CHEMISTRY ONLINE
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# BIOLOGY

## ORGANISMS RESPOND TO CHANGES IN ENVIRONMENTS

| | |
|---|---|
| Level & Board | AQA (A-LEVEL) |
| TOPIC: | OSMOREGULATION |
| PAPER TYPE: | SOLUTION - 1 |
| TOTAL QUESTIONS | 7 |
| TOTAL MARKS | 45 |

# Osmoregulation - 1

**1.**

**(a)** An osmoreceptor is a sensory receptor primarily found in the hypothalamus of most homeothermic organisms that detects changes in osmotic pressure.

**OR**

Hypothalamus.

(b) Dehydration increases blood concentration, which is detected by osmoreceptors in the hypothalamus. This prompts the release of the antidiuretic hormone, signaling the kidneys to recover water from urine and effectively decreasing the cell volume of osmoreceptors.

**OR**

Water potential of blood will decrease;

Water moves from osmoreceptor into blood by osmosis.

**(c)** The ADH binds onto the receptors on the collecting duct controlling the permeability of the collecting duct. If there is more ADH the permeability increases and which means more water is reabsorbed via osmosis. This will result in a higher concentration of urine as the volume of urine produced decreases.

**OR**

Permeability of membrane / cells (to water) is increased

More water absorbed from / leaves distal tubule / collecting duct

Smaller volume of urine

Urine becomes more concentrated.

**2.**

**(a)**

(1660 / 0.01)/(24 X 60)

= 115.3 $cm^3 minute^{-1}$

**(b)**

Muscle / body mass

Ethnicity

Exercise

Kidney disease

**3.**

**(a)** Urea is carried in the blood to the kidneys. This is where it is removed, along with water and other wastes in the form of urine. The kidneys have other important functions. They control blood pressure and make the hormone erythropoietin.

**OR**

Hydrostatic pressure / description of pressure / description of how pressure generated

Causes ultrafiltration at Bowman's capsule / glomeruli / renal capsule

Through basement membrane

Enabled by small size urea molecule

**(b)** Because water is reabsorbed from the filtrate (by osmosis, due to the hypertonicity of the medulla), urea becomes more concentrated in urine. The concentration of urea in the urine will depend on the amount of water in the urine.

**OR**

Reabsorption of water / by osmosis

At the PCT / descending LoH

At the DCT / CD

Active transport of ions / glucose creates gradient

**4.**

**(a)** The hydrostatic pressure forces the small molecules to leave the glomerulus and enter in the Bowman's capsule. Cells and proteins are not

able to pass due to the large size. In Bowman's capsule, the plasma that has come from the glomerulus is called the filtrate.

**OR**

Blood pressure / hydrostatic pressure

Small molecules / named example

Pass through basement membrane / basement membrane acts as filter

Protein too large to go through / large so stays behind

Presence of pores in capillaries / presence of podocytes

**(b)**

High concentration of glucose in blood

High concentration in tubule / in filtrate

Reabsorbed by facilitated diffusion / active transport

Requires proteins / carriers

These are working at maximum rate / are saturated

Not all glucose is reabsorbed / some is lost in urine

**(c)** Some desert mammals have adaptations such as long loops of Henle and the secretion of large amounts of antidiuretic hormone (ADH) to survive in a desert environment. The long loops of Henle in the kidneys help in water conservation by increasing the reabsorption of water.

**OR**

More water from filtrate reabsorbed / returned to blood / less lost in urine

By osmosis

From collecting duct / from end of second convoluted tubule

Due to longer loop of Henle

Sodium / chloride ions absorbed from filtrate in ascending limb

Gradient established in medulla / concentration of ions increases down medulla



Acts on collecting duct / distal convoluted tubule / second convoluted tubule

Makes cells more permeable / inserts aquaporins in plasma membranes

**5.**

**(a)**

**In Diabetic person**

Lack of insulin / reduced sensitivity of cells to insulin

Reduced uptake of glucose by cells / liver / muscles

Reduced conversion of glucose to glycogen

**6.**

**(a)** In normal individuals, nearly all glucose filtered through the glomerulus is reabsorbed in the tubules, mainly in the proximal tubules, and glucose appears in the urine at the concentration less than 25 mg/dL

**OR**

Leaves the blood at kidney

Taken back into blood / reabsorbed from kidney tubule

Reabsorbed in 1st convoluted tubule

(b) Diabetes causes glycosuria because there either isn't enough insulin, or your body can't use what's available. Without insulin, blood glucose levels become too high, and your kidneys can't filter and reabsorb it. Your body gets rid of the excess through your urine.

