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AN ANALYSIS OF STANDARDIZED TESTS FOR SECONDARY SCHOOL SCIENCE

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GRADUATE COLLEGE

AN ANALYSIS OF STANDARDIZED TESTS FOR SECONDARY SCHOOL SCIENCE

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degree of

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By

CAROL FALTIN MORGENSTERN

Norman, Oklahoma

1982

AN ANALYSIS OF STANDARDIZED TESTS FOR

SECONDARY SCHOOL SCIENCE

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TABLE OF CONTENTS

Page

ACKNOWLEDGMENTS iii

LIST OF TABLES vi

LIST OF ILLUSTRATIONS vii

Chapter

I. INTRODUCTION 1

Statement of the Problem 3
Overview of the Problem 3
Review of Related Research 4
Definitions 5
Premises of the Study 6
Limitations 6

II. DESIGN AND PROCEDURES OF THE RESEARCH 8

Introduction 8
Validation 8
Instruction of Evaluators 15
Tests and Test Items 22

III. PRESENTATION AND INTERPRETATION OF THE DATA . . . 27

IV. CONCLUSIONS, IMPLICATIONS, AND RECOMMENDATIONS OF THE RESEARCH 79

Conclusions and Implications 79
Recommendations of the Research 81

BIBLIOGRAPHY 82

APPENDICES 84

LIST OF TABLES

Table		Page
2-1	Standardized Science Tests: A Descriptive Listing.	23
3-1	Test Items Selected for Evaluation.	28
3-2	Group Decision of Evaluators for Test Items Analyzed	31
3-3	Percentages of Test Items in All Tests Measuring Student Achievement of the Rational Powers	58
3-4	Summary of Biology Tests Used in the Research .	61
3-5	Summary of Chemistry Tests Used in the Research	62
3-6	Summary of an Earth Science Test Used in the Research	63
3-7	Summary of General Science Tests Used in the Research	64
3-8	Summary of Physics Tests Used in the Research .	65
3-9	Summary of All Tests Used in the Research . . .	66

LIST OF ILLUSTRATIONS

Figure		Page
2-1	Recording of Data After Analysis of Test Items by Single and Group Evaluation	18
2-2	Recording of Individual Decisions After an Analysis of Test Items	20
3-1	Percentages of Test Items Measuring Use of the Rational Power of Recalling.	67
3-2	Percentages of Test Items Measuring Use of the Rational Power of Imagining.	68
3-3	Percentages of Test Items Measuring Use of the Rational Power of Classifying.	69
3-4	Percentages of Test Items Measuring Use of the Rational Power of Generalizing	70
3-5	Percentages of Test Items Measuring Use of the Rational Power of Comparing.	71
3-6	Percentages of Test Items Measuring Use of the Rational Power of Inferring.	72
3-7	Percentages of Test Items Measuring Use of the Rational Power of Deducing	73
3-8	Percentages of Test Items Measuring Use of the Rational Power of Analyzing.	74
3-9	Percentages of Test Items Measuring Use of the Rational Power of Evaluating	75
3-10	Percentages of Test Items Measuring Use of the Rational Power of Synthesizing	76
3-11	Percentages of Test Items Judged 'Other'.	77
3-12	Percentages of Test Items Judged 'Invalid'. . . .	78

AN ANALYSIS OF STANDARDIZED TESTS FOR SECONDARY SCHOOL SCIENCE

CHAPTER I

INTRODUCTION

Educators write and seek to achieve objectives considered desirable by the community whose children they serve. Curricula are then written or adopted which will provide activities designed to lead learners to achieve those objectives.

One widely used method of assessing student achievement of objectives is that of using written tests. Those tests may be constructed by individual teachers for use with their own students. Another type of test used by teachers to evaluate the achievement of objectives is the standardized test. In selecting and using the standardized test, the objectives the teacher wishes to lead students to achieve must be measured by that test. Should this not be the case, a standardized test would not provide an adequate measure of student achievement.

Presently there is no universally agreed-upon set of

objectives for science education. Since science is a part of the public school curriculum, any objectives adopted or established should assist students in achieving the purpose for which schools are maintained. To arrive at a set of objectives for science education, therefore, we will begin by examining the purpose of education.

In 1961, the Educational Policies Commission of the National Education Association proposed that a primary purpose of American education should be the development of the ability to think. The Commission said:

> The purpose which runs through and strengthens all other educational purposes--the common thread of education--is the development of the ability to think. This is the central purpose to which the school must be oriented if it is to accomplish either its traditional tasks or those newly accentuated by recent changes in the world.[1]

This statement emphasizes that among all of the objectives considered desirable by a community acting through its schools, this single goal lies at the center of and is basic to all other objectives, and educational objectives are achieved through the curriculum. The Commission listed ten rational powers as constituting the essence of the ability to think. The rational powers include: recalling, imagining classifying, generalizing, comparing, inferring, deducing, analyzing, evaluating, and synthesizing.[2] Science is a component of

---

[1]Educational Policies Commission, The Central Purpose of American Education (Washington, D.C.: National Education Association, 1961), p. 14.

[2]Ibid., p. 5.

curriculum. That content area, then, must have as one of its objectives leading students to develop the rational powers. Tests used, therefore, must measure student achievement of that objective. This investigation does not concern itself with teacher-made tests. Rather, this investigation concerns itself with standardized tests.

Statement of the Problem

The problem investigated was whether or not standardized tests constructed for use with secondary school science measured student achievement of the ability to think which is defined as the use of the ten rational powers just listed. Answers to the following questions were sought:

a. Are the presently available standardized tests for secondary school science measuring student achievement of the rational powers?

b. What percentages of test items found in standardized tests for secondary school science measure student achievement of each of the rational powers?

Overview of the Problem

Because of a lack of agreed-upon objectives among science educators, in addition to data about the rational

powers, this investigation sought to establish a complete and validated set of objectives. Possible objectives were first selected from the literature and from personal communication with science educators. An advisory panel of nationally recognized science educators was established to aid in the process of formation and validation of a set of objectives. Using the advisory panel, a complete set of objectives for science education was established; those objectives will be found in Chapter II. Development of the rational powers was one of the objectives established by the advisory panel.[3] That objective is the subject of this research. Data about this advisory group and the process of validation will be discussed in Chapter II.

Review of Related Research

A review of science education literature related to testing was carried out to determine what research had been done on the problem just stated.

A computer search of the literature was accomplished using these search words and descriptors: biology, academic

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[3]This investigator found that establishing a valid set of objectives for science education, then evaluating whether or not test items from standardized secondary school science tests measured achievement of those objectives was an enormous task. The project was thereby reduced in scope to consider one objective of a validated set of objectives for science education. Development of the rational powers was the objective selected for analysis from the validated set.

achievement, achievement tests, behavioral objectives, earth science, educational research, evaluation, evaluation criteria, evaluation techniques, instruction, measurement, multiple-choice tests, objective testing, research, student testing, science education, secondary school science, science tests, chemistry, physics, testing, tests, objective tests, secondary grades, secondary education, sciences, secondary-school testing, item analysis, junior high schools, test construction, test results, test selection, test validity, test reliability, test interpretation. A manual search in the pages of the Comprehensive Dissertation Index, the Educational Resources Information Center (ERIC), the Masters' Abstracts, and the Education Index was made. A computerized search in the resources of the ERIC was also performed. Each of these searches, manual and computer, failed to reveal evidence of any pertinent studies related to the problem identified here.

Definitions

Terms used in this study have been defined as follows:

a. Objective. Objective refers to a measurable outcome which a teacher leads students to achieve.

b. Science. Science refers to the quest or search for knowledge.

c. Content Areas of Science. Content areas of science refers to the disciplines of biology, chemistry,

physics, and the earth sciences (astronomy, geology, meteorology, and oceanography).

d. Secondary School. Secondary school refers to grades 7-12.

e. Standardized Test. A standardized test refers to "a test composed of a systematic sampling of behavior, having data on reliability and validity, administered and scored according to specific instructions, and interpreted in terms of adequate norms."[4]

Premises of the Study

This research is based upon two premises. The first is that members of a panel of validators are knowledgable and capable of assessing and validating objectives of science education. The second premise made is that members of a group of evaluators can be taught to judge whether or not test items of standardized secondary school science tests measure student achievement of the rational powers.

Limitations

The results of this study are limited to the

---

[4]Janet Wall and Lee Summerlin. Standardized Science Tests: A Descriptive Listing (Washington, D.C.: National Science Teachers Association, 1973), p. 53.

standardized tests that have been analyzed, and tests were included in the analysis only when they met the following criteria. Each test:

a. contains multiple-choice questions.

b. was copyrighted after 1960.

c. had been constructed for use in the science subjects taught in secondary schools.

d. provides a measure of a student's content achievement only.

CHAPTER II

DESIGN AND PROCEDURES OF THE RESEARCH

Introduction

Three tasks were necessary prior to the collection of valid data to answer the questions raised in Chapter I. Those tasks were (1) the establishment of a valid set of objectives for science education, (2) the establishment of valid evaluative statements--statements to be used to evaluate tests and test items to ascertain whether or not those test items could be used to measure student achievement of each objective, and (3) the establishment of a validated procedure to be used in the training of test item evaluators in the analysis of test items of standardized secondary school science tests.

Validation

The initial phase of the validation process began in December, 1977, when the last six persons who had been elected to the office of President of the National Association for

Research in Science Teaching (NARST) were asked if they would assist in the establishment of a valid set of objectives for science education and in the preparation of an instrument to be used to analyze standardized tests in the area of science, which could be used to measure achievement of those objectives. Since those science educators had been elected by their peers and had served NARST in the capacity of its highest leadership, they were believed to have the professional expertise necessary to rate the appropriateness of an instrument designed to analyze test items of secondary school standardized science tests. Five of the last six persons who served as President of the NARST prior to 1979 served as a panel of experts throughout this study. Membership of the panel is given in the Acknowledgment section.

In January, 1978, objectives for science education which had been isolated from the literature were submitted to the panel. The panel was asked to judge the defensibility of each of these objectives as suitable for science education. Accompanying these objectives were evaluative statements to be used to evaluate test items to ascertain whether or not those items could measure student achievement of each objective. In addition to judging the objectives stated, the panel was asked to judge the defensibility of each of the evaluative statements. Their comments and suggestions indicated that a refinement was necessary for some of the objectives and certain of the evaluative statements.

A six point scale for the use of the panel to indicate their decisions was developed. That scale included the choices of uncertain, strongly disagree, disagree, neutral, agree, and strongly agree. The decision was made that, for this study, only judgments of 'agree' and 'strongly agree' would be acceptable in establishing the defensibility and validity of the objectives and their evaluative statements.

After refining the original list of objectives and evaluative statements, on the basis of the panel's suggestions, in September, 1979, a new group of objectives and their corresponding evaluative statements were submitted to the panel. The panel' members were asked to make their evaluations, using the scale referred to earlier, of each objective and its evaluative statement. The responses received from the panel for each of the objectives were all in the 'agree' and 'strongly agree' categories. The following five objectives were, therefore, considered valid.

1. To develop the rational powers,[1] that is, to develop skill with the principal components of that process called thinking:

a. recalling	f. inferring
b. imagining	g. deducing
c. classifying	h. analyzing
d. generalizing	i. evaluating
e. comparing	j. synthesizing

---

[1]Educational Policies Commission, The Central Purpose Of American Education (Washington, D.C.: National Education Association, 1961), p. 5.

2. To develop the ability to withold judgment rather than primarily answering a question.

3. To develop skill in the use of a system of measurement.[2]

4. To develop the ability to make predictions from information.[3]

5. To develop the ability to make accurate observations.[4]

Some of the evaluative statements had not met the criterion required to be considered valid. Those were rewritten and sent to the panel in February, 1980. By May, 1980, the panel had judged the rewritten evaluative statements, and all responses fell in the 'agree' and 'strongly agree' categories. With these decisions, all of the evaluative statements had been judged valid. In June, 1981, the enormity of the research as originally visualized became evident and the decision was made to consider the first valid objective only. Data were collected therefore to evaluate the ability of standardized tests to measure student achievement of the development of the rational powers, that is, "the essence of the ability to think."[5]

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[2]Science Curriculum Improvement Study, Material Objects, Teacher's Guide (Chicago: Rand McNally and Company, 1970), p.8.

[3]Ibid., p. 8.

[4]Ibid., p. 8.

[5]Educational Policies Commission, The Central Purpose of American Education, p. 5.

The five validated objectives in a set of objectives for science education and their validated evaluative statements--statements which permit measurement by a test item from a standardized test of a particular objective--are presented in Appendix A.

As was said earlier, the development of the rational powers is the objective that this research is concerned with. Because students might develop each rational power (which will be referred to hereinafter as a sub-objective) independently of the others, the ability of the test items to measure attainment of each rational power was evaluated separately. The rational powers (sub-objectives) and the evaluative statements used to determine if a test item measures achievement of that particular rational power follow:

To develop the rational powers, that is, to develop skill with the principal components of that process called thinking:

a. RECALLING:

   Evaluative Statement: Test item requires only bringing back to mind (remembering) information from experiences prior to, but not provided by, the test item.

b. IMAGINING:

   Evaluative Statement: Test item requires that the student use the information provided and design a mental model that is not restricted by or limited

to reality or actuality.

c. CLASSIFYING:

Evaluative Statement: Test item requires grouping information provided into categories sharing common characteristics.

d. GENERALIZING:

Evaluative Statement: Test item requires the combination of items of information provided, in order to express broad relationships among those items.

e. COMPARING:

Evaluative Statement: Test item requires examination of information provided, to enumerate the similarities and differences of specific features of that information.

f. INFERRING:

Evaluative Statement: Test item requires developing logical relationships which have an applicability broader than the information provided by the test item, and these relationships are based upon either the information, or upon an assumption about that information.

g. DEDUCING:

Evaluative Statement: Test item requires the application of a general principle, provided by the test item, to a specific situation.

h. ANALYZING:

Evaluative Statement: Test item requires the division of information provided into categories and an examination of those categories.

i. EVALUATING:

Evaluative Statement: Test item requires that the student form a judgment of the value (merit or worth) of information provided in the item with respect to certain criteria provided in the test item.

j. SYNTHESIZING:

Evaluative Statement: Test item requires the combination of information provided, in such a way as to express a relationship which is harmonious with all of the participating elements.

A Manual detailing the procedures to be used in training those who would analyze test items was developed. That Training Manual was sent to the advisory panel in June, 1981, and judged valid by them by July, 1981. This Manual, (see Appendix B) is composed of two parts. Part I includes the training program used with the item-evaluators. Part II contains procedures followed by the evaluators during the analysis of the test items of standardized secondary school science tests.

In order to instruct evaluators in the application of the Evaluative Statements to test items from standardized

tests, experiences in doing that had to be provided. Illustrative test items--one for each Evaluative Statement--were written. Accompanying each of these illustrative test items was the rationale explaining how that specific test item measured student achievement of a particular sub-objective (rational power). These examples of how to use the Evaluative Statements were submitted to the panel as 'Examples of the Use of Evaluative Statements', and these were judged valid in July, 1981.

The evaluators next needed to practice evaluating test items. Forty additional test items--four for each of the ten sub-objectives--were developed. These forty items were presented to the panel as "Practice Test Items," and were also judged valid in July, 1981. Prior to being sent to the panel for their consideration, potential practice test items were field-tested for readability by high school students during Fall, 1980, and Winter, 1981.

Instruction of Evaluators

In July, 1981, a training program for test item evaluators was conducted by the investigator. Four evaluators were selected according to the following criteria. Each of the evaluators must:

1. be certified as a teacher of science by the Department of Education of a state of the United States

2. have been a teacher of one or more of the disciplines of science for at least one year
3. have taught in one or more areas of science in the secondary school.

Personal data about the test item evaluators are presented in Appendix C.

Training sessions were conducted in a secondary school science classroom on July 27 and July 28, 1981, from 8 A.M. to 12 P.M. Periodic rest breaks were provided during these sessions. The only persons present at these sessions were the four evaluators and the project director.

At the beginning of the first session, a copy of the Training Manual was given to each of the four evaluators. The project director then read aloud each of the sections listed below, and each section was discussed individually. The sections included: Foreword; Introduction; Validation of An Objective of Science Education; Development and Validation of Evaluative Statements; Maintenance of Confidentiality of Tests; Criteria for Selection of Tests; and Instruction of Evaluators.

After reading and discussing each section, questions that arose were answered. That procedure familiarized the evaluators with the project and their roles in it. Familiarization was especially necessary with the objective and subobjectives, evaluative statements, and application of evaluative statements to test items.

The evaluators then familiarized themselves with Table 2, which is shown here as Figure 2-1. That table was used to record individual and group decisions for each of the test items. Following this, the evaluators studied examples of the use of Evaluative Statements. The project director read aloud each of the examples individually, explaining how each of the test items measured use of a particular rational power for which it had been written. This discussion lasted for two and one half hours.

When the evaluators indicated that they were ready to begin the analysis of some test items, the practice test-items were introduced.

In guiding the evaluators through the practice test-item evaluation, the following instructions were given by the project director:

> Using the Evaluative Statements, each of you will work independently to analyze the first four items of the practice group of test items. Please read the entire test item. Ask yourself: 'On what sub-objective (rational power) is the student being evaluated?' After you have made your decision, please record it by the letter of the sub-objective (a through j; or 'Other') in the column of Section II, Table 2, labelled "Individual Evaluation." If for example, you are working with practice Test Item Number 1, locate that number in the column marked 'Individual Evaluation: Number of Test Item'. Then record your decision in the space provided beside it in the column marked 'Sub-Objective Measured (a through j, or 'Other')'. We shall stop after you have completed the first four practice test items and obtain your group decision. When each of you has completed this work individually, the group as a whole will share those individual decisions. During the group discussions, I will serve as the discussion leader. That will enable each of you to express your opinions and decisions, so that a group decision

Figure 2-1. Recording of data after analysis of test items by single and group evaluation.

TABLE 2

ANALYSIS OF ITEMS OF AN INDIVIDUAL TEST BY A SINGLE EVALUATOR, THEN BY GROUP EVALUATION

Section I

Name of Test:

Author of Test:

Number and Form of Test:

Name of Evaluator:

Date of Evaluation: Beginning Time:

Place of Evaluation: Ending Time:

Remarks:

Section II

Individual Evaluation		Group Evaluation	
Number of Test Item	Sub-Objective Measured (a-j; 'Other')	Number of Test Item	Sub-Objective Measured (a-j; 'Other')
1		1	
2		2	
3		3	
↓		↓	

will be arrived at for each test item. I shall also act as the recorder of your decisions, I shall not take part in your discussions. When each of you evaluators has indicated that you are ready to share your individual decisions, I shall ask each of you for your decision for a specific test item. I will then announce each decision and record each at that time on an overhead transparency, Table 1, 'Decision of Evaluators'. Use of a Sub-Objective (a through j; or 'Other') that each test item measures will be recorded on that Table.

When agreement regarding a specific test item is reached among at least three of you, that particular item will be considered to be a valid measure of a particular sub-objective. Such a group decision will be recorded appropriately in Table 2.

When a difference of judgment among you exists for a specific test item, the entire group of evaluators will discuss such an item. Following this discussion, I shall call for individual decisions, which again I shall record on an overhead transparency, Table 1.

When agreement regarding a test item can not be reached by at least three of you, that item will be judged to be and recorded as an invalid measure of a sub-objective. This decision of the group of evaluators about such an item will be appropriately recorded in Table 2 in that section entitled 'Remarks'.

It is conceivable that a test item could measure achievement of more than one sub-objective. Should that be true, those data will be recorded in Table 2.

Table 1, 'Decision of Evaluators' is shown in Figure 2-2.

The analysis of the initial four items of the group written for the evaluators to practice with lasted for forty minutes. Then the evaluators began the analysis of the remaining items in the practice group. This practice with test items provided the evaluators with experience that allowed them to become skilled and comfortable with the Evaluative Statements and with their application.

Figure 2-2. Recording of individual decisions after an analysis of test items.

TABLE 1

DECISION OF EVALUATORS

Decision of Evaluators--(Sub-Objective Measured a-j; 'Other')				
Name of Test:				
Evaluator	1	2	3	4
Test Item Number				
1				
2				
3				
↓				

To begin the practice session, the project director said:

> Use the same procedure for analyzing these test items as you did for the initial four. When you have finished all of the remaining test items, please tell me. We shall then discuss them one at a time and record these data using the same method as before.

The analysis of the remaining items was carried out in the manner as had been done for the initial four. The analysis of and discussion about the remaining items took two and one half hours. Then the evaluators indicated that

they were ready to begin with the items in the standardized tests. The project director gave instructions saying:

> These tests will be analyzed one at a time. We will discuss the items of a particular test when all of you have completed it and have indicated so. Decisions will be arrived at and data recorded in the same way as was done with the practice test items.

The setting and procedures were the same as in the training program. Tests were handled under security, in accordance with the rules for their use and storage, as set forth by the American Psychological Association.[6] Because of the restrictions in the use of standardized tests, the test items which were analyzed are not a part of the Appendix. Tests were analyzed one at a time on July 28, 29, 30, and 31, 1981. On July 28, at the conclusion of the training program and rest break, one hour of that morning was devoted to analyzing test items of the sample of standardized tests. The other three days were devoted entirely to test item analyses, 8 A.M. to 12 P.M. Frequent rest breaks were taken as desired by the evaluators at the convenience of each. The only persons present during the entire period of item-analysis were the four evaluators and the project director. The project director did not take part in any discussions but served to facilitate discussion and to be a recorder of individual and group decisions.

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[6]Qualifications Section, Registration Form, (New York, New York: The Psychological Corporation, 1980), p. 2.

The order in which the sample of standardized tests was analyzed was that derived by random selection. This procedure will be described in the following pages. Six hundred and forty-eight test items from twelve tests were analyzed.

Tests and Test Items

For the research problem identified, the population of tests selected consisted of those in Standardized Science Tests: A Descriptive Listing written by Janet Wall and Lee Summerlin and published by the National Science Teachers Association. That publication describes all of the standardized science tests which were published between 1959 and 1973. The population of tests, including later editions available when the sample of tests was selected, consisted of thirty tests and fifty-four test forms, that is, equivalent forms of a particular test. Both the tests and test forms are distributed unevenly among the five categories into which secondary school tests are divided. For example, some tests for biology purport to include test items that would measure student achievement of the content area of only one discipline of science. Other tests, for example, general science, purport to include test items distributed unevenly among several disciplines of science. The distributions of secondary school science tests and test forms among the five groups of tests is shown in Table 2-1.

