

CHAPTER 4 — ARTERIAL BLOOD GASES

Normal Blood Gas Parameters

	Arterial		Mixed Venous	
	Normal	Range	Normal	Range
pH (pHa, pHv), units	7.40	7.35-7.45	7.36	7.31-7.41
PCO ₂ (PaCO ₂ , P \bar{V} CO ₂), mmHg	40	35-45	46	41-51
PO ₂ (PaO ₂ , P \bar{V} O ₂), mmHg	100	80-100	40	35-42
O ₂ Sat (SaO ₂ , S \bar{V} O ₂), %	97%	95-100%	75%	68-77%
HCO ₃ ⁻ , mEq/L	24	22-26	24	22-26
Tco ₂	25	23-27	25	23-27
BE, mEq/L	0	± 2	0	± 2
O ₂ content (CaO ₂ , C \bar{V} O ₂) mL/dl	20	15-24	15	12-15

Calculated parameters: (normals) (See Equations, Chapter 11)	
PAO ₂	100mmHg
A-a DO ₂ (PAO ₂ -PaO ₂)	10-25mmHg
a- \bar{v} DO ₂ (PaO ₂ - P \bar{V} O ₂)	60mmHg
Ca- \bar{v} O ₂	4.2-5.0 ml/dl
\dot{V} O ₂ (CO x Ca- \bar{v} O ₂)	200-250 ml/min
DO ₂ (CO x CaO ₂)	750-1000 ml/min

Oxygenation

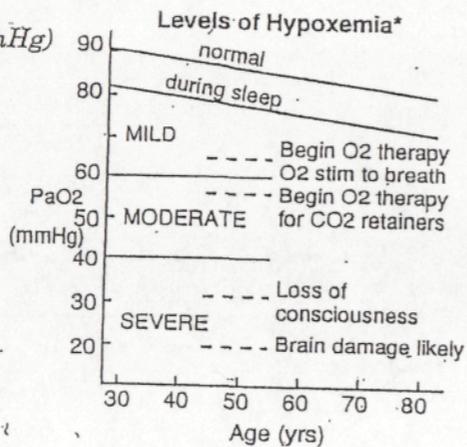
Variations in Normal PaO₂

Age: PaO₂ = 110-1/2 patient's age

Position:

young adult PaO₂ (mmHg)
 sitting 90-100
 supine 85-95
 sleeping 70-85

CO₂ Levels: As CO₂ levels in the alveoli change, they cause an inverse change in PAO₂. While on room air: PAO₂ - 150 - PaCO₂. This relationship can also be used to doublecheck the accuracy of arterial blood gases, i.e., PaO₂ should not be greater than PAO₂.



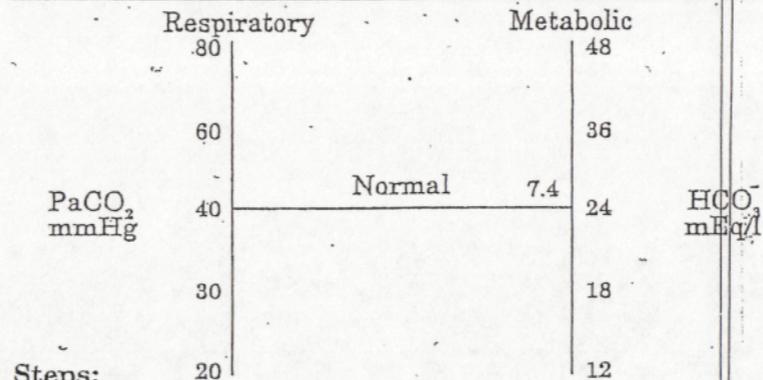
Acid-Base Disorders and Parameter Changes

	pH	PCO ₂	HCO ₃ ⁻	K ⁺	Cl ⁻
Respiratory Acidemia (ventilatory failure)					
acute	↓	↑	N	N	N
chronic	N	↑	↑	NT	↓
Respiratory Alkalemia (alveolar hyper-ventilation)					
acute	↑	↓	N	N	N
chronic	N	↓	↓	↓	↑
Metabolic Acidemia					
acute	↓	N	↓	↑	↑
partly compensated	↓	↓	↓	↑	↑
compensated	N	↓	↓	N	N
Metabolic Alkalemia					
acute	↑	N	↑	↓	↓
partly compensated	↑	↑	↑	↓	↓
compensated	N	↑	↑	N	N

Note: A corrected blood gas disorder is one in which the pH is returned to near normal by altering the component primarily affected.

A compensated blood gas disorder is one in which the pH is returned to normal by altering the component not primarily affected.

Guide to Interpretation of Acid-Base Disorders: The H-Diagram*



Steps:

1. Plot PaCO₂ and HCO₃⁻.
2. Draw a line connecting PaCO₂ and HCO₃⁻.
3. Position of line gives interpretation (see Figures through page 4-9).

Reprinted with permission from Fullagar, L.; Michaels, D., editor. *Diagnostic Procedures: The Patient and Health Care Team*. Copyright 1983 by John Wiley and Sons, Inc.; New York.