



Item Writing Handbook

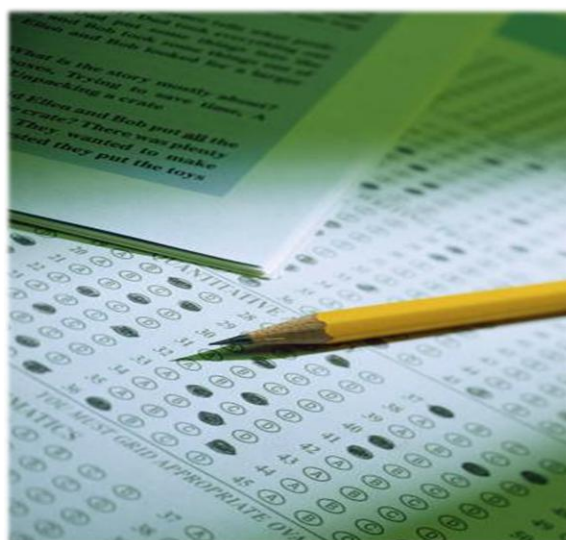


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I. Introduction

Welcome to the NETA Certification Board's Item Writing Handbook. The purpose of this handbook is to familiarize subject matter experts (SMEs) with the overall process of writing high-quality multiple-choice items for NETA's certification exams. Throughout this handbook, we will refer to multiple-choice 'items' rather than 'questions' since exam items may be presented in the form of a statement rather than an actual question. **Item writing** refers to the process of creating test questions (Fein, 2012).

The most commonly used type of question on certification examinations is the **conventional multiple-choice item**. By following the instructions and guidelines presented in this orientation module, exam item writers will increase their proficiency in the writing and reviewing of this type of item. On the surface, writing multiple-choice items may appear relatively simple, but experienced test developers and item writers find that a great deal of skill, patience, and creativity is required to write effective multiple-choice questions. Like any other craft, multiple-choice item writing requires a significant amount of painstaking practice and appropriate feedback (PES, 2005).

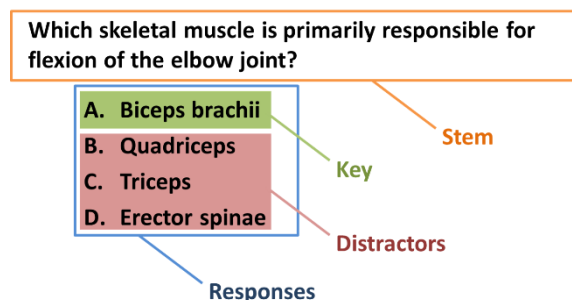
Although difficult to construct, multiple-choice test items with a single best or correct response are easy to administer, score, and analyze. An item analysis, which among other information provides item discrimination and test reliability, can provide data regarding test items' effectiveness in discriminating between those candidates (i.e., test-takers) who know the content and those who do not (Morrison et al., 2001).

Properly written multiple-choice questions measure not only the candidate's knowledge, but also the candidates' critical-thinking abilities within a given discipline such as personal training, or group exercise instruction (Morrison et al., 2001).

II. Item Writing Basics

A. Anatomy of a Multiple-Choice Item

As noted in the introduction, the most common type of question found on certification examinations is the multiple-choice question or item, and in particular the conventional multiple-choice item. The conventional multiple-choice item consists of two basic parts: the stem and the response options or responses. The **stem** is the introductory question or statement that allows the exam candidate to understand what is being asked or assessed and provides the information necessary to elicit the correct response. The **responses** are suggested options that may answer the question or complete the statement presented in the stem, only one of which is the correct answer, known as the keyed response or simply the **key**. The remaining three options are incorrect responses, known as **distractors**.



B. Types of Multiple-Choice Items

The stem of a conventional multiple-choice item may be written as a direct question (i.e., closed stem) or an incomplete statement (i.e., open stem).

The following is an exam of a multiple-choice item written as a direct question.

What is the name of the major muscle located on the anterior aspect of the humerus?

- A. Biceps brachii
- B. Gastrocnemius
- C. Tibialis anterior
- D. Rectus femoris

Notice that the first letter of each response option is capitalized when using this item format.

The following is an exam of a multiple-choice item written as an incomplete statement.

