AC NO: 141-2A
DATE: 10/3/75

ADVISORY CIRCULAR

WRITTEN TESTS

PREPARED BY PILOT SCHOOLS WITH EXAMINING AUTHORITY UNDER PART 141 (REVISED) OF THE FEDERAL AVIATION REGULATIONS

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

AFS-590
Initiated by: AFS-820

AC NO: 141-2A

DATE: 10/3/75

ADVISORY CIRCULAR

DEPARTMENT OF TRANSPORTATION
FEDERAL AVIATION ADMINISTRATION

SUBJECT: WRITTEN TESTS PREPARED BY PILOT SCHOOLS WITH EXAMINING AUTHORITY UNDER PART 141 (REVISED) OF THE FEDERAL AVIATION REGULATIONS

1. PURPOSE. This Advisory Circular provides guidance to FAR 141 Pilot Schools with examining authority in developing final written tests for FAA certificates and ratings which are equal in scope, depth, and difficulty to comparable written tests prescribed by the Administrator. It also prescribes the acceptable formats for written tests and the procedures for administering, maintaining security of, and replacing those tests.

2. CANCELLATION. AC No. 141-2, dated 9/18/74, is cancelled.

3. REFERENCES. United States Air Force Manual 50-9, "Principles and Techniques of Instruction"; United States Air Force Manual 50-1, "Programmed Learning"; "The Instructor and His Job," Rose, Homer C.; and "Educational Measurement," Lindquist, E. F. (editor).

4. BACKGROUND. With the implementation of Part 141 (Revised) of the Federal Aviation Regulations, it is imperative that guidance be provided with regard to acceptable procedures and techniques for developing, administering, and replacing final written certification and rating tests used by Pilot Schools whose programs encompass examining authority.

5. HOW TO OBTAIN THIS PUBLICATION. Order additional copies of this Advisory Circular from the Department of Transportation, Publications Section, TAD-443.1, Washington, D.C. 20591.

J. A. Ferrarese

J. A. FERRARESE, Acting Director
Flight Standards Service

Initiated by: AFS-590
AFS-820

CONTENTS

1. **DEFINITIONS.**

a. Achievement Test. A test designed to measure what a student HAS LEARNED.

b. Alternative. Competing courses of action or answers between which a choice is involved—a forked-road situation in which one must decide which way to go or which is correct.

c. Application Type Item. An item which requires the individual to apply a rule, principle, or procedure in a practical or functional situation.

d. Choices. A group of alternatives from which an individual is to select an answer.

e. Comprehensiveness. The adequate sampling, in a test, of all the major components of the course content being tested rather than only part of the content.

f. Compromise. Impairment of test effectiveness due to any form of cheating which occurs before, during, or after a test has been administered.

g. Determiners. A word or words in a test item which telegraph or assist the student in responding correctly, regardless of his knowledge of the material.

h. Discrimination. The characteristic of a test item which enables it to differentiate between the better and poorer students in a group being tested.

i. Distractors. Those alternatives in a multiple-choice item which are incorrect.

j. Evaluation. The overall process of determining individual achievement. It may take the form of interviews, laboratory exercises, and observation, as well as written and performance achievement tests.

k. Face Validity. A test item has face validity if it "appears" to qualified individuals to measure the item objective.

l. Item. The smallest unit of test construction. A multiple-choice item consists of a stem and a number of choices.

m. Item Analysis. The process of evaluating single items by any of several methods. It usually involves determining the level of difficulty and the discrimination power of an item.

n. Knowledge-Type Item. An item designed to measure what an individual or group knows about a given subject area.

o. Multiple-Choice Item. An item for which a student selects the answer from an accompanying list of possible answers.

p. Objective Test. A test whose items are normally answered by the student circling or underlining the correct answer or blacking-in a space on an answer sheet. In this type of test, two graders should arrive at the same score for a particular student, and thus the grading is "objective" rather than "subjective." An objective test is sometimes referred to as a test which has "singleness of scoring."

q. Question Book. A large number of questions (test items), assembled in book form, based on the required aeronautical knowledge in a particular certification or rating area.

r. Question Selection Sheet. A sheet containing a list of numbers which identifies questions in a question book to be answered by a student. One question selection sheet represents one test.

s. Reliability. A test or test item producing consistent and accurate results.

t. Sampling. In test construction, the selection for evaluation of important representative skills and knowledges which constitute the content of the course being learned.

u. Singleness of Scoring (Objectivity). A test or test item which can be scored (checked) by anyone and still produce the same results.

v. Stem. That part of a multiple-choice test item excluding the choices from which the answer must be selected.

w. Subjective Test. A test that is often scored on the basis of attitudes, opinions, and idio-

syncrasies of the scorer. Usually, this type test will produce a wide range of differences in scores when scored by different examiners.

x. Test Booklet. A limited number of test items, assembled in booklet form, which sample the student's aeronautical knowledge in a particular certification or rating area.

y. Usability. A test has high usability when it is easy to administer, easy to score, and directions are clear and easy to follow.

z. Validity. A test is valid when it measures what is was intended to measure.

2. DISCUSSION.

a. Evaluation. The term "evaluation" is a general one which means the determination of the knowledge or skill level of an individual based on a predetermined set of criteria. Evaluation is used by many organizations, other than schools to measure an individual's effectiveness. In this advisory circular, however, the term will be used as it applies to the learning process. Evaluation is an integral part of the learning process.. Whenever learning takes place, the result is a definable, observable, measurable change in behavior. Some sort of evaluation or measurement is essential to determine both WHAT and HOW WELL the students are learning. This evaluation may consist of a simple observation of performance, or it may be accomplished by oral quizzing, performance tests, or by the administration of written achievement tests. This advisory circular is concerned with evaluation from the standpoint of written achievement tests used by FAR 141 Pilot Schools with examining authority, to determine that their students meet the minimum aeronautical knowledge requirements of Part 61 (Revised) of the Federal Aviation Regulations.

b. Characteristics of Good Written Tests. As evaluation devices, written tests are only as good as the knowledge and skill of the individual who develops the test. The following are characteristics of a test if it is to be an effective evaluation instrument. A good test must have: (1) validity, (2) reliability, (3) usability, (4) comprehensiveness, and (5) discrimination.

(1) Validity. A measuring instrument, including a written test, is valid only when it measures what it is supposed to measure. This is the most important characteristic of a good test. The fact that a test is highly reliable does not necessarily mean it is valid. Using complex words in the construction of a test decreases validity because the test becomes more an evaluation of vocabulary than of knowledge of subject matter. A practical method of determining the face validity of a test is to have qualified individuals read the test critically. Any test item that does not appear to pertain to the objectives of the course should be eliminated.

(2) Reliability. A reliable measuring instrument, including a written test, is one that yields consistent and accurate results. If identical measurements are obtained every time a certain measuring instrument is applied to a certain dimension, the instrument is considered to be reliable. For example, assume that a number of students with approximately equal aptitude and intelligence complete the same ground school course under the same instructor and receive approximately the same grades on stage tests. If those students were administered the same final test and achieved widely varying grades, the test used would be unreliable. The reliability of a test can be increased by (a) giving clear instructions for taking the test, (b) writing test items which avoid the use of complex, vague, and ambiguous wording that encourages guessing, and (c) increasing the number of items in the test. The percentage of correct responses due to guessing is far lower in a long test than in a short one.

(3) Usability. For a test to be usable it should be easy to give; it should be written in a type size large enough for the students to read easily; the wording of both the directions for taking the test and of the test items themselves should be clear and concise; graphs, charts, and illustrations should be appropriate to the test item and clearly drawn; and the test should be easily graded.

