Acid Base Pathology

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	CO_2	H^+ + HCO2
Respiratory Acidosis	↑	↑
Respiratory Alkalosis	↓	↓
Metabolic Acidosis	40	↑ ↓↓
Metabolic Alkalosis		↓ ↑↑

Respiratory Acidosis

- Caused by a decrease in alveolar ventilation → increase $PaCO_2$
- Result: decrease in pH, slight increase in HCO_3^-
- Causes:
  - ✓ Respiratory depression
  - ✓ COPD
  - ✓ Restrictive lung diseases
  - ✓ Airways obstruction
  - ✓ Pulmonary edema, cardiac arrest
  - ✓ Neuromuscular

Respiratory Alkalosis

- Caused by an increase in alveolar ventilation relative to body CO_2 → decrease in $PaCO_2$
- Result: decrease in H+ (increase pH)
- Causes:
  - ✓ Anxiety
  - ✓ Hypoxemia
  - ✓ Pneumothorax
  - ✓ Ventilation-perfusion inequality
  - ✓ Hypotension
  - ✓ High altitude

Metabolic Acidosis

- Caused by gain in H^+ as fixed acid (or Loss of HCO_3^-)
- Results: decrease in pH and HCO_3^-
- Causes:
  1. Increase acid production
  2. Bicarbonate loss: (RTA type II, diarrhea)
  3. Decreased ability of the nephron to excrete fixed acid (RTA type I)

Metabolic Alkalosis

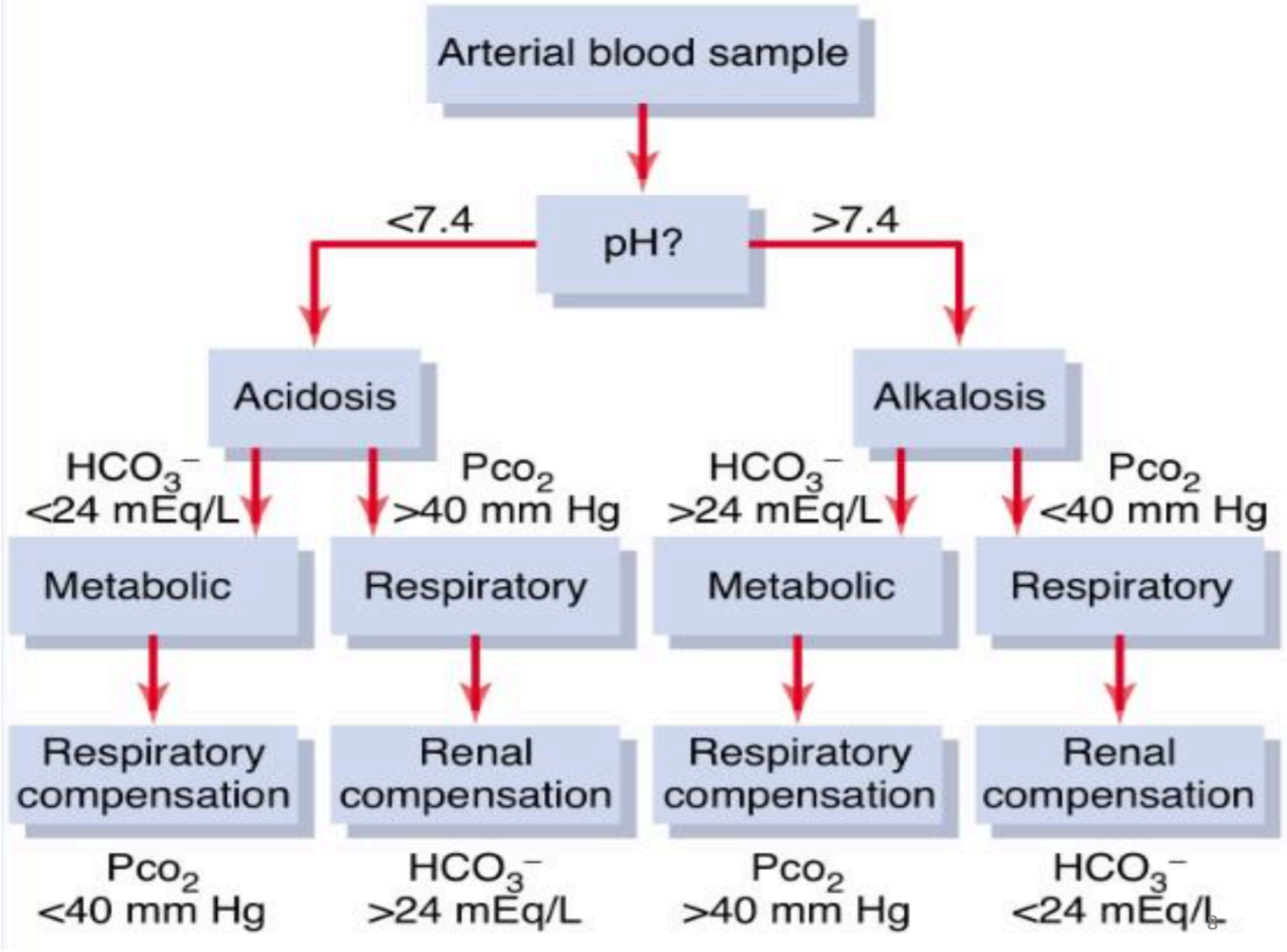
- Caused by a loss of H^+ as fixed acid (or gain in HCO_3^-)
- Result:increaseinpHandHCO3-
- Causes:
  - ✓ Vomiting
  - ✓ Loop and thiazides
  - ✓ Barter and Gitelman syndromes
  - ✓ Intracellular shift of H^+
  - ✓ Primary hyperaldosteronism

