

Zoology 121, Human Physiology: Exam IV
110 Points; please read each question carefully
Exam is 2-sided (6 pages)

Name 2002 exam IV Lab section: T8:30 T11:30 T2:30 Th11:30 Th2:30

Part I. Multiple Choice. 2 Points each (24 points total).

- 1 Which of the following forces/factors has no direct effect on the rate of glomerular filtration?
 - A Blood protein concentration
 - B Myogenic response to changes in blood pressure
 - C Rate of fluid flowing in the distal tubule of the nephron
 - D Blood potassium (K⁺) concentration

- 2 Which of the following statements about renin is incorrect?
 - A It is an enzyme
 - B It is released from the liver
 - C Its actions (directly or indirectly) result in an increase in blood pressure
 - D Its actions (directly or indirectly) result in an increase in aldosterone release

- 3 Which of the following statements about the kidney's role in maintaining blood pH is incorrect?
 - A Under normal conditions, there is some transfer of protons (H⁺) to the filtrate in the proximal tubule
 - B Under conditions of severe acidosis, the collecting ducts may secrete protons (H⁺) into the filtrate
 - C Under conditions of alkalosis, protons (H⁺) are actively reabsorbed into the blood from the filtrate
 - D Regulation of body pH by the kidneys is a slow process relative to regulation by other mechanisms

- 4 Which statement about CO₂ is incorrect?
 - A It is converted to carbonic acid (H₂CO₃) by the enzyme carbonic anhydrase
 - B An increase in blood CO₂ results in an elevation in ventilation which results in increased removal of CO₂
 - C An increase in CO₂ is associated with an increase in pH
 - D In the kidney, bicarbonate (HCO₃⁻), from CO₂, is exchanged for chloride (Cl⁻) across the cell membrane

- 5 Which TWO of the following buffer systems are important in regulating intracellular fluid (ICF) pH?
- A proteins
 - B ammonia ($\text{NH}_4^+/\text{NH}_3$)
 - C bicarbonate ($\text{H}_2\text{CO}_3/\text{HCO}_3^-$)
 - D phosphates ($\text{H}_2\text{PO}_4/\text{HPO}_4^-$)
- 6 The loop of Henle: which statement is incorrect?
- A Water can diffuse out of the descending limb
 - B The primary function is to generate a concentration gradient in the interstitial fluid of the kidney
 - C Urea can diffuse out of the descending limb
 - D It is the primary site for glucose recovery from the filtrate
- 7 Which of the following is NOT correct?
- A Fluid entering the collecting duct has a high osmolarity
 - B The concentration of the fluid leaving the collecting duct will not be modified in the bladder
 - C Fluid entering the collecting duct has an elevated concentration of waste products
 - D The volume of fluid leaving the collecting duct is variable depending upon the osmotic state of the body
- 8 Which of the following is NOT a brush-border enzyme?
- A enteropeptidase
 - B trypsin
 - C lactase
 - D sucrase
- 9 Which hormone inhibits gastric emptying?
- A glucagon
 - B CCK
 - C insulin
 - D gastrin

- 10 A hormone that thought to regulate appetite (hunger vs. satiety) is:
- A leptin
 - B CCK
 - C insulin
 - D all of the above
- 11 The “fasting state” is characterized by high levels of
- A insulin
 - B glucagon
 - C secretin
 - D CCK
- 12 The order in which energy sources are used during exercise is:
- A ATP, creatine phosphate, fatty acids, glucose (derived from glycogen)
 - B creatine phosphate, ATP, fatty acids, glucose (derived from glycogen)
 - C creatine phosphate, ATP, glucose (derived from glycogen), fatty acids
 - D ATP, creatine phosphate, glucose (derived from glycogen), fatty acids

Part II. Short Answer. 3 Points each (66 points total).

- 13 Most of the water reabsorbed in the kidney is reabsorbed in what part of the nephron?

- 14 Regulation of water recovery/elimination based on body water needs occurs in what part of the nephron? _____
- 15 Most of the sodium reabsorbed in the kidney is reabsorbed in what part of the nephron?

