

MY WORKBOOK

TOPIC 8

EXCRETION IN HUMANS

In this topic we will be looking at:

- (1) Introduction
- (2) Organs of excretion in humans
- (3) The human urinary system
 - (3.1) Structure and function of the kidney
 - (3.2) Internal structure of the kidney
 - (3.3) Functions of the kidney
 - (3.4) Structure and functions of the nephron
 - (3.5) Functioning of the nephron
 - (3.6) Summary of the urinary system
- (4) Homeostatic control of water + salts (osmoregulation)
- (5) Dialysis and kidney transplants

DAY 1:

⇒ Complete page 2 of your workbook using the Teachers guidelines slides 3 and 4.

DATE:

(1) Introduction

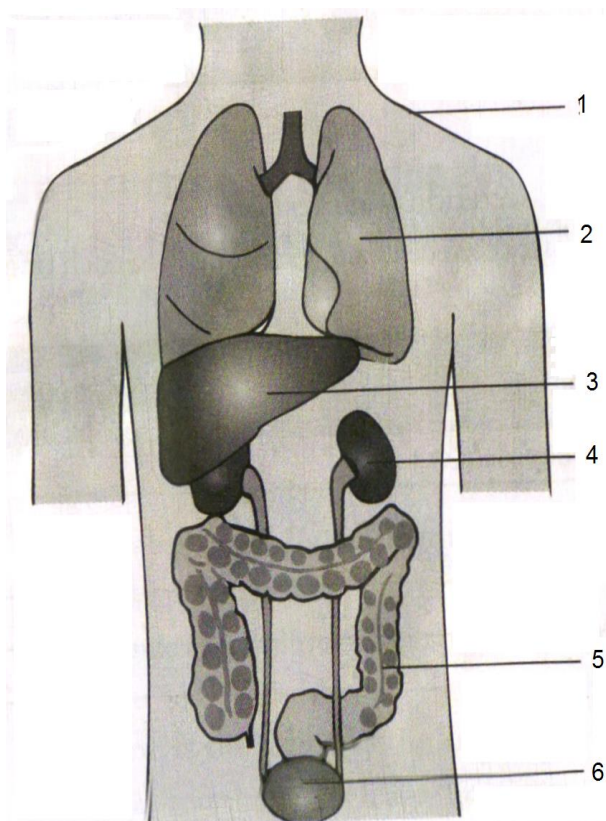
Excretion is the _____ of _____ produced by chemical reaction (_____) in the cells of the body,

Why is excretion necessary?

Waste products such as _____, _____ and _____ are produced during metabolism. These waste products _____ be excreted from the cells and from the body. If they accumulate they will _____ with the functioning of cells and eventually _____ their metabolic processes.

(2) Organs of excretion

»Activity 1: Organs of excretion



⇒ Complete page 3 of your workbook using the Teachers guidelines slide 5.

The table below lists the various excretory organs and their excretions:

ORGAN	EXCRETORY PRODUCT	ORIGIN OF EXCRETORY PRODUCT
Lungs		
Skin (sweat gland)		
Liver		
Gut		
Kidney		

END OF DAY 1

HOW DO YOU FEEL ABOUT THE WORK OF DAY 1? 😊 or 😞

IF YOU DO NOT FEEL COMFORTABLE WITH THE WORK, CONSIDER TO WORK THROUGH THE CONTENT AGAIN.

DAY 2:

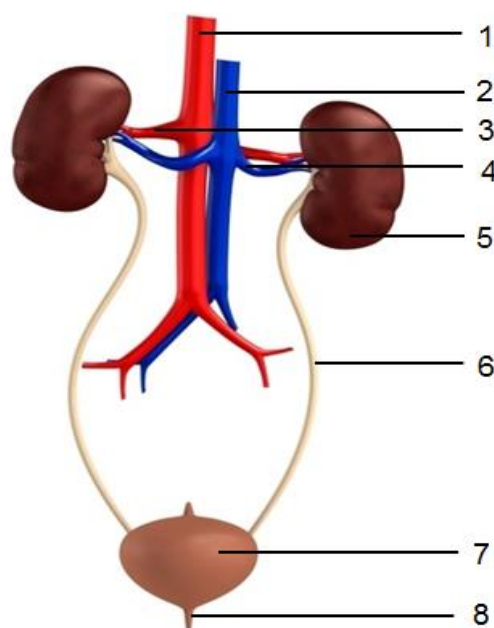
⇒ Please do Activity 2 by completing the labels of the diagram below using slide 6 of the Teachers guidelines.