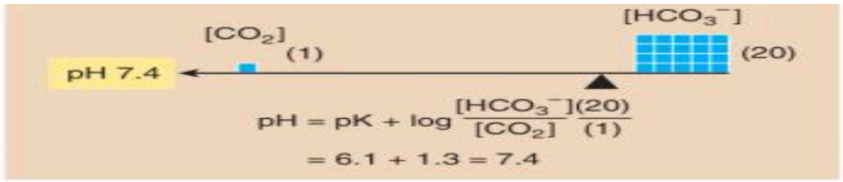
How to Solve a Question

1. Look at pH first. Determine if Acidosis or Alkalosis (Normal 7.35-7.45)

2. Look at $PaCO_2$ (Normal 35-45) (does it explain the problem?)

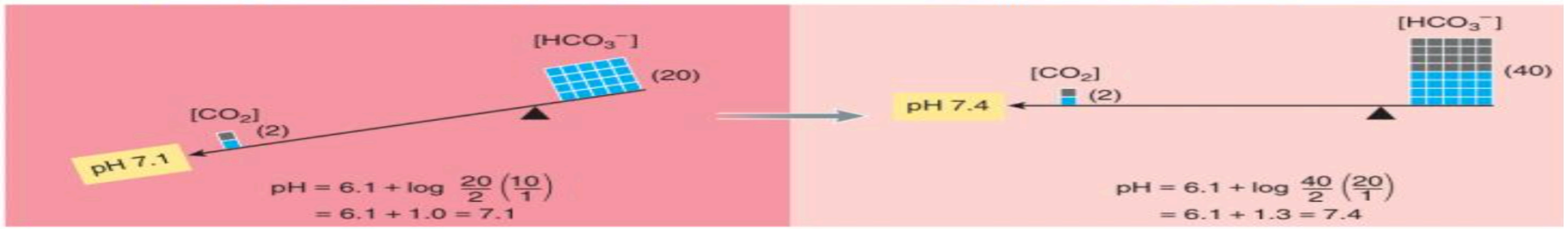
3. Look at HCO_3^- (Normal: 22-26) (does it explain the problem?)



