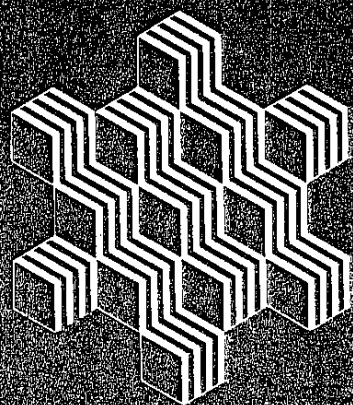


Secondary School Curriculum



SECONDARY

**PHYSICAL SCIENCE
(PHYSICAL ENVIRONMENT)**

REVISED VERSION

Québec 

Secondary School Curriculum

SECONDARY

**PHYSICAL SCIENCE
(PHYSICAL ENVIRONMENT)**

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This program in Physical Science (Physical Environment) for level two of secondary school is issued in accordance with Section 3 of the Regulation Respecting the Basis of Secondary School Organization. It has been approved by the Comité catholique and the Comité protestant of the Conseil supérieur de l'éducation in conformity with the provisions of paragraph (e) of Section 22 of An Act Respecting the Conseil supérieur de l'éducation (RSQ. c. C-60). This program has been authorized for teaching Physical Science in the schools as of July 1 1983.

A handwritten signature in black ink, reading "Claude Ryan". The signature is written in a cursive style with a large, sweeping flourish at the end.

Claude Ryan
Minister of Education

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1. KEY ISSUES

1.1 I.P.S. COURSE

As a result of the Parent Report, the ministère de l'Éducation introduced the American Introductory Physical Science (I.P.S.) course to meet the requirements recommended by the new educational reform. In 1977, the Introductory Physical Science course was revised and a core program entitled Physical Science 220 was produced. A brief evaluation of how this course was implemented showed that the objectives were attained to varying degrees and that the teaching strategies differed considerably from school to school.

Nevertheless, the adoption of the I.P.S. course was a step forward in the teaching of science in Secondary II and Secondary III. Some teachers later developed their own versions of this course to better suit the needs and expectations of the students in their particular milieu. This resulted in a great variety of teaching methods. The title of the course was the only common element.

1.2 BRIEF ANALYSIS OF THE SITUATION

The teaching of science, like teaching in general in the schools of Québec, came under much criticism. The lack of interest shown for science on the part of adolescents has been attributed to the elitist nature of the science courses, to the fact they are not adapted to the Québec reality and to their lack of relevance for young people.

Initially, the I.P.S. course emphasized the study of the subject by focussing mainly on the structure of physical concepts. The study of daily phenomena relating to the students' experiences were not given priority. The everyday occurrence or application of the physical science phenomena covered in the course were virtually ignored. By virtue of its organization, the course incorporated concepts that were highly abstract for the majority of students. In addition, as these concepts were not related to the students' everyday experience, they held little interest for them. The I.P.S. course favored an instructional approach based on experimentation. The new physical science course retains this particular approach, which has been found to be very effective in helping the students to understand certain physical phenomena and to improve their psychomotor skills.

1.3 POST-I.P.S. PERIOD

The foregoing analysis of the teaching of physical science in Québec helps to identify certain needs. The new course should be:

- related to the students' everyday experience, needs and concerns;
- relevant to the cultural context in order to arouse the interest of as many students as possible. The topics and activities it proposes should be closely related to the students' environment, thus preparing them to live in a milieu which they will learn to know and appreciate;
- suitable for all students and, consequently, each student's educational background should be taken into consideration.

2. RATIONALE

2.1 VALUES EMPHASIZED

The aim of this course is to help the students to acquire a certain knowledge and also help them to develop skills and attitudes. These objectives can be achieved by emphasizing certain values, by fostering a rigorous approach to the study of physical science and by relating the course to the students' immediate environment. Particular emphasis is put on the following values:¹

- good work habits
- hard work
- respect for the environment.

2.1.1 Good Work Habits

The course stresses the acquisition of good work habits. Students of thirteen and fourteen years of age cheerfully consent to, and conscientiously participate in the activities recommended, although they do not always understand the purpose of such activities. Gradually, they become aware of the necessity for good work habits. This is an essential value at this stage in the students' personal and cultural development.

