DOCUMENT RESUME

ED 167 398 SE 026 782

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TITLE British Columbia Elementary Science Materials Based Units Program. Interim Edition, 1977.
INSTITUTION British Columbia Dept. of Education, Victoria. Curriculum Development Branch.
PUB DATE 77
NOTE 79p.

EDRS PRICE MF-$0.83 HC-$4.67 Plus Postage.
DESCRIPTORS *Curriculum Guides; Elementary Education; *Elementary School Science; Instructional Materials; *Process Education; Program Descriptions; *Science Activities; Science Course Improvement Project; Science Education
IDENTIFIERS British Columbia

ABSTRACT

This document, published by the Ministry of Education of British Columbia, represents an extensive modification of the 1969 permissive elementary science program, a materials-based program which necessitates the involvement of students in scientific activities and explorations. Science teaching involves the student in the processes of science. Throughout the program, from year one to year seven, the child engages in "hands-on" activities in the investigational climates of the classroom and community. For each unit a discription is given, followed by learning outcomes in terms of process emphasis and content. References for teacher and for pupil as well as equipment information are included. Within the program, a balance has been maintained between the biological and physical sciences. (Author/GA)

MATERIALS BASED UNITS PROGRAM

ELEMENTARY SCIENCE
Interim 1977

BRITISH COLUMBIA

ELEMENTARY SCIENCE

MATERIALS BASED

UNITS

PROGRAM

(INTERIM EDITION) 1977

ACKNOWLEDGEMENT

The Ministry of Education appreciates the work of the following members of the Elementary Science Revision Committee in compiling this Materials Based Units Program:

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Appreciation is also extended to Dr. Larry Yore (University of Victoria) for his assistance in reviewing this program.

The Ministry of Education has approved the publication of this interim program and accepts responsibility for its contents.

TABLE OF CONTENTS

INTRODUCTION

This program represents an extensive modification of the 1969 permissive elementary science program. It is a materials based program which necessitates the involvement of students in scientific activities and explorations. Science teaching here involves the student in the processes of science. Throughout the program, the student works in an environment which invites and supports curiosity, investigation and inquiry; from year one to year seven, the child engages in "hands-on" activities in the investigational climates of the classroom and community.

Within the program a balance has been maintained between the biological and physical sciences. Continuing and expanding pupil growth is possible in both content areas.

EQUIPMENT

Information concerning equipment needs is provided on the description page of each unit.

For some units, prepackaged kits and/or print material are available. Where no kit is available, an equipment list is provided to assist the teacher in organizing the unit. The list identifies only those items that under normal conditions may not already be available in the classroom or school.

For those units where a list has not been provided, under normal conditions the necessary equipment is easily obtainable.

In organizing a unit for study, especially those where a prepackaged kit is not available, the teacher should study the teacher's guide to determine the total equipment requirements.

GLOSSARY OF ABBREVIATIONS

B.C.T.F. - B.C.T.F. Lesson Aid

E.S.S. - Elementary Science Study; McGraw-Hill Science Module

E.Y.E. - Examining Your Environment; Holt, Rinehart and Winston

Science 5/13 - Macdonald Educational, Science Series, Ages 5 to 13 (G.L.C.)

T.P.S. - Teaching Primary Science Series, Macdonald Educational (G.L.C.)

PROCESSES - DESCRIPTION & EXAMPLES

The processes commonly used in scientific investigation have been delineated by science educators. The following is a list of science processes as developed by the American Association for the Advancement of Science.[2] They are listed in an order of simple to complex.

Observing
Classifying
Quantifying
Communicating
Interpreting Data
Inferring
Formulating Hypotheses
Predicting
Controlling Variables
Experimenting
Defining Operationally
Formulating Models

To add uniformity and clarity to the understanding of what these processes mean, a brief definition of each with accompanying examples is provided. Further clarification may be obtained by referring to the teachers' guides.

Observing

The student will perceive similarities, differences and changes by using his/her senses.

Example 1 - The student, using a mirror, will distinguish sameness and differences. (Mirror Cards, E.S.S.)

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[2] American Association for the Advancement of Science, Science - A Process Approach, Parts A - G, New York: Xerox, 1967.

Example 2 - The student will see small plant and animal life through a microscope. (Small Things, E.S.S.)

Example 3 - The student will use the senses of touch, taste, sight, and smell to distinguish between common white powders. (Mystery Powders, E.S.S.)

Classifying

The student will organize materials, events, and phenomena into logical grouping. In its beginning stages classifying is a sorting process.

Example 1 - The student will sort a given set of blocks into subsets based on common characteristics. (Attributes Games & Problems, E.S.S.)

Example 2 - Given a selection of rocks, the student will construct a chart which categorizes the rocks, according to such properties as color, texture, weight, size or shape. (Rocks & Charts, E.S.S.)

Quantifying

The student will demonstrate the ability to compare objects or events to agreed upon standards of length, area, volume, mass, temperature, force and time.

Example 1 - The student will measure each day's growth of sprouting seeds. (Life of Beans & Peas, E.S.S.)

Example 2 - The student will measure and record soil temperatures at various depths. (Mini-climates, E.Y.E.)

Communication

The student will present objects or events, through various media, in such a manner as to allow for their understanding by others. Much scientific communication is diagrammatic, numerical or graphic in form.

Example 1 - The student will explain similiarities and differences between seeds and seed-like materials. (Growing Seeds, E.S.S.)

Example 2 - The student, with the use of a series of diagrams, will record the change in the state of bread as it molds. (Changes, E.S.S.)

Example 3 - The student will construct a graph to show the reading speed of classmates. (Your Senses, E.Y.E.)

Interpreting Data

The student will be able to identify trends from data. It is the perception of these trends which allows for inferring and predicting to occur.

Example 1 - Given a track record of an animal moving at differing speeds, the student will identify where change in rate of movement occurred. (Tracks, E.S.S.)

Example 2 - After constructing a graph of the lengths of the various thicknesses of water columns before they bead, the student will suggest that thinner columns bead sooner than thicker columns. (Kitchen Physics, E.S.S.)

Inferring

The student interprets data or observations and perceives trends which lead toward conclusions.

Example 1 - Given mixtures of white substances and using data previously collected concerning powder characteristics, the student will suggest the identity of the powders forming the mixture. (Mystery Powders, E.S.S.)

Example 2 - After experiences in measuring the relative surface "grabbiness" of various liquids on flat floating objects, the student will be able to suggest that surface tension increases with an increase in the surface area of the floating objects. (Kitchen Physics, E.S.S.)

Formulating Hypotheses

The student will formulate generalized statements from observing or inferring. Further investigation is then required.

Example 1 - After collecting data on temperature variations at different heights in the classroom, the student will state that temperature is greater at increased height. (Mini-Climates, E.Y.E.)

Example 2 - The student, after observing an animal's behavior in various situations, will state that animals are less active after having eaten. (Animals in the Classroom, E.S.S.)

Predicting

The student, using existing data and information, will suggest future outcomes or occurrences.

Example 1 - When presented with a balance apparatus in an unbalanced state, the student will suggest a method of balancing the apparatus by adding or subtracting weights. (Primary Balancing, E.S.S.)

Example 2 - Given a number of golf tees set on end within the orbit of a pendulum's swing, the student will predict which will be the last to be knocked down. (Pendulums, E.S.S.)

Controlling Variables

The student will identify possible variables influencing the outcome of an experiment or investigation. Those variables not being tested are held constant.

Example 1 - The student will investigate the effect of planting depth on seed germination by maintaining uniformity of all other conditions. (Starting from Seeds, E.S.S.)

Example 2 - The student will study the quality of photographs taken with different exposure times but maintaining uniformity of all other variables. (Pinhole Photography, B.C.T.F. Lesson Aids.)

Experimenting

The student will test predictions and hypotheses by developing appropriate procedures. A scientific investigation and reporting of the results should follow.

Example 1 - In order to investigate one of the mealworm's senses, the student will design and carry out a test to determine if a mealworm has a sense of smell. (Behavior of Mealworms, E.S.S.)

Example 2 - The student will investigate the surface tension of different liquids by designing and carrying out an appropriate investigation. (Kitchen Physics, E.S.S.)

Defining Operationally

The student will define or identify in precise terms an object or event so that others can replicate the situation or result.

Example 1 - The student will describe in precise terms the conditions under which seeds sprouted and grew in a variety of locations and situations. (Life of Beans & Peas, E.S.S.)

Example 2 - The student will describe the procedures, outcomes, and results after completing an experiment on the behavior of rusting steel wool in a confined area. (Gases and Airs, E.S.S.)

