

THE CONSTRUCTION OF A CRITERION-REFERENCED  
PHYSICAL EDUCATION KNOWLEDGE TEST

by

GAIL E. WILSON

B.P.H.E., University of Toronto, 1968

A THESIS SUBMITTED IN PARTIAL FULFILLMENT OF  
THE REQUIREMENTS FOR THE DEGREE OF  
MASTER OF PHYSICAL EDUCATION

in

THE FACULTY OF GRADUATE STUDIES  
School of Physical Education and Recreation

We accept this thesis as conforming  
to the required standard

THE UNIVERSITY OF BRITISH COLUMBIA

April 1980

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Department of Physical Education & Recreation

The University of British Columbia  
2075 Wesbrook Place  
Vancouver, Canada  
V6T 1W5

Date April 25, 1980

## ABSTRACT

Throughout the last two decades, physical educators have worked to develop a specific body of knowledge. Associated with the formation of this body of knowledge has been a trend by most physical educators to include a cognitive objective as one of the stated aims in their physical education curricula. As a result, the need for adequate knowledge assessment instruments has become apparent.

Although some assessment of knowledge in physical and health education has occurred since the late 1920's, the majority of tests which have been developed to date are directed towards the evaluation of knowledge in specific sports or activities. Relatively few tests are available that assess general knowledge concepts in physical education. As well, all of the knowledge tests that have been produced are norm-referenced instruments. That is, they have been constructed for the purpose of ranking individuals and comparing differences among them.

The purpose of this study was to design a criterion-referenced test which would assess the physical education knowledge of grade eleven high school students in British Columbia and which could function as a measurement instrument for the evaluation of groups or classes. As a criterion-referenced assessment tool, the knowledge test assesses the performance of individuals based on objectives which had been previously formulated by the Learning Assessment Branch of the Ministry of Education in British Columbia.

In order to prepare a table of specifications for the design of the test, the specific objectives to be measured were grouped into six sub-test areas. Multiple-choice items were then constructed according to the requirements of the table of specifications.

For the initial pilot administration of the test, two test forms, of 48 items each, were developed. Each of these forms included three of the six sub-test areas. One half of the 288 students to whom the first pilot was administered answered Form A while the remaining students answered Form B.

Following the administration of pilot test 1, the results obtained were analysed by the Laboratory of Educational Research Test Analysis Package (LERTAP), and were subjectively reviewed by an advisory panel. As a result of these procedures, 70 items were retained for use on the second pilot test. This test was administered to 133 students and the results were again analysed subjectively and psychometrically.

Thirty-eight items from pilot test 2 were considered acceptable for use on the final pilot test. In order to maintain adherence to the table of specifications, nine new items were developed and after approval by the advisory panel, were included on the third test form. This form was given to 800 grade eleven students and the responses of 250 randomly selected students were analysed by the LERTAP procedure. The analysis indicated that all items were psychometrically sound and the reliability of this form was estimated at .71.

Thus, the items utilized during the third pilot administration constituted the final form of the knowledge test. The test is suitable for evaluating groups and the six sub-tests, as well as the total test, can be used to identify strengths and weaknesses within programs.



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## ACKNOWLEDGMENT

I offer my thanks to Mr. J. Appleby, Dr. A. Carre, and Dr. G. Sinclair for their contribution to this thesis. Special gratitude is extended to Dr. R. Mosher, the chairman of my committee, for his perseverance and patience, and to Miss Mary Cooper for her knowledgeable guidance.

I am grateful to the students, teachers, and administrators who were involved in the pilot testing phases of this project.

Sincere appreciation is extended to the Learning Assessment Branch of the Ministry of Education, Province of British Columbia, and to British Columbia Research for the financial support, assistance and co-operation that was provided in the preparation of this study.

## CHAPTER I

### THE PROBLEM

#### Introduction

The gradual admission of physical education to the ranks of disciplines and professions over the past two decades has been largely due to the recognized need for, and consequent development of, a unique body of knowledge (Barrow, 1977; Bucher, 1975; Cunningham, 1975; Henry, 1964; Kroll, 1971; Paddick, 1967; Thompson, 1971).

Although this recently founded body of knowledge is not universally defined or accepted by all physical educators, its proponents have strongly encouraged the inclusion, in physical education programs, of a cognitive or knowledge component (Mand, 1962; Walker, 1967). Willgoose (1963:39) stated that:

A person is not educated physically by the mere development of motor skills and factual knowledge. One must understand why the skills are beneficial and why exercise is necessary to appreciate the role of recreational activity in a rich and full life.

Supporting the philosophy further, Paddick (1967:67) proposed that:

An understanding of the significance of movement does not automatically follow from participation in a curriculum based on one or two arbitrarily selected sports.

Bucher and Goldman (1969:14) emphasized the need to go beyond physical activity and insure that students do some thinking--"to get at the 'why' of

the activity."

In 1969, The American Association for Health, Physical Education, and Recreation prepared a manual entitled Knowledge and Understanding in Physical Education (1969:xi). In the preface to this document, the following statement appeared:

The intellectual, the verbally expressive content of physical education is as significant as the motor content and needs to be assessed. In appraising the student's progress in physical education, therefore, evidence should be obtained on the acquisition of knowledges and understandings in addition to the mastering of physical skills.

It was apparent that a cognitive component would appear in future physical education curricula.

Although the knowledge concept had been considered an element of physical education in the past, the teaching of this component has, for the most part, been incidental and without direction. However, Barrow (1977:27) spoke of physical education and its place in the general sphere of education:

If the use of the rational powers of man is to be the paramount goal of education and if physical education is to be an educational experience, it too must make a contribution in this area.

It was Barrow's belief that the intellectual objective in physical education involved several major areas: thinking as it is required to co-ordinate the mind and the muscles, the associated learnings that accompany skill learning--rules, techniques, strategies, terminologies--and an understanding and awareness of the values of developing and maintaining good health and fitness.

As the acquisition of knowledge became a commonly stated objective

of physical education, a suitable means of assessing the attainment of this objective was needed. Unfortunately, the availability of instruments for evaluating knowledge in physical education has been less than adequate. Although there are a great many knowledge tests in existence, the majority of these deal with specific sports. There are, in fact, very few instruments which evaluate the theoretical component of physical education programs. This situation has evolved because of the eclectic nature of physical education curricula and the lack of a universally accepted body of knowledge.

In a profession with such variability in program and content, the development of suitable evaluation tools is necessary for continued accreditation and recognition.

#### Statement of the Problem

The purpose of this study was to construct a criterion-referenced knowledge test which would be suitable for evaluating grade eleven physical education programs and which could be utilized as a diagnostic tool for class assessment.

The test was designed to assess the knowledges and understandings in physical education based on previously established student objectives. These objectives, known as Learning Outcomes, were identified by the Contract Team\* of the Physical Education Learning Assessment

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\*The Contract Team, retained by the Learning Assessment Branch, included three members of the School of Physical Education and Recreation, the University of British Columbia, a primary consultant employed as a Faculty Associate at Simon Fraser University, an intermediate teacher from the Vancouver School District, and a secondary teacher from the Burnaby School District.

The Ministry convened an Advisory Committee consisting of the chairman of the Contract Team, teacher educators, a trustee, a physical education co-ordinator, a recreation specialist, a school administrator,

Program of the Ministry of Education in British Columbia. Appendix A contains a summary of the specified Learning Outcomes.

#### Delimitations

1. This test is delimited to the measurement of knowledge inherent in the Learning Outcomes and thus does not necessarily reflect the total body of knowledge in physical education.
2. This test is delimited to performance by grade eleven students in British Columbia schools.
3. The design of this test delimits its use to the assessment of group performances.

#### Definition of Terms

##### Criterion-Referenced Test

A test which measures the degree to which achievement resembles desired or expected performance. That is, a test for which scores are interpreted primarily in terms of a standard performance in contrast to comparing the scores to norms or to class performance.

##### Norm-Referenced Test

A test which is designed to provide rankings of members within a group or compare individuals with such rankings. Each score is judged according to its relationships to other scores.

##### Item

A question on a multiple-choice objective test. Each item on this test consists of a stem and four responses. One response is correct.

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teachers at the elementary and secondary levels, and representatives of the Learning Assessment Branch. This group met regularly throughout all phases of the assessment to review progress and to provide reactions and suggestions to the Contract Team.

The three incorrect responses are known as foils or distractors.

#### Statements of Information

Concepts or facts which are based on the Learning Outcomes.

These facts form the basis for the development of questions.

#### Table of Specifications

This is the initial format for the construction of a multiple choice test. It represents the allocation of questions to each Learning Outcome and indicates the cognitive domains being assessed.



## CHAPTER II

### REVIEW OF LITERATURE

#### Knowledge Tests in Physical and Health Education

The purpose of this section is to investigate the availability of knowledge tests in physical and health education. Because of the inclusion in the learning outcomes of "structure and function of the body systems" and of "the effects of diet and exercise on the body," a review of health knowledge tests was considered relevant for this chapter.

The construction and use of knowledge tests for evaluation in physical and health education began in 1929 when Bliss (1929) designed a basketball knowledge test for use with college men. Since then, well over 80 tests have been recorded in the literature. Of these, 49 are directed to specific sports and activities, 25 relate to health or hygiene, and only 9 deal with several domains within physical and health education. An examination of Table 1 allows some further conclusions to be drawn.

The majority of the tests constructed to date measure knowledge and understanding in particular sports or activities. Examples of such tests are: Rodgers and Heath (1931), Hooks (1966), baseball; Bliss (1929), Snell (1935), Schwartz (1937), Fisher (1950), McCutcheon (1965), basketball; Kraft (1971), wrestling; Pake (1972), movement

TABLE 1

## KNOWLEDGE TESTS IN PHYSICAL AND HEALTH EDUCATION

Year	Author	Area	Grade Level
A: Sports and Activity			
1929	Bliss	basketball	college men
1931	Rodgers-Heath	baseball	5 and 6 boys
1931	Knighton	soccer	college men
1932	Heath-Rodgers	soccer	5 and 6 boys
1933	Murphy	golf	college women
1934	Grisier	field hockey	high school & college
1935	Shambaugh	folk dance	college women
1935	Wagner	tennis	college women
1937	Hewitt	tennis	college men & women
1937	Schwartz	basketball	high school men & women
1937	Thompson	dance & rhythm	college women
1939	Rogers	baseball	
1940	Dietz & Trech	field hockey	high school girls
1943	Scott	swimming, badminton, tennis	college women
1946	Philips	badminton	college women
1950	Stradtman & Cureton	fitness	high school
1950	Broer & Miller	tennis	college women
1952	Kelly-Brown	field hockey	college women
1952	Langston	volleyball	college men
1953	Fox	badminton	college men
1953	Miller	tennis	college women
1953	Waglow-Rehling	golf	college men
1955	Waglow-Stephens	softball	college men
1956	Goll	badminton	high school girls
1957	Gershon	gymnastics	college men
1957	Winn	soccer	college men
1958	Park	track & field	high school boys
1958	Power	touch football	jr. high school boys
1959	Bradley	baseball	college men
1961	Hardin	bowling	college men & women
1964	Hewitt	tennis	college men & women
1965	Blaess	archery	
1965	McCutcheon	basketball	college women
1965	Hambright	jumping, ball handling	grade 5
1967	Hodges	lacrosse	college women
1970	Mood	physical fitness	college
1971	Kraft	wrestling	college men
1971	Warren	lacrosse	college women
1972	Pake	movement principles	grade 6
1973	Reichle	boating knowledge	

Table 1, continued

Year	Author	Area	Grade Level
B: Multi-Activity Tests			
1935	Snell	fundamentals, hockey, baseball, tennis, golf, riding, archery, hygiene	college women
1936	Snell	soccer, volleyball, basketball	college women
1943	French	badminton, basketball, body mechanics, canoeing, field hockey, folk dance, stunts, swimming, tennis, track & field, volleyball, recreational sports	college women
1950	Fisher	badminton, basketball, archery, table tennis, tennis, volleyball, soccer	college women
1953	Goldberg	baseball, basketball, football	
1956	Hennis	basketball, bowling, field hockey, soft- ball, tennis, volleyball	college women
1960	Ley	badminton, basketball, bowling, archery, golf, soccer, soft- ball, tennis, volleyball	college women
1966	Hook	badminton, softball, tennis, volleyball	college men
1971	Farrow	archery, badminton, bowling, golf, tennis	college women

Table 1, continued

Year	Author	Grade Levels
C: Health Tests		
1931	Gates-Strang	high school and college men
1935	Forsythe & Rugen	college freshmen
1937	Kilander	high school and college men
1937	Murphy	college women
1945	Gold	grades 7, 8, 9
1952	Bridges	college freshmen
1952	Colebank	junior high school girls and boys
1953	Hinrichs	college
1953	Dzenowagis	grade 5-6 girls & boys
1965	Reid	college students
1957	Shaw, Troyer	7-12, college students
1957	Yellen	grades 3, 4, 5
1957	Veenker	grade 7
1958	Klein	grade 5
1958	Poole	high school students
1959	Augustin	senior high school students
1961	Lohr	senior elementary
1965	Dann	grade eleven, twelve
1967	Kussman	grade five
1967	Spears	grade five
1968	Yeakle	senior high school
1970	Davila	grade 1
1972	Seffrin-Veenker	high school
1973	Cook	grade 6
1973	Gunter	college men
D: General Knowledge Tests		
1932	Hemphill	9-12 boys
1935	Snell	college women
1962	Cowell	college men and women
1965	Walker	college freshmen
1968	Wade	college men and women
1971	A.A.H.P.E.R.	elementary school and high school
1976	Markly	senior high school

principles.

Some authors such as French (1943), Hennis (1956), and Ley (1960), constructed objective tests for several different sport activities. These multi-sport tests, similar to most of the specific sport tests, were all designed for use at the college level and with the exception of those of Goldberg (1953), and Hooks (1966), all of the multi-sport tests were designed for women.

In the area of health and hygiene, more tests have been constructed for use at elementary and high school levels than at the college level. Most of the items on these tests deal with health in terms of safety, nutrition, personal, community, and mental hygiene. Very few health tests relate health to exercise and activity. However, the test by Stradtman and Cureton (1950:53) did examine knowledge in the area of fitness:

Since physical education is a vital part of the normal student's life he should know not only games and activities but the more common psychological and physiological implications of activities of various kinds.

Questions on this test relate to the effects of exercise on circulation and respiration, the assessment of personal fitness, the components of physical fitness, and methods for developing fitness. Similar tests have since been developed by Mood (1971) and Cook (1973).

More pertinent to this study are knowledge tests which examine several areas within the broad framework of physical and health education. In 1931, Hemphill developed a test for boys in grades eight through twelve. Questions were divided into five different areas: major athletic activities (baseball, football, basketball), minor

sports (soccer, tennis, handball, volleyball), health related to physical education, self-defence (boxing, wrestling), recreational sports (hiking, camping, swimming). Health questions related to activity, diet, and good health.

Snell's battery of knowledge tests (1935) for use with college women included questions on various activities, fundamentals, and hygiene. The fundamentals test contained items relating to running, climbing, jumping, throwing, safety, and body mechanics. The hygiene test was composed mainly of questions relating to structure and function of all body systems although several questions referred to the effects of exercise on those systems.

Similarly, in order to assess the background of physical education students in college, Cowell (1962) and Walker (1965) developed general knowledge tests in physical education. Topics covered included social psychology, philosophy, biology, measurement, growth and development, physiology, sports knowledge, and safety.

Perhaps the best known general knowledge tests in physical education are those that have been constructed, standardized, and published by the American Association of Health, Physical Education, and Recreation (A.A.H.P.E.R.). These tests, known as the A.A.H.P.E.R. Co-operative Physical Education Tests, were designed to measure "a broad range of understandings of the cognitive aspects of physical education" (A.A.H.P.E.R., 1971:5). There are six tests available; two forms for elementary school usage, two forms designed for junior high school, and two forms for use at the senior high school level.

The A.A.H.P.E.R. tests are based on the body of knowledge outlined

in Knowledge and Understanding in Physical Education, a manual published by A.A.H.P.E.R. (1969). Consequently, the tests are most appropriate for students who have had instruction based on the content of this manual. Therefore, although the A.A.H.P.E.R. tests constitute a major step in the development of test instruments for physical education, their applicability to other situations is limited.

Thus, in spite of the A.A.H.P.E.R. tests, there is a scarcity of evaluation tools which will provide an assessment of general knowledge in physical education. The majority of the seven general knowledge tests listed in Table 1 have been designed for use at the college level and the items on these tests reflect the content of foundation courses in college physical education programs. Of the three general knowledge tests suitable for use at lower levels of education, only two (A.A.H.P.E.R., 1971; Markly, 1976) are applicable to both boys and girls.

Further, all of the physical and health education tests reviewed above, including the A.A.H.P.E.R. tests, are norm-referenced instruments, and, as such, are designed to compare and rank the performances of individuals. Criterion-referenced tests which compare individual performances to a pre-determined standard, although evident in other disciplines --music (Simons, 1976), mathematics (Sheehan, 1979), and English (Macdonald, 1974),--have apparently not been constructed nor utilized by physical educators.

#### Criterion-Referenced Testing

Criterion-referenced measurement became prominent in the late 1950's as a result of Skinner's work in programmed instruction. Educators at that time were soon to realize that available

methods of evaluation, based on norm-referenced measurement, did not work well with innovative methods of instruction (Popham, 1975).

In spite of this, virtually all commercially available standardized tests are norm-referenced (Martuza, 1977), and while this type of test provides a comparison between a particular individual's performance and the performance of other members of the group, little information is provided regarding the individual's degree of skill or competency. According to Radocy (1978:6) "existing achievement tests appear to have as their purpose the demonstration of the great range of individual differences in behaviour."

Also, "the very nature of norm-referenced tests suggests that evaluation in education should provide a normal distribution of those being tested" (Popham, 1975:126). Bloom (1971) notes that the normal curve describes a random process whereas education is a purposeful activity in which we seek to have students learn what we teach. Bloom contends that the achievement distribution should be very different if our instruction is effective and that instructional efforts may in fact be unsuccessful if student achievement is normally distributed.

As a result therefore, of innovative trends in instruction and a dissatisfaction with available measurement instruments, new methods of evaluation evolved. Hambleton (1978:2) summarized this dissatisfaction:

Over the years standard procedures for testing and measurement within a norm-referenced framework have been well known to educators; however these procedures are much less appropriate when the questions being asked concern what examinees can and cannot do.

It was obvious that there was a need for a different type of measurement instrument with different specifications than those previously established for norm-referenced testing (Glaser, 1963; Hambleton, 1978;



Millman, 1974).

The catalyst for criterion-referenced testing seemed to come from an article by Robert Glaser in 1963. According to Glaser (1963:520), "a criterion-referenced test is one that is deliberately constructed to yield measurements that are directly interpretable in terms of specified performance standards." Similar definitions describe the use of criterion-referenced tests to measure performance in relation to a criterion of behaviour and point out the contrast with norm-referenced tests which make comparisons among individuals (Gronlund, 1976; Hambleton, 1978; Popham, 1975; Popham & Husek, 1971).

Strictly speaking, the terms criterion-referenced and norm-referenced refer only to the methods which are used to interpret and evaluate results (Gronlund, 1976; Taylor & Greer, 1978). However, there are also important differences in the methods used to develop criterion- and norm-referenced tests.

In terms of item selection, Popham and Husek (1971) state that the writer of the norm-referenced test, in an effort to promote variant scores for the purpose of discriminating among individuals, rejects items that are too easy or too difficult. Yet an item with a difficulty level of 0.00 or 1.00 that is likely to be rejected as non-discriminating by the norm-referenced writer, may be thorough evidence, on a criterion-referenced test, that the expected behaviour has or has not been attained. Thus, in criterion-referenced testing, items are selected on the basis of whether or not they are judged to measure a component of the knowledge or skill specified in the learning outcomes and "no attempt should be made to eliminate easy items or alter item difficulties in order to obtain a range of scores" (Gronlund, 1976:153).

It is apparent that traditional item selection methods are not uniformly applicable for the design of criterion-referenced tests.

In a discussion of reliability and criterion-referenced tests, Gronlund (1976) points out that since criterion-referenced mastery tests are not designed to discriminate among individuals, and thus variability need not be present in the scores, the traditional correlational estimates of reliability are inappropriate. Hambleton (1978:3) supports this view:

A criterion-referenced test is not constructed specifically to maximize the variability of test scores whereas a norm-referenced test is so constructed. Thus, since the distribution of scores on a criterion-referenced test will be more homogeneous, it is obvious that such a test will be less useful for ordering individuals on their measured ability.

Variability then, which is a prime factor in a well constructed norm-referenced test, is not a prerequisite for a good criterion-referenced test. Correlational methods, in order to be fully effective, require a reasonably large response variance in the measures under consideration. Thus estimates of internal-consistency, and test-retest coefficients for example, are likely to be inappropriate in criterion-referenced testing because they depend on total test score variability (Glaser, 1970; Popham, 1975).

The variability among scores that is essential for reliability in norm-referenced testing is also necessary for computing validity coefficients (Gronlund, 1976:96). Therefore, established methods for estimating validity of norm-referenced measures do not apply when assessing the validity of criterion-referenced instruments.

What is important in assessing the validity of a criterion-

referenced test is content validity. "Tests are validated primarily in terms of the adequacy with which they represent the criterion behaviour" (Popham, 1971:29). Items must reflect the criterion they are testing.

In summary, although the differences between criterion- and norm-referenced tests are not readily apparent, they are important both in terms of test development and interpretation. In spite of the fact that "over six hundred articles have been written to date on this topic" (Hambleton, 1978:3), techniques specifically adopted for evaluating criterion-referenced tests have not yet been fully developed (Glaser, 1970; Gronlund, 1976). As research continues in this area, methods of development and assessment should become more clearly defined.

#### The Taxonomy of Educational Objectives

Central to the development of any test is a clear statement of the objectives that the test is expected to measure. Related to this statement is the attempt to provide a conceptual framework within which all the specific goals can be placed.

In 1956, Bloom and his associates developed a taxonomy of educational objectives. This system provides a hierarchical classification of the universe of educational objectives into three domains: cognitive, affective, and psychomotor.

The cognitive domain, which is the consideration in this study, contains six categories arranged from simple concepts to complex concepts and since the system is hierarchical in nature, it is assumed that each level is an extension of all previous levels. A brief description of these six categories follows (Bloom, 1956:201).

Knowledge--This is the lowest level of the system. It involves the

recall of specific facts or information and emphasizes the psychological process of remembering.

Comprehension---This concept requires that the individual be able to utilize knowledge accurately. That is, to explain or demonstrate an understanding of knowledge concepts.

Application---An individual functioning at this stage must be able to use and apply knowledge in new situations.

Analysis---This stage requires the ability to break down a concept or idea into its constituent parts.

Synthesis---An individual at this level is able to arrange and organize elements or units into patterns and structures.

Evaluation---This is the most complex and abstract level of the taxonomy. It assumes competence in the lower five categories and requires the ability to evaluate and make decisions.

Although Bloom's classification includes six levels of cognitive operations, there is some controversy with regard to the suitability of all six levels for objective testing and in fact, some concern regarding the explicitness of Bloom's groupings. Ebel (1972:109) maintains that Bloom's terminology is subjective and thus "questions the functional independence of such concepts as comprehension, analysis, and synthesis." Bloom himself contends (1971) that in order to function at higher levels of cognition, items must be new to all students. That is, the nature of the events that has preceded the point at which a student is being assessed, will reflect the classification of any test item for that student. If the student has previously learned the material, the educational response required will be recall or recognition and thus the item can be classified as one that assesses knowledge. However, if the

concept being presented is new or original, a different level of functioning will be necessary. Further, Krathwohl and Payne (1971) suggested that there is support for the rationale of Bloom's first three categories but little evidence for the order of the more complex categories.

Popham (1972:22) suggests that "sufficient utility is gained by using a two level breakdown such as 'lowest level' and 'higher than lowest level.'" The fact that there seems to be a clear distinction between the first level and the five higher levels provides support for this view.

In spite of the lack of clarity surrounding the specific classifications, the taxonomy serves a useful purpose in test construction. A classification system such as this prevents unsuspected omissions or overemphases on particular levels of functioning. The common tendency of constructing tests which tax only the memory system, and which therefore fail to assess a student's ability to think as well as to memorize, can be avoided by adhering to such classifications as provided by Bloom's taxonomy.

In light of the above considerations, for the purpose of this test, a knowledge item is one that requires specific recall of information. An understanding item measures the student's ability to comprehend some concept or idea. An item which presupposes an understanding and measures the ability to apply that understanding to novel situations is an application item. All test items will be categorized in one of these three classifications.

## CHAPTER III

### METHODS AND PROCEDURES

#### Development of the Objectives

In order to develop any test, consideration must be given to what is being measured. Since criterion-referenced tests are designed to determine whether or not certain standards or criterion behaviours have been attained, the standards or criterion behaviours which the test purports to measure must be specified.

Glaser and Klaus (1962) maintain that the specification of the behaviour which is to be observed and assessed is the first step in developing a measure of proficiency. A similar position is taken by Lehman (1968:79) who contends that "identification of the objectives is the most important part of test construction."

As previously stated, the purpose of this research was to construct a criterion-referenced test which would assess knowledge and understanding in physical education based on pre-established goals and learning outcomes. In order to arrive at the specific goals and learning outcomes, the Learning Assessment Branch of the Ministry of Education in British Columbia conducted an extensive survey of a variety of information sources. These sources are presented in Table 2.

As a result of the investigation by the Ministry of Education, six goals, each with specific learning outcomes, were established to

TABLE 2

SOURCES SURVEYED FOR INFORMATION ON THE DEVELOPMENT  
OF THE GOALS AND LEARNING OUTCOMES

- 
1. The existing British Columbia guides in Physical Education (Elementary: 1975 Revision, and Secondary: 1961).
  2. All Canadian provincial curriculum guides in Physical Education.
  3. Major United States state curriculum guides in Physical Education.
  4. Over 200 books and periodicals related to objectives in Physical Education.
  5. Major information retrieval systems such as E.R.I.C. (Educational Resources Information Center).
  6. Instructional Objectives Exchange.
  7. Working paper developed by the Ministry of Education workshop held in Richmond, B.C., December 1976.
  8. Rough draft of the Secondary Physical Education Curriculum Guide developed by the Secondary Physical Education Revision Committee.
  9. Advisory groups such as: (1) British Columbia Physical Education Society, (2) British Columbia Teachers Federation Physical Education Provincial Specialists Association, (3) Interested university and school based individuals.
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SOURCE: Appraisal of Goals and Learning Outcomes: Provincial Learning Assessment Program in Physical Education. Ministry of Education, British Columbia, 1978.

reflect both the existing and the proposed directions for physical education in the province of British Columbia. A complete list of the goals and learning outcomes appears in appendix A. Several of the specific learning outcomes were directed towards the acquisition of knowledge and understanding in various domains of physical education. These outcomes, which are presented in Table 3, denote the criterion behaviours to be measured by this test.

