

EMOGASANALISI ARTERIOSA INTERPRETAZIONE

A cosa serve?

Esame rapido



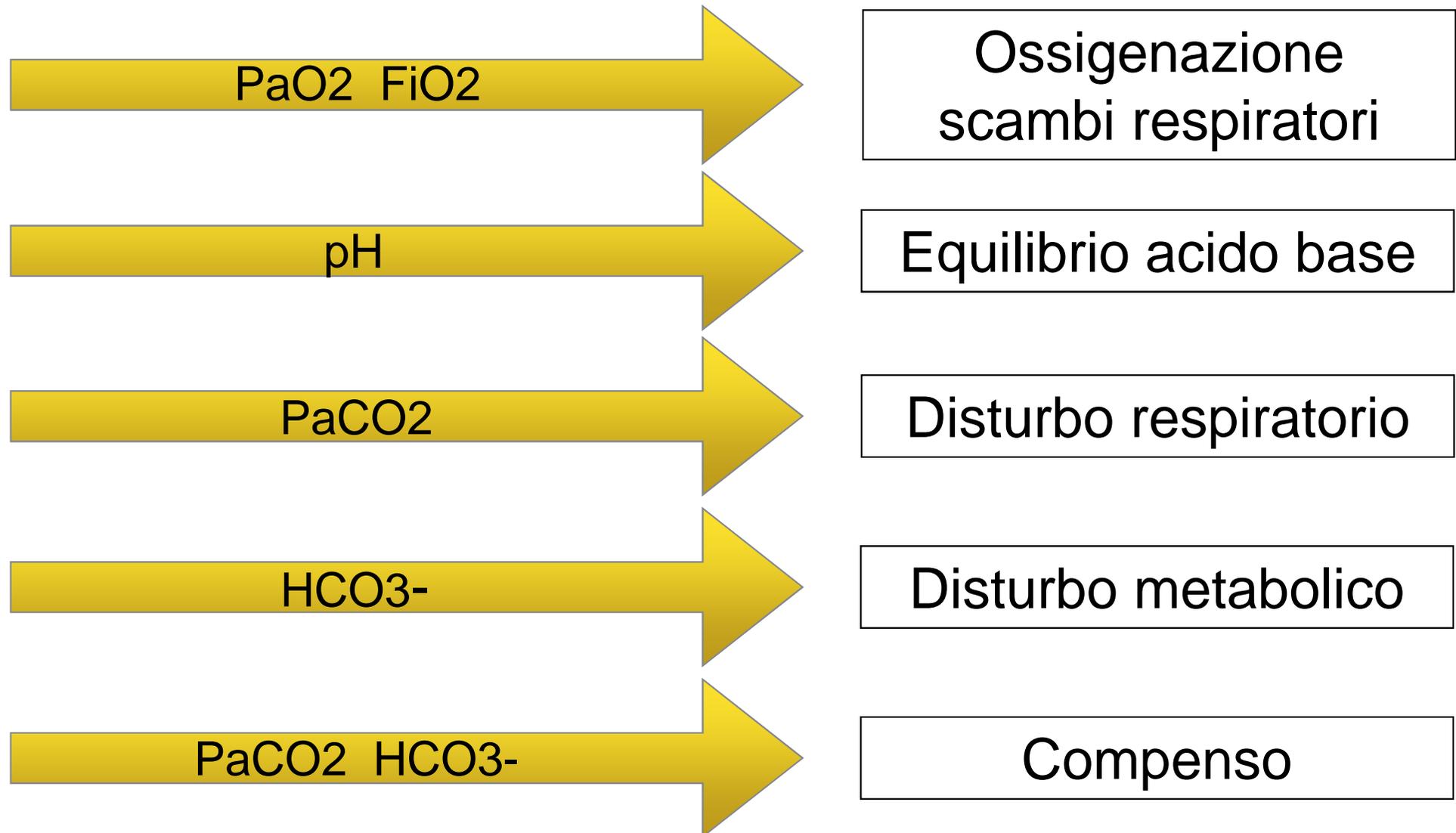
Valutare la ventilazione

Valutare il metabolismo

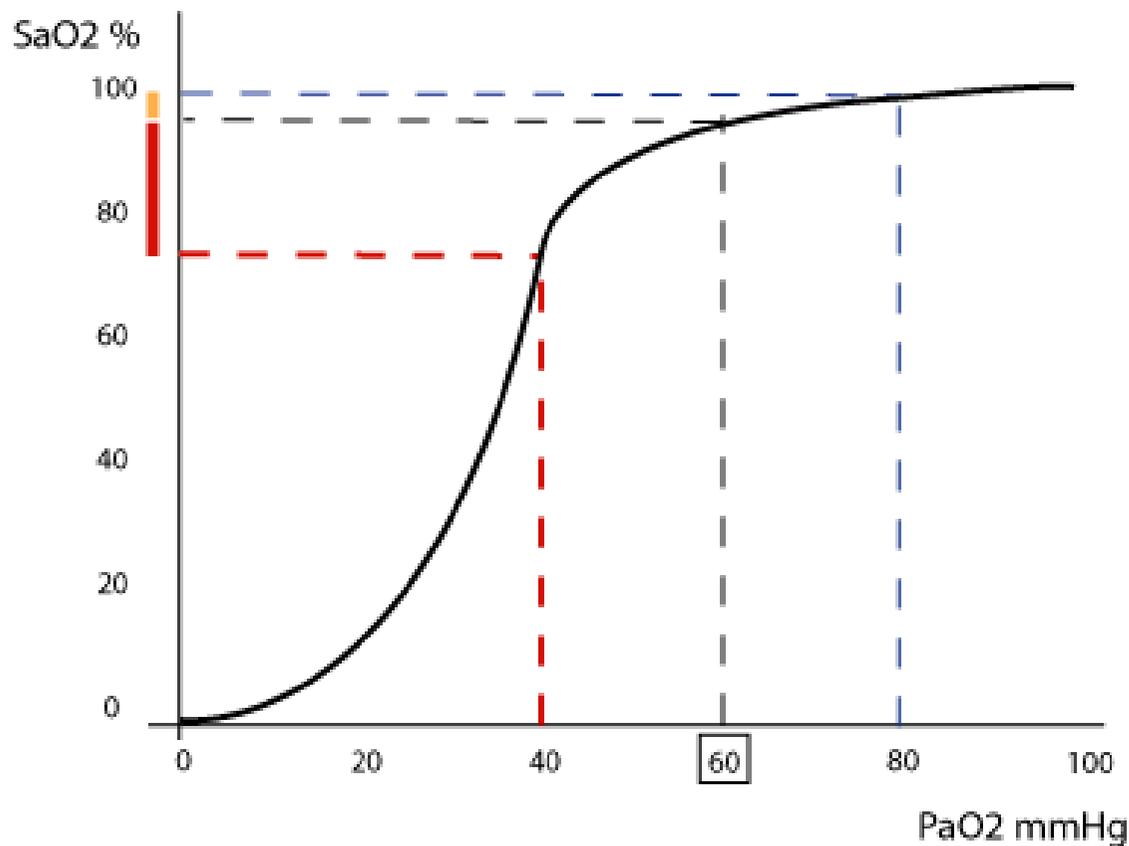
Valutare parametri quali:

- Emoglobina
- Glicemia
- Elettroliti

Interpretazione emogasanalisi in 5 step



E' presente insufficienza respiratoria?

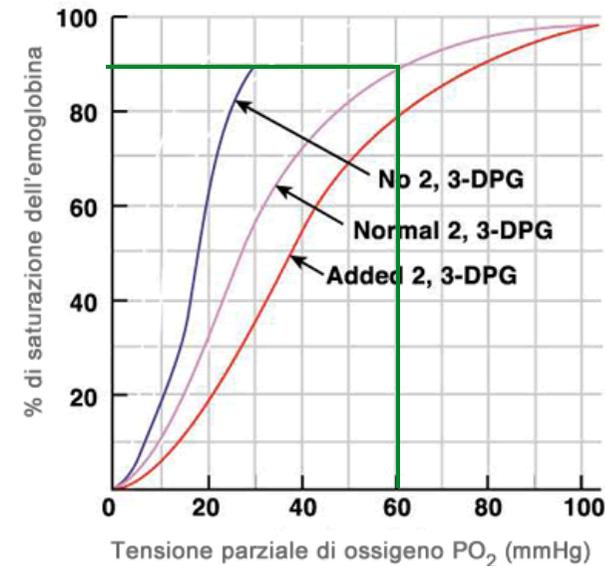
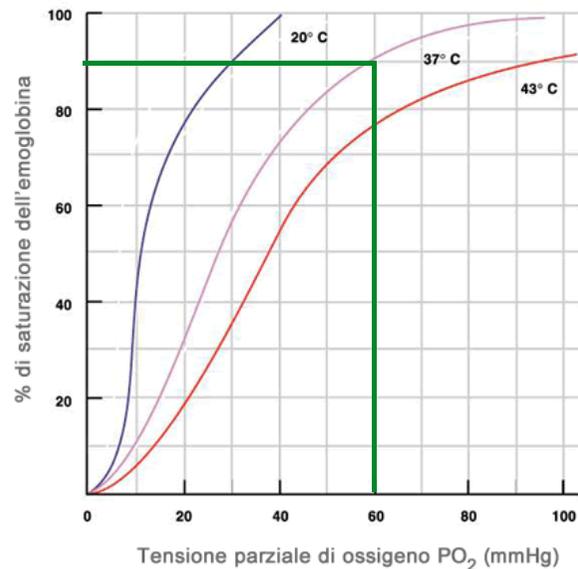
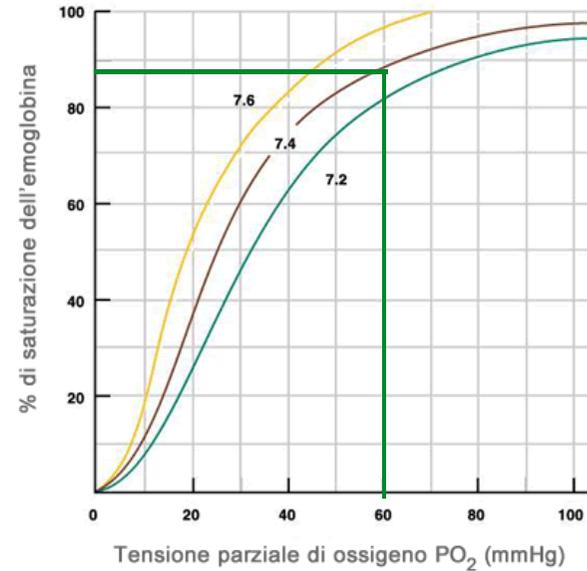
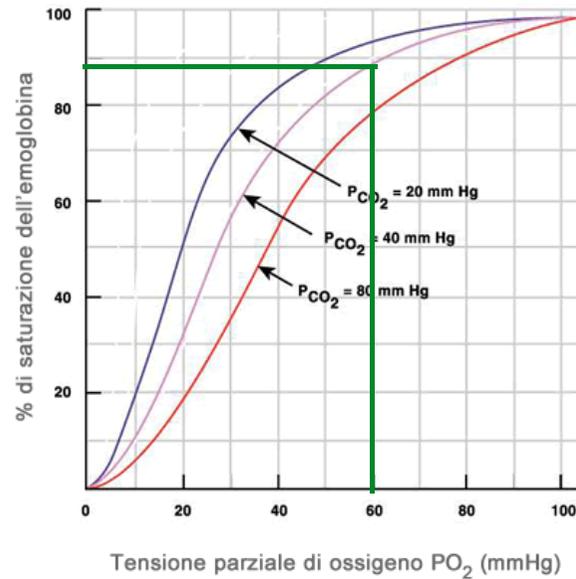


All'età di 20 anni il valore normale di PaO2 in aa è di 95-100 mmHg

Tips & Tricks

Anni	PaO2
60	80
70	70
80	60

E' presente insufficienza respiratoria?



