MODULE 8: URINALYSIS AND ACID BASE BALANCE

This lab involves a tutorial that teaches you how to analyze a urine reagent strip. If you are taking the lab on campus, you will be given the opportunity to do your own test on your own urine. This lab will also discuss the concepts of Glomerular Filtration Rate and Plasma Clearance. Finally, this lab will look at acid base balance for the primary types of acidosis and alkalosis. You will also see a nomogram and learn how to use it. There will be an online worksheet that you will enter your answers on. You will be allowed to "Save for Later" and "Submit" the worksheet as many times as you want. However, there are a couple of things to keep in mind.

1. You will not be allowed to Submit your worksheet after the deadline. If you do not submit before the deadline, you may be able to work out a way to submit it as a late assignment but there will be point deductions.

2. If you Submit the lab assignment, and then decide to retake it before the deadline, all of your answers will be gone and you will have to retype all answers before submitting again.

The lab worksheet has been reproduced for you on the following pages, so that you can work on things offline. If you have printed the lab manual, you might write notes in the textbox fields, or you might use a .pdf document annotator on your computing device. Whatever you decide to do is fine, but ultimately, only answers entered on the I-learn worksheet can be submitted for grading.

Follow the instructions below very carefully. Many of the items in this assignment require reading or videos or something else to do. Be sure to write your answers completely before submitting the assignment. There is an option in the bottom right to save your answers and come back later, but once you submit this assignment, it will be graded.

Urinalysis

The careful analysis of urine and urine production and reveal pathologies that would normally go unnoticed for a long time because of non-significant symptoms. Just a few examples of such diseases that urinalysis might help identify are diabetes, various forms of urinary tract infections and kidney disease. If you are attending the lab, your lab instructor will give you a urinalysis reagent strip and let you do your own analysis.

CLICK HERE to do a tutorial that will guide you through some practice with Urinalysis. Then answer the following questions.

1. Which of the following results from a urinalysis reagent strip would MOST likely suggest that there is an increase of red blood cell break down in the body?

- O High levels of urobilinogen in the urine
- O Low levels of glucose in the urine
- O Blood in the urine
- O High levels of ketones in the urine

2. Which of the following results from a urinalysis reagent strip would MOST likely suggest that someone was following an extreme and long term version of the Atkins diet?

- O Increased urobilinogen in the urine
- O Increased ketones in the urine
- O Increased glucose in the urine
- O Increased protein in the urine

3. Some patients who take a class of drugs called statins can experience a side effect called Rhabdomyolysis. Which of the following results from a urinalysis reagent strip would MOST likely suggest that a person was experiencing this negative side effect.

- O Increased glucose in the urine
- O Increased ketones in the urine
- O Increased protein in the urine
- O Increased leukocytes in the urine

4. Do your own research on the internet and explain what Rhabomyolysis is. Make sure you include some of the causes of this condition.

Glomerular Filtration Rate and Renal Clearance

This section of the lab discusses the fraction of plasma that actually gets filtered by the kidneys as it passes through the kidneys. The kidneys have the responsibility to filter our blood and remove toxins and waste products. Kidneys also regulate fluid removal from our blood and body. This helps us control our blood pressure. Kidneys also help regulate the concentration of many important ions and nutrients. Finally, kidneys help us regulate our pH within a very narrow acceptable range. For all these reasons, it is important for us to measure how well the kidneys are functioning when we track a person's health.

CLICK HERE to watch a video that discusses the concepts of Filtration, Reabsorption, Secretion and Excretion. This video will also discuss the concept of Glomerular Filtration Rate (GFR) and the role of inulin in calculating GFR.

CLICK HERE to complete a short tutorial on Creatinine Clearance.

Use the knowledge you gained from the assignments above to answer the following questions.

Substance	**Clearance (Cx)**
Inulin	Cx = 125 ml/min
Glucose	Cx = 0 ml/min
PAH	Cx = 625 ml/min
Urea	Cx = 70 ml/min
Cl-	Cx = 8 ml/min
Creatinine	Cx = 120 ml/min

5. Look at the information above and decide which substance appears to be extensively secreted.

- ○ Inulin
- ○ Glucose
- ○ PAH
- ○ Urea
- ○ Cl-
- ○ Creatinine

Substance	**Clearance (Cx)**
Inulin	Cx = 125 ml/min
Glucose	Cx = 0 ml/min
PAH	Cx = 625 ml/min
Urea	Cx = 70 ml/min
Cl-	Cx = 8 ml/min
Creatinine	Cx = 58 ml/min

6. Look again at the information above and decide which substance appears to be extensively reabsorbed.

1. Inulin and Creatinine
2. PAH
3. Urea and Creatinine
4. Glucose and Cl-

- ○ 1
- ○ 1,2
- ○ 2
- ○ 3
- ○ 1,4
- ○ 4
- ○ 3,4
- ○ 2,4

Substance	Clearance (Cx)
Inulin	Cx = 125 ml/min
Glucose	Cx = 0 ml/min
PAH	Cx = 625 ml/min
Urea	Cx = 70 ml/min
Cl-	Cx = 8 ml/min
Creatinine	Cx = 58 ml/min

7. Look at the information one last time and notice that the Cx value for Creatinine has changed. Which of the following is the most likely reason for this change?