#### Construction of the Table of Specifications

The preliminary step in the construction of the test was to design a table of specifications to ensure that the final test would measure the

TABLE 3  
KNOWLEDGE LEARNING OUTCOMES

Goal	Learning Outcome
II	<ol style="list-style-type: none"> <li>1. An understanding of advanced rules, techniques, and strategies involved in physical activities.</li> <li>2. An understanding of advanced movement principles such as combining quick and slow elements of time with the strong element of weight and the change of direction element of space to develop a successful spike in volleyball.</li> <li>3. An understanding of the advanced psychological factors related to physical activity such as the interaction between co-operative and competitive behaviour.</li> <li>4. An understanding of advanced physiological factors relating to physical activity such as the effects of chronic exercise on cardio-vascular function.</li> <li>5. An understanding of the advanced safety procedures relative to physical activity such as the relationship between strenuous training and individual body capabilities.</li> </ol>
III	<ol style="list-style-type: none"> <li>2. An awareness of advanced methods necessary to achieve an appropriately high level of physical fitness such as the specificity of aerobic and anaerobic training.</li> <li>3. The ability to assess and interpret personal physical fitness, utilizing appropriate measurement techniques and instruments in fitness components such as cardiovascular endurance, strength, flexibility, and anthropometrical measures such as height, weight, girth, and per cent body fat.</li> </ol>
IV	<ol style="list-style-type: none"> <li>1. An understanding of the relationship between advanced concepts relative to healthful nutrition such as the effects of salt and water depletion during exercise, and the role of physical activity as they interact to provide for healthful daily living.</li> <li>3. An understanding of advanced concepts of body mechanics such as the use of the arms for increasing and decreasing speed of rotation in skills such as spinning in figure skating.</li> <li>5. An understanding of the basic concepts related to the structure and function of the following systems: digestive, muscular, skeletal, respiratory, nervous, circulatory, and endocrine relative to physical activity; together with an understanding of the basic interrelationships between these systems.</li> </ol>



learning outcomes in a balanced manner.

As previously mentioned, the knowledge learning outcomes were identified within the six goals formulated by the Ministry of Education (see Table 3). In criterion-referenced testing it is necessary to ensure that there is adequate content coverage within an objective. This can be achieved by constructing a sufficient number of items for each objective. In fact, a minimum number of items is required in order to apply appropriate psychometric procedures and to ensure that content validity is maintained. The greater the number of items per objective, the better the quality of the test. However, because of the desire to limit the length of this test to a specific time period, it was necessary to restrict the number of items that could be used to represent each of the ten learning outcomes. Therefore, after a careful review of the learning outcomes, a decision was made to combine the ten outcomes into six content or sub-test areas: rules, techniques, and strategies; principles and mechanics of movement; concepts and methods of fitness; body structures and functions; the effects of physical activity; factors affecting participation. These categories afforded a logical framework for the organization of the knowledge learning outcomes. Table 4 illustrates the distribution of the learning outcomes within the six content areas.

Once the sub-test, or content areas, were established they were placed along the vertical side of the table of specifications. Since the purpose of this test was to determine the amount of knowledge students possess with regard to each content area, equal emphasis, where possible, was to be given to each content area within the table.

The cognitive levels to be assessed--knowledge, understanding, application--were placed along the horizontal axis of the table. Because it is

TABLE 4

TABLE OF SPECIFICATIONS ILLUSTRATING THE DISTRIBUTION OF ITEMS FOR PILOT TEST 1  
AND THE PROPOSED DISTRIBUTION FOR THE FINAL TEST FORM

Content Area	Related Goals and Learning Outcomes	Distribution of Items Pilot Test 1				Proposed Distribution Final Test Form			
		Know.	Understand.	Apply	Total	Know.	Understand.	Apply	Total
Rules, techniques, and strategies of physical activity	Goal II,1	8	4	4	16	4	2	2	8
Principles and mechanics of movement	Goal II,2 Goal IV,3	8	4	4	16	4	2	2	8
Concepts and methods of fitness	Goal III,2,3	8	4	4	16	4	2	2	8
Body structures and functions	Goal IV,5	8	4	4	16	4	2	2	8
The effects of physical activity	Goal II,3,4,5	8	4	4	16	4	2	2	8
Factors affecting participation	Goal II,3,4,5 Goal IV,1	8	4	4	16	4	2	2	8
Totals		48	24	24	96	24	12	12	48

possible to more accurately classify knowledge items and because it is more difficult to construct good quality objective items for understanding and application than for knowledge (Solleder, 1972), approximately 50 percent of the items in the table of specifications were assigned to measure knowledge. The remaining items were apportioned equally in the table of specifications for the assessment of understanding and application abilities.

The desired length of the preliminary test form was approximately 96 items. This allowed for the elimination of some items after item analysis and subjective evaluation and still ensured a sufficient number of items for the final form. On this basis, at least 16 items were designed for each content area.

#### Designing the Items

As a result of an investigation of the relevant literature, 18 statements of information were prepared to embody the concepts inherent in each of the 6 content areas. From these statements, 108 multiple-choice items were constructed.

A review of test construction literature disclosed several advantages and benefits of a multiple-choice format for items: multiple-choice items are adaptable to the measurement of some of the most important educational outcomes and are less susceptible to chance errors from guessing than are true-false type items (Baumgartner, 1975; Ebel, 1972; Safrit, 1973; Scott, 1959; Westman, 1971); further, the American Association of Health, Physical Education and Recreation believe that multiple-choice items "measure the ability to recall and recognize information, as well as to apply facts, analyse situations and solve problems" (A.A.H.P.E.R., 1969:128).

According to the rules of multiple-choice item construction, the

stem of each newly designed item was phrased as either an incomplete statement or a direct question. An attempt was made to keep all possible answers to each question parallel in grammatical form and of a similar length. Wesman (1971) advises that three to five alternatives can be used but he warns against adding distractors that fail to distract. Each item in this test was provided with four alternatives, one of which was the correct answer.

#### Preparation and Administration of Pilot Test 1

After the items had been constructed they were submitted to members of the contract team in order to be assessed for content validity. Each of the experts examined each item to ensure that it reflected the content expressed in the goals and learning outcomes. Items were also scrutinized for proper grammatical construction, clarity, and suitability for use at the grade eleven high school level. As a result of the assessment by the contract team, and subsequent revisions, 96 items were accepted for preliminary administration.

The projected time limit for the final form of the test was set at 40 minutes. Philips (1964) reported that college women answered 100 multiple-choice items in 50 minutes. A 45-minute time limit, according to Safrit (1973), would limit the test size to 60 items. In order to accurately assess the number of items high school students could answer in 40 minutes, and to ensure that there was adequate time for the completion of the preliminary test form, the 96 items were arranged into two forms. As well, students were allowed up to 1 hour to complete the test and a record was kept of the approximate times of completion.

Form A was composed of items from three of the six content areas:

principles and mechanics of movements; effects of activity; concepts and methods of fitness. The remaining knowledge outcomes made up Form B: rules, techniques and strategies; factors affecting participation; body structures and functions. This procedure was followed so that items could be selected on the basis of their relationship to the sub-test. The items for each test form are presented in appendix E.

The seven grade 11 classes to which the test forms were administered were chosen from high schools in British Columbia. The classes selected represented a wide variation in geographic and socio-economic distributions. Instructions to the students emphasized that they should give only one answer per question and that questions to which students did not know the answer should be left blank.

Samples of the two preliminary forms were sent to the teachers of the students taking part in this phase and to other physical educators in the province. These people were asked to comment on the appropriateness of the content, item difficulty, item construction, and vocabulary (see appendix B).

#### Preparation and Administration of Pilot Test 2

The Laboratory of Educational Research Test Analysis Package (LERTAP) was used to perform a psychometric analysis on the items used in pilot test 1. In addition, since psychometric results should only be used as a guide in selecting items (Popham & Husek, 1971), all comments received from students, teachers, and other involved physical educators were used to help evaluate the effectiveness of each item. Based on computer and subjective analysis, poorly performing items were eliminated.

The revised form of the test was composed of 72 items. An attempt was made to provide at least ten items for each of the six content areas. This form of the test was subjected to careful examination by the advisory panel and the contract team for content validity, grammatical correctness, adherence to objective test construction principles, terminology, and suitability for grade 11 students. The test was administered to seven grade 11 high school classes in the greater Vancouver area. Since the major purpose in administering the second pilot was to eliminate errors and weaknesses within the items, all students were allowed 1 hour to complete the test. (Items that appeared on pilot test 2 are listed in appendix E.)

#### Preparation and Administration of Pilot Test 3

In order to obtain the appropriate number of items for the third pilot test, the responses from pilot test 2 were again analysed by the LERTAP program and extensively reviewed by the contract team, the advisory panel, and high school physical educators. All items were closely examined for proper grammatical construction and technical correctness. Any items which were unclear or ambiguous were considered unacceptable and were either altered or deleted.

As a result of these procedures, 38 items from the second pilot were considered suitable for inclusion in the next pilot. In order to ensure content validity, and to approximate as closely as possible the original table of specifications, ten new items were constructed for inclusion on pilot test 3. This test was administered to approximately 850 grade 11 students throughout British Columbia. From this population, the responses of 250 randomly selected students were analysed by the LERTAP program. Based on this analysis, a final form of the test was established. (Items that were used on the third pilot test are listed in appendix E.)

## CHAPTER IV

### ANALYSIS OF THE DATA

#### Methods of Analysis

Following the administration of each pilot test all items were subjected to a psychometric item analysis. This analysis was performed using the Laboratory of Educational Research Test Analysis Package (LERTAP) which was developed by Nelson in 1974. This is a classical item analysis program which can be used for test scoring but emphasizes item and test analysis.

The LERTAP program computes indices relative to the quality of each item for item difficulty, discriminating ability, and distractor adequacy as well as providing information with regard to test means and estimates of reliability.

Difficulty levels are expressed as p values. This value indicates the proportion or percent of test takers who chose the correct response. A high p value is an indication of a relatively easy item while a low value indicates a more difficult item.

The ability of an item to discriminate is established by the computation of a Point Biserial Correlation (P.B.S.). This is the correlation between the item option and the sub-test or total test scores. It is computed by coding those who select the option as '1' and those who don't choose the option as '0'. An item positively discriminates if

those responding correctly to the item do well on the total test. It is desirable that the correct choice has a high positive P.B.S. and that all incorrect choices have negative correlations. Point biserial indices have a tendency to become smaller as difficulty levels depart from fifty percent.

All incorrect options are known as distractors. Good distractors will have a negative point biserial correlation with the sub-test and total test scores. Distractors which have a positive correlation with these criteria should be carefully examined. In addition, all distractors must function. Those which fail to attract responses should be removed, or altered so that they are more attractive.

As well as being psychometrically reviewed, all items were subjectively evaluated by a panel of experts following each pilot test. The purposes of this procedure were to ensure content validity within each form, and to verify that all items measured knowledge that grade eleven physical education students would be expected to master. The experts made critical decisions with regard to the retention, omission, or modification of items on the basis of vocabulary suitability, clarity, correctness, grammatical construction, and appropriateness.

It is important to emphasize that decisions made during the subjective evaluations with regard to item quality generally predominated over decisions made based on the psychometric performance of items. According to Millman (1974:339): "the use of item statistics destroys the selection process which is the defining characteristic of domain-referenced tests." Thus, the standard method of eliminating all items with extreme difficulty levels or low discriminating abilities, is not suitable. The psychometric analysis was used primarily to detect flaws in items and was



utilized more as a diagnostic device than as a measure for item selection.

Therefore, p values which were notably extreme were reviewed in order to detect any errors within the item. Items which appeared to be 'too easy' were examined for improper wording which might have made the correct answer obvious. Item 7 on form B of pilot 1 is an example of this procedure (see appendix C). Items which caused great difficulty were inspected for ambiguity. For example, the foils of item 28, form B of pilot 1, could all be considered correct. It was this weakness within the item rather than the content of the item that created a p value of 9.9. In cases where word problems could not be eliminated, or ambiguity removed, items were omitted.

Of course, not all items which recorded extreme p values were removed from the tests. Several items such as 27, 2, 4 on form A of pilot 1, and 13, 39 on pilot 3 were very difficult but were retained because their content was considered relevant and important. Similarly, items such as 16, 36 on form B of pilot 1, and 18, 23, 33, and psychology item 7 on pilot 3 recorded high p values but were retained (see appendix C).

Discrimination indices were reviewed in the same manner. Poorly discriminating items were examined carefully for ambiguity or other flaws. Most items which were poor discriminators were removed if the error within the item could not be identified or corrected. Items 46 on Form A of pilot 1 and 19, 28, 42, and 68 on form B of pilot 1 are examples of this process. Some items recording weak point-biserial correlations were retained, in spite of those weaknesses, with modifications made to improve the item. Foil A on item 16 pilot 2 recorded a positive P.B.S. of .02 and also contained a typographical error. This item was altered for inclusion on pilot 3 (13) and recorded good indices. The second

option of item 10 on pilot 3 recorded a positive P.B.S. of .03. However, since only 4 percent of the sample tested chose this response incorrectly, the foil was not changed.

In most cases, poor distractors were amended to attract more responses. As an example, distractor D on item 5, form B of pilot 1 attracted only .07% response. This foil was modified for pilot 2 (14) and attracted 16.5% of the responses.

In conclusion, because of the fundamentals of criterion-referenced test construction methods, some items on this test with poor item statistics were retained over items which were psychometrically more sound. The decision to retain or omit items was based on the value of the content, and the feasibility of correcting weaknesses.

#### Results of the Analysis--Psychometric and Subjective Assessment of Individual Items

A complete summary containing item difficulty levels and discriminatory values for each item on the three pilot tests, and subjective comments and suggestions is listed in appendix C. In situations where an item was removed the rationale for that removal is given.

As a result of the evaluation of the items from pilot test 1, 72 items were selected for pilot test 2. In order to maintain content validity, equal number of items, where possible, were allotted to each of the six content areas. Table 5 indicates the distribution of items for the second pilot test.

On the recommendation of the review panel the phrase 'I don't know' was included as a fifth option on all items. The purpose of this inclusion was to further reduce the possibility that students would guess the correct answer when they did not know it.

TABLE 5  
SUMMARY OF ITEM PERFORMANCES---PILOT TEST 1

Content Areas	Number of Items Pilot 1	Number of Items Omitted	Number of Items retained for Pilot 2
Movement principles	16	4	12
Rules, techniques, strategies	16	4	12
Fitness concepts	16	4	12
Body structures and functions	16	5	11
Effects of activity	16	4	12
Factors affecting participation	16	4	12

In preparation for pilot test 3 many items underwent minor modifications. Options such as 'all of the above' (pilot 2, item 64) were replaced, where possible, with more meaningful foils. Further, all items which contained diagrams were removed because the general quality of the diagrams was questionable and their interpretation confusing.

Since only 38 items from pilot test 2 were considered acceptable for inclusion on the third pilot it was necessary to construct ten new items. Prior to the administration of this pilot, the new items were critically evaluated by members of the Contract Team and the Learning Assessment Branch of the Ministry of Education. On the recommendation of these groups, nine of the new items were included. The new items which appeared on pilot test 3 are 12, 38, 39, psychological items 3, 4, 5, 6, 7, 8.

During the subjective assessment of the potential items for the third test, considerable discussion took place with respect to items dealing with the area of sport psychology. It was the opinion of the evaluators that such items contained more than one correct answer and for that reason, should be separated from the other items on the test form. As a result, all items in this category were removed from the body of the test and placed, with a separate set of instructions (see appendix B) at the end of the test.

Pilot test 3 therefore contained 47 items in total, 8 of which were assigned to the sport psychology classification. Table 6 indicates the allocation of items to each content area.

TABLE 6  
SUMMARY OF ITEM PERFORMANCES--PILOT TEST 2

Content Area	Number of Items Pilot 2	Number of Items Omitted	Number of Items Refined or Added for Pilot 3
Movement principles	11	5	7
Rules, techniques, strategies	13*	5	8
Fitness concepts	13*	7	8
Body structures and functions	12**	5	8
Effects of activity	12	7	8
Factors affecting participation	11*	6	8

\*1 item incorrectly classified during the item analysis

\*\*1 new item added

The 47 items from pilot test 3 were analysed once more by the LERTAP procedure. A summary of this final analysis is included in appendix C. All items which were new to this pilot proved to be psychometrically sound although most of the psychological items produced high p values.

Several items revealed very high percentages of responses to the 'I don't know' option. Twenty-six percent of the students chose this response on item 11. On psychology item 4, 23 percent indicated that they were unaware of the answer. Other such findings were: item 10--46%, item 26--27%, item 39, a new item on this pilot, 41%.

These extreme values for the 'I don't know' options would seem to indicate that a large number of students have not been exposed to the concepts expressed in these particular items.

Since all items on the third pilot test produced satisfactory item statistics, and had all received in-depth examination and review, these items remained intact and constituted the final form of the knowledge test. These items are presented in appendix E. The actual distribution of the final form items relative to the sub-test areas and cognitive domains of the table of specifications is given in Table 7.

#### Results of the Analysis--Psychometric and Subjective Assessment of Sub-Test and Total Test Data

As well as producing item analyses to aid in test construction, the LERTAP program also computes scores which reflect the overall performance and quality of the total test and its sub-components. Relative to an evaluation of test quality are indices for the mean, the reliability estimates and standard errors of measurement, as well as correlations between sub-test and total test scores.

In order to produce such values, each of the six content areas, as

TABLE 7

TABLE OF SPECIFICATIONS--DISTRIBUTION OF ITEMS--  
FINAL TEST FORM

Content Area	Knowledge	Understanding	Application	Total
Rules, techniques, and strategies of physical activity	5	1	2	8
Principles and mechanics of movement	3	2	2	7
Concepts and methods of fitness	4	3	1	8
Body structures and functions	5	3	0	8
The effects of physical activity	4	2	2	8
Factors affecting participation	5	2	1	8
Total	26	13	8	47

outlined in the original table of specifications, was treated as a sub-test in the LERTAP format. Table 8 illustrates the relevant statistics for each of the six sub-tests on each of the three pilot tests. Except for two sub-tests on pilot 3, 'movement principles' and 'factors affecting participation,' all of the content areas can be classified as being moderately difficult. The two sub-tests mentioned recorded means of approximately 70 percent. On all three pilot tests the 'concepts of fitness' sub-tests provided the lowest means (43%,38%,37%) of all sub-tests. Since pilots 1 and 2 contained several weak items which affected the sub-test means, the values produced on the third pilot give the most accurate reflection of test difficulty. The mean score for each total

TABLE 8

## SUB-TEST STATISTICS FOR PILOT TESTS 1,2,3

Sub-Test Content	Means			Standard Deviation		
	Pilot 1	Pilot 2	Pilot 3	Pilot 1	Pilot 2	Pilot 3
<u>Movement principles</u>						
16 items--pilot 1A	9.0	5.5	5.0	2.3	2.1	1.3
11 items--pilot 2	56%	50%	71%	14%	19%	20%
7 items--pilot 3						
<u>Rules, techniques, strategies</u>						
16 items--pilot 1B	7.1	6.2	4.3	2.2	2.6	1.6
12 items--pilot 2	43%	50%	50%	13%	21%	20%
8 items--pilot 3						
<u>Concepts of fitness</u>						
16 items--pilot 1A	6.8	4.6	3.3	2.2	2.1	1.5
13 items--pilot 2	43%	38%	37%	13%	16%	20%
8 items--pilot 3						
<u>Body structures and functions</u>						
16 items--pilot 1B	7.9	5.0	3.0	2.2	2.1	1.4
12 items--pilot 2	50%	41%	37%	13%	17%	17%
8 items--pilot 3						
<u>Effects of activity</u>						
16 items--pilot 1A	8.4	5.7	4.8	2.4	2.3	1.5
12 items--pilot 2	50%	41%	60%	15%	17%	18%
8 items--pilot 3						
<u>Factors affecting participation</u>						
16 items--pilot 1A	9.2	5.5	5.6	2.44	2.02	1.60
11 items--pilot 2	56%	45%	70%	15%	18%	20%
8 items--pilot 3						

N = pilot 1A 142  
       pilot 1B 141  
       pilot 2 133  
       pilot 3 250

test appears in Table 9. A mean of 26 (55%) on pilot test 3 is an indication that the total test is moderately difficult.

TABLE 9  
TOTAL TEST STATISTICS

Statistic	Pilot 1 Form A N=142	Pilot 1 Form B N=141	Pilot 2 N=133	Pilot 3 N=250
Number of items	48	48	72	47
High score	38	36	54	41
Low score	8	10	2	7
Mean	24.2 50%	24.4 50%	32.6 45%	26.0 55%
Standard deviation	5.7 12%	5.0 10%	9.9 13%	5.5 12%

Perhaps the most important measure for assessing the quality of a test is the estimate of the test's reliability. Reliability has been defined in many ways; it is "the consistency of evaluation results" (Gronlund, 1976:80), "the taste of the pie--the accuracy of the measures taken by the test" (Nelson, 1974:256), "the degree of consistency with which a test measures" (Stanley, 1972:71). Implicit in these definitions is the suggestion that a test may produce scores that are inaccurate because there may be errors within the test itself.

There are two main sources of error for most measurements. The greatest factor in producing measurement error is the sampling error. Sampling errors exist when the boundaries of content areas or objectives are unclear. It reflects how well the sample of test items selected are



representative of the total domain of items which could be used to assess any specific object or content area. An additional source of error for measurement instruments is created by the circumstances under which a test is written. Such factors as physical or mental fatigue, poor test environment, poor test instructions, and reading deficiencies can all contribute to possible sources of error.

A perfectly reliable test has a coefficient of +1.00, indicating an error-free test. A test that is completely unreliable has a coefficient of 0.00. According to Cronbach (1951:320), "if a test has sufficient internal consistency it is psychologically interpretable." Thus, in order for a test to be meaningful, it must be reliable. There are several variables which can affect the reliability of a test. One of these variables involves the length of the test. In general, the longer the test the higher the reliability. This is due to the fact that a longer test will provide a better sample of the particular domain being measured.

Also affecting a test's reliability is the spread of the obtained scores. Again, the larger the spread, the higher the estimate of reliability is likely to be. Errors of measurement have less influence on the relative position of individuals when the differences among those individuals are great. Since a spread of scores is an unimportant goal in criterion-referenced tests, reliability estimates will tend to be low because of the probability of homogeneous responses. Directly related to the distribution of scores and thus to reliability, is the difficulty level of items on the test. Because items of extreme levels of difficulty are retained on criterion-referenced tests, scores tend to polarize. Therefore, variability will be low and reliability estimates

affected.

The method used by the LERTAP program to compute the reliability estimate is the Hoyt analysis of variance routine (Hoyt, 1941). This procedure, which is similar to the Kuder-Richardson method (Kuder-Richardson, 1937) and Cronbach's alpha (Cronbach, 1951) is known as the internal consistency method. In a test that has perfect internal consistency each item measures, without error, exactly the same factor as every other item. In order to estimate the reliability of the measurement tool by the internal consistency method it is necessary to calculate the percentage of the obtained variance in the scores that may be regarded as true variance. Reliability then, is the ratio of true variance to total variance.

The reliability estimates for all sub-tests and total tests in this study are listed in Table 10. The relatively low values for the sub-tests in pilot 3 can be partially explained by the low numbers of items within each category and by the extreme difficulty levels of the various items (Stanley, 1972). Conversely, the reliability estimate of .85 for pilot test 2 reflects, to a degree, the large number of items in each sub-test and on the total test.

The reliability estimate for pilot test 3 is .71. This score is an indication that the test is suitable for evaluating programs and assessing groups (Nelson, 1974). Although there are low reliabilities within the sub-tests, they too are suitable for group evaluation and program assessment.

The reliability of a test is directly related to the correlations among the sub-tests. A summary of the sub-test and total test correlation of pilot 3 is provided in Table 11.

TABLE 10

## SUMMARY OF SUB-TEST AND TOTAL TEST RELIABILITY ESTIMATES

Content Areas	Pilot Test 1	Pilot Test 1	Pilot Test 2	Pilot Test 3
	Form A	Form B		
Movement principles	.44		.52	.32
Rules, techniques, strategies		.40	.60	.38
Concept of fitness	.47		.50	.42
Body structures and functions		.45	.47	.26
Effects of activity	.48		.54	.28
Factors affecting participation		.46	.42	.53
Total test reliabilities	.72	.64	.85	.71

TABLE 11

## CORRELATION MATRIX FOR PILOT TEST 3

Sub-Test Areas	Movement Principles	Rules, techn- niques & strategies	Concepts of fitness	Body struc- tures & functions	Effects of activity	Factors affecting participation	Total test
Movement principles	1.00	0.27	0.19	0.15	0.21	0.30	0.57
Rules, techniques, strategies	0.27	1.00	0.26	0.10	0.28	0.24	0.61
Concepts of fitness	0.19	0.26	1.00	0.14	0.30	0.28	0.61
Body structure and functions	0.15	0.10	0.14	1.00	0.24	0.15	0.48
Effects of activity	0.21	0.28	0.30	0.24	1.00	0.39	0.67
Factors affecting participation	0.30	0.24	0.28	0.15	0.39	1.00	0.66
Total test	0.57	0.61	0.61	0.48	0.67	0.66	1.00

All correlations with the total test are reasonably high. The sub-test which correlates to the greatest degree with the total test is 'effects of activity' recording a value of .67. The sub-test 'body structures and functions' has the lowest correlation with the total test (.48) and it also correlates minimally with all other sub-tests. This content area could be considered to be most directly related to health education concepts and as such, it contains items that make little if any inference to physical education and activity. Perhaps for this reason, it does not correlate well with the other areas. Further, the sub-tests of 'effects of activity' and 'factors affecting participation' provided higher correlations than any other sub-tests.

While reliability estimates provide an important and necessary measure for the assessment of test quality, the validity of a test is just as significant, if not more so. And while good reliability is necessary in order to produce a valid test, it is no guarantee of validity and steps must be taken to ensure that the test is measuring what it is intended to measure. Stanley and Hopkins (1972:101) state that "regardless of all other merits of a test, if the test lacks validity, for a particular purpose, the information provided is useless."

In measurement theory there are several types of validity. One of these, known as content validity, is of primary consideration in criterion-referenced testing. If it can be demonstrated that the behaviours performed in testing constitute a representative sample of the behaviours specified by the objectives, a test can be considered valid (Taylor, 1978). In other words, all items on this knowledge test should measure one or more of the learning outcomes and the total should represent an appropriate sample of all of the outcomes on which the test is based.

