

GCSE Biology

Worksheet: Maintaining water and nitrogen balance

TIME 30 min	TOTAL 30 marks	CALCULATOR Allowed	DIFFICULTY Easy, Medium
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Topics: Maintaining water and nitrogen balance

NAME _____

CLASS _____

DATE _____

- Use black ink or black ball-point pen. Pencil should only be used for drawing.
- Answer all questions in the spaces provided.
- In all calculations, show clearly how you work out your answer.
- The marks for questions are shown in brackets.

0 1

People whose kidneys have failed can be treated using kidney dialysis. In a dialysis machine, the patient's blood flows past one side of a partially permeable membrane and dialysis fluid flows past the other side.

0 1 . 1

Which substance passes from the patient's blood into the dialysis fluid?

Tick (✓) **one** box.

Protein

☐

Red blood cells

☐

Urea

☐

White blood cells

☐

[1 mark]

0 1 . 2

Name the process by which urea moves from the blood into the dialysis fluid.

.....

.....

.....

[1 mark]

0 1 . 3

Healthy kidneys remove urea from the blood.
Name **one** other substance that healthy kidneys remove from the blood in urine.

.....

.....

.....

.....

[1 mark]

0 1 . 4

Complete the sentence.
Healthy kidneys produce urine by of the blood, followed by selective reabsorption of useful substances.

.....

.....

.....

.....

[1 mark]

0 2

Water, ions and urea are lost from the body in several ways.

0 2 . 1

Which **two** organs lose water from the body with no control over the amount of water lost?

Tick (✓) **two** boxes.

Kidneys

☐

Liver

☐

Lungs

☐

Pancreas

☐

Skin

☐

[2 marks]

0 2 . 2

Name the organs that remove excess water, ions and urea from the body in urine.

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.....

.....

.....

[1 mark]

0 2 . 3

Which substances are lost from the skin in sweat?

Tick (✓) **one** box.

Glucose, ions and water

☐

Ions, urea and water

☐

Protein, urea and water

☐

Water only

☐

[1 mark]

0 2 . 4

Explain why it is important that body cells do not lose or gain too much water.

.....

.....

.....

.....

[2 marks]

.....

0 3

The kidneys produce urine by filtering the blood and then reabsorbing useful substances. Table 1 shows the concentrations of some substances in the blood plasma entering a kidney, in the filtrate and in the urine of a healthy person.

Table 1

Substance	Blood plasma in g per dm ³	Filtrate in g per dm ³	Urine in g per dm ³
protein	75	0	0
glucose	1.0	1.0	0
urea	0.3	0.3	20.0
sodium ions	3.2	3.2	3.5

0 3 . 1

Protein is not found in the filtrate.
Suggest why.

.....

.....

[1 mark]

0 3 . 2

Glucose is found in the filtrate but not in the urine.
Explain why.

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.....

.....

.....

[2 marks]

0 3 . 3

Calculate how many times more concentrated urea is in the urine than in the filtrate.
Give your answer to 2 significant figures.

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.....

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.....

.....

[2 marks]

0 3 . 4

Suggest why the concentration of urea in the urine is much higher than in the filtrate.

.....

.....

[1 mark]

0 3 . 5

The concentration of sodium ions in the urine changes from day to day.
Suggest why.

.....

.....

[1 mark]

0 4

Table 2 shows the volumes of water that one person gains and loses on a typical day. The person's body water content stays constant.

Table 2

Water gained	Volume in cm ³ per day	Water lost	Volume in cm ³ per day
in drinks	1450	breathing out	300
in food	850	in sweat	500
made by respiration	350	in faeces	150
		in urine	X

0 4 . 1

Calculate volume X, the volume of urine the person produces each day.

.....

.....

.....

.....

$X = \dots\dots\dots \text{cm}^3$

[2 marks]

0 4 . 2

Calculate the percentage of the total volume of water lost each day that is lost in urine.

Give your answer to 3 significant figures.

.....

.....

.....

.....

Percentage = $\dots\dots\dots \%$

[2 marks]

0 5

A student modelled a dialysis membrane using a length of Visking tubing, a partially permeable membrane. The student filled the tubing with a mixture of starch solution and glucose solution, sealed both ends, and placed it in a beaker of water for 30 minutes.

0 5 . 1

Iodine solution can be used to test for starch, turning blue-black if starch is present.

Describe how the student could use iodine solution to find out whether starch had left the tubing.

[2 marks]

0 5 . 2

Explain why a sample of the water from the beaker would **not** be expected to turn blue-black when iodine solution is added.

