Control of Blood Water Potential: AQA A Level Biology Exam Questions

14 questions · 35 marks · about 46 minutes. Answer in the spaces, then check the mark schemes at the end.

Question 1 · A level Paper 2 · June 2022 · Q09.1 · 1 mark

0 9 . 1 Name the part of the body which releases antidiuretic hormone (ADH) into the blood.

[1 mark]

Question 2 · A level Paper 2 · June 2022 · Q09.2 · 2 marks

0 9 . 2 Alcohol decreases the release of ADH into the blood.

Suggest **two** signs or symptoms which may result from a decrease in ADH.

[2 marks]

1 _____

2 _____

Question 3 · A level Paper 2 · June 2023 · Q06.2 · 1 mark

0 6 . 2 Antidiuretic hormone (ADH) binds to **V** receptors found in cell-surface membranes in two parts of a nephron.

Name the **two** parts of a nephron where **V** receptors are found.

[1 mark]

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Question 4 · A level Paper 2 · June 2022 · Q09.3 · 3 marks

0 9 . 3 Describe the effect of ADH on the collecting ducts in kidneys.

[3 marks]

Question 5 · A level Paper 3 · June 2019 · Q01.1 · 3 marks

0 1 . 1 Describe how ultrafiltration occurs in a glomerulus.

[3 marks]

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Question 6 · A level Paper 3 · June 2025 · Q02.2 · 2 marks

0 2 . 2 Protein is **not** normally present in the urine of a person.

Explain why.

[2 marks]

Question 7 · A level Paper 2 · November 2020 · Q08.1 · 2 marks

0 8 Alport syndrome (AS) is an inherited disorder that affects kidney glomeruli of both men and women. Affected individuals have proteinuria (high quantities of protein in their urine).

0 8 . 1 Suggest how AS could cause proteinuria.

[2 marks]

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Question 8 · A level Paper 2 · June 2023 · Q06.1 · 3 marks

0 6 . 1 Describe and explain how **three** features of the cells in the proximal convoluted tubule allow the rapid reabsorption of glucose into the blood.

[3 marks]

1 _____

_____

2 _____

_____

3 _____

_____

Question 9 · A level Paper 2 · November 2021 · Q05.3 · 3 marks

0 5 . 3 Using your knowledge of the kidney, explain why glucose is found in the urine of a person with untreated diabetes.

[3 marks]

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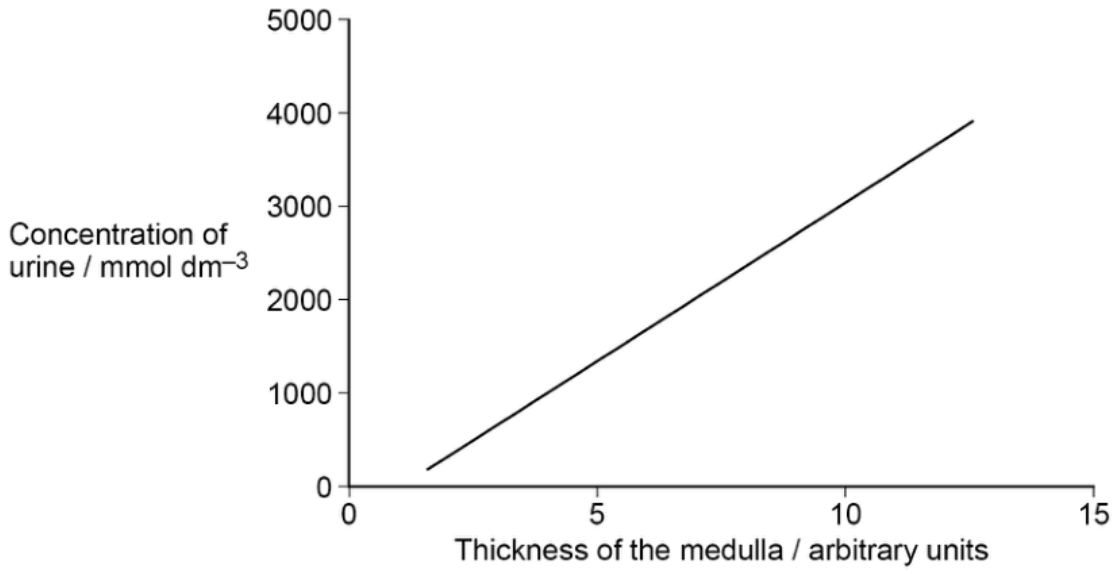
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0 1 . 4 Scientists investigated the relationship between the thickness of the kidney medulla of different species of mammals and the concentration of their urine.

Figure 1 shows their results.

Figure 1



Explain the pattern shown by the results in **Figure 1**.