(4) Comprehensiveness. This characteristic of a good test may be defined as the degree to which the test measures the student's accomplishment of the course objectives, or in the case of an FAR 141 Pilot School's final written test, how well it covers the aeronautical knowledge requirement set forth in FAR Part 61 (Revised). Comprehensiveness implies SAMPLING. Because of economy considerations, no test can be expected to

1. DEFINITIONS.

a. Achievement Test. A test designed to measure what a student HAS LEARNED.

b. Alternative. Competing courses of action or answers between which a choice is involved—a forked-road situation in which one must decide which way to go or which is correct.

c. Application Type Item. An item which requires the individual to apply a rule, principle, or procedure in a practical or functional situation.

d. Choices. A group of alternatives from which an individual is to select an answer.

e. Comprehensiveness. The adequate sampling, in a test, of all the major components of the course content being tested rather than only part of the content.

f. Compromise. Impairment of test effectiveness due to any form of cheating which occurs before, during, or after a test has been administered.

g. Determiners. A word or words in a test item which telegraph or assist the student in responding correctly, regardless of his knowledge of the material.

h. Discrimination. The characteristic of a test item which enables it to differentiate between the better and poorer students in a group being tested.

i. Distractors. Those alternatives in a multiple-choice item which are incorrect.

j. Evaluation. The overall process of determining individual achievement. It may take the form of interviews, laboratory exercises, and observation, as well as written and performance achievement tests.

k. Face Validity. A test item has face validity if it "appears" to qualified individuals to measure the item objective.

l. Item. The smallest unit of test construction. A multiple-choice item consists of a stem and a number of choices.

m. Item Analysis. The process of evaluating single items by any of several methods. It usually involves determining the level of difficulty and the discrimination power of an item.

n. Knowledge-Type Item. An item designed to measure what an individual or group knows about a given subject area.

o. Multiple-Choice Item. An item for which a student selects the answer from an accompanying list of possible answers.

p. Objective Test. A test whose items are normally answered by the student circling or underlining the correct answer or blacking-in a space on an answer sheet. In this type of test, two graders should arrive at the same score for a particular student, and thus the grading is "objective" rather than "subjective." An objective test is sometimes referred to as a test which has "singleness of scoring."

q. Question Book. A large number of questions (test items), assembled in book form, based on the required aeronautical knowledge in a particular certification or rating area.

r. Question Selection Sheet. A sheet containing a list of numbers which identifies questions in a question book to be answered by a student. One question selection sheet represents one test.

s. Reliability. A test or test item producing consistent and accurate results.

t. Sampling. In test construction, the selection for evaluation of important representative skills and knowledges which constitute the content of the course being learned.

u. Singleness of Scoring (Objectivity). A test or test item which can be scored (checked) by anyone and still produce the same results.

v. Stem. That part of a multiple-choice test item excluding the choices from which the answer must be selected.

w. Subjective Test. A test that is often scored on the basis of attitudes, opinions, and idio-

syncrasies of the scorer. Usually, this type test will produce a wide range of differences in scores when scored by different examiners.

x. Test Booklet. A limited number of test items, assembled in booklet form, which sample the student's aeronautical knowledge in a particular certification or rating area.

y. Usability. A test has high usability when it is easy to administer, easy to score, and directions are clear and easy to follow.

z. Validity. A test is valid when it measures what is was intended to measure.

2. DISCUSSION.

a. Evaluation. The term "evaluation" is a general one which means the determination of the knowledge or skill level of an individual based on a predetermined set of criteria. Evaluation is used by many organizations other than schools to measure an individual's effectiveness. In this advisory circular, however, the term will be used as it applies to the learning process. Evaluation is an integral part of the learning process.. Whenever learning takes place, the result is a definable, observable, measurable change in behavior. Some sort of evaluation or measurement is essential to determine both WHAT and HOW WELL the students are learning. This evaluation may consist of a simple observation of performance, or it may be accomplished by oral quizzing, performance tests, or by the administration of written achievement tests. This advisory circular is concerned with evaluation from the standpoint of written achievement tests used by FAR 141 Pilot Schools with examining authority, to determine that their students meet the minimum aeronautical knowledge requirements of Part 61 (Revised) of the Federal Aviation Regulations.

b. Characteristics of Good Written Tests. As evaluation devices, written tests are only as good as the knowledge and skill of the individual who develops the test. The following are characteristics of a test if it is to be an effective evaluation instrument. A good test must have: (1) validity, (2) reliability, (3) usability, (4) comprehensiveness, and (5) discrimination.

(1) Validity. A measuring instrument, including a written test, is valid only when it measures what it is supposed to measure. This is the most important characteristic of a good test. The fact that a test is highly reliable does not necessarily mean it is valid. Using complex words in the construction of a test decreases validity because the test becomes more an evaluation of vocabulary than of knowledge of subject matter. A practical method of determining the face validity of a test is to have qualified individuals read the test critically. Any test item that does not appear to pertain to the objectives of the course should be eliminated.

(2) Reliability. A reliable measuring instrument, including a written test, is one that yields consistent and accurate results. If identical measurements are obtained every time a certain measuring instrument is applied to a certain dimension, the instrument is considered to be reliable. For example, assume that a number of students with approximately equal aptitude and intelligence complete the same ground school course under the same instructor and receive approximately the same grades on stage tests. If those students were administered the same final test and achieved widely varying grades, the test used would be unreliable. The reliability of a test can be increased by (a) giving clear instructions for taking the test, (b) writing test items which avoid the use of complex, vague, and ambiguous wording that encourages guessing, and (c) increasing the number of items in the test. The percentage of correct responses due to guessing is far lower in a long test than in a short one.

(3) Usability. For a test to be usable it should be easy to give; it should be written in a type size large enough for the students to read easily; the wording of both the directions for taking the test and of the test items themselves should be clear and concise; graphs, charts, and illustrations should be appropriate to the test item and clearly drawn; and the test should be easily graded.

(4) Comprehensiveness. This characteristic of a good test may be defined as the degree to which the test measures the student's accomplishment of the course objectives, or in the case of an FAR 141 Pilot School's final written test, how well it covers the aeronautical knowledge requirement set forth in FAR Part 61 (Revised). Comprehensiveness implies SAMPLING. Because of economy considerations, no test can be expected to

cover every detail of the subject matter taught during a course; however, a properly constructed test will make a representative and comprehensive sampling of that subject matter. For example, assume that an airman written test contains 100 test items covering five subject areas of equal importance. If 50 items are devoted to weather, 25 items to navigation, and the remaining 25 items to the other subject areas, the test would NOT be comprehensive. There should be a reasonable balance in the number of test items in each subject area if the test is to properly sample the student's knowledge.

(5) Discrimination. A measuring instrument, including a written test, must be constructed so it will detect small differences in individual achievement. Therefore, a written test should discriminate between high and low achieving students. On every item the high achieving students should provide the largest number of correct responses. When a written test is constructed to identify the difference in the achievement of students, there are three features: (a) there is a wide range of scores, (b) it includes test items having all levels of difficulty, and (c) each item distinguishes between the students who are low and those who are high in achievement of course objectives.

c. Designing Written Test Items. Written tests are no more than a combination of many individual test items. Because of this, a major responsibility is placed on the person who develops the test to determine which type of item will best measure the achievement of course objectives. To avoid a haphazardly constructed written test, it is important to study, review, and set forth guidelines that can be used to aid in writing acceptable test items. There are two general categories of test items: the supply type and the selection type.

