

Acid-base disorders

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**Recording of the seminar can be found on the
Studyaid teams-channel:**

**Files → General → Recordings → Renal and
respiratory physiology 2024**

Topics for today ;))

1. Acid-base balance of the body
2. Mechanisms to maintain homeostasis
3. Pathogenesis behind the basic disturbances
4. Compensatory mechanisms

And lots of arterial blood gasses to interpretate inbetween!

Arterial blood gas (ABG) values

pH 7.35-7.45

pCO₂ 35-45 mmHg

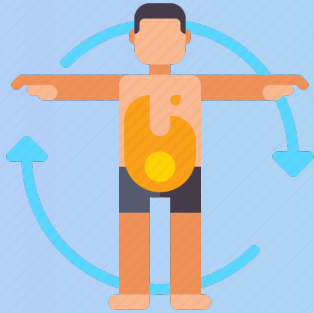
HCO₃⁻ 22-26 mEq/L

pO₂ 75-100 mmHg

Factors that influence body pH

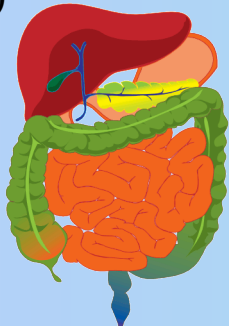
METABOLISM

(Processes that generate energy)



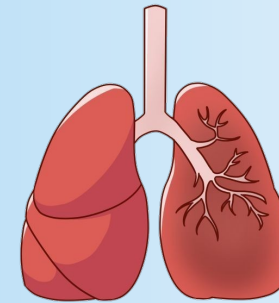
INTAKE, DIGESTION AND FECAL LOSS

(GI tract)



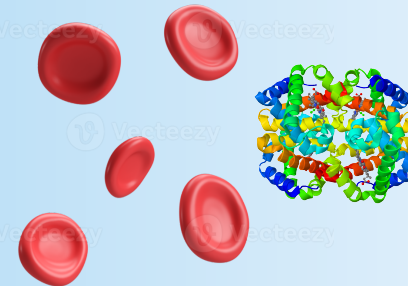
H⁺ in body fluids

RESPIRATION

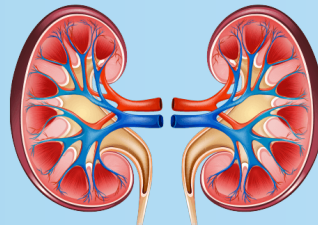


CIRCULATION

(Hemoglobin as a buffer)



RENAL PROCESSES



Mechanism to maintain homeostasis

LUNGS

Rate and depth of breathing → control CO₂ levels
Fast adaption

KIDNEYS

Control amount of bicarbonate (HCO₃²⁻)
Slow adaption



LE CHATELIER`S PRINCIPLE

When a change is made to a chemical equilibrium, the equilibrium will change to counteract the imposed change.



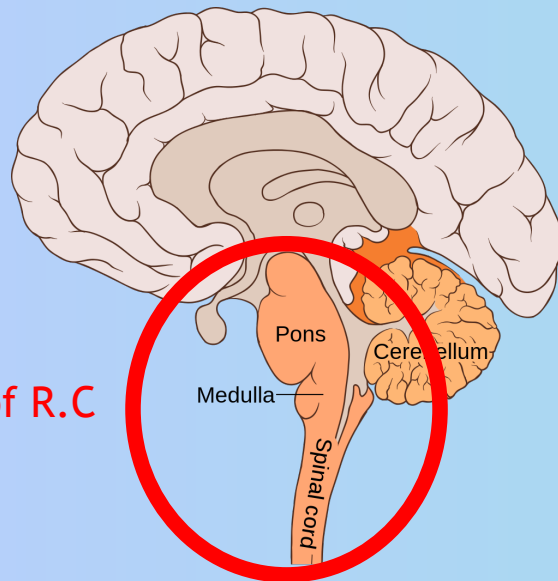
Respiratory acidosis

Depression of R.C:

→ Medications, damage/trauma, hypothermia, hypothyroidism

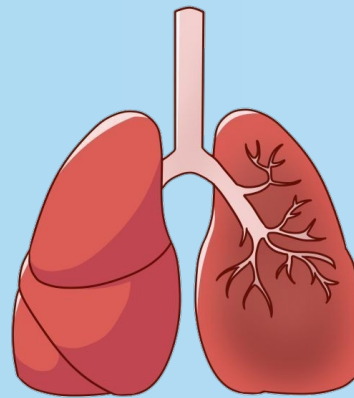
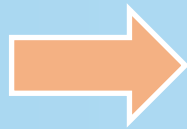
Pathologies directly causing decreased rate of breathing

→ obstructive lung disease, neuromuscular diseases or exhaustion



Depression of R.C

R.C = Respiratory center



Decreased rate of breathing



↑ CO₂ levels in blood



↓ pH

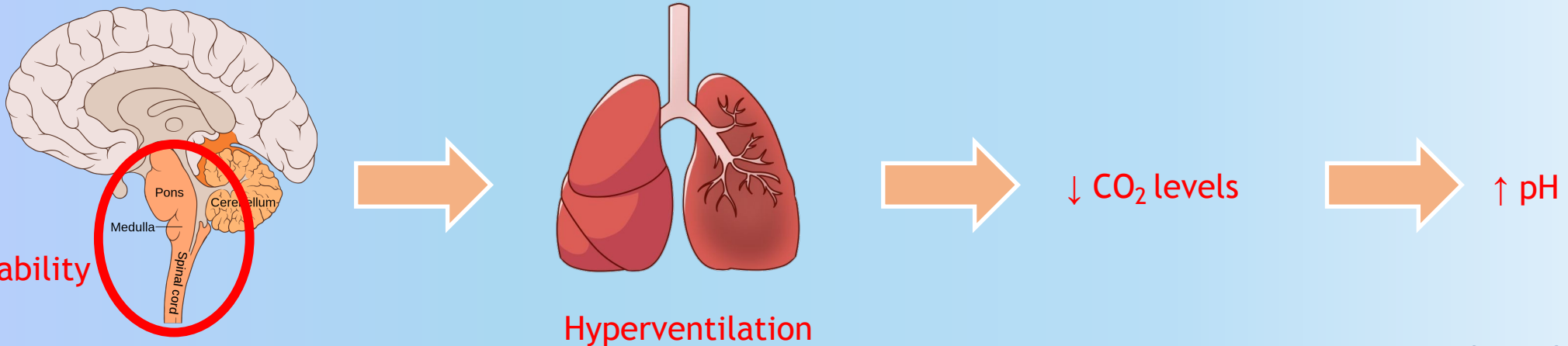
Respiratory alkalosis

Overexcitability of R.C:

→ Certain drugs, bacterias causing sepsis, hepatic encephalopathy (due to liver failure), hyperthyroidism, pregnancy, fever and anxiety.

Lung pathologies directly affecting the lungs:

