

Exercise

Master's degree in environmental science and engineering

Occupational and environmental health

3.4 Physical agent - Extreme environments

1) Diving to the top

Mr. Grandbleu is diving in a mountain lake located at an altitude of 2400 meters. His equipment is in perfect condition and he dives respecting scrupulously the profile indicated by his usual dive tables. A few minutes after getting out of the water, however, Mr. Granbleu began to feel tingling and joint pain. What happened?

2) Nitrogenation of tissues

The partial pressure of nitrogen in the tissues increases progressively during the dive (according to an exponential relationship). Assuming a constant depth dive, the evolution of the partial pressure of nitrogen in a tissue can be written as:

$$P_{tissus}(t) = P_0 + [P_1 - P_0]e^{-kt}$$

How long do you have to stay in the water for the tissue to be in equilibrium with the pressure of the surrounding environment? We consider here that equilibrium is reached if 90% of the initial pressure gradient is compensated:

3) Another nitrogen story

After filling a Dewar with liquid nitrogen at the nitrogen generator in the basement of the building, a lab technician takes the elevator back up to the lab. The elevator breaks down. Knowing that the volume of the elevator is 3m^3 , the air renewal negligible and that the Dewar loses 3ml of its content per minute (fictive case). What will be the volume content in O_2 of the elevator after 1h ?

*for the record, 1 liter of liquid nitrogen produces ~ 0.7
 m^3 of nitrogen gas (odorless and invisible)*