# Constructing Tests with Course Content and Learning Objectives In Mind

Center for Teaching Excellence Series
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# Learning Objectives

- *Upon completion of this workshop, the student should be able to:*
  - Describe Revised Bloom's Taxonomy
  - Compare and contrast Revised and
  - Categorize action verbs according to the revised Bloom Taxonomy
  - Enumerate the types of test questions and cite advantages and disadvantages of each question type
  - Develop Test Items which correlate the various levels of Bloom's Taxonomy
  - Using Revised Bloom' s Taxonomy , Develop Test Items that Match the Same Level of Learning Objectives

# Old Bloom's Taxonomy
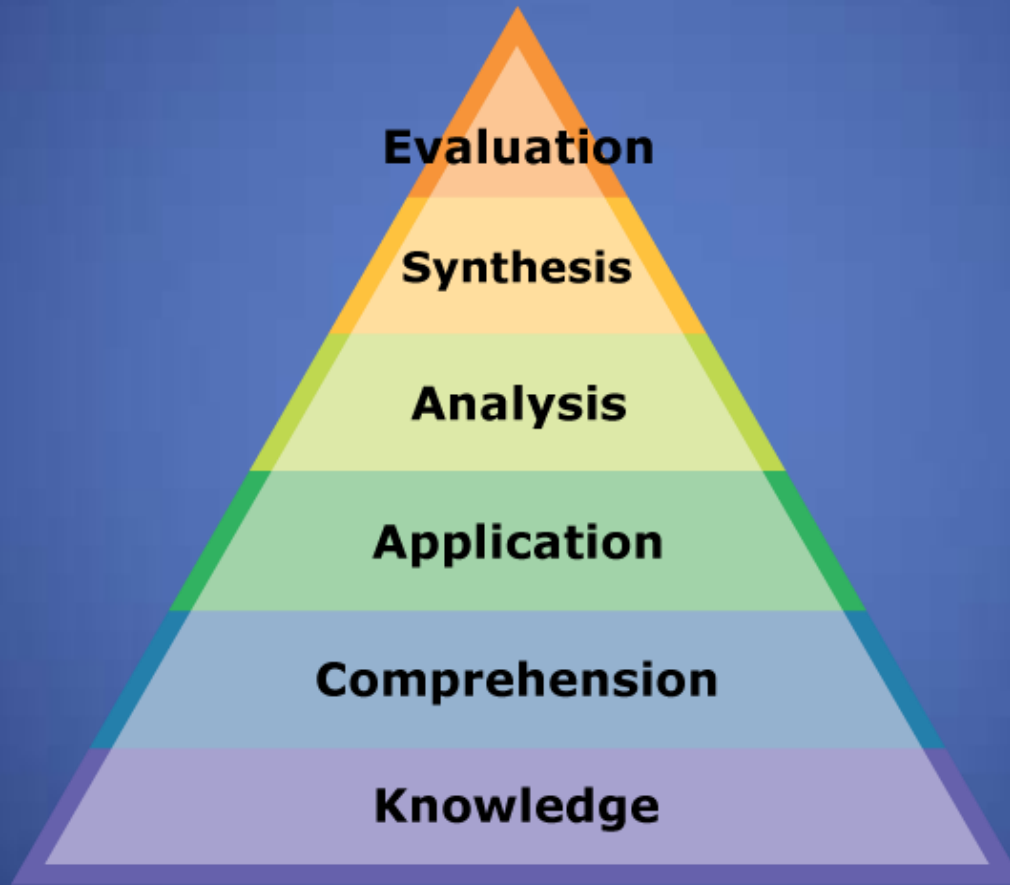
# Revised Bloom's Taxonomy
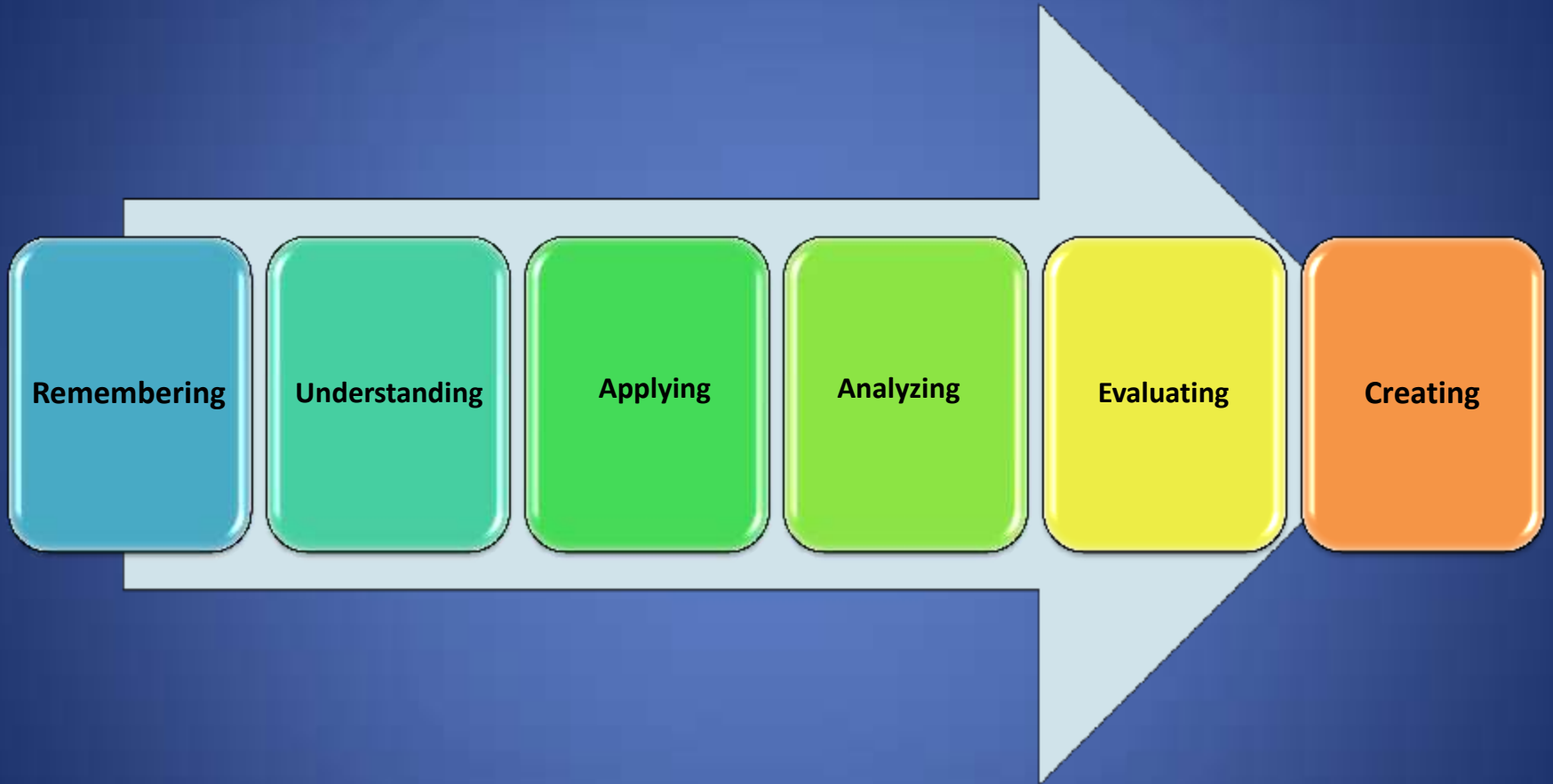
# Comparison of Revised and Old Bloom's Taxonomy

