena;
   b) create models that can be used to interpret natural phenomena;
4. list possible sources of error in an investigation when given a description of the data, procedure, and instrumentation;
5. a) collect and organize data;
   b) construct graphs using scales which are appropriate for the data;
   c) extrapolate from and interpolate within a set of data;
   d) interpret models which have been created to represent natural phenomena.

Course-Content Objectives (CCO)

At the completion of the course, the student should be able to identify examples from observations of his environment which illustrate that:

1. Change is universal and results from energy flow across an interface.
2. Mass-energy is conserved as change occurs.
3. The sun is the major source of energy which drives earth systems.
4. Natural systems tend to move toward a state of dynamic equilibrium.
5. Many earth processes reflect cyclical changes.
6. Changes or events reflect interactions between physical, chemical, and biological aspects of an environment, and are described within the frames of reference of space and time.
7. The properties of the environment and the materials of which it is composed indicate how they were formed and how they may change.
8. The study of present environments may be used to predict the future and to explain the past.
9. Data derived from a microenvironment may be used as a guide to the interpretation of a macroenvironment.
10. Observations occur when one or more of the senses are focused on an aspect of the environment.
11. Powers of observation are limited by the senses, and can be extended by the use of instruments.
12. There is a difference between information based on sensory perception and inferences made from these observations

*Mager, R.F. *Preparing Instructional Objectives.* Palo Alto, California. Fearon, 1962, pp. 3-4.

THE EARTH SCIENCE SYLLABUS FORMAT

The format has been designed to facilitate teaching by the investigative method. The materials consist of three publications:

The Syllabus

The main body of the syllabus consists of three columns:

column 1: Topic Outline
column 2: Major Understandings
column 3: Information to Teachers

The Topic Abstract of each topic lists the *Major Behavioral Objectives* that are to be attained as a result of the experiences gained during the topic and provides, in the *Approach*, general information about the topic and its relationship to other topics.

The Topic Outline (column 1) is a statement of the course content in outline form. Each section of a topic begins with the significant *Section Question* which initiates the learning experience. It is intended that the investigations, activities, and discussions for the section will provide the student with the major understandings listed in the section.

The Major Understandings (column 2) consist of concepts related to the section question. It includes concepts that can be derived directly from the suggested activities as well as ideas which would be derived indirectly. It is *not* intended that this column list *all* the understandings which can be related to the question.

The Information to Teachers column contains suggestions for approaching the material within a topic, appropriate cross references to understandings appearing in other topics, and the listing of process-of-inquiry and course-content objectives which relate to the understandings.

The Supplement

The supplement contains the investigations indexed by topic and section, and contains lists of multimedia and other reference materials.

Each set of topic investigations is preceded by the Investigations-Understandings Matrix which is designed to illustrate the relationship of the investigation to the major understandings. It can also be used to relate multimedia materials to the topic.

The descriptions of the student laboratory investigations are presented in two forms:

1. Teacher Laboratory Guide Sheet - provides orientation and approach for teacher use.

2. Student Laboratory Guide Sheet - provides a structured procedure for the student. The sheet can be easily duplicated at the discretion of the teacher.

Some investigations require special maps, charts, diagrams, or other items not readily available elsewhere. These appear on separate pages to facilitate duplication.

Long-Term Investigations (L.T.I.) and Field Experiences (F.E.), have been grouped together in topic II of the supplement even though many of these are used in other topics. The individual activities are listed in a special matrix sheet which shows the topics to which they apply. In addition, each activity is listed in the matrix sheet for the specific topics where the activity applies.

Both types of investigations may be conducted by individual students or with an entire class.

The two categories of investigations are not mutually exclusive. Many of the long-term investigations are intended to be performed in the field, and many of the procedures described in the field experiences may be treated as long-term investigations.

Additional suggestions for the long-term investigations and field experiences appear in topic II of the supplement.

While the investigations have been placed in a "supplement," it should be clearly understood that they are *not* supplementary — *they are essential, and comprise the core of the course.*

The supplement also contains a glossary of some terms which are used throughout the syllabus. It is *not* intended that these terms be memorized by the student. Vocabulary testing *is not* an appropriate activity for this course. The glossary should be used by the student as another reference source. Thus, the teacher can include terminology in discussions or laboratory activities and not feel obligated to "teach" definitions.