2.1.2 Hard Work

Acquiring good work habits requires a willingness on the part of the students to work hard if they are to learn basic scientific concepts and new ways of thinking and acting.

2.1.3 Respect for the Environment

People are becoming increasingly aware of the impact their activities have on the environment. This course should help young people become aware of the environmental impact resulting from certain actions. It should also encourage them to develop a responsible attitude toward the environment.

2.2 APPLICATIONS OF EDUCATIONAL PSYCHOLOGY

The content of many of the programs and courses developed in recent years often did not correspond to the intellectual capabilities of the students for whom they were intended. As several studies^{1,2} have shown, at thirteen and fourteen years of age, the majority of students have reached the concrete operational stage where they characteristically arrive at simple concepts through concrete observations or experiments. By manipulating or observing a simple phenomenon, they can identify simple facts and relate them to one another in such a way as to bring out an underlying principle or concept. It is through experimentation that they achieve understanding.

In general, students will be unable to solve problems if they are not given opportunities to do so. The basic tenet of the course is that the best laboratory for the students is their immediate environment. This environment is a world made of facts, events, and phenomena that must be understood. The teacher should help the students to discover different physical phenomena in the environment, so that they will have a greater understanding and awareness of these events.

1. Québec, ministère de l'Éducation, *The Schools of Québec: Policy Statement and Plan of Action* (Québec: Éditeur officiel, 1979), p. 28.

1. Revue « Chercheurs. » Montréal: Université de Montréal, Vol. II, No. 4, July 1976.
2. Torkia-Lagacé, Mirette. *La pensée formelle chez les étudiants de Collège I: objectif ou réalité?* Québec: Laurentides de Québec Inc., 1981.

3. RELATIONSHIP WITH OTHER PROGRAMS AND COURSES

The Physical Science (Physical Environment) course is part of the general education recommended in *The Schools of Québec*.¹ This course is intended to provide the students with basic concepts in physical science by placing greater emphasis on scientific skills and attitudes which will help the students acquire practical work habits. Thus, this course will prepare the students for future science courses in Secondary IV and Secondary V.

This course is also intended to take the students beyond the scientific training begun in elementary school and in Secondary I by focussing on the study of physical elements (water, air, soil) in the students' immediate environment.

Elementary School

The teaching of natural science in elementary school is intended to:

- help the students become independent and creative individuals in a scientific and technological society;
- encourage the students to develop a scientific attitude;
- foster the students' gradual exploration of their natural and technological environment;
- increase the students' awareness of current environmental problems;
- help the students to develop certain attitudes and behaviors which will contribute to the protection of the environment.

Secondary School

Ecology (Secondary I)

By stressing the study of living organisms, the Ecology Program helps the students to discover the various interrelationships at work in the environment. In addition, the students become aware of their role in maintaining a certain equilibrium in nature. They are also introduced to various experimentation techniques and are taught how to organize their thinking according to a scientific method.

4. TARGET POPULATION

The Physical Science (Physical Environment) course is intended for all the students in Secondary II.* It is designed for young people of thirteen and fourteen years of age. Its objectives and content have been selected to correspond to the intellectual capabilities, needs, and immediate concerns of these young students.

5. UNDERLYING EDUCATIONAL PRINCIPLE: DISCOVERY THROUGH EXPERIMENTATION

The instructional approach recommended for this course is discovery through experimentation. This particular approach should be kept in mind when reading the terminal and intermediate objectives. Thus, each terminal or intermediate objective should be read by starting each sentence as follows: "*The student will be able . . .*"

Consequently, the students will progressively familiarize themselves with the scientific method by putting it into practice and by asking pertinent questions. It is therefore the teacher's responsibility to guide them in their search for solutions to scientific problems.

1. Québec, ministère de l'Éducation, *The Schools of Québec: Policy Statement and Plan of Action*. (Québec: Éditeur officiel, 1979), p. 141.

* As expressed in the revisions to the secondary school organization ("régime pédagogique") approved by the "Conseil des ministres".

6. AIMS

The Physical Science (Physical Environment) course is designed to help the students:

1. **GAIN KNOWLEDGE** of certain physical phenomena in the environment, and consequently, learn about the properties of matter;
2. **DEVELOP** certain skills necessary for scientific experiments;
3. **DEVELOP** certain attitudes regarding the scientific method, such as a critical sense and a taste for research. This will help the students increase their awareness of the impact of modern technology on the physical environment.

