



BIOTECHNOLOGY

Purpose: To provide Health Science students with an opportunity to develop and demonstrate knowledge and skills in the medical laboratory and health care biotechnology careers.

Description of Event: This event will consist of two rounds of competition. Round One will be a written, multiple choice test of knowledge and understanding. The top scoring competitors will advance to Round Two for the performance of selected skill procedure(s) identified in a written scenario. The scenario will require the use of critical thinking skills. The performance will be timed and evaluated according to the event guidelines.

Dress Code: Competitors shall wear proper business attire or official HOSA uniform, or attire appropriate to the occupational area, during the orientation and written test. Competitors will wear attire appropriate to the occupational area during the skill procedure(s). Bonus points will be awarded for proper dress.

- Rules and Procedures**
- Competitors in this event must be active members of HOSA in good standing in the category in which they are registered to compete (Secondary or Postsecondary/Collegiate).
 - The test shall be developed from the National HOSA test item bank and will consist of fifty (50) multiple choice items. Competitors will be given one hour to complete the test. There will be a verbal announcement when there are 15 minutes remaining for the test period.

Round One: **Written Test Plan**

Biotechnology industry, equipment and products	10%
Raw materials of biotechnology	8%
Lab safety and infection control	10%
DNA structure and function	8%
Proteins and enzymes	10%
Genetic engineering.....	8%
Biotechnology in Health Care	10%
DNA synthesis, sequencing and genomics	8%
Clinical Chemistry	8%
Hematology and Serology.....	10%
Careers in medical lab and biotechnology.....	10%

- All competitors shall report to the site of the event orientation at the time designated. The Round One test will immediately follow the orientation. **No proxies will be allowed for the orientation.** No study materials are allowed in the room.
- All official references, including websites, are used in the development of the written test. The specific reference selected for each procedure is listed in the Facilities, Equipment and Materials section of these guidelines.
 - Walters, Estridge, Reynolds. *Basic Clinical Laboratory Techniques*. Delmar Publishing. Latest edition.
 - Daugherty, Ellyn. *Biotechnology: Science for the New Millennium, First Edition, Revised*. Paradigm Publishing. Latest edition. (<http://paradigm.emcpublishingllc.com/page/paradigm/>)
 - Simmers, Louise. *Diversified Health Occupations*. Delmar Cengage Learning, latest edition.
 - Biotechnology Industry Organization <http://www.bio.org/>

5. The test score from Round One will be used to qualify the competitor for the Round Two skill procedures, and will be used as a part of the final score for the event. The skill procedures approved for Round Two for this event are:

Procedure I: Identifying Laboratory Instruments (*Including name of instrument and purpose or use.*)

Procedure II: Infection control and transmission-based precautions

Procedure III: Inoculate and streak an agar plate

Procedure IV: Using a microscope

Procedure V: ABO Grouping

Procedure VI: Gram Stain

Procedure VII: Fecal Occult Blood

***(FOR ALL PROCEDURES, BODY FLUIDS WILL BE A SIMULATED PRODUCT)**

6. States/National HOSA have the option of including Procedure I: Identification of laboratory equipment, at the same time as the Round One written test.
7. The selected procedure(s) for Round Two, in the form of a written scenario, will be presented to the competitor at the start of the skill(s) to be performed. One – three skills will be selected and may be combined in the scenario. The timing for the skill will begin when the scenario is presented. The scenario will be the same for each competitor and will include a challenging component that will require the competitor to apply critical thinking skills.
8. The scenario is a secret topic. Professional ethics demand that competitors DO NOT discuss or reveal the secret topic until after the event has concluded. Competitors who violate this ethical standard will be disqualified.
9. In case of a tie, the highest test score will be used to determine the rank.
10. Competitors must complete all steps of the procedure listed in the guidelines even if the steps must be simulated/verbalized. Steps may not be simulated/verbalized when the equipment/materials are available.
11. The competitor must earn a score of 70% or higher on the combined skill procedure(s) of the event (excluding the test and ID lab equipment) in order to be recognized as an award winner at the NLC.
12. Competitors will be stopped at the end of the time allowed for a selected procedure(s).
13. Competitors must bring all items noted with *** in the materials section of these guidelines to the event.
14. Competitors must be familiar with and adhere to the "**General Rules and Regulations of the National HOSA Competitive Events Program.**"