→ Pulmonary edema/effusion, ARDS/pneumonia, pulmonary embolism

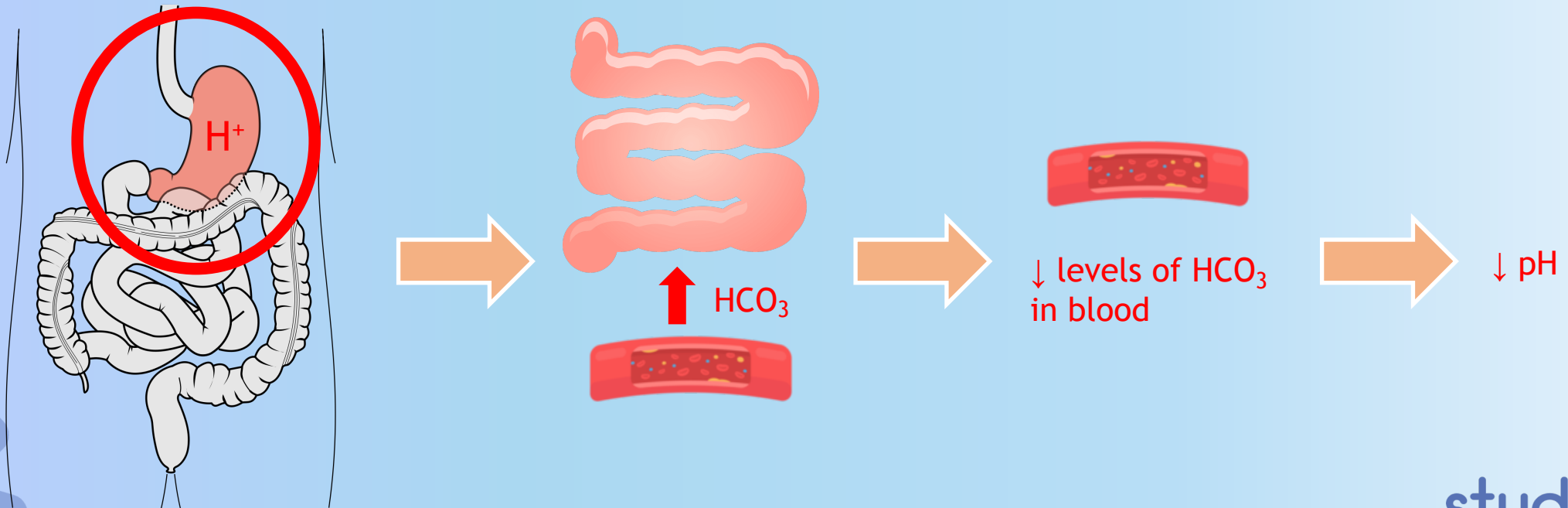


Overexcitability
of R.C

Metabolic acidosis

Pathologies causing ↓ HCO_3^- in blood

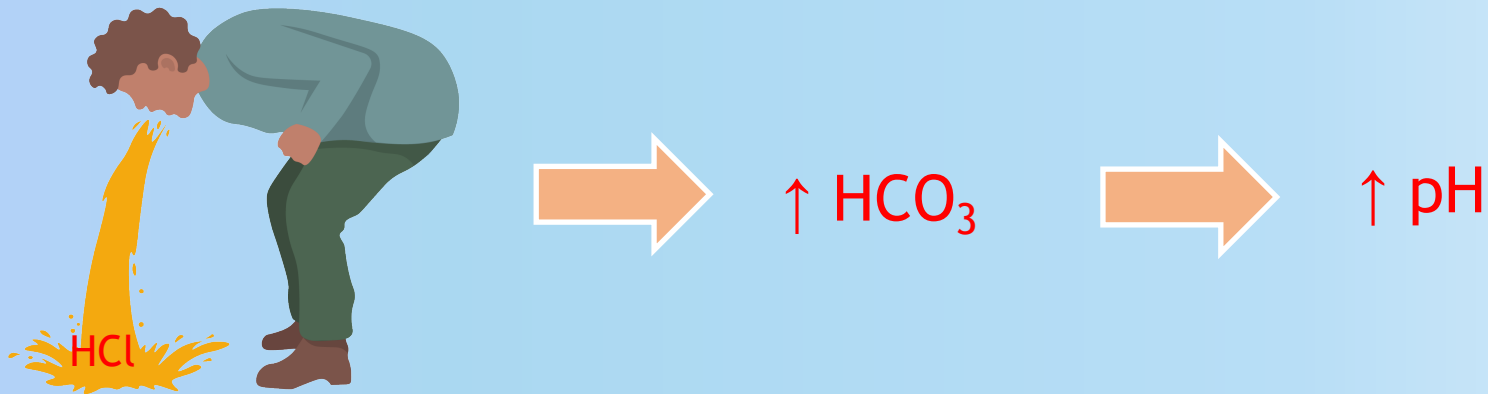
→ Early renal failure, diarrhea, certain diuretic medications, renal tubular acidosis (Addison's disorder), Fluid infusions, TPN (nutrition directly in the vein)



