1. Describe the physiological functions of the kidneys.
Physiological functions of the kidneys include maintaining fluid, electrolyte and solute balance, filtration of blood, Regulation of water homeostasis, Regulation of blood pressure- glomerulus secretes renin when blood volume decreases, renin stimulates formation of angiotensin (vasoconstrictor), angiotensin stimulates aldosterone to reabsorb sodium and fluid and increases pressure. The kidney is also responsible for the production of erythropoietin and production of active form of Vitamin D.

2. What disease/conditions can lead to chronic kidney disease (CKD)?
Explain the relationship between diabetes and CKD.
Hypertension, Diabetes, ages over 65 and certain ethnicity's can lead to chronic kidney disease. The relationship between diabetes and CKD is related to blood sugar levels caused by diabetes damaging the blood vessels in the kidneys. If blood sugar levels are high, the damage reduces the kidney's functions.

3. Outline the stages of CKD, including the distinguishing signs and symptoms.
Stage 1: kidney damage but no loss of function. No symptoms of kidney damage. Signs include: blood or protein in urine, higher than normal levels of creatinine or urea in blood, family history of kidney disease.
Stage 2: decrease function, some signs of kidney damage. Signs similar to stage 1.
Stage 3: Moderate decrease in kidney function. Symptoms include feeling fatigue, edema, change in urine (foamy), kidney pain, and problems with sleep.
Stage 4: Severe decrease in kidney function. Same signs as stage 3 and n/v, taste changes, loss of appetite, bad breath from Uremia, nerve problems.
Stage 5: Kidney failure with treatment necessary. Dialysis. Signs and symptoms include loss of appetite, N/V, headaches, fatigue, itching, little to no urine, increased skin pigmentation, swelling, muscle cramps.

5. What are the treatment options from Stage 5 CKD? Explain the differences between hemodialysis and peritoneal dialysis.
Hemodialysis: Renal replacement therapy where wastes or uremic toxins are filtered from the blood by a semipermeable membrane and removed by dialysis fluid. Treatment is usually 3-4 hours. There are three methods to gain access to blood including intravenous catheter, arteriovenous fistula, and synthetic graft.
Peritoneal dialysis: The peritoneal cavity serves as the reservoir for the dialysate and peritoneum acts as the semipermeable membrane across which excess body fluid and solutes are removed.

6. Explain the reasons for the following components of Mrs. Joaquin’s medical nutrition therapy:

<table>
<thead>
<tr>
<th>Nutrition Therapy</th>
<th>Rationale</th>
</tr>
</thead>
<tbody>
<tr>
<td>35 kcal/kg</td>
<td>This provides adequate calories to prevent excessive protein loss.</td>
</tr>
<tr>
<td>1.2 g protein/kg</td>
<td>Restrictions in protein helps the kidneys work less and delays the progression of CKD.</td>
</tr>
<tr>
<td>2 g K</td>
<td>It’s important to consume very little of Pottasium because the kidneys are no longer able to remove potassium from the blood.</td>
</tr>
<tr>
<td>1g phosphorus</td>
<td>Kidney’s are not able to remove excess phosphorus from the body. Too much Phosphorus can lead to hyperphosphatemia which can lead to heart and bone problems.</td>
</tr>
<tr>
<td>2 g Na</td>
<td>Sodium is important to control blood pressure and fluid retention.</td>
</tr>
<tr>
<td>1000 mL fluid + urine output</td>
<td>Patients with CKD don’t urinate often which can lead to fluid retention.</td>
</tr>
</tbody>
</table>

7. Calculate and interpret Mrs. Joaquin’s BMI. How does edema affect your interpretation.

BMI = 170/3600 x 704.5 = 33.26

Edema is caused by the accumulation of fluid around the intestinal spaces that surround the cells. Mrs. Joaquin’s assessment states that she is experiencing edema in her extremities, face, and eyes. The BMI formula does not include the edema that she is experiencing therefore it’s important to consider the edema.

8. What is edema-free weight? Calculate Mrs. Joaquin’s edema-free weight.

Edema-free weight is weight without excess fluid builds up in the body.

- Edema-free weight = 165 + [(65-165) x 0.25]
  = 165 + [(-100) x 0.25]
  = 165 + (-25)
  = 140 lbs or 63.6 kg
12. What are the considerations for differences in protein requirements among predialysis hemodialysis, and peritoneal dialysis patients?