**OLD TAXONOMY**

**REVISED TAXONOMY**

**HIGHER ORDER THINKING SKILLS**

**HIGHER ORDER THINKING SKILLS**

| OLD TAXONOMY | REVISED TAXONOMY |
|---|---|
| EVALUATION | CREATING |
| SYNTHESIS | EVALUATING |
| ANALYSIS | ANALYZING |
| APPLICATION | APPLYING |
| COMPREHENSION | UNDERSTANDING |
| KNOWLEDGE | REMEMBERING |

**LOWER ORDER THINKING SKILLS**

**LOWER ORDER THINKING SKILLS**

# Creating Learning Objectives

- **What is a learning objective?**
  - *A statement that describes the skill or information that the learner (student) will acquire after engaging in a learning activity (instruction)*
- **When and Where Do We Use Learning Objectives?**
  - Learning Objectives should be stressed before the start of a lecture or learning activity
  - Learning Objectives should be part of the syllabus

# Purpose of Learning Objectives

- To Focus Students on What is Important
- To Facilitate Lecture planning and test/assessment development
- To Assist in Curricular Mapping (essential for curricular mapping)

# Learning Objectives and Curricular Mapping
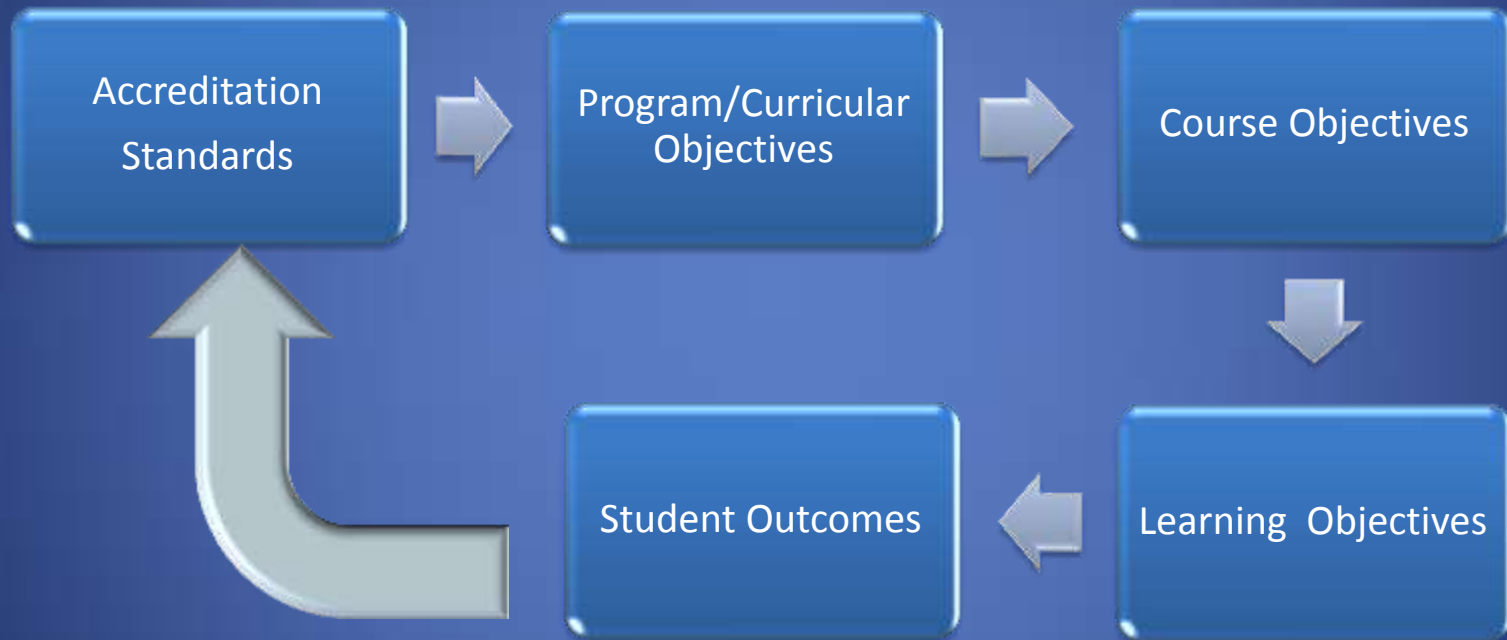
# **Anatomy of <u>Effective</u> Learning Objectives**

- Consistent with the goals of the program/curriculum
- Contains "***measurable***" action verbs
- Must be clear, concise and prioritizes salient points necessary mastery of course materials
- Appropriate for the level of the learner and for the course