The major muscle located on the anterior aspect of the humerus is called the

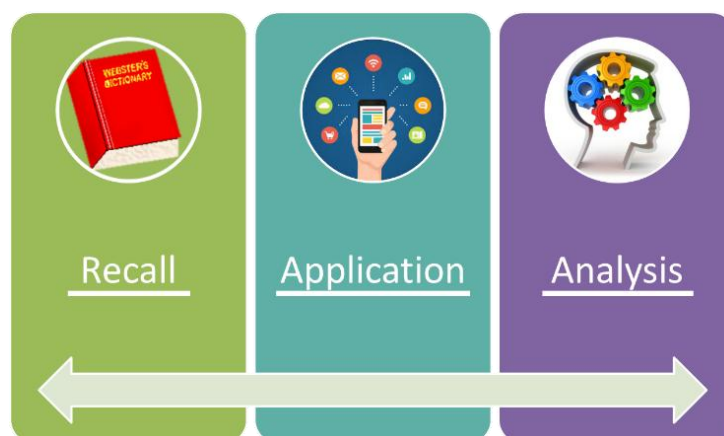
- A. biceps brachii.
- B. gastrocnemius.
- C. tibialis anterior.
- D. rectus femoris.

Notice that each response option begins with a lowercase letter and is followed by a period to complete the sentence started in the stem of the item.

Although both types of multiple-choice item may be used on NETA's certification exams, **whenever possible it is preferred that the stem of the item is written as a direct question.**

C. Multiple-Choice Item Cognitive Complexity

Multiple choice items may be written to assess various cognitive levels moving along a conceptual continuum from the recall of basic knowledge, to the application of knowledge, followed by analysis using critical thinking and problem solving, and other higher-order abilities further to the right.



Recall items primarily assesses the candidate's recognition or recall of facts, definitions, terminology, principles, or guidelines. Items of this nature predominately test the candidate's memory of basic knowledge. The following is an example of a recall item.

What muscle group extends the knee joint?

- A. Hamstrings
- B. Quadriceps
- C. Gastrocnemius
- D. Rhomboids

Application items assess the candidate's ability to correctly use information or apply knowledge in a specific situation. Items of this nature require some problem-solving to select the appropriate or best response based on the limited information provided to or known by the candidate. The following is an example of an application item.

A client recently began taking a beta-blocker medication as prescribed by their healthcare provider. Which of the following methods is most appropriate to monitor the client's cardiorespiratory exercise intensity?

- A. Rating of perceived exertion
- B. Target heart rate derived from maximal heart rate
- C. Metabolic equivalents of task
- D. Percentage of oxygen consumption reserve

Analysis questions require the candidate to take more than one piece of information into consideration and recognize the relationship between the information and/or variables presented to identify a problem and an appropriate solution or response. The following is an example of an analysis item.

A new client reports being sedentary for the last twelve months. The health and lifestyle questionnaire completed by the client indicates no known cardiovascular, metabolic, or renal disease. The client mentions feeling short of breath with mild exertion and sometimes when at rest. The client also notes pain in the lower legs when walking short distances and particularly when walking upstairs or a hill. Which of the following is the best course of action for this client?

- A. Request that the client obtain medical clearance before beginning an exercise program
- B. Proceed with moderate-intensity cardiorespiratory exercise on a stationary bike
- C. Perform a series of fitness assessments to quantify the client's baseline level of fitness
- D. Begin a resistance training program focused on lower extremity strength

Candidates who know how to think make better judgements than those who have merely memorized facts. Certified exercise professionals must be capable of applying knowledge and concepts to the infinite variety of real-life situations that will occur throughout the course of their fitness career (Morrison et al., 2001).

III. Guidelines for Writing Multiple-Choice Items

The following guidelines are essential when developing multiple-choice items that neither confuse nor penalize the candidate, nor reward the candidate by inadvertently providing clues that make the correct answer obvious. Please refer to and apply these principles when writing new items or evaluating items written by other subject matter experts.

- A. The stem should be written as clearly and succinctly as possible to provide the candidate with sufficient information to anticipate the type of answer before looking at the responses.

Poor	Better
The biceps muscle is	What is the function of the biceps muscle?
A. located on the posterior of the upper arm.	A. Elbow flexion
B. responsible for flexion of the elbow.	B. Shoulder extension
C. the primary muscle used during a push-up.	C. Elbow extension
D. comprised of smooth muscle tissue.	D. Shoulder horizontal abduction

- B. The stem should be unambiguous to align with a single correct response as supported by the consensus of experts rather than an individual opinion. When there is doubt or controversy about the correct response, not only is the candidate confused, but the item could be challenged as being inappropriate or intentionally tricky.