[3 marks]

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0 5 Furosemide and CVT are drugs used to remove excess fluid from the body. Scientists investigated the effect of these drugs on the volume of urine produced by human volunteers. The scientists used the following method.

- They divided volunteers into three groups, **A**, **B** and **C** at random.
- They gave all the volunteers the same food for 3 days.
- After 3 days, they gave the volunteers in group **A** a tablet containing furosemide, the volunteers in group **B** a tablet containing CVT and the volunteers in group **C** a placebo (a tablet that did **not** contain either drug).
- They then found the mean volume of urine produced by each group in the 4 hours after taking the tablets.

Some of the results the scientists obtained are shown in **Table 1**.
A value of ± 2 standard deviations from the mean includes over 95% of the data.

Table 1

Group	Mean volume of urine produced in 4 hours / cm^3 (± 2 standard deviations)
A (furosemide)	1980 (± 152)
B (CVT)	1201 (± 119)
C (placebo)	312 (± 57)

0 5 . 1 All the volunteers were given the same food for 3 days.

Suggest and explain **one** reason why they were given the same food.

[2 marks]

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Question 12 · A level Paper 2 · June 2018 · Q05.4 · 3 marks

0 5 . 4 Furosemide inhibits the absorption of sodium and chloride ions from the filtrate produced in the nephrons.

Explain how furosemide causes an increase in the volume of urine produced.

[3 marks]

Question 13 · A level Paper 2 · June 2018 · Q05.2 · 2 marks

0 5 . 2 Using **Table 1**, what can you conclude about the effectiveness of furosemide and CVT in the removal of excess fluid from the body?

[2 marks]

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0 2 . 3 Glomerular sclerosis (GS) is a type of kidney damage that can cause protein to be present in the urine.

High-protein diets are linked to GS in adults.

Scientists investigated the development of GS in underweight, 5-day-old rats.

They fed:

- 14 rats a high-protein milk diet
- 14 rats a normal-protein milk diet.

From day 21, they fed both groups of rats the **same** diet of solid food. At 160 days old, they examined nephrons in the rats' kidneys for GS.

They identified the number of nephrons with GS for each group of rats.

Rats fed a high-protein diet had a larger number of nephrons with GS than rats fed a normal-protein diet. The scientists performed a statistical test on these data and they calculated $P < 0.01$

A journalist reported on this investigation and stated 'feeding high-protein milk to underweight human babies could cause kidney damage in adults'.

Use all of the information provided to evaluate this statement.

[5 marks]

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Mark schemes

Question 1 · A level Paper 2 · June 2022 · Q09.1 · 1 mark

09.1	Posterior pituitary;	1 (AO1)	Accept phonetic spelling. Ignore any other additional wording.

Question 2 · A level Paper 2 · June 2022 · Q09.2 · 2 marks

09.2	1. Dehydration/thirst; 2. Frequent urination **OR** Increase in volume of urine; 3. Less concentrated urine OR Dilute urine **OR** Urine paler/lighter in colour;	2 max (2 x AO2)	2. Ignore amount. 2. Accept increased urination.

Question 3 · A level Paper 2 · June 2023 · Q06.2 · 1 mark

06.2	Collecting duct **and** distal (convoluted) tubule;	1 (AO1)	Do not accept DCT for distal convoluted tubule.

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Question 4 · A level Paper 2 · June 2022 · Q09.3 · 3 marks

09.3	1. (Stimulates) addition of channel proteins into <u>membrane</u>; 2. Increases permeability to water **OR** (More) water (re)absorbed; 3. By <u>osmosis</u>;	3 (3 x AO1)

1. Accept aquaporins for channel proteins.

1. Accept movement for addition.

1. Accept (stimulates) opening of channel proteins in <u>membrane</u>.

2. Accept for reabsorbed ‘enters blood’ or ‘leaves collecting duct’.

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01.1	1. High blood/hydrostatic pressure; 2. **Two named** small substances pass out eg water, glucose, ions, urea; 3. (Through small) gaps/pores/fenestrations **in** (capillary) endothelium; 4. (And) through (capillary) basement membrane;	3 max

Ignore references to podocytes

1. Ignore references to afferent and efferent arterioles
1. Ignore 'increasing/higher blood pressure' as does not necessarily mean high
2. Accept correct named ions
2. Accept mineral ions/minerals
2. Accept amino acids/small proteins
2. Ignore references to molecules **not** filtered
3. Accept epithelium for endothelium

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Question 6 · A level Paper 3 · June 2025 · Q02.2 · 2 marks

02.2	1. (Plasma) proteins are (too) large; 2. To filter/pass through <u>basement membrane</u>;	2 (2 x AO1)

2. Ignore any other structures

Question 7 · A level Paper 2 · November 2020 · Q08.1 · 2 marks

08.1	1. Affects/damages <u>basement</u> <u>membrane</u> **OR** More protein channels/carriers in <u>basement membrane</u>; 2. Proteins can pass into the (glomerular) filtrate/tubule;	2	2. Ignore nephron.