# Measurable Action Verbs For Creating Learning Objectives

**Creating**

Formulating
Hypothesizing

Inventing
Estimating
Predicting
Forecasting
Producing

**Evaluating**

Critiquing

Monitoring

Measuring

Experimenting

Checking

Rating

Assessing

Diagnosing

Judging

**Analyzing**

Breakdown

Combining

Differentiating

Deconstructing

Outlining

Organizing

Distinguishing
D

**Applying**

Calculating

Dividing

Implementing

Using

Illustrating

Organizing

Modifying

Mapping

**Understanding**

Classifying

Defending

Explaining

Interpreting

Matching

Paraphrasing

**Remembering**

Describing

Locating

Reproducing

Naming

# CLASS DISCUSSION

- **Classify Learning Objectives Using Revised Bloom's Taxonomy Categories:**
  - List the herpetic viruses that cause cancer in HIV patients
  - Given a patient case description which includes symptomology, patient history and clinical findings, determine which infectious agent produces cancer in the HIV patient
  - Identify and describe the function of the major segments of the renal tubule

# CLASS DISCUSSION

- **Classify Learning Objectives Using Revised Bloom's Taxonomy Categories:**
  - Given a case scenario which includes symptomology, patient history and clinical findings and medication records, predict which drug classes will produce and exacerbate pre-existing electrolyte imbalances or become toxic in the presence of diuretic-induced electrolyte imbalances
  - Select the appropriate compensation formula to determine whether pH correction (compensatory mechanisms) are occurring

# Evolution of A Learning Objective

- **Original Objective:** *Know how to interpret ABGs and to apply compensation formulas*

- **Instructor's intent:** **The instructor wants students to be able to identify arterial blood gases (ABGs) lab values in a case study, ascertain if they are abnormal, determine the primary cause of the abnormal lab values and then use the compensation formulas to determine if the body is attempting to correct the abnormality appropriately**

- *Can the student determine instructor's expectations from the Learning Objective?*

# Evolution of A Learning Objective

- **Revision #1:** Interpret lab values (arterial blood gases) to determine whether the patient is suffering from an Acid-Base disturbance, and then apply compensation formulas

- *Instructor's intent:* **The instructor wants students to be able to identify arterial blood gases (ABGs) lab values in a case study, ascertain if they are abnormal, determine the primary cause of the abnormal lab values and then use the compensation formulas to determine if the body is attempting to correct the abnormality appropriately**

- *Can the student determine instructor's expectations from the Learning Objective?*

# Evolution of A Learning Objective

- **Revision#2:**
- Using the ABG diagnosis algorithm, identify the primary (most prominent) acid-base disturbance (acidosis or alkalosis) that is present in a patient profile which contains ABG lab values, symptoms, clinical findings and medical histories.

- Apply the compensation formula associated with the primary acidosis or alkalosis condition as well as the anion gap formula to determine if there is a "hidden acid-base disturbance" or whether the lungs and kidneys are correcting appropriately

# SO NOW YOU'VE WRITTEN THE PERFECT OBJECTIVE.....

# WHAT HAPPENS NEXT ?

## ANSWER:  Students "Bomb" Your Exam

# Types of Test Questions

- True/False Questions
- Multiple Choice Questions
- Matching
- Short Answer Questions
- Essay Questions
- Fill-in-the Blanks

# CLASSROOM DISCUSSION

## TRUE AND FALSE QUIZZES

# TRUE AND FALSE QUESTIONS

- **Bloom's Taxonomy Levels:**
  - Remembering (LEVEL 1)
  - Understanding (LEVEL 2)

- **Strengths:**
  - Easy to create
  - Students can answer several questions per minute

- **Weaknesses:**
  - Easy questions
  - May not accurately assess knowledge because students have a 50-50 chance of guessing correct answer

# TIPS FOR WRITING T/F QUESTIONS

- **TRUE-FALSE OR ALTERNATIVE RESPONSE ITEMS**
  - **ALTERNATIVE RESPONSE CONSISTS OF A DECLARATIVE STATEMENT**
  - **ONLY TWO POSSIBLE ANSWERS**
    - **TRUE OR FALSE; CORRECT OR INCORRECT; YES OR NO; FACT OR OPINION; AGREE OR DISAGREE; RIGHT OR WRONG**

# TIPS FOR WRITING T/F QUESTIONS

- **AVOID BROAD GENERAL STATEMENTS**
- **AVOID TRIVIAL STATEMENTS**
- **AVOID THE USE OF NEGATIVE STATEMENTS**
- **AVOID LONG, COMPLEX SENTENCES**
- **AVOID INCLUDING TWO IDEAS IN ONE STATEMENT**
- **AVOID USING OPINION THAT IS NOT ATTRIBUTED TO SOME SOURCE**
- **AVOID USING TRUE STATEMENTS AND FALSE STATEMENTS THAT ARE UNEQUAL IN LENGTH**
- **AVOID USING DISPROPORTIONATE NUMBERS OF TRUE STATEMENTS AND FALSE STATEMENTS**

# Matching Questions

- **Bloom's Taxonomy Levels**
  - Remembering (Level 1)
  - Understanding (Level 2)

- **Strengths:**
  - Useful when covering discipline with lots of facts
  - Useful for comparing related ideas
  - Useful for testing cause and effect associations
  - Easy to score

- **Weaknesses:**
  - Time consuming for students
  - Does not test higher orders of learning
  - Student guessing
  - Does not evaluate knowledge of isolated facts or concepts
  - Promotes rote memorization

# TIPS FOR WRITING GOOD MATCHING QUESTIONS

- **USE ONLY HOMOGENEOUS MATERIAL IN A SINGLE MATCHING EXERCISE**
- **INCLUDE AN UNEQUAL AMOUNT OF RESPONSES AND PREMISES, AND INSTRUCT THE STUDENT THAT RESPONSES MAY BE USED ONCE, MORE THAN ONCE, OR NOT AT ALL**
- **KEEP THE LIST OF ITEMS TO BE MATCHED BRIEF**
- **ARRANGE THE LIST OF RESPONSES IN LOGICAL ORDER**
- **INDICATE IN THE DIRECTIONS THE BASIS FOR MATCHING THE RESPONSES AND PREMISES**
- **PLACE ALL OF THE ITEMS FOR ONE MATCHING EXERCISE ON THE SAME PAGE**

