Table 1 – Using the word bank, match the parts of the microscope to their function

<table>
<thead>
<tr>
<th>Table 1 – Using the word bank, match the parts of the microscope to their function</th>
</tr>
</thead>
<tbody>
<tr>
<td>Controls power (on/off) to the scope</td>
</tr>
<tr>
<td>Contains viewing/ocular lenses (10x)</td>
</tr>
<tr>
<td>Circular illuminated area seen through the eyepieces</td>
</tr>
<tr>
<td>Opens/closes amount of light passing through the specimen</td>
</tr>
<tr>
<td>Allows magnification of specimen by 40x</td>
</tr>
<tr>
<td>Resting surface for the specimen slide</td>
</tr>
<tr>
<td>Holds specimen slide in place on stage</td>
</tr>
<tr>
<td>Allows magnification of specimen by 4x</td>
</tr>
<tr>
<td>Rotates (black ridged band) and positions objective lenses</td>
</tr>
<tr>
<td>Allows magnification of specimen by 10x</td>
</tr>
<tr>
<td>Magnifies specimen by raising and lowering the stage</td>
</tr>
<tr>
<td>Focuses specimen</td>
</tr>
</tbody>
</table>

Word Bank:
- Coarse adjustment knob
- Stage
- medium objective
- field of view
- stage clips
- main switch
- high power objective
- revolving nosepiece
- scanning objective
- eyepiece
- fine adjustment knob
- diaphragm knob

How small are microbes? They are small, but actually many can be detected with the naked eye if you know where to look. As a point of reference, consider the millimeter, \( 1 \text{ mm} = \frac{1}{1000} \text{ of a meter} \), which is the smallest division on your metric ruler. Microbes are less than a millimeter in size and are usually measured in micrometers, \( 1 \text{ μm} = \frac{1}{1000} \text{ of a mm} \). They could range in size from 1 to 1000 μm. You should be able to see the organism with your naked eye if it were about 100 μm or larger, but you wouldn’t be able to see much detail. Plant and animal cells are typically 5 to 40 μm in size, so they are not visible unless magnified under the microscope.

Part 1: Computing Magnification & Field of View:

If the field of view is a certain size under the lowest power or magnification, it will be correspondingly smaller as the power is increased. If the magnification is known, the relative sizes of the two fields can be calculated.
• Obtain a small/ plastic ruler from the materials table
  With the scanning objective in place and the stage all the way down, place the ruler on your stage
• Raise the stage until the mm lines on the ruler are in focus.
• Measure the size of the field under the lowest magnification:
  
  (a) Field = __________ mm
  (b) Scanning total magnification = __________ x

• Now switch to medium magnification:
  (d) Medium total magnification = __________ x

• You can use what you identified above to determine the field size of the medium magnification (c) with the following:

  \[ a \times b = c \times d \]

  (a) (b) (c) (d)

  field 1 \times magnification 1 = field 2 \times magnification 2

Using the information provided (objective magnifications are listed on the microscope) and the formula above, complete the table below.

<table>
<thead>
<tr>
<th>Objective</th>
<th>Objective Magnification</th>
<th>Ocular Lens</th>
<th>Total Magnification</th>
<th>Field size in mm</th>
<th>Field size in ( \mu m ) (mm x1000)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scanning/low</td>
<td>10x</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Medium</td>
<td>10x</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>10x</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Part 2: Measuring objects in the microscope**

1. Start with the scanning objective in place and the stage all the way down.
2. Obtain a blank microscope slide and a permanent marker from the materials table.
3. Using the mm side of your ruler, use the permanent marker to mark 5 dots on the blank slide 1mm apart. (try and stay towards the center of the slide)
4. Obtain a prepared slide from the materials table.
5. Place the dotted slide on the microscope stage first, so the dots are in the field of view. Then place the prepared slide over it so you can see the specimen over the mm dots.
6. Use the scanning objective to center and focus the specimen properly.
If the specimen takes up 2mm of 4 possible mm in your field of view while in the scanning objective, then it takes up about ½ or 50% of the total field of view. Since you calculated your field size in μm in the above chart for the scanning objective (*), you can estimate the size of the specimen.

\[ \frac{1}{2} \times 4000 \text{ μm} = 2000 \text{ μm estimated size} \]

7. Calculate the estimated size of your specimen:

\[ \text{______ (% field of view)} \times \text{_________ (field size)} = \]

**Part 3: Drawing Specimens to Scale**

*To make your drawings to scale:*

1. Determine the diameter of your circle representing the field of view. Be sure to measure it in metrics (centimeters are fine.)
2. Recall the actual size of your field of view in micrometers (μm).
3. Divide the number of micrometers by the diameter of the circle representing the field of view. By doing this, you determine the scale for your drawing.
4. Ex: your circle representing the field of view has a diameter of 8 cm. Your actual field of view in micrometers (μm) is 425μm.

\[ \text{scale} = \frac{\text{Your actual field of view in micrometers (μm)}}{\text{diameter of your circle representing the field of view (cm)}} \]

\[ \text{scale} = \frac{425\text{μm}}{8\text{cm}} \]
\[ \text{scale} = 53.125\text{μm/cm} \]

This means that for each centimeter on your circle representing the field of view you are representing 53.125μm.

5. Draw a line in your circle representing the field of view for your drawing that is 1 cm in length. Mark that it is equal to the μm you calculated it to represent.

6. Make your drawing. Be sure to draw the structure as filling 1/2 of the circle representing the field of view if it did in your actual field of view. This will ensure that your scale remains accurate.

- Draw the specimen you measured in part 2 in the circle labeled Specimen #1. Draw it and calculate scale. Draw this scale key in your circle.
Part 4: Prokaryotic vs. Eukaryotic

1. Obtain a clean glass slide & coverslip.
2. Place a small drop of Iodine onto your clean slide
   **CAUTION: IODINE STAINS SKIN & CLOTHES*****
3. Obtain ONE toothpick and use it to gently scrape the inside of your cheek.
4. Place the toothpick into the iodine on your slide and mix. The iodine will hopefully stain your cells so you can see them
5. THROW AWAY THE TOOTHPICK and then place a coverslip onto the slide
6. Use the 4x objective to center and focus the specimen properly.
7. Switch to Medium power. Draw what you see in the circle labeled Specimen #2. You do not have to label it with the proper scale.

• Is your cell prokaryotic or eukaryotic? How can you tell just by looking at it?

• If our microscopes were powerful enough, what other organelles would we probably find in this cheek cell? Name at least 3 and write their functions.

• The world did not start off with eukaryotic cells. What is the prevailing theory of how eukaryotic cells evolved? Give details. (Try Chapter 25 for help!)

Analysis Problems

Use your estimated field diameters for our microscopes to complete the following, show work!

1. A cell is observed to stretch half way across the high power field. How long is the cell?

2. A cell is observed under high power to be about half the field diameter. A student draws the cell 25cm in length. What is the magnification of the drawing?

3. The advantage of light microscopy over electron microscopy is that
   A) light microscopy provides for higher magnification than electron microscopy.
   B) light microscopy provides for higher resolving power than electron microscopy.
   C) light microscopy allows one to view dynamic processes in living cells.
   D) light microscopy provides higher contrast than electron microscopy.
   E) specimen preparation for light microscopy does not produce artifacts.