1) What are the indications and contraindications for Parenteral Nutrition (PN)?

**Indications:**
1. Impaired nutrient absorption (short bowel syndrome, enterocutaneous fistula where distal access cannot be established, small bowel obstruction).
2. Required bowel rest (mesenteric ischemia, severe pancreatitis, NEC)
3. Disordered motility (prolonged paralytic ileus – not gastric stasis, pseudo-obstruction)
4. Inability to achieve or maintain EN access within 3-4 days (unstable clinical condition)

**Contraindications:**
- Peripheral: < 2 weeks of usage (> 2 weeks needs to be changed to central)
  - Large nutrient or electrolyte needs
  - Significant malnutrition
  - Basically anything where they need a “truck-load” of nutrients, peripheral can only provide so much... then need central for access to TPN.
- If they’re DNR

2) Identify complications of PN treatment
- Thrombophlebitis
- Gastrointestinal
- Cholestasis (esp. if they’ve been on TPN for a long time, you may D/C the manganese and copper, or only administer once per week to reduce the likelihood of cholestasis)
- Metabolic bone disease
- Refeeding syndrome (basically shocking their body after they’ve been malnourished; in order to prevent this, best to titrate them on to this).
  - Note: does not affect the digestive enzymes (regards to dec. expression)

3) Identify monitoring requirements, including rational and frequency for a patient on PN

**Unstable blood work (daily until stable)**

<table>
<thead>
<tr>
<th>Daily</th>
<th>Additional Q Monday</th>
<th>Additional Q Thursday</th>
</tr>
</thead>
<tbody>
<tr>
<td>Serum Na</td>
<td>CBC + diff, Plt, Alb, ionized Ca, Cl, HCO3, Coag studies, blood gas, LFTs, ammonia, TG</td>
<td></td>
</tr>
<tr>
<td>Serum K</td>
<td></td>
<td>Coag studies, ionized Ca, alb, alk phos, AST, blood gas, LFTs, TG</td>
</tr>
<tr>
<td>Glucose</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PO4, Mg, BUN, Cr, Bili</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Stable blood work**

<table>
<thead>
<tr>
<th>Twice weekly (Mon/Thurs)</th>
<th>Additional each Monday</th>
<th>Every 4 weeks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Serum Na</td>
<td>Glucose, BUN, Ammonia, Cl, HCO3, LFTs, coag studies, Cr, bili, Alb, TG, LFTs, CBC + diff, platelets</td>
<td>Serum Zn, Selenium, Copper Manganese, Carnitine</td>
</tr>
</tbody>
</table>
Carnitine is added to the metabolic kids who can’t take carnitine orally.

4) Identify potential sources of incompatibility and instability in PN formulations
   - Ca/Phos precipitates
     o Amino acid [ ] can affect the Ca/Phos that it’ll precipitate into
   - Drugs that interact w/ TPN (refer to Trissol's, pedmed, NICU team site – IV compatibility chart)

5) Explain the importance and complexity of adding calcium and phosphate in PN solutions?
   - Check against the compatibility chart of the amino acids to ensure that Ca/Phos does not precipitate in the TPN solution.

6) Discuss the differences between 2-in-1 and 3-in-1 TPN
   2 in 1: Protein + carbs in one bag
   3 in 1: Protein + carb + fat in one bag (usually only done in adults)

7) Which amino acid mixtures do we use at BCCH?
   - Primine (1-10kg) and Travasol (>10kg)

8) Some TPN tips:
   - To check TPN, first double check the name, MRN, weight and ensure the addressograph matches, and compare the order to yesterday’s (if available) to see if there are any large changes
   - Ensure the right sheet is used (e.g. for 10-30 kg for a pt who weighs 24.9kg)
   - The TPN can’t pump doesn’t pump anything <0.2mLs
   - Check the rates/doses of the components:
     o Check rate of K+: take vol of TPN (pt specific) / vol of standard TPN specific * dose (mmol/kg) / 24 hours = “x” mmol/kg/hr
     o Check amount of K+ = vol of TPN (pt specific) / vol of standard TPN specific * dose (mmol/kg) = “x” mmol/kg
     o Check Na+ (on pharmacy use only side – for mmol/L): dose (mmol/kg)*wt / TPN vol (in L)
     o Check multivitamin dose (e.g. Max is 5 mL/day)
       ▪ Take dose e.g. 1.5 mL/kg * pt’s wt / 130 mL/kg (standard TPN vol/[]) * pt’s rate
       ▪ If > 5mL put max 5mL/day in Rx use only side