(1) The Supply-Type Test Items. The supply-type item requires the student to furnish his own response in the form of a word, sentence, or paragraph. Although this type of item can be devised to secure adequate evaluation of student accomplishment, it demands the ability to express ideas that is not required in the selection-type test item. The chief disadvantage of supply-type items is that they are often graded subjectively rather than objectively, due to malpractice in grading. A student is often graded on his ability to write, and his neatness and penmanship, rather than his specific knowledge of subject matter.

(2) The Selection-Type Test Items. Selection-type items are highly objective. The results of such a test would be graded the same regardless of the student taking the test or the person grading it. The results of selection-type tests can be easily used to compare the performance of students within the same class or different classes, and students under one instructor with those under another instructor. Selection-type items provide the test writer with an opportunity to test in many more areas of knowledge in a given time. This increase in comprehensiveness can be expected to increase validity and discrimination. They are also well adapted to statistical analysis. Selection-type items include true-false, matching, and multiple-choice. Only multiple-choice selection-type items will be discussed in this advisory circular.

d. Multiple-Choice Test Items. When properly constructed, multiple-choice test items may be used to measure student achievement, ranging from recall of facts, to measurement of understanding, reasoning, and ability to apply what has been learned.

e. Multiple-Choice Test Item Construction. Three major difficulties are encountered during the construction of multiple-choice test items. They are: (1) the development of an item stem that is expressed clearly and without ambiguity, (2) an answer which cannot be refuted, and (3) the invention of "lures" or "distractors" which will be attractive to those who do not possess the knowledge or understanding to identify the correct answer. Multiple-choice test item stems and the alternatives may take several basic forms. The stems of multiple-choice items may take three forms: (1) a direct question, (2) an incomplete statement, and (3) a stated problem. The alternatives may take three forms: (1) one correct answer, (2) best answer, and (3) incorrect answer. This advisory circular will be concerned only with the "one correct answer" type.

(1) Examples of Various Types of Multiple-Choice Items.

(a) *It may be a direct question* followed by several possible answers. Experience has

shown that inexperienced test writers are more successful with the direct question form.

7. What gas forms the largest part of the atmosphere?

1—Oxygen.
2—Nitrogen.
3—Helium.
4—Hydrogen.

(b) *It may be an incomplete statement* followed by several possible completions of that statement. When using this form, care should be exercised to avoid ambiguity, giving clues, and unnecessarily complex or unrelated alternatives.

7. The atmosphere is a mixture of gases, the largest part being

1—oxygen.
2—nitrogen.
3—helium.
4—hydrogen.

NOTE: When using the incomplete sentence stem form, place the alternative responses at the end, not at the beginning of the stem as shown below.

POOR

14. The _____ is the angle between the chord line of an airfoil and the relative wind.

1—angle of incidence
2—pitch angle
3—climb angle
4—angle of attack

IMPROVED

14. The angle between the chord line of an airfoil and the relative wind is the

1—angle of incidence.
2—pitch angle.
3—climb angle.
4—angle of attack.

(c) *It may be a stated problem, a graph, a table, or a diagram* followed by one correct and three incorrect statements covering that problem, graph, table, or diagram.

22. What is the indicated altitude?

1—440 feet.
2—4,000 feet.
3—4,400 feet.
4—40,000 feet.

(d) *"All of the above" as an alternative.* This type of alternative should be used sparingly. "None of the above" should NOT be used as an alternative.

(e) *Multiple Response Required.* Students are instructed to select all correct answers.

16. What two gases make up the largest part of the atmosphere?

A. Oxygen.
B. Nitrogen.
C. Helium.
D. Hydrogen.
E. Neon.

1—A and B.
2—B and D.
3—C and D.
4—A and E.

(f) *The Negative Variety.* When a negative is used, emphasize by underlining or italicizing the negative word or phrase. The student who is pressed for time may identify a wrong response simply because, in his haste, he has overlooked a negative form.

27. Which of the following is *not* used to control a helicopter in flight?

1—Cyclic.
2—Collective pitch.
3—Antitorque pedals.
4—Ailerons.

(g) *Definition Type.*

19. The erratic movement of the magnetic compass card due to turbulence or rough control technique is known as

1—acceleration error.
2—deceleration error.
3—oscillation error.
4—northerly turning error.

(2) Item Construction Principles.

(a) In general, the form with the alternatives as answers to a question is preferable to the form which uses an incomplete statement as the stem. It is more easily phrased and is more natural for the student to read. It is less likely to contain ambiguities, and it usually results in more uniformity among the alternatives and gives fewer clues to the correct response.

(b) When multiple-choice items are used, four alternatives are generally provided. It is usually difficult to construct more than four plausible responses (responses which appear to be correct to one who has not mastered the subject matter). If there are less than four alternatives, the probability of guessing the correct response is considerably increased. It is recommended that final written certification and rating tests be multiple-choice and that test items contain four alternatives. Students are not supposed to guess the correct alternative; they should select it only if they know it is correct.

(c) Items intended to measure the knowledge level of learning should have but one correct alternative, all other alternatives should be clearly incorrect.

(d) Make each item independent of every other item in the test. If the solution of any item is required to determine the correct solution to another item or the items are allowed to depend on each other, it becomes impossible to pinpoint specific deficiencies in either students or instruction.

18. What is your estimated time en route from Junction City to Jonesville, assuming an average groundspeed of 126 knots?

1—1:24.
2—1:32.
3—1:37.
4—1:42.

19. Based on the time en route determined in item 18 and a fuel consumption rate of 7.5 gallons per hour, how much fuel will be consumed between Junction City and Jonesville?

1—10.5 gallons.
2—11.5 gallons.
3—12.1 gallons.
4—12.7 gallons.

(e) Do not permit any item to reveal the correct answer to another item.

Example of one test item providing the correct response to another item.

20. Pilots of light airplanes must be particularly careful to avoid wake turbulence. The most severe wake turbulence is produced by

1—light airplanes during takeoffs and landings.
2—heavy airplanes during approaches.
3—light airplanes during high speed cruising flight.
4—heavy airplanes during cruising flight.

21. The most dangerous wake turbulence the pilot of a light airplane can expect to encounter is *during takeoffs and landings of heavy airplanes.* When landing behind such an airplane, you should plan your approach to

1—
2—
3—
4—

NOTE: The words that are italicized in item 24 reveal the correct response to item 20.

(f) Design items which call for essential knowledge rather than for abstract background knowledge or unimportant facts. State each item in the working language of the student. Failure to do so can result in decreased validity of the test since the ability to work with the language will be measured as well as the subject matter knowledge or achievement.

Example of stem containing unnecessarily complex wording.

28. Which movable structural surface or surfaces are utilized by the pilot to achieve an asymmetrical wing lift condition, thereby inducing rotation about the longitudinal axis?

1—Elevators.
2—Rudder.
3—Ailerons.
4—Flaps.

Example of stem with simple wording.

28. A pilot banks an airplane by the use of

1—elevators.
2—rudder.
3—ailerons.
4—flaps.

(g) A common criticism of written tests is the emphasis on the reading ability of the student. Include sketches, diagrams, or pictures when they can present a situation more vividly than words. They generally speed the testing process, generate interest, and help to avoid reading difficulties and technical language. This increases validity.

(h) Items containing double negatives invariably cause confusion. If a word such as "not," or "false" appears in the stem, avoid using another negative word in the stem or in any of the alternatives.

(i) The same words repeated at the beginning of all alternatives should be placed in the stem.

Example of words repeated in all alternates which could be included in stem.

31. The most severe wake turbulence is generated by

1—*heavy airplanes in* clean configuration during high speed level flight.

2—*heavy airplanes in* clean configuration during descents.

3—*heavy airplanes in* landing configuration during approaches.

