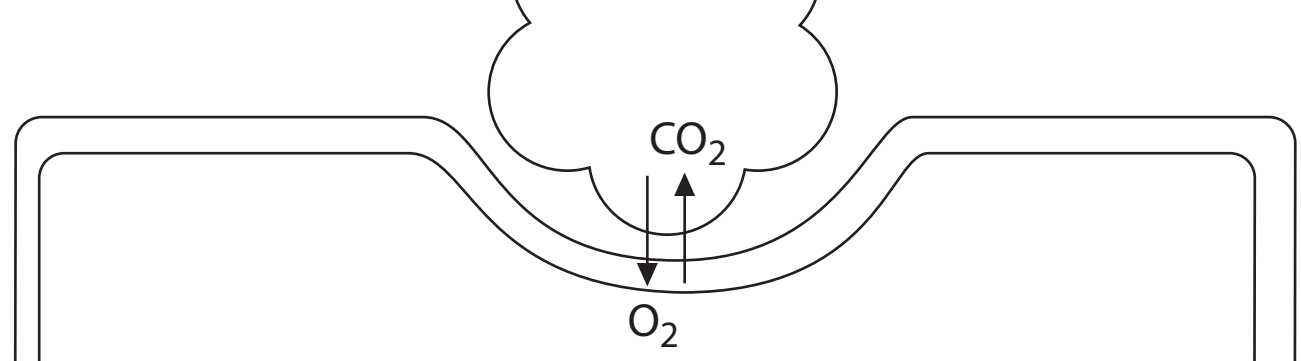


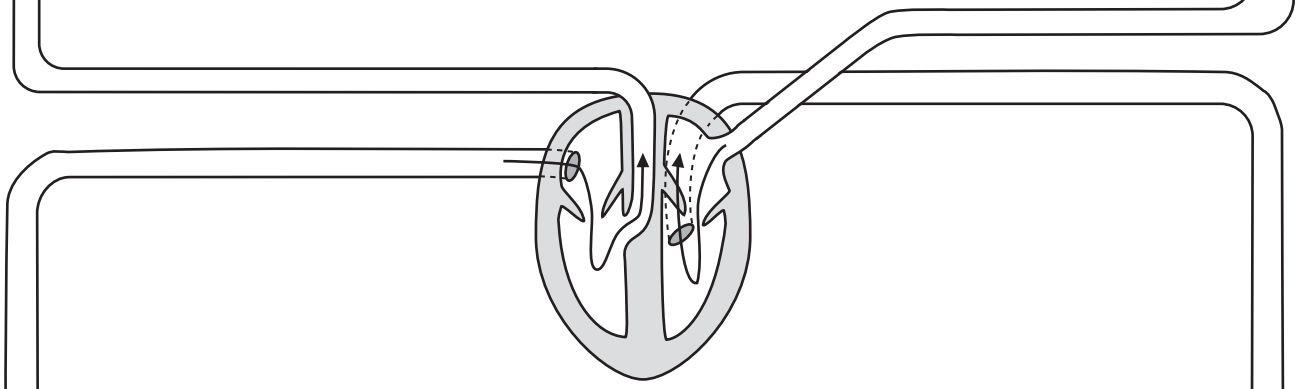
Partial Pressure and Gas Exchange

An Illustrated Guide to

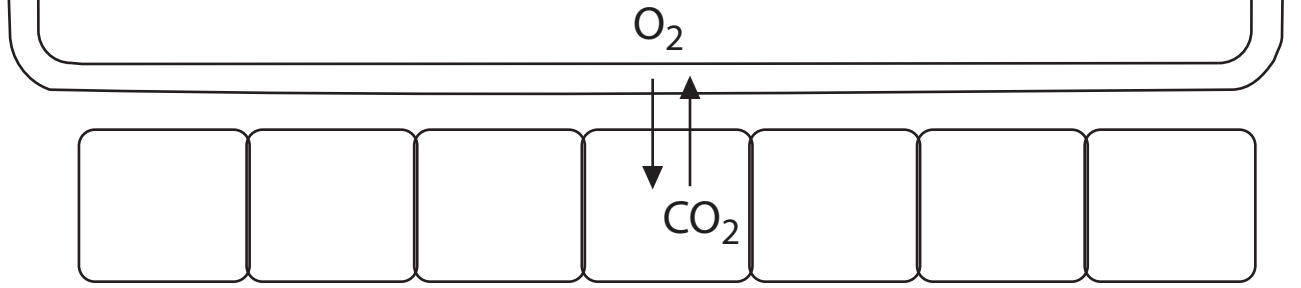
Partial Pressure

and gas exchange during

Internal and External Respiration