Formulating Models

The student will create analogies to demonstrate or explain an understanding. Models might take the form of concrete (diagrams and constructions) or abstract representations (mathematical expressions or relationships)

Example 1 - After constructing a functioning electrical circuit, the student will make a diagram using appropriate electrical symbols illustrating the circuit. (Batteries and Bulbs, E.S.S.)

Example 2 - The student, after carrying out appropriate investigation, will construct a map of the human tongue which shows the tongue's specific taste areas. (Your Senses, E.Y.E.)

PROCESS AND CONTENT CHART

YEAR ONE

Science Processes

■ Process Emphasis

▨ Supporting Processes

UNIT NO.	UNIT TITLE	Observing	Classifying	Quantifying	Communicating	Interpreting Data	Inferring	Formulating Hypotheses	Predicting	Controlling Variables	Experimenting	Defining Operationally	Formulating Models
101	ANIMALS IN THE CLASSROOM (ESS)	■						■					
102	EARLY EXPLORATIONS (Science 5/13)	■	■	■	■	■			▨				
103	GEO BLOCKS (ESS)	■	■	▨	■								
104	GROWING SEEDS (ESS)	■	■	▨	■		▨		▨				
105	LIGHT AND SHADOWS (ESS)	■											
106	MATCH AND MEASURE (ESS)	■											
107	SCIENCE FROM WATER PLAY (TPS)	■	■	■	▨		▨						

Descriptions of Unit and Learning Outcomes

101 ANIMALS IN THE CLASSROOM (ESS)

This unit is designed to teach animal care and in addition to science, provides experiences for learning in language arts, mathematics and social studies.

Learning Outcomes:

Process Emphasis - observing, formulating hypotheses

Content - life habits and habitats of selected animals

Pupil References

1)	Nash:	The Butterfly, (Macmillan)
2)	Nash:	The Frog, (Macmillan)
3)	Nash:	The Bird, (Macmillan)
4)	Carle, Eric:	The Very Hungry Caterpillar, (Scholastic), 1974
5)		Frogs, Vol. 31, (Macdonald Starters)
6)		Birds, Vol. 8, (Macdonald Starters)
7)		Snakes, Vol.56, (Macdonald Starters)
8)		Bees, Vol. 6, (Macdonald Starters)
9)		Fish, Vol. 28, (Macdonald Starters)
10)		Dogs, Vol. 21, (Macdonald Starters)
11)		Spiders, Vol. 59, (Macdonald Starters)
12)		Cats, Vol. 13, (Macdonald Starters)
13)		Butterflies, Vol. 11, (Macdonald Starters)
14)		Mice, Vol. 38, (Macdonald Starters)
15)		Very Small Animals, Vol. 3 (Macdonald Starters)

Teacher References

1)		Caring For Gerbils and Other Small Pets, (Scholastic)
2)	Dobrin, Arnold:	Gerbils, (Scholastic), 1971
3)	Hogner, Dorothy:	Odd Pets, (Scholastic)

Equipment - No kit available.
Equipment required: Animal cage, animal.

Descriptions of Unit and Learning Outcomes

102 EARLY EXPLORATIONS (Science 5/13)

This unit provides for teachers guidelines for conducting a wide variety of explorations for students, to be conducted both inside and outside the classroom. Many of the activities initiate experiences related to basic conservation topics.

Learning Outcomes:

Process Emphasis

- observing, classifying, quantifying, communicating

Content

- basic conservation conducted through a variety of experiments and sense awareness activities.

Equipment - No kit available.

Descriptions of Unit and Learning Outcomes

103 GEO BLOCKS (ESS)

Activities in linear, area and volume relationships.

Learning Outcomes:

Process Emphasis - observing, classifying, communicating

Content - three dimensional geometric shapes

Equipment - Kit available.
Print material available.

Descriptions of Unit and Learning Outcomes

104 GROWING SEEDS (ESS)

The student learns to distinguish seeds from other objects, to plant them, and to observe their growth.

Learning Outcomes:

Process Emphasis - observing, classifying, communicating

Content - seeds vary in appearance

- all seeds have characteristics in common

- certain conditions are necessary for the germination of seeds and for the growth of plants

Pupil References

1)		A Seed is a Promise, (Scholastic)
2)	Nash	The Bulb, (Macmillan)
3)	Nash:	The Tree, (Macmillan)
4)	Nash:	The Seed, (Macmillan)
5)	Nash:	The Loaf of Bread, (Macmillan)
6)		Trees, Vol. 69, (Macdonald Starters)
7)		Apples, Vol. 2, (Macdonald Starters)
8)		Bread, Vol. 10, (Macdonald Starters)
9)		Farms, Vol. 25, (Macdonald Starters)
10)		Food, Vol. 30 (Macdonald Starters)
11)		Growing Things Indoors, Vol. 1, (Macdonald Starters)
12)		How Life Began, Vol. 10, (Macdonald Starters- Long Ago Series)
13)	Bulla:	A Tree Is A Plant, (Let's Read and Find Out Science Book), (Crowell, 1973)

Teacher References

1)	Hammond, W.;	The Riddle of Seeds, (Longman) 1965
2)	Jordan, Helene J.:	How A Seed Grows, (Fitzhenry and Whiteside)
3)	Rahn, J.E.:	Seeing What Plants Do, (McClelland and Stewart) 1972.

Equipment - Kit available.

Descriptions of Unit and Learning Outcomes

105 LIGHT AND SHADOWS (ESS)

This unit provides the student with experiences involving light and shadows; reflection, direction, recording and casting. Inherent here are opportunities for integrated experiences in art and drama.

Learning Outcomes:

Process Emphasis - observing

Content - experiences with spatial relationships

Pupil References

1) Bulla, Clyde Robert: What Makes A Shadow, (Scholastic)
2) The Moon, Vol.41. (Macdonald Starters
3) The Sun, Vol. 61 (Macdonald Starters)
4) Night, Vol. 44 (Macdonald Starters)

Teacher References

1) Branley, Franklyn M.: What Makes Day and Night, (Let's Read and Find Out Science Book)
2) "Shadows, An Environmental Investigation", 1971, National Wildlife Federation, 1412 - 16th Street, NW, Wash., D.C.

Equipment - No kit available.

106 MATCH AND MEASURE (ESS)

The student makes comparisons and notes similarities and differences. By matching and comparing the student comes to realize that mass, volume, length and quantity remain constant when the appearance of objects change. The student develops the ability to focus on several dimensions at once.

Learning Outcomes:

Process Emphasis - observing, quantifying

Content - emphasis for standard units of measurement

- the use of measuring devices

Pupil References

1) Balancing Things (Macdonald Starters Sc.Vol.1
2) Kitchen Math (Macdonald Starters - Math 1-5)
3) Garage Math (Macdonald Starters - Math Bk.2)
4) Circus Math (Macdonald Starters - Math Bk.3)
5) Seaside Math (Macdonald Starters - Math Bk.4)
6) Toyshop Math (Macdonald Starters - Math Bk.5)
7) Froman: Bigger and Smaller - A Young Math Book- Crowell (Fitzhenry and Whiteside)

Teacher References

1) Schneider: How Big Is Big? (Scholastic) -to be read to children

Equipment - Kit available. The kit materials prepared by McGraw-Hill are not metric. Comparable metric materials are available from numerous suppliers.

Descriptions of Unit and Learning Outcomes

107 SCIENCE FROM WATER PLAY (TPS)

The student investigates sinking and floating as well as other related ideas in a structured "water play" setting.

Learning Outcomes:

Process Emphasis - observing, classifying, quantifying

Content - sinking and floating
- water has buoyancy
- capacity and volume

Pupil References

1) Webster, James: Water, Ladybird Books, (Wills & Hepworth), 1973

Teacher References

Equipment - No kit available.
Equipment required: Water tank.

PROCESS AND CONTENT CHART

YEAR TWO

Science Processes

■ Process Emphasis

▨ Supporting Processes

UNIT NO.	UNIT TITLE	Observing	Classifying	Quantifying	Communicating	Interpreting Data	Inferring	Formulating Hypotheses	Predicting	Controlling Variables	Experimenting	Defining Operationally	Formulating Models
201	BRINE SHRIMP (ESS)	■											
202	EARLY EXPERIENCES (Science) 5/13	■	■	■	■		▨		▨				
203	LIFE OF BEANS AND PEAS (ESS)	■		■	■		▨		■				
204	PAINTS AND MATERIALS (TPS)	■	▨	▨	▨		▨	▨		■			
205	PRIMARY BALANCING (ESS)	▨		▨					■				

Descriptions of Unit and Learning Outcomes

201 BRINE SHRIMP (ESS)

The student learns about animal behavior by observing the hatching, growing and reproducing of brine shrimp.