# Multiple Choice Questions

- Bloom' Taxonomy Levels
  - Applying (Level 3)
  - Analyzing (Level 4)
  - Evaluating (Level 5)
  - Creating (Level 6)

# Multiple Choice Questions

- **Strengths:**
  - Minimum of writing for student
  - Can cover broad range of content
  - Versatility; can cover a lot of topics and test different levels of learning
- **Weaknesses:**
  - Difficult to construct good test items

# TIPS FOR WITING GOOD MCQs

- **STEM SHOULD BE MEANINGFUL BY ITSELF AND SHOULD PRESENT A DEFINITE PROBLEM**
- **STEM SHOULD INCLUDE AS MUCH OF THE ITEM AS POSSIBLE AND FREE OF IRRELEVANT MATERIAL.**
- **AVOID NEGATIVELY STATED STEMS.**
- **ALTERNATIVES SHOULD BE GRAMMATICALLY CONSISTENT WITH THE STEM.**
- **ITEM SHOULD CONTAIN ONLY ONE CORRECT OR CLEARLY BEST ANSWER**
- **UNDERSTANDING MEASUREMENTS SHOULD CONTAIN SOME NOVELTY**

# TIPS FOR WITING GOOD MCQs

- **ALL DISTRACTORS SHOULD BE PLAUSIBLE**
- **VERBAL ASSOCIATIONS BETWEEEN THE STEM AND THE CORRECT ANSWER SHOULD BE AVOIDED.**
- **RELATIVE LENGTH OF THE ALTERNATIVES SHOULD NOT PROVIDE A CLUE TO THE ANSWER**
- **CORRECT ANSWERS SHOULD APPEAR IN EACH OF THE ALTERNATIVE POSITIONS EQUALLY BUT RANDOMLY.**
- **USE SPARINGLY SPECIAL ALTERNATIVES**
- **DO NOT USE WHEN OTHER ITEM TYPES ARE MORE APPROPRIATE.**

# New Testing Items:
## Hot Spot Questions

- Labeling and MCQs with a new Twist
- Utilized by online standardize exams
- Hot Spot Questions require the student to click on a picture in order to answer a question.
- Users indicate the answer by clicking a specific area of an image
- Test Student Application and Evaluation skills

