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About This Guide

Purpose
The AAN created this reference to help faculty item writers in the development of high-quality, technically-accurate test items for CME courses. By drawing attention to how tests are properly (and poorly) constructed, we hope to help you craft clean, technically-accurate items that test for learning outcomes.

A high-quality, technically-accurate test item is one that focuses on the relevant content and is constructed to avoid technical flaws (NBME, 1996). Such technical flaws introduce an element of bias into the exam.

 Audience
This guide serves as a practical reference for the following groups:

1. Faculty members of the AAN who contribute content and test items to the following CME products:
   - Continuum: Lifelong Learning in Neurology® CME,
   - Neurology® CME
   - “Test Your Knowledge”
   - NeuroLearn®
   - NeuroSAE®
   - NeuroPI®
   - The RITE® exam

2. Any member who creates or evaluates items may find this a useful resource.

A Little More about Our Tests
AAN’s CME credits must include student assessment, which takes the form of domain-referenced multiple-choice tests that allow for one best answer.

The Academy uses multiple-choice test items for CME for the following reasons:

1. Increased test validity because of number of questions that can be used to target learning outcomes
2. Higher test reliability because of objective scoring
3. Measurement of multiple types of learning outcomes from a simple recall of facts to more complex outcomes, like evaluation and analysis

This places special importance on writing technically-accurate test item.
How to Use This Guide

Navigation

This guide is designed as a reference to the best practices in item-writing. Depending on your needs and level of expertise, you might:

1) Read this guide from cover to cover
2) Find a particular section with the table of contents
3) Look for a particular example using the Best Practices Checklist
Writing Strong Test Items: A Checklist of Best Practices

1. **Test what is important.**
   - Does the question **test the concepts related to the objectives** of the CME?
   - Did you tighten up the focus by editing for wordiness and **eliminating unnecessary information**?

2. **Ask a clear and focused question.**
   - Can the **question be answered by a master neurologist** without looking at the list of responses?
   - Have you reread your stem and lead-in for **complex or tricky phrasing**?
   - Does the stem contain a **clear, well-worded problem and lead-in**?
   - Does your stem **contain the bulk of the information**?
   - Are **normal ranges of lab results referenced** directly in your question?

3. **Format the item properly.**
   - Did you **screen for negatively-phrased items**?
   - Have you removed vague terms like “rarely,” “frequently” or “usually”?
   - Have you used **the proper format when writing a clinical case**?
   - Have you removed poor phrasing like “Which of the following is NOT correct”?
   - Have you removed items that can be answered by reading the lead-in alone?

4. **Don't give clues to the test-wise.**
   - Are your **distractors plausible** and **grammatically and logically homogenous**?
   - Have you avoided “absolutism” by not using terms like “never” or “always”?
   - Are the **distractors and the correct answer similarly phrased** and are they grammatically consistent with the stem?
   - Have you put the responses in a **logical order**?
   - Can a non-master test taker differentiate the correct answer by **length**, specificity or **technical accuracy**?
   - Did you **avoid using the same word** in the stem and the response?
   - Have you removed phrasing like “all of the above” and “none of the above”?

5. **Don't let confusing issues ruin your item.**
   - **Could any distractors be construed as partially correct**?
   - Is numeric data presented clearly and consistently?
   - Is your item free of spelling, typographical and grammatical errors?

6. **Make the discussion relevant**
   - Did you **use the lead-in as context** to justify the right answer?
Multiple-Choice Test Items: The Basics

The Anatomy of an Item

The multiple-choice-item has the following four parts:

1. **Stem**
   - a. Consists of the presentation, e.g. clinical case study
   - b. May include diagrams
   - c. Focuses on an important fact

2. **Lead-in**
   - a. Poses the clear question that the list of responses will answer

3. **List of Responses**
   - a. Contains one correct answer with a list of “distractors”
   - b. Distractors should be homogenous

4. **Discussion**
   - a. Justifies the correct answer and may explain why the distractors are incorrect
   - b. May include references

Figure 1 presents a clinical case that requires test-takers to apply what they know; this is consistent with the purpose of the NeuroSAE®. Notice the following:

- The item focuses on one topic and has only one best answer.
- The stem contains most of the information related to the question. There is some incidental information that one would encounter when meeting a patient, but it is not “padded” with irrelevant information.
- The responses are brief and parallel; no words or phrases are repeated in the responses.
- The responses are listed in alphabetical order to avoid providing clues about the correct answer.

Each RITE℠, NeuroSAE®, Continuum: Lifelong Learning in Neurology® CME, and Test Your Knowledge item has five responses; each journal Neurology CME item has four responses.
A 28-year-old man without significant past medical history comes to the emergency department because of a sudden headache and difficulty with vision that began 2 hours ago. Review of systems is positive for occasional mild headaches since his teenage years, and diminished libido for 1 year. Blood pressure is 90/60 mm Hg, pulse rate is 92/min, and temperature is 37 degrees C. He is in distress because of the headache. There is no nuchal rigidity. Neurologic examination shows the visual fields displayed in the accompanying figure and is otherwise normal. Which of the following is the most likely diagnosis?

A. aneurysmal subarachnoid hemorrhage  
B. carotid dissection  
C. migraine  
D. occipital ischemic stroke  
E. pituitary apoplexy

This patient presents with sudden-onset headache and a bitemporal hemianopsia, most consistent with hemorrhagic infarction (pituitary apoplexy) of an underlying pituitary macroadenoma. Although a subarachnoid hemorrhage due to ruptured saccular aneurysm is also possible, the 1-year history of diminished libido and the visual field findings are more consistent with pituitary apoplexy.

How to Write a Stem

**Stem Length**

The stem should contain all the relevant information to answer the question without the addition of irrelevant, distracting details. The stem may be long enough to contain content from clinical vignettes.

**Writing a Clinical Vignette**

A clinical vignette is designed to be brief, condensed version of a case study. Think of it like the abstract of a clinical research paper. You will need to give the important information but not every detail.

