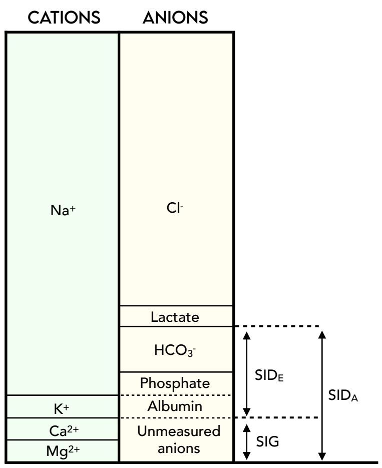
LAST UPDATED: 01/27/24

PLASMA OSMOLALITY

$$P_{OSM} = (2 \times Na) + (Glucose \div 18) + (BUN \div 2.8)$$

P_{OSM} = Plasma osmolality
Na = serum sodium concentration
BUN = blood urea nitrogen concentration



Normal SID_A = 40-45 mEq/L

Principle of electroneutrality → assumption there are unmeasured anions in serum (SID_E), primarily HCO_3^-, Phosphate, and Albumin

Cations are constituents of basic compounds (eg, NaOH, KOH)
↑ cations (or ↓ anions) → ↑ SID_A → alkalosis

Anions are constituents of acidic compounds (eg, HCl, lactic acid)
↑ anions (or ↓ cations) → ↓ SID_A → acidosis

STRONG ION DIFFERENCE APPARENT (SID_A)

$$SID_A = (Na^+ + K^+ + Ca^{2+} + Mg^{2+}) - (Cl^- + lactate^-)$$

STRONG ION DIFFERENCE EFFECTIVE (SID_E)

$$SID_E = HCO_3^+ + Phosphate + Albumin$$

STRONG ION GAP

$$SIG = SID_A - SID_E$$

SID_A = difference between abundant cations and abundant anions in serum
SID_E= measure of remaining anions

ACUTE KIDNEY INJURY

Finding	Prerenal	Intrinsic	Postrenal
BUN:Cr	>20	<15	>15
FENa (%)	<1%	>2%	>4%
UNa (mEq/L)	<10	>20	>40
UOsm (mOsm/kg)	>500	<350	<350

BUN:Cr = BUN:Creatinine ratio
FENa = Fractional excretion of sodium
UNa = Urine sodium
UOsm = Urine osmolality

APPROPRIATE ACID-BASE COMPENSATION

Metabolic Acidosis	$P_aCO_2 = 1.5 \times HCO_3^- + 8 \pm 2$
Metabolic Alkalosis	↑ $P_aCO_2 = 0.7 \times \Delta HCO_3^-$
Respiratory Acidosis (acute)	↑ $HCO_3^- = 0.1 \times \Delta P_aCO_2$
Respiratory Alkalosis (acute)	↓ $HCO_3^- = 0.2 \times \Delta P_aCO_2$
Respiratory Acidosis (chronic)	↑ $HCO_3^- = 0.3 \times \Delta P_aCO_2$
Respiratory Alkalosis (chronic)	↓ $HCO_3^- = 0.4 \times \Delta P_aCO_2$

P_aCO_2 = partial pressure of CO_2 in arterial blood
HCO_3^- = Bicarbonate
ΔHCO_3^- = change in bicarbonate (baseline - current)
ΔP_aCO_2 = change in CO_2 (baseline - current)

Baseline P_aCO_2 = 40 mmHg
Baseline HCO_3 = 24 mEq/L

ANION GAP

$$= (Na^+ + K^+) - (HCO_3^- + Cl^-)$$

Normal AG = 8-12 mEq/L

ANION GAP (CORRECTED)

$$= AG + 0.25 \times (4.5 - Albumin)$$

HCO_3 DEFICIT

$$= 0.2 \times Base\ Deficit \times Weight\ (kg)$$

HCO_3^- Deficit = Amount of HCO_3^- needed to correct metabolic acidosis

BODY FLUID COMPARTMENTS

Total Body Water 20-40-60 Rule:

- Water (60%)
  - Intracellular (40%)
  - Extracellular (20%)
    - Interstitial (15%)
    - Intravascular (5%)

Age	Total Body Water (%)
Neonate	80
< 1 year	70
< 12 years	65
Men ♂	60
Women ♀	50
Elderly	45

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