# Hotspot Questions

- Identify the planet that has the least density in the solar system

# Hotspot Questions

Identify the planet that has the least density in the solar system. Click on the appropriate planet
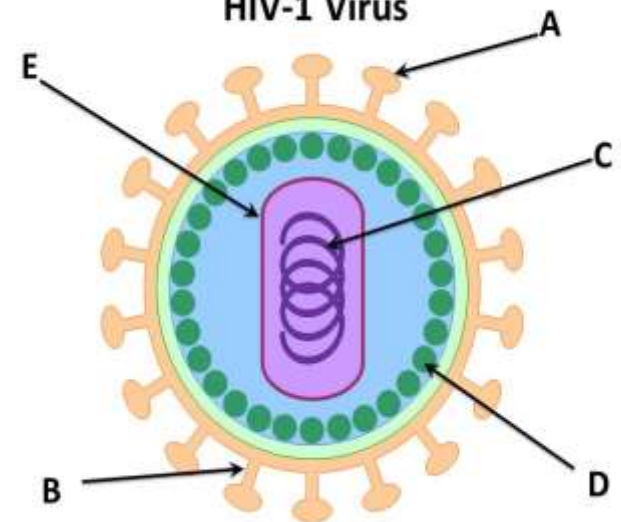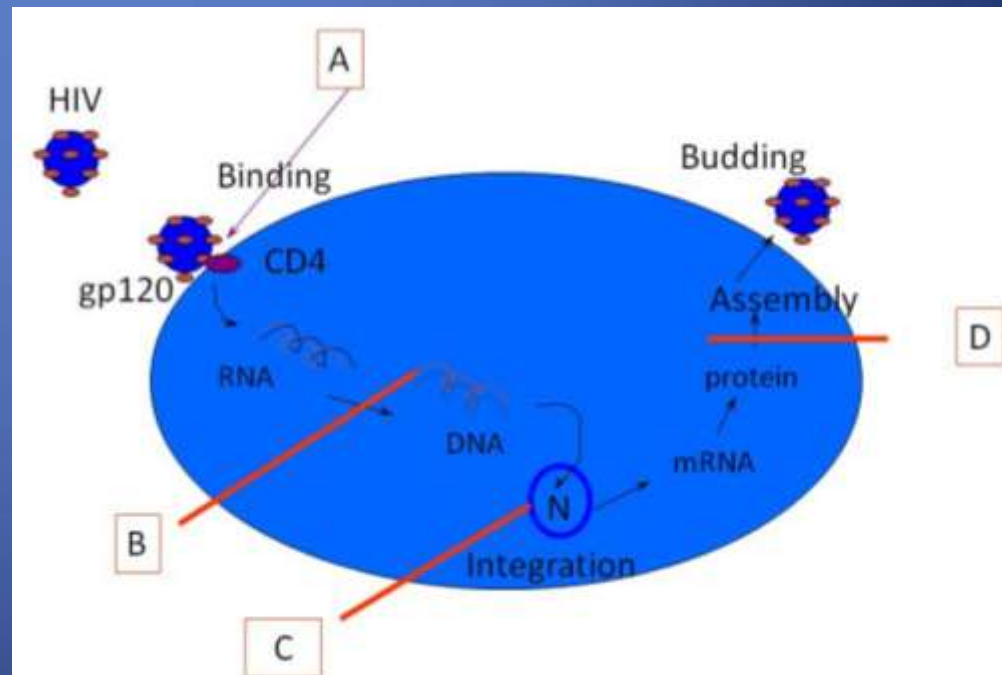
# Writing a "Paper" Hotspot Question
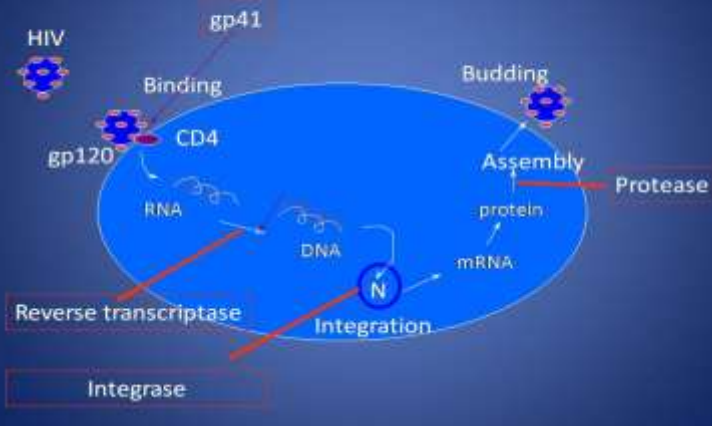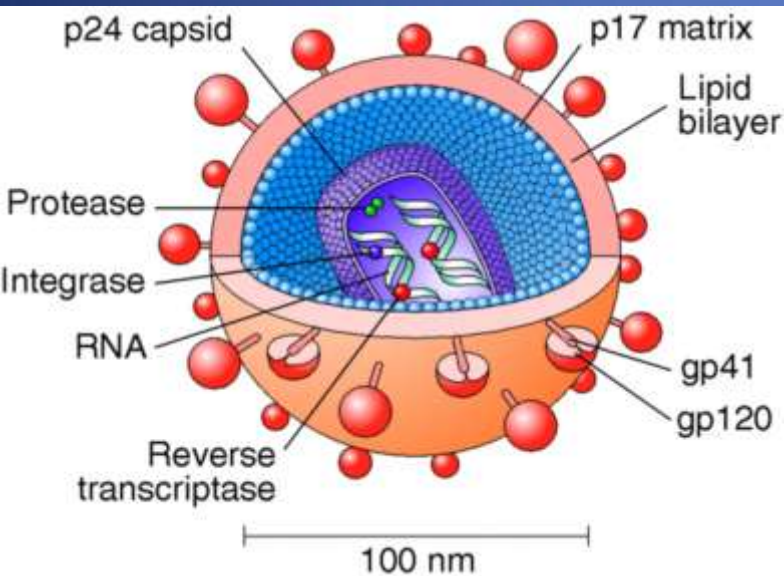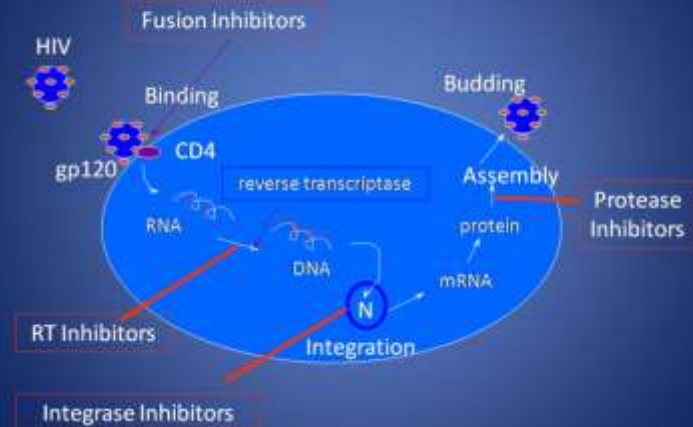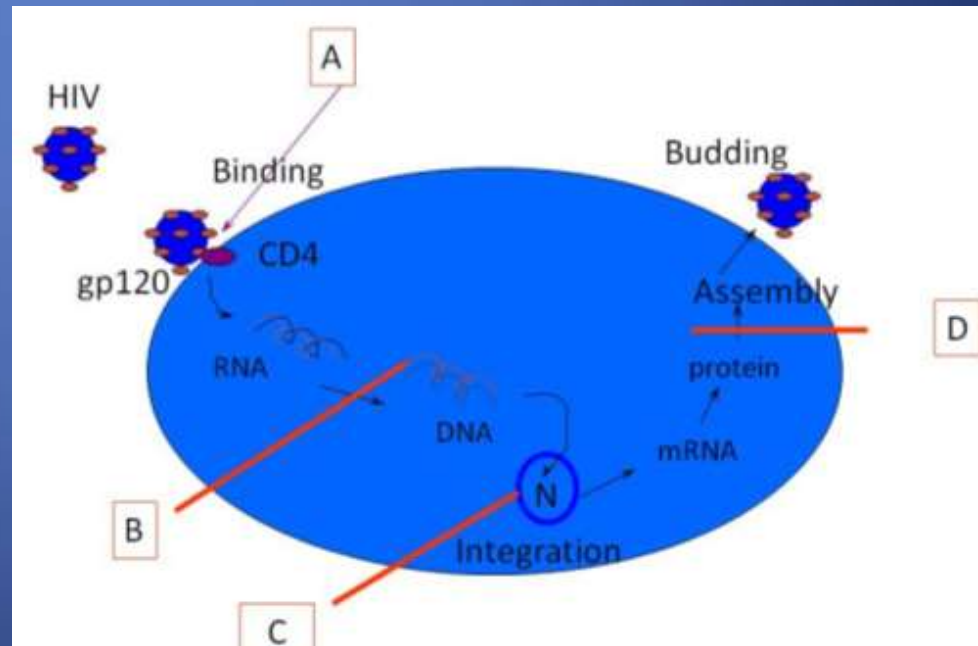
# Writing a "Paper" Hotspot Question

- Reverse Transcriptase produces its biological effect at which site_____? **LEVEL 1**

