March 2011
QUESTION 19

Explain the role of haemoglobin as a buffer

Buffer

- is a substance with the capacity to bind or release H^+ and thus minimise changes in pH.
- consist of a mixture of a weak acid and its conjugate base
- is most effective when pH equals its pKa, at which it is 50% ionised
- effectiveness in a physiological system is also dependent on if it is open
  - eg bicarbonate system where CO2 may be removed via the lungs

Blood buffering

- Is mostly due to the bicarbonate - CO2 system (80%) (but unable to buffer respiratory disturbances)
- Haemoglobin and plasma protiens play an important secondary role esp in resp acid base disturbances
- Phosphate buffering is insignificant in the blood

Haemoglobin

- is formed in red blood cells
- concentration in plasma is 130-170g/L
- consists of 4 globulin chains covalently linked to a haem molecule
- main role is transportation for O2 to tissues and CO2 to the lungs
- CO2 carrying role enables it to act as a physiological buffer
  - CO2 binds to the protien imidazole groups of histidine residues
  - Is six times more effective than the plasma protiens which have a similar role
  - DeoxyHb is more effective than OxyHb because the histidine pKa is closer to 7.4 (haldane effect)
  - Is particularly important in respiratory acidosis