TABLE 2-1

STANDARDIZED SCIENCE TESTS: A DESCRIPTIVE LISTING[7]

Classification of Tests	Number of Tests	Number of Test Forms
Secondary Biology Tests	7	14
Secondary Chemistry Tests	7	10
Secondary Earth Science Tests	2	2
Secondary General Science Tests	10	19
Secondary Physics Tests	4	9
TOTALS:	30	54

The decision was made to use a test-sample size of twenty percent, corrected to the nearest whole number, of the test forms of each of the five categories shown in Table 2-1. The name of each of the forms of each test was written on a small piece of paper. These pieces were placed into a large bowl and stirred. Drawing one at a time, a random sample of twelve tests was selected. By this method each and every test had an equal chance of being selected. Tests selected for analysis include:

Biology

Emporia Biology Test, Test I, Form A, 1964, Ted Andrews and M. W. Sanders, Bureau of Educational Measurements, Kansas State University, Emporia, Kansas

[7]Janet Wall and Lee Summerlin, Standardized Science Tests: A Descriptive Listing (Washington, D. C.: National Science Teachers Association, 1973), p. iii.

Minnesota High School Achievement Examinations-Biology-Form EH Revised, 1968, V. L. Lohmann, Editor, American Guidance Service, Inc., Circle Pines, Minnesota

Nelson Biology Test, Revised Edition, Form E, 1965, Clarence H. Nelson, Harcourt Brace Jovanovich, New York, New York

Chemistry

ACS-NSTA Cooperative Examination in High School Chemistry, Form 1977, Examinations Committee, American Chemical Society, University of South Florida, Tampa, Florida

Emporia Chemistry Test, Test II, Form A, 1964, A. T. Ericson and M. W. Sanders, Bureau of Educational Measurements, Kansas State University, Emporia, Kansas

Earth Science

Content Evaluation Series, Earth Science Test, Form I, 1969, Ernestine O'Connell, Houghton Mifflin Company, Boston, Massachusetts

General Science

Emporia General Science Test, Test I, Form B, 1964, Donald Cross and M. W. Sanders, Bureau of Educational Measurements, Kansas State University, Emporia, Kansas

Sequential Tests of Educational Progress, Series II, Science, Form 2A, 1969, Educational Testing Service, Addison-Wesley Publishing Company. Reading, Massachusetts

Stanford Achievement Test-Advanced Science Test, Form X, 1964, Truman Kelley, Richard Madden, Eric Cardner, and Herbert Rudman, Harcourt Brace Jovanovich, Inc., New York, New York

Tests of Achievement and Proficiency-Science--Levels 15-18, Form T, 1979, Dale P. Scannell, Houghton Mifflin Company, Boston, Massachusetts

Physics

Emporia Physics Test, 1964, Gerald Witten and M. W. Sanders, Bureau of Educational Measurements, Kansas State University, Emporia, Kansas

Minnesota High School Achievement Examinations-Physics, Form EH Revised, 1968, V. L. Lohmann, Editor, American Guidance Service, Inc., Circle Pines, Minnesota

The exact items analyzed from each test are listed in Table 3-2. Those data are also provided in Appendix D. Sixty percent of a test's questions were evaluated. Test items from each of the twelve tests were randomly selected using the same procedure used to select the tests included in the sample. Then number of each item in a test was written on a piece of paper, placed in a large bowl, and stirred. Then, item numbers were drawn one at a time until sixty percent of the items had been selected. This procedure was followed for each of the twelve tests.

All test items of a particular test, of the sample, that were to be analyzed, were separated from the entire questions of that test. These items were then taped onto paper, in consecutive order, so that the evaluators saw only those test items that had been selected for the analysis. That is, they only saw the sixty percent of the test items that were to be analyzed. This process was followed for each of the twelve tests.

The order in which the standardized tests were analyzed also was determined by random selection. The name of each of

the twelve tests was written on a small piece of paper. These slips were placed in a large bowl, stirred, then selected one at a time until the order had been determined.

The numbers of test items that were analyzed includes: biology, 173 items; chemistry, 108 items; earth science, 24 items; general science, 215 items; and physics, 128 items. These 648 items represented sixty percent of the 1077 test items in the twelve tests selected.

CHAPTER III

PRESENTATION AND INTERPRETATION OF THE DATA

Data collected during this investigation were for the purpose of determining whether test items from standardized secondary school science tests measure student achievement of the ability to think, that is, whether test items measure student achievement of the rational powers. Those data are presented in this chapter.

Table 3-1 lists, by academic area, the tests that were analyzed, the total number of items in each test, and the number of items evaluated from each test. A total of 648 test items were analyzed. The exact numbers of the test items in each science field, and the evaluators' decisions on these items are presented in this chapter and in Appendix D.

Table 3-2 lists the test items analyzed from each of the tests and the group decisions of the evaluators regarding which rational powers the items measured. When agreement regarding a specific item was reached among at least three evaluators, that particular item was considered to be a valid measure of a particular rational power. When agreement was

TABLE 3-1

TEST ITEMS SELECTED FOR EVALUATION

Field	Total Number of Items in Test	Number of Items Selected for Evaluation	Percentage of Total Items Selected
BIOLOGY			
Emporia Biology Test	115	69	60
Minnesota High School Achievement Examinations-Biology	107	65	60
Nelson Biology Test	65	39	60
Biology Total:	287	173	60
CHEMISTRY			
ACS-NSTA Cooperative Examination in High School Chemistry	80	48	60
Emporia Chemistry Test	100	60	60
Chemistry Total:	180	108	60
EARTH SCIENCE			
Content Evaluation Series-Earth Science Test	40	24	60
Earth Science Total:	40	24	60

TABLE 3-1--Continued

Field	Total Number of Items in Test	Number of Items Selected for Evaluation	Percentage of Total Items Selected
GENERAL SCIENCE			
Emporia General Science Test	100	60	60
Sequential Tests of Educational Progress-Science	75	45	60
Stanford Achievement Test Advanced Science Test	60	36	60
Tests of Achievement and Proficiency-Science Levels 15-18	123	74	60
General Science Total:	358	215	60
PHYSICS			
Emporia Physics Test	90	54	60
Minnesota High School Achievement Examinations-Physics	122	74	60
Physics Total:	212	128	60
TOTAL OF ALL CATEGORIES:	1077	648	60

not reached among at least three of the evaluators, that test item was judged and recorded as 'Invalid'. Test items that were determined to measure an objective other than the rational powers were labelled 'Other'.

In Table 3-2, the rational powers measured are identified by name. In other tables, Table 3-4, for example, where space is limited, the rational powers are identified by letter as follows:

a. recalling
b. imagining
c. classifying
d. generalizing
e. comparing
f. inferring
g. deducing
h. analyzing
i. evaluating
j. synthesizing

As has been said, a total of 648 test items in the five fields of biology, chemistry, earth science, general science, and physics, were analyzed. The distribution of the items among the fields is as follows: biology, 173; chemistry, 108; earth science, 24; general science, 215; and physics, 128.

Data derived from this research indicate that test items provide varying degrees of measurement of student use of the rational powers. This range of measurement extended from adequate for the rational power of recalling, to minimal for the rational powers of classifying, generalizing, inferring, deducing, evaluating and synthesizing. No items were determined to have measured student use of those rational

TABLE 3-2

GROUP DECISION OF EVALUATORS FOR TEST ITEMS ANALYZED

Field: Biology

Name of Test: Emporia Biology Test, Test I, Form A

Item Number	Rational Power(s) Tested
2	Recalling
3	Recalling
5	Recalling
6	Recalling
7	Recalling
9	Recalling
11	Recalling
13	Recalling
14	Recalling
16	Recalling
18	Recalling
19	Recalling
21	Recalling
23	Recalling
24	Recalling
25	Recalling
26	Recalling
27	Recalling
28	Recalling
29	Recalling
30	Recalling
31	Recalling
32	Recalling
33	Recalling
35	Recalling

TABLE 3-2--Continued

Field: Biology

Name of Test: Emporia Biology Test, Test I, Form A--Continued

Item Number	Rational Power(s) Tested
36	Recalling
39	Recalling
42	Recalling
48	Recalling
50	Recalling
51	Recalling
54	Recalling
55	Recalling
57	Recalling
60	Recalling
61	Recalling
62	Recalling
63	Recalling
64	Recalling
66	Recalling
68	Recalling
70	Recalling
71	Recalling
73	Recalling
74	Recalling
76	Recalling
79	Recalling
81	Recalling
84	Recalling
85	Recalling
87	Recalling
88	Recalling

TABLE 3-2--Continued

Field: Biology

Name of Test: Emporia Biology Test, Test I, Form A--Continued

Item Number	Rational Power(s) Tested
89	Recalling
90	Recalling
91	Recalling
92	Recalling
93	Recalling
94	Recalling
95	Recalling
99	Recalling
100	Recalling
101	Recalling
106	Recalling
107	Recalling
108	Recalling
109	Recalling
112	Recalling
114	Recalling
115	Recalling

Name of Test: Minnesota High School Achievement Examinations-Biology, Form EH Revised

1	Recalling
3	Recalling
8	Recalling
9	Recalling
10	Recalling
12	Recalling
13	Recalling

TABLE 3-2--Continued

Field: Biology

Name of Test: Minnesota High School Achievement Examinations-Biology, Form EH Revised--Continued

Item Number	Rational Power(s) Tested
16	Recalling
21	Recalling
22	Recalling
23	Recalling
25	Recalling
26	Recalling
28	Recalling
29	Recalling
31	Recalling
32	Recalling
33	Recalling
34	Recalling
35	Recalling
36	Recalling
37	Recalling
39	Recalling
41	Recalling
43	Recalling
45	Recalling
46	Recalling
47	Recalling
50	Recalling
51	Invalid
52	Recalling
53	Recalling
55	Recalling

TABLE 3-2--Continued

Field: Biology

Name of Test: Minnesota High School Achievement Examinations-Biology, Form EH Revised--Continued

Item Number	Rational Power(s) Tested
56	Recalling
57	Recalling
60	Invalid
63	Recalling
68	Recalling
69	Recalling
71	Recalling
72	Recalling
74	Recalling
75	Recalling
77	Recalling
78	Recalling
79	Recalling
80	Recalling
81	Recalling
82	Recalling
83	Recalling
84	Recalling
86	Recalling
88	Recalling
90	Recalling
91	Recalling
93	Recalling
94	Recalling
95	Recalling
97	Recalling

TABLE 3-2--Continued

Field: Biology

Name of Test: Minnesota High School Achievement Examinations-Biology, Form EH Revised--Continued

Item Number	Rational Power(s) Tested
99	Recalling
100	Recalling
101	Recalling
104	Recalling
105	Recalling
107	Recalling
Name of Test: Nelson Biology Test, Revised Edition, Form E	
2	Recalling
3	Recalling
8	Recalling
9	Recalling
10	Recalling
13	Synthesizing
14	Synthesizing
16	Synthesizing
17	Recalling
18	Recalling
21	Recalling
22	Recalling
24	Inferring
26	Recalling
27	Recalling
28	Recalling
29	Recalling
33	Synthesizing

TABLE 3-2--Continued

Field: Biology

Name of Test: Nelson Biology Test, Revised Edition, Form E--Continued

Item Number	Rational Power(s) Tested
36	Synthesizing
37	Recalling
39	Inferring
42	Recalling
43	Invalid
46	Deducing
47	Deducing
48	Deducing
49	Deducing
51	Recalling
52	Recalling
53	Recalling
54	Recalling
56	Recalling
57	Recalling
58	Recalling
59	Recalling
60	Recalling
61	Recalling
63	Recalling
64	Recalling

Name of Test: ACS-NSTA Cooperative Examination in High School Chemistry

2	Recalling
3	Recalling

TABLE 3-2--Continued

Field: Chemistry

Name of Test: ACS-NSTA Cooperative Examination in High School Chemistry--Continued

Item Number	Rational Power(s) Tested
6	Recalling
9	Recalling
11	Recalling
13	Recalling
16	Recalling
20	Recalling
21	Recalling
23	Recalling
24	Recalling
25	Recalling
26	Recalling
27	Recalling
28	Recalling
29	Recalling
31	Recalling
32	Recalling
34	Recalling
35	Recalling
36	Recalling
37	Recalling
38	Recalling
39	Recalling
40	Recalling
41	Recalling
42	Recalling
43	Recalling

TABLE 3-2--Continued

Field: Chemistry

Name of Test: ACS-NSTA Cooperative Examination in High School Chemistry--Continued

Item Number	Rational Power(s) Tested
48	Recalling
50	Recalling
51	Recalling
53	Recalling
54	Recalling
55	Recalling
58	Recalling
60	Recalling
61	Recalling
62	Recalling
64	Recalling
65	Recalling
68	Recalling
71	Recalling
72	Recalling
73	Recalling
74	Recalling
76	Recalling
77	Recalling
79	Recalling

TABLE 3-2--Continued

Field: Chemistry

Name of Test: Emporia Chemistry Test, Test II, Form A

Item Number	Rational Power(s) Tested
1	Recalling
2	Recalling
3	Recalling
5	Recalling
6	Recalling
9	Recalling
11	Recalling
13	Recalling
15	Recalling
16	Recalling
20	Recalling
21	Recalling
22	Recalling
24	Recalling
25	Recalling
26	Recalling
28	Recalling
29	Recalling
31	Recalling
35	Recalling
37	Recalling
39	Recalling
43	Recalling
45	Recalling
46	Recalling
47	Recalling
48	Recalling

TABLE 3-2--Continued

Field: Chemistry

Name of Test: Emporia Chemistry Test, Test II, Form A--Continued

Item Number	Rational Power(s) Tested
50	Recalling
52	Recalling
54	Recalling
56	Recalling
57	Recalling
58	Recalling
59	Recalling
60	Recalling
62	Recalling
63	Recalling
66	Recalling
67	Recalling
68	Recalling
69	Recalling
70	Recalling
71	Recalling
73	Recalling
75	Recalling
78	Recalling
79	Recalling
80	Recalling
82	Recalling
83	Recalling
84	Recalling
85	Recalling
86	Recalling

TABLE 3-2--Continued

Field: Chemistry

Name of Test: Emporia Chemistry Test, Test II, Form A--Continued

Item Number	Rational Power(s) Tested
87	Recalling
89	Recalling
90	Recalling
91	Recalling
97	Recalling
98	Recalling
100	Recalling

Field: Earth Science

Name of Test: Content Evaluation Series, Earth Science Test, Form 1

1	Recalling
2	Recalling
3	Recalling
4	Recalling
6	Recalling
9	Recalling
11	Recalling
12	Recalling
13	Recalling
14	Recalling
16	Recalling
18	Recalling
20	Recalling
22	Recalling
23	Recalling

TABLE 3-2--Continued

Field: Earth Science

Name of Test: Content Evaluation Series, Earth Science Test, Form 1

Item Number	Rational Power(s) Tested
24	Recalling
26	Recalling
27	Recalling
28	Recalling
31	Recalling
35	Recalling
38	Recalling
39	Recalling
40	Recalling

Field: General Science

Name of Test: Emporia General Science Test, Test I, Form B

7	Recalling
8	Recalling
10	Recalling
12	Recalling
14	Recalling
15	Recalling
16	Recalling
17	Recalling
18	Recalling
21	Recalling
23	Recalling
24	Recalling
25	Recalling

TABLE 3-2--Continued

Field: General Science

Name of Test: Emporia General Science Test, Test I, Form B--Continued

Item Number	Rational Power(s) Tested
28	Recalling
29	Recalling
32	Recalling
33	Recalling
35	Recalling
36	Recalling
39	Recalling
44	Recalling
45	Recalling
46	Recalling
49	Recalling
50	Recalling
51	Recalling
52	Recalling
53	Recalling
55	Recalling
56	Recalling
57	Recalling
60	Recalling
61	Recalling
63	Recalling
67	Recalling
68	Recalling
69	Recalling
71	Recalling
73	Recalling

TABLE 3-2--Continued

Field: General Science

Name of Test: Emporia General Science Test, Test I, Form B--Continued

Item Number	Rational Power(s) Tested
74	Recalling
75	Recalling
76	Recalling
77	Recalling
79	Recalling
80	Recalling
82	Recalling
83	Recalling
84	Recalling
85	Recalling
87	Recalling
89	Recalling
90	Recalling
91	Recalling
92	Recalling
94	Recalling
95	Recalling
96	Recalling
97	Recalling
99	Recalling
100	Recalling

TABLE 3-2--Continued

Field: General Science

Name of Test: Sequential Tests of Educational Progress, Series II, Science, Form 2 A (Part I)

Item Number	Rational Power(s) Tested
1	Recalling
2	Evaluating
5	Recalling
7	Recalling
9	Deducing
10	Recalling
12	Recalling
13	Recalling
14	Evaluating
16	Recalling
18	Recalling
19	Recalling
21	Recalling
22	Recalling
23	Recalling
25	Evaluating
26	Recalling
28	Evaluating
29	Recalling
30	Recalling
32	Recalling
35	Recalling
36	Recalling
37	Recalling
39	Recalling
41	Recalling

TABLE 3-2--Continued

Field: General Science

Name of Test: Sequential Tests of Educational Progress, Series II, Science, Form 2 A (Part I)--Continued

Item Number	Rational Power(s) Tested
42	Recalling
45	Recalling
(Part II)	
1	Classifying
2	Classifying
5	Invalid
6	Recalling
7	Evaluating
8	Deducing
9	Deducing
10	Evaluating
12	Invalid
15	Recalling
17	Recalling
19	Evaluating
22	Deducing
26	Recalling
27	Deducing
28	Deducing
30	Evaluating

Name of Test: Stanford Achievement Test-Advanced Science Test-Form X

2	Recalling
3	Recalling

TABLE 3-2--Continued

Field: General Science

Name of Test: Stanford Achievement Test-Advanced Science Test-Form X--Continued

Item Number	Rational Power(s) Tested
4	Recalling
5	Recalling
10	Recalling
12	Recalling
13	Recalling
16	Recalling
17	Recalling
19	Recalling
20	Recalling
21	Recalling
22	Recalling
23	Recalling
24	Recalling
25	Recalling
26	Inferring
28	Recalling
30	Recalling
31	Recalling
32	Recalling
34	Recalling
36	Recalling
39	Recalling
41	Deducing
42	Recalling
43	Recalling
45	Recalling

TABLE 3-2--Continued

Field: General Science

Name of Test: Stanford Achievement Test-Advanced Science Test-Form X--Continued

Item Number	Rational Power(s) Tested
46	Evaluating
48	Recalling
50	Recalling
51	Recalling
52	Recalling
53	Recalling
55	Recalling
58	Recalling

Name of Test: Tests of Achievement and Proficiency-Science-Levels 15-18, Form T

3	Synthesizing
4	Recalling
5	Recalling
10	Recalling
11	Recalling
12	Recalling
13	Recalling
14	Recalling
15	Recalling
19	Recalling
20	Recalling
23	Recalling
24	Recalling
27	Recalling
28	Synthesizing

TABLE 3-2--Continued

Field: General Science

Name of Test: Tests of Achievement and Proficiency-Science-Levels 15-18, Form T--Continued

Item Number	Rational Power(s) Tested
29	Inferring
30	Recalling
31	Invalid
35	Evaluating
36	Recalling
38	Recalling
41	Recalling
42	Deducing
43	Recalling
47	Recalling
49	Recalling
50	Recalling
51	Recalling
52	Recalling
53	Evaluating
56	Recalling
57	Recalling
58	Recalling
60	Invalid
61	Recalling
64	Recalling
65	Evaluating
66	Recalling
67	Inferring
70	Evaluating
71	Evaluating

TABLE 3-2--Continued

Field: General Science

Name of Test: Tests of Achievement and Proficiency-Science-Levels 15-18, Form T--Continued

Item Number	Rational Power(s) Tested
73	Invalid
75	Recalling
76	Synthesizing
77	Generalizing
80	Recalling
81	Recalling
83	Recalling
85	Recalling
89	Recalling
91	Inferring
93	Recalling
95	Recalling
96	Deducing
97	Synthesizing
99	Evaluating
100	Generalizing
101	Recalling
103	Recalling
104	Recalling
105	Evaluating
106	Synthesizing
108	Recalling
111	Recalling
113	Recalling
114	Recalling
115	Deducing

TABLE 3-2--Continued

Field: General Science

Name of Test: Tests of Achievement and Proficiency-Science-Levels 15-18, Form T--Continued

Item Number	Rational Power(s) Tested
116	Recalling
117	Invalid
118	Recalling
120	Evaluating
121	Evaluating
122	Recalling
123	Recalling

Field: Physics

Name of Test: Emporia Physics Test

1	Recalling
2	Recalling
4	Recalling
5	Recalling
6	Recalling
8	Recalling
9	Recalling
11	Recalling
12	Recalling
13	Recalling
17	Recalling
18	Recalling
21	Recalling
26	Recalling
27	Recalling

TABLE 3-2--Continued

Field: Physics

Name of Test: Emporia Physics Test --Continued

Item Number	Rational Power(s) Tested
30	Recalling
31	Recalling
33	Recalling
35	Recalling
37	Recalling
38	Recalling
39	Recalling
41	Recalling
43	Recalling
46	Recalling
48	Recalling
50	Recalling
51	Recalling
53	Recalling
54	Recalling
55	Recalling
57	Recalling
59	Recalling
61	Recalling
62	Recalling
63	Recalling
65	Recalling
67	Recalling
68	Recalling
69	Recalling
71	Recalling
72	Recalling

TABLE 3-2--Continued

Field: Physics

Name of Test: Emporia Physics Test--Continued

Item Number	Rational Power(s) Tested
73	Recalling
74	Recalling
75	Recalling
79	Recalling
80	Recalling
81	Recalling
83	Recalling
85	Recalling
87	Recalling
88	Recalling
89	Recalling
90	Recalling

Name of Test: Minnesota High School Achievement Examinations-Physics, Form EH Revised

1	Recalling
5	Recalling
9	Recalling
10	Recalling
12	Recalling
16	Recalling
18	Recalling
19	Recalling
20	Recalling
21	Recalling
23	Recalling
24	Recalling

TABLE 3-2--Continued

Field: Physics

Name of Test: Minnesota High School Achievement Examinations-Physics, Form EH Revised--Continued

Item Number	Rational Power(s) Tested
26	Recalling
29	Recalling
30	Recalling
31	Recalling
33	Recalling
35	Recalling
37	Recalling
38	Recalling
40	Recalling
41	Recalling
43	Recalling
48	Recalling
49	Recalling
50	Recalling
52	Recalling
53	Recalling
55	Recalling
57	Recalling
58	Recalling
60	Recalling
61	Recalling
62	Recalling
63	Recalling
64	Recalling
65	Recalling
67	Recalling

TABLE 3-2--Continued

Field: Physics

Name of Test: Minnesota High School Achievement Examinations-Physics, Form EH Revised--Continued

Item Number	Rational Power(s) Tested
68	Recalling
69	Recalling
72	Recalling
75	Recalling
76	Recalling
77	Recalling
78	Recalling
80	Recalling
81	Recalling
82	Recalling
83	Recalling
86	Recalling
87	Recalling
88	Recalling
89	Recalling
90	Recalling
92	Recalling
93	Recalling
94	Recalling
95	Recalling
98	Recalling
99	Recalling
100	Recalling
101	Recalling
102	Recalling
104	Recalling

TABLE 3-2--Continued

Field: Physics

Name of Test: Minnesota High School Achievement Examinations-Physics, Form EH Revised--Continued

Item Number	Rational Power(s) Tested
107	Recalling
108	Recalling
111	Recalling
112	Recalling
115	Recalling
118	Recalling
119	Recalling
120	Recalling
121	Recalling
122	Recalling

powers of imagining, comparing, and analyzing. Percentages of test items in all twelve tests measuring student achievement of each of the ten rational powers are presented in Table 3-3.

