2013-1-12 Describe the physiological role, distribution and regulation of potassium (K+).

Role
- Regulation of resting membrane potential
- Regulation of action potential
  - Heart/skeletal muscle function
  - Nerve conduction

Distribution
- Principal intracellular cation (98%)
  - Intracellular concentration 140mmol/L
  - Extracellular concentration 4.2mmol/L
- Total body potassium approx. 50mmol/kg

Regulation
- Intake
  - Approx. 100mmol/day
- Transcellular balance
  - Insulin
    - Causes K+ uptake into cells
  - β2 adrenergic stimulation
    - Causes K+ uptake
  - Aldosterone
    - Causes K+ uptake
  - Acid-base balance
    - Acidosis causes K+ efflux from cells
  - Cell death
    - Release of intracellular K+
  - Strenuous exercise
    - Skeletal muscle releases K+
  - Extracellular osmolarity
    - Increased extracellular osmolarity → osmosis of water from cells →
increased intracellular $[\text{K}^{+}] \rightarrow \text{K}^{+}$ efflux

- Elimination
  - Renal – 92mmol/day
  - Glomerular filtration = 756mmol/day (180L x 4.2mmol/L)
  - PCT
    - 65% reabsorption
  - LoH
    - 25~30% reabsorption
  - DCT/Collecting Ducts - variable
    - Determined by
      - Aldosterone
        - Stimulated by increased $[\text{K}^{+}]$
      - Plasma $[\text{K}^{+}]$
      - Tubular flow rate
    - Secreted by principal cells
      - $\text{Na}^{+}/\text{K}^{+}$ ATPase in basolateral membrane
      - $\text{K}^{+}$ channel in luminal membrane (passive diffusion)
    - Reabsorbed by intercalating cells
      - $\text{H}^{+}/\text{K}^{+}$ ATPase in luminal membrane
  - Faecal – 8mmol/day
Potassium is the second most common cation in the body and the main intracellular cation. It is widely distributed and has many important roles. Maintenance of potassium balance depends mainly on secretion by the kidneys in the distal and collecting tubules. Candidates were expected to mention the influence of aldosterone, and other hormones such as glucocorticoids, catecholamines and vasopressin have as well as factors such as acidosis/alkalosis. Candidates who had a systematic and structured approach performed better.