1. (6 points) Write a balanced equation for the conversion of 2-butanone to its 2,4-DNP derivative.

2. (4 points) Circle the compound which you would expect to travel most slowly (lowest Rf) on a silica gel TLC plate and underline that which would travel most rapidly (highest Rf).

3. (2 points) Suppose you are sure your derivative is fairly pure since it has a sharp (narrow) melting point range, but on TLC it gives a long smear whereas the standard samples all give single spots. Suggest what you could do to obtain a more desirable result.
3. (8 points) Refer to the 2-butanone reaction you have drawn in Problem (1).

The following data is given:

<table>
<thead>
<tr>
<th>Compound</th>
<th>MW</th>
<th>d</th>
</tr>
</thead>
<tbody>
<tr>
<td>butanone</td>
<td>72</td>
<td>0.807</td>
</tr>
<tr>
<td>2,4-DNPH</td>
<td>198</td>
<td></td>
</tr>
</tbody>
</table>

and 420 mL of the 2,4-DNPH reagent contains 12.0g of 2,4-DNPH.

Suppose 5.0mL of 2-butanone and 100 mL of the 2,4-DNPH reagent are allowed to react. Answer the following questions.

(a) How many grams of 2,4-DNPH is contained in the reagent?

(b) What is the molecular weight of the DNP derivative of 2-butanone?

(c) What is the limiting reagent?

(d) What is the theoretical yield (in grams)?