PAL Worksheet
Week 9 Problem Set 2

DIABETES MELLITUS

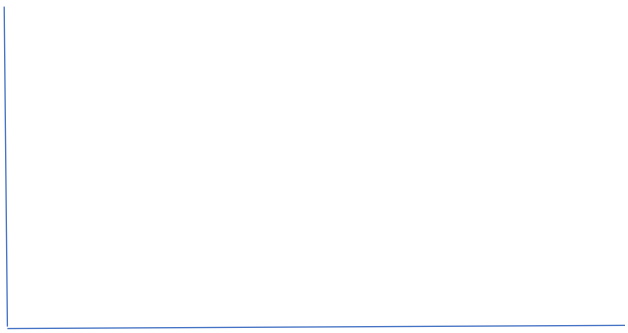
John (14 years old) has been complaining of frequent hunger, urination and thirst. He has been eating constantly (polyphagia), drinking water and sodas all day (polydipsia) and running to the bathroom during the day and many times at night (polyuria). Initially, his parents thought that he was behaving the way a growing teenager should, but over time, they became concerned and made an appointment with a physician. During the visit, a quick urine test showed that John had glucose in his urine. Following several other tests, the physician concluded that John has uncontrolled insulin-dependent diabetes mellitus.

Diabetes mellitus encompasses a group of endocrine disorders that result in elevated blood glucose levels (hyperglycemia). In John's case, the lack of insulin production by his pancreas results in tissues such as skeletal muscle and adipose, not being able to utilize the glucose.

1) Is glucose normally found in the urine of healthy individuals? Please describe in the detail how glucose is normally handled by the nephron?

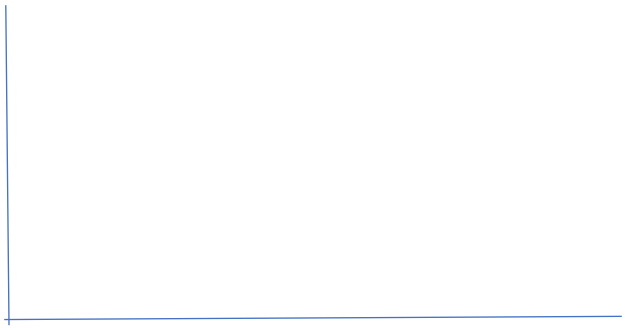
2) Individuals with uncontrolled diabetes mellitus can have blood glucose levels as high as 1000 mg/dl (normal range 70-110 mg/dl). John's blood glucose level was 400 mg/dl. Will glucose still be filtered by John's kidneys?

3) Using the graph below, plot the relationship between John's renal filtration of glucose and his blood glucose levels. Label the X axis: Plasma glucose levels (mg/dl) and the Y axis: Glucose filtered load



4) Why was there glucose in John's urine? Please use the terms "transport maximum", "saturation" and "spillover" in your answer.

5) Using the graph below, plot the relationship between John's his blood glucose levels and his glucose excretion rate. Label the X axis: Plasma glucose levels (mg/dl) and the Y axis: Glucose excretion rate



6) Why did John have polyuria?

- Define osmotic diuresis:
- Why was John thirsty all the time?

7) When measured by the physician, John's blood pressure was low. Why should this not surprise you?

DIABETES INSIPIDUS

After months of constant thirst and frequent urination, Beth was diagnosed with diabetes insipidus. Following tests, her physician concluded that she cannot produce and release ADH.

1) How does this finding explain Beth's polyuria?

2) Given that polyuria and polydipsia are also symptoms associated with diabetes mellitus, how did the physician rule out diabetes mellitus (what simple test was performed)?

3) How is diabetes insipidus similar to diabetes mellitus? How is it different? Please be sure to include the urine volume and concentration similarities/ differences between the two endocrine disorders.