4—*heavy airplanes in* clean configuration during climbs.

NOTE: The words italicized should be placed in the stem.

(j) Statements containing absolutes such as "all," "every," "only," "no," and "never" should be avoided since they are usually false. Similarly, avoid statements containing "some," "any," and "generally." These words are known as DETERMINERS and provide clues to the correct answer. These words LEAN toward FALSE: ALL, NO, and NONE—approximately 80% of alternatives which contain them are FALSE. ALWAYS—approximately 80% of alternatives which contain it are FALSE. ONLY—approximately 90% of alternatives which contain it are FALSE.

Example of distractors containing "determiner."

34. Which airports along your route have ATIS?

*1—Smithville, Jonesville, Rossville, and Leadville.

2—Only Jonesville, Rossville, and Leadville.

3—Rossville and Smithville only.

4—Only Smithville, Jonesville, and Rossville.

(k) Patterns in the sequence of correct responses should be avoided because students can often identify the patterns. Instructors sometimes deliberately use patterns to make hand scoring easier. This is a poor practice.

(l) Catch questions, unimportant details, and ambiguities should be avoided for they do not contribute to effective evaluation in any way. Instead, they tend to confuse and antagonize the student.

(m) Items should reflect knowledge essential to the accomplishment of course objectives.

(n) Items should test for APPLICATION OF KNOWLEDGE, and when possible, should present an operational situation.

(o) Question form items should begin with: who, what, where, how, why, or which.

(3) Stem Construction Principles. In preparing the stem of a multiple-choice item or in reviewing an old one, the following general principles should be kept in mind:

(a) The stem of the item should clearly present the central problem or idea. The function of the stem is to set the stage for the alternatives which follow. If the stem is properly written, a knowledgeable student should be able to come up with a logical answer without seeing the alternatives.

Example of a stem which contains no central problem is shown below.

16. Refer to the supplementary information on page 24 of this test booklet and select the correct response.

1—Smithville Airport has an elevation of 1,500 feet.

2—Rossville Airport has a 4,000-foot hard surfaced runway.

3—Jonesville Airport has runway lights.

4—Hobbsville Airport has an operating control tower.

(b) The stem should contain only material relevant to its solution unless the selection of what is relevant is part of the problem.

(c) The stem should be worded in such a way that it does not give away the correct response. Clue words or phrases (determiners) should be avoided.

(d) Everything that pertains to all alternatives should be in the stem of the item. This helps to avoid repetitious alternatives and saves time.

(e) Generally avoid using "a" or "an" at the end of the stem. They may give away the correct choice. Every alternative should fit grammatically with the stem of the item.

(4) Alternative Construction Principles. The alternatives in a multiple-choice test item are as important as the stem. They should be formulated with care; incorrectness should not be the only criterion for the distracting alternatives. When writing alternatives for a multiple-choice item, the following principles are important to remember:

(a) Distractors which can be used are: (1) a response which is related to the situation and which sounds plausible to the poorly informed, but which is incorrect; (2) a common misconception; (3) a statement which itself is true but does not satisfy the requirements of the problem.

(b) All alternatives should be approximately equal in length. Research of instructor-made tests reveals that, in general, correct alternatives are longer than incorrect ones.

(c) When alternatives are numbers, they should generally be listed in ascending or descending order of magnitude.

f. Whole Test Development and Construction. To develop a written test, some organized method or plan should be used. The plan of development should be based on the ground school syllabus contained in the training course outline which is submitted to the FAA for approval. This syllabus will cover the required knowledge for the particular certificate or rating as set forth in FAR Part 61 (Revised).

(1) In any training course, a primary purpose of written tests administered during or at the end of that course is to determine how well the student has achieved the objectives of the course. The final written test given at the end of a certification or rating course by schools with examining authority must, therefore, determine how well the students have achieved the objectives of THAT particular course.

(2) The final written test has other major purposes. It can assist the school in determining the following: (a) the areas in which student achievement is less than adequate and therefore dictates the need for improvement in course materials and instruction for use in subsequent courses; (b) the areas in which the student needs remedial instruction if he fails the test; (c) the student's weak areas which should be reviewed on his flight check; and (d) the effectiveness of different instructional approaches and techniques.

(3) The test items should be based on selected individual topics covered in each lesson of the syllabus. Each test item should be constructed to determine how well the student meets the objective of the lesson. If this method is used, the test will be valid and comprehensive. There should be a reasonable balance of test items in each subject area.

(4) General items should be grouped in the test by subject areas—for example, Federal Aviation Regulations, navigation, weather, etc. If appropriate to the testing area, the items should be arranged in a logical order reflecting the sequence of events that would occur on an actual cross-country flight; i.e., preflight planning, departure, en route, arrival, and post-flight activity.

g. Scoring Tests.

(1) Each test booklet submitted by the school should have an answer sheet and scoring key. Each question book submitted by the school should have accompanying question selection sheets and scoring keys.

Example of an acceptable answer sheet arrangement:

RESPONSES

Item Numbers	*1*	*2*	*3*	*4*
1	(X)	( )	( )	( )
2	( )	(X)	( )	( )
3	(X)	( )	( )	( )

(2) An answer sheet can be converted into a scoring key by perforating the spaces that rep-

resent the correct responses. The scoring key can be placed over the answer sheet and easily scored by making a red mark in the perforation that contains no answer.

	1	*2*	*3*	*4*
1	(•)	( )	( )	( )
2	( )	(•)	( )	( )
3	(•)	( )	( )	( )

(3) It is recommended that a conversion scale be typed on the answer sheet which will show the "items correct" and the "percentage grade equivalent." This will reduce the burden of calculating a percentage grade for each test during grading.

Conversion Scale—50 item test

Items Correct	*Percentage Grade Equivalent*
50	100
49	98
48	96

Conversion Scale—60 item test

Items Correct	*Percentage Grade Equivalent*
60	100
59	98
58	97
57	95

(4) The scoring key should NOT have a detectable pattern of responses. A pattern is often used to ease the problem of scoring. This is a poor practice.

Scoring Key with a Detectable Pattern

	1	*2*	*3*	*4*
1	(•)	( )	( )	( )
2	( )	(•)	( )	( )
3	( )	( )	(•)	( )
4	( )	( )	( )	(•)
5	(•)	( )	( )	( )
6	( )	(•)	( )	( )
7	( )	( )	(•)	( )
8	( )	( )	( )	(•)

h. Test Item Pool. The task of devising a valid test within a few minutes and administering it within the hour is practically impossible. Much time and thought must be devoted to the development of each individual test item. After test items have been developed they can be placed in a "test item pool." The use of an item pool will greatly simplify and accelerate the process of test development and construction. The use of an item pool will help the school produce tests that do not appear to have a haphazard design, and aid in maintaining a sound testing program. The test item pool should be organized as follows: (1) After a test item is developed, it should be typed on a 5" x 8" index card and filed according to the major and minor groupings of the subject areas, and (2) a separate file should be kept for each certification or rating area—for example, the private pilot airplane and the commercial pilot airplane. This will prevent using the same test item in two different final certification or rating tests.

i. Historical Record of Pass Percentage.

(1) It is recommended that the school maintain at least a record of the pass percentage of each test. This is a fairly simple procedure and is used to determine the level of difficulty of each test.

(2) Example of Pass Percentage—Test No. 101

	Pass	*Fail*	*Pass Percentage*
Class 71-10 (15 students)	13	2	87%
Class 74-11 (12 students)	10	2	83%
Class 74-12 (10 students)	7	3	70%

j. Item Analysis.