Poor	Better
Which of the following is regarded as the best mode of cardiorespiratory exercise?	Which is regarded as the best mode of cardiorespiratory exercise to promote maintenance of bone density among post-menopausal women?
A. Walking	A. Walking
B. Bicycling	B. Bicycling
C. Swimming	C. Swimming
D. Rowing	D. Rowing

- C. **Do not write negatively stated stems that include words such as ‘not,’ ‘least,’ ‘unlikely,’ or ‘except.’** Items of this nature require the candidate to select an incorrect response rather than a correct response. These types of stems tend to confuse candidates and thus tend to make the items less effective at assessing subject matter knowledge and understanding.

Poor	Better
Which of the following muscles is not included in the rotator cuff group?	Which muscle is included in the rotator cuff group?
A. Teres major	A. Teres minor
B. Supraspinatus	B. Subclavius
C. Subscapularis	C. Pectoralis minor
D. Infraspinatus	D. Deltoid

Typically, the only negative stem item that may be used are those related to knowledge that is specifically learned in that context. For example, knowing specific relative or absolute *contraindications* is important and relevant.

- D. Do not include non-essential information (i.e., ‘window dressing’) in the stem. The phrase ‘window dressing’ is used for situations where useless information is embedded in the stem without any purpose or value. As noted in guideline number one, the stem should present the question as clearly and succinctly as possible. Try to write the stem as brief as possible without compromising the content and cognitive demand intended to be measured by the item.

Poor	Better
Type 1 diabetes, previously called juvenile-onset diabetes or insulin dependent diabetes mellitus (IDDM), is characterized by insufficient production of insulin by the pancreas. Approximately what percent of individuals who have diabetes are classified as type 1?	Approximately what percent of individuals who have diabetes are classified as type 1?

However, there are times when more information in the stem may be appropriate. For example, in items or problems where the candidate is expected to sort through information and distinguish between relevant and irrelevant information to solve a problem or identify the best course of action.

- E. Avoid the use of definitive words such as “always,” “only,” or “never” since these extremes tend to make items less defensible and when used in a distractor are often recognizable as false statements dismissed by the candidate as a potential correct response. Also avoid nebulous words or phrases such as “maybe,” “could,” “might,” “can sometimes,” or “is often.” The use of these terms and phrases opens the door for candidates to argue in favor of alternate correct responses.
- F. Do not use “you” in the stem. There is no way to mark an item correct or incorrect since the candidate could always defend their incorrect response as being correct based on their personal choice or opinion, no matter how uninformed and misguided their beliefs may appear to be.

Poor	Better
Which of the following do you believe is the best exercise for a client with a history of shoulder impingement syndrome?	Which exercise is the most appropriate for a client with a history of shoulder impingement syndrome?

- G. Items should be written to assess knowledge of meaningful facts and concepts, not trivial information. Exam items should reflect well-known and publicly supported facts, concepts, principles, and procedures. The judgement of content importance and relevance is subjective. Whether or not item content is too trivial is a decision that should be made by a panel of subject matter experts and item writers. The ability to recall specific facts or data may or may not be a realistic or necessary expectation depending on the nature and criticality of this information in

practice. In addition, items assessing the knowledge of meaningless, trivial information are likely to be seen as trick questions by candidates.

According to data from the Centers for Disease Control and Prevention (CDC), in 2009-10, what percent of American Adults were overweight or obese?

Poor	Better
A. 68.8%	A. 35% to 39%
B. 57.9%	B. 45% to 49%
C. 73.4%	C. 55% to 59%
D. 62.5%	D. 65% to 69%

- H. Use appropriate language. Avoid the use of language that is unnecessarily technical or unfamiliar to appropriately trained candidates. Always consider the relative reading level and the degree of knowledge and experience of candidates taking the test (i.e., whether the exam is designed for entry-level or advanced specialist candidates). Use appropriate professional terminology, but do not use longer, more complicated words when shorter, less complex words will suffice.

Poor	Better
The widely accepted phenomenon explaining the physiological sequence of biochemical and neuromuscular events leading to contraction of skeletal muscle is known as the	What is the widely accepted explanation describing the contraction of skeletal muscle?
A. sliding filament theory.	A. Sliding filament theory
B. Krebs cycle.	B. Krebs cycle
C. post-activation potentiation.	C. Law of motion
D. iontophoresis of acetylcholine	D. All-or-none principle

- I. Use a person-centered orientation when referring to clients or class participants. A person is not defined by their disease, illness, or disability. For example, “a client with diabetes” rather than “a diabetic client.”

