DEVELOPMENT AND VALIDATION OF OBJECTIVE TEST ITEMS IN THE SUBJECT OF PHYSICS FOR CLASS IX IN RAWALPINDI CITY

AZIZ-UR-REHMAN
(25-SS/PbD /ED/03)

DEPARTMENT OF EDUCATION
FACULTY OF SOCIAL SCIENCES
INTERNATIONAL ISLAMIC UNIVERSITY
ISLAMABAD, PAKISTAN
2007
DEVELOPMENT AND VALIDATION OF OBJECTIVE TEST ITEMS IN THE SUBJECT OF PHYSICS FOR CLASS IX IN RAWALPINDI CITY

BY
Aziz-Ur-Rehman
(25-SS/PhD/ED/03)

A Masters level thesis submitted as a pre-requisite of Ph.D. Programme

DEPARTMENT OF EDUCATION
FACULTY OF SOCIAL SCIENCES
INTERNATIONAL ISLAMIC UNIVERSITY
ISLAMABAD, PAKISTAN
2007
APPROVAL SHEET

DEVELOPMENT AND VALIDATION OF OBJECTIVE TEST ITEMS ANALYSIS IN THE SUBJECT OF PHYSICS FOR CLASS IX IN RAWALPINDI CITY

BY

AZIZ-UR-REHMANN

(25-SS/Ph.D./Ed/03)

Accepted by the Department of Education, Faculty of Social Sciences, International Islamic University, Islamabad, in the partial fulfillment of the requirements of "Masters of Arts in Education." (Pre-requisite of Ph.D. Education)

Supervisor
(Dr. Maqsood Alam Bokhari)

Internal Examiner
(Dr. Muhammad Munir Kiani)

External Examiner
(Dr. A.R. Saghir)

Dated: 17/3/07

Head
Department of Education.
International Islamic University,
Islamabad.

Dean
Faculty Social Sciences
International Islamic University,
Islamabad.
ABSTRACT

The research was designed to develop and validate objective type test items in the subject of physics for the students of 9th class in Rawalpindi city. Following were the objectives of the study:

1. To develop objective test items in the subject of Physics for class IX in Rawalpindi city.

2. To validate the test items of the test administered in the subject of Physics for class IX.

3. To develop a pool of validated test items for the teachers of physics in Rawalpindi city.

Six schools were selected out of 29 secondary schools for boys in Rawalpindi city and 400 students of 9th class were taken as the sample of the study. The instructional objectives were designed. A table of specification was prepared in two ways, tests items were constructed, edited, corrected, recorrected and selected finally, the received answer sheets were score objectively after administering the test and interpreting the data by finding difficulty level and discriminative index of each items by applying the formulas. The researcher made his best in constructing the test items more suitable for the learners and keeping the validity, reliability, objectivity and practicability of the test in view. The test was administered personally by the researching with the help of the teachers and principals of the respective schools. The scoring of answer sheets was done objectively and interpretation of the data was
made after its analysis. Two groups were selected, namely low achievers (L.A.) and high achievers (H.A.), for the interpretation of analysis of data.

From the interpretation of findings, main conclusions drawn were:

1. Maximum of the items had difficulty level of good standards.

2. Only few of the items were either too easy or too difficult.

3. One fourth of the test items were having D.I. in ideally good range.

4. The Mean, Median, and Mode values for H.A.'s group were falling close to one another.

The important recommendations suggested in this connection were:

1. Too easy or too difficult test items make a test invalid and unreliable.

2. Such items should be avoided in order to construct a valid test.

3. Catchy or dodgy items are always deceptive. Such items promote guessing or cheatings factors. Hence, in a validated test, there should be no dodgy items.

4. The instructional objectives, table of specification, construction of test items, scoring and interpretation of data should move forward in this order and there should be a complete harmony among them.

5. A valid test should contain items which are very difficult, difficult, very good, good, normal or easy in a good proportion. It is suggested that 20% of the items should be, at least, very difficult or difficult, 70% of the items should be very good, good or Normal and remaining 10% should be easy.
DEDICATION

DEDICATED TO HIGHER EDUCATION
COMMISSION ON THE INTRODUCTION
OF HEALTHY
INNOVATIVE IN HIGHER EDUCATION
FOR THE FIRST TIME IN PAKISTAN
ACKNOWLEDGMENTS

All praises are for Almighty Allah Who sent Hazrat Muhammad S.A.W. as His messenger to the mankind and jinn.

I render special thanks to my supervisor Dr. Maqsood Alam Bokhari who guided me during the accomplishment of my study.

I am also thankful to all those friends who offered me their help in the calculation of data.

(Aziz-ur-Rehman)
# TABLE OF CONTENTS

Acknowledgements

Abstract

---

## Chapter 1

**INTRODUCTION**

1.1 Statement of the problem

1.2 Objectives of the study

1.3 Significance of the study

1.4 Methods of the study

1.4.1 Population

1.4.2 Sample

1.4.3 Instrument

1.4.4 Data Collection

1.4.5 Data Analysis

1.6 Delimitations

---

## Chapter 2

**REVIEW OF RELATED LITERATURE**

2.1 History and scope of tests

2.2 Group testing and test validation

2.3 Planning classroom tests and assessments

2.4 Test, measurement, and evaluation

2.5 Integrating objectives with evaluation and measurement

2.5.1 Purpose of a test
<table>
<thead>
<tr>
<th>Section</th>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.5.2</td>
<td>Definition of objectives</td>
<td>19</td>
</tr>
<tr>
<td>2.5.3</td>
<td>Preparation of content outline</td>
<td>22</td>
</tr>
<tr>
<td>2.5.4</td>
<td>Principles of preparing content outline selection</td>
<td>22</td>
</tr>
<tr>
<td>2.5.5</td>
<td>Table of specification</td>
<td>22</td>
</tr>
<tr>
<td>2.5.6</td>
<td>Practical considerations in planning a test</td>
<td>23</td>
</tr>
<tr>
<td>2.5.7</td>
<td>Construction of test items</td>
<td>23</td>
</tr>
<tr>
<td>2.6</td>
<td>Constructing multiple choice (MC) items</td>
<td>24</td>
</tr>
<tr>
<td>2.6.1</td>
<td>Suggestions for constructing multiple-choice items</td>
<td>26</td>
</tr>
<tr>
<td>2.7</td>
<td>Qualities of a good test</td>
<td>27</td>
</tr>
<tr>
<td>2.7.1</td>
<td>Nature of reliability</td>
<td>28</td>
</tr>
<tr>
<td>2.7.2</td>
<td>Validity</td>
<td>31</td>
</tr>
<tr>
<td>2.7.3</td>
<td>Objectivity</td>
<td>33</td>
</tr>
<tr>
<td>2.7.4</td>
<td>Usability</td>
<td>33</td>
</tr>
<tr>
<td>2.8</td>
<td>Standardized vs teacher-constructed tests</td>
<td>35</td>
</tr>
<tr>
<td>2.8.1</td>
<td>Uses of standardized achievement tests</td>
<td>36</td>
</tr>
<tr>
<td>2.9</td>
<td>Items analysis</td>
<td>38</td>
</tr>
<tr>
<td>2.9.1</td>
<td>Item difficulty level (D.L.)</td>
<td>39</td>
</tr>
<tr>
<td>2.9.2</td>
<td>Discrimination index (D.I.)</td>
<td>40</td>
</tr>
<tr>
<td>2.9.3</td>
<td>Distractibility</td>
<td>42</td>
</tr>
<tr>
<td>2.10</td>
<td>Measures of central tendency</td>
<td>42</td>
</tr>
<tr>
<td>2.10.1</td>
<td>The arithmetic mean or mean</td>
<td>43</td>
</tr>
<tr>
<td>2.10.2</td>
<td>The median</td>
<td>43</td>
</tr>
</tbody>
</table>
2.10.3 The mode 44
2.10.4 Comparison of measures of central tendency 45
2.10.5 Quartiles 45
2.10.6 Percentiles 46
2.10.7 Measures of variability 46
2.10.8 The range 47
2.10.9 Quartile deviation 47
2.10.10 The mean deviation or average deviation 47
2.10.11 The standard deviation 48
2.10.12 The coefficient of variation 48
2.10.13 Standard scores 48
2.10.14 Some basic properties of the normal curve 49

Chapter 3 METHOD AND PROCEDURE OF RESEARCH 50

3.1 Population 50
3.2 Sample 50
3.3 Instrument 52
3.4 Data collection 52
3.5 Data analysis 52
3.6 Delimitations 52

Chapter 4 PRESENTATION AND ANALYSIS OF DATA 54

Chapter 5 SUMMARY, FINDINGS, CONCLUSIONS AND RECOMMENDATIONS 78
5.1 Summary 78
5.2 Findings 79
5.3 Conclusions 83
5.4 Recommendations 84

BIBLIOGRAPHY 85
ANNEXURES 86
<table>
<thead>
<tr>
<th>Table No</th>
<th>Statement</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Item-wise analysis</td>
<td>54</td>
</tr>
<tr>
<td>2</td>
<td>Frequency distribution of values of D.L</td>
<td>63</td>
</tr>
<tr>
<td>3</td>
<td>Frequency distribution of values of D.I</td>
<td>65</td>
</tr>
<tr>
<td>4</td>
<td>Measures of central tendencies for high achievers (H.A)</td>
<td>67</td>
</tr>
<tr>
<td>5</td>
<td>Measures of central tendencies for low achievers (L.A)</td>
<td>68</td>
</tr>
<tr>
<td>6</td>
<td>Measures of variability for H.A</td>
<td>70</td>
</tr>
<tr>
<td>7</td>
<td>Measures of variability for L.A</td>
<td>72</td>
</tr>
<tr>
<td>8</td>
<td>Standard deviation for H.A</td>
<td>74</td>
</tr>
<tr>
<td>9</td>
<td>Standard deviation for L.A</td>
<td>75</td>
</tr>
<tr>
<td>10</td>
<td>Frequency distribution of D.L. and decision-making</td>
<td>76</td>
</tr>
</tbody>
</table>
CHAPTER I

INTRODUCTION

It is success of a teaching – learning process if the learners undergo a desirable change of behavior on permanent basis. To attain this target, it is necessary to design learning objectives according to the needs of the learners. The curriculum should be constructed to achieve those objectives. The teaching methodologies should cover the wide range of interests and needs of the learners. Finally, the evaluation of the process reveals the effectiveness of the whole programme.

Evaluation of a teaching learning process can be done by different ways. One of the way is classroom testing. Gronlund (2005) defines test as “A test is a particular type of assessment that typically consists of a set of questions administered during a fixed period of time under reasonably comparable conditions for all students.”

In the perspective of classroom teaching, it is necessary to construct a test that is reliable and valid, otherwise the true judgment of the achievement of the learners will not be possible; and also the credibility of the effectiveness of teaching strategies will fade away. The invalid and unreliable tests depict an unrealistic picture of teaching – learning process and thereby wrong conclusions are extracted out of them. The strategies based on such conclusions remain fruitless and the concerned authorities may not be able to facilitate the learners effectively. Similarly, one cannot infer correctly from the raw scores of any test. The raw scores are
number of points received on a test when the test has been scored according to the instructions. Raw score is not very meaningful without further information. To mitigate such negative effects, it is necessary to construct a valid and reliable test. After maintaining the objectivity of the test, it is important to validate the test by finding the difficulty level and discriminative index of its each item. Such a validated and standardized test serves the needs of the learners and the evaluation process moves toward the realistic direction. Once a standardized test is constructed, it offers a guiding help to the all personnels.

Testing, in education and psychology, is an attempt to measure a person's knowledge, intelligence, or other characteristics in a systematic way. There are many types of tests. Teachers give tests to discover the learning abilities of their students. They also give tests to see how well students have learned a particular subject. Most printed tests taken by students and others are standardized. A test has been standardized after it has been used, revised, and used again until it shows consistent results and average levels of performance have been established. Firms that prepare standardized tests include information with them on how to give and score each test. The results of one person's performance may be compared with those of many others who have taken the same test. Most teachers use nonstandardized tests that they make up themselves. Such tests are hardly constructed by following any table of specifications. The items are included haphazardly without judging the difficulty levels and discriminative indices of the learners. The scoring of such classroom tests is poorly objective. In this situation, it is necessary to develop valid and reliable tests which may help the teachers to infer realistic conclusions and to introduce reforms in
their teaching learning strategies. This study is an attempt to construct a test, comprising of validated items in the subject of physics for the students of 9th class, with the spirit of paving the way to construct such tests by which not only the achievement of the learners may be measured exactly but also the teaching learning situation may be analyzed realistically.

1.1 STATEMENT OF THE PROBLEM

This study was designed to validate the test items of an objective type test in the subject of Physics for 9th class within Rawalpindi city and to develop a pool of test items for the teachers of physics.

1.2 OBJECTIVES OF THE STUDY

Following were the objectives of the study:

1. To develop objective test items in the subject of Physics for class IX in Rawalpindi city.

2. To validate the items of the test administered in the subject of Physics for class IX.

3. To develop a pool of validated test items for the teachers of physics in Rawalpindi city.
1.3 SIGNIFICANCE OF THE STUDY

The teachers of physics may take help from this study in the construction of an objective test, containing multiple-choice items, which is valid and reliable. They may follow the pattern of table of specification in the perspective of construction of such tests from the textbook of physics in particular and for other disciplines in general. The teachers may avail from the findings, conclusions and recommendations of the study in the perspective of development of the classroom tests and the interpretation of the raw scores of the learners.

The students of 9th class, studying physics, may use the test to estimate their knowledge, comprehension and application of different concepts in the subject of physics for the concerned chapters of the test. They may improve the skill of how to attempt such tests keeping in view the retrieving of concepts within the allotted time. This attempt may enhance their curiosity of knowledge.

The authorities, officials and experts, related to students’ assessments and evaluation may benefit from the findings of this research study and they may introduce changes and reforms with respect to construction of curriculum, evaluation techniques, teachers training programs etc.

1.4 METHODS OF THE STUDY

1.4.1 Population

All male science students of 9th class, studying in 20 English medium secondary schools for boys in Rawalpindi city, were the population of the study.
1.4.2 Sample

All the schools included in the population of the study were arranged under stratified sampling into following three categories:

1. F.G. Secondary Schools  Cantt Garrison of Rawalpindi Cantt.
2. Provincial Secondary Schools of Rawalpindi City
3. Private Secondary Schools of Rawalpindi City

Two of the schools were to be taken as sample from each of the three categories. For this purpose, all the names of schools were written on slips of papers. The slips of each of the three categories were separated from one another. After folding the slips of names of schools of each category properly, the researcher applied the technique of random sampling. Two of the schools from each of the three categories were taken as sample of the study with the help of draws.

The sample of the study contains six schools. The total number of students, taken proportionally with respect to total number of students in each category as sample of the study, is 400. The details of this procedure are given in the table as follows:

<table>
<thead>
<tr>
<th>Categories of Schools</th>
<th>Total No. of students of IX Class</th>
<th>Total No. of Schools</th>
<th>Total students taken as sample</th>
<th>Total No. of Schools taken as sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>F.G. Schools Garrison, Cantt and Rawalpindi cantt.</td>
<td>750</td>
<td>5</td>
<td>200</td>
<td>2</td>
</tr>
<tr>
<td>Province</td>
<td>Secondary Schools of Rawalpindi City</td>
<td>500</td>
<td>5</td>
<td>150</td>
</tr>
<tr>
<td>----------</td>
<td>-------------------------------------</td>
<td>-----</td>
<td>---</td>
<td>-----</td>
</tr>
<tr>
<td>Private</td>
<td>Secondary Schools of Rawalpindi City</td>
<td>250</td>
<td>10</td>
<td>50</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>1500</td>
<td>20</td>
<td>400</td>
</tr>
</tbody>
</table>

### 1.4.3 Instrument

An objective type test consisting of 80 items was prepared from the first seven chapters of the textbook of Physics for class IX, prescribed by the Punjab Textbook Board, Lahore. This test was administered to 400 students of class IX included in the sample. The test was scored on the basis of the key already prepared. Item analysis was done using the difficulty level and discrimination index. The items within the range of 16 and 84 with respect to difficulty level and discrimination index were retained.

### 1.4.4 Data Collection

Data were collect by the researcher by administering the test in all sampled schools with the help of teachers of the concerned school.

### 1.4.5 Data Analysis

The data was analyzed through items analysis by finding difficulty levels and discrimination indices of high and low achievers. The findings were extracted and the conclusions were finalized and recommendations were given.
1.5 DELIMITATIONS

1. The study was delimited to only English medium schools for boys, studying physics in 9th class, in Rawalpindi city.

2. Private English medium schools, which are located in Dhoke Chaudharian, Afshan Colony, Misrial Road and Allama Iqbal Colony only, were taken as population in the study.
CHAPTER II

REVIEW OF THE LITERATURE

In this chapter, all the related literature will be reviewed under the following topics:

2.1. History and Scope of Tests
2.2. Group Testing and Test validation
2.3. Planning Classroom Tests and Assessments
2.4: Test, Measurement, and Evaluation.
2.5: Integrating Objectives with Evaluation and Measurement
2.6: Constructing Multiple Choice (MC) Items
2.7: Qualities of a Good Test
2.8: Standardized Vs Teacher-Constructed Tests.
2.9: Item Analysis.
2.10: Measures of Central Tendency

Let us give a detailed look to these topics one by one:

2.1 HISTORY AND SCOPE OF TESTS

There have been repeated accounts of the system of civil service examinations prevailing in the Chinese empire for some 2000 years. Among the ancient Greeks, testing was an established adjunct to the educational process. Tests were used to assess the mastery of physical as well as intellectual skills. From their
beginnings in the middle Ages, European universities relied on formal examinations in awarding degrees. Some educators believe multiple-choice tests penalize a student who has an expert knowledge of a subject. Such a student may see flaws in the answer generally accepted as correct. Other critics say that standardized tests discriminate against disadvantaged and minority groups. These students may be unfamiliar with words, terms, and concepts used in the tests. To give these students an equal chance, educators have tried to prepare culture-fair or culture-free tests. Such tests might consist of pictures, symbols, and nonsense syllables that are equally unfamiliar to everyone taking the test. This type of test reduces the influence of cultural background on performance. Tests that use no words at all are called nonverbal tests.

