

Facility Representative Qualification Program Guidelines for Writing Test Items



**Oak Ridge Office
Human Capital Assessment Group**

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Guidelines for Test Item Development

This guideline is a tool for you to use as you develop and review test items to be included in the written item bank for the Facility Representative qualification examination. This process is an important part of the Training and Qualification Program at the Oak Ridge Office. Poor test-item writing practices can yield inaccurate information about what was taught AND about the student's capabilities. Thus, poor items can be misleading about both the value of the training program and the student's abilities.

This guideline has been prepared for your future reference and is yours to keep and use. Please refer to it as often as you write and review items. In addition, you will receive an easy-to-use pullout reference that summarizes the material provided in this workbook. Once you are familiar with the terminology used in the item development process, you may find the pullout reference most useful in writing and reviewing items. You will also receive a checklist you can use to review your own and others' items to ensure the items follow the principles outlined in this guideline.

Once items have been generated and reviewed, they will be subjected to a process termed "field testing." This field test will determine if items need to be revised or may be included in the bank without revision. Thus, it is important to follow the guidelines provided here closely to minimize the need for revision at a later date.

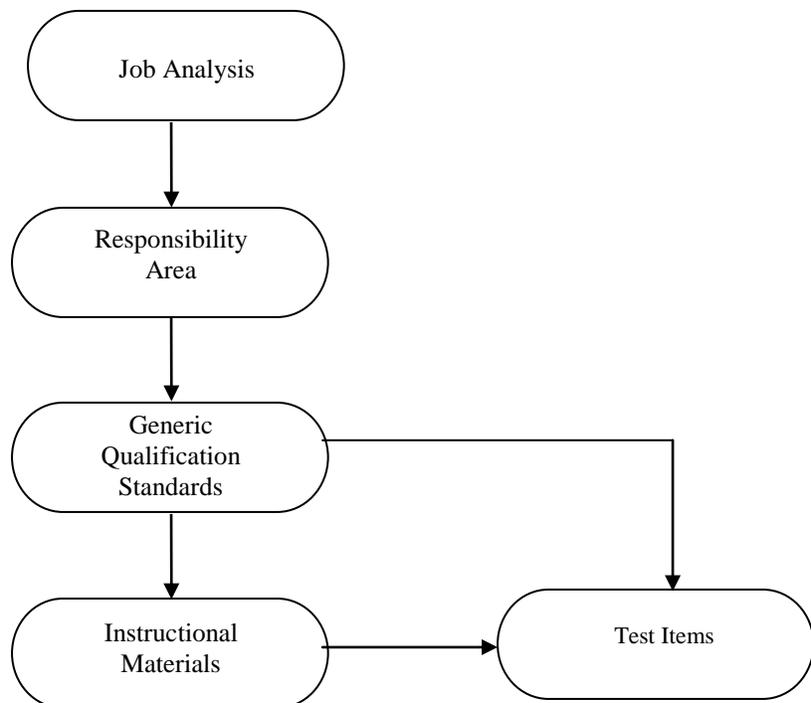
Introduction

Introduction

Writing quality test items is a demanding task. There are a number of factors you must consider, such as the most appropriate item format, ensuring that the item meets sound psychometric principles, and obtaining necessary copyright permission, if appropriate. All items you write should be based on and measure the Generic Qualification Standards for Facility Representatives at the Oak Ridge Office. These guidelines were developed to assist you in developing sound items for inclusion on a certification examination.

Process

The first step in the item development process is to perform a job analysis to determine the tasks performed on the job. Once this job analysis is completed, the Responsibility Area with associated Generic Qualification Standards are developed and validated. Instruction is then developed to teach these Generic Qualification Standards. Test items are also written to measure the Generic Qualification Standards and are based on the instruction. This process can be seen in the figure below.



Introduction

Process (continued)

Note that all these steps are interrelated. In addition, the test items should be tied to both the instructional materials and the Generic Qualification Standards. This entails documenting which Generic Qualification Standard the item is intended to measure and a reference in the instructional materials where this Generic Qualification Standard is taught. This process is important for documenting that the test is valid.

Copyright

In the course of writing items, you may find that a particular chart, graphic, or other materials is necessary to the item you are writing. If this is the case, it is important to realize that you must obtain written permission to use any copyrighted materials. If you paraphrase words or ideas or redraw a diagram or graphic, you can usually avoid the need to obtain written permission.

Please refrain from using materials verbatim unless it is absolutely necessary. Obtaining written permission to use copyrighted materials is usually not difficult but is, nonetheless, a time-consuming process. If you must use copyrighted materials, you must obtain written permission from the author or publisher. To do this, include all pertinent publication information in your written request. Include the title, author, edition, publisher, etc., plus the page number(s) of the material you wish to copy. Photocopying the information in the front matter of a resource is a good way to be sure you have accurate publication information.

Bias and Stereotyping

Bias and stereotyping occur when one makes disparaging remarks about a particular group or when one categorizes a particular group into “traditional” roles. This should be avoided in all professional writing, including test items. Bias and stereotyping can be avoided by observing the following guides:

Introduction

Bias and Stereotyping (continued)

- If possible, avoid use of personal pronouns such as “he” or “she.” If you must use personal pronouns, use an equal number of references to males and females.
- Avoid using gender-based stereotypes such as female nurses and male doctors, female secretaries and male managers, etc. If you create scenario items, show an equal mix of males and females in the supervisory and supporting roles.
- Avoid racial and ethnic stereotypes such as white supervisors and minority janitors. If you assign names in scenario items, be sure to include names that may be easily recognized as Hispanic (e.g., Juarez), Asian (e.g., Wang), Native American (e.g., Robert Whitecloud), or associated with a particular ethnic or religious group (e.g., names such as Steinberg or Cohen may be associated with the Jewish religion). Place these “characters” in a variety of roles—supervisory as well as supporting roles.
- Avoid sexist language and titles wherever possible. For example, try to use a term like “supervisor” rather than “foreman.”

Introduction

Two Types of Tests

There are two basic types of tests. The first is “norm-referenced.” In this type of test, students who take the test are compared against one another or some reference group. The results of a norm-referenced test are often reported in “percentiles.” An exam to determine who is awarded a scholarship is an example of a norm-referenced test. Perhaps only the top ten percent of those taking the exam can be awarded the scholarship.

The second type of test is a “criterion-referenced” test. In this type of test, students who take the exam are compared against some predetermined criterion rather than one another. The student taking the test is classified into one of two categories, usually “passed” or “not passed” or “certified” or “not certified.” There is not set number of students who may be classified as certified or not certified. If all students achieve the preset criterion, all are certified. Items included on a criterion-referenced test are geared toward those students considered to be minimally competent to perform the job.

The items used on these two types of exams may differ. Norm referenced tests may require very difficult items (for example, when the purpose of the exam is to determine who will obtain a scholarship) or may cover a wide range of abilities (for example, a school placement test). Items included on a criterion-referenced test, on the other hand, are written to measure the knowledge required by a *minimally competent* individual. That is, an individual who possesses the minimal skills required to perform the job in an acceptable manner.

Introduction

Types of Items

There are two types of items to which a student may respond. The first is a selected response item (such as multiple choice, true-false, or matching). In this type of item, the student must select the best response to the problem posed.

The advantages of selected response items include

- ease of scoring.
- objective scoring.
- students can respond to a greater number of items in a given time than with constructed response items (see below).
- measurement of only the skills desired while constructed response items may also assess the student's writing ability.
- elimination of poorly performing items from the test with less loss of information than constructed response items.

The disadvantages of selected response items include that they are

- subject to guessing (this is particularly true of items that are not well written and of true-false items).
- more time-consuming to write.

The second type of item is a constructed response item (such as short answer, essay, or performance items). These items pose a problem and require the student to formulate their own response.

The advantages of constructed response items include

- reduced guessing.
- serving as a good measure of writing ability.
- ease of construction

Introduction

Types of Items (continued)

The disadvantages of constructed response items include that

- the scoring criteria are difficult to construct.
- scoring is difficult and time consuming.
- each item requires at least two scores per student.
- the items may be unreliable.
- it is difficult to delete poorly performing or unreliable items because too much information may be lost.
- the items are more time consuming to complete so that not as much information can be assessed.
- scoring bias is likely.