The following content is presented in the order below:

1. Age and gender of patient
2. Site of care
3. Presenting complaint
4. Duration
5. Patient history, if needed
6. Physical findings
7. Positive and negative results diagnostic findings
8. Positive and negative results in initial treatment
9. Subsequent findings

**Formatting the Lead-in**

Lead-ins should NOT take the following forms:

- “Which of the following statements is correct?”
- “Each of the following statements is correct EXCEPT…”

These increase the cognitive burden of the test-taker.

**Defining a Technically-accurate Stem**

A technically-accurate stem can be described as following these guidelines:

- Focus on objectives
- Clear, concise description of the problem
- Includes enough information to answer the question
Stems:  Best Practices and Examples

Best Practice #1 – Test what is important.

1.1 The most important thing you as a writer can do is create items that test important concepts or objectives. Writing an item is time-consuming and it would be a waste of your time to write a question testing for knowledge of a trivial or isolated fact.

Example 1.1: Item that tests a trivial or isolated fact

A 65-year-old man with amnestic mild cognitive impairment comes in for a follow-up visit. His wife asks what his likelihood is of developing Alzheimer’s disease. Which of the following is the correct percentage?

A. 1-5%
B. 5-10%
C. **10-15%**
D. 15-20%
E. 20-25%

This item would be rejected for three reasons.

1) The item is testing for information that is not part of an important concept.
2) The numeric data in the list of responses contains overlapping percentages (i.e. 5-10% and 10-15%).
3) The clinical vignette is not necessary to answer the question. One could ask instead, “approximately what percentage of patients with amnestic MCI will progress to Alzheimer’s disease.
1.2 Items should only contain what is absolutely necessary to answer the question. When writing, make sure that the item is clearly related to an outcome or an objective within the assignment.

Example 1.2: Item with unnecessary information

A 63-year-old right-handed man with gastro-esophageal reflux, long-standing generalized anxiety disorder, and degenerative joint disease was brought to the clinic by his daughter for behavioral changes. The changes began about 2 years ago at the time of her mother’s death from Alzheimer’s disease. He had been her primary caretaker and was quite close to her throughout the terminal period of her decline. He now lives alone in a single story home with two pets, a salamander and a Chihuahua. His diet changed and he began eating primarily sweets and junk food although he will still sometimes eat macaroni and cheese provided that it is not the store brand. His behavior was inappropriate; he stopped showering, urinated from the front steps of his home, and was arrested for bringing a gun to city hall. He is presently out on bail awaiting trial. He stopped paying his bills and his daughter noticed his checkbook was disorganized and illegible. Although his daughter thinks his short term memory is slightly worse than it was 2 years ago, she believes that he does not have the same memory problems that she saw in her mother. On examination, he had a flat affect, paucity of speech, impaired attention and judgment, and bilateral grasp reflexes. Which of the following is the most likely diagnosis?

- A. corticobasal degeneration
- B. dementia with Lewy bodies
- C. frontotemporal dementia
- D. Gerstmann-Straüssler disease
- E. major depressive disorder

Example 1.2: Revised

A 63-year-old man was brought to the clinic by his daughter for behavioral changes. The changes began about 2 years ago at the time of her mother’s death from Alzheimer’s disease. His diet changed and he began eating primarily sweets and junk food. His behavior was inappropriate; he stopped showering, urinated from the front steps of his home, and was arrested for bringing a gun to city hall. He stopped paying his bills and his daughter noticed his checkbook was disorganized and illegible. Although his daughter thinks his short term memory is slightly worse than it was 2 years ago, she believes that he does not have the same memory problems that she saw in her mother. On examination, he had a flat affect, paucity of speech, impaired attention and judgment, and bilateral grasp reflexes. Which of the following is the most likely diagnosis?

- A. corticobasal degeneration
- B. dementia with Lewy bodies
- C. frontotemporal dementia
- D. Gerstmann-Straüssler disease
- E. major depressive disorder
**Best Practice #2– Ask a clear and focused question.**

2.1 A clearly written item has a strong focus on one idea. A stem should contain enough relevant information that a veteran neurologist could answer the question without referring to the list of responses.

**Example 2.1: Item with not enough information for a diagnosis**

An 80-year old man is evaluated for low back pain of one year’s duration. He describes buttock and lateral leg pain not relieved with anti-inflammatory medication. His neurologic examination shows absent Achilles reflexes. Which of the following is the most likely diagnosis?

- A. bilateral hip arthritis
- B. dural arteriovenous fistula
- C. lumbar spinal stenosis
- D. musculoskeletal lumbar pain
- E. sciatic nerve entrapment

**Example 2.1: Revised**

An 80-year old man is evaluated for low back pain of one year’s duration. He describes buttock and lateral leg pain not relieved with anti-inflammatory medication. Pain is described as worse with walking and relieved by sitting and is felt on both sides. His neurologic examination shows absent Achilles reflexes. Which of the following is the most likely diagnosis?

- A. bilateral hip arthritis
- B. dural arteriovenous fistula
- C. lumbar spinal stenosis
- D. musculoskeletal lumbar pain
- E. sciatic nerve entrapment
2.2 Re-read your stem and lead-in for complex or “tricky” phrasing. Tricky phrasing might provide a false impression that there are two answers to a question.

Example 2.2: Item that is “tricky” or misleading

A 19-year-old man with a history of temporal lobe epilepsy lost his health care insurance and could no longer afford to take his medication (oxcarbazepine). He stopped it 4 days ago. He had several partial seizures consisting of deja-vu and anxiety. He then had a witnessed secondarily generalized seizure while riding the bus to his neurology appointment and hit his head on the floor, causing a large scalp laceration. He is taken to the emergency department and goes on to have 2 other convulsions without regaining full consciousness. The emergency room physician says that he has stable vital signs and a nonfocal examination, but is unconscious. He has received lorazepam 2 mg and a head CT shows a scalp hematoma. Which of the following is the most appropriate next step in treatment?

A. diazepam  
B. fosphenytoin  
C. intubation  
D. lorazepam  
E. oxcarbazepine
2.3 The stem is stated in **clear, simple language**. The examinees should not have to read the stem more than once in order to understand the question.

