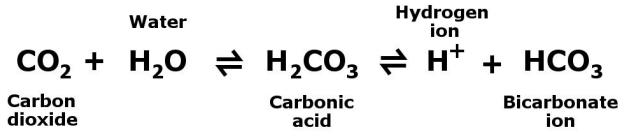

The 5-step process

1. Determine if there is an acidemia or alkalemia
2. Determine if there is a primary respiratory or metabolic process
3. Further investigation
   a. If respiratory disorder present, determine if it's acute or chronic; is there metabolic compensation?
   b. If metabolic disorder present, determine if respiratory compensation is adequate
4. Calculate the anion gap
5. (If anion gap is high) Calculate the corrected bicarbonate (surrogate for delta gap)

The patterns

Primary Disorder	Blood pH	Primary abnormality (aka "what matches")	How can we compensate?
Respiratory Acidosis	↓	↑ pCO2	Retain bicarbonate
Respiratory Alkalosis	↑	↓ pCO2	Excrete bicarbonate
Metabolic Acidosis	↓	↓HCO3-	Hyperventilate – blow off CO2
Metabolic Alkalosis	↑	↑HCO3-	Hypoventilate – retain CO2

Normal Values

Value	Normal Range	Cognitive "normal"
pH	7.35-7.45	7.4
pCO2	35-45mmHg	40
HCO3-	22-26mmol/L	24

Normal Values (continued)

Value	Normal Range
Anion Gap	8-16
Delta Gap	22-26
paO2	80-100mmHg

Primary Respiratory Disorder: Acute or Chronic?

For every 10mmHg change (↑ OR ↓) from "40"	Acute		Chronic	
	Respiratory Acidosis	Respiratory Alkalosis	Respiratory Acidosis	Respiratory Alkalosis
	pH will DECREASE by 0.08	pH will INCREASE by 0.08	pH will DECREASE by 0.03	pH will INCREASE by 0.03

Primary Metabolic Disorder: Resp. Compensation

Expected pCO2	Metabolic Acidosis	Metabolic alkalosis
	1.5 x [HCO3-] +8 (+/- 2)	0.7 x [HCO3-] +20 (+/-5)
	AKA Winter's Formula	(should be b/w 40-55)

Anion gap (AG)

Equation	May need to correct for…
[Na+] – ([Cl-] + [HCO3-])	Hypoalbuminemia
	Hyperglycemia

Corrected Bicarbonate (Delta Gap Surrogate)

Equation	Result	Interpretation
(AG – 12) + [HCO3-]	If > 26	Concomitant metabolic alkalosis
	If < 22	Concomitant non-AG metabolic acidosis

- **Anion Gap Metabolic Acidosis**
  - **M**ethanol
  - **U**remia
  - **D**KA/AKA/SKA
  - **P**araldehyde
  - **I**soniazid
  - **L**actic Acidosis
  - **E**TOH/Ethylene Glycol
  - **S**alicylates
- **Non-AG Metabolic Acidosis**
  - **A**ddison's Disease
  - **B**icarb loss (GI/RTA)
  - **C**hloride
  - **D**rugs (acetazolamide)
- **Metabolic Alkalosis**
  - Vomiting/NG suction
  - Diuretics
- **Respiratory Acidosis**
  - Hypoventilation
  - ↑ CO2 production
- **Respiratory alkalosis**
  - **C**NS disease
  - **H**ypoxia
  - **A**nxiety
  - **M**echanical Vent
  - **P**regnancy
  - **S**alicylates