



3) 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. **(6 points)**.

4) The chart below shows pH, pCO<sub>2</sub> and HCO<sub>3</sub><sup>-</sup> levels measured from an arterial blood sample. For each example, indicate whether 1) acidosis or alkalosis is present, 2) whether the cause is metabolic or respiratory and 3) whether the condition is compensated or uncompensated. **(18 points)**.

Blood Gases			Acidosis or Alkalosis	Metabolic or Respiratory	Compensated or Uncompensated
HCO <sub>3</sub> <sup>-</sup> (mM)	pCO <sub>2</sub> (mm Hg)	pH			
36	46	7.51			
18.3	40	7.28			
33	60	7.35			

- 5) A patient has Chronic Obstructive Pulmonary Disorder (COPD), but otherwise their lungs are healthy (no change in compliance or alveolar surface area). Assume that the patient is not being treated for the condition. Indicate whether the disorder causes an increase, decrease, or no change in the following: **(2 points each; 10 points total)**

<b>Residual Volume:</b>	Increase	Decrease	No Change
<b>Transpulmonary Pressure:</b>	Increase	Decrease	No Change
<b>Blood Viscosity:</b>	Increase	Decrease	No Change
<b>Vital Capacity:</b>	Increase	Decrease	No Change
<b>Activity of External Intercostal Muscles:</b>	Increase	Decrease	No Change

- 6) A Pittsburgh native who has never before left Allegheny County is transported to La Rinconada, Peru (altitude 16,728 feet above sea level), to work in the gold mine located there. In the chart below, indicate how plasma levels of  $pO_2$ ,  $pCO_2$ , and  $HCO_3^-$  and blood pH change in this individual relative to the levels in Pittsburgh. Indicate the changes measured 10 minutes after arriving in La Rinconada, and those measured 15 days later. **(2 points each; 16 points total).**

<b>Values at 10 minutes after arriving at high altitude (relative to those before leaving Pittsburgh)</b>			
$pO_2$	Lower	Higher	Same
$pCO_2$	Lower	Higher	Same
$pH$	Lower	Higher	Same
$HCO_3^-$	Lower	Higher	Same
<b>Values at 15 days after arriving at high altitude (relative to those at 10 minutes after arriving at high altitude)</b>			
$pO_2$	Lower	Higher	Same
$pCO_2$	Lower	Higher	Same
$pH$	Lower	Higher	Same
$HCO_3^-$	Lower	Higher	Same

- 7) After approving the pain killer Vioxx in 1999, the FDA withdrew the drug from the market in 2004 when it was discovered that it resulted in an increased incidence of stroke and heart attack. It was subsequently determined that Vioxx inhibits the synthesis of prostacyclin. Briefly explain how a prostacyclin inhibitor would increase the likelihood of suffering a stroke or heart attack. **(7 points)**.
- 8) An arterial blood sample from a patient shows an oxygen content of 200 ml O<sub>2</sub>/L. The patient's venous blood content is determined to be 150 ml O<sub>2</sub>/L. The patient has a body surface area of 1.9 m<sup>2</sup>. What is the patient's cardiac output? You must show your calculations. **(7 points)**.

- 9) Dendritic cells participate in the inflammatory response that can lead to arterial hypertension. Briefly discuss the role of dendritic cells in this process. **(6 points)**.
- 10) During inflammatory responses, histamine is released by mast cells. Describe the actions of histamine that result in inflammation. **(6 points)**.

11) Natural killer cells play a particular role in immune responses that is unique to this cell class. Briefly describe the role of natural killer cells in immune function. **(6 points)**.

12) What is complement, and what role does it play in producing immune responses? **(6 points)**.