It is necessary when discussing and assessing content validity to make a distinction between that concept and the concept of 'educational importance.' According to Safrit (1973:97), "the educational importance of a test is being determined when judgements are being made about the description of the universe or the suitability of the test items." Content validity, the concept under consideration here, reflects how well the items adequately sample the domain under investigation.

Unfortunately, the assessment of content validity is not a simple matter and there are no statistical procedures available to assess that aspect of a test's quality. The principle of expressing validity as a correlation coefficient applies only to criterion-related or predictive validity (not relevant in this situation) and therefore, the interpretation and assessment of content validity must be qualitative instead of quantitative.

The procedures involved in estimating content validity by a qualitative or logical interpretation involve the opinion and judgements of professionals in the field and the test constructor who ascertain the validity of the test. However, steps taken during the construction of the test can help ensure that the test is valid.

Stanley and Hopkins (1972:102) list three considerations that test reviewers should be aware of in assessing content validity:

- (1) the degree to which the content of the test items overlaps the content of the subject matter being measured.
- (2) the degree of concordance between the content emphasis of the test and the content emphasis of the instruction.
- (3) the degree to which test items are free from factors which are irrelevant or incidental to the measurement (e.g., reading and vocabulary factors).

This knowledge test can be said to possess content validity because of the qualitative evaluation of items that was provided by experts in the

field and because of the specific methods used in the test's development: (i) the learning outcomes to be assessed were clearly identified and stated; (ii) in constructing the table of specifications, equal numbers of items were allocated to each content area; (iii) at each review session the evaluators carefully examined each item with regard to its relevancy for grade 11 physical education students and its relation to the behaviours suggested by the objectives; and (iv) items which were not considered suitable for grade 11 students or which did not reflect the specified behaviours, were omitted.

### Interpreting the Test Results

One of the purposes of criterion-referenced testing is to distinguish between those students who have mastered the content being sampled by a test and those who have not. In order to make such a distinction, it is necessary to specify the performance standards, or criterion behaviours, which the students who are considered successful are expected to attain. The identification of such standards is one of the most difficult and controversial aspects of criterion-referenced testing.

Many theories have been put forward regarding the establishment of standards for assessing criterion-referenced test results and although opinions vary, most experts agree that the procedures involved in the setting of standards require judgement and evaluation by professionals.

In the assessment of this knowledge test, the results of the test were presented to provincially representative panels of educators and informed members of the public for the purpose of judging strengths or weaknesses in particular objective or sub-test areas. Four separate panels, a preliminary panel and three interpretation panels, were required to complete the analysis.

The preliminary panel was represented by individuals expert in measurement, growth and development, curriculum content, and instructional practices in physical education. The task of this panel was to establish standards indicative of 'minimally acceptable' performances. Performances falling below the acceptable range were considered a weakness, while those above the acceptable range were identified as a strength.

Once these standards had been established, a 15-member panel was convened by the Ministry of Education. This panel was composed of teachers, supervisors, teacher educators, trustees, and members of the public who considered the results of the test and rated the performances on each item and sub-test on a 5-point scale (weak, marginally satisfactory, satisfactory, very satisfactory, and strong) based upon the percentage of students who had answered each item correctly.

While the above procedures no doubt provide a comprehensive and accurate evaluation of the test results, they are time consuming, and somewhat impractical for most classroom teachers who do not have the resources, the time, or the personnel required to assess their test results in this manner. Fortunately, there are more simplified methods available which classroom teachers can use in order to set standards and thus interpret test results.

One such method involves the establishment of 'minimally acceptable performance levels' (Taylor, 1978) as set by groups of teachers or other qualified personnel. Each teacher is given a copy of the test and asked to individually estimate, for each question, how many of 100 minimally competent students would answer that question correctly. This figure is expressed as a percentage or a probability. The easier the question, the higher the figure will be. Since the items on this test are multiple-

choice, the percentage or probability should never be lower than .25, the chance of guessing the correct answer by luck (Taylor, 1968:43).

Once the panel of teacher judges have individually established percentages for each item, the results are then announced to the group. Teachers who have given the most extreme scores are asked to give their reason for such decisions but any changes that are made are optional.

In order to establish the standard for the test, each teacher calculates their total percentage by adding the set values for each item. The average of these totals is the standard or criterion level which can be expressed as a single cut-off score or which can be expanded to include a range of scores. Once minimal competency levels have been identified, the panel of judges must decide the percentage of students who should score above that level. Utilizing these standards, teachers can identify strengths and weaknesses within their programs and, with caution, within their students.

It is important to note that with respect to this particular knowledge test, decisions regarding individual performance should only be made in situations where the test is administered in its entirety. The six sub-tests which make up the total test should not be used individually to identify strengths and weaknesses in particular students. However, teachers who are interested in evaluating the performance of their classes or the success of their programs with respect to a specific sub-test content area can use this instrument with confidence if the content of their programs is reflected by the learning outcomes described earlier in this study.



## CHAPTER V

### SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

The purpose of this study was to design a criterion-referenced physical education knowledge test that would be suitable for program assessment and group evaluation at the grade eleven high school level. The cognitive domains to be evaluated were based on goals and specific learning outcomes which had been formulated by the Contract Team and Advisory Panel of the Learning Assessment Branch of the Ministry of Education in British Columbia. From these goals and learning outcomes, six content areas were developed and these areas formed the framework for the construction of test items.

In accordance with the recommended procedures for constructing objective tests, a table of specifications was designed to indicate the proposed allotment of items for each content area. Since it was the purpose of this test to discover what knowledge students did or did not have with respect to each of the six areas, equal numbers of items were projected for each category.

To prepare an initial pilot test form, 108 multiple-choice test items, based on a similar number of statements of information, were presented to the Contract Team for approval. As a result of this review process, 96 items (16 for each content area) were accepted for inclusion on pilot test 1.

In order to facilitate the administration of this pilot test, two test forms, each containing 48 items, were used. Each form included

all of the items from three of the six content areas. This test was administered to seven grade 11 classes in British Columbia.

Following the administration of the test, all items were analysed using the Laboratory of Educational Research Test Analysis computer program so that the psychometric performance of each item could be identified. In addition, item quality was assessed by a panel of experts in order to appraise content validity and the appropriateness of item content.

The psychometric and subjective evaluation of pilot test 1 produced 72 suitable items for inclusion on the next pilot test. Each of the six content, or sub-test areas, was represented by approximately eleven items on the second pilot test form which was presented to seven grade 11 classes in the greater Vancouver region.

The responses to pilot test 2 were again statistically analysed and were reviewed extensively by the Contract Team, Advisory Panel, and other interested high school educators. From this evaluation, 38 items from the second pilot test were considered acceptable for the third test form.

In order to maintain content validity and to ensure an adequate number of items for each sub-test, ten new items were constructed and subsequently reviewed by members of the Contract Team and the Learning Assessment Branch of the Ministry of Education. As a result of this appraisal, nine new items were included in pilot test 3.

The review panel also recommended that because of the unique nature of the items which relate to knowledges and understandings in sport psychology, these items should be removed from the test and grouped together at the conclusion of pilot test 3. The third pilot test was

administered to approximately 800 grade 11 students from various parts of British Columbia. A random sample of the responses of 250 of these students was used to assess the performance of the items and the general quality of the third test form utilizing the LERTAP program.

Since the performance of all items was considered to be satisfactory, the items from pilot 3 remained intact, and the final form was produced using these items. On the final form, which contained 47 items, each of the 6 content areas except one was represented by 8 items. Utilizing the Hoyt method of analysis of variance routine, the reliabilities for all sub-tests and for the total test were estimated. The reliability estimate for the final form was .71. This value provided an indication that the test was a satisfactory one and could be utilized therefore, for its intended purpose.

As a result of this study, the following conclusions can be drawn:

1. A criterion-referenced knowledge test which assesses knowledge and understanding in physical education has been constructed.
2. The knowledge test can be utilized to an additional method for evaluating progress and programs in grade eleven physical education.
3. The test is considered to be reliable (+.71) and both the total test and the six sub-tests can be used with confidence in assessing group performance and evaluating programs.
4. If the test is administered in its entirety, and used with caution, it can serve to evaluate and diagnose individual strengths and weaknesses. Because of the relatively low reliabilities within the sub-tests, they should not be used alone for such purposes.
5. Due to the methods employed in the construction of the test and the qualitative analysis provided by experts in the profession, the test

can be considered to possess content validity.

6. The knowledge test is considered to be moderately difficult. This difficulty is due in part to: (i) the innovative nature of the curriculum as expressed by the goals and learning outcomes, (ii) the inexperience of students in writing physical education tests.
7. Although the test is designed to assess the knowledge and understanding of grade 11 students in British Columbia, the wide range of objectives which are common to most physical education curricula make the test applicable to other programs if the distribution of content in those programs is in close agreement with the test specifications.

#### Recommendations

Because of the ever-increasing concern for the transmission of the body of knowledge fundamental to physical education and the apparent lack of suitable measurement tools to assess that knowledge, there is a striking need for further research of this type. Such research should be continued to develop tests to assess the acquisition of physical education at different stages of schooling and to improve the quality of assessment instruments.

Criterion-referenced tests, while not a panacea for all of the difficulties prevalent in educational evaluation, do provide one means of assessing individual or group competency relative to established criteria. In a discipline such as physical education, where the individual is deemed to be of paramount importance, this form of measurement tool would appear to be suitable.

Because criterion-referenced tests are more sensitive to instruction than traditional norm-referenced methods, they have greater potential for

identifying strengths and weaknesses within both individuals and programs. They could also serve, when used cautiously, as indicators of teacher effectiveness.

When the results of tests of any kind are used to make important decisions about individuals, such as teachers or students, it is vital to utilize as many sources of information and types of evaluation instruments as is possible. In situations where this test is to be used for placement or promotion, supplemental information should be obtained from other sources such as daily work performance, class assignments, and other assessment devices.

In order to stimulate further study into criterion-referenced evaluation in physical education, the following suggestions are provided:

1. Since the general body of knowledge in physical and health education is so large and varied, it is difficult to include items to cover all aspects of physical and health education on one test form. It would be advisable therefore, to limit the cognitive domains being assessed by any one test. This procedure would also allow a more precise definition of the objectives being measured and would provide an increase in the number of items designed to assess each specific objective.
2. In order to take full advantage of the expertise offered by the panel of experts, it is recommended that this group be encouraged to provide critical input at all stages of test development. In this manner, items which are considered unacceptable will be modified or discarded at the preliminary stages of test construction.
3. Items which relate to the area of sport psychology should be used with caution and may in fact have no place on a test where all

answers are either correct or incorrect. Although it has been suggested that such items do have a 'correct' or 'best' answer, that answer is specific to the individual and not to a defined body of knowledge.

4. Efforts should be made to produce a higher estimate of reliability within the sub-tests. This can be partially accomplished by defining the sub-test area more precisely, increasing the number of items in the sub-test, and ensuring that all items within that area are relevant to the concept being assessed.
5. Attempts should be made to construct items which assess the more complex levels of cognitions such as analysis, evaluation, and synthesis. Although objective type tests do not readily lend themselves to the assessment of these domains, as physical education knowledge testing becomes more common, the quality of items and the cognitions being tested will have to be improved and expanded.

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## APPENDIX A

Physical Education Learning Assessment  
Goals and Learning Outcomes

January 1979

Secondary LevelGoal I

THE SECONDARY PHYSICAL EDUCATION PROGRAM SHOULD ASSIST STUDENTS IN DEVELOPING EFFICIENT AND EFFECTIVE MOTOR SKILLS AND ENABLE THEM TO APPLY THESE SKILLS TO A VARIETY OF PHYSICAL ACTIVITIES.

Learning Outcomes

By the end of the secondary level physical education program, students should be able to demonstrate:

1. & 2. not specific learning outcomes of secondary program. Advanced proficiency developed by intermediate program.
3. an advanced level of proficiency in manipulative skills (projection and reception) such as throwing, catching, kicking, and striking, together with effective utilization of these skills in physical activities.
4. an advanced level of proficiency in motor abilities such as balance, hand-eye coordination, and agility, together with effective utilization of these abilities in physical activities.
5. an advanced level of proficiency in the use of space such as moving in different directions using forward, backward and sideward movements, together with effective utilization in physical activities.
6. a solution to a movement problem such as finding as many ways of crossing a box horse with or without contact, stressing symmetrical or asymmetrical use of the body.
7. an advanced level of proficiency in a variety of activities selected from individual, dual, and group activities in games, gymnastics, dance, aquatics, and outdoor pursuits.

GOAL II

THE SECONDARY PHYSICAL EDUCATION PROGRAM SHOULD ASSIST STUDENTS IN DEVELOPING KNOWLEDGE AND UNDERSTANDING OF FACTORS INVOLVED IN ATTAINING COMPETENCE IN AND APPRECIATION OF PHYSICAL ACTIVITY.

Learning Outcomes

By the end of the secondary level physical education program, students should be able to demonstrate:

1. an understanding of advanced rules, techniques, and strategies involved in physical activities.
2. an understanding of advanced movement principles such as combining quick and slow elements of time with the strong element of weight and the change of direction element of space to develop a successful spike in volleyball.
3. an understanding of advanced psychological factors related to physical activity such as the interaction between cooperative and competitive behavior.
4. an understanding of advanced physiological factors related to physical activity such as the effects of chronic exercise on cardiovascular function.
5. an understanding of advanced safety procedures relative to physical activity such as the relationship between strenuous training and individual body capabilities.

### GOAL III

THE SECONDARY PHYSICAL EDUCATION PROGRAM SHOULD ASSIST STUDENTS IN DEVELOPING AND MAINTAINING PHYSICAL FITNESS TOGETHER WITH AN AWARENESS OF THE METHODS NECESSARY FOR ITS ATTAINMENT.

#### Learning Outcomes

By the end of the secondary level physical education program, students should be able to demonstrate:

1. an appropriately high level of physical development in the specific fitness components of cardiovascular endurance, muscular endurance, strength, and flexibility.
2. an awareness of advanced methods necessary to achieve an appropriately high level of physical fitness such as the specificity of aerobic and anaerobic training.
3. the ability to assess and interpret personal physical fitness, utilizing appropriate measurement techniques and instruments in fitness components such as cardiovascular endurance, muscular strength, flexibility, and anthropometrical measures such as height, weight, girth and percent body fat.

### GOAL IV

THE SECONDARY PHYSICAL EDUCATION PROGRAM SHOULD ASSIST STUDENTS IN UNDERSTANDING THE STRUCTURES, FUNCTIONS, AND NEEDS OF THE HUMAN BODY RELATIVE TO PHYSICAL ACTIVITY.

### Learning Outcomes

By the end of the secondary level physical education program, students should be able to demonstrate:

1. an understanding of the relationship between advanced concepts relative to healthful nutrition such as the effects of salt and water depletion during exercise, and the role of physical activity as they interact to provide for healthful daily living.
2. the application of healthful eating habits.
3. an understanding of advanced concepts of body mechanics such as the use of the arms for increasing and decreasing speed of rotation in skills such as spinning in figure skating.
4. the application of advanced concepts of body mechanics.
5. an understanding of basic concepts related to the structure and function of the following body systems: digestive, muscular, skeletal, respiratory, nervous, circulatory and endocrine relative to physical activity; together with an understanding of the basic interrelationships between these systems.

### GOAL V

THE SECONDARY PHYSICAL EDUCATION PROGRAM SHOULD ASSIST STUDENTS IN DEVELOPING AND MAINTAINING A POSITIVE ATTITUDE TOWARDS PARTICIPATION IN PHYSICAL ACTIVITY.

### Learning Outcomes

By the end of the secondary level physical education program, students should be able to demonstrate:

1. a positive attitude toward physical activity as a social experience such as the need to follow basic rules of conduct relative to sportsmanship.
2. a positive attitude toward the value of physical activity as an aesthetic experience such as an appreciation of form and style as it applies to their personal movement patterns.
3. a positive attitude toward physical activity for health and fitness.
4. a positive attitude toward the development and lifetime maintenance of an appropriately high level of fitness.
5. a positive attitude toward the fact that the development of personal competence in physical activities can be a positive experience.
6. a positive attitude toward physical activity for the release of tension such as the sense of relaxation which follows strenuous exercise.

GOAL VI

THE SECONDARY PHYSICAL EDUCATION PROGRAM SHOULD ASSIST STUDENTS IN DEVELOPING POSITIVE PERSONAL ATTRIBUTES AND INTERPERSONAL RELATIONSHIPS THROUGH PHYSICAL ACTIVITY.

Learning Outcomes

By the end of the secondary level physical education program, students should be able to demonstrate:

1. a positive attitude toward one's unique physical ability.
2. a positive attitude toward the physical abilities of others.
3. responsibility for one's own behavior.
4. through a variety of opportunities responsibility in different leadership roles.

## APPENDIX B

TO: Teachers of Grade 11 Physical Education involved in P.E.L.A. Pilot Testing

Cognitive Test

The items in this test are based on the Goals and Learning Outcomes as established by the Physical Education Learning Assessment Team.

Its purpose is to assess the knowledge that students have acquired as a result of their physical education experiences.

You, the teacher, can provide valuable input which will help to improve this measuring instrument so that it can become an effective tool in evaluating cognitive knowledge in physical education.

It will be extremely helpful if you could go through the items in the test and make comments and suggestions where applicable. Any feedback that you can provide regarding the content matter of the questions, their difficulty, their construction or the concepts involved, will be welcomed.

Please keep in mind that some of your students are answering Form A of the questionnaire while others are answering Form B. Your comments on both forms would be appreciated.

Replies should be forwarded as soon as possible to:

Dr. R. Mosher

Thank you for your co-operation and assistance.

Instructions to Contract Team

Jan. 25, 1979

To: All members of the Contract Team

From: Gail Wilson

Content Validity Assessment--Grade 11 Cognitive Test

The purpose of this assessment is to investigate the items on the test in terms of Content Validity. At this stage of the test construction it is important to make sure that the test items reflect the content of the Goals and Learning Outcomes for secondary school physical education.

The questions are presently grouped according to the major headings on the Table of Specifications. If you have any comment to make on a specific item please be sure that you have numbered it correctly. Thank you for your time.

## Instructions to students--Pilot Test 1

## INSTRUCTIONS

There are several answer choices available for each question. Use a BLACK PENCIL to mark an × in the box which corresponds to your answer for each question. Mark only one box per question. If you have no idea of the correct answer, leave that question blank.

Do not begin until you are told to do so.

## Instructions to students--Pilot Test 2

## INSTRUCTIONS

There are several answer choices available for each question. Use a BLACK PENCIL to mark an × in the box which corresponds to your answer for each question. Mark only one box per question. If you have no idea of the correct answer, mark the box against "I don't know."

Do not begin until you are told to do so.



## Instructions--Pilot Test 3

This booklet contains a number of questions for you to answer. Your answers to these questions will tell us how much you know and understand about Physical Education. We will be asking these same questions of many other students in British Columbia. Your answers will help to improve the Physical Education program in the province.

Whenever we say *Physical Education*, we mean only the activities that you have in your regular Physical Education classes. This does not include organized games or activities which occur during recess, lunch time, or after school. Physical Education in your school may also be called *Gym* or *P.E.*

Please read each question carefully and choose one of the answers provided. Mark a ✓ in the box which corresponds to your answer for each question. Mark only one box per question. If you have no idea of the correct answer, mark a ✓ in the box next to the answer "I don't know."

If you have difficulty reading certain words, raise your hand and we will come and assist you.

## Instructions to students--Pilot Test 3--Sport Psychology Items

Here are eight more questions that we want you to answer. These questions are a little different from the ones you have already answered. We want to know what you think about these questions. Read each one carefully and mark the answer that says what you think is the *best* answer to each question.

## APPENDIX C

## Item Development--Pilots 1, 2, 3

Test No.	Item No.	Item Content
Pilot 1 Form A	1.	Physical activity is beneficial because it provides an opportunity to: *A. increase social contacts B. avoid reality C. show aggression towards others D. take advantage of others  <u>Analysis:</u> P 84.5; PBS .27; more than one correct answer; omit
Pilot 1 Form A	2.	What is the best method for developing muscle strength? A. Exercising with light weights for many repetitions B. Exercising with light weights for few repetitions *C. Exercising with a heavy weight for few repetitions D. Exercising with maximum weight for one repetition  <u>Analysis:</u> P 21.8; PBS .33; change foil A and order of foils; alter
Pilot 2	16.	What is the best method for developing muscle strength? A. Exercising with maximum weights for many repetitions B. Exercising with light weights for few repetitions *C. Exercising with a heavy weight for few repetitions D. Exercising with a maximum weight for one repetition E. I don't know  <u>Analysis:</u> P 28.6; PBS .30; foil A positive, PBS alter; alter
Pilot 3	13.	What is the best method for developing muscle strength? A. Exercising with light weights for many repetitions B. Exercising with light weights for a few repetitions *C. Exercising with heavy weights for a few repetitions D. Exercising with a maximum weight for one repetition E. I don't know  <u>Analysis:</u> P 14.0; PBS .30; retain as is
Pilot 1 Form A	3.	What is the best position for the arm to be in to absorb force? A. Elbow extended at the moment of contact B. Elbow higher than the force *C. Elbow flexed at the moment of contact D. Elbow lower than the force  <u>Analysis:</u> P 58.5; PBS .35; reword stem; alter

\*correct answer

Test No.	Item No.	Item Content
Pilot 2	41.	<p>What is the best position for the arms to be in to correctly catch an object thrown through the air in order to absorb force?</p> <p>A. Arms extended at the moment of contact</p> <p>B. Elbows held higher than the hands</p> <p>*C. Arms bent at the moment of contact</p> <p>D. Elbows spread away from the body</p> <p>E. I don't know</p> <p><u>Analysis:</u> P 45.1; PBS .52; foils weak--wording poor; omit</p>
Pilot 1 Form A	4.	<p>If physical activity is to have a beneficial effect on the cardiovascular system of a teenager, what is the minimum heart beat that must be reached?</p> <p>A. 70</p> <p>B. 90</p> <p>C. 110</p> <p>*D. 130</p> <p><u>Analysis:</u> P 9.9; PBS .17; very difficult but concept important--change all foils; alter</p>
Pilot 2	72.	<p>If physical activity is to have a beneficial effect on the heart and circulatory system, which of the following conditions must be met?</p> <p>A. The heart beat must not increase during activity</p> <p>*B. The heart beat must increase during activity</p> <p>C. The activity must be continuous, with no rest periods</p> <p>D. The body must not be 'warmed-up' prior to the activity</p> <p>E. I don't know</p> <p><u>Analysis:</u> P 29.3; PBS .34; foils C and D unclear; omit</p>
Pilot 1 Form A	5.	<p>Predict the flight of an object released at an angle of greater than 45 degrees.</p> <p>*A. Greater height than distance</p> <p>B. Equal height and distance</p> <p>C. Greater distance than height</p> <p>D. No prediction possible</p> <p><u>Analysis:</u> P 23.2; PBS .07; revise stem and foils; alter</p>

Test No.	Item No.	Item Content
Pilot 2	43.	What is the best angle for releasing a baseball in order to achieve the greatest distance? A. 30° *B. 45° C. 60° D. 90° E. I don't know  <u>Analysis:</u> P 39.8; PBS .38; vague foils--too general; omit
Pilot 1 Form A	6.	Physical activity will provide an outlet for the release of emotions most often if: A. you are allowed to say and do exactly what you wish *B. you choose the activity C. you play without rules D. you are very tense before the activity  <u>Analysis:</u> P 37.3; PBS .20; foil D attracts most students; alter
Pilot 2	36.	Physical activity will provide an outlet for the release of emotions most often if: A. you are allowed to say exactly what you wish *B. you choose the activity C. you play without rules D. you are allowed to do exactly what you wish E. I don't know  <u>Analysis:</u> P 51.9; PBS .39; correct answer depends on the individual; omit
Pilot 1 Form A	7.	When striking an object with an implement (for example, in tennis, badminton, golf, or baseball), it is most efficient if the weight is transferred from the back foot to the front foot. Why? A. Transfer of weight provides better balance B. Transfer of weight gives more control of direction C. Transfer of weight improves the timing *D. Transfer of weight causes an increase in power  <u>Analysis:</u> P 71.1; PBS .43; change foil C--poor distractor; alter
Pilot 2	51.	When striking an object with an implement (for example, in tennis, badminton, golf, or baseball) it is most efficient if the body weight is transferred from the back foot to the front foot. Why? A. Transfer of weight provides better balance B. Transfer of weight gives more control of direction

Test No.	Item No.	Item Content
		C. Transfer of weight helps to avoid injury *D. Transfer of weight causes an increase in power E. I don't know <u>Analysis:</u> P 65.4; PBS .47; retain concept--alter wording; alter
Pilot 3	27.	When striking an object with an implement (for example, hitting a ball with a bat or racquet), it is most efficient if: A. you contact the ball slightly behind your back foot B. you keep your weight evenly distributed throughout the swing C. you transfer your weight from your front foot to your back foot *D. you transfer your weight from your back foot to your front foot E. I don't know <u>Analysis:</u> P 68.4; PBS .51; retain as is
Pilot 1 Form A	8.	Why is there an increase in the breathing rate during exercise? A. Excessive carbon dioxide must be released to the air B. Muscle tissue requires more oxygen C. The heart needs more oxygen in order to pump faster *D. All of the above <u>Analysis:</u> P. 55.6; PBS .27; foil D poor; item good; retain as is
Pilot 2	42.	Why is there an increase in the breathing rate during exercise? A. Excessive carbon dioxide must be released to the air B. Muscle tissue requires more oxygen C. The heart needs more oxygen in order to pump faster *D. All of the above E. I don't know <u>Analysis:</u> P 16.5; PBS .06; foils A,B,C, positive PBS; omit
Pilot 1 Form A	9.	If a person is attempting to improve their physical condition how often should they exercise? A. After heavy meals *B. Regularly C. As soon as they detect an increase in weight D. Whenever they feel the necessity <u>Analysis:</u> P 98.6; PBS .23; too obvious--poor question; omit

