Question 4.1:

Given data:

Partial pressure of oxygen in alveoli=1.4×10^{-4}M=1.4×10^{-4}mol/L=$1.4\times10^{-4}\times10^{3}$mol/$m^3$=

1.4×10^{-1}mol/ m^3

Partial pressure of oxygen in blood=5.6×10^{-5}M=5.6×10^{-5}mol/L=$5.6\times10^{-5}\times10^{3}$mol/$m^3$=

5.6×10^{-2}mol/ m^3

Thickness of membrane= 20 µm=20×10^{-6}m

D_{O2}=1 µm^2/msec=10^{3-6} m^2/sec=10^{-3} m^2/sec

To find:

Rate of oxygen transport=?

Formula:

Rate of oxygen transport= $\frac{DO2}{\Delta x}$(P_{02}.alveoli-P_{02}.blood)

Calculations:

By putting values:

Rate of oxygen transport= $\frac{10-3\ m2/sec}{20\times10-6m}$(1.4×$10^{-1}$mol/ m3 -5.6×$10^{-2}$mol/ m3)

Rate of oxygen transport=10^{6-3}/20 (0.084mol/m3)=**4.2mol/s per m^2**

Question 4.2:

Given data:

Partial pressure of oxygen in alveoli=1.4×10^{-4}M=1.4×10^{-4}mol/L=$1.4\times10^{-4}\times10^{3}$mol/$m^3$=

1.4×10^{-1}mol/ m^3

Partial pressure of oxygen in blood=5.6×10^{-5}M=5.6×10^{-5}mol/L=$5.6\times10^{-5}\times10^{3}$mol/$m^3$=

5.6×10^{-2}mol/ m^3

Thickness of membrane= 20 µm=20×10^{-6}m

D_{O2}=0.5 μm^2/msec=0.5 ×10$^{3-6}$ m^2/sec=0.5 ×10^{-3} m^2/sec

To find:

Rate of oxygen transport=?

Formula:

Rate of oxygen transport= $\frac{DO2}{\Delta x}$(P_{02}.alveoli-P_{02}.blood)

Calculations:

By putting values:

Rate of oxygen transport= $\frac{0.5\times10-3\ m2/sec}{20\times10-6m}$(1.4×10^{-1}mol/ m3 -5.6×10^{-2}mol/ m3)

Rate of oxygen transport=0.5 ×10$^{6-3}$/20 (0.084mol/m3)=**2.1mol/s per m^2**

Question 4.3

Rate of oxygen transport per square meter through injured lung is 2.1mol/s. Rate of oxygen transport per square meter through healthy lung is 4.2 mol/s. considering both values, it s inferred that rate of oxygen transport is reduced to half in injured tissue.

Question 4.4

Given data:

Partial pressure of oxygen in alveoli=1.4×10^{-4}M=1.4×10^{-4}mol/L=1.4×10^{-4}×10^{3}mol/m^3=

1.4×10^{-1}mol/ m^3

Rate of oxygen transport=4.2 mol/s per m^2

Thickness of membrane= 20 μm=20×10^{-6}m

D_{O2} of half injured lung=0.5×1 μm^2/msec=0.5×10$^{3-6}$ m^2/sec=0.5×10^{-3} m^2/sec

Since D_{O2} is directly proportional to area, quarter injured tissues' D_{O2} value=0.75×10^{-3} m^2/sec

To find:

Partial pressure of oxygen in blood=?

Formula:

Rate of oxygen transport= $\frac{DO2}{\Delta x}$(P_{02}.alveoli-P_{02}.blood)

Calculations:

By putting values:

4.2mol/s/m^2= $\frac{0.75\times 10-3\ m2/sec}{20\times 10-6m}$($1.4\times 10^{-1}$mol/ m^3-P02.blood)

$8.4\times 10^{-5}/0.75\times 10^{-3}$= 1.4×10^{-1}mol/ m^3-P02.blood

0.112= 1.4×10^{-1}mol/ m^3-P02.blood

P_{02}.blood=1.4×10^{-1}-0.112=0.14-0.112=0.028mol/m^3

Value of partial pressure of oxygen in blood should be **0.028mol/m^3=20000mmHg**