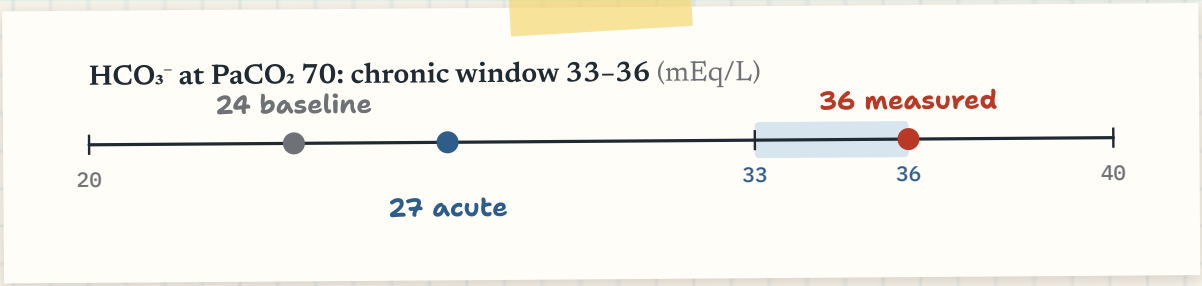
Respiratory acidosis: expected HCO_3^-

Acute vs chronic compensation



Step by step

1. Find the rise: $(PaCO_2 - 40) / 10$
2. Multiply by 1 (acute) or 4 (chronic)
3. Add to 24
4. Compare with the measured HCO_3^-

EXPECTED HCO_3^-

$$24 + rate \times (PaCO_2 - 40) / 10$$

rate 1 = acute (some sources 1–2); rate 4 = chronic (sources 3–4)

	Acute	Chronic
Mechanism	Buffers	Kidney
Timing	Minutes–hours	3–5 days
HCO_3^- rise	about +1	about +4 (3–4)
pH fall (rough)	about 0.08	about 0.03

Per +10 mm Hg $PaCO_2$

Rule of thumb

Acute 1 per 10; chronic 4 per 10

Lungs are the problem: buffers first, kidney later

$PaCO_2$ 70: three tens, so acute 27, chronic 36

Exam traps

- Acute compensation is buffering only; a high HCO_3^- takes days of renal adaptation.
- The pH moves toward normal but usually not all the way back.
- A bicarbonate far from the window suggests a second, metabolic disorder.

Respiratory acidosis compensation: acute vs chronic

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

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