

Clinical Lab Science

Dress Code	Attire appropriate to the occupational area
SLC Orientation	Event explained to the competitors and individual timecards handed out. Students will return to the event room at least 5 minutes before their allotted time. Students will have a secret scenario to solve when it is their turn to compete. Students should not share the secret scenario when they leave the event as it is an automatic disqualification.
Round # 1	Competitors must submit technical skill video to Montana HOSA by deadline. Additionally, competitors will take an online test during the testing window. Advisors will be informed of which competitors have moved on from Round 1 to qualify to participate in Round 2 at SLC.
Round # 2	Skill procedures from rubric guidelines will be performed by each competitor. Competitors may be asked to do one or multiple of the performance skills.
Scoring	Round 1 online testing scores will be combined with Round 2 skill procedures for a total score.

Official References

The below references are used in the development of the test questions and skill rating sheets unless otherwise noted.

- a. [Estridge and Reynolds. *Basic Clinical Laboratory Techniques*. Cengage Learning. Latest edition.](#)
- b. [Simmers, Simmers-Hartker, Simmers-Kobelak, Fuller. *DHO Health Science*. Cengage Learning. Latest edition.](#) (used for Skills only)
- c. [OneLabREACH](#)
 - o Fundamentals of Bloodborne Pathogens
 - o Fundamentals of Laboratory Safety
 - o Fundamentals of Personal Protective Equipment (PPE) in Clinical Laboratories
 - o Routine Microscopy Procedures

Round One Test

[Test Instructions](#): The written test will consist of 50 multiple-choice items in a maximum of 60 minutes.

Written Test Plan

The test plan for Clinical Laboratory Science is:

- Clinical Lab Professions - 8%
- Biological Safety - 12%
- Laboratory Math - 6%
- Hematology & Hemostasis - 14%

- Immunology - 16%
- Urinalysis - 8%
- Clinical Chemistry - 14%
- Clinical Microbiology - 14%
- Parasitology - 8%

Sample Round One Test Questions

1. What is the title for a person with a high school diploma or GED that has been trained to collect blood specimens for laboratory testing? (Estridge pp 25-26)
 - A. Medical laboratory assistant
 - B. Laboratory manager
 - C. Phlebotomy technician**
 - D. Medical laboratory technician

2. Which of the following solutions is a common disinfectant used to clean laboratory work surfaces before and after each use? (Estridge pp 56)
 - A. 40% alcohol
 - B. 2% iodine
 - C. 50% formaldehyde
 - D. 10% chlorine bleach**

3. What does 95 mean in N95 respirators? (Lab One PPE Module)
 - A. 95% effective
 - B. removes at least 95% of particulates of a certain size**
 - C. should be worn by laboratory staff 95% of the time
 - D. removes 95% of all particulates

Round Two Skills

Round Two is a selected skill(s) performance. The Round Two skills approved for this event are:

Skill I: Identifying Laboratory Instruments/Equipment (*Including name of instrument/equipment and purpose or use.*) 15 minutes

Instruments or photos from the following list:

24-hr Urine Specimen Container	Clinical Centrifuge	N95 Respirator	Single-Use Lancet
Acetest	Coagulation Instrument	Needleless Transfer Device	Slide Staining Rack
Agar Plate	Culture Swabs & Transport Tubes	Perianal Paddle Kit	Sterile Vacuum Tube for Urine
Acrylic Shield	Disposable Needle Holder with Safety Guard	pH Indicator Strips	Stool Specimen Container
Analytical Balance	Electric Incinerator	pH Meter	Tabletop Autoclave
Automatic Slide Stainer	Emergency Eye Wash Station	Pipet Aids	Test Tubes
Bacteriological Incubator	Erlenmeyer Flask	Plastic Vacuum Tubes	Top-Loading Balance
Beakers	Fume Hood	Platelet Aggregation Profiler	Tourniquet
Beral (Transfer) Pipette	Glucose Meter	Point-of-Care Coagulation Analyzer	Transmission Electronic Microscope
Binocular Bright-Field Microscope	Graduated Cylinders	Rapid-Latex Agglutination Test for D-Dimer	Urine Particle Analyzer
Blood Collection Tubes	Hemocytometer	Refractometer	Urine Reagent Strip
Blood Bank Refrigerator	Inoculating Loop	Saf-T Wing Blood Collection Set	Urine Sterile Collecting Straw
Candle Jar	Manual Differential Cell Counter	Safety Shower	Urine Strip Reader
Capillary Collection Vials	Microhematocrit Centrifuge	Safety Syringes	Urinometer
Chromatographic Immunoassay for Urine hCG	Microhematocrit Tubes with Sealant Pad	Scanning Electron Microscope	Volumetric Flask