Learning Outcomes:

Process Emphasis - observing

Content - use of magnifying lens
- an animal's behavior
- environmental requirements
- reproduction rates

Teacher References

Note - see bibliograph contained in manual

1) "Brine Shrimp and Their Habitat, An Environmental Investigation," 1972, National Wildlife Federation, 1412 - 16th Street, NW, Washington, D.C. 20036 Order No. 79169, $1.50

Equipment - Kit available

Descriptions of Unit and Learning Outcomes

202 EARLY EXPERIENCES (Science 5/13)

This teacher's manual provides many suggestions which involve explorations of the student's immediate environment.

Learning Outcomes:

Process Emphasis - observing, classifying, quantifying, communicating

Content - refer to manual

- a wide variety of topics which could constitute a year's general program

Teacher References

1) Moodie, John: A Book of Real Science, (Scholastic) 1974

Equipment - No kit available.

Descriptions of Unit and Learning Outcomes

203 LIFE OF BEANS AND PEAS (ESS)

This unit focuses on the raising of easily available seeds and their growth through successive generations.

Learning Outcomes:

Process Emphasis - observing, quantifying, communicating, predicting

Content - plants reproduce their own kind

- all the parts of a flower perform necessary functions in the reproduction of seeds

Pupil References

1)		Growing Plants From Fruits and Vegetables, (Scholastic)
2)	Zion, Gene:	The Plant Sitter ,(Scholastic), 1973
3)	Elting & Folsom:	Secret Story of Pueblo Bonito
4)	Webber:	Up Above and Down Below ,(Addison-Wesley)
5)	Others	See Growing Seeds List (Year 1), (Scholastic)

Equipment - No kit available.

Descriptions of Unit and Learning Outcomes

204 PAINTS AND MATERIALS (TPS)

The activities in this unit draw upon some of the materials and techniques of artistic expression to explore ways of asking questions and finding answers in a scientific way.

Learning Outcomes:

Process Emphasis - observing, controlling variables

Content - properties of drawing and painting materials
- properties of liquids
- development of secondary colours as a result of mixing primary colours.

Pupil References

1) Reiss, John: Colors, (Bradbury Press, Scarsdale, New York), 1969

2) Label: The Great Blueness and Other Predicaments, (Harper and Row, New York),1968

3) O'Neil, Mary: Hailstones and Halibut Bones, Doubleday, New York), 1961.

4) Duvoisin: The House of Four Seasons, (Lothrop, Lee and Shepard, New York), 1969

5) Emberley, Ed.,: Green Says Go, (Little, Brown and Company, Toronto)

6) Lund, Doris; The Paint-Box Sea, (McGraw-Hill Book Company, Toronto), 1973

Teacher References

1) Law, Felicia: Red (Collins Dandilions), 1976

2) Coloured Things, Science 5/13 (Macdonald Educational)

Equipment - No kit available.

Descriptions of Unit and Learning Outcomes

205 PRIMARY BALANCING (ESS)

This unit suggests what can be done with familiar and simple equipment to help the student gain an understanding of balance and weight. The student is involved in the exploration and manipulation of the equipment.

Learning Outcomes:

Process Emphasis - predicting

Content - mass and how to measure it

- physical laws of balance

Pupil References

1) Balancing Things, Vol. 1 (MacDonald Starters) Science

Teacher References

1) Srivastava: Weighing and Balancing, (Fitzhenry & Whiteside)

Equipment - Kit available

PROCESS AND CONTENT CHART

YEAR THREE

Science Processes

■ Process Emphasis

▨ Supporting Processes

UNIT NO.	UNIT TITLE	Observing	Classifying	Quantifying	Communicating	Interpreting Data	Inferring	Formulating Hypotheses	Predicting	Controlling Variables	Experimenting	Defining Operationally	Formulating Models
301	CANDLES (TPS)	■		■	▨					■	▨	▨	
302	CHANGES (ESS)	■			■					▨			
303	ICE CUBES (ESS)	■		▨	▨				▨	■			
304	OURSELVES (Science 5/13)	■		■	▨								
305	POND WATER (ESS)	■	■		■								
306	SEEDS AND SEEDLINGS (TPS)	■	■	■	■	▨	▨	▨	▨	▨	▨		

Descriptions of Unit and Learning Outcomes

301 CANDLES (TPS)

The student investigates changes in the state of matter and energy by conducting a variety of activities burning candles.

Learning Outcomes:

Process Emphasis - observing, quantifying, controlling variables

Content - burning, evaporation, condensation, melting and hardening are as factors affecting changes in the state of matter.

Teacher References

1) School Council Science 5/13 Change, (Macdonald Educational), 1972

Equipment - No kit available

Description of Unit and Learning Outcomes

302 CHANGES (ESS)

This unit is concerned with understanding natural changes. Physical, chemical and biological changes are studied.

Learning Outcomes:

Process Emphasis - observing, communicating

Content - the effect of water, heat, air and time on common objects

- conditions alter the rate of change

Pupil References

1)	Schneider:	Let's Find Out About Heat, Weather and Air, (Scholastic)
2)	Lefkowitz:	Matter All Around You - A Book About Solids, Liquids and Gases, 1972 (Parents' Magazine Press)
3)		Wet and Dry, Vol. 3 (Macdonald Starters)
4)	Podendorf:	Change and Time - Stepping Into Science, (Childrens' Press)

Teacher References

1)	Dahlherg:	From Food to Fertilizer - Young Scott Books, (Addison-Wesley), 1973

Equipment - No kit available.
Equipment needed: variety of plastic containers with lids, electric hot plate, desk lamps, microscope.

Descriptions of Unit and Learning Outcomes

303 ICE CUBES (ESS)

The student investigates the effects of varying conditions on the melting rate of ice cubes.

Learning Outcomes:

Process Emphasis - observing, controlling variables

Content - melting rates
- heat transfer
- effects of insulation

Pupil References

1) Branley: Snow is Falling, (Fitzhenry and Whiteside)

2) Snow, Vol. 57, (Macdonald Starters)

Teacher References

1) Lauber, Patricia: Icebergs and Glaciers, (Thomas Nelson)

2) Lauber, Patricia: Junior Science Book of Icebergs and Glaciers, (Scholastic)

Equipment - kit available.

Description of Unit and Learning Outcomes

304 OURSELVES (Science 5/13)

This unit suggests many activities which allow the student to learn more about his/her body. The children question one another, take measurements, perform certain tasks, carry out tests and record information.

Learning Outcomes:

Process Emphasis - observing, quantifying

Content - types of measurement
- biological variation

Pupil References

1)		Teeth, Vol. 62 (Macdonald Starters)
2)		Sleep, Vol. 55 (Macdonald Starters)
3)		Hair, Vol. 33 (Macdonald Starters)
4)		Eyes, Vol. 24 (Macdonald Starters)
5)	Bendick:	The Human Senses - Science Experiences, (Franklin Watts)
6)	Goldin:	Straight Hair, Curly Hair - Let's Read & Find Out Science Book, (Crowell, 1966)
7)	Showers:	Use Your Brain - Let's Read & Find Out Science Book, (Crowell, 1971)
8)	Showers:	Your Skin and Mine - Let's Read & Find Out Science Book, (Crowell, 1965)
9)	Aliki:	My Five Senses - Let's Read & Find Out Science Book, (Crowell, 1962)
10)	Branley:	High Sounds, Low Sounds - Let's Read & Find Out Science Book, (Crowell, 1967)
11)	Showers:	A Drop of Blood - Let's Read & Find Out Science Book, (Crowell, 1967)
12)	Showers:	A Baby Starts To Grow - Let's Read & Find Out Science Book, (Crowell, 1969)
13)	Showers:	Follow Your Nose - Let's Read & Find Out Science Book, (Crowell, 1963)
14)	Showers:	Hear Your Heart - Let's Read & Find Out Science Book, (Crowell, 1968)
15)	Showers:	How You Talk - Let's Read & Find Out Science Book, (Crowell, 1966)

Teacher References

1) Your Senses, (Holt, Rinehart & Winston)
NOTE: This is a unit for Year 6

2) Stannard, P., : Sense Systems, (Man and Nature Series) MacMillan, 1976

Equipment - No kit available

Description of Unit and Learning Outcomes

305 POND WATER (ESS)

After collecting pond water the student has the opportunity to observe the interaction of plant and animal life in pond water.

Learning Outcomes:

Process Emphasis - observing, classifying, communicating

Content - animals take different forms during their life cycle

Pupil References

1) Brouillette: Insects, (McGraw-Hill)

2) Crosby: Pond Life - Junior Science Books, (Garrard Pub.)

3) Insects - A Golden Bookshelf of Natural History, (Fitzhenry & Whiteside)

4) Buck: In Ponds and Streams - Abingdon Press, (G.R. Welch Ltd.)