(1) The responses to the correct and to the incorrect alternatives should be recorded. This item performance information is a valuable aid in determining improperly written test items and in redesigning test items. For example, if the correct response was alternative number 3 and 50 percent of the students selected alternative number 2, the item should be carefully checked to determine that it is valid and that it is not ambiguous. The statistics or record of each item can be entered on the item pool cards for easy reference. An example is shown on page 9.

(2) Example of test item analysis—alternatives.

28. Pilots of light airplanes must be particularly careful to avoid wake turbulence. The most severe wake turbulence is produced by

Percent Responses			
74-10	*74-11*	*74-12*	
10	0	10	1—light airplanes during takeoffs and landings.
15	50	60	*2—heavy airplanes during approaches.
50	25	15	3—light airplanes during high speed cruising flight.
25	25	15	4—heavy airplanes during cruising flight.

NOTE: 50% of class 74-10 selected the wrong response, requiring a rewording of the item. This resulted in 50% of class 74-11 selecting the correct response, but also left response number 1 too obviously wrong. After the third rework, class 74-12 indicates a well-balanced set of statistics.

k. Acceptable Formats for Written Tests. The school may submit final written certification or rating tests using either the test booklet or the question book format. (See Appendix 2 and Appendix 3.)

l. Test Booklet—Number of Tests, Test Replacement, and Number of Test Items.

(1) If this format is used, AT LEAST two final certification or rating written tests booklets should be developed and be available for use in each certification or rating area. Items contained in the final certification or rating test booklets should not be extracted from the stage tests.

(2) In the interest of the integrity of the testing and certification process, FAA inspectors may assume a test booklet has been compromised if it has been in use for a period of more than one year. Also, it is recommended that one of the test booklets described in paragraph (1) be replaced every six months. A replacement written test booklet will be acceptable to the FAA when at least the following changes have been made in the original test booklet: (a) changing the position of items while still maintaining the original acceptable logical organization; (b) changing the position of the alternatives and, therefore, changing the scoring key; (c) changing numerical values in all items containing such values; and (d) replacing 20% or more of the items in the test booklet with items that are in the same subject area as the ones replaced, but rewritten so as to remove exact identification of the item replaced.

(3) Written test booklets should be based on current reference material and any test item which becomes inaccurate due to changes in reference material should be promptly replaced. All written test items SHOULD be referenced to Government publications that are available to the public. However, if test items are referenced to commercial publications, the subject matter contained in those references SHOULD NOT be in conflict with material found in Government publications. A copy of the references used should be included with the test submitted to the FAA for approval.

(4) Replacement test booklets and test booklets containing replacement items should be submitted to the FAA District Office for approval.

(5) The minimum number of test items required in each certification or rating area is as follows: (a) Private Pilot—all categories—60 items; (b) Commercial Pilot—all categories—60 items; and (c) Instrument Rating—all categories—75 items.

m. Question Book—Number of Question Books, Arrangement of Questions, Question Book Replacement, Number of Questions in Question Book, and Question Selection Sheets.

(1) If this format is used, AT LEAST one question book should be developed and be available for use in conducting final written tests in each certification or rating area. Questions contained in the question book should not be extracted from the stage tests.

(2) Questions in the question book should be arranged by subject area; i.e., Federal Aviation Regulations, meteorology, navigation, etc. If appropriate to the testing area, the questions should be arranged in an order reflecting the sequence of events that would occur on an actual cross-country flight; i.e., preflight planning, departure, en route, arrival, and post-flight activity.

(3) Each question should be independent of every other question in the question book. Also, each question should have the related data and

illustrations located near it to simplify the student's task.

(4) There should be no exact duplication of questions in the question book.

(5) In the interest of the integrity of the testing and certification process, FAA inspectors may assume that a question book has been compromised if it has been in use for a period of more than one year. A replacement question book is acceptable to the FAA when at least the following changes have been made in the book: (a) changing the wording of questions; (b) changing the position of the alternatives and, therefore, changing the scoring key; (c) changing numerical values in all questions containing such values; and (d) replacing 20% or more of the questions in the question book with questions that are in the same subject area but rewritten so as to remove exact identification of the question replaced.

(6) Questions in the question book should be based on current reference material, and any question which becomes inaccurate due to changes in reference material should be promptly replaced. All questions SHOULD be referenced to Government publications that are available to the public. However, if questions are referenced to commercial publications, the subject matter contained in those references SHOULD NOT be in conflict with the material found in Government publications. A copy of the references used should be included with the question book submitted to the FAA for approval.

(7) At least five hundred questions are required in each question book.

(8) Question selection sheets must be developed for use in conjunction with each question book. One question selection sheet represents one written test. The question selection sheet identifies questions in the question book to be answered by the student. An example of a question selection sheet appears in Appendix 4. At least ten question selection sheets should be developed for each question book. All of the question selection sheets for a question book should be replaced every six months. Each question selection sheet should list a different set of questions; however, duplication of some items on different question selection sheets is acceptable but should be kept to a minimum. The minimum number of questions required on the question selection sheets for each certification or rating area is as follows: (a) Private Pilot—all categories—60 questions; (b) Commercial Pilot all categories—60 questions; and (c) Instrument Rating—all categories—75 questions.

n. Written Test Security. The security of written tests is of paramount importance in preventing compromise and ensuring that students meet the aeronautical knowledge standards for various certificates and ratings. These tests should be carefully controlled during development and administration.

(1) Responsibility. The Pilot School with examining authority is responsible for establishing and carrying out appropriate security procedures that conform with FAA approved standards. Instructors, students, and the general public should not be allowed to use these tests for study or discussion purposes, nor copy any portion of these tests or supplementary material. The intent of FAR 141 is that individual schools develop their own final written certification and rating tests and not use tests developed by commercial publishing firms. The failure of a school to develop its own written tests indicates that it lacks the professional competence required for the issuance of examining authority. In addition, it is the FAA's position that commercially produced written tests cannot be adequately controlled from a security standpoint, either during their development or distribution to schools.

(2) Inspection of Schools' Security of Written Tests. Both prior to approval and periodically after examining authority has been granted, the school will be inspected by FAA officials to determine that: (a) there is adequate security; e.g., lock safe file, personnel involved are fully informed of measures concerning security, etc.; (b) the space and physical facilities are such that they are conducive to good administration of written tests; (c) the school is adequately staffed to provide continuous monitoring during testing; and (d) adequate measures to destroy retired test materials (including carbon paper, if used) are shown by the school.

(3) Shipment of Test Materials. Packages containing test materials should be securely prepared for all shipping. Schools should use padded paper bags, or equivalent security-type envelopes. Test materials should be either car-

ried in person by an authorized school official or sent by registered mail. A record of the contents of the package should be maintained. A shipping list should be included, which should be signed by the receiver and returned to the sender to indicate receipt of the material. (See Appendix 5, page 1, for sample Shipping List Form.)

(4) Shipment of Test Materials Between the Main Operations Base and a Satellite Base (within 25 miles). The transportation of test materials between the main operations base and a satellite base should be accomplished using the procedure outlined in paragraph (3) above.

(5) Storing of Test Materials at the Main Operations Base or a Satellite Base (within 25 miles).

(a) Test materials should be stored in locked spaces or cabinets (preferably three-tumbler lock safes) combination type, which provide deterrent to theft. (Note: Cabinets with standard, push-in type locks are easily opened and do not ensure appropriate security.) If three-tumbler combination lock safe files are not available for storage of test materials, the opening to the storage area should be secured with lock bars or hasps and combination locks or security-type key locks.

