A 41yo, 160 lb, 5’ 6” female is admitted for bowel rest after surgical repair to a perforated duodenum. She is to be placed on TPN. Labs are:

- **sodium**: 137 mEq/L (normal range 135 – 150 mEq/L)
- **potassium**: 3.7 mEq/L (normal range 3.5 – 5.0 mEq/L)
- **chloride**: 100 mEq/L (normal range 100 – 106 mEq/L)
- **bicarbonate**: 31 mEq/L (normal range 24 – 30 mEq/L)
- **BUN**: 13 mg/dL (normal range 8 – 20 mg/dL)
- **creatinine**: 0.7 mg/dL (normal range 0.6 – 1.2 mg/dL)
- **glucose**: 110 mg/dL (normal range 70 – 110 mg/dL, fasting)
- **calcium**: 7.8 mEq/L (normal range 8.5 – 10 mEq/L)
- **phosphorus**: 4.4 mg/dL (normal range 2.6 – 4.5 mg/dL)
- **magnesium**: 1.7 mEq/L (normal range 1.8 – 2.5 mEq/L)
- **albumin**: 1.6 g/dL (normal range 3.5 – 5 g/dL (long-term nutritional status))
- **triglycerides**: 40 mg/dL (desired range < 200 mg/dL)

Calculate her nutritional needs. Your pharmacy has a pump to which are attached these stock solutions: 10% amino acids, 70% dextrose, 20% intravenous fat emulsion, and sterile water for injection.

**Analysis of patient situation:**
- She is around 124% of IBW. You do not want to feed her at her actual body weight, nor is it reasonable to feed her at ideal body weight since healing will increase her caloric needs slightly. It would be reasonable in this situation to select a feed weight about halfway between her ideal and actual body weight. Rounding the feed weight to a whole kilogram (rather than a tenth of a kg) will make your computations a bit more straightforward.
- She is post-surgical so has mild to moderate tissue repair needs. Additionally, her albumin shows long-term nutritional deficiency, so use a protein target of 1.5 g/kg/day.
- She is hospitalized, confined to bed, and has had recent surgery, so choose the stress factors associated with those conditions when you do your non-protein calorie calculations.
- Her creatinine clearance is good, so she has no underlying renal dysfunction; she also has no other known disease states which would compromise volume status, so do not be concerned about fluid restriction.
- Her triglycerides are OK, so don’t need to restrict fat amount.

When you are deciding how to dose the electrolytes (problem 8 on the worksheet):
- Her sodium is on the low side, so you may want to choose a number at the higher end of the recommended range.
- Her chloride is low and bicarbonate high, suggesting metabolic alkalosis, so give all sodium as the chloride salt.
- You correct her calcium for her very low albumin and find a Ca_corr of 9.7 mEq/L. Because this number is at the high end of the normal serum concentration range for calcium (see labs above), it would be best to select a calcium dose at the lower end of the dosing range that you calculate (i.e., closer to 2 mEq/1000 calories than to 5 mEq/1000 calories).
- Her phosphorus is at the high end of normal, so it’s fine to go at the lower end of the dosing range for that electrolyte.
- Her magnesium serum concentrations are low so dose on the high side of the suggested range.

Use the TPN worksheet on the following page to determine what will go into her TPN. Please show your work. You may use the back side of this page or the TPN worksheet if you need more room to show how you derived your answers and include any explanation of your decision-making you think I might need to know. If you do not show your work, I will take off points when your calculated amount does not appear logical. If your calculated numbers are not logical, but you show your calculations and explain any decision-making you think I should know about, then I may be able to award partial credit.

