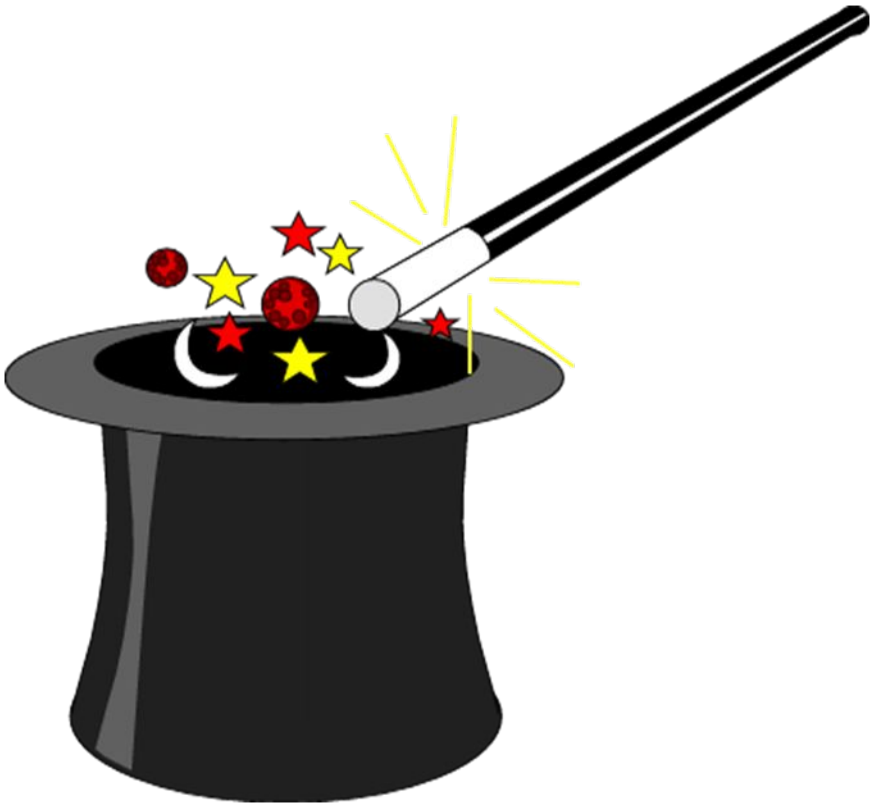
- ABG CASE STUDIES & INTERPRETATION

It’s not magic understanding ABG’s, it just takes a little practice!



Acid-base imbalances

- Metabolic acidosis
- Metabolic alkalosis
- Respiratory acidosis
- Respiratory alkalosis

Metabolic

- METABOLIC ACIDOSIS: Decrease the HCO_3^- --> the pH goes down.
- Compensation: Respiratory Alkalosis (hyperventilation) will bring the pH back near normal.
- Causes: Diarrhea, DKA, LA, renal failure.

- METABOLIC ALKALOSIS: Increase the HCO_3^- --> the pH goes up.
- Compensation: Respiratory Acidosis (hypoventilation) can help to bring the pH+

Respiratory

- RESPIRATORY ACIDOSIS: Increase the pCO_2---> the pH goes down. *Hypoventilation.* Compensation: Metabolic Alkalosis can help bring the pH back near normal.
- Causes: pneumonia, Bronchitis, Asthma
- RESPIRATORY ALKALOSIS:Decrease the pCO_2-> the pH goes up. *Hyperventilation.*
- Compensation: Metabolic Acidosis can help bring the pH back near normal.

METABOLIC ALKALOSIS

CAUSES:

- Vomiting: Lose enough stomach acid to produce alkalosis.

- Diuretics: Loop diuretics and thiazides can lead to hypokalemia ------> secondary metabolic alkalosis.