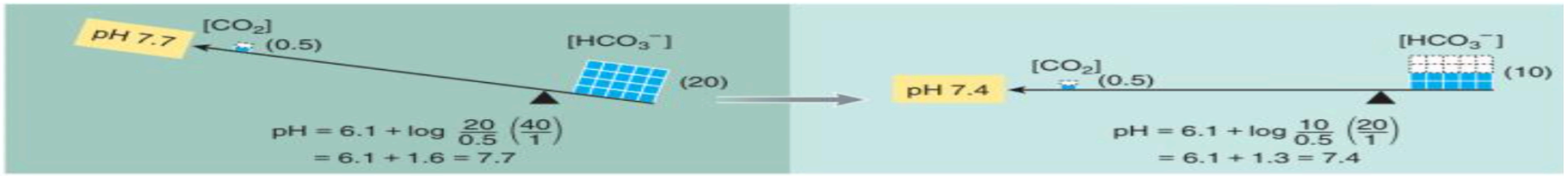


(a) Normal acid-base balance

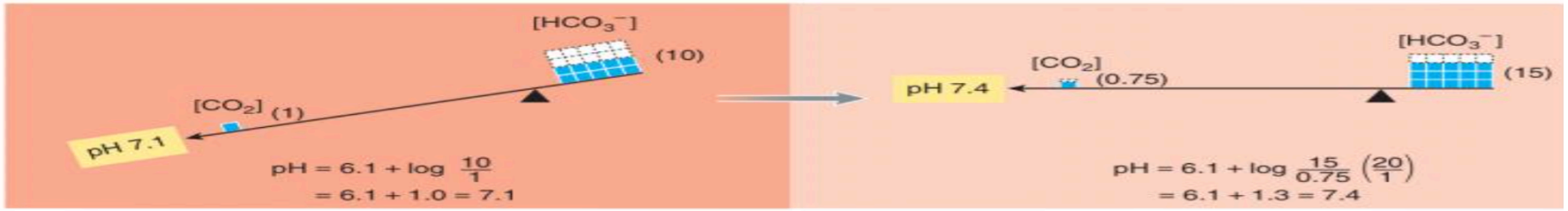
Uncompensated acid–base disorders | Compensated acid–base disorders



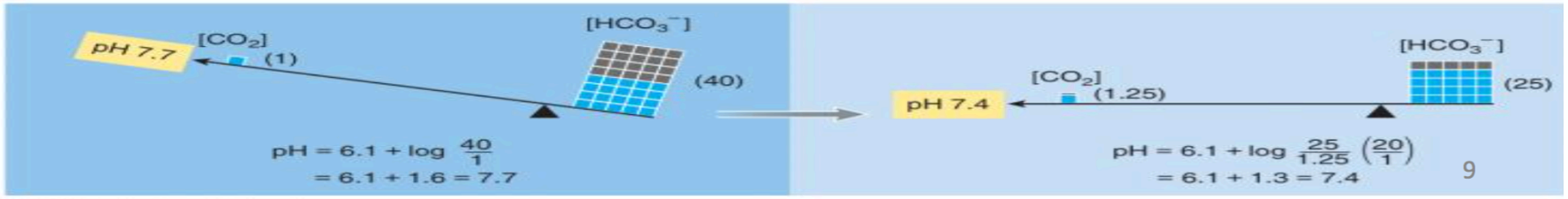
(b) Respiratory acidosis



(c) Respiratory alkalosis



(d) Metabolic acidosis



(e) Metabolic alkalosis

Plasma Anion Gap

- $Na^+ - (Cl^- + HCO_3^-)$
- $Na^+ = 140$
- $Cl^- = 108$
- $HCO_3^- = 24$
- Anion Gap is most useful in determining the cause of metabolic acidosis

Non-Anion Gap Metabolic Acidosis

- Cause: Loss of HCO_3^-
  - ✓ Renal tubular acidosis (I and II)
  - ✓ Diarrhea
  - ✓ Early renal failure
  - ✓ Acetazolamide therapy
  - ✓ Rapid intravenous hydration

Anion Gap Metabolic Acidosis

❖Cause: increase in anions other than chloride

- Another frequently used mnemonic is KARMEL:
  - K — Ketoacidosis
  - A —Aspirin
  - R — Renal Failure
  - M — Methanol
  - E — Ethylene Glycol
  - L — Lactic Acidosis

For any questions or comments please contact us at:

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