DATE:

(3) The human urinary system

(3.1) Structure and function of the kidney

» Activity 2: Structure of the human urinary system

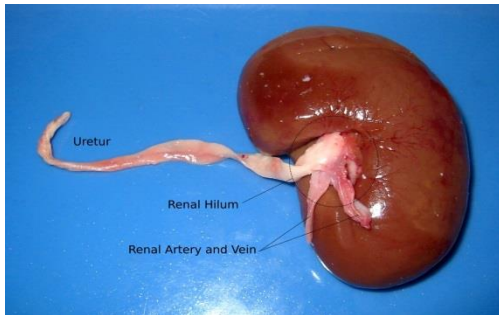


⇒ Complete the rest of page 4 of your workbook using the Teachers guidelines slide 7.

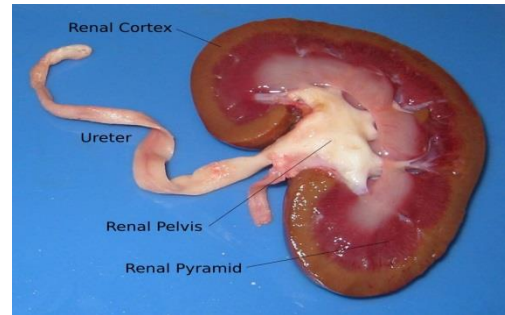
- ❖ The human urinary system consists of **two** _____, **two** _____, the _____ and the _____.
- ❖ The two kidneys are located near the _____ just below the diaphragm, _____.
- ❖ A _____ carries **blood** _____ each kidney to be _____, while a _____ the filtered blood.
- ❖ The ureters are tubes which carry _____ from the kidney to the bladder.
- ❖ The bladder **stores** the urine _____.
- ❖ The urethra is the tube through which _____ passes from the bladder to the _____.

⇒ Study the diagrams below showing the External and Internal structure of a kidney.