The general effect of testing on education has also caused concern. Standardized tests sometimes lag behind educational thought and practice. If tests do not measure the content of new syllabuses, they may fail to encourage educational progress.

Tests can determine whether one method of teaching works better than another. Tests can also tell a teacher what help a student needs most.

2.2 GROUP TESTING AND TEST VALIDATION

Group testing like the first Binet scale, was developed to meet a practical need. When the United States entered World War I in 1917, a committee was appointed by the American Psychological Association to consider ways in which psychology might assist in the conduct of the war. This committee recognized the
need for the rapid classification of a million and a half recruits with respect to general intellectual level. It was in this setting that that first group intelligence test was developed. In this task, the army psychologists drew on all available test materials, and especially on an unpublished group intelligence test prepared by Arthur S. Otis, which he turned over to the army. A major contribution of Otis’s test, which he designed while a student in one of Terman’s graduate courses was the introduction of multiple-choice and other “objective” item types. The tests finally developed by the army psychologists came to be known as the Army Alpha and Army Beta. Both tests were suitable for administration to large groups. Shortly after the end of World War I, the army tests were released for civilian use. Not only did the Army Alpha and Army Beta themselves pass through many revisions, but they also served as models for most group intelligence tests. Soon group intelligence tests were being devised for all ages and types of persons, from preschool children to graduate students.

**Nature of Objective Tests and Subjective Tests**

There is no subjective judgement exercised by the examiner when assessing the mark given for the answers in an objective test. The answers are either right or wrong. There are several formats for objective tests.

Typically subjective tests are composed of several multipart questions, a selection of which must be attempted by the candidate. These tests usually require to do a fair amount of writing.
Advantages and Disadvantages of Subjective Tests

Disadvantages

• Dependence on presentation.

If you have bad handwriting the examiner may be unable/unwilling to struggle in order to understand your answer. Conversely, you may present a well laid out and planned answer that contains a lot of hazy knowledge, yet receives a good mark.

• Facility in writing.

Those who write fluently, speedily and whose flow of thought comes easily, have an advantage over those who think more slowly (but possibly more deeply) and those who write with less facility (but possibly with better quality content).

• Question evasion.

If there are several questions in a subjective test, only some of which must be answered, then it is possible for the candidate to avoid questions in areas of the curriculum in which they are weak. It also follows that as candidates are free to choose a subset of the test questions, it becomes difficult to compare candidates as they are effectively taking different tests.

• Question Spotting.

A good strategy for preparing to take a subjective test is to look at past papers. Candidates soon spot recurring questions on specific topic areas so that it becomes possible to only revise some of the syllabus and still obtain a respectable grade.
• Variation in marking.

This is possibly the greatest disadvantage to a subjective test i.e. inconsistency in subjective assessment. The experienced examiners award widely varying marks not only on the same piece of work marked by other examiners, but on their own marked scripts re-marked after a passage of time.

Advantages

Unlike objective tests, subjective tests can demonstrate the candidates' ability to marshall material and present it in a logical order. Subjective tests allow a candidate to express originality of thought.

Subjective tests allow the candidate to demonstrate their ability to develop an argument. In addition, subjective tests allow the examiner to assess the candidate's quality of written expression.

Suggestions to Take a Test

Experts in testing offer the following suggestions:

1. Get all the experience you can in taking tests. The ability to take tests improves with practice.

2. Cramming before a test is better than no study at all. But a careful review spread over several days is better than cramming.

3. Be sure you understand the directions at the beginning of a test. Otherwise, you may get a lower score than you deserve because you failed to follow certain instructions.
4. Answer the questions that are easy for you, and then go back to the hard ones.

Interpreting Test Scores

First, a test reflects only a sample of a person's skill or knowledge, not everything about an individual. A test score can tell only how well the person performed on one particular test on one particular day.

Second, a score on a standardized test compares one person's performance with the performance of others. Such a comparison may provide useful information if all the people taking the test are alike in some important ways. Most standardized tests give scores for persons of the same age or in the same class.

Third, every test score is an estimate rather than a precise measurement.

Test Validation

Test validation is a procedure that demonstrates that a test is job-related and correlates to on-the-job performance. There are three main types of validation:

1. Content Validation - is a procedure where the content of the job in question is analyzed, matched and compared, (function by function) to the abilities measured by the test. This shows that the test is related to the job.

2. Concurrent Validation - is a procedure which tests individuals currently in the position, and then statistically compares their test results with their current performance.
3. **Predictive Validation** - is a procedure which tests individuals when they are hired, and then statistically compares the test results, after a certain time, to on-the-job performance. A successful comparison or correlation suggests that the test is predictive of on-the-job success. For a good predictive study, a large application pool and considerable time and effort are required. A suggested scenario would be to test all applicants as they are hired -- but not use the test results for selection. At the end of a period, say one year, a comparison is made between the test results and on-the-job performance criteria.

2.3 **PLANNING CLASSROOM TESTS AND ASSESSMENTS**

The main goal of classroom testing and assessment is to obtain valid, reliable, and useful information concerning student achievement. This requires determining what is to be measured and then defining it precisely so that tasks can be constructed that require the intended knowledge, skills, and understanding while minimizing the influence of irrelevant skills. It also requires specifying the achievement domain in such a manner that the sample of items and assessment tasks will represent the total domain of achievement tasks, giving appropriate emphasis to high-priority objectives. Satisfying these requirements provides the foundation for obtaining results that will be valid for the intended instructional uses.

The likelihood of preparing valid, reliable, and useful classroom tests and assessments is greatly enhanced in a series of steps as follows:

1. Determining the purpose of measurement
2. Developing specifications
3. Selecting appropriate assessment tasks
4. Preparing relevant assessment tasks
5. Assembling the assessment
6. Administering the assessment
7. Appraising the assessment
8. Using the results

**Suggestions for Constructing Short-Answer Items**

1. The required answer should be brief and specific.
2. Do not take statements directly from textbooks to use as a basis for short-answer items.
3. A direct question is generally more desirable than an incomplete statement.
4. If the answer is to be expressed in numerical units, indicate the type of answer wanted.
5. Blanks for answers should be equal in length and in a column to the right of the question.

**Suggestions for Constructing True False Items**

1. Avoid broad general statements if they are to be judged true or false.
2. Avoid trivial statements.
3. Avoid the use of negative statements, especially double negatives.
4. Avoid long, complex sentences.
5. Avoid including two ideas in one statement, unless causes-effect relationships are being measured.

6. Avoid using opinion that is not attributed to some source, unless the ability to identify opinion is being specially measured.

7. Avoid using true statements and false statements that are unequal in length.

8. Avoid using disproportionate numbers of true statements and false statements.

Suggestions for constructing Matching Exercises

1. Use only homogenous material in a single matching exercise.

2. Include an unequal number of responses and premises, and instruct the student that responses may be used once, more than once, or not at all.

3. Keep the list of items to be matched brief, and place the shorter responses on the right.

4. Arrange the list of responses in logical order place words in alphabetical order and numbers in sequence.

5. Indicate in the directions the basis for matching the responses and premises.

6. Place all of the items for one matching exercise on the same page.

2.4 TEST, MEASUREMENT, AND EVALUATION

The terms test measurement and evaluation are easily confused because all may be involved in a single process. If we ask students to answer a series of questions concerning science, obtain their scores by counting the number of correct
answers and conclude that the students are making good learning progress, we are concerned with all three concepts. The test is the set of questions, measurement is the assigning of numbers to the test results according to a specific rule (counting correct answers), and evaluation adds the value judgment (good learning progress). The specific meaning of each term, as applied to classroom evaluation, is summarized as:

a. TEST

It is an instrument or systematic procedure for measuring a sample of behavior like answer the question "How well does the individual perform ---either in comparison with others or in comparison with a domain of performance tasks?"

A test is a set of questions each of which has a correct answer and the examinees usually answer orally or in writing.

b. MEASUREMENT

It is the process of obtaining a numerical (quantitative) description of the degree to which an individual possesses a particular characteristic (Answers the question "How much"). According to Thorndike and Hagen (1977):

Measurement provides information such as a test score and not the judgment of insight that is required for reaching a sound conclusion or plan of action. The judgment of insight is to consider as the set of evaluative procedure used to interpret information into an appraisal.
c. EVALUATION

It is the systematic process of collecting, analyzing and interpreting information to determine the extent to which pupils are achieving instructional objectives. (Norman E. Gronlund)

Evaluation is defined as "Examining and judging the worth, quality, significance, amount and degree of condition of something". (Webster)

It determines "the extent to which the educational institutions have accomplished that what was set out to accomplish". (Kaufman)

Evaluation is "An examination of whether desired educational objectives are attained or not". (Taylor)

Evaluation is "The collection and use of, "information to discuss about an education programme"". (Cronbach)

According to L.R.Gay (1985):

i. Evaluation is the systematic process of collecting and analyzing data in order to determine whether, and to what degree, objects have been or are being achieved.

ii. Evaluation is the systematic process of collecting and analyzing data in order to make decisions.
INTEGRATING OBJECTIVES WITH EVALUATION AND MEASUREMENT

2.5.1 Purpose of a Test

The first and foremost step in teaching process is to identify and formulate the objectives of instruction. There are numerous day-to-day decisions that a teacher has to make that require some knowledge of the pupils' attitudes, achievement and personal development. This knowledge can only be required through various tests and the teacher can decide, "What is achieved and what is to be achieved by his pupils and in this way he approaches to an educational need of learners.

Tests can be used in an instructional programme to:

(a) Assess entry behaviour (placement test).

(b) Monitor learning progress (formative test).

(c) Diagnose learning difficulties (diagnostic test).

(d) Measure performance at the end of instruction (summative test).

2.5.2 Definition of Objectives

Goals are general statement of purpose, or desired outcomes and these are not directly measurable. Each goal may be translated into one or more specific measurable objectives. Hence objectives may be defined as specific statements of what are to be accomplished and how well are expressed in terms of quantitatively measurable outcomes.
TAXONOMY OF OBJECTIVES

In 1956 Benjamin S. Bloom with a group of associates, mostly college examiners, brought out a taxonomy (classification system) dealing with educational objectives. A particular important contribution of the 1956 taxonomy was its division of educational objectives into three domains.

COGNITIVE DOMAIN

Cognitive domain is concerned with those behaviors of learners which reflect intellectual skills.

AFFECTIVE DOMAIN

Affective domain is concerned with the behaviours of learner which reflect attitudes, values and interests.

PSYCHOMOTOR DOMAIN

Psychomotor domain is concerned with the physical and motor skills one hopes learner will require.

Let us give a brief look to the following table in the perspective of the taxonomies of learning outcomes.
<table>
<thead>
<tr>
<th>Categories in cognitive domain (Bloom 1956)</th>
<th>Categories in affective domain (Krathwohl 1964)</th>
<th>Categories in psychomotor domain (Harrow 1972)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge: Specific facts, terminology, etc. And universals, principles, generalities, etc.</td>
<td>Receiving: Sensitivity to the existence of stimuli (e.g. awareness, selected attention, etc.) Responding: Active attention to stimuli (e.g. feelings and satisfaction) Valuing: Beliefs and attitudes of worth (e.g. acceptance, preference, commitments, etc.) Organization: Internationalization of values, beliefs involving Conceptualization of a value system. Characterization: Reflecting a generalized set of values, a philosophy of life.</td>
<td>Reflex movements: Segmented and intersegmented reflexes involving spiral segments. Fundamental movements: Behaviour related to walking, running, jumping, pushing, pulling and manipulating. Perceptual movement: Kinesthetic, visual, auditory, coordination abilities. Physical abilities: Endurance, flexibility, strength, ability, reaction-response time, and dexterity. Skilled movements: Concerning with games, sports, dances and arts. No discursive communication: Expressive movements through postures, gestures, facial expressions and creative movements.</td>
</tr>
</tbody>
</table>
2.5.3 Preparation of Content Outline

When instructional objective and outcomes have identified, the next step in test construction is planning the test. The sooner you begin planning and the more care you take, the more likely it is that you will develop a good test. The next step in planning a test is to prepare a detailed content outline.

2.5.4 Principles of Preparing Content Outline Selection

1. Identify the objectives.
2. Compare the objectives with educational outcomes.
3. Be specific in three domains of taxonomy of objectives.
4. Formulate the objectives.
5. Categorize the main topics into as many sub-headings as possible.
6. Compare the sub-headings with the specific objectives formulated before.
7. Put boundaries what is to be covered in the test.

2.5.5 Table of Specification

Table of specification is a chart, which relates the instructional objectives to the course content and specifies the relative emphasis to be given to each type of learning out-comes, usually expressed in percentage.

Preparation of table of specification includes.

1. Obtaining the list of instructional objectives.
2. Outlining the course content.
3. Preparing the two-way chart.

2.5.6 Practical Considerations in Planning a Test

If a teacher wants to prepare a test, which is valid, reliable and useful, he should carefully plan the test. The practical considerations in planning a test include the following areas.

1. Determining the purpose of the test.
2. Preparing the test specifications.
3. Selecting the appropriate item type.
4. Preparing relevant test items.

2.5.7 Construction of Test Items

Keeping the above-cited considerations in view, the items of a test are constructed. There must be a perfect reflection of application of principles involved to this most sensitive task.

The tests constructed by classroom teacher are classified as objectives test and essay tests. These may be further subdivided as follows.

1. OBJECTIVE TEST

A: Supply Type

(i) Short answer
(ii) Completion
B: SELECTION TYPE

(i) True- false items
(ii) Matching
(iii) Multiple choice item

2. ESSAY TYPE

A: Extended Response
B: Restricted Response

2.6 CONSTRUCTING MULTIPLE CHOICE (MC) ITEMS

In multiple-choice items, a problem is stated in the form of a question or a statement and list of suggested solution is given. The statement or problem stated is called stem. The list of suggested solutions are called alternatives. The correct alternative in each item is called answer and remaining alternatives are called distracters or foils. Terms used in multiple-choice items are:

1. Stem
2. Alternative (correct is answer)
3. Distracters or foils

The pupil is directed to read the stem and list of alternatives and to select one correct or best alternative.

The following outcomes can be measured through multiple choice items.

1. Knowledge
   i Knowledge of terminology.
   ii Knowledge of principles.
iii Knowledge of method and procedures.

2. Understanding and Application

i Ability to identify application of facts and principles.

ii Ability to interpret cause and effect of relationships.

iii Ability to justify methods and procedures.

2.6.1 Suggestions for Constructing Multiple-Choice Items

1. The stem should be meaningful and should present a definite problem.

Compare the stems in the following example.

Ammeter (POOR)

a. Is an instrument used for measuring Amperes.

b. Is an instrument used for measuring Volts.

c. Is an instrument used for regulating Voltage.

d. Is an instrument used for regulating deflection.

The instrument for measuring Amperes is (Better)

a. Voltmeter b. Ammeter

c. Galvanometer d. Wattmeter

2. The stem should include as much of the items as possible and should not have irrelevant material.

Example: The reason of settling Spanish in South America was, (poor)

a. They were adventurous.

b. They were in search of wealth.
They were seeking religious freedom.

Spanish colonists settled most in South American in search of (Better)

a. Lower taxes  
   b. Adventure.

   c. Wealth.  
   d. Religious freedom.

3. Avoid negative statement in the stem:

Example: (for class iii) (poor)

Which one of the following city is not located north of Multan.

a. D.G.Khan.  
   b. Bahawalpur.

   c. Muzaffar Ghar.  
   d. Vehari.

Which one of the city is located to South of Multan (Better)

a. D.G.Khan.  
   b. Bahawalpur.

   c. Muzaffar Ghar.  
   d. Vehari.

4. All the distracters should be homogeneous:

Example :(Better)

An electric transformer can be used to

a. Storing electricity

b. Increase the voltage of alternating current

c. Convert Electricity energy to mechanical energy

d. Change AC to DC

5. Verbal association between the stem and the correct answer should be avoided:
Example: (poor)

You can inform about the violent windstorm to the following agencies in your locality.

a. Weather Station  
b. Local Radio Station  
c. Post office  
d. Police Station

You can inform about the violent wind storm to the following agencies in your locality. Better

a. Local Weather Station  
b. Nearest Radio Station  
c. Local Post office  
d. Local Police Station

Local and locality is verbal association.

6. Length of alternatives should possibly be equal.

7. Use of “None of these” or “all of the above” should be avoided in alternatives.

8. All the alternatives should be grammatically consistent

2.7 QUALITIES OF A GOOD TEST

All good measuring instruments have certain primary qualities, which differentiate good tests from inferior ones whether they are used by the educator, the psychologist, the medical technician, the physicist, or people in other fields.

A test that lacks known and substantial degree of these primary qualities is not a measuring instrument in any true sense, and little or no dependence can be placed upon results obtained by its use. The two of universally accepted qualities, generally agreed upon by many experts, are reliability and validity.
Besides these two universal requirements for a good test, whatever the field, there are certain secondary characteristics, which are desirable in all good educational and psychological tests: Adequacy, objectivity and usability. These are less crucial than reliability and validity, since a test may function efficiently without the presence of the secondary characteristics as long as it is valid and reliable. However, the secondary qualities to some extent affect validity and reliability and in any event make the use of a test much simpler.

Reliability is the consistency of a test. If a youngster is tested in the morning and again in the afternoon, we expect fairly similar scores. If not, the test isn't consistent or "reliable". A test must give us accurate results.

2.7.1 Nature of Reliability

The meaning of reliability, as applied to testing and evaluation, can be clarified by the following general points:

1. Reliability refers to the results obtained with an evaluation instrument and not to the instrument itself. Any particular instrument may have a number of different reliabilities, depending on the group involved and the situation in which it is used. Thus, it is more appropriate to speak of the reliability of the “test scores” or of the “measurement” than of the “test” or the “instrument”.