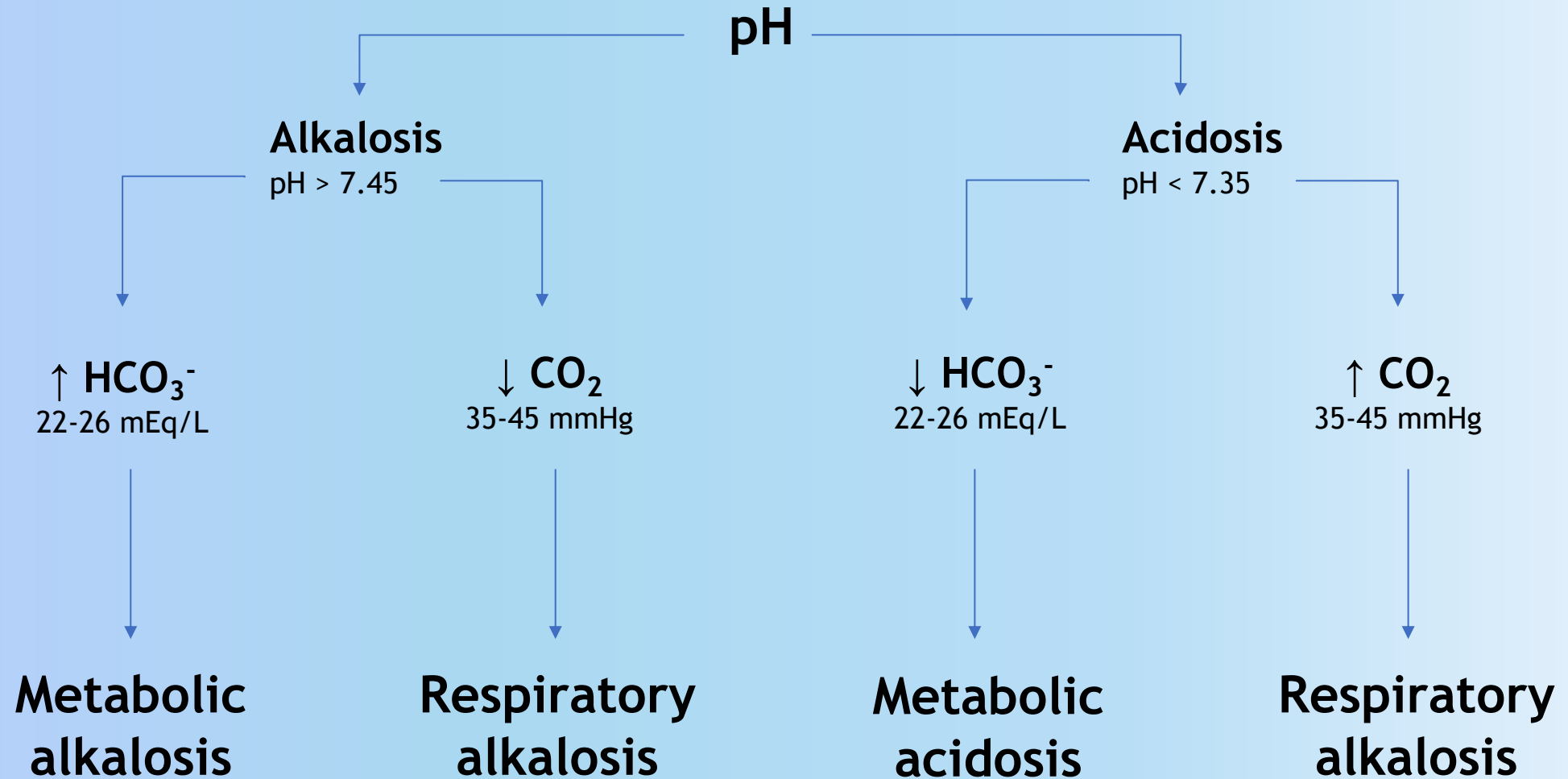
Metabolic alkalosis

Causes

→ Overcorrection of hypercapnia, mineralocorticoid excess (Conn syndrome), vomiting, total volume loss.