Clean-Catch Urine Collection Kit	Micropipettes	Serological Centrifuge	
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Skill II:	Infection control and transmission-based precautions	5 minutes
Skill III:	Using a microscope	10 minutes
Skill IV:	ABO Grouping	6 minutes
Skill V-A:	Preparing a Blood Film or Smear	5 minutes
Skill V-B:	Staining a Blood Film or Smear	10 minutes
Skill VI:	Physical Examination of Urine	6 minutes
Skill VII:	Inoculate and Streak Agar Plate	5 minutes

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

The selected skill(s) will be presented to competitors as a written scenario at the beginning of the round. The scenario will be the same for each competitor. Some scenarios may involve the combination of multiple skill sheets, in which case some elements may not be scored due either to being duplicative or not appropriate within the scenario. A sample scenario can be found [here](#).

The scenario is a secret topic. Competitors MAY NOT discuss or reveal the secret topic until after the event has concluded or will face penalties per [the GRRs](#).

Competitors must provide:

- Safety glasses or goggles
- Disposable gown (PPE)
- Sterile non-latex surgical gloves
- Disposable non-latex gloves
- Full-face shield (or equivalent PPE)
- Disposable masks with ties or loops

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SKILL 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.)	

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Section # _____ Division: _____ SS _____ PS/C
 Competitor # _____ Judge's Signature _____

Skill II:	Infection Control and Transmission-Based Precautions (Time: 5 minutes)	Possible		Awarded
1.	Assembled equipment and PPE (Personal Protective Equipment - including gloves, mask and gown).	2	0	
2.	Washed hands using antiseptic soap			
	a. Turned on warm water using a paper towel to turn the faucet handle, then discarded the towel	2	0	
	b. Dispensed soap into hands, then rubbed fronts and backs of hands and between fingers vigorously for 15 – 30 seconds.	2	0	
	c. Rinsed hands, fingertips downward, under warm running water.	1	0	
	d. Used clean towel to dry hands and turn off faucet.	1	0	
	e. Disposed of towel, touching only the clean side.	1	0	
3.	Used waterless antiseptic handrub.	2	0	
	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 skill until all alcohol has evaporated and hands are completely dry.	1	0	
	<i>* Steps for donning PPE must be performed in the order listed below.</i>	1	0	
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.	1	0	
6.	Donned mask			
	a. Picked up mask and place it over the mouth and nose, being careful not to touch the face with the fingers.	1	0	
	b. Secured the mask by tying or looping over the ears.	1	0	
7.	Donned sterile gloves			
	a. Opened the package of gloves, avoiding touching the outside of the gloves.	1	0	
	b. Picked up the right glove by the cuff and inserted the right hand.	2	0	
	c. Picked up and held the left glove by inserting the fingertips of the gloved right hand under the cuff of the left glove.	2	0	

Skill II cont'd: Infection Control and Transmission-Based Precautions (con't)	Possible	Awarded
d. Inserted the left hand into the glove.	1 0	
e. Adjusted to cover arm and sleeve of gown.	1 0	
* Judge states, skill is completed, remove PPE.		
8. Removed the gloves by folding them down and turning them inside out, avoiding touching the outside of the gloves.	2 0	
9. Discarded gloves in biohazard receptacle.	1 0	
10. Untied gown ties at neck and waist.	1 0	
11. Removed gown by pulling down from the neck and slipping hands back into gown sleeve, touching only the inside of the gown.	2 0	
12. Folded the gown down over the arms inside-out and discarded in biohazard receptacle.	1 0	
13. Removed mask, touching only the ties.	1 0	
14. Held the mask by the ties and discarded in biohazard receptacle.	1 0	
15. Washed hands or used antiseptic hand-rub for hand hygiene	2 0	
TOTAL POINTS - SKILL II 70% Mastery for Skill II = 23.8	34	

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Section # _____ Division: _____ SS _____ PS/C
 Competitor # _____ Judge's Signature _____