○ This person has severe atherosclerosis on both renal arteries and this has caused the renal fraction to decrease to about 8%
○ This person has damaged their glomerlular capillaries and the filtration fraction has increased to about 30%
○ This person has high blood pressure
○ This person could have diabetes and has been urinating so much that dehydration has set in

8. CLICK HERE to read a wikipedia article on Penicillin. Pay particular attention to the section on Mass Production.

Which of the following would you expect if you were to use the renal clearance formula to calculate the Cx of Penicillin

○ Ux * V would be a larger number than Px
○ Ux * V would be a smaller number than Px
○ Ux * V would be somewhere around 120-125 ml/min
○ Ux * V / Px would be nearly 0

9. Explain your answer in the previous question.

Carbonic Acid / Bicarbonate Buffer System

The purpose of this lab is come to a basic understanding of the following...

An understanding of the Carbonic Acid Bicarbonate Buffer System and how it relates to:

Primary:

- **Respiratory Acidosis**
- **Respiratory Alkalosis**
- **Metabolic Acidosis**
- **Metabolic Alkalosis**

You may have gotten this in lecture already. If you feel that you have a basic understanding of this, Answer the questions below and continue on.

Optional: If you feel that you do not understand this as much as you should, and would like a good lecture refresher, try the following link:
http://www.youtube.com/watch?v=v9-9MfJMtyg (This video is about an hour long)

Question:
10. If you hold your breath for a long time, you would expect:

○ The equation below to shift to the left and generate more CO2 which will lower the pH
CO2 + H2O <--- ---> H2CO2 <-- --> H+ + HCO3-

○ The equation below to shift to the right and generate more H+ which will lower the pH
CO2 + H2O <--- ---> H2CO2 <-- --> H+ + HCO3-

○ The equation below to shift to the left and generate more CO2 which will raise the pH
CO2 + H2O <--- ---> H2CO2 <-- --> H+ + HCO3-

○ The equation below to shift to the right and generate more HCO3- which will raise the pH
CO2 + H2O <--- ---> H2CO2 <-- --> H+ + HCO3-

CLICK HERE to complete an online self test. Follow the instructions to see if you understand how CO2, H+, and HCO3- contribute to primary forms of respiratory and metabolic pH imblances. Also, we want you to understand the how these things contribute to attempts at compensating with these conditions.

Answer the following questions:

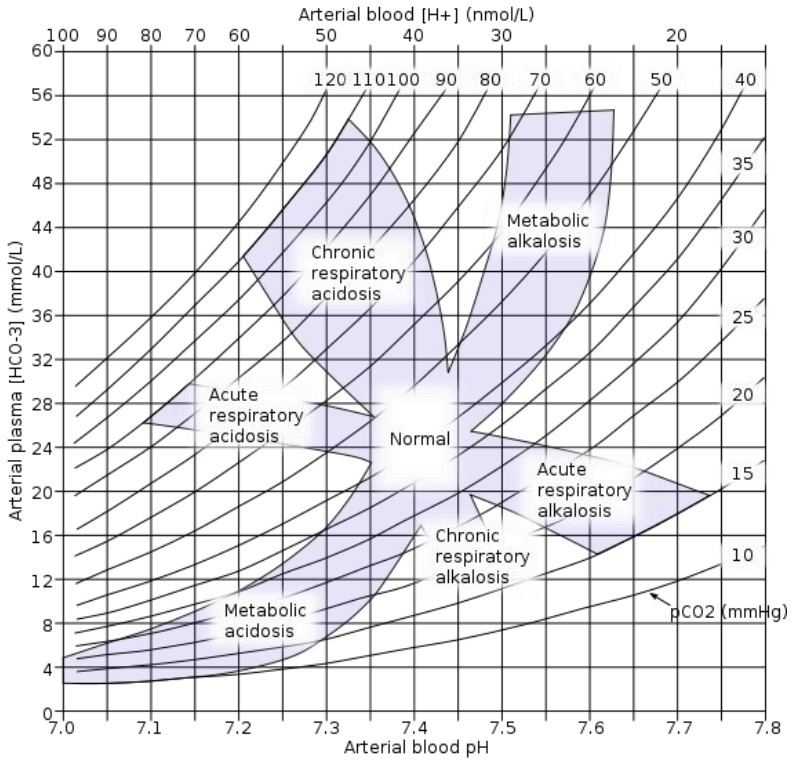
11. A high pH, low H+, High PCO2, and High HCO3- would result in which type of condition?

- ○ Respiratory Alkalosis non compenstated
- ○ Metabolic Alkalosis non compensated
- ○ Respiratory Alkalsosis compensated
- ○ Metabolic Alkalosis compensated

12. A low pH, high PCO2, and normal HCO3- would result in which type of condition?

- ○ Respiratory Acidosis non compensated
- ○ Respiratory Alkalosis compensated
- ○ Respiratory Acidosis compensated
- ○ Respiratory Alkalosis non compensated
- ○ Metabolic Acidosis non compensated
- ○ Metabolic Alkalosis compensated
- ○ Metabolic Acidosis compensated
- ○ Metabolic Alkalosis non compensated

CLICK HERE to learn how to use a nomogram for acid / base imbalances. After working through this tutorial, try the question below.



Use the following information and the nomogram above to answer the question

A 75 year old man has suffered from COPD for many years. He also has insulin dependent diabetes mellitus. A recent bout of pneumonia has left him struggling for breath, depressed and a little confused. He has not taken insulin for nearly 26 hours now.

Some values from his blood tests are as follows:

Blood pH= 7.21
pCO2 = 60 mmhg
pO2 = 70 mmhg
HCO3- = 27 mmol/L

Hint: He is NOT diagnosed with Acute Respiratory Acidosis.

Try and explain what you think is going on.