Acid-Base Rules

pH ~ HCO3/pCO2

1. Do the numbers make sense?
    a. Gather the necessary data (pH, pCO2, HCO3) and check internal consistency
    b. HCO3 from the electrolyte panel and from ABG should be within 2, otherwise uninterpretable
    c. {H+} = 24 x pCO2/HCO3: {H+} ~ 80 – last 2 digits of pH
2. Is the patient acidemic or alkalemic?
    a. Determine if blood pH (pH < 7.38 is acidemic, pH > 7.42 is alkalemic)
3. What is the primary disturbance (metabolic or respiratory)?
    a. Measure arterial carbon dioxide tension (PaCO2) and serum bicarbonate level
4. Is the compensation appropriate for the primary disturbance?
    a. Calculate the degree of compensation
    b. Metabolic acidosis: ∆pCO2 = 1.0 to 1.4 x ∆HCO3 **(1.2)**
    c. Metabolic alkalosis: ∆pCO2 = 0.5 to 1.0 x ∆HCO3 **(0.7)**
        i. But pCO2 not < 55 mmHg; no hypoxia
    d. Respiratory Acidosis (Up 1,3)
        i. Acute: ∆ HCO3 = 1 mEq/L ↑/10 mmHg ↑ pCO2
        ii. Chronic: ∆ HCO3 = 3 mEq/L ↑/10 mmHg ↑ pCO2
    e. Respiratory Alkalosis (Down 2.4)
        i. Acute: ∆ HCO3 = 2 mEq/L ↓/10 mmHg ↓ pCO2
        ii. Chronic: ∆ HCO3 = 4 mEq/L ↓/10 mmHg ↓ pCO2
5. What is the anion gap?
    a. Measure serum sodium, chloride, and bicarbonate levels to assess the size of the anion gap (remember correction factor for hypoalbuminemia)
    b. Normal = 10 ±2
    c. AG = Na+ - (Cl- + HCO3)
    d. Remember: Anion gap goes ↓ 2.75 mEq/L for every ↓ in albumin of 1 gm/dL
    e. Urine AG = Urine (Na + K – Cl)
6. If the anion gap is elevated, is the bicarbonate appropriate for the anion gap?
    a. Determine the corrected bicarbonate level and compare with the measured bicarbonate level
    b. Exception: primary respiratory acidosis or respiratory alkalosis
    c. Potential Bicarb = ∆ AG + HCO3
    d. Winter's formula: expected pCO2 = 1.5 (HCO3) + 8 ± 2
        i. (Determine expected pCO2 to check if adequate compensation for pure metabolic acidosis)
7. If anion gap is elevated, calculate the osmolar gap
    a. OG = measured plasma osm – calculated plasma osm
    b. Normal OG = 5 – 10
        i. To recognize the presence of unmeasured substanced like ethylene glycol or another alcohol)
        ii. Calculated plasma osm = 2 Na + glucose/18 + BUN/2.8 + EtOH%/2.4