



# Writing Application and Analysis Test Questions

AST Instructors Forum

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# PRESENTERS:

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# Presentation Objectives:

- ▶ After completion of this session, the participant will be able to:
  - ▶ Distinguish between the three general types of test questions:
    - ▶ Recall
    - ▶ Application
    - ▶ Analysis
  - ▶ Explore ways in which to structure standardized multiple-choice questions for better assessment of actual student comprehension of complex materials/concepts
  - ▶ Identify common mistakes in question writing to prevent:
    - ▶ “Giveaways” or cueing
    - ▶ Multiple “correct” choices
    - ▶ Redundancy and/or superfluous information





# Multiple Choice Question Terminology

- ▶ **ITEM:** The entire question or statement for completion along with its associated options (multiple choices)
- ▶ **STEM:** The question, statement, photo, diagram, graph, etc. which appears first and includes the central idea, problem, concept, definition, or procedure that is being assessed
- ▶ **OPTIONS:** Typically 4 or 5 options are provided which should relate back to the stem. These options should be lettered items (A,B,C,D). The two types of options are:

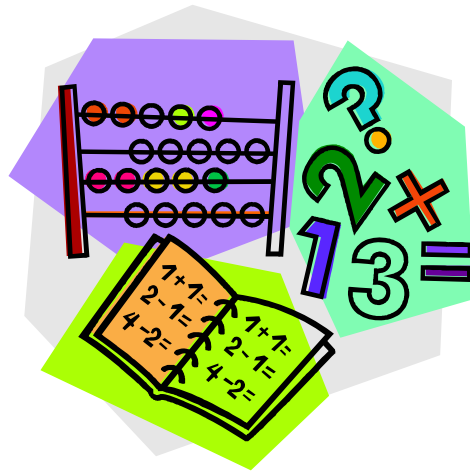


- ▶ **Key:** The only and/or BEST choice that is the answer to the question or completion to a statement or sequence
- ▶ **Distractors:** The remainder of the INCORRECT choices that should be tempting, but definitely NOT the appropriate choice for the item being assessed



## Do you recall...?

- ▶ Recall items/questions are designed to assess BASIC facts, definitions, concepts, principles, procedures, generalizations, and processes
- ▶ Items typically test the recognition or memory of isolated information from unit materials and subject matter
- ▶ Performance is not dependent on acquisition and practice of skills and can be achieved through lecture and textbook assignments



# Recall questions

- ▶ Well-suited for beginning topics to bolster student confidence
- ▶ Should be less utilized as courses progress into more complex topics
- ▶ May also be used in addition to advanced items as “fillers”





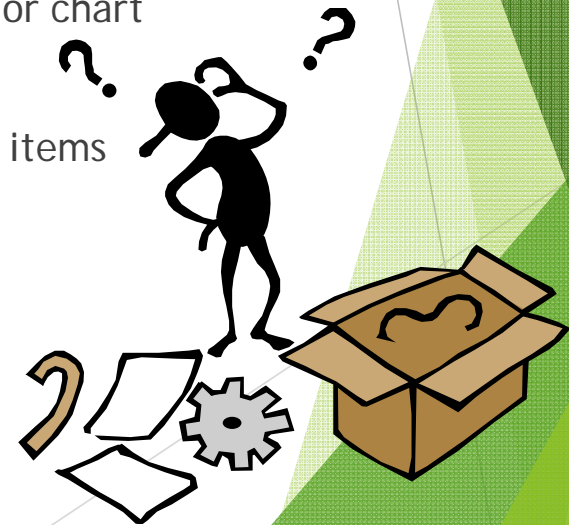
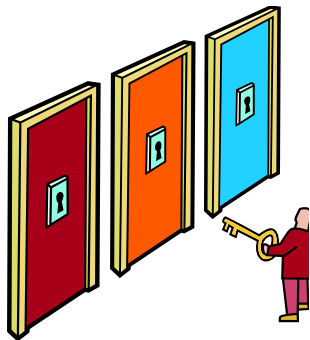
## For example:

- ▶ Which peripheral nerve is decompressed in a carpal tunnel release procedure?
  - A. Ulnar
  - B. Sciatic
  - C. **Median \***
  - D. Peroneal
  