**OR**

Large amount / high concentration of glucose in filtrate

Cannot all be reabsorbed / 1st convoluted tube too short to reabsorb all of glucose / saturation of carriers

**(c)**

Enzyme has specific shape of active site

Only glucose fits / has complementary structure/can form ES complex

**(d)**

Glucose in filtrate lowers water potential

Less difference in water potential between filtrate and plasma.

Less water reabsorbed by osmosis

**(e)**

The Bowman's capsule

It is a basement membrane

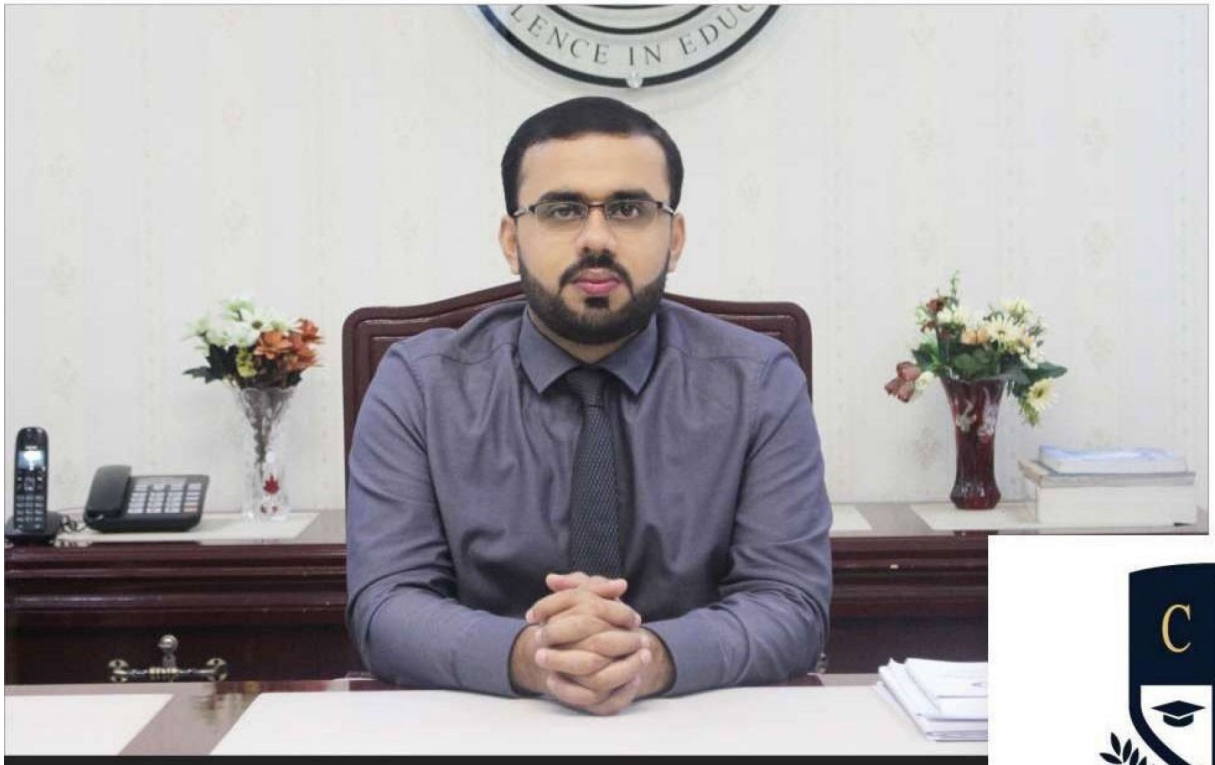
Should stop large proteins from entering loop of Henle

**7.**

**(a)** metabolic water from aerobic respiration





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