LESSON 1-2 The Medical Laboratory Professional
Career Information Fact Sheet

LESSON 1-2 The Medical Laboratory Professional
Interview Fact Sheet

LESSON 1-4 The Metric System
Worksheet—Distance

LESSON 1-4 The Metric System
Worksheet—Weight

LESSON 1-4 The Metric System
Worksheet—Volume

LESSON 1-5 Laboratory Safety: Physical and Chemical Hazards
Safety Worksheet

LESSON 1-6 Laboratory Safety: Biological Hazards
Worksheet

LESSON 1-7 Quality Assurance in the Laboratory
Worksheet

LESSON 1-8 General Laboratory Equipment
Worksheet

LESSON 1-10 The Microscope
Student Performance Guide
Career Information Fact Sheet

LESSON 1-2 The Medical Laboratory Professional

Name _________________________________________________________________ Date ______________________

Job Title:

Legal Requirement:

Name of Program:

   Educational Institution:

Cost of Program:

Length of Program:

Admission Requirements:

Nature of the Job:

Earnings:

Advancement:

Related Occupation(s):

Advantages:

Disadvantages:
Interview Fact Sheet

LESSON 1-2 The Medical Laboratory Professional

Name ____________________________________________ Date ____________________

Job Title:

Educational Preparation:

Approximate Cost of Education Program:

Job Functions:

Approximate Salary:

Job Satisfaction:

Job Dissatisfaction:

Opportunities for Advancement:

Options Available to Broaden Employment Opportunities:
Worksheet—Distance

LESSON 1-4 The Metric System

Name _________________________________________________________________ Date ______________________

Obtain a meter stick or metric ruler and an English ruler from the instructor. Use the information in Tables 1-13 through 1-17 to answer the questions below.

1. Look at the meter stick. Locate the cm and mm divisions. How many centimeters are in a meter? _________
   How many mm in a cm? _________ How many mm in a meter? _________

2. Draw the indicated length of line beside each number, beginning at the dot.
   35 mm .
   6 cm .
   83 mm .
   1.2 dm .

3. Measure the lines above using a ruler marked in English units (inches):
   35 mm = __________ inches
   6 cm = __________ inches
   83 mm = __________ inches
   1.2 dm = __________ inches
   Which of the measurements (English or metric) do you feel is the most accurate? __________

4. How many mm in one inch? __________ one mm= __________ inch
   How many cm in one inch? __________ one cm = __________ inch
   Convert the following units:
   4 inches = __________ cm
   0.5 inches = __________ cm
   38 cm = __________ inches
   7 cm = __________ inches
   3.5 inches = __________ mm
   35 mm = __________ inches

5. How many inches are in a meter? _________ What English unit of measurement is closest in size to the meter? _________

6. Measure your height or the height of another student using the meter stick. What is the height in cm? _________
   in meters? _________ Convert the height in cm to inches: _________ Now measure the height in inches and compare the results.
Use Tables 1-13 through 1-17 to answer the questions below.

1. What is the basic metric unit of weight? __________________

2. How many mg in a g? ________ How many µg in a g? ________ How many g in a kg? ________

3. Convert the following units:
   - 300 mg = ________ g = ________ kg
   - 50 mg = ________ g = ________ kg
   - 4000 mg = ________ g = ________ kg
   - 200 µg = ________ g
   - 750 µg = ________ mg
   - 80 g = ________ kg

   What decimal rule did you follow to make the conversions? _____________________________________________

4. Convert the following units:
   - 0.4 kg = ________ mg = ________ µg
   - 9.2 kg = ________ mg = ________ µg
   - 0.6 g = ________ µg
   - 10 mg = ________ µg = ________ pg
   - 280 mg = ________ µg = ________ pg

   What decimal rule did you follow to make the conversions? _____________________________________________

5. Weigh yourself or another student. What is the weight in g? ________ in kg? ________

6. A man who weighs 165 pounds would weigh ________ kg.

7. A child who weighs 32 pounds would weigh ________ kg or ________ g.

8. Is a man who is 178 cm tall and weighs 135 kg overweight, underweight, or of normal weight? ________

9. If scales are available, weigh a container, add 10 mL of water, and weigh again. How much does the water weigh? ________ Does one milliliter of water weigh approximately 1 gram? Yes ________ No ________
Worksheet—Volume

LESSON 1-4 The Metric System

Name _________________________________________________________________ Date ______________________

Obtain a medicine cup, a 50 mL graduated cylinder, and a 50 mL beaker from the instructor. Use Tables 1-13 through 1-17 to answer the questions below.