2. A closely related point is that an estimate of reliability always refers to a particular type of consistency. Test scores are not reliable in general. They
are reliable (or generalizable) over different periods of time, over different samples of questions, over different rates etc. It is possible for test scores to be consistent in one of these respects and not in another.

3. Reliability is a necessary but not a sufficient condition for validity. In short, reliability merely provides the consistency that makes validity possible.

4. Reliability is primarily statistical. The logical analysis of a test will provide little evidence concerning the reliability of the scores. The test must be administered, one or more times, to an appropriate group of persons, and the consistency of the results be determined.

**Determining reliability by correlation methods**

<table>
<thead>
<tr>
<th>Methods</th>
<th>Type of Reliability Measure</th>
<th>Procedure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Test-retest method</td>
<td>Measure of stability</td>
<td>Give the same test Twice to the same group with any time interval between tests, from several minutes to several years</td>
</tr>
<tr>
<td>Equivalent-forms method</td>
<td>Measure of equivalence</td>
<td>Give two forms of the test to the same group in close succession</td>
</tr>
<tr>
<td>(Test-retest with equivalent forms)</td>
<td>measure of stability and equivalence</td>
<td>Give two forms of the test to the same group with increased time interval between forms</td>
</tr>
<tr>
<td>Spilt-half method</td>
<td>Measure of internal consistency</td>
<td>Give test once. Score two equivalent halves of a test (e.g. odd items and even items): correct correlation between halves to fit whole test by Spearman-Brown formula</td>
</tr>
<tr>
<td>Kuder-Richardson method</td>
<td>Measure of internal consistency</td>
<td>Give test once. Score total test and apply Kuder-Richardson formula</td>
</tr>
</tbody>
</table>
2.7.1.1 Factors influencing reliability measures

Following factors may effect the measurement of reliability:

1. LENGTH OF TEST

A large test also tends to lessen the influence of chance factors such as guessing. For example, on a ten-item true-and-false test, a pupil might know seven of the items and guess at the other three. A correct guess on all three items would result in a perfect score, and incorrect guesses on all three items would result in only seven correct. This would represent considerable variation in the test score resulting from guessing alone.

2. SPREAD OF SCORES

Reliability coefficients are directly influenced by the spread of scores in the group tested. Other things being equal, the larger the spread of scores is, and the higher the estimate of reliability will be. Because larger reliability coefficients result when individuals tend to stay in the same relative position in a group from one testing to another, it naturally follows that anything that reduces the possibility of shifting positions in the group also contributes to larger reliability coefficients. In this case, greater differences between the scores of individuals reduce the possibility of shifting positions.

3. DIFFICULTY OF TEST

Norm-referenced tests that are too easy or too difficult for the group members taking it will tend to produce scores of low reliability. This is because both easy and difficult test result in a restricted spread of scores. For the easy test, the scores are close together at the top end of the scale. For the difficult test, the scores are grouped
together at the bottom end of the scale. For both, however, the differences among individuals are small and tend to be unreliable. A norm-referenced test of ideal difficulty will permit the scores to spread out over the full range of the scale.

2.7.2 Validity

Validity of a test refers to the degree to which a test really measures what it claims to assess. The term validity, when applied to a set of test scores, refers to the consistency (accuracy) with which the scores measure a particular cognitive ability of interest. Thus, there are two aspects to validity: what is measured and how consistently it is measured.

Validity has traditionally been regarded as test characteristic, but the most current thinking of measurement experts has changed that. The most recent Standards for Educational and Psychological Testing (American Psychological Association, 1985) associates the term with a set of test scores rather than with the test used to produce them.

2.7.2.1 Content-related validation evidence

All test-score interpretations require that an inference be made. Tests usually contain only a sample of all possible items that could be used to measure the attainment of knowledge in the content areas of interest. We infer that students who answer correctly 75 percent of the items on a test would likely to answer 75 percent of the items in the universe. If we mean that 75 percent is a more accurate estimate
than 80 or 70 for example, the inference is based on score reliability. On another
different but similar set of items from that population, we would expect the students
to answers about 75 percent of the items correctly.

Content-related evidence for achievement tests, also, must be supplemented
by information about the administration conditions, scoring criteria, and nature of
examinees.

2.7.2.2 Criterion-related validation evidence

A criterion measure is an accepted standard against which some test is
compared to validate the use of the test as a predictor. For example, scores on a
dictation test are a generally accepted measure of spelling achievement. If we were
to build and give a true-false spelling test, we might compare the true-false scores
with scores obtained on a comparable dictation test to demonstrate that the true-false
test is an acceptable measure of spelling achievement.

Criterion-related evidence takes either of two norms: one relates to determine
present standing on a criterion measure and the other relates to predicting future
performance on a criterion measure. The type of evidence needed for a given
situation depends on how the scores from the test are intended to be used.

2.7.2.3 Construct-related validation evidence

The term construct refers to a psychological construct, a theoretical
conceptualization about an aspect of human behaviour that cannot be measured or
observed directly. Construct validation is the process of gathering evidence to support the contention that a given test indeed measures the psychological construct which testers intend for it to measure. The goal is to determine the meaning of the scores from the test, to assure that the scores mean what we expect them to mean.

2.7.3 Objectivity

The objectively of a test refers to the degree to which equally competent scorers obtain the same results. Most standardized test of aptitude and achievement are high in objectively. The test items are of the objective type (e.g., multiple choices) and the resulting scores are not influenced by the scorers' judgment or opinion. In fact, such tests are usually constructed so that trained clerks and scoring machines can accurately score them. When such highly objective procedures are used, the reliability of the test result is not affected by the scoring procedures. For classroom tests constructed by teachers, however, objectivity may play an important role in obtaining reliable measures of achievement.

2.7.4 Usability

In selecting tests and other evaluation instruments, practical considerations cannot be neglected. Tests are usually administered and interpreted by teachers with only minimum amount of training in measurement. The time available for testing is almost limited. Likewise, the cost of testing, although a minor consideration, is as carefully scrutinized by budget-conscious administrators, as are other expenditures
of school funds. These and other factors are important to the usability of tests and evaluation proceeding must be taken into account when selecting evaluation instruments. Such practical considerations are especially important when selecting published tests. The usability or practicability or economy of a test depends on following factors.

1. **EASY ADMINISTRATION**

   If the tests are to be administered by teachers or others with limited training, ease of administration is an especially important quality to seek in a test. For this purpose the directions should be simple and clear, the subtests should be relatively few, and the timing of the test should not be too difficult to be managed properly.

2. **TIME REQUIRED FOR ADMINISTRATION**

   With time for testing at a premium, one always favors the shorter test, other things being equal. But in this case, other things are seldom equal, because reliability is directly related to the test’s length. If we attempt to cut down too much on the time allocated to testing, we may reduce drastically the reliability of our scores.

3. **EASE OF INTERPRETATION AND APPLICATION**

   In the final analysis, the success or failure of a testing program is determined by the use of the test results. If they are interpreted currently and applied effectively, they will contribute to more intelligent educational decisions. On the other hand, if the test results are misinterpreted or misapplied or not applied at all, they will be of little value and actually be harmful to some individual or group.
4 AVAILABILITY OF EQUIVALENT OR COMPARABLE FORMS

For many educational purposes, equivalent forms of the same test are often desirable. Equivalent forms of a tests measure the same aspect of behaviour by using test items that are alike in content, level of difficulty, and other characteristics.

5. COST OF TESTING

The factor of cost has been left to the last because it is relatively unimportant in selecting tests. The reason for discussing it is that it is sometimes given far more weight than it deserves. Testing is relatively inexpensive, and cost should not be a major consideration. In large-scale testing programs, in which small savings per pupil add up, using separate answer sheets, machine scoring, and reusable booklets will reduce the cost appreciably. To select one test instead of another, however, because the test booklets are a few rupees cheaper, is false economy. After all, validity and reliability are the important characteristics to look for, and a test lacking these qualities is too expensive at any price. On the other hand, the contribution that valid and reliable test scores can make to educational decisions seems to indicate that such tests are always economical in the long run.

2.8 STANDARDIZED VS TEACHER-CONSTRUCTED TESTS

The term standardized actually refers to specific instructions for administration and scoring, and both criterion-and norm-referenced tests fulfill this requirement. In the case of norm-referenced tests, norms are prepared that represent performance for similar groups. These give teachers an independent yardstick for checking student achievement. While their own tests can measure only the relative
performance of the students in their classes, norms provide the opportunity to compare achievement with that of students in other schools.

Most commonly, test designers establish performance norms for a standardized test based upon representative groups of individuals (including various age and grade groups on a state, regional, or national level). This feature allows educators to interpret a pupil’s performance in a norm-referenced manner. Accordingly, it is possible to compare the level of a student’s performance with that of other groups of students. Standardized tests can be classified in number of ways. The most popular classification is according to Mehrens and Lehmann, 1978, as follows:

1. Achievement tests.
2. Aptitude tests.
3. Personality, Attitude, interest, self-concept and adjustment inventories.

2.8.1 Uses of Standardized Achievement Tests

Although norm-referenced and criterion-referenced achievement tests are designed for largely different purposes, some are used for all practical purposes. This becomes clear as one compares the uses of standardized norm-referenced tests with those for criterion-referenced tests.

a. NORM-REFERENCED TESTS

Five uses of norm-referenced tests are of interest to teachers.

First, they provide teachers with a reference point for checking their own emphasis in teaching. A second use of norm-referenced tests is to determine student
progress. Generally there are comparable forms of the test available: this allows the teacher to administer one test at the beginning of the year and another at the end. A third function of these tests is to provide a comparison of achievement between various subject matter areas and specific phases of a particular area. A fourth use of norm-referenced tests is for diagnosis of difficulties in achievement. Often the source of student difficulty may be determined through one or a number of very effective standardized instruments. Because test items have been constructed on the basis of studies that have determined frequent sources of difficulty, it is possible to analyze the adequacy of performance in crucial areas. Finally, a fifth use is for purposes of selection and classification. Achievement tests can serve as aptitude tests predicting performance in a given subject area. Not only achievement-test results are helpful in grouping for instruction, but scores are useful in determining whether students can be expected to do well or poor in given courses.

b. CRITERION-REFERENCED TESTS

Criterion-referenced tests also have a wide variety of uses. They are particularly well suited for the following purposes:

1. They can contribute to curriculum development.

2. They can contribute to the improvement of instruction, especially that emphasizing mastery learning and individualized instruction.

3. They reflect effective instruction and provide considerable feedback to both teachers and students. Such positive reinforcement contributes to effective teaching and learning.

4. They are well adapted to the evaluation of educational programs.
5. One use of standardized tests is grouping students for instruction.

2.9 ITEMS ANALYSIS

Classroom teachers will not normally validate their tests prior to administering them on their students. They may however, perform item analysis after the test has been administered, especially if some or all of the items will be used again. Item analysis basically involves examination of the pattern of responses for each item in order to assess its effectiveness. The results of item analysis permit better interpretation of test results and provide guidance for item revision. If many students miss the same item, for example, it does not necessarily mean that they did not achieve the corresponding objectives. The item itself may be defective. Item analysis also indirectly provides feedback to the test developer about concerning factors related to good and poor items, which can be useful in future, test development efforts. Usually we associate item analysis with multiple-choice tests. The two major aspects of item analysis-item difficulty and discriminating power-applied to all types of items. The third aspect of item analysis-analysis i.e. distracters-does apply mainly to multiple-choice items.

Items analysis procedures are different for norm-referenced tests and criterion-referenced tests, mainly because the items in such tests are designed for norm-referenced tests. Since they are concerned with score variability and how well the test items correctly identify high achievers and low achievers, they are basically inappropriate for criterion-referenced tests. In fact the whole process is designed to maximize the degree to which items discriminate between high a low achievers.
The two major aspects of traditional item analysis are determination of degree of item difficulty and discriminating power. The third aspect of item analysis, which is appropriate for certain types of items, is analysis of distracters. In a multiple-choice test, for example, if no one chooses alternative D of item 4, it is a poor distracter, that is it is apparently not a plausible response even for students who do not know the correct response. The steps and calculations involved in the analysis are really quite simple. The first step is to score the test and rank the test scores, i.e., put them in order from highest total score to lowest total scores. The next step is to select approximately the top one-fourth and bottom one-fourth of the scores for analysis. If there are 400 tests, for example, the 100 highest scores will be the top or high achievers and same for low achievers. The responses of the middle are not included in the analysis: it is assumed that they follow the same pattern as the others.

After the membership of the upper and lower groups has been determined, we calculate and interpret the difficulty level of each item and the discriminating power of each item. If appropriate we then tabulate the number of students in each group who choose each alternative and assess the effectiveness of each.

2.9.1 Item Difficulty Level (D.L.)

Item difficulty refers to the percentage of students who got the item correct. There are two ways to find it.

1. The formula for estimating item difficulty level is:

\[ D.L. = \frac{(A+B)}{2} \]
Where

\[ A = \% \text{ of high achievers doing correct} \]

\[ B = \% \text{ of low achievers doing correct} \]

2. The formula for estimating item difficulty level is:

\[ D.L = \frac{R}{T} \times 100 \]

Where

\[ R = \text{the number of students (in the upper and lower group combined) who got the item correct} \]

\[ T = \text{the total number of students (in the upper and lower groups combined) who responded to the item} \]

Now the question is what is 'good'. Since we are dealing with a norm-referenced test, we do not want items which are too difficult or too easy. We want items of average difficulty in order to permit maximum score variability. The ideal value of D.L. varies with the type of item. Anyhow, for multiple choice items, the D.L. below than 16 or above than 84 makes the item too difficult or too easy. So such items should be rejected for a validated and standardized test.

2.9.2 **Discrimination Index (D.I.)**

Discriminating index (D.I.) refers to the degree to which an item discriminates between high and low achievers throughout the test. In other words, if an item has high, positive D.I., then high achievers got it right and low achievers did not. Ideally, we would prefer to validate items by investigating how performance on each relates to some valid measure of achievement in the area being tested, other
than the tests itself. Usually no such independent measures exist, mainly because the test was developed to measure a specific set of objectives or a selected area of content. The best measure of overall achievement that we have is the test itself, and we determine how each item on the test relates to performance on the total test, that is, high scorers get it right and low scorers get it wrong, then the item has good discriminating power. If the test is indeed a valid measure of the intended outcomes, then the process of determining discriminating power does validate the items.

Discrimination Index is estimated using the following two fairly simple formulas:

1. \( D.I. = \frac{(A-B)}{2} \)

Where

\( A = \) % of high achievers doing correct

\( B = \) % of low achievers doing correct

If D.I. is too less or too large, it will make the item invalidated. Its value is supposed to be acceptable in between 16-84. Any negative value of D.I. makes the item catchy or dodgy. Such items are invalidated and, hence, are rejected.

2. \( D.I. = R_u - R_L / (0.5 T) \)

Where

\( D.I. = \) Discrimination Index

\( R_u = \) the number of students in the upper group who responded correctly

\( R_L = \) the number of students in the lower group who responded correctly

\( T = \) the total number of students in the item analysis
As the formula suggest, there are three basic possibilities:

\[ R_u > R_L \] (more students in the upper group responded correctly),

\[ R_u = R_L \text{ or } R_L < R_U \]

When \( R_u > R_L \), the item is behaving the same way as the total test and has positive D.I. When \( R_L \) and \( R_U \) is essentially the same, or very close, the item has a D.I. near .00, which means that it does not discriminate. Such an item serves no useful purpose since a student's overall achievement level has nothing to do with whether or not she or he can respond correctly to the item. When \( R_L < R_U \), the item is behaving in a manner opposite to that of the total test and has negative D.I.

2.9.3 **Distractibility**

The items of an objective test are constructed in accordance to the difficulty level of the learners. If four options are suggested in an item, one should not be able to guess easily simply because of the fact that the three distract ores were too irrelevant to think. All of the given options should have a close link with the correct response.

2.10 **MEASURES OF CENTRAL TENDENCY**

A single score calculated to represent all the scores is called an average. Average tends to lie in the centre of an array. That is why averages are called measures of central tendency. Since Averages \( \mu \) locate in the centre of a data set; these are also called measures of location.
Several types of averages can be defined. Most commonly used averages are arithmetic mean, median and mode.

2.10.1 The Arithmetic Mean or Mean

The arithmetic mean is the most commonly used average. It is usually called mean or average. The arithmetic mean is defined as the number obtained by dividing the sum of the scores by their total number. It is denoted by putting bar on the variable symbol (read as $X$ bar)

$\text{Mean} = \frac{\sum X}{N}$

Short formula for calculating arithmetic mean for common class interval width for a grouped data, is

$\text{Mean} = A + \left( \frac{\sum f i}{\sum f} \right) \cdot i$

$A$ is assumed or guessed mean usually chosen from the values of $X$ and $i$ is the common class interval length.

2.10.2 The Median

The median of a set of scores is the middle score or the arithmetic mean of two middle most scores in an array. 50% of the scores are less than median and 50% of the scores are greater than median.

In symbols

$\text{Median} = \frac{(N+1)}{2^{\text{th}}} \text{ score}$

When the data is grouped into a frequency distribution,
Median = \( L + \frac{i}{f} (N/2 - C) \)

\( L \) = lower class boundary of the median class interval.

\( i \) = length of the median class interval.

\( f \) = the frequency of the median class interval.

\( N = \sum f \)

\( C \) = the cumulative frequency of the class interval below the median class interval

2.10.3 The Mode

The mode is the score, which occurs greatest number of times in a data set. Mode does not always exist. If each score occurs the same number of times, there is no mode. There may be more than one mode. If two or more scores occur greatest number of times, then there is more than one mode.

For group data, the mode can be calculated by the formula

\( \text{Mode} = L + \left( \frac{f_m - f_1}{f_2 - f_1} \right) i \)

The mode lies in the class interval having maximum frequency. This class interval is called the modal class.

\( L \) = lower class boundary of the modal class interval.

\( f_m \) = the maximum frequency.

\( f_1 \) = the frequency proceeding to the modal class.

\( f_2 \) = the frequency succeeding to the modal class.