The differences in protein requirements for dialysis depend on the degree of protein wasting. Protein requirements increase the more often you are on dialysis because you often waste protein when on dialysis.

13. Mrs. Joaquin has a PO4 restriction. Why? What foods have the highest levels of phosphorus?

Mrs. Joaquin has a PO4 restriction because it is important to prevent hyperphosphatemia, which causes even more harm to the kidneys and bone health. Foods that are high in phosphorus and that should be limited include: Dairy, animal products, whole grains, legumes, and nuts.

14. Mrs. Joaquin tells you that one of her friends can drink only certain amounts of liquids and wants to know if that is the case for her. What foods are considered to be fluids? What recommendations can you make for Mrs. Joaquin? If the patient must follow a fluid restriction, what can be done to help reduce his or her thirst?

Foods that are considered to be fluids are soups, popsicle, ice cream, juice, coffee, soda, etc. Recommendations for Mrs. Joaquin would be to limit high sodium foods (to avoid thirstiness), use ice cubes instead of water to quench thirst, moisten mouth by using gums.

15. Several biochemical indices are used to diagnose chronic kidney disease. One is glomerular filtration rate (GFR). What does GFR measure? What is a normal GFR? Mrs. Joaquin’s GFR is 28 mL/min. Interpret her value.

GFR (Glomerular Filtration Rate) is a number based on blood test for creatinine and measures how efficiently the kidney filters waste. Normal GFR is 90-120mL/min/1.73 m2. Mrs. Joaquin has a low GFR of 28 mL/min, which indicated she has kidney disease. This GFR value indicates that she is in stage 5 of kidney disease where dialysis and kidney transplant is necessary.

16. Evaluate Mrs. Joaquin’s chemistry report. What labs support the diagnosis of stage 5 CKD?

Sodium 130 mEq/L (normal 136-145) low
Potassium 5.8 mEq/L (normal 3.5-5.5) high
CO2 20 mEq/L (normal 23-30) low
Creatinine 12.0 mg/dL (normal 0.6- 1.2) high
Glucose 282 mg/dL (normal 70-110) high
Phosphate 9.5 mg/dL (normal 2.3-4.7) high
Calcium 8.2mg/dL (normal 9-11) low
18. Explain why the following medications were prescribed by completing the following table.

<table>
<thead>
<tr>
<th>Medication</th>
<th>Indications/Mechanism</th>
<th>Nutritional Concerns</th>
</tr>
</thead>
<tbody>
<tr>
<td>Capoten/ Captopril</td>
<td>Treats high blood pressure and congestive heart failure</td>
<td>Want to take with a low sodium diet.</td>
</tr>
<tr>
<td>Erythropoietin</td>
<td>A glycoprotein which stimulates red blood cell production.</td>
<td></td>
</tr>
<tr>
<td>Sodium bicarbonate</td>
<td>Makes urine less acidic. Helps the kidneys get rid of uric acid, thereby helping to prevent gout and kidney stones</td>
<td></td>
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<tr>
<td>Renal caps</td>
<td>Combination of B vitamins used to treat or prevent vitamin deficiency due to poor diet, certain illnesses</td>
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</tr>
<tr>
<td>Renvela</td>
<td>Lowers the amount of phosphorus in blood of patients receiving kidney dialysis.</td>
<td></td>
</tr>
<tr>
<td>Hectorol</td>
<td>Lowers high levels of parathyroid hormone in the body in kidney dialysis patients. Doxercalciferol is a form of vitamin D.</td>
<td></td>
</tr>
<tr>
<td>Glucophage</td>
<td>Used with diet and exercise to control blood sugar in patients with type 2 diabetes. May be used alone or with other medicines.</td>
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</table>

19. What health problem has been identified in the Pima Indians through epidemiological data? Explain what is meant by the “thrifty gene” theory. Are the Pima at higher risk for complications of diabetes? Explain?

Pima Indians have a high obesity and diabetes rate. Many of their complications are caused by diabetes. “Thrifty gene” theory is a genetic change, which allows the population to adapt to alternating period of feast. They developed that gene is more efficient at storing fat during period of excess.
22. Why is it recommended for patients to have at least 50% of their protein from sources that have high biological value?
Protein sources with high biological value have complete essential amino acids, which produce the least amount of waste products. Examples of these proteins are meat, poultry, fish, eggs, milk, cheese and yogurt.