Determining the Appropriate Test and Item Types

Different types of items are intended to meet different testing needs. The writing of selected response items is more difficult than writing constructed response items. However, constructed response items are much more difficult to score. In choosing the mix of selected and constructed response items for inclusion in the item bank and on the exam, keep in mind the time required to write each type of item, the time the student has to respond to the test, and the amount of material you wish to cover on the test. For example, an exam composed of mostly constructed response items will be costly to administer (due to the need for at least two scorers to actually score the exam) and will measure less information than will a test composed mostly of selected response items.

Introduction

Blueprinting

One useful process for any test is the development of a blueprint. A blueprint determines how much weight is assigned to each Responsibility Area and to each Generic Qualification Standard. The more weight assigned to a particular Generic Qualification Standard, the more items will appear on the test to measure this standard. The weight assigned is based on the importance of that Generic Qualification Standard to the job, the frequency with which the Generic Qualification Standard is performed on the job, and the criticality of the Generic Qualification Standard to environmental and personnel health and safety. You have already completed the blueprinting process.

Cognitive Ability Levels

Levels of Cognition

When developing test items, it is important to measure the type of knowledge required on the job. In some instances, simple recall of knowledge will be necessary. In other instances, however, the ability to apply knowledge, synthesize several different bits of knowledge, and use this synthesis to make an analysis will be required. Thus, it is helpful to distinguish between different levels of cognition. Many learning theorists have proposed a taxonomy of cognition. Perhaps the most widely known and used, however, is Bloom's (1956) taxonomy. This taxonomy defines six levels of cognition:

- Knowledge – entails remembering previously learned materials (e.g., recalling a definition). The cognitive level is often referred to as recall.
- Comprehension – entails the ability to understand the meaning of material (e.g., explaining or summarizing a particular theory).
- Application – entails the ability to apply learned material in new and concrete situations (e.g., applying Ohm's law to determine voltage).
- Analysis – entails the ability to break down material into its component parts so its organizational structure can be understood (e.g., algebraic manipulation of a formula to solve for an unknown).
- Synthesis – entails the ability to put parts together to form a new whole (e.g., producing a report or research proposal).
- Evaluation – entails the ability to judge the value of material for a given purpose based on definite internal or external criteria (e.g., determining the type information necessary to include in a research proposal).

You should write items to the level specified in the Generic Qualification Standard. If the Generic Qualification Standard requires the student to recall a bit of information, such as a definition, any items used to measure this standard should reflect recall information only. If, on the other hand, the Generic Qualification Standard requires the student to apply some knowledge, items should be written at a higher cognitive level

Cognitive Ability Levels

Matching Item Type to Cognitive Level

Selected response items, particularly multiple choice items, can be used to measure higher-level cognitive ability. For example,

While walking your spaces as a DOE Facility Representative, you observe an operator carrying a tagout sheet checking the position of valves that are already tagged. He checks the position of a valve, closes the valve and continues checking the other valves listed on the sheet.

What should you do?

- a. Ask the operator to explain what he is doing.
- b. Assist the operator in any way you can.
- c. Determine if the operator is assigned to this duty.
- d. Tell the operator he should follow proper procedure.

This item presents a novel problem to the student and the student must choose the most appropriate action to address the problem presented.

Thus, if they are well written, multiple choice items are a good way to measure many of the Generic Qualification Standards, even those which require measurement at a high cognitive ability. For example,

List four items generally contained in Safety Analysis Reports.

This item requires simple recall of the items contained in Safety Analysis Reports.

Cognitive Ability Levels

**Matching Item Type to
Cognitive Level**
(continued)

Even some essay items may be simple recall. For example, Describe three levels of the defense-in-depth design philosophy of the DOE Nuclear Safety Plan.

While the answer to this item requires an answer of several paragraphs, it is written at the recall level. The student must only recall the three levels of the defense-in-depth design philosophy. This item could easily have been reworded to read:

List the three levels of the defense-in-depth design philosophy of the DOE Nuclear Safety Plan.

Given this wording, it is readily apparent that the item is written at the recall level.

As a general rule of thumb, ask yourself if the answer to an item can be memorized or not. Regardless of items type, if the answer to the item can be memorized, it is most likely written at the recall level. If the answer to the item cannot be memorized, it is most likely written at one of the higher cognitive levels.

General Guidelines for Writing Items

General Guidelines

There are some general guidelines for writing items you should follow regardless of the type of item you are writing or reviewing. These guidelines are:

- Be sure that each item tests important information, not a trivial fact.
- Use clear, unambiguous language.
- Keep vocabulary and sentence structure as simple as possible. It is not the purpose of this exam to test a student's reading ability or vocabulary.
- Use positive statements and avoid using negative words such as *except*, *no*, *not*, etc. This may cause unnecessary confusion and usually increases an item's difficulty.
- Be sure that the item is appropriate for measuring the Generic Qualification Standard it is being used to assess in terms of cognitive level.
- Be sure the item actually measures the Generic Qualification Standard it is purported to measure.
- Be sure that the content is accurate and up to date.

Some of these guidelines are repeated in the sections detailing tips for writing specific types of items along with examples.

Writing Multiple Choice Items

Multiple Choice Items

Multiple choice items require that a student select a correct answer from among several options that seem plausible. Most multiple choice items have two or three major sections: the stem that asks a question, and options that provide answers to the question. The correct answer is called a key, and the incorrect answers are called distracters. Some multiple choice items also provide a display such as a graph, chart, or scenario on which one or more questions are based. This is shown below.

While walking your spaces as a DOE Facility Representative, you observe an operator carrying a tagout sheet checking the position of valves that are already tagged. He checks the position of the valve, looks again at the tagout sheet and the tag on the valve, closes the valve and continues checking the other valves listed on the sheet.



Display

What should you do?



Stem

- a. Ask the operator to explain what he is doing.
- b. Assist the operator in any way you can.
- c. Determine if the operator is assigned to this duty.
- d. Tell the operator he should follow proper procedure.



Options

Writing Multiple Choice Items

Multiple Choice Items (continued)

As you progress through this text, you will notice that more time and space is devoted to writing multiple choice items than other item formats. This is not because this type of item is viewed as more desirable than the other item types. This is due simply to the fact that writing good multiple choice items is a difficult process and you must keep a variety of considerations in mind during the item writing process.

Multiple choice items can measure simple recall as well as more complex cognitive skills. In addition, they are less susceptible to guessing than true-false items. Thus, well-written multiple choice items are extremely versatile and useful. The guidelines and examples on the following pages indicate the characteristics of poorly written and well written multiple choice items.

Writing Multiple Choice Items

Tips for Writing Multiple Choice Items

The stem should form a complete thought or question. The student should be able to answer the question without looking at the options. A poor example and better example are shown below.

POOR: A controlled area

- a. is any area where access is controlled in order to protect people from exposure to radiation and radioactive materials.
- b. is any area where radioactive concentrations of more than ten percent of the derived air concentrations are present.
- c. is any area where surface contamination levels are greater than those specified in Attachment 2 of DOE Order 5480.11.
- d. is any area where an individual receives more than five mrem per hour whole body radiation exposure or contamination.

This item cannot be answered without looking at the options. The stem is not a complete thought or question. In addition, it has a number of other flaws covered later.

BETTER: A controlled area may be defined as any area where

- a. access is regulated in order to protect individuals from exposure to radiation and radioactive materials.
- b. airborne concentrations of more than ten percent of the derived air concentrations are present.
- c. an individual receives more than five mrem per hour whole body radiation exposure or contamination.
- d. surface contamination levels are greater than those specified in Attachment 2 of DOE Order 5480.11.

This item can now be answered without looking at the options. The stem is a complete thought. In addition, the other flaws have been corrected.

Writing Multiple Choice Items

Tips for Writing Multiple Choice Items (continued)

Avoid KLANGS (also called alliterating associations). This occurs when words in the stem are repeated in one or more of the options (but not all of the options) and may provide a clue to the correct answer. If you must have a KLANG, repeat the word in all options rather than just one. This is the “all or none” rule of KLANGS.