Poor	Better
Which of the following activities is most appropriate for an asthmatic participant?	Which activity is most appropriate for a participant with asthma?

- J. The item stem and responses should not be worded so that they might be out of date at the time of testing. When necessary, note the specific timeframe or edition from which the correct response is expected and referenced.

Poor

According to the Dietary Guidelines for Americans, what is the recommended percent of total daily calories derived from fat among adults aged 19 years and older?

- A. Less than 30%
- B. 20% to 35%
- C. 35% to 45%
- D. Greater than 45%

Better

According to the 2020-25 Dietary Guidelines for Americans, what is the recommended percent of total daily calories derived from fat among adults aged 19 years and older?

- A. Less than 30%
- B. 20% to 35%
- C. 35% to 45%
- D. Greater than 45%

The poor item example above refers generally to the Dietary Guidelines for Americans but does not specify the date of publication. The Dietary Guidelines are updated and republished every 5 years. Prior to 2005, the recommendation for fat intake was less than or equal to 30% of daily calories. However, beginning in 2005 and through the 2020-25 edition, the recommendation is 20 to 35% of daily calories from fat. By not specifying the date, a candidate may argue that option A is correct, although option B is correct according to most current guidelines. In the better example, the stem of the item specifies the 2020-25 Dietary Guidelines are being referenced.

- K. Whenever possible, include in the stem all words that would otherwise have to be repeated in each of the responses.

Poor

Resistance training involving both a concentric and an eccentric phase performed against a constant workload

- A. is known as isotonic.
- B. is known as isocaloric.
- C. is known as isokinetic.
- D. is known as isometric.

Better

Resistance training involving both a concentric and an eccentric phase performed against a constant workload is known as

- A. isotonic.
- B. isocaloric.
- C. isokinetic.
- D. isometric.

- L. Utilize standard American English grammar and spelling throughout the stem and response options. Always write the response options grammatically correct and consistent with the stem. If the stem asks for a singular or plural response, then be certain that all the response options are consistent with the stem. When the stem is presented in the form of an incomplete statement, be sure the grammar and punctuation in all the response options is consistent with the stem to complete the statement. Each response must smoothly follow or connect with the stem, both logically and grammatically. Each response options should begin with a capital letter and end with a period or other terminal punctuation if it is a complete sentence. If the stem of an item is a direct question and the response options are not complete sentences, then the response options should not have terminal punctuation. If the stem is an incomplete statement, then each response option should begin with a lowercase letter.

Poor

The primary muscles responsible for extension of the hip are the

- A. Gluteus maximus and hamstrings
- B. Gastrocnemius
- C. Quadriceps
- D. Adductor brevis

Better

What are the primary muscles responsible for extension of the hip?

- A. Gluteus maximus and hamstrings
- B. Gastrocnemius and soleus
- C. Iliopsoas and rectus femoris
- D. Adductor brevis and piriformis

In the poor item example, the stem indicates 'primary muscles,' with muscles plural. Grammatically this calls for a plural response. Only two response options, A and C, provide a plural response to correctly complete the statement. This lack of grammatical consistency may cue an uninformed candidate to eliminate B and D, since these options are not grammatically consistent with the stem. Also note in the poor item example, that each response option is capitalized and lacks sentence-ending punctuation, in this case a period, which is necessary to finish the incomplete statement provided in the stem.

In the better item example, the stem has been re-written as a direct question and each response options provides at least two muscles or muscle groups.

- M. Avoid phrasing the correct response directly from a textbook. Such answers are usually more technical than the distractors and can be easily answered by the candidate, with little or no content knowledge.

What is anorexia nervosa?

Poor

- A. A psychophysiological disorder characterized by self-starvation and an irrational fear of weight gain
- B. A prolonged period of nausea
- C. An adolescent growth disorder
- D. A metabolic disorder

Better

- A. A mental illness associated with very low caloric intake
- B. A metabolic disorder characterized by weight gain
- C. A preoccupation with muscle development and leanness
- D. A disorder characterized by periods of excessive over-eating

In the poor item example, response A stands out as a more technical-sounding response. In addition, this option is much longer than the distractors. An uninformed candidate is likely to correctly guess the answer based on the characteristics of response A compared to the distractors.

In the better item example, all the response options are all written using similar language and at a similar length, which reduces the likelihood of uninformed candidates guessing the correct answer.