Required Personnel

1. One Event Manager per event
2. One Section Leader per section
3. One judge per procedure selected per section (with expertise in the specific skill area)
4. Proctors for testing
5. One-two event assistants per section
6. Timekeepers (if necessary)

Facilities, Equipment and Materials (Per Section)

General

1. Clinical and/or laboratory stations for selected procedures
2. Holding rooms or areas for competitors
3. Written scenario (one copy per competitor and judge)
4. Calculators, note pads, pencils for judges
5. Certificates for each competitor who completes Round One
6. Event evaluations and pencils to complete.
7. Stopwatch
- *** 8. Watch with second hand
- *** 9. Pens and pencils for all events
- *** 10. Print copy of the event guidelines for the event orientation

Round One

Written Test (Reference: All resources)

1. One test copy per competitor
2. Scantron forms

Round Two

Procedure I

Identification of laboratory equipment (Reference: Estridge/Reynolds and Daugherty)

- | | |
|--|--------------------------|
| 1. 15 instruments or photos from the following list: | 23. Laminar flow hood |
| 2. Agar plate | 24. Medicine dropper |
| 3. Agar slant tube | 25. Micropipet |
| 4. Autoclave | 26. Micropipet tips |
| 5. Automatic pipet | 27. Monocular microscope |
| 6. Beaker | 28. Peg rack |
| 7. Bottle | 29. Petri dish |
| 8. Centrifuge | 30. Pipet pump, blue |
| 9. Concave microscope slide | 31. Pipet pump, green |
| 10. Disposable pipet | 32. Pipetting bulbs |
| 11. Erlenmeyer flask | 33. Pipetting device |
| 12. Florence flask | 34. Safety glasses |
| 13. Forceps | 35. Scalpel |
| 14. Funnel | 36. Stirring rod |
| 15. Gloves | 37. Swab |
| 16. Graduated cylinder | 38. Test tube |
| 17. Graduated pipet | 39. Test tube rack |
| 18. Hot water bath | 40. Transfer pipet |
| 19. Hot plate | 41. Thermometer |
| 20. Incubator | 42. Volumetric flask |
| 21. Inoculating loop | 43. Volumetric pipet |
| 22. Laboratory balance | |

*** Must be provided by student competitor

Procedure II Infection control and transmission-based precautions (Reference: Estridge and Reynolds)

1. Sink
2. Antiseptic soap
3. Alcohol-based antiseptic
4. Paper towels
- *** 5. Disposable masks with ties
- *** 6. Disposable gown
- *** 7. Disposable glove
8. Disposal receptacle for used items
9. Biohazard bags or other plastic bags with materials for labeling

Procedure III Inoculate and streak an agar plate (Reference Estridge and Reynolds)

- *** 1. Gloves
2. Alcohol-based antiseptic
3. Surface disinfectant
4. Pre-inoculated (simulated) swabs stored in capped culture tube
5. Blood agar plates
6. Sterile disposable inoculating loops, 4 per competitor
7. Incubator set at 35° - 37° C (may be simulated)
8. Waterproof marker (fine point Sharpie)
9. Biohazard container
10. Paper towels

Procedure IV Using a microscope (Reference: Simmers)

1. Alcohol-based handrub
2. Microscope with low power, high power, and oil-immersion lenses
3. Lens paper
4. Prepared slides
5. Immersion oil
6. Surface disinfectant
7. Paper towels
8. Cloth for cleaning microscope
- *** 9. Gloves
10. Scenario – must indicate the type of slides to be viewed so the competitor can determine if gloves should be worn.
11. Sink with running water