The Reference Tables

The reference tables, which are available in quantity, contain useful information such as charts, scales, tables of constants, and graphs, which can be used by the student at any time throughout the year.

It is *not* intended that the information in the table be memorized.

The tables are provided for use on the state-prepared examination and may be used during classroom testing at teacher discretion.

ANNOTATED FORMAT EXAMPLE

Syllabus Pages

The topic question is an indication of the inquiry theme of the entire topic.

Topic title from outline

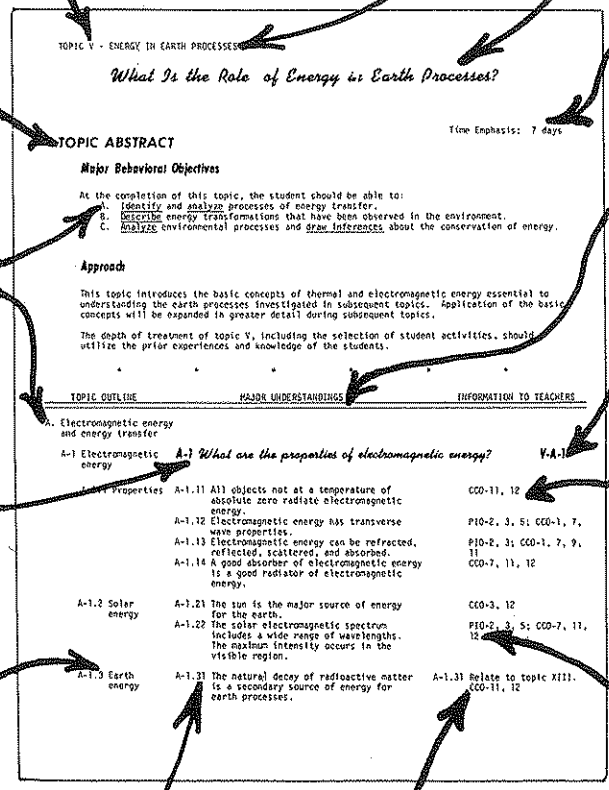
Topic number

Digest of -
1. *Major Behavioral Objectives for students.*
2. *Suggested Approach for the teacher with emphasis on what precedes or follows.*

The letter designation indicates the Major Behavioral Objective which is related to a specific section of the topic.

Whole number integers designate section questions. The understandings will develop from the investigation of the question, enabling the student to accomplish the appropriate Major Behavioral Objective.

A number in tenths (A-1.3) designates a subtopic required to develop an answer to the section question.



TOPIC V - ENERGY IN EARTH PROCESSES

What Is the Role of Energy in Earth Processes?

Time Emphasis: 7 days

TOPIC ABSTRACT

Major Behavioral Objectives

At the completion of this topic, the student should be able to:
A. Identify and analyze processes of energy transfer.
B. Describe energy transformations that have been observed in the environment.
C. Analyze environmental processes and draw inferences about the conservation of energy.

Approach

This topic introduces the basic concepts of thermal and electromagnetic energy essential to understanding the earth processes investigated in subsequent topics. Application of the basic concepts will be expanded in greater detail during subsequent topics.

The depth of treatment of topic V, including the selection of student activities, should utilize the prior experiences and knowledge of the students.

TOPIC OUTLINE	MAJOR UNDERSTANDINGS	INFORMATION TO TEACHERS
A. Electromagnetic energy and energy transfer		
A-1 Electromagnetic energy	*A-1 What are the properties of electromagnetic energy?*	V-A-1
A-1.1 Properties	A-1.11 All objects not at a temperature of absolute zero radiate electromagnetic energy.	CCO-11, 12
	A-1.12 Electromagnetic energy has transverse wave properties.	PIO-2, 3, 5; CCO-1, 7,
	A-1.13 Electromagnetic energy can be refracted, reflected, scattered, and absorbed.	PIO-2, 3; CCO-1, 7, 9, 11
	A-1.14 A good absorber of electromagnetic energy is a good radiator of electromagnetic energy.	CCO-7, 11, 12
A-1.2 Solar energy	A-1.21 The sun is the major source of energy for the earth.	CCO-3, 12
	A-1.22 The solar electromagnetic spectrum includes a wide range of wavelengths. The maximum intensity occurs in the visible region.	PIO-2, 3, 5; CCO-7, 11, 12
A-1.3 Earth energy	A-1.31 The natural decay of radioactive matter is a secondary source of energy for earth processes.	A-1.31 Relate to topic XIII. CCO-11, 12