Of all of the rational powers, data indicate that use of the rational power of recalling was the most frequently measured. This ranged from 100 percent in six tests to a low of 60 percent in one test. All of the test items that were analyzed in the fields of chemistry, earth science, and physics measured only student achievement of the rational power of recalling.

TABLE 3-3

PERCENTAGES OF TEST ITEMS IN ALL TESTS MEASURING STUDENT ACHIEVEMENT OF THE RATIONAL POWERS

Rational Power	Percentages of Items in All Tests Measuring Each Rational Power
Recalling	90.6
Imagining	0.0
Classifying	0.3
Generalizing	0.5
Comparing	0.0
Inferring	0.9
Deducing	2.2
Analyzing	0.0
Evaluating	2.6
Synthesizing	1.5
Invalid Items	1.4
TOTAL	100%

The other nine rational powers collectively were measured by less than ten percent of the test items. These data suggest that the test constructors believe that they are measuring what science teachers hold as their primary objective, recall. The data presented here show that the rational powers of imagining, comparing, and analyzing have not been acknowledged as important.

No items were judged 'Other', that is, measuring an objective(s) other that the rational powers. Less than two percent, 1.4 percent, of all of the test items were judged 'Invalid', that is, agreement was not reached among at least three of the four evaluators.

Tables 3-4, 3-5, 3-6, 3-7, and 3-8 list each of the tests in a science field and the number--and percentages--of items measuring use of the rational powers, or indicating 'Other' of 'Invalid'. Table 3-9 shows the total number of items evaluated in each academic area and the distribution of those items among the rational powers. The percentages of items measuring each rational power in all of the tests is also shown.

Figures 3-1 through 3-10 graphically show percentages of test items from all tests used in the research which measure use of each of the rational powers. Figures 3-11 and 3-12 graphically show percentages of test items of the research judged 'Other' and 'Invalid', respectively.

As was said in Chapter I, a primary purpose of American education is the development of the ability to think, the essence of which is the ten rational powers. Science (the quest, or search, for knowledge) is a part of the curriculum which seeks to lead students to achieve that primary purpose. Tests then, designed to measure student achievement of the rational powers, each and every one of them, should include test items designed to measure each rational power, and, with

the exception of the rational power of recalling, in greater percentages than the data of this research have indicated.

TABLE 3-4

SUMMARY OF BIOLOGY TESTS USED IN THE RESEARCH

(PERCENTAGES)

Name of Test	Number of Test Items	Number of Items Measuring Use of the Rational Powers											
		A	B	C	D	E	F	G	H	I	J	Other	Invalid
Emporia Biology Test	69	69 100.0											
Minnesota High School Achievement Examinations-Biology	65	63 96.9											2 3.1
Nelson Biology Test	39	27 69.2					2 5.1	4 10.3			5 12.8		1 2.6
Biology Total	173	159 91.9					2 1.1	4 2.3			5 3.0		3 1.7

RATIONAL POWERS:

A. Recalling
B. Imagining
C. Classifying
D. Generalizing
E. Comparing
F. Inferring
G. Deducing
H. Analyzing
I. Evaluating
J. Synthesizing

Other--Not Invalid, and not measuring use of the Rational Powers

Invalid--Agreement not reached among at least three of the four evaluators

TABLE 3-5

SUMMARY OF CHEMISTRY TESTS USED IN THE RESEARCH

(PERCENTAGES)

Name of Test	Number of Test Items	Number of Items Measuring Use of the Rational Powers											
		A	B	C	D	E	F	G	H	I	J	Other	Invalid
ACS-NSTA Cooperative Examination in High School Chemistry	48	48 / 100											
Emporia Chemistry Test	60	60 / 100											
Chemistry Total	108	108 / 100											

Rational Powers:

A. Recalling
B. Imagining
C. Classifying
D. Generalizing
E. Comparing
F. Inferring
G. Deducing
H. Analyzing
I. Evaluating
J. Synthesizing

Other--Not Invalid, and not measuring use of the Rational Powers

Invalid--Agreement not reached among at least three of the four evaluators

TABLE 3-6

SUMMARY OF AN EARTH SCIENCE TEST USED IN THE RESEARCH

(PERCENTAGES)

Name of Test	Number of Test-Items	Number of Items Measuring Use of the Rational Powers											
		A	B	C	D	E	F	G	H	I	J	Other	Invalid
Content Evaluation Series-Earth Science Test	24	24 / 100											
Earth Science Total	24	24 / 100											

Rational Powers:

A. Recalling
B. Imagining
C. Classifying
D. Generalizing
E. Comparing
F. Inferring
G. Deducing
H. Analyzing
I. Evaluating
J. Synthesizing

Other--Not Invalid, and not measuring use of the Rational Powers

Invalid--Agreement not reached among at least three of the four evaluators

TABLE 3-7

SUMMARY OF GENERAL SCIENCE TESTS USED IN THE RESEARCH

(PERCENTAGES)

Name of Test	Number of Test Items	Number of Items Measuring Use of the Rational Powers											
		A	B	C	D	E	F	G	H	I	J	Other	Invalid
Emporia General Science Test	60	60 100.0											
Sequential Tests of Educational Progress-Science	45	27 60.0		2 4.4				6 13.3		8 17.9			2 4.4
Stanford Achievement Test-Advanced Science	36	33 91.6					1 2.8	1 2.8		1 2.8			
Tests of Achievement and Proficiency-Science-Levels 15-18	74	48 64.8			3 4.1		3 4.1	3 4.1		8 10.8	5 6.7		4 5.4
General Science Total	215	168 78.1		2 0.9	3 1.4		4 1.9	10 4.7		17 7.9	5 2.3		6 2.8

See Legend on Table 3-6

TABLE 3-8

SUMMARY OF PHYSICS TESTS USED IN THE RESEARCH

(PERCENTAGES)

Name of Test	Number of Test Items	Number of Items Measuring Use of the Rational Powers											
		A	B	C	D	E	F	G	H	I	J	Other	Invalid
Emporia Physics Test	54	54/100											
Minnesota High School Achievement Examinations-Physics	74	74/100											
Physics Total	128	128/100											

Rational Powers:

A. Recalling
B. Imagining
C. Classifying
D. Generalizing
E. Comparing
F. Inferring
G. Deducing
H. Analyzing
I. Evaluating
J. Synthesizing

Other--Not Invalid, and not measuring use of the Rational Powers

Invalid--Agreement not reached among at least three of the four evaluators

TABLE 3-9

SUMMARY OF ALL TESTS USED IN THE RESEARCH

(PERCENTAGES)

Field	Number of Test Items	Number of Items Measuring Use of the Rational Powers											
		A	B	C	D	E	F	G	H	I	J	Other	Invalid
Biology	173	159					2	4			5		3
Chemistry	108	108											
Earth Science	24	24											
General Science	215	168		2	3		4	10		17	5		6
Physics	128	128											
Field Total	648	587 90.6		2 0.3	3 0.5		6 0.9	14 2.2		17 2.6	10 1.5		9 1.4

Rational Powers:

A. Recalling
B. Imagining
C. Classifying
D. Generalizing
E. Comparing
F. Inferring
G. Deducing
H. Analyzing
I. Evaluating
J. Synthesizing

Other--Not Invalid, and not measuring use of the Rational Powers

Invalid--Agreement not reached among at least three of the four evaluators

Figure 3-1. Percentages of test items measuring use of the rational power of recalling.

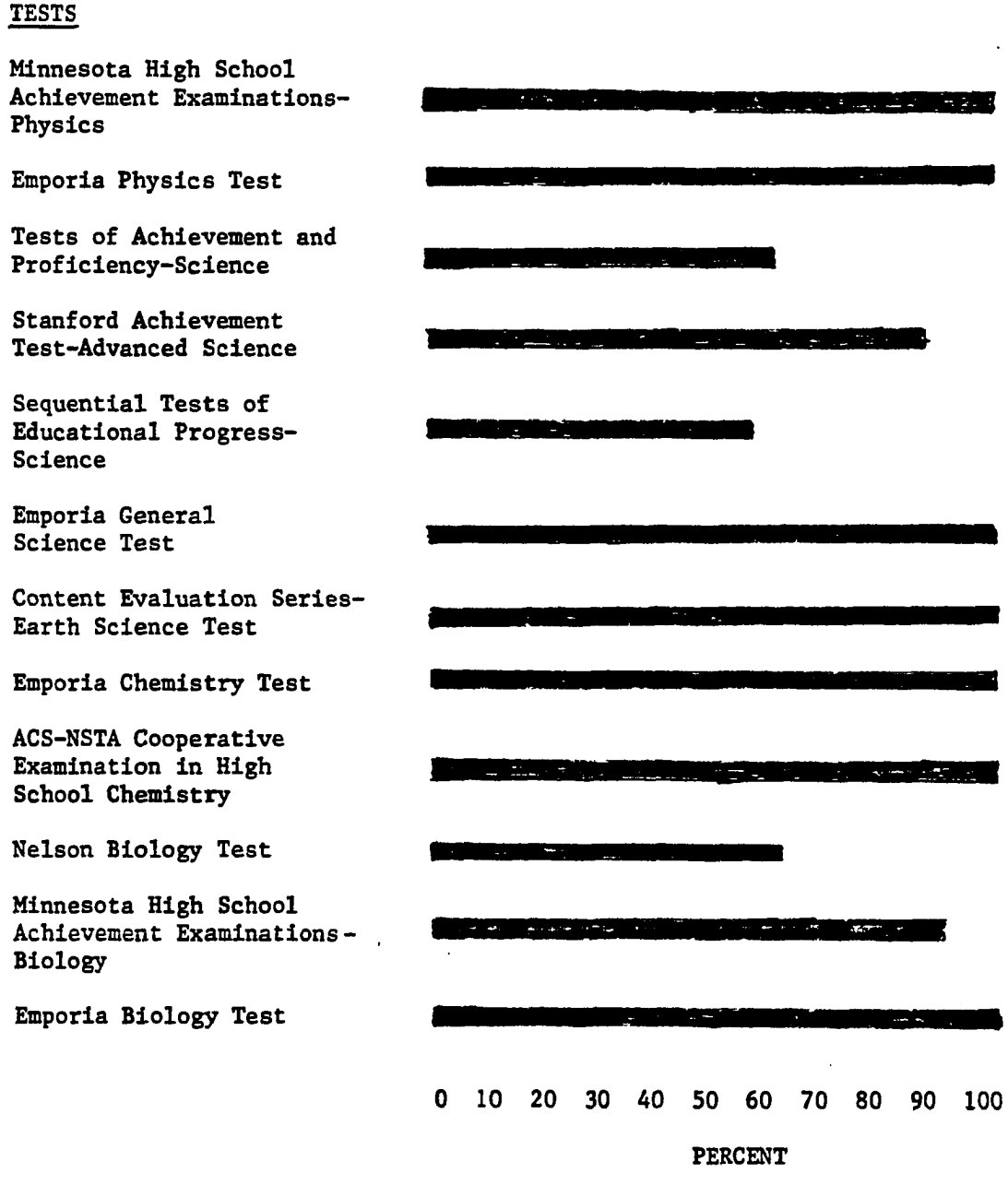


Figure 3-2. Percentages of test items measuring use of the rational power of imagining.

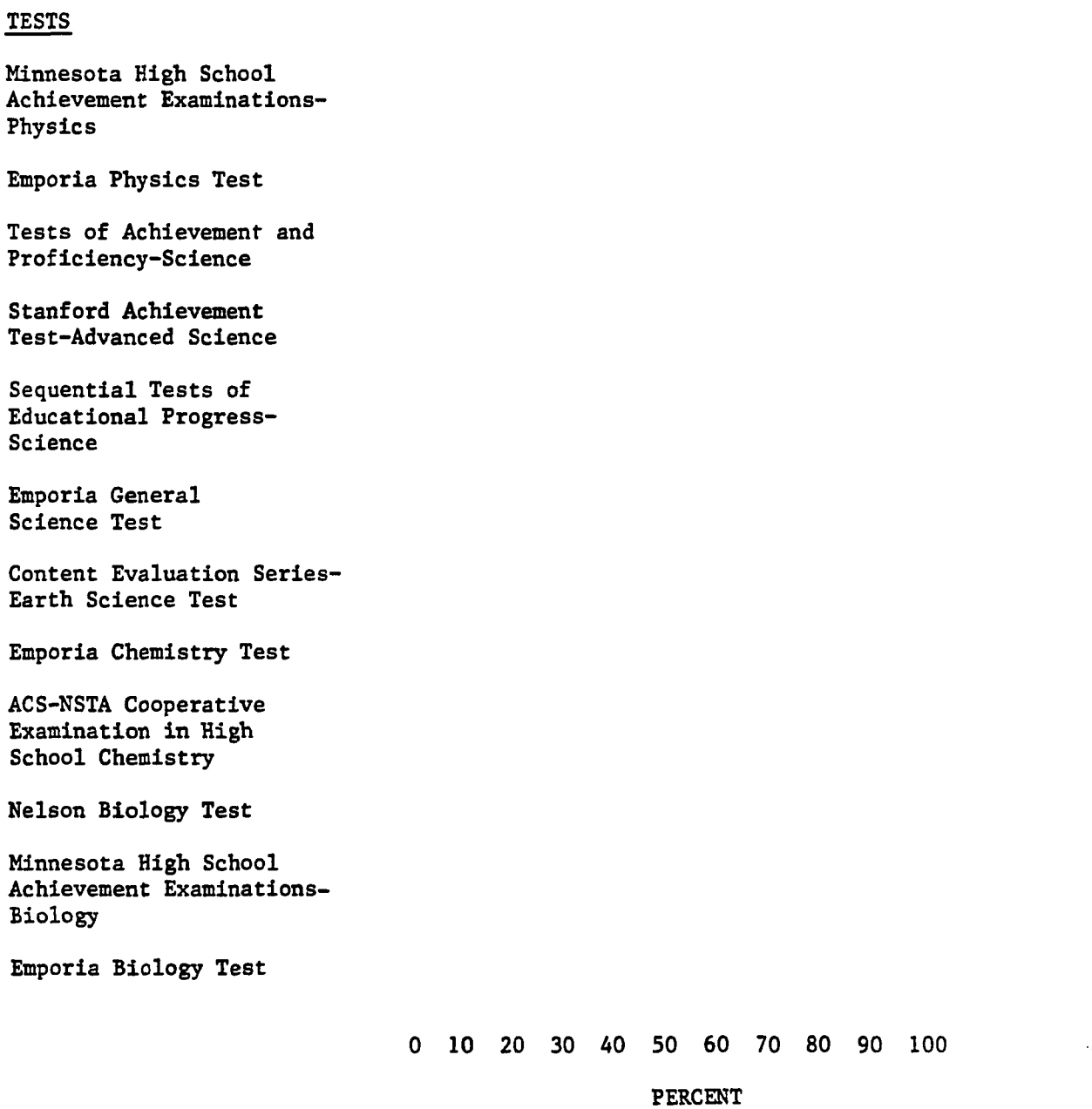


Figure 3-3. Percentages of test items measuring use of the rational power of classifying.

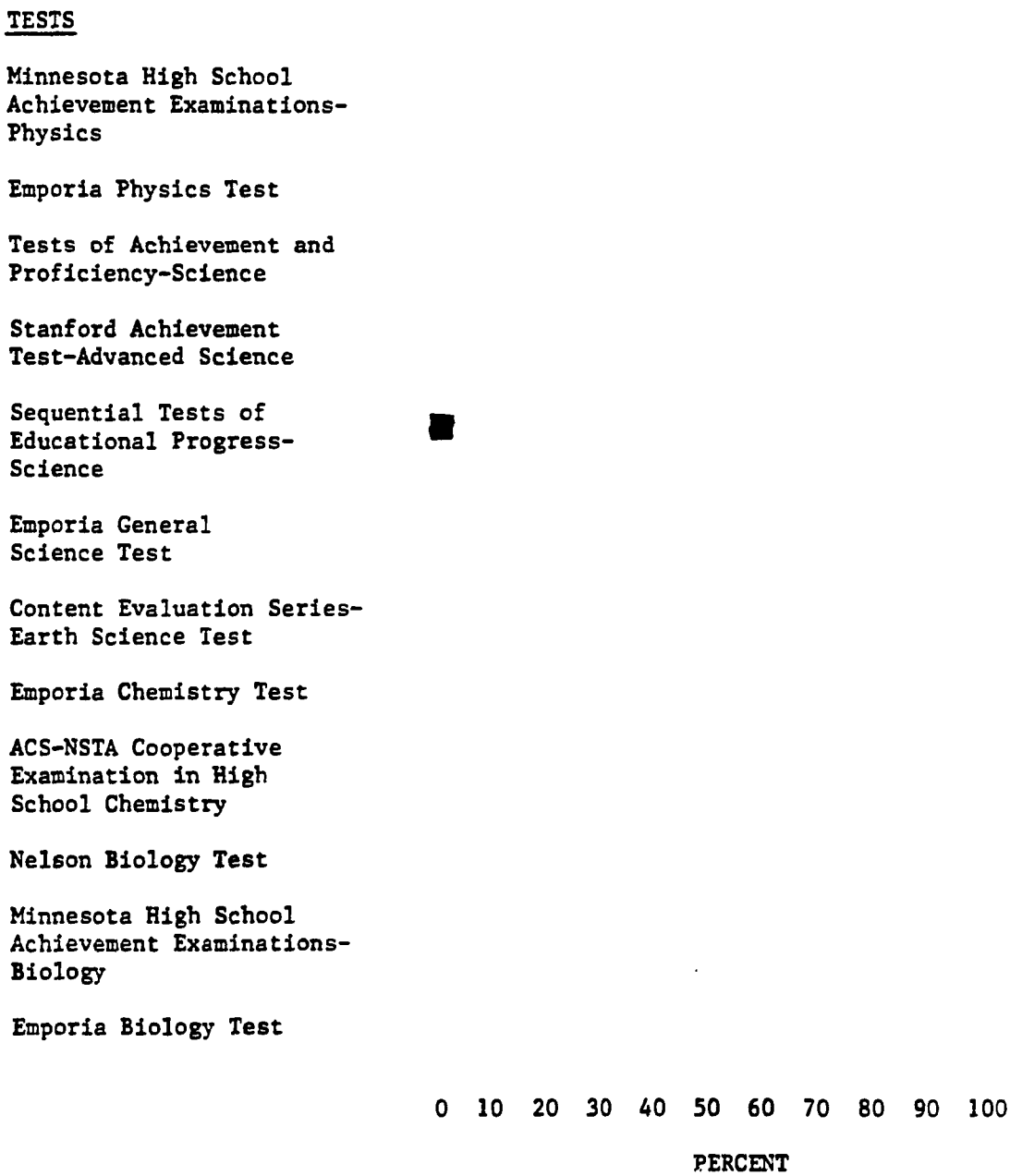


Figure 3-4. Percentages of test items measuring use of the rational power of generalizing.

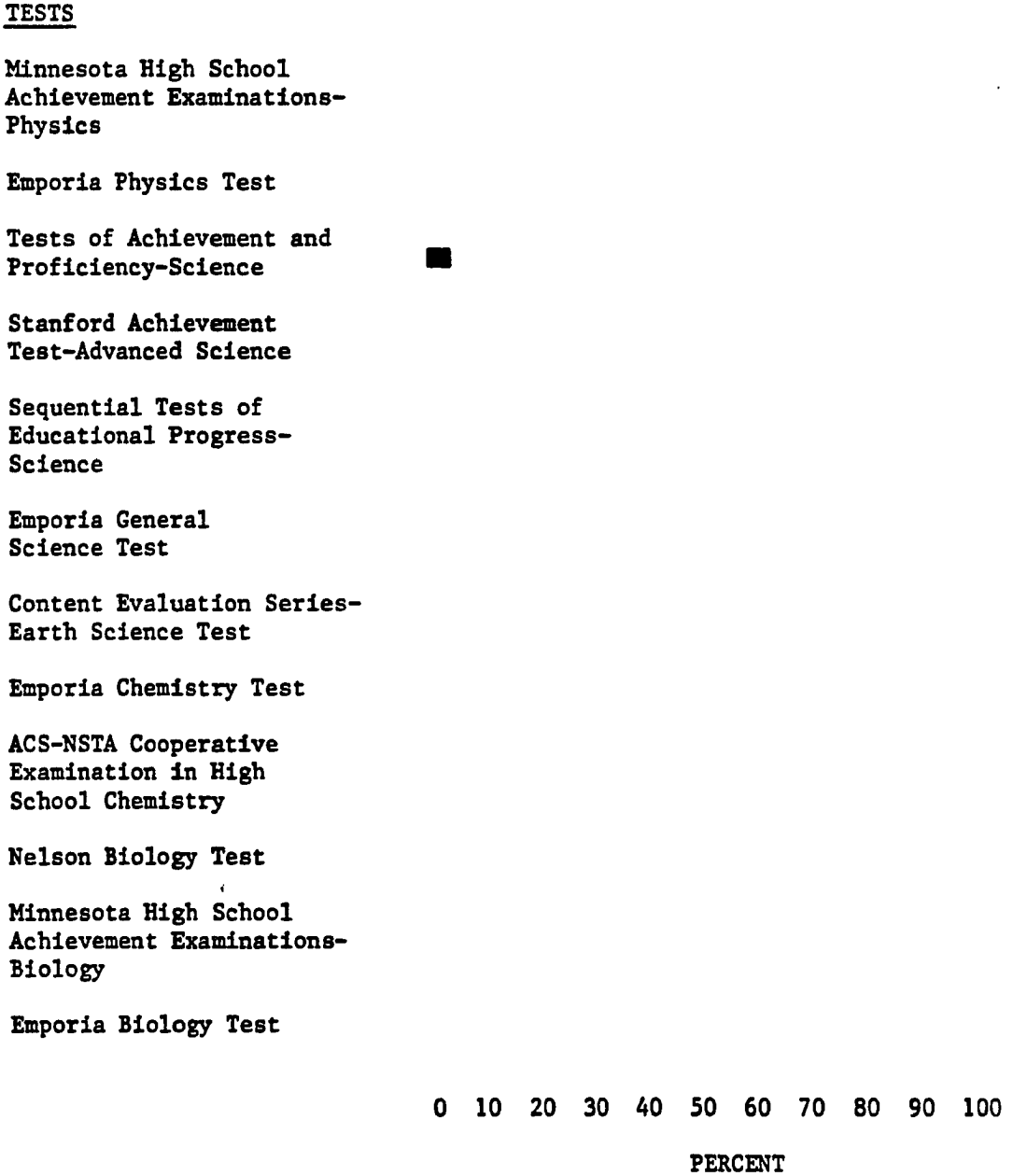


Figure 3-5. Percentages of test items measuring use of the rational power of comparing.