Rapporto PaO₂/FiO₂ (P/F)

$$\frac{\text{PaO}_2}{\text{FiO}_2} = \text{indice della respirazione alveolare}$$

Il rapporto P/F in un paziente sano è indicativamente 450
 $95 : 0,21 = 452$

P/F > 350 è da considerarsi normale

P/F < 200 è indice di grave insufficienza respiratoria

CIANOSI

Più di 5 g/dl di Hb ridotta (deossiHb)/composti anomali dell'Hb (Metaemoglobina, Carbossiemoglobina)

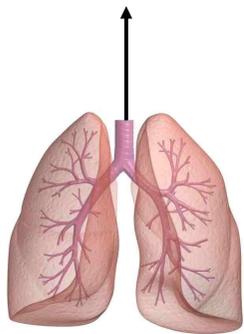
Hb ridotta dà il colore violetto

Non è sinonimo di insufficienza respiratoria dato che dipende dall'Hb ridotta (Policitemia vs Anemia)

Equilibrio acido base

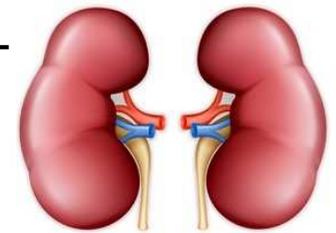
$$[H^+] = \frac{\text{polmone}}{\text{rene}} = \frac{\text{componente respiratoria}}{\text{componente metabolica}}$$

$$pH = \frac{HCO_3^-}{CO_2}$$

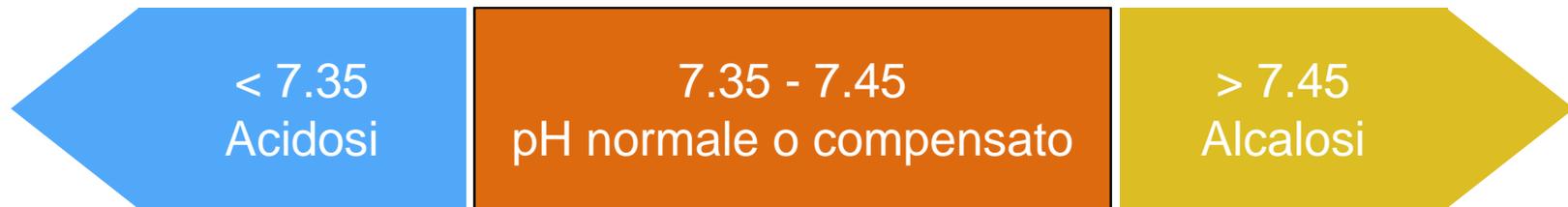


← CO₂

HCO₃⁻ ←



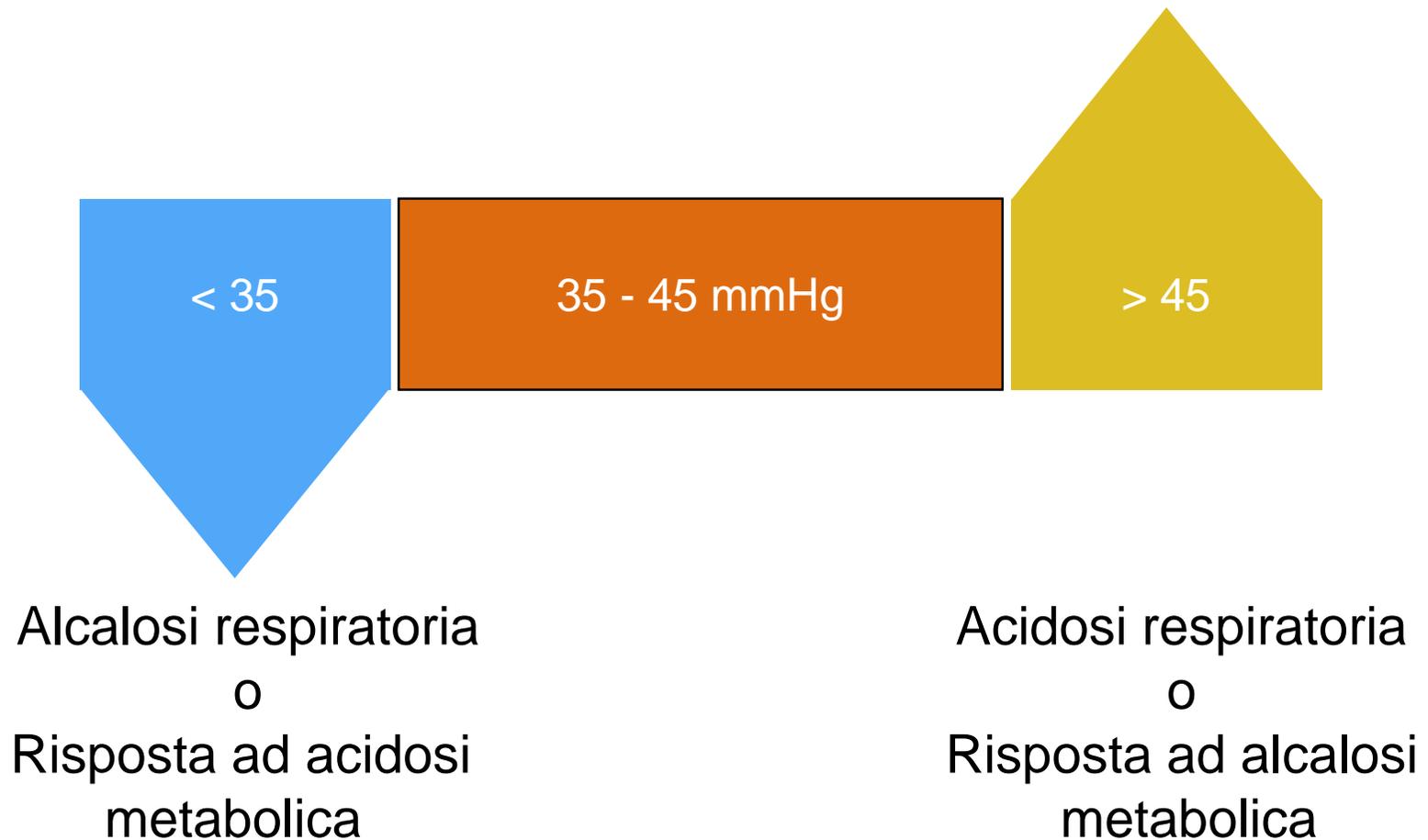
pH (Equilibrio acido base)



Acidemia

Alcalemia

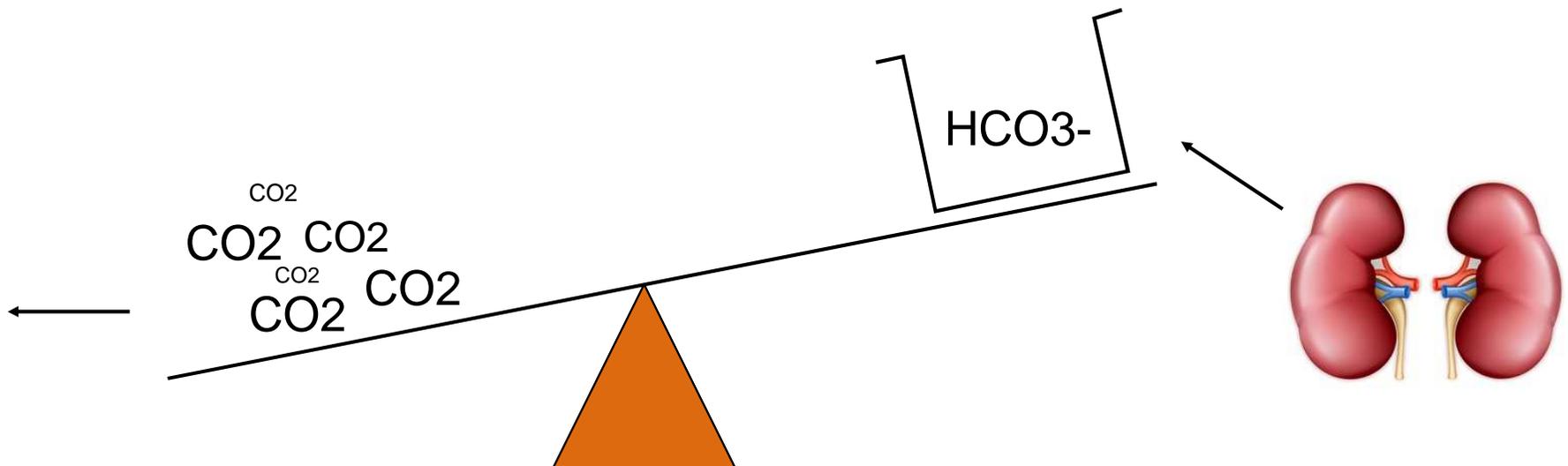
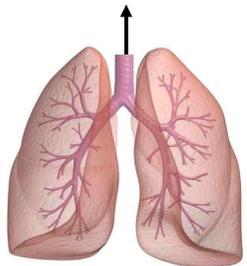
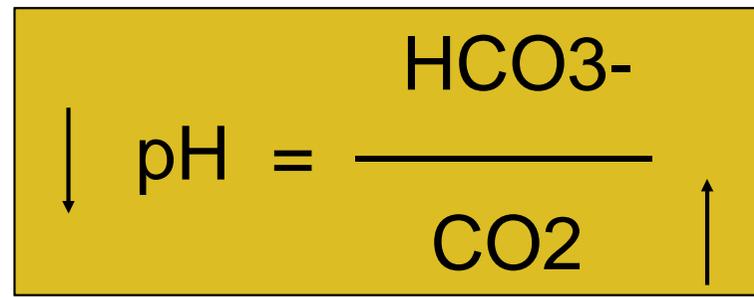
CO₂ (disturbo respiratorio?)