External structure



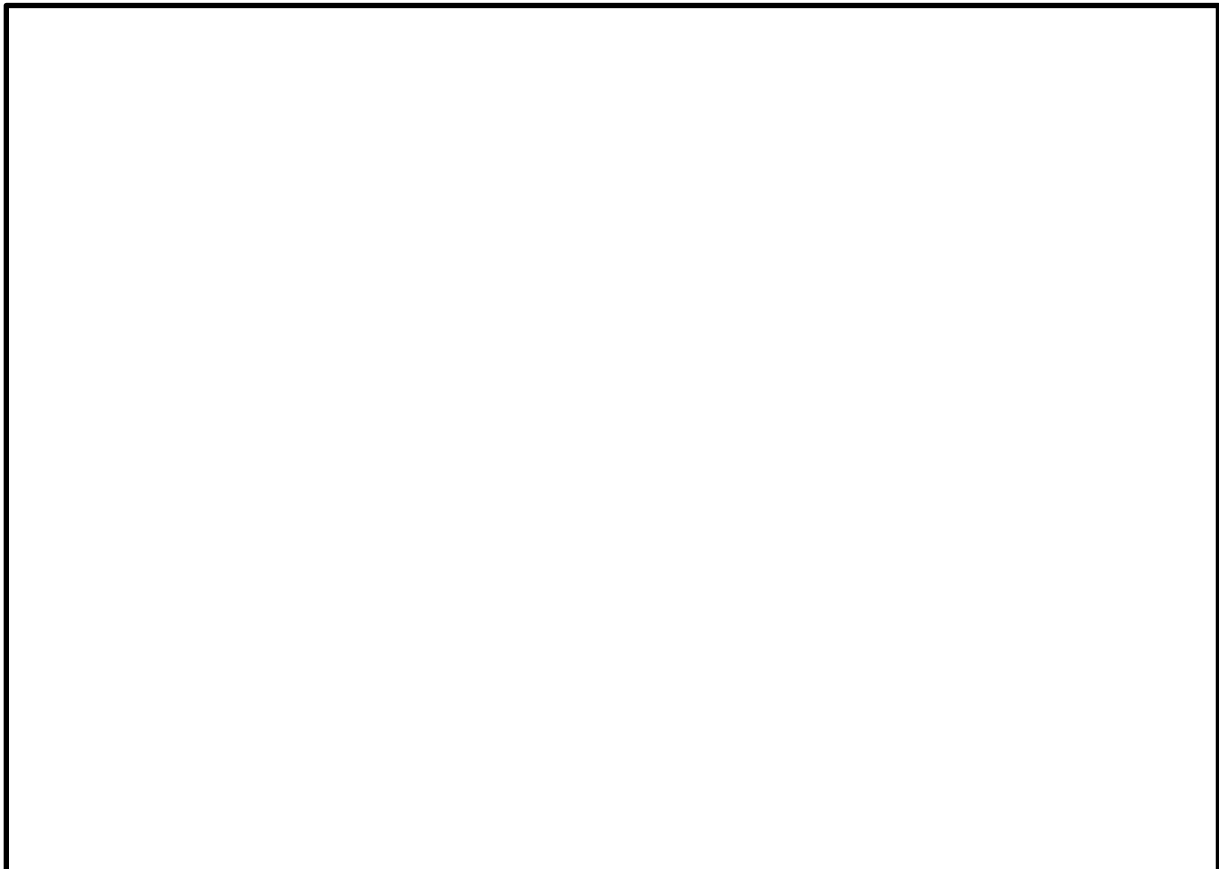
Internal structure



⇒ Please do Activity 3 by drawing a diagram of the internal structure of a kidney, by using slide 10 of the Teachers guidelines.

(3.2) Internal structure of the kidney

» Activity 3: Internal structure of the kidney



⇒ Complete page 6 of your workbook using the Teachers guidelines slides 11 and 12.

- ❖ _____: The outer part of the kidney, consist of the Malpighian bodies and the proximal and distal convoluted tubules of nephrons.
- ❖ _____: the middle part of the kidney makes up of about 12 pyramids.
- ❖ _____: group of collecting ducts (part of the medulla)
- ❖ _____: receives urine from the calyces. Urine leaves the renal pelvis and drains into the ureter and then into the bladder.
- ❖ _____: collecting ducts open into it. Urine drains from the collecting ducts into the calyx (part of the medulla)
- ❖ _____: leaves the kidney. Carries urine to the bladder
- ❖ _____: a tough fibrous tissue surrounding the kidney to support the soft tissue.

NOTE: adipose tissue/fat tissue surrounds each kidney to _____ it, acting like a shock absorber.

END OF DAY 2

HOW DO YOU FEEL ABOUT THE WORK OF DAY 2? 😊 or 😞

IF YOU DO NOT FEEL COMFORTABLE WITH THE WORK, CONSIDER TO WORK THROUGH THE CONTENT AGAIN.

DAY 3:

⇒ Please do Activity 4 (Quick Quiz), by using the information on page 1 – 6 of your workbook and slide 1 – 12 of the Teacher's guidelines.

DATE:

»Activity 4: Quick Quiz

Answer	Column A	Column B
	1. Excretion	A Stores urine temporarily.
	2. Homeostasis	B Liquid which carries nitrogenous wastes out of the body.
	3. Renal vein	C Transports oxygenated blood (from the aorta to the kidney) with useful substances and wastes.
	4. Renal artery	D Maintaining a constant internal environment.
	5. Ureter	E Regulation of the water content of the body.
	6. Urethra	F Outer membrane covering of the kidney.
	7. Sphincter	G The process by means of which the body removes metabolic wastes.
	8. Urea	H Carries urine from the urinary bladder to the outside.
	9. Urine	I Transports deoxygenated blood with useful substances and less wastes away from the kidney.
	10. Bladder	J Controls the release of urine from the bladder.
	11. Renal capsule	K Carries urine from the kidney to the bladder.
	12. Osmoregulation	L Excretory product (nitrogenous waste products) from the deamination of excess amino acids.

⇒ Complete the rest of page 7 of your workbook using the Teachers guidelines slide 14.

(3.3) Functions of the kidney

Functions of the kidney are:

- ❖ _____ of metabolic waste such as urea, uric acid, ammonia and creatinine.
- ❖ _____ regulates the water content of body fluids.
- ❖ _____ in body fluids.
Solute include sodium and potassium.
- ❖ _____ of body fluids.

