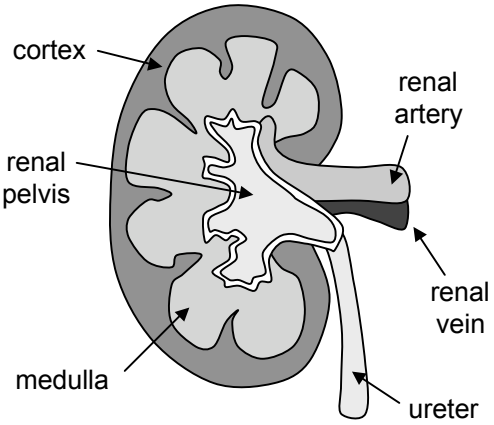
The Kidney (11.3)

Definitions of key terms (11.3.1 / 11.3.5)

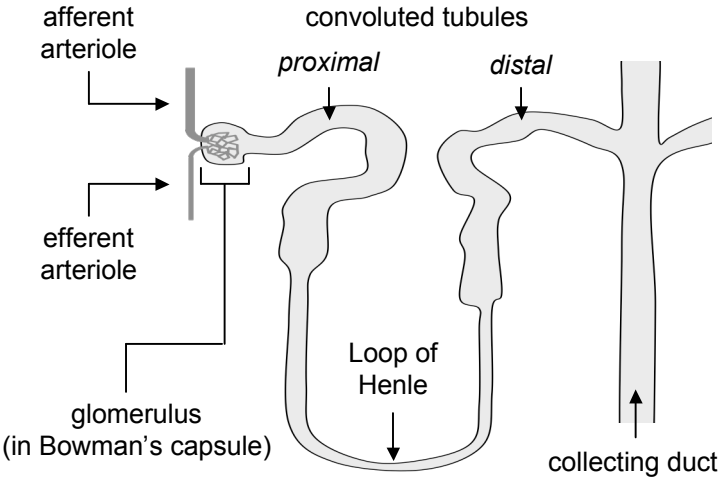
Excretion: The removal from the body of the waste products of metabolic activities

Osmoregulation: The control of the water balance of the blood, tissue or cytoplasm

Draw a kidney (11.3.2)



Annotate a diagram of a nephron (11.3.3)



Explain the production of urine (11.3.4 / 11.3.6 / 11.3.7)

Ultrafiltration:

- The filtration of blood requires high hydrostatic pressure to force blood through a semi-permeable barrier
- The glomerulus increases blood pressure (and SA:Vol ratio) by forming narrow branches, and this pressure is maintained by a narrow efferent arteriole which limits the outflow of blood
- The capillary walls are fenestrated (have gaps) and the inner lining of the Bowman's capsule has spaces between cellular extensions (pedicels), creating a path of low resistance for the blood
- The basement membrane is the sole filtration barrier and precludes the passage of large proteins and cells

Selective Reabsorption:

- The proximal convoluted tubule is where most of the reabsorption of materials from the nephron occurs
- The tubule lining has a microvilli cell border which increases the surface area available for reabsorption
  - Salts are reabsorbed by primary active transport
  - Glucose is reabsorbed by secondary active transport (symport with Na^+ ions)
  - Water is reabsorbed via osmosis (salt reabsorption makes the filtrate hypotonic)

Osmoregulation:

- The descending limb of the loop of Henle is permeable to water but not salts, while the ascending limb is permeable to salts but not water
- As the blood in the vasa recta moves in the opposite direction to the filtrate, this makes the base of the loop (in the medulla) very hypertonic (high mOsm)
- As the filtrate moves down the collecting duct (through the medulla), water will be reabsorbed by osmosis
- The amount of osmosis is controlled by the hormone ADH (vasopressin) released from the pituitary
- In response to low water levels, ADH makes the collecting ducts more permeable (makes aquaporins)

Composition of fluids (11.3.8)

- **Blood plasma:** Contains proteins, glucose & urea
- **Glomerular filtrate:** Contains glucose & urea
- **Urine:** Contains urea (glucose in diabetics)

Diabetes (11.3.9)

- Diabetics are unable to produce or respond to insulin, resulting in high blood sugar levels
- Excess glucose is removed via urine and hence can be used to diagnose diabetes