1. What is the basic unit of volume in the metric system? __________
3. Convert the following units:
   45 cc = __________ liter = __________ mL
   550 mL = __________ liter
   4 dL = __________ liter
   60 µL = __________ liter = __________ mL
   0.1 dL = __________ liter
   6,700 mL = __________ liter

   What decimal rule did you follow to make the conversions? _____________________________________________
   __________________________________________________________________________________________

4. Convert the following units:
   0.3 liter = __________ dL = __________ mL
   5 liters = __________ mL
   7 mL = __________ µL
   3 dL = __________ mL = __________ µL
   0.1 dL = __________ mL

   What decimal rule did you follow to make the conversions? _____________________________________________
   __________________________________________________________________________________________

5. What English unit is closest in volume to the liter? _____________________________________________________

6. Convert the following English units:
   3.5 pints = __________ mL = __________ L
   3 quarts = __________ mL = __________ L
   5 fl. oz. = __________ mL = __________ L

7. If gasoline is $1.20 per gallon at station A and 30 cents a liter at station B, which has the cheapest gasoline? __________________________________________________________________________________________________________________________________________________________

8. Fill the medicine cup to the one fl oz mark with water. Transfer the water to a 50 mL graduated cylinder. How many milliliters of water are in one fl oz? __________________________________________________________________________

   Fill the medicine cup again with water and transfer the one fl oz to a 50 mL beaker. Which gives the most accurate measurement, the beaker or the graduated cylinder? __________________________________________________________________________
LESSON 1-5 Laboratory Safety: Physical and Chemical Hazards

Use the worksheet to make a safety check of the laboratory. For each item listed below, determine if the conditions are satisfactory (safe), S, or unsatisfactory (unsafe), U. If unsatisfactory, recommend correction(s) in the spaces indicated.

I. Safety Check for Physical Hazards
   A. Examine all electrical instruments (microscopes, spectrophotometers, etc.) for frayed wires and proper storage conditions (storage away from water and harsh chemicals, use of dust covers, etc.). Evaluate conditions and record recommendations for each instrument examined.

<table>
<thead>
<tr>
<th>Instrument</th>
<th>S</th>
<th>U</th>
<th>Observation/Recommendation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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</tbody>
</table>

B. Make a fire safety check of the laboratory.
   1. Are fire extinguishers present? _____________
      When was the last inspection date? _____________
      Do extinguishers have instructions for their use posted with them? _____________
      **Fire extinguishers:** S _______ U _______

   2. Is the fire exit route posted? _____________
      Is it up to date? _____________
      Walk the fire exit route. Was it easy to follow? _____________
      Could all exit doors be opened? _____________
      **Fire exit route:** S _______ U _______

Recommendation(s) for improving fire safety: ____________________________________________
__________________________________________________________________________________
__________________________________________________________________________________
II. Safety Check for Chemical Hazards

A. Examine the chemicals in the laboratory.
   1. Are all clearly labeled? ___________
   2. Do the labels contain information on storage, disposal, and procedure in case of spills or accidental exposure? ___________
   3. Are chemicals labeled “flammable” stored away from fire (Bunsen burners)? ___________
   4. Where are concentrated acids and bases stored? ___________

   **Chemical storage:** S ________ U ________

B. Is a fume hood present? ___________
   When was it last checked for proper air flow? ___________

   **Fume hood:** S ________ U ________

C. Is an eyewash station present? ___________
   Are instructions for its use posted? ___________

   **Eyewash station:** S ________ U ________

Recommendation(s) for improving chemical safety:
________________________________________________________________________________________
________________________________________________________________________________________
________________________________________________________________________________________

III. Laboratory Safety Policy

Inquire about the laboratory’s policy regarding employee safety orientation and training.

