Thoughts: You may use ONLY those materials you submitted to me (that I will return to you). You may NOT use any other material, including others in the class or their work. I typically deal very harshly with cheating. I am happy to clarify a question and to help you find some obscure fact (mass of the Earth) or obscure formula (area of a sphere – but NOT things you should have learned from the class: e.g., Ohm’s law). I won’t help you do the test (i.e., don’t ask me whether or not you need to know the area of a sphere - you’re supposed to know what you need). There are exam questions that involve working with the equipment - if everybody saves those for the end, then everybody will wind up waiting for the person before you. So don’t save them for the end.

1) Draw a bar magnet (a rectangle labelled N on one end and S on the other). Then sketch the magnetic field lines both outside AND inside the magnet.

2) Imagine that a permanent magnet is moved ACROSS a loop of wire (not THROUGH the loop, but SIDEWAYS across it).
A) Sketch a graph of the magnetic flux through the loop as a function of time.
B) Sketch a graph of the induced voltage in the loop as a function of time.

3) Recall from the magnetic permeability lab that the force on a wire of length, L, in a magnetic field, B, is \( F = ILB \) and the field in a solenoid is \( B = \mu_0 n I \). In that lab, the length of the wire was 1.8 cm and the number of turns per unit length was 3750/m. Determine whether the data shown satisfies the theory described. If it does, use it to determine \( \mu_0 \). If it doesn't, explain how you know.

<table>
<thead>
<tr>
<th>F [g]</th>
<th>0</th>
<th>0.4</th>
<th>0.8</th>
<th>1.2</th>
</tr>
</thead>
<tbody>
<tr>
<td>I [A]</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

4) An RLC circuit excited by a DC voltage is set up for you. Adjusting ONLY the controls of the oscilloscope, determine the frequency of the oscillation.

5) Suppose a laser with wavelength 532 nm is shined through a diffraction grating with a 2 mm spacing.
A) From \( d \sin(\theta) = m \lambda \), calculate the maximum possible m.
B) At what angle does this maximum diffracted order occur?