Nei disturbi respiratori primari PaCO₂ e pH si modificano in direzioni opposte

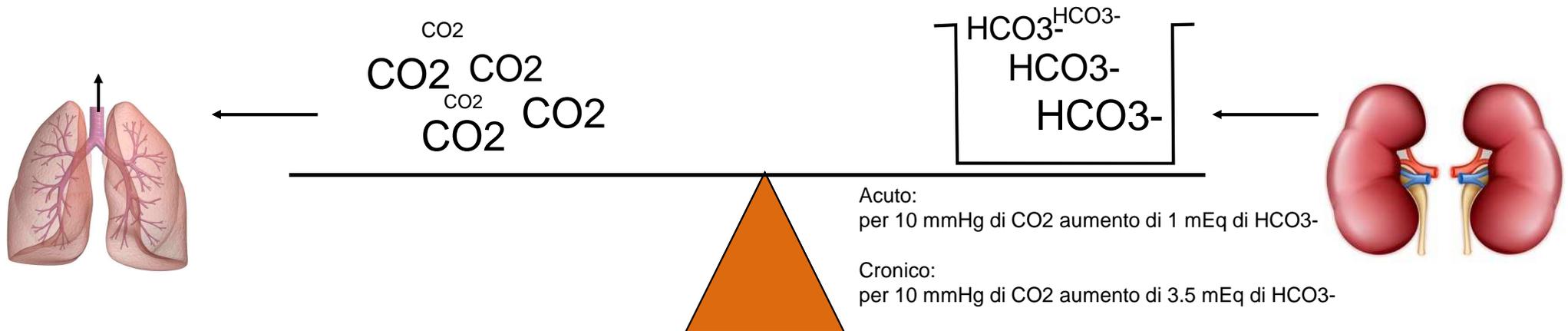
Acidosi respiratoria

Ipoventilazione; alterato rapporto Va/Q



Acidosi respiratoria compensata

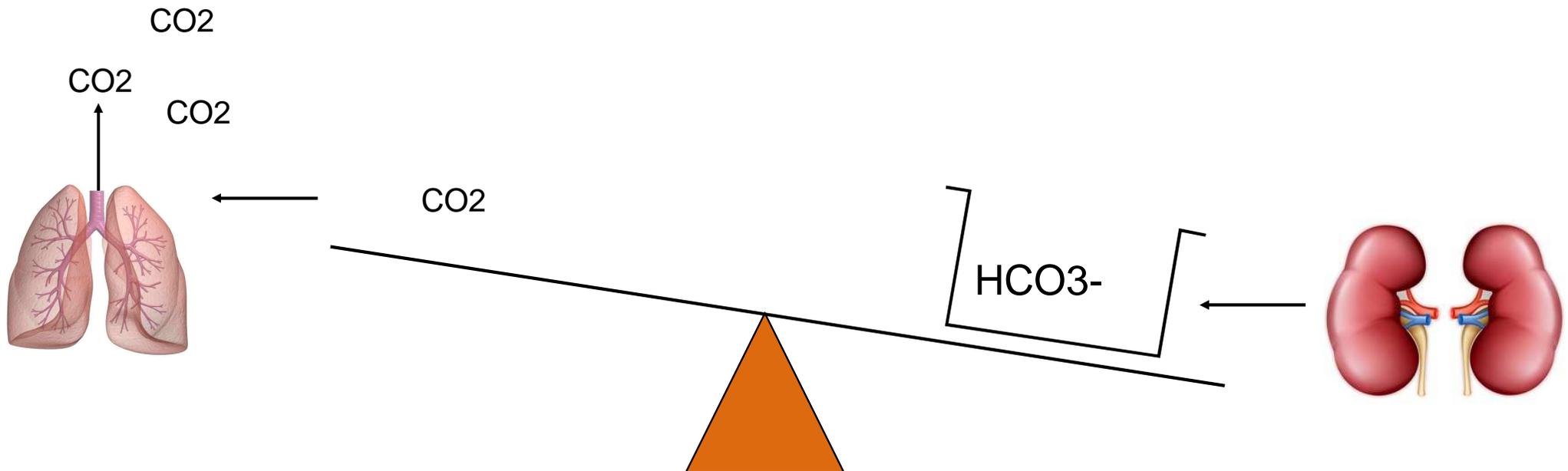
$$\text{pH} = \frac{\text{HCO}_3^-}{\text{CO}_2}$$



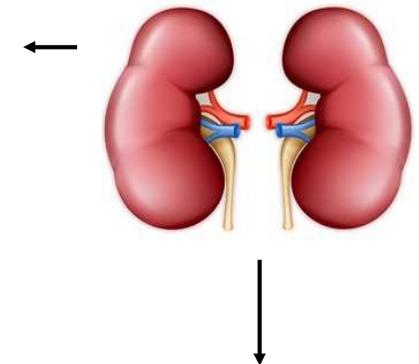
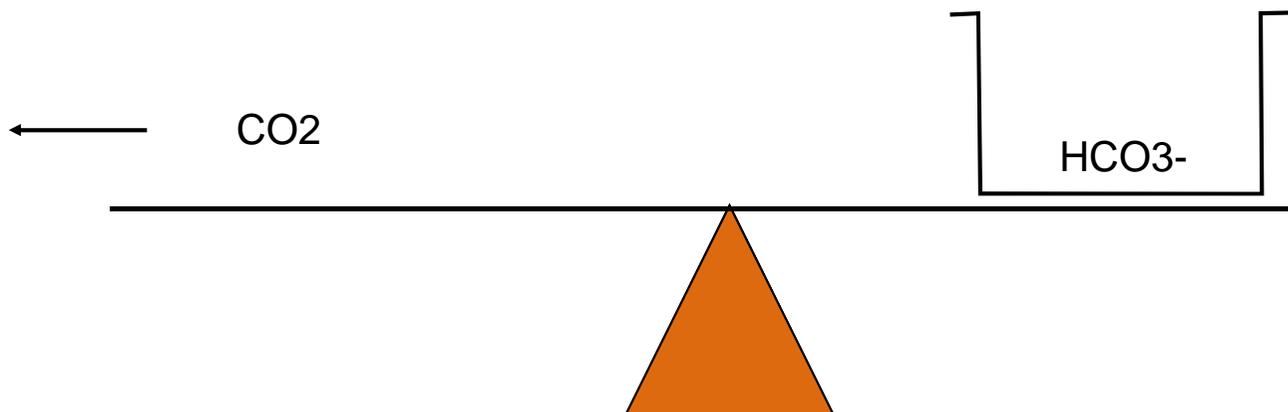
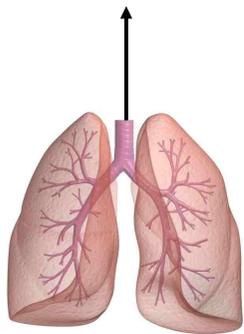
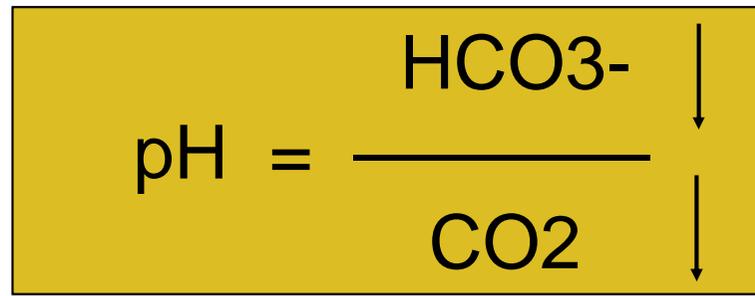
Alcalosi respiratoria

Iperventilazione

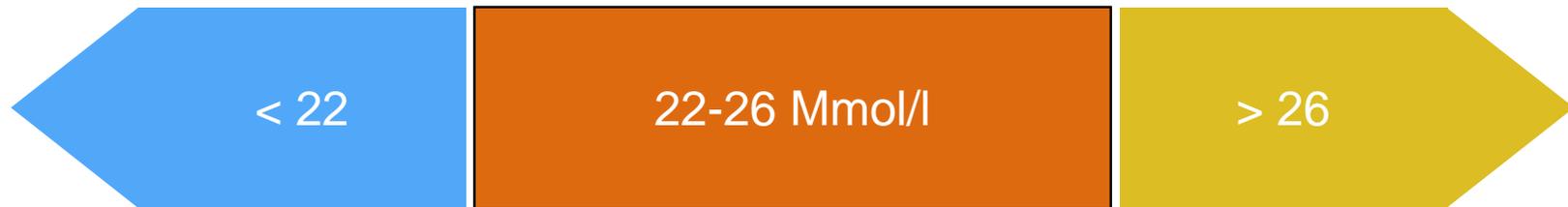
$$\uparrow \text{pH} = \frac{\text{HCO}_3^-}{\text{CO}_2} \downarrow$$



Alcalosi respiratoria compensata



HCO₃⁻ (disturbo metabolico?)



Acidosi metabolica

o

Risposta ad alcalosi
respiratoria

Alcalosi metabolica

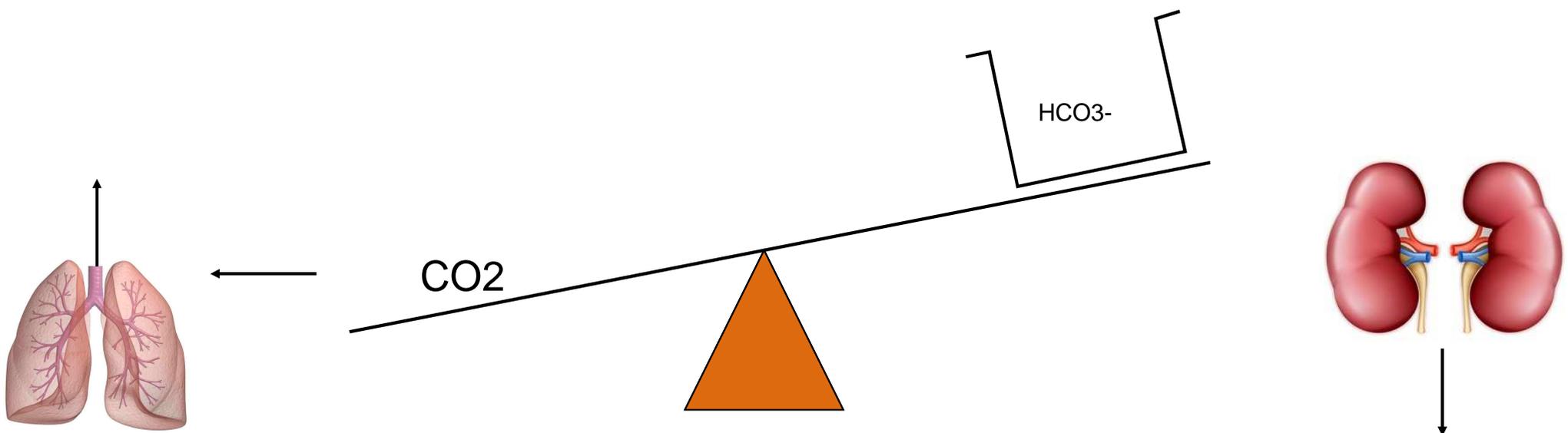
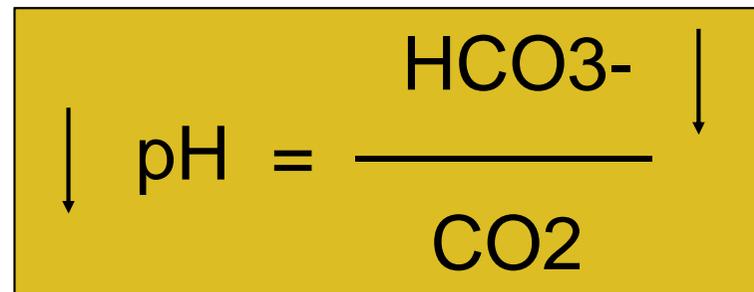
o