- Antacids overuse

RESPIRATORY ACIDOSIS:

causes:

CNS DEPRESSION

- DRUGS:Opiates,sedatives,anaesthetics
- OBESITY HYPOVENTILATION SYNDROME
- STROKE

NEUROMUSCULAR DISORDERS:

- NEUROLOGIC: POLIO,GBS,TETANUS,BOTULISM
- MUSCULAR DYSTROPHY

AIRWAY OBSTRUCTION

- ACUTE ASPIRATION, LARYNGOSPASM

CHEST WALL RESTRICTION

- PLEURAL: Effusions, empyema,pneumothorax,fibrothorax
- CHEST WALL: Kyphoscoliosis, scleroderma,ankylosing spondylitis,obesity

SEVERE PULMONARY RESTRICTIVE DISORDERS

- PULMONARY FIBROSIS

RESPIRATORY ALKALOSIS

- Causes:
- High altitude.
- Neuromuscular disease
- Respiratory center depression
- Inadequate mechanical ventilation
- Sepsis
- Burns

Metabolic acidosis

- Metabolic acidosis: Is caused by a decrease in HCO_3^- concentration in blood.
- Causes:

1. Increased production of acids: LA, kA, Salicylate poisoning.
2. Loss of HCO_3^-: Diarrhea and kidneys RTA.
3. Blood profile: pH decreased

- $[HCO_3^-]$ decreased, PCO_2 decreased

Compensation of Metabolic acidosis:

- Respiratory compensation: decrease in pH stimulates respiratory center causing hyperventilation which produces decrease in PCO2.
- Renal Compensation: excess H+ is excreted as titratable acid and NH4+.
- Treatment: lactate containing solution which converts HCO3- ion the liver.

ABG Disorders

Disorder	Change	Compensation
Respiratory Acidosis	↑ $PaCO_2$	↑ HCO_3 (Metabolic alkalosis)
Respiratory Alkalosis	↓ $PaCO_2$	↓ HCO_3 (Metabolic acidosis)
Metabolic Acidosis	↓ HCO_3	↓ $PaCO_2$ (Respiratory alkalosis)
Metabolic Alkalosis	↑ HCO_3	↑ $PaCO_2$ (Respiratory acidosis)

Assessment of acid base status

- Direct arterial blood measurements: *ABG*

  pH

  pCO_2

  pO_2

NB: use heparinised blood, measured within 10 minutes

- Derived measures:

  Bicarbonate (HCO_3^-)

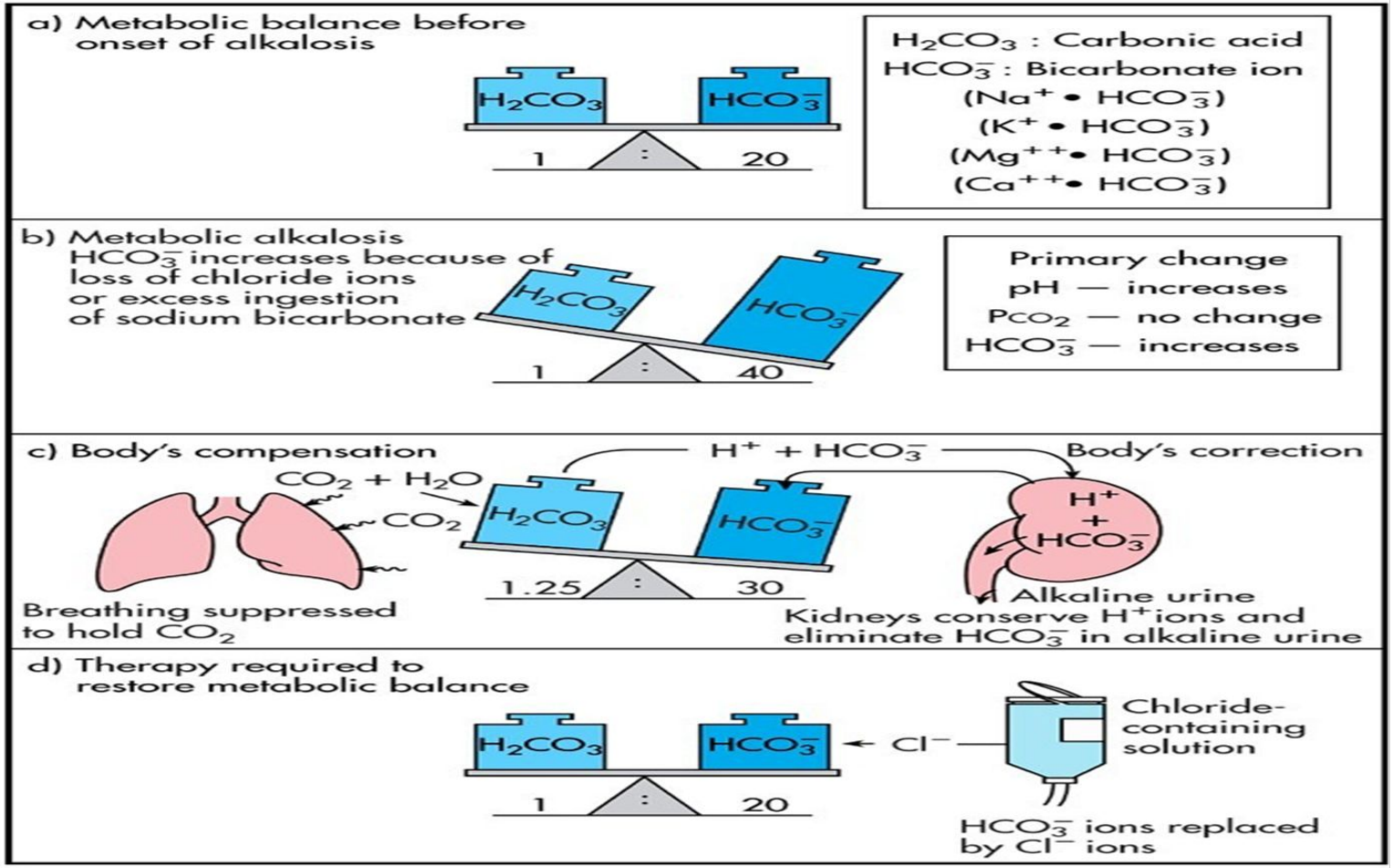
Normal Values:

pH =7.35-7.45 (7.4)

HCO_3^- = 22 - 26 mEq/L (24 mEq/L)

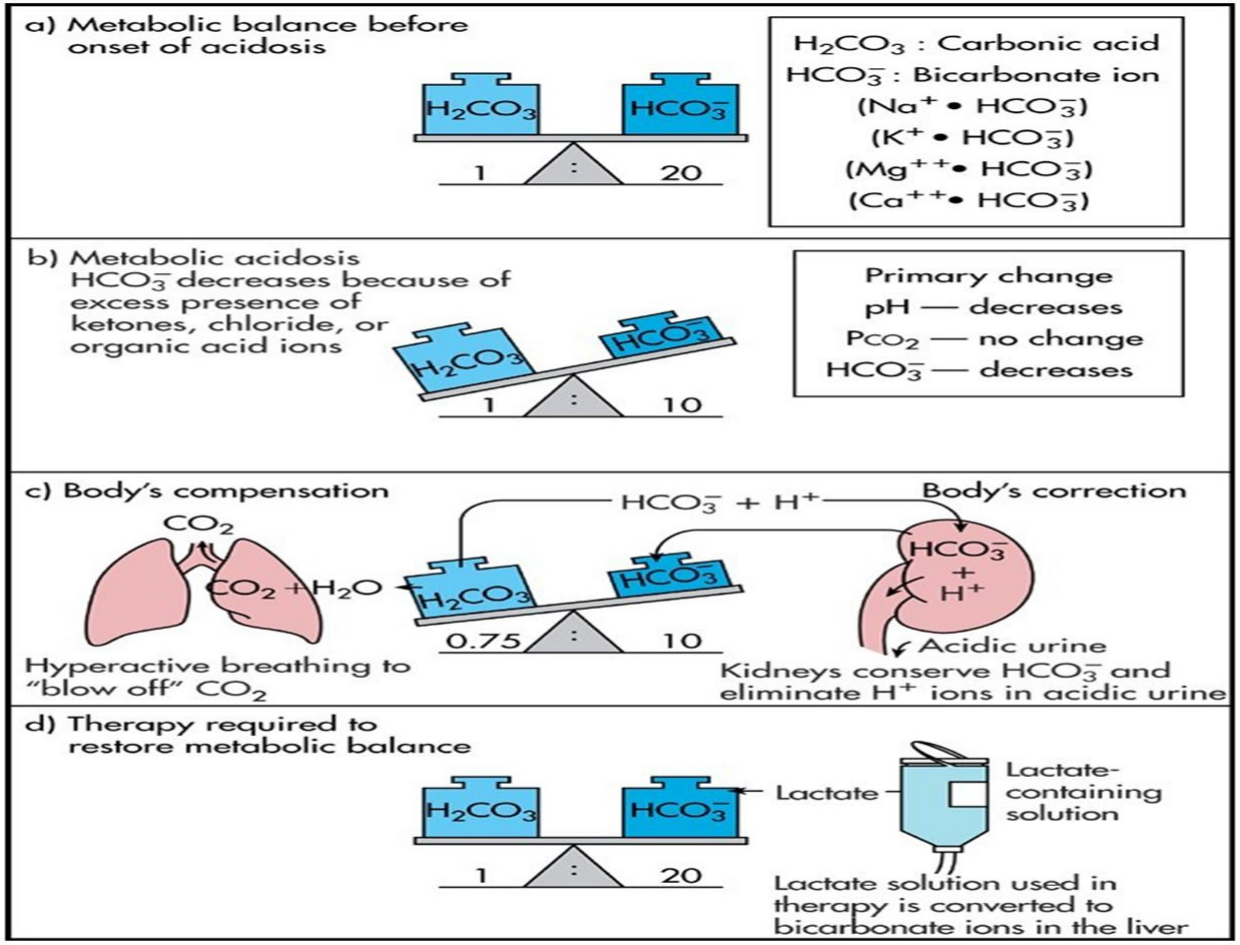
pCO2 = 35 - 45mm Hg (40mm Hg)

