

# Supplemental Material

*CBE—Life Sciences Education*

Bass *et al.*

## Supplemental Documents

- A. Multiple choice item-writing tips
- B. Instrument cover sheet

A. Extended list of tips for writing multiple-choice questions (Compiled from sources through AAAS Project 2061 and adapted with permission [AAAS Project 2061, 2011]).

### **General**

- Test for important or significant information (base each question on student learning objective of the lesson, not trivial information).
- Be sure the item would be comprehensible to your students
  - Avoid unfamiliar vocabulary that is not defined and that are not related to the learning goal
  - Avoid complex sentences
  - Avoid words and phrases with confusing or ambiguous meanings.
- Items should have only one right answer.
- Use present tense and active voice.
- Minimize the time required to read each question.
- Items should use the same format (space between answer choices, indent answer choices...)
- Do not use contractions (don't, can't, etc.)
- Do not rephrase or change terminology (e.g., do not interchange the words "particles" and "atoms within an item").

### **Stem**

- Include the central idea in **the** order to avoid repetition in answer choices.
- When using context in an item, include sufficient contextual information to make the item clearer to students that may not have the same experiences. E.g., if your item is about a cactus, say "a cactus, a plant that..."
- Keep sentences brief and straightforward with a simple phrase structure and no additional clauses.
- Word positively---avoid negative phrasing.
- Avoid phrasing "all of the following except" or "which of the following is false."
- Capitalize "TRUE" in "Which of the following is TRUE?"
- Place conversational statements in double (not single) quotation marks.

### **Answer choices**

- Each item should have an identifiable theme and all of the answer choices should be related to that theme.
- Link one or more of the distractors to misconceptions related to the key idea.
- Each answer choice should be a single word, phrase or single sentence (*keep options short*).
- Keep all options homogeneous in content.
- Keep answer choice length similar.
- Keep the structure of answer choices as similar as possible (e.g., all single words or all phrases)
- Avoid "all of the above."
- Avoid "none of the above." There should be at least one correct answer; otherwise you will not know if students understand the idea being tested.

- Avoid using the terms “never” and “always” in only one of the answer choices.
- Use logical order in answer choices if there is one. Examples: (1) list all “yes” choices together and all “no” choices together, (2) if the answer choices are numbered list them in ascending order
- If there is not a conflict with the logical order, order answer choices by length (shortest to longest)
- Avoid “*I don’t know.*”
- Include from three to five options for each question.
- Keep options independent; options should not be overlapping.
- Phrase options positively, not negatively.
- Avoid distractors that can clue test-wise examinees (e.g., absurd options, formal prompts, or overly specific or overly general clues).
- Avoid giving clues through the use of faulty grammatical construction.
- End each answer choice that is a sentence with a period. Do not end phrases or single-word answer choices with a period.
- When possible, make each answer choice a single word, phrase, or sentence. (avoid using more than one sentence).
- Balance the placement of correct answer (not all As and Ds)

**Illustrations**

- Keep illustrations simple and to the point.
- Illustration can also be used to break the monotony of a word-heavy test. Also, some students rely on pictures to help orient them to the context.
- Illustrations should facilitate the understanding of what is being asked.
- Include the same information in the text and the illustration (mirroring).

B. A sample instrument cover sheet (also useful for planning)

<Project name>

<date>

<*Name of instrument*>

General purpose: (e.g., to evaluate the impact of XYZ curriculum on students' understanding of XYZ concepts):

Constructs measured:

Population being measured, including any distinguishing characteristics (e.g., a high percentage of English Language Learners):

Intended use of instrument data:

Item format (e.g., multiple choice, open ended):

Approximate instrument completion time:

Administration times (e.g., pre and post, or at specific times during a unit):

Resources consulted: