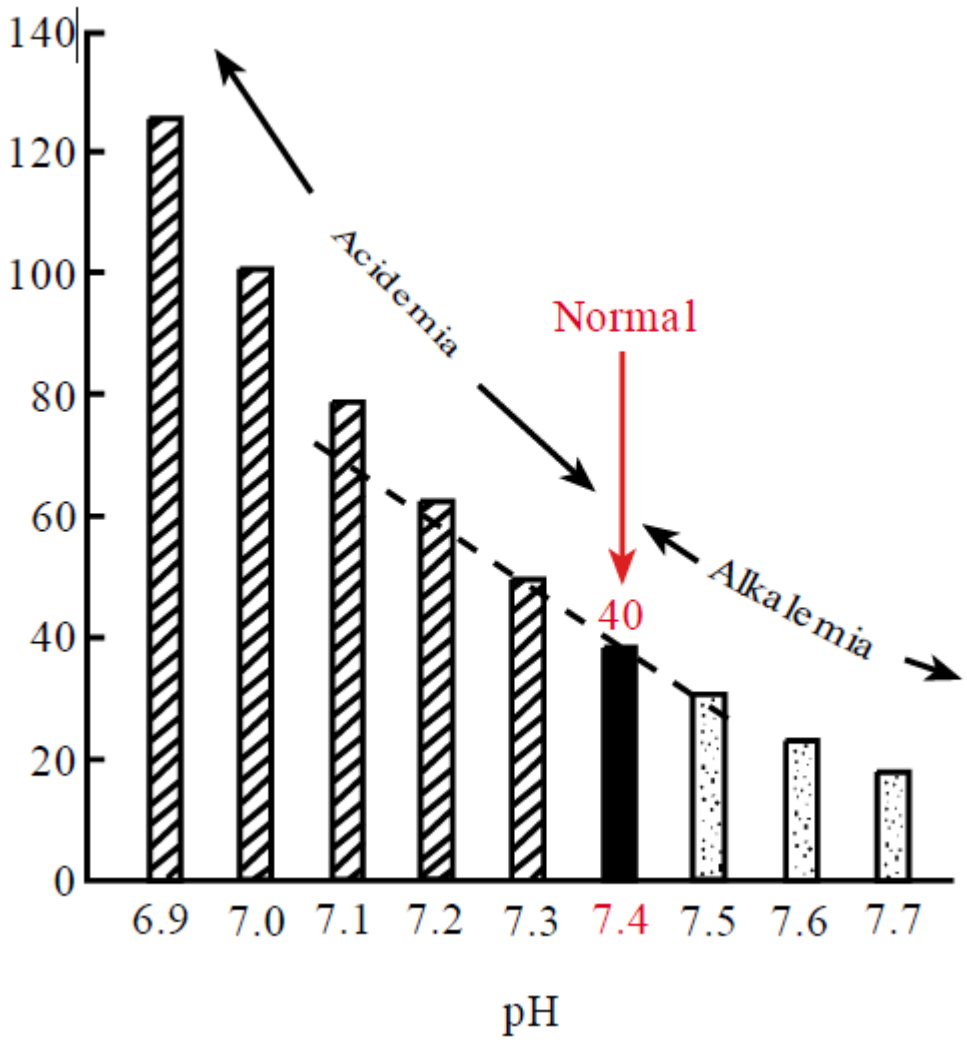
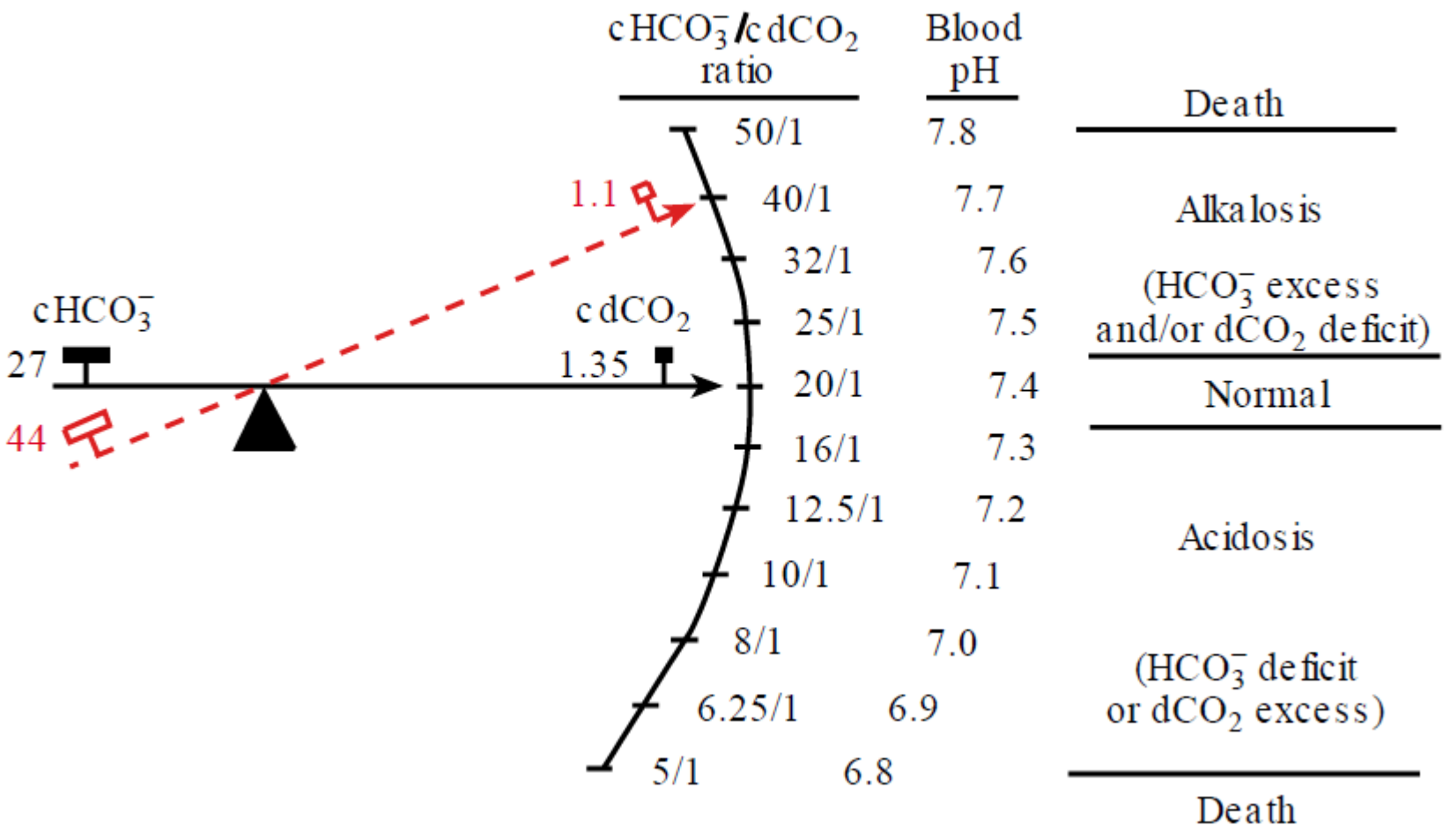
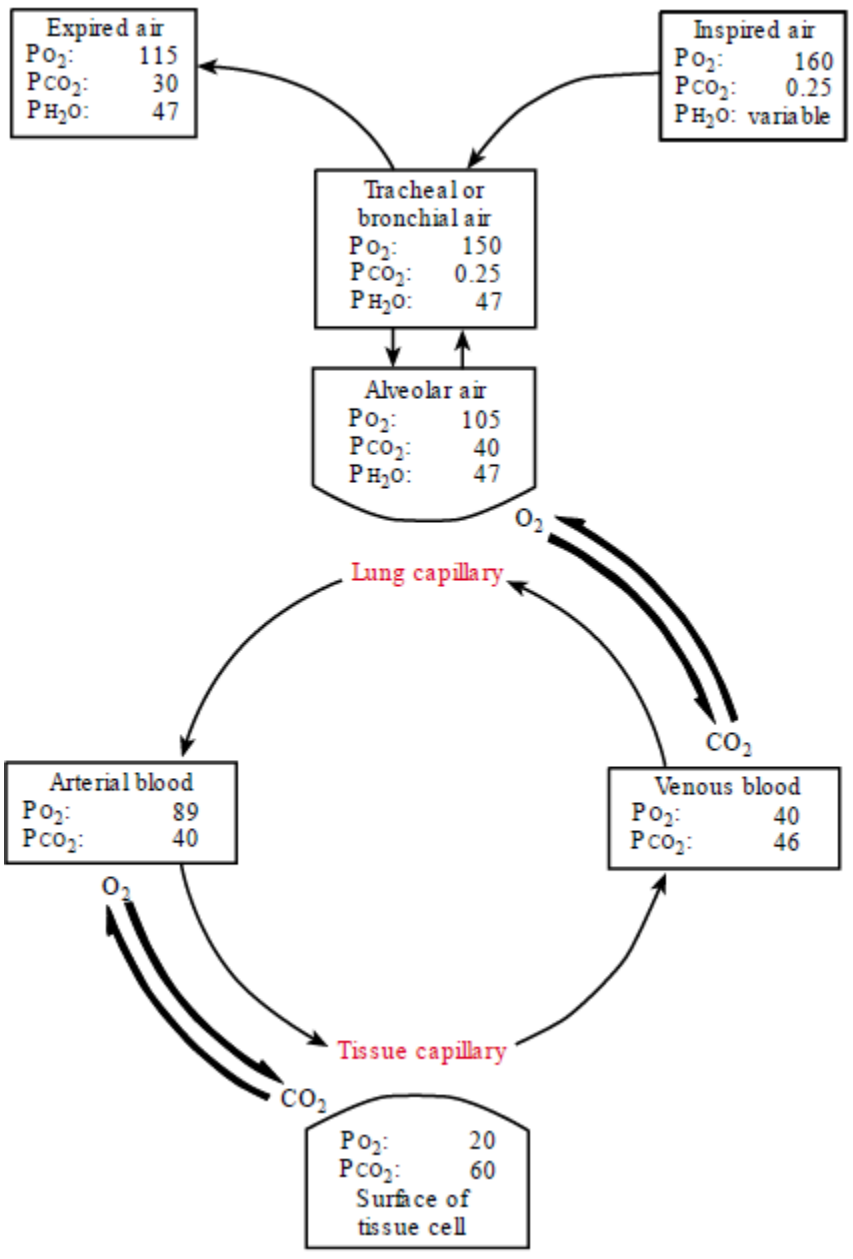
Relationship of pH to hydrogen ion concentration

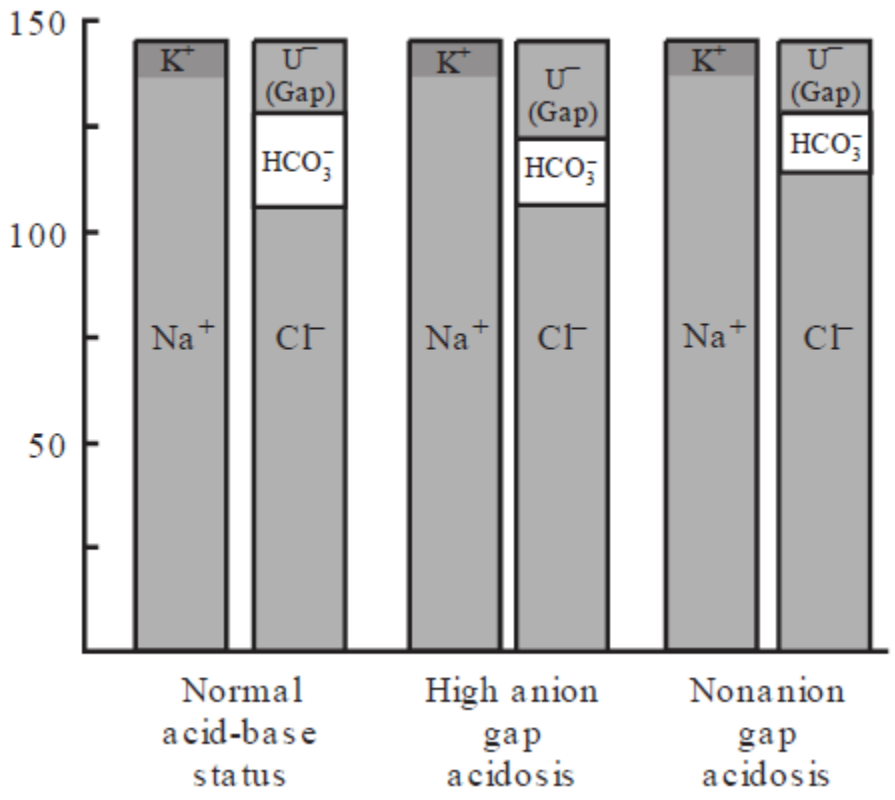


Scheme demonstrating the relation between pH and the ratio of bicarbonate concentration to the concentration of dissolved CO2.