5) Frogs, Vol. 16, (Macdonald Starters)

Teacher References

1) Kellin, S.M.: A Book of Snails - Young Scott Books, (Addison-Wesley) 1968

2) Borden, John H. & Herrin, Brian D. Insects, (B.C.T.F. Lesson Aid)

Equipment - No kit available
Print material available.

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Description of Unit and Learning Outcomes

306 SEEDS AND SEEDLINGS (TPS)

This unit suggests many factors which influence the germination of seeds and growth of seedlings. It offers more complex investigations than those to which students have been exposed in previous year levels.

Learning Outcomes:

Process Emphasis - observing, classifying, quantifying, communicating.

Content - factors affecting seed germination
- characteristics of seeds
- factors affecting plant growth
- stages of plant development
- parts of a plant - their functions
- seeds and grains as food

Pupil References

1) Griffin-King, J. Indoor Gardening, (Ladybird), 1969

2) Nuving, F.E. and Bowood, R.: Plants and How They Grow, (Ladybird Natural History Series), 1965

Teacher References

See Teacher references for Unit 104, Growing Seeds

Equipment - No kit available

PROCESS AND CONTENT CHART

YEAR FOUR

Science Processes

■ Process Emphasis

▨ Supporting Processes

UNIT NO.	UNIT TITLE	Observing	Classifying	Quantifying	Communicating	Interpreting Data	Inferring	Formulating Hypotheses	Predicting	Controlling Variables	Experimenting	Defining Operationally	Formulating Models
401	EARTHWORMS (ESS)	■							▨	■	■		
402	EGGS AND TADPOLES (ESS)	■			■	▨	▨		▨				
403	FIBRES AND FABRICS (TPS)	■	■	■	▨	▨	■	▨	▨	■	■		
404	MIRRORS AND MAGNIFIERS (TPS)	■			▨			■	■	■	■	▨	
405	MOBILES (ESS)	■					▨						■
406	MYSTERY POWDERS (ESS)	■	■				■		■				
407	STARTING FROM SEEDS (ESS)	■		▨			▨		▨	■	■		
408	TRACKS (ESS)	■	■		■	■	▨	■					

Description of Unit and Learning Outcomes

401 EARTHWORMS (ESS)

This unit deals with the behavior of earthworms. Watching the worms raises questions and the students find the answers to their questions by observing and experimenting.

Learning Outcomes:

Process Emphasis - observing, controlling variables,

Content - habits and developmental stages of a living creature

Pupil References

1) Pringle: Twist, Wiggle & Squirm,(Fitzhenry & Whiteside)
2) Darling: Worms,(Geo. McLeod Ltd.)
3) Simon: Discovering What Earthworms Do,(McGraw-Hill)

Equipment - Kit available

Description of Unit and Learning Outcomes

402 EGGS AND TADPOLES (ESS)

In the study of the growing tadpole in its environment, basic biological concepts are studied. The frogs eggs are collected and observed as they hatch into tadpoles, then develop into frogs.

Learning Outcomes:

Process Emphasis - observing, communicating

Content - life cycle of an amphibian

- environmental requirements

Pupil References

1) Darby: What Is A Frog, (Scholastic)
2) Hawes: What I Like About Toads - Let's Read & Find Out, (Crowell, 1969)
3) Hawes: Why Frogs Are Wet - Let's Read & Find Out Sc. Bk., (Crowell, 1968)
4) Frogs and Toads, Vol. 23 (Macdonalds First Library)
5) Life In Fresh Water, Vol. 40 (Macdonalds Junior Reference Library)
6) Amphibians & Reptiles, Vol. 2 (Macdonalds Junior Reference Library)

Equipment - Kit available.

Description of Unit and Learning Outcomes

403 FIBRES AND FABRICS (TPS)

Because fibres and fabrics are so much a part of everyday life, they are appropriate materials to use for scientific investigations. This unit offers many student activities which develop scientific processes.

Learning Outcomes:

Process Emphasis - observing, classifying, quantifying, inferring, controlling variables, experimenting

Content -
- classification of fibres
- water absorption of various fibres
- surface tension
- dyeing techniques
- weaving techniques

Pupil References

1) Cochrane, J.(ed): Textiles, (Macdonald Junior Reference Library), 1969

2) Thomson, Ruth (ed): Cloth and Weaving, (Macdonald First Library), 1973

Equipment - No kit available

Description of Unit and Learning Outcomes

404 MIRRORS AND MAGNIFIERS (TPS)

Using mirrors and magnifiers students test their own hypotheses through experimentation. The initial action of 'looking in the mirror' places emphasis upon, and immediately improves, students' actual observations. The unit embodies a carefully structured sequence of activities and experiences which give the child extensive opportunities to interact with the environment and to develop problem-solving skills.

Learning Outcomes:

Process Emphasis - observing, hypothesizing, experimenting, predicting, controlling variables.

Content - laws governing reflected light and the effects of magnification.

Pupil References

See bibliography contained in manual

Teacher References

See bibliography contained in manual

Equipment

No kit available.
Equipment required: mirrors of assorted shapes and sizes, playing cards.

Description of Unit and Learning Outcomes

405 MOBILES (ESS)

This unit provides opportunities for students to balance by constructing mobiles that are of their own design.

Learning Outcomes:

Process Emphasis - observing, formulating models

Content - familiarity with laws and problems of balance

Pupil References

1) Srivastava, Jane Jonas: Weighing & Balancing, (Fitzhenry and Whiteside)

Equipment - Kit available

Description of Unit and Learning Outcomes

406 MYSTERY POWDERS (ESS)

This unit deals with the properties of safe household powders.Students attempt to identify these "unknown" powders through various methods and to determine the presence of individual powders when two or more are mixed together.

Learning Outcomes:

Process Emphasis - observing, classifying, inferring, predicting

Content - use of indicators to identify common household powders

Equipment -- Kit available

Description of Unit and Learning Outcomes

407 STARTING FROM SEEDS (ESS)

Students germinate seeds and grow plants under varied conditions. They are guided by questions to conduct investigations such as causing plants to bend, growing new plants from cuttings and growing plants upside down.

Learning Outcomes:

Process Emphasis - observing, controlling variables, experimenting

Content - study of factors which affect plant growth

Pupil References

1) Hammond: The Riddle of Seeds, (Longman)
2) Selsam: The Tomato, (Morrow-Geo. McLeod Ltd.)
3) Selsam: Maple Tree, (Morrow-Geo. McLeod Ltd.)
4) Flowering Plants, Vol. 27 (Macdonald Junior Reference Library)
5) Plants Without Flowers, Vol. 50 (Macdonald Junior Reference Library)
6) Flowers in The Garden, Vol. 28 (Macdonald Junior Reference Library)
7) Trees, Vol. 67 (Macdonald Junior Reference Library)
8) Wild Flowers, Vol. 70, (Macdonald Junior Reference Library)
9) Bulla, Clyde Robert: A Tree is a Plant, (Fitzhenry & Whiteside), 1973

Teacher References

1) Rahn: Seeing What Plants Do, (McClelland & Stewart)
2) "Plants in the Classroom, An Environmental Investigation", 1971, National Wildlife Federation, 1412 - 16th Street, N.W., Washington, D.C.

Equipment - No kit available

Description of Unit and Learning Outcomes

408 TRACKS (ESS)

This unit involves the student in the study of animal tracks, and the unravelling of events that shaped the track-identity, direction of travel, speed, size, method of finding food and habitat. The student learns how the animal track is an intricate record of a particular creature's activity at a particular time.

Learning Outcomes:

Process Emphasis - observing, classifying, communicating, formulating hypothesis, interpreting data

Content - animal locomotion

- adaptations

- animal habits and habitats

Pupil References

1) Webster: Track Watching,(Fitzhenry & Whiteside)

2) Ennion: Tracks,(Oxford University Press)

3) Selsam: How To Be A Nature Detective, (Scholastic Tab)