A. Is a written Hazard Communication Program available in the laboratory? ___________

B. Does the laboratory administration follow appropriate “employee right-to-know” policies in the safety orientation and training programs? ___________

C. Are written records kept of employee safety training sessions? ___________

D. Are all employees asked to sign safety agreement forms after safety training? ___________

E. Is the location of the laboratory procedure manual posted? ___________
   Does the manual contain safety guidelines and procedures? ___________

F. Are MSDS sheets on file for all chemicals? ___________

   **Laboratory safety policy:** S ________ U ________

Recommendation(s) for improving laboratory safety policy:
________________________________________________________________________________________
________________________________________________________________________________________
________________________________________________________________________________________
Worksheet

LESSON 1-6 Laboratory Safety: Biological Hazards

Name _____________________________________________ Date ______________________

Use this worksheet to make a biological hazard safety check of the laboratory.

SAFETY CHECK FOR BIOLOGICAL HAZARDS

I. Examine the laboratory for biological hazards

A. Are safety rules posted? __________
B. Where are blood specimens discarded? __________
C. How are contaminated lab coats or gowns disposed of? __________
D. Where are needles and other sharps discarded? __________
   Is the container puncture-resistant? __________
E. Are all sizes of gloves available for workers? __________
F. Are eye protection devices available? __________
   faceshields __________ goggles __________ safety glasses __________
G. Are fluid-resistant gowns or coats available for tasks that might involve splashes? __________
H. Is a policy in place to require counters to be wiped at certain intervals and after every spill? __________
   Recommendation(s) for improvements: ____________________________________________________________
   ____________________________________________________________________________________________
   ____________________________________________________________________________________________

II. Laboratory Safety Policy

Inquire about the laboratory’s policy regarding employee orientation and training in the safe handling of hazardous materials.
A. Does the laboratory have a written Hazard Communication Program? __________
B. Does the laboratory have Standard Precautions included in the exposure control plan? __________
C. Have all employees considered at risk of exposure to bloodborne pathogens been offered the hepatitis B vaccination series at no charge? __________
D. Are written records kept of all employee safety training sessions? __________
   Do employees sign forms acknowledging the training? __________
E. Is safety training updated yearly? __________
   Recommendations or comments concerning the laboratory’s safety program: __________________________
   ____________________________________________________________________________________________
   ____________________________________________________________________________________________

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Lesson 1-7 Quality Assurance in the Laboratory

Name _________________________________________________________________ Date ______________________

I. Calculating the Mean and the Standard Deviation

Use this worksheet and the data presented below to calculate the mean and the standard deviation. The red blood cell (RBC) counts from an RBC control solution are: 3.2, 3.3, 3.5, 3.2, 3.0, 3.4, 3.8, 3.5, 3.4, and 3.3.

1. What is the formula for finding the mean?
2. Substitute the values into the formula.
3. The mean of the red cell counts is: _______________
4. Following the example in Figure 1-23, calculate the deviation squared for each of the values above.
5. What is the formula for variance?
6. Determine the variance from the calculation in step 4.
7. What is the formula for determining standard deviation?
8. Substitute values from step 6 into the formula.
9. What is the standard deviation?

What is ± 2σ? ___________ What is ± 3σ? ___________
II. Constructing a Levey-Jennings Chart

1. Use the mean and standard deviation ($\sigma$) from part A to construct a Levey-Jennings chart. Indicate the mean value, $\pm 1\sigma$, $\pm 2\sigma$, and $\pm 3\sigma$ (from part A) on the appropriate lines.

2. Plot these control values obtained for days 1–10 on the chart: Day 1 = 3.2, Day 2 = 3.3, Day 3 = 3.5, Day 4 = 3.2, Day 5 = 3.0, Day 6 = 3.4, Day 7 = 3.8, Day 8 = 3.5, Day 9 = 3.4, and Day 10 = 3.3.
LESSON 1-8 General Laboratory Equipment

Use this form to record general laboratory equipment maintenance and performance. Identify each piece of equipment on the sheet. Locate instruction manuals for the equipment and find out what maintenance and/or calibration procedures are recommended and how often.

I. Temperature-Controlled Chambers

Record the temperatures of any refrigerators, freezers, water baths, or incubators in the laboratory. In a working laboratory, this must be done at least daily. If a thermometer does not stay in the equipment, place one inside for 20-30 minutes, then record temperature. Refrigerator thermometers may be stored with the bulb immersed in water or propylene glycol in a stoppered bottle. If the temperature is not within range, make the proper adjustment and remeasure or inform the supervisor.