**Example 2.3: Item that has complex phrasing**

On which of the following tests did patients in this study with PD plus SFMD worsen the most after 4 years of follow-up versus the PD group without SFMD?

A. Clinician Assessment of Fluctuation (CAF)
B. Dementia Rating Scale-2 (DRS-2)
C. Frontal Assessment Battery (FAB)
D. Hoehn/Yahr staging (H/Y)

**Example 2.3: Revised**

During a 4-year follow-up, PD patients with SFMD did worse than those without SFMD on which of the following tests?

A. Clinician Assessment of Fluctuation (CAF)
B. Dementia Rating Scale-2 (DRS-2)
C. Frontal Assessment Battery (FAB)
D. Hoehn/Yahr staging (H/Y)
2.4. The stem should contain as much of the item content as possible: words or phrases should not be repeated in the responses.

Example 2.4: Item has repeated words and phrases in the list of responses

A 35-year-old woman with 7-year history of relapsing remitting multiple sclerosis presents with 3 relapses in the past 18 months. She had been on glatiramer acetate for the past 3 years. Early in her disease course, she was on interferon beta-1a once weekly intramuscularly however she could not tolerate it. She will be started on mitoxantrone. Considering the choice of therapy, what is the optimal specific monitoring she will need?

A. repeated MRI to check for progressive multifocal leukoencephalopathy
B. repeated echocardiogram to measure left ventricular ejection fraction
C. repeated blood testing to check for neutralizing antibodies
D. repeated liver function test
E. repeated cerebrospinal fluid evaluation to check for JC virus

Example 2.4: Revised

A 35-year-old woman with 7-year history of relapsing remitting multiple sclerosis presents with 3 relapses in the past 18 months. She had been on glatiramer acetate for the past 3 years. Early in her disease course, she was on interferon beta-1a once weekly intramuscularly however she could not tolerate it. She will be started on mitoxantrone. Considering the choice of medication, which of the following tests will need to be repeatedly monitored over the course of her therapy?

A. blood test to check for neutralizing antibodies
B. cerebrospinal fluid evaluation to check for JC virus
C. echocardiogram to measure left ventricular ejection fraction
D. liver function test
E. MRI to check for progressive multifocal leukoencephalopathy
2.5 When necessary, the stem should **provide normal ranges of test or laboratory results**. Do not expect the examinee to have this information memorized.

**Example 2.5: Item doesn’t provide normal range of test**

A 36-year-old woman comes to the office because of a 2-month history of progressive upper and lower extremity numbness and difficulty with gait. Two years ago she underwent gastric bypass for morbid obesity. Examination shows markedly diminished vibration and proprioception sense in the hands and feet, 3+ reflexes diffusely, and bilateral extensor plantar responses. She has a sensory ataxic gait, and Romberg sign is present. MRI of the spinal cord shows high signal in the dorsal aspect of the cervical and thoracic spinal cord. Laboratory testing shows a mild anemia and vitamin B12 level is 682 pg/mL. Which of the following serum tests is most likely to be diagnostic in this patient?

A. copper
B. folate
C. selenium
D. vitamin B1 (thiamine)
E. vitamin B6 (pyridoxine)

**Example 2.5: Revised**

A 36-year-old woman comes to the office because of a 2-month history of progressive upper and lower extremity numbness and difficulty with gait. Two years ago she underwent gastric bypass for morbid obesity. Examination shows markedly diminished vibration and proprioception sense in the hands and feet, 3+ reflexes diffusely, and bilateral extensor plantar responses. She has a sensory ataxic gait, and Romberg sign is present. MRI of the spinal cord shows high signal in the dorsal aspect of the cervical and thoracic spinal cord. Laboratory testing shows a mild anemia and vitamin B12 level is 682 pg/mL (normal 200 pg/mL to 900 pg/mL). Which of the following serum tests is most likely to be diagnostic in this patient?

A. copper
B. folate
C. selenium
D. vitamin B1 (thiamine)
E. vitamin B6 (pyridoxine)
Best Practice #3 – Format item properly.

3.1 State stems in positive forms and avoid using the words “not,” “least,” and “except.” The exception is when “not” and “except” are used in guidelines. For example, physicians may state that certain drugs must not be prescribed for women of child-bearing age. If “not” or “except” are used in a stem, highlight the word by using bold typeface or all capitals.

**Example 3.1: Stem contains “except”**

All of the following anticonvulsant medications would be appropriate for the treatment of generalized epilepsy except for?

A. lamotrigine  
**B. oxcarbazepine**  
C. topiramate  
D. valproic acid  
E. zonisamide

**Example 3.1: Revised**

Which of the following anticonvulsant medications would be most appropriate for the treatment of generalized epilepsy?

A. carbamazepine  
B. lacosamide  
C. oxcarbazepine  
D. phenytoin  
E. valproic acid
3.2 Avoid the use of the following words as their meanings are vague. Here are some common examples: Frequently, Usually, Associated, Useful, Important, May, Could be.

**Example 3.2: Stem contains vague wording**

Usually, patients with migraine with aura typically do not need neuroimaging in their evaluation. What is usually the most reasonable indication that a neuroimaging study may be useful in a patient with migraine with aura?

A. decreasing frequency of attacks  
B. frequent attacks  
C. headache that alternates in side  
D. nausea and vomiting during the headache  
E. prolonged aura

**Example 3.2: Revised**

What is the best indication that a neuroimaging study should be obtained in a patient with migraine with aura and a normal neurological exam?

A. decreasing frequency of attacks  
B. frequent attacks  
C. headache that alternates in side  
D. nausea and vomiting during the headache  
E. prolonged aura
3.3 For optimal comprehension, order information in the stem by using this template. Categories may be omitted depending on the case.