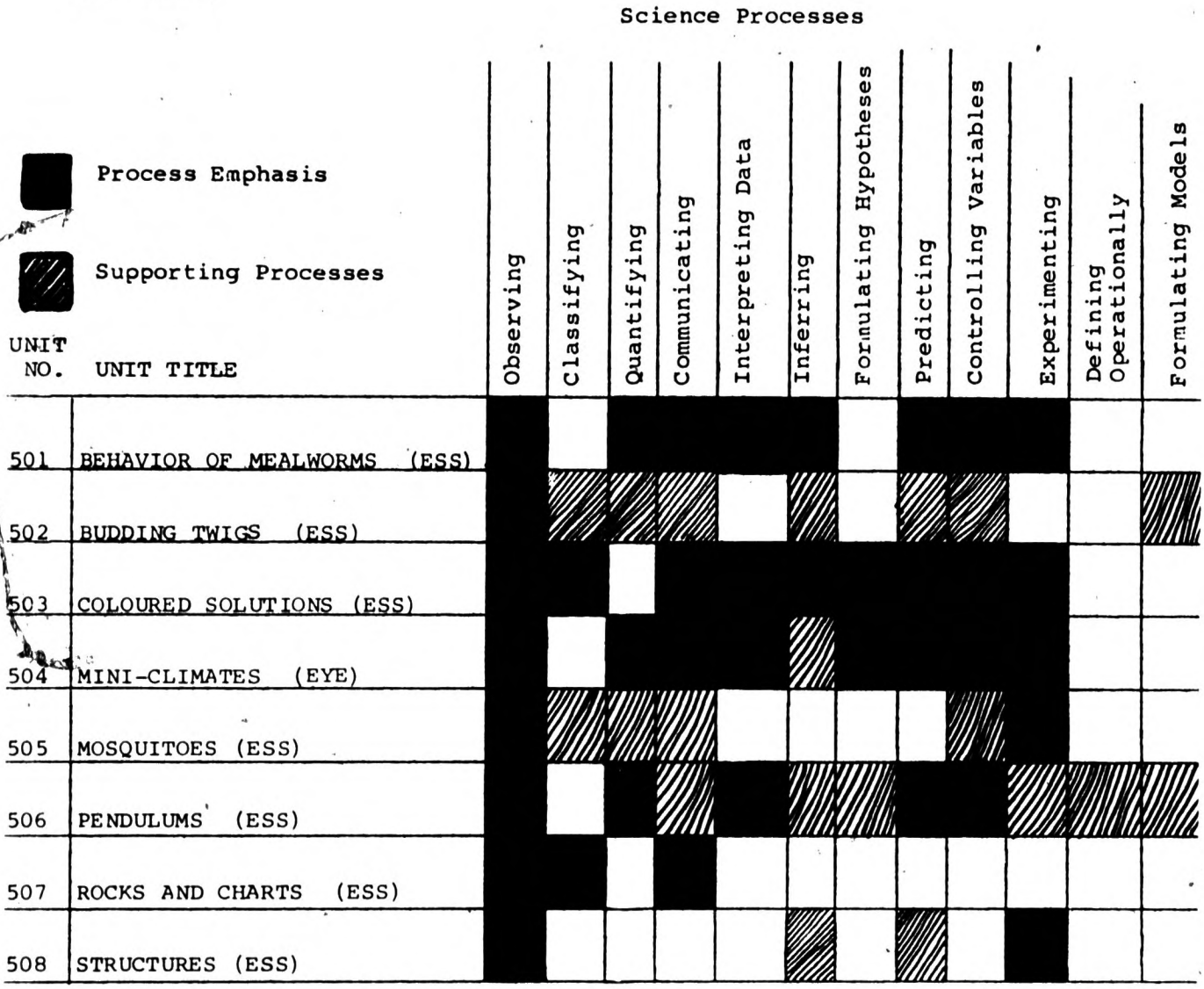
4) Selsam: How To Be An Animal Detective, (Scholastic Tab)

5) Branley: Big Tracks; Little Tracks, (Fitzhenry & Whiteside)

Equipment - No kit available
Print material available.

PROCESS AND CONTENT CHART

YEAR FIVE



Descriptions of Unit and Learning Outcomes

501 BEHAVIOR OF MEALWORMS (ESS)

Through the process of investigation students study the behavior of the mealworm.

Learning Outcomes:

Process Emphasis - observing, quantifying, communicating, inferring, predicting, controlling variables, interpreting data, experimenting.

Content - habits and characteristics of a mealworm
- sensory perception of the mealworm
- life cycle of an insect

Pupil References

1) Insects, Vol. 38, (Macdonald Starters)

2) Carthy, J.D.: An Introduction to The Behavior of Invertebrates, (Macmillan) 1958

3) Carthy, J.D.: The World of Feeling (Phoenix House, London-Roy Publishers, New York, 1960)

4) Roeder, K.: Nerve Cells and Insect Behavior, (Harvard University Press, Cambridge, Massachusets), 1963

5) von Frisch, K.: Bees, Their Vision, Chemical Senses and Language, (Cornell University Press, Ithaca, N.Y.), 1951 (paperback)

6) von Uexkull, J.: "A Stroll Through the World of Animals And Men", (essay in Instinctive Behavior, translated and edited by Schiller, C.H.) (International Universities Press, N.Y.) 1957

Teacher References

1) Knaack, Janey: "Interdisciplinary Outdoor Education, Behavior of Mealworms", 1968, Shoreline School District No. 412, 158th and 20th Avenue, N.E., Seattle, Washington, 98155

Equipment - No kit available.
Equipment required: mealworms, bran.
Print material available.

Descriptions of Unit and Learning Outcomes

502 BUDDING TWIGS (ESS)

The students study the complexity and variety of plant structure. Various types of twigs are collected in early spring and forced into leaf and blossom in the classroom.

Learning Outcomes:

Process Emphasis - observing

Content - the structure of some plant parts and their functions

Pupil References

1) Timber, Vol. 64, (Macdonalds Jr. Reference Library)
2) Trees, Vol. 67, (Macdonalds Jr. Reference Library)
3) Once There Was A Tree, (Scholastic)

Equipment - No kit available
Equipment required: pruning shears, keyhole saw, half round file, sandpaper.

Descriptions of Unit and Learning Outcomes

503 COLOURED SOLUTIONS (ESS)

By experimenting with a variety of coloured and clear liquids, students gain concepts of density and the layering of liquids. Liquids are classified according to their "density".

Learning Outcomes:

Process Emphasis - observing, classifying, communicating, inferring, predicting, formulating hypotheses, controlling variables, interpreting data, experimenting.

Content - density and layering of liquids
- effect of temperature in mixing liquids

Equipment - kit available.

Descriptions of Unit and Learning Outcomes

504 MINI-CLIMATES (EYE)

> This unit is presented in an investigation guidebook for students. Its inclusion here is intended as a teacher's guide in establishing student inquiries.

This unit requires the study of small areas in the immediate environment outside the school and provides a foundation for broader studies of weather and climate. Students make many observations involving temperature, light, humidity, wind and soil.

Learning Outcomes:

Process Emphasis - observing, quantifying, communicating, predicting, formulating hypotheses, controlling variables, interpreting data, experimenting.

Content - interaction and interdependence of environmental factors, particularly temperature, humidity, and air movement

- soil types, composition, pH

Pupil References

1) Irving, Robert: Hurricanes & Twisters,(Scholastic) 1973

2) Benton, Allen H. & Werner, Wm.E. Jr.: Manual of Field Biology and Ecology, (Burgess Publishing) 1965

3) Franklin, T. Bedford: Climates In Miniature,(New York, Philosophical Library, Inc.) 1955

4) Geiger, Dr. Rudolf: The Climate Near the Ground,(Cambridge, Massachusetts, Harvard University Press) 1950

5) Rockcastle, V.: Little Climates - Cornell Science Leaflet, Volume 55, #1 (Ithaca, N.Y., Cornell University) 1961

6) Unesco: Practical Microclimatology (N.Y. Unesco) 1967

Equipment - No kit available
Equipment required: 1 ammeter (vacuum tube type), light meter.

Descriptions of Unit and Learning Outcomes

505 **MOSQUITOES (ESS)**

This unit deals with the raising of mosquitoes from egg to adult form. Opportunities are provided for the observation of the various stages of development. The unit encourages experimentation during the various stages.

Learning Outcomes:

Process Emphasis - observing, experimenting

Content - developmental stages of a living creature
- the life cycle including reproduction

Pupil References

1) Insects, Vol. 38 (Macdonald Junior Reference Library)

2) Life in Fresh Water, Vol. 40 (Macdonald Junior Reference Library)

Teacher References

1) Insects in the Classroom, (B.C.T.F. Lesson Aid #9520) 1972

2) Sadler, D: Studying Insects,(McGraw-Hill Ryerson) 1973

3) Know the Bug, I.S.I.S., (Ginn and Company),1976

Equipment - No kit available
Equipment required: mosquito eggs, clear plastic tubing.

506 PENDULUMS (ESS)

Students' explorations with swinging objects lead to questions about gravity and the laws of the pendulum. From free play the students progress to planned experiments for the investigation of specific problems.

Learning Outcomes:

Process Emphasis - observing, quantifying, interpreting data, predicting, controlling variables.

Content - gravitational force, mass and momentum

Teacher References

1) Rogers, Eric M.: Physics For the Inquiring Mind (Princeton, New Jersey, Princeton University Press) 1960

Equipment - Kit available

Descriptions of Unit and Learning Outcomes

507 ROCKS AND CHARTS (ESS)

This unit is designed to help children look closely at rocks and establish their own ways of comparing them. Students are involved in the recognition of mineral constituents of common rocks. Activities relating to the use of charts for recording data are provided.