(b) The school should designate in writing one or more individuals responsible for opening and closing these security cabinets and also monitoring cabinet areas when open. These individuals should be responsible for maintaining inventory records of all test materials by titles and serial numbers. An inventory of all test materials should be accomplished at least weekly. This is recommended to ensure early detection of missing test materials.

(c) A complete inventory should be made when circumstances dictate—such as forced entry, cabinets left unsecured during absence of responsible personnel, theft, or misplacement of any test materials.

(d) When test materials are removed from security cabinets for any reason, a log-out and log-in sheet containing the test title and test number should be maintained. When test materials are returned after use, the log-in sheet should so indicate.

(6) Destruction of Obsolete Test Materials. Obsolete test materials should be shipped to the FAA District Office having jurisdiction over the school. Destruction of these materials should be accomplished by following the same procedures as prescribed for FAA test materials. One copy of each set of obsolete test materials may be retained by the school in its security file.

(7) Missing Test Materials. When test materials that would be considered an aid to compromise are missing because of loss, theft, or for any other reason, the person discovering the loss should:

(a) Determine, if possible, the identity of the person or persons responsible for the missing test materials and attempt to recover the materials as soon as possible.

(b) Notify the FAA District Office having jurisdiction over the school immediately following a quick appraisal of the circumstances surrounding the loss of the test materials.

(c) Promptly submit a complete written report to the FAA District Office relating the circumstances and findings, what effort has been made to recover the missing materials, and what disciplinary action, if any, has been taken or is being contemplated.

(d) Withdraw the test from use and develop a replacement test.

o. Written Test Administration.

(1) Identification of the Student. Assurance should be made that all persons who are permitted to take the written test are bona fide enrollees of the school and enrolled in the appropriate course for which the test is being given.

(2) Marking on Test Materials. Students should not mark or deface test booklets, question books, or supplementary materials; however, drawing lines on aeronautical charts is permissible if those charts are not part of the test booklet or question book. Plastic overlays should be placed over performance charts for plotting.

(3) Separation of Students During Administration of Written Tests. The test monitor should separate students as much as possible during the conduct of written tests and should issue different tests to students seated adjacent to each other.

(4) Time Allowed for Tests. The time allowed for the completion of a test should be indicated on the page immediately following the cover page of the test booklet or question book.

This allotted time should not be considered an absolute maximum; the test monitor may, at his discretion, extend the time allowed. A test should not be given to the student too late to allow him the full allotted time. **Exception:** A test may be administered when less than the allotted time is available, provided (a) there is full agreement of the student; (b) he signs an agreement waiving his right to the full allotted time; and (c) his answer sheet is picked up at the closing time of the test session. The time allowed for tests is as follows:

Private Pilot—All categories ---- 4 hours
Commercial Pilot—All categories 4 hours
Instrument Pilot—All categories 6 hours

(5) Use of Aids and Reference Materials. The student may use only those reference materials provided with the test. He may use scales, straightedges, protractors, plotters, navigation computers, and log sheets of direct use in making mathematical and navigational computations. Permanently inscribed or printed instructions on such aids which pertain only to their operation and use are permissible. Information not pertinent to the actual operation of the above-mentioned aids such as regulations, signals, cloud data, holding pattern diagrams, frequencies, weight-and-balance formulae, ATC procedures, etc., must be obscured with suitable tape or other masking material. The applicant may also use electronic or mechanical calculators, subject to the following limitations: (a) prior to, and on completion of the test, the test monitor will instruct the student to actuate the "ON/OFF" switch, observing this action, to ensure erasure of any data stored in memory circuits; (b) tape printout of data must be surrendered to the test monitor if the calculator incorporates this design feature; and (c) the student is not permitted to use any material containing instructions related to operation of the calculator during the written test.

(6) Each Student Should be Furnished the Following for the Test.

(a) The proper test booklet or the appropriate question book.

(b) Supplementary material (listed on the front cover of, and used only with, the test booklet).

(c) An answer sheet, if a test booklet is used.

(d) An appropriate question selection sheet, if a question book is used.

(e) A specific number of sheets of scratch paper.

(7) Monitoring of Test to Avoid Malpractice.

(a) The test monitor should be present and be able to view the students at all times. He should be aware of all activities in the testing room and should be alert for any malpractice. The monitor should not perform other tasks during this period of time that would divert his attention for extended periods of time or remove him physically from the testing room or monitoring position. The monitor should answer no questions that will give the student an indication of the correct answer.

(b) If a student appears to be cheating, the monitor should discontinue the test immediately and pick up the test materials. He should tell the student that he will not be able to take another school or FAA test until the suspicion of cheating is investigated and he is cleared of suspicion. The test monitor should then notify, in writing, the appropriate school authorities and the FAA District Office having jurisdiction over the school, with an explanation of the circumstances involved in the case.

(8) Check-In Process at Close of Test. At the close of the test, the monitor should collect the test materials and each sheet of scratch paper. He should check each sheet of scratch paper for missing parts on which portions of test items may have been written. In the presence of the student, he should leaf through the test booklet or question book and any supplementary materials to determine that no marks have been made nor pages removed.

(9) Retesting After Failure. A student who fails a school's final written certification or rating test should not be administered a retest until 30 days after the date he failed the test. However, in the case of his first failure he may be retested before the 30 days have expired, by presenting a written statement from an authorized school instructor certifying that he has given the student ground instruction as appropriate and finds him competent to pass the test. Under no circumstances should a student be permitted to take the same test twice. If a school develops only two test booklets in a particular certification or rating area and a student fails both, he

will be considered to have completed the course, but NOT satisfactorily. The student is considered to be no longer enrolled in the course and, if he wishes to seek certification, he must take the appropriate FAA written test. As an alternative, the school may develop additional tests to accommodate more than two failures.

(10) Use of Written Test Results in Conducting Oral and Practical Tests. Some means should be implemented to record the areas in which the student experienced difficulty. This record should be available to the instructor for his guidance in remedial study with the student before the flight check. The flight check pilot should refer to this record to ascertain that the student has overcome his deficiencies in the noted areas.

(11) General Comments on Test Administration.

(a) The decision as to WHEN to administer the test does not always rest with the instructor, but there are times when he can establish the schedule for the test.

(b) The selection of a place in which to administer the test is important for reliable testing results. For best results, a quiet, well-lighted, well-ventilated room with a comfortable temperature should be used. Ample working space should also be provided. This is particularly important in tests that require the use of aeronautical charts, supplementary materials, etc.

(c) The instructor or test monitor should arrive at the testing room in advance of the students to prepare the room for test taking. Some may prefer to have test materials at the students' seats before the students arrive. All required test materials should be available, so that leaving the room to obtain additional materials will not be necessary. All pretest verbal instructions should be given, and any student questions should be resolved prior to beginning the test. Monitoring practices prescribed in paragraph 2.o.(7) should be followed.

APPENDIX 1.—Checklist to Assist the School In Reviewing and Handling Test Materials

1. Determine that the test booklet or question book:

a. Is legible and properly bound.

b. Has proper spacing between items.

c. Has proper spacing between stems and alternatives.

2. Determine that all pages are numbered in sequence and that any removed pages can be easily detected. A method for doing this is described on Page 2 of Appendix 5.

3. Determine that the test booklet or question book and accompanying question selection sheets include coverage of all subject matter areas listed in the knowledge requirements of FAR Part 61 (Revised) and in the course objectives; that a reasonable number of test items is included for each subject matter area; and that the total number of items is the same as that recommended by this advisory circular for the particular certification or rating area.

4. Determine that the test booklet or question book has a cover page which contains the following information:

a. Title.

b. Test number.

c. List of supplementary materials, if test booklet is used.