Test No.	Item No.	Item Content
Pilot 1 Form A	10.	Which of the following diseases can be partially attributed to sedentary lifestyles? A. Coronary heart disease B. High blood pressure C. Obesity *D. All of the above
<u>Analysis:</u> P 65.5; PBS. 52; foil D poor; item good; retain as is		
Pilot 2	18.	Which of the following conditions can be partially attributed to sedentary (inactive) lifestyles? A. Coronary heart disease B. High blood pressure C. Obesity *D. All of the above E. I don't know
<u>Analysis:</u> P 71.4; PBS .46; foils A and D unclear; omit		
Pilot 1 Form A	11.	Which position will best allow for a quick stop after a sudden burst of speed? A. Feet together, centre of gravity low B. Feet apart, centre of gravity high *C. Feet apart, centre of gravity low D. Feet apart, centre of gravity high
<u>Analysis:</u> P 66.2; PBS .33; typing error foils B and D; retain as is		
Pilot 2	31.	Which body position will best allow for a quick stop after a sudden burst of speed? A. Feet together, centre of gravity low B. Feet apart, centre of gravity high *C. Feet apart, centre of gravity low D. Feet together, centre of gravity high E. I don't know
<u>Analysis:</u> P 57.9; PBS .55; remove complex terminology "centre of gravity"; alter		
Pilot 3	7.	Which body position will allow for the most efficient stop after a sudden burst of speed? A. Feet together, knees bent B. Feet together, legs straight C. Feet apart, legs straight *D. Feet apart, knees bent E. I don't know
<u>Analysis:</u> P 66.8; PBS .38; retain as is		

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Test No.	Item No.	Item Content
Pilot 1 Form A	12.	In terms of building general fitness the average person should be most concerned with developing: A. strength B. anaerobic power *C. aerobic power D. skilled running patterns  <u>Analysis:</u> P 31.7; PBS .50; foil A--strong distractor, change foil A; alter
Pilot 2	20.	In terms of building general fitness, the average person should be most concerned with developing: A. flexibility B. anaerobic power *C. aerobic power D. skilled running patterns E. I don't know  <u>Analysis:</u> P 23.3; PBS .40; foil A still attracting most--use concept from pilot 1; alter
Pilot 3	19.	In terms of building long term fitness, the average person should be most concerned with developing their: A. muscular system *B. aerobic energy system C. anaerobic energy system D. skilled running patterns E. I don't know  <u>Analysis:</u> P 30.8; PBS .57; retain as is
Pilot 1 Form A	13.	Which one of the following statements does <u>not</u> describe good running technique? A. Lean slightly forward B. Swing the arms back and forth *C. Land on the soles of the feet D. Bend the elbows  <u>Analysis:</u> P 69.7; PBS .28; change foil D--poor distractor; alter
Pilot 2	1.	Which of the following statements does <u>not</u> describe good running technique? A. Lean slightly forward B. Swing the arms back and forth *C. Land on the soles of the feet D. Reduce trunk rotation E. I don't know  <u>Analysis:</u> P 54.9; PBS .51; foils vague--modify foils slightly; alter

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Test No.	Item No.	Item Content
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Pilot 3	1.	What should you do when you run? A. Lean slightly backwards *B. Move the arms alternately backwards and forwards C. Land on the heels of the feet D. Increase trunk rotation E. I don't know
<u>Analysis:</u> P 78.0; PBS .39; retain as is		

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Pilot 1 Form A	14.	Toe-touching is an exercise to improve: A. strength B. power *C. flexibility D. co-ordination
<u>Analysis:</u> P 94.4; PBS .23; too obvious; omit		

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Pilot 1 Form A	15.	As a result of extensive physical activity, muscle fuel will eventually be used up and waste products will accumulate. The muscle is then in a state of: A. sensitivity *B. fatigue C. irritability D. extension
<u>Analysis:</u> P. 57.7; PBS .47; good item; retain as is		

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Pilot 2	44.	As a result of extensive physical activity, muscle fuel will be used up and waste products will accumulate. The muscle is then in a state of: A. sensitivity *B. fatigue C. irritability D. extension E. I don't know
<u>Analysis:</u> P 50.4; PBS .65; retain as is		

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Pilot 3	36.	As a result of intensive physical activity, energy will be used up and waste products will accumulate. The muscles are then in a state of: A. sensitivity *B. fatigue C. irritability D. extension E. I don't know
<u>Analysis:</u> P 47.6; PBS .41; retain as is		

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Test No.	Item No.	Item Content
Pilot 1 Form A	16.	Which of the following tests is <u>not</u> used to measure cardiovascular endurance? A. 12 Minute Run B. Astrand Bicycle Test *C. The Sit-up Test D. The Step Test  <u>Analysis:</u> P 37.3; PBS .51; difficult but concept important; retain as is
Pilot 2	10.	Which of the following tests is <u>not</u> used to measure cardiovascular endurance? A. 12 Minute Run B. Astrand Bicycle Test *C. The Sit-up Test D. The Step Test E. I don't know  <u>Analysis:</u> P 50.4; PBS .44; clarify foil B; alter
Pilot 3	37.	Which of the following tests is <u>not</u> used to measure cardiovascular endurance? A. 12 Minute Run B. Stationary Bicycle Test *C. The Sit-up Test D. The Step Test E. I don't know  <u>Analysis:</u> P 44.8; PBS .56; retain as is
Pilot 1 Form A	17.	What happens to the heart beat immediately after intense activity? A. It is slower than during rest *B. It is faster than during rest C. It is more irregular than during rest D. It is no different than during rest  <u>Analysis:</u> P 89.4; PBS .25; concept too easy for this level; omit
Pilot 1 Form A	18.	Where should the non-kicking foot be placed in order to correctly kick a ball along the ground? A. Ahead of the ball *B. Beside the ball C. Behind the ball D. Well away from the ball  <u>Analysis:</u> P 62.7; PBS .32; change foil C,D,--poor distractors; alter

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Test No.	Item No.	Item Content
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Pilot 2	22.	Where should the non-kicking foot be placed in order to correctly kick a ball forward along the ground? A. Ahead of the ball *B. Beside the ball (even with the ball) C. Directly behind the ball D. Behind the ball and to the side E. I don't know
		<u>Analysis:</u> P 41.4; PBS .29; too situation specific; omit

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Pilot 1 Form A	19.	If your class has started a weight training and conditioning program which of the following outcomes might be expected? A. The females in the class will develop bulging muscles B. The number of voluntary muscles in the body will increase *C. The muscles in the body will become stronger D. The number of muscle fibres in each muscle will increase
		<u>Analysis:</u> P 58.5; PBS .45; foil A weak; alter

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Pilot 2	67.	If your class has started a weight training and conditioning program which of the following outcomes might be expected? A. The girls in the class will develop large muscles B. The number of voluntary muscles in the body will increase *C. The muscles in the body will become stronger D. The number of muscle fibres in each muscle will increase E. I don't know
		<u>Analysis:</u> P 60.9; PBS .41; remove gender connotations; alter

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Pilot 3	23.	If your class has started a weight training and conditioning program, which of the following results might be expected? A. The girls and boys in the class will develop large, bulky muscles B. The number of muscles in the body will increase *C. The muscles in the body will become stronger D. The number of muscle fibres in each muscle will increase E. I don't know
		<u>Analysis:</u> P. 70.8; PBS .36; retain as is

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Test No.	Item No.	Item Content
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Pilot 1 Form A	20.	<p>Fatigue that occurs during exercise is most often caused by:</p> <ul style="list-style-type: none"> <li>A. muscle cramps</li> <li>B. inadequate food prior to exercise</li> <li>C. insufficient sleep</li> <li>*D. a build-up of waste products</li> </ul> <p><u>Analysis:</u> P 45.1; PBS .45; somewhat difficult; concept important; retain as is</p>
Pilot 2	35.	<p>Fatigue that occurs during exercise is most often caused by:</p> <ul style="list-style-type: none"> <li>A. muscle cramps</li> <li>B. inadequate food prior to exercise</li> <li>C. insufficient sleep</li> <li>*D. a build-up of waste products</li> <li>E. I don't know</li> </ul> <p><u>Analysis:</u> P 18.0; PBS .37; poor discriminator--more than one correct answer; omit</p>

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Pilot 1 Form A	21.	<p>What is the purpose of the approach in high jump, vaulting, or in the volleyball spike?</p> <ul style="list-style-type: none"> <li>A. To allow time for mental preparation</li> <li>B. To assure that the jump is taken from the correct foot</li> <li>*C. To build up power</li> <li>D. To allow the heart and lungs time to reach peak efficiency</li> </ul> <p><u>Analysis:</u> P 62.0; PBS .42; good item; retain as is</p>
Pilot 2	12.	<p>What is the purpose of the approach in high jump, vaulting, or in the volleyball spike?</p> <ul style="list-style-type: none"> <li>A. To allow time for mental preparation</li> <li>B. To assure that the jump is taken from the correct foot</li> <li>*C. To build up power</li> <li>D. To allow the heart and lungs to reach peak efficiency</li> <li>E. I don't know</li> </ul> <p><u>Analysis:</u> P 64.7; PBS .44; foil D weak, change in foil D, alter stem; alter</p>

Test No.	Item No.	Item Content
Pilot 3	2.	What is the main purpose of the approach run in high jumping or pole vaulting? A. It allows time for mental preparation B. It ensures that the jump is taken from the correct foot *C. It develops momentum D. It establishes good balance E. I don't know
<u>Analysis:</u> P 71.6; PBS .49; retain as is		
Pilot 1 Form A	22.	Physical Work Capacity is best estimated by measuring: A. the amount of work that can be done before fatigue occurs *B. the maximum oxygen consumption rate C. the maximum breathing rate during exercise D. the maximum attainable heart rate during exercise
<u>Analysis:</u> P 12.0; PBS .26; too complex for this level; omit		
Pilot 1 Form A	23.	If you apply force to the ground or floor but find that you slip, what is missing? A. Weight B. Movement *C. Friction D. Balance
<u>Analysis:</u> P 47.9; PBS .47; reword foils A,B; alter		
Pilot 2	17.	If you press your feet to the ground but find that you slip, what is missing? A. Force B. Resistance *C. Friction D. Balance E. I don't know
<u>Analysis:</u> P 36.1; PBS .36; vocabulary item; omit		
Pilot 1 Form A	24.	Which of the following benefits can <u>not</u> be attributed to regular physical activity? *A. An immunity to bacterial infections B. An aid in relieving depression C. A method to delay the ageing process D. An aid in keeping the digestive system regular
<u>Analysis:</u> P 50.7; PBS .40; good item; retain as is		

Test No.	Item No.	Item Content
Pilot 2	56.	Which of the following benefits can <u>not</u> be attributed to regular physical activity? *A. An immunity to bacterial infection B. An aid in relieving depression C. A method to delay the effects of ageing D. An aid in keeping the digestive system regular <u>Analysis:</u> P 42.1; PBS .51; foils B,C--positive PBS,--weak item; not in stem; omit
Pilot 1 Form A	25.	When receiving an object that is coming toward you with great speed what is the best position for the feet to be in? *A. One well ahead of the other facing the throw B. One slightly ahead of the other facing the throw C. Side by side and wide apart D. Side by side and close together <u>Analysis:</u> P 26.8; PBS .25; poorly worded; omit
Pilot 1 Form A	26.	Which of the following statements describes an efficient circulatory system? A. A pulse that increases rapidly during exercise *B. A pulse that returns quickly to normal after exercise C. A pulse that returns slowly to normal after exercise D. Both A and C are correct <u>Analysis:</u> P 50.0; PBS .39; foil D poor but concept and item good; retain as is
Pilot 2	50.	Which of the following statements describes an efficient circulatory system? A. A pulse that increases rapidly during exercise *B. A pulse that returns quickly to normal after exercise C. A pulse that returns slowly to normal after exercise D. Both A and C are correct E. I don't know <u>Analysis:</u> P 57.9; PBS .39; alter foil D; alter
Pilot 3	24.	Which of the following statements describes an efficient circulatory system?

Test No.	Item No.	Item Content
		A. A pulse that increases rapidly during exercise *B. A pulse that returns quickly to normal after exercise C. A pulse that returns slowly to normal after exercise D. A pulse that is high all the time E. I don't know
		<u>Analysis:</u> P 68.4; PBS .48; retain as is
Pilot 1 Form A	27.	Which of the following exercises utilizes anaerobic energy? A. 10 sit-ups B. A 3-mile run C. A 200-metre swim *D. A 50-metre sprint
		<u>Analysis:</u> P 18.3; PBS .31; poor distractors--change to clarify concept, alter
Pilot 2	29.	Which of the following exercises relies mainly on anaerobic energy? A. A 200-metre swim B. A 3-mile run C. A marathon run *D. A 25-metre sprint E. I don't know
		<u>Analysis:</u> P 16.5; PBS .41; change all terms to metric--emphasize differences; alter
Pilot 3	10.	Which of the following activities relies mainly on anaerobic energy? A. A 400-metre swim B. A 5000-metre run C. A marathon run *D. A 60-metre sprint E. I don't know
		<u>Analysis:</u> P 20.4; PBS .39; retain as is
Pilot 1 Form A	28.	If the breathing rates of trained and untrained athletes were compared during exercise, what would be the result? A. The untrained athlete would breathe deeper and slower

Test No.	Item No.	Item Content
		B. The trained athlete would breathe deeper and faster C. The untrained athlete would breathe deeper and faster *D. The trained athlete would breathe deeper and slower <u>Analysis:</u> P 54.9; PBS .40; good item--foil A weak; retain as is
Pilot 2	65.	If the breathing rates of trained and untrained athletes were compared during exercise, what would be the result? A. The untrained athlete would breathe deeper and slower B. The trained athlete would breathe deeper and faster C. The untrained athlete would breathe deeper and faster *D. The trained athlete would breathe deeper and slower E. I don't know <u>Analysis:</u> P 52.6; PBS .62; minor wording modifications; alter
Pilot 3	22.	If the breathing rates of trained and untrained individuals were compared during a long run, what would be the result? A. The untrained athlete would breathe shallower and slower B. The trained athlete would breathe shallower and faster C. The untrained athlete would breathe deeper and faster *D. The trained athlete would breathe deeper and slower E. I don't know <u>Analysis:</u> P 50.4; PBS .47; retain as is
Pilot 1 Form A	29.	If a person is attempting to jump as high as possible, which of the following techniques will increase the height of the jump? A. Reach up as high as possible with the arms prior to leaving the floor B. Lean forward with the trunk after leaving the floor *C. Bend the knees prior to leaving the floor D. Both A and C are correct <u>Analysis:</u> P 25.4; PBS .30; change foil D; alter

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Test No.	Item No.	Item Content
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Pilot 2	25.	<p>If a person is attempting to jump as high as possible, which of the following techniques will increase the height of the jump?</p> <p>A. Reach up as high as possible with the arms prior to leaving the floor</p> <p>B. Lean forward with the trunk after leaving the floor</p> <p>*C. Bend the knees prior to leaving the floor</p> <p>D. Bend the knees after leaving the floor</p> <p>E. I don't know</p> <p><u>Analysis:</u> P 56.4; PBS .39; foil A misleading; alter</p>
Pilot 3	14.	<p>If a person is attempting to jump as high as possible, which of the following techniques will increase the height of the jump?</p> <p>A. Keep the arms beside the body when leaving the floor</p> <p>B. Lean forward with the trunk after leaving the floor</p> <p>*C. Bend the knees before leaving the floor</p> <p>D. Bend the knees after leaving the floor</p> <p>E. I don't know</p> <p><u>Analysis:</u> P 68.0; PBS .44; retain as is</p>

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Pilot 1 Form A	30.	<p>Exercises which involve a change in the length of a muscle are classified as:</p> <p>*A. isotonic</p> <p>B. static</p> <p>C. adaptive</p> <p>D. isometric</p> <p><u>Analysis:</u> P 23.2; PBS .22; vocabulary item--retain concept and reword stem and foils; alter</p>
Pilot 2	47.	<p>Isotonic exercises are exercises which:</p> <p>A. cause an increase in the number of muscle fibres</p> <p>B. cause a decrease in the number of muscle fibres</p> <p>*C. cause a change in the length of a muscle</p> <p>D. cause an increase in tension within a muscle</p> <p>E. I don't know</p> <p><u>Analysis:</u> P 9.8; PBS .32; poor psychometrically, concept above grade 11 content; omit</p>

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Test No.	Item No.	Item Content
Pilot 1 Form A	31.	<p>If you were learning to play badminton, which method would be most effective?</p> <ul style="list-style-type: none"> <li>*A. Learn the large, general movement pattern first</li> <li>B. Learn the small, specific patterns first</li> <li>C. Learn the entire sequences of movement at the same time</li> <li>D. Take part in a game and perfect skills as it becomes necessary</li> </ul> <p><u>Analysis:</u> P 36.6; PBS .29; change foil C--poor distractor; alter</p>
Pilot 2	68.	<p>If you were learning to play tennis, which method would be most effective?</p> <ul style="list-style-type: none"> <li>*A. Learn the large, general movement pattern first</li> <li>B. Learn the small, specific movement patterns first</li> <li>C. Practice alone as often as possible</li> <li>D. Take part in a game and perfect skills as you need them</li> <li>E. I don't know</li> </ul> <p><u>Analysis:</u> P 1.5; PBS -.06; concept not relevant to curricular content--item very poor psychometrically; omit</p>
Pilot 1 Form A	32.	<p>Which of the following methods is most accurate for locating and assessing the pulse?</p> <ul style="list-style-type: none"> <li>A. While exercising, press the palm against the heart</li> <li>*B. After exercising, press two fingers against the side of the neck</li> <li>C. After exercising, press one hand against the heart and the other against the neck</li> <li>D. While exercising, keep the fingers of one hand on the wrist of the other arm</li> </ul> <p><u>Analysis:</u> P 69.7; PBS .33; foil C poor distractor---alter; alter</p>
Pilot 2	52.	<p>Which of the following methods is most accurate for locating and assessing the pulse?</p> <ul style="list-style-type: none"> <li>A. During activity, press two fingers against the heart</li> <li>*B. After activity, press two fingers against the side of the neck</li> <li>C. After activity press the thumb against the heart</li> <li>D. After activity keep the thumb of one hand on the wrist of the other arm</li> <li>E. I don't know</li> </ul> <p><u>Analysis:</u> P 84.2; PBS .36; reword foil A; poor distractor; alter</p>

Test No.	Item No.	Item Content
Pilot 3	31.	Which of the following methods is most accurate for locating and recording the pulse? A. During activity, keep the thumb of one hand on the wrist of the other arm *B. After activity, press two fingers against the side of the neck C. During activity press two fingers against the side of the neck D. After activity, keep the thumb of one hand on the wrist of the other arm E. I don't know
<u>Analysis:</u> P 71.2; PBS .53; retain as is		
Pilot 1 Form A	33.	Why does regular participation in an activity usually lead to better skill performance? A. Through practice muscles learn to contract automatically *B. Repetition reinforces the correct nerve responses C. The longer you practice the more relaxed you become D. Practice makes perfect
<u>Analysis:</u> P 15.15; PBS .33; poor item--too nebulous--"usually" content not suitable; omit		
Pilot 1 Form A	34.	Persons who possess good flexibility are less likely to injure muscles and joints because: A. they have a large range of mobility around their joints B. unstretched muscles become sore when exerted C. stretched muscles have greater elasticity *D. all of the above
<u>Analysis:</u> P 51.4; PBS .40; foil B poor; retain as is		
Pilot 2	61.	Persons who possess good flexibility are less likely to injure muscles and joints because: A. they have a large range of mobility around their joints B. unstretched muscles become sore when exerted C. stretched muscles have greater elasticity *D. All of the above E. I don't know
<u>Analysis:</u> P 31.6; PBS .47; all answers correct!--weak item; omit		

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Test No.	Item No.	Item Content
Pilot 1 Form A	35.	Which of the following statements best describes the role of regular physical activity in preparation for future life? A. It prepares students for interschool teams B. It provides a needed break in the day *C. It provides for the constructive use of leisure time D. It prepares students for a profession in athletics
		<u>Analysis:</u> P 64.1; PBS .28; foil B weak; alter

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Pilot 2	21.	Which of the following statements best describes the role of regular physical activity in preparation for future life? A. It prepares students for interschool teams *B. It provides for the constructive use of leisure time C. It prepares students for a profession in athletics D. None of the above E. I don't know
		<u>Analysis:</u> P 59.4; PBS .26; clarify wording in stem--alter foil D; alter

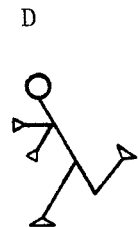
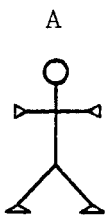
Pilot 3	Psychology Item	2. Which of the following statements <u>best</u> describes an important role of a good physical education program? A. It prepares students for interschool teams *B. It teaches students how to make good use of leisure time C. It prepares students for a profession in athletics D. It provides a rest from other school subjects E. I don't know
		<u>Analysis:</u> P 55.2; PBS .42; retain as is

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Pilot 1 Form A	36	Which diagram represents the safest position for landing after a jump?
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Analysis: P 97.9; PBS .25; diagrams poor; omit

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Test No.	Item No.	Item Content
Pilot 1 Form A	37.	Physical activity immediately following a meal may produce pain because: A. increased action of the rib cage affects the digestive system *B. blood moves from the digestive organs to the active muscles C. digestive juices are not produced during exercise D. the abdominal muscles contract during exercise  <u>Analysis:</u> P 24.6; PBS .17; foil D weak--item difficult; alter
Pilot 2	38.	Physical activity immediately following a meal may produce pain because: A. increased action of the rib cage affects the digestive system *B. blood moves from the digestive organs to the active muscles C. digestive juices are not produced during exercise D. undigested food presses on the walls of the abdomen E. I don't know  <u>Analysis:</u> P 19.5; PBS .34; correct answer unclear; omit
Pilot 1 Form A	38.	Interval training is a training method which involves: A. sprinting mixed with distance running at prescribed intervals B. running long distances at specific intervals *C. short sprints separated by measured recovery periods D. distance running with short sprints at prescribed intervals  <u>Analysis:</u> P 26.8; PBS .19; difficult question--foil D confusing; alter
Pilot 2	58.	Interval training is a training method which involves: A. sprinting mixed with distance running at prescribed intervals B. running long distances at specific intervals *C. short sprints separated by measured recovery periods D. short sprints separated by bouts of heavy calisthenics E. I don't know  <u>Analysis:</u> P 20.3; PBS .38; foils too similar--weak item; omit

Test No.	Item No.	Item Content
Pilot 1 Form A	39.	<p>What happens when a stationary object is struck by an object in motion?</p> <p>A. There is no change in either object</p> <p>B. The object in motion will go faster after the impact</p> <p>*C. The force of the moving object is transferred to the stationary object</p> <p>D. Both objects become stationary because of resistance</p> <p><u>Analysis:</u> P 63.4; PBS .41; concept not important at this level; omit</p>
Pilot 1 Form A	40.	<p>Why does a person who is in poor physical condition often feel dizzy and find breathing painful during exercise?</p> <p>A. Muscles cramp causing pain, and dizziness is a psychological effect</p> <p>B. Overstretched muscles produce pain and retard the flow of blood to the brain</p> <p>*C. The oxygen demands of the body are greater than the supply available</p> <p>D. The muscles of respiration are overworked</p> <p><u>Analysis:</u> P 66.2; PBS .44; good item; retain as is</p>
Pilot 2	3.	<p>Why does a person who is in poor physical condition often feel dizzy and find breathing painful during exercise?</p> <p>A. Muscles cramp causing pain, and dizziness is a psychological effect</p> <p>B. Overstretched muscles produce pain and retard the flow of blood to the brain</p> <p>*C. The oxygen demands of the body are greater than the supply available</p> <p>D. The muscles of respiration are over-worked</p> <p>E. I don't know</p> <p><u>Analysis:</u> P 65.4; PBS .35; foils weak; omit</p>
Pilot 1 Form A	41.	<p>What is the safest position to take during a fall?</p> <p>A. Let your arms support you so that your body doesn't hit the ground</p> <p>B. Keep your head up to see where you are going</p> <p>C. Spread your body as wide as possible to lessen the impact</p> <p>*D. Roll on to your shoulder and over on to your back as you land</p> <p><u>Analysis:</u> P 71.8; PBS .38; change foil C--poor distractor; alter</p>

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Test No.	Item No.	Item Content
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Pilot 2	63.	<p>What is the safest position to take during a fall?</p> <p>A. Let your arms support you so that your body doesn't hit the ground</p> <p>B. Keep your head up to see where you are going</p> <p>C. Keep your feet together and your weight low</p> <p>*D. Roll on to your shoulder and over on to your back as you land</p> <p>E. I don't know</p> <p><u>Analysis:</u> P 68.4; PBS .46; clarify wording in foils; alter</p>
Pilot 3	33.	<p>What is the safest way to fall?</p> <p>A. Keep your head up to see where you are going</p> <p>B. Put your arms straight ahead of you</p> <p>C. Land on your hands and knees</p> <p>*D. Curl up and roll as your fall</p> <p>E. I don't know</p> <p><u>Analysis:</u> P 84.8; PBS .34; retain as is</p>

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Pilot 1 Form A	42.	<p>Weak abdominal muscles will:</p> <p>A. make you look thinner</p> <p>*B. contribute to poor posture</p> <p>C. grow stronger with proper diet</p> <p>D. create digestive problems</p> <p><u>Analysis:</u> P 54.9; PBS .42; foil A poor distractor; alter</p>
Pilot 2	5.	<p>Weak abdominal muscles will:</p> <p>A. grow stronger with stretching</p> <p>*B. contribute to poor posture</p> <p>C. grow stronger with proper diet</p> <p>D. create digestive problems</p> <p>E. I don't know</p> <p><u>Analysis:</u> P 22.6; PBS .34; foil A--positive PBS, two answers technically correct--alter foil A; alter</p>
Pilot 3	6.	<p>Weak abdominal muscles will:</p> <p>A. make you less flexible</p> <p>*B. contribute to poor posture</p> <p>C. grow stronger with proper diet</p> <p>D. create digestive problems</p> <p>E. I don't know</p> <p><u>Analysis:</u> P 40.0; PBS .37; retain as is</p>