# Writing a "Paper" Hotspot Question

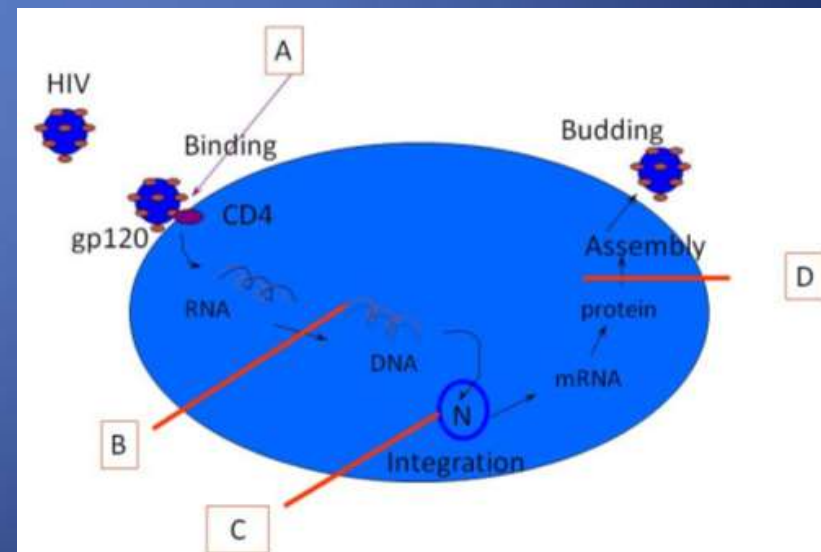- **AZT produces its pharmacological effect at which site_____?**

# Writing a "Paper" Hotspot Question

- A HIV+ 30 year old male who is an IV drug user attends the AIDS free clinic for disease state management. Laboratory results reveal VL=50,000 copies/uL and CD4+ count of 400 cells/uL. Patient is diagnosed with Category B HIV Disease

- **A <u>standard</u> regimen (HAART) for treating a Patient with Category B HIV Disease consists of**

**LEVEL 3**

A. At least two drugs which act at Site A
B. One drug that acts at Site B
C. Two drug which act at Site D
D. Two drugs which act at Site B combined with at least one drug which acts at Site D
E. Two drugs which act at Site C combined with at least one drug which acts at Site A

# Writing a "Paper" Hotspot Question

- A HIV+ 30 year old male who is an IV drug user attends the AIDS free clinic for disease state management. Laboratory results reveal VL=50,000 copies/uL and CD4+ count of 550 cells/uL. He is immediately placed on Didanosine, Lamivudine and Nelfinavir. Lab results reveal VL=150,000 copies/uL and CD4+ count 150cells/uL. Alarmed by the lack of efficacy of the current HAART. The physician considers discontinuing Didanosine and Nelfinavir and substituting other ARVs.

- Predict which of the following medications is **LEAST LIKELY** to be effective in this patient?
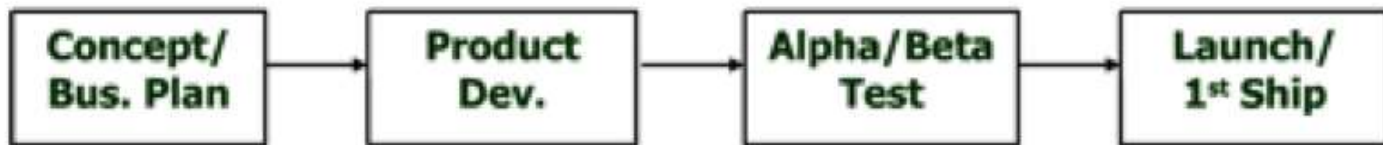
**Select All That Apply**

Drug that acts at Site A
Drug that acts at Site B
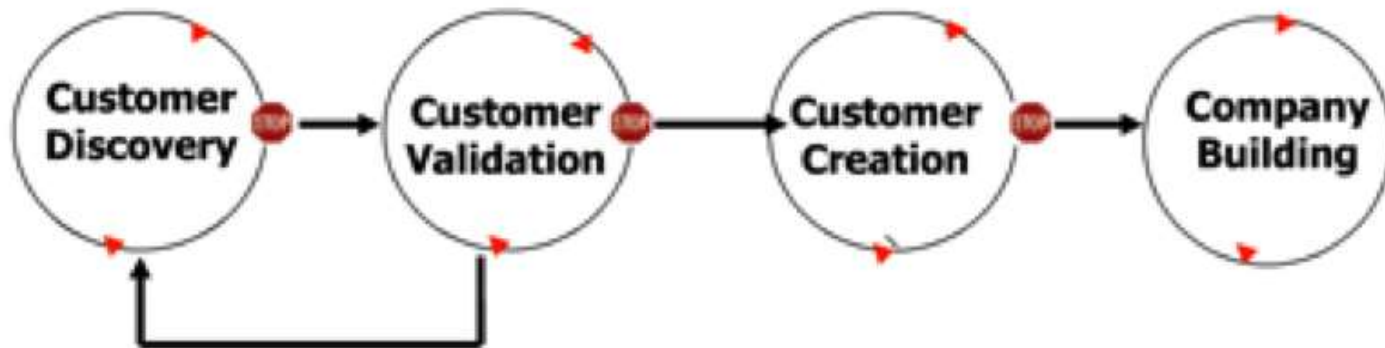Drug that acts at Site C
Drug that acts at Site D
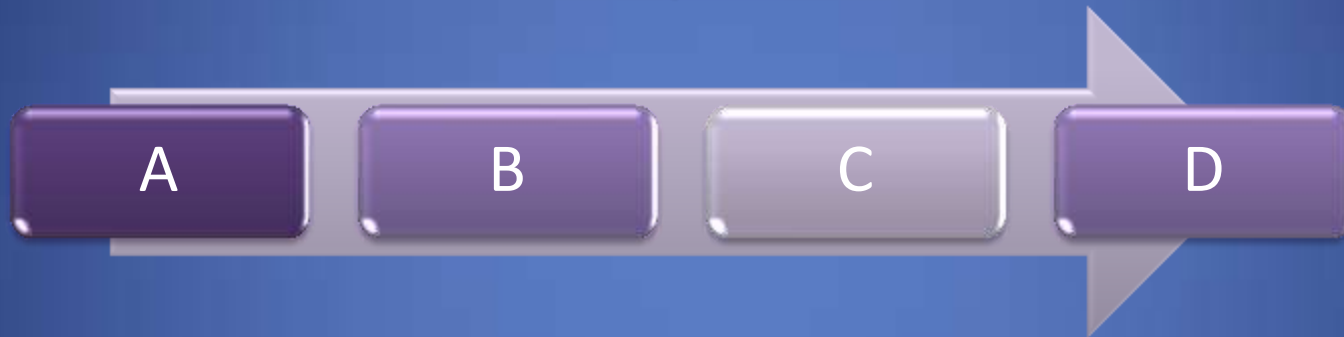
**LEVEL 6**