- Age and gender
- Site of care
- Presenting complaint
- Duration
- Patient history, if needed
- Physical findings
- Positive and negative results diagnostic findings
- Positive and negative results in initial treatment
- Subsequent findings

Example 3.3 Stem contains information in the incorrect order

A 36-year-old woman comes to the office because of a 2-month history of progressive upper and lower extremity numbness and difficulty with gait. She has a sensory ataxic gait, and Romberg sign is present. MRI of the spinal cord shows high signal in the dorsal aspect of the cervical and thoracic spinal cord. Laboratory testing shows a mild anemia and vitamin B12 level is 682 pg/mL (normal 200 pg/mL to 900 pg/mL). Examination shows markedly diminished vibration and proprioception sense in the hands and feet, 3+ reflexes diffusely, and bilateral extensor plantar responses. Two years ago she underwent gastric bypass for morbid obesity. Which of the following serum tests is most likely to be diagnostic in this patient?

A. copper  
B. folate  
C. selenium  
D. vitamin B1 (thiamine)  
E. vitamin B6 (pyridoxine)

Example 3.3: Revised

A 36-year-old woman comes to the office because of a 2-month history of progressive upper and lower extremity numbness and difficulty with gait. Two years ago she underwent gastric bypass for morbid obesity. Her examination shows markedly diminished vibratory sense and proprioception in the hands and feet, diffuse hyper-reflexia, bilateral extensor plantar responses, and positive Romberg sign. MRI of the spinal cord shows high signal in the paramedian aspect of the cervical and thoracic spinal cord. Laboratory testing shows a mild anemia with a serum vitamin B12 level of 682 pg/mL (normal 200 to 900 pg/mL). Which of the following serum tests is most likely to be diagnostic in this patient?

A. copper  
B. folate  
C. selenium  
D. vitamin B1 (thiamine)  
E. vitamin B6 (pyridoxine)
3.4 DO NOT ASK, “Which of the following is NOT correct?” An examinee may identify an incorrect answer but may not be able to identify the correct answer.

**Example 3.4 Stem contains poor formatting**

Which of the following is NOT a symptom of hemiplegic migraine?

- A. ipsilateral numbness
- B. recurrent headaches
- C. **scintillating scotomata**
- D. speech disturbance
- E. temporary unilateral hemiparesis

This item would be rejected for two reasons:

1) Formatting that leads to confusion

2) The question suggests that scintillating scotoma is emphatically not a symptom of hemiplegic migraine. While scintillating scotoma is rarer than the other choices, it can still occur in a hemiplegic migraine.

3.5 DO NOT create items that can be answered by reading the lead-in alone.

**Example 3.5 Item can be answered by just reading the lead-in question**

A 67-year-old man with a “magnetic gait”, cognitive deficits meeting criteria for dementia, and urinary incontinence has undergone shunting. Unfortunately he has not improved since the procedure. Which factor is associated with a lack of clinical improvement after shunting in normal pressure hydrocephalus?

- A. **cognitive impairment preceding gait disturbance**
- B. gait disturbance preceding cognitive impairment
- C. long duration of gait abnormality
- D. secondary normal pressure hydrocephalus
- E. short duration of cognitive impairment.

This item would be rejected for the following reason:

1) The examinee does not need to know the clinical scenario to answer the question

[Click here to see some sample lead-ins.](#)
How to Write a Response

When writing responses, keep in mind that the goal is the same as when you write a stem, that is, to ensure masters get the item correct and non-masters get the item wrong.

To a non-master, distractors, or the incorrect answers, should be plausible alternatives to the correct answer.

Responses should be as brief as possible. Do not repeat words in the response; instead, rewrite the response so the repeated word is incorporated in the stem.

Formatting a Response

Responses should be formatted so that they do not provide any clues to those who are considered “test-wise,” or practiced in test-taking.

- All responses should be similarly phrased
- All responses should be of similar length
- All responses should have parallel construction
- Numeric data is presented clearly and consistently
- There are no spelling, typographical and grammatical errors

Technically-accurate Responses

A technically-accurate list of responses can be described as following these guidelines:

- All responses should be homogenously constructed
- All responses should be plausible
Responses: Best Practices and Examples

Best Practice #4 – Do not provide clues to the test-wise.

4.1 Non-masters should find the distractors as plausible answers to the item. If possible, include common misconceptions as distractors.

Example 4.1: Distractors are not plausible

A 23-year-old woman presents with a several-day history of headache and vomiting followed by a single generalized seizure. This was preceded by a flare of her Crohn’s disease, manifested by 3 days of severe diarrhea and resultant dehydration. Her examination shows bilateral papilledema but is otherwise unremarkable. CT scan of the head is normal. Which of the following is the most appropriate diagnostic test?

A. liver function tests  
B. MR venography of the brain  
C. MRI of the orbits  
D. thyroid function studies  
E. transesophageal echocardiography

Example 4.1: Revised

A 23-year-old woman presents with a several-day history of headache and vomiting followed by a single generalized seizure. This was preceded by a flare of her Crohn’s disease, manifested by 3 days of severe diarrhea and resultant dehydration. Her examination shows bilateral papilledema but is otherwise unremarkable. CT scan of the head is normal. Which of the following is the most appropriate diagnostic test?

A. carotid duplex ultrasonography  
B. Goldmann visual field testing  
C. MR venography of the brain  
D. MRI of the orbits  
E. transesophageal echocardiography
Example 4.2: Distractors are not homogenous

A 65-year-old woman with no known prior medical history began having nausea and vomiting, and was apathetic and confused 2 days prior to admission. On the day of admission, she woke up at 3 a.m. to pay her bills and thought it was the afternoon. She was driving her car erratically and appeared unsteady on her feet before she was brought to the hospital. Her temperature was 39 degrees C and she complained of pain on urination. She was alert and oriented to person, place and time, but had impaired attention and slowed response time. She had a mild left hemiparesis. Her lumbar puncture was 12 WBC (0-5 WBC), 2 RBC (0 RBC), glucose 60 (50-80 mg/dL), and protein 60 (15-60 mg/dL). Which of the following is the next appropriate action?