- ▶ The position used for most vaginal surgical procedures is
  - A. Prone
  - B. Supine
  - C. Lateral
  - D. **Lithotomy \***

\* Indicates the KEY, all others are distractors

## Applications being accepted - Inquire within

- ▶ Application items/questions are more complex than simple recall questions
- ▶ Additional understanding of concepts and skills may be required to distinguish between plausible distractors and the one correct key answer
- ▶ Sets of variables may be provided within the stem or on a table or chart
- ▶ Scenarios may be provided initially with several multiple choice items following which relate back to the data provided within them





# Applications being accepted - Inquire within

- ▶ Hierarchical progressions and sequencing of steps may be included in application-type items
  - ▶ If this situation occurs, then the next step would be....
  - ▶ Which of the following steps would be performed first?
  - ▶ How would you calculate the strength if...?
- ▶ Avoid overly wordy stems that teach or preach and add non-relevant data
- ▶ Due to the higher complexity, insure that the question being asked is clear and that only one correct (key) choice can be made



## Examples:

- ▶ Which of the following constitute Federal law and carry legal implications?
  - A. HIPPA regulations \*
  - B. Institutional policies
  - C. Joint Commission recommendations
  - D. AST and AORN Recommended Standards of Practice
  
- ▶ In an ORIF of a humeral fracture, which of the following is done first?
  - A. Tap
  - B. **Drill** \*
  - C. Screw
  - D. Measure

## Examples:

- ▶ When 50 ml of injectable saline is added to a 50 ml vial of full-strength radiopaque contrast medium, what would the strength of the mixture be?
  - A. 25%
  - B. 50% \*
  - C. 100%
  - D. 200%
  
- ▶ The primary responsibility of a CST in an intraoperative code blue would be:
  - A. perform chest compressions
  - B. prepare the defibrillator paddles
  - C. place defibrillator pads on patient
  - D. protect the sterile field from contamination \*



## More examples...

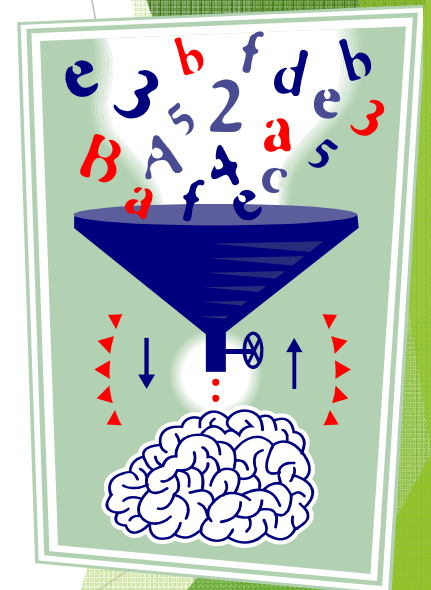
- ▶ If a mastectomy is scheduled to follow a breast biopsy and frozen section results indicate carcinoma, what is done?
  - A. Protect the field until second procedure begins.
  - B. Bring up a Mayo with new instruments for the mastectomy.
  - C. Use same instruments, but be sure to change all gloves first.
  - D. **Re-prep, re-drape; change gowns and gloves; use new instruments.\***
  
- ▶ In this item/question, the test examinee would have to apply his/her knowledge of techniques and methods utilized to prevent seeding of cancer cells.

## More examples...

- ▶ Which structure is ligated and transected first in a radical nephrectomy or laparoscopic simple nephrectomy, following isolation of the vessels and ureter?
  - A. Renal vein
  - B. Renal artery \***
  - C. Gerota's fascia
  - D. Proximal ureter
  
- ▶ In this item/question, the examinee would have to have knowledge of the order of steps in nephrectomy procedures.