- 16 What triggers the release of atrial natriuretic factor (ANF)? _____
- 17 List one (and only one) of the effects of the release of ANF: _____

- 18 Excess potassium (K⁺) is secreted in what part of the nephron? _____
- 19 Give one (and only one) of the effects of increased angiotensin II release _____

20 About how much of the urea that is filtered is reabsorbed under normal circumstances?

21 The primary site of action of vasopressin (ADH) within the kidney is where?

22 What is the primary action of vasopressin? _____

21 - 25: Fill in the missing enzymes (e) and breakdown products (p) of the digestive process.

21 _____ (e)
Trypsin
Chymotrypsin
Carboxypeptidase
Protein → peptides → aminopeptidase → _____ (p)

22 _____ (e)
Pancreatic amylase
Starch → maltose → Maltase → _____ (p)

Pancreatic amylase
Glycogen
Lactose → _____ (e) → glucose + _____ (p)

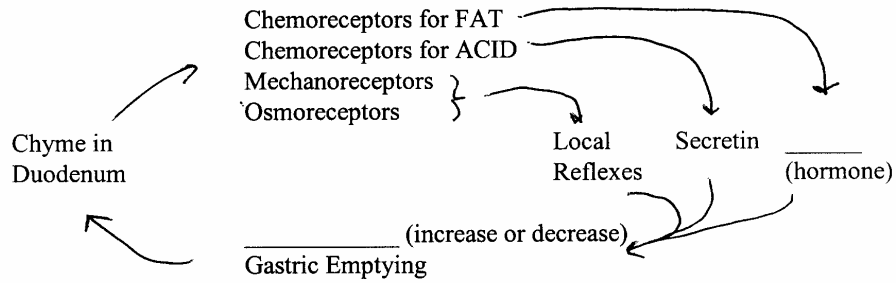
24 Sucrose → Sucrase (e) → _____ (p) + _____ (p)

bile
25 Fats → _____ (e) → monoglycerides + _____ (p)

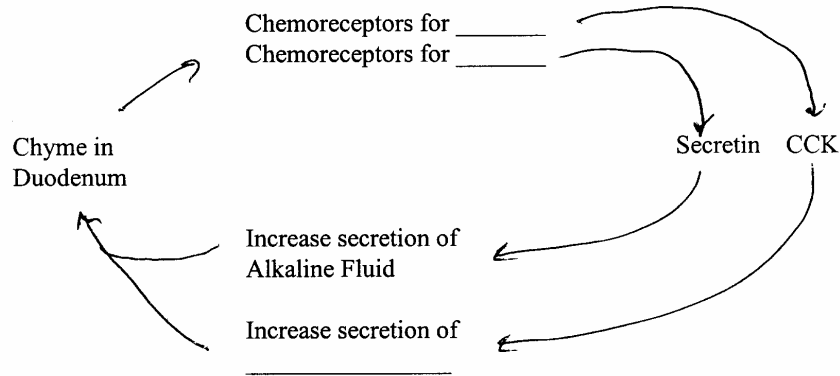
26 Name one gastric secretion (thing secreted into the lumen of the stomach) and briefly describe its function.

27 One function of the liver is to produce and secrete bile. Describe one other function.

28 Complete the feedback loop describing the regulation of gastric emptying by factors in the duodenum.



29 Complete the feedback loop describing the regulation of pancreatic secretion.



30 The animal energy equation:
 $\text{Food} = \text{BMR} + \text{_____} + \text{Activity} + \text{Production} + \text{_____}$

31 Heat balance equation: Heat gain = heat loss. Generally speaking, the mechanisms for heat gain are _____ and _____, while the mechanisms for heat loss are only _____.

32 After a high protein meal, what hormone prevents blood glucose levels from becoming dangerously low? _____

Part III. Describe/Illustrate. Points as indicated (20 points total).

33 10 points. The Na/K ATPase has many important functions in kidney physiology. Describe TWO roles of this enzyme in kidney function. Be explicit in terms of mechanism and effect. If you describe more than two roles, only the first two will be graded.

34 10 points. Choose one of the following. Please circle your choice.

- A Describe the effects of insulin (during the fed state) on the liver, muscle, adipose, and other tissues.
- B Describe the effects of glucagon and low insulin (during the fasting state) on the liver, muscle, adipose and other tissues. Assume a prolonged fast is in progress (starvation) and cortisol levels are rising.

Extra Credit. Dr. Stenkamp likes beer and (salty) french fries. Briefly predict the outcome of ingesting this combination on the release of vasopressin, and subsequent effects of vasopressin on its target organs.