7. ORGANIZATION

7.1 CATEGORIES OF OBJECTIVES

The course has two broad categories of objectives: general objectives and specific objectives.

7.1.1 General Objectives

The general objectives define in broad terms the skills expected of the students upon completion of the course. These objectives should be perceived as a framework within which the specific objectives are to be pursued and achieved.

7.1.2 Specific Objectives

The specific objectives describe the skills expected of the students upon completion of a learning period which can be of varying length. There are two categories of specific objectives: terminal objectives and intermediate objectives.

- (a) The **terminal objectives** describe the outcomes anticipated upon completion of a given learning period. In this course, the learning period is relatively short, so that the students do not lose sight of the objectives to be achieved. **The terminal objectives are compulsory.**
- (b) The **intermediate objectives** describe a more specific behavior or learning outcome that makes it possible to achieve a terminal objective. The intermediate objectives are merely suggestions of various possible ways of attaining the terminal objectives. **The intermediate objectives are optional.**

7.2 GENERAL OBJECTIVES

7.2.1 Attitudes

Upon completion of this course the students should have developed a number of attitudes and acquired certain personal and social habits, such as:

- awareness of the importance of science in daily life;
- development of a more critical outlook with respect to scientific ideas, their development and application in society;
- awareness of the environmental impact of science and technology;
- acquisition of the necessary work habits and development of sound intellectual abilities.

7.2.2 Skills

Upon completion of this course the students should have acquired certain skills which should enable them to:

- use standard laboratory equipment;
- master proper techniques for the use of laboratory instruments;
- follow and observe safety guidelines in the laboratory and on the site;
- solve problems using the scientific method.

7.2.3 Knowledge

Upon completion of this course the students should:

- have a better knowledge and understanding of certain physical phenomena in the environment as well as be aware of certain properties of matter;
- be able to use this knowledge in daily life.

7.3 MODULES

The course comprises four modules:

- Module I : Meteorology
- Module II : Rocks and Minerals
- Module III : Mixtures
- Module IV : Heat and Thermal Effects

The scientific phenomena selected for each module should be an effective starting point for the study of certain properties of matter. The modules can be studied within the framework of certain situations in the students' environment.

The course should be taught in accordance with the instructional approach recommended earlier, specifically, discovery through experimentation. Thus, the teacher will help the students to develop certain skills, as well as certain attitudes such as good work habits, hard work, and respect for the environment.

7.3.1 Timetable

To enable the students to be in direct contact with the physical environment, it is recommended that:

- the module on Meteorology be studied throughout the entire school year;
- the module on Rocks and Minerals be studied in the fall or in the spring.

The other two modules can be studied at any time.

7.3.2 Physical Science in the School Schedule

The Physical Science (Physical Environment) course is a compulsory course for students of Secondary II. A minimum of 100 hours of class time is required to enable the students to reach the objectives of this course.

MODULE I: METEOROLOGY

(approximately 25 hours of class time)

T.O. 1.1 TO DESCRIBE THE MAIN CHARACTERISTICS OF THE EARTH'S ATMOSPHERE.

RELATED CONTENT

- 1.1.1 To locate the planet earth in relation to the sun.
- 1.1.2 To name the four main layers or regions of the atmosphere.
- 1.1.3 To name the main characteristic of each one of the layers of the atmosphere.
- 1.1.4 To conduct at least one experiment which proves the existence of atmospheric pressure.
- 1.1.5 To read atmospheric pressure in kilopascals on an aneroid barometer.
- 1.1.6 To explain why there are temperature differences between:
 - the equator and the poles,
 - day and night (diurnal variations),
 - summer and winter (annual variations).
- 1.1.7 To demonstrate through experiments:
 - the greenhouse effect,
 - the black-body effect.

Revolution, rotation and inclination of the earth

Layers of the atmosphere:
troposphere, stratosphere
mesosphere and ionosphere

Atmospheric pressure: existence,
measurement

Energy in the atmosphere:
cause
effects
benefits

T.O. 1.2 TO DESCRIBE THE VARIOUS PHASE-CHANGES OF WATER VAPOR.

