Appendix 1

Basic equations/principles

(a) \( \text{pH} = 6.1 + \log \left( \frac{\text{HCO}_3^-}{(0.03 \times \text{pCO}_2)} \right) \)

(b) \( \log \frac{A}{B} = \log A - \log B; \log A \times B = \log A + \log B \)

(c) For change in pH driven by acute hypercapnoea, proportionate change in \( \text{pCO}_2 \) >> than in \( \text{HCO}_3^- \) \text{[23]} \n
Change in pH

Given (a)

Change in \( \text{pH} = 6.1 + \log \left( \frac{\text{[HCO}_3^- \text{ initial}]}{(0.03 \times \text{[pCO}_2 \text{ initial})}] \times (\text{proportion new HCO}_3^- \text{ is of [HCO}_3^- \text{ initial}] / (0.03 \times \text{[pCO}_2 \text{ initial}]}) \right) - (6.1 + \log \left( \frac{\text{[HCO}_3^- \text{ initial}]}{(0.03 \times \text{[pCO}_2 \text{ initial}]}) \right) \)

Given (b)

Change in \( \text{pH} = \log \left( \text{proportion new HCO}_3^- \text{ is of [HCO}_3^- \text{ initial}] / \text{[pCO}_2 \text{ initial}] \right) - \log \left( \text{proportion new pCO}_2 \text{ is of [pCO}_2 \text{ initial}] \right) \)

Given (c)

Change in \( \text{pH} \) driven by acute hypercapnoea \( \approx - \log \left( \text{proportion post pCO}_2 \text{ is of [pCO}_2 \text{ initial}] \right) \)