All of the above contribute to maintaining a _____ internal environment of the body i.e. homeostasis

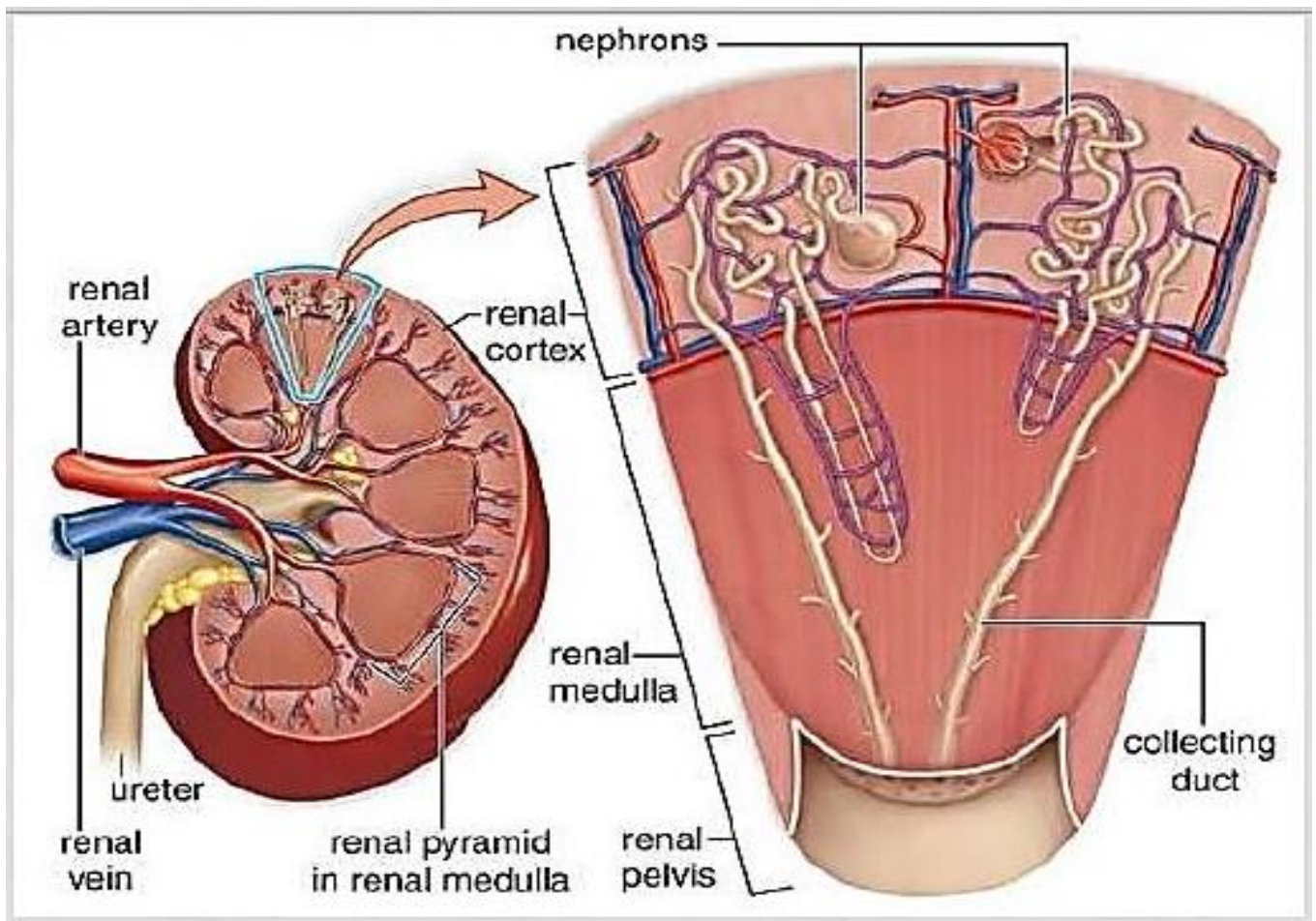
⇒ Complete page 8 of your workbook using the Teachers guidelines slides 14 and 15.

(3.4) Structure and functions of the nephron

The _____ is the structural and functional unit of the kidney. In other words, the function of the kidney is the same as the function of nephrons.