This time estimate suggests the extent of depth of treatment. It is exclusive of time required for testing.

This column represents statements of student understandings which should be derived primarily from investigations.

V-A-1 refers to the specific section of the supplement.

This designates the Course-Content Objectives. The CCO(s) represent broad themes which permeate the syllabus, and should be stressed accordingly at this point.

This designates the Process-of-Inquiry Objectives. The PIO(s) should be employed in helping the student achieve the understanding.

A number in hundredths (A-1.31) designates the specific major understandings.

This information refers only to the single understanding if it is coded in hundredths (A-1.31). It refers to the entire section of the topic if it is coded in tenths only.

ANNOTATED FORMAT EXAMPLE

Investigations-Understandings Matrix

Investigation number (topic omitted) found at top of both teacher and student laboratory guide sheet.

The blocks in a horizontal column designate which investigations will support and explain a single understanding. For C-1.12, (The amount of energy lost....) any or all of the investigations (A-2a, B-1a, C-1a) might be used.

Estimated time in 45-minute class periods.

Long Term Investigations and Field Experiences

The understandings are coded directly to the syllabus, Major Understandings column. (i.e., C-1.12, The amount of energy lost by a source equals....)

Space left for teachers to place resources of their school into matrix (i.e., films, filmstrips, slides, videotapes, off-prints, library books, etc.)

Those Process Objectives used in an investigation.