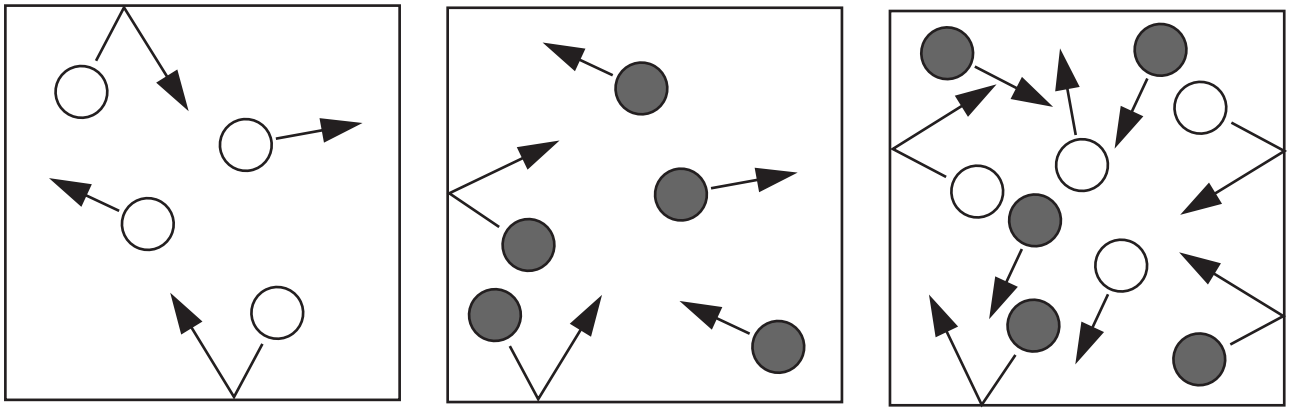


By Noel Ways



Partial Pressure

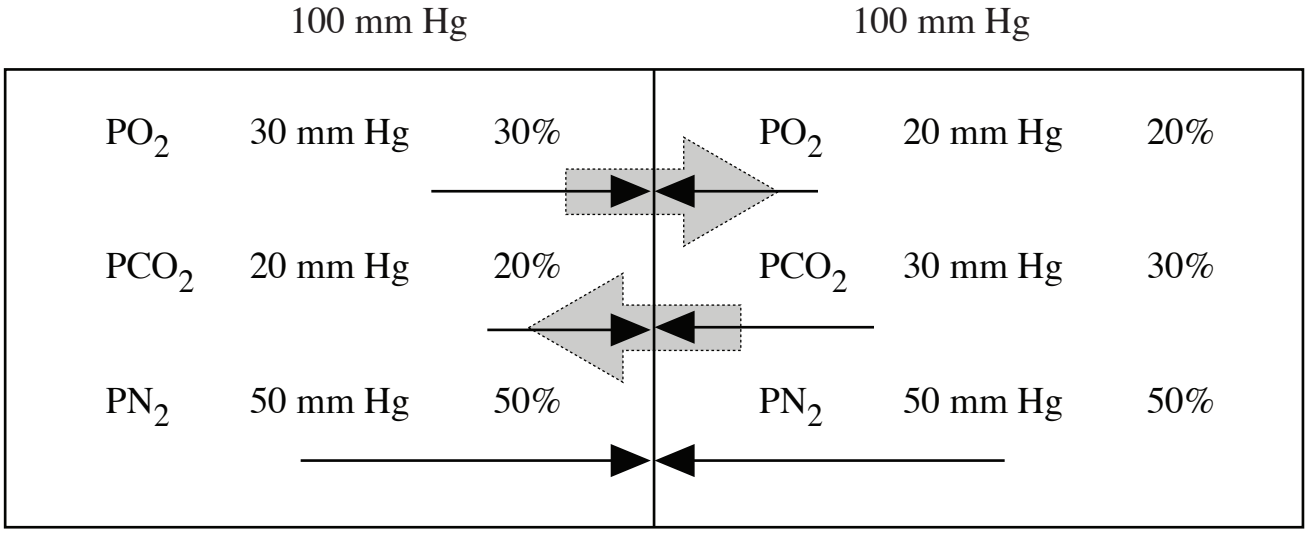
When there is a mixture of gasses, each gas will exert a pressure in direct proportion to its representation in the mixture.