## Upon further analysis, we find...

- ▶ Analysis items/questions represent the highest level of complexity in test preparation and performance
- ▶ The student/examinee must demonstrate the ability to synthesize multiple variables beyond simple recall of basic facts
- ▶ Application of ordered steps demonstrates conceptual thinking
- ▶ Analysis-type items/questions involve
  - ▶ evaluation of data
  - ▶ complex problem solving
  - ▶ making judgments about best, most appropriate or effective course of action in a given situation or scenario
  - ▶ integrating aspects of various areas of curricula to formulate a complete picture of the data represented in the stem or given scenario





## For example...

- ▶ Which of the following specialists might be asked by a neurosurgeon to provide the operative exposure and subsequent closure in a transsphenoidal approach to the sella turcica?
  - A. Otorhinolaryngologist \*
  - B. Cardiothoracic surgeon
  - C. Interventional radiologist
  - D. Orthopedic spine surgeon
  
- ▶ In this analysis-type item/question, the examinee would need a good grasp of
  - ▶ basic medical terminology
  - ▶ Anatomy of the skeletal system, specifically the skull
  - ▶ neurosurgical approaches for various pathological conditions
  - ▶ types of procedures the various specialists would likely perform as part of their skill set

## More examples:

- ▶ Which signal should alert the surgical team that prostate capsule perforation is imminent and may conclude the procedure?
  - A. Coughing
  - B. Groaning
  - C. Flatulence
  - D. Leg jerking \*
  
- ▶ Which additional pain control measure is taken for patients undergoing pectus excavatum repair by VATS?
  - A. Epidural \*
  - B. Bier block
  - C. Topical lidocaine jelly
  - D. Injectable local with epinephrine

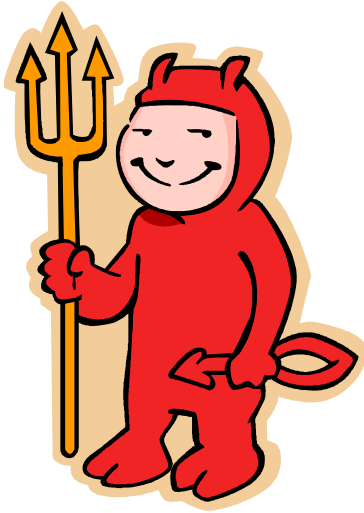
## And more...

- ▶ Which method of tubal ligation is less frequently performed, requires use of longer instruments, but may pose higher risk of post-op SSI due to the surgical approach?
  - A. Colpotomy \*
  - B. Laparoscopic
  - C. Mini-laparotomy
  - D. Open, in conjunction with C-section
  
- ▶ In this item/question, much information is given that the examinee must consider in order to choose the BEST answer including which procedures
  - ▶ are less routine in general
  - ▶ typically require longer instruments due to the anatomical structures and approach
  - ▶ may have a higher likelihood of SSI based on the wound classification, determined by the surgical approach chosen



# Tips for creating better multiple choice exams

► The



is in the details

► Don't make the



too obvious

# Tips for creating better multiple choice exams

► Watch your



s

and



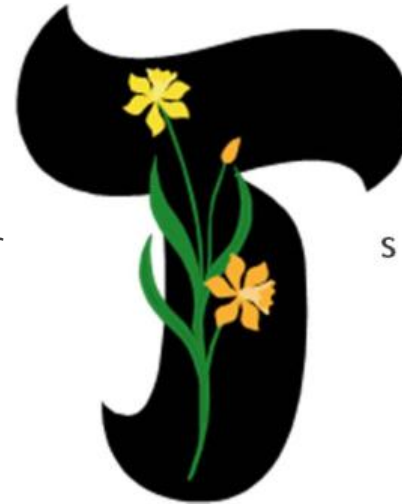
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# Tips for creating better multiple choice exams

► Dot your



s and cross your



s



# How does it look?

- ▶ Items/questions should be written so that the choices (key and distractors)

