

Homeostasis, hormones and the kidney: practice questions

8 questions • 33 marks • mark scheme at the back

For Pearson Edexcel International AS Biology XBI11 and International A Level Biology YBI11. **A Level only** is IA2 content (Units 4 to 6), not needed for the International AS.

Name

Total / 33

1 UNIT 5 STYLE [1 mark]

Which part of the nephron is found mainly in the medulla of the kidney?

- A. ☐ Bowman's capsule
- B. ☐ Proximal convoluted tubule
- C. ☐ Loop of Henle
- D. ☐ Glomerulus

2 UNIT 5 STYLE [4 marks]

Explain the difference between negative feedback and positive feedback, and why negative feedback is important in homeostasis.

3 UNIT 5 STYLE [4 marks]

During vigorous exercise a person's core temperature rises. Describe how the hypothalamus brings about a return of the temperature to normal.

[4 marks]

[illegible]

[5 marks]

[illegible]

[4 marks]

Concentration (g per 100 cm ³)			
Substance	Plasma	Glomerular filtrate	Urine
Protein	8.00	0.00	0.00
Glucose	0.10	0.10	0.00
Urea	0.03	0.03	2.00

[illegible]

7 UNIT 5 STYLE

[6 marks]

Explain how the loop of Henle acts as a countercurrent multiplier to increase the reabsorption of water.

8 UNIT 5 STYLE

[5 marks]

A person drinks very little water for a day and does not sweat. Explain how the changes in the blood are corrected by negative feedback.

Mark scheme

One mark for each point unless a maximum is given. Words in brackets are not needed for the mark.

1. [1]

C C: the loop of Henle (the glomerulus, Bowman's capsule and proximal tubule are in the cortex).

2. [4]

- negative feedback: a change is detected and the response reverses / corrects it
- positive feedback: the response increases / amplifies the change
- negative feedback keeps the factor within narrow limits / around a set point
- so conditions remain suitable for enzymes / cells
- Max 4

3. [4]

- thermoreceptors in the hypothalamus detect the rise in temperature of the blood
- hypothalamus sends impulses to effectors
- sweat glands secrete sweat; evaporation of water takes heat from the skin
- vasodilation of skin arterioles, more blood near the surface and more heat lost by radiation
- temperature falls to normal, so response reduced (negative feedback)
- Max 4

4. [4]

- steroid is lipid-soluble and passes through the cell surface membrane
- binds to a receptor inside the cell; the complex acts as a transcription factor binding to DNA
- peptide hormone cannot cross the membrane; binds to a receptor on the cell surface
- activates a second messenger / cascade in the cell, which activates a transcription factor or enzyme
- similarity: both act through transcription factors that switch genes on or off, changing the proteins made
- Max 4

5. [5]

- excess amino acids are deaminated in the liver; amino group removed
- ammonia formed is converted to urea (ornithine cycle) which is less toxic
- urea carried in blood plasma to the kidney
- high pressure in glomerulus because afferent arteriole is wider than efferent arteriole
- urea and small molecules are filtered through capillary endothelium, basement membrane and podocytes into the Bowman's capsule
- Max 5

6. [4]

- protein absent from filtrate because too large to pass through the basement membrane
- glucose is the same in plasma and filtrate because it is small and filtered freely
- no glucose in urine because all of it is reabsorbed in the proximal tubule by co-transport / active transport
- urea is much more concentrated in urine because water is reabsorbed and urea is not (all) reabsorbed

7. [6]

- sodium and chloride ions are actively transported out of the ascending limb into the medulla
- ascending limb is impermeable to water, so water cannot follow
- medulla tissue fluid has low water potential
- descending limb is permeable to water, so water leaves by osmosis into the medulla
- filtrate is most concentrated at the bottom of the loop; fluid flows in opposite directions, maintaining a steep gradient along the whole length
- water then leaves the collecting duct by osmosis (when permeable), and is carried away by the blood capillaries
- Max 6

8. [5]

- blood plasma becomes more concentrated / lower water potential
- detected by osmoreceptors in the hypothalamus
- posterior pituitary gland releases more ADH
- ADH makes collecting duct walls more permeable to water (more aquaporins)
- more water reabsorbed by osmosis, so a small volume of concentrated urine is produced
- plasma concentration and blood volume return to normal, so less ADH is released
- Max 5