Appendix 1

Basic equations/principles

(a) $pH = 6.1 + \log (HCO_3^- / (0.03 \times pCO_2))$

(b) $\log A/B = \log A - \log B$; $\log A \times B = \log A + \log B$

(c) For change in pH driven by acute hypercapnoea, proportionate change in pCO_2 >> than in HCO_3^- [23]

Change in pH

Given (a)

Change in $pH = 6.1 + \log ([HCO_3^-$ initial] x (proportion new HCO_3^- is of [HCO_3^- initial]) / (0.03 x [pCO_2 initial]) x (proportion new pCO_2 is of [pCO_2 initial]) – (6.1 + log ([HCO_3^- initial]/(0.03 x [pCO_2 initial]))

Given (b)

Change in pH = log (proportion new HCO_3^- is of [HCO_3 initial]) – log (proportion new pCO_2 is of [pCO_2 initial])

Given (c)

Change in pH driven by acute hypercapnoea ≈ – log (proportion post pCO_2 is of [pCO_2 initial])