POOR: A controlled area

- a. is any area where access is controlled in order to protect people from exposure to radiation and radioactive materials.
- b. is any area where radioactive concentrations of more than ten percent of the derived air concentrations are present.
- c. is any area where surface contamination levels are greater than those specified in Attachment 2 of DOE Order 5480.11.
- d. is any area where an individual receives more than five mrem per hour whole body radiation exposure or contamination.

This item contains a KLANG in the correct answer (option a.). The stem consists of “A controlled area” and the correct answer reads “any area where access is controlled in order to protect people from exposure to radiation and radioactive materials.” Thus, the phrase “controlled area” is a KLANG.

Writing Multiple Choice Items

**Tips for Writing
Multiple Choice Items**
(continued)

BETTER: A controlled area may be defined as any area where

- a. access is regulated in order to protect individuals from exposure to radiation and radioactive materials.
- b. airborne concentrations of more than ten percent of the derived air concentrations are present.
- c. an individual receives more than five mrem per hour whole body radiation exposure or contamination.
- d. surface contamination levels are greater than those specified in Attachment 2 of DOE Order 5480.11.

This item removes the KLANG by substituting “access is regulated” for “access is controlled.” The word “area” is no longer repeated in the answer since it is now contained as part of the stem. Removing KLANGS often involves substituting a synonym for the word(s) involved.

Writing Multiple Choice Items

Tips for Writing Multiple Choice Items (continued)

Avoid length clues. All options should be about the same length and specificity.

- POOR: The purpose of wearing heavy gauntlets when welding is to
- a. avoid a reprimand from your supervisor.
 - b. keep your hands cool.
 - c. prevent electric shocks.
 - d. prevent your hands from being burned by sparks of flying metal particles.

The correct answer (option d.) is much longer and more specific than the other options.

- BETTER: The purpose of wearing heavy gauntlets when welding is to
- a. avoid a reprimand from your supervisor.
 - b. keep your hands cool.
 - c. prevent electric shocks.
 - d. prevent burns to your hands.

The options are now much more similar in length and specificity.

Writing Multiple Choice Items

**Tips for Writing
Multiple Choice Items**
(continued)

Avoid grammatical clues. Be sure all options are grammatically parallel.

- POOR: An instrument used to measure electromotive force is a
- a. ammeter.
 - b. ohmmeter.
 - c. voltmeter.

The correct answer (option c.) is the only option that completes the sentence begun in the stem in a grammatically correct manner since it is grammatically incorrect to refer to “a ammeter.”

- BETTER: Which instrument is used to measure electromotive force?
- a. Ammeter
 - b. Ohmmeter
 - c. Voltmeter

This problem was corrected by rephrasing the stem into the form of a complete question.

Writing Multiple Choice Items

Tips for Writing Multiple Choice Items (continued)

Avoid redundant reading in items. Put as much information in the stem as possible.

- POOR: A controlled area
- a. is any area where access is controlled in order to protect people from exposure to radiation and radioactive materials.
 - b. is any area where radioactive concentrations of more than ten percent of the derived air concentrations are present.
 - c. is any area where surface contamination levels are greater than those specified in Attachment 2 of DOE Order 5480.11.
 - d. is any area where an individual receives more than five mrem per hour whole body radiation exposure or contamination.

The phrase “is any area where” is repeated in each of the four options. By placing this in the stem, unnecessary time spent reading is eliminated.

- BETTER: A controlled area may be defined as any area where
- a. access is regulated in order to protect individuals from exposure to radiation and radioactive materials.
 - b. airborne concentrations of more than ten percent of the derived air concentrations are present.
 - c. an individual receives more than five mrem per hour whole body radiation exposure or contamination.
 - d. surface contamination levels are greater than those specified in Attachment 2 of DOE Order 5480.11.

This item avoids unnecessary reading by placing as much information as possible in the stem. A more extreme example is shown on the next page.

Writing Multiple Choice Items

**Tips for Writing
Multiple Choice Items**
(continued)

- POOR:** Good corn selection is best accomplished by
- a. shucking and planting those seeds from the least populated stalks.
 - b. shucking and planting those seeds from the tallest stalks.
 - c. shucking and planting those seeds from the most populated stalks.
 - d. shucking and planting those seeds from the shortest stalks.

The phrase “shucking and planting those seeds from the” is repeated in each of the four options. By placing this in the stem, unnecessary time spent reading is eliminated.

- BETTER:** Good corn selection can be accomplished by shucking and planting the seeds from the
- a. least populated stalks.
 - b. most populated stalks.
 - c. shortest stalks.
 - d. tallest stalks.

This item avoids unnecessary reading by placing as much information as possible in the stem.

Writing Multiple Choice Items

Tips for Writing Multiple Choice Items (continued)

Arrange options in a logical order, such as numerical or alphabetic. This is logical to the student taking the test and helps avoid using one option as the correct answer more often than another distracter (for example, many item writers have a “c” bias, and tend to make “c” the correct option more often than any other option).

POOR: Which metal is usually die cast?

- a. Steel
- b. Copper
- c. Titanium
- d. Iron

The options are not given in any particular order.

BETTER: Which metal is usually die cast?

- a. Copper
- b. Iron
- c. Steel
- d. Titanium

The options are in alphabetical order. Another example, using numerical order, is provided on the next page.

Writing Multiple Choice Items

Tips for Writing Multiple Choice Items (continued)

POOR:

If applied voltage is 12 volts and the circuit current is 2 amps, use Ohm's law to find the resistance.

- a. 6Ω
- b. 24Ω
- c. $.17\Omega$
- d. 14Ω

The options are not given in any particular order. Notice this item tests at a higher level than simple recall. Not only does the student need to know Ohm's law, the student must use an algebraic manipulation of Ohm's law since the law is given in a form that solves for voltage. In this problem, voltage is known and the student must find the resistance. To determine resistance, the student must algebraically manipulate the formula.

BETTER:

If the applied voltage is 12 volts and the circuit current is 2 amps, use Ohm's law to find the resistance.

- a. $.17\Omega$
- b. 6Ω
- c. 14Ω
- d. 24Ω

The options are now in numerical order.

Writing Multiple Choice Items

Tips for Writing Multiple Choice Items (continued)

Avoid negatives. Negatively stated items are usually more difficult than positively stated ones (this is called spurious difficulty). In addition, they can be confusing, and in many cases “double negatives” are involved. A double negative occurs when there is a negative in the stem and in one or more of the options. This tip applies to all types of items, not just multiple choice.

POOR: Which metal is not die cast?

- a. Aluminum
- b. Magnesium
- c. Steel
- d. Zinc

This item is negative. Many students will “read over” the NOT and answer in the positive as if the item read “Which metal is die cast?”

BETTER: The metal usually die cast is

- a. copper
- b. iron
- c. steel
- d. titanium

This item is now positively stated. Note that some manipulation of the options may be necessary if you change an item from negative to positive. Do not write items in which you list two or three characteristics and ask what is NOT a characteristic. Use only one true characteristic and two or three characteristics that are NOT true.

Writing Multiple Choice Items

Tips for Writing Multiple Choice Items (continued)

POOR:

Estimated safe and adequate intakes are given in ranges for all of the following nutrients except:

- a. biotin
- b. pantothenic acid
- c. chromium
- d. potassium
- e. copper

This item is also negative. It is one of the items which lists three things that are true and asks the student to determine which thing is NOT true.

BETTER:

For which of the following nutrients do guidelines provide estimated safe and adequate intakes in ranges?

- a. Calcium
- b. Iron
- c. Phosphorus
- d. Potassium
- e. Zinc

The item is now positively stated. Note the manipulation of the options.

Writing Multiple Choice Items

Tips for Writing Multiple Choice Items (continued)

POOR:

The FAO/WHO RDA recommendations would not be appropriate for people in the U.S. for all of the following reasons except:

- a. the protein intake would be too high.
- b. recommendations are based on different body sizes.
- c. recommendations are based on different levels of physical activity.
- d. the food supply and nutrients provided are totally different.

This item is a double negative. It is worded such that the student must read the item several times to determine what is being asked.

BETTER:

The FAO/WHO recommendations for nutrients are inappropriate for people in the U.S. because these recommendations are based on different

- a. age categories.
- b. caloric needs.
- c. foods consumed.
- d. levels of physical activity.