\( i \) = the length of the modal class interval.
2.10.4 *Comparison of Measures of Central Tendency*

The numerical value of every score in a data set contributes to the mean. This is not true of the mode or median because only the mean is based on the sum of all the scores. In single peaked symmetrical distribution mean=median=mode. In practice, no distribution is exactly symmetrical, so the mode, median, and mean usually have different values. If a population is not symmetrical, the mean, median and mode will not be equal. The mean is affected by the presence of a few extreme scores while the median and mode are not. The mean is preferred if values are not present in the data. Median is preferred if interest is centered on the typical rather than the total score and if the distribution is skewed. If some scores are missing so that the mean cannot be computed directly, the median is appropriate. Mode is preferred only if the distribution is multimodal and a multi-valued index are satisfactory.

2.10.5 *Quartiles*

The values that divide a set of scores into four equal parts are called quartiles and are denoted by $Q_1$, $Q_2$ and $Q_3$. $Q_1$ is called the lower quartile; $Q_3$ is called the upper quartile. 25% of the scores are less than $Q_1$ and 75% of the scores are less than $Q_3$, $Q_2$ is the median.

For the grouped data

$Q_1=L+i/f (N/4-C)$

$Q_2=\text{median}= L+i/f (N/2-C)$

$Q_3=L+ i/f (N/4-C)$
2.10.6 **Percentiles**

The values that divide a set of scores into hundred equal parts are called percentiles and are denoted by \( P_1, P_2, P_3, \ldots, P_{99} \). \( P_{25} \) is the first quartile, \( P_{75} \) is the third quartile and \( P_{50} \) is the median.

The formulas for the percentiles are

\[
\begin{align*}
P_1 &= (N+1/100) \text{ th score}, \\
P_2 &= 2(N+1/100) \text{ th score}, \\
P_3 &= 3(N+1/100) \text{ th score} \\
P_{99} &= 99(N+1/100) \text{ th score}
\end{align*}
\]

For grouped data

\[
\begin{align*}
P_1 &= L+i/f \ (N/100-C), \\
P_2 &= L+i/f \ (2N/100-C), \\
P_3 &= L+i/f \ (3N/100-C)\ldots \\
P_{50} &= \text{median} = L+i/f \ (N/2-C)\ldots P_{75} = L+i/f \ (75N/100-C), \text{ etc.}
\end{align*}
\]

2.10.7 **Measures of Variability**

Measures of central tendency measure the centre of a set of scores. However, two sets can have the same mean, median or mode and yet be quite different in other respects. For example, consider the heights (in inches) of the players of two basketball teams

**Team 1** 72 73 76 76 78

**Team 2** 67 72 78 76 84
The two teams have the same mean height. 75 inches, but it is clear that the
heights of the players of team 2 vary much more than those of team 2. If we have
information about the centre of scores and the manner in which they are spread out,
we know much more about set of scores. The degree to which scores tend to spread
about an average value is called dispersion.

2.10.8 The Range

It is the simplest measure of dispersion. The range of a set of scores is the
difference between maximum scores and minimum scores.

2.10.9 Quartile Deviation

The quartile deviation is defined as half of the difference between the third
and first quartiles.

In symbols

$$Q.D = \frac{Q_3 - Q_1}{2}$$

Where $Q_1$ is the first quartile and $Q_3$ is the third quartile.

2.10.10 The Mean Deviation or Average Deviation

The average deviation is defined as the arithmetic mean of the deviations of
the scores from the mean or median: the deviations are taken as positive.

In symbols

$$M.D = \frac{1}{N} \sum |X - \bar{X}|$$

For grouped data

$$M.D = \frac{1}{\sum f} \sum f |X - \bar{X}|$$
2.10.11 The Standard Deviation

The standard deviation is the positive square root of the arithmetic means of the squares of deviations of all the scores from their mean.

Calculation of the standard deviation using the short formula:

\[ S = \frac{\sum X^2}{N} - \left( \frac{\sum X}{N} \right)^2 \]

2.10.12 The Coefficient of Variation

Karl Pearson introduced a relative measure of dispersion known as coefficient of variation (denoted by c.v). It expresses the standard deviation as a percentage of the arithmetic mean of a data set. It is a number without units and is used to compare variation in two or more distribution. The smaller value of the c. v. indicates lesser variation. It is also used as a criterion for consistent performance of the students, players etc.

\[ C.V = \frac{s}{X} \times 100 \]

Where s is the standard deviation.

2.10.13 Standard Scores

A frequently used quantity in statistical analysis is the standard score or Z-score. The standard score for a data value is the number of standard deviations that the data value is away from the mean of the data set.
2.10.14 Some Basic Properties of the Normal Curve

1. The total area under the normal curve is equal to 1.

2. The normal curve extends indefinitely in both directions.

3. The normal distribution is symmetric about the mean μ.

4. The mean, the median and the mode are equal.

5. Mean deviation is 0.7979σ

6. Quartile deviation is 0.06745σ

7. In a normal distribution,

   \[ \mu - 0.6745 \sigma \text{ to } \mu + 0.6745 \sigma \text{ covers } 50\% \text{ of the area.} \]

   \[ \mu - \sigma \text{ to } \mu + \sigma \text{ covers } 68.27 \% \text{ of the area.} \]

   \[ \mu - 2\sigma \text{ to } \mu + 2\sigma \text{ covers } 95.73\% \text{ of the area.} \]

   \[ \mu - 3\sigma \text{ to } \mu + 3\sigma \text{ covers } 99.73\% \text{ of the area.} \]
CHAPTER III

METHOD AND PROCEDURE OF RESEARCH

This study was designed to validate the test items of an objective type test in the subject of Physics for 9th class within Rawalpindi city and to develop a pool of test items for the teachers of physics.

Method and procedure of the study was as following:

1.1 Population
1.2 Sample
1.3 Research instrument
1.4 Data collection
1.5 Data analysis
1.6 Delimitations

3.1 POPULATION

All male science students of 9th class, studying in 20 English medium secondary schools for boys in Rawalpindi city, were the population of the study.

3.2 SAMPLE

All the schools included in the population of the study were arranged under stratified sampling into following three categories:
1. F.G. Secondary Schools  Canitt Garrison of Rawalpindi cantt.

2. Provincial Secondary Schools of Rawalpindi City

3. Private Secondary Schools of Rawalpindi City

Two of the schools were to be taken as sample from each of the three categories. For this purpose, all the names of schools were written on slips of papers. The slips of each of the three categories were separated from one another. After folding the slips of names of schools of each category properly, the researcher applied the technique of random sampling. Two of the schools from each of the three categories were taken as sample of the study with the help of draws.

The sample of the study contains six schools. The total number of students, taken as sample of the study, is 400. The details of this procedure are given in the table as follows:

<table>
<thead>
<tr>
<th>Categories of Schools</th>
<th>Total No. of students of IX Class</th>
<th>Total No. of Schools</th>
<th>Total students taken as sample</th>
<th>Total No. of Schools taken as sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>F.G. Secondary Schools</td>
<td>750</td>
<td>5</td>
<td>200</td>
<td>2</td>
</tr>
<tr>
<td>Cantt Garrison, Rawalpindi cantt.</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Provincial Secondary Schools of Rawalpindi City</td>
<td>500</td>
<td>5</td>
<td>150</td>
<td>2</td>
</tr>
<tr>
<td>Private Secondary Schools of Rawalpindi City</td>
<td>250</td>
<td>10</td>
<td>50</td>
<td>2</td>
</tr>
</tbody>
</table>

Total 1500 20 400 6

For selection of 400 students as sample of the study, the concept of a normal distribution was adopted by which $\mu-\sigma$ and $\mu+\sigma$ cover 68.27% of the total population.
3.3 **INSTRUMENT**

An objective type test consisting of 80 items was prepared from the first seven chapters of the text book of Physics for class IX, prescribed by the Punjab Text book Board, Lahore. The test was repeatedly discussed with the working science teachers and expert in the subject of physics. The addition and deletion of items of the test were discussed with them and thereby 80 items were finalized. This test was administered on 400 students of class IX included in the sample. The test was scored on the basis of the key already prepared. Item analysis was done using the difficulty level and discrimination index. The items within the range of 16 and 84 with respect to difficulty level and discrimination index were retained.

3.4 **DATA COLLECTION**

Data was collect by the researcher by administering the test in all sampled schools with the help of teachers of the concerned school.

3.5 **DATA ANALYSIS**

The data were analyzed through items analysis by finding difficulty levels and discrimination indices of high and low achievers. The findings were extracted and the conclusions were finalized and recommendations were given.

3.6 **DELIMITATIONS**

1. The study was delimited to only English medium schools for boys, studying physics in 9th class, in Rawalpindi city.
2. Private English medium schools, which are located in Dhoke Chauhdarian, Afshan Colony, Misrial Road and Allama Iqbal Colony only, were taken as population of the study keeping in view the time constraints, conveyance and expenditures problems and the administrative problems of the schools included in the population.
CHAPTER IV

PRESENTATION AND ANALYSIS OF DATA

The data, collected through scoring of the test and administered on the sample of the study, were analyzed. The analysis of each of the two groups i.e. H.A. and L.A. was done separately. The decision making table was prepared by which the acceptance or rejection of a test item was finalized.

Table 1: Item-wise analysis

<table>
<thead>
<tr>
<th>Item No.</th>
<th>A % of H.A. (High Achievers), Doing Correct</th>
<th>B % of L.A. (Low Achievers), Doing Correct</th>
<th>(A+B)/2 Difficulty Level D.L.</th>
<th>A-B Discrimination Index D.I.</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>92</td>
<td>76</td>
<td>86</td>
<td>16</td>
<td>Too easy, less discriminative, Rejected</td>
</tr>
<tr>
<td>2</td>
<td>84</td>
<td>51</td>
<td>67.5</td>
<td>33</td>
<td>Normal, Accepted</td>
</tr>
<tr>
<td>3</td>
<td>88</td>
<td>47</td>
<td>67.5</td>
<td>31</td>
<td>Normal, Accepted</td>
</tr>
<tr>
<td>4</td>
<td>79</td>
<td>31</td>
<td>55</td>
<td>48</td>
<td>Normal, Accepted</td>
</tr>
<tr>
<td>5</td>
<td>90</td>
<td>60</td>
<td>75</td>
<td>30</td>
<td>Discriminative, easy, accepted</td>
</tr>
<tr>
<td>6</td>
<td>89</td>
<td>45</td>
<td>67</td>
<td>44</td>
<td>Normal, Accepted</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Too easy, Rejected</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---------------------</td>
</tr>
<tr>
<td>8</td>
<td>62</td>
<td>28</td>
<td>45</td>
<td>38</td>
<td>Normal, Accepted</td>
</tr>
<tr>
<td>9</td>
<td>54</td>
<td>23</td>
<td>38.5</td>
<td>31</td>
<td>Difficult, accepted</td>
</tr>
<tr>
<td>10</td>
<td>91</td>
<td>59</td>
<td>75</td>
<td>32</td>
<td>Discriminatively easy, accepted</td>
</tr>
<tr>
<td>11</td>
<td>78</td>
<td>40</td>
<td>59</td>
<td>38</td>
<td>Normal, Accepted</td>
</tr>
<tr>
<td>12</td>
<td>69</td>
<td>32</td>
<td>50.5</td>
<td>47</td>
<td>Normal, Accepted</td>
</tr>
<tr>
<td>13</td>
<td>52</td>
<td>16</td>
<td>34</td>
<td>36</td>
<td>Very difficult, Accepted</td>
</tr>
<tr>
<td>14</td>
<td>60</td>
<td>25</td>
<td>42.5</td>
<td>35</td>
<td>Difficult, accepted</td>
</tr>
<tr>
<td>15</td>
<td>64</td>
<td>21</td>
<td>42.5</td>
<td>43</td>
<td>Difficult, accepted</td>
</tr>
<tr>
<td>16</td>
<td>76</td>
<td>35</td>
<td>55.5</td>
<td>41</td>
<td>Normal, Accepted</td>
</tr>
<tr>
<td>17</td>
<td>84</td>
<td>22</td>
<td>53</td>
<td>62</td>
<td>Normal, well discriminative, accepted</td>
</tr>
<tr>
<td>18</td>
<td>77</td>
<td>48</td>
<td>62.5</td>
<td>29</td>
<td>Normal, Accepted</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Easy, less discriminative, accepted</td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>-----------------------------------</td>
</tr>
<tr>
<td>19</td>
<td>80</td>
<td>65</td>
<td>72.5</td>
<td>15</td>
<td>Difficult, accepted</td>
</tr>
<tr>
<td>20</td>
<td>60</td>
<td>12</td>
<td>36</td>
<td>48</td>
<td>Very difficult, Accepted</td>
</tr>
<tr>
<td>21</td>
<td>43</td>
<td>13</td>
<td>28</td>
<td>30</td>
<td>Accepted</td>
</tr>
<tr>
<td>22</td>
<td>21</td>
<td>07</td>
<td>14</td>
<td>14</td>
<td>Too Difficult, less discriminative, Rejected</td>
</tr>
<tr>
<td>23</td>
<td>75</td>
<td>53</td>
<td>64</td>
<td>22</td>
<td>Normal, Accepted</td>
</tr>
<tr>
<td>24</td>
<td>66</td>
<td>54</td>
<td>60</td>
<td>12</td>
<td>Normal, less discriminative, Accepted</td>
</tr>
<tr>
<td>25</td>
<td>51</td>
<td>21</td>
<td>36</td>
<td>30</td>
<td>Difficult, accepted</td>
</tr>
<tr>
<td>26</td>
<td>80</td>
<td>14</td>
<td>47</td>
<td>66</td>
<td>Good, less discriminative, Accepted</td>
</tr>
<tr>
<td>27</td>
<td>34</td>
<td>11</td>
<td>22.5</td>
<td>23</td>
<td>Very difficult, Accepted</td>
</tr>
<tr>
<td>28</td>
<td>38</td>
<td>10</td>
<td>24</td>
<td>28</td>
<td>Very difficult, Accepted</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>-----------------------------------------------</td>
</tr>
<tr>
<td>29</td>
<td>31</td>
<td>07</td>
<td>19</td>
<td>24</td>
<td>Very difficult, Accepted</td>
</tr>
<tr>
<td>30</td>
<td>27</td>
<td>08</td>
<td>17.5</td>
<td>19</td>
<td>Very difficult, less discriminative Accepted</td>
</tr>
<tr>
<td>31</td>
<td>41</td>
<td>11</td>
<td>26</td>
<td>30</td>
<td>Very difficult, Accepted</td>
</tr>
<tr>
<td>32</td>
<td>76</td>
<td>24</td>
<td>50</td>
<td>52</td>
<td>Very good, Accepted</td>
</tr>
<tr>
<td>33</td>
<td>81</td>
<td>41</td>
<td>62</td>
<td>40</td>
<td>Normal, Accepted</td>
</tr>
<tr>
<td>34</td>
<td>78</td>
<td>29</td>
<td>53.5</td>
<td>49</td>
<td>Good, Accepted</td>
</tr>
<tr>
<td>35</td>
<td>70</td>
<td>38</td>
<td>59</td>
<td>32</td>
<td>Good, Accepted</td>
</tr>
<tr>
<td>36</td>
<td>68</td>
<td>24</td>
<td>46</td>
<td>44</td>
<td>Very Good, Accepted</td>
</tr>
<tr>
<td>37</td>
<td>82</td>
<td>31</td>
<td>55.5</td>
<td>51</td>
<td>Normal, Accepted</td>
</tr>
<tr>
<td>38</td>
<td>69</td>
<td>45</td>
<td>57</td>
<td>24</td>
<td>Normal, less discriminative, Accepted</td>
</tr>
<tr>
<td>39</td>
<td>44</td>
<td>10</td>
<td>27</td>
<td>34</td>
<td>Very difficult, Accepted</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>40</td>
<td>81</td>
<td>49</td>
<td>65</td>
<td>32</td>
<td>Normal, Accepted</td>
</tr>
<tr>
<td>41</td>
<td>24</td>
<td>06</td>
<td>15</td>
<td>18</td>
<td>Too difficult, less discriminative, Rejected</td>
</tr>
<tr>
<td>42</td>
<td>34</td>
<td>16</td>
<td>25</td>
<td>28</td>
<td>Very difficult, Accepted</td>
</tr>
<tr>
<td>43</td>
<td>58</td>
<td>26</td>
<td>42</td>
<td>32</td>
<td>Very Good, Accepted</td>
</tr>
<tr>
<td>44</td>
<td>63</td>
<td>33</td>
<td>48</td>
<td>30</td>
<td>Very Good, Accepted</td>
</tr>
<tr>
<td>45</td>
<td>29</td>
<td>07</td>
<td>18</td>
<td>22</td>
<td>Very difficult, discriminative, Accepted</td>
</tr>
<tr>
<td>46</td>
<td>64</td>
<td>40</td>
<td>52</td>
<td>24</td>
<td>Good, Accepted</td>
</tr>
<tr>
<td>47</td>
<td>75</td>
<td>37</td>
<td>60</td>
<td>38</td>
<td>Normal, Accepted</td>
</tr>
<tr>
<td>48</td>
<td>54</td>
<td>13</td>
<td>33.5</td>
<td>31</td>
<td>Very difficult, discriminative, Accepted</td>
</tr>
<tr>
<td>49</td>
<td>61</td>
<td>20</td>
<td>40.5</td>
<td>41</td>
<td>Very difficult, discriminative, Accepted</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>50</td>
<td>66</td>
<td>32</td>
<td>49</td>
<td>34</td>
<td>Good, Accepted</td>
</tr>
<tr>
<td>51</td>
<td>77</td>
<td>24</td>
<td>50.5</td>
<td>53</td>
<td>Good, Accepted</td>
</tr>
<tr>
<td>52</td>
<td>68</td>
<td>30</td>
<td>49</td>
<td>38</td>
<td>Good, Accepted</td>
</tr>
<tr>
<td>53</td>
<td>85</td>
<td>55</td>
<td>70</td>
<td>30</td>
<td>Easy, discriminative, accepted</td>
</tr>
<tr>
<td>54</td>
<td>79</td>
<td>35</td>
<td>57</td>
<td>44</td>
<td>Good, Accepted</td>
</tr>
<tr>
<td>55</td>
<td>41</td>
<td>15</td>
<td>28</td>
<td>26</td>
<td>Very difficult, discriminative, Accepted</td>
</tr>
<tr>
<td>56</td>
<td>54</td>
<td>21</td>
<td>37.5</td>
<td>33</td>
<td>Difficult, discriminative, Accepted</td>
</tr>
<tr>
<td>57</td>
<td>73</td>
<td>29</td>
<td>51</td>
<td>44</td>
<td>Good, Accepted</td>
</tr>
<tr>
<td>58</td>
<td>45</td>
<td>11</td>
<td>28</td>
<td>34</td>
<td>Very difficult, discriminative, Accepted</td>
</tr>
<tr>
<td>59</td>
<td>61</td>
<td>27</td>
<td>44</td>
<td>34</td>
<td>Good, Accepted</td>
</tr>
<tr>
<td>60</td>
<td>30</td>
<td>04</td>
<td>17</td>
<td>26</td>
<td>Very difficult, Accepted</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>----</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>61</td>
<td>41</td>
<td>13</td>
<td>27</td>
<td>28</td>
<td>Very difficult, discriminative, Accepted</td>
</tr>
<tr>
<td>62</td>
<td>24</td>
<td>12</td>
<td>18</td>
<td>12</td>
<td>Very difficult, less discriminative, Accepted</td>
</tr>
<tr>
<td>63</td>
<td>36</td>
<td>08</td>
<td>22</td>
<td>28</td>
<td>Very difficult, discriminative, Accepted</td>
</tr>
<tr>
<td>64</td>
<td>73</td>
<td>21</td>
<td>47</td>
<td>52</td>
<td>Very Good, discriminative, Accepted</td>
</tr>
<tr>
<td>65</td>
<td>91</td>
<td>53</td>
<td>72</td>
<td>38</td>
<td>Easy, discriminative, accepted</td>
</tr>
<tr>
<td>66</td>
<td>80</td>
<td>30</td>
<td>55</td>
<td>50</td>
<td>Good, discriminative, Accepted</td>
</tr>
<tr>
<td>67</td>
<td>54</td>
<td>19</td>
<td>36.5</td>
<td>35</td>
<td>Difficult, discriminative, Accepted</td>
</tr>
</tbody>
</table>