ABG-interpretation



ABG 1

pH 7.20

pCO₂ 40 mmHg

HCO₃⁻ 15 mEq/L

pH 7.35-7.45

pCO₂ 35-45 mmHg

HCO₃⁻ 22-26 mEq/L

ABG 2

pH 7.50

pCO₂ 31 mmHg

HCO₃⁻ 24 Eq/L

pH 7.35-7.45

pCO₂ 35-45 mmHg

HCO₃⁻ 22-26 mEq/L

ABG 3

pH 7.49

pCO₂ 44 mmHg

HCO₃⁻ 30 mEq/L

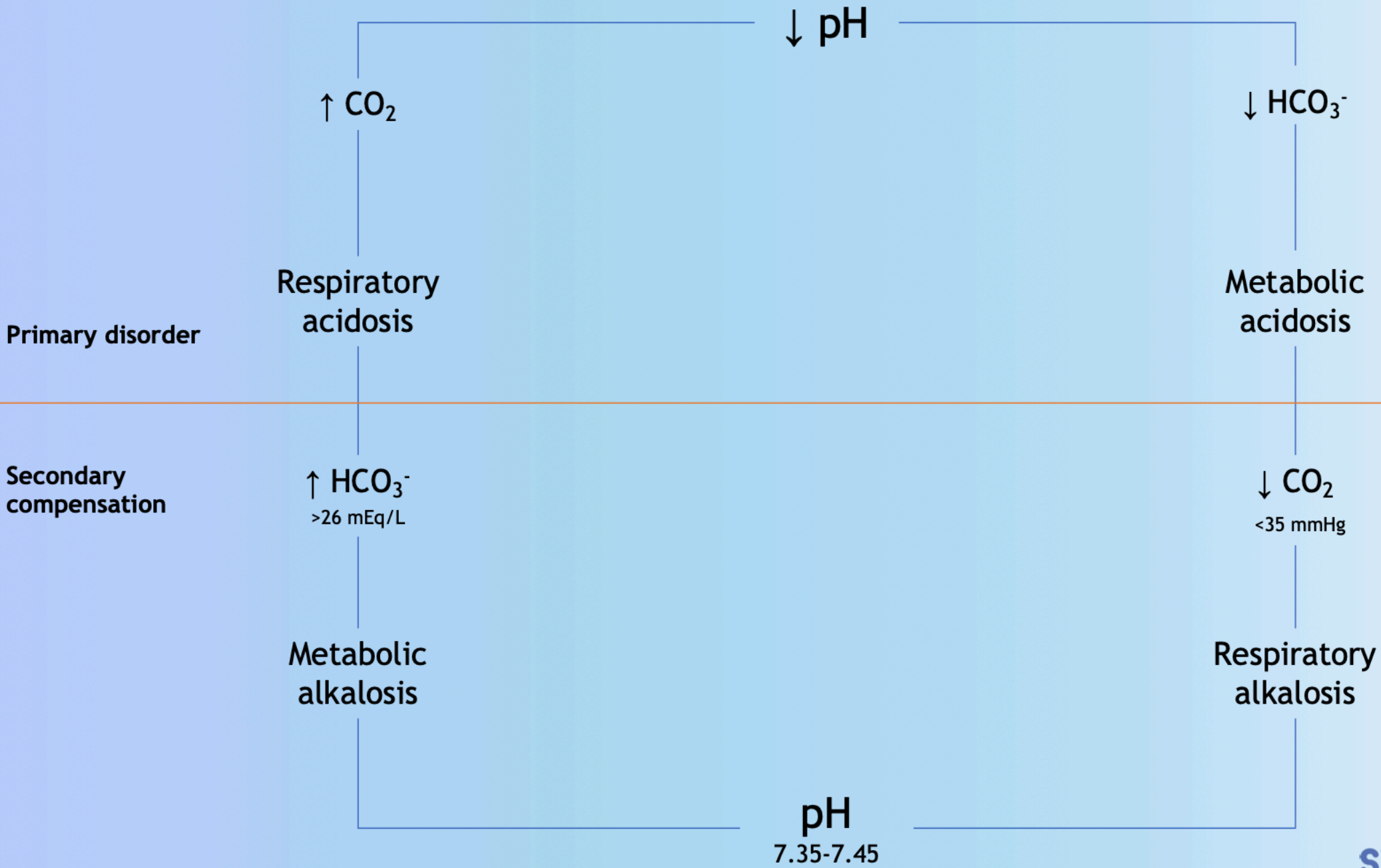
pH 7.35-7.45

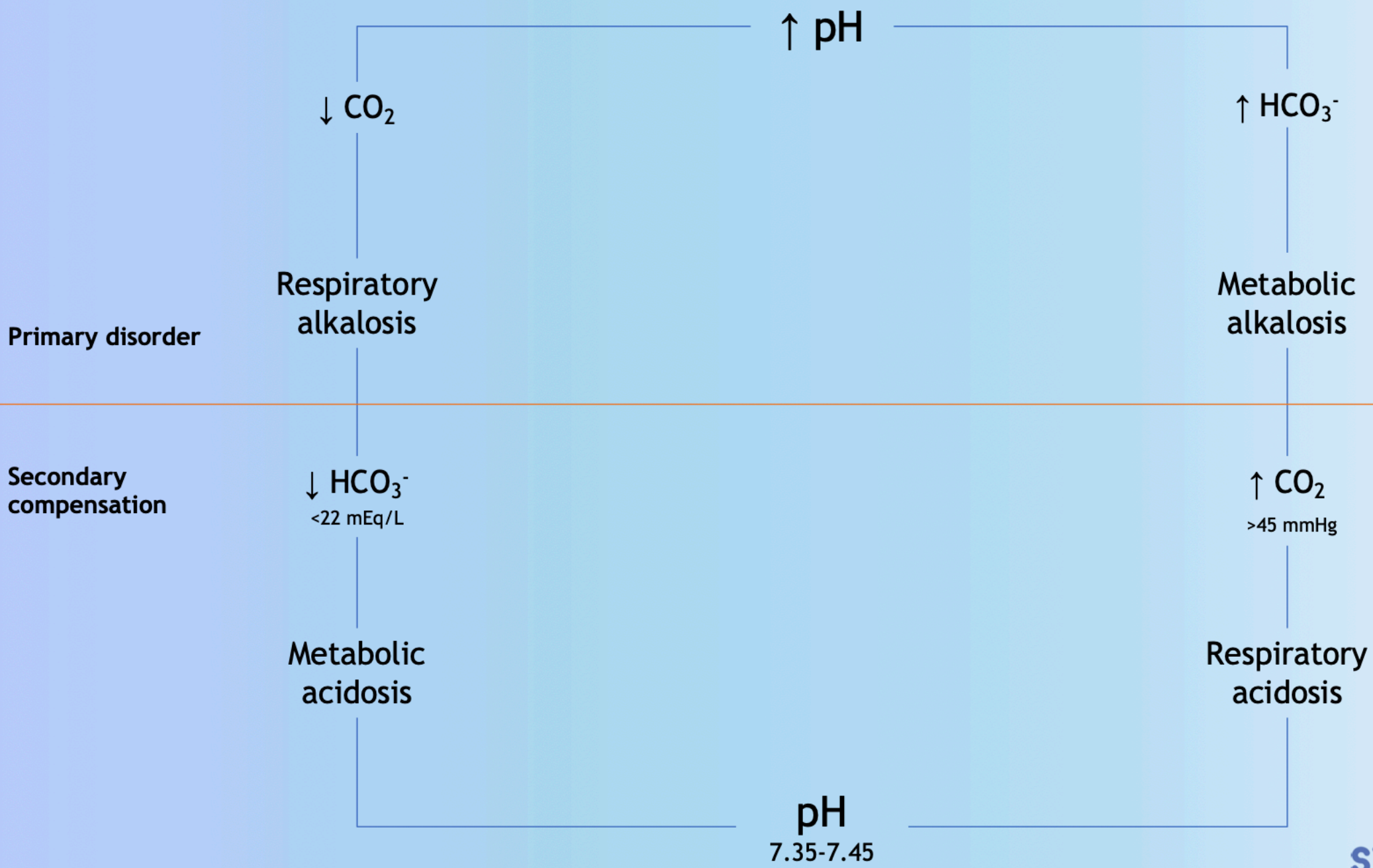
pCO₂ 35-45 mmHg

HCO₃⁻ 22-26 mEq/L

ABG interpretation in 1-2-3

