

**BIO 3302 Animal Physiology II**  
**Midterm #1**

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**February 14<sup>th</sup>, 2013**  
**80 min**

**NAME:** \_\_\_\_\_

**STUDENT #:** \_\_\_\_\_

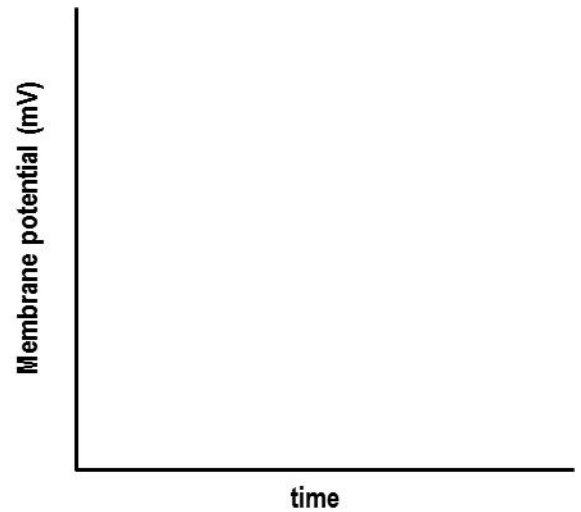
**Part A:** Answer the following questions in the space provided on the question sheet. (1 mark per answer unless otherwise stated; 25 marks in total)

1. Systolic blood pressure can be detected during a visit to the doctor's office by listening for noise or vibrations in the brachial artery caused by \_\_\_\_\_ blood flow.
  
2. Which one of the following statements is correct?
  - a. Cerebral blood flow in mammals is insensitive to a fall in  $PCO_2$ .
  - b. An increase in the  $PO_2$  of the pulmonary vasculature leads to vasoconstriction in mammals.
  - c. Skeletal muscle exhibits a strong vasoconstrictory response to a fall in blood  $PO_2$ .
  - d. The pulmonary blood flow of birds does not exhibit hypoxic vasoconstriction.
  - e. All of the statements above are correct.
  
3. Blood entering a capillary exerts a pressure of 40 mmHg. If the interstitial fluid pressure is 1 mmHg and the osmotic pressure of the blood exceeds that of the interstitial fluid by 25 mmHg, the net filtration pressure is \_\_\_\_\_ and water will exit OR enter the capillary.
  
4. Label the peaks in the ECG trace below (1.5 marks). Indicate the peak that represents ventricular depolarization (0.5 marks). As indicated by the arrows, the period between two of the peaks in this ECG trace is quite variable. What might be the cause of this variability? (1 mark)



5. Why is ventilation keyed to  $O_2$  in water breathers, but  $CO_2/pH$  in air breathers? (3 marks)

6. On the axes at right, sketch the action potentials that would be observed in a conducting versus a contractile cardiac muscle fibre (2 marks). Explain the functional significance of the differences between these two curves. (2 marks)



7. Sympathetic stimulation of the heart increases OR decreases (**choose one**) heart rate. This effect is mediated by  $\alpha_1$  OR  $\beta_1$  OR  $\beta_2$  (**choose one**) adrenoceptors.

8. What is the Haldane effect? Use a labelled sketch of the CO<sub>2</sub> equilibrium curve to illustrate your answer. (3 marks)
9. An unnamed cyclist used EPO to increase blood O<sub>2</sub> carrying capacity, causing a doubling of blood viscosity. To maintain constant blood flow and blood pressure under these conditions, the arterioles would have to dilate OR constrict by a factor of \_\_\_\_\_.
10. For what vertebrate animal are the solubility and capacitance of the blood for O<sub>2</sub> identical? Explain your answer. (2 marks)
11. \_\_\_\_\_ are located in the carotid sinus and contribute to the regulation of blood pressure, whereas \_\_\_\_\_ are located in the carotid body (in mammals) and contribute to the regulation of ventilation.

**Part B:** Answer the following questions in the exam booklet. (21 marks in total)

1. Sketch on the same set of axes the O<sub>2</sub> equilibrium curves that might be expected for a rainbow trout under control conditions and a rainbow trout following several days of hypoxia (low water PO<sub>2</sub>). Label the axes, and in a sentence or two, explain your sketch. (4 marks)

2. Structure and function are often intimately linked in physiological systems, *i.e.* structures are often uniquely adapted to carry out particular functions, or the function of a particular system is made possible by its structure. Discuss such structure-function relationships with respect to the capillaries, making specific reference to the Fick equation and explaining its relevance. (5 marks)
3. As Betty the blue-fin tuna speeds through the water searching for prey, she ram ventilates  $1.5 \text{ L min}^{-1}$  of air-equilibrated water (atmospheric pressure is 760 Torr). The extraction efficiency of her gills is 60%, allowing an arterial blood  $\text{O}_2$  concentration of  $5 \text{ mmol L}^{-1}$  to be achieved even though venous blood entering the gill has an  $\text{O}_2$  concentration of only  $2 \text{ mmol L}^{-1}$ . Assuming a value of  $2 \text{ } \mu\text{mol L}^{-1} \text{ Torr}^{-1}$  for the solubility of  $\text{O}_2$  in water ( $\alpha_w\text{O}_2$ ), what is Betty's cardiac output? (4 marks)
4. Contrast and compare the cardiorespiratory systems of a bird and a reptile. Use your analysis to explain why the metabolic rate of a bird can be 4-10 times higher than that of a similarly-sized reptile at the same body temperature. (8 marks)

**Bonus:** With today being Valentine's Day, it might interest you to learn that many fish are considered to be aphrodisiacs! For a bonus mark that, in the spirit of socialism will be applied to the entire class if even one person answers correctly, fill in the name of aphrodisiac fish in the following statements...

\_\_\_\_\_ flesh has a deliciously rosy colour, is an excellent source of protein and is loaded with omega 3 fatty acids, thought to elevate serotonin levels in the brain and thereby enhance "mood".

\_\_\_\_\_ can grow to over 3,000 lb but usually average 60 lb. These fish live in saltwater but spawn in freshwater. The lightly salted eggs, or roe, of this fish are highly prized as caviar.

\_\_\_\_\_ is considered both a delicacy and an aphrodisiac in Japan. If the fish tissue is not properly prepared, the tiniest taste is deadly. The flirt with death is said to enhance libido.

\_\_\_\_\_ are bottom-dwelling jawless marine fish that feed on rotting flesh and are considered to be so repulsive that they made a cameo appearance on TV's "Fear Factor". Nevertheless, the so-called "slime eel" has found popularity as an aphrodisiac in Korea.