60
<p>| | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>68</td>
<td>65</td>
<td>25</td>
<td>45</td>
<td>40</td>
<td>Very Good, discriminative, Accepted</td>
</tr>
<tr>
<td>69</td>
<td>52</td>
<td>21</td>
<td>36.5</td>
<td>31</td>
<td>Difficult, discriminative, Accepted</td>
</tr>
<tr>
<td>70</td>
<td>49</td>
<td>15</td>
<td>32</td>
<td>34</td>
<td>Difficult, discriminative, Accepted</td>
</tr>
<tr>
<td>71</td>
<td>65</td>
<td>29</td>
<td>47</td>
<td>36</td>
<td>Very Good, discriminative, Accepted</td>
</tr>
<tr>
<td>72</td>
<td>45</td>
<td>17</td>
<td>27</td>
<td>28</td>
<td>Difficult, discriminative, Accepted</td>
</tr>
<tr>
<td>73</td>
<td>62</td>
<td>25</td>
<td>43.5</td>
<td>37</td>
<td>Very Good, discriminative, Accepted</td>
</tr>
<tr>
<td>74</td>
<td>48</td>
<td>26</td>
<td>37</td>
<td>22</td>
<td>Difficult, less discriminative, Accepted</td>
</tr>
<tr>
<td>75</td>
<td>60</td>
<td>19</td>
<td>39.5</td>
<td>41</td>
<td>Difficult, discriminative, Accepted</td>
</tr>
<tr>
<td>----</td>
<td>----</td>
<td>----</td>
<td>------</td>
<td>----</td>
<td>-----------------------------------</td>
</tr>
<tr>
<td>76</td>
<td>83</td>
<td>23</td>
<td>53</td>
<td>60</td>
<td>Good, discriminative, Accepted</td>
</tr>
<tr>
<td>77</td>
<td>54</td>
<td>34</td>
<td>44</td>
<td>20</td>
<td>Very Good, less discriminative, Accepted</td>
</tr>
<tr>
<td>78</td>
<td>67</td>
<td>45</td>
<td>56</td>
<td>21</td>
<td>Good, less discriminative, Accepted</td>
</tr>
<tr>
<td>79</td>
<td>71</td>
<td>58</td>
<td>64.5</td>
<td>13</td>
<td>Normal, less Discriminative, Accepted</td>
</tr>
<tr>
<td>80</td>
<td>78</td>
<td>34</td>
<td>56</td>
<td>54</td>
<td>Normal, Discriminative, Accepted</td>
</tr>
</tbody>
</table>

The table shows that:

1. Four items out of 80 (0.5%) were rejected.
2. Seventy-six items (95%) were accepted.
3. There were no catchy or dodgy items.
Table 2: Frequency distribution of values of D.L

\[=100\% \quad \text{sum}=80\]

<table>
<thead>
<tr>
<th>Class interval(D.L.)</th>
<th>Item numbers</th>
<th>% of items</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>More than 84</td>
<td>1,7</td>
<td>2.5</td>
<td>02</td>
</tr>
<tr>
<td>77-68</td>
<td>2,3,5,10,19,53,65</td>
<td>8.75</td>
<td>07</td>
</tr>
<tr>
<td>67-58</td>
<td>6,11,18,23,24,33,35,47,79</td>
<td>11.25</td>
<td>09</td>
</tr>
<tr>
<td>57-48</td>
<td>4,12,16,17,32,34,37,38,46,49,50,51,52,54,57,66,76,78,80</td>
<td>23.75</td>
<td>19</td>
</tr>
<tr>
<td>47-38</td>
<td>8,9,14,15,26,36,43,44,45,56,59,64,68,71,73,75,77</td>
<td>20</td>
<td>16</td>
</tr>
<tr>
<td>37-28</td>
<td>13,20,21,25,40,48,55,58,67,69,70,74</td>
<td>15</td>
<td>12</td>
</tr>
<tr>
<td>27-18</td>
<td>27,28,29,30,31,39,42,45,61,62,63,72</td>
<td>15</td>
<td>12</td>
</tr>
<tr>
<td>17</td>
<td>60</td>
<td>1.25</td>
<td>01</td>
</tr>
<tr>
<td>Below 17</td>
<td>22,41</td>
<td>2.5</td>
<td>02</td>
</tr>
</tbody>
</table>

Following facts were observed:

1. Items No.1 and 7 had D.L. in the interval of more than 84.
2. Item No. 22 had D.L. of 16 and D.I. of 18.
3. Item No.41 was too difficult and less discriminative because its D.L. is 15 and D.I. 18.
4. 2.5% Items had the D.L. in the interval of 87-78.
5. Items No. 2, 3, 5, 10, 19, 53, and 65 (8.75%) had the D.L. in the interval of 77-68.

6. Items No. 6, 11, 18, 23, 24, 33, 35 and 79 (11.25%) had the D.L. in the interval of 67-58.

7. Items No. 4, 12, 16, 17, 32, 34, 37, 38, 46, 49, 50, 51, 52, 54, 57, 66, 76, 78 and 80 (23.75%) had the D.L. in the interval of 57-48.

8. Items No. 9, 14, 15, 26, 36, 39, 43, 44, 56, 64, 68, 71, 73, 75 and 77 (20%) had the D.L. in the Interval of 47-38.


10. Items No. 27, 28, 29, 30, 31, 42, 45, 60, 61, 62, 63 and 72 (15%) had the D.L. in the interval of 27-18.

11. Items No. 22, 41 had the D.L. in the interval below than 17.
Table 3: Frequency distribution of values of D.I

<table>
<thead>
<tr>
<th>Class Interval(D.I)</th>
<th>Item numbers</th>
<th>% of item</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>71-64</td>
<td>26 (It had the value of 66)</td>
<td>1.25</td>
<td>01</td>
</tr>
<tr>
<td>63-56</td>
<td>17,76</td>
<td>2.5</td>
<td>02</td>
</tr>
<tr>
<td>55-48</td>
<td>4,20,32,34,37,51,64,66,80</td>
<td>11.25</td>
<td>09</td>
</tr>
<tr>
<td>47-40</td>
<td>6,12,15,16,33,36,49,54,57,68,75</td>
<td>13.75</td>
<td>11</td>
</tr>
<tr>
<td>39-32</td>
<td>2,8,10,11,13,14,35,39,40,43,47,48,50,52,56,58,59,65,67,70,71,73</td>
<td>27.5</td>
<td>22</td>
</tr>
<tr>
<td>31-24</td>
<td>3,5,7,9,18,21,25,28,29,31,38,42,44,46,53,55,60,61,63,69,72</td>
<td>26.25</td>
<td>21</td>
</tr>
<tr>
<td>23-16</td>
<td>1,22,23,27,30,18,45,74,77,78</td>
<td>12.5</td>
<td>10</td>
</tr>
<tr>
<td>15 and below</td>
<td>19,24,62,79</td>
<td>5.0</td>
<td>04</td>
</tr>
</tbody>
</table>

Following results were observed:

1. Item No. 26 had the discriminative index in the interval of 64-71. The value was 66 actually.

2. Items No. 17 and 76 had the discriminative index in the interval of 63-56.

3. Items No. 4, 20, 32, 34, 51, 64, 66 and 80 had the discriminative index in the interval of 55-48.

4. Items No. 6, 12, 15, 16, 33, 36, 49, 54, 57, 68 and 75 had the discriminative index in the interval of 47-40.
5. Items No. 2, 8, 10, 11, 13, 14, 15, 16, 39, 40, 43, 47, 48, 50, 52, 56, 58, 59, 65, 67, 70, 71 and 73 had the discriminative index in the interval of 39-32.

6. Items No. 3, 5, 7, 9, 21, 25, 28, 29, 30, 38, 42, 44, 46, 53, 55, 60, 61, 63, 69 and 72 had the discriminative index in the interval of 31-24.

7. Items No. 1, 22, 23, 27, 30, 45, 74, 77 and 78 had the discriminative index in the interval of 23-16.

8. Items No. 19, 24, 62 and 79 had the discriminative index in the interval of below than 15.
Table 4: Measures of central tendencies for high achievers (H.A)

<table>
<thead>
<tr>
<th>Marks obtained</th>
<th>Mid Value</th>
<th>Number of students</th>
<th>Cumulative frequency</th>
<th>x</th>
<th>f.x</th>
</tr>
</thead>
<tbody>
<tr>
<td>66-68</td>
<td>67</td>
<td>05</td>
<td>100</td>
<td>3</td>
<td>15</td>
</tr>
<tr>
<td>63-65</td>
<td>64</td>
<td>26</td>
<td>95</td>
<td>2</td>
<td>52</td>
</tr>
<tr>
<td>60-62</td>
<td>61</td>
<td>16</td>
<td>69</td>
<td>1</td>
<td>16</td>
</tr>
<tr>
<td>57-59</td>
<td>58(A.M.)*</td>
<td>12</td>
<td>53</td>
<td>0</td>
<td>00</td>
</tr>
<tr>
<td>54-56</td>
<td>55</td>
<td>29</td>
<td>41</td>
<td>-1</td>
<td>-29</td>
</tr>
<tr>
<td>51-53</td>
<td>52</td>
<td>04</td>
<td>12</td>
<td>-2</td>
<td>-08</td>
</tr>
<tr>
<td>48-50</td>
<td>49</td>
<td>08</td>
<td>08</td>
<td>-3</td>
<td>-24</td>
</tr>
</tbody>
</table>

*Assumed Mean  
Sum(N)=100

1: Mean (M) = A.M.+\left( \frac{\sum f.x}{\sum f} \right). i  
=58 +\left( \frac{22}{100} \right) \times 3 = 58.66

2: Median (Mdn) = l + \left( \frac{N/2-f_i}{f} \right) \times i  
=56.5 +\left( \frac{50-41}{12} \right) \times 3 /12  
=58.75

3: Mode (Mo) = 3 Mdn − 2 M  
=3(58.75) − 2(58.66)  
=176.25 − 117.32  
=58.93

The table shows that;

1. The mean value of raw scores, for high achievers, was 58.66.
2. The median of raw scores, for high achievers, was 58.75.
3. The modal value of raw scores, for high achievers, was 58.93.
Table 5: Measures of central tendencies for low achievers (L.A)

<table>
<thead>
<tr>
<th>Marks obtained</th>
<th>Mid value X</th>
<th>No. of students F</th>
<th>Cumulative frequency c.f.</th>
<th>x</th>
<th>f.x</th>
</tr>
</thead>
<tbody>
<tr>
<td>30-32</td>
<td>31</td>
<td>18</td>
<td>100</td>
<td>3</td>
<td>54</td>
</tr>
<tr>
<td>27-29</td>
<td>28</td>
<td>23</td>
<td>82</td>
<td>2</td>
<td>46</td>
</tr>
<tr>
<td>24-26</td>
<td>25</td>
<td>12</td>
<td>59</td>
<td>1</td>
<td>12</td>
</tr>
<tr>
<td>21-23</td>
<td>22(A.M)*</td>
<td>10</td>
<td>47</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>18-20</td>
<td>19</td>
<td>11</td>
<td>37</td>
<td>-1</td>
<td>-11</td>
</tr>
<tr>
<td>15-17</td>
<td>16</td>
<td>18</td>
<td>26</td>
<td>-2</td>
<td>-36</td>
</tr>
<tr>
<td>12-14</td>
<td>13</td>
<td>08</td>
<td>08</td>
<td>-3</td>
<td>-24</td>
</tr>
</tbody>
</table>

*Assumed mean

\[
\text{Sum}=100(N)
\]

1: Mean (M) = A.M. + \( \frac{\sum f.x}{i} \times (i)/N \)

\[
= 22 + 41 \times 3/100
\]

\[
= 22 + 1.23
\]

\[
= 23.23
\]

2: Median (Mdn) = 1 + (50\% \ of \ N - f_c) \times i/f_i

\[
= 20.5 + (50 - 37) \times 33/10
\]

\[
= 20.5 + 3.9
\]

\[
= 24.4
\]

3: Mode (Mo) = 3 Mdn - 2 M

\[
= 3(24.4) - 2(23.23)
\]

\[
= 73.2 - 46.46
\]

68
= 26.74

The table shows that;

1. The mean value of raw scores, for low achievers, was 23.23.
2. The median of raw scores, for low achievers, was 24.4.
3. The modal value of raw scores, for low achievers, was 26.74.
Table 6: Measures of variability for H.A

<table>
<thead>
<tr>
<th>Marks obtained</th>
<th>Mid Value</th>
<th>Number of students</th>
<th>Cumulative frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>66-68</td>
<td>67</td>
<td>05</td>
<td>100</td>
</tr>
<tr>
<td>63-65</td>
<td>64</td>
<td>26</td>
<td>95{for Q3}</td>
</tr>
<tr>
<td>60-62</td>
<td>61</td>
<td>16</td>
<td>69</td>
</tr>
<tr>
<td>57-59</td>
<td>58</td>
<td>12</td>
<td>53</td>
</tr>
<tr>
<td>54-56</td>
<td>55</td>
<td>29</td>
<td>41{for Q1}</td>
</tr>
<tr>
<td>51-53</td>
<td>52</td>
<td>04</td>
<td>12</td>
</tr>
<tr>
<td>48-50</td>
<td>49</td>
<td>08</td>
<td>08</td>
</tr>
</tbody>
</table>

1: Range: \( U-L+1 \)
   \[ = 68-50+1 \]
   \[ = 21 \]

2: Lower Quartile, \( Q_1 = l+(N/4-f_o) \times i/f_i \)
   \[ = 53.5+(25-12) \times 3/29 \]
   \[ = 53.5+1.34=53.84 \]

3: Upper Quartile, \( Q_3 = l+ (75\% \text{ of } N-f_o) \times i/f_i \)
   \[ = 62.5+(75-69) \times 3/26 \]
   \[ = 62.5+0.69 \]
   \[ = 63.19 \]

4: Inter Quartile range = \( Q_3-Q_1 \)
   \[ = 63.19-53.84 \]
   \[ = 9.35 \]
5: Semi Inter Quartile Range = \( \frac{9.35}{2} = 4.675 \)

The table shows that;

1. The range of scores, obtained by high achievers, was 21.

2. The lower quartile range of scores, obtained by high achievers, was 53.84.

3. The upper quartile range of scores, obtained by high achievers, was 63.19.

4. The inter-quartile range of scores, obtained by high achievers, was 9.35.

5. The semi inter-quartile range of scores, obtained by high achievers, was 4.675.
Table 7: Measures of variability for L.A

<table>
<thead>
<tr>
<th>Marks obtained</th>
<th>Mid value X</th>
<th>No. Of students F</th>
<th>Cumulative frequency C.f.</th>
</tr>
</thead>
<tbody>
<tr>
<td>30-32</td>
<td>31</td>
<td>18</td>
<td>100</td>
</tr>
<tr>
<td>27-29</td>
<td>28</td>
<td>23</td>
<td>82 {for Q3}</td>
</tr>
<tr>
<td>24-26</td>
<td>25</td>
<td>12</td>
<td>59</td>
</tr>
<tr>
<td>21-23</td>
<td>22</td>
<td>10</td>
<td>47</td>
</tr>
<tr>
<td>18-20</td>
<td>19</td>
<td>11</td>
<td>37</td>
</tr>
<tr>
<td>15-17</td>
<td>16</td>
<td>18</td>
<td>26 {for Q1}</td>
</tr>
<tr>
<td>12-14</td>
<td>13</td>
<td>08</td>
<td>08</td>
</tr>
</tbody>
</table>

1: Range: \( U-L+1 \)
   \[ = 32-12+1 \]
   \[ = 21 \]

2: Lower Quartile, \( Q_1 = l + (N/4-f_c) \times i/f_i \)
   \[ = 14.5 + (25-8) \times 3/18 \]
   \[ = 14.5 + 17 \times 3/18 \]
   \[ = 17.33 \]