In general, you will lose a maximum of one point per numbered problem done incorrectly. However, if you erroneously calculate a fluid or electrolyte dose that could potentially harm a patient, then you will automatically fail the exam and will need to retake it.
TPN Worksheet using pump

age: ________  sex: ___

height: _______ cm  ABW: _______ kg  IBW: _______ kg  feed weight: _______ kg

Targets:
1. Daily fluid needs.
>20 kg: 1500mL + (20 mL)(W - 20 kg), or calculated target: __________ mL/day
30 - 35 mL/kg/day

2. Protein requirements.
normal, unstressed individual: 0.8g/kg/day calculated target: __________ g protein/day
hospitalized patient: 1-1.2g/kg/day
stressed patient: 1.5-2g/kg/day

3. Non-protein calories
BEE_men = 66.67 + 13.75(W) + 5.0(H) - 6.76(A) calculated target: __________ kcal/day
BEE_women = 665.1 + 9.56(W) + 1.86(H) - 4.68(A)
activity factors: confined to bed: 1.2, out of bed: 1.3
stress factors: surgery: 1.2; infection: 1.4; trauma: 1.5; burns: 1.7
TDE = (BEE) (activity factor) (stress factor)

Amounts:
4. Total TPN volume _______ mL

5. Protein Volume

10% AA calculated volume: __________ mL

6. Dextrose volume (3.4 kcals/g) 4 mg/kg/min = __________ g/day

D70W calculated volume: __________ mL

7. Fat volume (9 kcals/g; 2 kcals/mL)

20% lipid calculated volume: __________ mL  plus  sterile water volume: __________ mL

Electrolytes:
8. Daily electrolyte needs total kcals/day from fat and dextrose: __________ (___ % fat)

<table>
<thead>
<tr>
<th>electrolyte</th>
<th>amt/1000 calories</th>
<th>(amt)(# daily cals)/1000</th>
<th>amount/bag</th>
</tr>
</thead>
<tbody>
<tr>
<td>sodium</td>
<td>40-50 mEq</td>
<td></td>
<td></td>
</tr>
<tr>
<td>potassium</td>
<td>40mEq</td>
<td></td>
<td></td>
</tr>
<tr>
<td>magnesium</td>
<td>8-12mEq</td>
<td></td>
<td></td>
</tr>
<tr>
<td>calcium</td>
<td>2-5 mEq</td>
<td></td>
<td></td>
</tr>
<tr>
<td>phosphate</td>
<td>15-25mmol</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

9. Calculate the volume of each electrolyte solution that you will add volume to add

<table>
<thead>
<tr>
<th>electrolyte</th>
<th>23.4% (4mEq/mL)</th>
<th>mL</th>
<th>16.4% (2mEq/mL)</th>
<th>mL</th>
<th>3mmol phosphate/mL, 4.4 mL potassium/mL</th>
<th>mL</th>
<th>2mEq/mL</th>
<th>mL</th>
<th>4mEq/mL</th>
<th>mL</th>
<th>0.465mEq/mL</th>
<th>mL</th>
</tr>
</thead>
<tbody>
<tr>
<td>sodium chloride</td>
<td>23.4% (4mEq/mL)</td>
<td>mL</td>
<td>16.4% (2mEq/mL)</td>
<td>mL</td>
<td>3mmol phosphate/mL, 4.4 mL potassium/mL</td>
<td>mL</td>
<td>2mEq/mL</td>
<td>mL</td>
<td>4mEq/mL</td>
<td>mL</td>
<td>0.465mEq/mL</td>
<td>mL</td>
</tr>
<tr>
<td>sodium acetate</td>
<td>16.4% (2mEq/mL)</td>
<td>mL</td>
<td>3mmol phosphate/mL, 4.4 mL potassium/mL</td>
<td>mL</td>
<td>2mEq/mL</td>
<td>mL</td>
<td>4mEq/mL</td>
<td>mL</td>
<td>0.465mEq/mL</td>
<td>mL</td>
<td>20.0 mL</td>
<td></td>
</tr>
<tr>
<td>potassium phosphate</td>
<td>2mEq/mL</td>
<td>mL</td>
<td>4mEq/mL</td>
<td>mL</td>
<td>0.465mEq/mL</td>
<td>mL</td>
<td>20.0 mL</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>magnesium sulfate</td>
<td>4mEq/mL</td>
<td>mL</td>
<td>0.465mEq/mL</td>
<td>mL</td>
<td>20.0 mL</td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>calcium gluconate</td>
<td>10% (0.465mEq/mL)</td>
<td>mL</td>
<td>20.0 mL</td>
<td></td>
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</tbody>
</table>

Infusion rate: ________ mL/hr