

**Study Exercise #2: Osmoregulation & Kidney Function**

**Some questions may have more than one correct answer. Mark all correct answers.** You may use books or notes and discuss answers with your classmates. Use an 882-E Scantron®. Please write "**SE-2**" in the area on the back of your Scantron along with your name and section number and today's date. If you don't write this, your score might not be recorded.

Note the questions start with #51, so record your answers on the **back side** of the Scantron.

51. Which of the following is true?
- A. Freshwater fish generally make urine that is hyperosmotic to their blood; marine fish usually make urine that is hypoosmotic to their blood.
  - B. Freshwater fish generally make urine that is hypoosmotic to their blood; marine fish usually make urine that is hyperosmotic to their blood.
52. The urine of earthworms is normally
- A. hypoosmotic to their cells.
  - B. isoosmotic to their cells.
  - C. hyperosmotic to their cells.
53. Which of these costs the most energy to produce?
- A. Ammonia.
  - B. Urea.
  - C. Uric acid.
54. Insects conserve water by reabsorbing water from the rectum before waste materials are excreted. Which of the following help create the osmotic gradient necessary for this reabsorption?
- A. Active transport of ions from the Malpighian tubules into the hemolymph.
  - B. Active transport of ions from the hemolymph into the Malpighian tubules.
  - C. Active transport of ions from the rectum into the hemolymph.
  - D. Active transport of ions from the hemolymph into the rectum.
  - E. Precipitation of uric acid in the rectum.
55. Most marine bony fish are
- A. osmoregulators.
  - B. osmoconformers.
56. Most cartilaginous fish such as sharks normally live in an environment that is
- A. hypotonic to their cells.
  - B. isotonic to their cells.
  - C. hypertonic to their cells.
57. Which of the following taxa have true metanephridia?
- A. Annelida    B. Arthropoda    C. Platyhelminthes    D. Mollusca    E. Vertebrata
58. Which of the following taxa have true protonephridia?
- A. Annelida    B. Arthropoda    C. Platyhelminthes    D. Mollusca    E. Vertebrata
59. One aspect that true metanephridia and protonephridia are different from nephrons is that flow through the tubules of metanephridia and protonephridia is caused by
- A. ciliary motility in the proximal region of the tubules.
  - B. high osmotic pressure in the proximal region of the tubules.
  - C. ventilation currents sweeping fluid from the distal region of the tubules.
  - D. physical pressure of the body fluids pushing into the proximal region of the tubules.

60. What body fluid is directly filtered into the tubules of metanephridia?  
A. Chyme      B. Cytosol      C. Blood plasma      D. Coelomic fluid      E. Interstitial fluid
61. What body fluid is directly filtered into the tubules of protonephridia?  
A. Chyme      B. Cytosol      C. Blood plasma      D. Coelomic fluid      E. Interstitial fluid
62. What body fluid is directly filtered into the tubules of nephrons  
A. Chyme      B. Cytosol      C. Blood plasma      D. Coelomic fluid      E. Interstitial fluid
63. What is the main function of the antennal gland in the freshwater crayfish?  
A. Excrete ammonia  
B. Convert ammonia into uric acid.  
C. Secrete  $\text{Cl}^-$ .  
D. Excrete water.  
E. Reabsorb water.
64. What **percentage** of the total water budget for a human can be obtained from metabolic water?  
A. 100%  
B. 90%  
C. 10%  
D. 1.8%
65. What **percentage** of the total water budget for a kangaroo rat can be obtained from metabolic water?  
A. 100%  
B. 90%  
C. 10%  
D. 1.8%
66. Why do seeds comprise an ideal diet for kangaroo rats?  
A. high water moisture content  
B. high starch content  
C. high protein and oil content  
D. high protein, but low oil content  
E. high oil, but low protein content

**The following questions apply the human kidney.**

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67. Which of these components of blood would pass from the blood into the initial filtrate in the glomerulus?  
A. Water  
B. Glucose  
C. Urea  
D. Proteins  
E. Red blood cells
68. Where does active transport occur?  
A. In the proximal tubules of the kidney.  
B. In the distal tubules of the kidney.  
C. In the loops of Henle of the kidney.  
D. In the collecting ducts.