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Test No.	Item No.	Item Content
Pilot 1 Form A	43.	<p>The best technique for catching an object is:</p> <ul style="list-style-type: none"> <li>A. to catch it in front of the face</li> <li>B. to catch it with outstretched arms</li> <li>*C. to pull the object close to the body</li> <li>D. to catch it with one hand</li> </ul> <p><u>Analysis:</u> P 76.1; PBS .38; change foil D--poor distractor; alter</p>
Pilot 2	60.	<p>The best technique for catching an object is:</p> <ul style="list-style-type: none"> <li>A. to catch it close to the face</li> <li>B. to catch it with outstretched arms</li> <li>*C. to catch it with arms bent</li> <li>D. to catch it close to the centre of gravity</li> <li>E. I don't know</li> </ul> <p><u>Analysis:</u> P 60.2; PBS .37; all foils weak; omit</p>
Pilot 1 Form A	44.	<p>Why is the competitive environment provided by some physical activities beneficial?</p> <ul style="list-style-type: none"> <li>A. Competition brings out the best in everyone</li> <li>B. Only in competition do we learn what people are really like</li> <li>C. Competition separates the winners from the losers</li> <li>*D. We learn how to cope with competition in life</li> </ul> <p><u>Analysis:</u> P 64.8; PBS .47; good item; retain as is</p>
Pilot 2	8.	<p>Why is the competitive environment provided by some physical activities beneficial?</p> <ul style="list-style-type: none"> <li>A. Everyone gives their best performance when they compete against others</li> <li>B. In competitive environment we do learn what people are really like</li> <li>C. Competition separates the winners from the losers</li> <li>*D. Competitive environment in physical activities teaches us how to cope with competition in life</li> <li>E. I don't know</li> </ul> <p><u>Analysis:</u> P 66.2; PBS .39; foil A--positive PBS; misleading; omit</p>
Pilot 1 Form A	45.	<p>Why is 'overloading' a muscle important in developing muscle strength?</p> <ul style="list-style-type: none"> <li>A. Overload destroys weak muscle fibres and replaces them with stronger ones</li> <li>*B. Muscles grow larger and stronger only in response to progressively increasing loads</li> </ul>

Test No.	Item No.	Item Content
		C. During overload, muscles are stretched beyond their previous capacity thus making them stronger D. Waste materials do not accumulate during overload <u>Analysis:</u> P 41.5; PBS .22; good item--PBS low; retain as is
Pilot 2	38.	Why is 'overloading' a muscle important in developing muscle strength? A. Overload destroys weak muscle fibres and replaces them with stronger ones *B. Muscles grow larger and stronger only in response to progressively increasing loads C. Overload stretches muscles beyond their capacity D. Waste materials do not accumulate during overload E. I don't know <u>Analysis:</u> P 46.6; PBS .39; weak item; retain as is
Pilot 3	26.	Why is 'overloading' a muscle important in developing muscle strength? A. "Overloading" destroys weak muscle fibres and replaces them with stronger ones *B. Muscles grow larger and stronger only in response to progressively increasing loads C. "Overloading" stretches muscles beyond their capacity D. Waste materials do not accumulate during overload E. I don't know <u>Analysis:</u> P 35.2; PBS .47; retain as is
Pilot 1 Form A	46.	Standing in one position for an extended period of time should be avoided because: A. it is bad for the bones of the feet B. it promotes poor posture *C. it hampers the return of blood to the heart D. none of the above <u>Analysis:</u> P 14.8; PBS -.05; poor item--concept weak; omit
Pilot 1 Form A	47.	Which of the following statements applies to skill learning: A. Individual practice is more important than team practice B. Practice is the easiest and shortest phase of learning a skill *C. Incorrect as well as correct techniques can be learned through practice



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Test No.	Item No.	Item Content
		D. In order to learn a new skill an individual must be in good physical condition
		<u>Analysis:</u> P 43.0; PBS .29; not relevant content; omit

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Pilot 1 Form A	48.	Which of the following statements is <u>not</u> true with regard to muscle endurance?
	A.	It is measured by the number of repetitions that can be performed at a given exercise load
	*B.	It is developed by working the muscles against a heavy resistance through few repetitions
	C.	It is the ability to sustain effort over a long period of time
	D.	It is developed by working the muscles against a light resistance through many repetitions
		<u>Analysis:</u> P 35.2; PBS .48; negative stem--foils too complex; omit

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Test No.	Item No.	Item Content
Pilot 1 Form B	1.	Coronary heart disease is caused by: A. an emotional trauma which creates a rapid firing of nerve impulses to the heart *B. a blockage of one of the arteries that provides nourishment for the heart C. a seepage of blood from one side of the heart to the other D. a faulty valve that affects the flow of blood in the heart
		<u>Analysis:</u> P 46.1; PBS .35; good item; retain as is
Pilot 2	30.	Coronary heart disease is caused by: A. an emotional experience which causes a rapid firing of nerve impulses to the heart *B. a blockage of one of the arteries that provides nourishment for the heart C. a seepage of blood from one side of the heart to the other D. a faulty valve that affects the flow of blood to the heart E. I don't know
		<u>Analysis:</u> P 49.6; PBS .40; vocabulary item; omit
Pilot 1 Form B	2.	In a game of badminton doubles, where should the partners stand when the opponents are on attack? A. Side by side at the net *B. Side by side at mid-court C. One at the net, the other directly behind D. Outside the service area
		<u>Analysis:</u> P 16.3; PBS .36; vague item; omit
Pilot 1 Form B	3.	Team sports are beneficial because: *A. individual goals are sacrificed for group goals B. individuals are provided with an opportunity to excel C. strong players can hide the weaknesses of others D. substitutions can be made in case of injury
		<u>Analysis:</u> P 37.6; PBS .35; foil B may also be correct; alter
Pilot 2	24.	Team sports are beneficial because: *A. individual goals are sacrificed for group goals B. players without skill don't have to play C. strong players can hide the weaknesses of others

Test No.	Item No.	Item Content
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- D. substitutions can be made in case of injury  
E. I don't know

Analysis: P 57.9; PBS .42; incorrect classification re table of specifications--move to effects of activity for pilot 3--alter foils; alter

Pilot 3 Psychology Item

1. Which of the following statements suggests a worthwhile benefit of team sports?
  - \*A. The needs of the team are important as well as the needs of each person
  - B. People can make the team even though they don't get to play
  - C. Coaching for team sports is usually of a higher calibre than for individual sports
  - D. Players on teams are always under a great deal of stress or anxiety
  - E. I don't know

Analysis: P 78.8; PBS .38; retain as is

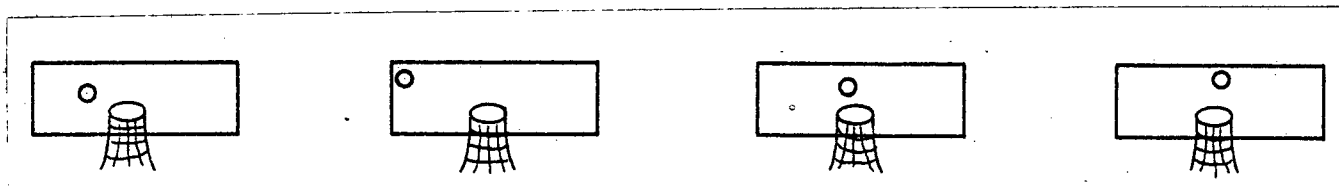
- Pilot 1 Form B
4. When executing a basketball lay-up shot, it is wise to rebound the ball off the backboard. Which of the following diagrams best illustrates the correct point of contact on the backboard if the lay-up is attempted from the left?

A

B

C

D



Analysis: P 20.6; PBS .09; foil B--not distracting; alter

- Pilot 2
62. When executing a basketball lay-up shot, it is wise to rebound the ball off the backboard. Which diagram below best illustrates the correct point of contact on the backboard if the lay-up is attempted from the left?

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Test No.	Item No.	Item Content
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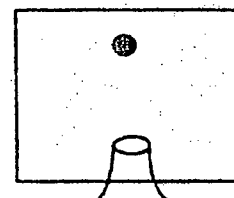
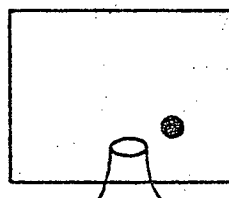
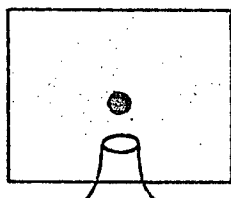
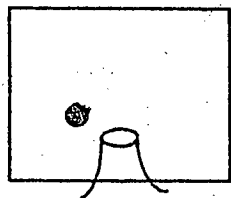
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A

B

C

D



E. I don't know

Analysis: P 41.4; PBS .39; diagrams confusing; omit

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Pilot 1 5. Identify the sequence which best describes the path taken by oxygenated blood.

Form B

- A. Heart, lungs, arteries, capillaries
- B. Capillaries, arteries, lungs, heart
- \*C. Lungs, heart, arteries, capillaries
- D. Heart, lungs, capillaries, arteries

Analysis: P 51.1; PBS .45; good item; retain as is

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Pilot 2 23. Identify the sequence which best describes the path taken by oxygenated blood:

- A. heart, lungs, arteries, capillaries
- B. capillaries, arteries, lungs, heart
- \*C. lungs, heart, arteries, capillaries
- D. heart, lungs, capillaries, arteries
- E. I don't know

Analysis: P 42.1; PBS .51; reword stem; alter

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Pilot 3 4. What is the path followed by the blood in order to get oxygen to the body cells?

- A. Heart, lungs, arteries, capillaries
- B. Capillaries, arteries, lungs, heart
- \*C. Lungs, heart, arteries, capillaries
- D. Heart, lungs, capillaries, arteries
- E. I don't know

Analysis: P 29.6; PBS .44; retain as is

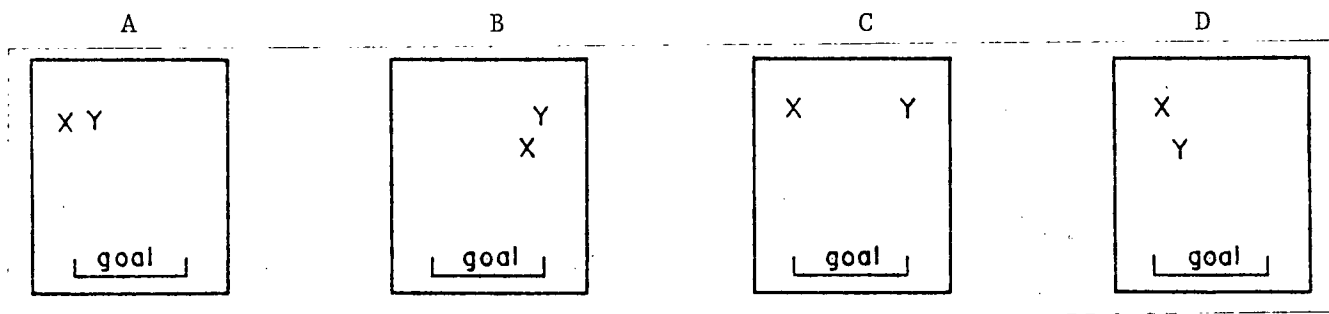
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Test No.	Item No.	Item Content
Pilot 1 Form B	6.	Which of the following foods will definitely improve athletic performance? A. Peanuts B. Enriched beverages C. Steak *D. None of the above
	<u>Analysis:</u>	P 51.8; PBS .31; foil A correct also; poor item; alter
Pilot 2	54.	Which of the following foods will definitely improve athletic performance? A. Spaghetti B. Enriched beverages C. Steak *D. None of the above
	<u>Analysis:</u>	P 30.1; PBS .24; foils A,B positive PBS--controversial! omit
Pilot 1 Form B	7.	Which of the following statements identifies a person who has a strong need to achieve? A. One who places friendship ahead of competition as a desirable goal for sport B. One who believes that the essence of sport and activity lies in the beauty of movement C. One who participates in activity to reduce frustration effectively *D. One who sees constant improvement as the main goal of sport
	<u>Analysis:</u>	P 80.9; PBS .35; complex---answer obvious; omit
Pilot 1 Form B	8.	Which of the following food types requires the shortest time to be digested? *A. Carbohydrates B. Proteins C. Fats D. There is no difference
	<u>Analysis:</u>	P 31.2; PBS .23; good item--difficult; retain as is
Pilot 2	32.	Which of the following food types requires the shortest amount of time to be digested? *A. Carbohydrates B. Proteins C. Fats

Test No.	Item No.	Item Content
		D. There is no difference E. I don't know <u>Analysis:</u> P 32.3; PBS .36; foil C poor discriminator; retain as is
Pilot 3	5.	Which of the following food types requires the shortest amount of time to be digested? *A. Carbohydrates B. Proteins C. Fats D. There is no difference E. I don't know <u>Analysis:</u> P 29.2; PBS .39; retain as is
Pilot 1 Form B	9.	In order to increase your power you should work on: A. endurance and strength *B. speed and strength C. co-ordination and speed D. agility and strength <u>Analysis:</u> P 11.3; PBS .20; Foil A--+PBS--ambiguous; alter
Pilot 2	59.	In order to increase your power you should work on: A. flexibility and strength *B. speed and strength C. coordination and speed D. agility and strength E. I don't know <u>Analysis:</u> P 20.3; PBS .18; vocabulary item--concept beyond grade eleven level; omit
Pilot 1 Form B	10.	Which of the following minerals contributes to the ability of the red blood cells to carry oxygen? A. Calcium B. Potassium *C. Iron D. None of the above <u>Analysis:</u> P 59.6; PBS .29; all answers could be correct; omit

Test No.	Item No.	Item Content
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Pilot 1 Form B	11.	In which of the following situations would player 'Y' be in the best position to prevent player 'X' from getting to the goal?
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Analysis: P 87.9; PBS .28; item confusing; omit

Pilot 1 Form B	12.	The internal exchange of oxygen and carbon dioxide takes place in the: *A. body cells B. veins C. throat D. arteries
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Analysis: P 44.0; PBS .48; change foil C; alter

Pilot 2	13.	The internal exchange of oxygen and carbon dioxide takes place in the: *A. body cells B. veins C. arterioles D. arteries E. I don't know
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Analysis: P 24.1; PBS .25; advanced concept--not required; omit

Pilot 1 Form B	13.	Which term best describes the nerves that carry messages from the brain to the muscles? A. Sensory B. Impulse C. Receptor *D. Motor
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Analysis: P 8.5; PBS .21; very difficult--but concept important  
foil B distracts most; alter

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Test No.	Item No.	Item Content
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Pilot 2	70.	Which term describes the nerves that transmit messages from the brain to the muscles in order to produce movement? A. Sensory B. Axon C. Receptor *D. Motor E. I don't know
		<u>Analysis:</u> P 19.5; PBS .44; vocabulary item; omit

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Pilot 1 Form B	14.	What will happen to a ball that is released with topspin? A. It will swerve to the right *B. It will hit the ground sooner than a ball without topspin C. It will go further before hitting the ground than a ball without topspin D. It will go higher than a ball without topspin
		<u>Analysis:</u> P 42.6; PBS .40; good item; retain as is

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Pilot 2	2.	What will happen to a ball that is released with topspin? A. It will swerve to the right *B. It will hit the ground sooner than a ball without topspin C. It will go further before hitting the ground than a ball without topspin D. It will go higher than a ball without topspin E. I don't know
		<u>Analysis:</u> P 43.6; PBS .51; clarify foil D; alter

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Pilot 3	11.	What will happen to a ball that is released with topspin? A. It will swerve to the right *B. It will hit the ground sooner than a ball without topspin C. It will go farther before hitting the ground than a ball without topspin D. It will go higher before hitting the ground than a ball without topspin E. I don't know
		<u>Analysis:</u> P 36.4; PBS .47; retain as is

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Test No.	Item No.	Item Content
Pilot 1 Form B	15	Which of the following gases is found in tobacco smoke and affects physical endurance? *A. Carbon Monoxide B. Nitrogen C. Carbon Dioxide D. Oxygen  <u>Analysis:</u> P 53.2; PBS .31; foil D--poor distractor; alter
Pilot 2	14.	Which of the following gases is found in tobacco smoke and affects physical endurance? *A. Carbon Monoxide B. Nitrogen C. Carbon Dioxide D. Sulphur Dioxide E. I don't know  <u>Analysis:</u> P 29.3; PBS .28; alter stem
Pilot 3	29.	Which of the following gases is found in tobacco smoke and reduces physical endurance? *A. Carbon Monoxide B. Nitrogen C. Carbon Dioxide D. Sulphur Dioxide E. I don't know  <u>Analysis:</u> P 27.2; PBS .29; retain as is
Pilot 1 Form B	16.	Which body part is most effective in receiving a volley-ball that is coming at you low and hard? Why? A. Your upper leg, because it is close to the ground *B. The inside of your forearm, because it provides better control C. Your fist, in order to prevent injury D. The back of your hand, because it is a flat, hard surface  <u>Analysis:</u> P 76.6; PBS .39; easy item--reword foils to increase responses; alter
Pilot 2	39.	Which body part is most effective in receiving a volley-ball that is coming at you low and hard? Why? A. The back of your forearm because it is a hard, smooth surface B. Your fist, in order to prevent injury C. The back of your hand because it is a flat surface

Test No.	Item No.	Item Content
		*D. The inside of your forearm because it is soft E. I don't know <u>Analysis:</u> P 52.6; PBS .47; simplify foils; alter
Pilot 3	35.	When playing volleyball, which body part should be used to receive a ball that is coming at you low and hard? A. Palms of your hands B. Fists C. Knee *D. Forearms E. I don't know <u>Analysis:</u> P 67.6; PBS .47; retain as is
Pilot 1 Form B	17.	Under which of the following circumstances will exercise place a greater load on the body? A. During hot weather B. During cold weather C. At high altitudes *D. Both A and C are correct <u>Analysis:</u> P 63.1; PBS .38; good item; retain as is
Pilot 2	7.	Under which of the following circumstances will exercise place a greater load on the body? A. During hot weather B. During cold weather C. At high altitudes *D. Both A and C are correct E. I don't know <u>Analysis:</u> P 65.4; PBS .50; alter foil D "both A and C"; alter
Pilot 3	32.	Strenuous activities will place the greatest strain on the body: *A. during hot humid weather B. during cold weather C. during wet weather D. at low altitudes E. I don't know <u>Analysis:</u> P 71.6; PBS .35; retain as is

Test No.	Item No.	Item Content
Pilot 1 Form B	18.	Identify the gas which causes you to breath in. *A. Carbon Dioxide B. Oxygen C. Nitrogen D. Carbon Monoxide  <u>Analysis:</u> P 25.5; PBS .32; reword stem; alter
Pilot 2	53.	Identify the gas which triggers respiration: *A. Carbon Dioxide B. Oxygen C. Nitrogen D. Carbon Monoxide E. I don't know  <u>Analysis:</u> P 33.8; PBS .46; stem wording unacceptable; omit
Pilot 1 Form B	19.	You are running a 400-metre race. As you near the finish line you decide to go faster. Which technique will help you to increase your speed? A. Straighten your body B. Take shorter strides C. Use less arm action *D. Lengthen your stride  <u>Analysis:</u> P 69.5; PBS .22; poor item--controversial; omit
Pilot 1 Form B	20.	Which of the following combinations is most effective for losing weight? A. A health food diet with regular sauna baths B. Daily massages plus a reduction in calories C. A weight training program with daily massages *D. Regular exercise plus a reduction in calories  <u>Analysis:</u> P 94.3; PBS .38; too obvious; omit
Pilot 1 Form B	21.	Alcohol affects motor performance because it is: *A. a depressant B. a stimulant C. an anti-coagulant D. a pain reliever  <u>Analysis:</u> P 39.7; PBS .43; foil D--poor distractor; alter

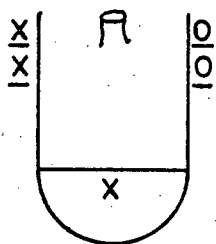
Test No.	Item No.	Item Content
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- Pilot 2 26. Alcohol is detrimental to motor performance because it is:
- \*A. a depressant
  - B. a stimulant
  - C. an anti-coagulant
  - D. a catalyst
  - E. I don't know

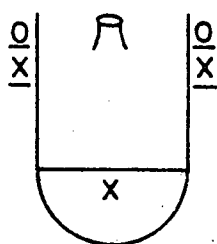
Analysis: P 42.9; PBS .45; vocabulary item; omit

- Pilot 1 22. Which of the following diagrams best illustrates the correct line-up of players for a basketball free throw?

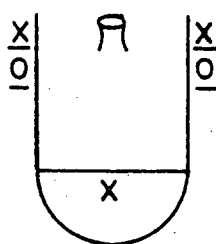
A



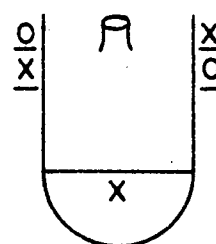
B



C



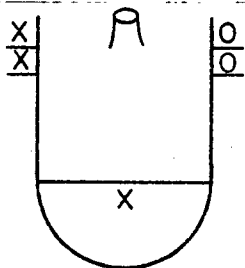
D



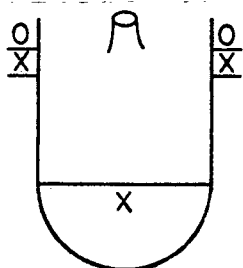
Analysis: P 27.0; PBS .39; clarify diagrams; alter

- Pilot 2 71. Which of the following diagrams best illustrates the correct line-up of players for a basketball free throw?

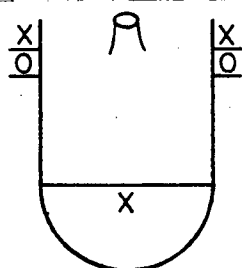
A



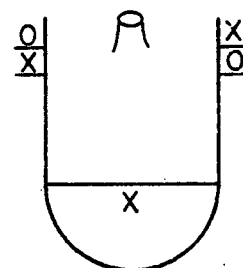
B



C



D



E. I don't know

Analysis: P 28.6; PBS .39; diagram, therefore omit; omit

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Test No.	Item No.	Item Content
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Pilot 1 Form B	23.	<p>What is the primary function of protein?</p> <p>A. To slow down digestive processes</p> <p>B. To form simple sugars</p> <p>C. To produce energy</p> <p>*D. To repair tissue</p> <p><u>Analysis:</u> P 29.8; PBS .28; foils A and C--partially correct; alter</p>
Pilot 2	48.	<p>What is the primary function of protein?</p> <p>A. To speed up digestive processes</p> <p>B. To form simple sugars</p> <p>C. To absorb acids</p> <p>*D. To repair tissue</p> <p>E. I don't know</p> <p><u>Analysis:</u> P 51.9; PBS .43; relate stem to activity; alter</p>
Pilot 3	16.	<p>Why is protein essential for a physically active person?</p> <p>A. It speeds up digestive processes</p> <p>B. It helps form simple sugars</p> <p>C. It absorbs acids</p> <p>*D. It builds body tissues</p> <p>E. I don't know</p> <p><u>Analysis:</u> P 62.8; PBS .46; retain as is</p>

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Pilot 1 Form B	24.	<p>Drugs which are taken to improve performance are dangerous primarily because:</p> <p>A. they accelerate the functioning of the muscles and heart</p> <p>B. they affect the utilization of food</p> <p>C. they increase the rate of nerve firings</p> <p>*D. they push a person beyond his current physical capabilities</p> <p><u>Analysis:</u> P 55.3; PBS .34; foil B--poor distractor; alter</p>
Pilot 2	37.	<p>Drugs which are taken to improve performance are dangerous primarily because:</p> <p>A. they speed up reaction time</p> <p>B. they relax you too much</p> <p>C. they cause an increase in muscle bulk</p> <p>*D. they push people beyond their current physical capabilities</p> <p><u>Analysis:</u> P 45.9; PBS .31; concept controversial possibly more than one correct answer; omit</p>

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Test No.	Item No.	Item Content
Pilot 1 Form B	25.	Which of the following situations would be most likely to result in a 'point' in a badminton game? A. The server steps on the serving line B. The receiver sends the bird high and deep into the opponent's court C. The receiver sends a fast, sharply angled shot down into the opponent's court *D. The server sends a fast, sharply angled shot down into the opponent's court  <u>Analysis:</u> P 55.3; PBS .30; wording in foil D incorrect; alter
Pilot 2	19.	Which of the following situations would be most likely to result in a 'point' in a badminton game? A. The server steps on the serving line B. The receiving side sends the bird high and deep into the opponent's court C. The receiving side sends a fast, sharply angled shot down into the opponent's court *D. The serving side sends a fast, sharply angled shot down into the opponent's court E. I don't know  <u>Analysis:</u> P 46.6; PBS .38; retain as is
Pilot 3	30.	Which of the following situations would be most likely to result in a "point" in a badminton game? A. The server steps on the serving line B. The receiving side sends the bird high and deep into the opponent's court C. The receiving side sends a fast, sharply angled shot to the floor of the opponent's court *D. The serving side sends a fast, sharply angled shot to the floor of the opponent's court E. I don't know  <u>Analysis:</u> P 60.8; PBS .40; retain as is
Pilot 1 Form B	26.	Which one of the following nutrients is lost during excessive perspiration? *A. Salt B. Vitamins C. Proteins D. Amino Acids  <u>Analysis:</u> P 74.5; PBS .35; easy but important; retain as is

Test No.	Item No.	Item Content
Pilot 2	9.	Which of the following nutrients is lost during excessive perspiration? *A. Salt B. Vitamins C. Proteins D. Amino Acids E. I don't know
<u>Analysis:</u> P 78.9; PBS .40; all answers possibly correct; omit		
Pilot 1 Form B	27.	Which of the following considerations regarding drugs should be of most concern to athletes? A. Will the drug improve the performance? *B. Is the drug dangerous or unethical? C. Will the drug relieve pain? D. Will the onset of fatigue be delayed?
<u>Analysis:</u> P 79.4; PBS .36; easy--but important concept; retain as is		
Pilot 2	6.	Which of the following considerations regarding drugs should be of most concern to athletes? A. Will the drug improve performance? *B. Is the drug dangerous or unethical? C. Will the drug relieve pain? D. Will the onset of fatigue be delayed? E. I don't know?
<u>Analysis:</u> P 71.4; PBS .40; reword foil B; alter		
Pilot 3	18.	Which of the following questions about a drug should be of most concern to athletes? A. Will the drug improve performance? *B. Is the drug safe? C. Will the drug relieve pain? D. Will the drug delay the onset of fatigue? E. I don't know
<u>Analysis:</u> P 82.0; PBS .51; retain as is		
Pilot 1 Form B	28.	Which system activates respiration in the body? A. Circulatory B. Respiratory C. Muscular *D. Nervous
<u>Analysis:</u> P 9.9; PBS .20; confusing item; omit		

