Acid-Base Disorders Worksheet

Adapted from Joshua Steinberg MD

Step #1: Gather the necessary data (Na^+, Cl^-, $HCO3^-$, pH, pCO_2)
Preferably, all obtained from the same blood sample.

Step #2: Look at the pH.
If pH >7.4 → the patient has a primary alkalosis → proceed to Step 3a
If pH < 7.4 → the patient has a primary acidosis → proceed to Step 3b

Patient has primary:
acidosis | alkalosis

Step #3: Look at the pCO_2.
3a: If pCO_2 is >40 → patient's alkalosis is metabolic;
If pCO_2 is <40 → patient's alkalosis is respiratory
3b: If pCO_2 is >40 → patient's acidosis is respiratory;
If pCO_2 is <40 → patient's acidosis is metabolic

Primary process is:
respiratory | metabolic

Step #4: Look for disorders revealed by failure of compensation.
- If 1^o process is metabolic alkalosis → pCO_2 should be >40 but <55*
  * There are several metabolic alkalosis PCO_2 prediction formulas, but fraught with clinical inaccuracy/unreliability
- If 1^o process is metabolic acidosis → calc. predicted $pCO_2 = (1.5 \times HCO_3) + 8 +/- 2$
  In either case above:
  - If actual pCO2 is too high → there is additional respiratory acidosis
  - If actual pCO2 is too low → there is additional respiratory alkalosis
- If 1^o process is respiratory → skip to steps 5 & 6 (where further metabolic disorders revealed)

Additional disorder:
resp. acidosis | resp. alkalosis
-or-
no additional disorder

Step #5: Check if the patient has a significant anion gap (>12-18). (AG = Na-Cl-HCO_3)
If AG is significantly elevated → the patient has an anion gap metabolic acidosis in addition to (or in confirmation of) whatever Steps 2 through 4 yielded

Patient
has | does not have:
AG met. acidosis

Step #6: Calculate the corrected bicarb. (Pt's gap – 12 + pt's serum bicarb)
In addition to whatever disorders Steps 1 through 5 yielded,
- If corrected bicarb >30 → the patient has an underlying metabolic *alkalosis*;
- If corrected bicarb <23 → the patient has an underlying non-AG metabolic *acidosis*

Patient has underlying metabolic:
non-AG acidosis | alkalosis

Step #7: Make the diagnosis(es) using the differentials below and knowledge of the patient

Anion Gap Metabolic Acidosis	Non-Anion Gap Metabolic Acidosis	Acute Respiratory Acidosis	Metabolic Alkalosis	Respiratory Alkalosis
"MUDPILERS"	**"HARDUPS"**	*anything that causes*	**"CLEVER PD"**	*anything that causes*
Methanol	**H**yperalimentation	*hypoventilation, i.e.:*	**C**ontraction	*hyperventilation, i.e.:*
Uremia	**A**cetazolamide	CNS depression (drugs/CVA)	**L**icorice*	**C**NS disease
DKA/Alcoholic KA	**R**enal tubular acidosis	Airway obstruction	**E**ndo: Conn's/Cushing's/	**H**ypoxia
Paradehyde	**D**iarrhea	Pneumonia	Bartter's)*	**A**nxiety
Isoniazid	**U**retero-Pelvic shunt	Pulmonary edema	**V**omiting, NG suction	**M**echanical ventilators
Lactic acidosis	**P**ost-hypocapnia	Hemo/Pneumothorax	**E**xcess alkali*	**P**rogesterone
EtOH/**E**thylene glycol	**S**pironolactone	Myopathy	**R**efeeding alkalosis*	**S**alicylates/**S**epsis
Rhabdo/**R**enal failure			**P**ost-hypercapnia	
Salicylates		*(**Chronic** respiratory acidosis*	**D**iuretics*	
		is caused by COPD and		
		restrictive lung disease)	*assoc w/high urine Cl levels	

Step #8: Fix it!