- ▶ follow in a logical sequence

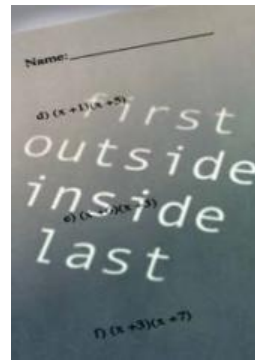
- ▶ provide plausible consideration

- ▶ have orderly progression of length

- ▶ Similar/balanced formatting of wording/phrasing

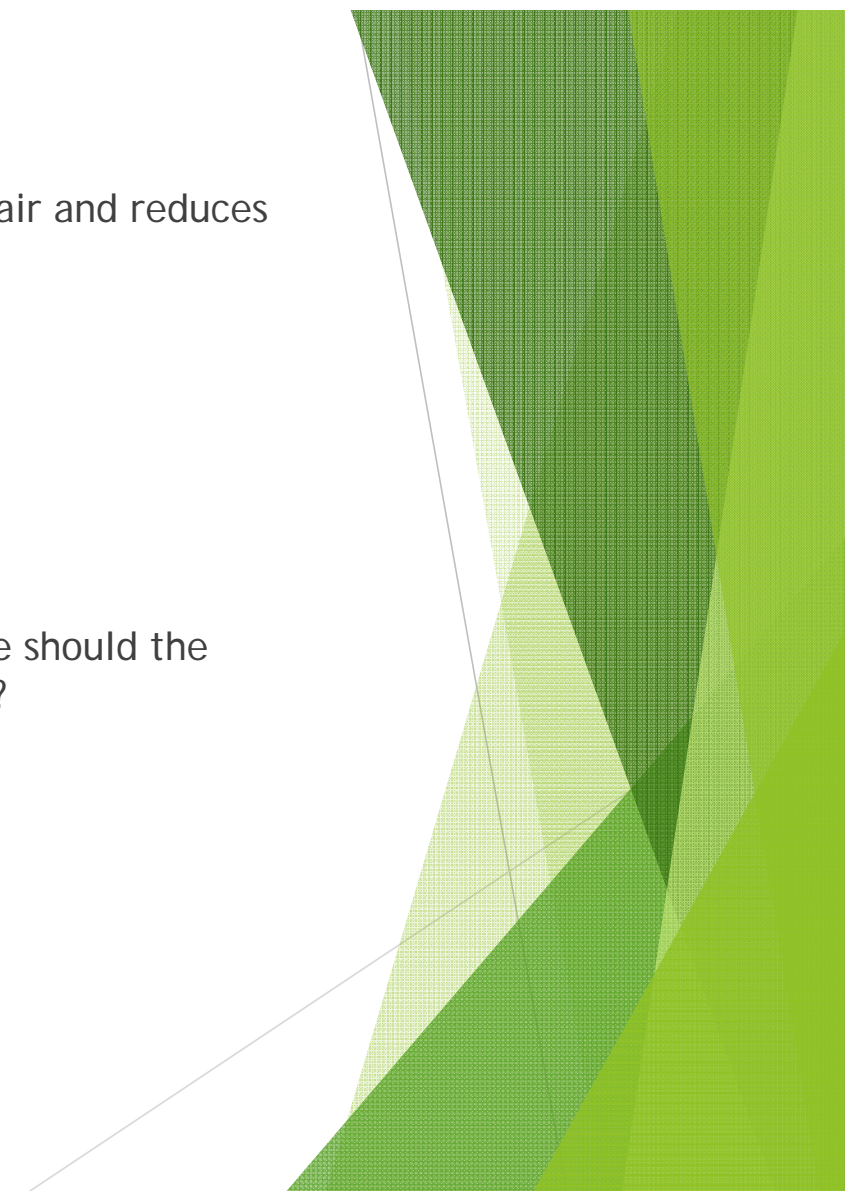
- ▶ all relate clearly back to the stem statement or question

- ▶ maintain grammatical correctness (tense, singular/plural, capitalization, etc.)



## For example...

- ▶ Which type of ventilation system provides a supply of clean air and reduces contaminants and fumes from the OR?
  - A. Negative, bidirectional
  - B. Negative, unidirectional
  - C. Positive, bidirectional
  - D. Positive, unidirectional \*
  
- ▶ What distance from the impact site of a laser beam on tissue should the smoke evacuator be positioned to capture 98% of the plume?
  - A. 1 cm \*
  - B. 2 cm
  - C. 5 cm
  - D. 10 cm



## Play it again, Sam

- ▶ Which of the following terms describes the system of principles that become standards of conduct for professionals?
  - A. Doctrines
  - B. Ethics \*
  - C. Morals
  - D. Precedents
  
- ▶ Which of the following terms describes the principles such as benevolence, trustworthiness, and honesty for the care and well-being of others in society?
  - A. Doctrines
  - B. Ethics
  - C. Morals \*
  - D. Precedents

NOTE: It is acceptable to use the same choices in multiple items/questions, especially when concepts are similar and may be confused or transposed





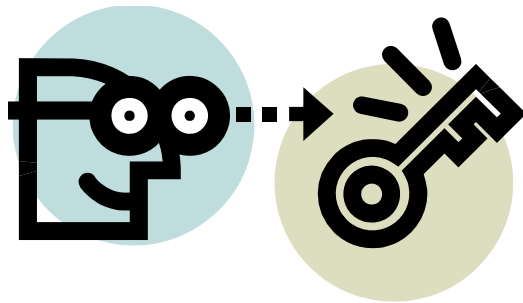
# May I be direct?

