

Acid Base Balance and Imbalance

Q.1. What is an acid?

An acid is defined as a substance, ion, molecule or particle that yields H^+ ions (Protons) in solution.

Q.2. What is a base?

A base is defined as a substance, ion, molecule or particle that combines with H^+ ions (Protons).

Q.3. What is a strong acid? Give an example of a strong acid.

A strong acid dissociates extensively to produce large numbers of protons (H^+).

Example: Hydrochloric acid

Q.4. What is a weak acid? Give an example of a weak acid.

A weak acid dissociates less to produce smaller numbers of H^+ (Protons).

Example: Acetic acid

Q.5. What is meant by conjugate acid base pairs? Explain.

- The stronger the acid, the weaker is the base which results from its dissociation. Such pairs have been termed conjugate base pairs.
- HCl is a strong acid by virtue of its extensive dissociation into H^+ and Cl^- . Cl^- is an extremely weak base because it has very little capacity for combining with H^+ ions.



Q.6. What is a buffer?

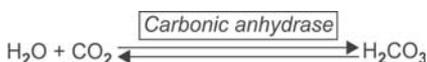
For answer refer to answer of Q 11, Chapter 21, p-407.

Q.36. Name at least three clinical conditions where paradoxical aciduria can occur due to K deficiency.

- Patients treated for prolonged periods with corticosteroids.
- In persons with hypercorticism. (Cushing's syndrome).
- In post-operative patients with K-free fluids, in whom depletion may occur due to continued loss in urine and G.I. fluids.

Q.37. What is carbonic anhydrase? What is its function?

- Carbonic anhydrase is a Zn-containing metalloenzyme.
- It catalyzes the formation of H_2CO_3 (carbonic acid) from H_2O and CO_2 . It is a reversible reaction.



Q.38. State some sites in the body where carbonic anhydrase is found.

In most of the tissues where it catalyzes formation of H_2CO_3 from H_2O and metabolic CO_2 . Specially the enzyme is found in:

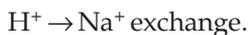
- Red blood cells (Not in plasma).
- In parietal cells of stomach, involved in secretion of HCl.
- In renal tubular epithelial cells, involved in $\text{H}^+ \rightarrow \text{Na}^+$ exchange. Recently, also demonstrated in small quantities in:
 - Muscle tissue; pancreas and
 - spermatozoa.

Q.39. Name one drug of clinical importance which inhibits the enzyme carbonic anhydrase.

Acetazolamide (Diamox), a common diuretic used in edema due to congestive heart failure and in hypertensive heart disease.

Q.40. Why urine becomes alkaline in diamox therapy?

- Diamox inhibits the enzyme carbonic anhydrase.
- Increased amount of NaHCO_3 excreted in urine due to less



- There is also reduction in titratable acidity \downarrow NH_3 formation \downarrow and an increase in K^+ excretion \uparrow from distal tubular epithelial cells.

Q.81. What is meant by the term “anion gap”?

The “anion gap” is a mathematical approximation of the difference between anions and cations that are routinely measured in serum.

Q.82. What is the normal value of anion gap?

- If the Cl^- and the total CO_2 concentrations are summed up and subtracted from the total of Na^+ and K^+ concentrations, the difference should be less than <17 mEq/L (mmol/L)

Q.83. If the anion gap exceeds 17 mmol/L, what does it indicate?

This usually, indicates significantly increased concentrations of unmeasured anions viz PO_4^- , SO_4^- , proteins and organic acids.

Q.84. Mention some conditions where anion gap can exceed 17 mmol/L.

- Uremia with retention of fixed acids.
- Ketotic states, e.g. diabetes mellitus, alcoholism, starvation
- Lactic acidosis, e.g. shock and hemorrhage.
- Toxins ingestion, e.g. methanol, salicylates, ethylene glycol.
- Increased plasma proteins, e.g. in dehydration

Q.85. If the anion gap is less than <10 mmol/L, what does it signify?

Decreased anion gap less than 10 mmol/L can result from either:

- An increased in the unmeasured cation viz Ca^{++} , Mg^{++} .
- A decrease in unmeasured anions viz. PO_4^- , SO_4^- , proteins and organic acids.

Q.86. Mention some conditions in which an increase in unmeasured cations can occur.

- Hyper magnesemia
- Lithium intoxication
- Multiple myeloma
- Polyclonal gammopathy
- Polymyxin B therapy-juice the drug is polycationic.