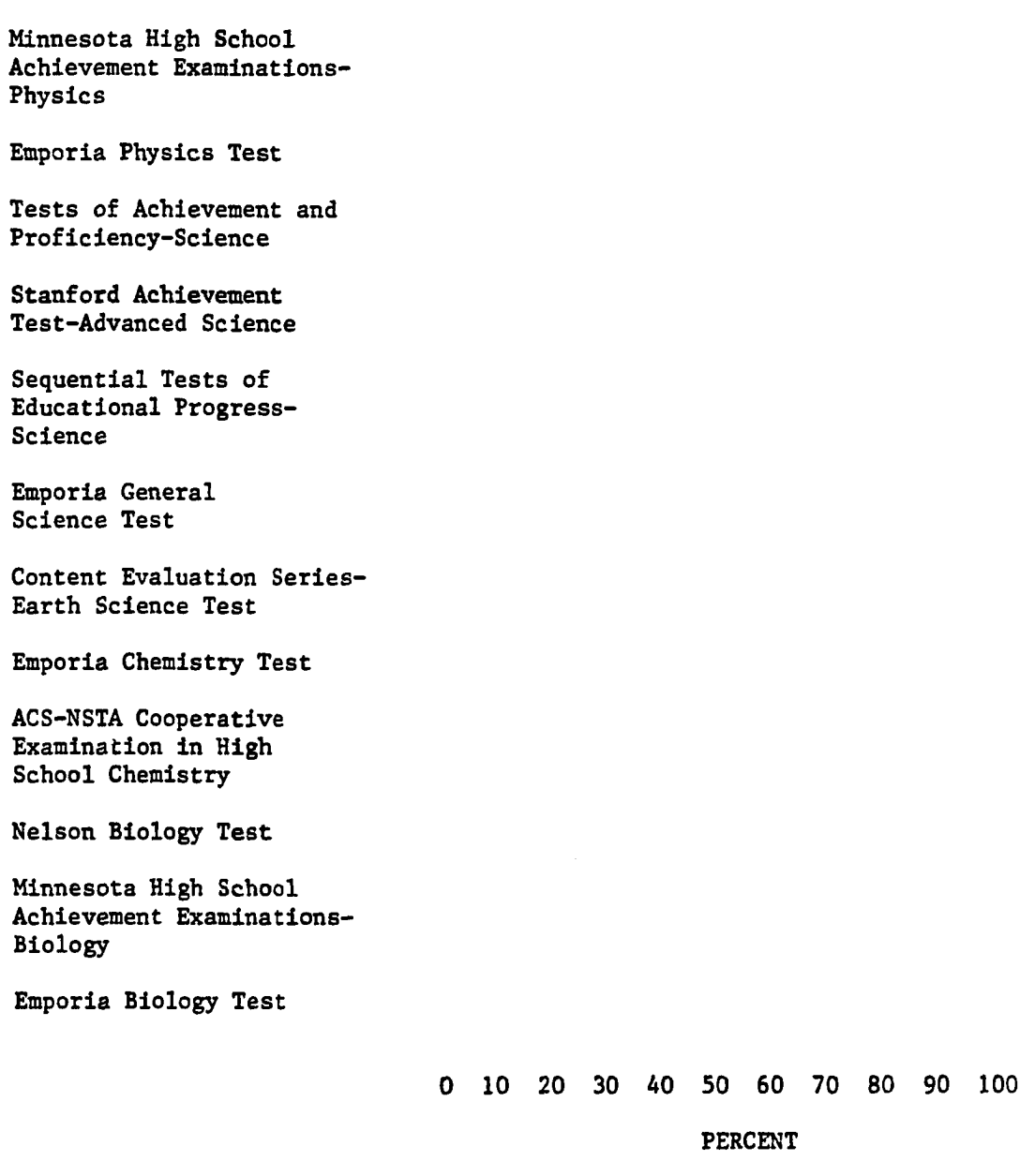


Figure 3-6. Percentages of test items measuring use of the rational power of inferring.

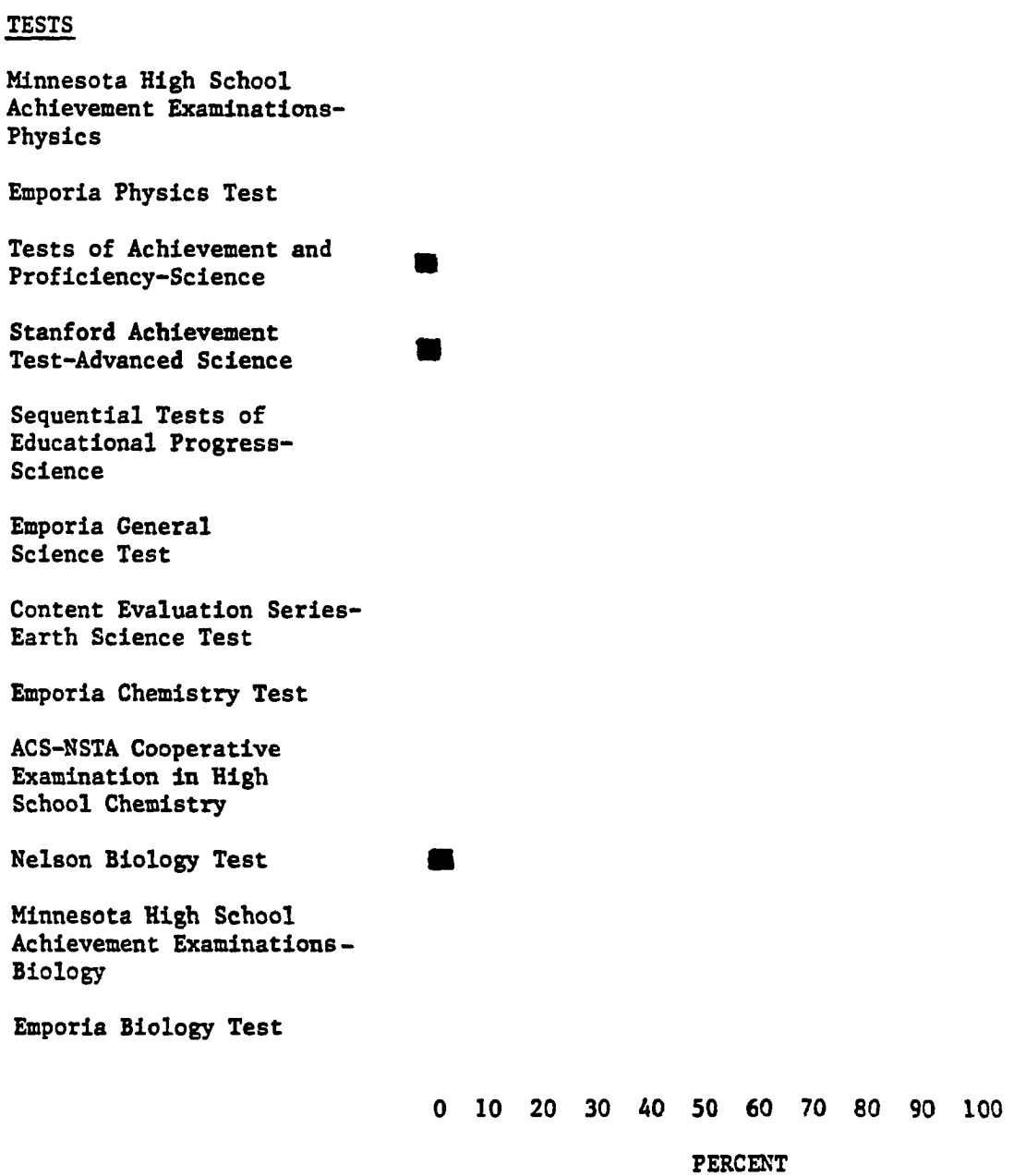


Figure 3-7. Percentages of test items measuring use of the rational power of deducing.

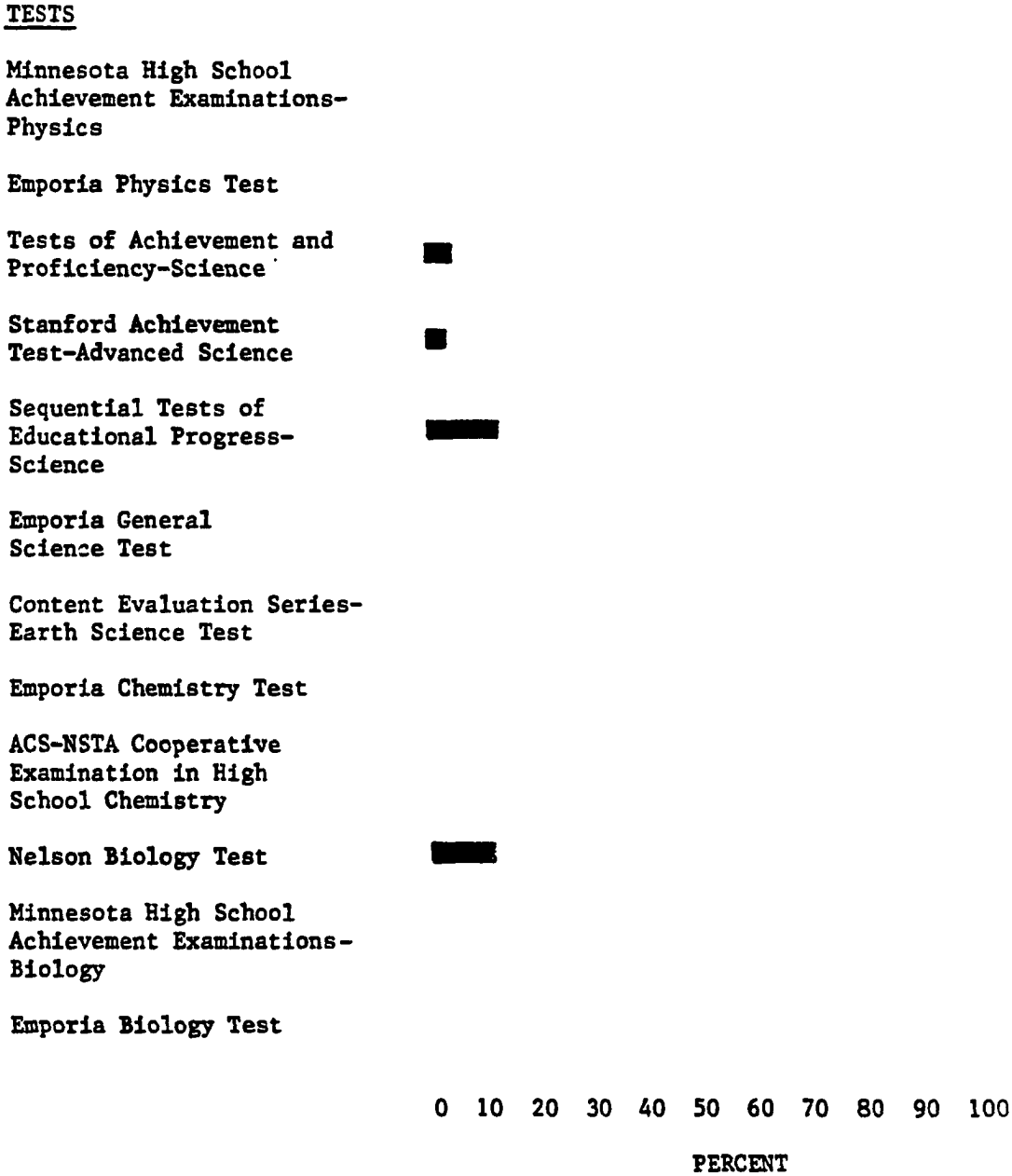


Figure 3-8. Percentages of test items measuring use of the rational power of analyzing.

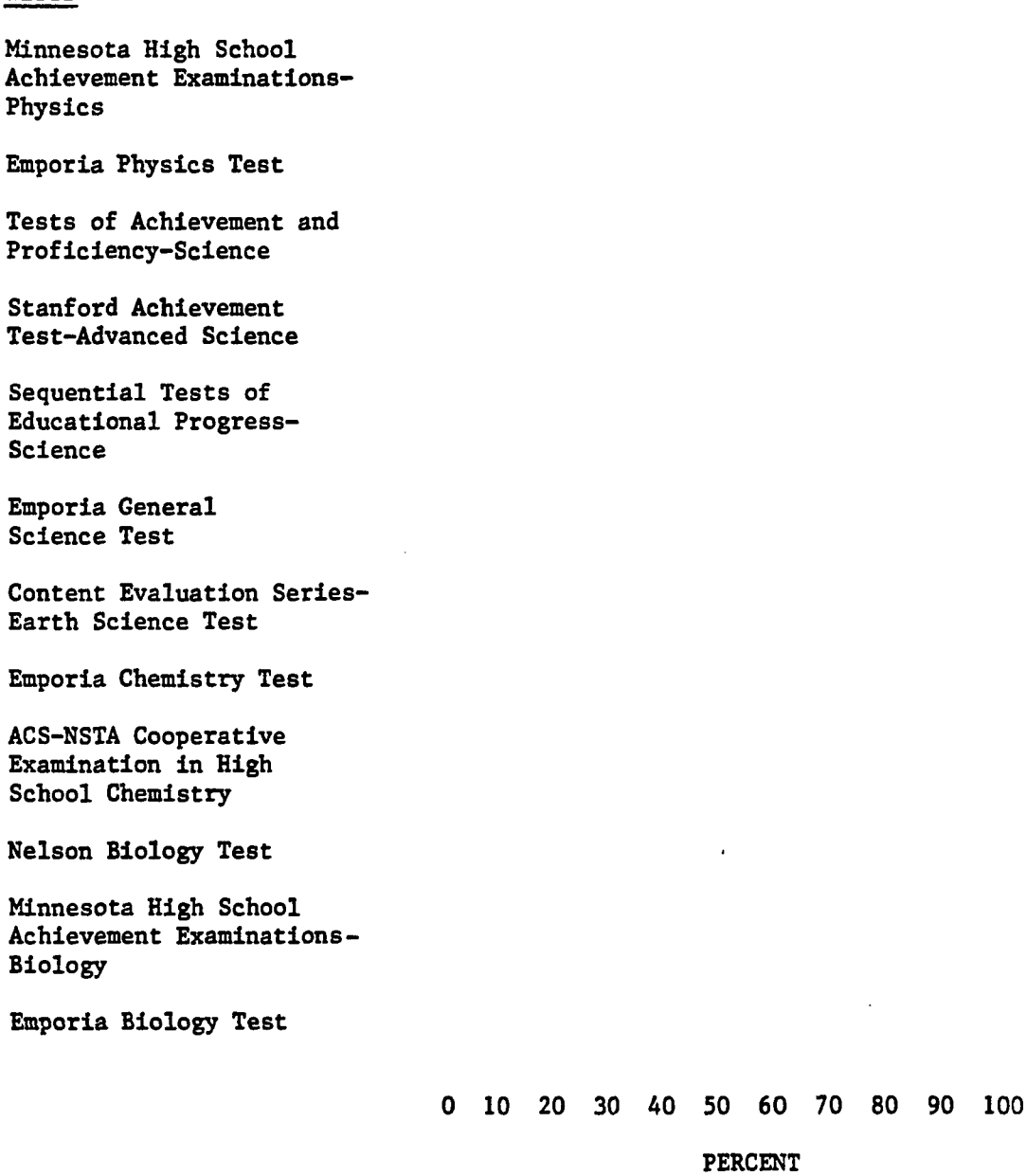


Figure 3-9. Percentages of test items measuring use of the rational power of evaluating.

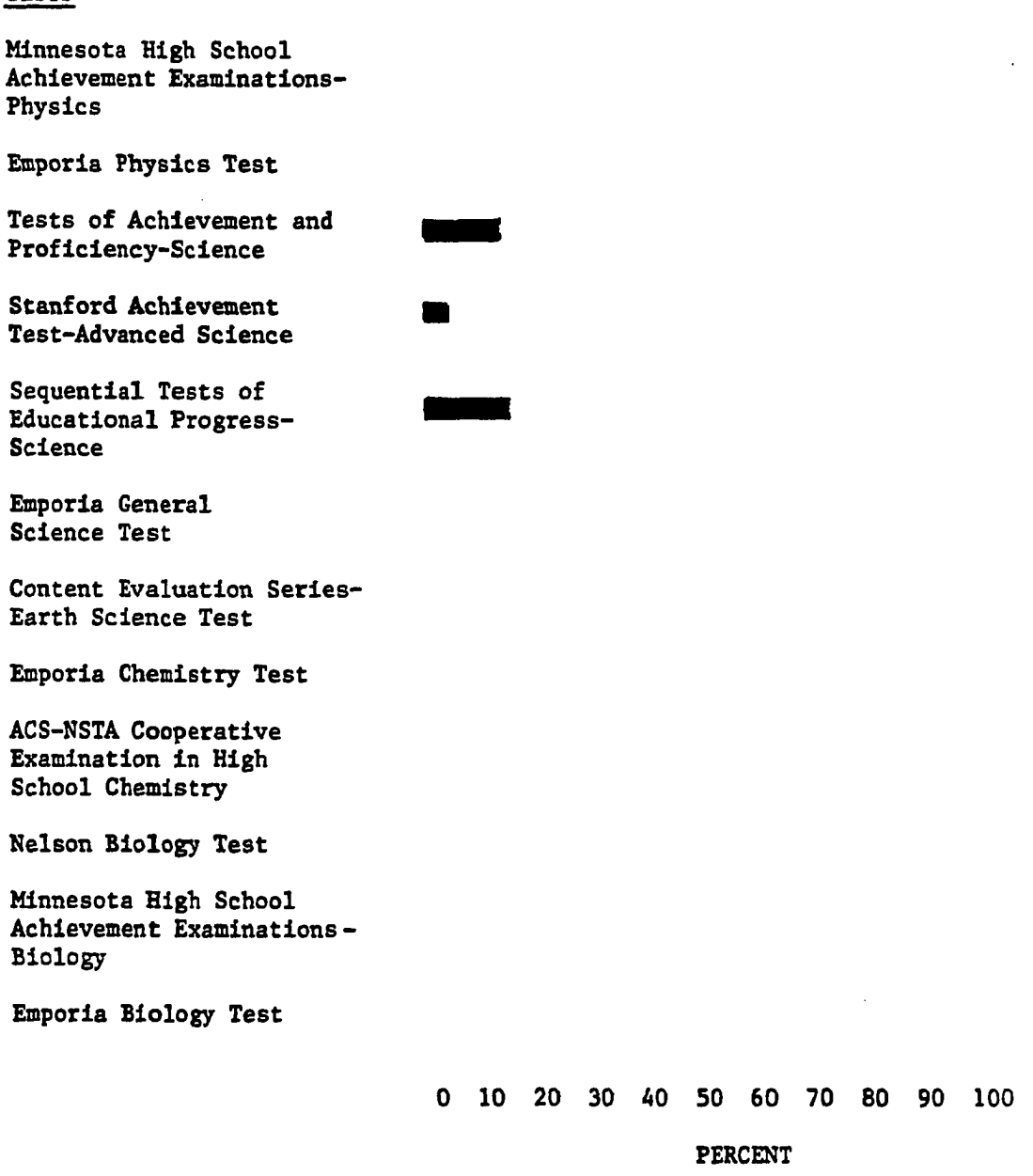


Figure 3-10. Percentages of test items measuring use of the rational power of synthesizing.

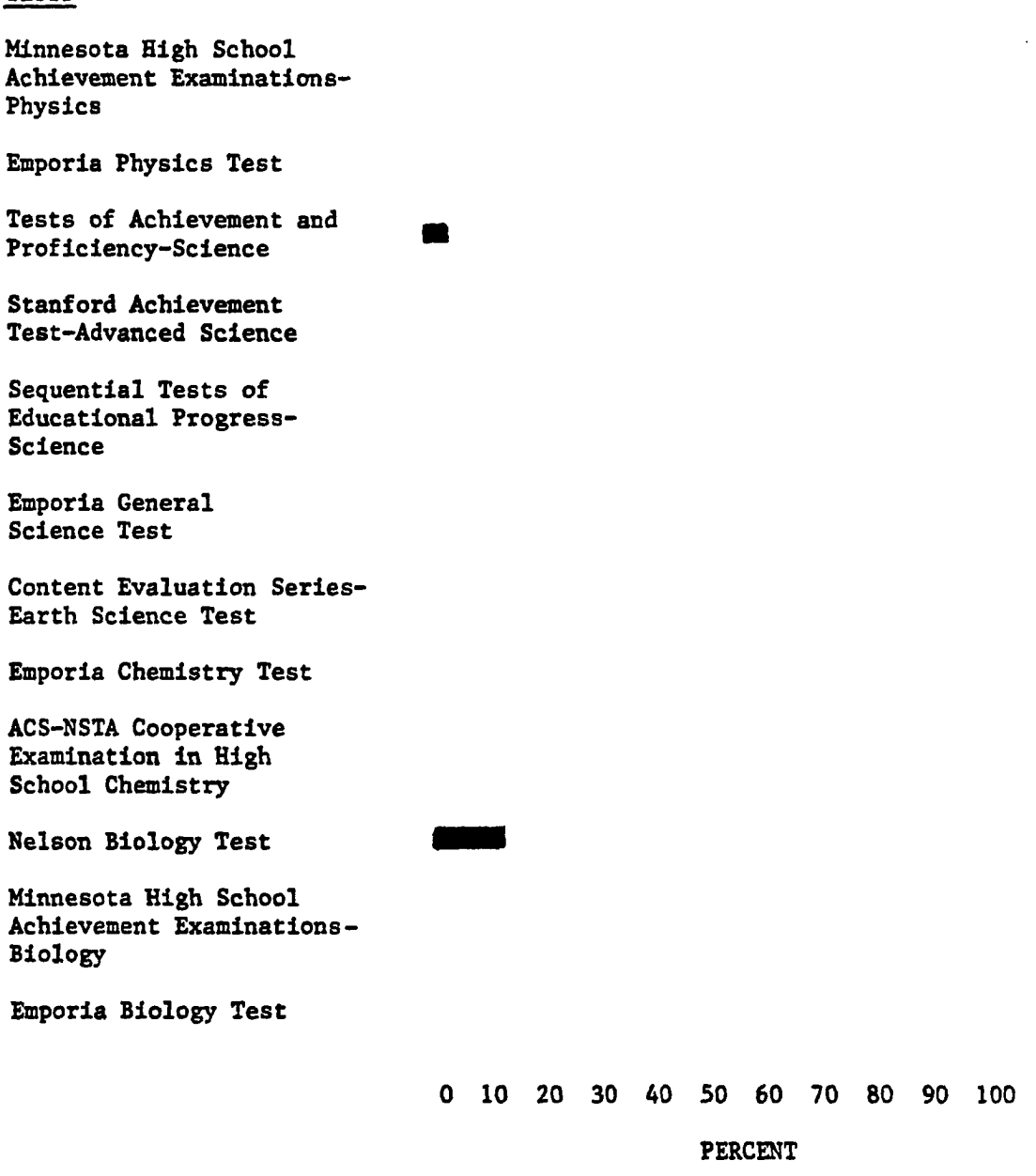


Figure 3-11. Percentages of test items judged 'Other'.