A. perform an evaluation for hypercoagulable states
B. perform an electroencephalogram
C. treat with acyclovir
D. treat with heparin
E. treat with vitamin K

Example 4.2: Revised

A 65-year-old woman with no known prior medical history began having nausea and vomiting, and was apathetic and confused 2 days prior to admission. On the day of admission, she woke up at 3 a.m. to pay her bills and thought it was the afternoon. She was driving her car erratically and appeared unsteady on her feet before she was brought to the hospital. Her temperature was 39 degrees C and she complained of pain on urination. She was alert and oriented to person, place and time, but had impaired attention and slowed response time. She had a mild left hemiparesis. Her lumbar puncture was 12 WBC (0-5 WBC), 2 RBC (0 RBC), glucose 60 (50-80 mg/dL), and protein 60 (15-60 mg/dL). Which of the following is the most appropriate medication for this patient?

A. acyclovir
B. aspirin
C. ciprofloxacin
D. heparin
E. vitamin K
4.3 There are few absolutes in clinical medicine. Avoid using words like “never” and “always” in responses. This is also true of “0%” as in the responses below.

**Example 4.3: Distractors are not homogenous**

A 65-year-old man has become forgetful. He has missed numerous golf tee times with his friends and has misplaced items at home. However, he continues to perform his activities of daily living without difficulty and has made no errors in the family finances. On examination, he scores 27/30 on the Mini-Mental State Examination, missing only the three recall items. What is his risk of developing Alzheimer’s disease in the next year?

A. 0%
B. **10% to 15%**
C. 30% to 35%
D. 50% to 55%
E. 85% to 90%

**Example 4.3: Revised**

A 65-year-old man has become forgetful. He has missed numerous golf tee times with his friends and has misplaced items at home. However, he continues to perform his activities of daily living without difficulty and has made no errors in the family finances. On examination, he scores 27/30 on the Mini-Mental State Examination, missing only the three recall items. What is his risk of developing Alzheimer’s disease in the next year?

A. 1% to 5%
B. **10% to 15%**
C. 30% to 35%
D. 50% to 55%
E. 85% to 90%
4.4 Responses must have parallel construction and each of them must be grammatically consistent with the stem.

**Example 4.4: Responses do not have parallel construction**

A 33-year-old man with AIDS (CD4 lymphocyte count 60) presents with a several-week history of worsening left hemiparesis. His examination is notable for a mild fever (38.0 degrees C) and mild left-sided weakness. A head CT with and without contrast shows a single ring-enhancing lesion at the gray-white junction of the right frontal lobe with some associated mass effect. No other lesions are seen, including on an MRI done the following day. The most appropriate next step in management

A. biopsy of lesion  
B. chest radiography  
C. **is empiric treatment with pyrimethamine/sulfadiazine**  
D. lumbar puncture  
E. whole brain radiation therapy

**Example 4.4: Revised**

A 33-year-old man with AIDS (CD4 lymphocyte count 60) presents with a several-week history of worsening left hemiparesis. His examination is notable for a mild fever (38.0 degrees C) and mild left-sided weakness. A head CT with and without contrast shows a single ring-enhancing lesion at the gray-white junction of the right frontal lobe with some associated mass effect. No other lesions are seen, including on an MRI done the following day. Which of the following is the most appropriate next step in management?

A. biopsy of lesion  
B. chest radiography  
C. **empiric treatment with pyrimethamine/sulfadiazine**  
D. lumbar puncture  
E. whole brain radiation therapy

**Note:** Remember, however, that the length of a response may make it stand out from the other distractors and this may tip off test-wise examinees.
4.5 List responses in logical order. Responses that are words or phrases should be listed alphabetically. Numerical values should be listed from the lowest value to the highest.

Example 4.5: Responses are not listed from lowest to highest

A 65-year-old man has become forgetful. He has missed numerous golf tee times with his friends and has misplaced items at home. However, he continues to perform his activities of daily living without difficulty and has made no errors in the family finances. On examination, he scores 27/30 on the Mini-Mental State Examination, missing only the three recall items. What is his risk of developing Alzheimer’s disease in the next year?

A. 85% to 90%
B. 50% to 55%
C. 30% to 35%
D. 10% to 15%
E. 1% to 5%

Example 4.5: Revised

A 65-year-old man has become forgetful. He has missed numerous golf tee times with his friends and has misplaced items at home. However, he continues to perform his activities of daily living without difficulty and has made no errors in the family finances. On examination, he scores 27/30 on the Mini-Mental State Examination, missing only the three recall items. What is his risk of developing Alzheimer’s disease in the next year?

A. 1% to 5%
B. 10% to 15%
C. 30% to 35%
D. 50% to 55%
E. 85% to 90%
4.6 Avoid making the longest response the correct answer.

Exception: responses that are lengthy because of the name of a disease or drug are acceptable.

Example 4.6: Correct response is too lengthy

A 28-year-old woman is seen because of headaches that began in her childhood. Intermittent sumatriptan treatment had been effective for several years, but over the past 5 years the headaches have gradually increased in frequency and are now occurring daily. She describes the pain as a dull constant ache behind the eyes. It becomes more severe every 2 to 3 days, at which time it is pulsatile and associated with nausea and photophobia. She takes ibuprofen with caffeine 2 to 3 times daily and uses sumatriptan for the more severe episodes. She has been on amitriptyline 50 mg nightly for 2 years. She is otherwise healthy and takes no other medications. She takes a daily multivitamin and megadoses of vitamins C and E. She has had difficulty sleeping at night. Her examination is normal, including optic discs. Which of the following is the most essential component of a successful headache treatment plan for this woman?

A. abruptly discontinue ibuprofen with caffeine
B. discontinue megadose vitamins
C. increase amitriptyline dose to 100 mg
D. initiate treatment with caffeine and then, in 2-3 days, fully taper ibuprofen over 2 to 3 weeks with scheduled follow-up by phone
E. replace amitriptyline with topiramate

Example 4.6: Revised

A 28-year-old woman is seen because of headaches that began in her childhood. Intermittent sumatriptan treatment had been effective for several years, but over the past 5 years the headaches have gradually increased in frequency and are now occurring daily. She describes the pain as a dull constant ache behind the eyes. It becomes more severe every 2 to 3 days, at which time it is pulsatile and associated with nausea and photophobia. She takes ibuprofen with caffeine 2 to 3 times daily and uses sumatriptan for the more severe episodes. She has been on amitriptyline 50 mg nightly for 2 years. She is otherwise healthy and takes no other medications. She takes a daily multivitamin and megadoses of vitamins C and E. She has had difficulty sleeping at night. Her examination is normal, including optic discs. Which of the following is the most essential component of a successful headache treatment plan for this woman?