Test No.	Item No.	Item Content
Pilot 1 Form B	29.	<p>If a basketball team is playing a man-to-man system of defence, each member of the team should:</p> <ul style="list-style-type: none"> <li>*A. stay between the designated opponent and the basket when the opponents are on attack.</li> <li>B. use the position of the ball to determine the best defensive position on the court</li> <li>C. stay with the designated opponent at all times during the game</li> <li>D. ignore the designated opponent if he moves away from the ball</li> </ul> <p><u>Analysis:</u> P 36.9; PBS .33; clarify foils; alter</p>
Pilot 2	27.	<p>If a basketball team is playing a man-to-man system of defence, each member of the team should:</p> <ul style="list-style-type: none"> <li>*A. stay between the designated opponent and the basket when the opponents are on attack</li> <li>B. use the position of the ball to determine the best defensive position on the court</li> <li>C. stay with the designated opponent at all times wherever he is on the court</li> <li>D. stay with the designated opponent only if he is near the ball</li> <li>E. I don't know</li> </ul> <p><u>Analysis:</u> P 39.1; PBS .48; retain as is</p>
Pilot 3	8.	<p>If a basketball team is playing a man-to-man system of defence, each member of the team should:</p> <ul style="list-style-type: none"> <li>*A. stay between the designated opponent and the basket when the opponents are attacking</li> <li>B. use the position of the ball to determine the best defensive position on the court</li> <li>C. stay with the designated opponent at all times, wherever he is on the court</li> <li>D. stay with the designated opponent only if he is near the ball</li> <li>E. I don't know</li> </ul> <p><u>Analysis:</u> P 36.4; PBS .42; retain as is</p>
Pilot 1 Form B	30.	<p>Extremely overweight people are not likely to take part in physical activity because:</p> <ul style="list-style-type: none"> <li>*A. they have a low personal self-image</li> <li>B. they lack skill</li> <li>C. they can't find a team to play on</li> <li>D. they don't think physical activity will help them</li> </ul> <p><u>Analysis:</u> P 72.3; PBS .32; foil C--poor distractor; alter</p>



Test No.	Item No.	Item Content
Pilot 2	33.	Extremely overweight people are not likely to take part in physical activity because: *A. they have a low opinion of themselves B. they lack skill C. they don't like activity D. they don't think physical activity will help them E. I don't know
		<u>Analysis:</u> P 40.6; PBS .20; possibly more than one correct answer; omit
Pilot 1 Form B	31.	'Movement' is the end result of action by the body's: A. bones B. nerves C. muscles *D. all of the above
		<u>Analysis:</u> P 61.7; PBS .38; good item; retain as is
Pilot 2	4.	Movement is the end result of action by the body's: A. bones B. nerves C. muscles *D. all of the above E. I don't know
		<u>Analysis:</u> P 57.1; PBS .31; retain as is
Pilot 3	15.	Movement is the end result of action by the body's: A. bones B. nerves C. muscles *D. all of the above E. I don't know
		<u>Analysis:</u> P 63.6; PBS .30; retain as is
Pilot 1 Form B	32.	Which type of personality is likely to avoid competitive sports? A. A person with a low need to avoid failure and a high need to achieve B. A person who has a high degree of self confidence and self-worth C. A person high in aggression and low in inhibition *D. A person with a low need to achieve and a high need to avoid failure
		<u>Analysis:</u> P 66.0; PBS .49; complex question; retain as is

Test No.	Item No.	Item Content
Pilot 2	46.	Which type of personality is likely to avoid competitive sports? A. A person with a low need to avoid failure and a high need to achieve B. A person who has a high degree of self-confidence and self-worth C. A person high in aggression and low in inhibition *D. A person with a low need to achieve and a high need to avoid failure E. I don't know
<u>Analysis:</u> P 67.7; PBS .53; foils too complex; omit		
Pilot 1 Form B	33.	Why do fewer girls than boys participate in physical activity? A. Anatomical limitations B. Safety reasons *C. Cultural factors D. Physiological limitations
<u>Analysis:</u> P 35.5; PBS .36; foils confusing; alter		
Pilot 2	55.	Why do fewer girls than boys participate in physical activity? A. Girls' bodies aren't built for physical activity B. They are afraid they'll get hurt C. Girls don't like activity as much as boys *D. Society discourages girls from being physically active E. I don't know
<u>Analysis:</u> P 64.7; PBS .48; wording in foil D controversial; omit		
Pilot 1 Form B	34.	During regular breathing, as the rib cage expands, air: A. leaves the lungs *B. enters the lungs C. enters the blood D. exits through the nose and mouth
<u>Analysis:</u> P 81.6; PBS .39; elementary concept; omit		

Test No.	Item No.	Item Content
Pilot 1 Form B	35.	<p>Most team sports involve movement into open spaces. The purpose of moving into an open space is:</p> <p>A. to cause an opponent to move with you</p> <p>B. to make room for the player with the ball</p> <p>C. to avoid an opponent who is staying near you</p> <p>*D. all of the above</p> <p><u>Analysis:</u> P 60.3; PBS .37; good item; retain as is</p>
Pilot 2	15.	<p>Most team sports involve movement into open spaces. The purpose of moving into an open space is:</p> <p>A. to cause an opponent to move with you</p> <p>B. to make room for the player with the ball</p> <p>C. to avoid an opponent who is staying near you</p> <p>*D. all of the above</p> <p>E. I don't know</p> <p><u>Analysis:</u> P 56.4; PBS .46; retain as is</p>
Pilot 3	21.	<p>Most team sports involve movement into open spaces. The purpose of moving into an open space is:</p> <p>A. to cause an opponent to move with you</p> <p>B. to make room for the player with the ball</p> <p>C. to avoid an opponent who remains close to you</p> <p>*D. all of the above</p> <p>E. I don't know</p> <p><u>Analysis:</u> P 55.6; PBS .40; retain as is</p>
Pilot 1 Form B	36.	<p>If you are passing the ball to a teammate who is accelerating forward the ball should be aimed:</p> <p>A. at the hands of the receiver</p> <p>*B. ahead of the receiver</p> <p>C. at eye level</p> <p>D. to the right of the receiver</p> <p><u>Analysis:</u> P 73.0; PBS .33; foil D weak; alter</p>
Pilot 2	11.	<p>If you are passing the ball to a teammate who is accelerating forward, the ball should be aimed:</p> <p>A. at the hands of the receiver</p> <p>*B. ahead of the receiver</p> <p>C. at eye level</p> <p>D. at the waist of the receiver</p> <p>E. I don't know</p> <p><u>Analysis:</u> P 70.7; PBS .59; retain as is</p>

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Test No.	Item No.	Item Content
Pilot 3	17.	If you are passing the ball to a teammate who is running forward, where should the ball be aimed? A. At the hands of the receiver *B. Ahead of the receiver C. At the eye level of the receiver D. At the waist of the receiver E. I don't know
<u>Analysis:</u>		P. 74.0; PBS .45; retain as is

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Pilot 1 Form B	37..	Fuel for muscles is provided by which one of the following systems? A. Respiratory B. Nervous *C. Circulatory D. Endocrine
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Analysis: P.59.6; PBS .47; foil D--"vocabulary"; alter

Pilot 2	57.	Fuel for muscles is provided by which one of the following systems: A. respiratory B. nervous *C. circulatory D. none of the above E. I don't know
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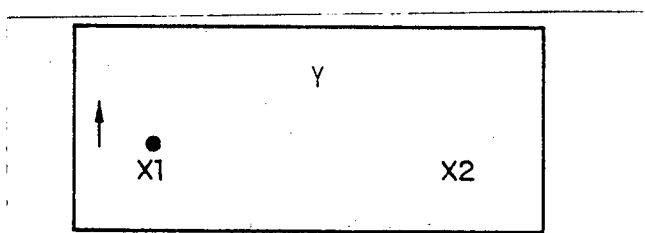
Analysis: P 42.9; PBS .38; foil D weak; alter

Pilot 3	9.	Fuel for muscles is provided by which of the following systems: A. Respiratory B. Nervous *C. Circulatory D. Digestive E. I don't know
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Analysis: P 36.8; PBS .5; retain as is

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Pilot 1 Form B	38.	In the diagram below there are two attackers (X1, X2) against one defender (Y). In order to get past the defender, when is the best time for 'X1' to pass to 'X2'?
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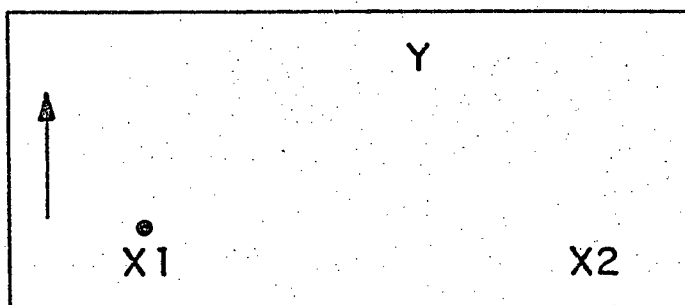
Test No.	Item No.	Item Content
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- \*A. If 'Y' attempts to take the ball from 'X1'
- B. As soon as 'X2' calls for the ball
- C. As soon as 'X1' gets past 'Y'
- D. As soon as 'X2' gets past 'Y'

Analysis: P 56.7; PBS .33; vague diagrams; alter

- Pilot 2 34. In the diagram below there are two attackers (X1, X2) against one defender (Y). In order to get past the defender, when is the best time for 'X1' to pass to 'X2'?



- \*A. If 'Y' attempts to take the ball from 'X1'
- B. As soon as 'X2' calls for the ball
- D. As soon as 'X1' gets past 'Y'
- D. As soon as 'X2' gets past 'Y'
- E. I don't know

Analysis: P 63.9; PBS .56; diagram confusing; omit

- Pilot 1 39. Which of the following statements best describes a person who participates in physical activity for social benefits?
- Forb B
- A. Seeks to get even with an opponent
  - B. Seeks opportunities to try new things
  - \*C. Happy just to be on the team
  - D. Enjoys the pleasurable physical sensations derived from activity

Analysis: P 20.6; PBS .17; subjective question--more than one correct answer; omit

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Test No.	Item No.	Item Content
Pilot 1 Form B	40.	Which of the following statements does <u>not</u> apply to both badminton and volleyball? *A. The serve must land in a specific area of the court B. 'On the line' is considered in bounds C. One person may serve an entire game D. Contact between a player and the net is illegal <u>Analysis:</u> P 15.6; PBS .32; difficult question--confusing; retain as is
Pilot 2	45.	Which of the following statements does not apply to <u>both</u> badminton and volleyball? *A. The serve must land in a specific area of the court B. 'On the line' is considered in bounds C. One person may serve an entire game D. Contact between a player and the net is illegal E. I don't know <u>Analysis:</u> P 46.6; PBS .01; concept good--item complex--foil A, positive discriminator--reword and simplify; alter
Pilot 3	25.	Which of the following statements is <u>true</u> when playing both badminton doubles and volleyball? A. Overhand serves are illegal B. Serves that contact the net are legal C. The serve must land within a designated service area of the court *D. It is possible for one person to serve an entire game E. I don't know <u>Analysis:</u> P 36.8; PBS .42; retain as is
Pilot 1 Form B	41.	Which of the following statements is correct: *A. After puberty, boys, on the average, are stronger than girls B. After puberty, boys, on the average, are more flexible than girls C. Before puberty, boys, on the average, are taller than girls D. All of the above are correct <u>Analysis:</u> P 61.7; PBS .39; good item; retain as is
Pilot 2	64.	Which of the following statements is correct? *A. After puberty, boys, on the average, are stronger than girls B. After puberty, boys, on the average, are more flexible than girls

Test No.	Item No.	Item Content
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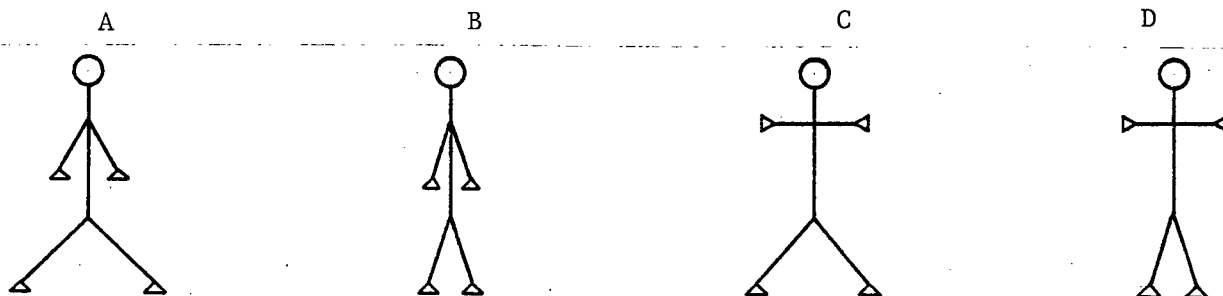
- C. Before puberty, boys, on the average, are taller than girls  
 D. All of the above are correct  
 E. I don't know

Analysis: P 60.2; PBS .46; alter foil D "all of the above"; alter

- Pilot 3 20. Which of the following statements is correct?  
 \*A. After puberty, boys, on the average, are stronger than girls  
 B. After puberty, boys, on the average, are more flexible than girls  
 C. Before puberty, boys, on the average, are taller than girls  
 D. Before puberty, boys, on the average, are heavier than girls  
 E. I don't know

Analysis: P 80.4; PBS .45; retain as is

- Pilot 1 42. In which of the following positions will the body spin fastest?  
 Form B



Analysis: P 50.4; PBS .31; diagrams confusing; omit

- Pilot 1 43. What happens to a muscle that is not used?  
 Form B  
 A. It becomes stronger  
 \*B. It becomes weaker  
 C. It becomes larger  
 D. Both A and C are correct

Analysis: P 95.7; PBS .32; foils poor--correct answer obvious; omit

Test No.	Item No.	Item Content
Pilot 1 Form B	44.	<p>What is the best way to make a sudden change of direction?</p> <p>A. Turn to face the way you want to go</p> <p>B. Keep the centre of gravity inside the supporting base</p> <p>*C. Move the centre of gravity outside the supporting base</p> <p>D. Turn your body but keep your head facing forward</p> <p><u>Analysis:</u> P 22.7; PBS .32; foils weak--redundant; omit</p>
Pilot 1 Form B	45.	<p>How does alcohol affect physical performance?</p> <p>*A. It slows down activity in the brain and affects co-ordination</p> <p>B. It relaxes you and therefore you perform better</p> <p>C. It speeds up brain activity and allows you to make quicker decisions</p> <p>D. It improves muscular strength and endurance</p> <p><u>Analysis:</u> P 97.9; PBS .34; foils all poor; omit</p>
Pilot 1 Form B	46.	<p>Which of the following phrases best describes the path of the shuttlecock in a badminton overhead clear shot?</p> <p>*A. High and deep to the opponent's court</p> <p>B. High and shallow to the opponent's court</p> <p>C. Low and deep to the opponent's court</p> <p>D. Cross court, high and shallow to the opponent's court</p> <p><u>Analysis:</u> P 46.8; PBS .41; good item; retain as is</p>
Pilot 2	49.	<p>Which of the following phrases best describes the path of the shuttlecock in a badminton overhead clear shot?</p> <p>*A. High and deep to the back of the opponent's court</p> <p>B. High and short to the front of the opponent's court</p> <p>C. Low and deep to the back of the opponent's court</p> <p>D. Low and shallow into the front of the opponent's court</p> <p>E. I don't know</p> <p><u>Analysis:</u> P 54.1; PBS .57; foils weak; omit</p>



Test No.	Item No.	Item Content
Pilot 1 Form B	47.	Which of the following is <u>not</u> a type of muscle tissue? A. Voluntary B. Involuntary C. Cardiac *D. Connective
	<u>Analysis:</u>	P 29.1; PBS .15; difficult; retain as is
Pilot 2	40.	Which of the following is <u>not</u> a type of muscle tissue? A. Voluntary B. Smooth C. Cardiac *D. Connective E. I don't know
	<u>Analysis:</u>	P 16.5; PBS .21; clarify foil B; vocabulary item but terminology important; alter
Pilot 3	34.	Which of the following is <u>not</u> a type of muscle tissue? A. Smooth B. Skeletal C. Cardiac *D. Connective E. I don't know
	<u>Analysis:</u>	P 8.4; PBS .23; retain as is
Pilot 1 Form B	48.	The performance of which of the following athletes would be <u>least</u> impaired by smoking? A. A basketball player B. A runner *C. A high jumper D. A badminton player
	<u>Analysis:</u>	P 53.2; PBS .39; foil A attracts no one; alter
Pilot 2	69.	The performance of which of the following athletes would be <u>least</u> impaired by smoking tobacco? A. A swimmer B. A runner *C. A high jumper D. A badminton player E. I don't know
	<u>Analysis:</u>	P 41.4; PBS .35; minor word change foil D; alter

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Test No.	Item No.	Item Content
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Pilot 3	3.	<p>The performance of which of the following athletes is <u>least</u> likely to be affected by smoking tobacco?</p> <p>A. A swimmer</p> <p>B. A runner</p> <p>*C. A high jumper</p> <p>D. A tennis player</p> <p>E. I don't know</p> <p><u>Analysis:</u> P 55.6; PBS .51; retain as is</p>
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New Item	66.	<p>Which of the following tissues is not easily repaired once it is injured?</p> <p>A. Smooth Muscle</p> <p>*B. Nerve</p> <p>C. Striated Muscle</p> <p>D. Skin</p> <p>E. I don't know</p> <p><u>Analysis:</u> P 51.1; PBS .42; reword stem and alter foils; alter</p>
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Pilot 3	28.	<p>Which of the following tissues is not as easily repaired by the body once it is injured?</p> <p>A. Muscle</p> <p>*B. Nerve</p> <p>C. Bone</p> <p>D. Skin</p> <p>E. I don't know</p> <p><u>Analysis:</u> P 59.2; PBS .40; retain as is</p>
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New Item	12.	<p>When doing sit-ups, the abdominal muscles work hardest when:</p> <p>A. your legs are straight and your hands are locked behind your head</p> <p>*B. your knees are bent and your hands are locked behind your head</p> <p>C. your legs are straight and your back is arched</p> <p>D. your knees are bent and your back is arched</p> <p>E. I don't know</p> <p><u>Analysis:</u> P 36.0; PBS .41; retain as is</p>
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Test No.	Item No.	Item Content
New Item Pilot 3	38	<p>In which position will a skater or a diver rotate, or spin most quickly?</p> <p>A. Arms away from the body; legs together</p> <p>B. Arms above the head; legs apart</p> <p>*C. Arms close to the body; legs together</p> <p>D. Arms close to the body; legs apart</p> <p>E. I don't know</p> <p><u>Analysis:</u> P 66.4; PBS .54; retain as is</p>
New Item Pilot 3	39.	<p>Which blood vessels carry nourishment <u>to</u> the heart muscle?</p> <p>A. Coronary veins</p> <p>B. Carotid arteries</p> <p>*C. Coronary arteries</p> <p>D. Pulmonary veins</p> <p>E. I don't know</p> <p><u>Analysis:</u> P 18.4; PBS .45; retain as is</p>
New Item Pilot 3 Psych.	3.	<p>Which of the following is the <u>least</u> important thing in determining good team play?</p> <p>A. Each member appreciates the contribution of every other member</p> <p>*B. Players on the same team have many different characteristics</p> <p>C. Each team member has a positive attitude</p> <p>D. Good communication exists between players and coach</p> <p>E. I don't know</p> <p><u>Analysis:</u> P 82.0; PBS .49; retain as is</p>
New Item Pilot 3 Psych.	4.	<p>Your game skills will probably improve most quickly if:</p> <p>A. you win all of your games easily</p> <p>B. you lose all of your games by large scores</p> <p>*C. all of your games are close</p> <p>D. all of your games are against rough players</p> <p>E. I don't know</p> <p><u>Analysis:</u> P 68.0; PBS .44; retain as is</p>

Test No.	Item No.	Item Content
New Item Pilot 3 Psych.	5.	<p>People involved in competitive physical activities will likely experience high levels of anxiety and stress during a game if:</p> <ul style="list-style-type: none"> <li>*A. winning becomes essential to them</li> <li>B. the game is well officiated</li> <li>C. they decrease their amount of physical exertion</li> <li>D. winning becomes unimportant to them</li> <li>E. I don't know</li> </ul> <p><u>Analysis:</u> P 84.4; PBS .59; retain as is</p>
New Item Pilot 3 Psych.	6.	<p>You are most likely to be physically fit if:</p> <ul style="list-style-type: none"> <li>A. your parents are good athletes</li> <li>*B. your attitude towards fitness is good</li> <li>C. you know a great deal about fitness</li> <li>D. your school has good physical education facilities and equipment</li> <li>E. I don't know</li> </ul> <p><u>Analysis:</u> P 94.0; PBS .28; retain as is</p>
New Item Pilot 3 Psych.	7.	<p>If you want to help your team mates become better players, you should probably:</p> <ul style="list-style-type: none"> <li>A. keep reminding them of all their errors</li> <li>*B. praise them, while pointing out their errors</li> <li>C. be strict with them</li> <li>D. tell them how the professionals do it</li> <li>E. I don't know</li> </ul> <p><u>Analysis:</u> P 90.8; PBS .50; retain as is</p>
New Item Pilot 3 Psych.	8.	<p>Which one of the following ways of helping children to learn sports skills is the <u>least acceptable</u>?</p> <ul style="list-style-type: none"> <li>A. Setting goals that the children can work towards</li> <li>*B. Getting the children to work harder by always pointing out their mistakes</li> <li>C. Giving the children encouraging talks before games and practices</li> <li>D. Getting the children to improve on their previous scores</li> <li>E. I don't know</li> </ul> <p><u>Analysis:</u> P 58.4; PBS .59; retain as is</p>

## APPENDIX D

## Summary of Item Development--Pilot Tests--1,2,3

Item No. Pilot Test 1	Item No. Pilot Test 2	Item No. Pilot Test 3
Form A 1	omitted	
2	16	13
3	41	omitted
4	72	omitted
5	43	omitted
6	36	omitted
7	51	27
8	42	omitted
9	omitted	
10	18	omitted
11	31	7
12	20	19
13	1	1
14	omitted	
15	44	36
16	10	37
17	omitted	
18	22	omitted
19	67	23
20	35	omitted
21	12	2
22	omitted	
23	17	omitted
24	56	omitted
25	omitted	
26	50	24
27	29	10
28	65	22
29	25	14
30	47	omitted
31	68	omitted
32	52	31
33	omitted	
34	61	omitted
35	21	Psychology item 2
36	omitted	
37	28	omitted
38	58	omitted
39	omitted	
40	3	omitted
41	63	33
42	5	6
43	60	omitted
44	8	omitted
45	38	26
46	omitted	
47	omitted	
48	omitted	

Item No. Pilot Test 1	Item No. Pilot Test 2	Item No. Pilot Test 3
Form B 1	30	omitted
2	omitted	
3	24	Psychology item 1
4	62	omitted
5	23	4
6	54	omitted
7	omitted	
8	32	5
9	59	omitted
10	omitted	
11	omitted	
12	13	omitted
13	70	omitted
14	2	11
15	14	29
16	39	35
17	7	32
18	53	omitted
19	omitted	
20	omitted	
21	26	omitted
22	71	omitted
23	48	16
24	37	omitted
25	19	30
26	9	omitted
27	6	18
28	omitted	
29	27	8
30	33	omitted
31	4	15
32	46	omitted
33	55	omitted
34	omitted	
35	15	21
36	11	17
37	57	9
38	34	omitted
39	omitted	
40	45	25
41	64	20
42	omitted	
43	omitted	
44	omitted	
45	omitted	
46	49	omitted
47	40	34
48	69	3

Item No.  
Pilot Test 2

Item No.  
Pilot Test 3

66 (new item)

28

12 (new item)

38 (new item)

39 (new item)

Psychology Items 3 (new item)

4 (new item)

5 (new item)

6 (new item)

7 (new item)

8 (new item)

## Test Items--Pilot 1--Form A

1. Physical activity is beneficial because it provides an opportunity to:
  - \*A. increase social contacts
  - B. avoid reality
  - C. show aggression towards others
  - D. take advantage of others
2. What is the best method for developing muscle strength?
  - A. Exercising with light weights for many repetitions
  - B. Exercising with light weights for few repetitions
  - \*C. Exercising with a heavy weight for few repetitions
  - D. Exercising with maximum weight for one repetition
3. What is the best position for the arm to be in to absorb force?
  - A. Elbow extended at the moment of contact
  - B. Elbow higher than the force
  - \*C. Elbow flexed at the moment of contact
  - D. Elbow lower than the force
4. If physical activity is to have a beneficial effect on the cardiovascular system of a teenager, what is the minimum heart beat that must be reached?
  - A. 70
  - B. 90
  - C. 110
  - \*D. 130
5. Predict the flight of an object released at an angle of greater than 45 degrees.
  - \*A. Greater height than distance
  - B. Equal height and distance
  - C. Greater distance than height
  - D. No prediction possible
6. Physical activity will provide an outlet for the release of emotions most often if:
  - A. you are allowed to say and do exactly what you wish
  - \*B. you choose the activity
  - C. you play without rules
  - D. you are very tense before the activity
7. When striking an object with an implement (for example, in tennis, badminton, golf, or baseball), it is most efficient if the weight is transferred from the back foot to the front foot. Why?
  - A. Transfer of weight provides better balance
  - B. Transfer of weight gives more control of direction
  - C. Transfer of weight improves the timing
  - \*D. Transfer of weight causes an increase in power



8. Why is there an increase in the breathing rate during exercise?
  - A. Excessive carbon dioxide must be released to the air
  - B. Muscle tissue requires more oxygen
  - C. The heart needs more oxygen in order to pump faster
  - \*D. All of the above
9. If a person is attempting to improve their physical condition how often should they exercise?
  - A. After heavy meals
  - \*B. Regularly
  - C. As soon as they detect an increase in weight
  - D. Whenever they feel the necessity
10. Which of the following diseases can be partially attributed to sedentary lifestyles?
  - A. Coronary heart disease
  - B. High blood pressure
  - C. Obesity
  - \*D. All of the above
11. Which body position will best allow for a quick stop after a sudden burst of speed?
  - A. Feet together, centre of gravity low
  - B. Feet apart, centre of gravity high
  - \*C. Feet apart, centre of gravity low
  - D. Feet apart, centre of gravity high
12. In terms of building general fitness the average person should be most concerned with developing:
  - A. strength
  - B. anaerobic power
  - \*C. aerobic power
  - D. skilled running patterns
13. Which one of the following statements does not describe good running technique?
  - A. Lean slightly forward
  - B. Swing the arms back and forth
  - \*C. Land on the soles of the feet
  - D. Bend the elbows
14. Toe-touching is an exercise to improve:
  - A. strength
  - B. power
  - \*C. flexibility
  - D. co-ordination

15. As a result of extensive physical activity, muscle fuel will eventually be used up and waste products will accumulate. The muscle is then in a state of:
- A. sensitivity
  - \*B. fatigue
  - C. irritability
  - D. extension
16. Which of the following tests is not used to measure cardiovascular endurance?
- A. 12 Minute Run
  - B. Astrand Bicycle Test
  - \*C. The Sit-up Test
  - D. The Step Test
17. What happens to the heart beat immediately after intense activity?
- A. It is slower than during rest
  - \*B. It is faster than during rest
  - C. It is more irregular than during rest
  - D. It is no different than during rest
18. Where should the non-kicking foot be placed in order to correctly kick a ball along the ground?
- A. Ahead of the ball
  - \*B. Beside the ball
  - C. Behind the ball
  - D. Well away from the ball
19. If your class has started a weight training and conditioning program which of the following outcomes might be expected?
- A. The females in the class will develop bulging muscles
  - B. The number of voluntary muscles in the body will increase
  - \*C. The muscles in the body will become stronger
  - D. The number of muscle fibres in each muscle will increase
20. Fatigue that occurs during exercise is most often caused by:
- A. muscle cramps
  - B. inadequate food prior to exercise
  - C. insufficient sleep
  - \*D. a build-up of waste products
21. What is the purpose of the approach in high jump, vaulting, or in the volleyball spike?
- A. To allow time for mental preparation
  - B. To assure that the jump is taken from the correct foot
  - \*C. To build up power
  - D. To allow the heart and lungs time to reach peak efficiency

22. Physical Work Capacity is best estimated by measuring:
- A. the amount of work that can be done before fatigue occurs
  - \*B. the maximum oxygen consumption rate
  - C. the maximum breathing rate during exercise
  - D. the maximum attainable heart rate during exercise
23. If you apply force to the ground or floor but find that you slip, what is missing?
- A. Weight
  - B. Movement
  - \*C. Friction
  - D. Balance
24. Which of the following benefits can not be attributed to regular physical activity?
- \*A. An immunity to bacterial infections
  - B. An aid in relieving depression
  - C. A method to delay the ageing process
  - D. An aid in keeping the digestive system regular
25. When receiving an object that is coming toward you with great speed what is the best position for the feet to be in?
- \*A. One well ahead of the other facing the throw
  - B. One slightly ahead of the other facing the throw
  - C. Side by side and wide apart
  - D. Side by side and close together
26. Which of the following statements describes an efficient circulatory system?
- A. A pulse that increases rapidly during exercise
  - \*B. A pulse that returns quickly to normal after exercise
  - C. A pulse that returns slowly to normal after exercise
  - D. Both A and C are correct
27. Which of the following exercises utilizes anaerobic energy?
- A. 10 sit-ups
  - B. A 3-mile run
  - C. A 200-metre swim
  - \*D. A 50-metre sprint
28. If the breathing rates of trained and untrained athletes were compared during exercise, what would be the result?
- A. The untrained athlete would breathe deeper and slower
  - B. The trained athlete would breathe deeper and faster
  - C. The untrained athlete would breathe deeper and faster
  - \*D. The trained athlete would breathe deeper and slower

29. If a person is attempting to jump as high as possible, which of the following techniques will increase the height of the jump?
- A. Reach up as high as possible with the arms prior to leaving the floor
  - B. Lean forward with the trunk after leaving the floor
  - \*C. Bend the knees prior to leaving the floor
  - D. Both A and C are correct
30. Exercises which involve a change in the length of a muscle are classified as:
- \*A. isotonic
  - B. static
  - C. adaptive
  - D. isometric
31. If you were learning to play badminton, which method would be most effective?
- \*A. Learn the large, general movement pattern first
  - B. Learn the small, specific patterns first
  - C. Learn the entire sequences of movement at the same time
  - D. Take part in a game and perfect skills as it becomes necessary
32. Which of the following methods is most accurate for locating and assessing the pulse?
- A. While exercising, press the palm against the heart
  - \*B. After exercising, press two fingers against the side of the neck
  - C. After exercising, press one hand against the heart and the other against the neck
  - D. While exercising, keep the fingers of one hand on the wrist of the other arm
33. Why does regular participation in an activity usually lead to better skill performance?
- A. Through practice muscles learn to contract automatically
  - \*B. Repetition reinforces the correct nerve responses
  - C. The longer you practice the more relaxed you become
  - D. Practice makes perfect
34. Persons who possess good flexibility are less likely to injure muscles and joints because:
- A. they have a large range of mobility around their joints
  - B. unstretched muscles become sore when exerted
  - C. stretched muscles have greater elasticity
  - \*D. all of the above

35. Which of the following statements best describes the role of regular physical activity in preparation for future life?