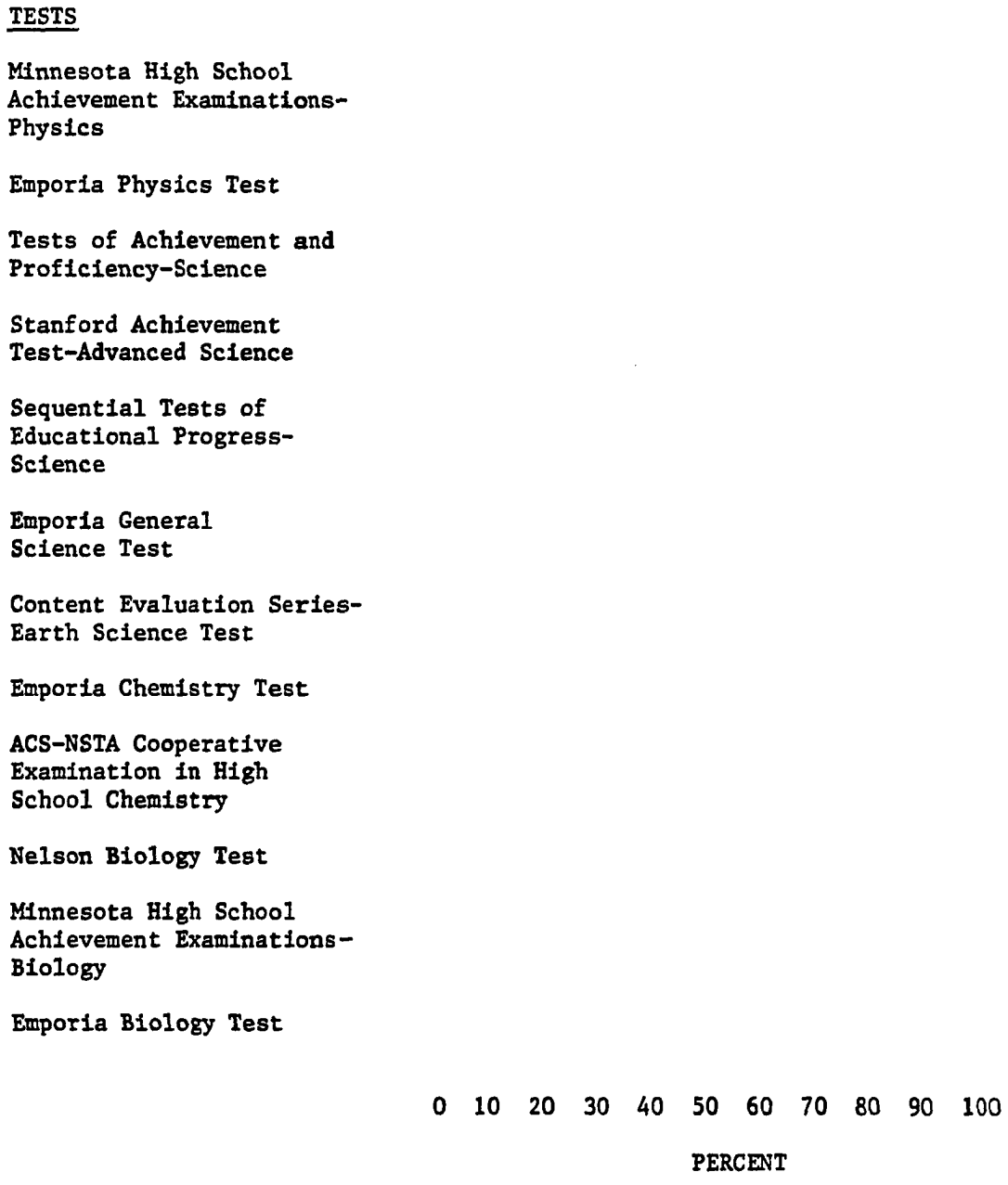
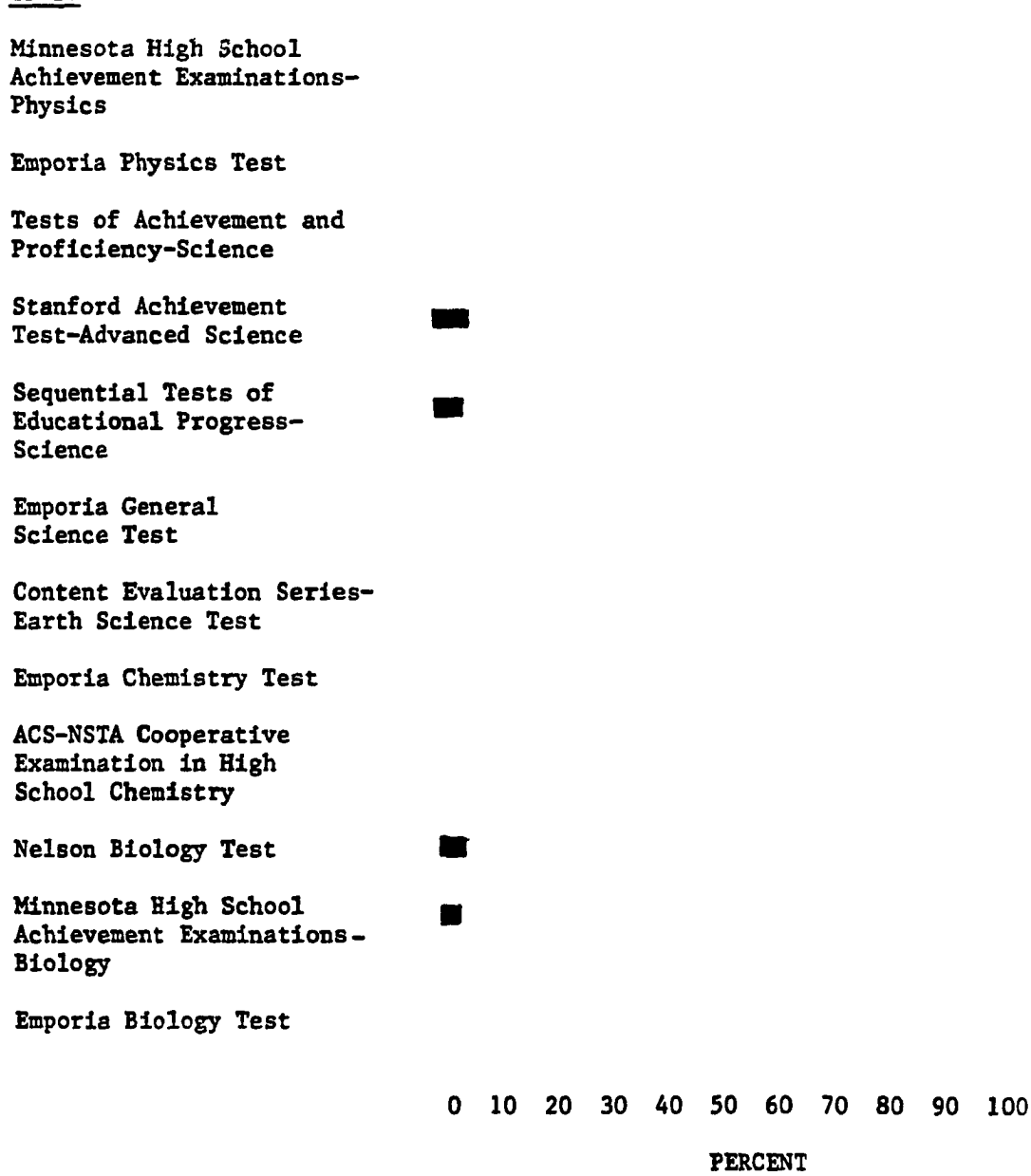


Figure 3-12. Percentages of test items judged 'Invalid'.



CHAPTER IV

CONCLUSIONS, IMPLICATIONS, AND RECOMMENDATIONS OF THE RESEARCH

This investigation was carried out to find answers to the following questions:

1. Are the presently available standardized tests for secondary school science measuring student achievement of the rational powers?
2. What percentages of test items found in secondary school science tests measure student achievement of each of the rational powers?

Conclusions and Implications

Data derived from the research indicated that use of the rational power of recalling was measured more than adequately, while minimal measurement was provided for the rational powers of classifying, generalizing, inferring, deducing, evaluating, and synthesizing. In contrast to the large amount of data provided for recalling, the tests provided

little or no data for the rational powers of imagining, comparing, and analyzing. Ninety percent of the items measured use of the rational power of recalling, while less than ten percent were distributed unevenly among six others. The data presented here represent an analysis of 648 test items randomly selected from twelve standardized secondary school science tests in biology, chemistry, earth science, general science and physics. The conclusion can be drawn from those data that standardized tests do not provide an adequate measurement of student achievement of the rational powers.

One inference that might be drawn from those data is that test constructors believe that they are testing what science teachers are teaching, that is, factual knowledge. If that inference is true, then the schools are misdirecting their time, energy, and money in their science programs when providing laboratories. If memorization is all that is needed, providing a hands-on, inquiry experience in an activity-centered classroom with materials of the life, earth, and physical sciences is superfluous. When memorization is the objective, what is needed are books or other media that provide listening and/or reading experiences. The teacher may be expendable also, if all a student is asked to do is memorize and then later repeat what has been memorized.

Thinking is a complex process, composed of at least the ten rational powers. Recall is an important component of that process, but it is only a portion of the whole. For any

one of the rational powers to be considered as representative of any other or of all of these different thinking abilities is a lack of understanding of the nature of the similarities and differences that exist among the ten rational powers. Perhaps this is the essence of the problem.

Recommendations of the Research

The present study was confined to a sample of twelve of the available standardized secondary school science tests. Further research needs to be conducted which analyzes test items from standardized science tests, with a percentage of test items selected from all available science tests. Furthermore, areas of the curriculum other than science need to be evaluated for measurement of the rational powers of the ability to think, the central purpose of American education. Perhaps this would lead to a better degree of achievement of that purpose.

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BIBLIOGRAPHY

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APPENDIX A

APPENDIX A

A SET OF OBJECTIVES AND THEIR EVALUATIVE STATEMENTS

Objectives and Evaluative Statements are as follows:

1. To develop the rational powers, that is, to develop skill with the principal components of that process called thinking:

   a. RECALLING:

      Evaluative Statement: Test item requires only bringing back to mind (remembering) information from experiences prior to, but not provided by, the test item.

   b. IMAGINING:

      Evaluative Statement: Test item requires that the student use the information provided and design a mental model that is not restricted by or limited to reality or actuality.

   c. CLASSIFYING:

      Evaluative Statement: Test item requires grouping information provided into categories sharing common characteristics.

d. GENERALIZING:

Evaluative Statement: Test item requires the combination of items of information provided, in order to express broad relationships among those items.

e. COMPARING:

Evaluative Statement: Test item requires examination of information provided, to enumerate the similarities and differences of specific features of that information.

f. INFERRING:

Evaluative Statement: Test item requires developing logical relationships which have an applicability broader than the information provided by the test item, and these relationships are based upon either the information, or upon an assumption about that information.

g. DEDUCING:

Evaluative Statement: Test item requires the application of a general principle, provided by the test item, to a specific situation.

h. ANALYZING:

Evaluative Statement: Test item requires the division of information provided into categories and an examination of those categories.

i. EVALUATING:

Evaluative Statement: Test item requires that the student form a judgment of the value (merit or worth) of information provided in the item with respect to certain criteria provided in the test item.

j. SYNTHESIZING:

Evaluative Statement: Test item requires the combination of information provided, in such a way as to express a relationship which is harmonious with all of the participating elements.

2. To develop the ability to withhold judgment rather than primarily answering a question.

Evaluative Statement: Test item requires information be regarded as conditional until subjected to experimental validation.

3. To develop skill in the use of a system of measurement.

Evaluative Statement: Test item requires the ability to apply a system of comparison that is provided.

4. To develop the ability to make predictions from information.

Evaluative Statement: Test item requires, after a consideration of prior experiences, a

declaration of future events which is based upon the information provided.

5. To develop the ability to make accurate observations.

   Evaluative Statement: Test item requires precise application of one's senses to the information provided in order to gain information about an object or event.

APPENDIX B

APPENDIX B

MANUAL FOR TRAINING OF TEST ITEM EVALUATORS AND ANALYZING TEST ITEMS

AN ANALYSIS OF STANDARDIZED TESTS FOR SECONDARY SCIENCE

MANUAL

for

Training of Test Item Evaluators

and

Analyzing Test Items

Carol Morgenstern - Project Director

CONTENTS

Part

I. TRAINING PROGRAM FOR TEST ITEM EVALUATORS

Foreword

Introduction

Validation of an Objective of Science Education

Development and Validation of Evaluative Statements

Maintenance of Confidentiality of Tests

Criteria for Selection of Tests

Instruction of Evaluators

Recording of Data after Analyzing Test Items--
Table 1 "Decision of Evaluators"

Recording of Data after Analyzing Test Items--
Table 2 "Analysis of Items of an Individual Test
by a Single Evaluator, then by Group Evaluation"

Examples of the Use of Evaluative Statements

Materials Needed for Analyzing Practice Test Items

Practice Test-Items

II. ANALYSIS OF TEST ITEMS

Directions for Analyzing Test Items

Materials Needed for Analyzing Test Items

PART I. TRAINING PROGRAM FOR TEST ITEM EVALUATORS

Foreword

The project, "An Analysis of Standardized Tests for Secondary Science," has been developed with the guidance of John W. Renner, Ph.D., Professor of Science Education, the University of Oklahoma, and Donald G. Stafford, Ph.D., Professor of Science Education, the University of Oklahoma. This manual contains the need for this study and the rationale which has guided its development. Also found in the manual is an objective for science education and statements used to evaluate how test items measure student achievement of that objective. This manual, the objective, and the evaluative statements have been validated by a panel of science educators, each of whom is a Past-President of the National Association for Research in Science Teaching (NARST). Directions for using the evaluative statements and for scoring the test items are also included.

Introduction

One aspect of science education observed by this investigator has been that science teachers prepare plans designed to lead learners to achieve objectives. There exists, however, no universally agreed-upon set of objectives of science education. The probability is very good, then, that teachers

may be leading and guiding students toward the achievement of differing objectives. Possibly, therefore, a standardized science test may not provide an adequate measurement of student achievement for students in the classes of different teachers.

Since no universally agreed-upon set of objectives of science education exists, student achievement of objectives doesn't mean the same thing to all people using a particular standardized science test. A standardized science test, then, might not provide adequate comparisons of student achievement, when the base upon which a test rests--its objectives--is undefined or vague. An inadequacy of comparison might also occur when the objectives of the test constructor are markedly different from those objectives held by teachers who use such a test. A science teacher who relies upon a certain test is making the assumption that this test provides an accurate measurement of the course being taught. Such an assumption may be untrue.

This investigator believes that the central purpose of American education is the development of the ability to think. By 'central,' this investigator means that this purpose is basic to all other objectives that may be held. This investigator also believes that the central purpose of science education, which is itself a part of the fabric that we call "education," is the development of the ability to think.

This investigator believes that if a group of science

educators could reach agreement upon an objective for science education, it would be intellectually exciting to ask if the presently existing standardized secondary-school science tests could measure student achievement of that objective.

Validation of an Objective of Science Education

After conducting a review of current literature in science education and communication of this investigator with the projects' advisors, several objectives of science education were selected. The investigator then asked the last six people who had been elected to the office of President of the National Association for Research in Science Teaching (NARST) if they would assist in the preparation of an instrument to be used to analyze standardized tests in the area of science. Five Past-Presidents of the NARST have served as a panel of experts throughout this study. Each of the members of this panel was asked to judge the defensibility of these objectives of science education. Judgments of these educators about these objectives were obtained through the use of a six-point scale. Each member has judged each of these objectives of science education to be a valid objective of science education. One of these validated objectives has been selected for this project. It is:

To develop the rational powers,[1] that is, to develop skill with the principal components of that process called thinking:

a. recalling	f. inferring
b. imagining	g. deducing
c. classifying	h. analyzing
d. generalizing	i. evaluating
e. comparing	j. synthesizing

These ten components constitute the essence of the ability to think, and for this study they will be referred to as sub-objectives.

Development and Validation of Evaluative Statements

Procedures were developed to evaluate test items in order to determine whether individual test items measured student achievement of that objective and of a particular sub-objective of science education. To accomplish this, evaluative statements were written--one statement corresponding to each sub-objective--to determine whether that test item measured student achievement of that particular sub-objective.

The advisory panel was asked to judge whether the evaluative statements measured student achievement of the

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[1]Educational Policies Commission, The Central Purpose of American Education (Washington, D.C.: National Education Association, 1961), p. 5.

sub-objectives for which they had been written. Each member of the panel has judged each of the evaluative statements to be valid. This decision was the result of a combination of judgments of 'agree' and 'strongly agree.' The six-point scale used by members of the panel to indicate judgments included the choice of decisions: uncertain, strongly disagree, disagree, neutral, agree, and strongly agree.

The validated objective has ten sub-objectives (the rational powers). Because it is conceivable that students might achieve each part independently of the other parts, each part--sub-objective--will be evaluated separately. Following each sub-objective is an evaluative statement that will allow us to determine if a test item measures achievement of that particular rational power. Each evaluative statement will be used by a group of four evaluators to judge if a test item measures student achievement of that sub-objective. Each of the evaluators will:

1. be certified as a teacher of science by the Department of education, of a state of the United States, in one or more areas of science,

2. have been a teacher of one or more of the disciplines of science for at least one year,

3. have taught in one or more areas of science in the secondary school.

The Objective, Sub-Objectives and Evaluative Statements

The objective, sub-objectives, and evaluative statements are as follows:

To develop the rational powers, that is, to develop skill with the principal components of that process called thinking:

a. RECALLING:

Evaluative Statement: Test item requires only bringing back to mind (remembering) information from experiences prior to, but not provided by, the test item.

b. IMAGINING:

Evaluative Statement: Test item requires that the student use the information provided and design a mental model that is not restricted by or limited to reality or actuality.

c. CLASSIFYING:

Evaluative Statement: Test item requires grouping information provided into categories sharing common characteristics.

d. GENERALIZING:

Evaluative Statement: Test item requires the combination of items of information provided, in order to express broad relationships among those items.

e. COMPARING:

Evaluative Statement: Test item requires examination of information provided, to enumerate the similarities and differences of specific features of that information.

f. INFERRING:

Evaluative Statement: Test item requires developing logical relationships which have an applicability broader than the information provided by the test item, and these relationships are based upon either the information, or upon an assumption about that information.

g. DEDUCING:

Evaluative Statement: Test item requires the application of a general principle, provided by the test item, to a specific situation.

h. ANALYZING:

Evaluative Statement: Test item requires the division of information provided into categories and an examination of those categories.

i. EVALUATING:

Evaluative Statement: Test item requires that the student form a judgment of the value (merit or worth) of information provided in the item with respect to certain criteria provided in the test item.

j. SYNTHESIZING:

Evaluative Statement: Test item requires the combination of information provided, in such a way to express a relationship which is harmonious with all of the participating elements.

After the evaluators have indicated that they understand the objective, its sub-objectives, and evaluative statements, the project director will lead them in practicing an analysis of practice test-items. The second section of Table 2 will be used to record individual and group decisions for each of the practice test-items.

Maintenance of Confidentiality of Tests

The sale of many of the tests is restricted in accordance with the principles of the American Psychological Association. When this is true, qualification for the use of test instruments also is restricted by this Association. Use of such tests will be in accordance with the rules of that organization.

The contents of standardized tests used in this study will be carefully guarded by all individuals involved in this study. Tests shall be properly handled and stored by the project director. No tests shall be used except when being analyzed at those times and places allocated for this analysis.

Criteria for Selection of Tests

The population of tests is composed of those listed in Standardized Tests: A Descriptive Listing, by J. Wall and L. Summerlin and published by the National Science Teachers Association, Washington, D.C., 1973. Updated editions of these tests which were available at the time of selection of the sample have been included in the test' population.

The sample of tests has been selected as a random sample in each class of tests. The objective tests of twelve standardized tests for secondary science will be analyzed. The sample's size will represent twenty percent of the test forms. Distribution among the classes of tests will be as follows:

Secondary Biology Tests--three tests

Secondary Chemistry Tests--two tests

Secondary Earth Science Tests--one test

Secondary General Science Tests--four tests

Secondary Physics Tests--two tests

Instruction of Evaluators

1. General Instructions

Each of the four evaluators will be given a copy of the Manual at the first meeting of the group. Each of the sections listed below will be read and discussed individually.

Foreword

Introduction

Validation of an Objective of Science Education

Development and Validation of Evaluative Statements

Maintenance of Confidentiality of Tests

Criteria for Selection of Tests

Instruction of Evaluators

After reading and discussing each section, questions that arise will be answered. That procedure will familiarize each evaluator with the project and his/her role in it. Familiarization is especially necessary for the objective, its evaluative statements, and application of evaluative statements to test items.

The evaluators will then familiarize themselves with the table to be used to record individual and group decisions for each of the test items (see Table 2). Following this, the evaluators will study the examples of the use of evaluative statements. Each of the examples will be discussed by the project director.

2. Instructions for Evaluating Four Practice Test Items

In guiding the evaluators through practice test item evaluation, the following instructions will be given by the project director:

> Using the Evaluative Statements, each of you will work independently to analyze the first four items

> of the practice group of test items. Please read the entire test item. Ask yourself; "On what sub-objective is the student being evaluated? After you have made your decision, please record it by the letter of the sub-objective (a-j; or 'Other') in the column of Section II, Table 2, labelled "Individual Evaluation." If, for example, you are working with practice test item number 1, locate that number in the column marked 'Individual Evaluation: Number of Test Item.' Then record your decision in the space provided beside it in the column marked, Sub-Objective Measured (a-j; 'Other').' We shall stop after you have completed the first four practice test items and obtain your group decision. When each of you has completed this work individually, the group as a whole will share those individual decisions. During the group discussions, I will serve as the discussion leader. That will enable each of you to express your opinions and decisions, so that a group decision will be arrived at for each test item. I shall also act as the recorder of your decisions. I shall not take part in your discussions.

When the evaluators have indicated that they are ready to share individual decisions, they will be asked to give individual decisions for a specific test item. Those decisions will be announced orally and recorded at that time on an overhead transparency, Table 1, as shown on the following page. Use of a sub-objective (a-j; 'Other') that each test item measures will be recorded on that table.

