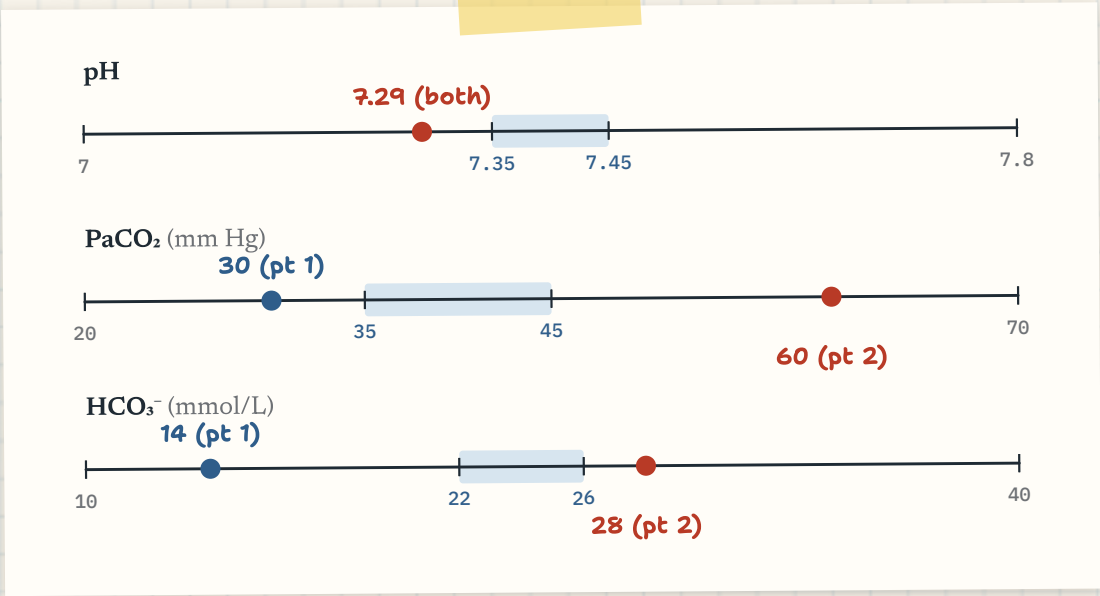
ABG, step by step

Name the primary acid–base disorder



Step by step

1. pH low (< 7.35, acidemia) or high (> 7.45, alkalemia)?
2. Which number explains that pH? That is the primary disorder.
3. The other number, moving the same way, is compensation; the opposite way, suspect a mixed disorder.
4. Lungs: minutes to hours. Kidneys: hours to days.

Disorder	Primary	Compensation
Metabolic acidosis	HCO_3^- ↓	$PaCO_2$ ↓ (lungs)
Metabolic alkalosis	HCO_3^- ↑	$PaCO_2$ ↑ (lungs)
Respiratory acidosis	$PaCO_2$ ↑	HCO_3^- ↑ (kidneys)
Respiratory alkalosis	$PaCO_2$ ↓	HCO_3^- ↓ (kidneys)

Four primary disorders

HENDERSON–HASSELBALCH

$$pH = 6.1 + \log\left(HCO_3^- / (0.03 \times PaCO_2) \right)$$

Normal: 24 / (0.03 × 40) = 20 → log 20 ≈ 1.3 → pH 7.4

Rules of thumb

- Normal ratio HCO_3^- : dissolved CO_2 ≈ 20 : 1
- pH and $PaCO_2$ same direction = metabolic
- pH and $PaCO_2$ opposite directions = respiratory

Exam traps

- Normal pH with abnormal $PaCO_2$ and abnormal HCO_3^-: suspect a mixed disorder.
- Compensation usually stops short of a normal pH and does not overshoot.
- A high $PaCO_2$ in metabolic alkalosis is the lungs compensating, not the cause.
- The same pH can hide different problems: pH 7.29 with $PaCO_2$ 30 / HCO_3^- 14 (metabolic) versus $PaCO_2$ 60 / HCO_3^- 28 (respiratory).

ABG interpretation, made simple

Video, written lesson, practice question and sources: medservatory.com/usmle-step-1/renal-acid-base/abg-interpretation

For exam study only, not medical advice. Follow local guidelines and your lab's ranges.
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