[2 marks]

0 5 . 3

Describe how the student could test a sample of the water for glucose.

[3 marks]

0 5 . 4

The test for glucose on the water is positive.
Suggest why this investigation is a useful model of kidney dialysis.

.....

.....

.....

.....

[2 marks]

END OF QUESTIONS

Original practice questions written to match the specification. Not produced by, affiliated with or endorsed by AQA.

Mark scheme

GCSE Biology · Worksheet: Maintaining water and nitrogen balance · 30 marks

Question 1 (4 marks)

01.1 [1 mark]

Correct: Urea

01.2 [1 mark]

Answer: Diffusion

- diffusion (1)
-

01.3 [1 mark]

Answer: (Excess) water or (excess) ions

- (excess) water / (excess) ions (e.g. sodium ions / salt) (1)
-

01.4 [1 mark]

Answer: Filtration

- filtration (1)
-

Question 2 (6 marks)

02.1 [2 marks]

Correct: Lungs; Skin

02.2 [1 mark]

Answer: Kidneys

- kidneys (1)
-

02.3 [1 mark]

Correct: Ions, urea and water

02.4 [2 marks]

Answer: Water moves into or out of cells by osmosis; if cells gain or lose too much water they do not function efficiently (they may swell and burst or shrink)

- water moves into / out of cells by osmosis (1)
 - cells do not function efficiently / cells may burst or shrink (1)
-

Question 3 (7 marks)

03.1 [1 mark]

Answer: Protein molecules are too large to be filtered out of the blood

- protein molecules are too large (to be filtered) (1)

03.2 [2 marks]

Answer: All of the glucose is selectively reabsorbed from the kidney tubules back into the blood because it is a useful substance needed for respiration

- all the glucose is (selectively) reabsorbed (into the blood) (1)
- because glucose is useful / needed for respiration (1)

03.3 [2 marks]

Answer: 67 times

- $20.0 \div 0.3$ (1)
- 67 (1)

Notes: Correct answer with no working scores 2 marks. 66.7 (not given to 2 significant figures) scores 1 mark.

03.4 [1 mark]

Answer: Most of the water in the filtrate is reabsorbed into the blood but the urea is not

- (most of the) water is reabsorbed but (most) urea is not (1)

03.5 [1 mark]

Answer: The amount of ions reabsorbed depends on how much salt / how many ions are in the diet

- depends on the ion / salt content of the diet / only some ions are reabsorbed depending on the body's needs (1)

Notes: Allow 'depends on how much is lost in sweat'.

Question 4 (4 marks)

04.1 [2 marks]

Answer: 1700 cm^3

- total water gained = $1450 + 850 + 350 = 2650 \text{ (cm}^3\text{)}$ (1)
- $X = 2650 - (300 + 500 + 150) = 1700 \text{ (cm}^3\text{)}$ (1)

Notes: Correct answer with no working scores 2 marks.

04.2 [2 marks]

Answer: 64.2%

- $1700 \div 2650 \times 100$ (1)
- $64.2 \text{ (}\%\text{)}$ (1)

Notes: Correct answer with no working scores 2 marks. An answer not given to 3 significant figures scores 1 mark. Allow ECF from an incorrect value of X.

Question 5 (9 marks)

05.1 [2 marks]

Answer: Take a sample of the water from the beaker and add a few drops of iodine solution; if it turns blue-black, starch is present

- take a sample of the water from the beaker (after 30 minutes) (1)
- add a few drops of iodine solution: a colour change to blue-black shows starch is present (1)

05.2 [2 marks]

Answer: Starch molecules are too large to pass through the partially permeable Visking tubing, so no starch gets into the water

- starch molecules are too large (to pass through the partially permeable membrane) (1)
- so starch cannot pass through the Visking tubing into the water (1)

05.3 [3 marks]

Answer: Add Benedict's solution to a sample of the water and heat it in a water bath; a colour change from blue towards green, yellow, orange or brick-red shows that glucose (a reducing sugar) is present

- add Benedict's solution to a sample of the water (1)
- heat the mixture (in a water bath) (1)
- a colour change from blue to green / yellow / orange / brick-red shows glucose is present (1)

05.4 [2 marks]

Answer: Like a dialysis membrane, the tubing lets small molecules through but not large ones, so small molecules such as urea can pass from the blood into the dialysis fluid while large molecules such as proteins stay in the blood

- the Visking tubing lets small molecules through but not large ones, like the membrane in a dialysis machine (1)
 - so small molecules such as urea (and glucose / ions) can pass from the blood into the dialysis fluid, while large molecules such as proteins (and blood cells) stay in the blood (1)
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