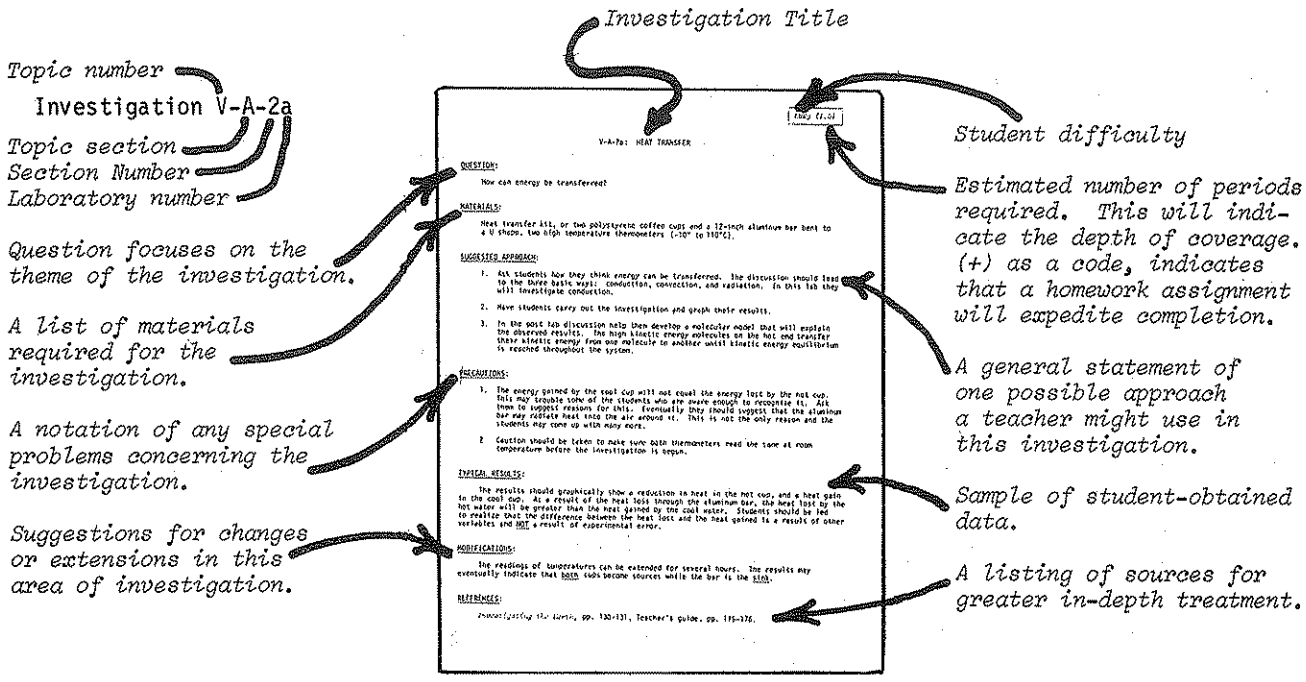
Name of investigation

All multimedia are located in front of supplement by topic.

The blocks in a vertical column designate which understandings are included in a single investigation. Investigation B-1c: Energy Absorption, includes understandings: A-1.13, A-1.14, B-1.31, B-1.12.

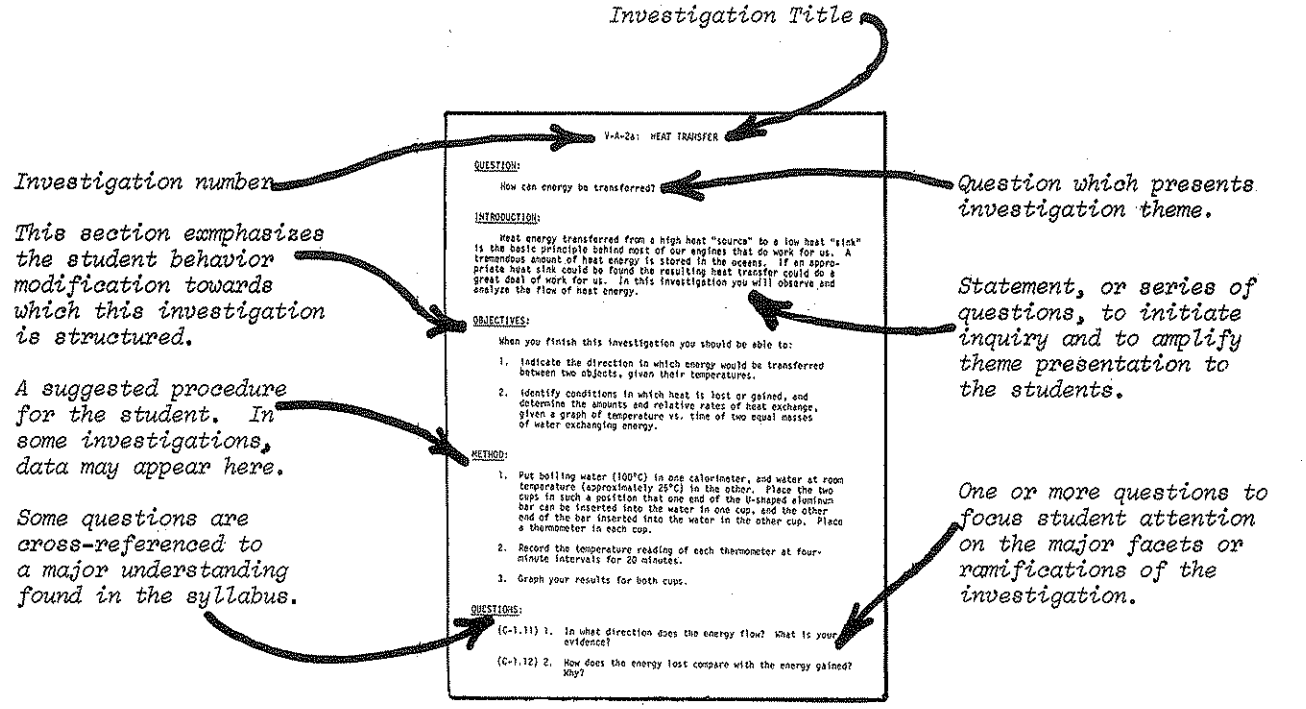
ANNOTATED FORMAT EXAMPLES

Teacher Laboratory Guide Sheet



Student Laboratory Guide Sheet

This will be available for each investigation for duplication and distribution to students if the teacher chooses.



