This booklet was designed to help those involved in the education of histotechnologists and histologic technicians.

Its intended use is to explain the construction of written exam questions that can be used in:

- NAACLS-accredited HT or HTL programs
- On-the-Job Training (OJT) of HT or HTL
- Continuing Education courses required by JCAHO, CAP, OSHA, etc.
- Helping someone study for the ASCP Board of Registry HT or HTL exam
  - Competency or proficiency assessment
  - Professional workshops or presentations
    - ASCP Tech Samples

This booklet is intended to be a general guide on writing exam questions. For more specific guidelines on requirements, contact the agencies listed above.

REFERENCES:


National Society for Histotechnology Education Committee
Written exam questions can be used for more than teaching students in an accredited histotech program.

Have you ever thought about using written exam questions to:
- test the knowledge level of people learning on-the-job (OTJ) at your institution?
- assess if your techs really learned to use the new tissue processor?
- appraise the competency of your techs for the new stain?
- evaluate if your techs really read the new procedure?
- document comprehension of required safety lectures?
- include as pre- and/or post-tests for workshops you are presenting?
- use as the continuing education questions at the end of the ASCP Tech Sample you are writing?

**DOMAINS**

Most behaviors of learning fall into one of three categories, also known as **DOMAINS**: Affective, Cognitive, and Psychomotor. There is also a fourth domain, Perceptual, which is usually not used in evaluating what people have learned in a laboratory.

**Cognitive:** The cognitive domain emphasizes behaviors that require the use of the intellect, such as memorizing facts, applying concepts, and analyzing material, creating plans, or solving problems.

Oral or written exams are often used to evaluate learning in the cognitive domain.

**Affective:** The affective domain emphasizes behaviors that involve feelings, emotions, interests, attitudes and values. Examples include: respecting the safety standards needed to perform a staining procedure; valuing time by coordinating multiple staining procedures at the same time; or showing consideration of confidentiality by not discussing cases in elevators or hallways.

Evaluating the affective domain can be done by way of written or oral exams, or by observation of behavior.

**Psychomotor:** The psychomotor domain is concerned with tasks involving muscular action and motion, such as the physical pouring of a solution into a coplin jar, or the physical sectioning of a block, or the physical adjusting of a knob on the microscope.

Evaluation of the psychomotor domain is usually done by observation and the use of a checklist. Yes, the person did this task, or No, they forgot to do this step. Yes, they did this step very well, or, No, they did not perform a step correctly and need to practice this step again.

**Perceptual:** The perceptual domain is related to sensory-dependent behavior in voluntary motor response, such as feeling that the solution is hot and removing your hand, or by seeing that the solution is boiling and turning down the heat.

This domain is usually not tested for in the histology laboratory.

This booklet will concentrate on evaluation systems) exam questions) used in the Cognitive Domain.

**TAXONOMY LEVELS**

There should be a variety of taxonomy levels in any written exam.

**Taxonomy I = Recall:** These questions assess the ability to recall previously memorized material.

Concepts include: identify, indicate, name, select, state, define, list, match, compare, and discuss.

*In the Grocott stain, fungi are stained what color?*

The test-taker either knows the correct answer is “black”, or doesn’t.

**Taxonomy Level II – Analyze:** These questions assess the ability to analyze, interpret or apply the previously recalled/memorized material. A common style of question is to ask the person to figure out “What went wrong?” or “Why didn’t it work?” or “Is it OK?” The questions may also relate to lab math, charts, diagrams, or photos of stains or tissues.
Concepts used include: associate, compare, modify, solve, categorize, determine, analyze, appraise, differentiate, distinguish, and calculate.

Microscopic review of a Grocott stain reveals totally black fungi. The most likely cause is:

The test-taker must know how GMS-stained fungi are to be black on the outside, gray on the inside (Tax I = Recall). Then, they must determine why the fungi are totally black (Tax II – Analyze). If someone did not know how GMS-stained fungi are supposed to look and the steps in the stain (both Tax I), they could not determine what went wrong. (Tax II).

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Taxonomy III – Troubleshooting: These questions assess the ability to problem-solve to correct the error, or to invent a new way to do something.

Concepts used include: assess, evaluate, propose, create, recommend, compose, design, formulate, justify, solve, formulate, appraise, critique, and revise.

Microscopic review of a Grocott stain reveals totally black fungi. To correct this in the future:

The test-taker must know how fungi are supposed to appear (Tax 1), what could have gone wrong (Tax II), and figure out how to correct this (Tax III).

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Percentages of Taxonomy Questions on Exams:

There are no “rules” dictating that exams should contain a certain percentage of each taxonomy level, such as 1/3 each, or 50% Tax I, 30% Tax II and 20% Tax III.

Factors that determine the taxonomy ratio on exams are:

- **What is the learning level of the student?** Are they just starting in the field> Then their exams will be more Tax 1 and 2. Are they near the end of their training? Then they should be able to do more Tax 2 and 3 questions.
- **What do you want the learner to do or know?** If you only want the histotech to know how to load the tissue processor (Tax 1) and respond to a few alarms (Tax 2), but do **not** want them to reprogram the machine when given tissue never seen before in your lab (Tax 3), then exam questions on only Taxonomy 1 and 2 levels are appropriate.

OBJECTIVES

In any learning situation, objectives should be available to the learner to let them know what they are to learn and know at the end of the training or teaching session. Exam questions should be at the same taxonomy level as the objectives.

**Taxonomy 1:**

**Objective:** Upon completion of the lecture, the student will be responsible on a written exam to list three fixatives which contain picric acid, with a minimum score of 75%.

