A Primer on Writing Effective Multiple-Choice Questions

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Outline

• General Guidelines
• Bad and Ugly and Good
• Single Best Answer Formats
• Resources to Use
• Examples to Evaluate
General Guidelines

**USMLE Single Best Answer**

- Focus on important concepts, not trivial facts
- Assess using a combination of Bloom levels
- Pose a clear question
- Provide homogeneous plausible distracters
- Avoid technical flaws or cueing
- Use a balanced number of answer choices
# Bloom’s Taxonomy Levels

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<th>Knowledge</th>
<th>Comprehension</th>
<th>Application</th>
<th>Analysis</th>
<th>Synthesis</th>
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<tr>
<td>Remembering</td>
<td>Understanding</td>
<td>Applying</td>
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lowest
The Bad and Ugly

Sedoheptulose-7-phosphate is in a pathway that depends on which vitamin for activity?

A. Vitamin B1  Transketolase
B. Vitamin B2  There are two best answer choices!
C. Vitamin B12  May be better to use all vitamin labels or names
D. Niacin  Glucose-6-phosphate dehydrogenase
E. Vitamin C  6-Phosphogluconate dehydrogenase

Stem needs to be in appropriate style and to ask a clear question (is this asking about the pentose phosphate pathway or a particular step in the pathway?)
The Bad and Ugly

Stem needs to be in appropriate style (avoid NOT, LEAST, FALSE)

- A GTP-requiring enzyme is NOT needed to convert which of the following compounds to glucose?
  A. Aspartate
  B. Lactate
  C. Alanine
  D. **Glycerol**
  E. \( \alpha \)-Ketoglutarate

The question is testing where glycerol derivatives enter gluconeogenesis
The Bad and Ugly

Stem should be a clinical scenario)

• Which of the following is true about pseudogout?
  A. It occurs frequently in women.
  B. It is seldom associated with acute pain in a joint.
  C. It may be associated with a finding of chondrocalcinosis.
  D. It is clearly hereditary in most cases.
  E. It responds well to treatment with allopurinol.

There isn’t a clear question in the stem, you must read the stem along with each choice, making this a multiple True/False question. While ‘C’ is true, a case could be made for ‘A’ since it occurs as frequently in women as in men.

The choices don’t fall along a single dimension: you’re asked to compare apples and oranges, or in this case, gender, location, pathology, genetics, and pharmacology.
A 72-year-old man comes to the physician complaining of the sudden onset of knee pain that began a week ago. He describes the pain as sharp and severe and located in the joint. The knee is swollen, warm to the touch, and the skin over it is red. Joint fluid is aspirated, examined using polarized light microscopy, and shows the following:

What is the most likely diagnosis for the patient’s knee pain?
A. Gout
B. Osteoarthritis
C. **Pseudogout**
D. Rheumatoid arthritis
E. Traumatic effusion
SBA Disease

- A n-year-old (Age) boy/girl/man/woman (Gender) comes/is brought to the physician/emergency department (Site of Care) for evaluation of/with a problem (Presenting Complaint including Duration and Patient/Family History).
- Physical examination shows some combination of pertinent findings.
- Laboratory studies show some combination of test results (normal ranges provided for non-adult age groups/special tests).
- Which drug, toxic exposure, diet; predict physical findings, lab findings, sequelae; identify underlying cause/diagnosis, cause of drug response, drug to administer (Questions)
SBA Normal

• A n-year-old (Age) boy/girl/man/woman (Gender) comes/is brought to the physician/emergency department (Site of Care) for evaluation of/with a problem (Presenting Complaint including Duration and Patient/Family History).

• Physical examination shows some combination of pertinent findings.

• Laboratory studies show some combination of test results (normal ranges provided for non-adult age groups/special tests).

• Which drug, toxic exposure, diet; predict physical findings, lab findings, sequelae; identify underlying cause/diagnosis, cause of drug response, drug to administer (Questions)
Resources

• Textbooks with clinical correlations
• Internet sites for selected diseases
  emedicine.com
  Harrison’s eSupplement
  NCBI endocrinology
  Online pathology cases
• Primary literature
• Normal ranges for ages/gender (pediatric)
Samples to Evaluate

Stem is not in the form of a question and tests an isolated fact

A decrease of transthyretin in plasma would most likely also cause a decrease of plasma transport of:

A. Copper
B. Heme
C. **Thyroxine**
D. Iron
E. Bilirubin

Foils should be alphabetical order
A patient comes to the physician with severe liver disease, due to many years of alcohol abuse. Liver-specific protein synthesis and secretion is greatly reduced due to the disease. The transport of which of the following in the plasma may be reduced as a result of the failing liver?