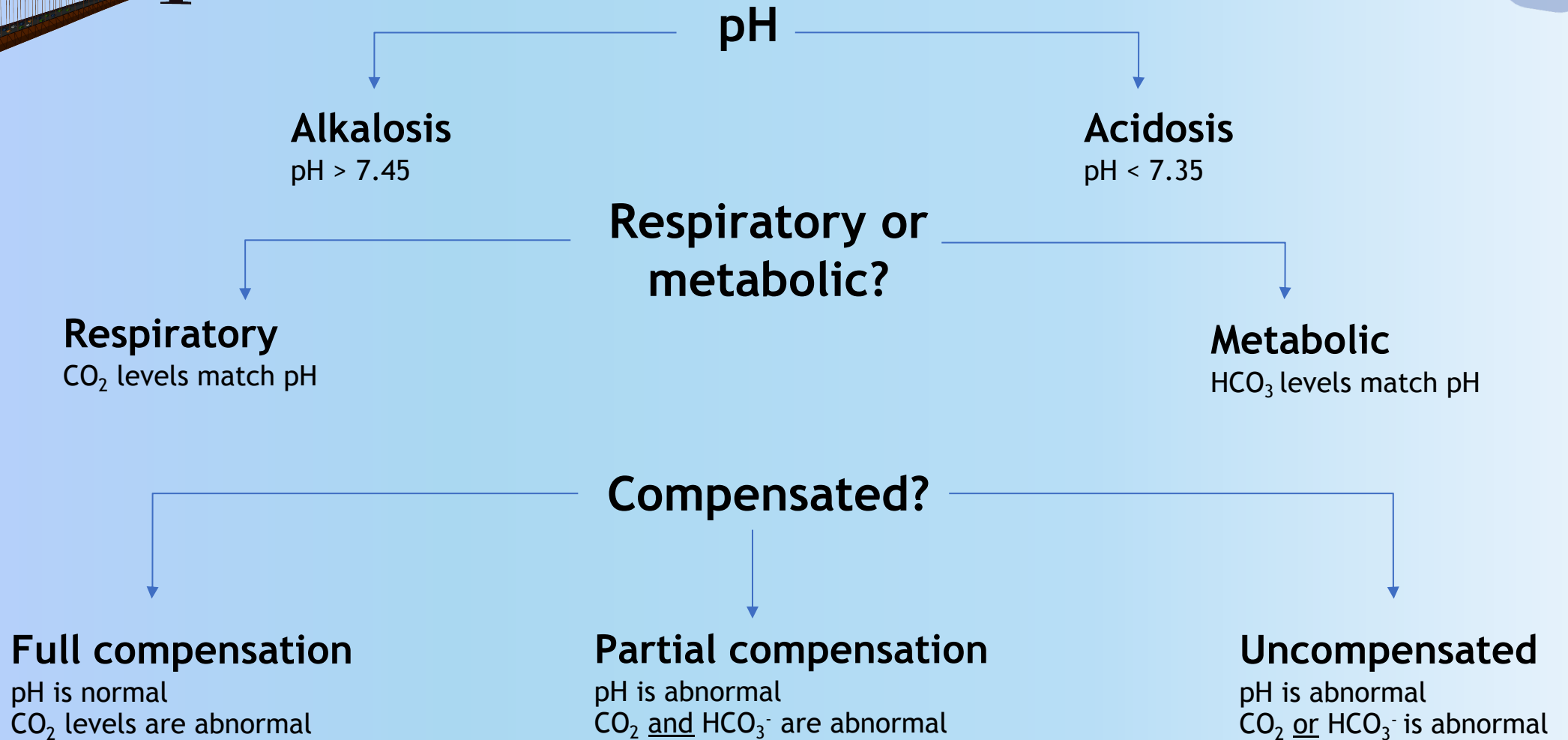
1. Identify if the imbalance is a acidosis or alkalosis? (pH)
2. Identify if its respiratory or metabolic? (CO_2/HCO_3)
3. Identify if its compensated (fully/partially?) or uncompensated