The item is now positively stated.

Writing Multiple Choice Items

Tips for Writing Multiple Choice Items (continued)

Use language and a reading level as simple and direct as possible.

POOR: The promiscuous use of sprays, oils, and antiseptics in the nose while suffering acute colds is pernicious practice because it may have a deleterious effect on the

- a. olfactory nerve.
- b. red blood cells.
- c. sinuses.
- d. white blood cells.

The vocabulary use in this item could be simplified and still measure the same information. Remember, the purpose of this test is NOT to determine the candidate's vocabulary.

BETTER: Frequent use of sprays, oils, and antiseptics during colds may result in

- a. damaging the olfactory nerve.
- b. destroying the white blood cells.
- c. inhibiting production of red blood cells.
- d. spreading the infection to the sinuses.

This item is easier to read and understand and measures the same information.

Writing Multiple Choice Items

Tips for Writing Multiple Choice Items (continued) Be sure all options are parallel in tense.

POOR: Frequent use of sprays, oils, and antiseptics during colds may result in

- a. damage to the olfactory nerve.
- b. destruction of white blood cells.
- c. inhibiting production of red blood cells.
- d. spreading the infection to the sinuses.

BETTER: Frequent use of sprays, oils, and antiseptics during colds may result in

- a. damaging the olfactory nerve.
- b. destroying the white blood cells.
- c. inhibiting production of red blood cells.
- d. spreading the infection to the sinuses.

The verbs used to introduce the option phrases are now parallel in tense.

Writing Multiple Choice Items

Tips for Writing Multiple Choice Items (continued) Be sure all options are parallel in concept or structure.

POOR: Which type of alarm is most reliable for indicating personnel contamination?

- a. Half-body monitor
- b. Hand-held frisker
- c. Ohmmeter

An ohmmeter is not an instrument used to measure contamination from radiation. Thus, it is not parallel in concept.

BETTER: Which type of alarm is most reliable for indicating personnel contamination?

- a. Dosimeter
- b. Half-body monitor
- c. Hand-held frisker

All the options are now instruments that measure contamination and are parallel in concept.

Writing Multiple Choice Items

Tips for Writing Multiple Choice Items (continued)

Avoid “sore thumb” options.

POOR: Which of the following are categories of reportable occurrences?

- a. Emergencies, normal occurrences, and off-normal occurrences
- b. Emergencies, unusual occurrences, and normal occurrences
- c. Emergencies, unusual occurrences, and off-normal occurrences
- d. Unusual occurrences, normal occurrences, and off-normal occurrences

Option “d.” is different from options “a.”, “b.”, and “c.” It sticks out like a “sore thumb,” hence the name. Sore thumb options may or may not be parallel in structure with other options. In this example, the sore thumb is, indeed, parallel with the other options.

BETTER: Which of the following are categories of reportable occurrences?

- a. Emergencies, normal occurrences, and off-normal occurrences
- b. Emergencies, unusual occurrences, and normal occurrences
- c. Unusual occurrences, normal occurrences, and off-normal occurrences
- d. Unusual occurrences, normal occurrences, and off-normal occurrences

The options are more balanced now, with two options beginning with “emergencies” and two beginning with “unusual occurrences.”

Writing Multiple Choice Items

Tips for Writing Multiple Choice Items (continued)

Be sure all options answer the question posed by the stem.

POOR: The computer language most often used in business applications is

- a. COBOL.
- b. FORTRAN.
- c. Chinese.
- d. German.

Chinese and German are not computer languages. They do not answer the question posed in the stem. In addition, they are not conceptually the same as COBOL and FORTRAN.

BETTER: The computer languages most often used in business applications is

- a. ADA.
- b. BASIC.
- c. COBOL.
- d. FORTRAN.

All the options are now computer languages and answer the question posed in the stem. In addition, they are all now parallel in concept. Options that answer the question posed in the stem will **USUALLY** be parallel in concept. However, there are exceptions; make sure to check for this as you write and review items.

Writing Multiple Choice Items

Tips for Writing Multiple Choice Items (continued) Choose distracters that are attractive to unprepared students. Common errors are good choices.

POOR: Subtract:
 8,043
 -5,754

 a. 2,288
 b. 2,289
 c. 2,387
 d. 3,378

The distracters are simply random numbers.

BETTER: Subtract:
 8,043
 -5,754

 a. 2,289
 b. 2,389
 c. 3,399
 d. 3,711

The distracters consist of numbers that would result from common subtraction errors such as failure to decrease digits borrowed from, failure to change the “0” to a “9”, and subtracting the wrong way.

Writing Multiple Choice Items

Tips for Writing Multiple Choice Items (continued) Options should flow logically from the stem.

POOR: You are preparing to enter a radiation area that contains a single point source of radiation. The survey map of the area shows a reading of 10 mR/hr due to gamma radiation at a distance of four feet from the radiation source. You plan to perform a surveillance of work being done at a distance of ten feet from the source.

What can you do to remain in the area for two hours without exceeding a dose of 25 mrem?

- a. Ask for permission to stay.
- b. Get your supervisor to do the work.
- c. Use shielding if available.

The first two options don't seem to be a logical response. Note that this tip is close to several others, making sure options answer the item and making distracters attractive to unprepared students. Options that do NOT flow logically from the stem are usually not attractive to any student and may not answer the item.

Writing Multiple Choice Items

Tips for Writing Multiple Choice Items (continued)

BETTER:

You are preparing to enter a radiation area that contains a single point source of radiation. The survey map of the area shows a reading of 10 mR/hr due to gamma radiation at a distance of four feet from the radiation source. You plan to perform a surveillance of work being done at a distance of ten feet from the source.

What can you do to remain in the area for two hours without exceeding a dose of 25 mrem?

- a. Monitor your exposure with a hand-held frisker.
- b. Use whatever shielding is available in the area.
- c. Work with others in one-hour shifts.

All of the options in the example on the previous page seem to flow more logically from the stem and may be attractive to unprepared students.

Writing Multiple Choice Items

Tips for Writing Multiple Choice Items (continued) Avoid asking trivia. Ask about information that is pertinent and important.

POOR: Approximately how many teens in the United States are killed each year in automobile accidents?

- a. 10,000
- b. 25,000
- c. 50,000
- d. 75,000

This may be an interesting statistics to know and may serve some purpose, such as providing evidence that many teens are killed yearly in auto accidents. But for most purposes, it is most likely not important for an individual to know approximately how many teens are killed in auto accidents.

BETTER: The major cause of death among teens in the United States each year is

- a. automobile accidents.
- b. cancer.
- c. heart disease.
- d. suicide.

For most purposes, it is more important to know the major cause of something rather than approximately how many are affected.

Writing Multiple Choice Items

Tips for Writing Multiple Choice Items (continued) Be sure the content is accurate and up-to-date.

POOR: What is the most advanced music technology currently on the market?

- a. 45 rpm records
- b. 78 rpm records
- c. 8 track tapes
- d. Cassette tapes

The most advanced music technology currently on the market (compact disks) is not listed among the options. Thus, this item is dated.

BETTER: What is the most advanced music technology currently on the market?

- a. 8 track tapes
- b. 33 1/3 rpm records
- c. Cassette tapes
- d. Compact disks

The latest technology is now represented among the options.

Writing Multiple Choice Items

Tips for Writing Multiple Choice Items (continued)

Avoid using absolutes (such as *all*, *always* or *never*).

POOR: Minor discrepancies in a written procedure and the performance of a task are

- a. acceptable if the intent of the procedure is unchanged.
- b. always to be expected.
- c. never acceptable.

The student can usually rule out options that contain absolutes immediately because they are almost never the correct answer. Also note that these options are often shorter than the other options.

BETTER: Minor discrepancies in a written procedure and the performance of a task may be acceptable if the

- a. intent of the procedure remains the same.
- b. intent of the procedure is changed.
- c. procedure is obviously out of date.
- d. procedure is still in draft form.

Note that the absolutes have been removed and that this item follows the “all or none” rule for KLANGS.

Another example, with the absolute contained in the stem, is provided on the next page.

Writing Multiple Choice Items

Tips for Writing Multiple Choice Items (continued)

POOR:

Which of the following is characteristic of all plants?