A R E A T I M E E M P H A S I S C H A R T

			Time Emphasis
AREA 1	INVESTIGATING PROCESSES OF CHANGE		10 days
	Topic I	Observation and Environment	5 days
	Topic II	The Changing Environment	5 days
AREA 2	THE EARTH MODEL		20 days
	Topic III	Measuring the Earth	10 days
	Topic IV	Earth Motions	10 days
AREA 3	THE EARTH'S ENERGY BUDGET		38 days
	Topic V	Energy in Earth Processes	7 days
	Topic VI	Insolation and the Earth's Surface	5 days
	Topic VII	Energy Exchanges in the Atmosphere	16 days
	Topic VIII	Moisture and Energy Budgets and Environment Change	10 days
AREA 4	THE ROCK CYCLE		37 days
	Topic IX	The Erosional Process	6 days
	Topic X	The Depositional Process	6 days
	Topic XI	The Formation of Rocks	12 days
	Topic XII	The Dynamic Crust	13 days
AREA 5	THE HISTORY OF THE EARTH		30 days
	Topic XIII	Interpreting Geologic History	15 days
	Topic XIV	Landscape Development and Environmental Change	15 days
		Total Instructional Time	135 days

TOPIC OUTLINE

AREA 1 INVESTIGATING PROCESSES OF CHANGE

TOPIC I - OBSERVATION AND MEASUREMENT OF THE ENVIRONMENT

A. The local environment

A-1 Observation
- A-1.1 Sensory perception
- A-1.2 Sensory limitations
- A-1.3 Inferences

A-2 Classification
- A-2.1 A system of classification
- A-2.2 Purpose

B. Properties of the environment

B-1 Measurement
- B-1.1 Dimensional quantities
- B-1.2 Comparison
- B-1.3 Error

B-2 Density
- B-2.1 Variations

TOPIC II - THE CHANGING ENVIRONMENT

A. The nature of change

A-1 Characteristics of change
- A-1.1 Occurrence of events
- A-1.2 Frames of reference
- A-1.3 Rate of change
- A-1.4 Cycles — noncycles
- A-1.5 Predictability of change
- A-1.6 Occurrence of change

B. Energy and change

B-1 Relationship between energy and change
- B-1.1 Energy flow and exchange

C. Environmental change

C-1 Man's influence on the environment
- C-1.1 Environmental balance
- C-1.2 Environmental pollution

AREA 2 THE EARTH MODEL

TOPIC III - MEASURING THE EARTH

A. Earth dimensions

A-1 Shape
- A-1.1 Evidence

A-2 Size
- A-2.1 Measurement techniques
- A-2.2 Measurement determination

A-3 Extent of the atmosphere, hydrosphere, and lithosphere
- A-3.1 Atmosphere
- A-3.2 Hydrosphere
- A-3.3 Lithosphere

B. Positions on the earth

B-1 Position determination
- B-1.1 Coordinate systems

B-2 Position description
- B-2.1 Vector-scalar properties
- B-2.2 Fields

TOPIC IV - EARTH MOTIONS

A. Celestial observations

A-1 Motion of objects in the sky
- A-1.1 Star paths
- A-1.2 Planetary motions
- A-1.3 Satellite motion
- A-1.4 Sun motion

B. Terrestrial observations

B-1 Motion at the earth's surface
- B-1.1 Foucault pendulum
- B-1.2 Coriolis effect

C. Time

C-1 Frames of reference for time
- C-1.1 Earth motions

D. Solar system models

D-1 Geocentric and heliocentric models
- D-1.1 Geocentric model
- D-1.2 Heliocentric model

D-2 Simple celestial model
- D-2.1 Geometry of orbits
- D-2.2 Force and energy transformations

