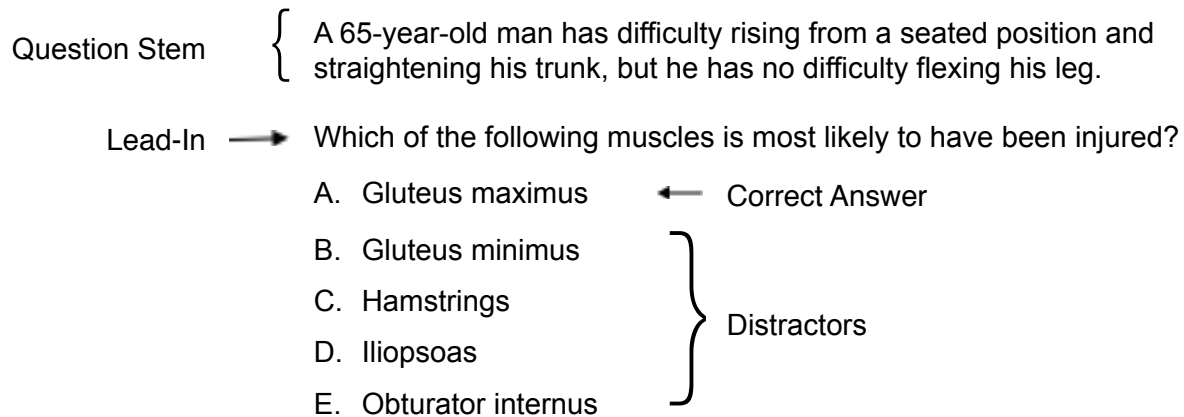


Writing Multiple Choice Questions (MCQs)

UWSOM Guidelines and Examples

ANATOMY OF A “ONE-BEST-ANSWER” MCQ



Basic Rules for One-Best-Answer Item Stems (questions)

1. **Each item should map to a specific course objective and should focus on an important concept.** Questions should cover important basic concepts or common or potentially catastrophic clinical problems that would be encountered in real life.
2. **Each item should assess application of knowledge, not recall of isolated facts.** Using clinical vignettes or descriptions of experiments will help you focus on testing higher order learning. Examples of tasks requiring application of knowledge are: reaching a conclusion, making a prediction, selecting a course of action.
3. **The item stem/lead-in must pose a clear and focused question.** For a question to be focused, you must be able to answer it WITHOUT being able to view the answer options. The lead-in must be a complete sentence written as a question; no sentence fragments. Do not use questions of the form “Which of the following statements is correct/incorrect?”

4. **Avoid trivial or overly tricky/complex questions.** Questions aimed at unnecessary subtleties usually end up confusing even the brightest, most prepared student. The more complex a question stem or answer is, the less you are testing about specific medical knowledge and the more you are testing the ability to comprehend the question. Questions should be written clearly and concisely, with no more reading than is necessary.
5. **Avoid technical flaws that cue students to the correct answer, or introduce irrelevant difficulty.** See list of flaws below.

Writing Answer Options



It may be helpful to visualize your distractors this way. The incorrect answers should not be completely wrong, but they should be clearly “less correct” than the keyed answer.

1. **Write 3-4 distractors for each question.** Distractors should all be plausible and attractive to students who don’t have a full grasp of the concept. Common student misconceptions/mistakes can be a good source of distractors. If you have trouble coming up with a fourth option, stop at three—writing distractors that students don’t choose is a waste of your time and theirs!
2. **All answer options should be as homogeneous as possible.** Answer options should be short (not long) and of approximately the same length. They should all be of the same category/type (e.g., diagnoses, tests, treatments, etc.). They should all be grammatically consistent and logically compatible with the stem.
3. **Do not use “All of the above” or “None of the above” as options.**
4. **Do not use combinations of options as answer choices** (e.g., A and C are correct)

Common Technical Flaws to Avoid

1. **Case clusters: Avoid cueing and hinging**
When writing a case cluster (i.e., several questions that all derive from the same patient vignette), there are two important things to avoid: Cueing (providing hints in one question to another question) and Hinging (questions where students must answer one question correctly to get subsequent questions correct). Students should be able to answer the questions independently of each other.
2. **Long correct answer**
In an effort to ensure the correct answer is clearly the most correct, instructors will often provide more specific or complete information in the correct option compared to incorrect options, giving a cue to the students.