69. How does the kidney help maintain the pH of blood?
- A. The kidney doesn't control pH; it only functions in osmoregulation & excretion.
  - B.  $H^+$  is reabsorbed.
  - C.  $H^+$  is secreted.
  - D.  $HCO_3^-$  is reabsorbed.
  - E. Active transport of  $Na^+$  &  $Cl^-$  helps regulate pH.
70. The proximal tubule causes what change in the **osmolarity** of the filtrate.
- A. Increase.
  - B. Decrease.
  - C. No significant change.
71. The proximal tubule causes what change in the **volume** of the filtrate?
- A. Increase.
  - B. Decrease.
  - C. No significant change.
72. The proximal tubule causes what change in the **urea concentration** of the filtrate.  
(Think carefully!)
- A. Increase.
  - B. Decrease.
  - C. No significant change.
73. The descending limb of the loop of Henle causes what change in the **volume** of the filtrate.
- A. Increase.
  - B. Decrease.
  - C. No significant change.
74. The descending limb of the loop of Henle causes what change in the **osmolarity** of the filtrate.
- A. Increase.
  - B. Decrease.
  - C. No significant change.
75. The ascending limb of the loop of Henle causes what change in the **volume** of the filtrate.
- A. Increase.
  - B. Decrease.
  - C. No significant change.
76. The ascending limb of the loop of Henle causes what change in the **osmolarity** of the filtrate.
- A. Increase.
  - B. Decrease.
  - C. No significant change.
77. The loop of Henle causes what change in the **urea concentration** of the filtrate.
- A. Increase.
  - B. Decrease.
  - C. No significant change.
78. How does urea leave the filtrate in the collecting duct?
- A. Simple diffusion.
  - B. Facilitated diffusion.
  - C. Active transport.
  - D. It doesn't; the collecting duct isn't permeable to urea.
79. How does water leave the filtrate in the descending limb of the loop of Henle?
- A. Simple diffusion.
  - B. Facilitated diffusion.
  - C. Active transport.
  - D. It doesn't; the descending limb isn't permeable to water.
80. How does  $Na^+$  leave the filtrate in the ascending limb of the loop of Henle?
- A. Simple diffusion.
  - B. Facilitated diffusion.
  - C. Active transport.
  - D. It doesn't; the ascending limb isn't permeable to  $Na^+$ .

81. How does  $\text{Cl}^-$  leave the filtrate in the ascending limb of the loop of Henle?
- A. Simple diffusion.
  - B. Facilitated diffusion.
  - C. Active transport.
  - D. It doesn't; the ascending limb is not permeable to  $\text{Cl}^-$ .
82. How many of the nephrons in the human kidney have loops of Henle that extend deep into the inner renal medulla?
- A. 1%.
  - B. 15%.
  - C. 85%.
  - D. 100%.
83. How much blood typically flows through a person's pair of kidneys each day?
- A. 1100 to 2000 mL.
  - B. 1100 to 2000 L.
  - C. 275 L.
  - D. 180 mL.
  - E. 180 L.
84. From that amount of blood, how much initial filtrate is usually produced?
- A. precisely 1.5 L.
  - B. 1100 to 2000 mL.
  - C. 1100 to 2000 L.
  - D. 180 mL.
  - E. 180 L.
85. From that amount of initial filtrate, how much urine is usually produced?
- A. precisely 1.5 L.
  - B. 1100 to 2000 mL.
  - C. 1100 to 2000 L.
  - D. 180 mL.
  - E. 180 L.
86. Which of these processes contribute to the difference between the volume of initial filtrate and the volume of urine?
- A. Water passing from the collecting duct to the interstitial fluid of the renal medulla by osmosis.
  - B. Water passing from the interstitial fluid of the renal medulla into the collecting duct by osmosis.
  - C. Water passing from the loop of Henle to the interstitial fluid of the renal medulla by osmosis.
  - D. Water passing from the interstitial fluid of the renal medulla into the loop of Henle by osmosis.
  - E. Water actively transported out of the loop of Henle.
87. What is the osmolarity of the blood before it enters the glomerulus?
- A. 100 mOsm/L.
  - B. 300 mOsm/L.
  - C. 600 mOsm/L.
  - D. 900 mOsm/L.
  - E. 1200 mOsm/L.