RELATED CONTENT

- 1.2.1 To describe the water cycle.
- 1.2.2 To explain the process of evaporation.
- 1.2.3 To identify the various environmental factors which make the evaporation of water possible.
- 1.2.4 To measure the relative humidity of the air.
- 1.2.5 To establish the difference between the various natural changes of water in the atmosphere.
- 1.2.6 To identify the different types of clouds according to their basic forms and heights.

Water in the atmosphere

The three states of matter:
gas, liquid and solid

Evaporation, atmospheric humidity

Hair hygrometer, psychrometer

Dew, frost, clouds, rain, snow, hail

Cirrus, cirrostratus, cirrocumulus,
altostratus, altocumulus, stratus,
stratocumulus, nimbostratus,
cumulus, cumulonimbus

T.O. 1.3 TO EXPLAIN THE DIRECT EFFECT OF THE WIND ON AIR CIRCULATION AND WEATHER SYSTEMS.

RELATED CONTENT

- 1.3.1 **To conduct** an experiment which requires convection currents.
- 1.3.2 **To illustrate** the phenomenon of inversion (pollution).
- 1.3.3 **To explain** the following phenomena:
— land breeze;
— sea breeze.
- 1.3.4 **To illustrate** air movement due to the earth's rotation.
- 1.3.5 **To illustrate** air movement due to local topography.
- 1.3.6 **To determine** the direction and speed of the wind by observing certain elements in the environment.
- 1.3.7 **To determine** the direction and speed of the wind using common instruments.
- 1.3.8 **To explain** how cold and warm fronts affect weather conditions.

Air in motion
Effect of temperature
Effect of earth's rotation

Prevailing winds and general circulation

Beaufort scale

Weathervane
Anemometer

T.O. 1.4 TO FORECAST THE WEATHER FROM RECORDED OBSERVATIONS.

RELATED CONTENT

- 1.4.1 **To build**, as a team project, a basic weather station using standard meteorological instruments.
- 1.4.2 **To prepare**, as a team project, a weather chart by compiling information obtained from observing weather conditions.
- 1.4.3 **To observe** the sky in a given location.
- 1.4.4 **To interpret** the information obtained from observing the sky in order to forecast weather conditions.
- 1.4.5 **To read** a weather map.
- 1.4.6 **To interpret** a weather map in order to evaluate weather conditions.

Pluviometer
Thermometer
Weathervane
Anemometer
Barometer
Psychrometer
Hair hygrometer

Clouds

Weather symbols

MODULE II: ROCKS AND MINERALS

(approximately 25 hours of class time)

T.O. 2.1 TO DISTINGUISH MINERALS FROM ROCKS.

RELATED CONTENT

- | | |
|---|--------------------------------------|
| 2.1.1 To give an operational definition of a mineral and a rock. | Minerals, rocks |
| 2.1.2 To compare the characteristics of minerals to those of rocks. | Luster, color, constancy, grain size |
| 2.1.3 To understand that rocks and minerals have different histories. | History of rocks and minerals |

T.O. 2.2 TO IDENTIFY THE MOST COMMON MINERALS ON THE BASIS OF THEIR PHYSICAL PROPERTIES.

RELATED CONTENT

- | | |
|---|-----------------------|
| 2.2.1 To determine the luster of a mineral. | Luster |
| 2.2.2 To determine the color of a mineral by observing a fresh break. | Color |
| 2.2.3 To determine the streak of a mineral by rubbing it on a piece of unglazed porcelain. | Streak |
| 2.2.4 To determine the hardness of a mineral by scratching it with a fingernail or a steel blade. | Hardness |
| 2.2.5 To determine whether a mineral has a cleavage. | Cleavage |
| 2.2.6 To estimate qualitatively the specific gravity of a given mineral compared with that of a piece of quartz. | Specific gravity |
| 2.2.7 To determine the density of a solid (rock or mineral) | Mass, volume, density |
| 2.2.8 To determine whether a mineral has magnetic properties, by means of a small magnet. | Magnetism |
| 2.2.9 To determine whether a mineral is effervescent, by means of the acid test. | Effervescence |
| 2.2.10 To use a table which identifies minerals on the basis of their main physical properties: luster, color, streak, hardness, cleavage, specific gravity, magnetism and effervescence. | Identification table |

T.O. 2.3 TO DESCRIBE THE VARIOUS USES OF THE MOST COMMON MINERALS.

