Metric Measurement and Microscopes

Honors Biology 1
Metric System Prefixes

<table>
<thead>
<tr>
<th>Prefix</th>
<th>Symbol</th>
<th>Meaning</th>
<th>Order of Magnitude</th>
</tr>
</thead>
<tbody>
<tr>
<td>giga-</td>
<td>G</td>
<td>1 000 000 000</td>
<td>$10^9$</td>
</tr>
<tr>
<td>mega-</td>
<td>M</td>
<td>1 000 000</td>
<td>$10^6$</td>
</tr>
<tr>
<td>kilo-</td>
<td>k</td>
<td>1 000</td>
<td>$10^3$</td>
</tr>
<tr>
<td>hecto-</td>
<td>h</td>
<td>100</td>
<td>$10^2$</td>
</tr>
<tr>
<td>deka-</td>
<td>da</td>
<td>10</td>
<td>$10^1$</td>
</tr>
<tr>
<td></td>
<td>base unit</td>
<td>1</td>
<td>$10^0$</td>
</tr>
<tr>
<td>deci-</td>
<td>d</td>
<td>0.1</td>
<td>$10^{-1}$</td>
</tr>
<tr>
<td>centi-</td>
<td>c</td>
<td>0.01</td>
<td>$10^{-2}$</td>
</tr>
<tr>
<td>milli-</td>
<td>m</td>
<td>0.001</td>
<td>$10^{-3}$</td>
</tr>
<tr>
<td>micro-</td>
<td>μ</td>
<td>0.000 001</td>
<td>$10^{-6}$</td>
</tr>
<tr>
<td>nano-</td>
<td>n</td>
<td>0.000 000 001</td>
<td>$10^{-9}$</td>
</tr>
</tbody>
</table>
SI (system international vs. the Metric System)

<table>
<thead>
<tr>
<th>Measurement</th>
<th>SI Base Unit</th>
<th>Metric</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length</td>
<td>meter</td>
<td>meter</td>
</tr>
<tr>
<td>Mass</td>
<td>kilogram</td>
<td>gram</td>
</tr>
<tr>
<td>Temperature</td>
<td>kelvin</td>
<td>Celsius</td>
</tr>
</tbody>
</table>

- In all measurements, estimate one place value
Length

• Meter (m)

• CONVERSIONS
  • $1 \text{ m} = \underline{\hspace{2cm}} \text{cm}$
  \[1 \text{ m} \times \frac{100 \text{ cm}}{1 \text{ m}} = 100 \text{ cm}\]

  \[124 \text{ mm} = \underline{\hspace{2cm}} \text{km} =\]

  \[124 \text{ mm} \times \frac{1 \text{ km}}{1000 \text{ mm} \times 1000 \text{ m}} = 0.000124 \text{ km}\]

  \[= 124 \text{ mm} \times \frac{1 \text{ km}}{10^6 \text{ mm}} = 0.000124 \text{ km}\]
Mass

• Measured with a balance
• Grams (g)
• Mass vs. weight
  ▫ **Mass** = the amount of matter in an object
    • Same on earth, moon, sun, etc.
  ▫ **Weight** = mass x acceleration of gravity
    • Changes

• They are used interchangeably because in biology almost all measurements are on the Earth (gravity is nearly constant)
Volume

- Liter (L)
- Measured with a graduated cylinder
- Curved line = meniscus = caused by adhesion (water sticking to the side) and cohesion (water sticking to water)
Temperature

- Celcius C
- Freezing = 0  Boiling = 100

- Conversions (We usually use Celcius in biology – you will use Kelvin in Chemistry!)
  
  \[
  \begin{align*}
  \°F &= 1.8 (\°C) + 32 \\
  \°C &= \frac{(\°F - 32)}{1.8} \\
  \°C &= K - 273
  \end{align*}
  \]
The History of the Microscope

- **1595** – Zacharias Jensen – 1st Compound microscope???
- **Anton van Leeuwenhoek** (1632-1732) invented a simple microscope with better lenses 200x magnification (could see cells – bacteria, muscle cells, sperm, etc.)
- **Robert Hooke** (1635-1703) discovered plant cells, added a stage, course/fine focus
Microscopes

- Types of microscopes we will use in Honors Biology
  - **Compound**
    - 2 lenses – one in the eyepiece (10x) and one on the nosepiece
    - Light must pass through the sample
    - See 1 small “slice”
  - **Stereoscope (Dissecting Scope)**
    - Used to see larger objects
    - Can magnify opaque objects
Parts of a Compound Microscope

Monocular

Binocular
Microscope Review

- Microscope Review Quiz
let's Review!

1. Body tube
2. Nosepiece
3. Low power
4. Medium power
5. High power
6. Stage clips
7. Diaphragm
8. Light source
9. Eyepiece
10. Arm
11. Stage
12. Coarse adjustment
13. Fine adjustment
14. Base
SEM and TEM

- Scanning Electron Microscopes and Transmission Electron Microscopes
  - Use electrons instead of light to form image
  - SEM Image Gallery Black and White
  - Colored SEM pictures
Measuring with a microscope