



# Understanding ABGs

## Understanding ABG Components

Before diving into ROME, it's essential to understand the primary components of an ABG:

1. **pH:** Indicates the acidity or alkalinity of the blood.
  - Normal range: 7.35 - 7.45
  - Below 7.35: Acidosis
  - Above 7.45: Alkalosis
2. **PaCO<sub>2</sub> (partial pressure of carbon dioxide):** Reflects the respiratory component.
  - Normal range: 35 - 45 mm Hg
  - Below 35: Alkalosis (respiratory)
  - Above 45: Acidosis (respiratory)
3. **HCO<sub>3</sub><sup>-</sup> (bicarbonate):** Reflects the metabolic component.
  - Normal range: 22 - 26 mEq/L
  - Below 22: Acidosis (metabolic)
  - Above 26: Alkalosis (metabolic)



## Applying the ROME Method

**ROME: Respiratory Opposite, Metabolic Equal**

### Step-by-Step Interpretation

- Determine if the pH indicates acidosis or alkalosis:**
  - **pH < 7.35:** Acidosis
  - **pH > 7.45:** Alkalosis
- Analyze the PaCO<sub>2</sub> and HCO<sub>3</sub><sup>-</sup> levels:**
  - Check if the PaCO<sub>2</sub> is moving in the opposite direction of the pH (respiratory component).
  - Check if the HCO<sub>3</sub><sup>-</sup> is moving in the same direction as the pH (metabolic component).
- Identify the primary cause of the imbalance:**
  - If pH and PaCO<sub>2</sub> move in opposite directions, the problem is **Respiratory**.
    - **Respiratory Acidosis:** pH ↓, PaCO<sub>2</sub> ↑
    - **Respiratory Alkalosis:** pH ↑, PaCO<sub>2</sub> ↓
  - If pH and HCO<sub>3</sub><sup>-</sup> move in the same direction, the problem is **Metabolic**.
    - **Metabolic Acidosis:** pH ↓, HCO<sub>3</sub><sup>-</sup> ↓
    - **Metabolic Alkalosis:** pH ↑, HCO<sub>3</sub><sup>-</sup> ↑
- Assess for compensation:**
  - **Compensated:** The pH is within the normal range (7.35 - 7.45), but PaCO<sub>2</sub> and HCO<sub>3</sub><sup>-</sup> are abnormal, indicating the body is compensating.
  - **Partially Compensated:** The pH is abnormal, and both PaCO<sub>2</sub> and HCO<sub>3</sub><sup>-</sup> are abnormal, indicating the body is trying to compensate.
  - **Uncompensated:** The pH is abnormal, and either PaCO<sub>2</sub> or HCO<sub>3</sub><sup>-</sup> is abnormal, indicating no compensation is occurring.



## Examples

### 1. Respiratory Acidosis:

- **pH:** 7.30 (Acidosis)
- **PaCO<sub>2</sub>:** 50 mm Hg (↑, Opposite direction of pH, Respiratory)
- **HCO<sub>3</sub><sup>-</sup>:** 26 mEq/L (Normal or slightly increased if compensating)

### 2. Metabolic Alkalosis:

- **pH:** 7.48 (Alkalosis)
- **PaCO<sub>2</sub>:** 40 mm Hg (Normal or increased if compensating)
- **HCO<sub>3</sub><sup>-</sup>:** 30 mEq/L (↑, Same direction as pH, Metabolic)

### 3. Partially Compensated Respiratory Alkalosis:

- **pH:** 7.47 (Alkalosis)
- **PaCO<sub>2</sub>:** 30 mm Hg (↓, Opposite direction of pH, Respiratory)
- **HCO<sub>3</sub><sup>-</sup>:** 20 mEq/L (↓, Indicating compensation)

### 4. Partially Compensated Metabolic Acidosis:

- **pH:** 7.32 (Acidosis)
- **PaCO<sub>2</sub>:** 28 mm Hg (↓, Indicating compensation)
- **HCO<sub>3</sub><sup>-</sup>:** 18 mEq/L (↓, Same direction as pH, Metabolic)

### 5. Uncompensated Respiratory Alkalosis:

- **pH: 7.50 (Alkalosis)**
- **PaCO<sub>2</sub>: 30 mm Hg (↓, indicating respiratory cause)**
- **HCO<sub>3</sub><sup>-</sup>: 24 mEq/L (Normal)**

### 6. Uncompensated Metabolic Acidosis:

- **pH: 7.32 (Acidosis)**
- **PaCO<sub>2</sub>: 40 mm Hg (Normal)**
- **HCO<sub>3</sub><sup>-</sup>: 18 mEq/L (↓, indicating metabolic cause)**

## Review

The ROME method is a straightforward way to interpret ABGs:

- **Respiratory Opposite:** PaCO<sub>2</sub> and pH move in opposite directions.
- **Metabolic Equal:** HCO<sub>3</sub><sup>-</sup> and pH move in the same direction.