**Exam Question:** List three (3) fixatives that contain picric acid.

**Taxonomy 2:**

**Objective:** After a competency assessment training on stains for acid fast bacteria, and with the use of the procedure manual, the student will be responsible to compare two stained slides and determine which is the better stain.

**Exam Question:** Look at two Kinyoun stained slides with the microscope; determine which of the two slides is a better stain and explain the reason.

**Taxonomy 3:**

**Objective:** After reviewing the changes on microorganism stains in the procedure manual, and without the use of reference material, the student will be responsible on a written examination to recommend changes to staining procedures to correct errors, with a minimum score of 70%.

**Exam Question:** A Grocott stain was done. The fungi are totally black, and connective tissue is also stained black. Recommend two (2) changes that could be made in regards to the oxidizer.

Notice – The objective verb is often used again in the exam question. This assures that taxonomy levels are the same.

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Multiple Level Verbs: Some verbs, such as discuss, describe, or explain, could be used for Tax 1, 2 or 3, though are best reserved for Tax 2. Either make the objective very clear as to its taxonomy level, or use another verb.

**Tax 1:** Discuss the color outcome of a GMS. (Use “State”)
**Tax 2:** Discuss two causes of overstained fungi with GMX/Tax 3:** Discuss two methods to correct overstained fungi the next time a GMS is done. (Use “Recommend”)
GENERAL RULES

BEGINNING

Be fair: Write questions that will accurately assess what the test-taker is supposed to know. Do NOT write questions to “Trick” the student, or to find out what they do NOT know. This is depressing to the test-taker, and is often perceived as egotistical of the teacher.

Name and Date: Make certain to leave spaces for the test-taker to write their name and the date on the test.

Don’t laugh! It’s very easy to forget this. And very hard to record a grade if you don’t know who earned which score.

DIRECTIONS

Number of points – total AND per question: Indicate on the test how many total points this test is worth, and how much each question is worth. It helps the test-taker decide how long to spend on a question. If one essay question is worth 5 points, and another essay question is worth 2 points, and the test-taker knows this, they should be spending more time on the five point question than the two point question.

Points can be indicated by a sentence at the start of a series of similar style questions:

Multiple Choice Questions: One (1) point each

or at the start of each question:

(2 points) Discuss four (4) safety precautions...

Time Limit: indicate the time allowed to take the exam. This allows the test-takers to pace themselves.

For a long exam, such as 45 minutes or longer, let the students know periodically how much time they have left. For example, if the test is 90 minutes long, let them know when they have 30 minutes left and again when there are only 15 minutes left. This again allows the students to pace themselves.

Directions: Directions should be very clear, concise and specific. Additional information about directions will be given under each question type in this booklet.

HINTS ON QUESTIONS

First question(s): It is helpful to the test-taker if one or two easy questions are placed as the first question(s). If the test-taker knows the answer to the first question, it gives them a psychological boost for the rest of the exam. Conversely, if the first question is difficult, and the test-taker does not know the answer, then panic can begin to set in, which can effect their performance on the rest of the exam.

Length of Question: Questions should not be too long or too wordy. It confuses the test-taker. If the question needs to be long, break it up into short sentences and/or use bullets.

Incorrect: When observed with a microscope, a piece of lung tissue stained with H&E reveals black material. Additional sections were stained with Prussian blue, alizarin red, von Kossa, and Fontana-Masson, and none showed any positive staining. The black material is probably:

a. calcium
b. carbon
c. iron
d. melanin

Correct: Black material is seen in cells in lung sections stained with H&E. Additional sections were stained with:

• Alizarin red
• Fontana-Masson
• Prussian blue
• von Kossa

None of these procedures stained the unknown material. The black material is probably:

Length of Answer: Leave enough space for answers, particularly essay and/or short answer.

In the case of fill-in-the-blank, make all the “blanks” the same length, so not to give hints as to which is a long word and which is a short word.

Complete Question on One Page: To make certain that the test-taker is aware of all the information in the question, or all the answer options in the multiple choice question, it is best that the question is contained on only one page.
Punctuation and Spelling: Use the grammar and spell checker on the computer, look up words in textbooks, and ask people to proof-read your questions.

You’ll be surprised the errors other people find. After all, your brain already knows what it means to say.

Noun and Verb Agreement: The subject and the verb must agree in tense. Is the subject plural or single? Then the verb must agree. Incorrect noun-verb agreement can sometimes clue good student in on the correct answer:

Incorrect:
The staining solutions used in the Brown & Hopps stain are:
  a. crystal violet and basic fuchsin  
  b. hematoxylin  
  c. light green  
  d. silver nitrate
(Note: The “s” on the end of “solutions” and the word “are” indicates more than one solution.)

Correct, but not the best:
The staining solution(s) used in Brown & Hopps stain is:

Correct, and best:
A staining solution used in the Brown & Hopps stain is:
  a. crystal violet  
  b. hematoxylin  
  c. light green  
  d. silver nitrate

A/An: Watch these articles, especially if it is the last word of the question. This can tip off experienced test-takers.

Incorrect: Squamous epithelium is found in an:
  a. bone  
  b. esophagus  
  c. liver  
  d. spleen

Correct: Squamous epithelium is found in a/an:
  a. bone  
  b. esophagus  
  c. liver  
  d. spleen

You: Avoid the word “you” in the question.

It may intimidate some (“I don’t know what I’d do!”), or make someone defensive (“I’d never do that!”). Plus, the test-taker may be correct in telling you what THEY WOULD do, but it may not be the true correct answer, since what they would be doing is wrong.

Use the more generic “histotech” or “student” instead of “you”, and not the more specific “histotechnologist” or “histologic technician”. If the question contains the word histotechnologist, and they are a histologic technician (or vice versa), they may think it doesn’t pertain to them, or that they don’t have to answer it, or they may become offended.