Procedure V ABO Grouping (Reference: Ward's Natural Science Simulated ABO Blood Typing Lab Activity 36W0022)

1. Antiseptic
2. EDTA anticoagulated blood specimen (simulated)
3. Timer
4. Pen or pencil for labeling slides
5. Applicator sticks or stirrers
- *** 6. Gloves
- *** 7. Safety glasses, face shield or goggles
7. Disposable plastic pipets
8. Anti-A
9. Anti-B
10. Cell typing slides
11. ABO worksheet
12. Surface disinfectant and paper towels
13. Biohazard container

* Simulated ABO blood typing kit available at www.pocketnurse.com Item # 09-19-0022

Procedure VI Gram Stain (Reference: Estridge and Reynolds)

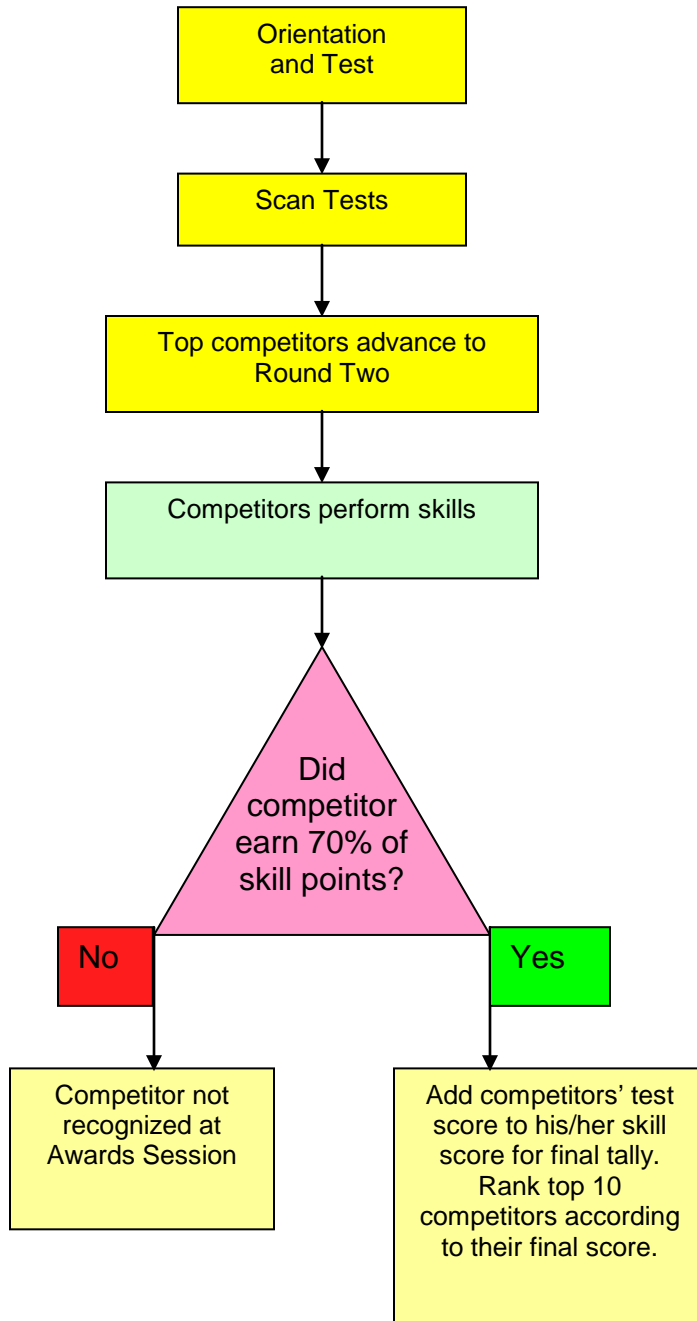
1. Sink with tap water and/or distilled water from beaker or plastic squeeze bottle
2. Gram's stain kit or individual gram stain reagents
3. Microscope
4. Staining rack
5. Lens paper/gauze or soft tissue
6. Bibulous paper
7. Lab timer
8. Saline
- *** 9. Gloves
- *** 10. Safety glasses, face shield or goggles
11. Surface disinfectant and paper towels
12. Biohazard container
13. Sharps container
14. Forceps or spring clothespin
15. Alcohol-based handrub
16. Surface disinfectant and paper towels
17. Prepared smear (1 per competitor)