Metabolic alkalosis



From Thibodeau GA, Patton KT: *Anatomy & physiology*, ed 5, St Louis, 2003, Mosby.

Metabolic acidosis



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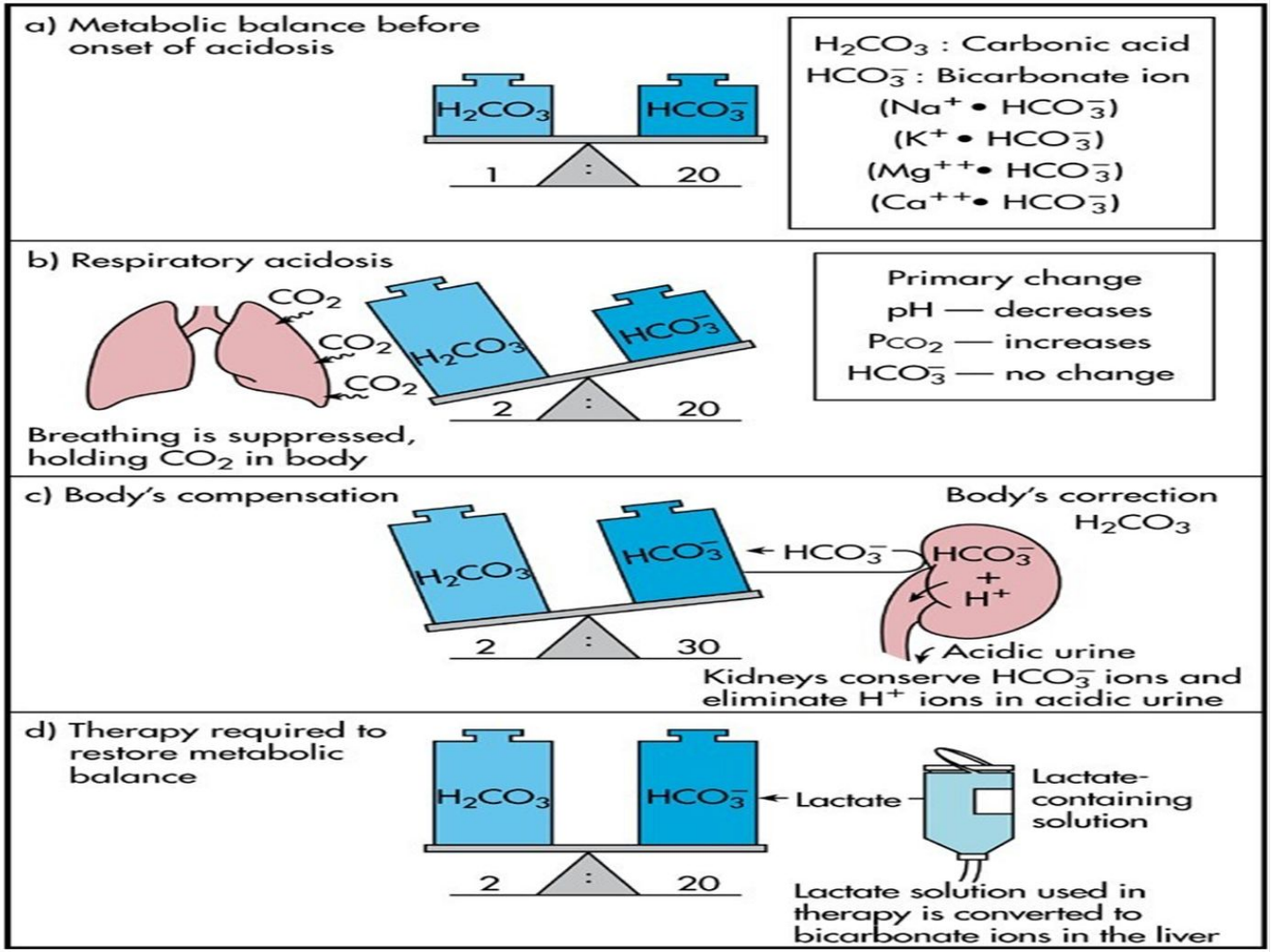
Respiratory acidosis