The best method is to make the sentence passive.

Incorrect: Into which fixative should you place a lymph node?

Correct: Into which fixative should the histotech place a lymph node?

Correct and Best: Into which fixative should a lymph node be placed?

Dangling Participle: This is a phrase, placed BEFORE the main sentence that modifies or relates to the subject of the main sentence. The phrase often has an “-ing” verb.

Usually, the meaning of the sentence is clear. But, it does lead to some funny mental images.

The sentence must be written, often into several shorter sentences.

Incorrect:
While microtoming a block of breast tissue, the knife hits a hard area in the tissue. This area is most likely:
  a. calcium  
  b. copper  
  c. iron  
  d. zinc
(NOTE: The knife is using the microtome machine.)

Correct:
A block of breast tissue is being sectioned. The knife hits a hard area in the tissue. This area is most likely:
**VOCABULARY**

**Simplify:** Try using simpler words, particularly for the non-medical/non-laboratory terms. Often, people will know the scientific material, but will answer the question wrong because they did not understand the purpose of the question.

<table>
<thead>
<tr>
<th>DIFFICULT</th>
<th>EASIER</th>
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<tbody>
<tr>
<td>Analyze</td>
<td>Evaluate</td>
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<tr>
<td>Assess</td>
<td>Measure/Rate/Consider</td>
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<tr>
<td>Correlate</td>
<td>Compare/Associate</td>
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<td>Differentiate</td>
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<td>Distinguish</td>
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<td>Formulate</td>
<td>Solve/Plan/Devis</td>
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<td>Prescribe</td>
<td>Define/Establish</td>
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<td>Specify</td>
<td>Define/Indicate</td>
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**Adverbs and Adjectives:** use as few of these as possible. This is a histology exam, not a poetry contest.

Adjectives and adverbs can confuse the test-taker, particularly those for whom English is second language.

**Medical Terminology:** Use familiar words, especially those previously used in text books. Avoid local jargon.

**Abbreviations:** Avoid is possible. Use the full terminology, and then place the abbreviation at the end in parenthesis, e.g., Fine Needle Aspirate (FNA). If the abbreviation is very common, and has been used repeatedly in the course, then using it on an exam may be fine, such as GMS and PASH.

**OTHER HINTS**

**Positive Wording:** Phrase the stem in the positive format. Avoid negative wording, such as “no”, “not”, or “except”.

Negative questions are considered “trick” type questions, where the person may answer the question wrong because they did not see the “not” or the “except”.

*IF* the question is about a valid concept that can ONLY be constructed in the negative, then capitalize, bold, italicize, and/or underline the negative. If possible, put the negative word at the end of the stem.

**Incorrect:**
Which of the following is not a red dye used in the trichrome stain?

- a. Biebrich scarlet
- b. chromotrope 2R
- c. nuclear fast red
- d. ponceau de xylidene

**Correct, but NOT in the best format:**
Which of the following is NOT a red dye used in the trichrome stain?

**Correct, better, but not the best format:**
All of the following are red dyes used in the trichrome stain **EXCEPT:**

**Best, phrased as a positive statement:**
Which of the following is a red dye used in the trichrome stain?

- a. Biebrich scarlet
- b. Congo red
- c. nuclear fast red
- d. phloxine

*(NOTE: Responses had to be changed.)*

**Highlighting:** highlight (bold, underline, capitalize, and/or italicize) key words or phrases.

This helps eliminate the “trick question” which is not fair to the test-taker. They may know the material, but miss the question because they read it too fast, and missed the “trick” word.

**Incorrect:** The PTAH stain can be ripened for immediate use by:

- a. acetic acid
- b. potassium permanganate
- c. sunshine
- d. heat

*(Note: Sunshine and heat will ripen slowly.)*

**Correct:** The PTAH stain can be ripened for **IMMEDIATE** use by:

- a. acetic acid
- b. potassium permanganate
- c. sunshine
- d. heat
CONSTRUCTING MULTIPLE-CHOICE QUESTIONS

ADVANTAGES

Versatile and Adaptable:
- Of all cognitive question types, the multiple choice is the most versatile and flexible.
- Can measure all three Taxonomy levels.
- Can test all subject material.
- Can be used for all learning levels of test-takers.
- Test-taker can answer a large number of questions in a short amount of time.
- Can be used to test cognitive and affective objectives.

Grading:
- Exam can be graded quickly, accurately, objectively, and by someone other than the person who wrote the exam.
- Scoring is not influenced by the test-taker’s performance on a previous exam, or by their appearance.

DISADVANTAGES

Writer:
- May lack sufficient knowledge to write plausible wrong answers.
- May lack sufficient skill in writing this type of question.
- Needs to take effort and time to write good questions.

Test-Taker:
- Takes time to read, consider choices and circle answer.
- Does not measure test-taker’s ability to organize material or to clearly express answers in appropriate language.

INSTRUCTIONS

Circle the one correct response.
Circle the one best response.

If the instructions state to circle the one correct response, there must be only ONE correct response. The other responses cannot be correct under any circumstance, or under any twisting turn of logic. It is sometimes difficult to write a multiple choice question with only one correct answer, if there are two correct answers, one a better choice and one a poor correct answer, the both must be given to the test-taker, regardless of which one they marked as correct.

On the other hand, if the instructions state to circle the one best response, there may be more than one correct answer, but one is a much better answer than the others.

Which of the following should be used as a counterstain with GMS?
- a. crystal violet
- b. eosin
- c. hematoxylin
- d. methylene blue

If the instruction was to select the ONE CORRECT answer, the test-taker could argue (possibly successfully) that the correct is light green, which was not a choice. Or that all the stains listed could be used, which they could.

