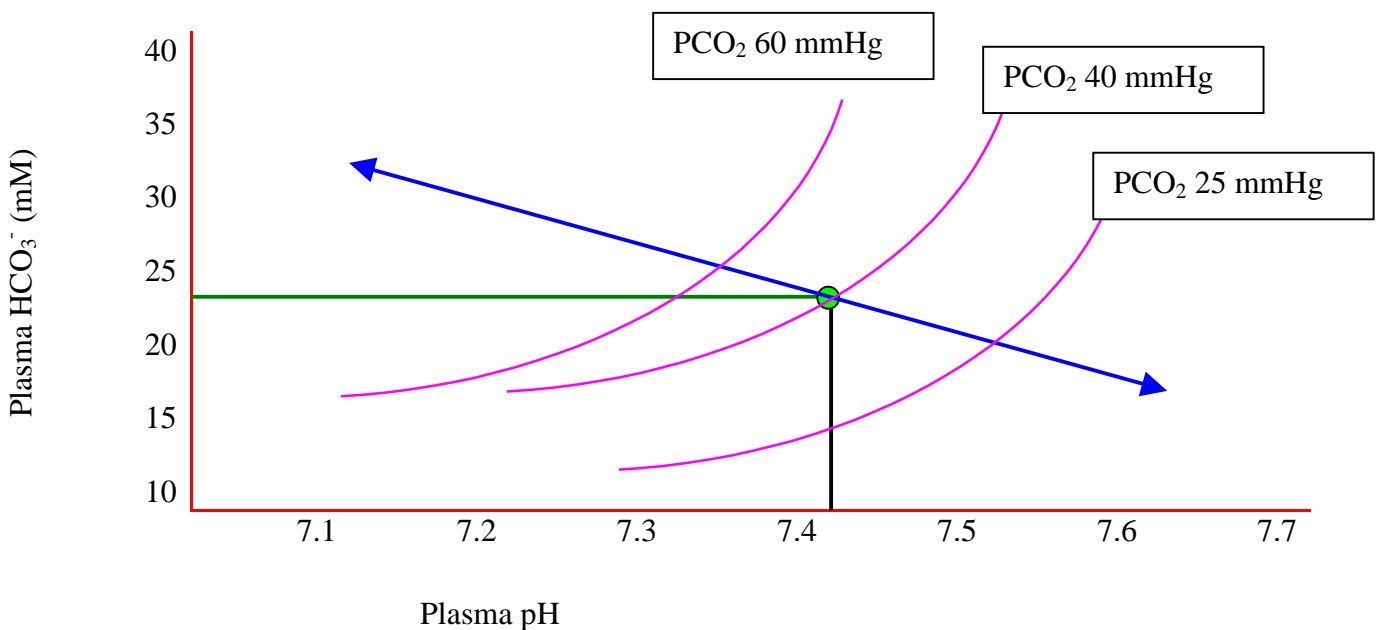


Acid-Base Balance

- ❖ Homeostasis of body $[H^+]$ concentration between 40-45 nmoles/L (pH 7.35 – 7.4).
 - $pH = -\log_{10} [H^+]$
 - $[H^+] = 10^{-pH}$ (if $pH = 7.4$ $[H^+] = 10^{-7.4} = 39.8 \times 10^{-9}$ moles/L)
- ❖ Maximum pH range compatible with life = 6.8 – 7.7. This very narrow range is maintained by:
 - Buffering of $[H^+]$ by absorption by other molecules
 - Elimination of $[H^+]$ from the body with other acid products
- ❖ Henderson-Hasselbach equation: $pH = pK_a + \log_{10} \frac{[Base]}{[Acid]}$
 - i.e. ratio of base to undissociated acid depends on pH of solution
- ❖ Effectiveness of a buffer depends on its plasma concentration and pK_a
 - The closer the pK_a to plasma pH the more effective the buffer
- ❖ Buffer systems: phosphate, bicarbonate, plasma proteins & haemoglobin
 - Phosphate: $H_2PO_4^- \rightleftharpoons H^+ + HPO_4^{2-}$
 - Bicarbonate: $H_2O + CO_2 \rightleftharpoons H_2CO_3 \rightleftharpoons H^+ + HCO_3^-$
 - Note that the concentration of phosphate buffer is fixed while the concentration of bicarbonate buffer is variable because CO_2 can be eliminated to the atmosphere making it a very powerful buffering system (greater than its pK_a of 6.1 suggests)