Risposta ad acidosi
respiratoria

Nei disturbi metabolici primari HCO₃⁻ e pH si modificano nella stessa direzione

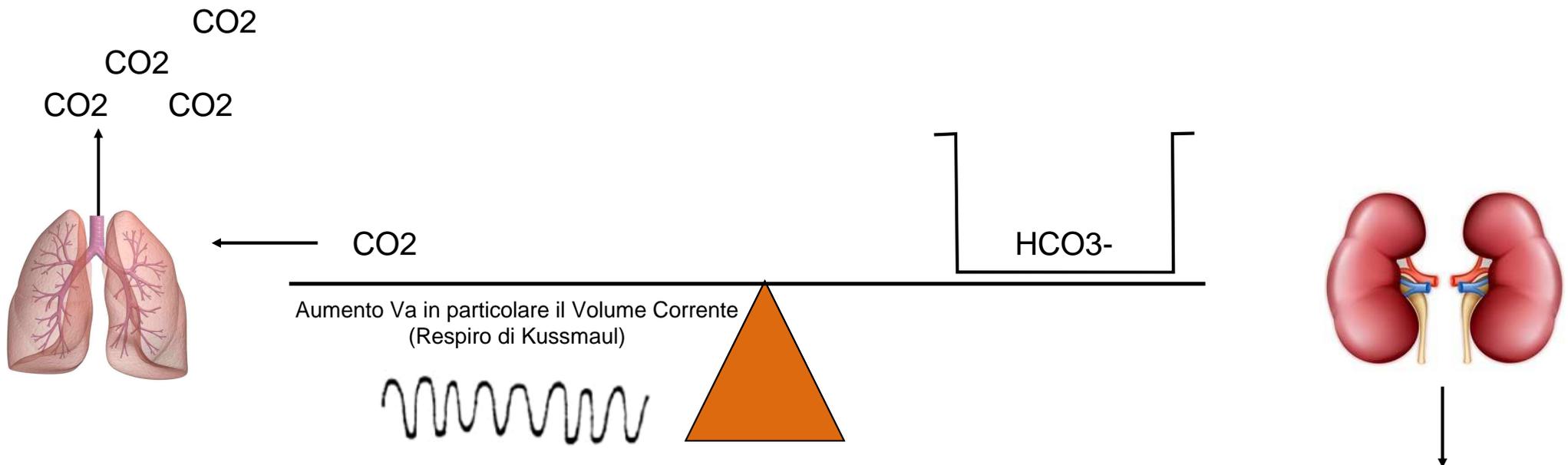
Acidosi metabolica

Acidosi lattica, chetoacidosi, uremia, alcuni tipi di avvelenamento (metanolo, glicole etilenico, aspirina, isoniazide), diarrea, acidosi tubulare renale, nefrite interstiziale.



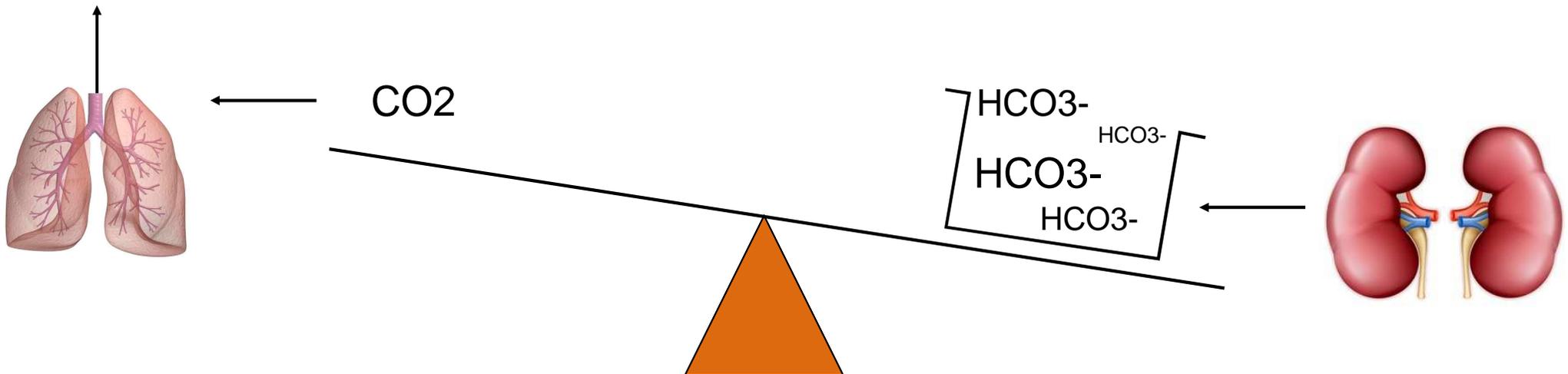
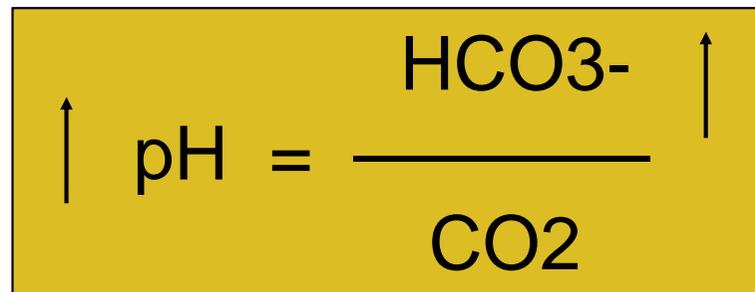
Acidosi metabolica compensata

$$\text{pH} = \frac{\text{HCO}_3^-}{\text{CO}_2}$$

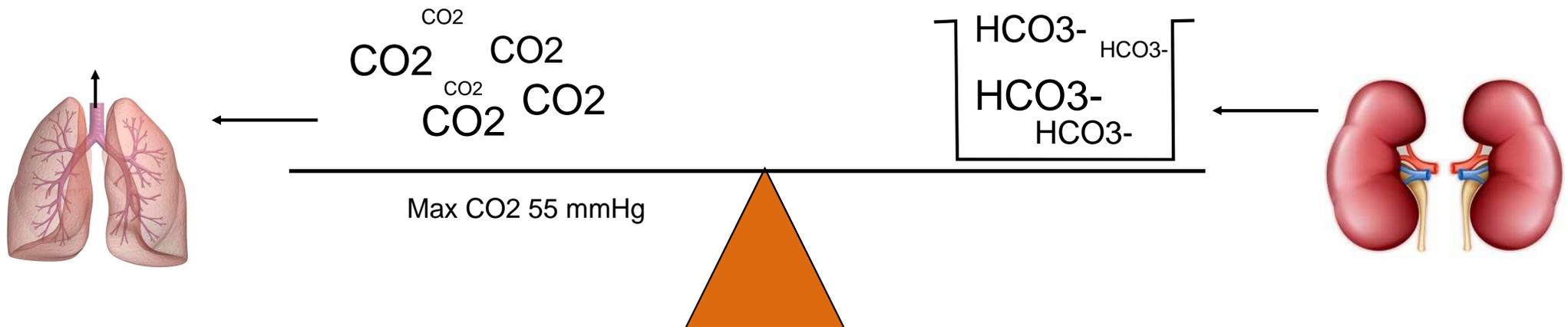
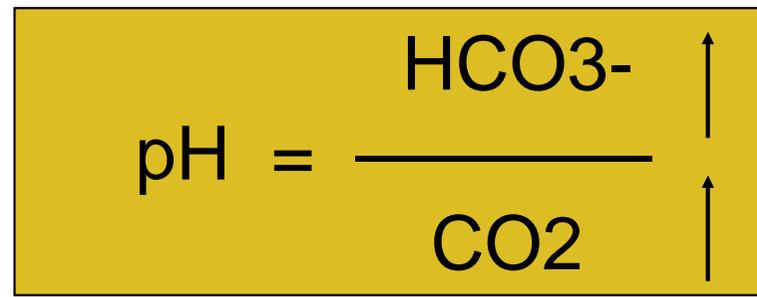


Alcalosi metabolica

Ipovolemia, uso di diuretici, vomito, sondino naso-gastrico, grave deplezione di potassio



Alcalosi metabolica compensata



Altri parametri

BE (eccesso di basi)
da - 2 a + 2 mmol/l

ABE (BE)

(actual base excess)

rappresentano la quantità di acido
o base forte necessaria per
riportare il pH a 7.4

SBE

(standard base excess)

Simile all'ABE ma il riferimento
è il liquido
extracellulare

Altri parametri

Na⁺

135 - 147 mEq/l

K⁺

3.5 - 5.0 mEq/l

Ca⁺⁺

8.5 - 10.5 mEq/l

Cl

95 - 105 mEq/l

Lat

< 4 mEq/l (durante esercizio)

Ricordare !!!