However, if the instruction was to select the ONE BEST answer, then the BEST response of those listed would be eosin, as pink gives the best contrast with gray/black, as compared with blue or purple counterstains.

CONSTRUCTION

Two Parts to the Question:

Stem is the main part of the question or statement. It should include all the information necessary to come up with an answer.

Response is the choices listed, the A, B, C, D, etc. under the stem. Responses can be placed in two categories.

Keyed Response is the correct answer, or the one answer that is the most correct (the best answer).

Distracters are the wrong answers, or the “not as correct” answers.

STEM

Question or Incomplete Statement: The question can be written either way, which ever works best.

Incomplete Statement: A dehydrant commonly used in tissue processing is:
- a. butanol
- b. dioxane
- c. ethanol
- d. xylol

Question format: Which of the following is a dehydrant commonly used in tissue processing?
Repetitive Wording: Place repetitive words or phrases in the stem, NOT in the responses. This makes the question and responses easier to read.

Incorrect: In the PAS stain:
- sections are oxidized with chromic acid
- sections are oxidized with periodic acid
- sections are oxidized with potassium permanganate
- sections are oxidized with sodium thiosulfate

Correct: In the PAS stain, sections are oxidized with:
- chromic acid
- periodic acid
- potassium permanganate
- sodium thiosulfate

**RESPONSES**

Do Not Use as your “D” answer:
- All of the above
- None of the above
- A and C

These are usually correct, and tip off good test-takers.

It also does not differentiate between those who know all the information vs. those who only know some of the information. If a person knows that “a” is correct, but thinks “b” might be too, they have the option of “All of the Above” for “d”, then they will know that “d” must be correct without knowing for certain if “b” was correct. If there was only one best answer, then they would have to know whether the correct answer was “a” or “b”.

Randomize Correct Answers: Experienced test-takers know that “A” and “D” are less likely to be the correct answer than “B” and “C”. If the test-taker does not know the correct answer, they may guess “B” or “C” because they know that the odds are in their favor of one of them being correct.

Therefore, position the correct answers randomly. If all the questions have four responses, then each of the responses should be correct about ¼ of the time in the exam.

Same Length of Response: Make all the responses about the same length. A good test-taker knows that, often, the longest response is the correct answer.

Incorrect: The purpose of using de-ionized water in a silver stain is to:
- change the pH
- stop false negative staining
- oxidize the silver
- prevent contamination of the silver solution

Correct: The purpose of using de-ionized water in a silver stain is to prevent:
- changes in the pH of the silver solution
- false negative staining of the tissue
- premature oxidation of the silver
- contamination of the silver solution

Overlap Responses: Avoid responses that overlap. Answers may be partially correct in more than one response.

Incorrect: Fixation in B-5 fluid requires that the tissue be small enough to ensure complete fixation in:
- 1-3 hours
- 2-4 hours
- 5-7 hours
- 6-8 hours

Correct: Fixation in B-5 fluid requires that the tissue be small enough to ensure complete fixation in:
- 1-2 hours
- 3-4 hours
- 5-6 hours
- 7-8 hours

(Note: The correct answer is 3-4 hours. In the “Incorrect” version, “a” contains 3 hours, which is correct, but 1-2 is incorrect. “b” contains 2 hours, which is incorrect, but also contains 3-4 hours, which is correct.)
Logical Order: Arrange the responses in a logical order, such as alphabetical, numerical or chronological.

If the test-taker is aware the answers are in alphabetical order, then they will not be so concerned if “d” is the correct answer five times in a row.

It also helps in that the test writer does not have to spend so much time making certain that each of the answers (a, b, c, d) is being used ¼ of the time. The correct answer choice is dictated by the alphabet or numerically.

Incorrect: The cryostat temperature used for most routine frozen sections is:
   a. -40°C.
   b. -20°C.
   c. -10°C.
   d. -30°C.

Correct: The cryostat temperature used for most routine frozen sections is:
   a. -10°C.
   b. -20°C.
   c. -30°C.
   d. -40°C.

Incorrect: The Von Kossa stain demonstrates:
   a. iron
   b. copper
   c. calcium
   d. lead

Correct: The Von Kossa stain demonstrates:
   a. calcium
   b. copper
   c. iron
   d. lead

Clang Words: Watch out for the words in the stem and the responses that would set off a bell (“clang”) of recognition in the mind of the test-taker.

Incorrect: Which of the following is an aldehyde fixative commonly used in electron microscopy?
   a. B-5
   b. Glutaraldehyde
   c. Hollandes
   d. Zenker fluid

(Note: “aldehyde” in “glutaraldehyde”)

Correct: Which of the following is a fixative commonly used in electron microscopy?

Opposites: Avoid responses that are the opposite. Good test-takers know that one of the two is usually correct.

Opposites include such combinations as increase/decrease, raise/lower, longer/shorter, etc.

Incorrect: A frozen section CANNOT be obtained on a piece of omentum during cryotomy. To correct this:
   a. increase the cryostat temperature
   b. decrease the cryostat temperature
   c. fix the tissue first in formalin
   d. use the dull part of the knife

(Note: increase and decrease in “a” and “b” are opposites.

Correct: A frozen section CANNOT be obtained on a piece of omentum during cryotomy. To correct this:
   a. cut it on a freezing microtome
   b. lower the cryostat temperature
   c. fix the tissue first in formalin
   d. use the dull part of the knife

Grammatically Consistent: Make all responses similar in structure. It is less confusing to the test-taker.

- Use the same verb tense.
- Keep the order of the verbs and subjects the same.
- Have the number of adjectives and adverbs the same and minimal.