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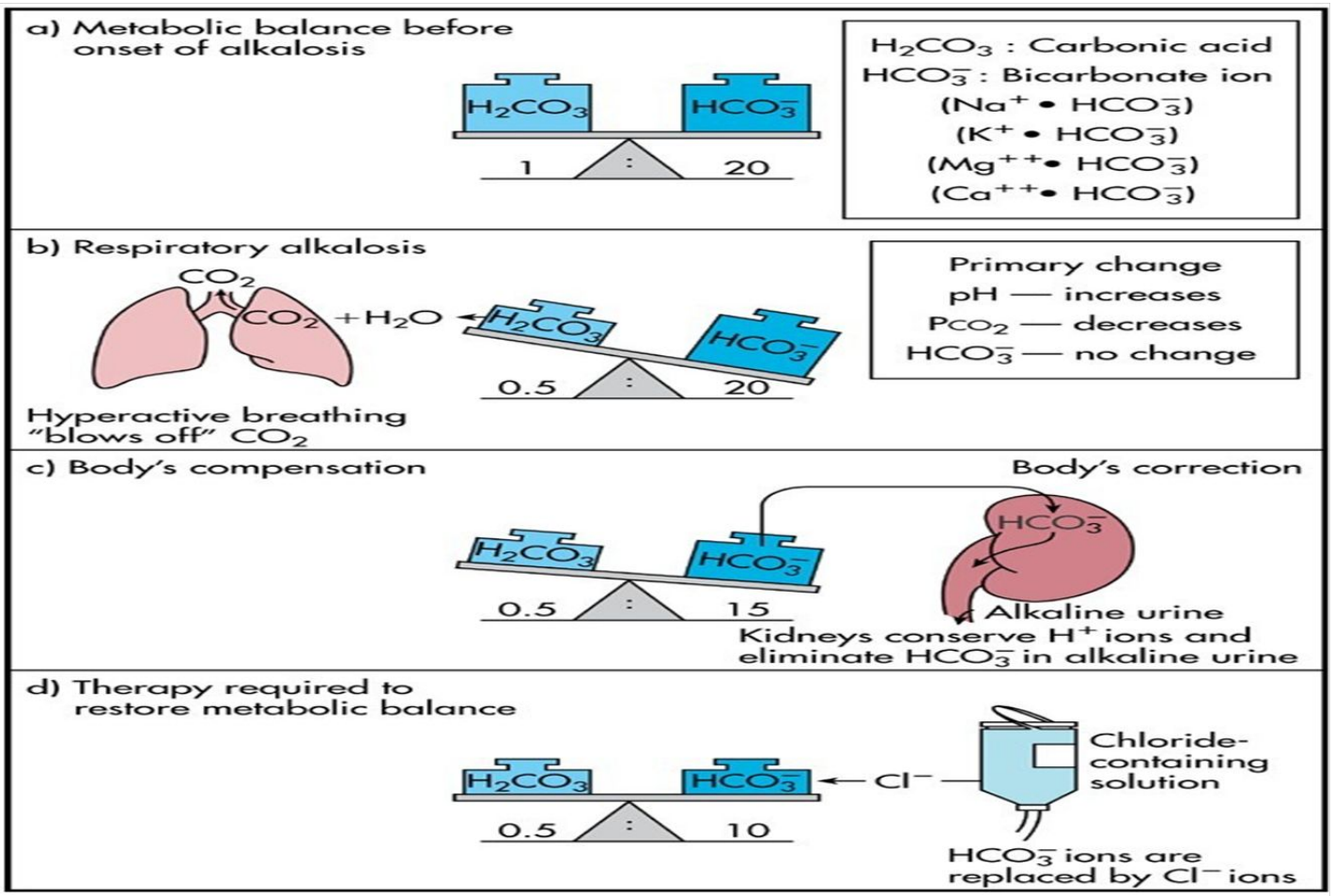
Respiratory Alkalosis