## Practice Questions

1. A patient's ABG results are: pH 7.28, PaCO<sub>2</sub> 55 mm Hg, HCO<sub>3</sub><sup>-</sup> 24 mEq/L.
  - a. What is the interpretation?
2. A patient's ABG results are: pH 7.50, PaCO<sub>2</sub> 28 mm Hg, HCO<sub>3</sub><sup>-</sup> 22 mEq/L.
  - a. What is the interpretation?
3. A patient's ABG results are: pH 7.36, PaCO<sub>2</sub> 48 mm Hg, HCO<sub>3</sub><sup>-</sup> 26 mEq/L.
  - a. What is the interpretation?
4. A patient's ABG results are: pH 7.29, PaCO<sub>2</sub> 38 mm Hg, HCO<sub>3</sub><sup>-</sup> 17 mEq/L.
  - a. What is the interpretation?
5. A patient's ABG results are: pH 7.60, PaCO<sub>2</sub> 35 mm Hg, HCO<sub>3</sub><sup>-</sup> 29 mEq/L.
  - a. What is the interpretation?
6. A patient's ABG results are: pH 7.33, PaCO<sub>2</sub> 50 mm Hg, HCO<sub>3</sub><sup>-</sup> 26 mEq/L.
  - a. What is the interpretation?
7. A patient's ABG results are: pH 7.48, PaCO<sub>2</sub> 44 mm Hg, HCO<sub>3</sub><sup>-</sup> 29 mEq/L.
  - a. What is the interpretation?
8. A patient's ABG results are: pH 7.25, PaCO<sub>2</sub> 60 mm Hg, HCO<sub>3</sub><sup>-</sup> 25 mEq/L.
  - a. What is the interpretation?
9. A patient's ABG results are: pH 7.44, PaCO<sub>2</sub> 40 mm Hg, HCO<sub>3</sub><sup>-</sup> 26 mEq/L.
  - a. What is the interpretation?
10. A patient's ABG results are: pH 7.31, PaCO<sub>2</sub> 42 mm Hg, HCO<sub>3</sub><sup>-</sup> 20 mEq/L.
  - a. What is the interpretation?



## Answers

1. **Uncompensated Respiratory Acidosis**
  - pH 7.28 (Acidosis)
  - PaCO<sub>2</sub> 55 mm Hg (↑, respiratory)
  - HCO<sub>3</sub><sup>-</sup> 24 mEq/L (Normal)
2. **Uncompensated Respiratory Alkalosis**
  - pH 7.50 (Alkalosis)
  - PaCO<sub>2</sub> 28 mm Hg (↓, respiratory)
  - HCO<sub>3</sub><sup>-</sup> 22 mEq/L (Normal)
3. **Compensated Respiratory Acidosis**
  - pH 7.36 (Normal, leaning towards acidosis)
  - PaCO<sub>2</sub> 48 mm Hg (↑, respiratory)
  - HCO<sub>3</sub><sup>-</sup> 26 mEq/L (Normal, indicating compensation)
4. **Uncompensated Metabolic Acidosis**
  - pH 7.29 (Acidosis)
  - PaCO<sub>2</sub> 38 mm Hg (Normal)
  - HCO<sub>3</sub><sup>-</sup> 17 mEq/L (↓, metabolic)
5. **Uncompensated Metabolic Alkalosis**
  - pH 7.60 (Alkalosis)
  - PaCO<sub>2</sub> 35 mm Hg (Normal)
  - HCO<sub>3</sub><sup>-</sup> 29 mEq/L (↑, metabolic)
6. **Uncompensated Respiratory Acidosis**
  - pH 7.33 (Acidosis)
  - PaCO<sub>2</sub> 50 mm Hg (↑, respiratory)
  - HCO<sub>3</sub><sup>-</sup> 26 mEq/L (Normal)
7. **Uncompensated Metabolic Alkalosis**
  - pH 7.48 (Alkalosis)
  - PaCO<sub>2</sub> 44 mm Hg (Normal)
  - HCO<sub>3</sub><sup>-</sup> 29 mEq/L (↑, metabolic)
8. **Uncompensated Respiratory Acidosis**
  - pH 7.25 (Acidosis)
  - PaCO<sub>2</sub> 60 mm Hg (↑, respiratory)
  - HCO<sub>3</sub><sup>-</sup> 25 mEq/L (Normal)
9. **Normal ABG**
  - pH 7.44 (Normal)
  - PaCO<sub>2</sub> 40 mm Hg (Normal)
  - HCO<sub>3</sub><sup>-</sup> 26 mEq/L (Normal)
10. **Uncompensated Metabolic Acidosis**
  - pH 7.31 (Acidosis)
  - PaCO<sub>2</sub> 42 mm Hg (Normal)
  - HCO<sub>3</sub><sup>-</sup> 20 mEq/L (↓, metabolic)