# Writing a "Paper" Hotspot Question
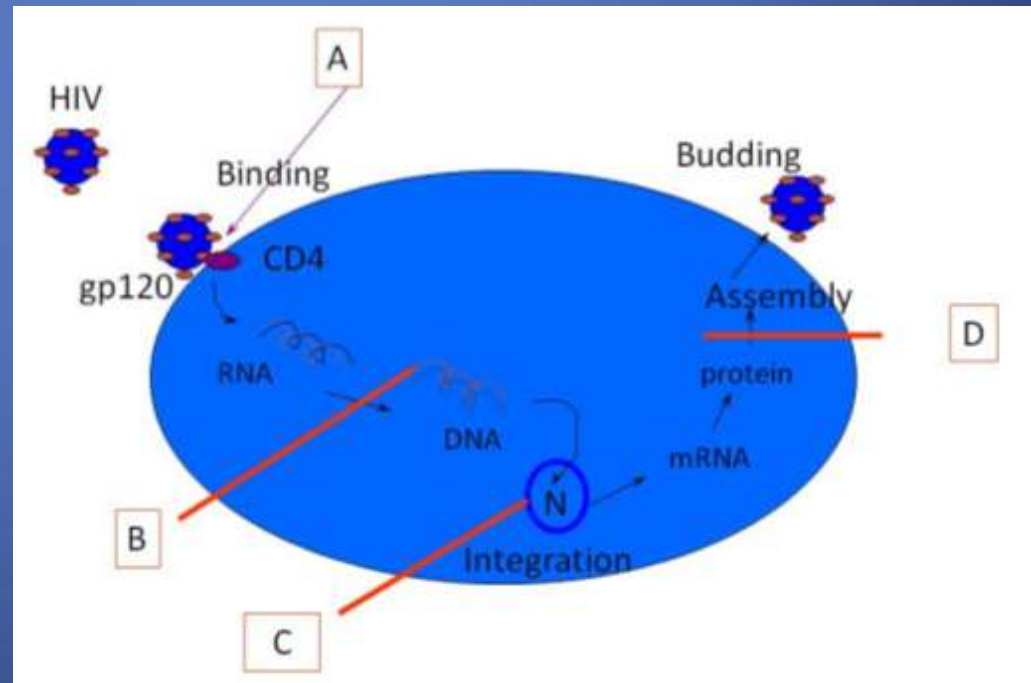
# Writing a "Paper" Hotspot Question

## Customer Development Process



A · B · C · D

## Product Development Process

1 · 2 · 3 · 4
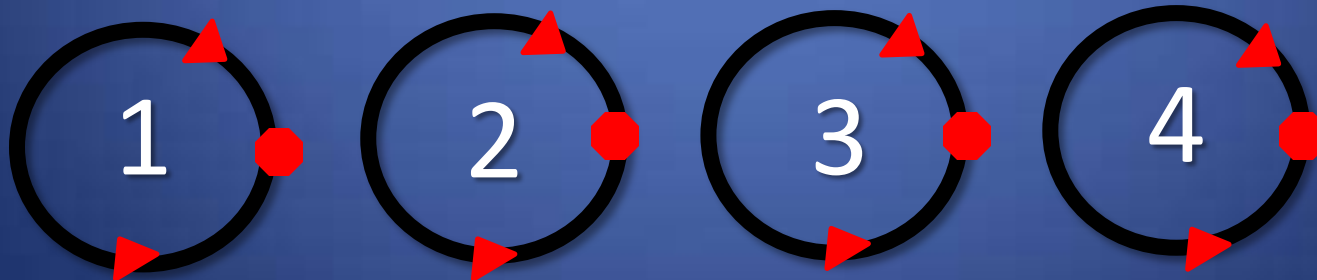
# Writing a "Paper" Hotspot Question

The troubled department-store chain  JC Penney announced that its CEO , Ron Johnson is stepping down and leaving the company after just a year and a half.    Johnson announced a series of new initiatives -- including overhauled prices, redesigned store layouts, and offered free hair kids -- in an effort to revitalize the company. He eliminated older traditional brands and announced plans to eliminate checkout counters in favor of mobile and self-checkout. The results, however, were dismal. The company suffered steep losses. During the last  quarter (fourth) , the company lost  $427 million  dollars as sales fell 28% relative to the prior year.  J.C. Penney shares have plunged more than 50% over the past year

**Using the Diagrams provided, determine which of the following  step (s) in the Customer Development and Product Development Process  did the CEO of JC Penny fail to  execute?**  (LEVEL 5)

A.  Steps   A and 1
B.  Steps   B and 2
C.  Steps  A and  3
D.  Steps  A and  4
E.  Steps  B  and  4

# Essay Test Items

- **Bloom' Taxonomy Levels**
  - Applying (Level 4)
  - Evaluating (Level 5)
  - Creating  (Level 6)

- **Types:**
  - Short Answers
  - Full Essays

# Essay Test Items

- **Strengths**
  - Permit students to demonstrate achievement of higher level learning objectives
  - Students have the opportunity to use their own judgment, writing styles, and vocabularies
  - Students preparing for essay tests focus on broad issues, concepts, and interrelationships rather than on specific details

# Essay Test Items

- **Weaknesses**
  - permit only a limited sampling of content learning
  - not efficient for assessing knowledge of basic facts
  - Subjective, students with better writing skills and vocabulary get better scores
    - Requires the development of a grading rubric to reduce bias
  - Students tend to bluff and ramble
  - Time-consuming to grade