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Metabolic Acidosis

- pH 7.30
- PaCO2 40
- HCO3 15

Metabolic Alkalosis

- pH 7.50
- PCO_2 40
- HCO_3 30

Respiratory Acidosis

- pH 7.30
- PaCO2 60
- HCO3 26

Respiratory Alkalosis

- pH 7.50
- PaCO2 25
- HCO3 23

- What are the compensations?
- • Respiratory acidosis --metabolic alkalosis
- • Respiratory alkalosis --metabolic acidosis
- • In respiratory conditions, therefore, the kidneys will attempt to compensate and visa versa.

- Buffers kick in within minutes.
- Respiratory compensation is rapid and starts within minutes and complete within 24 hours. Kidney compensation takes hours and up to 5 days

Acid base disorder-worksheet

Type of Disorder	pH	$PaCO_2$	$[HCO_3]$
Metabolic Acidosis	↓		↓
Metabolic Alkalosis			
Respiratory Acidosis			
Respiratory Alkalosis			

Practice ABG's

pH 7.48	$PaCO_2$ 32	HCO_3 24
pH 7.32	$PaCO_2$ 48	HCO_3 25
pH 7.30	$PaCO_2$ 40	HCO_3 18
pH 7.38	$PaCO_2$ 48	HCO_3 28
pH 7.49	$PaCO_2$ 40	HCO_3 30
pH 7.35	$PaCO_2$ 48	HCO_3 27
pH 7.45	$PaCO_2$ 47	HCO_3 29
pH 7.31	$PaCO_2$ 38	HCO_3 15
pH 7.30	$PaCO_2$ 50	HCO_3 24
pH 7.48	$PaCO_2$ 40	HCO_3 30

Answers:

1. Respiratory alkalosis
2. Respiratory acidosis
3. Metabolic acidosis 4.Compensated Respiratory
acidosis
5. Metabolic alkalosis

6. Compensated Respiratory acidosis
7. Compensated Metabolic
alkalosis
8. Metabolic acidosis
9. Respiratory acidosis
10. Metabolic alkalosis

STEPS OF ASSESSING ABG

- *STEP 1:* Diagnose whether it is acidosis or alkalosis- (pH will help)
- *STEP2:*Diagnose whether compensated or non compensated
- *STEP 3:* Diagnose whether it is metabolic or respiratory(Look at the value of bicarbonate and pCO2)

Work sheet

- Diarrhea may lead to----------?
- Acid loss due to vomiting and gastric suction may lead to _____ alkalosis?
- Overuse of _____may lead to metabolic alkalosis?

Problem#1

- 67 year female known diabetic for past 20years presented with sudden onset of severe chest pain and Shortness of breath.
- ABG analysis showed:
- pH 7.36
- PCO_2 33 mmHg
- HCO_3 18 mmol/L
- Discuss the probable diagnosis.

Problem #2

- A 30-year old man with DM presents with polyuria, polydipsia, fever, cough, and purulent sputum.
- His ABG shows the following Na+140 / Cl-104

  K+7.0
- pH:6.95
- pCO2 : 33
- Hco3 : 7.0
- Discuss the probable diagnosis.

Problem#3

- 45 year old male was admitted to the emergency room with complaints of mild vomiting, associated with disorientation and muscular weakness. His blood investigations showed the following
  - pH =7.20 Na -137meq/l
  - HCO_3^-=16mEq / L Cl-108meq/l
  - pCO_2 = 34mm Hg K -5.8
  - Glucose=685mg/dl
  - urea49mg/dl

Problem #4

- 60 year male presents to the ED from a nursing home. You have no history other than he has been breathing rapidly and is less responsive than usual.
-
-
-
-
- Na^+ 123 Cl^- 99 HCO_3^- 5
- pH7.31 pCO_2 10
- Discuss the probable diagnosis.

Problem # 5

- 60year old man was admitted with severe abdominal pain, which started some 2 hours back.
- Clinically he was in a state of shock with distended abdomen. Femoral pulses could not be palpable
- His ABG shows the follows pH : 7.05
- pCO2: 26.3 mmHg
- HCO3: 7 mmol/L Discuss the probable diagnosis.

THANK YOU FOR LISTENING!