Pressure 4 Pressure 5 Pressure 9

Adapted fromClinical Applications of Blood Gasses, 5th edition
by Shapiro, Peruzzi, and Templin
From Figure 2-1, page 14

Consider this hypothetical model:

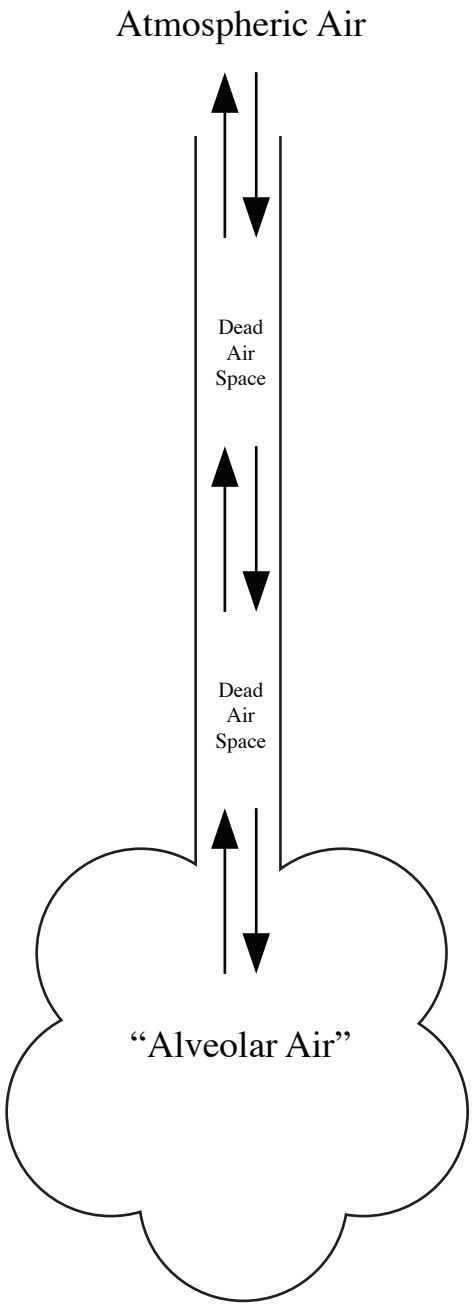


Although the pressure in both containers is identical, 100 mm Hg, each gas will exert a partial pressure in direct proportion to its representation in the mixture. Each gas will move down its pressure gradient until an equilibrium is reached.

Atmospheric Pressures

Atmospheric pressue at sea level is 760 mm Hg.

Gas	*Partial Pressure*	*Percent Distribution In Mixture of Gases*
PO_2 =	159 mm Hg	20.9%
PCO_2 =	0.3 mmHg	0.04 %
PN_2 =	597 mm Hg	78.6 %
PH_2O =	3.7 mm Hg	0.46 %
	760 mm Hg	100 %



Inter-Alveolar Pressures

Gas	*Partial Pressure*	*Percent Distribution In Mixture of Gases*
PO_2 =	104 mm Hg	13.7 %
PCO_2 =	40 mmHg	5.2 %
PN_2 =	569 mm Hg	74.9 %
PH_2O =	47 mm Hg	6.2 %
	760 mm Hg	100 %

Because ventilation does not result in a complete exchange of air due to significant "dead air space" in the conducting portion of the respiratory tree, gas proportions are significantly different between atmospheric air and inter-alveolar air.