A. abruptly discontinue ibuprofen with caffeine
B. discontinue megadose vitamins
C. increase amitriptyline dose to 100 mg
D. replace amitriptyline with topiramate
E. taper ibuprofen with caffeine over 2 to 3 weeks
4.7 Avoid making the correct response the only one that uses technical terms.

**Example 4.7: Incorrect responses are not all technical**

A 63-year-old man was diagnosed with ALS 2 years ago. The disease has progressed to the stage where he is experiencing significant hypoventilation and respiratory insufficiency with intermittent air hunger. In the past 2 months he experienced several episodes of respiratory decompensation due to aspiration pneumonia. He tells his physician and wife that he is tired of fighting and wishes to be made comfortable rather than experience significant air hunger next time he has an infection. When the next respiratory infection occurs, he is given increasing doses of morphine that decreases his air hunger, respiratory drive, and discomfort. Which of the following is the ethical principle that guides administration of a narcotic to this patient that may hasten his death by respiratory suppression?

A. ends justifies the means  
B. **double effect**  
C. justice  
D. cure worse than the disease  
E. health care agent

**Example 4.7: Revised**

A 63-year-old man was diagnosed with ALS 2 years ago. The disease has progressed to the stage where he is experiencing significant hypoventilation and respiratory insufficiency with intermittent air hunger. In the past 2 months he experienced several episodes of respiratory decompensation due to aspiration pneumonia. He tells his physician and wife that he is tired of fighting and wishes to be made comfortable rather than experience significant air hunger next time he has an infection. When the next respiratory infection occurs, he is given increasing doses of morphine that decreases his air hunger, respiratory drive, and discomfort. Which of the following is the ethical principle that guides administration of a narcotic to this patient that may hasten his death by respiratory suppression?

A. consequentialism  
B. **double effect**  
C. justice  
D. nonmaleficence  
E. substituted judgment
4.8 Avoid using the same word (or synonym) in the stem and the response.

**Example 4.8 Correct response can be guessed because of synonym**

Which of the following variants of frontotemporal dementia typically presents with decreased speech output?

A. behavioral
B. behavioral and semantic
C. **progressive nonfluent aphasia**
D. semantic

This item would be rejected because nonfluent is similar to decreased speech output.
4.9 Avoid using “none of the above” as a response.

**Example 4.9: Responses are improperly formatted**

A 30-year-old woman is evaluated for recurrent seizures. She had febrile seizures as a young child. At age 8 she developed episodes of staring and was treated with an anticonvulsant. She was taken off medication in her teens. One month ago she developed a generalized tonic-clonic seizure and was started on lamotrigine. Review of her family history reveals a 4-year-old daughter with developmental delay who has been admitted on several occasions for status epilepticus. A mutation in which of the following ion channels is most likely to be found in this family?

A. calcium  
B. chloride  
C. magnesium  
D. potassium  
E. none of the above

**Example 4.9: Revised**

A 30-year-old woman is evaluated for recurrent seizures. She had febrile seizures as a young child. At age 8 she developed episodes of staring and was treated with an antiepileptic drug. She was taken off antiepileptic medication in her teens. One month ago she developed a generalized tonic-clonic seizure and was started on lamotrigine. Review of her family history reveals a 4-year-old daughter with developmental delay who has been admitted on several occasions for status epilepticus. A mutation in which of the following ion channels is most likely to be found in this family?

A. calcium  
B. chloride  
C. magnesium  
D. potassium  
E. sodium
4.10 Avoid using “all of the above” as a response. The examinee might select the first correct answer without reading the remaining responses.

**Example 4.10: Responses are improperly formatted**

A 22-year-old woman with mixed primary generalized epilepsy has been having recurrent absence seizures despite treatment with valproic acid. Her last level was in the high therapeutic range. Treatment using lamotrigine is contemplated. Which of the following measures should be used to reduce the likelihood of a life-threatening rash?

- A. begin at a low dose and slowly advance
- B. coadministration of carnitine
- C. coadministration of coenzyme Q10
- D. coadministration of diphenhydramine
- E. all of the above

**Example 4.10: Revised**

A 22-year-old woman with mixed primary generalized epilepsy has been having recurrent absence seizures despite treatment with valproic acid. Her last level was in the high therapeutic range. Treatment using lamotrigine is contemplated. Which of the following measures should be used to reduce the likelihood of a life-threatening rash?

- A. begin at a low dose and slowly advance
- B. coadministration of carnitine
- C. coadministration of coenzyme Q10
- D. coadministration of diphenhydramine
- E. keep the dosage of lamotrigine below 100 mg daily
Best Practice #5 – Avoid unnecessary confusion

5.1 Do not write distractors that are partially correct.

Example 5.1: Distractor could be partially correct

A 35-year-old man is brought to the ER by his wife because of a generalized tonic-clonic seizure which began 10 minutes before arrival. They had eaten at a nearby restaurant and were driving home when his wife (who was driving) noticed that he stopped talking, would not respond, then began convulsing. He has a history of a closed head injury last year, following which he has had epilepsy treated with carbamazepine. Evaluation in the ER demonstrates pulse rate 110/min, blood pressure 160/90, respirations 24/minute, temperature 99.5 degrees and active generalized clonic seizure. Oxygen is administered by face mask, with oxygen saturation 95%. Which of the following is the most appropriate next step in his management?

- A. administer carbamazepine by nasogastric tube
- B. administer intravenous diazepam
- C. administer intravenous lorazepam
- D. obtain head CT scan
- E. perform endotracheal intubation

Example 5.1: Revised

A 35-year-old man is brought to the ER by his wife because of a generalized tonic-clonic seizure which began 10 minutes before arrival. They had eaten at a nearby restaurant and were driving home when his wife (who was driving) noticed that he stopped talking, would not respond, then began convulsing. He has a history of a closed head injury last year, following which he has had epilepsy treated with carbamazepine. Evaluation in the ER demonstrates pulse rate 110/min, blood pressure 160/90, respirations 24/minute, temperature 99.5 degrees and active generalized clonic seizure. Oxygen is administered by face mask, with oxygen saturation 95%. Which of the following is the most appropriate next step in his management?