5. Determine that the test booklet or question book has a page, immediately following the cover page, which gives the student complete and clearly-stated instructions for taking the test. See Page 2 of Appendix 2 and Page 2 of Appendix 3. The instructions should include:

a. Equipment that can be used during the test.

b. Time allowed for taking the test.

c. Warning statement.

d. Number of test items to be answered by the student.

e. Manner in which the student should mark answers.

f. Minimum passing grade is 70%. No score adjustment is permitted.

6. Determine that all items are multiple-choice type and have four alternatives.

7. Determine the acceptability of each test item by using the following guidelines:

a. Check to assure that items reflect knowledge essential to the accomplishment of the course objectives.

b. Items should use words with precise meanings (working language of the student).

c. Items should be specific and brief.

d. Question-form items should begin with: Who, what, where, how, why, or which.

e. Do not repeat words in the alternatives that can be included in the stem.

f. Items should be stated in positive terms.

g. Alternatives should not contain giveaways (determiners).

h. Items should include pictures or diagrams if they present the problem more clearly.

i. Item responses should be logical, grammatically consistent, and plausible.

j. Unless the item is of the multiple-response type there should be only one correct response.

k. Items should test for application of knowledge and, when possible, should present an operational situation.

8. Transporting written test materials.

a. All test materials should be enclosed in an acceptable security package and sealed.

b. Test materials should be delivered by an official of the school or, if this procedure is not practicable, the test materials should be mailed by registered mail.

c. A test materials shipping list form which requires the signature of the people involved in handling those materials should be used.

9. Contents of the "Test Materials" package should include:

a. The bound test booklet or bound question book with appropriate question selection sheets.

b. The answer sheet that will be used by the students, if a test booklet is used.

c. The scoring key that will be used by the school in grading the test.

d. All supplementary materials needed by a student to take the test. This includes aeronautical charts, excerpts from weather information, and excerpts from the Airman's Information Manual, etc.

APPENDIX 2.—Suggested Format for an Acceptable Test Booklet

Copy No. 101

PRIVATE PILOT TEST BOOKLET
AIRPLANE

List of Supplemental Material:

NAME AND NUMBER OF SCHOOL

ADDRESS

This test booklet is the property of _____ school and is not to be copied or reproduced.

COVER PAGE

Suggested Format for an Acceptable Instruction Page In A Test Booklet

Number of Test Items _____
Maximum Time Allowed for Test _____
Minimum Passing Grade 70%

GENERAL INSTRUCTIONS

1. Use only those reference materials provided with the test booklet. You may use scales, straightedges, protractors, plotters, navigation computers, electronic or mechanical calculators, and logsheets of direct use in making mathematical and navigational computations. You may *not* use devices or aids containing *legible* information on regulations, signals, cloud data, holding pattern diagrams, frequencies, weight and balance formulae, ATC procedures, etc. This information must be obscured with suitable tape or other masking material.

2. Read each test item carefully and select the alternative which you consider to be the best answer. *Always* answer test items in terms of current regulations, procedures, or techniques.

3. Your answers in this test can be scored accurately only if you *carefully* observe the following precautions:

   a. Use the soft lead pencil.

   b. Blacken completely the space between the parenthesis corresponding to the answer you have selected for each test item.

   c. If you change your answer, *completely* erase the previously marked response. Partially erased answers or multiple answers are scored as wrong.

WARNING

WRITTEN TESTS: CHEATING OR OTHER UNAUTHORIZED CONDUCT.

A. NO PERSON MAY . . .

   1. COPY, OR INTENTIONALLY REMOVE, A SCHOOL'S WRITTEN TEST;

   2. GIVE TO ANOTHER, OR RECEIVE FROM ANOTHER, ANY PART OR COPY OF THAT TEST;

   3. GIVE HELP ON THAT TEST TO, OR RECEIVE HELP ON THAT TEST FROM, ANY PERSON DURING THE PERIOD THAT TEST IS BEING GIVEN;

   4. TAKE ANY PART OF THAT TEST IN BEHALF OF ANOTHER PERSON;

   5. USE ANY UNAUTHORIZED MATERIAL OR AID DURING THE PERIOD THAT TEST IS BEING GIVEN; OR

   6. INTENTIONALLY CAUSE, ASSIST, OR PARTICIPATE IN ANY ACT PROHIBITED BY THIS PARAGRAPH.

B. IF THE TEST MONITOR OR OTHER SCHOOL REPRESENTATIVE DETERMINES THAT A STUDENT HAS COMMITTED ANY ACT PROHIBITED BY PARAGRAPH A, DURING THE TIME HE IS TAKING A TEST, THAT TEST SHALL BE DISCONTINUED AND A GRADE WILL NOT BE GIVEN. IN ADDITION, IF IT IS DETERMINED THAT A STUDENT HAS, DURING THE TIME HE IS ENROLLED IN THE SCHOOL, COMMITTED ANY ACT PROHIBITED IN PARAGRAPH A, HE WILL NOT BE PERMITTED TO TAKE ANOTHER SCHOOL TEST FOR A PERIOD OF ONE YEAR, OR THE SCHOOL IN COORDINATION WITH THE FAA MAY TAKE OTHER PUNITIVE ACTION DEEMED APPROPRIATE FOR THE SITUATION.

Suggested Test Booklet Format

Assume that you have a Private Pilot Certificate and are employed by a manufacturing company. This company uses several business aircraft. You are to fly three sales representatives on a VFR cross-country flight from Port Columbus International Airport to Wood County Airport (Parkersburg) and then to Kanawha Airport at Charleston. Landings will be made at Parkersburg and Charleston.

The proposed route of this cross-country flight is as follows:

LEG I

Depart Port Columbus International Airport, Columbus, Ohio (40°00'N-82°50'W), direct to Wood County Airport, Parkersburg, West Virginia (39°21'N-81°26'W).

LEG II

Depart Wood County Airport on a true course of 180° until intercepting V115 then via V115 to Charleston VORTAC; then direct to Kanawha Airport, Charleston, West Virginia (38°22'N-81°36'W).

* * * * * *

Draw the courses for the proposed flight on the Sectional Chart.

* * * * * *

1. Assume that you were issued a Third-Class Medical Certificate on June 1, 1976. Your medical certificate is valid until the end of

1—May 1978.
2—June 1978.
3—May 1977.
4—June 1977.

DO NOT MARK ON THIS TEST BOOKLET

2. According to FAR Part 91, an airplane shall not be operated unless it has had an annual inspection within the preceding 12 calendar months. When an airplane has received this inspection, it is indicated by

1—the issuance of a new Airworthiness Certificate.
2—the issuance of a new Aircraft Registration Certificate.
3—an entry in the maintenance records.
4—completion of an alteration and repair form.

* * * * * *

After filing a flight plan, you conduct a thorough preflight inspection of the airplane and prepare for takeoff.

* * * * * *

3. While allowing the engine to warm up prior to your "before takeoff check," you remember that detonation may result in severe damage to the engine and occurs when the fuel mixture explodes instead of burning evenly and progressively. *One* factor that is likely to cause detonation is

1—high density altitudes.
2—excessively rich fuel-air mixtures.
3—the abrupt opening of the throttle.
4—the use of higher-than-recommended fuel octanes.

AC 141-2A

BEFORE TURNING IN YOUR TEST BOOKLET AND ANSWER SHEET, EXAMINE YOUR ANSWER SHEET TO BE SURE THAT

1—the answers are marked legibly.

2—only one answer is marked in each row.

3—all erasures are complete and clean.

FAILURE TO OBSERVE THESE PRECAUTIONS MAY RESULT IN INCORRECT SCORING WHICH WILL LOWER YOUR GRADE.