Learning Outcomes:

Process Emphasis - observing, classifying, communicating

Content - distinction between rock and mineral
- identification, properties and characteristics of rocks

Pupil References

1) Search For A Living Fossil, (Scholastic)
2) They Turn to Stone, (Scholastic)
3) Ridpath: Stone - Man & Materials, (MacMillan)
4) Ridpath: Minerals - Man & Materials, (MacMillan)
5) Rocks & Minerals, Vol. 56, (Macdonald Junior Science)
6) Gems & Jewellery, Vol. 32, (Macdonald Junior Science)
7) Earth, Vol. 23, (Macdonald Junior Science)
8) Gilbert, Miriam: Starting a Rock and Mineral Collection, (Maplewood, New Jersey, Hammond Inc.), 1961.
9) Loomis, F.B.,: Field Book of Common Rocks and Minerals, rev. ed. (New York, G.P. Putnam's Sons), 1948.
10) MacFall, Russell P.: Collecting Rocks, Minerals, Gems, and Fossils, (New York, Popular Mechanics Press) (Hawthorn Books, Inc.), 1963
11) Pearl, Richard M.: How to Know the Minerals and Rocks, (New York, McGraw-Hill Book Company), 1955 (Available in paperback)
12) Zim, Herbert S.: & Cooper, Elizabeth K: Minerals: Their Identification, Uses, and How to Collect Them, (New York, Harcourt, Brace & World, Inc.), 1943.

13) Zim, Herbert S., & Shaffer, Paul R.: Rocks and Minerals, (New York, Golden Press), 1957.

14) Wyler and Ames: Secrets in Stones, (Scholastic), 1972

Teacher References

1) Pough, Fred: Field Guide To Rocks & Minerals, (Houghton Mifflin)

2) Zim, Herbert, & Shaffer, Paul R.: Rocks & Minerals - A Golden Guide, (Golden Press, New York)

3) Identification of Common Minerals, (Department of Mines, Victoria)

4) Jones, J.R.: Rocks, Minerals & Fossils - Searching For Structure Series, (Holt, Rinehart & Winston)

Equipment - Kit available

Descriptions of Unit and Learning Outcomes

508 STRUCTURES (ESS)

Through an open ended approach, this unit permits students to create structures of their own choosing, utilizing a variety of simple materials.

Learning Outcomes:

Process Emphasis - observing, experimenting

Content - basic concepts of stress and strain of materials

- relating geometric shapes to structural strength

Pupil References

1) Architecture Vol. 9, (Macdonald Jr. Reference Library)

2) Roads, Bridges and Tunnels, Vol. 55 (Macdonald Junior Reference Library)

3) Two art books for children - Paper Art and Constructions - (The Whitman Publishing Company)

4) Barr, Donald, The How and Why Wonder Book of Building, (Grosset)

5) Schneider, Herman & Nina Science for Today and Tomorrow, pages 343-356. (Heath), 1965.

6) Goldwater, Daniel, Bridges and How They Are Built, (Scott), 1965.

The following three books were written for adults but contain many interesting pictures of structures that may help to stimulate students' interest in different ways of building:

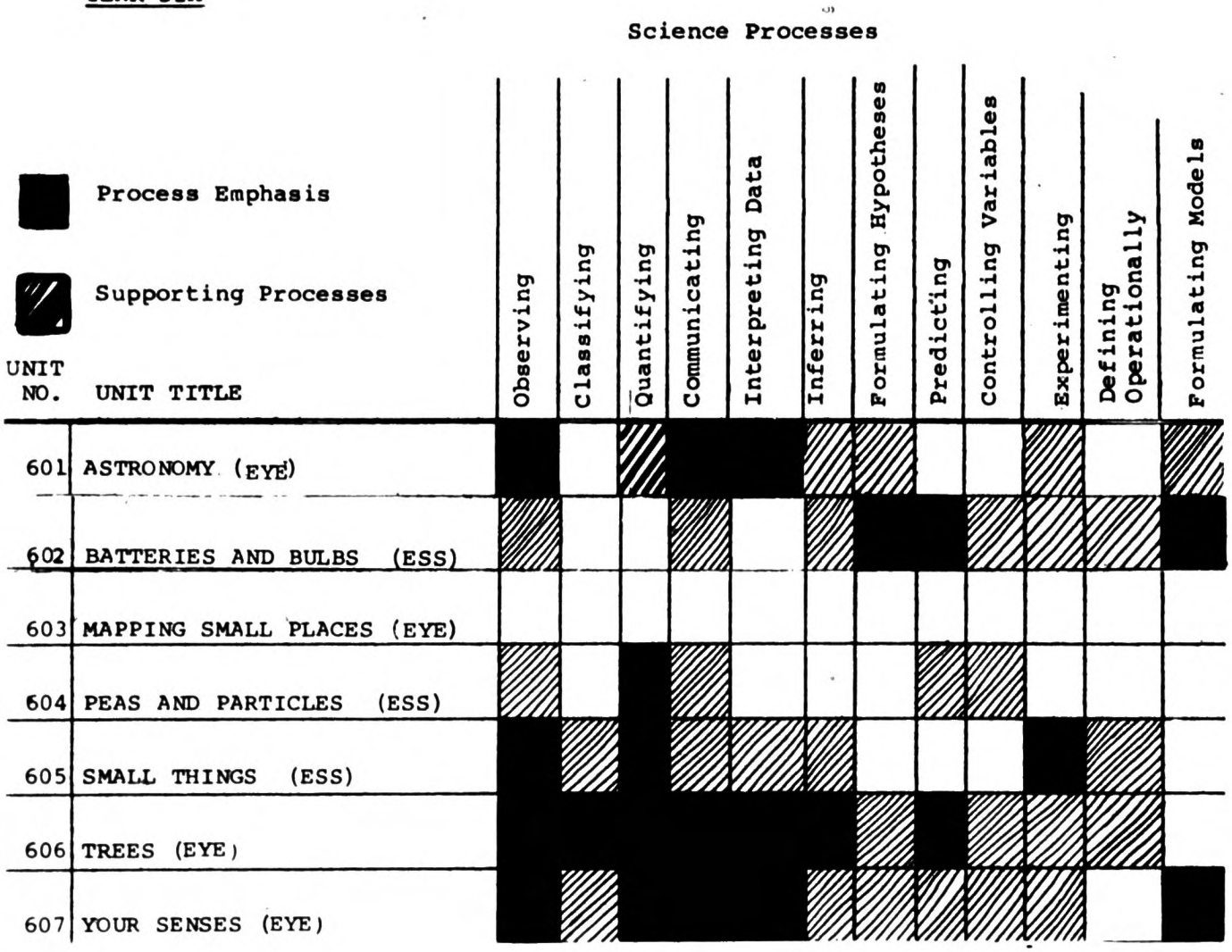
7) O'Neill, Richard W., High Steel, Hard Rock, and Deep Water - The Exciting World of Construction, (Macmillan, 1965)
8) Billings, Henry, Bridges, (Viking, 1956)
9) Giles, Joseph, Bridges and Men, (Doubleday, 1963)

Also recommended are books on Origami (the Japanese art of paper-folding).

Equipment - No kit available

PROCESS AND CONTENT CHART

YEAR SIX



Description of Unit and Learning Outcomes

601 ASTRONOMY (EYE)

> This unit is presented in an investigation guidebook for students. Its inclusion here is intended as a teacher's guide in establishing student inquiries.

The unit focuses on the student developing skills and acquiring knowledge of astronomy by investigating the earth's environment and its relation to the universe.

Learning Outcomes:

Process Emphasis - observing, communicating, interpreting data

Content - examination of the stars and constellations
- investigation of the moon and sun
- examination of the solar system

Pupil References

1) Branley, F.M.: Experiments in Sky Watching, (Crowell), 1967

2) Gallant, R.A.: The ABC's of Astronomy, (Doubleday) 1972

3) Gardner, M.: Space Puzzles, (Simon and Schuster) 1971

4) Land, B.: Telescope Makers From Galileo to the Space Age, (Crowell), 1968

5) Moore, P. and Hardy, D: Challenge of the Stars, (Rand McNally), 1972

Teacher References

1) Hawkins, G.: Splendor in the Sky, (Harper & Row), 1969

2) Moore, P.: The Amateur Astronomer, (Norton) 1964

3) Pickering, J.S.: 1001 Questions Answered About Astronomy, (Dodd, Mead), 1966

Equipment
No kit available.
Equipment required: star chart, sky calendar, 35mm camera & tripod, dinometer, binoculars, telescope kit (see manual p. 64)

Descriptions of Unit and Learning Outcomes

602 BATTERIES AND BULBS (ESS)

Students investigate electrical circuits using dry cell batteries.