Procedure VII Fecal Occult Blood (Reference: Estridge and Reynolds)

1. Laboratory timer
 2. Test kit for fecal occult blood
 3. Applicator sticks
 4. Specimen cups
 5. Fecal specimen (simulated)
 - *** 6. Gloves
 - *** 7. Safety glasses, face shield or goggles
 8. Surface disinfectant and paper towels
 9. Biohazard container
 10. Paper towels and lab tissues
 11. Fume hood or biosafety cabinet (may be simulated)
- * Fecal Occult Blood test kit 09-49-5076 available at www.pocketnurse.com

*** Must be provided by student competitor

Event Flow Chart



BIOTECHNOLOGY

PROCEDURE I: IDENTIFYING LABORATORY INSTRUMENTS

Time = 15 minutes

Competitor #: _____ Judge's Initials: _____ Total Points (45 poss.) _____

	Name of Instrument	Points (1 each for name & spelling)	Purpose or Use	Points (1 point for correct purpose/use)
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
TOTAL: ID & Spelling (30 poss)			TOTAL: Purpose (15 poss.)	

BIOTECHNOLOGY

Competitor #: _____

Judge's Signature: _____

Procedure II:	Infection Control and Transmission-Based Precautions (5 minutes)	Possible	Awarded
1.	Assembled equipment and PPE (Personal Protective Equipment including gloves, mask and gown).	2	
2.	Washed hands using antiseptic soap <ul style="list-style-type: none"> a. Turned on warm water using a paper towel to turn the faucet handle, then discarded the towel. b. Dispensed soap into hands, then rubbed fronts and backs of hands and between fingers vigorously. Verbalized the duration of handwashing as 1 – 2 minutes. (Actual event time approx. 15 seconds.) c. Rinsed hands, fingertips downward, under warm running water. d. Used clean towel to dry hands and turn off faucet. e. Disposed of towel, touching only the clean side. 	2 4 2 2 2	
3.	Used alcohol-based handrub <ul style="list-style-type: none"> a. Applied handrub to palm of hand and rubbed hands together vigorously for at least 15 seconds, covering all surfaces of hands and fingers. b. Continued procedure until all alcohol has evaporated and hands are completely dry. 	3 1	
	<i>* Steps for donning PPE must be performed in the order listed below.</i>	2	
4.	Slipped arms into the sleeves of a gown, being careful to touch only the inside of the gown.		
5.	Secured gown at neck and back of waist, covering clothing completely.	2	
6.	Donned mask <ul style="list-style-type: none"> a. Picked up mask and place it over the mouth and nose, being careful not to touch the face with the fingers. b. Tied the ends of the mask around the head and neck. 	2 1	
7.	Donned gloves <ul style="list-style-type: none"> a. Put on gloves, avoiding touching the outside of the gloves b. Pulled the glove cuffs over the sleeves of the gown. 	2 1	

Items Evaluated	Possible	Awarded
* Judge instructs competitor to remove PPE.		
8. Removed the gloves by folding them down and turning them inside out, then discarded them in receptacle for contaminated materials.	3	
9. Untied ties at neck and waist.	1	
10. Removed gown by pulling down from the neck and slipping hands back into gown sleeve, touching only the inside of the gown.	2	
11. Folded the gown down over the arms inside-out and discarded in appropriate receptacle.	2	
12. Removed mask, touching only the ties.	2	
13. Held the mask by the ties and discarded in proper receptacle.	2	
14. Used alcohol-based handrub for hand hygiene	2	
TOTAL POINTS - PROCEDURE II	42	