Nei disturbi Respiratori primari PaCO₂ e pH si modificano in direzioni opposte

pH ↓ CO₂ ↑ Acidosi Respiratoria

pH ↑ CO₂ ↓ Alcalosi Respiratoria

Nei disturbi Metabolici primari HCO₃⁻ e pH si modificano nella stessa direzione

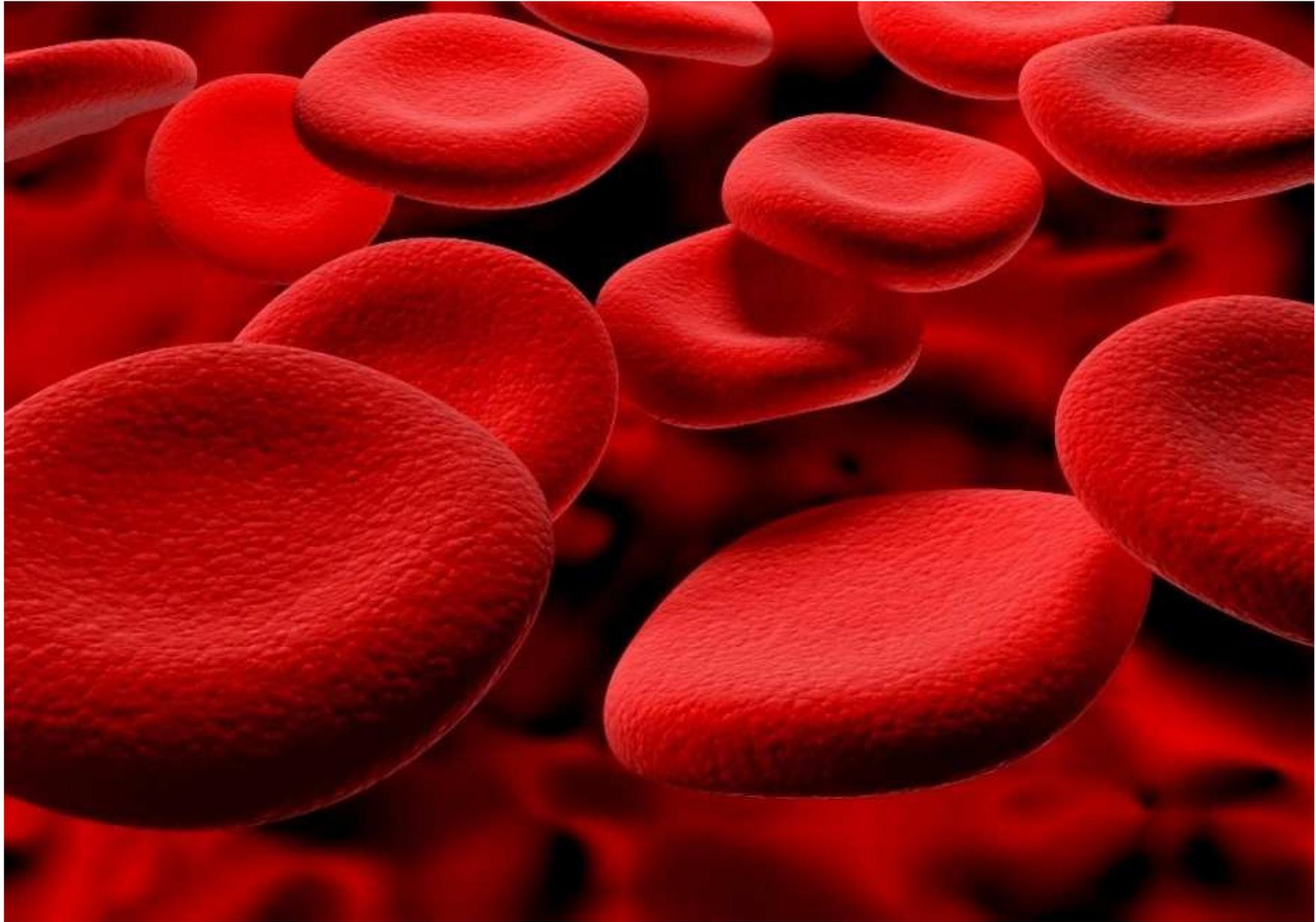
pH ↓ HCO₃⁻ ↓ Acidosi Metabolica

pH ↑ HCO₃⁻ ↑ Alcalosi Metabolica

Il compenso sia Respiratorio che Metabolico va nella stessa direzione del disturbo primario

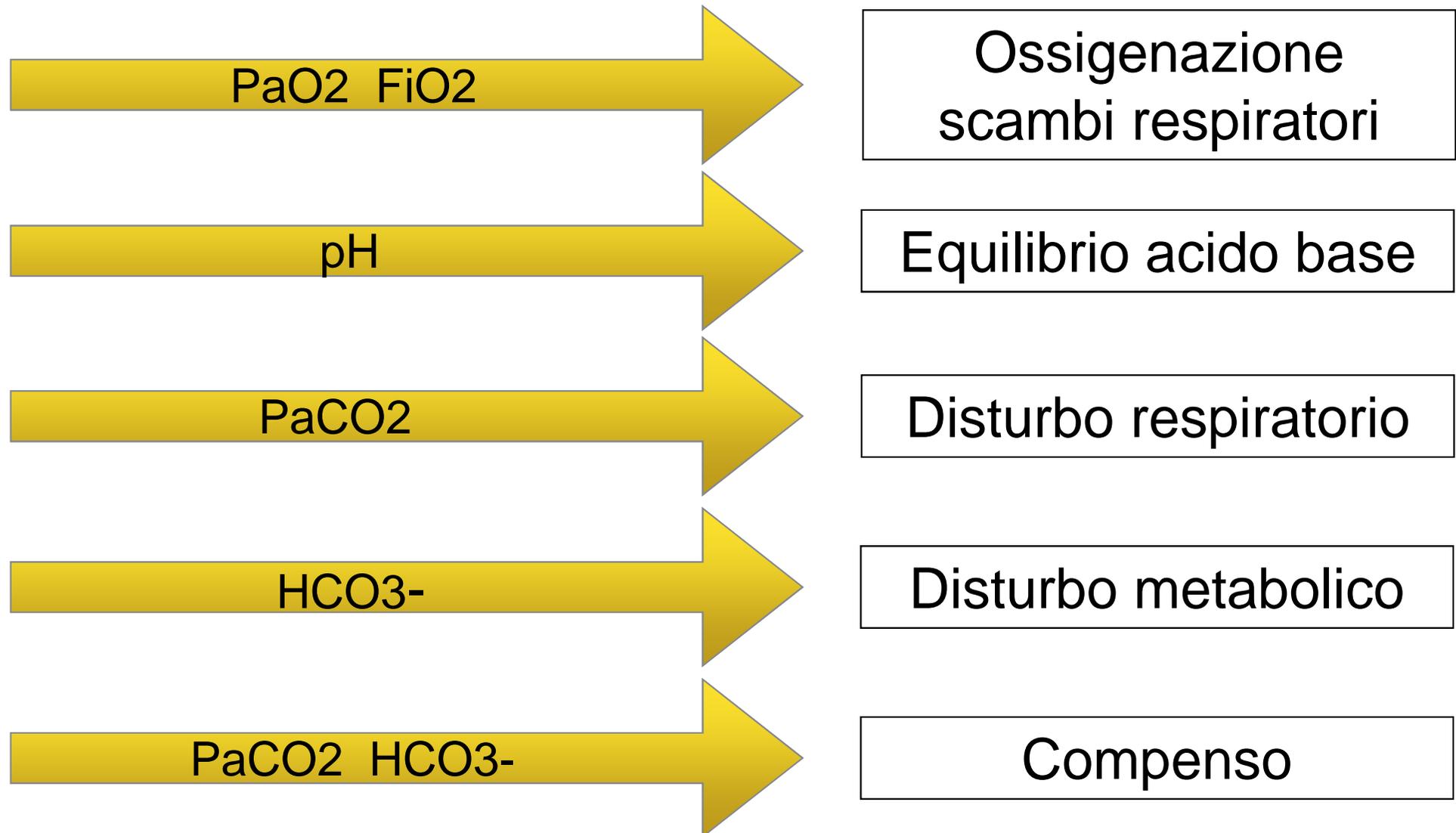
Ricordare !!!

Se, ad eccezione dell'alcalosi respiratoria, ci troviamo di fronte ad alterazione di $p\text{CO}_2$ e/o di HCO_3^- con pH normale, ci troviamo di fronte a un disturbo misto



INTERPRETAZIONE
Alcuni esempi

Interpretazione emogasanalisi in 5 step



Esempio 1

pH 7.36

pCO₂ 32

pO₂ 44

SatO₂ 78%

HCO₃⁻ 17

Paziente con Ventimask
FiO₂ 35% (O₂ 3L)

P/F = 125

Acidosi metabolica
compensata

Esempio 2

pH 7.55

pCO₂ 37

pO₂ 99

SatO₂ 98%

HCO₃⁻ 31

Paziente con Ventimask
FiO₂ 40%

P/F = 247

Alcalosi metabolica

Esempio 3

pH 7.33

pCO₂ 46

pO₂ 19

SatO₂ 22%

HCO₃⁻ 21

Paziente con Ventimask
FiO₂

EGA venosa!!!

Acidosi metabolica

Esempio 4

pH 7.48

Paziente in AA

pCO₂ 28

P/F = 404

pO₂ 85

SatO₂ 92%

Alcalosi respiratoria

HCO₃⁻ 22

Esempio 5

pH 7.33

pCO₂ 135

pO₂ 82

SatO₂ 96%

HCO₃⁻ 69

Paziente con Ventimask
FiO₂ 60%

P/F = 136

Acidosi respiratoria
acuta su cronica

Esempio 6

pH 7.31

pCO₂ 49

pO₂ 125

SatO₂ 98%

HCO₃⁻ 29

Paziente con Ventimask
FiO₂ 70%

P/F = 178

Acidosi respiratoria
con parziale compenso

Esempio 7

pH 7.42

pCO₂ 37

pO₂ 152

SatO₂ 96%

HCO₃⁻ 27

Paziente con Ventimask
FiO₂ 40%

P/F = 380

Equilibrio acido base
normale

Esempio 8

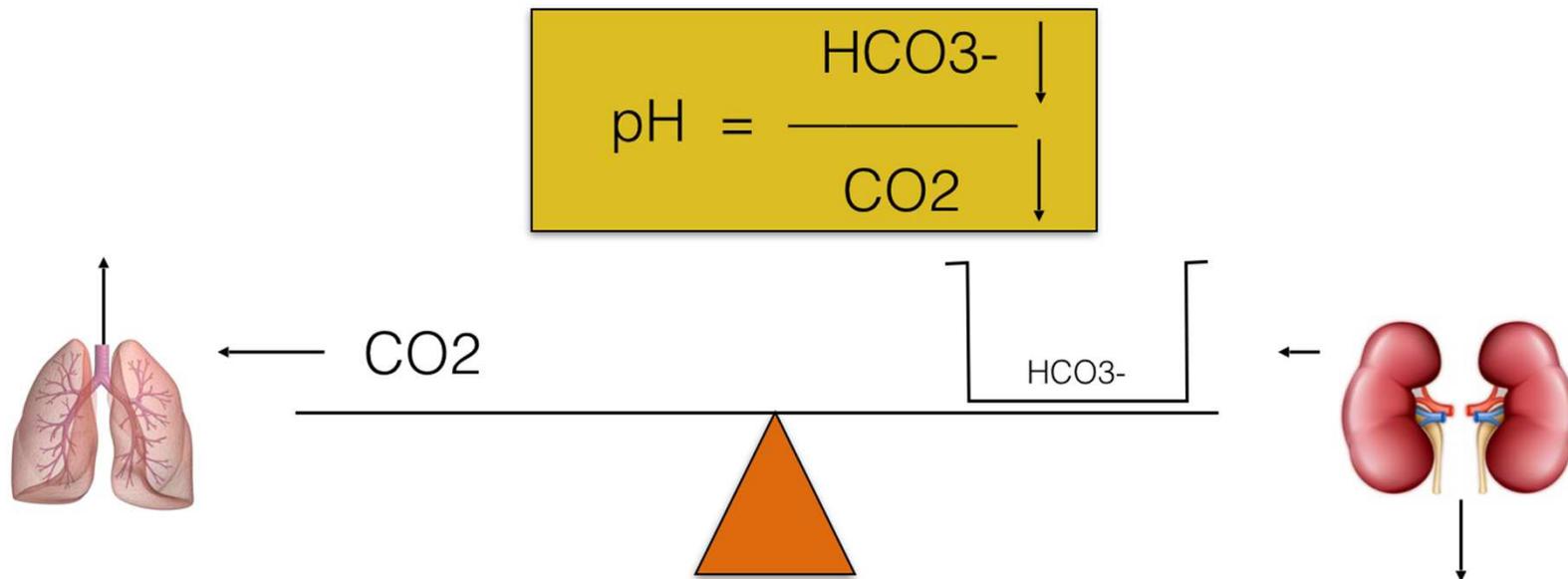
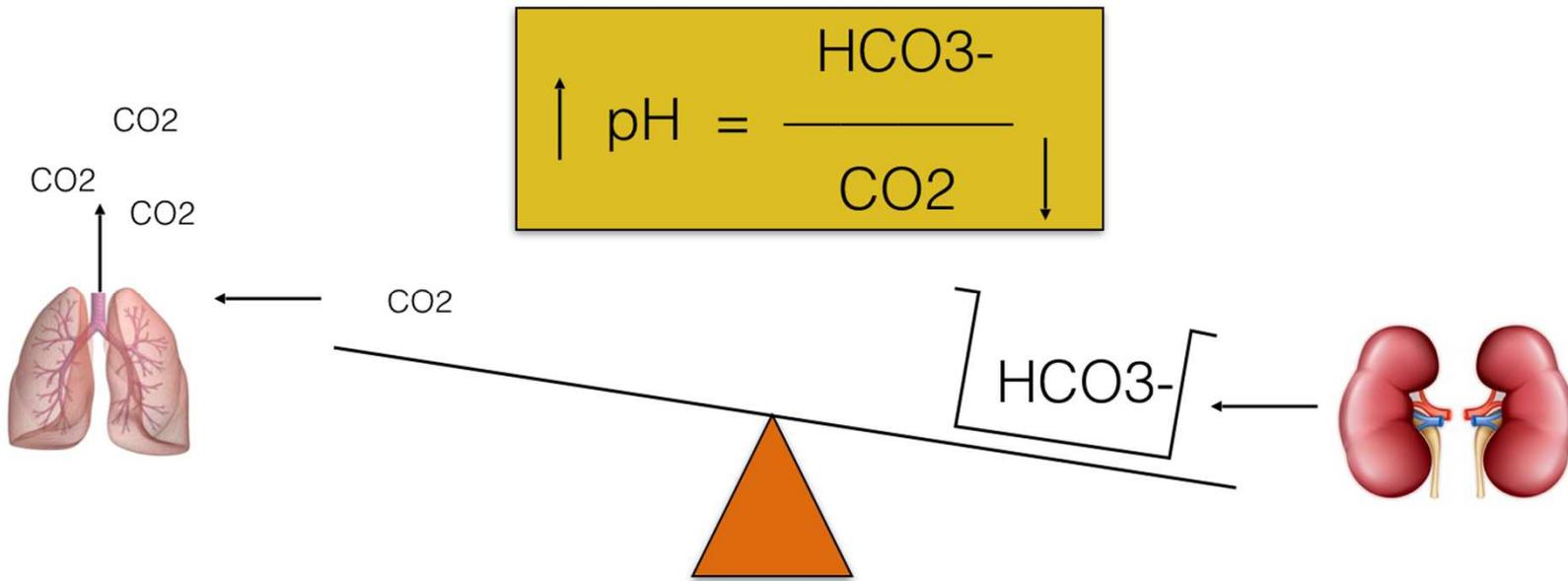
#pH	7.53	
#pCO2	32	mmHg
#pO2	50	mmHg
Na+	139	mmol/L
#K+	3.2	mmol/L
#Ca++	1.09	mmol/L
#Glu	199	mg/dL
Lat	2.0	mmol/L
Hct	43	%