Incorrect: Mercuric chloride is NOT used alone as a fixative because:
   a. it does not coagulate proteins
   b. mercury is too acidic alone
   c. shrinking of cells was excessive
   d. fixatives make frozen sections too mushy

Correct: Fixatives that contain mercuric chloride usually contain other chemicals as additives. This is because mercuric chloride:
   a. coagulates proteins poorly
   b. decreases pH excessively
   c. shrinks cells considerably
   d. penetrates cytoplasm slowly

(Note: All responses now are three words long, begin with a verb in the plural tense, and have one adverb each at the end. To achieve this, the question stem had to be rewritten, deleting the negative “not”. It is not always necessary to rewrite the stem, but it sometimes helps.)
Plausible Alternatives: Make the distracters seem attractive to the test-taker who lacks basic knowledge. One answer should NOT stand out as correct to someone unprepared.

Use common misconceptions, familiar errors, and logical but false clues. Use wrong answers given by previous test-takers or in the classroom or teaching session.

Incorrect: The Steiner silver procedure was done. The spirochete control slide does NOT demonstrate any positivity. What might have caused this?
- a. the patient’s tissue was fixed in B-5
- b. a reticulin control slide should have been used
- c. the Grocott stain should have been used instead
- d. the slides were taken out of the developer too soon

Correct: The Steiner procedure was done. The spirochete control slide does NOT demonstrate any positivity. What might have caused this?
- a. uranyl nitrate was used before the silver solution
- b. time in the counterstain was too long
- c. silver solution was fresh, instead of ripened
- d. slides were removed from the developer too soon

(Note: In the incorrect version, the wrong responses discuss the patient’s tissue (not the control slide) and two other stains (not the Steiner). Only “D” relates to the Steiner stain. In the correct version, all responses involve a staining step in the Steiner procedure.)

Similarity and Difficulty: in general, the more similar the distracters and the response are to each other, the more difficult the question usually becomes. The question stays within the same taxonomy level, but becomes less obvious.

Use questions with less similar responses as your easier questions, and use questions with more similar responses as your harder questions.

Easier: A black precipitate is seen over the slide in the reticulin technique. To correct this in the future:
- a. post-fix the sections in Bouin solution
- b. cut the block at 4 µ instead of 7 µ
- c. dry the sections in a 60°C oven for 1 hour
- d. rinse in deionized water instead of tap water

Harder: A black precipitate is seen over the slide in the reticulin technique. To correct this in the future:
- a. over-tone the slides with gold chloride
- b. under-oxidize with potassium permanganate
- c. incubate in the silver solution at room temperature
- d. use deionized water instead of tap water to rinse

(Note: Responses in “harder” version all pertain to staining. The responses in the “easier” version involve fixation, section thickness, slide drying and staining.)

MULTIPLE-MULTIPLE CHOICE
This is a variation of the True-False format of test questions. The construction is similar to the usual multiple choice question. However, there is not one correct answer. Instead, each response is considered separately, and the student must decide of each one is correct or incorrect. All responses may be correct, some may be correct, or none may be correct.

ADVANTAGES
- More thoroughly tests knowledge level, since there is not just one correct/best answer.
- Can be used to evaluate cognitive and affective domains.
- Can be constructed to test all three taxonomy levels.
- There does not have to be three good “wrong” answers.
- Works very well for case studies.

DISADVANTAGES
- Students are often unfamiliar with this format.
- Directions have to specify this format, and how to mark.
- Scoring may be confusing.
- If using this style for more than one question, answers must be randomized, as usually the correct answers tend to be listed first.

For the following questions, circle each answer that is correct. 3 points each question.

Stratified squamous epithelium is found covering:
- a. bladder
- b. bronchus
- c. esophagus
- d. skin
- e. stomach
- f. uterus

A GMS was done. There is an increase in background staining. Using which of the following may have caused this problem?
- a. 2 um thick section
- b. 80°C incubator oven
- c. Bouin fixed tissue
- d. fresh silver solution
- e. reused chromic acid
- f. periodic acid
CONSTRUCTING MATCHING QUESTIONS

ADVANTAGES

• Similar in construct to the multiple-choice question, with a set of related stems sharing the same set of alternatives.
• Good way to measure the lower taxonomy levels.

DISADVANTAGES

• Difficult to write higher taxonomy levels.
• Often difficult to find enough ideas that are similar to form a matching set.
• Overemphasizes a small portion of the lecture area.

CONSTRUCTION

There are three (e) parts to the Matching Question:

Introductory Statement: Contains the instructions on how to match the items.

Premise: The words, sentences, or portions of sentences to which the alternatives are matched.
- Usually placed on the left.
- Should have between 6 and 12 premises.
- Should have a header over it.
- Placed in a logical order (alphabetical, etc.)
- Should be a similar set (same topic)

Alternatives: The words or portions of sentences that are the answers” to the premises.
- Usually placed on the right with a header
- Be grammatically consistent with the premises
- Usually only ONE BEST answer for each premise
- Placed in a logical order (alphabetical, numerical)
- Identify with capital letters (A, B, C, etc.)

Numbers of alternatives: There should be three or four extra alternatives than the number of premises.

This stops the “process of elimination”, where the test-taker may not know the answer to one of the premises, but is able to figure out by matching up all the rest. The one alternative left over must be the answer to the premise they did not know. By having two or three additional premises, this discriminates the people who know the answer from those who guess by process of elimination.

DIRECTIONS/INTRO STATEMENT

• State total number of points
• State to match the (header) on the right with the (header) on the left.
• State whether the premises each have an alternative, or if some premises may not have an alternative.
• State whether all alternatives are used, if some may be used more than once, or if some may not be used.