***If a competitor jeopardizes the patient's or his/her own safety or fails to perform a critical step and does not take immediate action to correct the error, the total points for the procedure or specific subpart(s) of the procedure will be deducted by the judge(s).*

BIOTECHNOLOGY

Competitor #: _____

Judge's Signature: _____

Procedure III:	Inoculate and streak agar plate (Time: 5 minutes)	Possible	Awarded
1.	Assembled materials and equipment.	2	
2.	Used alcohol-based handrub and put on gloves.	2	
3.	Selected an agar plate to be inoculated and labeled the bottom with a marker.	1	
4.	Selected an inoculated swab	1	
5.	Placed package of sterile disposable loops within reach.	1	
6.	Removed pre-inoculated swab from package.	2	
7.	Opened the lid of the agar plate just enough to insert the swab and spread the inoculum over the surface of one quadrant of the agar plate	2	
8.	Replaced the lid on the Petri dish	1	
9.	Disposed of swab in biohazard container.	1	
10.	Picked up a sterile disposable loop and lifted the lid of the Petri dish just enough to be able to insert the inoculating loop.	1	
11.	Streaked the second quadrant of the plate by touching the loop into the first quadrant and streaking all the way across the second quadrant, making six to eight strokes	2	
12.	Disposed of swab in biohazard container.	1	
13.	Picked up a sterile disposable loop and lifted the lid of the Petri dish just enough to be able to insert the inoculating loop.	1	
14.	Streaked the third quadrant by touching the loop into the second quadrant and streaking into the third quadrant, making six to eight strokes	2	
15.	Disposed of swab in biohazard container.	1	
16.	Picked up a sterile disposable loop and lifted the lid of the Petri dish just enough to be able to insert the inoculating loop.	1	
17.	Streaked the fourth quadrant in a manner to produce isolated colonies: Touched the loop to the third quadrant and spread the organism into the fourth quadrant using a continuous streak in a "tornado" pattern. Decreased the width of the streaks horizontally and increased the distance between the streaks vertically	2	
18.	Replaced the lid on the Petri dish	1	
19.	Disposed of swab in biohazard container.	1	

Items Evaluated	Possible	Awarded
20. Placed the agar plate upside down in the 35-37°C incubator.	2	
21. Cleaned reusable equipment and returned to proper storage; put disposables in biohazard containers	1	
22. Cleaned work area with surface disinfectant	1	
23. Removed gloves	2	
24. Used alcohol-based handrub for hand hygiene	2	
TOTAL POINTS - PROCEDURE III	34	

***If a competitor jeopardizes the patient's or his/her own safety or fails to perform a critical step and does not take immediate action to correct the error, the total points for the procedure or specific subpart(s) of the procedure will be deducted by the judge(s).*

BIOTECHNOLOGY

Competitor #: _____

Judge's Signature: _____

Procedure IV: Using a Microscope (10 minutes)	Possible	Awarded
1. Assembled equipment and materials.	1	
2. Used alcohol-based handrub for hand hygiene.	1	
3. Donned gloves and observed standard precautions if the specimen is contaminated by blood or body fluids, or while examining pathogenic organisms.	1	
4. Obtained the correct prepared slide to examine.	1	
5. Used lens paper to clean the eyepiece and the objectives.	1	
6. Turned on the illuminating light and opened the iris diaphragm so that the largest hole is located directly under the hole in the stage platform.	2	
7. Turned the revolving nosepiece until the low-power objective clicks into place.	1	
8. Placed the slide on the stage and fastened it with slide clips while avoiding getting fingerprints or smudges on the slide.	2	
9. While watching the stage and slide, turned the coarse adjustment so that the objective moved down close to the slide.	2	
10. Used the coarse adjustment to raise the nosepiece unit.	1	
11. Changed to the fine adjustment and turned the knob until the object came into finest focus.	1	
12. <i>JUDGE looked in the objective and confirmed the fine focus.</i>	2	
13. Without moving the body tube, turned the revolving nosepiece until the high power objective was in placed and focused with the fine adjustment only.	2	
14. Watched the slide while turning the objectives and avoided breaking the slide and objectives.	1	
15. Turned the revolving nosepiece until the oil-immersion objective is in position, and focused by properly repeating coarse and fine adjustment steps.	2	
16. Rotated the oil-immersion objective slightly to the side.	1	
17. Placed one drop of immersion oil on the portion of the slide that will be directly under the objective.	1	
18. Rotated the oil-immersion objective into position, being careful not to rotate the high-power objective through the oil. Looked to see that the oil-immersion objective is touching the drop of oil.	2	
19. Looked through the eyepiece and slowly turned the fine adjustment until the image is in focus.	1	