Learning Outcomes:

Process Emphasis - predicting, formulating hypotheses, formulating models.

Content - the components necessary to construct a complete circuit

- light bulbs and batteries; their parts and how they work

Pupil References

1) Freeman, M. & I.: The Story of Electricity, (Random House), 1961

2) Pitchforth Hays: Samuel Morse and the Electronic Age (Franklin Watts), 1960

3) Loubser L.: Making Electricity, (MacLean Hunter)

4) Radio and Television, Vol. 53, (Macdonald Junior Reference Library)

Equipment

Kit available.
Print material available.

Description of Unit and Learning Outcomes

603 **MAPPING SMALL PLACES (EYE)**

> **This unit is presented in an investigation guidebook for students. Its inclusion here is intended as a teacher's guide in establishing student inquiries.**

Students learn the skills of constructing and reading maps by developing simple equipment in carrying out a wide variety of mapping activities.

Learning Outcomes:

Process Emphasis - observing, classifying, quantifying, communicating, interpreting data

Content - correlation possibilities with mathematics and social studies, e.g. scale, direction, measurement, triangulation

Teacher References

1) "Contour Mapping, An Environmental Investigation", 1971, National Wildlife Federation, 1412 - 16th Street, N.W., Washington, D.C.

Equipment

No kit available.
Equipment required: carpenter's spirit level.

Descriptions of Unit and Learning Outcomes

604 PEAS AND PARTICLES (ESS)

The students develop methods of counting and estimating large numbers of common household articles. This unit lends itself to an integration of science and mathematics.

Learning Outcomes:

Process Emphasis - quantifying

Content - methods of estimating
- understanding of large quantities

Equipment

Kit available.

Descriptions of Unit and Learning Outcomes

605 SMALL THINGS (ESS)

Presented here is an introduction to magnification and the use of the microscope. The student learns to make slides and to use a simple microscope to investigate plant and animal cells.

Learning Outcomes:

Process Emphasis - observing, quantifying, experimenting

Content - identification of various protozoa
- generalizations concerning living things and cellular composition
- structure of crystals

Pupil References

1) Schwartz, J.: Through the Magnifying Glass, (McGraw-Hill)
2) Invisible World Vol. 39 (Macdonald Jr. Reference Library)
3) Life in Fresh Water, Vol. 40, (Macdonald Junior Reference Library)
4) Silverstein, A. & V.: A World in a Drop of Water, (McClelland & Stewart), 1969

Equipment

Kit available.
Print material available.

Descriptions of Unit and Learning Outcomes

606 TREES (EYE)

A unit suggesting many investigations which lead to the students learning about the structure of trees and man's dependency on them.

Learning Outcomes:

Process Emphasis - observing, classifying, quantifying, communicating, interpreting data, inferring, predicting

Content - the parts of a tree and their functions in its survival
- plant and animal life found on and under trees
- varying types of seeds and their ability to scatter and germinate

Pupil References

1) Timber, Vol. 64 (Macdonald Junior Reference Library)

2) Trees, Vol. 67 (Macdonald Junior Reference Library)

Teacher References

1) Lyons, C.P.: Trees, Shrubs & Flowers in B.C.

2) Horwood, R.H.: Trees, - Our Science Program Series, 1973 (Macmillan)

3) Project Learning Tree - Education/ Research Systems Incorporated (American Forest Institute Incorporated, 1619 Massachusetts Ave., N.W., Washington, D.C. 20036)

4) Working With Wood, (Science 5/13)

5) Working With Wood - Background Information (Science 5/13)

6) Trees, (Science 5/13)

7) Science From Wood, Teaching Primary Science, 1976, Macdonald Educational

8) Canadian Forestry Association, #410 - 1200 W. Pender Street, Vancouver, B.C. V6E 259. (assortment of free pamphlets and booklets).

Equipment

No kit available.
Equipment required: spring scale to 15 kg, maximum-minimum thermometer.

Description of Unit and Learning Outcomes

607 YOUR SENSES (EYE)

> This unit is presented in an investigation guidebook for students. Its inclusion here is intended as a teacher's guide in establishing student inquiries.

Through a wide variety of activities students develop skills in conducting simple investigations and learn about their senses and physiology.

Learning Outcomes:

Process Emphasis - observing, quantifying, communicating, interpreting data, formulating hypotheses

Content - function and measuring of human senses
- related terminology

Pupil References

1) Branley, F.: High Sounds, Low Sounds - Let's Read & Find Out Science Book, (Crowell)

2) Schneider, L.: You And Your Senses, (Harcourt, Brace & World)

3) The Human Body, Vol 37, (Macdonald Junior Reference Library)

Teacher References

1) Ourselves (Science 5/13)

NOTE: This is a unit for Year 3

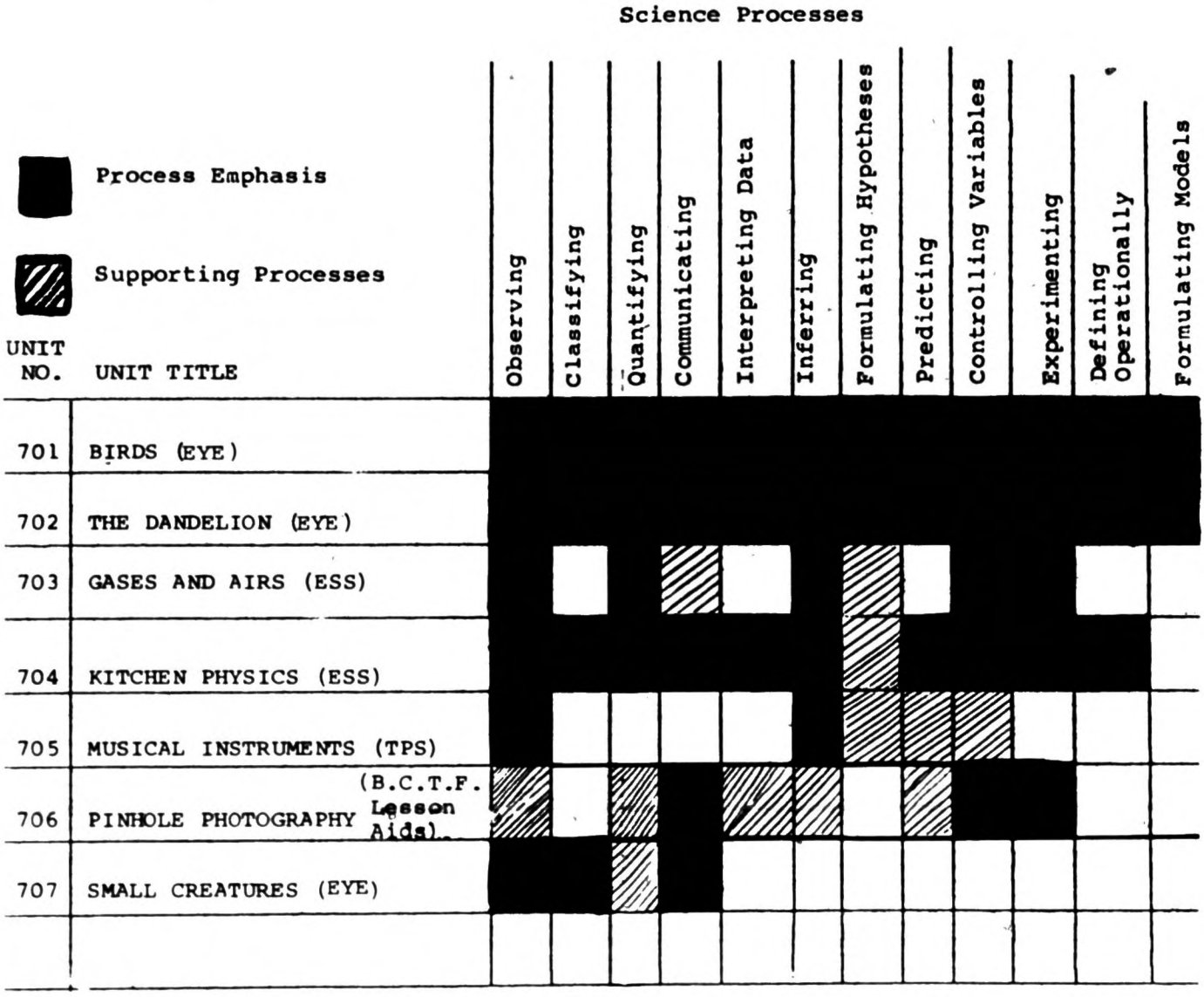
Equipment

No kit available

Equipment required: stethoscope.

