

BIO 3302 Animal Physiology II
Midterm #2

K.M. Gilmour
March 28th, 2011
80 min

NAME: _____

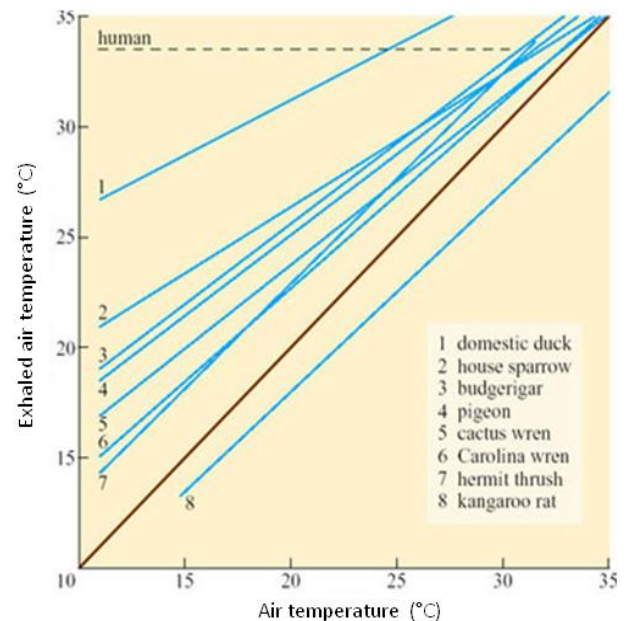
STUDENT #: _____

Part A: Answer the following questions in the space provided on the question sheet. (1 mark per answer unless otherwise stated; 20 marks in total)

1. Which of the following fish species continues to use ammonia as the end-product of nitrogen metabolism even when removed from water?
 - a. the Gulf toadfish
 - b. the African lungfish
 - c. the Lake Magadi tilapia
 - d. the mangrove killifish
 - e. None of these fish continues to use ammonia as the end-product of nitrogen metabolism during air exposure

2. Inulin is freely filtered at the renal corpuscle and is neither secreted nor reabsorbed. If the concentration of inulin in the plasma is 1% of that in the urine and the glomerular filtration rate is 125 mL min^{-1} , then the volume of urine produced per day must be _____.

3. Based on the figure at right, which bird would you predict to experience the lowest pulmonary water loss at 25°C ? Justify (briefly) your selection. (2 marks)



4. True OR false (select one): A deep-sea fish is homeothermic because its body temperature of $\sim 4^\circ\text{C}$ varies by less than a degree over the course of a year.

5. True OR false (select one): Exposure of rainbow trout to hyperoxic (high O₂) water causes a respiratory alkalosis.
- Justify your answer.

- What compensatory mechanism(s) would the rainbow trout employ to correct the acid-base disturbance resulting from exposure to hyperoxic water? (2 marks)

6. Urinary water loss in mammals is...
- an obligatory exchange
 - a regulated exchange
 - an exchange that is both obligatory and regulated

Justify your answer. (2 marks)

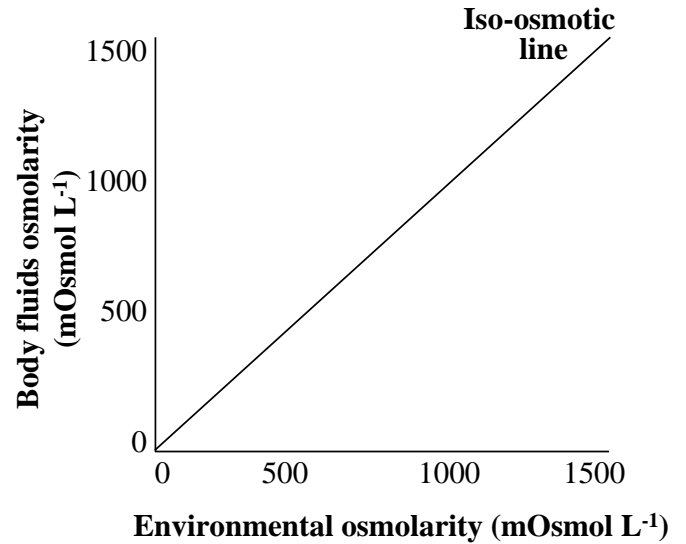
7. Which one of the following responses is not involved in the autoregulation of glomerular filtration rate?
- Stretch-induced contraction of the smooth muscle of the afferent arteriole
 - Release of vasodilatory substances by the juxtaglomerular cells in response to low filtrate flow through the distal tubule
 - Vasoconstriction of the afferent arteriole induced by the sympathetic nervous system
 - All of the above are involved in the autoregulation of glomerular filtration rate
8. Which one of the following will cause urine flow rate in a mammal to increase?
- a decrease in blood volume
 - an increase in aldosterone secretion
 - an increase in blood osmolarity
 - an increase in atrial natriuretic peptide (ANP) secretion
 - an increase in arginine vasopressin (AVP) secretion

9. A dry suit is more effective in protecting a human diver from heat loss to the surrounding water because its main impact is to reduce conductive OR convective OR evaporative OR radiant (**select one**) heat loss, whereas a wet suit primarily reduces conductive OR convective OR evaporative OR radiant (**select one**) heat loss
10. Adult *Xenopus* (African clawed frogs) typically excrete ammonia. What can you infer from this observation? (2 marks)
11. Alcohol suppresses ADH secretion. Explain the likely impact of this effect on a student who has consumed several pitchers of beer at the pub. (2 marks)

Part B: Answer the following questions in the exam booklet. (25 marks in total)

1. List two structural adaptations for life in a desert that are displayed by the kangaroo rat, and briefly explain the functional significance of each. (4 marks)
2. Most freshwater teleost fish are unable to survive in water with high concentrations of bicarbonate ions. Sketch a diagram of the base-secreting mitochondrion-rich cell of the freshwater fish gill, and use your diagram to suggest a possible physiological reason for the observation that freshwater fish cannot tolerate bicarbonate-rich water. (4 marks)
3. Sketch and label the two types of nephrons found in a bird kidney. Explain the physiological significance of the structural differences you have illustrated. (7 marks)

4. Sketch the axes at right in the exam booklet and then add to them a euryhaline teleost fish (e.g. salmon), a stenohaline marine elasmobranch (e.g. dogfish), and a hagfish. Contrast and compare the ionoregulatory and osmoregulatory challenges faced by these animals. (10 marks)



Bonus: For a bonus mark that, in the spirit of socialism will be applied to the entire class if even one person answers correctly, choose from the following list the one shoe that is truly fishy, *i.e.* the one that does not actually exist...

- a. New Balance 1400 Super Team 33 Neon Fish Edition
- b. Big Fish Little Fish Pro Keds Hi Top Shoe
- c. Skelly Fish Shoe by SuanSKatra
- d. The Nike 78 Aquarium Shoe by Weiden + Kennedy
- e. Jimmy Choo Patent Leather Goldfish Ankle Strap
- f. Chuck Taylor All Star Fish Print by Converse
- g. England Rare Blue Fish Dr Martens
- h. Sperry Top Sider fish Tassel Mule Deck for Women
- i. 3 1/2 Inch Men's Platform Filled Heel Fish Retro Disco
- j. Miss Fish Fashion Heels | Peep Toe Shoes