**Length:** 750 words (calculations are not included in the word limit)

**Topic:** Virtual Lab Report

**requirements:**

* A minimum of 5 references. These can include journals, books, reputable websites or videos.

**Life at high altitudes and hemoglobin production**

Physiology is affected by environmental conditions. The consequences of a sudden change in altitude dramatize this fact. At an altitude of 3 km the partial pressure of oxygen is only about 0.14 atm, compared with 0.2 atm at sea level. Flying from San Francisco, which is at sea level, to Mexico City where the elevation is 2.3 km or scaling a 3 km mountain in two days can cause headache, nausea, unusual fatigue and other discomforts. These are all symptoms of hypoxia, a deficiency in the amount of oxygen reaching body tissues. In serious cases the victim may slip into a coma and die if not treated quickly.

The combination of oxygen with hemoglobin (Hb) molecule, which carries oxygen through the blood, is a complex reaction, but for our purposes here it can be represented by a simplified equation:

**Hb *(aq)* + O2 *(g) ↔* HbO2 *(aq)***

Where HbO2 is oxyhemoglobin, the hemoglobin-oxygen complex that actually transports oxygen to tissues.

Explain the connection between O2, Hb and red blood cells. Hb transport protein requires a particular metal ion to effectively transport oxygen around the body. Research which ion this is and state if it is a cation or an anion. Explain why O2 requires the transport protein Hb incorporating Henry’s Law in your explanation. Explain why there is less O2 at higher altitudes.

The above reaction is reversible. State Le-Chatelier’s principle and discuss the effects of the following:

1. In the lung (where there is a high concentration of O2), which direction is the equilibrium favoured?
2. In the tissues (where there is a low concentration of O2), which direction is the equilibrium favoured?
3. In which direction will the equilibrium shift if there is a lower than normal level of hemoglobin in the blood?

Write the equilibrium expression for the above reaction. Calculate the equilibrium constant given the following [O2] = 0.0078 M, [Hb] = 0.005 M and [HbO2] = 0.9 M. Explain what the equilibrium constant tells us about the equilibrium and state if the products, reactants or neither is favoured in your calculation above.