RELATED CONTENT

- | | |
|--|--|
| 2.3.1 To give an operational definition of ores, minerals, precious stones and collection specimens. | Ores
Industrial minerals
Precious stones
Collection specimens |
| 2.3.2 To locate on a map Québec's major mining centers for iron, copper, zinc, niobium, gold, asbestos, and molybdenum. | |
| 2.3.3 To be aware that minerals are nonrenewable natural resources, and that they should not be wasted. | Renewable resources
Nonrenewable resources |
| 2.3.4 To identify the origin of the parts of an object. | |
| 2.3.5 To explain the economic, social and cultural importance of minerals in modern life. | |

T.O. 2.4 TO CLASSIFY THE MOST COMMON ROCKS ON THE BASIS OF THEIR PHYSICAL PROPERTIES.

RELATED CONTENT

- | | |
|---|----------------|
| 2.4.1 To give an operational definition of igneous rocks, sedimentary rocks and metamorphic rocks. | Types of rocks |
| 2.4.2 To determine the texture of a rock. | Texture |
| 2.4.3 To determine the origin of a rock. | |

T.O. 2.5 TO EXPLAIN THE ROCK-FORMATION CYCLE.

RELATED CONTENT

- | | |
|--|--|
| 2.5.1 To give an operational definition of erosion, melting, heat, pressure, metamorphosis and recrystallization. | Erosion, melting, heat, pressure, metamorphosis, recrystallization |
| 2.5.2 To explain how different rocks were formed. | Igneous rocks, sedimentary rocks, metamorphic rocks |

T.O. 2.6 TO DESCRIBE THE VARIOUS USES OF THE MOST COMMON ROCKS.

RELATED CONTENT

- 2.6.1 **To distinguish** between construction materials and industrial materials.
- 2.6.2 **To identify** the most common rocks used in Québec as industrial minerals (in the chemical and petroleum industries).
- 2.6.3 **To identify** the most common rocks used in Québec as construction materials for:
 - buildings,
 - other types of structures.
- 2.6.4 **To be aware** that fossil fuels and combustible materials are non-renewable resources (in terms of centuries) and that they should not be wasted.
- 2.6.5 **To explain** the economic, social and cultural importance of rocks and minerals in modern life.

Construction materials, industrial materials

Industrial minerals

Fossil fuels, combustible materials

MODULE III: MIXTURES

(approximately 20 hours of class time)

T.O. 3.1 TO DISTINGUISH BETWEEN HETEROGENEOUS MIXTURES AND SOLUTIONS (HOMOGENEOUS MIXTURES)*.

- 3.1.1 To **prepare**, in laboratory experiments, various types of mixtures using different components in various phases and proportions.
- 3.1.2 To **distinguish** between pure substances and mixtures.
- 3.1.3 To **distinguish** between solutions and heterogeneous mixtures.

* Solutions are the only type of homogeneous mixtures that will be studied in this module.

RELATED CONTENT

Solvents and solutes
Phases
Mixtures:
Solids-solids, insoluble solids-liquids, soluble solids-liquids, miscible liquids, immiscible liquids, gases-gases.
Pure substances and mixtures
Solutions and heterogeneous mixtures

T.O. 3.2 TO DESCRIBE THE CHARACTERISTICS OF A SOLUTION.

- 3.2.1 To **describe** what happens to the mass and the volume of a substance before and after dissolution.
- 3.2.2 To **determine** the density of various solutions.
- 3.2.3 To **distinguish** between a saturated and an unsaturated solution through experimentation.
- 3.2.4 To **determine** the solubility of a substance in water at a given temperature through experimentation.
- 3.2.5 To **compare** experimentally the solubility of a substance (solute) in water at various temperatures.
- 3.2.6 To **name** the characteristics (qualities) of drinking water as a solution.

RELATED CONTENT

Mass, volume
Mass, volume, density
Saturated solutions and unsaturated solutions
Homogeneous mixtures, heterogeneous mixtures, solubility
Solubility
Solution, drinking water

T.O. 3.3 TO PROVE THAT PURE AIR IS A HOMOGENEOUS MIXTURE.

RELATED CONTENT

- 3.3.1 **To find** the percentage of oxygen in air (expressed as volume percentage) through experimentation.
- 3.3.2 **To prove** the presence of water vapor and carbon dioxide in air through experimentation.
- 3.3.3 **To name** the principal components of pure unpolluted air.