- A. administer carbamazepine by nasogastric tube
- B. administer intravenous labetalol
- C. administer intravenous lorazepam
- D. obtain head CT scan
- E. perform endotracheal intubation
How to Write a Discussion

The goal of the discussion portion of the test item is to provide a clear defense of the correct answer and convincing arguments for rejecting the distractors.

There should be enough material provided to insure that students can learn from the discussion.

Formatting the Discussion

- Discussion should use the lead-in as the context for justifying the correct answer and explaining why the distractors are incorrect.

- Discussions for online CME courses do not need references; instead the author may refer the learner to passages in the instructional materials.
Discussions: Best Practices and Examples

Best Practice #6 – Make the discussion relevant

6.1 Use the lead-in as the context to justify the correct answer.

Example 6.1: Discussion doesn’t immediately seem relevant to the question

A 52-year-old man comes to the physician for evaluation of sleep problems that began 5 years ago. Several times per month he gets out of bed while asleep and acts out his dreams. They are typically frightening and often violent. Last week he fell down a staircase while trying to escape from an intruder in his dream. He is otherwise healthy, and his examination is normal. Which of the following conditions is he at most risk of developing over the next 1 to 2 decades?

A. Alzheimer’s disease
B. Huntington’s disease
C. normal pressure hydrocephalus
D. Parkinson’s disease
E. progressive myoclonus epilepsy

REM sleep behavior disorder (RBD) is defined by intermittent loss of REM sleep atonia resulting in dream enactment. Behaviors frequently involve violent features such as punching, kicking, leaping, running, and yelling. Bed partners and patients are frequently injured. Acute RBD is typically induced by medications such as tricyclic antidepressants, monoamine oxidase inhibitors, and serotonin reuptake inhibitors. It can also occur during withdrawal of alcohol or benzodiazepines. More commonly RBD is chronic and begins in late adulthood, with a male predominance. Up to 60% of patients with chronic RBD develop Parkinson’s disease, multiple system atrophy, or Lewy body dementia. Diagnosis of RBD is based on the clinical features and polysomnographic evidence of excessive phasic EMG tone during REM sleep. In order to avoid injuries, potential hazards should be removed from the bedroom, and the bed partner should sleep separately pending effective medical treatment. Clonazepam (0.5 mg to 3.0 mg) is effective in most cases.
Example 6.1: Revised

A 52-year-old man comes to the physician for evaluation of sleep problems that began 5 years ago. Several times per month he gets out of bed while asleep and acts out his dreams. They are typically frightening and often violent. Last week he fell down a staircase while trying to escape from an intruder in his dream. He is otherwise healthy, and his examination is normal. Which of the following conditions is he at most risk of developing over the next 1 to 2 decades?

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How to Write an Extended-Matching Test Item

The Anatomy of an Extended-Matching Item

The extended-matching item has the following six parts:

1. **Prompt** – establishes context for the questions
2. **Theme** - describes what aspect of the content will be tested
3. **Options** - the list of responses
4. **Questions** – the stem, focuses on a question within the theme
5. **Discussion** – justifies the correct answer
6. **Notes** – provides references

Important Differences with Multiple-Choice Test Items

Extended matching items have many of the same elements as multiple choice items. There are two main differences:

1. Two or more stems will use the same list of responses or option
2. The list of responses is much longer than those for multiple choice

Guidelines for Writing an Extended-Matching Item

1. The context for the extended matching questions is established by the **Prompt** and the **Theme**. Each stem focuses on one question and the questions must be related to the theme.

2. The examinee must know how many responses are correct for each question. In the RITESM one answer is correct per question.

3. Each of the options, or responses, must be as simple as possible.

4. In general, the same guidelines for multiple-choice stems apply to the extended-matching stems. Click here to see some sample lead-ins and topics for option lists.

The following example is an extended-matching question from the RITESM database.
Figure 2: RITE℠ extended-matching item

Prompt: For the following case histories choose the above appropriate localization

Theme: Anatomic localization of behavior

Options:
- A. amygdala
- B. dominant angular gyrus region
- C. dominant perisylvian frontal cortex
- D. dominant supplementary motor area
- E. dorsolateral prefrontal cortex
- F. dorsomedial thalamic nuclei
- G. hippocampus
- H. medial frontal cortex
- I. non-dominant parietal association cortex
- J. non-dominant perisylvian frontal cortex
- K. occipitoparietal cortex
- L. occipitotemporal cortex
- M. orbitofrontal cortex

Questions:
1. A 22-year-old male college student is involved in a motor vehicle accident and sustains a contusion to a part of his brain. He had been an “A” student and was known for his involvement in community improvement projects. Since the accident, he has become impulsive, quick to anger, and aggressive. He has also begun to make sexually explicit comments and gestures to the women on campus and then laugh at them when they exhibit shock. He is finally expelled from school after exposing himself in a theology class. Where is the location of the contusion responsible for this change in behavior? Correct Answer: M

2. A 27-year-old woman attempted suicide by running her car engine in a closed garage. She was rescued but remained in a coma for 3 days. After regaining consciousness, she had difficulty laying down new memory. She failed to understand the meaning of others’ facial expressions and gestures. She also failed to recognize signs of danger or threat. Other than her memory deficit, the behavioral changes she experienced arose from impairment in what part of her brain? Correct Answer: A

Discussion: This is the syndrome of the subthalamic-mesencephalic artery. Patients may initially become comatose. After regaining consciousness they often manifest decreased arousal, abulia, impaired vertical gaze, and anterograde and retrograde amnesia. Involvement of the dorsomedial thalamic nuclei is responsible for the later symptoms. This may also extend into the anterior cingulated as well.