AREA 3 THE EARTH'S ENERGY BUDGETS

TOPIC V - ENERGY IN EARTH PROCESSES

A. Electromagnetic energy and energy transfer

A-1 Electromagnetic energy
- A-1.1 Properties
- A-1.2 Solar energy
- A-1.3 Earth energy

A-2 Energy transfer
- A-2.1 Conduction
- A-2.2 Convection
- A-2.3 Radiation

B. Energy transformation

B-1 Transformation in earth processes
B-1.1 Latent heat
B-1.2 Movement of matter
B-1.3 Wavelength absorption and radiation
B-1.4 Friction

C. Energy relationships in earth processes

C-1 Conservation of energy
C-1.1 Closed system

TOPIC VI - INSOLATION AND THE EARTH'S SURFACE

A. Insolation at the earth's surface

A-1 Insolation factors
A-1.1 Angle
A-1.2 Duration
A-1.3 Absorption
A-1.4 Reflection
A-1.5 Scattering
A-1.6 Energy conversion

B. Terrestrial radiation

B-1 Radiation factors
B-1.1 Material radiation
B-1.2 Gases
B-1.3 Balance

TOPIC VII - ENERGY EXCHANGES IN THE ATMOSPHERE

A. Atmospheric variables

A-1 Local atmospheric variables
A-1.1 Probability of occurrence
A-1.2 Temperature variations
A-1.3 Pressure variations
A-1.4 Moisture variations
A-1.5 Air movement
A-1.6 Atmospheric transparency
A-1.7 Other variables

B. Synoptic weather data

B-1 Synoptic analysis
B-1.1 Airmass characteristics
B-1.2 Airmass source regions
B-1.3 Airmass tracks

C. Atmospheric energy exchanges

C-1 Input of moisture and energy
C-1.1 Evaporation and transpiration
C-1.2 Vapor pressure
C-1.3 Saturation vapor pressure
C-1.4 Other input energy

C-2 Moisture and energy transfer
C-2.1 Density differences
C-2.2 Wind speed and direction
C-2.3 Adiabatic changes
C-3 Release of moisture and energy within the atmosphere
C-3.1 Condensation and sublimation
C-3.2 Cloud formation
C-4 Release of moisture and energy from the atmosphere
C-4.1 Precipitation
C-4.2 Wind-water interaction

TOPIC VIII - MOISTURE AND ENERGY BUDGETS AND ENVIRONMENT CHANGE

A. Earth's water

A-1 Ground water
A-1.1 Infiltration
A-1.2 Permeability
A-1.3 Porosity
A-1.4 Capillarity
A-2 Surface water
A-2.1 Runoff
A-3 Pollution of the earth's water
A-3.1 Sources of pollutants
A-3.2 Types of pollutants
A-3.3 Concentration of pollutants
A-3.4 Long-range effects

B. The local water budget

B-1 Water budget variables
B-1.1 Precipitation (P)
B-1.2 Potential evapotranspiration (E_p)
B-1.3 Moisture storage
B-1.4 Moisture utilization
B-1.5 Moisture deficit
B-1.6 Moisture recharge
B-1.7 Moisture surplus
B-2 Streams
B-2.1 Stream discharge and the water budget
B-3 Climates and the local water budget
B-3.1 Climatic regions

C. Climate pattern factors

C-1 Factors
C-1.1 Latitude
C-1.2 Elevation
C-1.3 Large bodies of water and ocean currents
C-1.4 Mountain barriers
C-1.5 Wind belts
C-1.6 Storm tracks

AREA 4 THE ROCK CYCLE

TOPIC IX - THE EROSIONAL PROCESS

A. Weathering

A-1 Evidence of weathering
- A-1.1 Weathering processes
- A-1.2 Weathering rates
- A-1.3 Soil formation
- A-1.4 Soil solution

B. Erosion

B-1 Evidence of erosion
- B-1.1 Displaced sediments
- B-1.2 Properties of transported materials

B-2 Factors affecting transportation
- B-2.1 Gravity
- B-2.2 Water erosion
- B-2.3 Wind and ice erosion
- B-2.4 Effect of erosional agents
- B-2.5 Effect of man
- B-2.6 Predominant agent