- ▶ Items/questions should be written in such a way as to allow the examinee to begin formulating a choice or an answer prior to reading the choices provided
  - ▶ Undirected stems that require reading of every choice in order to determine what is being asked may cause undue confusion
    - ▶ Counts are done
      - A. by the nurse and surgeon
      - B. in some cases, but not in all
      - C. because AORN says they should be
      - D. to prevent retention of foreign items
  - ▶ The primary reason surgical counts are performed is
    - A. to prevent loss of inventory
    - B. because AST says they should be done
    - C. so that charges can be submitted for reimbursement
    - D. to prevent injury to the patient from retention of foreign items



## In other words...

- ▶ In preparation of all items/questions, the language of the profession should be used in order to assess examinees' comprehension
- ▶ Recall type items may include definitions of basic medical terminology, but more complex application and analysis items should utilize terms as standard wording
- ▶ Proper names of instruments, supplies, equipment, etc. should be capitalized
  - ▶ Mayo stand, not mayo stand; Kocher clamp, not kocher clamp; Vicryl, not vicryl
  - ▶ back table, not Back table; malleable, not Malleable; lap sponge, not Lap sponge





## As we were saying...

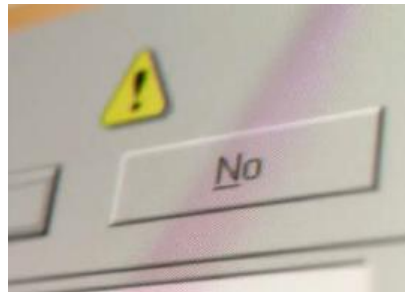
- ▶ Standard acronyms and abbreviations which have already been covered in the curriculum may be used, but non-standard acronyms should be avoided
  - ▶ ESU = electrosurgical unit, instead of Bovie which is likely NOT the name of the device used, but a holdover from years ago and the inventor's name
  - ▶ RSOP = recommended standards of practice
  - ▶ HIPPA - Health Insurance Privacy and Portability Act
  - ▶ PASS = pull the pin, aim the nozzle, squeeze the handle, sweep the base of fire
  - ▶ LAVH = laparoscopically assisted vaginal hysterectomy
  - ▶ ORIF = open reduction, internal fixation
  - ▶ VATS = video assisted thoracoscopic surgery
  - ▶ AAA = abdominal aortic aneurysm
  - ▶ C&S = culture and sensitivity
  - ▶ CNS = central nervous system





# Don't be so negative!

- ▶ Items written which require use of the exception (NOT, EXCEPT, ALL BUT...) can cause confusion and should be avoided if possible
- ▶ However, when an adequate number of plausible negative distractors cannot be created, it may require an exception to the rule
- ▶ Use of appropriate medical terminology such as contraindication will elevate an item to assess understanding of the term as well as keeping the exception clause in the stem
- ▶ Use of all capital letters or underlining emphasizes negatives/exceptions



## Examples:

- ▶ Which of the following prep solutions would be contraindicated in a patient with a history of allergy to shellfish?
  - A. Alcohol
  - B. Iodophors \*
  - C. Parachorametaxyleneol
  - D. Chlorhexidine gluconate
  
- ▶ Which of the following members of the operating room team is NOT required by law to be licensed?
  - A. Circulating nurse
  - B. Operating surgeon
  - C. Anesthesia provider
  - D. Surgical technologist \*

# Alternative wording

- ▶ Stems may be reworded or rephrased to include use of “un” or “non”
  
- ▶ Which of the following members of the operating room team is unlicensed?
  - A. Circulating nurse
  - B. Operating surgeon
  - C. Anesthesia provider
  - D. **Surgical technologist \***