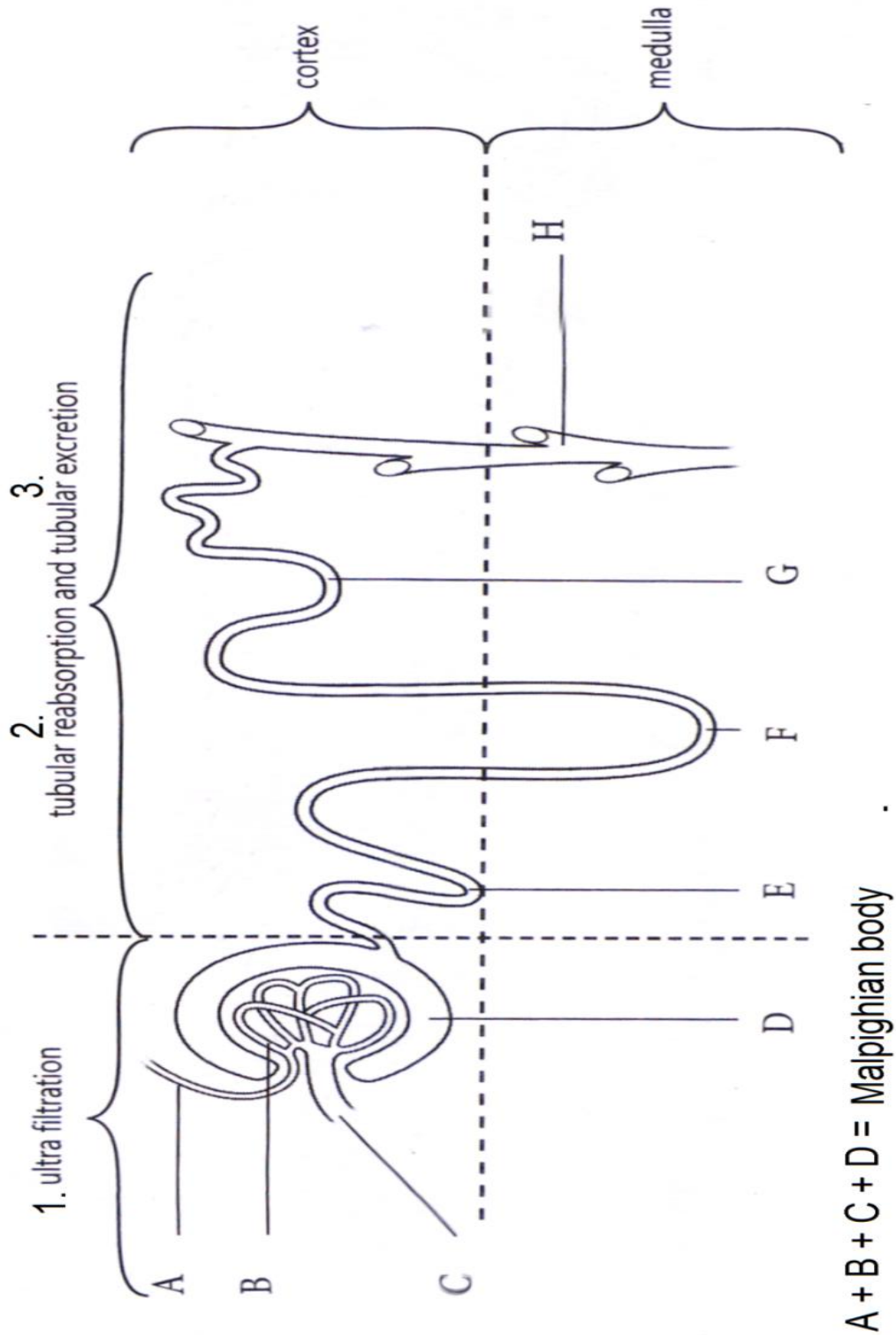
The nephron carries _____ of the kidney by carrying out the following functions:

1. _____ (glomerular function)
2. _____
3. _____



⇒ Please do Activity 5, by labelling the diagram of the Nephron, using the slides 16 and 17 of the Teacher's guidelines.

»Activity 5: Structure of a Nephron



END OF DAY 3

HOW DO YOU FEEL ABOUT THE WORK OF DAY 3? 😊 or 😞

IF YOU DO NOT FEEL COMFORTABLE WITH THE WORK, CONSIDER TO WORK THROUGH THE CONTENT AGAIN.