- A. It prepares students for interschool teams
- B. It provides a needed break in the day
- \*C. It provides for the constructive use of leisure time
- D. It prepares students for a profession in athletics

36. Which diagram represents the safest position for landing after a jump?



37. Physical activity immediately following a meal may produce pain because:

- A. increased action of the rib cage affects the digestive system
- \*B. blood moves from the digestive organs to the active muscles
- C. digestive juices are not produced during exercise
- D. the abdominal muscles contract during exercise

38. Interval training is a training method which involves:

- A. sprinting mixed with distance running at prescribed intervals
- B. running long distances at specific intervals
- \*C. short sprints separated by measured recovery periods
- D. distance running with short sprints at prescribed intervals

39. What happens when a stationary object is struck by an object in motion?

- A. There is no change in either object
- B. The object in motion will go faster after the impact
- \*C. The force of the moving object is transferred to the stationary object
- D. Both objects become stationary because of resistance

40. Why does a person who is in poor physical condition often feel dizzy and find breathing painful during exercise?

- A. Muscles cramp causing pain, and dizziness is a psychological effect
- B. Overstretched muscles produce pain and retard the flow of blood to the brain
- \*C. The oxygen demands of the body are greater than the supply available
- D. The muscles of respiration are overworked

41. What is the safest position to take during a fall?
- A. Let your arms support you so that your body doesn't hit the ground
  - B. Keep your head up to see where you are going
  - C. Spread your body as wide as possible to lessen the impact
  - \*D. Roll on to your shoulder and over on to your back as you land
42. Weak abdominal muscles will:
- A. make you look thinner
  - \*B. contribute to poor posture
  - C. grow stronger with proper diet
  - D. create digestive problems
43. The best technique for catching an object is:
- A. to catch it in front of the face
  - B. to catch it with outstretched arms
  - \*C. to pull the object close to the body
  - D. to catch it with one hand
44. Why is the competitive environment provided by some physical activities beneficial?
- A. Competition brings out the best in everyone
  - B. Only in competition do we learn what people are really like
  - C. Competition separates the winners from the losers
  - \*D. We learn how to cope with competition in life
45. Why is 'overloading' a muscle important in developing muscle strength?
- A. Overload destroys weak muscle fibres and replaces them with stronger ones
  - \*B. Muscles grow larger and stronger only in response to progressively increasing loads
  - C. During overload, muscles are stretched beyond their previous capacity thus making them stronger
  - D. Waste materials do not accumulate during overload
46. Standing in one position for an extended period of time should be avoided because:
- A. it is bad for the bones of the feet
  - B. it promotes poor posture
  - \*C. it hampers the return of blood to the heart
  - D. none of the above
47. Which of the following statements applies to skill learning?
- A. Individual practice is more important than team practice
  - B. Practice is the easiest and shortest phase of learning a skill
  - \*C. Incorrect as well as correct techniques can be learned

through practice

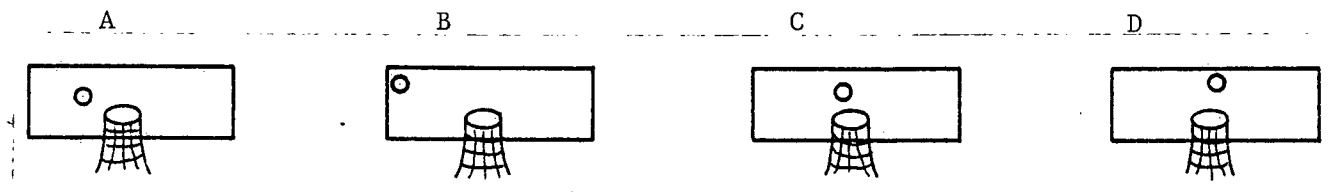
- D. In order to learn a new skill an individual must be in good physical condition

48. Which of the following statements is not true with regard to muscle endurance?

- A. It is measured by the number of repetitions that can be performed at a given exercise load
- \*B. It is developed by working the muscles against a heavy resistance through few repetitions
- C. It is the ability to sustain effort over a long period of time
- D. It is developed by working the muscles against a light resistance through many repetitions

## Test Items--Pilot 1--Form B

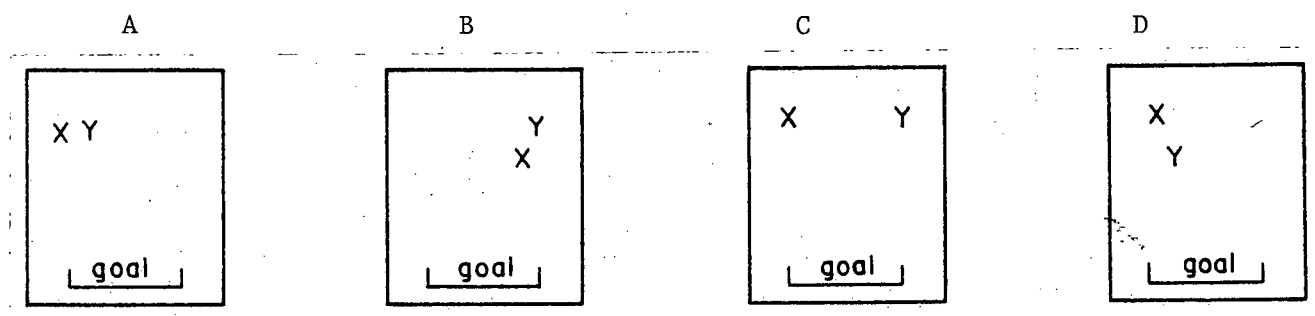
1. Coronary heart disease is caused by:
  - A. an emotional trauma which creates a rapid firing of nerve impulses to the heart
  - \*B. a blockage of one of the arteries that provides nourishment for the heart
  - C. a seepage of blood from one side of the heart to the other
  - D. a faulty valve that affects the flow of blood in the heart
2. In a game of badminton doubles, where should the partners stand when the opponents are on attack?
  - A. Side by side at the net
  - \*B. Side by side at mid-court
  - C. One at the net, the other directly behind
  - D. Outside the service area
3. Team sports are beneficial because:
  - \*A. individual goals are sacrificed for group goals
  - B. individuals are provided with an opportunity to excel
  - C. strong players can hide the weaknesses of others
  - D. substitutions can be made in case of injury
4. When executing a basketball lay-up shot, it is wise to rebound the ball off the backboard. Which of the following diagrams best illustrates the correct point of contact on the backboard if the lay-up is attempted from the left?



5. Identify the sequence which best describes the path taken by oxygenated blood.
  - A. Heart, lungs, arteries, capillaries
  - B. Capillaries, arteries, lungs, heart
  - \*C. Lungs, heart, arteries, capillaries
  - D. Heart, lungs, capillaries, arteries
6. Which of the following foods will definitely improve athletic performance?
  - A. Peanuts
  - B. Enriched beverages
  - C. Steak
  - \*D. None of the above



7. Which of the following statements identifies a person who has a strong need to achieve?
- A. One who places friendship ahead of competition as a desirable goal for sport
  - B. One who believes that the essence of sport and activity lies in the beauty of movement
  - C. One who participates in activity to reduce frustration effectively
  - \*D. One who sees constant improvement as the main goal of sport
8. Which of the following food types requires the shortest time to be digested?
- \*A. Carbohydrates
  - B. Proteins
  - C. Fats
  - D. There is no difference
9. In order to increase your power you should work on:
- A. endurance and strength
  - \*B. speed and strength
  - C. co-ordination and speed
  - D. agility and strength
10. Which of the following minerals contributes to the ability of the red blood cells to carry oxygen?
- A. Calcium
  - B. Potassium
  - \*C. Iron
  - D. None of the above
11. In which of the following situations would player 'Y' be in the best position to prevent player 'X' from getting to the goal?



12. The internal exchange of oxygen and carbon dioxide takes place in the:
- \*A. body cells
  - B. veins
  - C. throat
  - D. arteries

13. Which term best describes the nerves that carry messages from the brain to the muscles?
- A. Sensory
  - B. Impulse
  - C. Receptor
  - \*D. Motor
14. What will happen to a ball that is released with topspin?
- A. It will swerve to the right
  - \*B. It will hit the ground sooner than a ball without topspin
  - C. It will go further before hitting the ground than a ball without topspin
  - D. It will go higher than a ball without topspin
15. Which of the following gases is found in tobacco smoke and affects physical endurance?
- \*A. Carbon Monoxide
  - B. Nitrogen
  - C. Carbon Dioxide
  - D. Oxygen
16. Which body part is most effective in receiving a volleyball that is coming at you low and hard? Why?
- A. Your upper leg, because it is close to the ground
  - \*B. The inside of your forearm, because it provides better control
  - C. Your fist, in order to prevent injury
  - D. The back of your hand, because it is a flat, hard surface
17. Under which of the following circumstances will exercise place a greater load on the body?
- A. During hot weather
  - B. During cold weather
  - C. At high altitudes
  - \*D. Both A and C are correct
18. Identify the gas which causes you to breathe in
- \*A. Carbon Dioxide
  - B. Oxygen
  - C. Nitrogen
  - D. Carbon Monoxide
19. You are running a 400-metre race. As you near the finish line you decide to go faster. Which technique will help you to increase your speed?
- A. Straighten your body
  - B. Take shorter strides
  - C. Use less arm action
  - \*D. Lengthen your stride

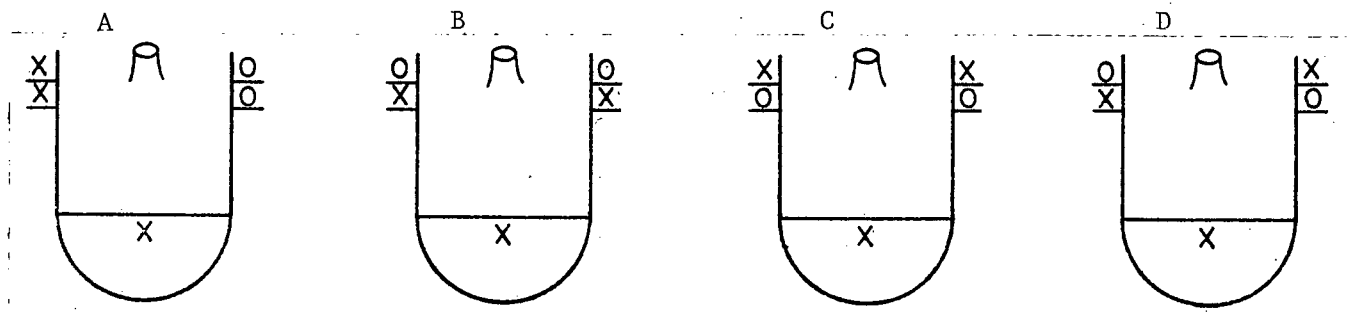
20. Which of the following combinations is most effective for losing weight?

- A. A health food diet with regular sauna baths
- B. Daily massages plus a reduction in calories
- C. A weight training program with daily massages
- \*D. Regular exercise plus a reduction in calories

21. Alcohol affects motor performance because it is:

- \*A. a depressant
- B. a stimulant
- C. an anti-coagulant
- D. a pain reliever

22. Which of the following diagrams best illustrates the correct line-up of players for a basketball free throw?



23. What is the primary function of protein?

- A. To slow down digestive processes
- B. To form simple sugars
- C. To produce energy
- \*D. To repair tissue

24. Drugs which are taken to improve performance are dangerous primarily because:

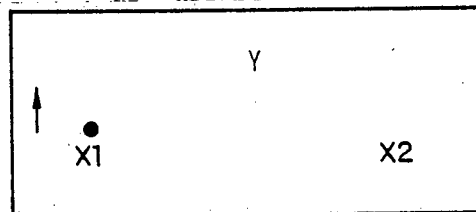
- A. they accelerate the functioning of the muscles and heart
- B. they affect the utilization of food
- C. they increase the rate of nerve firings
- \*D. they push a person beyond his current physical capabilities

25. Which of the following situations would be most likely to result in a 'point' in a badminton game?

- A. The server steps on the serving line
- B. The receiver sends the bird high and deep into the opponent's court
- C. The receiver sends a fast, sharply angled shot down into the opponent's court
- \*D. The server sends a fast, sharply angled shot down into the opponent's court

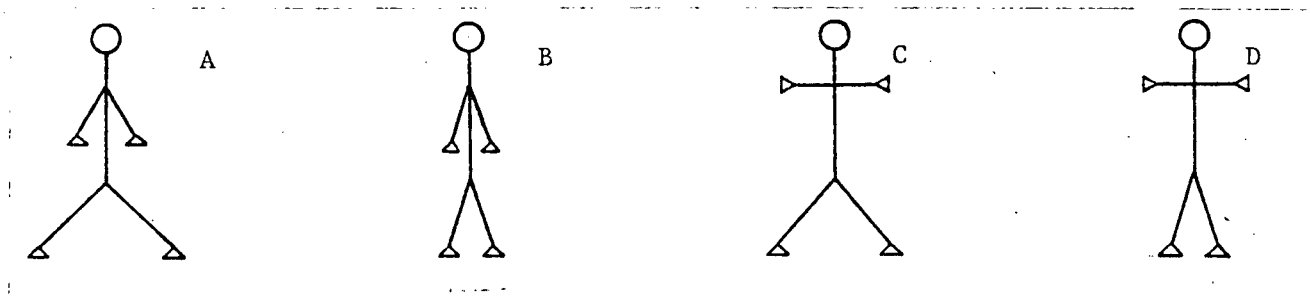
26. Which one of the following nutrients is lost during excessive perspiration?
- \*A. Salt
  - B. Vitamins
  - C. Proteins
  - D. Amino Acids
27. Which of the following considerations regarding drugs should be of most concern to athletes?
- A. Will the drug improve the performance?
  - \*B. Is the drug dangerous or unethical?
  - C. Will the drug relieve pain?
  - D. Will the onset of fatigue be delayed?
28. Which system activates respiration in the body?
- A. Circulatory
  - B. Respiratory
  - C. Muscular
  - \*D. Nervous
29. If a basketball team is playing a man-to-man system of defence, each member of the team should:
- \*A. stay between the designated opponent and the basket when the opponents are on attack
  - B. use the position of the ball to determine the best defensive position on the court
  - C. stay with the designated opponent at all times during the game
  - D. ignore the designated opponent if he moves away from the ball
30. Extremely overweight people are not likely to take part in physical activity because:
- \*A. they have a low personal self-image
  - B. they lack skill
  - C. they can't find a team to play on
  - D. they don't think physical activity will help them
31. 'Movement' is the end result of action by the body's:
- A. bones
  - B. nerves
  - C. muscles
  - \*D. all of the above
32. Which type of personality is likely to avoid competitive sports?
- A. A person with a low need to avoid failure and a high need to achieve
  - B. A person who has a high degree of self confidence and self-worth
  - C. A person high in aggression and low in inhibition

- \*D. A person with a low need to achieve and a high need to avoid failure
33. Why do fewer girls than boys participate in physical activity?
- A. Anatomical limitations
  - B. Safety reasons
  - \*C. Cultural factors
  - D. Physiological limitations
34. During regular breathing, as the rib cage expands, air:
- A. leaves the lungs
  - \*B. enters the lungs
  - C. enters the blood
  - D. exits through the nose and mouth
35. Most team sports involve movement into open spaces. The purpose of moving into an open space is:
- A. to cause an opponent to move with you
  - B. to make room for the player with the ball
  - C. to avoid an opponent who is staying near you
  - \*D. all of the above
36. If you are passing the ball to a teammate who is accelerating forward the ball should be aimed:
- A. at the hands of the receiver
  - \*B. ahead of the receiver
  - C. at eye level
  - D. to the right of the receiver
37. Fuel for muscles is provided by which one of the following systems?
- A. Respiratory
  - B. Nervous
  - \*C. Circulatory
  - D. Endocrine
38. In the diagram below there are two attackers (X1, X2) against one defender (Y). In order to get past the defender, when is the best time for 'X1' to pass to 'X2'?



- \*A. If 'Y' attempts to take the ball from 'X1'
- B. As soon as 'X2' calls for the ball
- C. As soon as 'X1' gets past 'Y'
- D. As soon as 'X2' gets past 'Y'

39. Which of the following statements best describes a person who participates in physical activity for social benefits?
- A. Seeks to get even with an opponent
  - B. Seeks opportunities to try new things
  - \*C. Happy just to be on the team
  - D. Enjoys the pleasurable physical sensations derived from activity
40. Which of the following statements does not apply to both badminton and volleyball?
- \*A. The serve must land in a specific area of the court
  - B. 'On the line' is considered in bounds
  - C. One person may serve an entire game
  - D. Contact between a player and the net is illegal
41. Which of the following statements is correct?
- \*A. After puberty, boys, on the average, are stronger than girls
  - B. After puberty, boys, on the average, are more flexible than girls
  - C. Before puberty, boys, on the average, are taller than girls
  - D. All of the above are correct
42. In which of the following positions will the body spin fastest?



43. What happens to a muscle that is not used?
- A. It becomes stronger
  - \*B. It becomes weaker
  - C. It becomes larger
  - D. Both A and C are correct
44. What is the best way to make a sudden change of direction?
- A. Turn to face the way you want to go
  - B. Keep the centre of gravity inside the supporting base
  - \*C. Move the centre of gravity outside the supporting base
  - D. Turn your body but keep your head facing forward

45. How does alcohol affect physical performance?
- \*A. It slows down activity in the brain and affects co-ordination
  - B. It relaxes you and therefore you perform better
  - C. It speeds up brain activity and allows you to make quicker decisions
  - D. It improves muscular strength and endurance
46. Which of the following phrases best describes the path of the shuttlecock in a badminton overhead clear shot?
- \*A. High and deep to the opponent's court
  - B. High and shallow to the opponent's court
  - C. Low and deep to the opponent's court
  - D. Cross court, high and shallow to the opponent's court
47. Which of the following is not a type of muscle tissue?
- A. Voluntary
  - B. Involuntary
  - C. Cardiac
  - \*D. Connective
48. The performance of which of the following athletes would be least impaired by smoking?
- A. A basketball player
  - B. A runner
  - \*C. A high jumper
  - D. A badminton player

## Test Items--Pilot 2

1. Which of the following statements does not describe good running technique?
  - A. Lean slightly forward
  - B. Swing the arms back and forth
  - \*C. Land on the soles of the feet
  - D. Reduce trunk rotation
  - E. I don't know
2. What will happen to a ball that is released with topspin?
  - A. It will swerve to the right
  - \*B. It will hit the ground sooner than a ball without topspin
  - C. It will go further before hitting the ground than a ball without topspin
  - D. It will go higher than a ball without topspin
  - E. I don't know
3. Why does a person who is in poor physical condition often feel dizzy and find breathing painful during exercise?
  - A. Muscles cramp causing pain, and dizziness is a psychological effect
  - B. Overstretched muscles produce pain and retard the flow of blood to the brain
  - \*C. The oxygen demands of the body are greater than the supply available
  - D. The muscles of respiration are over-worked
  - E. I don't know
4. Movement is the end result of action by the body's:
  - A. bones
  - B. nerves
  - C. muscles
  - \*D. all of the above
  - E. I don't know
5. Weak abdominal muscles will:
  - A. grow stronger with stretching
  - \*B. contribute to poor posture
  - C. grow stronger with proper diet
  - D. create digestive problems
  - E. I don't know
6. Which of the following considerations regarding drugs should be of most concern to athletes?
  - A. Will the drug improve performance?
  - \*B. Is the drug dangerous or unethical?
  - C. Will the drug relieve pain?
  - D. Will the onset of fatigue be delayed?
  - E. I don't know?



