ACID BASE SHEET

STEP I-GET LABS
Blood Gas (Art or Venous), Lactate, Albumin, Beta-HydroxyButyrate, Chemistry Panel

STEP II-LOOK AT PH
If >7.45 then patient’s primary problem is **alkalosis**
If <7.35 then patient’s primary problem is **acidosis**

STEP III-LOOK AT BLOOD GAS CO2
If >45 then **respiratory acidosis**
If <35 then **respiratory alkalosis**

STEP IV-CALCULATE THE STRONG ION DIFFERENCE (SID)

SID=Na - Cl

**LOW SID IF <38**
This is a metabolic acidosis (Low SID acidosis); causes include:
- **Fluid Administration**: Any fluid that has an SID of <24 (or pt's current SID) can cause acidosis (i.e. NS, ½ NS, D5W, water)
- 2 liters of NS in <24 hours is enough to cause acidosis.
- **Renal Tubular Acidosis**: Calculate Urine Anion Gap (Urine Na + K – Cl); if negative, not an RTA, consider other causes
- Type I-Urine pH > 5.55 (auto-immune, sicklers, cirrhosis, idiopathic)
- Type II-Urine pH < 5.55 (think myeloma, Wilson’s, Vit D deficiency, heavy metals)
- Type IV-Hyperkalemic, Urine pH < 5.55; (aldosterone deficiency, diabetes)
- **Diarrhea**

**HIGH SID IF >38**
This is metabolic alkalosis (High SID alkalosis); causes include:
- Nasogastric Suction, Diuretics, hyperaldosteronism, volume depletion

STEP V-LOOK AT THE LACTATE

If >2 then the patient has hyperlactatemia
If >4 and the patient has an infection, **start severe sepsis treatment**
If patient not infected, consider any other shock state, seizures, dead gut, hepatic failure, malignancies or just from hyperlactetemic state such as exercise or the use of b-agonists, or
- **Toxicologic causes** of elevated lactate include Cyanide, Carbon Monoxide, Metformin, Didanosine, Stavudine, Zidovudine, Linezolid, Strychnine, Emtriva, Rotenone (Fish Poison), NaAzide (Lab Workers), Apap (if Liver Fx), Phosphine (rodenticide), NaMonofluoroacetate (Coyote Poison-Give Etoh as antidote), INh (if patient seizes), Hemlock, Depakote, Hydrogen Sulfide, Nitroprusside (If cyanide toxic), Ricin & Castor Beans, Propofol, Linezolid, Sympathomimetics (Cocaine, Methamphetamine), Jequity peas (Abrus precatorius), Prunus Amygdalus Plants as well as Crab Tree Apple Seeds & Cassava (yucca).

Most of the toxins under SIG acidoses will also cause elevated lactate.
Rare causes: pyroglutamic acidemia (from taking tylenol in combination with severe sepsis, renal fx, or hepatic fx); Shoshin beri beri (from severe thiamine deficiency).

STEP VI - CALCULATE THE STRONG ION GAP (SIG)

\[ \text{SIG} = (\text{Base Deficit}) + (\text{SID} - 38) + 2.5 (4.2 - \text{Albumin (g/dL)}) - \text{Lactate} \]
This can also be thought of as the corrected base deficit, or put a minus sign in front and it is the corrected base excess

IF SIG>2, THIS IS A SIG METABOLIC ACIDOSIS

Uremia, DKA, AKA, (Note: Beta-Hydroxybutyrate [BHB] can be subtracted directly from the SIG, Acetoacetate is still unquantified)
Tox-ASA, ethylene glycol, methanol, propylene glycol (ativan, valium, dilantin infusions), iron, INH, & paraldehyde.
D-Lactic Acidosis from short gut/blind loop & propylene glycol. Will not show on lactate assay

NEGATIVE SIG
Hypercalcemia, Hypermagnesemia, Hyperkalemia, Immunoglobulins, Bromide, Nitrates, Lithium
Overdose

STEP VII - THINK ABOUT COMPENSATIONS

If primary is respiratory and you feel it is chronic, you can calculate the expected metabolic compensation.

Expected \( \Delta \text{BE} \) (or expected decrease of SID) = 0.4 x (Chronic Change in CO2)

If the primary problem is metabolic acidosis
Expected \( \downarrow \text{CO2} = \text{Base Deficit} \)

If the primary problem is metabolic alkalosis
Expected \( \uparrow \text{CO2} = 0.6 \times \text{Base Excess} \)

Old school formula may be useful for figuring out to correct PaCO2 in a COPD Patient
0.08 decrease in pH = for every 10 mmHg increase in PaCO2 acutely

STEP VIII - OSMOLAR GAP

If elevated SIG without explanation, get osmolar gap
Osm Gap = Measured Osmal – (2 Na + Gluc/18 + BUN/2.8 + ETOH/3.7)
Positive if osm gap >10
Causes: Methanol, Ethylene glycol, mannitol, isopropanol (isopropyl alcohol), propylene glycol, lithium
If Osm Gap is >50, almost certainly toxic alcohol induced

Notes:
If no BD is available, 24.2 – serum bicarb can be used as a poor man’s substitute
The more complex but correct formula for SID is \((Na + K + \text{Ionized Mg} + ICaI – Cl)\). If this formula is used, then normal should be considered 42. In clinical practice, if the patient is not hyperkalemic, this more complex formula is not necessary.