- a. They are multicellular.
- b. They bear seeds.
- c. They contain nonwoody stems.
- d. They produce chlorophyll.

In this example, the absolute (all) is in the stem, and there is no correct answer to this item.

BETTER:

Which of the following is characteristic of green plants?

- a. They are multicellular.
- b. They bear seeds.
- c. They contain nonwoody stems.
- d. They produce chlorophyll.

In this example, the absolute has been eliminated from the stem, and the item now has a correct answer.

Writing Multiple Choice Items

Tips for Writing Multiple Choice Items (continued) Avoid teaching on the test. This results in testing time being taken up by instruction. If the information is important enough for the student to know, it should be communicated during instruction rather than on the exam.

- POOR: DOE Order 5480.11 divides areas with radioactivity, or elevated radiation levels, into two major groups: controlled areas and radiological areas. A controlled area is one where
- a. access is regulated in order to protect individuals from exposure to radiation and radioactive materials.
 - b. airborne concentrations of more than ten percent of the derived air concentrations are present.
 - c. an individual receives more than five mrem per hour whole body radiation exposure or contamination.
 - d. surface contamination levels are greater than those specified in Attachment 2 of DOE Order 5480.11.

The first sentence is irrelevant to answering the item and attempts to teach the student something while the student something while the student is taking the exam.

Also notice the KLANG in option “d”.

Writing Multiple Choice Items

Tips for Writing Multiple Choice Items (continued)

BETTER:

A controlled area is defined as one where

- a. access is regulated in order to protect individuals from exposure to radiation and radioactive materials.
- b. airborne concentrations of more than ten percent of the derived air concentrations are present.
- c. an individual receives more than five mrem per hour whole body radiation exposure or contamination.
- d. surface contamination levels are greater than those specified in Attachment 2 of DOE Order 5480.11.

This item is somewhat shorter because it does not attempt to teach new information. The KLANG is also avoided.

Writing Multiple Choice Items

Tips for Writing Multiple Choice Items (continued) Avoid unnecessary information in the stem.

POOR: While walking your spaces at your facility, you notice a worker working with a circuit. As you approach the worker, you notice that he is in a high voltage area. If the current of the circuit is 2A and the resistance is 240Ω , what is the voltage the worker is working with?

- a. 120V
- b. 220V
- c. 480V
- d. 57600V

This item contains information that is not germane to the question to be answered. Unless the purpose of the item is to determine if the student can deduce which information is pertinent, unnecessary information wastes testing time and confuses students.

BETTER: If the current of a circuit is 2A and the resistance is 240Ω , what is the voltage of the circuit?

- a. 120V
- b. 220V
- c. 480V
- d. 57600V

This item is shorter because the unnecessary information has been deleted.

Writing Multiple Choice Items

Tips for Writing Multiple Choice Items (continued)

Avoid “hang-on” options such as “all of the above” or “none of the above.” In most cases “all of the above” will be the correct answer, and “none of the above” will be an incorrect response. Avoid providing more than one correct answer and tacking “all of the above” on at the end.

POOR: Which instrument is used to find the mid-point of an 11-inch iron rod?

- a. A protractor
- b. A straightedge
- c. Calipers
- d. All of the above
- e. None of the above
- f. a and c only

This item contains three hang-on options that simply waste the student’s testing time. These should be eliminated.

BETTER: Which instrument is used to find the midpoint of an 11-inch iron rod?

- a. A protractor
- b. A straightedge
- c. Calipers

This item is shorter because the hang-ons have been deleted. Another example is on the next page.

Writing Multiple Choice Items

Tips for Writing Multiple Choice Items (continued)

POOR:

You are preparing to enter a radiation area that contains a single point source of radiation. The survey map indicates a reading of 100 mR/hr due to gamma radiation at a distance of four feet from the radiation source. You plan to perform a surveillance of work being done at a distance of ten feet from the source. What can you do to remain in the vicinity for two hours without exceeding a dose of 25 mrem?

- a. Stand as far from the source as possible.
- b. Temporarily leave the area when no activity is expected.
- c. Use shielding such as walls or large equipment that is available.
- d. All of the above

This item contains four correct answers.

BETTER:

You are preparing to enter a radiation area that contains a single point source of radiation. The survey map indicates a reading of 100 mR/hr due to gamma radiation at a distance of four feet from the radiation source. You plan to perform a surveillance of work being done at a distance of ten feet from the source. What can you do to remain in the vicinity for two hours without exceeding a dose of 25 mrem?

- a. Ask permission from an HP to stay in the area.
- b. Monitor your exposure before leaving the area.
- c. Use whatever shielding is available in the area.

This option has only one best answer (option c.).

Writing Multiple Choice Items

Tips for Writing Multiple Choice Items (continued) If the stem contains a blank, place it near the end of the sentence.

POOR: _____ radiation confirms the presence of Rn-222.

- a. Alpha
- b. Beta
- c. Gamma

The blank at the beginning of the stem is confusing and difficult to read.

BETTER: The presence of Rn-222 can be confirmed by the presence of _____ radiation.

- a. alpha
- b. beta
- c. gamma

The blank has been moved to the end of the stem and is easier to read. Note that this could easily be a short-answer item.

Writing Multiple Choice Items

Tips for Writing Multiple Choice Items (continued)

Avoid using one pair of opposites as distracters.

POOR: Minor discrepancies in a written procedure and the performance of a task is

- a. acceptable.
- b. acceptable if the intent of the procedure is unchanged.
- c. acceptable if the procedure is still in draft form.
- d. unacceptable.

This item contains one pair of opposites (acceptable and unacceptable). If opposites are used, there should be two pair. Also notice that there is a **KLANG** in options b. and c. The rule for **KLANGS** is “all or none”—all of the options should contain the **KLANG** or none of the options should contain the **KLANG**. Also note that the stem is not complete.

BETTER: Minor discrepancies in a written procedure and the performance of a task may be acceptable if the

- a. intent of the procedure remains the same.
- b. intent of the procedure is changed.
- c. procedure is obviously out of date.
- d. procedure is still in draft form.

The pair of opposites have been replaced. Another example is provided on the next page.

Writing Multiple Choice Items

Tips for Writing Multiple Choice Items (continued)

POOR:

Documents which may be disposed of WITHOUT archival authority are called

- a. active records.
- b. permanent records
- c. nonrecord material.
- d. record material.

This item contains one pair of opposites (record material and nonrecord material). If opposites are used, there should be two pair.

BETTER: Documents which may be disposed of WITHOUT archival authority are called

- a. active records.
- b. inactive records
- c. nonrecord material.
- d. record material.

The options now consist of two pairs of opposites (active and inactive records and nonrecord and record material).

Writing Multiple Choice Items

Tips for Writing Multiple Choice Items (continued) Use vertical format for mathematical items.

POOR: Add $272 + 486 + 977$.

- a. 775
- b. 1525
- c. 1635
- d. 1735

Use of horizontal format makes the item more difficult.

BETTER: Add:
272
486
977.

- a. 775
- b. 1525
- c. 1635
- d. 1735

The numbers to be added have been placed in vertical format, making the item easier to read.

Writing Multiple Choice Items

Tips for Writing Multiple Choice Items (continued)

Avoid numerical overlap among distracters.

POOR: Several drums containing radioactive liquid are being temporarily stored in your facility. A survey map of the area indicates seven R/hr at a distance of three feet from the drums.

How far away should you stand from the drums to avoid dangerous exposure?

- a. 3-5 feet
- b. 4-6 feet
- c. 5-7 feet
- d. 6-10 feet

POOR: Several drums containing radioactive liquid are being temporarily stored in your facility. A survey map of the area indicates seven R/hr at a distance of three feet from the drums.

How far away should you stand from the drums to avoid dangerous exposure?

- a. More than 2 feet
- b. More than 3 feet
- c. More than 4 feet
- d. More than 6 feet

Both of these items allow numeric overlap among the distracters. In the first example, if one should stand, say, 4 feet, both a. and b. will be correct answers. In the second example, if one stands more than six feet away, one is also standing more than two, three, and four feet away. Thus, there is numeric overlap among the options.