Incorrect:

Match the following:
____ hematoxylin A. basement membrane
____ eosin B. reticulin
____ PAS C. nuclei
____ trichrome D. collagen
____ retic E. cytoplasm

Correct:

(4 points total) Match the stains on the right with the tissue component on the left. Each tissue component will have ONE BEST stain. Indicate only the ONE BEST stain. Not all stains will be used. Some stains may be used more than once.

TISSUE COMPONENT STAIN
____ basement membrane A. Giemsa
____ cartilage B. Gordon-Sweet
____ collagen C. PASH
____ elastin D. PTAH
____ fibrin E. Sudan black B
____ lipid F. Trichrome
____ striated muscle G. Verhoeff
____ reticulin H. Weigert

NOTE: The second choice is better because:
• Gives detailed instruction
• Lists total points, which each premise is worth ½ point (total points = 4 multiple choice questions)
• Has headers on the columns
• All premises relate to connective tissue
• There are between 6 and 12 premises
• Each tissue component has only ONE BEST stain
• Both lists are alphabetical
• Stains and tissue components do not have any “clang” words, like “retic” and “reticulin”
• Though the number of components and stains are the same, some stains are used more than once, while others will not be used, stopping the “process of elimination”
CONSTRUCTING TRUE-FALSE QUESTIONS

ADVANTAGES

- Relatively easy and quick to write.
- Scoring is fast, accurate, objective, and done by anyone.
- Test-taker needs little directions.
- Good for testing lower taxonomy, factual information.

DISADVANTAGES

- Fifty-fifty chance of guessing the correct answer.
  - Encourages wild guessing
  - Does not do well in differentiating those who know the material from those who do not.
- Statement MUST be either absolutely true or completely false.
  - If not, then test-taker must decide how true or false the statement is, and guess how the instructor would rate the degree of trueness or falseness.
  - Often very difficult to write without being too wordy.
- Does not test high taxonomy objectives.

CONSTRUCTION

First of all, carefully consider the limitations of the True-False format. Since it is of little value in locating gaps in the student’s knowledge and can be used at the Tax I recall level, other exam question formats may be a better choice.

Mix Up Answers: Avoid the hint of a pattern – TTFFTTFF. Try flipping a coin – heads for a True statement, tails for a False statement. Make about ½ True and ½ False.

One Theme: Each question must have one, and only one, central theme. If there is more than one theme, half of the question may be true while the other half is false,

Incorrect: Histotechns have to follow Blood Born Pathogen guidelines because they use needles to draw blood.

Correct: Histotechns must follow Blood Born Pathogen guidelines.

(Note: In the incorrect, the first part is True, as histotechns DO have to follow BBP guidelines. However, the second part is false, because most histotechns do NOT draw blood.)

Determiners: Avoid “always,” “never,” “sometimes” and “often”. Good test-takers know that “always” and “never” are always false, and “sometimes” and “often” are often true.

Avoid Negatives: Using a negative in the statement should be AVOIDED. It involves convoluted thinking to realize that a double negative yields a positive. This is particularly true for students for whom English is a second language.

Incorrect: Bronchial epithelium is NOT ciliated (F)
Correct: Bronchial epithelium is ciliated. (T)

Incorrect: Esophageal epithelium is NOT ciliated. (T)
Correct: Esophageal epithelium is ciliated. (F)

(Note: In the first incorrect version, the person has to think “This is NOT true, because bronchial epithelium IS ciliated. Therefore the answer is FALSE.” In the second incorrect: “This is true, because esophageal epithelium is NOT ciliated.” Many will think for the second: “No, of course not. Esophageal epithelium is not ciliated. So this is FALSE”)

INSTRUCTIONS

Group: Group a bunch of T-F questions in one place, so that the instructions only have to be stated once.

Points: State how many points each T-F question is worth. And consider: Should each T-F question that is testing only Tax I knowledge, be worth the same number of points as a multiple choice question? The answer may be “yes”.

How to Answer: State whether they should write “True-False”, or “T-F”, or “Yes-No”. Leave a space or a line in front of the statement, where they can write their choice.

This will slow down grading. It will introduce subjectivity into the grading, since there is usually more than one way to correct the statement, and some will be better than others. But it does find the gaps in the test-takers’ knowledge.

Mark T for True and F for False for each of the following. ½ point each

Kidney is a good control for glycogen
Alizarin red will demonstrate calcium
Muscle enzymes stains require a frozen section
Potassium permanganate is the oxidizer used in the GMS stain
Methyl violet is a metachromatic dye
CONSTRUCTING Fill-IN-THE-BLANK QUESTIONS

Fill-in-the-Blank questions are also known as Completion Questions.

**ADVANTAGES**

- Good for testing lower taxonomy information.
- Measures recall of information, rather than recognition.
- Minimizes chances of guessing the correct answer.
- Relatively easy to write questions.

**DISADVANTAGES**

- Hard to write questions with only one correct response.
- Grading difficult when test-taker thinks of an answer that the instructor didn’t.
  - All valid answers must be given credit
- Takes time to read when grading.
- Test-takers may not know what the instructor wants in the question.

**CONSTRUCTION**

*Format:* The most common exam completion formats for histology labs are the question format, the statement format and the incomplete sentence format. The choice of which to use depends upon which format works best for the material.

**Question Format:** What blood cell is found in abundance in Peyer’s patches? ___________

**Statement Format:** Name the blood cell that is found in abundance in Peyer’s patches.

**Incomplete Sentence Format:** The blood cell that is found in abundance in Peyer’s patches is:

____________________________

**Hidden clues:** Watch for clues, similar to the Multiple Choice questions (a/an, verb/noun agreement, etc.)

**Blank position:** The best position is at the end of the statement. This gives the information to the test-taker first, so that they can formulate the answer in the same sequence as the question. The next best position for the test-taker, but easiest for the grader, is for the blank to be positioned first. The least desirable location is in the center of the sentence.