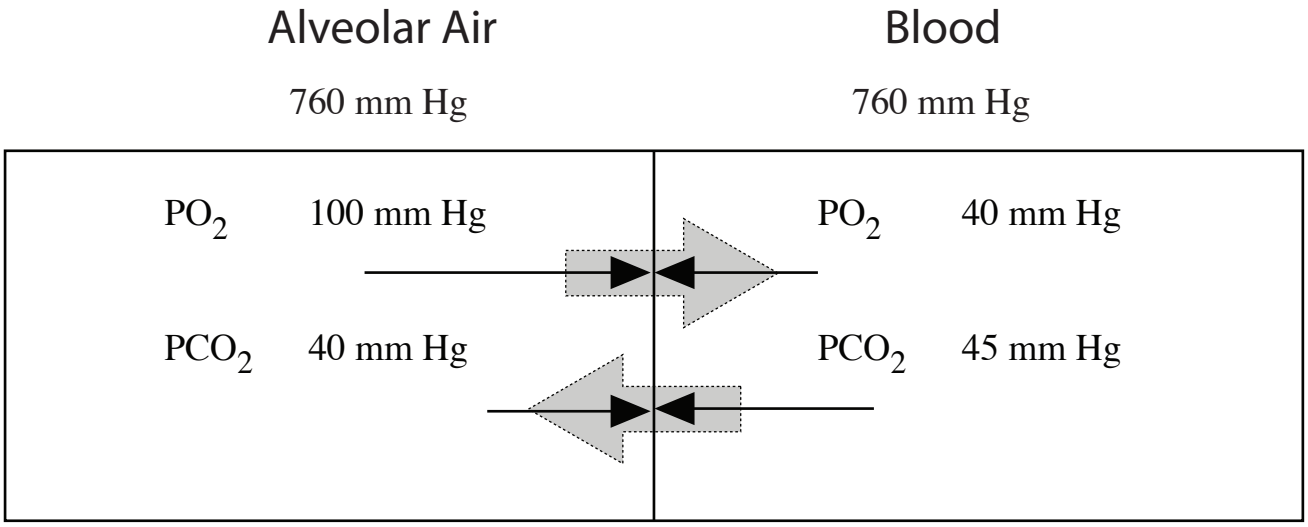
Further, as the air is moisturized within the respiratory system, the percent representation from water vapor increases. The values reflect this increase.

Values from Anatomy and Physiology, 3erd Edition
by Marieb and Hoehn

External Respiration

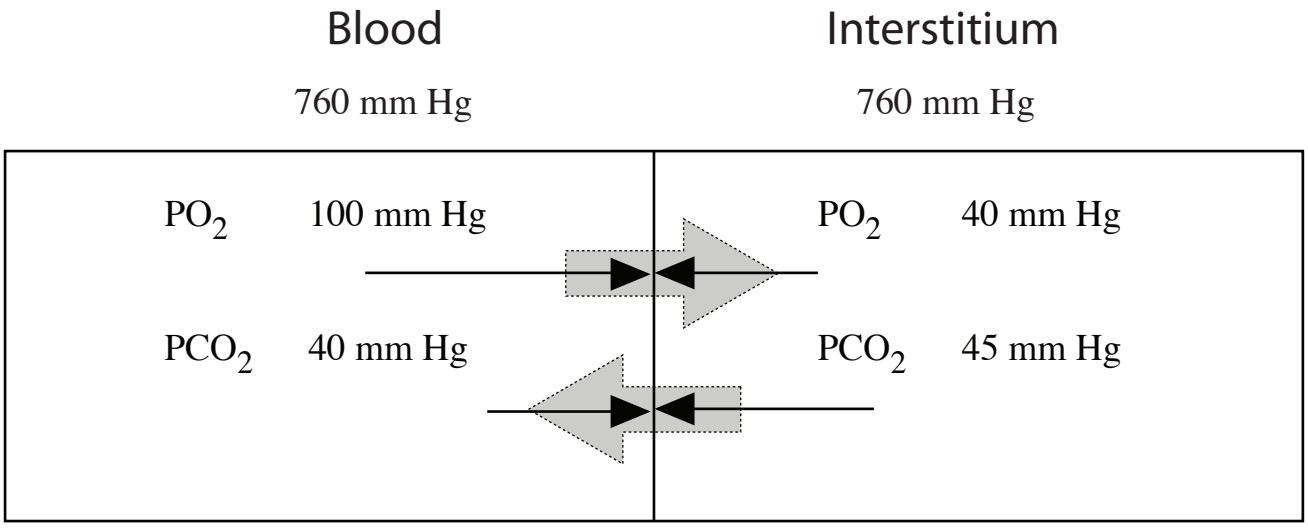
(Between Alveolar Air and Blood)

When considering gas exchange, O_2 and CO_2 are of primary importance, therefore in this illustration and from here on out, other gasses will be ignored.