3: Upper Quartile, \( Q_3 = l + (75\% \text{ of } N-f_c) \times i/f_i \)
   \[ = 26.5 + (75-59) \times 3/23 \]
   \[ = 26.5 + 2.09 \]
   \[ = 28.59 \]

4: Inter Quartile Range: \( = Q_3 - Q_1 \)
   \[ = 28.59 - 17.33 \]

72
=11.26

5: Semi- Inter Quartile Range = 11.26/2 = 5.63

The table shows that:

1. The range of scores, obtained by low achievers, was 21.
2. The lower quartile range of scores, obtained by low achievers, was 17.33.
3. The upper quartile range of scores, obtained by low achievers, was 28.59.
4. The inter quartile range of scores, obtained by low achievers, was 11.26.
5. The semi inter-quartile range of scores, obtained by low achievers, was 5.63.
Table 8: Standard deviation for H.A

<table>
<thead>
<tr>
<th>Marks obtained</th>
<th>Mid Value X</th>
<th>Number of students F</th>
<th>f.X</th>
<th>f X²</th>
<th>z-score ( \frac{X-M}{s.d} )</th>
</tr>
</thead>
<tbody>
<tr>
<td>66-68</td>
<td>67</td>
<td>05</td>
<td>335</td>
<td>8.34</td>
<td>347.78</td>
</tr>
<tr>
<td>63-65</td>
<td>64</td>
<td>26</td>
<td>1664</td>
<td>5.34</td>
<td>741.41</td>
</tr>
<tr>
<td>60-62</td>
<td>61</td>
<td>16</td>
<td>976</td>
<td>2.34</td>
<td>87.61</td>
</tr>
<tr>
<td>59</td>
<td>58</td>
<td>12</td>
<td>696</td>
<td>-0.66</td>
<td>5.23</td>
</tr>
<tr>
<td>54-56</td>
<td>55</td>
<td>29</td>
<td>1595</td>
<td>-3.66</td>
<td>388.47</td>
</tr>
<tr>
<td>51-53</td>
<td>52</td>
<td>04</td>
<td>208</td>
<td>-6.66</td>
<td>177.42</td>
</tr>
<tr>
<td>48-50</td>
<td>49</td>
<td>08</td>
<td>392</td>
<td>-9.66</td>
<td>746.52</td>
</tr>
</tbody>
</table>

Sum(N)=100    Sum=5866

Sum=2494.64

1: \[ M = \frac{5866}{100} \]
   \[ = 58.66 \]

2: Standard Deviation: \[ \sqrt{(2494.64/100)} \]
   \[ = 4.99 \]

3: Coefficient of Variance: \[ V=100 \times \text{S.D}/M \]
   \[ = 100 \times 4.99/58.66 \]
   \[ = 8.51 \]

The table shows that:

1. The standard deviation of the scores of high achievers was 4.99.
2. The co-efficient of Variance for this group was 8.51.
3. The z-score for the interval 66-68 was maximum and that for 48-50 is minimum in this group.
4. All the scores were lying within normal range of \(-1.96\) to \(+1.96\) of z-scores.
Table 9: Standard deviation for L.A

<table>
<thead>
<tr>
<th>Marks obtained</th>
<th>Mid value X</th>
<th>No. of students f</th>
<th>f.X</th>
<th>x=X-M</th>
<th>f.x²</th>
<th>Z-score Z=(X-M)/s..d.</th>
</tr>
</thead>
<tbody>
<tr>
<td>30-32</td>
<td>31</td>
<td>18</td>
<td>558</td>
<td>7.77</td>
<td>1086.71</td>
<td>1.29</td>
</tr>
<tr>
<td>27-29</td>
<td>28</td>
<td>23</td>
<td>644</td>
<td>4.77</td>
<td>523.32</td>
<td>0.79</td>
</tr>
<tr>
<td>24-26</td>
<td>25</td>
<td>12</td>
<td>300</td>
<td>1.77</td>
<td>37.59</td>
<td>0.29</td>
</tr>
<tr>
<td>21-23</td>
<td>22</td>
<td>10</td>
<td>220</td>
<td>-1.23</td>
<td>15.13</td>
<td>-0.20</td>
</tr>
<tr>
<td>18-20</td>
<td>19</td>
<td>11</td>
<td>209</td>
<td>-4.23</td>
<td>196.82</td>
<td>-0.70</td>
</tr>
<tr>
<td>15-17</td>
<td>16</td>
<td>18</td>
<td>288</td>
<td>-7.23</td>
<td>940.91</td>
<td>-1.20</td>
</tr>
<tr>
<td>12-14</td>
<td>13</td>
<td>08</td>
<td>104</td>
<td>-10.23</td>
<td>837.22</td>
<td>-1.70</td>
</tr>
</tbody>
</table>

N=100  Sum=2323

Sum=3637.7

1: \( M = \frac{23233}{100} = 23.23 \)

2: \( S.D. = \sqrt{\left( \sum f.x^2/N \right)} \)
   \[ = \sqrt{36337.7/100} \]
   \[ = 6.03 \]

3: Co-efficient of Variance = \( V = \frac{100 \times S.D}{M} \)
   \[ = \frac{100 \times 6.03}{23.23} \]
   \[ = 25.96 \]

The table shows that:

1. The standard deviation of the scores of low achievers was 6.03.
2. The co-efficient of Variance for this group was 25.96.
3. The z-score for the interval 30-32 was maximum and that for 12-14 is minimum in this group.
4. All the scores were lying within normal range of \(-1.96\) to \(+1.96\) of z-scores.
Table 9: Frequency distribution of D.L. and decision-making

<table>
<thead>
<tr>
<th>D.L. Class Intervals</th>
<th>Items Nos.</th>
<th>Total</th>
<th>%</th>
<th>Nature of items</th>
<th>Decision</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less than 16</td>
<td>22,41</td>
<td>02</td>
<td>02.50%</td>
<td>Too Difficult</td>
<td>Rejected</td>
</tr>
<tr>
<td>17-35</td>
<td>13,21,27,28,29,30,31,39,42,45,58,60,61,62,63,7,72</td>
<td>19</td>
<td>23.75%</td>
<td>Very Difficult</td>
<td>Accepted</td>
</tr>
<tr>
<td>36-40</td>
<td>9,20,25,40,56,67,69,74,75</td>
<td>09</td>
<td>11.25%</td>
<td>Difficult</td>
<td>Accepted</td>
</tr>
<tr>
<td>41-50</td>
<td>8,14,15,26,32,36,43,44,49,50,52,59,64,68,71,73,77</td>
<td>17</td>
<td>21.25%</td>
<td>Very Good</td>
<td>Accepted</td>
</tr>
<tr>
<td>51-60</td>
<td>4,11,12,16,17,34,35,37,38,46,47,51,54,57,66,76,78,80</td>
<td>18</td>
<td>22.50%</td>
<td>Good</td>
<td>Accepted</td>
</tr>
<tr>
<td>61-69</td>
<td>2,3,6,18,23,24,33,79</td>
<td>08</td>
<td>10.00%</td>
<td>Normal</td>
<td>Accepted</td>
</tr>
<tr>
<td>70-79</td>
<td>5,10,19,53,65</td>
<td>05</td>
<td>06.25%</td>
<td>Easy</td>
<td>Accepted</td>
</tr>
<tr>
<td>More than 84</td>
<td>1,7</td>
<td>02</td>
<td>02.50%</td>
<td>Too Easy</td>
<td>Rejected</td>
</tr>
</tbody>
</table>

=80 = 100%

It is quite from this table that:

1. Only 2.5% of the items (items No.22, 41) were too difficult. Hence they were rejected.

2. 23.75% of the items (items No.13, 21,27,28,29,30,31,39,42,45,48,55,58,60,61,62,63,70,72) were declared very difficult. They were, even then, accepted.
3. 11.25% of the items (items No.9, 20,25,40,56,67,69,74,75) were difficult but even then accepted.

4. 21.25% of the items (items No. 8, 14,15,26,32,36,43,44,49,50,52, 59,64,68,71,73,77) were very good.

5. 22.5% of the items (items No. 4, 11,12,16,17,34,35,37,38,46,47, 51,54,57,66,76,78,80) were good.

6. 10% of the items (items No. 2, 3,6,18,23,24, 33,79) were Normal.

7. 6.25% of the items (items No. 5, 10,19,53,65) were Easy.

8. 2.5% of the items (items No.1, 7) were too easy. Hence they were rejected.
CHAPTER V

SUMMARY, FINDINGS, CONCLUSIONS AND RECOMMENDATIONS

5.1 SUMMARY

The study had been focused on validation and standardization of objective test items in the subject of physics for students of 9th class in Rawalpindi city. It is common practice that the teacher-constructed tests hardly measure the exact behavioral change in the students simply because of the fact that invalid and unreliable tests are prepared. This study makes an attempt to mitigate the abovementioned drawback of tests in classroom situation.

Following were the objectives of the study:

1. To develop objective test items in the subject of Physics for class IX in Rawalpindi city.

2. To validate the items of the test administered in the subject of Physics for class IX.

3. To develop a pool of validated test items for the teachers of physics in Rawalpindi city.

To achieve these objectives an objective test, containing M.C.Q.s only, was constructed which contained 80 test items in the subjects of physics. Determining the purpose of the test, preparing the table of specifications and selecting the appropriate items were the practical considerations in planning a test. Six of the English medium schools were taken, randomly, as population and 400 students out
of them were selected as sample of examinees. The researcher, with the help of teachers of the schools, conducted the test personally. After scoring, the data were analyzed by finding the difficulty level and discriminative index of each item. For this purpose, 400 marked answer-sheets were placed in the descending order. Then, 25% answer-sheets, both from the top most and bottom, were selected for analysis and the in-between answer-sheets were not included in the analysis of the data. 25% from top were named as high achievers (H.A.) and 25% from bottom were named as low achievers (L.A.). The conclusions were drawn out of interpretation of the data and recommendations were designed in the light of findings and conclusions.

5.2 FINDINGS

From analysis of data, following findings were extracted:

1. Four items out of 80 (05%) were rejected.
2. Seventy-seven items (95%) were accepted.
3. There were no catchy or dodgy items.
4. Item No. 1 had D.L. of 86. It was too easy item which was less discriminative as well. So, it was rejected.
5. Item No. 22 had D.L. of 14 and D.I. of 14. This item was too difficult and less discriminative. So, it was rejected
6. Item No. 41 was too difficult and less discriminative because its D.L. was 15 and D.I. was 18.
7. Items No. 1 and 7 had the D.L. in the interval of 86-85.
8. Items No. 2, 3, 5, 10, 19, 53, and 65 had the D.L. in the interval of 77-68.

9. Items No. 6,11,18,23,24,33,35 and 79 had the D.L. in the interval of 67-58.

10. Items No. 4,12,16,17,32,34,37,38,46,49,50,51,52,54,57,66,76,78 and 80 had the D.L. in the interval of 57-48.

11. Items No. 8,9,14,15,26,36,39,43,44,56,64,68,71,73,75 and 77 had the D.L. in the interval of 47-38.


13. Items No.27,28,29,30,31,42,45,60,61,62,63 and 72 had the D.L. in the interval of 27-18.

14. Items No.22,41 and 60 had the D.L. in the interval below 17.

15. Item No. 26 had the discriminative index in the interval of 64-71. The value, actually recorded, was 66.

16. Items No. 17 and 76 had the discriminative index in the interval of 63-56.

17. Items No. 4,20,32,34,51,64,66 and 80 had the discriminative index in the interval of 55-48.

18. Items No. 6,12,15,16,33,36,49,54,57,68 and 75 had the discriminative index in the interval of 47-40.

19. Items No. 2,8,10,11,13,14,35,39,40,43,47,48,50,52,56,58,59,65,67,70,71 and 73 had the discriminative index in the interval of 39-32.

20. Items No. 3,5,7,9,21,25,28,29,30,38,42,44,46,53,55,60,61,63,69 and 72 had the discriminative index in the interval of 31-24.
21. Items No. 1,22,23,27,30,45,74,77 and 78 had the discriminative index in the interval of 23-16.

22. Items No. 19,24,62 and 79 had the discriminative index in the interval of below 15.

23. The mean value of actual scores, for high achievers, was 58.66.

24. The median of actual scores, for high achievers, was 58.75.

25. The modal value of actual scores, for high achievers, was 58.93.

26. The mean value of actual scores, for low achievers, was 23.23.

27. The median of actual scores, for low achievers, was 24.4.

28. The modal value of actual scores, for low achievers, was 26.74.

29. The range of scores, obtained by high achievers, was 21.

30. The lower quartile range of scores, obtained by high achievers, was 53.84.

31. The upper quartile range of scores, obtained by high achievers, was 63.19.

32. The inter-quartile range of scores, obtained by high achievers, was 9.35.

33. The semi inter-quartile range of scores, obtained by high achievers, was 4.675.

34. The range of scores, obtained by low achievers, was 21.

35. The lower quartile range of scores, obtained by low achievers, was 17.33.

36. The upper quartile range of scores, obtained by low achievers, was 28.59.

37. The inter quartile range of scores, obtained by low achievers, was 11.26.

38. The semi inter-quartile range of scores, obtained by low achievers, was 5.63.

39. The standard deviation of the scores of high achievers was 4.99.

40. The co-efficient of Variance for this group was 8.51.
41. The z-score for the interval 66-68 was maximum and that for 48-50 was minimum in this group.

42. The standard deviation of the scores of low achievers was 6.03.

43. The co-efficient of Variance for this group was 25.96.

44. The z-score for the interval 30-32 was maximum and that for 12-14 was minimum in this group.

45. Items No. 22 and 41 were too difficult. So, 2.50% of items were too difficult and hence rejected ones.

46. Items No. 3,21,27,28,29,30,31,39,42,45,48,55,58,60,61,62,63,70,72 (23.75%) were very difficult, being accepted because these items could be answered after thorough study of the concepts involved in them. These items give extra credit to those students whose I.Q. levels are higher than others.

47. Items No. 9,20,25,40,56,67,69,74,75 (11.25%) were difficult but accepted ones.

48. Items No. 8,14,15,26,32,36,43,44,49,50,52,59,64,68,71,73,77 (21.25%) were very good items and accepted ones.

49. Items No. 4,11,12,16,17,34,35,37,38,46,47,51,54,57,66,76,78,80 (22.50%) were good items and hence accepted ones.

50. Items No. 2,3,6,18,23,24,33,79 (10%) were normal items and accepted ones.

51. Items No. 5,10,19,53,65 (6.25%) were easy but even then accepted ones.

52. Items No. 1,7 (2.5%) were too easy and hence rejected ones.
5.3 CONCLUSIONS

From the interpretation of findings, following conclusions were drawn:

1. All the test items were valid except items No. 1, 7, 22 and 41.
2. Maximum of the items had difficulty level of good standards.
3. Only few of the items were either too easy or too difficult.
4. One fourth of the test items were having D.I. in ideally good range.
5. The Mean, Median, and Mode values for H.A.s group were falling close to one another.
6. The values of Mean, Mode and Median were not close enough for L.A.s as compared to H.A.s.
7. The range of actual scores for both groups was same.
8. The inter-quartile Range of L.A.s. was more than that for H.A.s.
9. The standard deviation of L.A.s was higher than that for H.A.s.
10. Coefficient of variance for the L.A's was nearly three times to that for H.A.s.
11. The Z-scores of less than half of H.A.s. were falling positively while the same were falling positively for more than half of L.A.s.
12. One fifth of the test items were declared as very difficult.
13. Few test items were declared as difficult.
14. Nearly half of the test items were either very good or good or normal.
15. Just few of the items were declared as easy.
16. Options A, B, C, D acted as distracters for 60,61,60 and 59 times respectively.
17. There were no catchy or dodgy test items in this test.
5.4 **RECOMMENDATIONS**

1. Too easy or too difficult test items should be avoided.

2. There should be no dodgy or catchy items.

3. The distracters should be at least four in numbers and each of them must have some kind of relation with the correct response.

4. The stem of the objective type should be crystal-clear that contains no negative statement or double negative statements.

5. There should be a complete harmony amongst the instructional objectives, table of specification and construction of test items. The interpretation of data should be based on the objective scoring of the test items in a validated test.

6. A valid test should contain a variety of items which must be very difficult, difficult, very good, good, normal or easy in a good proportion.

7. It is suggested that 20% of the items should be, at least, very difficult or difficult, 70% of the items should be very good, good or Normal and remaining 10% should be easy.