88. What is the osmolarity of the initial filtrate produced in the renal corpuscle?
- A. 100 mOsm/L.
  - B. 300 mOsm/L.
  - C. 600 mOsm/L.
  - D. 900 mOsm/L.
  - E. 1200 mOsm/L.
89. What is the osmolarity of the filtrate as it passes through the distal tubule?
- A. 100 mOsm/L.
  - B. 300 mOsm/L.
  - C. 600 mOsm/L.
  - D. 900 mOsm/L.
  - E. 1200 mOsm/L.
90. What is the maximum osmolarity of the filtrate (urine) as it leaves the collecting duct?
- A. 100 mOsm/L.
  - B. 300 mOsm/L.
  - C. 600 mOsm/L.
  - D. 900 mOsm/L.
  - E. 1200 mOsm/L.
91. What is the osmolarity of the blood as it passes through the lowest point of the vasa recta in the inner medulla?
- A. 100 mOsm/L.
  - B. 300 mOsm/L.
  - C. 600 mOsm/L.
  - D. 900 mOsm/L.
  - E. 1200 mOsm/L.
92. The volume of filtrate that passes through the distal tubule each day is
- A. less than the volume of filtrate that passes through the proximal tubule.
  - B. greater than the volume of filtrate that passes through the proximal tubule.
  - C. approximately equal to the volume of filtrate that passes through the proximal tubule.
93. How can the human kidney make urine that is hypoosmotic to blood when necessary?
- A. Make the loop of Henle more permeable to water.
  - B. Make the loop of Henle less permeable to water.
  - C. Make the collecting duct more permeable to water.
  - D. Make the collecting duct less permeable to water.
  - E. It can't; the kidney is designed to make urine that is hyperosmotic to blood.

**The following questions apply to regulating mammalian kidneys.**

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94. Antidiuretic hormone (ADH) causes an increase in reabsorption of water in the kidney.
- A. True.
  - B. False.
95. When blood pressure decreases, one of the body's natural responses is to
- A. **increase** Na<sup>+</sup> reabsorption in the distal tubules.
  - B. **decrease** Na<sup>+</sup> reabsorption in the distal tubules.

96. Hemorrhage (loss of blood volume) would cause
- A. **decrease** in ADH secretion, but **increase** in aldosterone secretion.
  - B. **increase** in ADH secretion, but **decrease** in aldosterone secretion.
  - C. **decrease** in both ADH and aldosterone secretion.
  - D. **increase** in both ADH and aldosterone secretion.
97. When would a vampire bat have higher levels of ADH?
- A. Shortly after feeding, before flying home to its cave.
  - B. During the day, when it is roosting in the cave and digesting its meal.
98. When would a vampire bat have higher levels of renin?
- A. Shortly after feeding, before flying home to its cave.
  - B. During the day, when it is roosting in the cave and digesting its meal.
99. What do *diabetes insipidus* and *diabetes mellitus* have in common?
- A. increased urine production.
  - B. increased water reabsorption.
  - C. increased Na<sup>+</sup> reabsorption.
  - D. decreased sugar reabsorption.
100. How does *diabetes insipidus* result in the above condition?
- A. decreased osmolality of the filtrate.
  - B. increased osmolality of the filtrate.
  - C. decreased water permeability of the collecting duct.
  - D. increased water permeability of the collecting duct.