TABLE 1

DECISION OF EVALUATORS

Decision of Evaluators--(Sub-Objective Measured a-j; 'Other')				
Name of Test:				
Evaluator	1	2	3	4
Test Item Number				
1				
2				
↓				

When agreement regarding a specific test item is reached among at least three of you, that particular item will be considered to be a valid measure of a sub-objective. Such a group decision will be recorded appropriately in Table 2.

When a difference of judgment among you exists for a specific test item, the entire group of evaluators will discuss such an item. Following this discussion, I will call for individual decisions, which again I shall record on an overhead transparency, Table 1.

When agreement regarding a test item can not be reached by at least three of you, that item will be judged to be and recorded as an invalid measure of a sub-objective. This decision of the group of evaluators about such an item will be appropriately recorded in Table 2 in that section entitled 'Remarks'.

It is conceivable that a test item could measure achievement of more than one sub-objective. Should that be true, those data will be recorded in Table 2, Secion II.

3. Instructions for Remaining Practice Test-Items

The project director will say,

Use the same procedure for analyzing these test items as you did for the initial four. When you have finished all of the remaining test items, please tell me. We shall then discuss them one at a time and record these data using the same method as before.

4. Instructions for Analyzing Test Items of Standardized Science Tests

The project director will say,

These tests will be analyzed one at a time. We will discuss the items of a particular test when all of you have completed it and indicated so. Decisions will be arrived at and data recorded in the same way as was done with the practice test items.

TABLE 2

ANALYSIS OF ITEMS OF AN INDIVIDUAL TEST BY A SINGLE EVALUATOR, THEN BY GROUP EVALUATION

Section I

Name of Test:

Author of Test:

Number and Form of Test:

Name of Evaluator:

Date of Evaluation: Beginning Time:

Place of Evaluation: Ending Time:

Remarks:

TABLE 2 - Continued

Section II

Individual Evaluation		Group Evaluation	
Number of Test Item	Sub-Objective Measured (a-j; 'Other')	Number of Test Item	Sub-Objective Measured (a-j; 'Other')
1		1	
2		2	
3		3	
4		4	
5		5	
6		6	
7		7	
8		8	
9		9	
10		10	
11		11	
12		12	
13		13	
14		14	
15		15	
16		16	
17		17	
18		18	
19		19	

TABLE 2 - Continued

Individual Evaluation		Group Evaluation	
Number of Test Item	Sub-Objective Measured (a-j; 'Other')	Number of Test Item	Sub-Objective Measured (a-j; 'Other')
20		20	
21		21	
22		22	
23		23	
24		24	
25		25	
26		26	
27		27	
28		28	
29		29	
30		30	
31		31	
32		32	
33		33	
34		34	
35		35	
36		36	
37		37	
38		38	
39		39	
40		40	

Examples of the Use of Evaluative Statements

Objective and Sub-Objectives

Objective

To develop the rational powers, that is, to develop skill with the principal components of that process called thinking.

Sub-Objective

a. RECALLING:

Evaluative Statement: Test item requires only bringing back to mind (remembering) information prior to, but not provided by, the test item.

Test Item

Considering food only, and in equal masses, most calories are found in:

A. vitamins
B. carbohydrates
C. proteins
D. minerals

Rationale: This test item measures use of the sub-objective of recalling, as the student only needs to bring with him/her knowledge about calories, especially how they are distributed in vitamins, proteins, minerals, and carbohydrates.

b. IMAGINING:

Evaluative Statement: Test item requires that the student use the information provided and design a mental model that is not restricted by or limited to reality or actuality.

Test Item

While exploring the solar system in a space ship and upon passing the outermost known planet, Pluto, you observe a solid-mass object the size of Earth. You decide to:

A. ignore your observations, as there are nine planets acknowledged for our solar system.

B. believe that you and your companions have lost your ability to observe, so disregard your observations

C. accept your observations and state that there may be at least one more planet in our solar system

D. believe that the instruments aboard your ship are faulty, so disregard your observations

Rationale: This test item measures use of the sub-objective of imagining, as the student is asked to change his/her mental picture of our solar system by the addition of another planet.

c. CLASSIFYING:

Evaluative Statement: Test item requires grouping information provided into categories sharing common characteristics.

Test Item

Which of the following statements about a rock is not an observation?

A. The rock is light in color.

B. The rock formed within the earth.

C. The rock has a sour taste.

D. The rock feels rough to touch.

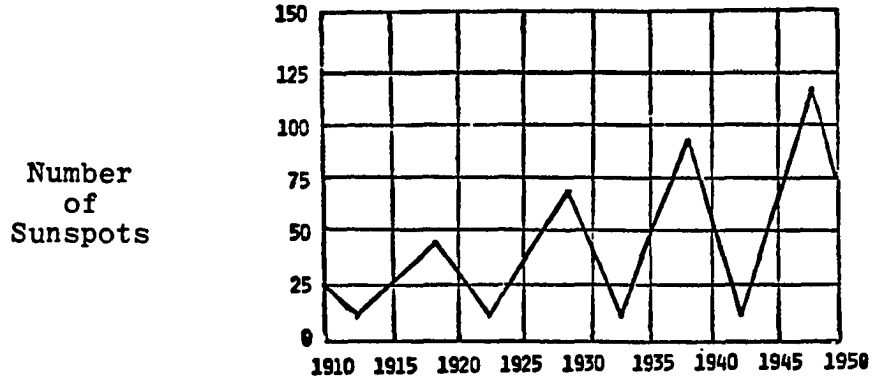
Rationale: This test item measures use of the sub-objective of classifying, as the student needs to group the data as being able to be perceived by the senses, that is, seen, felt, tasted, smelled, and heard.

d. GENERALIZING:

Evaluative Statement: Test item requires the combination of items of information provided, in order to express broad relationships among those items.

Test Items

The diagram below shows sunspot activity, that is, the number of storms occuring on the surface of the sun, between 1910 and 1950. Sunspot cycles are lengths of time during which storms form, reach a peak by increasing in number, then decline in number.



In general, how could sunspot cycles between 1910 and 1950 be described?

A. repeating and growing in number

B. repeating and decreasing in number

C. repeating and nearly constant in number

D. showing no general trend

Rationale: This test item measures use of the sub-objective of generalizing, as the student must examine the data of the number of sunspots and as they have occurred in specific years, then determine a relationship of these two elements one to another, broadly.

e. COMPARING:

Evaluative Statement: Test item requires examination of information provided, to enumerate the similarities and differences of specific features of that information.

Test Item

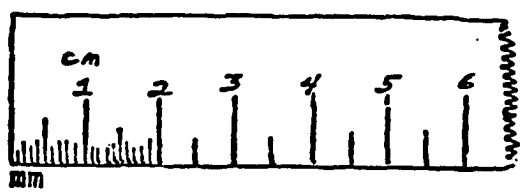
The section of the meter stick pictured below is 6 cm. (centimeters) long. How wide, in centimeters, is the picture of the maple leaf shown on the following page?

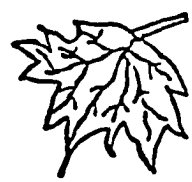
A. 0.1 cm.

B. 1.0 cm.

C. 2.5 cm.

D. 5.0 cm.





Rationale: This test item measures use of the sub-objective of comparing, as the student is required to examine the pictures with respect to the differences in length, as indicated in the metric system.

f. INFERRING:

Evaluative Statement: Test item requires developing logical relationships which have an application broader than the information provided by the test item, and these relationships are based upon either the information provided, or upon an assumption about that information.

Test Item

While walking, you notice a lighted object moving quickly across the night sky. What do you think has happened?

A. A planet has come into view.

B. An airplane has come into view.

C. A star has come into view.

D. The moon has come into view.

Rationale: This test item measures use of the sub-objective of inferring, as the student is required to form a relationship of the objects in the night sky and something which comes into that view quickly, forming an immediate judgment by the viewer.

g. DEDUCING:

Evaluative Statement: Test item requires the application of a general principle, provided by the test item, to a specific situation.

Test Item

An animal parasite is defined as an organism which gains nutrients and protection from an animal called the host. An animal parasite called a tapeworm gets its nourishment from:

A. flowers

B. dogs

C. trees

D. rocks

Rationale: This test item measures use of the sub-objective of deducing, as the principle of animal parasitism is provided, and the student is asked to apply this principle to a host, in this case 'dogs'.

h. ANALYZING:

Evaluative Statement: Test item requires the division of information provided into categories and an examination of those categories.

Test Item

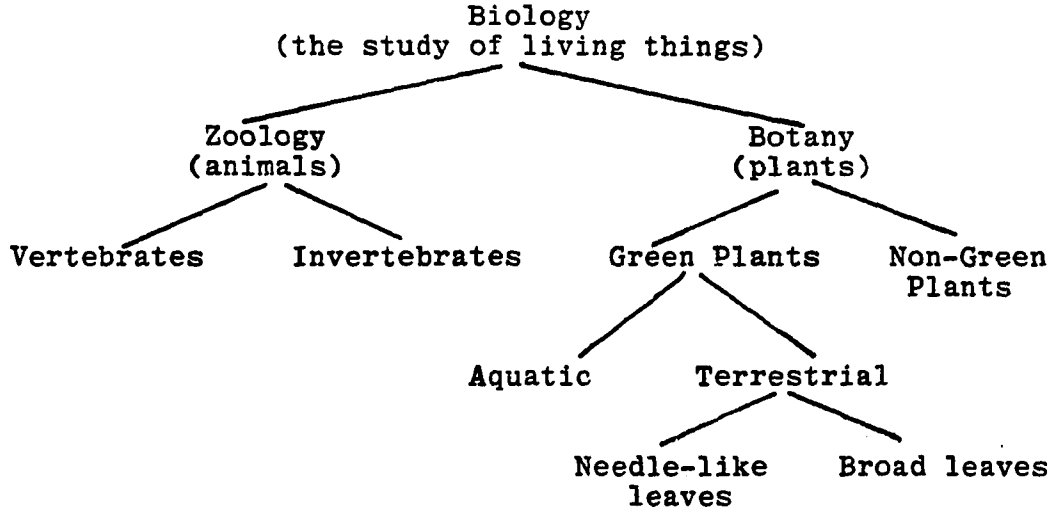
What item in the chart shown below is not part of the topic of Botany?

A. green plants

B. vertebrates

C. broad leaves

D. terrestrial



Rationale: This test item measures use of the sub-objective of analyzing, as the student is asked to separate the components of the two divisions of Biology, and examine them closely.

i. EVALUATING:

Evaluative Statement: Test item requires that the student form a judgment of the value (merit or worth) of information provided in the item with respect to certain criteria provided in the test item.

Test Item

What would be the very best way to determine if a ball-point pen is usable?

A. weigh it on a balance

B. shake it very hard

C. try to write with it

D. read the warranty on it

Rationale: This test item measures use of the sub-objective of evaluating, as the student is asked to judge what would provide him/her with the best evidence to determine if a pen can be used to write with.

j. SYNTHESIZING:

Evaluative Statement: Test item requires the combination of information provided, in such a way as to express a relationship which is harmonious with all of the participating elements.

Test Item

The length of time between fertilization and birth is called gestation. Shown below is a chart comparing the time of gestation for several organisms. List these organisms in decreasing order of these durations of time. Start with that organism that requires the longest amount of time and end with that organism which requires the shortest amount of time.

A. rat, rabbit, sheep, elephant

B. elephant, sheep, rabbit, rat

C. sheep, rabbit, elephant, rat

D. rabbit, rat, sheep, elephant

Gestation' Time

Animal	Number of Days
rat	21½ to 22
rabbit	30 to 32
sheep	147
elephant	600

Rationale: This test item measures use of the sub-objective of synthesizing, as the student must examine the information of the gestation periods for each of the four animals cited, then combine these data into an order of time and development beginning with the longest and ending with the shortest amount of time.

Materials Needed for Analyzing Practice Test-Items

Before starting the analysis of practice test-items, the project director shall make certain that all of the necessary materials have been assembled. These shall include:

1. a room sufficiently large enough for five people to work comfortably. Each person shall have independent work space, as a table and chair.
2. one overhead projector, a sufficient number of blank copies of overhead transparencies of Table 1, and marker pens, for recording of individual and group decisions.
3. the same number of copies of the Manual as there are evaluators, plus two extra copies.
4. the same number of copies of a group of practice test-items as there are evaluators, plus two extra copies.
5. the necessary pencils, pens, and erasers, as needed.
6. a sufficient number of blank copies of Table 2 for recording of data.

Practice Test-Items

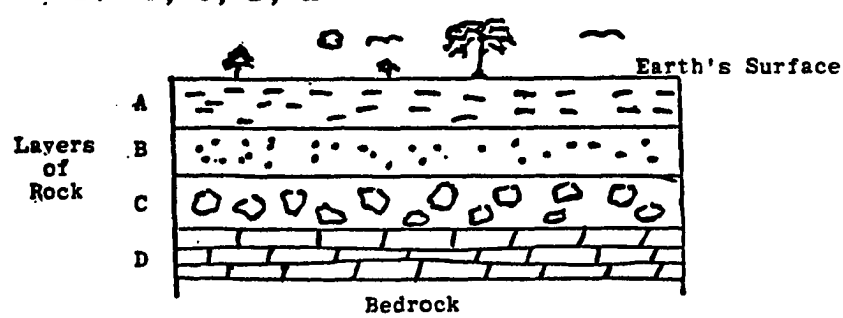
1-40

1. Which of the following activities is not associated with the sense of hearing?

   A. becoming aware of a bird's call
   B. becoming aware of mist or dew on your lawn
   C. becoming aware of thunder in the sky
   D. becoming aware of a tree being cut down

2. Sedimentary rock forms as layers. The layer at the bottom is the first material deposited and is therefore older than the layer directly above it. Each layer is younger than that layer directly beneath it. The diagram below shows a cross-section of the earth. What is the order of the layers of rock starting with the youngest layer then proceeding to the oldest?

   A. B, C, D, A
   B. C, B, A, D
   C. A, B, C, D
   D. D, C, B, A



CROSS-SECTION OF A HILLSIDE

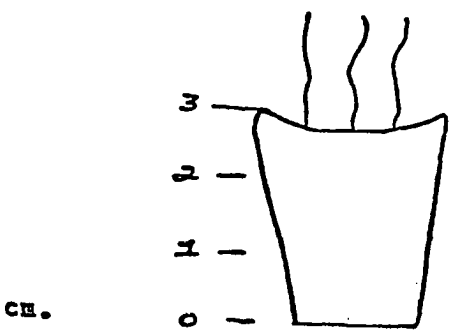
3. Study the picture below. How many centimeters tall are the blades of grass above the soil? The flower pot is 3 cm. tall.

   A. 0.5 cm.

   B. 1.5 cm.

   C. 3.0 cm.

   D. 5.0 cm.



4. The phenomenon of Boyle's Law is illustrated by the following example:

   A. floating wood

   B. bicycle pump

   C. flying airplane

   D. mercury barometer

5. When you see a pair of deer' antlers mounted on a hunter-friend's living room wall, what do you think has happened?

   A. While hunting, he shot a deer.

   B. While hunting, he was given a deer.

   C. He carved the antlers of a deer.

   D. He bought the antlers of a deer.

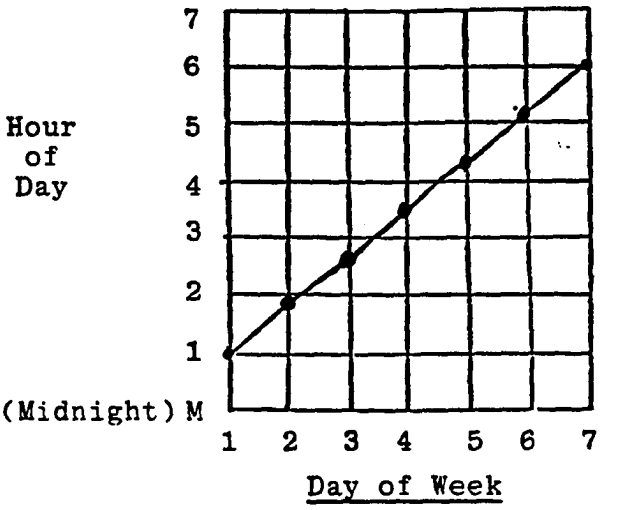
6. The graph below shows the time of rising of the moon during a week. In general, how could the behavior of the moon be described?

   A. It rises at about the same time each day.

   B. Its rising has no trend or pattern.

   C. It rises about an hour earlier each day.

   D. It rises about an hour later each day.



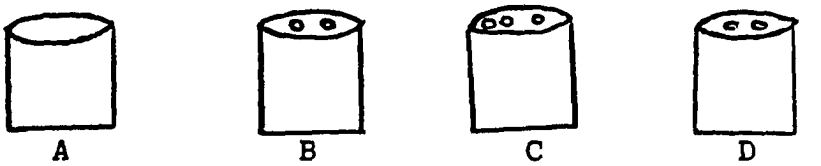
7. Which of the four rubber stoppers shown below would be most useless for holding two pieces of rubber tubing?

   A. A

   B. B

   C. C

   D. D



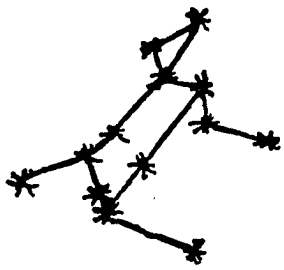
8. There is a group of stars called the constellation 'Big Dog' (Canis Major). The name comes by making a picture similar to the picture labelled A. Suppose that these stars had been thought to make the picture labelled B. Which of these would have been a good name for this group of stars?

   A. two boxes

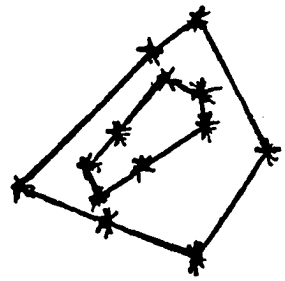
   B. bald eagles

   C. maple leaves

   D. birch trees



A



B

9. Plant parasites get their nourishment from a plant called the host. The plant parasite called mistletoe is commonly found in the American southwest. Where would it most likely be found?

   A. on a dog's skin

   B. on a rock

   C. on a person's toe

   D. on a tree

10. How is one of the four leaves pictured below very different from the others?

    A. There is no difference in the four leaves pictured.

    B. Leaf Number 2 is different from Numbers 1 and 3.

    C. The leaf Number 4 is needle-like.

    D. There is no similarity in the four leaves pictured.



11. Fresh water, essential for human life, is used daily by people in various ways. A comparison of amounts of water needed for several household activities is shown below. Rank the activities in the order of their increasing use of fresh water. Start with that activity which uses (requires) the least amount of water and end with that activity which requires the most amount of water.

    A. washing dishes in an automatic dishwasher, taking a shower, flushing a toilet, and washing clothes in an automatic clothes-washer

B. washing clothes in an automatic clothes-washer, washing dishes in an automatic dishwasher, taking a shower, and flushing a toilet

C. flushing a toilet, taking a shower, washing dishes in an automatic dishwasher, and washing clothes in an automatic clothes-washer

D. flushing a toilet, washing clothes in an automatic clothes-washer, taking a shower, and washing dishes in an automatic dishwasher

Purpose	Amount of Water Needed
Flushing a toilet	15 quarts
Taking a shower	27 quarts
Washing dishes in an automatic dishwasher	76 quarts
Washing clothes in an automatic clothes-washer	108 quarts

12. Which of the following activities would not be classified as one of the five senses?

A. tasting

B. thinking

C. touching

D. seeing

13. Tires on a bicycle become warm while the bicycle is being ridden. Which of the following events happens for the same reason that the bicycle tires get hot?

    A. A charcoal briquet placed in a fire becomes warm.

    B. The air above a hot radiator becomes warm.

    C. A wet person feels warm while drying with a towel.

    D. Bread placed into a toaster becomes hot.

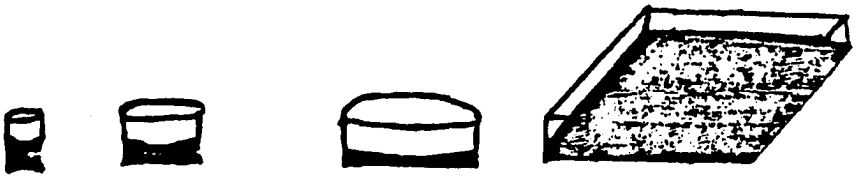
14. All of the glass containers shown below contain the same amount of water and are receiving the same amount of heat energy. In a given amount of time, from which container will the most water evaporate?

    A. A

    B. B

    C. C

    D. D



A B C D

15. Which of the senses listed below would be most useful in identifying a bird by its call?

    A. seeing

    B. hearing

    C. smelling

    D. touching

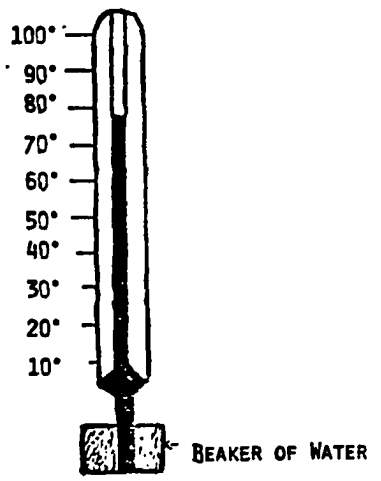
16. What is the temperature indicated by the Centigrade thermometer shown below?

    A. 78° C

    B. 28° C

    C. 60° C

    D. 100° C



17. You are exploring the solar system in a space ship. Upon passing the outermost known moon of Jupiter's twelve moons, you observe an object similar to these moons. You decide to:

    A. believe that the instruments aboard your ship are faulty, so disregard your observations

    B. ignore your observations, as there are twelve moons acknowledged for the planet Jupiter

    C. believe that you and your companion observers have lost your ability to observe so disregard your observation

    D. accept your observation and state that there may be at least one more moon in our solar system.

18. Which of the following activities is associated with the sense of touch?

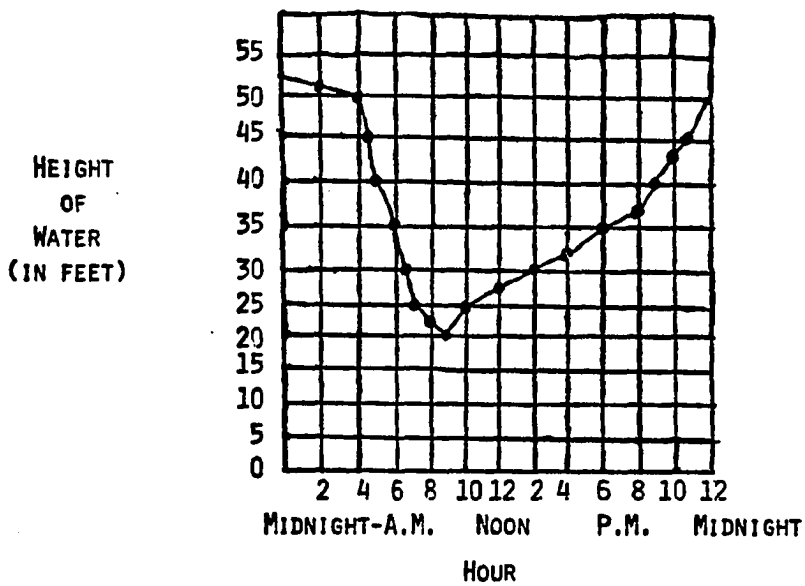
    A. noticing the puffy-looking clouds drift across the sky

    B. noticing that tea roses are fragrant, dainty, and colorful

    C. noticing that coffee feels hot to your lips and tongue

    D. noticing the laughter coming from the school play-yard

19. Refer to the graph on the following page which shows the height of water at a dam in a 24-hour period.



In general, which of the four statements listed below describes the height of the water in a 24-hour period?