Skill III:	Using a Microscope (Time:10 minutes)	Possible	Awarded
1.	Washed hands or used alcohol-based hand-rub for hand hygiene.	2	0
2.	Assembled equipment and materials.	1	0
3.	Used lens paper to clean the eyepiece and the objectives.	1	0
4.	Used the coarse adjustment to raise the nosepiece unit (if applicable).	1	0
5.	Raised the condenser as far as possible by adjusting the condenser knob.	1	0
6.	Rotated the low power (10x) objective into position, so it is directly over the condenser.	1	0
7.	Turned on the microscope light.	1	0
8.	Opened the iris diaphragm until maximum light comes up through the condenser.	1	0
9.	Placed and secured the prepared slide on the stage (specimen side up).	1	0
10.	Positioned the condenser so it is almost touching the bottom of the slide.	1	0
11.	Located the coarse adjustment and looked directly at the stage and low power objective and turned the coarse adjustment until the objective is as close to the slide as it will go.	1	0
12.	Looked into the ocular(s) and slowly turned the coarse adjustment in the opposite direction to raise the objective (or lower the stage) until the object on the slide comes into focus.	1	0
13.	Changed to the fine adjustment and turned the knob until the object came into finest focus.	1	0
14.	JUDGE looked in the objective and confirmed the fine focus.	2	0
15.	a. Rotated the high power objective (40X) into position while observing the objective and the slide to see that the objective does not strike the slide.	1	0
	b. Looked through the ocular(s) to view the object on the slide.	1	0
	c. Located the fine adjustment and turned it until the object is in fine focus WITHOUT using the coarse adjustment.	1	0
16.	Rotated the oil-immersion objective slightly to the side.	1	0
17.	Placed one drop of immersion oil on the portion of the slide that will be directly over the condenser.	1	0

Skill III cont'd: Using a Microscope		Possible	Awarded
18.	a. Rotated the oil-immersion objective into position, being careful not to rotate the high-power objective through the oil.	1	0
	b. Looked to see that the oil-immersion objective is touching the drop of oil.	1	0
19.	Looked through the ocular(s) and slowly turned the fine adjustment until the image is in fine focus.	1	0
20.	<i>JUDGE looked in the objective and confirmed the fine focus.</i>	2	0
21.	Rotated the low power (10X) objective into position, making sure no other objective comes in contact with the oil on the slide.	1	0
22.	Removed the slide from the microscope stage, gently blotted the oil from the slide, and returned the slide to the slidebox.	1	0
23.	Cleaned the oculars and low and high power objectives with clean lens paper and lens cleaner.	1	0
24.	Cleaned the oil-immersion objective with lens paper and lens cleaner to remove all oil.	1	0
25.	Cleaned all oil from the microscope stage and condenser.	1	0
26.	Positioned the nosepiece in the lowest position using the coarse adjustment.	1	0
27.	Turned off the microscope light and disconnected the microscope from power source.	1	0
28.	Centered the stage so it does not project from either side of the microscope and covered the microscope.	1	0
29.	Cleaned the work area with disinfectant.	2	0
30.	Washed hands or used alcohol-based hand-rub for hand hygiene.	2	0
TOTAL POINTS - SKILL III		38	
70% Mastery for Skill III = 26.6			

NOTE: For the purpose of this skill performance, a monocular microscope is recommended. If a binocular microscope is used, the normal step of adjusting the oculars to fit the interpupillary distance of the user is omitted because of the need for the judge to see the image as well and to save the time the frequent adjustments would cause.

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Section # _____ Division: _____ SS _____ PS/C
 Competitor # _____ Judge's Signature _____

Skill IV:	ABO Grouping (Time: 6 minutes)	Possible	Awarded
1.	Assembled equipment and materials.	1	0
2.	Washed hands or used alcohol-based hand-rub for hand hygiene and put on gloves.	2	0
3.	Performed slide grouping as follows:		
	a. Obtained a slide with two wells and labeled the slide with the patient's name.	2	0
	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	0
	c. Placed three drops of the anti-A serum in the A well.	2	0
	d. Placed three drops of the anti-B serum in the B well.	2	0
	e. Obtained two toothpicks (or disposable stirrers). Stirred each well with a separate clean stirrer for 30 seconds.	2	0
	f. Stirring motion was effective. Avoided splattering the simulated blood.	2	0
	g. Recorded agglutination results on ABO worksheet.	2	0
	h. Accurately determined the agglutination, blood type, and transfusion responses on the Laboratory Report form.	3	0
4.	Discarded disposable labware into appropriate biohazard receptacle.	1	0
5.	Returned simulated blood, reagents and unused equipment to proper storage.	1	0
6.	Cleaned work area with surface disinfectant.	2	0
7.	Removed gloves and discarded into biohazard receptacle.	2	0
8.	Washed hands or used alcohol-based hand-rub for hand hygiene.	2	0
TOTAL POINTS - SKILL IV		28	
70% Mastery for Skill IV = 19.6			

COMPETITOR # _____

*Each competitor will receive a copy of this form to complete during the skill demonstration.