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06.1	1. Microvilli provide a large surface area **OR** Folded (cell-surface) membrane provides a large surface area; 2. Many channel/carrier proteins for facilitated diffusion; 3. Many <u>carrier</u> proteins for active transport; 4. Many channel/carrier proteins for co-transport; 5. Many mitochondria produce ATP **OR** Many mitochondria for active transport; 6. Many ribosomes to produce carrier/channel proteins;	3 max (3 x AO1)

Max 2 from mark points 2, 3 and 4.

For 2, 3, 4, 5 and 6 penalise omission of 'many' only once.

1. Ignore 'brush border'.

3 and 4. Accept sodium-potassium pumps as an alternative to carrier proteins.

4. Accept 'co-transport protein' or 'symport' for type of transport protein.

5. Accept co-transport for active transport.

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Question 9 · A level Paper 2 · November 2021 · Q05.3 · 3 marks

05.3	1. High <u>concentration</u> of glucose in blood/filtrate; 2. Not all the glucose is (re)absorbed at the <u>proximal</u> <u>convoluted</u> <u>tubule</u>; 3. <u>Carrier/co-transport</u> <u>proteins</u> are working at maximum rate **OR** <u>Carrier/co-transport</u> <u>proteins/</u> are saturated;

3	1. Accept tubule for filtrate. 2. Reject no glucose is (re)absorbed. 3. Accept all carrier/co-transport proteins are 'in use' but reject all carriers are 'used up'. 3. Accept <u>symport</u> for carrier protein. 3. Accept not enough carrier proteins to absorb all the glucose.

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01.4	1. Thicker medulla means a longer loop (of Henle); 2. (The longer the loop of Henle means) **increase** in sodium ion concentration (in medulla) **OR** (The longer the loop of Henle means) sodium ion gradient maintained for **longer** (in medulla) **OR** (The longer the loop of Henle means) **more** sodium ions are moved out (into medulla); 3. (Therefore) water potential gradient maintained (for longer), **so** more water (re)absorbed (from loop and collecting duct); **OR** More water is (re)absorbed **from** the loop (of Henle) / collecting duct **by** osmosis;	3

2. Must have idea of increase/longer/more 3. Reject water being reabsorbed **into** the loop of Henle 3. Direction is important 3. Accept Ψ for water potential

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Question 11 · A level Paper 2 · June 2018 · Q05.1 · 2 marks

05.1	1. Affects water potential (of blood/body); 2. Affects <u>volume</u> of urine (produced/removed);	2	1. Accept Ψ for water potential

Question 12 · A level Paper 2 · June 2018 · Q05.4 · 3 marks

05.4	1.Water potential of filtrate/tubule decreased; 2. Less water (reabsorbed) by <u>osmosis</u> (from filtrate/tubule); 3. Collecting duct (is where osmosis occurs);	3	1. Accept correct reference to water potential gradient 1. Accept maintains low water potential. 1 and 2. Accept nephron for filtrate/tubule. 2. Accept no water (reabsorbed) for 'less' 2. Accept (more) water (absorbed) by <u>osmosis</u> (into filtrate/tubule) 3. Accept proximal convoluted tubule or distal convoluted tubule or (descending) loop of Henle 3.Ignore PCT, DCT.

Question 13 · A level Paper 2 · June 2018 · Q05.2 · 2 marks

05.2	1. Furosemide **and** CVT more effective than placebo/control/C **OR** Furosemide more effective (than CVT); 2. Correct reference to a significant increase/difference as SD's do not overlap;	2	1. Accept both (drugs)/A and B more effective than placebo/control/C

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02.3	**Max 4 for MP3-7** **(Yes – no mark)** 1. Probability of **less** than 0.01 that the increase (in GS) is due to chance **OR** Increase (in GS) is significant; 2. Rats and humans are both mammals, **so** similar; **(No – no mark)** 3. (Investigation only) done on rats **OR** (Investigation) not done on humans; 4. Do not know if (160-day-old) rats are adults; 5. Small sample size, **so** not representative; 6. Only two (different) quantities of protein (used) **OR** Only high and normal protein (milk/s) **OR** Protein content (of milk/s) not known **OR** Types of protein (in the milk/s) not known; 7. Only GS studied **OR** Other kidney damage (can) occur/s;	5 max (5 x AO3)

1. Accept probability of **less** than 1%/0.05/5% that the increase is due

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