- N. The distractors should represent unsafe practices, commonly held misconceptions, and most importantly must be plausible to the uninformed candidate. Avoid using distractors that even the most uninformed candidate would recognize as being incorrect. Also, the use of humorous or absurd distractors is not appropriate in standardized certification exam items.

Who is the psychologist credited for the introduction of the self-efficacy theory?

Poor	Better
A. Albert Bandura	A. Albert Bandura
B. Barack Obama	B. Burrhus Frederic (B.F.) Skinner
C. Babe Ruth	C. James Prochaska
D. Michael Jackson	D. Stephen Rollnick

In the poor item example, the three distractors will be easily identified by most candidates as being incorrect since these individuals are a United States President, famous baseball player, and popular singer, respectively. Even the most uninformed candidate is likely to select A as the correct answer despite not having the knowledge being tested. On the other hand, in the better item example, the individuals included as distractors all of whom are psychologists may appear to be plausible responses to the uninformed candidate.

Typically, the correct answer (i.e., key) is easier to create than the distractors. Writing plausible distractors requires hard work and practice. It is often the most difficult part of multiple-choice item writing. Remember that poorly crafted distractors increase the candidate's success at guessing the correct response.

Plausibility in this context refers to the notion that the item should be correctly answered by those with an adequate level of knowledge and incorrectly by those who do not. Each distractor must appear to be plausible to the candidates who have not yet learned the subject matter that the item is intended to measure. A plausible distractor will look like a potential correct answer to those who lack the necessary knowledge. An implausible distractor will be easily recognized as an incorrect response by many candidates including both high and low performers. In item writing, the good plausible distractors may be derived from common errors, misconceptions, and misunderstandings among candidates (Haladyna, 2004). Do not make up information to create a distractor, such as inventing a name for a nonexistent disease or body part.

- O. **Do not include the responses “all of the above”, “none of the above”, or multiple response options (e.g., “both A and C”).** The flaw in these items is that it is logically difficult to defend claims that one of the other responses is either correct or incorrect. If a candidate has partial information, for example knows that two of the three choices offered are correct, then that information can cue the candidate into correctly selecting “all of the above.” When “none of the above” is the intended correct answer, it still cannot be determined whether the candidate knows what the correct answer is, only that he or she recognizes wrong answers.

By removing the “none of the above” option as seen in the poor item example on the follow page and providing one correct response and three plausible distractors as seen in the better item example, the revised question is likely to perform better.

Which muscle is included in the rotator cuff group?

Poor	Better
A. Pectoralis major	A. Supraspinatus
B. Latissimus dorsi	B. Subclavius
C. Rhomboid	C. Rhomboid
D. None of the above	D. Deltoid

- P. The response options should not overlap or include each other so that the candidate could possibly select more than one response and still be technically correct.

Poor	Better
According to ACSM risk stratification, at what age is a woman considered to be at increased risk for cardiovascular disease?	According to ACSM risk stratification, at what minimum age is a woman considered to be at increased risk for cardiovascular disease?
A. 35 years	A. 40 years
B. 45 years	B. 45 years
C. 55 years	C. 50 years
D. 65 years	D. 55 years

In the poor example provided above, option C is intended to be the correct response; however, a candidate may legitimately argue that D is also correct. As defined by ACSM risk factor definitions, woman 55 years of age and older are at increased risk for cardiovascular disease. Therefore, both C and D are technically correct responses. In the better item example, the word “minimum” has been added to the stem, and the response options have been adjusted making just one response, in this case D, the correct answer.

- Q. The response options should always appear in either logical or numeric order. The options should be arranged in either ascending or descending numeric order. An item is intended to test knowledge in a direct manner. If candidates must hunt for the correct answer, then we unnecessarily increase the stress and anxiety levels of the candidates, and waste precious exam time (Haladyna, 2004).

What is the waist-to-hip ratio for an individual having a waist circumference of 33 inches (83.8 cm) and a hip circumference of 36 inches (91.4 cm)?

Poor	Better
A. .98	A. 0.86
B. 1.09	D. 0.92
C. 0.92	C. 0.98
D. 0.862	D. 1.09

Notice in the better example provided on the previous page, the options are listed in ascending numeric order from smallest to largest. In addition, the options have all been presented in a similar format, so the decimal points align, and the number of decimal places is consistent for uniformity.

- R. Do not personalize a client or class participant by using a proper name.