<table>
<thead>
<tr>
<th>Equipment I.D.</th>
<th>Range (°C)</th>
<th>Temperature Observed</th>
<th>Date</th>
<th>Comment/Sign</th>
</tr>
</thead>
<tbody>
<tr>
<td>Freezer</td>
<td>-20 ± 5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Refrigerator</td>
<td>6 ± 2</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Water bath</td>
<td>36 ± 1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Incubator</td>
<td>36 ± 1</td>
<td></td>
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</tr>
</tbody>
</table>

II. Autoclave

During or after each run of the autoclave, check to see that the proper temperature and chamber pressure were reached. Each run should be given a number.

Autoclave: Run #________ Temp °C __________ Chamber pressure______________

III. pH meter

Calibrate the meter before each use with two calibration solutions, one near the pH of the solution to be measured. (Commercial pH calibration solutions usually are pH 4, pH 7, and pH 10.) Check to see that the pH electrode is always stored in the appropriate solution when not in use.

<table>
<thead>
<tr>
<th>Date</th>
<th>Calibration Solution</th>
<th>Comment/Sign</th>
</tr>
</thead>
<tbody>
<tr>
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</tbody>
</table>
IV. Centrifuges

Use a stopwatch to check the timer on the centrifuge. If available, use a tachometer to check rpm. Do not attempt to check the speed if the centrifuge lid does not have an opening in the center or a see-through cover.

<table>
<thead>
<tr>
<th>I.D.</th>
<th>Date</th>
<th>Timer Check</th>
<th>RPM Check</th>
<th>Comment/Sign</th>
</tr>
</thead>
<tbody>
<tr>
<td>Serofuge</td>
<td></td>
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</tr>
<tr>
<td>Microfuge</td>
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<td></td>
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<tr>
<td>Centrifuge</td>
<td></td>
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</tbody>
</table>

V. Balances

Check balances to see that they are clean and placed on a stable counter in a draft-free location. If available, use standard weights to check the calibration of the balances. (Commercial services will perform maintenance and calibration on a contract basis.)

<table>
<thead>
<tr>
<th>I. D.</th>
<th>Date</th>
<th>Balance Checked</th>
<th>Comment/Sign</th>
</tr>
</thead>
<tbody>
<tr>
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</tbody>
</table>
# LESSON 1-10 The Microscope

**INSTRUCTIONS**

1. Practice using the microscope following the step-by-step procedure.
2. Show your understanding of this lesson by:
   a. Completing a written examination successfully, and
   b. Demonstrating the proper use of the microscope satisfactorily for the instructor. All steps must be completed as listed on the instructor’s Performance Check Sheet.

**Note:** Procedure will vary slightly according to microscope design. Consult operating procedure in microscope manual for specific instructions.

**MATERIALS AND EQUIPMENT**

- hand disinfectant
- microscope (monocular or binocular)
- lens paper
- lens cleaner
- prepared slides (commercially available)
- immersion oil
- surface disinfectant

---

**PROCEDURE**

Record in the comment section any problems encountered while practicing the procedure (or have a fellow student or the instructor evaluate the performance).  

<table>
<thead>
<tr>
<th>You must:</th>
<th>S</th>
<th>U</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Wash hands</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>2. Assemble equipment and materials</td>
<td></td>
<td></td>
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<tr>
<td>3. Clean the ocular(s) and objectives with lens paper</td>
<td></td>
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<tr>
<td>4. Use the coarse adjustment to raise the nosepiece unit</td>
<td></td>
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<tr>
<td>5. Raise the condenser as far as possible by turning the condenser knob</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Rotate the low-power (10X) objective into position, so it is directly over the opening in the stage</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Turn on the microscope light. If using a mirror, position the light about ten inches in front of the microscope so it shines directly on the mirror. Adjust the mirror position so a bright light is reflected upward into the center of the condenser</td>
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<tr>
<td>8. Open the iris diaphragm until maximum light comes up through the condenser</td>
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</table>
### You must:

<table>
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<th>Comments</th>
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<tbody>
<tr>
<td>9.</td>
<td>Place slide on stage (specimen side up) and secure with clips. Position the condenser so it is almost touching the bottom of the slide</td>
<td></td>
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<tr>
<td>10.</td>
<td>Locate the coarse adjustment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11.</td>
<td>Look directly at the stage and low-power (10X) objective and turn the coarse adjustment until the objective is as close to the slide as it will go. Stop turning when the objective no longer moves. <strong>Note:</strong> Do not lower any objective toward a slide while looking through the ocular(s)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12.</td>
<td>Look into the ocular(s) and slowly turn the coarse adjustment in the opposite direction (as in step 11) to raise the objective (or lower the stage) until the object on the slide comes into view</td>
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<tr>
<td>13.</td>
<td>Locate the fine adjustment</td>
<td></td>
<td></td>
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<tr>
<td>14.</td>
<td>Turn the fine adjustment to sharpen the image <strong>Note:</strong> If a binocular microscope is used, the oculars must be adjusted for each individual's eyes.</td>
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<tr>
<td></td>
<td>a. Adjust distance between oculars so one image is seen (as when using binoculars)</td>
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<td></td>
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<tr>
<td></td>
<td>b. Use coarse and fine adjustments to bring object into focus while looking through the right ocular with right eye</td>
<td></td>
<td></td>
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<tr>
<td></td>
<td>c. Close the right eye, look into the left ocular with left eye, and <strong>use the knurled collar on the left ocular</strong> to bring the object into sharp focus. (Do not turn coarse or fine adjustment at this time.)</td>
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<tr>
<td></td>
<td>d. Look into oculars with both eyes to observe that object is in clear focus. If not, repeat the procedure</td>
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<tr>
<td>15.</td>
<td>Scan the slide by either method:</td>
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<tr>
<td></td>
<td>a. Use the stage knobs to move the slide left and right and backward and forward while looking through the ocular(s), or</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>b. Move the slide with the fingers while looking through the ocular(s) (for microscope without movable stage)</td>
<td></td>
<td></td>
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<tr>
<td>16.</td>
<td>Rotate the high-power (40X) objective into position while observing the objective and the slide to see that the objective does not strike the slide</td>
<td></td>
<td></td>
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<tr>
<td>17.</td>
<td>Look through the ocular(s) to view the object on the slide; it should almost be in focus</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18.</td>
<td>Locate the fine adjustment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>19.</td>
<td>Look through the ocular(s) and turn the fine adjustment until the object is in focus. Do not use the coarse adjustment.</td>
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</tbody>
</table>

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<table>
<thead>
<tr>
<th>You must:</th>
<th>S</th>
<th>U</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>20. Scan the slide as in step 15, using the fine adjustment if necessary to keep the object in focus</td>
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<td></td>
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<tr>
<td>21. Rotate the oil-immersion objective to the side slightly (so no objective is in position)</td>
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<tr>
<td>22. Place one drop of immersion oil on the portion of the slide directly over the condenser</td>
<td></td>
<td></td>
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<tr>
<td>23. Rotate the oil-immersion objective into position, being careful not to rotate the high-power (40X) objective through the oil</td>
<td></td>
<td></td>
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<tr>
<td>24. Look to see that the oil-immersion objective is touching the drop of oil</td>
<td></td>
<td></td>
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<tr>
<td>25. Look through the ocular(s) and slowly turn the fine adjustment until the image is clear. Use only the fine adjustment to focus the oil-immersion objective</td>
<td></td>
<td></td>
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<tr>
<td>26. Scan the slide as in step 15</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>27. Rotate the low-power (10X) objective into position (do not allow high-power (40X) objective to touch oil)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>28. Remove the slide from the microscope stage and gently clean the oil from the slide with lens paper</td>
<td></td>
<td></td>
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</tr>
<tr>
<td>29. Clean the oculars, low-power (10X) objective and high-power (40X) objective with clean lens paper</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>30. Clean the oil-immersion objective with lens paper to remove all oil</td>
<td></td>
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<tr>
<td>31. Clean any oil from the microscope stage and condenser</td>
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<td></td>
<td></td>
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<tr>
<td>32. Turn off the microscope light and unplug the microscope</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>33. Position the nosepiece in the lowest position using the coarse adjustment</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>34. Center the stage so it does not project from either side of the microscope</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>35. Cover the microscope and return it to storage</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>36. Clean work area; return slides to storage</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>37. Wash hands</td>
<td></td>
<td></td>
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</tbody>
</table>

**Evaluator Comments:**

Evaluator ___________________________________________ Date ________________

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