NROSCI/BIOSC 1070 and MSNBIO 2070
Exam # 2
October 28, 2016

Total POINTS: 100 20% of grade in class

1) An arterial blood sample for a patient at sea level is obtained, and the following physiological values are measured:

pCO_2: 30 mmHg
$HCO3^-$: 22 mEq/L

a) What is the patient's arterial pH? You must show your calculations. ***(4 points)***.

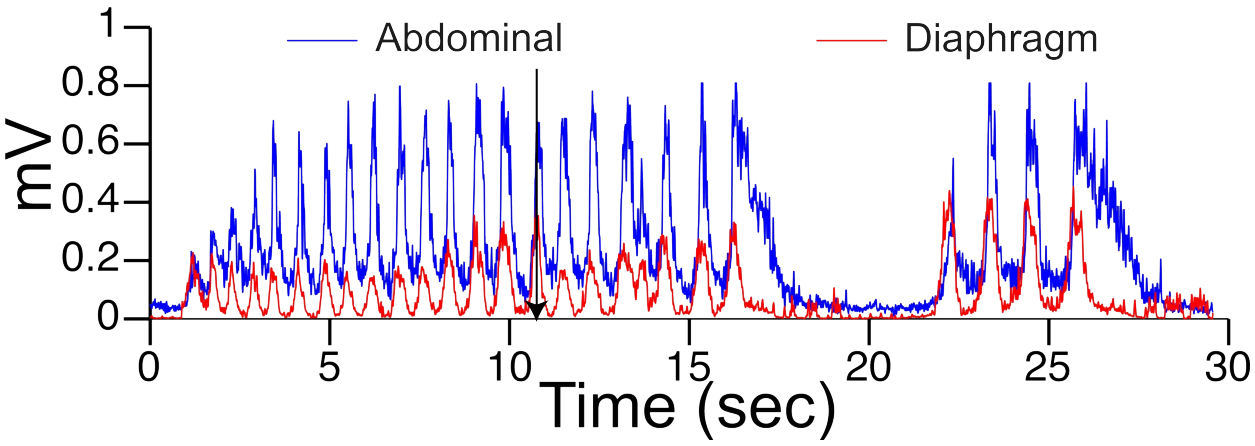
b) Circle below the patient's medical problem, and whether it is compensated or uncompensated. ***(4 points; 2 points for each answer)***.

Metabolic acidosis	Compensated
Metabolic alkalosis	Uncompensated
Respiratory acidosis	
Respiratory alkalosis	

2) To avoid “the bends” a diver must decompress slowly. Briefly describe why a diver who surfaces too quickly after a dive experiences the bends. ***(5 points).***

3) The graph below shows the electrical activity of the diaphragm and abdominal muscles during a particular response.

a) Indicate the response that is occurring, and briefly describe the basis of your answer. ***(2 points)***.



b) At the timepoint indicated by the arrow, is the activity of Inspiratory-Augmenting neurons (I-Aug) in the ventral respiratory group greater or lower than during normal tidal inspiration? Provide a brief explanation for your answer. ***(4 points)***.

c) If the response illustrated above occurs many times in a day, would blood pH be affected? Circle if blood pH is higher (more alkaline), lower (more acidic), or unchanged following multiple repetitions of the response above. ***(2 points)***.

Higher Unchanged Lower

4) An individual has a spinal transection at the T1 spinal level. Would this lesion result in transpulmonary pressure being higher, lower, or the same during maximal inspiration? Provide a brief explanation for your answer. ***(5 points).***

5) You are conducting an experiment on an animal model that entails the electrical stimulation of cranial nerve IX (glossopharyngeal nerve) to activate axons in the nerve. In some cases you find that stimulation causes an increase in blood pressure, and in others stimulation produces a decrease in blood pressure. Why does stimulation of cranial nerve IX produce these diverse responses? ***(8 points).***

6) A drug is injected into a pregnant woman that shifts her oxygen-hemoglobin dissociation curve to the right. This drug does not cross the placenta, and thus does not affect the fetus. Provided that the mother's hemoglobin remains saturated, would this drug impair oxygen delivery to the fetus? Discuss the basis for your answer. ***(8 points).***

7) A diver who is swimming just beneath the water's surface is breathing through a snorkel with a volume of 100 ml. The diver's breathing rate is 15 breaths/min, and each breath takes in 600 ml of air. Barometric pressure is 760 mm Hg, the diver's vital capacity is 4.5 liters, and expiratory reserve volume is 1.2 liters. Determine the following for the diver:

a) Inspiratory reserve volume. ***(2 points).***

b) Total pulmonary ventilation. ***(2 points).***

c) Alveolar ventilation. ***(2 points).***

8) Patients with chronic emphysema combined with chronic obstructive pulmonary disorder (COPD) often die from congestive heart failure. Explain why these diseases of the respiratory system result in congestive heart failure.

Your answer should indicate where blood would accumulate in the circulatory system, and the effect of this blood pooling. ***(10 points).***

9) Discuss the two major factors that contribute to regulating hydrostatic pressure in a capillary. Provide a brief rationale for your answers. ***(10 points).***

10) In the table below, indicate how circulating levels of the following hormones are affected (increase ↑, decrease ↓, no change —) during spaceflight and severe hemorrhage (relative to the typical values at rest in the same individual). ***(1 point per answer; 8 points total).***

Parameter	Spaceflight	Hemorrhage
Atrial natriuretic factor	↑ — ↓	↑ — ↓
Aldosterone	↑ — ↓	↑ — ↓
Angiotensin II	↑ — ↓	↑ — ↓
Vasopressin	↑ — ↓	↑ — ↓

11) During exercise, a number of changes in cardiovascular parameters occur. Briefly discuss the changes in the following parameters that are present during maximal exercise. ***(2 points per answer; 18 points total).***

Parameter	**Change *(if any)* During Exercise**
Stiffness of Large Arteries	
Venoconstriction	
Resistance in Renal Arterioles	
Resistance in Arterioles of Active Muscle	
Systolic Blood Pressure	
Diastolic Blood Pressure	
Mean Blood Pressure	
Total Peripheral Resistance	
Cardiac Output	

12) Some of the most lucrative drugs for drug companies have been phosphodiesterase type-5 inhibitors. Describe the physiological action of phosphodiesterase type-5 inhibitors (which mechanism is altered), and indicate why altering that mechanism provides for a useful medical treatment. ***(6 points).***