A. After midnight there is no change in height from hour to hour during the entire day.

B. After midnight there is a rising of water which continues throughout the day.

C. After midnight there is a drop in height which continues steadily from hour to hour during the entire day.

D. After midnight there is a drop in height followed by a gradual rising which continues in the afternoon and evening.

Type of Climate	P/Ep
Humid	Greater than 1.2
Sub-humid	0.8 to 1.2
Semi-arid	0.4 to 0.8
Arid	Less than 0.4

Climate data for Specific Cities

Cities	P	Ep
A	300	500
B	610	650
C	900	618
D	3650	575

20. Shown above are two charts. Those charts describe types of climate plus they provide information about four cities. P = total annual percipitation, expressed in millimeters. Ep = total annual potential evapo-transpiration, expressed in millimeters. Using the chart and the data, which city has a semi-arid climate?

    A. A

    B. B

    C. C

    D. D

21. Using the climate classification chart and the data shown above, which two cities are classified as having the same type of climate?

    A. A and B

    B. A and C

    C. B and C

    D. C and D

22. A student finds an unidentified liquid to have no color, no odor, no taste, but it is 'bubbly'. She says that this liquid is 'carbonated water'. Her comment can be considered as:

    A. a conclusion

    B. a fact

    C. a description

    D. an observation

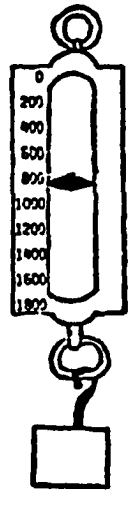
23. On the diagram shown below, how heavy in grams is the lead weight that has been attached to the spring balance?

    A. 400 grams

    B. 600 grams

    C. 850 grams

    D. 1400 grams



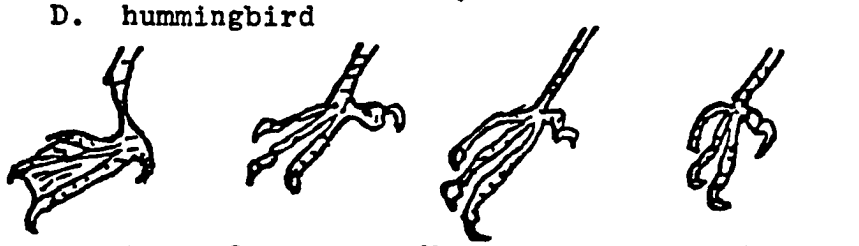
24. Which of the four types of feet of birds pictured below would be most useful for swimming?

    A. cormorant

    B. crow

    C. meadowlark

    D. hummingbird



Cormorant Crow Meadowlark Hummingbird

25. Upon entering your chemistry class on the first day of school, you notice a cabinet, marked "Chemicals," secured with a big lock on it. What do you think at this moment about that cabinet?

    A. This cabinet contains something that may be harmful.

    B. This cabinet contains only harmless chemicals.

    C. This cabinet is used for the sake of neatness.

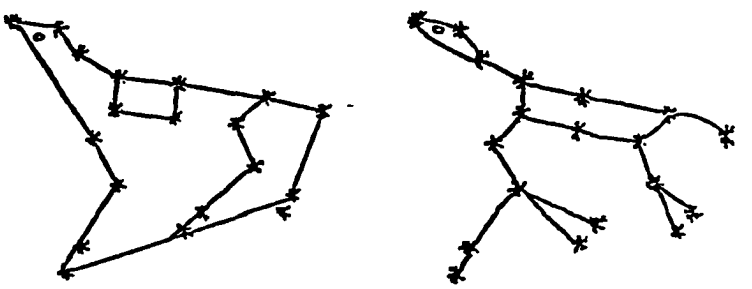
    D. This cabinet uses a lock which has no special meaning.

26. What portion of the volume of a floating iceberg is below the surface of the water?

    A. one tenth
    B. nine tenths
    C. three tenths
    D. five tenths

27. There is a group of stars called the constellation 'Great Bear' (Ursa Major). The name comes by making a picture similar to the picture labelled A. Suppose that these stars had been thought to make the picture labelled B. Which of these would have been a good name for this group of stars?

    A. galloping horse
    B. oak trees
    C. willow trees
    D. crawling spider



A B

28. Many salts are contained in ocean water. The table below indicates some of these salts and their approximate percentages in sea water. Rank the salts in the order of their increasing percentages in sea water. Start with that salt which is the least abundant in ocean water and end with that salt which is the most abundant.

    A. sodium chloride, magnesium chloride, magnesium sulfate, and calcium carbonate

    B. magnesium chloride, calcium carbonate, sodium chloride, and magnesium sulfate

    C. calcium carbonate, magnesium sulfate, magnesium chloride, and sodium chloride

    D. magnesium sulfate, calcium carbonate, sodium chloride, and magnesium chloride

Name of Salt	Percentage in Seawater (Ocean Water)
Sodium chloride	2.72
Magnesium chloride	0.38
Magnesium sulfate	0.17
Calcium carbonate	0.01

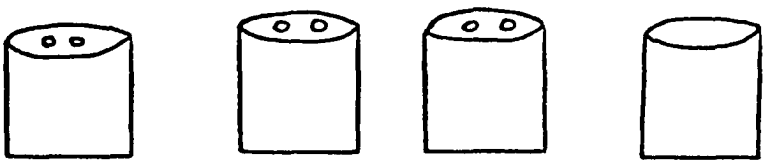
29. How is one of the four rubber stoppers pictured below very different from the others?

    A. Rubber Stopper Number 3 is different from Numbers 2 and 1.

    B. Rubber Stopper Number 4 has no holes.

    C. There is no similarity in the four rubber stoppers pictured.

    D. There is no difference in the four rubber stoppers pictured.



30. As you read this question, electromagnetic energy in the form of light is:

    A. scattered from the paper to your eyes

    B. convected from the paper to your eyes

    C. refracted from the paper to your eyes

    D. reflected from the paper to your eyes

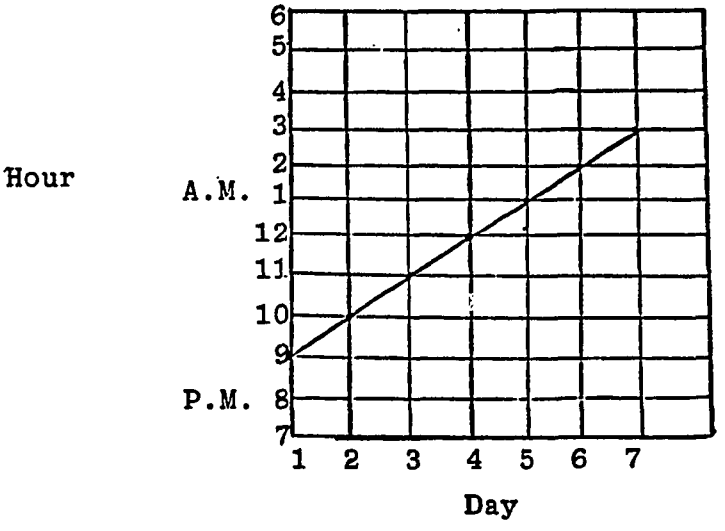
31. The graph below shows at what time a planet rises above the horizon during one week. In general, how could you describe the behavior of this planet?

    A. It rises at the same hour each day.

    B. It rises an hour earlier each day.

    C. It rises an hour hour later each day.

    D. Its rising has no trend or pattern.



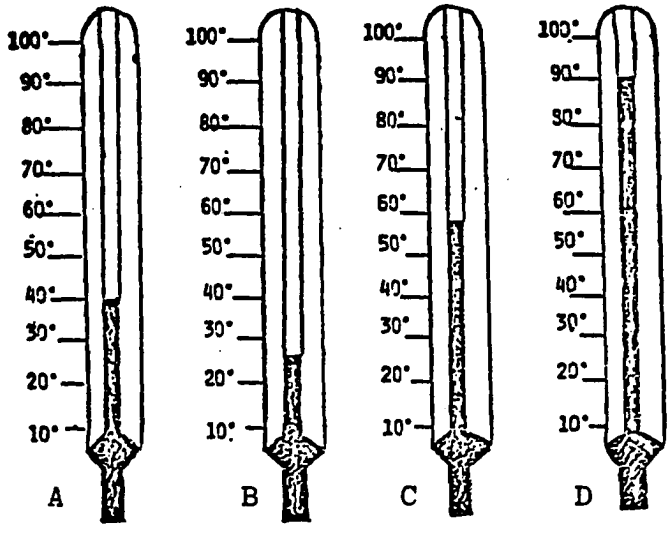
32. Study the four centigrade thermometers pictured below. List them in the order of increasing degrees of temperature starting with the coolest first and ending with the hottest.

A. D, C, A, B

B. A, C, B, D

C. B, C, A, D

D. B, A, C, D



33. On a 24-hour clock, 2 A.M. is 0200 and noontime is 1200. What time is 0800?

A. 2 P.M.

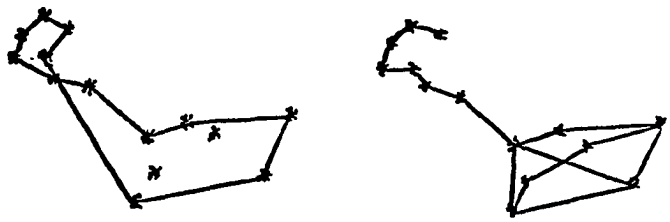
B. 8 A.M.

C. 8 P.M.

D. 10 P.M.

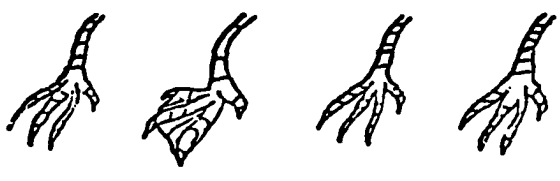
34. There is a group of stars called the constellation 'Great Whale' (Cetus). The name comes by making a picture similar to the picture labelled A. Suppose that these stars had been thought to make the picture labelled B. Which of these would have been a good name for this group of stars?

    A. soaring kite
    B. running dog
    C. swaying tree
    D. flowing stream



35. How is one of the bird-feet shown below very different from the others?

    A. There is no difference in the four feet pictured.
    B. There is no similarity in the four feet pictured.
    C. Foot Number 4 is different from Numbers 1 and 3.
    D. Foot Number 2 is webbed.



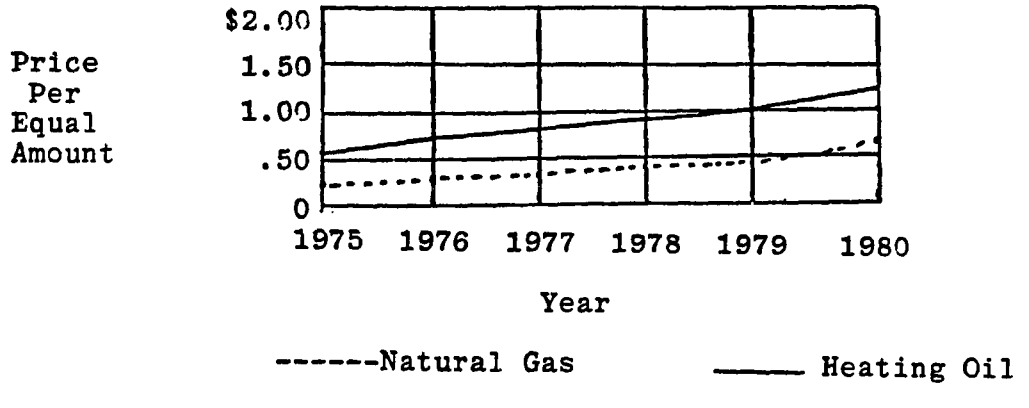
36. Pictured below is a graph showing a comparison of prices, per equal amount, of oil and natural gas from 1975 through 1980. In general, which statement below describes these prices?

A. Natural gas has consistently been higher in price than heating oil during this five-year period.

B. Heating oil has consistently been higher in price than natural gas during this five-year period.

C. The prices of natural gas and heating oil have been precisely the same during this five-year period.

D. There is no trend or pattern which can be seen for these prices during this five-year period.



37. Which of the following is <u>not</u> an observation?

    A. Crows make loud shrill calls

    B. Geese feathers are soft and white

    C. Gulf Stream' water is 72°

    D. Thinking about a happy event

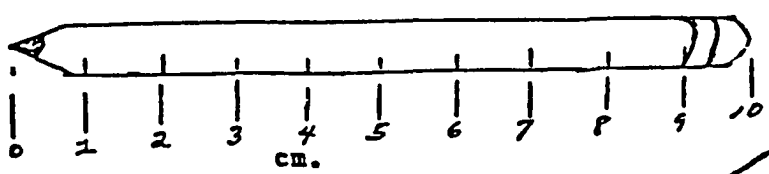
38. The pencil pictured below is 10 cm. (100 mm.) long. What is the distance from the right ear to the nose of the mouse pictured below?

    A. 2 cm.

    B. 4 cm.

    C. 6 cm.

    D. 8 cm.





39. When you notice a long heavy chain lying on the ground with one end attached to an unfamiliar house, what do think this means?

    A. There is no special meaning for this chain.

    B. There are no animals that live in this house.

    C. There is a large dog which lives in this house.

    D. This chain is an ornament of decoration for this house.

40. A person wishes to establish a herd of buffalo. Which of these is most useful to know in order to make a large herd?

    A. how buffalo identify enemies

    B. how buffalo reproduce themselves

    C. how buffalo eliminate wastes

    D. how buffalo digest food

PART II. ANALYSIS OF TEST ITEMS

Directions for Analyzing Test Items

The same setting and procedure will be used in this phase as with practice items.

Materials Needed for Analyzing Test Items

Before starting the analysis of test items of standardized science tests, the project director shall make certain that all of the necessary materials have been assembled. These shall include:

1. a room sufficiently large enough for five people to work comfortably. Each person shall have independent work space, as a table and chair.
2. one overhead projector, a sufficient number of blank copies of overhead transparencies of Table 1, and marker pens, for recording of individual and group decisions.
3. the same number of copies of standardized tests as there are evaluators, plus two extra.
4. the necessary pencils, pens, and erasers, as needed.
5. a sufficient number of blank copies of Table 2 for recording of data.

END OF MANUAL

PRACTICE TEST-ITEMS (40)

Analysis of Test Item by Use of Sub-Objective

Test Item		Sub-Objective Used	Test Item		Sub-Objective Used
1.	Classifying	(c)	21.	Classifying	(c)
2.	Synthesizing	(j)	22.	Analyzing	(h)
3.	Comparing	(e)	23.	Comparing	(e)
4.	Recalling	(a)	24.	Evaluating	(i)
5.	Inferring	(f)	25.	Inferring	(f)
6.	Generalizing	(d)	26.	Recalling	(a)
7.	Evaluating	(i)	27.	Imagining	(b)
8.	Imagining	(b)	28.	Synthesizing	(j)
9.	Deducing	(g)	29.	Analyzing	(h)
10.	Analyzing	(h)	30.	Recalling	(a)
11.	Synthesizing	(j)	31.	Generalizing	(d)
12.	Recalling	(a)	32.	Synthesizing	(j)
13.	Deducing	(g)	33.	Deducing	(g)
14.	Inferring	(f)	34.	Imagining	(b)
15.	Evaluating	(i)	35.	Analyzing	(h)
16.	Comparing	(e)	36.	Generalizing	(d)
17.	Imagining	(b)	37.	Classifying	(c)
18.	Classifying	(c)	38.	Comparing	(e)
19.	Generalizing	(d)	39.	Inferring	(f)
20.	Deducing	(g)	40.	Evaluating	(i)

Analysis of Test Items by Sub-Objective Used

	Sub-Objective	Test Item Number
a.	Recalling	4, 12, 26, 30
b.	Imagining	8, 17, 27, 34
c.	Classifying	1, 18, 21, 37
d.	Generalizing	6, 19, 31, 36
e.	Comparing	3, 16, 23, 38
f.	Inferring	5, 14, 25, 39
g.	Deducing	9, 13, 20, 33
h.	Analyzing	10, 22, 29, 35
i.	Evaluating	7, 15, 24, 40
j.	Synthesizing	2, 11, 28, 32

APPENDIX C

APPENDIX C

TEST ITEM EVALUATORS

Jerry Privett, Teacher of High School Earth Science. Oklahoma Certifications: Biology, Chemistry, Earth Science, General Science, and Physics

Rhea Seaberg, Teacher of High School Chemistry. Oklahoma Certifications: Biology, Chemistry, English, General Science, Library Science, Microbiology, and Physiology.

Debbie Shepherd, Teacher of High School Biology. Doctoral Student in Science Education, Ohio State University. Oklahoma Certifications: Biology, Chemistry, Earth Science, General Science, and Physics.

Carl Surber, Teacher of High School Biology. Oklahoma Certifications: Biology, Chemistry, Earth Science, English, General Science, and Physics. Florida Certifications: Astronomy, Botany, Invertebrate Zoology, and Psychology.

APPENDIX D

DECISIONS OF EVALUATORS

ANALYSIS OF ITEMS OF STANDARDIZED SCIENCE TEST: EMPORIA BIOLOGY TEST, TEST I, FORM A

DECISIONS OF EVALUATORS (4)

	INDIVIDUAL				GROUP
EVALUATOR:	1	2	3	4	
TEST ITEM NUMBER:					
2	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
3	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
5	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
6	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
7	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
9	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
11	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
13	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
14	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
16	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
18	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
19	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
21	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
23	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
24	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
25	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
26	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
27	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
28	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
29	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
30	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING

ANALYSIS OF ITEMS OF STANDARDIZED SCIENCE TEST: EMPORIA BIOLOGY TEST, TEST I, FORM A

DECISIONS OF EVALUATORS (4)--CONTINUED

	INDIVIDUAL				GROUP
EVALUATOR:	1	2	3	4	
TEST ITEM NUMBER:					
31	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
32	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
33	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
35	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
36	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
39	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
42	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
48	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
50	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
51	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
54	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
55	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
57	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
60	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
61	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
62	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
63	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
64	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
66	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
68	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
70	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING

ANALYSIS OF ITEMS OF STANDARDIZED SCIENCE TEST: EMPORIA BIOLOGY TEST, TEST I, FORM A

DECISIONS OF EVALUATORS (4)--CONTINUED

	INDIVIDUAL				GROUP
EVALUATOR:	1	2	3	4	
TEST ITEM NUMBER:					
71	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
73	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
74	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
76	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
79	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
81	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
84	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
85	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
87	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
88	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
89	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
90	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
91	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
92	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
93	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
94	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
95	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
99	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
100	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
101	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
105	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING

ANALYSIS OF ITEMS OF STANDARDIZED SCIENCE TEST: EMPORIA BIOLOGY TEST, TEST I, FORM A

DECISIONS OF EVALUATORS (4)--CONTINUED

	INDIVIDUAL				GROUP
EVALUATOR:	1	2	3	4	
TEST ITEM NUMBER:					
107	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
108	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
109	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
112	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
114	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
115	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING

ANALYSIS OF STANDARDIZED SCIENCE TEST: MINNESOTA HIGH SCHOOL ACHIEVEMENT EXAMINATIONS-
BIOLOGY, FORM EH REVISED

DECISIONS OF EVALUATORS (4)

	INDIVIDUAL				GROUP
EVALUATOR:	1	2	3	4	
TEST ITEM NUMBER:					
1	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
3	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
8	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
9	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
10	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
12	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
13	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
16	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
21	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
22	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
23	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
25	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
26	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
28	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
29	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
31	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
32	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
33	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
34	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING

ANALYSIS OF STANDARDIZED SCIENCE TEST: MINNESOTA HIGH SCHOOL ACHIEVEMENT EXAMINATIONS-BIOLOGY, FORM EH REVISED

DECISIONS OF EVALUATORS (4)--CONTINUED

	INDIVIDUAL				GROUP
EVALUATOR:	1	2	3	4	
TEST ITEM NUMBER:					
35	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
36	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
37	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
39	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
41	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
43	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
45	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
46	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
47	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
50	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
51	INFERRING	INFERRING	RECALLING	RECALLING	INVALID
52	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
53	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
55	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
56	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
57	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
60	EVALUATING	EVALUATING	RECALLING	RECALLING	INVALID
63	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
68	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING

ANALYSIS OF STANDARDIZED SCIENCE TEST: MINNESOTA HIGH SCHOOL ACHIEVEMENT EXAMINATIONS-BIOLOGY, FORM EH REVISED

DECISIONS OF EVALUATORS (4)--CONTINUED

	INDIVIDUAL				GROUP
EVALUATOR:	1	2	3	4	
TEST ITEM NUMBER:					
69	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
71	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
72	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
74	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
75	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
77	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
78	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
79	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
80	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
81	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
82	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
83	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
84	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
86	INFERRING	RECALLING	RECALLING	RECALLING	RECALLING
88	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
90	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
91	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
93	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
94	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING

ANALYSIS OF STANDARDIZED SCIENCE TEST: MINNESOTA HIGH SCHOOL ACHIEVEMENT EXAMINATIONS-BIOLOGY, FORM EH REVISED

DECISIONS OF EVALUATORS (4)--CONTINUED

	INDIVIDUAL				GROUP
EVALUATOR:	1	2	3	4	
TEST ITEM NUMBER:					
95	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
97	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
99	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
100	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
101	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
104	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
105	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
107	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING

ANALYSIS OF ITEMS OF STANDARDIZED SCIENCE TEST: NELSON BIOLOGY TEST, REVISED EDITION, FORM E

DECISIONS OF EVALUATORS (4)