TOPIC X - THE DEPOSITIONAL PROCESS

A. Deposition

A-1 Factors
- A-1.1 Size
- A-1.2 Shape
- A-1.3 Density
- A-1.4 Velocity

B. Erosional-depositional system

B-1 Characteristics
- B-1.1 Erosional-depositional change
- B-1.2 Dominant process
- B-1.3 Erosional-depositional interface
- B-1.4 Dynamic equilibrium
- B-1.5 Energy relationships

TOPIX XI - THE FORMATION OF ROCKS

A. Rocks and sediments

A-1 Comparative properties
- A-1.1 Similarities
- A-1.2 Differences

B. Minerals

B-1 Relation to rocks
- B-1.1 Composition

B-2 Characteristics
- B-2.1 Physical, chemical properties
- B-2.2 Chemical composition
- B-2.3 Structure

C. Rock formation

C-1 Sedimentary rocks
- C-1.1 Compression cementation
- C-1.2 Chemical processes
- C-1.3 Biological processes

C-2 Nonsedimentary rocks
- C-2.1 Solidification process
- C-2.2 Recrystallization process

C-3 Environment of formation
- C-3.1 Inferred characteristics
- C-3.2 Distribution

D. Rock cycle

D-1 Evidence
- D-1.1 Transition zones
- D-1.2 Rock composition

TOPIC XII - THE DYNAMIC CRUST

A. Evidence for crustal movement

A-1 Minor crustal changes
- A-1.1 Deformed rock strata
- A-1.2 Displaced fossils
- A-1.3 Displaced strata

A-2 Major crustal changes
- A-2.1 Zones of crustal activity
- A-2.2 Geosynclines
- A-2.3 Vertical movements
- A-2.4 Ocean floor spreading
- A-2.5 Continental drift
- A-2.6 Magnetic poles

B. Earthquakes

B-1 Wave properties
- B-1.1 Types of waves
- B-1.2 Velocities
- B-1.3 Transmission

B-2 Location of an epicenter
- B-2.1 Epicenter
- B-2.2 Origin time

C. Model of the earth's crust and interior

C-1 Properties
- C-1.1 Solid and liquid zones
- C-1.2 Crustal thickness
- C-1.3 Crustal composition
- C-1.4 Density, temperature, and pressure
- C-1.5 Interior composition

D. Theories of crustal change

D-1 Inferred processes
- D-1.1 Mantle convection cells
- D-1.2 Geosynclinal development
- D-1.3 Isostasy
- D-1.4 Process relationships

AREA 5 THE HISTORY OF THE EARTH

TOPIC XIII - INTERPRETING GEOLOGIC HISTORY

A. Geologic events

A-1 Sequence of geologic events
- A-1.1 Chronology of layers
- A-1.2 Igneous intrusions and extrusions
- A-1.3 Faults, joints, and folds
- A-1.4 Internal characteristics

B. Correlation techniques

B-1 Correlation
- B-1.1 Continuity
- B-1.2 Similarity of rock
- B-1.3 Fossil evidence
- B-1.4 Volcanic time markers
- B-1.5 Anomalies to correlation

C. Determining geologic ages

C-1 Rock record
- C-1.1 Fossil evidence
- C-1.2 Scale of geologic time
- C-1.3 Erosional record
- C-1.4 Geologic history of an area

C-2 Radioactive decay
- C-2.1 Decay rates
- C-2.2 Half-lives
- C-2.3 Decay product ratios

D. The fossil record

D-1 Ancient life
- D-1.1 Variety of life forms
- D-1.2 Evolutionary development

TOPIC XIV - LANDSCAPE DEVELOPMENT AND ENVIRONMENTAL CHANGE

A. Landscape characteristics

A-1 Quantitative observations
- A-1.1 Hillslopes
- A-1.2 Stream patterns
- A-1.3 Soil associations

A-2 Relationship of characteristics
- A-2.1 Landscape regions

B. Landscape development

B-1 Environmental factors
- B-1.1 Uplifting and leveling force
- B-1.2 Climate
- B-1.3 Bedrock
- B-1.4 Time
- B-1.5 Dynamic equilibrium
- B-1.6 Man