Pipette and Micropipette

Units

• Become familiar with metric units of measurement and their conversions.
• Prefixes apply to both liquid and dry measurements
• Examples
  – 1 ml = .001 Liter (1x10^{-3})
  – 1,000 ml (1x10^{3}) = 1 Liter
  – 1 μl = .001 ml (1x10^{-3})
  – 1,000 μl = (1x10^{3}) = 1 ml
  – 1 μl = .000001 Liter (1x10^{-6})
  – 1,000,000 μl (1x10^{6}) = 1 Liter
Pipette

- Use a pipette for larger volumes of liquid.
  - 1ml, 2ml, 5ml
- Use a pipette if a micropipette cannot fit or reach the liquid.

Pipette

- Do not open up the wrapper until you are ready to use the pipette.
- Try not to make contact with any part of the pipette, especially the tip.
- If the tip touches you or anything else consider it contaminated and use a new pipette.
- Do not cross contaminate solutions by using the same pipette.
- Always use a sterile pipette when transferring liquid to different solutions.
Micropipette

- Used to measure and transfer small volumes of liquid.
- P10 = 0.5-10μl
- P20 = 1-20μl
- P200 = 20-200μl
- P1000 = 100-1000μl

Micropipette

- Tips are usually color coded to the correct micropipette.
  - P10 = white
  - P20 and P200 = Yellow
  - P1000 = Blue
Micropipette

• Parts of a micropipette (youtube)
  – http://www.youtube.com/watch?v=QA5N3r49hoE

Micropipette Technique

• Adjust the pipette to the desired volume.
• Firmly attach the correct tip.
• Press the plunger to the first stop.
Micropipette Technique

• Place the tip into the solution.
• Slowly release the plunger.
• Visually confirm that there is solution in the tip.
• Place the tip in the tube where the solution will be expelled.
• Press the plunger to the first stop and continue to press through to the second stop.
• Withdraw the pipette before releasing the plunger.
• Release the plunger and discard the tip.

Micropipette Technique

• How to use a micropipette (youtube)
  – [http://www.youtube.com/watch?v=_2OxnTiSVzU](http://www.youtube.com/watch?v=_2OxnTiSVzU)
Micropipette

• NEVER rotate the volume adjuster beyond the upper or lower range of the pipette.
• NEVER invert or lay the micropipettor down with a filled tip; fluid can run back into the piston.
• NEVER let the plunger snap back after withdrawing or expelling fluid; this could damage the piston.
• NEVER immerse the barrel of the micropipettor in fluid.
• NEVER reuse a tip that has been used to measure a different reagent.

Today’s Lab

• Practice proper technique.
• Determine whether the micropipettes are calibrated properly
Data

- The density of water is 1g/cm$^3$
- \[ \% \text{ Error} = \left| \frac{\text{actual value} - \text{expected value}}{\text{expected value}} \right| \times 100 \]
- Average error = $\left( \sum \text{error} \right) \div \text{(\# trials)}$

<table>
<thead>
<tr>
<th>Pipette</th>
<th>Experimental Weight</th>
<th>Actual Weight</th>
<th>% Error</th>
<th>Average Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.5ml</td>
<td>2.5g</td>
<td>1.</td>
<td>1.</td>
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</tr>
<tr>
<td></td>
<td></td>
<td>2.</td>
<td>2.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>3.</td>
<td>3.</td>
<td></td>
</tr>
<tr>
<td>4ml</td>
<td>.4g</td>
<td>1.</td>
<td>1.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>2.</td>
<td>2.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>3.</td>
<td>3.</td>
<td></td>
</tr>
<tr>
<td>1.5ml</td>
<td>1.5g</td>
<td>1.</td>
<td>1.</td>
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<td></td>
<td></td>
<td>2.</td>
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<tr>
<td></td>
<td></td>
<td>3.</td>
<td>3.</td>
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</tr>
</tbody>
</table>
Data

- Standard deviation = $(\sum(x-u)^2 / (N-1))^{1/2}$
  - $\Sigma = \text{sum}$
  - $x = \% \text{ error}$
  - $u = \text{average error}$
  - $N = \text{total number of errors calculated (in our case 3)}$
  - $\frac{1}{2} = \text{Square root of the total sum}$

Micropipette Data

<table>
<thead>
<tr>
<th>Micropipette</th>
<th>Volume</th>
<th>Expected Weight</th>
<th>Actual Weight</th>
<th>% error</th>
<th>Average Error</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>P20 (low volume)</td>
<td>2µl</td>
<td>0.002g</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>2µl</td>
<td>0.002g</td>
<td></td>
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<td>0.002g</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>P20 (high volume)</td>
<td>18µl</td>
<td>0.018g</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>18µl</td>
<td>0.018g</td>
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</tr>
<tr>
<td></td>
<td>18µl</td>
<td>0.018g</td>
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</tbody>
</table>