ABO LABORATORY REPORT

SKILL IV: 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?

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Section # _____ Division: _____ SS _____ PS/C
 Competitor # _____ Judge's Signature _____

Skill V-A: Preparing a Blood Film or Smear	(Time: 5 minutes)	Possible	Awarded
1. Assembled equipment and materials.		1 0	
2. Washed hands or used alcohol-based hand-rub for hand hygiene.		2 0	
3. Put on gloves, gown, mask or face shield, and protective eyewear.		2 0	
4. Placed a small drop of blood on the slide approximately ¾ inch from the end of the slide and centered on the slide.		1 0	
5. The blood drop is approximately 2 mm in diameter, or the size of a match head.		1 0	
6. Placed the edge of the coverslip or spreader slide in front of the blood on the slide.		1 0	
7. Held the spreader slide at a 30-35 degree angle.		1 0	
8. Pulled the spreader back until it touches the blood.		1 0	
9. Held spreader steady while the blood spreads evenly to the edges of the spreader slide.		1 0	
10. Used a firm, steady movement to push the spreader to the opposite end of the slide.		1 0	
11. Motion was continuous and smooth with spreader in contact with slide at all times.		1 0	
12. Finished by raising the spreader in a smooth, low arc.		1 0	
13. Placed disposal coverslip or spreader slide in sharps container.		2 0	
14. Allowed the slide to air- dry.		1 0	
15. Judge verifies that the smear is approximately 1 ½ inches long, smooth, thin and with even margins on all sides.		4 0	
16. Labeled the slide with the patient's name, doctor's name and ID number		2 0	
17. Cleaned and replaced all equipment.		2 0	
18. Used a disinfectant to wipe the counter and any contaminated area.		2 0	
19. Removed PPE and discarded properly in an infectious waste bag.		2 0	
20. Washed hands or used alcohol based hand-rub for hand hygiene.		2 0	
TOTAL POINTS - SKILL V-A		31	
70% Mastery for Skill V-A = 21.7			

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 Competitor # _____ Judge's Signature _____

Skill V-B: Staining a Blood Film or Smear	(Time: 10 minutes)	Possible	Awarded
1. Assembled equipment and materials.		1 0	
2. Washed hands or used alcohol-based hand-rub for hand hygiene.		1 0	
3. Put on gloves and if splashing of blood is possible put on gown, mask or face shield, and protective eyewear.		2 0	
4. Obtained blood smear film.		1 0	
5. Placed the slide with the smear side up on the staining rack.		1 0	
6. Made sure the staining rack is level.		1 0	
7. Stained with Wright's stain.		1 0	
a. Completely covered the dry smear with staining.		1 0	
b. Counted out loud the number of drops of stain used as applied.		1 0	
c. Verbalized stain left in place and timed for 1 -3 minutes.		1 0	
8. Distilled water or Buffer in equal amount with stain		1 0	
a. Placed distilled water or buffer on slide one drop at a time in equal amount of stain.		1 0	
b. Between drops, blew gently along the length of the slide to mix the stain and water.		1 0	
c. Verbalized allowed to stand and timed for 2 - 4 minutes.		1 0	
9. Judge verifies that solution is well mixed as noted by oily, green sheen appearing.		4 0	
10. Washed the slide by flooding gently with distilled water.		1 0	
11. Cleaned and replaced all equipment.		2 0	
12. Used a disinfectant to wipe the counter and any contaminated area.		2 0	
13. Removed PPE and discarded properly in an infectious waste bag.		2 0	
14. Washed hands or used alcohol based hand-rub for hand hygiene.		2 0	
TOTAL POINTS - SKILL V-B		26	
70% Mastery for Skill V-B = 18.2			

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Section # _____ Division: _____ SS _____ PS/C
 Competitor # _____ Judge's Signature _____