DAY 4:

⇒ Complete page 10 of your workbook using the Teachers guidelines slides 18 and 19.

DATE:

(3.5) Functioning of the nephron

Malpighian body: (label A, B, C, D)

Main function: _____ = filtration at high pressure

- The _____ arteriole has a _____ than the _____ arteriole; therefore blood in the glomerulus is under _____, **forcing** the plasma with dissolve substances _____ of the glomerulus in to the capsular space of the Bowman's capsule.
- The plasma contains:
 - **W** – _____
 - **C** – _____
 - **U** – _____
 - **U** – _____
 - **A** – _____
 - **A** – _____
 - **G** – _____
 - **S** – _____

⇒ **Complete page 11 of your workbook using the Teachers guidelines slides 19 to 21.**

- Blood capillaries of the glomerulus are _____ i.e. single layer of squamous epithelium tissue with very small pores.

The inner wall of the Bowman's capsule is lined by a layer of special cells with slit pores between them.

These two layers of endothelium cells with pores and slit pores form a _____ allowing plasma with dissolved useful and waste substances to filter through but _____ blood cells and larger blood proteins from passing into the capsular space.

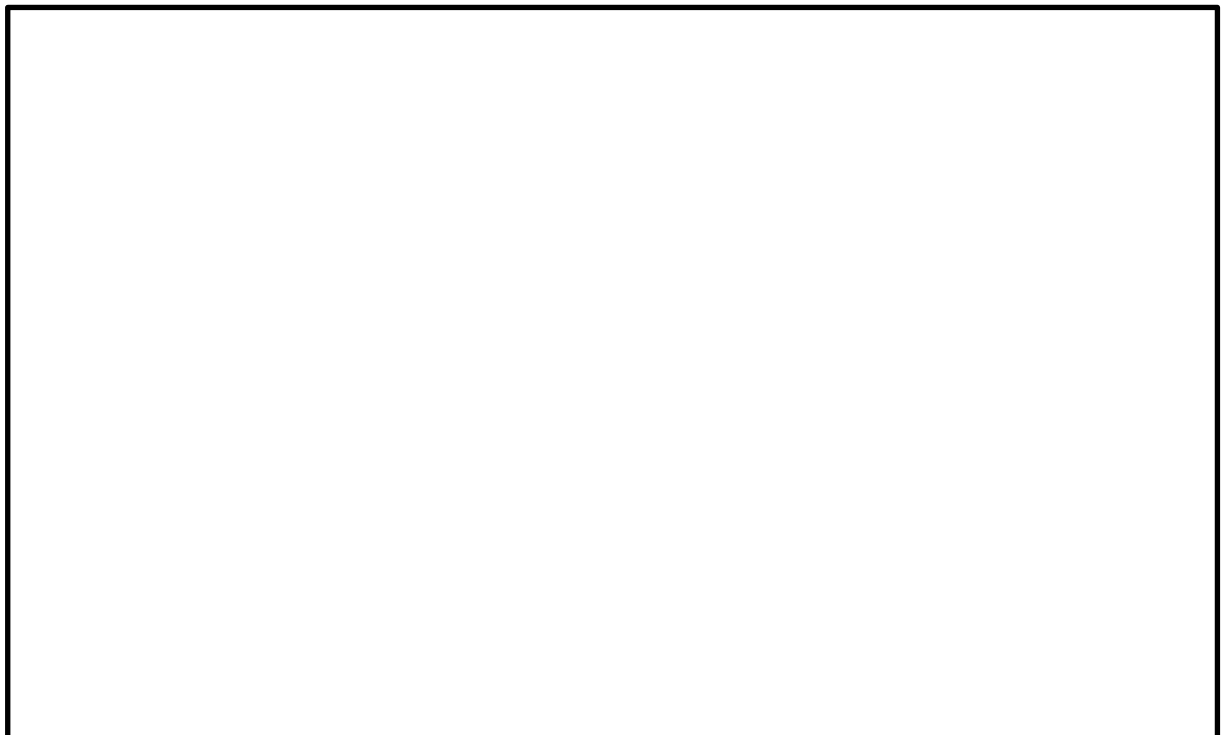
The plasma is now called _____ (and NOT urine yet).