Oxygen
Water, water vapor and carbon dioxide
Oxygen, nitrogen, water and carbon dioxide

T.O. 3.4 TO SELECT THE PROPER PROCESS OR PROCESSES TO SEPARATE THE COMPONENTS OF A GIVEN HETEROGENEOUS MIXTURE OR SOLUTION.

RELATED CONTENT

- 3.4.1 **To carry out** the following processes: sedimentation, decantation, filtration, and distillation (boiling and evaporation).
- 3.4.2 **To identify**, among the four processes mentioned above, the most effective one to separate heterogeneous mixtures.
- 3.4.3 **To identify**, among the four processes mentioned above, the most effective one to separate solutions.

Processes to separate mixtures: sedimentation, decantation, filtration, distillation (boiling, evaporation)
Decantation
Filtration
Distillation (boiling and evaporation)

T.O. 3.5 TO DESCRIBE THE MANY WAYS IN WHICH PEOPLE USE HOMOGENEOUS MIXTURES.

RELATED CONTENT

- 3.5.1 **To show**, with examples from the environment, the many uses of solutions and how they contribute to the well-being of people.
- 3.5.2 **To show**, with examples, the negative environmental impact resulting from the use of certain solutions.

Solutions

T.O. 3.6 TO DESCRIBE THE MANY WAYS IN WHICH PEOPLE USE HETEROGENEOUS MIXTURES.

RELATED CONTENT

- 3.6.1 **To show**, with examples from the environment, the many uses of heterogeneous mixtures and how they contribute to the well-being of people.
- 3.6.2 **To show**, with examples, the negative environmental impact resulting from the use of certain heterogeneous mixtures.

Heterogeneous mixtures

MODULE IV: HEAT AND THERMAL EFFECTS

(approximately 30 hours of class time)

T.O. 4.1 TO DISTINGUISH BETWEEN HEAT AND TEMPERATURE.

RELATED CONTENT

- 4.1.1 To **distinguish** between heat and temperature through experimentation.
- 4.1.2 To **name** the SI units of temperature and heat.
- 4.1.3 To **compare** the heat storing capacity of a common solid or liquid substance with that of another.

Heat and temperature
Kelvin and Celsius scales, Joules

T.O. 4.2 TO EXPLAIN CERTAIN PROPERTIES OF HEAT.

RELATED CONTENT

- 4.2.1 To **produce** heat in three different ways.
- 4.2.2 To **illustrate** two ways of conserving heat through experimentation.
- 4.2.3 To **discover** the phenomenon of heat transfer through experimentation.
- 4.2.4 To **plan** and carry out at least one experiment which proves that heat is conducted at different speeds by different solids.
- 4.2.5 To **classify** certain objects as good or poor heat conductors.
- 4.2.6 To **explain** the three methods by which heat is transferred.
- 4.2.7 To **illustrate** two ways of converting heat through experimentation.

Conservation
Heat transfer
Conduction
Conduction, convection, and radiation
Conversion

T.O. 4.3 TO SHOW THROUGH EXPERIMENTATION THAT A SUBSTANCE CHANGES STATE WHEN HEATED.

RELATED CONTENT

- 4.3.1 **To draw** a curve representing water as it changes from the solid state to the gaseous state, using information obtained from laboratory experiments.
- 4.3.2 **To draw** a curve representing the changes of state of a pure substance other than water, using information obtained from laboratory experiments.
- 4.3.3 **To indicate** on a graph the solid and liquid states and to locate on the curves the points where these two states coexist.
- 4.3.4 **To distinguish** between melting, solidification, evaporation, liquefaction, sublimation and condensation.
- 4.3.5 **To determine** the temperature at which a given substance melts or boils using curves which represent the changes of state.

States of matter, graphic representation

Melting, solidification, evaporation, liquefaction, sublimation, and condensation

Melting point and boiling point

T.O. 4.4 TO SHOW THAT A SUBSTANCE EXPANDS AS IT IS HEATED.

RELATED CONTENT

- 4.4.1 **To identify** through experimentation the effects of heat on various liquids.
- 4.4.2 **To identify** through experimentation the effects of heat on a gas such as air.
- 4.4.3 **To identify** through experimentation the effects of heat on various solids.