8. The test should cover the areas of knowledge, comprehensive, application etc. of cognitive domain.
BIBLIOGRAPHY


# APPENDIX A

## LIST OF SCORES OF HIGH ACHIEVERS

**TOTAL SCORE=80**

<table>
<thead>
<tr>
<th>Sr.No.</th>
<th>Name of Students</th>
<th>Marks obtained</th>
<th>Sr.No.</th>
<th>Name of Students</th>
<th>Marks Obtained</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Muhammad Mubeen</td>
<td>68</td>
<td>51</td>
<td>Asad Touqueer</td>
<td>58</td>
</tr>
<tr>
<td>2</td>
<td>Umar Yousuf</td>
<td>67</td>
<td>52</td>
<td>Sahaid</td>
<td>58</td>
</tr>
<tr>
<td>3</td>
<td>Awais Ikram</td>
<td>66</td>
<td>53</td>
<td>Ali Yaqoob</td>
<td>58</td>
</tr>
<tr>
<td>4</td>
<td>Haider Ali</td>
<td>66</td>
<td>55</td>
<td>M.khan</td>
<td>58</td>
</tr>
<tr>
<td>5</td>
<td>Zameer ul Hassan</td>
<td>66</td>
<td>56</td>
<td>Sulman jaffar</td>
<td>58</td>
</tr>
<tr>
<td>6</td>
<td>Farris Sarfraz</td>
<td>65</td>
<td>57</td>
<td>Nouman Arif</td>
<td>58</td>
</tr>
<tr>
<td>7</td>
<td>Masroor Bokhari</td>
<td>65</td>
<td>58</td>
<td>Zubair</td>
<td>57</td>
</tr>
<tr>
<td>8</td>
<td>Waqar Ahmed</td>
<td>65</td>
<td>59</td>
<td>Shahzad</td>
<td>57</td>
</tr>
<tr>
<td>9</td>
<td>Muhammad Farhan</td>
<td>65</td>
<td>60</td>
<td>M.Zeeshan</td>
<td>57</td>
</tr>
<tr>
<td>10</td>
<td>Usman Aziz</td>
<td>65</td>
<td>61</td>
<td>Qalb-e-Abbas</td>
<td>56</td>
</tr>
<tr>
<td>11</td>
<td>Umair Saeed</td>
<td>65</td>
<td>62</td>
<td>Faisal Iqbal</td>
<td>56</td>
</tr>
<tr>
<td>12</td>
<td>Dastgeer</td>
<td>65</td>
<td>63</td>
<td>Noman Hafeez</td>
<td>56</td>
</tr>
<tr>
<td>13</td>
<td>Zabeer Ullah Khan</td>
<td>64</td>
<td>64</td>
<td>Syed M. Waqas</td>
<td>56</td>
</tr>
<tr>
<td>14</td>
<td>Salman Ahmed</td>
<td>64</td>
<td>65</td>
<td>Wajahet</td>
<td>56</td>
</tr>
<tr>
<td>15</td>
<td>Naeem Ur Rehman</td>
<td>64</td>
<td>66</td>
<td>Asad mehmood</td>
<td>56</td>
</tr>
<tr>
<td>16</td>
<td>Talha</td>
<td>64</td>
<td>67</td>
<td>Mobshir</td>
<td>56</td>
</tr>
<tr>
<td>17</td>
<td>Syed Azher</td>
<td>64</td>
<td>68</td>
<td>Noman Askher</td>
<td>56</td>
</tr>
<tr>
<td>18</td>
<td>Aden Ahmad</td>
<td>64</td>
<td>69</td>
<td>M. Ali Shah</td>
<td>56</td>
</tr>
<tr>
<td>19</td>
<td>Jumshad Sheraz</td>
<td>64</td>
<td>70</td>
<td>M..Taimir</td>
<td>56</td>
</tr>
<tr>
<td>20</td>
<td>Aqib noor</td>
<td>64</td>
<td>71</td>
<td>Qasim javed</td>
<td>56</td>
</tr>
<tr>
<td></td>
<td>Name</td>
<td>Roll No</td>
<td>Class</td>
<td>Graduation Year</td>
<td>Hostel</td>
</tr>
<tr>
<td>---</td>
<td>----------------------</td>
<td>---------</td>
<td>-------</td>
<td>----------------</td>
<td>--------</td>
</tr>
<tr>
<td>21</td>
<td>Aamir Sohail</td>
<td>64</td>
<td>72</td>
<td>M.Faisal</td>
<td>56</td>
</tr>
<tr>
<td>22</td>
<td>Waleed Aslam</td>
<td>64</td>
<td>73</td>
<td>Anees</td>
<td>56</td>
</tr>
<tr>
<td>23</td>
<td>Zain Ur Rahman</td>
<td>64</td>
<td>74</td>
<td>Adil Pervez</td>
<td>55</td>
</tr>
<tr>
<td>24</td>
<td>Qasim Ali</td>
<td>64</td>
<td>75</td>
<td>Fahad Aman</td>
<td>55</td>
</tr>
<tr>
<td>25</td>
<td>Muhammad Umer</td>
<td>64</td>
<td>76</td>
<td>Hafiz Hassan</td>
<td>55</td>
</tr>
<tr>
<td>27</td>
<td>Bilal-Bin-Tariq</td>
<td>64</td>
<td>77</td>
<td>Awan Saleem</td>
<td>55</td>
</tr>
<tr>
<td>28</td>
<td>Syed Jawad Mohsin</td>
<td>63</td>
<td>78</td>
<td>M. Hassan Tahir</td>
<td>55</td>
</tr>
<tr>
<td>29</td>
<td>Ehsan Ali</td>
<td>63</td>
<td>79</td>
<td>Bilal Nawaz</td>
<td>55</td>
</tr>
<tr>
<td>30</td>
<td>Asad Aslam</td>
<td>63</td>
<td>80</td>
<td>Waqas Nadeem</td>
<td>55</td>
</tr>
<tr>
<td>31</td>
<td>Muhammad Anwer</td>
<td>63</td>
<td>81</td>
<td>Waqas Mahmoud</td>
<td>55</td>
</tr>
<tr>
<td>32</td>
<td>Syed Ali Abbas</td>
<td>62</td>
<td>82</td>
<td>Zeeshan Zahoo</td>
<td>55</td>
</tr>
<tr>
<td>33</td>
<td>Sumair Tariq</td>
<td>62</td>
<td>83</td>
<td>Ummad Abuzar</td>
<td>55</td>
</tr>
<tr>
<td>34</td>
<td>Abidal</td>
<td>62</td>
<td>84</td>
<td>Taimar Iqbal</td>
<td>55</td>
</tr>
<tr>
<td>35</td>
<td>Zubair Saleem</td>
<td>62</td>
<td>85</td>
<td>Majid Nawaz</td>
<td>55</td>
</tr>
<tr>
<td>36</td>
<td>Zahid Elahi</td>
<td>62</td>
<td>86</td>
<td>Sarmed Sarwar</td>
<td>55</td>
</tr>
<tr>
<td>37</td>
<td>Rehman Farooq</td>
<td>62</td>
<td>87</td>
<td>Ehsan Ali</td>
<td>54</td>
</tr>
<tr>
<td>38</td>
<td>Naveed Siddique</td>
<td>62</td>
<td>88</td>
<td>Abdillah iqbal</td>
<td>54</td>
</tr>
<tr>
<td>39</td>
<td>Bahader Aali Khan</td>
<td>62</td>
<td>89</td>
<td>Saran Ajmal</td>
<td>53</td>
</tr>
<tr>
<td>40</td>
<td>Awais javed</td>
<td>61</td>
<td>90</td>
<td>Raheel Sajid</td>
<td>53</td>
</tr>
<tr>
<td>41</td>
<td>Waqas khan</td>
<td>61</td>
<td>91</td>
<td>Ubid Ur Rehman</td>
<td>53</td>
</tr>
<tr>
<td></td>
<td>Name</td>
<td>61</td>
<td>92</td>
<td>Name</td>
<td>51</td>
</tr>
<tr>
<td>---</td>
<td>--------------------</td>
<td>----</td>
<td>------</td>
<td>--------------------</td>
<td>--------</td>
</tr>
<tr>
<td>42</td>
<td>Awais Zahoor</td>
<td>61</td>
<td></td>
<td>Hannan</td>
<td>51</td>
</tr>
<tr>
<td>43</td>
<td>Bilal Rasheed</td>
<td>61</td>
<td>93</td>
<td>Hasant Ahmed</td>
<td>50</td>
</tr>
<tr>
<td>44</td>
<td>Wasif Umer</td>
<td>61</td>
<td>94</td>
<td>Hashim Ali</td>
<td>50</td>
</tr>
<tr>
<td>45</td>
<td>Rashid Mehmood</td>
<td>61</td>
<td>95</td>
<td>Saad Mushtaq</td>
<td>50</td>
</tr>
<tr>
<td>46</td>
<td>Mugeeb Hassan</td>
<td>60</td>
<td>96</td>
<td>Syed Tayyed</td>
<td>49</td>
</tr>
<tr>
<td>47</td>
<td>Muhammad Ali</td>
<td>60</td>
<td>97</td>
<td>Adil Ali</td>
<td>49</td>
</tr>
<tr>
<td>48</td>
<td>Mohsin Yasir</td>
<td>59</td>
<td>98</td>
<td>Ali ahsan</td>
<td>48</td>
</tr>
<tr>
<td>49</td>
<td>Asif waheed</td>
<td>58</td>
<td>99</td>
<td>Abdul Rehman</td>
<td>48</td>
</tr>
<tr>
<td>50</td>
<td>Malik Farukh Raza</td>
<td>58</td>
<td>100</td>
<td>Nazer abbas</td>
<td>48</td>
</tr>
</tbody>
</table>
APPENDIX B

LIST OF SCORES OF LOW ACHIEVERS

TOTAL SCORE=80

<table>
<thead>
<tr>
<th>Sr.No.</th>
<th>Name of Students</th>
<th>Marks obtained</th>
<th>Sr.No.</th>
<th>Name of Students</th>
<th>Marks obtained</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Manam Ahmad</td>
<td>32</td>
<td>51</td>
<td>Bilal Ahmed</td>
<td>24</td>
</tr>
<tr>
<td>2</td>
<td>Muhammad Akhter</td>
<td>32</td>
<td>52</td>
<td>Muhammad Mohsin</td>
<td>24</td>
</tr>
<tr>
<td>3</td>
<td>Muhammad Imran</td>
<td>32</td>
<td>53</td>
<td>Qurban Ali</td>
<td>24</td>
</tr>
<tr>
<td>4</td>
<td>Raheem Mirza</td>
<td>32</td>
<td>54</td>
<td>Imran Khan</td>
<td>23</td>
</tr>
<tr>
<td>5</td>
<td>Ali Khan</td>
<td>31</td>
<td>55</td>
<td>Furqan Saleem</td>
<td>23</td>
</tr>
<tr>
<td>6</td>
<td>Raheel Ali</td>
<td>31</td>
<td>56</td>
<td>Naeem khan</td>
<td>22</td>
</tr>
<tr>
<td>7</td>
<td>Qasim</td>
<td>31</td>
<td>57</td>
<td>Ikram Ul haq</td>
<td>22</td>
</tr>
<tr>
<td>8</td>
<td>Mumtaz</td>
<td>31</td>
<td>58</td>
<td>Muhammad Afzal</td>
<td>22</td>
</tr>
<tr>
<td>9</td>
<td>Ali Rauf</td>
<td>31</td>
<td>59</td>
<td>Farhet Imran</td>
<td>22</td>
</tr>
<tr>
<td>10</td>
<td>Junaid Tahir</td>
<td>31</td>
<td>60</td>
<td>Tariq Aziz</td>
<td>21</td>
</tr>
<tr>
<td>11</td>
<td>Asad Mehmood</td>
<td>31</td>
<td>61</td>
<td>Hamad Husan</td>
<td>21</td>
</tr>
<tr>
<td>12</td>
<td>Abdul Rauf</td>
<td>30</td>
<td>62</td>
<td>Fazael Ali</td>
<td>21</td>
</tr>
<tr>
<td>13</td>
<td>Bilal Raza</td>
<td>30</td>
<td>63</td>
<td>Mazher Iqbal</td>
<td>21</td>
</tr>
<tr>
<td>14</td>
<td>Afzal Ali</td>
<td>30</td>
<td>64</td>
<td>Allam Khan</td>
<td>20</td>
</tr>
<tr>
<td>15</td>
<td>Siddique</td>
<td>30</td>
<td>65</td>
<td>Muhammad Rauf</td>
<td>20</td>
</tr>
<tr>
<td>16</td>
<td>Noman Zafar</td>
<td>30</td>
<td>66</td>
<td>Farooq Ali</td>
<td>19</td>
</tr>
<tr>
<td>17</td>
<td>Rizwan Khan</td>
<td>30</td>
<td>67</td>
<td>Muhammad Anwar</td>
<td>19</td>
</tr>
<tr>
<td>18</td>
<td>Muhammad Yousof</td>
<td>30</td>
<td>68</td>
<td>Habib khan</td>
<td>19</td>
</tr>
<tr>
<td>19</td>
<td>Farooq Ahsan</td>
<td>29</td>
<td>69</td>
<td>Hashem Ahmed</td>
<td>19</td>
</tr>
<tr>
<td>20</td>
<td>M. Rehman</td>
<td>29</td>
<td>70</td>
<td>Roshan khan</td>
<td>18</td>
</tr>
<tr>
<td>21</td>
<td>Uzair Ahmad</td>
<td>29</td>
<td>71</td>
<td>Ali Imran</td>
<td>18</td>
</tr>
<tr>
<td>22</td>
<td>Tahir Ali</td>
<td>29</td>
<td>72</td>
<td>Dost Muhammad</td>
<td>18</td>
</tr>
<tr>
<td>23</td>
<td>Zain Haide</td>
<td>29</td>
<td>73</td>
<td>Rahceel Ur Reman</td>
<td>18</td>
</tr>
<tr>
<td>24</td>
<td>Zahid Ilyas</td>
<td>29</td>
<td>74</td>
<td>Ihsan Ahmed</td>
<td>18</td>
</tr>
<tr>
<td>25</td>
<td>Fahad Ali</td>
<td>29</td>
<td>75</td>
<td>Sultan Ali</td>
<td>17</td>
</tr>
<tr>
<td>No.</td>
<td>Name</td>
<td>Contact No.</td>
<td>Room No.</td>
<td>Roommate</td>
<td>Roommate Contact No.</td>
</tr>
<tr>
<td>-----</td>
<td>--------------------</td>
<td>-------------</td>
<td>----------</td>
<td>-------------------</td>
<td>----------------------</td>
</tr>
<tr>
<td>26</td>
<td>Rafay Ikram</td>
<td>29</td>
<td>76</td>
<td>Imran Akhtar</td>
<td>17</td>
</tr>
<tr>
<td>27</td>
<td>Zahid Waris</td>
<td>29</td>
<td>77</td>
<td>Tanveer Ahmed</td>
<td>17</td>
</tr>
<tr>
<td>28</td>
<td>Muhammad Umer</td>
<td>28</td>
<td>78</td>
<td>Khan Muhammed</td>
<td>17</td>
</tr>
<tr>
<td>29</td>
<td>Waqar Akhter</td>
<td>28</td>
<td>79</td>
<td>Ali ahmed</td>
<td>17</td>
</tr>
<tr>
<td>30</td>
<td>M. Saeed</td>
<td>28</td>
<td>80</td>
<td>Ch. Iftekhar</td>
<td>16</td>
</tr>
<tr>
<td>31</td>
<td>Aslam Rahman</td>
<td>28</td>
<td>81</td>
<td>Muhammad Ali</td>
<td>16</td>
</tr>
<tr>
<td>32</td>
<td>Furqan</td>
<td>28</td>
<td>82</td>
<td>Umer iqbal</td>
<td>16</td>
</tr>
<tr>
<td>33</td>
<td>Kasif Ali</td>
<td>28</td>
<td>83</td>
<td>Zaman Akhter</td>
<td>16</td>
</tr>
<tr>
<td>34</td>
<td>Saleem Akhter</td>
<td>28</td>
<td>84</td>
<td>Naseem Akhter</td>
<td>16</td>
</tr>
<tr>
<td>35</td>
<td>Anwar</td>
<td>27</td>
<td>85</td>
<td>Mumtaz Khan</td>
<td>16</td>
</tr>
<tr>
<td>36</td>
<td>Waqas Farooq</td>
<td>27</td>
<td>86</td>
<td>Mian Muhammad</td>
<td>16</td>
</tr>
<tr>
<td>37</td>
<td>Rashid Sultan</td>
<td>27</td>
<td>87</td>
<td>Arif Khan</td>
<td>15</td>
</tr>
<tr>
<td>38</td>
<td>Hassan Jehangir</td>
<td>27</td>
<td>88</td>
<td>Haider Amin</td>
<td>15</td>
</tr>
<tr>
<td>39</td>
<td>Irfan Ahmed</td>
<td>27</td>
<td>89</td>
<td>Gul Khan</td>
<td>15</td>
</tr>
<tr>
<td>40</td>
<td>Shahid Aslim</td>
<td>27</td>
<td>90</td>
<td>Ahsan Butt</td>
<td>15</td>
</tr>
<tr>
<td>41</td>
<td>Ibrar kiani</td>
<td>27</td>
<td>91</td>
<td>Moin Qasim</td>
<td>15</td>
</tr>
<tr>
<td>42</td>
<td>Ahmed Ali</td>
<td>26</td>
<td>92</td>
<td>Fahad farooq</td>
<td>15</td>
</tr>
<tr>
<td>43</td>
<td>Nasir Akhter</td>
<td>26</td>
<td>93</td>
<td>Kamran Akmel</td>
<td>14</td>
</tr>
<tr>
<td>44</td>
<td>Usman Ashraf</td>
<td>26</td>
<td>94</td>
<td>Ramzaa Ahmed</td>
<td>14</td>
</tr>
<tr>
<td>45</td>
<td>Ramzan Gul</td>
<td>26</td>
<td>95</td>
<td>Naeem Ali</td>
<td>14</td>
</tr>
<tr>
<td>46</td>
<td>Tanzeel</td>
<td>26</td>
<td>96</td>
<td>Faiz Muhammed</td>
<td>14</td>
</tr>
<tr>
<td>47</td>
<td>Awas Irfan</td>
<td>26</td>
<td>97</td>
<td>Muhammad Ikram</td>
<td>14</td>
</tr>
<tr>
<td>48</td>
<td>Taimoor malik</td>
<td>26</td>
<td>98</td>
<td>Furqan Ali</td>
<td>13</td>
</tr>
<tr>
<td>49</td>
<td>Adeel Akhter</td>
<td>25</td>
<td>99</td>
<td>Zobair ahmed</td>
<td>13</td>
</tr>
<tr>
<td>50</td>
<td>Inam ul haq</td>
<td>25</td>
<td>100</td>
<td>Rizwan Ahmed</td>
<td>12</td>
</tr>
</tbody>
</table>
## LIST OF SCHOOLS

<table>
<thead>
<tr>
<th>Serial No.</th>
<th>Names Of Schools</th>
<th>Net Strength in 9th Class</th>
<th>Samples of Students taken</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>F.G.Secondary School Mahfooz Road R.Pindi</td>
<td>210</td>
<td>100</td>
</tr>
<tr>
<td>2</td>
<td>F.G.Sir Syed Sec. School Rawalpindi</td>
<td>250</td>
<td>110</td>
</tr>
<tr>
<td>3</td>
<td>Govt. Comprehensive Sec. School Shasabad R.Pindi</td>
<td>140</td>
<td>70</td>
</tr>
<tr>
<td>4</td>
<td>Cantt. Public School Afshan Colony R.Pindi</td>
<td>35</td>
<td>20</td>
</tr>
<tr>
<td>5</td>
<td>Hira Public School Afshan Colony R.pindi</td>
<td>60</td>
<td>30</td>
</tr>
<tr>
<td>6</td>
<td>Govt. Sec. School D.A.V. College Road R.pindi</td>
<td>150</td>
<td>70</td>
</tr>
</tbody>
</table>

TOTAL=845  TOTAL=400
MULTIPLE CHOICE QUESTIONS

INSTRUCTIONS

- Read the questions carefully and use the answer sheet for marking the correct answer.
- Time allowed is NOT MORE THAN 60 MINUTES
- Fill in the correct answer in the given four options.
- Do not write on the QUESTION PAPER.
- Use lead pencil, blue or black ink for filling the correct option (correct answer).
- Write your name, roll number and class on the ANSWER SHEET.
- Cutting and more than one answers for each question carry no marks.
- Return the QUESTION PAPER along with ANSWER SHEET.