Relationship between plasma pH and PCO_2

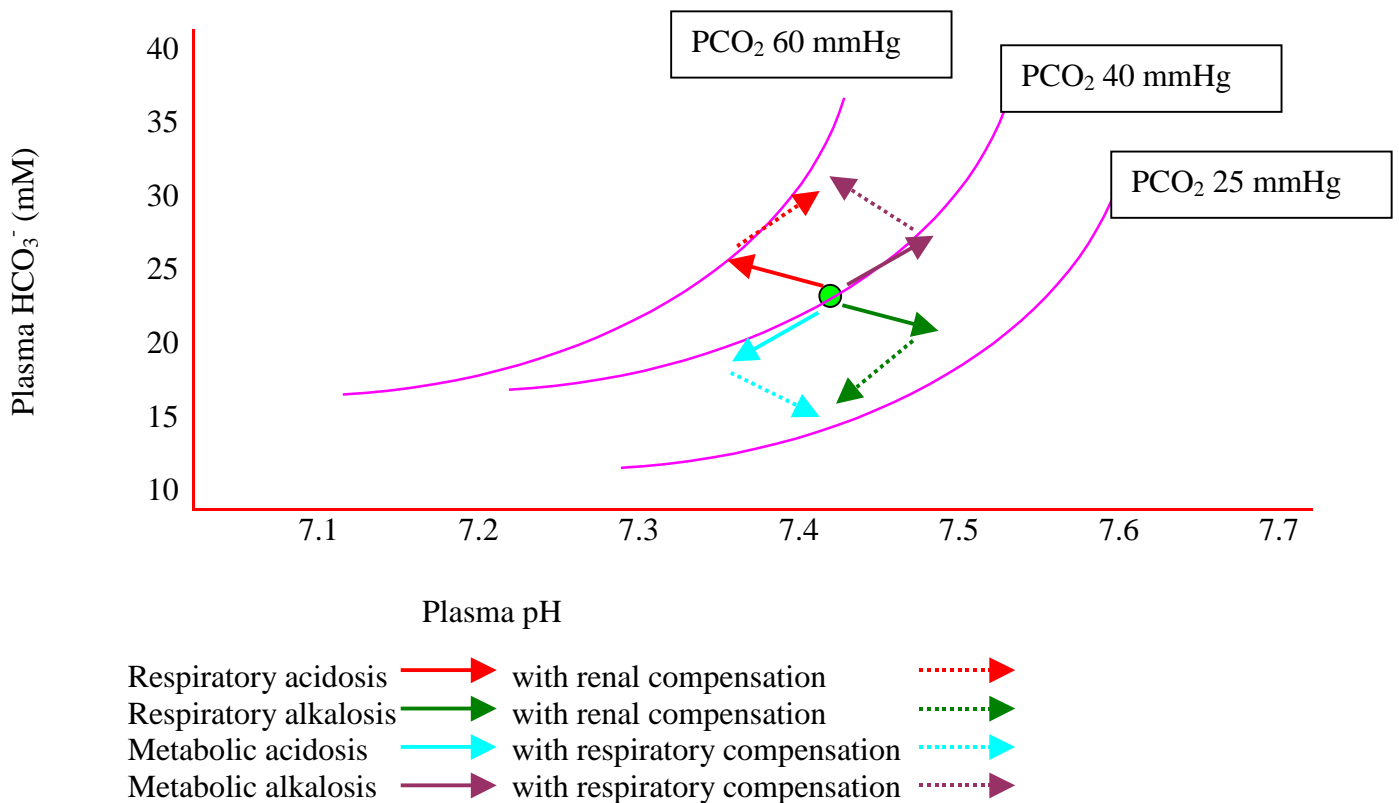


Acid-Base Balance

Some causes of acid-base disturbance

Respiratory acidosis	Impaired ventilation due to airway obstruction Impaired alveolar gas exchange Decreased respiratory drive Inhalation of carbon dioxide
Respiratory alkalosis	Hypoxia – high altitude living Increased respiratory drive eg CVA Hepatic failure Drugs and poisons
Metabolic acidosis	Endogenous acids – e.g. diabetic ketoacidosis Loss of base from gut – e.g. diarrhoea Impaired acid secretion by kidneys – e.g. renal tubular acidosis Exogenous acid loading – e.g. methanol ingestion
Metabolic alkalosis	Loss of gastric juice – e.g. vomiting Aldosterone excess Excess base ingestion

Regulation of plasma pH



Acid-Base Balance