Writing Multiple Choice Items

Tips for Writing Multiple Choice Items (continued)

BETTER: Several drums containing radioactive liquid are being temporarily stored in your facility. A survey map of the area indicates seven R/hr at a distance of three feet from the drums.

How far away should you stand from the drums to avoid dangerous exposure?

- a. 5 feet
- b. 10 feet
- c. 15 feet
- d. 20 feet

BETTER: Several drums containing radioactive liquid are being temporarily stored in your facility. A survey map of the area indicates seven R/hr at a distance of three feet from the drums.

To avoid dangerous exposure, you should stand at LEAST _____ feet away from the drums.

- a. 2
- b. 3
- c. 4
- d. 6

The numerical overlap has been eliminated. Notice that in many cases, there may be several methods available to eliminate the problem(s) observed in an item.

Writing Multiple Choice Items

Tips for Writing Multiple Choice Items (continued) The item should have one, and only one, correct answer. In addition, content experts should be able to agree on the correct answer.

POOR: The movement of free electrons through a conductor is called

- a. amperage.
- b. current.
- c. resistance.
- d. voltage.

There are two correct answers to this item (amperage and current).

BETTER: The movement of free electrons through a conductor is called

- a. amperage.
- b. power.
- c. resistance.
- d. voltage.

There is only one correct answer for this item now.

Writing Multiple Choice Items

Tips for Writing Multiple Choice Items (continued) The items should be independent. That is, the student's response to one item should NOT depend on her or his answer to a previous item.

POOR: Find the mean of the following ohmmeter readings:

15	12
16	14
18	17
22	19

- a. 4.5
- b. 16.605
- c. 33.25
- d. 133

What is the standard deviation?

- a. 2.449
- b. 3.114
- c. 6.000
- d. 9.696

The second item (What is the standard deviation?) is dependent on the first item because one must know the mean to calculate the standard deviation. Thus, if the student got the first item incorrect, they CANNOT get the second item correct.

Writing Multiple Choice Items

**Tips for Writing Multiple
Choice Items** (continued)

BETTER:

Find the standard deviation of the following
ohmmeter readings:

10	21
12	16
19	15
20	11

- a. 4.243
- b. 11.000
- c. 15.500
- d. 18.003

This item is now independent and can stand alone.

Writing Multiple Choice Items

Tips for Writing Multiple Choice Items (continued) Avoid giving an answer to one item in another item.

POOR: Find the mean of the following ohmmeter readings:

15	12
16	14
18	17
22	19

- a. 4.5
- b. 16.605
- c. 33.25
- d. 133

If the mean is 16.605, what is the standard deviation?

- a. 2.449
- b. 3.114
- c. 6.000
- d. 9.696

The second item is now independent, but it provides the answer to the first item—it gives the mean.

BETTER: Find the standard deviation of the following ohmmeter readings:

10	21
12	16
19	15
20	11

- a. 4.243
- b. 11.000
- c. 15.500
- d. 18.003

This item is now independent and can stand alone. In addition, it does not provide the answer to the first item.

Writing Multiple Choice Items

Tips for Writing Multiple Choice Items (continued) Avoid giving a clue to the answer to another item.

POOR: All of the following nutrients are organic except:

- a. minerals
- b. fats
- c. vitamins
- d. protein

Since vitamins are organic, we know that they:

- a. are not sensitive to heat and light
- b. can be destroyed by chemical and physical agents
- c. yield energy the body can use
- d. are the same as carbohydrate, protein, and fat

The second item provides a clue to the answer to the first item—it states that vitamins are organic. Thus, the student can rule out vitamins as a correct answer to the first item. Also notice that both of these items contain a variety of other problems.

Writing Multiple Choice Items

**Tips for Writing Multiple
Choice Items** (continued)

BETTER:

Which nutrients are organic?

- a. Minerals
- b. Vitamins
- c. Water

Which of the following is a property of organic nutrients?

- a. They are insensitive to temperature extremes and light.
- b. They can be destroyed by chemical and physical agents.
- c. They may lose carbon atoms during processing.

The second item no longer provides a clue to the answer to the first item. In addition, the additional problems found in the items (such as a negative) have been corrected.

Writing Multiple Choice Items

Tips for Writing Multiple Choice Items (continued)

Avoid writing items that measure the same information in several different ways. In other words, avoid simple rewording of items.

POOR: One item contained in a Safety Analysis Report is a description of the

- a. design basis.
- b. engineering features.
- c. equipment used.
- d. procedures followed.

One item necessary to establish the safety of a facility that is contained in a typical Safety Analysis Report includes a description of the

- a. design basis.
- b. engineering features.
- c. equipment used.
- d. procedures followed.

The second item is simply a rewording of the information already measured in the first item.

Writing Multiple Choice Items

Tips for Writing Multiple Choice Items (continued)

BETTER:

One of the items contained in a Safety Analysis Report includes a description of the

- a. design basis.
- b. engineering features.
- c. equipment used.
- d. procedures followed.

One of the items contained in a Safety Analysis Report includes a

- a. contamination analysis.
- b. security analysis.
- c. site assessment.
- d. survey map.

The two items measure different aspects of the same concept (the items contained in a Safety Analysis Report) rather than a simple rewording of items to measure the same aspect of the concept.

Writing Multiple Choice Items

Tips for Writing Multiple Choice Items (continued) Avoid writing items that are mirror images of one another.

POOR: Which law/regulation concerns waste sites abandoned or no longer operating prior to November, 1980?

- a. CERCLA
- b. NEPA
- c. RCRA
- d. SARA

What type of activities does the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) address?

- a. Abandoned waste site identification and cleanup
- b. Landfill operations
- c. Waste management and tracking
- d. Worker safety and training

The second item is a mirror image of the first item because it takes the correct answer to the first item, puts it in the stem, and then uses a revision of the first item's stem as the correct answer. Also notice the length clue.

Writing Multiple Choice Items

Tips for Writing Multiple Choice Items (continued)

BETTER:

Which law/regulation concerns waste sites abandoned or no longer operating prior to November, 1980?

- a. CERCLA
- b. NEPA
- c. RCRA
- d. SARA

Which law/regulation concerns cleaning up of hazardous waste dump sites?

- a. CERCLA
- b. NEPA
- c. RCRA
- d. SARA

The items now measure different laws.

Writing Multiple Choice Items

Additional Tips for Writing Multiple Choice Items

- Make certain that the item actually measures the skill to be assessed.
- Avoid asking for an opinion.
- Avoid bias and stereotyping.
- Avoid trick questions.
- If the question or material is controversial, cite an authority or theory.
- Use novel material in formulating problems to measure higher-level cognitive ability (e.g. application, analysis, synthesis, or evaluation) if called for by the Generic Qualification Standard.
- Avoid highly technical distracters if they are not necessary. The distracters should be parallel in technical difficulty with the correct answer.
- Do not write a series of true-false statements as a multiple choice item. Write a stem so that it asks a question or states a problem.
- There should be no clear-cut pattern of correct responses. You can usually avoid this by simply placing options in a logical order.

Writing Multiple Choice Items

Summary of Tips for Writing Multiple Choice Items

In General

- the language and reading level is as simple as possible
- the “all or none” rule for KLANGS is followed
- the item measures important content, not trivia
- the content is up to date and accurate
- absolutes are avoided
- bias and stereotyping are avoided
- the item measures the Generic Qualification Standard to which it is documented
- all items are independent
- one item does not provide the answer to or clues to the answer for another item
- there are no trick questions
- if material is controversial, a theory or authority is cited
- items are not a series of true-false items
- there is no clear-cut pattern of correct responses
- do not write items that measure the same information in several different ways
- avoid writing items that are mirror images of one another

The stem

- forms a complete thought or question
- provides as much information as possible, reducing redundant reading in the options
- avoids negatives, double negatives, and except
- avoids grammatical clues
- avoids teaching
- does not contain unnecessary information
- provides blanks near the end of the sentence
- does not ask for an opinion
- uses novel material when measuring higher-level cognitive skills

Writing Multiple Choice Items

Summary of Tips for Writing Multiple Choice Items (continued)

The Options

- do not contain “hang-ons”
- do not contain a “sore thumb”
- are grammatically parallel
- are parallel in concept
- are parallel in tense
- are parallel in technology or difficulty
- are parallel in length
- answer the question posed by the stem
- flow logically from the stem
- are arranged in a logical order
- do not contain one pair of opposites
- are in vertical format
- do not allow numerical overlap

The correct answer

- is the one, and only one, correct answer

The distracters

- are attractive to unprepared students

Writing Matching Items

Matching Items

Matching items may be used to measure recall as well as more complex applications. The student's task is to match words or phrases with definitions, events, places, rules, or concepts.