	INDIVIDUAL				GROUP
EVALUATOR:	1	2	3	4	
TEST ITEM NUMBER:					
2	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
3	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
8	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
9	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
10	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
13	SYNTHESIZING	SYNTHESIZING	SYNTHESIZING	SYNTHESIZING	SYNTHESIZING
14	SYNTHESIZING	SYNTHESIZING	SYNTHESIZING	SYNTHESIZING	SYNTHESIZING
16	SYNTHESIZING	SYNTHESIZING	SYNTHESIZING	SYNTHESIZING	SYNTHESIZING
17	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
18	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
21	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
22	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
24	INFERRING	INFERRING	INFERRING	INFERRING	INFERRING
26	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
27	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
28	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
29	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
33	SYNTHESIZING	SYNTHESIZING	SYNTHESIZING	SYNTHESIZING	SYNTHESIZING
36	SYNTHESIZING	SYNTHESIZING	SYNTHESIZING	SYNTHESIZING	SYNTHESIZING

ANALYSIS OF ITEMS OF STANDARDIZED SCIENCE TEST: NELSON BIOLOGY TEST, REVISED EDITION, FORM E

DECISIONS OF EVALUATORS (4)--CONTINUED

	Individual				Group
Evaluator:	1	2	3	4	
Test Item Number:					
37	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
39	INFERRING	INFERRING	INFERRING	DEDUCING	INFERRING
42	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
43	RECALLING	EVALUATING	RECALLING	GENERALIZING	INVALID
46	DEDUCING	DEDUCING	DEDUCING	DEDUCING	DEDUCING
47	DEDUCING	DEDUCING	DEDUCING	DEDUCING	DEDUCING
48	DEDUCING	DEDUCING	DEDUCING	DEDUCING	DEDUCING
49	DEDUCING	DEDUCING	DEDUCING	DEDUCING	DEDUCING
51	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
52	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
53	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
54	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
56	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
57	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
58	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
59	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
60	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
61	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
63	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
64	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING

ANALYSIS OF ITEMS OF STANDARDIZED SCIENCE TEST: ACS-NSTA COOPERATIVE EXAMINATION IN HIGH SCHOOL CHEMISTRY

DECISIONS OF EVALUATORS (4)

	INDIVIDUAL				GROUP
EVALUATOR:	1	2	3	4	
TEST ITEM NUMBER:					
2	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
3	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
6	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
9	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
11	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
13	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
16	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
20	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
21	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
23	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
24	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
25	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
26	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
27	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
28	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
29	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
31	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
32	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
34	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING

ANALYSIS OF ITEMS OF STANDARDIZED SCIENCE TEST: ACS-NSTA COOPERATIVE EXAMINATION IN HIGH SCHOOL CHEMISTRY

DECISIONS OF EVALUATORS (4)--CONTINUED

	INDIVIDUAL				GROUP
EVALUATOR:	1	2	3	4	
TEST ITEM NUMBER:					
35	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
36	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
37	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
38	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
39	SYNTHESIZING	RECALLING	RECALLING	RECALLING	RECALLING
40	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
41	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
42	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
43	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
48	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
50	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
51	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
53	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
54	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
55	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
58	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
60	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
61	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
62	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING

ANALYSIS OF ITEMS OF STANDARDIZED SCIENCE TEST: ACS-NSTA COOPERATIVE EXAMINATION IN HIGH SCHOOL CHEMISTRY

DECISIONS OF EVALUATORS (4)--CONTINUED

	INDIVIDUAL				GROUP
EVALUATOR:	1	2	3	4	
TEST ITEM NUMBER:					
64	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
65	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
68	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
71	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
72	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
73	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
74	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
76	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
77	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
79	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING

ANALYSIS OF ITEMS OF STANDARDIZED SCIENCE TEST: EMPORIA CHEMISTRY TEST, TEST II, FORM A

DECISIONS OF EVALUATORS (4)

	INDIVIDUAL				GROUP
EVALUATOR:	1	2	3	4	
TEST ITEM NUMBER:					
1	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
2	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
3	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
5	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
6	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
9	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
11	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
13	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
15	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
16	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
20	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
21	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
22	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
24	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
25	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
26	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
28	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
29	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
31	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
35	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
37	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING

ANALYSIS OF ITEMS OF STANDARDIZED SCIENCE TEST: EMPORIA CHEMISTRY TEST, TEST II, FORM A

DECISIONS OF EVALUATORS (4)--CONTINUED

	INDIVIDUAL				GROUP
EVALUATOR:	1	2	3	4	
TEST ITEM NUMBER:					
39	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
43	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
45	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
46	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
47	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
48	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
50	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
52	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
54	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
56	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
57	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
58	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
59	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
60	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
62	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
63	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
66	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
67	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
68	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
69	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
70	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING

ANALYSIS OF ITEMS OF STANDARDIZED SCIENCE TEST: EMPORIA CHEMISTRY TEST, TEST II, FORM A

DECISIONS OF EVALUATORS (4)--CONTINUED

	INDIVIDUAL				GROUP
EVALUATOR:	1	2	3	4	
TEST ITEM NUMBER:					
71	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
73	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
75	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
78	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
79	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
80	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
82	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
83	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
84	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
85	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
86	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
87	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
89	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
90	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
91	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
97	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
98	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
100	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING

ANALYSIS OF ITEMS OF STANDARDIZED SCIENCE TEST: CONTENT EVALUATION SERIES:
EARTH SCIENCE TEST, FORM 1
DECISIONS OF EVALUATORS (4)

	Individual				Group
Evaluator:	1	2	3	4	
Test Item Number:					
1	Recalling	Recalling	Recalling	Recalling	Recalling
2	Recalling	Recalling	Recalling	Recalling	Recalling
3	Recalling	Recalling	Recalling	Recalling	Recalling
4	Recalling	Recalling	Recalling	Recalling	Recalling
6	Recalling	Recalling	Recalling	Recalling	Recalling
9	Recalling	Recalling	Recalling	Recalling	Recalling
11	Recalling	Recalling	Recalling	Recalling	Recalling
12	Recalling	Recalling	Recalling	Recalling	Recalling
13	Recalling	Recalling	Recalling	Recalling	Recalling
14	Recalling	Recalling	Recalling	Recalling	Recalling
16	Recalling	Recalling	Recalling	Recalling	Recalling
18	Recalling	Recalling	Recalling	Recalling	Recalling
20	Recalling	Recalling	Recalling	Recalling	Recalling
22	Recalling	Recalling	Recalling	Recalling	Recalling
23	Recalling	Recalling	Recalling	Recalling	Recalling
24	Recalling	Recalling	Recalling	Recalling	Recalling
26	Recalling	Recalling	Recalling	Recalling	Recalling
27	Recalling	Recalling	Recalling	Recalling	Recalling
28	Recalling	Recalling	Recalling	Recalling	Recalling

ANALYSIS OF ITEMS OF STANDARDIZED SCIENCE TEST: CONTENT EVALUATION SERIES:

EARTH SCIENCE TEST, FORM 1

DECISIONS OF EVALUATORS (4)--CONTINUED

	INDIVIDUAL				GROUP
EVALUATOR:	1	2	3	4	
TEST ITEM NUMBER:					
31	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
35	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
38	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
39	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
40	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING

ANALYSIS OF ITEMS OF STANDARDIZED SCIENCE TEST: EMPORIA GENERAL SCIENCE TEST, TEST I, FORM B

DECISIONS OF EVALUATORS (4)

	INDIVIDUAL				GROUP
EVALUATOR:	1	2	3	4	
TEST ITEM NUMBER:					
7	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
8	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
10	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
12	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
14	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
15	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
16	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
17	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
18	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
21	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
23	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
24	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
25	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
28	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
29	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
32	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
33	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
35	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
36	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
39	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING

ANALYSIS OF ITEMS OF STANDARDIZED SCIENCE TEST: EMPORIA GENERAL SCIENCE TEST, TEST I, FORM B

DECISIONS OF EVALUATORS (4)--CONTINUED

	INDIVIDUAL				GROUP
EVALUATOR:	1	2	3	4	
TEST ITEM NUMBER:					
44	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
45	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
46	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
49	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
50	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
51	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
52	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
53	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
55	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
56	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
57	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
60	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
61	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
63	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
67	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
68	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
69	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
71	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
73	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
74	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING

ANALYSIS OF ITEMS OF STANDARDIZED SCIENCE TEST: EMPORIA GENERAL SCIENCE TEST, TEST I, FORM B

DECISIONS OF EVALUATORS (4)--CONTINUED

	INDIVIDUAL				GROUP
EVALUATOR:	1	2	3	4	
TEST ITEM NUMBER:					
75	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
76	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
77	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
79	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
80	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
82	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
83	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
84	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
85	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
87	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
89	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
90	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
91	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
92	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
94	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
95	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
96	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
97	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
99	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
100	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING

ANALYSIS OF ITEMS OF STANDARDIZED SCIENCE TEST: SEQUENTIAL TESTS OF EDUCATIONAL PROGRESS, SERIES II, SCIENCE, FORM 2 A

DECISIONS OF EVALUATORS (4)

	INDIVIDUAL				GROUP
EVALUATOR:	1	2	3	4	
TEST ITEM NUMBER:					
PART I					
1	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
2	EVALUATING	EVALUATING	EVALUATING	EVALUATING	EVALUATING
5	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
7	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
9	DEDUCING	DEDUCING	DEDUCING	DEDUCING	DEDUCING
10	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
12	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
13	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
14	EVALUATING	EVALUATING	EVALUATING	EVALUATING	EVALUATING
16	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
18	RECALLING	RECALLING	RECALLING	COMPARING	RECALLING
19	RECALLING	RECALLING	RECALLING	INFERRING	RECALLING
21	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
22	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
23	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
25	EVALUATING	EVALUATING	EVALUATING	EVALUATING	EVALUATING
26	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
28	EVALUATING	EVALUATING	EVALUATING	EVALUATING	EVALUATING

ANALYSIS OF ITEMS OF STANDARDIZED SCIENCE TEST: SEQUENTIAL TESTS OF EDUCATIONAL PROGRESS, SERIES II, SCIENCE, FORM 2 A

DECISIONS OF EVALUATORS (4)--CONTINUED

	Individual				Group
Evaluator:	1	2	3	4	
Test Item Number:					
Part I					
29	Recalling	Recalling	Recalling	Recalling	Recalling
30	Recalling	Recalling	Recalling	Recalling	Recalling
32	Recalling	Recalling	Recalling	Recalling	Recalling
35	Recalling	Recalling	Recalling	Recalling	Recalling
36	Recalling	Recalling	Recalling	Recalling	Recalling
37	Recalling	Recalling	Recalling	Recalling	Recalling
39	Recalling	Recalling	Recalling	Recalling	Recalling
41	Recalling	Recalling	Recalling	Recalling	Recalling
42	Recalling	Recalling	Recalling	Recalling	Recalling
45	Recalling	Recalling	Recalling	Recalling	Recalling
Part II					
1	Classifying	Classifying	Classifying	Classifying	Classifying
2	Classifying	Classifying	Classifying	Classifying	Classifying
5	Deducing	Synthesizing	Synthesizing	Recalling	Invalid
6	Recalling	Recalling	Recalling	Recalling	Recalling
7	Evaluating	Evaluating	Evaluating	Evaluating	Evaluating
8	Deducing	Deducing	Deducing	Deducing	Deducing
9	Deducing	Deducing	Deducing	Deducing	Deducing
10	Evaluating	Evaluating	Evaluating	Evaluating	Evaluating

ANALYSIS OF ITEMS OF STANDARDIZED SCIENCE TEST: SEQUENTIAL TESTS OF EDUCATIONAL PROGRESS, SERIES II, SCIENCE, FORM 2 A

DECISIONS OF EVALUATORS (4)--CONTINUED

	INDIVIDUAL				GROUP
EVALUATOR:	1	2	3	4	
TEST ITEM NUMBER:					
PART II					
12	IMAGINING	ANALYZING	DEDUCING	DEDUCING	INVALID
15	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
17	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
19	EVALUATING	EVALUATING	EVALUATING	EVALUATING	EVALUATING
22	SYNTHESIZING	DEDUCING	DEDUCING	DEDUCING	DEDUCING
26	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
27	DEDUCING	DEDUCING	DEDUCING	GENERALIZING	DEDUCING
28	DEDUCING	DEDUCING	DEDUCING	GENERALIZING	DEDUCING
30	EVALUATING	EVALUATING	RECALLING	EVALUATING	EVALUATING

ANALYSIS OF ITEMS OF STANDARDIZED SCIENCE TEST: STANFORD ACHIEVEMENT TEST

ADVANCED SCIENCE TEST-FORM X

DECISIONS OF EVALUATORS (4)

	INDIVIDUAL				GROUP
EVALUATOR:	1	2	3	4	
TEST ITEM NUMBER:					
2	RECALLING	RECALLING	RECALLING	SYNTHESIZING	RECALLING
3	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
4	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
5	RECALLING	RECALLING	RECALLING	SYNTHESIZING	RECALLING
10	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
12	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
13	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
16	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
17	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
19	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
20	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
21	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
22	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
23	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
24	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
25	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
26	INFERRING	INFERRING	INFERRING	INFERRING	INFERRING
28	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
30	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING

ANALYSIS OF ITEMS OF STANDARDIZED SCIENCE TEST: STANFORD ACHIEVEMENT TEST

ADVANCED SCIENCE TEST-FORM X

DECISIONS OF EVALUATORS (4)--CONTINUED

	INDIVIDUAL				GROUP
EVALUATOR:	1	2	3	4	
TEST ITEM NUMBER:					
31	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
32	RECALLING	RECALLING	RECALLING	SYNTHESIZING	RECALLING
34	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
36	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
39	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
41	DEDUCING	DEDUCING	DEDUCING	DEDUCING	DEDUCING
42	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
43	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
45	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
46	EVALUATING	EVALUATING	EVALUATING	EVALUATING	EVALUATING
48	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
50	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
51	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
52	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
53	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
55	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
58	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING

ANALYSIS OF ITEMS OF STANDARDIZED SCIENCE TEST: TESTS OF ACHIEVEMENT AND PROFICIENCY

SCIENCE LEVELS 15-18, FORM T

DECISIONS OF EVALUATORS (4)

	INDIVIDUAL				GROUP
EVALUATOR:	1	2	3	4	
TEST ITEM NUMBER:					
3	INFERRING	SYNTHESIZING	SYNTHESIZING	SYNTHESIZING	SYNTHESIZING
4	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
5	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
10	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
11	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
12	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
13	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
14	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
15	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
19	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
20	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
23	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
24	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
27	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
28	SYNTHESIZING	SYNTHESIZING	SYNTHESIZING	SYNTHESIZING	SYNTHESIZING
29	INFERRING	INFERRING	RECALLING	INFERRING	INFERRING
30	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
31	INFERRING	INFERRING	DEDUCING	RECALLING	INVALID
35	EVALUATING	EVALUATING	EVALUATING	EVALUATING	EVALUATING

ANALYSIS OF ITEMS OF STANDARDIZED SCIENCE TEST: TESTS OF ACHIEVEMENT AND PROFICIENCY

SCIENCE LEVELS 15-18, FORM T

DECISIONS OF EVALUATORS (4)--CONTINUED

	INDIVIDUAL				GROUP
EVALUATOR:	1	2	3	4	
TEST ITEM NUMBER:					
36	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
38	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
41	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
42	DEDUCING	DEDUCING	DEDUCING	DEDUCING	DEDUCING
43	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
47	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
49	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
50	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
51	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
52	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
53	EVALUATING	EVALUATING	EVALUATING	EVALUATING	EVALUATING
56	DEDUCING	RECALLING	RECALLING	RECALLING	RECALLING
57	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
58	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
60	ANALYZING	SYNTHESIZING	RECALLING	RECALLING	INVALID
61	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
64	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
65	EVALUATING	EVALUATING	EVALUATING	EVALUATING	EVALUATING
66	IMAGINING	RECALLING	RECALLING	RECALLING	RECALLING

ANALYSIS OF ITEMS OF STANDARDIZED SCIENCE TEST: TESTS OF ACHIEVEMENT AND PROFICIENCY

SCIENCE LEVELS 15-18, FORM T

DECISIONS OF EVALUATORS (4)--CONTINUED

	INDIVIDUAL				GROUP
EVALUATOR:	1	2	3	4	
TEST ITEM NUMBER:					
67	INFERRING	INFERRING	INFERRING	INFERRING	INFERRING
70	EVALUATING	EVALUATING	EVALUATING	EVALUATING	EVALUATING
71	EVALUATING	EVALUATING	EVALUATING	EVALUATING	EVALUATING
73	EVALUATING	RECALLING	RECALLING	EVALUATING	INVALID
75	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
76	SYNTHESIZING	SYNTHESIZING	SYNTHESIZING	SYNTHESIZING	SYNTHESIZING
77	GENERALIZING	GENERALIZING	GENERALIZING	GENERALIZING	GENERALIZING
80	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
81	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
83	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
85	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
89	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
91	INFERRING	INFERRING	INFERRING	INFERRING	INFERRING
93	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
95	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
96	DEDUCING	DEDUCING	DEDUCING	DEDUCING	DEDUCING
97	SYNTHESIZING	SYNTHESIZING	SYNTHESIZING	SYNTHESIZING	SYNTHESIZING
99	EVALUATING	EVALUATING	EVALUATING	EVALUATING	EVALUATING
100	DEDUCING	GENERALIZING	GENERALIZING	GENERALIZING	GENERALIZING

ANALYSIS OF ITEMS OF STANDARDIZED SCIENCE TEST: TESTS OF ACHIEVEMENT AND PROFICIENCY

SCIENCE LEVELS 15-18, FORM T

DECISIONS OF EVALUATORS (4)--CONTINUED

	INDIVIDUAL				GROUP
EVALUATOR:	1	2	3	4	
TEST ITEM NUMBER:					
101	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
103	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
104	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
105	EVALUATING	EVALUATING	EVALUATING	EVALUATING	EVALUATING
106	SYNTHESIZING	SYNTHESIZING	SYNTHESIZING	SYNTHESIZING	SYNTHESIZING
108	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
111	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
113	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
114	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
115	DEDUCING	DEDUCING	DEDUCING	DEDUCING	DEDUCING
116	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
117	INFERRING	RECALLING	RECALLING	INFERRING	INVALID
118	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
120	EVALUATING	EVALUATING	EVALUATING	EVALUATING	EVALUATING
121	EVALUATING	EVALUATING	EVALUATING	EVALUATING	EVALUATING
122	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
123	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING

ANALYSIS OF ITEMS OF STANDARDIZED SCIENCE TEST: EMPORIA PHYSICS TEST

DECISIONS OF EVALUATORS (4)

	INDIVIDUAL				GROUP
EVALUATOR:	1	2	3	4	
TEST ITEM NUMBER:					
1	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
2	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
4	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
5	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
6	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
8	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
9	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
11	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
12	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
13	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
17	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
18	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
21	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
26	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
27	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
30	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
31	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
33	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
35	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
37	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING

ANALYSIS OF ITEMS OF STANDARDIZED SCIENCE TEST: EMPORIA PHYSICS TEST

DECISIONS OF EVALUATORS (4)--CONTINUED

	INDIVIDUAL				GROUP
EVALUATOR:	1	2	3	4	
TEST ITEM NUMBER:					
38	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
39	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
41	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
43	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
46	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
48	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
50	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
51	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
53	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
54	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
55	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
57	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
59	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
61	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
62	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
63	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
65	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
67	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
68	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
69	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING

ANALYSIS OF ITEMS OF STANDARDIZED SCIENCE TEST: EMPORIA PHYSICS TEST

DECISIONS OF EVALUATORS (4)--CONTINUED

	INDIVIDUAL				GROUP
EVALUATOR:	1	2	3	4	
TEST ITEM NUMBER:					
71	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
72	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
73	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
74	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
75	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
79	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
80	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
81	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
83	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
85	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
87	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
88	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
89	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
90	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING

ANALYSIS OF ITEMS OF STANDARDIZED SCIENCE TEST: MINNESOTA HIGH SCHOOL ACHIEVEMENT EXAMINATIONS

PHYSICS, FORM EH REVISED

DECISIONS OF EVALUATORS (4)

	INDIVIDUAL				GROUP
EVALUATOR:	1	2	3	4	
TEST ITEM NUMBER:					
1	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
5	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
9	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
10	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
12	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
16	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
18	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
19	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
20	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
21	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
23	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
24	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
26	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
29	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
30	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
31	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
33	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
35	EVALUATING	RECALLING	RECALLING	RECALLING	RECALLING
37	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING

ANALYSIS OF ITEMS OF STANDARDIZED SCIENCE TEST: MINNESOTA HIGH SCHOOL ACHIEVEMENT EXAMINATIONS

PHYSICS, FORM EH REVISED

DECISIONS OF EVALUATORS (4)--CONTINUED

	INDIVIDUAL				GROUP
EVALUATOR:	1	2	3	4	
TEST ITEM NUMBER:					
38	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
40	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
41	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
43	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
48	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
49	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
50	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
52	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
53	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
55	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
57	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
58	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
60	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
61	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
62	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
63	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
64	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
65	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
67	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING

ANALYSIS OF ITEMS OF STANDARDIZED SCIENCE TEST: MINNESOTA HIGH SCHOOL ACHIEVEMENT EXAMINATIONS

PHYSICS, FORM EH REVISED

DECISIONS OF EVALUATORS (4)--CONTINUED

	INDIVIDUAL				GROUP
EVALUATOR:	1	2	3	4	
TEST ITEM NUMBER:					
68	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
69	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
72	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
75	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
76	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
77	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
78	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
80	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
81	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
82	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
83	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
86	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
87	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
88	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
89	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
90	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
92	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
93	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING
94	RECALLING	RECALLING	RECALLING	RECALLING	RECALLING

ANALYSIS OF ITEMS OF STANDARDIZED SCIENCE TEST: MINNESOTA HIGH SCHOOL ACHIEVEMENT EXAMINATIONS

PHYSICS, FORM EH REVISED

DECISIONS OF EVALUATORS (4)--CONTINUED

	Individual				Group
Evaluator:	1	2	3	4	
Test Item Number:					
95	Recalling	Recalling	Recalling	Recalling	Recalling
98	Recalling	Recalling	Recalling	Recalling	Recalling
99	Recalling	Recalling	Recalling	Recalling	Recalling
100	Recalling	Recalling	Recalling	Recalling	Recalling
101	Recalling	Recalling	Recalling	Recalling	Recalling
102	Recalling	Recalling	Recalling	Recalling	Recalling
104	Recalling	Recalling	Recalling	Recalling	Recalling
107	Recalling	Recalling	Recalling	Recalling	Recalling
108	Recalling	Recalling	Recalling	Recalling	Recalling
111	Recalling	Recalling	Recalling	Recalling	Recalling
112	Recalling	Recalling	Recalling	Recalling	Recalling
115	Recalling	Recalling	Recalling	Recalling	Recalling
118	Recalling	Recalling	Recalling	Recalling	Recalling
119	Recalling	Recalling	Recalling	Recalling	Recalling
120	Recalling	Recalling	Recalling	Recalling	Recalling
121	Recalling	Recalling	Recalling	Recalling	Recalling
122	Recalling	Recalling	Recalling	Recalling	Recalling