# Absolutely no exceptions!

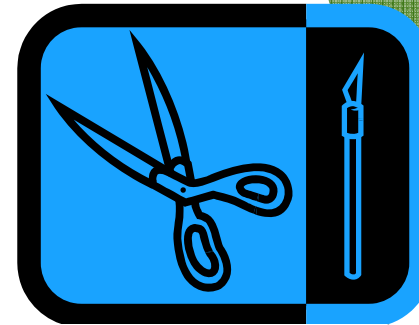
- ▶ Use of words that are exclusionary may provide wise test-takers clues to selecting the key without real knowledge of the correct information
- ▶ Exclusionary terms and absolutes include
  - ▶ All, none
  - ▶ Always, never
  - ▶ Every
  - ▶ Everybody, nobody
  - ▶ Only
  - ▶ Must, must not
- ▶ Use better options so that the test-taker will have to weigh the choices more carefully
- ▶ Non-exclusionary terms include
  - ▶ Usually, Sometimes
  - ▶ Often, Rarely
  - ▶ May, may not
  - ▶ Should, should not
  - ▶ Could, could not

# I can see clearly now

- ▶ Avoid mixing completely unrelated distractors
  - ▶ Example:
    - ▶ pear
    - ▶ Pencil \*
    - ▶ papaya
    - ▶ pineapple
- ▶ Write items/questions in third person, avoiding “you” or “your”
  - ▶ Example:
    - ▶ A CST...
    - ▶ The surgeon...
    - ▶ A circulating RN ...
    - ▶ Anesthesia providers...



## Cut to the chase...



- ▶ Stems should not be so wordy as to confuse the reader
  - ▶ One sentence should be used to describe the information being discussed
  - ▶ If a scenario is used for a number of subsequent questions, it should be stated clearly that the item/question relates back to the scenario
  - ▶ Test-taking time is NOT the time to be teaching about the material being assessed
    - ▶ Poor: A perforating towel clip used on the sterile field to keep a drape in place or to attach the ESU cord and suction tubing so that it would not fall below table level and become contaminated is removed by the surgeon and handed to the surgical technologist. What should the surgical technologist do with the towel clip?
    - ▶ Better: What should a surgical technologist do with a perforating towel clip removed from a sterile drape?



# Just the facts ma'am

- ▶ Direct questions or completion statements are most effective
  - ▶ Run-on sentences or questions should be avoided
  - ▶ If all distractors will contain the same beginning phrase, it is clearer and less time consuming to incorporate the phrase into the stem
    - ▶ Which of the following statements about opening sterile packages is incorrect?
      - A. The CST should put on sterile gloves.
      - B. The CST should check for package integrity.
      - C. The CST should not hold packages over sterile areas.
      - D. The CST should check for expiration dates if indicated.
  
- ▶ Which of the following is incorrect regarding what a CST should do before opening sterile packages?
  - A. Put on sterile gloves.
  - B. Check for package integrity.
  - C. Avoid holding item over sterile field.
  - D. Check for expiration dates if indicated.



# It's all or nothing

- ▶ An easy trap to fall into is the “all of the above” or “none of the above” choices
- ▶ Instead of using these, create a more complex item/question by using a list of four things (items, instruments, statements, steps, etc.) and include combinations of them in the multiple choices
- ▶ Example:
  1. Insufflator
  2. camera unit
  3. video monitor
  4. ultrasonic scalpel unit