Tips for Writing Matching Items

State clearly in the directions how the matching should be done. If items in a list may be used more than once, state this explicitly in the directions.

POOR: Match the following:

These directions are very general and do not clearly indicate the student's task.

BETTER: Match each term listed on the left with the correct definition on the right by writing the letter of the term next to the correct definition. Some terms may be used more than once, and some may not be used at all.

These directions provide a better indication of the student's task.

Writing Matching Items

Tips for Writing Matching Items (continued)

Make each list homogeneous. Each list should contain words or phrases similar in type or form. This is easiest to accomplish if each list is titled such as:

<u>Instrument</u>	<u>Use</u>
a. ammeter _____	1. measures conductance
b. dosimeter _____	2. measures resistance
c. ohmmeter _____	3. measures voltage
d. voltmeter	

Note that the terms on the left are instruments for measuring things while the phrases on the right are the items measured.

- Keep lists short—ten items or less per list.
- The lists should NOT be the same length. The response list is usually longer. This prevents the student from being able to answer correctly by the process of elimination.
- Arrange lists in a logical order, if one exists. This order may be alphabetic, numeric, or some other logical ordering.
- Make sure that all the options are plausible distracters for each description.
- The description list should contain the longer phrases while the options should consist of short phrases, words, or symbols.
- Each description in the list should be numbered, and the list of options should be identified by a letter.

Writing Matching Items

Summary of Tips for Writing Matching Items

The directions

- should state clearly how the matching should be done.
- should state explicitly if items may be used more than once.

The lists

- should be homogeneous.
- should be short—ten items or less per list.
- should NOT be of the same length. The response list is usually longer.
- should be arranged in a logical order, if one exists.
- should contain plausible distracters for each description.
- should provide longer phrases in the description list while the options should consist of short phrases, words, or symbols.
- should provide numbers for each description in the description list, and the list of options should be identified by a letter.

Writing True-False Items

True-False Items

True-false items seem to be fairly easy to write. This is not the case, however. Unambiguous true-false items are extremely difficult to write. In addition, they are susceptible to guessing—that is, the student is able to answer the item correctly by guessing the correct answer. In fact, the student can randomly guess the correct answer 50 percent of the time. In addition, many item writers tend to have a bias toward making items predominately true while others tend to make items predominately false. It is best to avoid using true-false items, if possible.

Writing Short Answer Items

Constructed Response Items

Constructed response items include short answer, essay, oral, and performance tests. This guideline will address short answer and essay items. The distinction between short answer and essay is often blurry and not easily determined. What some will classify as short answers, others may classify as essay.

Short Answer Items

Short answer items require a response ranging from a word or two to a complete sentence. So-called “fill in the blank” items are an example. The next few pages provide tips for writing good short answer items.

Writing Short Answer Items

Tips for Writing Short Answer Items

Include specific directions for the student to follow. For example, is a complete sentence required, or will a few words be sufficient? Where should the student record her/his answer? These are simple considerations, but they are important because they will let the student know what is expected and how to respond. They will also make scoring easier by ensuring each student has responded in a uniform method and in the same place (so that the scorer does not have to “search” for the student’s response).

POOR: List some desirable characteristics of oral communication between operators in your facility.

These directions are very general and do not clearly indicate the student’s task. For example, the student does not know how many characteristics to list or where to record her/his answer.

BETTER: List five desirable characteristics of oral communication between operators in your facility. You should list only the word or phrases needed to describe each characteristic. Place your answer on the blank lines below.

These directions let the student know exactly how many characteristics he/she must list, that words or phrases are sufficient, and where he/she should provide the answers.

Writing Short Answer Items

Tips for Writing Short Answer Items (continued)

- Use standard-length blanks to avoid giving clues as to the length of correct answer.
- Word the item so that it is unambiguous and is as precise as possible.

POOR: The declaration of Independence was approved in _____.

What response is expected from the student? Should he/she indicate the date that the Declaration of Independence was adopted or the city in which it was adopted?

BETTER: The Declaration of Independence was approved in the year _____.

Now the student knows the response expected.

- Avoid so-called “Swiss cheese items.” These items contain a lot of blanks and can be impossible to answer. Leave blanks for only key words or phrases.

POOR: The best way to _____ is to _____ after _____.

The student cannot answer this item unless he/she possesses psychic abilities.

BETTER: The best way to prevent cavities is to brush your teeth after _____.

Now the student knows the response expected.

Writing Short Answer Items

Tips for Writing Short Answer Items (continued)

- Place the blank near the end of the statement, if possible. This makes responding more consistent and makes scoring easier.
- Do not use exact quotations from a textbook. This encourages rote learning and memorization and relies on simple recall rather than higher order cognitive abilities. In addition, you may need to obtain permission to use copyrighted materials.
- Prepare an answer key for each item. Try to include all possible correct responses that could be given and indicate how many of these the student must provide. This helps reduce scoring time.

POOR: **ITEM:** What types of information do you expect to be recorded in the narrative section of operating logs?

SCORING: Acceptable answers will vary widely.

The item is written in such a way that the student does not know how many types of information to list. The scoring criteria do not indicate to the scorer what type of information is acceptable.

Writing Short Answer Items

Tips for Writing Short Answer Items (continued)

BETTER:

ITEM: List five types of information you expect to see recorded in the narrative section of operating logs. Place your answers in the spaces given below.

SCORING: The student may list any five of the types of information given below:

- Abnormal facility configurations
- Status changes to safety-related and/or other equipment
- Facility mode or condition changes
- Occurrence of any reportable events
- Initiation and completion of surveillance tests
- Entering and exiting operational limit actions
- Security incidents
- Out-of-specification chemistry or process results
- Shift relief

Now the student knows the response expected, and the scorer has a basis for scoring the student's response.

Writing Short Answer Items

Summary of Tips for Writing Short Answer Items

In general

- word the item so that it is unambiguous and is as precise as possible.
- do not use exact quotations from a textbook.

The directions

- provide specific directions for the student.

The blanks

- are standard in length to avoid giving clues as to the length of the correct answer
- avoid “Swiss cheese items.”
- are placed near the end of the statement, if possible.

Scoring

- prepare an answer key for each item.

Writing Essay Items

Essay Items

Essay items may be used to measure understanding and problem-solving ability. They are best suited to topics requiring the ability to organize and assimilate material or to make critical evaluations. Essay items may require either brief or extended responses.

Tips for Writing Essay Items

- Have the objective you wish to measure clearly in mind before you begin to write the item. It is easy to go off on a tangent and lose sight of the objective you originally intended to measure.
- State a specific question that measures the objective. The question should be clear and unambiguous. Questions often start with verbs such as *describe*, *explain*, *compare*, *analyze*, *interpret*, etc.
- Ask yourself if the question as it is written will elicit the type of response you want from the student.
- Provide clear and specific instructions to the student. This includes the length and specificity expected in the answer.
- Include scoring criteria in the instructions to the student.
- Indicate to the student (and scorer) whether spelling, grammar, sentence structure, neatness, and organization count in the score.

POOR: Explain bookkeeping.

This is so vague that students will have difficulty generating an acceptable response.

Writing Essay Items

Tips for Writing Essay Items (continued)

BETTER: In 100 words or less, compare and contrast the single-entry and double-entry methods of bookkeeping. Give at least one advantage and disadvantage of each. Spelling and neatness will NOT affect your score, but be sure to write in complete sentences. A complete answer is worth ten points. You will lose two points if you do NOT provide the advantages and another two points if you do NOT provide the disadvantages.

This gives the student a more definite task to complete and communicates how the student's response will be scored.

- If possible, ask a colleague to respond to the item. If the colleague cannot respond in a manner you think acceptable, the students will not be able to respond in that manner either.
- Write a model answer to the question. This will help you decide if the item is clear enough, how many points each part of the essay will be worth, and the length expected. In addition, it makes scoring easier and faster.