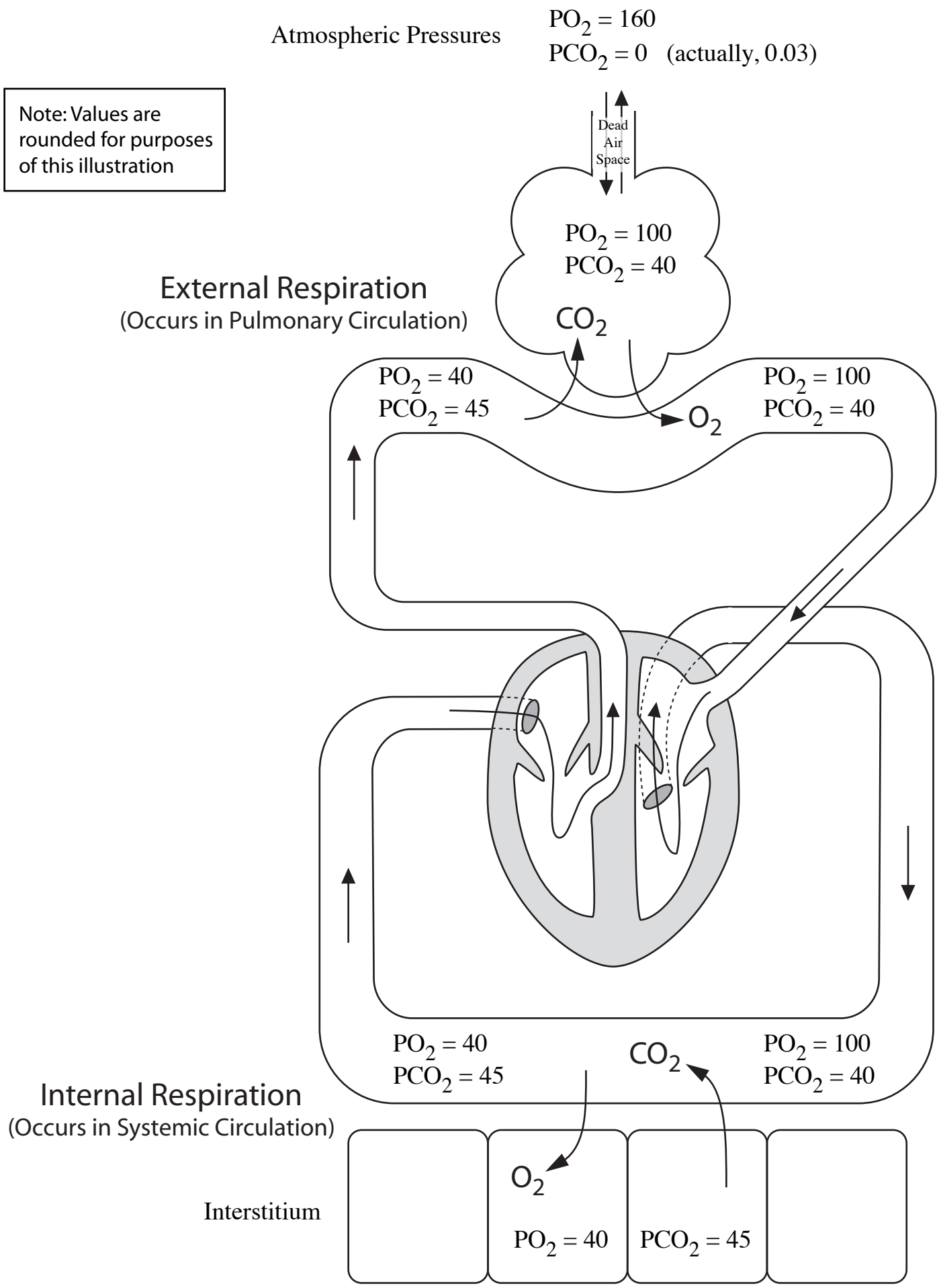


Internal Respiration

(Between Blood and Interstitum)



Although the pressure in all chambers is the same, the gasses move in different directions down their pressure gradients.


Atmospheric Pressures
$PO_2 = 160$
$PCO_2 = 0$ (actually, 0.03)
Note: Values are rounded for purposes of this illustration
Dead Air Space
$PO_2 = 100$
$PCO_2 = 40$
External Respiration
(Occurs in Pulmonary Circulation)
CO_2
$PO_2 = 40$
$PCO_2 = 45$
O_2
$PO_2 = 100$
$PCO_2 = 40$
$PO_2 = 40$
$PCO_2 = 45$
CO_2
$PO_2 = 100$
$PCO_2 = 40$
Internal Respiration
(Occurs in Systemic Circulation)
O_2
Interstitium
$PO_2 = 40$
$PCO_2 = 45$