

Lab 10 – Regulating Acid Base Balance

CHEMICAL BUFFERS (worksheet)

List the 3 chemical buffer systems of the body and state the fluid compartment where each is most effective.

Buffer System	Most effective in...

What is the overall objective of chemical buffers and how do they accomplish this?

How fast do they operate? _____

Which of the 3 chemical buffer systems accomplishes 75% of the buffering? _____

Give a specific example of this type of buffer in the body.

(Hint: It's involved in your #1 method of CO₂ transport)

If more H⁺ is added to the plasma how will the bicarbonate buffer system react?

Does the pH change? _____ If so, which way? _____

Then what did the buffer system accomplish?

If more HCO₃⁻ is added to the plasma how will the bicarbonate buffer system react?

Will the pH change? _____ If so, which way? _____

RESPIRATORY ADJUSTMENTS of blood pH (worksheet)

1) As cellular metabolism increases (think “Aerobic glycolysis”), blood levels of CO_2 tend to _____ (\uparrow or \downarrow) and the pH of the blood tends to _____ (\uparrow or \downarrow) and as a result, the RR should _____ (\uparrow or \downarrow) to compensate.

a) Write the equilibrium reaction that can be used to explain how changes in RR can affect pH. Start with CO_2 on the left.

b) Look at the reaction above. Note that one of the chemical buffer systems is part of the reaction and is being “manipulated” by changes in RR. Which one? _____

c) If RR decreases then _____ will accumulate and the reaction will proceed to the _____ (R / L) and pH will _____ (\uparrow or \downarrow)

d) If the pH changes for a non-respiratory reason then the RR should change to compensate.

If pH decreases then RR should _____ (\uparrow or \downarrow)

If pH increases then RR should _____ (\uparrow or \downarrow)

How quickly do changes in RR affect blood pH? _____ (seconds, minutes, hours)

Scenario:

You are working the ER of a local hospital. A patient arrives who is breathing deep and fast. He complains of feeling dizzy, light headed, and weak. *Assuming his breathing is compensatory due to a pH change of the blood and is not due to anxiety...* what is the pH status of your patient’s blood? _____ (\uparrow or \downarrow) You would say they are in _____.

After asking some questions you learn that this same patient is diabetic, has been eating sugary foods, and has not taken his insulin in two days.

What fuel do you expect to find in his blood in excess? _____ and what do you call that condition? _____

What secondary fuel are his cells likely to be burning? _____

Since this has been going on for two days what by-product of this secondary fuel do you expect to find accumulated in his blood? _____ and what do you call that condition? _____

If you were to do a urinalysis you would expect to find _____ and _____ in his urine.

What drug (a hormone) *might* be appropriate for you to give this patient? _____

RENAL ADJUSTMENTS of blood pH (worksheet)

The priority of the kidneys is to control the pH of the _____ rather than the pH of the _____.

Arterial blood pH is normally between _____ and _____.
with an extreme low of _____ and an extreme high of _____.

Kidneys typically secrete a combination both H^+ and K^+ .

If blood pH is low the kidneys will secrete more _____ and less _____.

In hyperkalemia the kidneys will secrete more _____ and less _____.

If H^+ is secreted: What happens to blood pH? _____ (\uparrow or \downarrow)
What happens to urine pH? _____ (\uparrow or \downarrow)

If H^+ is secreted what is usually reabsorbed? _____ and _____

If K^+ is secreted instead of H^+ : What happens to blood pH? _____ (\uparrow or \downarrow)
What happens to urine pH? _____ (\uparrow or \downarrow)

If bicarb is reabsorbed or if bicarb is generated and added to the blood what happens to blood pH? _____ (\uparrow or \downarrow)

If bicarb is reabsorbed what happens to urine pH? _____ (\uparrow or \downarrow)

Urine pH is normally between _____. The extreme low and high are _____ & _____.

Chemical buffer systems in the urine include the _____ and _____.

Also, the base _____ is usually secreted into the urine to bind up some of the free H^+ being secreted into it.

If the pH of your patient's urine is <6 what was the pH of the blood that led to the production of this urine? Give both the name of the condition of the blood and a realistic number for blood pH. _____

If you give $NaHCO_3$ (sodium bicarb) by IV or tablet to a patient what effect would it tend to have on blood pH? _____ (\uparrow or \downarrow) Explain how...

How long does it take for renal adjustments to have a significant impact on the blood pH?