Your golden gate to ABG-interpretation



ABG 4

pH 7.34

pCO₂ 24 mmHg

HCO₃⁻ 13 mEq/L

pH 7.35-7.45

pCO₂ 35-45 mmHg

HCO₃⁻ 22-26 mEq/L

ABG 5

pH 7.27

pCO₂ 60 mmHg

HCO₃⁻ 27 mEq/L

pH 7.35-7.45

pCO₂ 35-45 mmHg

HCO₃⁻ 22-26 mEq/L

ABG 6

pH 7.36

pCO₂ 30 mmHg

HCO₃⁻ 16 mEq/L

pH 7.35-7.45

pCO₂ 35-45 mmHg

HCO₃⁻ 22-26 mEq/L

ABG 7

pH 7.38

pCO₂ 65 mmHg

HCO₃⁻ 37 mEq/L

pH 7.35-7.45

pCO₂ 35-45 mmHg

HCO₃⁻ 22-26 mEq/L

ABG 8

pH 7.45

pCO₂ 55 mmHg

HCO₃⁻ 37 mEq/L

pH 7.35-7.45

pCO₂ 35-45 mmHg

HCO₃⁻ 22-26 mEq/L

	Definition	Compensation	Arterial blood gas
Metabolic acidosis	pH <7.35 caused by ↓ HCO ₃ ⁻ concentration in blood	Hyperventilation ↓ CO ₂ Compensation occurs within minutes	↓ pH ↓ HCO ₃ ⁻ ↓ CO ₂ (compensation)
Metabolic alkalosis	pH >7.45 caused by ↑ HCO ₃ ⁻ concentration in blood	Hypoventilation ↑ CO ₂ Compensation occurs within minutes	↑ pH ↑ HCO ₃ ⁻ ↑ CO ₂ (compensation)
Respiratory acidosis	pH <7.35 caused by ↑ CO ₂ concentration in blood	↑ renal reabsorption of HCO ₃ ⁻ Compensation occurs within hours to days	↓ pH ↑ CO ₂ ↑ HCO ₃ ⁻ (compensation)
Respiratory alkalosis	pH >7.45 caused by ↓ CO ₂ concentration in blood	↓ renal reabsorption of HCO ₃ ⁻ Compensation occurs within hours to days	↑ pH ↓ CO ₂ ↓ HCO ₃ ⁻ (compensation)



<https://abg.ninja/abg>