References: Grabowski TJ, Anderson SW, Cooper GE. Cardinal symptoms of disordered cognition. Continuum Lifelong Learning Neurol 2002:8(2);41-126.
How to Write a Vignette Test Item

The Anatomy of a Vignette Test Item

A vignette is a set of multiple choice items where there is one stem and two or more sets of lead-in questions with responses.

The vignette test item has the following four parts:

1. **Vignette** – presentation of a clinical case, the stem
2. **Question** – the lead-in, usually multiple questions for a vignette
3. **Discussion** – justifies the correct answer
4. **Notes** – provides references

Guidelines for Writing a Vignette Item

Vignette items have stems and responses and you will follow the same practices as when you are writing multiple-choice test items.

Here are some additional best practices, based on the unique nature of vignettes.

1. Information presented in one vignette question must not contain cues that will help the non-master answer the other vignette question.

2. The examinee’s response for one vignette question must not determine whether the examinee gets another vignette question correct. The questions are independent of each other and a wrong answer on one doesn’t mean the examinee must get the second question incorrect.

The following example is a vignette question from the RITE℠ database. You’ll notice that the number of lead-in questions with responses doesn’t exceed two.
Vignette: A 42-year-old man appears mute, stares straight ahead, and maintains his left upper extremity abducted at the shoulder with his hand and fingers pointing to the vertex of his head. He does not converse but periodically repeats numerous times a word spoken by the examiner. He does not move from this fixed posture, but his right upper extremity can be passively manipulated, and the new posture is sustained. Vital signs, CT scan, and basic laboratory screening are within normal limits.

Question 1: All of the following therapies may be beneficial for this condition except for one, which may worsen the condition. Which one may worsen the condition?

A. amobarbital  
B. baclofen  
C. diazepam  
D. electroconvulsive therapy  
E. lorazepam

Question 2: This patient's most likely condition is:

A. catatonia  
B. drug-induced parkinsonism  
C. elective mutism  
D. locked-in syndrome  
E. nonconvulsive status epilepticus

Discussion: Catatonia is a syndrome manifested by a number of motor and neurobehavioral features. It may have a "retarded-stuporous" form or an "excited-delirious" form. It may be seen in over 10% of inpatient psychiatric patients. Catatonia is more prevalent in mood disorders than in schizophrenia. The most common mood disorder in which it is seen is bipolar. Catalepsy, waxy flexibility, echophenomena, and negativism including mutism are common. Many neurological and systemic illnesses may also present as catatonia. Treatments include benzodiazepines, barbiturates, and electroconvulsive therapy. Dopamine antagonists as well as baclofen may worsen the condition.

## Glossary

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bias</td>
<td>A source of variance introduced systematically in test scores associated with group membership.</td>
</tr>
<tr>
<td>Distractor</td>
<td>An incorrect answer in a list of responses.</td>
</tr>
<tr>
<td>Domain of Knowledge</td>
<td>An endeavor (i.e. neurology) which contains its own specialized knowledge.</td>
</tr>
<tr>
<td>Domain-referenced Exam</td>
<td>The Academy builds examinations that can be categorized as domain-referenced achievement exams. These exams provide test-takers with an accurate assessment of their domain knowledge. For the purposes of Academy CME programs, domain knowledge will be determined by specific course objectives, or the skills and knowledge the examinee is expected to retain.</td>
</tr>
<tr>
<td>Learning Outcomes</td>
<td>The intended or unintended knowledge, skills and attitudes acquired through a learning experience. Measured learning outcomes are also known as learning goals.</td>
</tr>
<tr>
<td>Norm-referenced Exam</td>
<td>This type of exam gives the relative position of an examinee compared to a predefined sample of peers. The score, typically a percentile, is generated by comparing the examinee’s performance to the sample.</td>
</tr>
<tr>
<td>Reliability</td>
<td>The extent to which the results of a test are dependable and consistent when administered to the same group at different times.</td>
</tr>
<tr>
<td>Test Wiseness</td>
<td>A skill or strategy that involves using characteristics or formats of tests to achieve a high score.</td>
</tr>
<tr>
<td>Validity</td>
<td>The extent to which the test measures what it sets out to measure.</td>
</tr>
</tbody>
</table>
References


Appendix A

How to Write a Clinical Vignette

A clinical vignette is designed to be brief, condensed version of a case study. Think of it like the abstract of a clinical research paper. You will need to give the important information but not every detail.

The following content is presented in the order below:

1) Age and gender of patient
2) Site of care
3) Presenting complaint
4) Duration
5) Patient history, if needed
6) Physical findings
7) Positive and negative results diagnostic findings
8) Positive and negative results in initial treatment
9) Subsequent findings

List of Vague Words

Avoid the use of the following words which are too vague:

- Frequently
- Usually
- Associated
- Useful
- Important
- May
- Could be
Sample Lead-in Questions

Use these sample questions (Case and Swanson 2003) to generate ideas for your own lead-ins.

Treatment

- Which of the following immunizations should be administered at this time?
- Which of the following is the most appropriate screening test?
- Which of the following tests would have predicted these findings?
- Which of the following is the most appropriate intervention?
- For which of the following conditions is the patient at greatest risk?
- Which of the following is most likely to have prevented this condition?
- Which of the following is the most appropriate next step in management to prevent [morbidity/mortality/disability]?
- Which of the following should be recommended to prevent disability from this injury/condition?
- Early treatment with which of the following is most likely to have prevented this patient’s condition?
- Supplementation with which of the following is most likely to have prevented this condition?

Mechanisms that explain symptoms, signs, history, or lab study findings

- Which of the following is the most likely explanation for these findings?
- Which of the following is the most likely location of the patient’s lesion?
- Which of the following is the most likely pathogen?
- Which of the following findings is most likely to be increased/decreased?
- A biopsy is most likely to show which of the following?

Diagnoses

- Which of the following is the most likely diagnosis?
- Which of the following is the most appropriate next step in diagnosis?
- Which of the following is most likely to confirm the diagnosis?

Patient management

- Which of the following is the most appropriate initial or next step in patient care?
- Which of the following is the most effective management?
- Which of the following is the most appropriate pharmacotherapy?
- Which of the following is the first priority in caring for this patient? (eg, in emergency department)