PLEASE NOTE:

The glomerulus consists of a _____ of many capillaries and therefore offers a **large** _____.

The Bowman's capsule is _____ to **enlarge** the contact area with the glomerulus.

⇒ **Activity 6: Structure of the Malpighian body**



Complete page 12 of your workbook using the Teachers guidelines slide 22.

Proximal convoluted tubule: (label E)

There are three different types of _____ that takes place at the proximal convoluted tubule:

(1) _____ _____	(2) _____ _____	(3) _____ _____
The fluid that passes through the renal tubule is called tubular filtrate	All the glucose and some of the other useful substances are actively (requires energy) re-absorbed back into the capillary network. (to ensure it does not become part of urine and excreted) The epithelium contains a lot of mitochondrion – to supply energy and has microvilli to increase the absorption surface	Some water moves passively back into the capillaries back into the blood by means of Osmosis. (Definition of osmosis: <i>The movement of water from a high water potential to a low water potential through a selectively permeable membrane until an equilibrium has been reached</i>)

END OF DAY 4

HOW DO YOU FEEL ABOUT THE WORK OF DAY 4? 😊 or 😞

IF YOU DO NOT FEEL COMFORTABLE WITH THE WORK, CONSIDER TO WORK THROUGH THE CONTENT AGAIN.

DAY 5:

⇒ Complete page 13 of your workbook using the Teachers guidelines slides 23 and 24.

DATE:

Loop of Henle: (label F)

- Ensures that the medulla always has a _____ of sodium ions. (has to do with salt content)
- Sodium ions are _____ **out** of the loop of Henle **into** the tissue fluid of the _____.
- Sodium ions _____ the water potential of the tissue fluid in the medulla.
- Enables water to _____ the ascending limb, distal convoluted tubule and collecting duct by _____ and enter the _____ and then the _____.

The amount of water re-absorbed is controlled by the hormone _____.

Distal convoluted tubule: (label G)

The main function of the distal convoluted tubule is _____ (final formation of urine).

Some substances, which are in the blood and _____ by the body (waste) are _____ removed from the blood in the previous parts of the nephron.

Urine formation: The _____ is called _____ once the useful substances have been _____ and the waste substances have been _____ into the renal tubule.

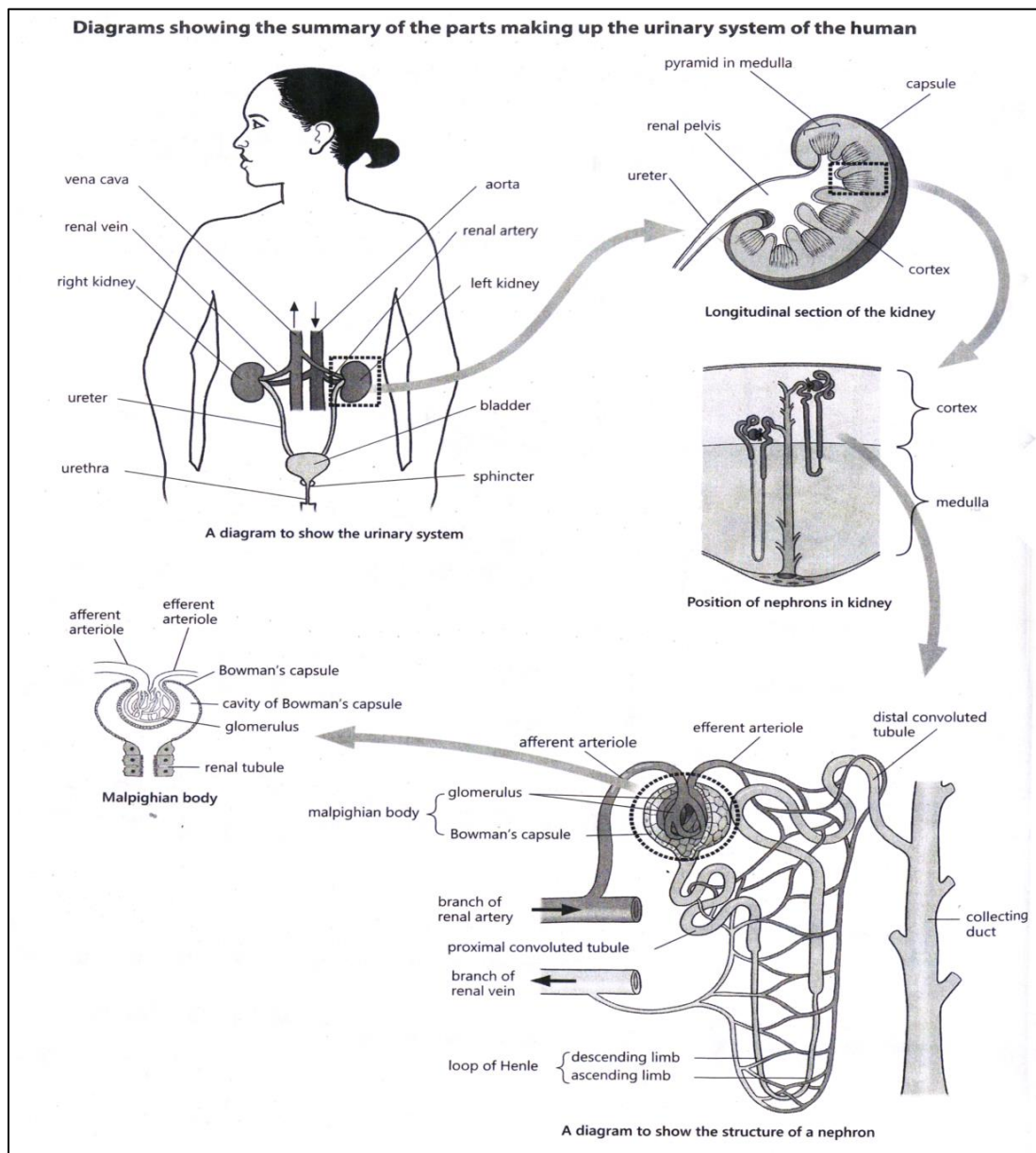
⇒ Complete page 14 of your workbook using the Teachers guidelines slide 25.