Simple depiction of normal gap, anion gap acidosis, and nonanion gap acidosis.



Increase in anion gap

Methanol
Uremia
Diabetic ketoacidosis
Paraldehyde
Iron, Isoniazid, Ibuprofen
Lactic acidosis
Ethylene glycol
Salicylates, starvation ketoacidosos

Decrease in Anion Gap

Laboratory error

1. Increase in unmeasured cations
2. Lithium intoxication
3. Increased immunoglobulin
4. Monoclonal gammopathies
5. Nephrotic syndrome
6. Hyperlipidemia

Normal Anion Gap

<u>GI fluid loss</u>	
Severe diarrhoea	Hypokalemia
Pancreatitis	K+ variable
<u>Renal tubular acidosis</u>	
Proximal (type II) RTA	Urine pH <5.5 , K+ normal or low
Distal (typeI) RTA	Urine pH >5.5 with hypokalemia
Type IV RTA	Urine pH < 5.5 with hyperkalemia

An alcoholic has been vomiting :

pH= 7.55, Hco3- =40 mmol/L, Na+= 135, k+= 2.8, Cl-= 80

AG= 135- (40+80) = 15

Superimposed alcoholic ketoacidosis

Beta hydroxy butyrate conc= 15 mM pH= 7.4, Hco3-= 25 mmol/L

AG= 135- (25+80)= 30

Mixed Acidosis and Alkalosis

Alcohol	Serum osmol gap	Anion Gap	Serum acetone	Urine oxalate
Ethanol	+	----	-----	-----
Methanol	+	+	-----	-----
Isopropanol	+	---	+	----
Ethylene glycol	+	+	-----	+

PREDICTION OF COMPENSATORY RESPONSES ON SIMPLE ACI DBA5E DISTURBANCES AND PATTERN OF CHANGES

Disorder	Prediction of compensation	pH	HCO3-	PaCO2
Metabolic acidosis	Paco2 will ↓ 1.25 mm H g per mmol/l↓ in [HC03-]	Low	Low	Low
Metabolic alkalosis	Paco2 will ↑ 6 mmHg per 10 mmol/l ↑ in [HC03-]	High	High	High
Respiratory alkalosis	[HCO3--] will ↓ 0.2 mmo1/L (Acute) and 0.4 mmol/l (chr) per mmH g ↓ in PaCO2	High	Low	Low
Respiratory acidosis	[HCO3--]will ↑ 0.1-0.4 mmo1/L per mm Hg ↑in PaCO2	Low	High	High

Conditions leading to Metabolic Alkalosis

Chloride responsive (Urine Cl- < 10 mmol/L)

Contraction alkalosis (Hypovolemia)

- Prolonged vomiting
- Upper duodenal obstruction
- Dehydration

Chloride resistant (Urine Cl- > 10 mmol/L)

Mineralocorticoid Excess

- Primary hyperaldosteronism
- Bilateral adrenal hyperplasia
- Secondary hyperaldosteronism

Glucocorticoid excess

- Primary adrenal adenoma
- Pituitary adenoma secreting ACTH
- Exogenous cortisol therapy

Bartter syndrome (defective renal Cl- absorption)

Exogenous base

Bicarbonate containing iv fluid therapy

Massive blood transfusion (Sodium citrate overload)

Milk Alkali syndrome

Conditions leading to Respiratory Acidosis

Factors that directly depress the respiratory centre

- Drugs such as narcotics
- CNS trauma, tumor
- Infections of the CNS
- Comatose states

Conditions that affect the Respiratory apparatus

- ***COPD (most common)***
- Severe pulmonary fibrosis
- Disease of the upper airway e,g laryngospasm, tumor
- Impair lung motion due to pleural effusion
- ARDS

Others

- Abdominal distension as in peritonotitis and ascites
- Extreme obesity
- Sleep disorder, sleep apnea

Factors causing respiratory Alkalosis

Nonpulmonary stimulation of respiratory center

- Anxiety, hysteria
- Febrile state
- Metabolic encephalopathy
- CNS infection
- Cerebrovascular accident
- Hypoxia
- Drugs and agents such salicylates, cathecholamines

Pulmonary disorder

- Pnemonia
- pulmonary emboli
- Interstitial lung diasease
- CHF
- Respiratory compensation after correction of metabolic acidosis

Others

- Ventilation induced hyperventilation