An example is shown on the next page.

Writing Essay Items

Tips for Writing Essay Items (continued)

POOR:

ITEM: While walking your spaces as a DOE Facility Representative, you observe an operator seated at a remote operating station with his head in his hands and you hear him snoring. What do you do?

SCORING: Wake the operator if appropriate. Notify appropriate level of facility management (and subsequently DOE). May be appropriate to inform operations supervisor first and have them wake the operator. Expect the facility management to take appropriate disciplinary action up to and including dismissal. Sleeping on shifts is an extremely serious problem. It has the potential for allowing operational facility/process problems that should be addressed to occur undetected. It may cause the operator to take inappropriate initial actions in response to a casualty/event because the operator is unaware of what preceded the event. An operator has the responsibility to ensure that he is fit for assigned duties before assuming his station. If the operator believes he is unable to perform duties due to fatigue, exhaustion, medication, etc., he should notify his manager. Only if the employee informed his supervisor that he was not fit for duty and was told to stand the shift despite this should the employee not be held fully accountable.

The item is somewhat vague and scoring criteria includes a great deal of information that is NOT asked for in the item. There is no indication how to score the item—does the student need to include all the information provided, even though it is not explicitly asked for in the stem? It even provides the responsibilities of the facility management—why does the student need to know this? In addition, the scoring criteria are qualified—wake the operator *if appropriate*. How will the student determine if this action is appropriate?

Writing Essay Items

Tips for Writing Essay Items (continued)

BETTER:

ITEM: While walking your space as a DOE Facility Representative, you observe an operator seated at a remote operating station with his head in his hands and you hear him snoring.

In one sentence, describe what you would do. Your complete answer will be worth a total of five points. Spelling and grammar will count against you, and you will lose ½ point for each misspelling, punctuation, and grammatical error identified.

SCORING: Notify the appropriate level of facility management of the problem.

This gives the student a more definite task to complete and communicates how the student's response will be scored. A model answer is provided and addresses only the question posed by the stem.

Writing Essay Items

Tips for Writing Essay Items (continued)

- Don't make the item too comprehensive. It is preferable to develop several more specific items rather than one broad item. This makes the item easier for the student to respond to and also makes scoring easier.
- Avoid "double barrel" items. These are items that ask two or more questions at once.

POOR: ITEM: While walking your spaces as a DOE Facility Representative, you observe an operator seated at a remote operating station with his head in his hands and you hear him snoring. What do you do? How serious is an occurrence of this nature? Under what circumstances should the operator NOT be held accountable for this type of conduct?

This item contains three separate items, and, hence, is double barrel. It is better to break each item up, repeating the scenario each time. Develop a scoring criteria for each of these items. Notice that the third question is negative.

Writing Essay Items

Tips for Writing Essay Items (continued)

BETTER:

ITEM 1: While walking your spaces as a DOE Facility Representative, you observe an operator seated at a remote operating station with his head in his hands and you hear him snoring.

In one sentence, describe what you would do. Your complete answer will be worth a total of five points. Spelling and grammar will count against you, and you will lose ½ point for each misspelling and grammatical error identified.

ITEM 2: While walking your spaces as a DOE Facility Representative, you observe an operator seated at a remote operating station with his head in his hands and you hear him snoring.

List six dangers to the facility and others that may result because of this behavior. Each danger listed is worth one point for a total point value of six points.

ITEM 3: While walking your spaces as a DOE Facility Representative, you observe an operator seated at a remote operating station with his head in his hands and you hear him snoring.

In one sentence, describe one condition under which operator's behavior should go unpunished. Spelling, punctuation, and grammar will NOT be scored.

The double barrel item has been eliminated by making three specific items. The items are discrete and specific. Note that the third item is no longer negative.

Writing Essay Items

Summary of Tips for Writing Essay Items

In general

- keep the objective you wish to measure clearly in mind before you begin to write them.
- ask a colleague to respond to the item, if possible. If the colleague cannot respond in a manner you think acceptable, the students will not be able to respond in that manner either.
- don't make the item too comprehensive. It is preferable to develop several more specific items rather than one broad item. This makes the item easier for the student to respond to and also makes scoring easier.
- avoid "double barrel" items.

The stem

- states a specific question that measures the objective. The question should be clear and unambiguous. Questions often start with verbs such as *describe*, *explain*, *compare*, *analyze*, *interpret*, etc.
- should elicit the type of response you want from the student.

Directions

- provide clear and specific instructions to the student. This includes the length and specificity expected in the answer.

Scoring

- include criteria in the instructions to the student.
- indicate to the student (and scorer) whether spelling, grammar, sentence structure, neatness, and organization count in the score.
- a model answer to the item is provided for scorers. This will help you decide if the item is clear enough, how many points each part of the essay will be worth, and the length expected. It will also make scoring easier and faster.

Validating Test Items

Validation Process

After test items have been written, they are reviewed by a testing expert for obvious violations of the guidelines set forth in this publication. In addition, it is wise to have items reviewed by another content expert for content considerations. The reviewers will use checklists provided to you. You may be asked to review someone else's items. Items may be changed as a result of these reviews.

Once the items have been reviewed, they are submitted for field testing. This involves giving the items to students who will be taking the items for qualification purposes. This field test will determine if the items need to be further revised or may be included in the item bank for possible inclusion on the examination as they are.

It is also desirable to interview individuals who participated in the field testing. These interviews will determine if the test administration procedures were clear, if the answering format was clear and adequate, if sufficient time was provided for the final exam, and if any other difficulties were encountered either by the students taking the exam or by those administering the exam.

Data from the field test will be scored and statistically analyzed. This analysis will indicate items with potential problems. Items flagged as potentially problematic need to be reviewed by both a testing and content expert for possible revision.

Validating Test Items

Validation Process (continued)

Be prepared to change your items one or more times. Few people, even those who have been developing items for many years, write items that need no revision. Do not feel as though you are not successful at writing items if your item is changed at some point during the development process. Changing items is the rule, not the exception. Many of the tips provided here appear to be common sense, but they are very easy to violate. In addition, everyone, at one time or another, violates one or more of these principles without realizing it.

Summary

Summary

The examination to be developed will be one of the criteria used to grant qualification to Facility Representatives at the Oak Ridge Office. It is important that the items contained on the examination follow the principles outlined in the guidelines presented here because poorly written items can produce misleading information about both the instruction provided to students as well as their ability.

The items included on the exam should measure the Generic Qualification Standards directly and should also be linked to the appropriate instructional materials. It is important to document both the Generic Qualification Standard the item is intended to measure and the resource where this information is taught for purposes of demonstrating the validity of the examination.

Keep in mind that if you wish to use any materials in an item taken directly from another source (such as a graph or chart), you must obtain written permission from the author or publisher to use this material. Obtaining copyright permission is a time-consuming process and should be pursued only if you cannot proceed without it.

Bias and stereotyping based on gender, racial, or ethnic background should be avoided in all professional writing. Test items and the scenarios on which some may be based are no exception. Bias and stereotyping are usually easily avoided if you follow the guidelines presented here.

There are two general types of examinations. The first is norm-referenced in which students are compared to one another. The second is criterion-referenced in which students are compared to some preset criterion. The exam you will be writing items for is criterion-referenced. Thus, items should be written at a level geared toward the minimally competent individual.

Summary

Summary (continued)

Written items may be classified into two general categories. The first is selected response in which the student chooses from among given responses. Multiple choice, true-false, and matching items are all selected response items. The second type of item is constructed response in which the student must provide an answer. Short answer and essay items are examples.

There are a variety of theories positing differing cognitive levels. One of the most popular and widely used is Bloom's (1956) taxonomy, which posits six distinct levels of cognitive ability. For the purpose of this exam, it is important that the item match the level of the Generic Qualification Standard. If the Generic Qualification Standard calls for simple recall (for example, providing a definition), the item should be written at this level. Well-written selected response items can be used to measure higher-level cognitive abilities.

The blueprint provides the basis for items selected for the exam. More items are selected to measure those Generic Qualification Standards seen as more important, performed more frequently, or more critical for the job of Facility Representative at the Oak Ridge Office.

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