SAMPLE PAGE FROM QUESTION BOOK

* * * * * *

DO NOT MARK ON THIS BOOK

01. Assume that you were issued a Third-Class Medical Certificate on June 1, 1976. Your medical certificate is valid until the end of

1—May 1978.
2—June 1978.
3—May 1977.
4—June 1977.

02. According to FAR Part 91, an airplane shall not be operated unless it has had an annual inspection within the preceding 12 calendar months. When an airplane has received this inspection, it is indicated by

1—the issuance of a new Airworthiness Certificate.
2—the issuance of a new Aircraft Registration Certificate.
3—an entry in the maintenance records.
4—completion of an alteration and repair form.

03. While allowing the engine to warm up prior to your "before takeoff check," you remember that detonation may result in severe damage to the engine and occurs when the fuel mixture explodes instead of burning evenly and progressively. *One* factor that is likely to cause detonation is

1—high density altitudes.
2—excessively rich fuel-air mixtures.
3—the abrupt opening of the throttle.
4—the use of higher-than-recommended fuel octanes.

NOTE: Legends for all charts and AIM data are in the Appendix.

APPENDIX 4.—Example of Question Selection Sheet

SELECTION SHEET - 60 ITEMS

TITLE	SELECTION NO.
PRIVATE PILOT - AIRPLANE	3

NAME _____

Answer Question Number	Responses 1	2	3	4	Answer Question Number	Responses 1	2	3	4	Answer Question Number	Responses 1	2	3	4
2	( )	( )	( )	( )	168	( )	( )	( )	( )	338	( )	( )	( )	( )
11	( )	( )	( )	( )	177	( )	( )	( )	( )	347	( )	( )	( )	( )
19	( )	( )	( )	( )	188	( )	( )	( )	( )	357	( )	( )	( )	( )
26	( )	( )	( )	( )	198	( )	( )	( )	( )	364	( )	( )	( )	( )
36	( )	( )	( )	( )	206	( )	( )	( )	( )	373	( )	( )	( )	( )
42	( )	( )	( )	( )	218	( )	( )	( )	( )	383	( )	( )	( )	( )
50	( )	( )	( )	( )	229	( )	( )	( )	( )	391	( )	( )	( )	( )
59	( )	( )	( )	( )	239	( )	( )	( )	( )	396	( )	( )	( )	( )
69	( )	( )	( )	( )	248	( )	( )	( )	( )	400	( )	( )	( )	( )
75	( )	( )	( )	( )	255	( )	( )	( )	( )	412	( )	( )	( )	( )
83	( )	( )	( )	( )	267	( )	( )	( )	( )	423	( )	( )	( )	( )
91	( )	( )	( )	( )	278	( )	( )	( )	( )	429	( )	( )	( )	( )
101	( )	( )	( )	( )	287	( )	( )	( )	( )	436	( )	( )	( )	( )
108	( )	( )	( )	( )	297	( )	( )	( )	( )	445	( )	( )	( )	( )
116	( )	( )	( )	( )	303	( )	( )	( )	( )	453	( )	( )	( )	( )
127	( )	( )	( )	( )	311	( )	( )	( )	( )	463	( )	( )	( )	( )
136	( )	( )	( )	( )	316	( )	( )	( )	( )	472	( )	( )	( )	( )
142	( )	( )	( )	( )	322	( )	( )	( )	( )	476	( )	( )	( )	( )
147	( )	( )	( )	( )	326	( )	( )	( )	( )	487	( )	( )	( )	( )
156	( )	( )	( )	( )	331	( )	( )	( )	( )	497	( )	( )	( )	( )

APPENDIX 5.—Example of Shipping List and Missing Page Identification

TEST MATERIALS SHIPPING LIST	DATE
SHIPPED TO	

INSTRUCTIONS: Check shipment against items listed on this form. Complete Part II; describe any discrepancies in the remarks space in Part II. Return original copy to the address below within 5 working days of receipt.

PART I – LIST OF MATERIALS SHIPPED

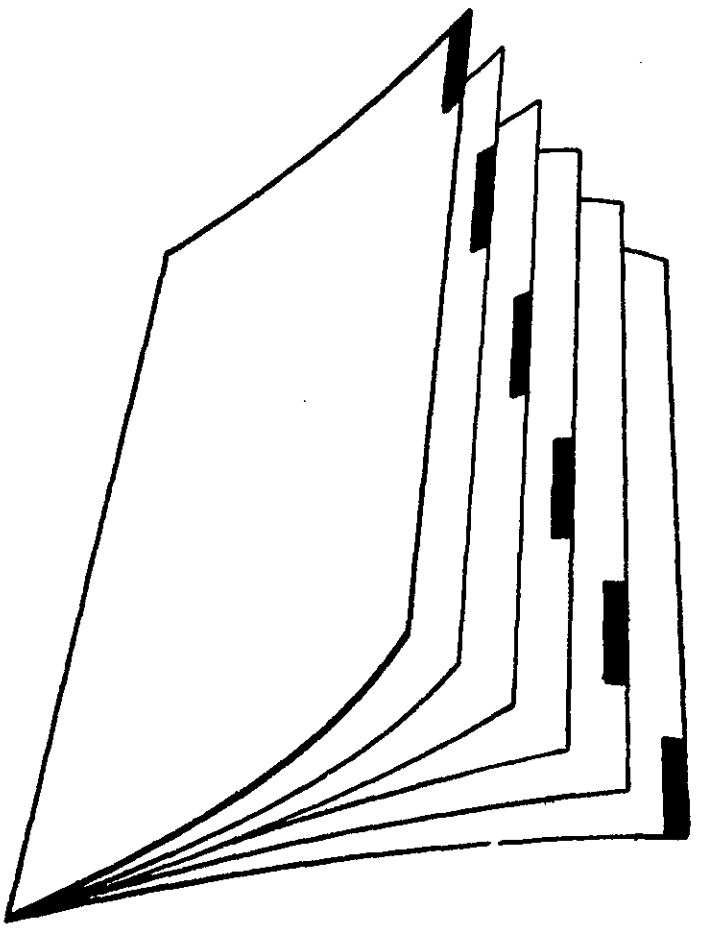
DESCRIPTION

PART II – RECEIPT OF MATERIAL

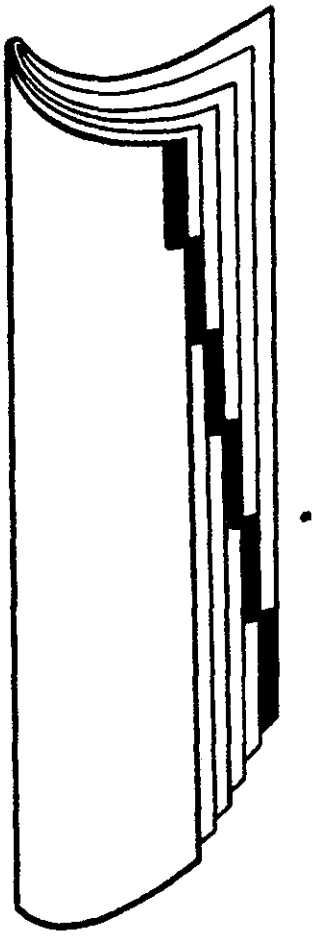
REMARKS (Discrepancies, etc.)

RETURN TO	DATE OF RECEIPT
	OFFICE IDENTIFICATION
	AUTHORIZED SIGNATURE

EXAMPLE OF METHOD OF DETECTING MISSING PAGES



Place black tabs on edges of pages.



When booklet is rolled, unbroken black line indicates no missing pages.