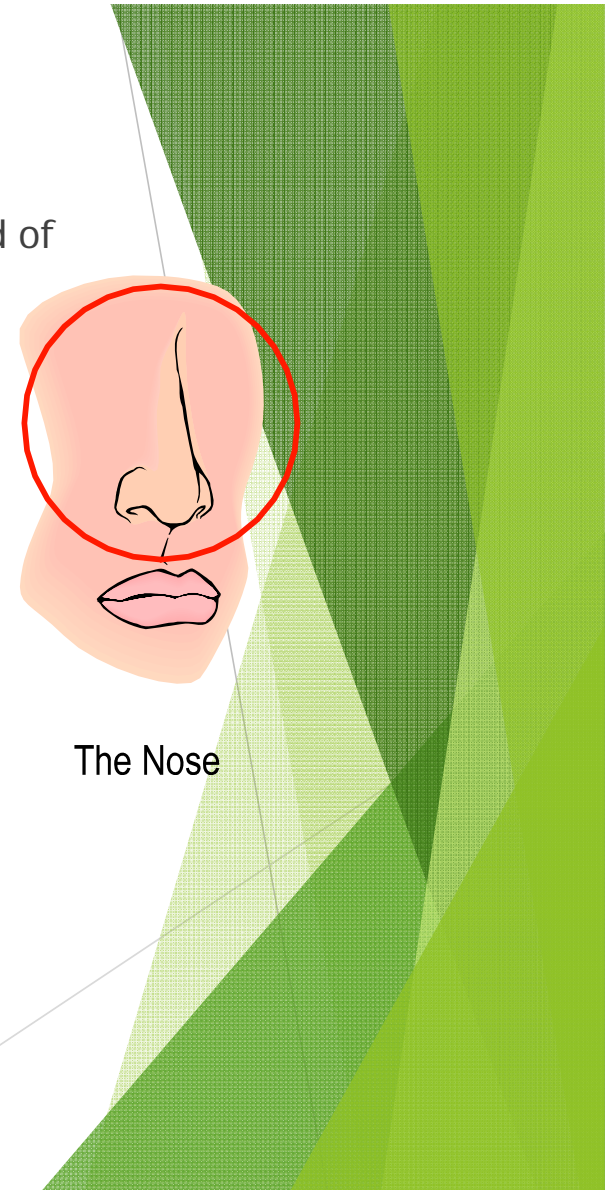
Which pieces of equipment listed above would most likely be used for a routine knee arthroscopy?

- A. 1 and 2 only
- B. 1, 2 and 3
- C. 2 and 3 only \*
- D. 1, 2, 3, and 4



# It's as plain as the nose on your face...

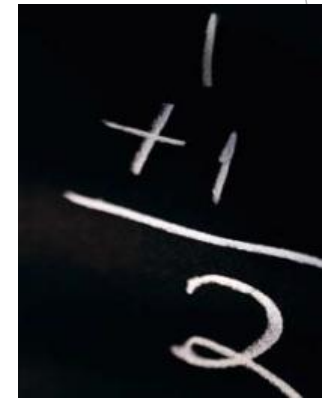
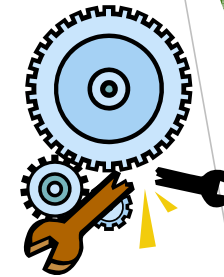
- ▶ Clues picked up by savvy examinees are giveaways and increase likelihood of success based on finding flaws in the exam rather than acquisition and understanding of the material
- ▶ Commonly made mistakes by test writers include
  - ▶ using similar or even exact words or phrases in both the stem and the key
  - ▶ wording the key better or with more technical detail than the distractors
  - ▶ including reasonable modifiers (usually, often, routinely, etc.) in the key and exclusionary modifiers (always, never, all, none, etc.) in distractors
  - ▶ creating keys that are basically irrefutable therefore must be true while the distractors are easily disputed





## continued...

- ▶ create grammatical incongruence in completion items by not using “a/an” to cover all possible choices (beginning with either vowels or consonants)
  - ▶ An otorhinolaryngologist is also known as an
    - A. radiologist
    - B. cardiologist
    - C. ENT surgeon \*
    - D. plastic surgeon
  - ▶ In the item above, the only choice which makes grammatical sense is “C”. If the stem had been written with “a/an”, the examinee would have to rely on knowledge, not cues
- ▶ grammatical dissonance with singular and plural objects
  - ▶ OSHA and the FDA are examples of
    - A. Insurance
    - B. A commission
    - C. Accreditation
    - D. Regulatory agencies \*
  - ▶ All of the distractors in the item above should be plural because there are two objects in the stem



## In conclusion...

- ▶ Writing multiple choice exams can be a challenge
- ▶ As educators, we have all been exposed to many examples of test platforms, either as standardized certification and/or licensure exams or college course assessments
- ▶ We have to remember to put ourselves in our students' "shoes" and read our own exam items as if we didn't know all that we know
- ▶ The philosophy of making tests so difficult that no student could make an "A" is unfair and divisive
- ▶ Conversely, making tests so easy that anyone could pass or make a higher grade fails to provide true feedback as to the effectiveness of the curriculum and teaching methodology
- ▶ Higher level exam questions such as application and analysis items/questions will raise the bar for both the writer and the taker and demonstrate whether students have gained the "Holy Grail" of education -

**CRITICAL THINKING SKILLS!!**