Items Evaluated	Possible	Awarded
20. Moved the diaphragm as necessary to adjust the amount of light for viewing the slide.	1	
21. <i>JUDGE looked in the objective and confirmed the fine focus.</i>	2	
22. Turned the revolving nosepiece until the low-power objective was in position, making sure no other objective comes in contact with the oil on the slide.	2	
23. Cleaned the oil-immersion objective with lens paper.	1	
24. Removed the slide from the microscope stage and gently cleaned off the oil with lens paper.	2	
25. Cleaned the eyepiece and objectives with lens paper.	1	
26. Used a damp, soft cloth to wipe the other parts of the microscope.	1	
27. Positioned the nosepiece in the lowest position using the coarse adjustment.	1	
28. Turned off the microscope light and unplugged the microscope.	1	
29. Covered the microscope and returned it to storage.	1	
30. Cleaned the work area and returned slides to storage.	1	
31. Removed gloves (if applicable) and used alcohol-based handrub.	1	
TOTAL POINTS - PROCEDURE IV	41	

***If a competitor jeopardizes the patient's or his/her own safety or fails to perform a critical step and does not take immediate action to correct the error, the total points for the procedure or specific subpart(s) of the procedure will be deducted by the judge(s).*

BIOTECHNOLOGY

Competitor #: _____

Judge's Signature: _____

Procedure V: ABO Grouping	(Total time: 6 minutes)	Possible	Awarded
1. Assembled equipment and materials.		2	
2. Used alcohol-based handrub for hand hygiene and put on gloves.		2	
3. Put on face shield or goggles.		2	
4. Performed slide grouping as follows:			
a. Obtained a slide with two wells and labeled the slide with the patient's name.		2	
b. Placed three drops of the patient's blood in each of the A and B wells. Did not allow dropper to touch the slide.		2	
c. Placed three drops of the anti-A serum in the A well.		2	
d. Placed three drops of the anti-B serum in the B well.		2	
e. Obtained two toothpicks. Stirred each well with a separate clean toothpick for 30 seconds.		3	
f. Stirring motion was effective. Avoided splattering the simulated blood.		2	
f. Recorded agglutination results on ABO worksheet.		2	
g. Accurately determined the agglutination, blood type, and transfusion responses on the Laboratory Report form.		5	
5. Discarded disposable labware into appropriate biohazard container.		2	
6. Returned simulated blood, reagents and unused equipment to proper storage.		2	
7. Cleaned work area with surface disinfectant.		2	
8. Removed gloves and discarded into biohazard container.		2	
9. Used alcohol-based handrub for hand hygiene.		2	
TOTAL POINTS - PROCEDURE V		36	

***If a competitor jeopardizes the patient's or his/her own safety or fails to perform a critical step and does not take immediate action to correct the error, the total points for the procedure or specific subpart(s) of the procedure will be deducted by the judge(s).*