CO-Ossimetria		
THb	14.1	g/dL
O2Hb	86.1	%
COHb	0.4	%
MethHb	0.3	%
HHb	11.2	%
S02	88.8	%

Parametri derivati		
#HCO3-	26.7	mmol/L
#HCO3std	28.1	mmol/L
TCO2	27.7	mmol/L
#BEecf	4.0	mmol/L
BE(B)	4.4	mmol/L

#=Fuori valori riferimento

Insufficienza respiratoria
ipossico ipocapnica
con alcalosi
prevalentemente
respiratoria

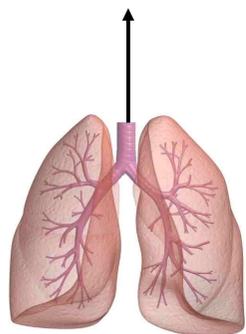


Esempio 9

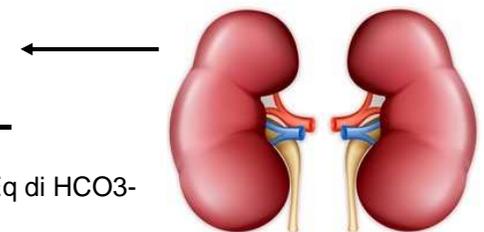
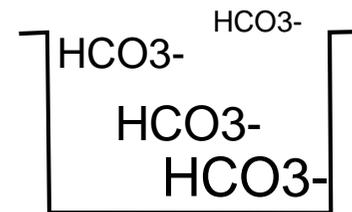
Misurati (37.0C)		
pH	7.41	
#pCO2	58	mmHg
#pO2	54	mmHg
Na+	134	mmol/L
#K+	5.5	mmol/L
#Ca++	1.05	mmol/L
#Glu	308	mg/dL
Lat	1.7	mmol/L
Hct	37	%

Parametri derivati		
#HCO3-	36.8	mmol/L
#HCO3std	32.8	mmol/L
TCO2	38.6	mmol/L
#BEecf	12.2	mmol/L
BE(B)	10.3	mmol/L
#SO2c	88	%

Insufficienza respiratoria
ipossico-ipercapnica
compensata



← CO2



Acuto:
per 10 mmHg di CO2 aumento di 1 mEq di HCO₃⁻

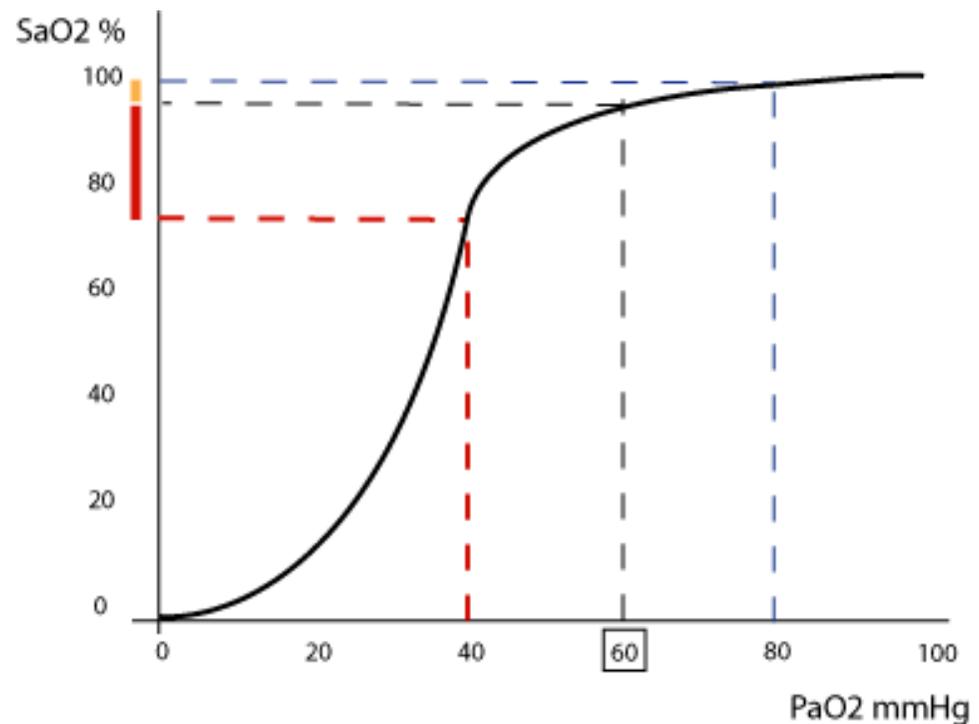
Cronico:
per 10 mmHg di CO2 aumento di 3.5 mEq di HCO₃⁻

Esempio 10

Misurati (37.0C)		
#pH	7.46	
pCO2	43	mmHg
#pO2	46	mmHg
#Na+	132	mmol/L
K+	4.5	mmol/L
#Ca++	1.12	mmol/L
#Glu	167	mg/dL
Lat	1.2	mmol/L
Hct	35	%

Parametri derivati		
Ca++ (7.4)	1.15	mmol/L
HCO3-	30.6	mmol/L
HCO3std	29.4	mmol/L
TCO2	31.9	mmol/L
BEecf	6.8	mmol/L
BE(B)	6.1	mmol/L
SO2c	84	%
THbc	10.9	g/dL

Insufficienza
respiratoria
ipossiêmica marcata
Iniziale Alcalosi
Metabolica



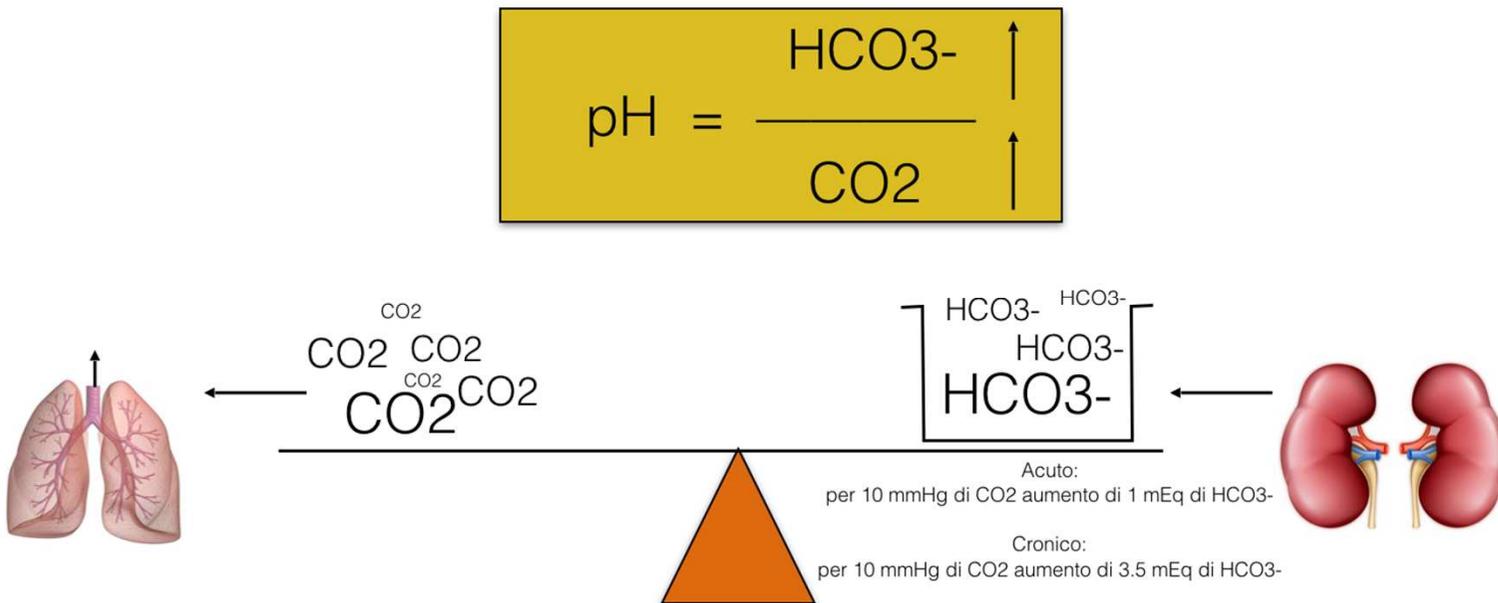
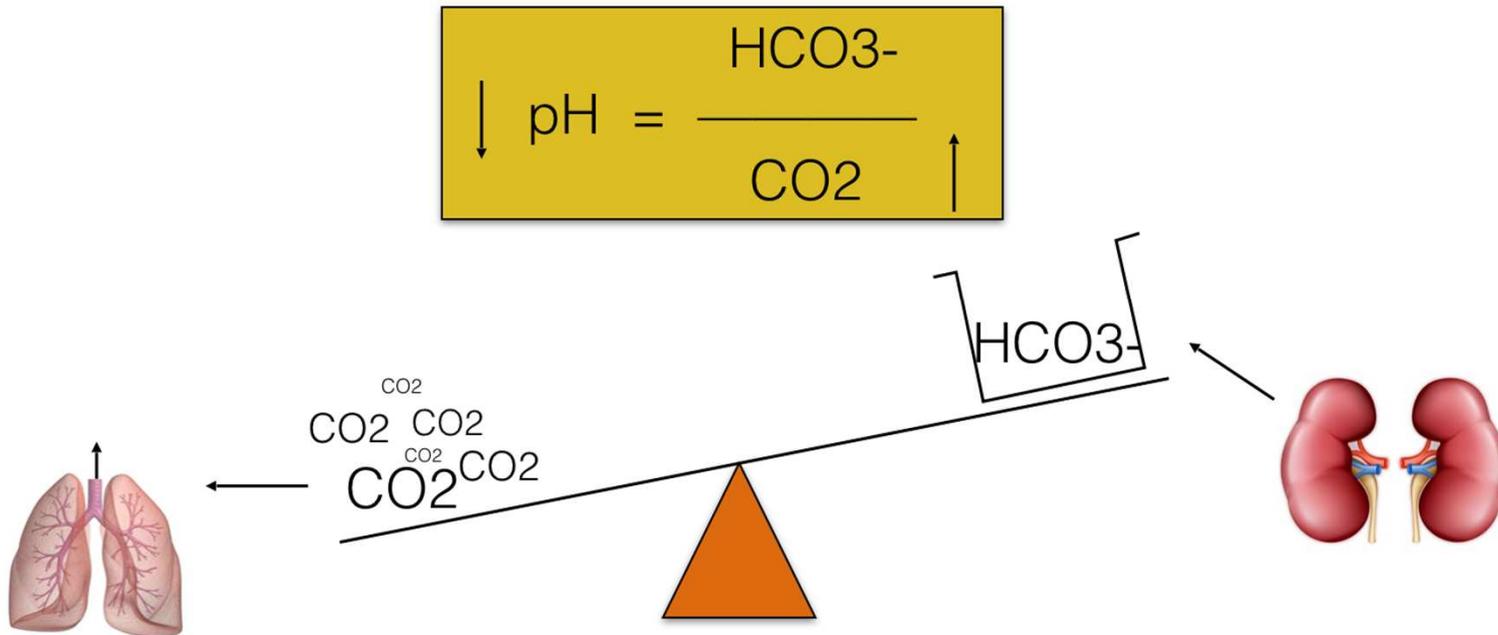
Esempio 11