A. Cobalamin
B. Glucagon
C. Insulin
D. Pyridoxal phosphate
E. Thyroxine

Answer choices are alphabetical but could be balanced with one more choice (add niacin, riboflavin, or thiamin)
Revised to Test a Different Concept

Stem is in appropriate style (abstracted from primary literature)

A 46-year-old woman comes to the physician with an inferior visual defect in her left eye. Ocular and systemic evaluation is within normal limits, including brain computed tomography scan. Deposits of white “fluffy” material are noted on the posterior capsule of the left eye. A vitreous biopsy is stained with Congo red and viewed with polarized microscopy; the resulting image is shown below.

Requires evaluation of data

The woman is found to have a heterozygous mutation of the transthyretin gene. This mutation would most likely result in which of the following?

A. Decreases the affinity for thyroxine
B. Decreases the pI for transthyretin
C. Decreases the rate of transthyretin unfolding
D. Increases the affinity for thyroxine
E. Increases the pI for transthyretin
F. Increases the rate of transthyretin unfolding

Tests an important concept

Answer choices are alphabetical and balanced
Myasthenia Gravis Example

Stem should be a clinical scenario.

Myasthenia gravis is an autoimmune disease against which component of the neuromuscular junction?

A. Acetylcholinesterase
B. Alpha (α) subunit of the acetylcholine receptor
C. Beta (β) subunit of the acetylcholine receptor
D. Choline acetyltransferase
E. Costamer-associated actin

There is some cueing with the provided foils.
Myasthenia Gravis Approach

- Find additional information about MG from emedicine
- Search (myasthenia gravis “clinical case”) for an appropriate clinical case to abstract
- Consider what relevant concept or content to assess
- Design a specific question
- Provide balanced homogeneous distractors
A 61-year old man comes to the physician complaining of eye droop and trouble breathing. The man states that he began to have double vision 6 months ago. He takes one aspirin each day and is on no other medication. Physical examination shows weak facial muscles including ptosis and weak intercostal muscles and diminished use of the diaphragm. Laboratory studies show normal thyroid levels.

Where do we go from here?
– Ask what test to run or predicted testing results.
– Ask the most likely diagnosis.
– Ask what medication to use or how it acts.
– Ask to explain the results.
A 61-year old man comes to the physician complaining of eye droop and trouble breathing. The man states that he began to have double vision 6 months ago. He takes one aspirin each day and is on no other medication. Physical examination shows weak facial muscles including ptosis and weak intercostal muscles and diminished use of the diaphragm. Laboratory studies show normal thyroid levels. Which of the following testing results would most likely confirm the diagnosis?

A. Absence of antistratiational antibodies  
B. Decreased muscle strength after a test dose of edrophonium (Tensilon)  
C. Increased summated compound muscle action potentials  
D. No change in single-fiber electromyography findings  
E. Presence of anti-acetylcholine receptor antibodies
A 61-year old man comes to the physician complaining of eye droop and trouble breathing. The man states that he began to have double vision 6 months ago. He takes one aspirin each day and is on no other medication. Physical examination shows weak facial muscles including ptosis and weak intercostal muscles and diminished use of the diaphragm. Laboratory studies show normal thyroid levels and the presence of anti-acetylcholine receptor antibodies. Which of the following is the most likely diagnosis?

A. Amyotrophic lateral sclerosis
B. Botulism
C. Multiple sclerosis
D. Myasthenia gravis
E. Polymyositis
Myasthenia Gravis #3

A 61-year old man comes to the physician complaining of eye droop and trouble breathing. The man states that he began to have double vision 6 months ago. He takes one aspirin each day and is on no other medication. Physical examination shows weak facial muscles including ptosis and weak intercostal muscles and diminished use of the diaphragm. Laboratory studies show normal thyroid levels and the presence of anti-acetylcholine receptor antibodies. The man is started on pyridostigmine bromide (Mestinon). Which of the following is the most likely mechanism of the therapeutic effect of this drug?

A. Activates activity of choline acetyltransferase
B. Decreases permeability of Na\(^+\) channels
C. Increases permeability of Ca\(^{2+}\) channels
D. **Inhibits activity of acetylcholinesterase**
E. Lowers levels of acetylcholine receptors
F. Raises levels of acetylcholine receptors
Bioavailability Example

“Drug bioavailability” is best defined by which of the following?

A. Amount of drug reaching the systemic circulation
B. AUC (i.v.) minus AUC (oral)
C. Percentage of the dose reaching the liver (before first pass)
D. Percentage of the dose reaching the small intestine
E. Percentage of the dose reaching the systemic circulation

PBS = -0.02

There is some cueing with the provided foils.
Bioavailability Revised

The physician administers 20 mg of Drug X in 100 cc of isotonic solution by continuous IV infusion at a rate of 5-6 cc/h. Which of the following is the most likely explanation of the delivery approach of Drug X?

A. Drug X is limited to the vascular compartment.
B. First-pass phase I metabolism of Drug X is increased.
C. First-pass phase II metabolism of Drug X is increased.
D. The amount of Drug X entering cells is decreased.
E. The bioavailability of Drug X is 100%.

PBS = 0.41