COMPETITOR # _____

LABORATORY REPORT

PROCEDURE III: ABO Typing

Patient Identification _____ DATE _____

Blood Type Analysis

Agglutination Reaction

Patient	Anti-A Serum	Anti-B Serum	Blood Type

1. If the patient needed a transfusion, what blood type(s) could this patient safely receive?

2. What blood type(s) could safely receive this patient's blood?

BIOTECHNOLOGY

Competitor #: _____

Judge's Signature: _____

Procedure VI:	Gram Stain	(Time: 7 mins)	Possible	Awarded
1.	Assembled equipment and materials.		2	
2.	Used alcohol-based handrub for hand hygiene and put on gloves.		2	
3.	Obtained prepared smear and placed on staining rack.		1	
4.	Flooded the slide with crystal violet for one minute.		2	
5.	Rinsed slide with gentle stream of water from a beaker, faucet, or plastic squeeze bottle and tilted the slides to remove excess water.		2	
6.	Flooded the slides with Gram's iodine for the recommended time.		2	
7.	Rinsed slide with gentle stream of water from a beaker, faucet, or plastic squeeze bottle and tilted the slides to remove excess water.		2	
8.	Held the slide by the short edge using forceps or clothespin. Added the decolorizer by squeeze bottle or Pasteur pipette until no more purple color ran off the slide (<i>Note: Important not to decolorize more than a few seconds to prevent over-decolorization</i>)		3	
9.	Rinsed the slides immediately to remove the decolorizer; tilted the slides to remove excess water		2	
10.	Counterstain the smears by flooding the slides with safranin for 30-60 seconds		2	
11.	Rinsed the slides, tilted to remove excess water; wiped the back of the slide with paper towel to remove stain; stood slides on end or blotted between bibulous paper to dry.		2	
12.	Judges will verify properly stained smear		3	
13.	Returned slides to storage or discard into proper biohazard containers for disposal		2	
14.	Cleaned work surfaces with disinfectant		2	
15.	Removed and discarded gloves into biohazard container and used alcohol-based handrub for hand hygiene		2	
TOTAL POINTS - PROCEDURE VI			31	

***If a competitor jeopardizes the patient's or his/her own safety or fails to perform a critical step and does not take immediate action to correct the error, the total points for the procedure or specific subpart(s) of the procedure will be deducted by the judge(s).*

BIOTECHNOLOGY

Competitor #: _____

Judge's Signature: _____

Procedure VII: Fecal Occult Blood Test	(5 minutes)	Possible	Awarded
1.	Used alcohol-based handrub for hand hygiene and put on gloves.	2	
2.	Assembled materials and equipment.	2	
3.	a. Filled out the patient information on the front of the slide package <i>Working in a fume hood or biosafety cabinet:</i>	2	
	b. Opened the flap on the front to expose two paper guaiac squares. Followed the directions and obtain small portion of the stool sample on the applicator stick. Applied thin smear to box A.	2	
	c. Reused the applicator stick to obtain a second sample from a different part of the specimen. Applied a thin smear to box B.	2	
	d. Closed the cover and discarded applicator into biohazard container.	2	
	e. Waited 3 to 5 minutes for the smears to dry. (verbalized).	2	
4.	Turned the slide over and opened the perforated flap to expose the backs of boxes A and B, and the performance monitor area.	2	
5.	Applied two drops of the developer onto each smear and started the timer.	2	
6.	Read the results after the appropriate time interval.	2	
7.	Noted (verbalized) that any blue color at the edge of the smear is a positive test.	2	
8.	Applied one drop of developer between the positive and the negative performance monitor areas. Read the results after the appropriate interval.	2	
9.	Correctly verbalized the results to the judge.	4	
10.	Disposed of all potentially infectious materials in a biohazard container.	2	
11.	Wiped the counter with surface disinfectant.	2	
12.	Returned equipment to proper storage.	2	
13.	Removed gloves and discarded in biohazard container.	2	
14.	Used alcohol-based handrub for hand hygiene.	2	
TOTAL POINTS – PROCEDURE VII		38	

***If a competitor jeopardizes the patient's or his/her own safety or fails to perform a critical step and does not take immediate action to correct the error, the total points for the procedure or specific subpart(s) of the procedure will be deducted by the judge(s).*