3. **Superfluous information in question stem**

Eliminate excessive verbiage (“window dressing”) from question stems. Including incidental findings is OK, but don’t include “red herrings” (i.e., information intended to trick/confuse students).

4. **Avoid negatively phrased items**

Do not use words such as EXCEPT or NOT in the lead-in.

5. **Avoid subjective terms** (e.g., frequently, often, common, rarely)

6. **Avoid absolute terms** (e.g., all, always, never)

TESTING APPLICATION OF BASIC SCIENCE KNOWLEDGE

Clinical or laboratory vignettes can be useful in writing items that test application of knowledge. Items to consider including in a clinical vignette are:

- Age, gender
- Patient/family history
- Site of care
- Physical findings
- Presenting complaint
- Results of diagnostic studies
- Duration
- Initial treatment, subsequent findings

For medical students, vignettes featuring “real patients” may be too complicated. Patients in MCQ items should be straightforward in presentation and honest (i.e., the student shouldn’t be given any reason to doubt self-reporting by the patient).

Here are some examples of lead-ins and option lists:

- Which of the following is (abnormal)? (sites of lesions, list of nerves, list of muscles, list of enzymes, list of hormones, types of cells, list of neurotransmitters, list of toxins, molecules, vessels, spinal segments)
- Which of the following findings is most likely? (list of laboratory results, list of additional physical signs, autopsy results, results of microscopic examination of fluids/muscle/joint tissue, DNA analysis results, serum levels, etc.)
- Which of the following is the most likely cause? (underlying mechanisms of the disease, medications that might cause side effects, drugs/drug classes, toxic agents, hemodynamic mechanisms, viruses, metabolic defects, etc.)
- Which of the following should be administered? (drugs, vitamins, amino acids, enzymes, hormones, etc.)
- Which of the following is defective/deficient/non-functioning? (list of enzymes, feedback mechanisms, endocrine structures, dietary elements, vitamins, etc.)
- Given the pedigree, what is the likelihood that the next (male/female) child will have the disease?
- Which of the following is the most appropriate next step in diagnosis?

EXAMPLES FOR WRITING MULTIPLE CHOICE QUESTION (MCQ) TEST ITEMS

*Preferred Versions are in **BOLD** Font*

Guidelines for Writing Stems

Single problem—related to one objective clearly stated—as if could be answered without having options.

Written as incomplete statements or question.

Which of the following pairs of stems is better, and why?

- 1. The most appropriate management of a fetus with a large sacrococcygeal teratoma would include**
2. Large sacrococcygeal teratoma

- 1. The technique of natural family planning that has shown the greatest effectiveness in preventing unwanted pregnancy is**
2. Postmenopausal patients receiving hormonal replacement therapy

1. Which of the following statements about the fibroplastic phase (days 5-20) of wound healing is correct?
- 2. Which of the following pathophysiologic changes occurs during the fibroplastic phase (days 5- 20) of wound healing?**

- 1. The distinguishing characteristic of insensitive ovary syndrome is**
2. Which of the following is applicable to insensitive ovary syndrome

Avoid extraneous material in the stem (and options).

Although most recent studies have been marked by problems with definition of degree of laceration, they have shown that, of women undergoing primary repair of third and fourth degree obstetric perineal lacerations, approximately the following percentage have some degree of anal incontinence (stool or flatus).

What percent women undergoing primary repair of third and fourth degree obstetric perineal lacerations have some degree of anal incontinence (stool or flatus).

Guidelines for Writing Options

The keyed answer should be clearly the best.

Use only truly plausible options.

It is better to have fewer options than to include options that will not attract an examinees' selections.

Options should be homogenous in content and parallel in form.

The correct answer and distractors (wrong answers) should be able to be placed on a continuum from least correct to most correct.

Homogenous Options: They are all surgical procedures

While performing a hysterectomy for endometriosis, the ureter was transected at the level of the uterine artery. What is the best intraoperative management?

- (A) transureteroureterostomy
- (B) ureteroneocystostomy
- (C) ureterostomy
- (D) ureteroureterostomy
- (E) percutaneous nephrostomy

Options Are NOT Homogenous: All options are NOT on a single continuum

Which of the following best applies to anorexia nervosa?