Misurati (37.0C)		
#pH	7.18	
#pCO2	93	mmHg
#pO2	46	mmHg
Na+	138	mmol/L
K+	3.4	mmol/L
#Ca++	1.05	mmol/L
#Glu	219	mg/dL
Lat	7.0	mmol/L
Hct	45	%

Parametri derivati		
#HCO3-	34.7	mmol/L
#HCO3std	26.6	mmol/L
TCO2	37.6	mmol/L
#BEecf	6.3	mmol/L
BE(B)	3.1	mmol/L
#SO2c	69	%

Insufficienza respiratoria
ipossico-ipercapnica

Acidosi respiratoria
scompensata



Esempio 12

 **Instrumentation Laboratory**

CAMPIONE PAZIENTE

AZ. OSPEDALIERA MODENA
P.S. SASSULO

Stato: VALIDATO
25/09/2007 20:42:56
Tipo campione:
Arterioso
Campione No.: 254
ID Operatore:
PSSA
Paziente:
ID: VERONI
Strumento:
Modello: GEM 3000
S/N: 17127
Nome: PSSAEGA
CO-Ossimetro:
Modello: GEM OPL
S/N: G6964

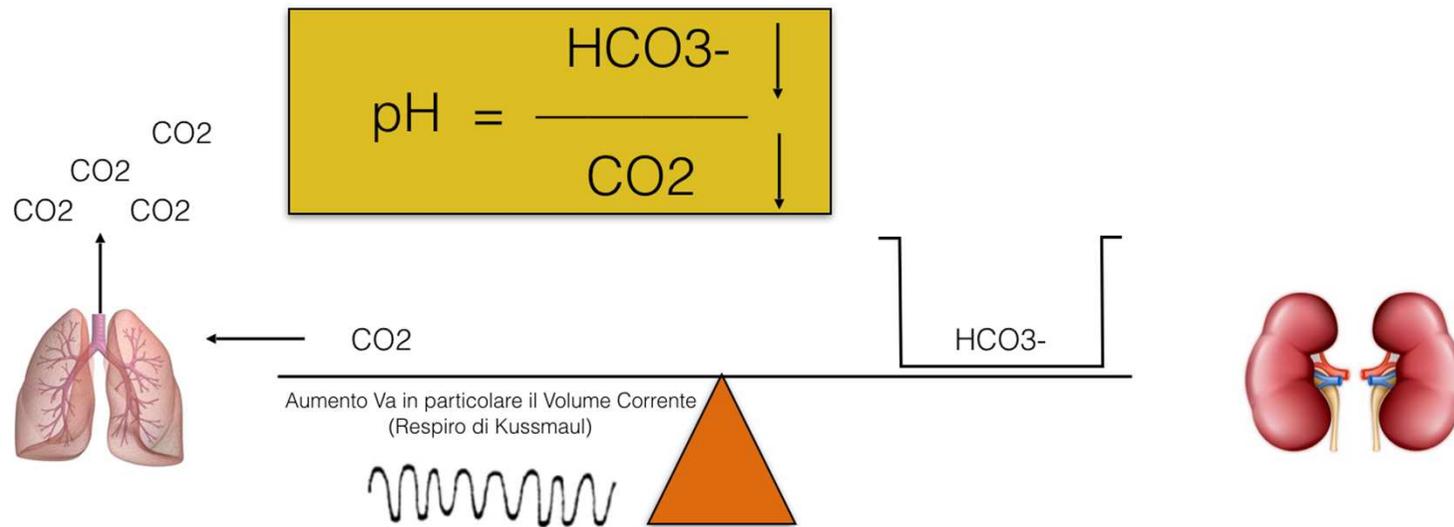
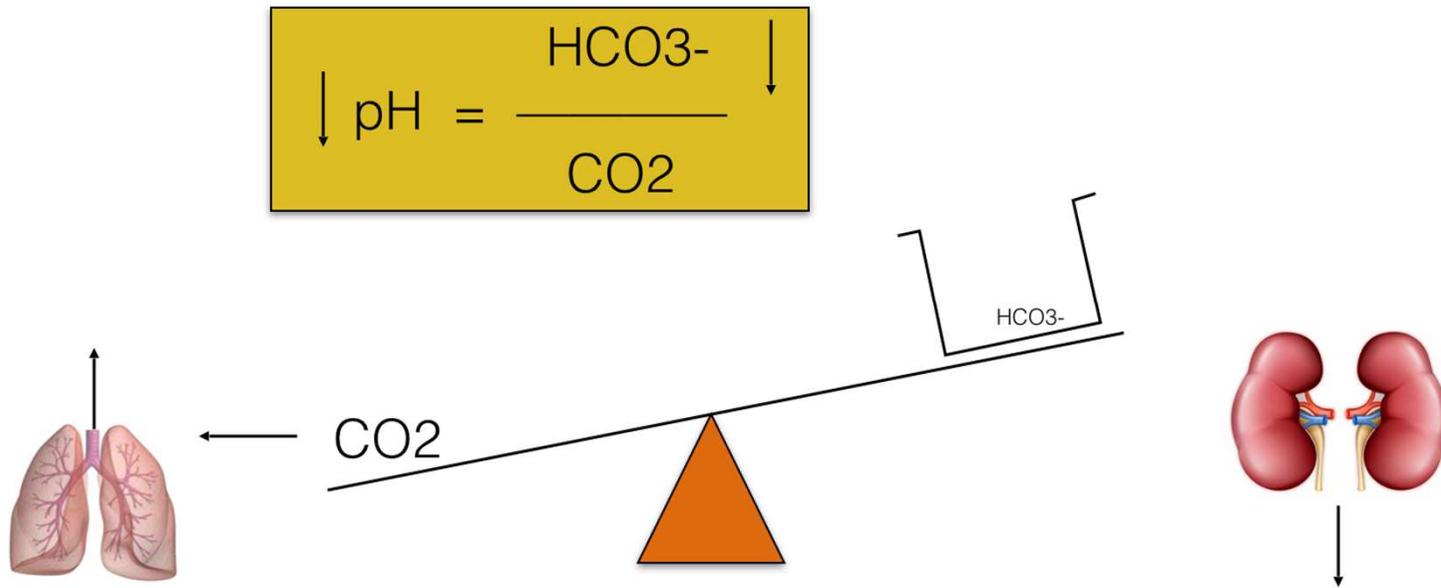
Misurati (37.0C)

pH	7.17	
pCO2	46	mmHg
pO2	55	mmHg
Na+	140	mmol/L
K+	2.6	mmol/L
Ca++	1.11	mmol/L
Glu	100	mg/dL
Lat	2.9	mmol/L
Hct	45	%

Parametri derivati

Ca++(7.4)	1.01	mmol/L
HCO3-	16.8	mmol/L
HCO3std	15.5	mmol/L
TCO2	18.2	mmol/L
BEecf	-11.7	mmol/L
BE(B)	-11.6	mmol/L
O2ct	16.5	mL/dL
O2cap	19.6	mL/dL

Acidosi metabolica
non compensata



Esempio 13

Misurati (37.0C)		
#pH	7.40	
#pCO2	76	mmHg
#pO2	69	mmHg
Na+	137	mmol/L
K+	3.4	mmol/L
#Ca++	1.05	mmol/L
#Glu	219	mg/dL
Lat	1.10	mmol/L
Hct	45	%

Parametri derivati		
#HCO3-	47.7	mmol/L
#HCO3std	36.6	mmol/L
TCO2	37.6	mmol/L
#BEecf	22.3	mmol/L
BE(B)	17.1	mmol/L
#SO2c	94	%

Ipercapnia cronica
compensata

Esempio 14

Misurati (37.0C)		
pH	7.49	
pCO2	23	mmHg
pO2	67	mmHg
Na+	132	mmol/L
K+	3.6	mmol/L
Ca++	1.08	mmol/L
Glu	107	mg/dL
Lat	1.9	mmol/L
Hct	42	%

CO-Ossimetria		
THb	13.5	g/dL
O2Hb	94.4	%
COHb	1.0	%
MetHb	0.9	%
HHb	3.7	%
SO2	96.2	%

Parametri derivati		
Ca++(7.4)	1.12	mmol/L
HCO3-	17.5	mmol/L
HCO3std	21.8	mmol/L
TCO2	18.2	mmol/L
BEecf	-5.8	mmol/L
BE(B)	-3.9	mmol/L
O2ct	17.7	mL/dL
O2cap	18.4	mL/dL