Skill VI:	Physical Examination of Urine (Time: 6 minutes)	Possible	Awarded
1.	Assembled equipment and materials.	1 0	
2.	Washed hands or used alcohol-based hand-rub for hand hygiene.	2 0	
3.	Put on gloves and face protection.	2 0	
4.	Obtained recently collected urine specimen.	1 0	
5.	Completed demographic information on the Laboratory Form, as received in the skill scenario.	4 0	
6.	Mixed urine by gently swirling & pouring approximately 10 mL into a clear, conical centrifuge tube.	1 0	
7.	Observed the color of the urine and recorded it on Laboratory Report Form.	4 0	
8.	Observed and recorded the transparency of the urine.	4 0	
9.	Noted the odor of the urine and record it in the comment section of the Laboratory Report Form.	4 0	
10.	Measured specific gravity using the refractometer.		
	a. Placed 1 drop of distilled water on the glass plate of the refractory and closed gently.	1 0	
	b. Looked through the ocular and read the specific gravity.	1 0	
	c. If water does not read 1.000; calibrated the refractometer.	2 0	
	d. Disinfected the refractometer glass plate and cover by rinsing with 1 or 2 drops of water and then drying with laboratory tissue.	2 0	
	e. Used a transfer pipette or eye dropper to place 1 drop of well-mixed urine on the glass plate of the refractometer.	1 0	
	f. Closed the lid gently.	1 0	
	g. Looked through the ocular and read the specific gravity on the scale.	1 0	
11.	Recorded the specific gravity accurately on the Laboratory Report Form.	4 0	
12.	Cleaned refractometer using lens paper with a disinfectant for cleaning and returned to proper storage.	2 0	
13.	Verbalized disposing of urine specimen.	2 0	
14.	Cleaned the work area with disinfectant.	2 0	

Skill VI Physical Examination of Urine (con't)	Possible	Awarded
15. Disposed of PPE appropriately.	2 0	
16. Washed hands or used alcohol-based hand-rub for hand hygiene.	2 0	
TOTAL POINTS - SKILL VI: Calibration of refractor	46	
TOTAL POINTS - SKILL VI: No calibration of refractor	44	
70% TOTAL POINTS - SKILL VI: Calibration of refractor = 32.2 70% TOTAL POINTS – SKILL VI: No calibration of refractor = 30.8		

Physical Examination of Urine

Patient _____ DATE _____

Date of Birth: _____ Gender: _____

Observation	Patient Results	Reference Values
<i>Transparency (appearance)</i> <ul style="list-style-type: none"> • clear • hazy (slightly cloudy) • cloudy (turbid) • milky (opalescent) • other 	Place an X on the appearance that matches the sample. _____ _____ _____ _____ _____	<i>clear</i>
Color:	_____	<i>Pale yellow to amber</i>
Specific gravity:		<i>1.010 – 1.025</i>

Comments:

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 Competitor # _____ Judge's Signature _____

Skill VII: Inoculate and streak agar plate (Time: 5 minutes)		Possible		Awarded
1.	Assembled materials and equipment.	1	0	
2.	Used alcohol-based handrub and put on gloves and face protection.	2	0	
3.	Selected an agar plate to be inoculated and labeled the bottom with a marker.	1	0	
4.	Selected an inoculated swab.	1	0	
5.	Placed package of sterile disposable loops within reach.	1	0	
6.	Removed pre-inoculated swab from package.	1	0	
7.	Opened the lid of the agar plate just enough to insert the swab.	1	0	
8.	Spread the inoculum over the surface of one quadrant of the agar plate.	1	0	
9.	Replaced the lid on the agar plate.	1	0	
10.	Disposed of swab in biohazard receptacle.	1	0	
11.	Picked up a sterile disposable loop and lifted the lid of the agar plate just enough to be able to insert the inoculating loop.	1	0	
12.	a. Streaked the second quadrant of the plate by touching the loop into the first quadrant and streaking all the way across the second quadrant, and	1	0	
	b. Made six to eight strokes.	1	0	
13.	Disposed of loop in biohazard receptacle.	2	0	
14.	Picked up a sterile disposable loop and lifted the lid of the agar plate just enough to be able to insert the inoculating loop.	1	0	
15.	a. Streaked the third quadrant by touching the loop into the second quadrant and streaking into the third quadrant, and	1	0	
	b. Made six to eight strokes.	1	0	
16.	Disposed of loop in biohazard receptacle.	2	0	
17.	Picked up a sterile disposable loop and lifted the lid of the agar plate just enough to be able to insert the inoculating loop.	1	0	

Skill VII: Inoculate and streak agar plate (con't)		Possible	Awarded
18.	a. 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.	1	0
	b. Decreased the width of the streaks horizontally and increased the distance between the streaks vertically.	1	0
19.	Replaced the lid on the plate.	1	0
20.	Disposed of loop in biohazard receptacle.	2	0
21.	Placed the agar plate upside down in the 35-37°C incubator.	1	0
22.	Cleaned reusable equipment and returned to proper storage; put disposables in biohazard containers.	2	0
23.	Cleaned work area with surface disinfectant.	2	0
24.	Removed gloves and face protection & disposed of it.	2	0
25.	Used alcohol-based handrub for hand hygiene.	2	0
TOTAL POINTS - SKILL VII		36	
70% Mastery for Skill VII = 25.2			