PROCESS AND CONTENT CHART

YEAR SEVEN



Description of Unit and Learning Outcomes

701 BIRDS (EYE)

> This unit is presented in an investigation guidebook for students. Its inclusion here is intended as a teacher's guide in establishing student inquiries.

The unit deals with observing birds in their natural environment thus leading to a better understanding and appreciation of them.

Learning Outcomes:

Process Emphasis - observing, classifying, quantifying, communicating, interpreting data, inferring, formulating hypotheses, predicting, experimenting, controlling variables, defining operationally

Content
- awareness of birds' ability to fly
- study of flight and migratory patterns of birds
- examination of eating habits
- study of coloration, feathers, feet and other related bodily structures
- examination of relative sizes and parts of eggs
- examination of the various stages of an embryo
- study of birds' nests
- study of the skeletons of birds

Pupil References

1) Robbins, Zim: Birds of North America, (Golden Press)
2) Peterson, R.T.: Field Guide To Western Birds, (Houghton-Mifflin)
3) Fenton & Pallas: Birds and Their World, (John Day Co.)
4) Mathewson, R.: Birds, How & Why Wonder Book, (Grosset/Dunlop)
5) Vevers, G.: Birds and Their Nests, (Bodley Head)
6) Ohmatt, E. & O.: Exploring and Understanding Birds, (Benefic Press)
7) Lemmon, R.S.: All About Birds, (Random House)

8) Birds, Vol. 10, (Macdonald Junior Reference Library)

9) Welty, S.F.: Birds With Bracelets, (Prentice-Hall)

10) Kirk, R.: Birds In Flight, (Follett)

11) Cox, V.: Nature's Flying Janitor, (Golden)

12) Burton, M.: Life of Birds, (Golden)

13) Henry, M.: Birds at Home, (Hubbard Press)

Teacher References

1) Bones (ESS) Teacher's Manual

Equipment

No kit available.

Description of Unit and Learning Outcomes

702 THE DANDELION (EYE)

> This unit is presented in an investigation guidebook for students. Its inclusion here is intended as a teacher's guide in establishing student inquiries

The unit deals with how the dandelion influences its environment and in turn how it is affected by the environment.

Learning Outcomes:

Process Emphasis - observing, classifying, quantifying, communicating, interpreting data, inferring, formulating hypotheses, predicting, experimenting, controlling variables, defining operationally, formulating models.

Content - interdependence of plants and animals
- population studies
- parts of the dandelion and other plants
- environmental conditions influencing growth

Pupil References

1) Flowering Plants, Vol. 27, (Macdonald Junior Reference Library)

2) Flowers of the Garden, Vol. 28, (Macdonald Junior Reference Library)

3) Sadler, D.: Studying Plants - Ryerson Science in Action Series, (McGraw-Hill Ryerson) 1973

Equipment

No kit available.

Descriptions of Unit and Learning Outcomes

703 GASES AND AIRS (ESS)

Gases and Airs offers an open-ended inquiry approach by experimentation into the properties of air and the changes it undergoes when it interacts with selected materials in a controlled environment.

Learning Outcomes:

Process Emphasis - observing, quantifying, inferring, experimenting, controlling variables

Content - awareness that air is real, has weight, and occupies space
- air interacts with materials
- identifying an "active fraction" of air

NOTE: The use of Pyrogallol is considered dangerous and therefore the experiment using this must be omitted.

Pupil References

1) Gases, Vol. 31, (Macdonald Junior Reference Library)

Equipment

Kit available.
Print material available.

Descriptions of Unit and Learning Outcomes

704 KITCHEN PHYSICS (ESS)

This unit presents an open-ended inquiry approach to studying the properties of common liquids: how they form drops and puddles; how they fall and break up and how fast they flow through various sizes of openings; how they heat up, mix and dissolve. Also included in this unit are experiments involving balance.

Learning Outcomes:

Process Emphasis - observing, classifying, quantifying, communicating, interpreting data, inferring, formulating hypotheses, predicting, experimenting, controlling variables, defining operationally

Content - awareness of the behavior of liquids as related to absorption, evaporation and surface tension

- interaction of liquids with various surfaces
- density and specific gravity of liquids

Equipment

Kit available.
Print material available.

Description of Unit and Learning Outcomes

705 **MUSICAL INSTRUMENTS (TPS)**

In this unit students are motivated to design and construct their own musical instruments using a variety of easily obtained material.

Learning Outcomes:

Process Emphasis - observing, inferring

Content - instrument construction and related sound production
- elements of sound - loudness, pitch, tone
- music appreciation

Pupil Reference

1) Music, Vol. 47 (Macdonald Junior Reference Library)

Teacher Reference

1) Musical Instrument Recipe Book 1971 (ESS)

Equipment

No kit available.

Descriptions of Unit and Learning Outcomes

706 PINHOLE PHOTOGRAPHY (B.C.T.F. Lesson Aid)

Students construct pinhole cameras from cardboard or tin cans, make exposures, develop negatives and print pictures.

Learning Outcomes:

Process Emphasis - communicating, experimenting, controlling variables.

Content - basic principles of photography

Pupil References

1)		Yours Senses, (Holt, Rinehart & Winston)
2)	Freeman, M. & I.:	Fun With Your Camera, (Random House)
3)	Hoke, John:	First Book of Photography, (F. Watts)
4)	Carrier & Carroll:	Super 8 Cassette Film Making, (Scribners)
5)		Photography, Vol.49, (Macdonald Junior Reference Library)(GLC)
6)	Shull, Jim	The Hole Thing, Morgan & Morgan Inc. New York, 1974.

Teacher References

1)		Classroom Cameras, VEEP, 1974 (U.B.C.)
2)	Verne Rockcastle:	Light, Volume 53 #3, 1960 (Cornell Science Leaflet)

Description of Unit and Learning Outcomes

707 SMALL CREATURES (EYE)

> This unit is presented in an investigation guidebook for students. Its inclusion here is intended as a teacher's guide in establishing student inquiries

The child studies small forms of animal life found in his/her school yard and neighborhood.

Learning Outcomes:

Process Emphasis - observing, classifying, quantifying, communicating

Content - characteristics of vertebrate and invertebrate

- life requirements

Pupil References

1)	Hutchins, R.:	The Carpenter Bee ,(Addison-Wesley)
2)	Kellin, S.:	A Book of Snails, (Young Scott Books)
3)	Selsam, M.:	Ants (Scholastic)
4)	Road, R.:	Bees, Bugs & Beetles ,(Scholastic)
5)		Insects, Vol. 38 ,(Macdonald Junior Reference Library)
6)		Life in Fresh Water, Vol. 40, (Macdonald Junior Reference Library)
7)		Mammals, Vol. 43 ,(Macdonald Junior Reference Library)

Equipment

No kit available.

MULTI-LEVEL

UNITS

Multi-level units - are intended to be used with minimal teacher direction at any grade level the teacher considers appropriate. Suggested level is indicated in ( )..

PROCESS AND CONTENT CHART

MULTI-LEVEL UNITS

Science Processes

■ Process Emphasis

▨ Supporting Processes

UNIT NO.	UNIT TITLE	Observing	Classifying	Quantifying	Communicating	Interpreting Data	Inferring	Formulating Hypotheses	Predicting	Controlling Variables	Experimenting	Defining Operationally	Formulating Models
1	Pattern Blocks (ESS) (1 - 3)	■	▨										
2	Attribute Games & Problems (ESS) (2 - 7)	■	■		▨					■	▨		
3	Mirror Cards (ESS) (1 - 3)	■											
4	Tangrams (ESS) (4 - 7)	■	■				▨		▨				

Descriptions of Multi-Level Unit and Learning Outcomes

1. PATTERN BLOCKS (ESS)

The student will construct original patterns and reproduce designs utilizing a variety of coloured blocks of different shapes.

Learning Outcomes:

Process Emphasis - observing

Content - geometric shapes

Equipment

Kit available.

Description of Multi-Level Unit and Learning Outcome

2. ATTRIBUTE GAMES AND PROBLEMS (ESS)

The material for this unit consists of many geometric shapes which differ in size and colour. The activities involve the students in an introduction to classifying which can lead into work with sets in mathematics.

Learning Outcomes

Process Emphasis - observing, classifying controlling variables

Content
- colour
- geometric shape
- counting experiences

Equipment

Kit available.
Print material available.

Description of Multi-Level Unit and Learning Outcome

3. MIRROR CARDS (ESS)

The students will reproduce designs by combining real and reflected images.

Learning Outcomes

Process Emphasis - observing

Content - reflection

Equipment

Kit available.

Description of Multi-Level Unit and Learning Outcome

4. TANGRAMS (ESS)

This unit uses puzzles to investigate problems in area.

Learning Outcomes

Process Emphasis - observing, classifying

Content - experiences with angles,
- fractional parts and area

Equipment

Kit available.
Print material available.