# ACID-B

concentration)

- Small changes of pH from normal can produce marked changes in enzyme activity & chemical reactions within the body
- Acidosis - CNS depression, coma (if severely acidotic, i.e., pH <7.0)
- Alkalosis - CNS excitability, tetany, seizures

$$pH = pK_a + \log\left(\frac{HCO_3}{PCO_2 \times 0.03}\right)$$

- The value of $pK_a$ is 6.1, and the normal $HCO_3$ and $PCO_2$ are 24 mmol/L and 40 mmHg respectively. Substitute these,

$$pH = 6.1 + \log\left(\frac{24}{40 \times 0.03}\right)$$

$$= 6.1 + \log 20$$

$$= 6.1 + 1.3$$

$$= 7.4$$

## Regulation of pH

- Buffer systems - very rapid (seconds), incomplete
- Respiratory responses -

- Commonly, the AG remains normal in an acidosis that is due to simple $HCO_3^-$ loss (as in diarrhea and certain renal diseases) because, as a general principle, $[Cl^-]$ increases to meet the drop in $HCO_3^-$ anions, thereby maintaining anionic balance.
- When an acid load is present, $HCO_3^-$ titrates acid and anion gap increases, creating a condition known as 'anion gap metabolic acidosis'.

## Major Acid Base Disorders and Compensatory Mechanism

| Primary Disorder | Primary Disturbance | Primary Compensation |
|---|---|---|
| Respiratory Acidosis | 9 $PCO_2$ | 9 $HCO_3^-$ |
| Respiratory Alkalosis | ; $PCO_2$ | ; + & $HCO_3^-$ 2 |
| Metabolic Acidosis | ; $HCO_3^-$ | ; $PCO_2$ (hyperventilation) |
| Metabolic Alkalosis | 9 $HCO_3^-$ | 9 $PCO_2$ (hypoventilation) |

- The primary compensation (acute compensation) is generally achieved most rapidly through respiratory control of $CO_2$
- Ultimately the renal system excretes acid or bicarbonate (chronic compensation) to reach the final response to the disturbance
- Mixed disorders are common

## Blood Gas Evaluation

### What do we get from a blood gas machine?

- pH - measured
- $PCO_2$ - measured
- $PO_2$ - measured
- $HCO_3^-$ - calculated (via Henderson Hesselbalch equation)
- Base excess (deficit) - calculated
- Hemoglobin oxygen saturation - calculated
- Gases (carbon dioxide & oxygen) are reported as partial pressures, commonly in unit of mmHg (US), or KPa (International); 1 KPa = 7.5 mmHg (torr)

### Blood Gas Sampling

- Arterial vs. venous
- Venous samples are

## Sites for Arterial Samples

- Dog: dorso pedal, femoral, anterior tibial, lingual
- Cat: femoral, dorso pedal
- Horse: facial, mandibular, lateral metatarsal, posterior auricular, carotid
- Cow: coccygeal, posterior auricular
- Pig: coccygeal, posterior auricular

# Normal Values

| | Arterial | Venous |
|---|---|---|
| pH | 7.35-7.45 | 7.35 |
| $PCO_2$ | 35-45 mmHg | 45 mmHg |
| $PO_2$ | 90-100 mmHg | 40 mmHg |
| $HCO_3^-$ | | |

Acid Base