**Best:** The fixative for the Gomori Trichrome stain is ________________________________.

**Next Best:** ________________________________ is the best fixative for the Gomori Trichrome stain.

**Poorest:** The following fixative, ____________, should be used for the Gomori Trichrome stain.

______________________________

**Length of Blank:** The blanks should be long enough for the length of the word.

The blanks should also be the same length. Students may interpret blanks of different lengths as "hints" to the length of the expected word. If the blank length does relate to the length of the word, good test-takers can use this to their advantage. If the blank lengths are different than the length of the words (e.g., short blanks for long words and long blanks for short words), it may confuse the test-taker.

**Incorrect:**

A silver stain that demonstrates calcium is: __________
Amyloid is composed primarily of which compound?

A dye insoluble in water is:

**Correct:**

A silver stain that demonstrates calcium is: __________
Amyloid is primarily composed of:
A dye that is insoluble in water is: __________

(Note: The third statement has more than one correct answer. Oil red O and Sudan black B would both be correct.)

______________________________

**More than One Blank:** The short answer fill-in-the-blank questions could contain more than one blank, either listed within the statement, or given space after the question.

**Within statement:** Two stations that specifically demonstrate basement membrane is __________ and __________.

**After statement:** Two stains that specifically demonstrate basement membranes are:

______________________________

(Note: In the “after statement” version, lines can be drawn as demonstrated, or an empty space can be left.)
CONSTRUCTING ESSAY/SHORT ANSWER QUESTIONS

ADVANTAGES

• Can be used to test all taxonomy levels.
• Excellent to test higher taxonomy levels, including analyzing, evaluating and problem solving
• Test-taker cannot guess the right answer.
• Assesses the ability of the student to organize the material and to use correct terminology.

DISADVANTAGES

• Rare to find only one correct answer.
  - Often, the student answers the question in a manner that the instructor does not expect.
  - All valid answers must be given credit.
• Directions must be worded specifically so that the student knows exactly what the instructor wants.
• Takes time for the student to write the answers, especially in an organized, logical order.
• Difficult for the English-as-a-second-language student.
• Grading can be difficult:
  - Time consuming.
  - Hard to be consistent.
  - Handwriting can be difficult to read.

DIRECTIONS

Concise and Precise: The more detailed instructions you can give the test-takers, the more likely they are to specifically answer the question, and the less likely they will try to guess what material they are supposed to write about.

Verb: The verb should relate to the objective. It should inform the test-taker of what is expected in the answer – discussion, explanation, analysis, comparison, justification, differentiation, etc.

Objective: Upon completion of the chapter on connective tissue, and on a written exam with a minimum of 75% score, the student will be responsible to compare the structure to the special stains used to demonstrate the connective tissues.

Essay Question: Compare the chemical structure of reticulin and basement membrane. State one (1) stain for each that will demonstrate these components, and relate the chemistry of the stains to the chemical structure of that connective tissue.

Topics and Key Point/Words: Indicate in the directions topics that are to be discussed and how much detail is expected. Indicate key points that are to be discussed. This will narrow the scope of the question.

Incorrect: Discuss how a microwave oven works.

Correct: Discuss how a microwave oven heats liquids. Include in the discussion: wavelength, electromagnetic energy, polarity, and friction.

Words: State how many words the essay should be, if applicable (long answers).

Points: State how many points the essay is worth.

This lets the student know that they should spend more time answering the question that is worth 6 points, and less time on the question that is worth 2 points.

OTHER CONSIDERATIONS

Room: Leave enough room for the answer.

Scoring: Have the key points that you are looking for in the answer already written out, as reference.

Correct one essay question on all the exams, then go on to the next essay question. This way, you can check to see if there are areas that no one wrote about in a question, possibly indicating that the area was not covered in class. It also is a way to find out if someone is copying off another test.

Location on exam: Try NOT to put the essay questions on the first page. Students often find them intimidating. Start with an easier question format, such as multiple choice.

Hide test-taker’s identity: To avoid bias, hide the test-taker’s name, and shuffle the papers before grading.

Example of Proper Construction:

(3 points) Name two (2) fixatives that should NOT be used for the demonstration of acid fast bacteria. Explain how the resulting changes in the cells walls would affect future staining.

(2 pts) The ATPase stain has black precipitate on the section. Suggest one cause for the precipitate and recommend methods to eliminate it next time.
BEFORE YOU GIVE THE EXAM

Let’s assume you have given the learners the objectives for the chapter on micro-organism stains, and they have received all the lectures and handout materials.

You have written an exam, 30 questions, using different question formats, covering different microorganisms and their stains.

Are you ready to give the exam to the students? Not yet.

An analysis of the questions needs to be done first.

• Doe the exam questions match the objectives? Does each question have an objective?
• Do the exam questions really cover all the material? Is there an area not adequately covered?
• Are all three taxonomy levels covered, in a percentage that you feel comfortable with?
• Is enough weight (percentage) given to the different types of question styles, is there more percentage points assigned to one style?

EXAMPLE

In chart A, an exam on Micro-organisms was analyzed. The columns covered controls and the stains for Bacteria on general AFB, Spirochetes, Fungus, Virus and Parasites.

Let’s assume you only mentioned viruses and parasites during lecture, so you do not want to ask a lot of questions on these two topics. So what does this grid show us?