# TIPS FOR WRITING ESSAY QUESTIONS

- **RESTRICT THE USE TO THOSE LEARNING OBJECTIVES THAT CANNOT BE MEASURED OTHERWISE**

- **CONSTRUCT QUESTIONS THAT WILL CALL FORTH THE SKILLS SPECIFIED IN THE LEARNING STANDARDS**

- **PHRASE THE QUESTION SO THAT THE STUDENT'S TASK IS CLEARLY INDICATED**

- **INDICATE AN APPROXIMATE TIME LIMIT FOR EACH**

- **AVOID THE USE OF OPTIONAL QUESTIONS**

# DEVELOPING TEST QUESTIONS WHICH MATCH LEARNING OBJECTIVES

## PUTTING IT ALL TOGETHER

# Putting It All Together

- **Learning Objective:**
  - *Describe the biochemical defect that causes Intermittent Porphyria* (Level 1 Objective)

- Testing Item
  - *Acute intermittent porphyria is the result of a defect in the biosynthetic pathway for* (Level 1 Test Item)
    - a) Collagen
    - b) Glucocorticoids
    - c) Glucose
    - **d) Heme**
    - e) Lipids

# Putting It All Together

- ## Learning Objective

  - Given a patient case description which includes symptomology, patient medical and family histories and clinical findings, ascertain which metabolic syndrome is present in the patient and identify the etiology of the disease **(Level 5 Objective)**

- ## Test Item

  - An otherwise healthy 33-year-old man has mild weakness and occasional episodes of steady, severe abdominal pain with some cramping but no diarrhea. One aunt and a cousin have had similar episodes. During an episode, his abdomen is distended, and bowel sounds are decreased. Neurologic examination shows mild weakness in the upper arms. **These findings suggest a defect in the biosynthetic pathway for: (Level 5 Test Item)**

    a) Collagen
    b) Glucocorticoids
    c) Glucose
    d) **Heme**
    e) Lipids

# Constructing Tests with Course Content and Learning Objectives In Mind

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# Action Verbs for creating learning outcomes (Bloom's Revised Taxonomy)

## Level 1. Remember

| | | | | |
|---|---|---|---|---|
| Choose | Describe | Define | Identify | Label |
| List | Locate | Match | Memorize | Name |
| Omit | Recite | Select | State | Count |
| Draw | Outline | Point | Quote | Read |
| Recall | Recognize | Repeat | Reproduce | |

## Level 2. Understand

| | | | | |
|---|---|---|---|---|
| Classify | Defend | Demonstrate | Distinguish | Explain |
| Express | Extend | Give Examples | Illustrate | Indicate |
| Interrelate | Interpret | Infer | Judge | Match |
| Paraphrase | Represent | Restate | Rewrite | Select |
| Show | Summarize | Tell | Translate | Associate |
| Compute | Convert | Discuss | Estimate | Extrapolate |
| Generalize | Predict | | | |

## Level 3. Apply

| | | | | |
|---|---|---|---|---|
| Apply | Choose | Dramatize | Explain | Generalize |
| Judge | Organize | Paint | Prepare | Produce |
| Select | Show | Sketch | Solve | Use |
| Add | Calculate | Change | Classify | Complete |
| Compute | Discover | Divide | Examine | Graph |
| Interpolate | Manipulate | Modify | Operate | Subtract |
| Use | | | | |

## Level 4. Analyze

| | | | | |
|---|---|---|---|---|
| Analyze | Categorize | Classify | Compare | Differentiate |
| Distinguish | Identify | Infer | Point out | Select |
| Subdivide | Survey | Arrange | Breakdown | Combine |
| Design | Detect | Diagram | Develop | Discriminate |
| Illustrate | Outline | Relate | Point out | Separate |
| Utilize | | | | |

## Level 5. Evaluate

| | | | | |
|---|---|---|---|---|
| Appraise | Judge | Criticize | Defend | Compare |
| Assess | Conclude | Contrast | Critique | Determine |
| Grade | Justify | Measure | Rank | Rate |
| Support | Test | | | |

## Level 6. Create

| | | | | |
|---|---|---|---|---|
| Choose | Combine | Compose | Construct | Create |
| Design | Develop | Do | Formulate | Hypothesize |
| Invent | Make | Originate | Organize | Plan |
| Produce | Role Play | Tell | Compile | Drive |
| Devise | Explain | Generate | Group | Integrate |
| Prescribe | Propose | Rearrange | Reconstruct | Reorganize |
| Revise | Rewrite | Transform | | |

Additional information about Bloom's Revised Taxonomy is available here:
http://coe.sdsu.edu/eet/Articles/bloomrev/index.htm

# QUIZ 1

# Version A

**CLASSIFY THE FOLLOWING STATEMENTS AS EITHER TRUE OR FALSE.**
**CHOOSE A IF THE STATEMENT IS TRUE**
**CHOOSE B IF THE STATEMENTIS FALSE**

1. George W.  Bush was elected President of the USA  in 2008
2. The capital of the USA is Washington, DC
3. Human Immunodeficiency Virus causes Chickenpox
4. Cold Medicines like Nyquil  and Robitussin are cures for the common cold
5. Antibiotics like Penicillin and Z-pac should be used to treat Influenza
6. If you get the flu vaccine too early in the year, your protection will wear off before flu season ends.
7. The 50$^{th}$ state to be admitted into the USA was Alaska
8. There are 27 amendments to the US Constitution
9. The first ten amendments to the US Constitution are collectively called the Bill of Rights
10. The capital of the state of Virginia is Norfolk
11. The three stages of stress according to Seyle General Adaptation Syndrome are Alarm, Resistance and Exhaustion
12.  Acceleration is defined as the rate of change of velocity with time.
13. Self-efficacy is the measure of one's own ability to complete tasks and reach goals.
14. The State of Florida resides in the Pacific Ocean
15. A tropical storm that has 75 mph or greater winds in the Northern Hemisphere is classified as a Typhoon

# QUIZ 1

# Version B

**CLASSIFY THE FOLLOWING STATEMENTS AS EITHER TRUE OR FALSE.**
**CHOOSE A IF THE STATEMENT IS TRUE**
**CHOOSE B IF THE STATEMENTIS FALSE**

1. Statement 1
2. Statement 2
3. Statement 3
4. Statement 4
5. Statement 5
6. Statement 6
7. Statement 7
8. Statement 8
9. Statement 9
10. Statement 10
11. Statement 11
12. Statement 12
13. Statement 13
14. Statement 14
15. Statement 15