

PAL Worksheet
Week 7 Problem Set 2

STRESS OF HIGH ALTITUDE AND THE RESPIRATORY SYSTEM

Stress of High Altitude on the Respiratory System

(Modified from: "Cases and Problems - Physiology" – Costanzo – 4th edition. (Lippincott))

Dan celebrated his graduation from college by joining a mountain climbing expedition in the French Alps (Mont Blanc; elevation 15,771 feet above sea level). Dan is in excellent physical condition and passed his pre-trip physical exam with flying colors. The barometric pressure at Mont Blanc is about 380 mmHg.

1) Using your whiteboard, show your calculations for determining the atmospheric PO₂ levels at Mont Blanc:

2) If Dan's **alveolar** PO₂ were to be measured upon arriving at Mont Blanc, how would it compare to his alveolar PO₂ at sea level?

3) If Dan's **systemic arterial** PO₂ were to be measured upon arriving at Mont Blanc, would the value be less than, the same as, or greater than his systemic arterial PO₂ at sea level?

4) Assume that Dan's arterial PO₂ value at Mont Blanc is less than 60mmHg. On your white board draw the sequence of events that lead to the almost immediate change in his ventilation. Please indicate how his ventilation changes and also which receptors are responsible for initiating this change?

- What will happen to Dan's arterial PCO₂ levels on Mt. Blanc, following his change in ventilation?
- On your white board, draw a normal oxygen-hemoglobin dissociation curve and then show how Dan's new blood PCO₂ levels will affect this curve?
- Is this a good thing or bad thing under this circumstance?

5) On Mont Blanc, all the climbers, including Dan, were encouraged to breathe from tanks of 100% O₂. What effect would breathing 100% O₂ have on Dan's arterial PO₂? Please explain:

6) Predict how the following parameters are affected after 2 weeks of acclimatization at Mont Blanc:

* breathing rate: _____

* hematocrit levels: _____

- What is the advantage of this change?

* 2,3, BPG: _____

- Considering the O₂-Hb dissociation curve, what is the benefit of this change in 2,3BPG levels at high altitude?