Example: 100 cm=-------

A: 5m              B: 1m
C: 1.5m            D: 2m

Answer Options: Correct Answer.

Incorrect Answers.

92
### ANSWER SHEET

<table>
<thead>
<tr>
<th>MARKS</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
<th>11</th>
</tr>
</thead>
<tbody>
<tr>
<td>21</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td>A</td>
<td>B</td>
<td>C</td>
</tr>
<tr>
<td>22</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td>A</td>
<td>B</td>
<td>C</td>
</tr>
<tr>
<td>23</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td>A</td>
<td>B</td>
<td>C</td>
</tr>
<tr>
<td>24</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td>A</td>
<td>B</td>
<td>C</td>
</tr>
<tr>
<td>25</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td>A</td>
<td>B</td>
<td>C</td>
</tr>
<tr>
<td>26</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td>A</td>
<td>B</td>
<td>C</td>
</tr>
<tr>
<td>27</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td>A</td>
<td>B</td>
<td>C</td>
</tr>
<tr>
<td>28</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td>A</td>
<td>B</td>
<td>C</td>
</tr>
<tr>
<td>29</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td>A</td>
<td>B</td>
<td>C</td>
</tr>
<tr>
<td>30</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td>A</td>
<td>B</td>
<td>C</td>
</tr>
<tr>
<td>31</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td>A</td>
<td>B</td>
<td>C</td>
</tr>
</tbody>
</table>

### APPENDIX E

**NAME**

**ROLL NO**

**CLASS**

**SUBJECT**
<table>
<thead>
<tr>
<th>ITEM NO</th>
<th>CORRECT OPTION</th>
<th>ITEM NO</th>
<th>CORRECT OPTION</th>
<th>ITEM NO</th>
<th>CORRECT OPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>C</td>
<td>28</td>
<td>D</td>
<td>55</td>
<td>D</td>
</tr>
<tr>
<td>2</td>
<td>D</td>
<td>29</td>
<td>C</td>
<td>56</td>
<td>D</td>
</tr>
<tr>
<td>3</td>
<td>A</td>
<td>30</td>
<td>B</td>
<td>57</td>
<td>D</td>
</tr>
<tr>
<td>4</td>
<td>B</td>
<td>31</td>
<td>C</td>
<td>58</td>
<td>D</td>
</tr>
<tr>
<td>5</td>
<td>D</td>
<td>32</td>
<td>D</td>
<td>59</td>
<td>A</td>
</tr>
<tr>
<td>6</td>
<td>B</td>
<td>33</td>
<td>D</td>
<td>60</td>
<td>D</td>
</tr>
<tr>
<td>7</td>
<td>A</td>
<td>34</td>
<td>D</td>
<td>61</td>
<td>B</td>
</tr>
<tr>
<td>8</td>
<td>B</td>
<td>35</td>
<td>A</td>
<td>62</td>
<td>D</td>
</tr>
<tr>
<td>9</td>
<td>A</td>
<td>36</td>
<td>C</td>
<td>63</td>
<td>C</td>
</tr>
<tr>
<td>10</td>
<td>C</td>
<td>37</td>
<td>A</td>
<td>64</td>
<td>D</td>
</tr>
<tr>
<td>11</td>
<td>D</td>
<td>38</td>
<td>B</td>
<td>65</td>
<td>D</td>
</tr>
<tr>
<td>12</td>
<td>C</td>
<td>39</td>
<td>C</td>
<td>66</td>
<td>B</td>
</tr>
<tr>
<td>13</td>
<td>A</td>
<td>40</td>
<td>A</td>
<td>67</td>
<td>C</td>
</tr>
<tr>
<td>14</td>
<td>D</td>
<td>41</td>
<td>C</td>
<td>68</td>
<td>C</td>
</tr>
<tr>
<td>15</td>
<td>B</td>
<td>42</td>
<td>A</td>
<td>69</td>
<td>D</td>
</tr>
<tr>
<td>16</td>
<td>C</td>
<td>43</td>
<td>A</td>
<td>70</td>
<td>A</td>
</tr>
<tr>
<td>17</td>
<td>D</td>
<td>44</td>
<td>D</td>
<td>71</td>
<td>A</td>
</tr>
<tr>
<td>18</td>
<td>C</td>
<td>45</td>
<td>B</td>
<td>72</td>
<td>B</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>B</td>
<td>46</td>
<td>A</td>
<td>73</td>
<td>A</td>
</tr>
<tr>
<td>20</td>
<td>A</td>
<td>47</td>
<td>D</td>
<td>74</td>
<td>C</td>
</tr>
<tr>
<td>21</td>
<td>B</td>
<td>48</td>
<td>B</td>
<td>75</td>
<td>C</td>
</tr>
<tr>
<td>22</td>
<td>D</td>
<td>49</td>
<td>A</td>
<td>76</td>
<td>B</td>
</tr>
<tr>
<td>23</td>
<td>B</td>
<td>50</td>
<td>C</td>
<td>77</td>
<td>A</td>
</tr>
<tr>
<td>24</td>
<td>A</td>
<td>51</td>
<td>C</td>
<td>78</td>
<td>A</td>
</tr>
<tr>
<td>25</td>
<td>C</td>
<td>52</td>
<td>D</td>
<td>79</td>
<td>A</td>
</tr>
<tr>
<td>26</td>
<td>B</td>
<td>53</td>
<td>C</td>
<td>80</td>
<td>B</td>
</tr>
<tr>
<td>27</td>
<td>C</td>
<td>54</td>
<td>B</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The objectives of the test are:

1. To validate the test items on the basis of difficulty levels and discriminative indexes.

2. To develop an objective type test which is valid.

### PHYSICS IX (Table of Specification)

<table>
<thead>
<tr>
<th>CHAPTERS</th>
<th>Kinematics</th>
<th>Force and Motion</th>
<th>Vectors</th>
<th>Equilibrium</th>
<th>Circular Motion</th>
<th>Work, Power and Energy</th>
<th>Simple machines</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>15%</td>
<td>15%</td>
<td>10%</td>
<td>15%</td>
<td>15%</td>
<td>15%</td>
<td>15%</td>
<td>100%</td>
</tr>
<tr>
<td>ITEMS OF KNOWLEDGE</td>
<td>6</td>
<td>6</td>
<td>4</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>6</td>
<td>40</td>
</tr>
<tr>
<td>50%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ITEMS OF COMPREHENSION</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>14</td>
</tr>
<tr>
<td>20%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ITEMS OF APPLICATION</td>
<td>4</td>
<td>4</td>
<td>2</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>26</td>
</tr>
<tr>
<td>30%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TOTAL ITEMS</td>
<td>12</td>
<td>12</td>
<td>8</td>
<td>12</td>
<td>12</td>
<td>12</td>
<td>12</td>
<td>80</td>
</tr>
<tr>
<td>100%</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX H

TEST

1: Distance covered per unit time is called
   A: velocity   B: acceleration   C: speed   D: displacement

2: Which of the following is a vector quantity
   A: time   B: distance   C: area   D: weight

3: The unit of acceleration is
   A: m/s²   B: m/s   C: s/m   D: s

4: If a body covers a distance of 80 km in 4 hours, its speed will be
   A: 10km/h   B: 20km/h   C: 30km/h   D: 40km/h

5: Newton is the unit of
   A: velocity   B: displacement   C: torque   D: force

6: Total number of equations of motion is
   A: 2   B: 3   C: 4   D: 5

7: Acceleration is represented by
   A: a   B: ac   C: acc   D: A

8: A body changes its speed from 15m/s to 50m/s in 5 seconds, its acceleration is
   A: 6m/s²   B: 7m/s²   C: 8m/s²   D: 9m/s²

9: The car, starting from rest, covers a distance of 32m at an acceleration of 1m/s².
   The time taken by the car is
   A: 8s   B: 8.5s   C: 9s   D: 9.5s

98
10: The value of \( g \) is nearly
   A: \( 9\text{m/s}^2 \)   B: \( 9.5\text{m/s}^2 \)   C: \( 10\text{m/s}^2 \)   D: \( 10.5\text{m/s}^2 \)

11: When a vehicle stops suddenly, its final velocity becomes
   A: maximum   B: minimum   C: 1m/s   D: zero

12: Two bodies of masses 5kg and 20kg are thrown down from the top of a high building. What is true to say?
   A: body of 5kg will fall first   B: body of 20kg will fall first   C: both fall simultaneously
   D: body of 20kg will cross the body of 5kg

13: Force of friction is responsible for
   A: opposing motion   B: increasing velocity   C: decreasing mass
   D: changing the state of rest

14: The unit of co-efficient of friction is
   A: m   B: m/s   C: N   D: no unit

15: Friction is directly proportional to
   A: mass   B: weight   C: torque   D: work

16: Force with which the earth attracts a body towards its centre is called
   A: inertia   B: energy   C: weight   D: elasticity

17: Which of the quantity can never be zero
   A: acceleration   B: distance   C: speed   D: mass

18: Shortest distance between two points is called
   A: length   B: velocity   C: displacement   D: measurement
19: The second equation of motion is
   A: \( v_f^2 - v_i^2 = 2as \)  B: \( s = v_i t + \frac{1}{2}at^2 \)  C: \( s = vt \)  D: \( v_f = v_i + at \)

20: 36 km/h, in m/s, is equal to
   A: 10  B: 12  C: 14  D: 16

21: 50 m/s, in km/h, is equal to
   A: 170  B: 180  C: 190  D: 200

22: Newton’s 1st law of motion is related to
   A: work  B: energy  C: power  D: inertia

23: One Newton is a force which produces an acceleration of 1 m/s^2 in a body of mass
   A: 0.5 kg  B: 1 kg  C: 1.5 kg  D: 2 kg

24: The equation, relating mass and weight, is
   A: \( W = mg \)  B: \( W = m/g \)  C: \( m = W/g \)  D: \( g = W/m \)

25: 2000 mm is equal to
   A: 200 m  B: 20 m  C: 2 m  D: 0.2 m

26: Sum of two vectors which has the combined effect of all the vectors, is called
   A: net vector  B: resultant vector  C: sum vector  D: total vector

27: Two vectors, of same lengths, are acting in same directions. They are
   A: similar vectors  B: same vectors  C: equal vectors  D: equivalent vectors

28: Two vectors, acting in opposite directions, make an angle of
   A: 0  B: 45  C: 90  D: 180
29: A force of 10N is acting at an angle of 30 with x-axis. Its vertical component is

A: 5N       B: 10N       C: 15N       D: 20N

30: A body of weight 60N is acting at an angle of 60. Its horizontal component is

A: 25N       B: 30N       C: 35N       D: 40N

31: $F_x$ and $F_y$ are called

A: same components       B: vector components       C: rectangular components       D: opposite components

32: The product of force and displacement is called

A: energy       B: torque       C: power       D: work

33: $P.E. = \ldots$

A: mat       B: $mgF$       C: $\frac{1}{2}mv^2$       D: $mgh$

34: $K.E. = \ldots$

A: $\frac{1}{2}v^2$       B: $mgh$       C: $mv$       D: $\frac{1}{2}mv^2$

35: The unit of energy is

A: joule       B: Newton       C: watt       D: hp

36: A force of 10N acts on a body till a distance of 20m. Work done by the body is

A: 100J       B: 150J       C: 200J       D: 250J

37: A body of 5kg is raised to a height of 15m. Its P.E. is

A: 75J       B: 100J       C: 125J       D: 150J

38: A body is raised to the top of a roof. At top,

A: K.E is maximum       B: P.E. is maximum       C: K.E is minimum       D: P.E. is minimum
39: 25N force acts on a body at an angle of 60 degree at a distance of 10m. Its work done is
   A: 25J  B: 50J  C: 125J  D: 150J

40: Rate of doing work is called
   A: power  B: energy  C: force  D: weight

41: A body falls from a height of 1.8m. Its maximum speed will be
   A: 2m/s  B: 4m/s  C: 6m/s  D: 8m/s

42: The ball is at rest on the ground. Its total energy will be
   A: maximum  B: minimum  C: undetermined  D: zero

43: b.p. is the unit of
   A: power  B: work  C: torque  D: friction

44: The product of force and moment arm is
   A: velocity  B: weight  C: charge  D: torque

45: kg.m/s =
    A: m  B: N  C: J  D: W

46: The train gains a velocity of 24m/s in 6s at an acceleration of 3m/s². Its initial velocity is
    A: 6m/s  B: 7m/s  C: 8m/s  D: 9m/s

47: The unit of torque is
    A: N.m²  B: N/m  C: m/N  D: N.m

48: If velocity is doubled, K.E becomes
    A: 2 times  B: 4 times  C: 6 times  D: no change
49: If mass of a body becomes 3 times, K.E will become
   A: 3 times      B: 6 times      C: 9 times      D: unchanged

50: P.E. depends upon
   A: weight      B: velocity      C: height      D: area

51: Energy is an ability of a body to do -----
   A: a task      B: a job      C: a work      D: a performance

52: If a body falls down on the ground, what is true to say?
   A: work done is zero      B: total energy decreases      C: gravity becomes zero
   D: velocity becomes maximum

53: Momentum is the product of
   A: mass and force      B: velocity and acceleration      C: mass and velocity
   D: force and acceleration

54: Which is the example of Newton’s third law of motion
   A: body falling downward      B: recoil of gun after being fired
   C: applying brakes to a vehicle      D: motion in a circular path

55: If 5 kg body moves at a velocity of 6 m/s in a circle of radius 400 cm, its
    centripetal force is
   A: 15 N      B: 25 N      C: 35 N      D: 45 N

56: Kg.m/s is the unit of
   A: torque      B: momentum      C: power      D: work

57: The work of 30 J is done in 6 s by a machine. Power of machine will be
   A: 36 W      B: 180 W      C: 24 W      D: 5 W
58: Centrifugal force helps the body to
   A: increase the speed       B: balance its weight       C: produce
   Acceleration               D: move away from centre of the circle

59: If radius of a circle is doubled, centripetal force will become
   A: \( \frac{1}{2} \) times       B: 2 times       C: 4 times       D: 6 times

60: To open the door nearer to its hinges needs a greater power. It is due to lesser value of
   A: velocity       B: centripetal force       C: mass       D: torque

61: Heavy body causes huge damages as compared to light ones. It happens due to what Characteristic of the body?
   A: torque       B: momentum       C: height       D: area

62: If a body falls from a height of 15m, with initial velocity of 24m/s, its velocity, while falling on the ground, will be approximately
   A: 15m/s       B: 18m/s       C: 21m/s       D: 24m/s

63: 1 Kilo Watt Hour = -----
   A: 1000X60 J       B: 100X360 J       C: 1000X360 J       D: 1000X60 J

64: G is called
   A: gram       B: gravity       C: gravitational acceleration
   D: gravitational constant
65: The force of attraction between or repulsion between two bodies is inversely
    Proportional to
    A: product of the two masses  B: square of the masses
    B: product of mass and distance  D: square of distance between bodies

66: Newton's law of universal gravitation helps us to find
    A: radius of the earth  B: mass of the earth
    C: area of the earth  D: volume of the earth

67: The unit of G is.
    A: N.m/kg  B: N.m²/kg  C: N².m²/kg²  D: N.m²/kg²

68: If a cyclist bends inward while taking a turn. It happens due to
    A: 1st law of motion  B: friction between tyres and road
    C: centripetal force  D: Law of conservation of momentum

69: The engine of a car can generate a power of 6-kilo watt in 2 minutes. Work done by
    it, is
    A: 3J  B: 12J  C: 40J  D: 50J

70: Force x distance moved by force = ----
    A: input  B: output  C: efficiency  D: mechanical advantage

71: If output of a machine is 30J and its input is 20J, mechanical advantage will be
    A: 1.5  B: 10  C: 50  D: 600

72. A screw jack always has an efficiency less than 100% which one is best
    A. a screw is really an inclined plane  B. there is always frictional force
between its parts C. a screw jack is not a totally efficient machine

D. no friction

73. A bar, which can move around any point, is called
   A. lever B. Pulley C. inclined plane D. wheel

74. The mechanical advantage of an inclined plane depends upon
   A. height of plane B. length of plane C. angle of inclined plane D. effort

75. The first foremost simple machine is
   A. inclined plane B. lever C. wheel D. pulley

76. Effort arm is straight distance between effort and
   A. lever B. fulcrum C. load arm D. load

77. If on disturbing a body slightly, there is no change in the height of its center of gravity, then the body is in state of which equilibrium?
   A. Neutral B. stable C. unstable D. disturbed

78. The center of gravity of an object
   A. Is always at its geometrical center B. Is always inside the object
   C. Is outside the object D. Any where

79. If a body of weight 40Kg experiences a friction of 20N, the coefficient of

   Friction is –
   A: 2 B: 1/2 C: 800 D: 60
What is an effort?

A. a weight lifted by a machine   B. force applied on machine for doing Work   C. the ratio of applied force to useful work   D. Force applied by machine