Poor	Better
George is 55 years old and has a resting heart rate of 63. What is his target heart rate at 75% of the heart rate reserve?	A client is 55 years old and has a resting heart rate of 63. What is the client's target heart rate at 75% of the heart rate reserve?

- S. Avoid providing the candidate with clues that will make it easier for them to detect the correct answer.
- Do not make the correct answer much shorter, longer, or more technical than the distractors. If this is not possible, then try to have two relatively short and two relatively long response options, or two relatively technical and two relatively non-technical response options.
 - Do not put the same key words or descriptive words both in the stem and in the correct answer, but not in the distractors.
 - Do not make the correct answer clear and concise and the distractors vague and ambiguous.
 - As noted previously, do not state the correct response directly from a textbook, potentially making this option more obvious as the correct answer in comparison to the distractors.

IV. Style Guidelines

A. Defined Use Abbreviations and Acronyms

The following terms should be written in full words followed by the abbreviation or acronym provided in parenthesis. Subsequent use of the term within the same item may be expressed by using the abbreviation or acronym.

- Adenosine triphosphate (ATP)
- Basal metabolic rate (BMR)
- Cardiovascular disease (CVD)
- Continuing education credit (CEC)
- Delayed onset muscle soreness (DOMS)
- Excess post-exercise oxygen consumption (EPOC)
- Heart rate reserve (HRR)
- Maximal oxygen consumption (VO_2max)
- Maximum heart rate (MHR)
- One repetition maximum (1-RM)
- Oxygen consumption (VO_2)
- Resting Heart Rate (RHR)
- Resting metabolic rate (RMR)

B. Open Use Abbreviations and Acronyms

The following acronyms and abbreviations should be known to all candidates and may be used freely on NETA's certification exams.

- ACSM – American College of Sports Medicine
- AED – Automated External Defibrillator
- BMI – Body Mass Index
- CPR – Cardiopulmonary Resuscitation

- MET – Metabolic Equivalent of Task or Metabolic Equivalent
- NETA – National Exercise Trainers Association
- PAR-Q – Physical Activity Readiness Questionnaire
- PAR-Q+ – Physical Activity Readiness Questionnaire for Everyone
- RPE – Rate or Rating of Perceived Exertion
- USDA – United States Department of Agriculture

C. Units of Measurement

The following abbreviations and expressions should be used without periods, and generally without capitalization except as noted, to indicate units of measurement.

- Absolute oxygen consumption: liters per minute – L/min
- Age: year – yr (age of a person should be written as XX-year-old or XX years old)
- Angle: degrees (do not abbreviate or use degree symbol)
- Blood glucose or cholesterol: milligrams per deciliter – mg/dL
- Blood pressure: millimeters of mercury - mmHg
- Body mass index: kilograms per meter squared – kg/m²
- Heart rate: beats per minute – b/min
- Height or distance (metric): millimeter – mm, centimeter – cm, meter – m, kilometer - km
- Height or distance (standard): feet – ft, inches – in
- Music tempo: beats per minute – bpm
- Music volume: decibels – dB
- Relative oxygen consumption: milliliters per kilogram per minute – mL/kg/min
- Speed: miles per hour – mph
- Temperature: degrees Fahrenheit – degrees F
- Time: hour – hr, minute – min, second - sec
- Weight: pound – lb or pounds – lbs

D. People

Use the following terms when identify a person or people. Capitalize the term when beginning a sentence or statement. Use lower case within a sentence or statement.

- Personal trainer
- Group exercise instructor
- Client (personal trainer)
- Participant (group exercise instructor)
- Health care provider
- Man, Men, Woman, Women
- Youth (aged 6 to 17 years)
- Adult (aged 18 to 64 years)
- Older adult (aged 65 years and over)

E. What Versus Which?

‘What’ is most appropriately used to begin a stem when there is only one possible correct answer, such as when the correct answer is a single fact. ‘Which’ is most appropriately used when there are many possible correct answers, but the focus of the item is only the one correct option included as the key.

F. Citing References

A reference must be provided for the correct response (i.e., key) for each item appearing on a NETA certification exam. An appropriate reference helps to ensure the legal defensibility of the key for an item. Appropriate references may include an approved textbook, nationally recognized guidelines, and expert opinion, position, or consensus statements published by a nationally recognized organization. When referencing a textbook, the most recent edition is preferred. When submitting a new item, always provide that full reference in APA format. For more information, please visit:

https://owl.purdue.edu/owl/research_and_citation/apa_style/apa_formatting_and_style_guide/reference_list_books.html

V. References

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