Rule 1: The 1 for 10 Rule for Acute Respiratory Acidosis
- The [HCO₃⁻] will increase by 1 mmol/l for every 10 mmHg elevation in pCO₂ above 40 mmHg.

 Expected [HCO₃⁻] = 24 + \{(Actual pCO₂ - 40) / 10\}

- The increase in CO₂ shifts the equilibrium between CO₂ and HCO₃⁻ to result in an acute increase in HCO₃⁻. This is a simple physicochemical event and occurs almost immediately.

Rule 2: The 4 for 10 Rule for Chronic Respiratory Acidosis
- The [HCO₃⁻] will increase by 4 mmol/l for every 10 mmHg elevation in pCO₂ above 40 mmHg.

 Expected [HCO₃⁻] = 24 + 4 \{(Actual pCO₂ - 40) / 10\}

- With chronic acidoses, the kidneys respond by retaining HCO₃⁻, that is, renal compensation occurs. This takes a few days to reach its maximal value.

Rule 3: The 2 for 10 Rule for Acute Respiratory Alkalosis
- The [HCO₃⁻] will decrease by 2 mmol/l for every 10 mmHg decrease in pCO₂ below 40 mmHg.

 Expected [HCO₃⁻] = 24 - 2 \{(40 - Actual pCO₂) / 10\}

- It takes 2 to 3 days to reach maximal renal compensation.
- The limit of compensation is a [HCO₃⁻] of about 12 to 15 mmol/l.

Rule 4: The 5 for 10 Rule for a Chronic Respiratory Alkalosis
- The [HCO₃⁻] will decrease by 5 mmol/l for every 10 mmHg decrease in pCO₂ below 40 mmHg.

 Expected [HCO₃⁻] = 24 - 5 \{(40 - Actual pCO₂) / 10\} (range: +/- 2)

- It takes 2 to 3 days to reach maximal renal compensation.

Rule 5: The One & a Half plus 8 Rule - for a Metabolic Acidosis
- The expected pCO₂ (in mmHg) is calculated from the following formula:

 Expected pCO₂ = 1.5 x [HCO₃⁻] + 8 (range: +/- 2)

- Maximal compensation may take 12-24 hours to reach.
- The limit of compensation is a pCO₂ of about 10 mmHg.
- Hypoxia can increase the amount of peripheral chemoreceptor stimulation.

Rule 6: The Point Seven plus Twenty Rule - for a Metabolic Alkalosis
- The expected pCO₂ (in mmHg) is calculated from the following formula:

 Expected pCO₂ = 0.7 x [HCO₃⁻] + 20 (range: +/- 5)

- The variation in pCO₂ predicted by this equation is relatively large.

Principle: - The net deviation in pH will indicate whether an acidosis or an alkalosis is present

Guidelines:
- IF an acidaemia is present THEN an acidosis must be present.
- IF an alkalaemia is present THEN an alkalosis must be present.
- IF pH is normal pH THEN Either (no acid-base disorder is present) or (Compensating disorders are present is a mixed disorder with an acidosis and an alkalosis).

Principle: - Certain disorders are associated with predictable changes in other biochemistry results

Guidelines:
(i) High anion gap
- Always strongly suggests a metabolic acidosis.
(ii) Hyperglycaemia
- If ketones also present in urine -> diabetic ketoacidosis
(iii) Hypokalaemia and/or hypochloraemia
- Suggests metabolic alkalosis.
(iv) Hyperchloraemia
- Common with normal anion gap acidosis
(v) Elevated creatinine and urea
- Suggests ureaemic acidosis or hypoaevolaemia (prerenal renal failure)
- With an elevated creatinine consider ketoacidosis: ketones interfere in the laboratory method (Jaffe reaction) used for creatinine measurement & give a falsely elevated result; typically urea will be normal.
(vi) Elevated glucose
- Consider ketoacidosis or hyperosmolar non-ketotic syndrome
(vii) Urine dipstick tests for glucose and ketones
- Glucose detected if hyperglycaemia; ketones detected if ketoacidosis.