- (A) elevated gonadotropins
- (B) psychiatric disorder without hormone changes
- (C) severe osteoporosis if prolonged
- (D) skin collagen is unaffected as in wrinkling
- (E) anovulation with normal estrogen levels

Avoid Cues to the Correct Answer

*(The correct answer is in **BOLD**)*

- Uneven length of options
- Cues of grammar
- Verbal cues - similarity of words between stem and correct option or between options
- Opposites in responses - allowing elimination of one option
- Non-random or illogical placement of options

The distinguishing histologic feature between labium majus and labium minus is

(A) a lack of fat cells and hair follicles in the latter

(B) glandular epithelium on the surface of the latter

(C) erectile tissue in the former

(D) Paget cells in the former

(E) shallow papillae in the latter

The cue is grammatical – correct answer starts with an object

Pregnancy rates in patients with minimal endometriosis

(A) are not improved over control by therapy

(B) are improved with almost any reasonable therapy

(C) are improved most by surgical treatment

(D) are improved most by GnRH agonist treatment

(E) are improved most by danazol treatment

The cue is in contrast between definitive answers (not, most) vs indefinite (almost)

The expected three month mortality rate in menopausal women as a direct or indirect result of hip fracture is

(A) 20%

(B) 5%

(C) 10%

(D) 30%

(E) 40%

The cue is order – item writer attempted to 'hide' the correct answer

A 28-year-old woman, gravida 2, para 2, whose last menstrual period began five days ago has a mass in her left breast. Examination discloses a discrete 2-cm apparently cystic mass in the upper-outer quadrant of the left breast. Supraclavicular and auxiliary areas are negative. The most appropriate next step in management is

- (A) danazol therapy
- (B) excisional biopsy
- (C) needle aspiration
- (D) careful periodic reexamination after onset of menses**
- (E) reassurance

The cue is the length of the correct answer

Avoid "all of the above" in one-best answer questions.

A student only has to know that two options are correct. The instructor cannot clearly evaluate student achievement with respect to other options.

Use "none of the above" only when all other answers can be excluded.

Do not use patterned response – eg 'Both C and D', K types, etc.

These items are frequently eliminated from the test on pos hoc analysis

WRITING ITEMS FOR ASSESSING APPLICATION OF KNOWLEDGE

Taxonomy of Examinee Tasks in MCQ's

Knowledge tasks include:

- recall isolated facts
- associate facts
- recall definitions, formulas

Application tasks include:

- calculate a result
- "if . . . then" problems
- reach a conclusion, diagnosis
- make a prediction
- patient disposition

- interpret data, graphs
- why something occurred
- ordering and interpreting studies
- select a course of treatment

Application items subsume knowledge

Goal for Foundations– 80% of all items should be application

Application items structure

- Include a brief vignette, clinical or experimental
- Include a ‘Lead-in’ statement following the vignette that defines the task
- Often have a ‘2 step’ appearance—the student must understand something about the vignette before able to answer the question: eg

Lead in statements for clinical vignettes

- The most likely diagnosis is
- The most appropriate next diagnostic study is
- The most appropriate treatment is
- The most appropriate patient examination is
- The patient is most likely to develop
- The patient is at greatest risk for
- The patient was most likely exposed to
- The physical examination would most likely show
- Diagnostic studies would most likely show
- Which of the following is most likely to reduce risk for (complication)

Content of clinical vignettes

Basic content include unessential by typical presenting information:

- age and presenting complaints
- individual vs. class of patients

Additional content history of complaint:

- associated symptoms
- family, social history
- findings from physical
- results of laboratory studies
- initial treatment and outcomes

References

NBME Test Item Construction Manual at:

http://www.nbme.org/PDF/ItemWriting_2003/2003IWGwhole.pdf

OR

USMLE Step 1 Sample Test Questions at:

http://www.usmle.org/pdfs/step-1/2015samples_step1.pdf

Case SM, Swanson DB. Constructing written test questions for the basic and clinical sciences. Third Edition, National Board of Medical Examiners, 2002 (<http://www.nbme.org/publications/item-writing-manual.html>)

Collins J. Education techniques for lifelong learning: Writing multiple-choice questions for continuing medical education activities and self-assessment modules. Radiographics 26:543-551, 2006 (<http://www.ncbi.nlm.nih.gov/pubmed/16549616>)

Haladyna TM, Downing SM, Rodriguez MC. A review of multiple-choice item-writing guidelines for classroom assessment. Applied Measurement in Education 15(3): 309-334, 2002 (<http://goo.gl/Zd48ep>)