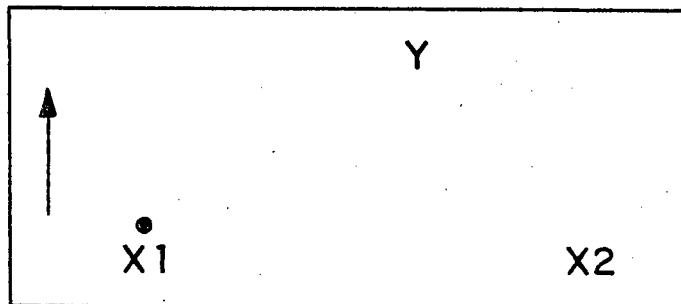
7. Under which of the following circumstances will exercise place a greater load on the body?
- A. During hot weather
  - B. During cold weather
  - C. At high altitudes
  - \*D. Both A and C are correct
  - E. I don't know
8. Why is the competitive environment provided by some physical activities beneficial?
- A. Everyone gives their best performance when they compete against others
  - B. In competitive environment we do learn what people are really like
  - C. Competition separates the winners from the losers
  - \*D. Competitive environment in physical activities teaches us how to cope with competition in life
  - E. I don't know
9. Which of the following nutrients is lost during excessive perspiration?
- \*A. Salt
  - B. Vitamins
  - C. Proteins
  - D. Amino Acids
  - E. I don't know
10. Which of the following tests is not used to measure cardiovascular endurance?
- A. 12 Minute Run
  - B. Astrand Bicycle Test
  - \*C. The Sit-Up Test
  - D. The Step Test
  - E. I don't know
11. If you are passing the ball to a teammate who is accelerating forward, the ball should be aimed:
- A. at the hands of the receiver
  - \*B. ahead of the receiver
  - C. at eye level
  - D. at the waist of the receiver
  - E. I don't know
12. What is the purpose of the approach in high jump, vaulting, or in the volleyball spike?
- A. To allow time for mental preparation
  - B. To assure that the jump is taken from the correct foot
  - \*C. To build up power
  - D. To allow the heart and lungs time to reach peak efficiency
  - E. I don't know

13. The internal exchange of oxygen and carbon dioxide takes place in the:
- \*A. body cells
  - B. veins
  - C. arterioles
  - D. arteries
  - E. I don't know
14. Which of the following gases is found in tobacco smoke and affects physical endurance?
- \*A. Carbon Monoxide
  - B. Nitrogen
  - C. Carbon Dioxide
  - D. Sulphur Dioxide
  - E. I don't know
15. Most team sports involve movement into open spaces. The purpose of moving into an open space is:
- A. to cause an opponent to move with you
  - B. to make room for the player with the ball
  - C. to avoid an opponent who is staying near you
  - \*D. all of the above
  - E. I don't know
16. What is the best method for developing muscle strength?
- A. Exercising with maximum weights for many repetitions
  - B. Exercising with light weights for few repetitions
  - \*C. Exercising with a heavy weight for few repetitions
  - D. Exercising with a maximum weight for one repetition
  - E. I don't know
17. If you press your feet to the ground but find that you slip, what is missing?
- A. Force
  - B. Resistance
  - \*C. Friction
  - D. Balance
  - E. I don't know
18. Which of the following conditions can be partially attributed to sedentary (inactive) lifestyles?
- A. Coronary heart disease
  - B. High blood pressure
  - C. Obesity
  - \*D. All of the above
  - E. I don't know

19. Which of the following situations would be most likely to result in a 'point' in a badminton game?
- A. The server steps on the serving line
  - B. The receiving side sends the bird high and deep into the opponent's court
  - C. The receiving side sends a fast, sharply angled shot down into the opponent's court
  - \*D. The serving side sends a fast, sharply angled shot down into the opponent's court
  - E. I don't know
20. In terms of building general fitness, the average person should be most concerned with developing:
- A. flexibility
  - B. anaerobic power
  - \*C. aerobic power
  - D. skilled running patterns
  - E. I don't know
21. Which of the following statements best describes the role of regular physical activity in preparation for future life?
- A. It prepares students for interschool teams
  - \*B. It provides for the constructive use of leisure time
  - C. It prepares students for a profession in athletics
  - D. None of the above
  - E. I don't know
22. Where should the non-kicking foot be placed in order to correctly kick a ball forward along the ground?
- A. Ahead of the ball
  - \*B. Beside the ball (even with the ball)
  - C. Directly behind the ball
  - D. Behind the ball and to the side
  - E. I don't know
23. Identify the sequence which best describes the path taken by oxygenated blood:
- A. heart, lungs, arteries, capillaries
  - B. capillaries, arteries, lungs, heart
  - \*C. lungs, heart, arteries, capillaries
  - D. heart, lungs, capillaries, arteries
  - E. I don't know
24. Team sports are beneficial because:
- \*A. individual goals are sacrificed for group goals
  - B. players without skill don't have to play
  - C. strong players can hide the weaknesses of others
  - D. substitutions can be made in case of injury
  - E. I don't know

25. If a person is attempting to jump as high as possible, which of the following techniques will increase the height of the jump?
- A. Reach up as high as possible with the arms prior to leaving the floor
  - B. Lean forward with the trunk after leaving the floor
  - \*C. Bend the knees prior to leaving the floor
  - D. Bend the knees after leaving the floor
  - E. I don't know
26. Alcohol is detrimental to motor performance because it is:
- \*A. a depressant
  - B. a stimulant
  - C. an anti-coagulant
  - D. a catalyst
  - E. I don't know
27. If a basketball team is playing a man-to-man system of defence, each member of the team should:
- \*A. stay between the designated opponent and the basket when the opponents are on attack
  - B. use the position of the ball to determine the best defensive position on the court
  - C. stay with the designated opponent at all times wherever he is on the court
  - D. stay with the designated opponent only if he is near the ball
  - E. I don't know
28. Physical activity immediately following a meal may produce pain because:
- A. increased action of the rib cage affects the digestive system
  - \*B. blood moves from the digestive organs to the active muscles
  - C. digestive juices are not produced during exercise
  - D. undigested food presses on the walls of the abdomen
  - E. I don't know
29. Which of the following exercises relies mainly on anaerobic energy?
- A. A 200-metre swim
  - B. A 3-mile run
  - C. A marathon run
  - \*D. A 25-metre sprint
  - E. I don't know
30. Coronary heart disease is caused by:
- A. an emotional experience which causes a rapid firing of nerve impulses to the heart
  - \*B. a blockage of one of the arteries that provides nourishment for the heart
  - C. a seepage of blood from one side of the heart to the other
  - D. a faulty valve that affects the flow of blood to the heart
  - E. I don't know

31. Which body position will best allow for a quick stop after a sudden burst of speed?
- A. Feet together, centre of gravity low
  - B. Feet apart, centre of gravity high
  - \*C. Feet apart, centre of gravity low
  - D. Feet together, centre of gravity high
  - E. I don't know
32. Which of the following food types requires the shortest amount of time to be digested?
- \*A. Carbohydrates
  - B. Proteins
  - C. Fats
  - D. There is no difference
  - E. I don't know
33. Extremely overweight people are not likely to take part in physical activity because:
- \*A. they have a low opinion of themselves
  - B. they lack skill
  - C. they don't like activity
  - D. they don't think physical activity will help them
  - E. I don't know
34. In the diagram below there are two attackers (X1, X2) against one defender (Y). In order to get past the defender, when is the best time for 'X1' to pass to 'X2'?



- \*A. If 'Y' attempts to take the ball from 'X1'
  - B. As soon as 'X2' calls for the ball
  - C. As soon as 'X1' gets past 'Y'
  - D. As soon as 'X2' gets past 'Y'
  - E. I don't know
35. Fatigue that occurs during exercise is most often caused by:
- A. muscle cramps
  - B. inadequate food prior to exercise
  - C. insufficient sleep
  - \*D. a build-up of waste products
  - E. I don't know

36. Physical activity will provide an outlet for the release of emotions most often if:
- A. you are allowed to say exactly what you wish
  - \*B. you choose the activity
  - C. you play without rules
  - D. you are allowed to do exactly what you wish
  - E. I don't know
37. Drugs which are taken to improve performance are dangerous primarily because:
- A. they speed up reaction time
  - B. they relax you too much
  - C. they cause an increase in muscle bulk
  - \*D. they push people beyond their current physical capacities
  - E. I don't know
38. Why is 'overloading' a muscle important in developing muscle strength?
- A. Overload destroys weak muscle fibres and replaces them with stronger ones
  - \*B. Muscles grow larger and stronger only in response to progressively increasing loads
  - C. Overload stretches muscles beyond their capacity
  - D. Waste materials do not accumulate during overload
  - E. I don't know
39. Which body part is most effective in receiving a volleyball that is coming at you low and hard? Why?
- A. The back of your forearm because it is a hard, smooth surface
  - B. Your fist, in order to prevent injury
  - C. The back of your hand because it is a flat surface
  - \*D. The inside of your forearm because it is soft
  - E. I don't know
40. Which of the following is not a type of muscle tissue?
- A. Voluntary
  - B. Smooth
  - C. Cardiac
  - \*D. Connective
  - E. I don't know
41. What is the best position for the arms to be in to correctly catch an object thrown through the air in order to absorb force?
- A. Arms extended at the moment of contact
  - B. Elbows held higher than the hands
  - \*C. Arms bent at the moment of contact
  - D. Elbows spread away from the body
  - E. I don't know

42. Why is there an increase in the breathing rate during exercise?
- A. Excessive carbon dioxide must be released to the air
  - B. Muscle tissue requires more oxygen
  - C. The heart needs more oxygen in order to pump faster
  - \*D. All of the above
  - E. I don't know
43. What is the best angle for releasing a baseball in order to achieve the greatest distance?
- A. 30°
  - \*B. 45°
  - C. 60°
  - D. 90°
  - E. I don't know
44. As a result of extensive physical activity, muscle fuel will be used up and waste products will accumulate. The muscle is then in a state of:
- A. sensitivity
  - \*B. fatigue
  - C. irritability
  - D. extension
  - E. I don't know
45. Which of the following statements does not apply to both badminton and volleyball?
- A. The serve must land in a specific area of the court
  - B. 'On the line' is considered in bounds
  - \*C. One person may serve an entire game
  - D. Contact between a player and the net is illegal
  - E. I don't know
46. Which type of personality is likely to avoid competitive sports?
- A. A person with a low need to avoid failure and a high need to achieve
  - B. A person who has a high degree of self-confidence and self-worth
  - C. A person high in aggression and low in inhibition
  - \*D. A person with a low need to achieve and a high need to avoid failure
  - E. I don't know
47. Isotonic exercises are exercises which:
- A. cause an increase in the number of muscle fibres
  - B. cause a decrease in the number of muscle fibres
  - \*C. cause a change in the length of a muscle
  - D. cause an increase in tension within a muscle
  - E. I don't know

48. What is the primary function of protein?
- A. To speed up digestive processes
  - B. To form simple sugars
  - C. To absorb acids
  - \*D. To repair tissue
  - E. I don't know
49. Which of the following phrases best describes the path of the shuttlecock in a badminton overhead clear shot?
- \*A. High and deep to the back of the opponent's court
  - B. High and short to the front of the opponent's court
  - C. Low and deep to the back of the opponent's court
  - D. Low and shallow into the front of the opponent's court
  - E. I don't know
50. Which of the following statements describes an efficient circulatory system?
- A. A pulse that increases rapidly during exercise
  - \*B. A pulse that returns quickly to normal after exercise
  - C. A pulse that returns slowly to normal after exercise
  - D. Both A and C are correct
  - E. I don't know
51. When striking an object with an implement (for example, in tennis, badminton, golf, or baseball) it is most efficient if the body weight is transferred from the back foot to the front foot. Why?
- A. Transfer of weight provides better balance
  - B. Transfer of weight gives more control of direction
  - C. Transfer of weight helps to avoid injury
  - \*D. Transfer of weight causes an increase in power
  - E. I don't know
52. Which of the following methods is most accurate for locating and assessing the pulse?
- A. During activity, press two fingers against the heart
  - \*B. After activity, press two fingers against the side of the neck
  - C. After activity press the thumb against the heart
  - D. After activity keep the thumb of one hand on the wrist of the other arm
  - E. I don't know
53. Identify the gas which triggers respiration:
- \*A. Carbon Dioxide
  - B. Oxygen
  - C. Nitrogen
  - D. Carbon Monoxide
  - E. I don't know

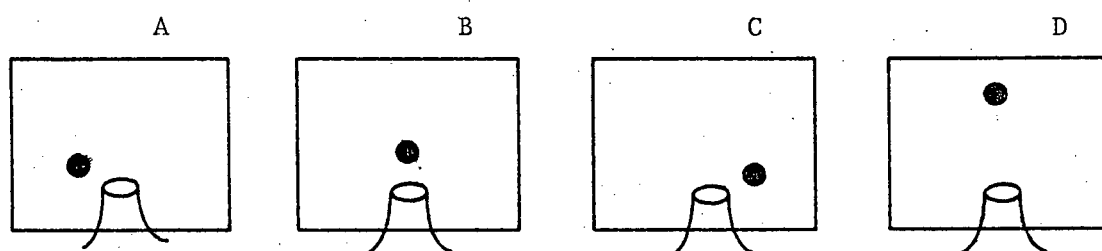


54. Which of the following foods will definitely improve athletic performance?
- A. Spaghetti
  - B. Enriched beverages
  - C. Steak
  - \*D. None of the above
  - E. I don't know
55. Why do fewer girls than boys participate in physical activity?
- A. Girls' bodies aren't built for physical activity
  - B. They are afraid they'll get hurt
  - C. Girls don't like activity as much as boys
  - \*D. Society discourages girls from being physically active
  - E. I don't know
56. Which of the following benefits can not be attributed to regular physical activity?
- \*A. An immunity to bacterial infection
  - B. An aid in relieving depression
  - C. A method to delay the effects of ageing
  - D. An aid in keeping the digestive system regular
  - E. I don't know
57. Fuel for muscles is provided by which one of the following systems:
- A. respiratory
  - B. nervous
  - \*C. circulatory
  - D. none of the above
  - E. I don't know
58. Interval training is a training method which involves:
- A. sprinting mixed with distance running at prescribed intervals
  - B. running long distances at specific intervals
  - \*C. short sprints separated by measured recovery periods
  - D. short sprints separated by bouts of heavy calisthenics
  - E. I don't know
59. In order to increase your power you should work on:
- A. flexibility and strength
  - \*B. speed and strength
  - C. coordination and speed
  - D. agility and strength
  - E. I don't know
60. The best technique for catching an object is:
- A. to catch it close to the face
  - B. to catch it with outstretched arms
  - \*C. to catch it with arms bent
  - D. to catch it close to the centre of gravity
  - E. I don't know

61. Persons who possess good flexibility are less likely to injure muscles and joints because:

- A. they have a large range of mobility around their joints
- B. unstretched muscles become sore when exerted
- C. stretched muscles have greater elasticity
- \*D. all of the above
- E. I don't know

62. When executing a basketball lay-up shot, it is wise to rebound the ball off the backboard. Which diagram below best illustrates the correct point of contact on the backboard if the lay-up is attempted from the left?



E. I don't know

63. What is the safest position to take during a fall?

- A. Let your arms support you so that your body doesn't hit the ground
- B. Keep your head up to see where you are going
- C. Keep your feet together and your weight low
- \*D. Roll on to your shoulder and over on to your back as you land
- E. I don't know

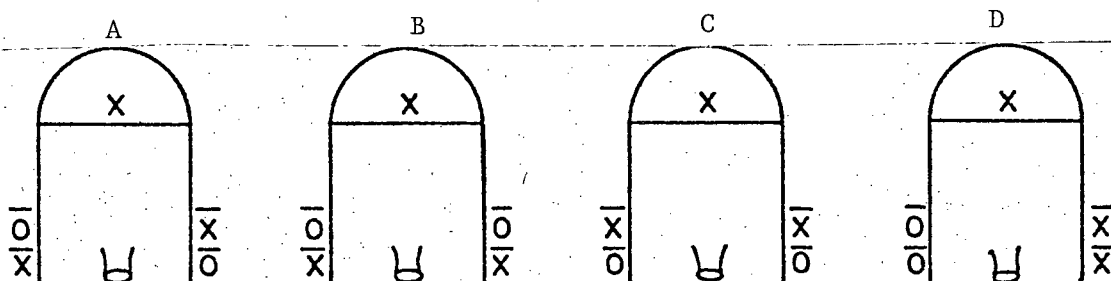
64. Which of the following statements is correct?

- \*A. After puberty, boys, on the average, are stronger than girls
- B. After puberty, boys, on the average, are more flexible than girls
- C. Before puberty, boys, on the average, are taller than girls
- D. All of the above are correct
- E. I don't know

65. If the breathing rates of trained and untrained athletes were compared during exercise, what would be the result?

- A. The untrained athlete would breathe deeper and slower
- B. The trained athlete would breathe deeper and faster
- C. The untrained athlete would breathe deeper and faster
- \*D. The trained athlete would breathe deeper and slower
- E. I don't know

66. Which of the following tissues is not easily repaired once it is injured?
- A. Smooth Muscle
  - \*B. Nerve
  - C. Striated Muscle
  - D. Skin
  - E. I don't know
67. If your class has started a weight training and conditioning program which of the following outcomes might be expected?
- A. The girls in the class will develop large muscles
  - B. The number of voluntary muscles in the body will increase
  - \*C. The muscles in the body will become stronger
  - D. The number of muscle fibres in each muscle will increase
  - E. I don't know
68. If you were learning to play tennis, which method would be most effective?
- \*A. Learn the large, general movement pattern first
  - B. Learn the small, specific movement patterns first
  - C. Practice alone as often as possible
  - D. Take part in a game and perfect skills as you need them
  - E. I don't know
69. The performance of which of the following athletes would be least impaired by smoking tobacco?
- A. A swimmer
  - B. A runner
  - \*C. A high jumper
  - D. A badminton player
  - E. I don't know
70. Which term describes the nerves that transmit message from the brain to the muscles in order to produce movement?
- A. Sensory
  - B. Axon
  - C. Receptor
  - \*D. Motor
  - E. I don't know
71. Which of the following diagrams best illustrates the correct line-up of players for a basketball free throw?



72. If physical activity is to have a beneficial effect on the heart and circulatory system, which of the following conditions must be met?
- A. The heart beat must not increase during activity
  - \*B. The heart beat must increase during activity
  - C. The activity must be continuous, with no rest periods
  - D. The body must not be 'warmed-up' prior to the activity
  - E. I don't know

## Test Items--Pilot 3--Final Form

1. What should you do when you run?
  - A. Lean slightly backwards
  - \*B. Move the arms alternately backwards and forwards
  - C. Land on the heels of the feet
  - D. Increase trunk rotation
  - E. I don't know
2. What is the main purpose of the approach run in high jumping or pole vaulting?
  - A. It allows time for mental preparation
  - B. It ensures that the jump is taken from the correct foot
  - \*C. It develops momentum
  - D. It establishes good balance
  - E. I don't know
3. The performance of which of the following athletes is least likely to be affected by smoking tobacco?
  - A. A swimmer
  - B. A runner
  - \*C. A high-jumper
  - D. A tennis player
  - E. I don't know
4. What is the path followed by the blood in order to get oxygen to the body cells?
  - A. Heart, lungs, arteries, capillaries
  - B. Capillaries, arteries, lungs, heart
  - \*C. Lungs, heart, arteries, capillaries
  - D. Heart, lungs, capillaries, arteries
  - E. I don't know
5. Which of the following food types requires the shortest amount of time to be digested?
  - \*A. Carbohydrates
  - B. Proteins
  - C. Fats
  - D. There is no difference
  - E. I don't know
6. Weak abdominal muscles will:
  - A. make you less flexible
  - \*B. contribute to poor posture
  - C. grow stronger with proper diet
  - D. create digestive problems
  - E. I don't know

\*correct answer

7. Which body position will allow for the most efficient stop after a sudden burst of speed?
- A. Feet together, knees bent
  - B. Feet together, legs straight
  - C. Feet apart, legs straight
  - \*D. Feet apart, knees bent
  - E. I don't know
8. If a basketball team is playing a man-to-man system of defense, each member of the team should:
- \*A. stay between the designated opponent and the basket when the opponents are attacking
  - B. use the position of the ball to determine the best defensive position on the court
  - C. stay with the designated opponent at all times, wherever he is on the court
  - D. stay with the designated opponent only if he is near the ball
  - E. I don't know
9. Fuel for muscles is provided by which of the following systems?
- A. Respiratory
  - B. Nervous
  - \*C. Circulatory
  - D. Digestive
  - E. I don't know
10. Which of the following activities relies mainly on anaerobic energy?
- A. A 400 metre swim
  - B. A 5000 metre run
  - C. A marathon run
  - \*D. A 60 metre sprint
  - E. I don't know
11. What will happen to a ball that is released with topspin?
- A. It will swerve to the right
  - \*B. It will hit the ground sooner than a ball without topspin
  - C. It will go farther before hitting the ground than a ball without topspin
  - D. It will go higher before hitting the ground than a ball without topspin
  - E. I don't know
12. When doing sit-ups, the abdominal muscles work hardest when:
- A. your legs are straight and your hands are locked behind your head
  - \*B. your knees are bent and your hands are locked behind your head
  - C. your legs are straight and your back is arched
  - D. your knees are bent and your back is arched
  - E. I don't know

13. What is the best method for developing muscle strength?
- A. Exercising with light weights for many repetitions
  - B. Exercising with light weights for a few repetitions
  - \*C. Exercising with heavy weights for a few repetitions
  - D. Exercising with a maximum weight for one repetition
  - E. I don't know
14. If a person is attempting to jump as high as possible, which of the following techniques will increase the height of the jump?
- A. Keep the arms beside the body when leaving the floor
  - B. Lean forward with the trunk after leaving the floor
  - \*C. Bend the knees before leaving the floor
  - D. Bend the knees after leaving the floor
  - E. I don't know
15. Movement is the end result of action by the body's:
- A. bones
  - B. nerves
  - C. muscles
  - \*D. all of the above
  - E. I don't know
16. Why is protein essential for a physically active person?
- A. It speeds up digestive processes
  - B. It helps form simple sugars
  - C. It absorbs acids
  - \*D. It builds body tissues
  - E. I don't know
17. If you are passing the ball to a team mate who is running forward, where should the ball be aimed?
- A. At the hands of the receiver
  - \*B. Ahead of the receiver
  - C. At the eye level of the receiver
  - D. At the waist of the receiver
  - E. I don't know
18. Which of the following questions about a drug should be of most concern to athletes?
- A. Will the drug improve performance?
  - \*B. Is the drug safe?
  - C. Will the drug relieve pain?
  - D. Will the drug delay the onset of fatigue?
  - E. I don't know
19. In terms of building long term fitness, the average person should be most concerned with developing their:
- A. muscular system
  - \*B. aerobic energy system
  - C. anaerobic energy system
  - D. skilled running patterns
  - E. I don't know

20. Which of the following statements is correct?
- \*A. After puberty, boys, on the average, are stronger than girls
  - B. After puberty, boys, on the average, are more flexible than girls
  - C. Before puberty, boys, on the average, are taller than girls
  - D. Before puberty, boys, on the average, are heavier than girls
  - E. I don't know
21. Most team sports involve movement into open spaces. The purpose of moving into an open space is:
- A. to cause an opponent to move with you
  - B. to make room for the player with the ball
  - C. to avoid an opponent who remains close to you
  - \*D. all of the above
  - E. I don't know
22. If the breathing rates of trained and untrained individuals were compared during a long run, what would be the result?
- A. The untrained athlete would breathe shallower and slower
  - B. The trained athlete would breathe shallower and faster
  - C. The untrained athlete would breathe deeper and faster
  - \*D. The trained athlete would breathe deeper and slower
  - E. I don't know
23. If your class has started a weight training and conditioning program, which of the following results might be expected?
- A. The girls and boys in the class will develop large, bulky muscles
  - B. The number of muscles in the body will increase
  - \*C. The muscles in the body will become stronger
  - D. The number of muscle fibres in each muscle will increase
  - E. I don't know
24. Which of the following statements describes an efficient circulatory system?
- A. A pulse that increases rapidly during exercise
  - \*B. A pulse that returns quickly to normal after exercise
  - C. A pulse that returns slowly to normal after exercise
  - D. A pulse that is high all the time
  - E. I don't know
25. Which of the following statements is true when playing both badminton doubles and volleyball?
- A. Overhand serves are illegal
  - B. Serves that contact the net are legal
  - C. The serve must land within a designated service area of the court
  - \*D. It is possible for one person to serve an entire game
  - E. I don't know



26. Why is "overloading" a muscle important in developing muscle strength?
- A. "Overloading" destroys weak muscle fibres and replaces them with stronger ones
  - \*B. Muscles grow larger and stronger only in response to progressively increasing loads
  - C. "Overloading" stretches muscles beyond their capacity
  - D. Waste materials do not accumulate during overload
  - E. I don't know
27. When striking an object with an implement (for example, hitting a ball with a bat or racquet), it is most efficient if:
- A. you contact the ball slightly behind your back foot
  - B. you keep your weight evenly distributed throughout the swing
  - C. you transfer your weight from your front foot to your back foot
  - \*D. you transfer your weight from your back foot to your front foot
  - E. I don't know
28. Which of the following tissues is not as easily repaired by the body once it is injured?
- A. Muscle
  - \*B. Nerve
  - C. Bone
  - D. Skin
  - E. I don't know
29. Which of the following gases is found in tobacco smoke and reduces physical endurance?
- \*A. Carbon monoxide
  - B. Nitrogen
  - C. Carbon dioxide
  - D. Sulphur dioxide
  - E. I don't know
30. Which of the following situations would be most likely to result in a "point" in a badminton game?
- A. The server steps on the serving line
  - B. The receiving side sends the bird high and deep into the opponent's court
  - C. The receiving side sends a fast, sharply angled shot to the floor of the opponent's court
  - \*D. The serving side sends a fast, sharply angled shot to the floor of the opponent's court
  - E. I don't know

31. Which of the following methods is most accurate for locating and recording the pulse?
- A. During activity, keep the thumb of one hand on the wrist of the other arm
  - \*B. After activity, press two fingers against the side of the neck
  - C. During activity, press two fingers against the side of the neck
  - D. After activity, keep the thumb of one hand on the wrist of the other arm
  - E. I don't know
32. Strenuous activities will place the greatest strain on the body?
- \*A. during hot humid weather
  - B. during cold weather
  - C. during wet weather
  - D. at low altitudes
  - E. I don't know
33. What is the safest way to fall?
- A. Keep your head up to see where you are going
  - B. Put your arms straight ahead of you
  - C. Land on your hands and knees
  - \*D. Curl up and roll as you fall
  - E. I don't know
34. Which of the following is not a type of muscle tissue?
- A. Smooth
  - B. Skeletal
  - C. Cardiac
  - \*D. Connective
  - E. I don't know
35. When playing volleyball, which body part should be used to receive a ball that is coming at you low and hard?
- A. Palms of your hands
  - B. Fists
  - C. Knee
  - \*D. Forearms
  - E. I don't know
36. As a result of intensive physical activity, energy will be used up and waste products will accumulate. The muscles are then in a state of:
- A. sensitivity
  - \*B. fatigue
  - C. irritability
  - D. extension
  - E. I don't know

37. Which of the following tests is not used to measure cardiovascular endurance?
- A. 12 Minute Run
  - B. Stationary Bicycle Test
  - \*C. The Sit-Up Test
  - D. The Step Test
  - E. I don't know
38. In which position will a skater or a diver rotate, or spin, most quickly?
- A. Arms away from the body; legs together
  - B. Arms above the head; legs apart
  - \*C. Arms close to the body; legs together
  - D. Arms close to the body; legs apart
  - E. I don't know
39. Which blood vessels carry nourishment to the heart muscle?
- A. Coronary veins
  - B. Carotid arteries
  - \*C. Coronary arteries
  - D. Pulmonary veins
  - E. I don't know

#### Sport Psychology Items

1. Which of the following statements suggests a worthwhile benefit of team sports?
- \*A. The needs of the team are important as well as the needs of each person
  - B. People can make the team even though they don't get to play
  - C. Coaching for team sports is usually of a higher calibre than for individual sports
  - D. Players on teams are always under a great deal of stress or anxiety
  - E. I don't know
2. Which of the following statements best describes an important role of a good Physical Education program?
- A. It prepares students for interschool teams
  - \*B. It teaches students how to make good use of leisure time
  - C. It prepares students for a profession in athletics
  - D. It provides a rest from other school subjects
  - E. I don't know

3. Which of the following is the least important thing in determining good team play?
- A. Each member appreciates the contribution of every other member
  - \*B. Players on the same team have many different characteristics
  - C. Each team member has a positive attitude
  - D. Good communication exists between players and coach
4. Your game skills will probably improve most quickly if:
- A. you win all of your games easily
  - B. you lose all of your games by large scores
  - \*C. all of your games are close
  - D. all of your games are against rough players
  - E. I don't know
5. People involved in competitive physical activities will likely experience high levels of anxiety and stress during a game if:
- \*A. winning becomes essential to them
  - B. the game is well officiated
  - C. they decrease their amount of physical exertion
  - D. winning becomes unimportant to them
  - E. I don't know
6. You are most likely to be physically fit if:
- A. your parents are good athletes
  - \*B. your attitude towards fitness is good
  - C. you know a great deal about fitness
  - D. your school has good physical education facilities and equipment
  - E. I don't know
7. If you want to help your team mates become better players, you should probably:
- A. keep reminding them of all their errors
  - \*B. praise them, while pointing out their errors
  - C. be strict with them
  - D. tell them how the professionals do it
  - E. I don't know
8. Which one of the following ways of helping children to learn sports skills is the least acceptable?
- A. Setting goals that the children can work towards
  - \*B. Getting the children to work harder by always pointing out their mistakes
  - C. Giving the children encouraging talks before games and practices
  - D. Getting the children to improve on their previous scores
  - E. I don't know