

Dan Hsieh celebrated his graduation from college by joining a mountain climbing expedition in the French Alps. Dan is in excellent physical condition: he runs 3 to 5 miles daily, and he played intramural soccer, volleyball, and rugby throughout college. At the insistence of his parents, Dan underwent a complete medical examination before the climb, which he passed with flying colors. He was off to the Alps!

Questions

1. Mont Blanc, the highest elevation in the French Alps, is 15,771 feet above sea level. The barometric pressure on Mont Blanc is approximately 420 mm Hg. (The barometric pressure at sea level is 760 mm Hg.) What is the fractional concentration of O_2 (F_{IO_2}) in atmospheric air on Mont Blanc? What is the partial pressure of oxygen (P_{O_2}) of humidified air on Mont Blanc? How does this value of P_{O_2} compare with the P_{O_2} of humidified air at sea level?
2. At his physical examination (performed at sea level), Dan's arterial P_{O_2} (P_{aO_2}) was 100 mm Hg. If Dan's P_{aO_2} had been measured when he arrived on Mont Blanc, it would have been approximately 50 mm Hg. Why would his P_{aO_2} be decreased at the higher elevation? What was Dan's alveolar P_{O_2} (P_{AO_2}) on Mont Blanc?
3. Predict whether each of the following parameters would be increased, decreased, or unchanged on Mont Blanc. Explain why each of the predicted changes would occur.
 - Breathing rate
 - Percent saturation of hemoglobin
 - P_{O_2} at which hemoglobin is 50% saturated (P_{50})
 - Pulmonary artery pressure
4. If Dan's arterial P_{CO_2} (P_{aCO_2}) had been measured on Mont Blanc, would it have been increased, decreased, or unchanged compared with normal? Why? If you predicted a change in P_{aCO_2} , what effect would this change have had on arterial pH? What acid-base disorder would it have caused?
5. The climbers were encouraged to breathe from tanks of 100% O_2 . What is the P_{O_2} of 100% humidified O_2 on Mont Blanc? What effect would breathing 100% O_2 have had on Dan's P_{aO_2} ? What effect would it have had on his breathing rate?
6. The physician suggested that Dan take acetazolamide, a carbonic anhydrase inhibitor, prophylactically. Which of the responses and changes that you predicted in Questions 3 and 4 would have been eliminated or offset if Dan took acetazolamide?