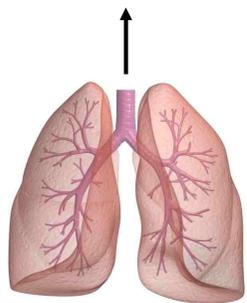
Alcalosi respiratoria
con iniziale compenso
metabolico

Esempio 15

Misurati (37.0C)		
#pH	7.51	
#pCO2	49	mmHg
#pO2	87	mmHg
Na+	137	mmol/L
K+	3.0	mmol/L
#Ca++	1.05	mmol/L
#Glu	219	mg/dL
Lat	7.0	mmol/L
Hct	45	%

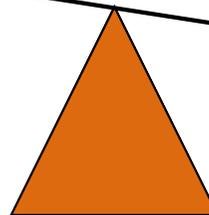
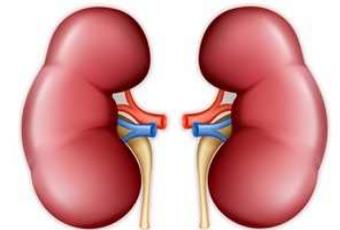
Parametri derivati		
#HCO3-	39.7	mmol/L
#HCO3std	36.6	mmol/L
TCO2	37.6	mmol/L
#BEecf	16.3	mmol/L
BE(B)	13.1	mmol/L
#SO2c	97	%

Alcalosi metabolica con
iniziale compenso respiratorio



CO2 CO2
CO2

HCO3-
HCO3-^{HCO3-}
HCO3-



Esempio 16

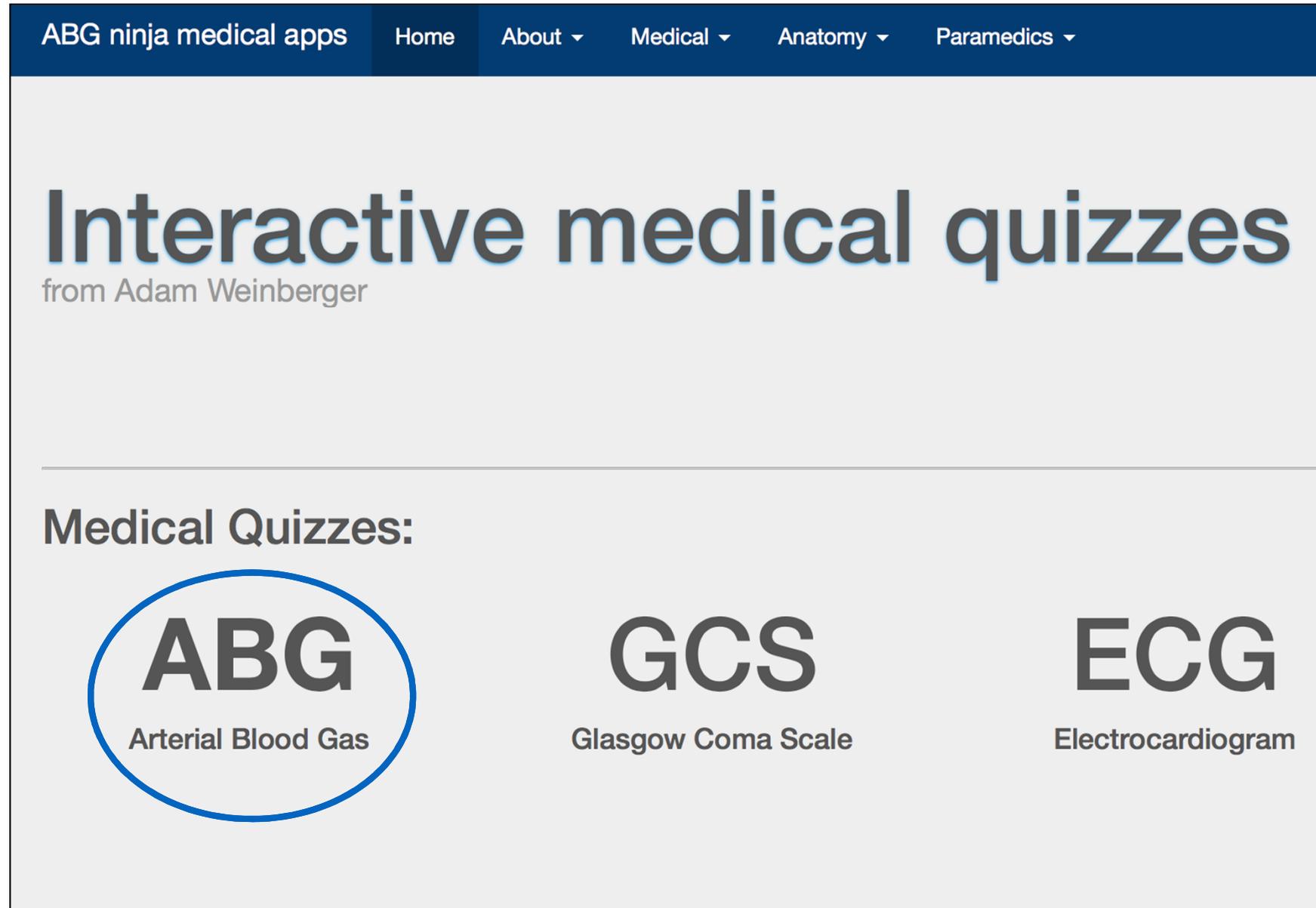
Instrumentation Laboratory	BESOTTI Instrumentation Laboratory	Instrumentation Laboratory
CAMPIONE PAZIENTE BESOTTI	CAMPIONE PAZIENTE	CAMPIONE PAZIENTE
AUSL MODENA MEDICINA A <i>02804</i> SASSUOLO POSTAZIONE POCT	AUSL MODENA MEDICINA B <i>02390u</i> SASSUOLO POSTAZIONE POCT	AUSL MODENA MEDICINA B SASSUOLO POSTAZIONE POCT
Stato: VALIDATO 02/10/2008 09:37:32 Tipo campione: Arterioso Campione No.: 43 Strumento: Modello: GEM 3000 S/N: 13168	Stato: VALIDATO 03/10/2008 06:30:42 Tipo campione: Arterioso Campione No.: 94 ID Operatore: OPERATORE Paziente: ID: B Sesso: S Strumento: Modello: GEM 3000 S/N: 17124	Stato: VALIDATO 04/10/2008 09:02:54 Tipo campione: Arterioso Campione No.: 111 ID Operatore: OPERATORE Paziente: <i>Con 3L</i> ID: B Sesso: S Strumento: Modello: GEM 3000 S/N: 17124
Misurati (37.0C)	Misurati (37.0C)	Misurati (37.0C)
#pH 7.27 #pCO2 85 mmHg #pO2 53 mmHg #Na+ 138 mmol/L #K+ 3.5 mmol/L #Ca++ 1.02 mmol/L #Glu 174 mg/dL #Lat 0.7 mmol/L #Hct 42 %	pH 7.36 #pCO2 77 mmHg #pO2 51 mmHg #Na+ 140 mmol/L #K+ 3.6 mmol/L #Ca++ 1.03 mmol/L #Glu 166 mg/dL #Lat 0.6 mmol/L #Hct 44 %	pH 7.42 #pCO2 64 mmHg #pO2 52 mmHg #Na+ 139 mmol/L #K+ 3.6 mmol/L #Ca++ 1.09 mmol/L #Glu 171 mg/dL #Lat 0.8 mmol/L #Hct 45 %
Parametri derivati	Parametri derivati	Parametri derivati
Ca++(7.4) 0.97 mmol/L #HCO3- 39.0 mmol/L #HCO3std 31.4 mmol/L #TCO2 41.6 mmol/L #BEecf 12.1 mmol/L #BE(B) 8.8 mmol/L #SO2c 82 % #THbc 13.0 g/dL	#HCO3- 43.5 mmol/L #HCO3std 35.6 mmol/L #TCO2 45.9 mmol/L #BEecf 18.1 mmol/L #BE(B) 14.2 mmol/L #SO2c 84 %	#HCO3- 41.5 mmol/L #HCO3std 35.5 mmol/L #TCO2 43.5 mmol/L #BEecf 17.0 mmol/L #BE(B) 13.9 mmol/L #SO2c 87 %
Va'		Va'

Acidosi respiratoria
cronica
trattata con VMNI

Per esercitarsi anche da casa...

<http://www.vectors.cx/med/apps/index.html>

Per esercitarsi anche da casa...



The image shows a screenshot of a website titled 'ABG ninja medical apps'. The navigation bar includes 'Home', 'About', 'Medical', 'Anatomy', and 'Paramedics'. The main heading is 'Interactive medical quizzes' by Adam Weinberger. Under 'Medical Quizzes:', three options are listed: 'ABG' (Arterial Blood Gas), 'GCS' (Glasgow Coma Scale), and 'ECG' (Electrocardiogram). The 'ABG' option is highlighted with a blue circle.

ABG ninja medical apps Home About ▾ Medical ▾ Anatomy ▾ Paramedics ▾

Interactive medical quizzes

from Adam Weinberger

Medical Quizzes:

ABG Arterial Blood Gas	GCS Glasgow Coma Scale	ECG Electrocardiogram
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Per esercitarsi anche da casa...

pH:	7.48	➤
PaCO ₂ :	61 mmHg	➤
[HCO ₃ ⁻]:	44 mEq/L	➤

normal ABG Submit ➤

Primary problem

Normal

or

Metabolic Respiratory Combined ➤

Acidosis Alkalosis ➤

Compensation

None

or

Metabolic Respiratory

Acidosis Alkalosis

Level of compensation

None ➤

or

Partial Full ➤

Per esercitarsi anche da casa...

pH: 7.48
PaCO₂: 61 mmHg
[HCO₃⁻]: 44 mEq/L

metabolic alkalosis, partially compensated by a respiratory acidosis

Submit

Primary problem

Normal

or

Metabolic Respiratory Combined

Acidosis Alkalosis

Compensation

None

or

Metabolic Respiratory

Acidosis Alkalosis

Level of compensation

None

or

Partial Full

Per esercitarsi anche da casa...

ABG interpretation

Analyze the following ABG



Test	Value	Normals	Analysis
pH:	7.48	7.35-7.45	Alkalotic (high): Overall state is (still) an alkalosis
PaCO ₂ :	61 mmHg	35-45 mmHg	Acidotic (high): CO ₂ tension is high (respiratory acidosis)
[HCO ₃ ⁻]:	44 mEq/L	22-26 mEq/L	Alkalotic (high): HCO ₃ ⁻ concentration is high (metabolic alkalosis)

The pH and HCO₃⁻ levels are both alkalotic, so the primary mechanism is a metabolic alkalosis. The respiratory acidosis is compensation for the HCO₃⁻, but the pH is not within normal limits, so it is only partially effective.

Primary problem

Answer:

Metabolic Alkalosis

You said:

Metabolic Alkalosis

Compensation

Answer:

Respiratory Acidosis

You said:

Respiratory Acidosis

Level of compensation

Answer:

Partial

You said:

Partial



GRAZIE DELL'ATTENZIONE