Taxonomy Level Percentage: As mentioned earlier in this paper, you need to decide what percentage of Tax 1, 2 and 3 you want to ask. There is nowhere that states there has to be a certain percentage of each. Are the students just starting out, so a 70-20-10 ratio is good? Have they been working for a while, so a 50-25-25 ratio should be considered? Is this the final, so a 33-33-33 ratio might be appropriate?

However, as you can see from the grid, 82% of the questions are Tax 1. This is probably too heavy in Tax 1.

Suggestion: Rewrite some of the Tax 1 Multiple Choice questions to be Tax 2 and 3. If there is a need for new questions, make them Tax 2 and 3.

Under-represented Topics: Looking at the grid, the following can be seen:
• Very few questions on spirochete stains (5%)
• No questions on Brown & Brenn.
• No questions on Gridley.
• Only one Multiple Choice Question on GMS.
• Essays cover many topics. If another essay question is wanted, maybe write one for the AFB topic.

Suggestion: Write more questions in these areas, particularly in the question format that is needed.

Weighting of Question Format: In this grid, (also seen in the second smaller grid), there is 1 Matching question, 6 T-F, 13 Multiple Choice, 7 Fill-in-the-Blank, and 3 Essay. This seems like a good combination.

But if the percentage of points is checked, 35% of the points come from Tax 1 Matching and T-F. Only 1/3 of the points are from Multiple Choice, which is the format that the ASCP registry exam is in.

Suggestion: Decrease the number of points for Matching, increase the Essay points, and write new Multiple Choice questions (which will increase the total number of Multiple-le Choice points).

BLUEPRINT

One of the easiest ways to map out the exam is with a blueprint, such as the one on the next page (Chart A).

• Head each column with a different topic you are teaching, such as the different micro-organisms, or if the topic was fixation, the different fixatives.
• Write under each column, and in the correct tax level:
  - the exam topic
  - the style of question (essay, T/F, etc.).
  - how many points each is worth
• Total up the number of points, and figure out the percentages of each topic, each taxonomy level, and each exam question format (essay, T/F, etc.).

Then look for:
• Topics/columns with not enough questions
• Taxonomy percentages that are not within the range you are striving for
• Questions with too much weight, or not enough weight
• Number of questions in each exam question format to see if one format is over- or under-represented

Possibly make another chart that shows the percentage of points for each style of exam question (Chart B). This will help to find the style of questions with too much weight.
### CHART A = BLUE PRINT FOR MICRO-ORGANISM EXAM – Before changes

<table>
<thead>
<tr>
<th>TAX 1</th>
<th>Control</th>
<th>Bacteria</th>
<th>AFB</th>
<th>Spirochete</th>
<th>Fungus</th>
<th>Virus</th>
<th>Parasite</th>
<th>TOTAL POINTS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M – 8 listings</td>
<td>MC – Giemsa – 1*</td>
<td>MC – Counterstain – 1</td>
<td>MC – Dieterle – Legionella – 1</td>
<td>6 TF – Procaryotic vs. Eucaryotic -6</td>
<td>FiB – CMV H&amp;E – 1</td>
<td>MC – PAS Entamoeba – 1</td>
<td>33</td>
</tr>
<tr>
<td></td>
<td>MC – B&amp;H – 1</td>
<td>MC – Fites – 1</td>
<td>MC – Fix – 1</td>
<td>FiB – Syphilis – 1</td>
<td>MC – Crypto – 1</td>
<td></td>
<td></td>
<td>8 pts.</td>
</tr>
<tr>
<td></td>
<td>FiB – DQ – Helicobacter – 1</td>
<td>MC – Aur-Rhod – 1</td>
<td>MC – Kinyoun – 1</td>
<td>FiB – Fites oil – 1</td>
<td>FiB – Fixation – 1</td>
<td>FiB – Fites oil – 1</td>
<td>FiB – Lipid layer – 1</td>
<td>8 pts.</td>
</tr>
<tr>
<td>TAX 3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2 pts.</td>
</tr>
<tr>
<td>TTL # PTS.</td>
<td>8</td>
<td>5</td>
<td>9</td>
<td>2</td>
<td>14</td>
<td>1</td>
<td>1</td>
<td>40</td>
</tr>
<tr>
<td>TTL % PTS.</td>
<td>20%</td>
<td>12.5%</td>
<td>22.5%</td>
<td>5%</td>
<td>35%</td>
<td>2.5%</td>
<td>2.5%</td>
<td>100%</td>
</tr>
</tbody>
</table>

*Translation = Tax 1 MC-Giemsa-1* = Taxonomy I; Multiple Choice – on the Giemsa stain for bacteria – 1 question,

**CHART B = PERCENTAGE AND POINTS OF QUESTION STYLES**

<table>
<thead>
<tr>
<th>QUESTION STYLE</th>
<th>BEFORE SUGGESTED CHANGES</th>
<th>AFTER SUGGESTED CHANGES (blueprint NOT shown)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td># Questions</td>
<td># Points</td>
</tr>
<tr>
<td>Matching (8 items)</td>
<td>1</td>
<td>8</td>
</tr>
<tr>
<td>True-false</td>
<td>6</td>
<td>6</td>
</tr>
<tr>
<td>Multiple choice</td>
<td>13</td>
<td>13</td>
</tr>
<tr>
<td>Fill-in-the-blank</td>
<td>37</td>
<td>7</td>
</tr>
<tr>
<td>Essay</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>TOTAL</td>
<td>30</td>
<td>40</td>
</tr>
</tbody>
</table>

National society for Histotechnology Education Committee*
FOR ANSWERS AND TAXONOMY LEVEL TO QUESTIONS IN THIS GUIDE

REFER TO .PDF FILE - CHART A

Listed on this CD