Expansion of liquids

Expansion of gases

Expansion of solids

T.O. 4.5 TO DESCRIBE SOME EVERYDAY USES OF HEAT.

RELATED CONTENT

- 4.5.1 **To make** a measuring instrument in which thermal expansion and contraction are used.
- 4.5.2 **To name** at least five common uses of the linear expansion of solids.
- 4.5.3 **To illustrate** examples of changes of state which occur in everyday situations.
- 4.5.4 **To show** with everyday examples that heat contributes to the well-being of people.

Thermometer

8. EVALUATION

8.1 DEFINITION

"Educational evaluation is a process intended to support appraisals of the situation of a pupil in certain areas of his development, with a view to making the best possible decisions about his future progress."¹

Educational evaluation is based on results obtained by means of suitable measurements instruments, so that the assessment will correspond as much as possible to the student's actual situation and the resulting decisions will be fair to all.

The process of evaluation recommended in this program corresponds to the instructional approach and is related to the methodology which it clarifies and supports.

8.2 AIMS OF EDUCATIONAL EVALUATION

"The basic aim of educational evaluation is to improve decisions about a pupil's learning and general development."²

As it is the teacher who spends the greatest amount of time with the students, she/he is practically the only one able to determine the extent to which the students have mastered the educational objectives. An assessment based on results obtained by means of appropriate measurement instruments will enable teachers to provide students with the anticipated instruction and guidance. As teachers are in a position to judge the effectiveness of their own teaching, they are able to identify the students' strengths and weaknesses, and therefore reach appropriate decisions, which is the main purpose of any evaluation.

"A second aim of educational evaluation is to furnish parents with information about their children's progress in reaching their educational objectives."³

8.3 EVALUATION PROCEDURE

In order to help teachers to fulfill their role in measurement and evaluation procedures, the Physical Science course sets forth a procedure which will assist them in preparing evaluations.

Each of the following four questions corresponds to a particular phase in preparing an evaluation:

Phase I : Why evaluate?

Phase II : What should be evaluated?

Phase III: How should appropriate measurement instruments be developed?

Phase IV: How should the results obtained be interpreted?

Phase I:

Evaluating students helps teachers to identify student needs. For example: is evaluation intended to measure the degree to which the objectives have been mastered? or to provide a general assessment of the group's progress? or to identify the strengths and weaknesses of the learning process? or to find out why the students may be experiencing certain difficulties?

Phase II:

The measurement instruments used should take into account the content covered by the objectives to be attained and should help to assess the acquisition of attitudes and skills recommended in the program.

For this purpose, a table of specifications is provided as a guide to preparing the measurement instruments and the rating scale. The table describes the content of test items, determines the importance of the related content by taking into account the time allocated to it, and finally, respects the mental processes required by the instruction (taxonomy).

Phase III:

The preparation of questions is a very important task. In order to avoid ambiguity and unfairness, the test items should be, above all, congruent with the objectives being measured. This means that the verb describing the objective, as well as the content and context covered, should be closely related to the instructional situation.

1. Québec, ministère de l'Éducation, Direction générale du développement pédagogique. *General Policy for Educational Evaluation*. (Québec: Éditeur officiel, 1981), page 7.

2. Op. cit. p. 6.

3. Op. cit. p. 6.

In addition, the items should be clearly defined and formulated according to an appropriate level of difficulty. There are various types of measurement instruments that can be used to gather information for evaluation. They include tests, examinations, attitude scales, observation and evaluation forms. Observation and evaluation forms offer certain definite advantages because they indicate the students' individual progress. Moreover, these forms provide the students with instructional support; they also help to monitor teaching activities.

Phase IV:

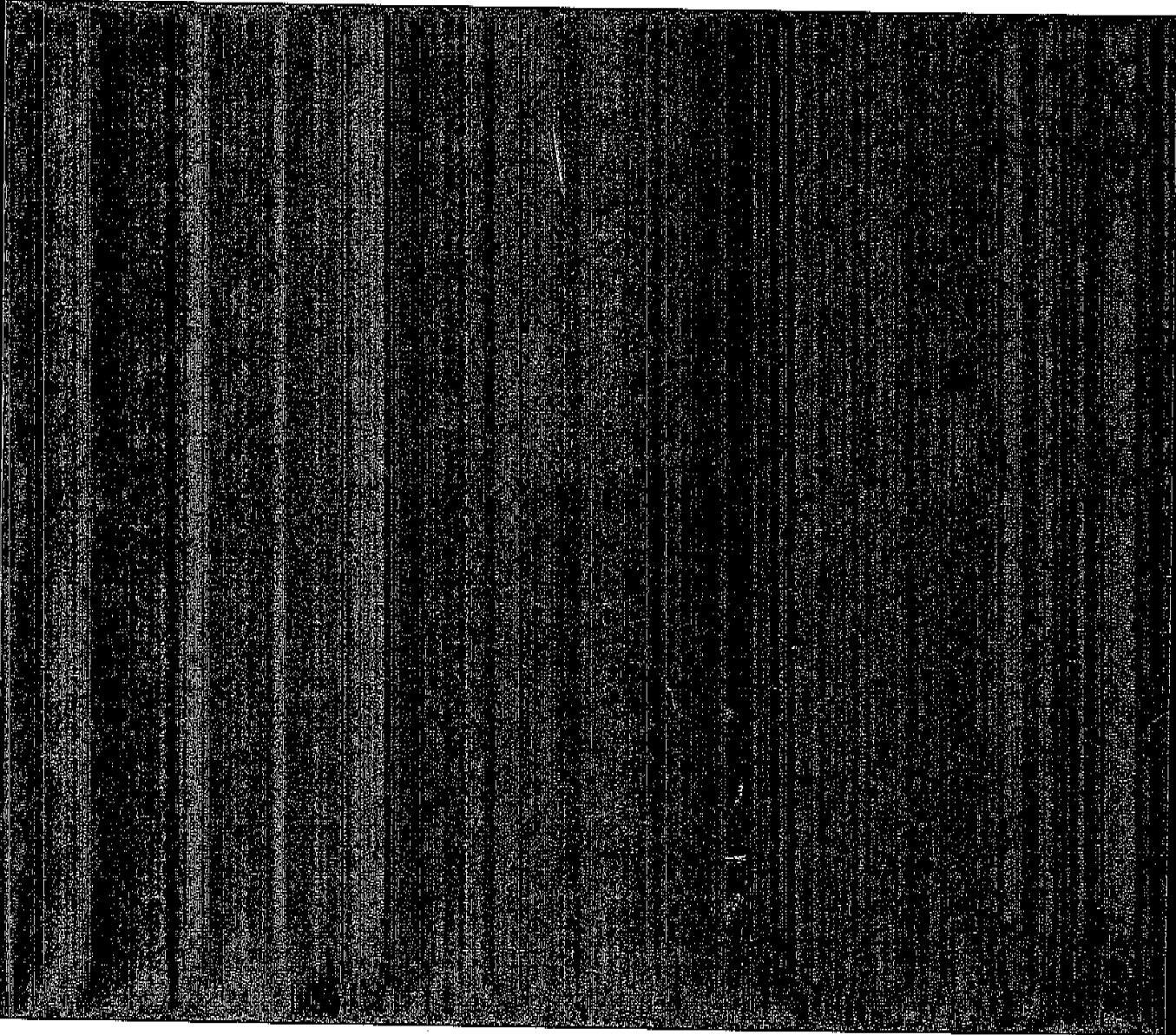
The interpretation of results is the step which follows the gathering of information since a value judgment must be made. Interpretation can be either criterion-referenced or norm-referenced.

Traditionally, norm-referenced interpretation of results has played an important role in the schools. However, greater importance should be given to criterion-referenced interpretation. Knowing the degree to

which an objective has been mastered is certainly more useful than knowing where a student ranks in relation to his/her classmates. A criterion-referenced interpretation ensures continuous support of the students' learning. It also enables them to overcome temporary learning difficulties. Furthermore, criterion-referenced interpretation provides guidance for a more practical choice of teaching strategies or learning activities. Formative evaluation is intended primarily to assist the students' immediate learning process.

Summative evaluation is intended to inform both the student and the teacher of the degree of mastery of a set of terminal objectives. It normally occurs at the end of a course or major segment of a course. Only results from summative evaluations are recorded and transmitted to parents.

In conclusion, thirteen- and fourteen-year-old students are greatly motivated by success. Teachers should therefore use this need for success to encourage learning and sustain achievement.



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