Collecting ducts: (Label H)

The collecting ducts “collect” all the urine _____ and then urine flows from the _____, into the _____ and then into the _____.

From here it moves down the _____ into the _____, where it is stored temporarily and then released via the _____.

(3.6) Summary of the urinary system



»Activity 7: Urinary system scientific terms

Provide the correct term for each of the following statements:

1. All the chemical processes which take place in living cells. _____
2. The region of the kidney where the Malpighian bodies are located. _____
3. The region of the kidney where the loops of Henle and collecting ducts are located. _____
4. The region of the kidney where the pyramids are found. _____
5. The structural and functional unit of the kidney. _____
6. The cup-shaped structure of the nephron. _____
7. The two structures that make up the Malpighian body. _____
8. The Malpighian body is also called the _____
9. The network of capillaries in the Bowman's capsule. _____
10. The type of tissue that lines the blood capillaries. _____
11. The hairpin-like part of the nephron between the proximal and distal convoluted tubules. _____
12. The hormone that increases the permeability of the collecting ducts of the nephron. _____
13. The hormone that controls the amount of sodium and potassium in the body. _____
14. The branch of the aorta that enters the kidney. _____
15. The indented or concave side of the kidney where the renal artery enters and renal vein and ureter leave the kidney.

16. The artificial kidney machine that a person, with malfunctioning kidneys, is attached to in order to remove wastes.

17. The vein that carries deoxygenated blood purified of excretory wastes, away from the kidney to the inferior vena cava.

[17]

My mark _____ out of 17.

END OF DAY 5

HOW DO YOU FEEL ABOUT THE WORK OF DAY 5? 😊 or 😞

IF YOU DID NOT RECEIVE 70% FOR ACTIVITY 7, CONSIDER WORKING THROUGH THE CONTENT AGAIN.

DAY 6:

⇒ Complete page 16 of your workbook using the Teachers guidelines slides 27 and 28.

DATE:

(4) Homeostatic control of water + salts (osmoregulation)

_____ is the name of the active maintenance of the correct balance of water and solutes in the body.

For the body to function properly, the concentration of solutes in the blood and tissue fluid must stay more or less the _____.

If there are too many solutes and not enough water, the blood and tissue fluid will be too _____ **AND** if there is too much water and not enough solutes, the blood and tissue fluid will be too _____.

The kidneys, under the control of the hormones _____ and _____, help to maintain the correct balance of water and solute in the body fluids.

Role of the hormone ADH

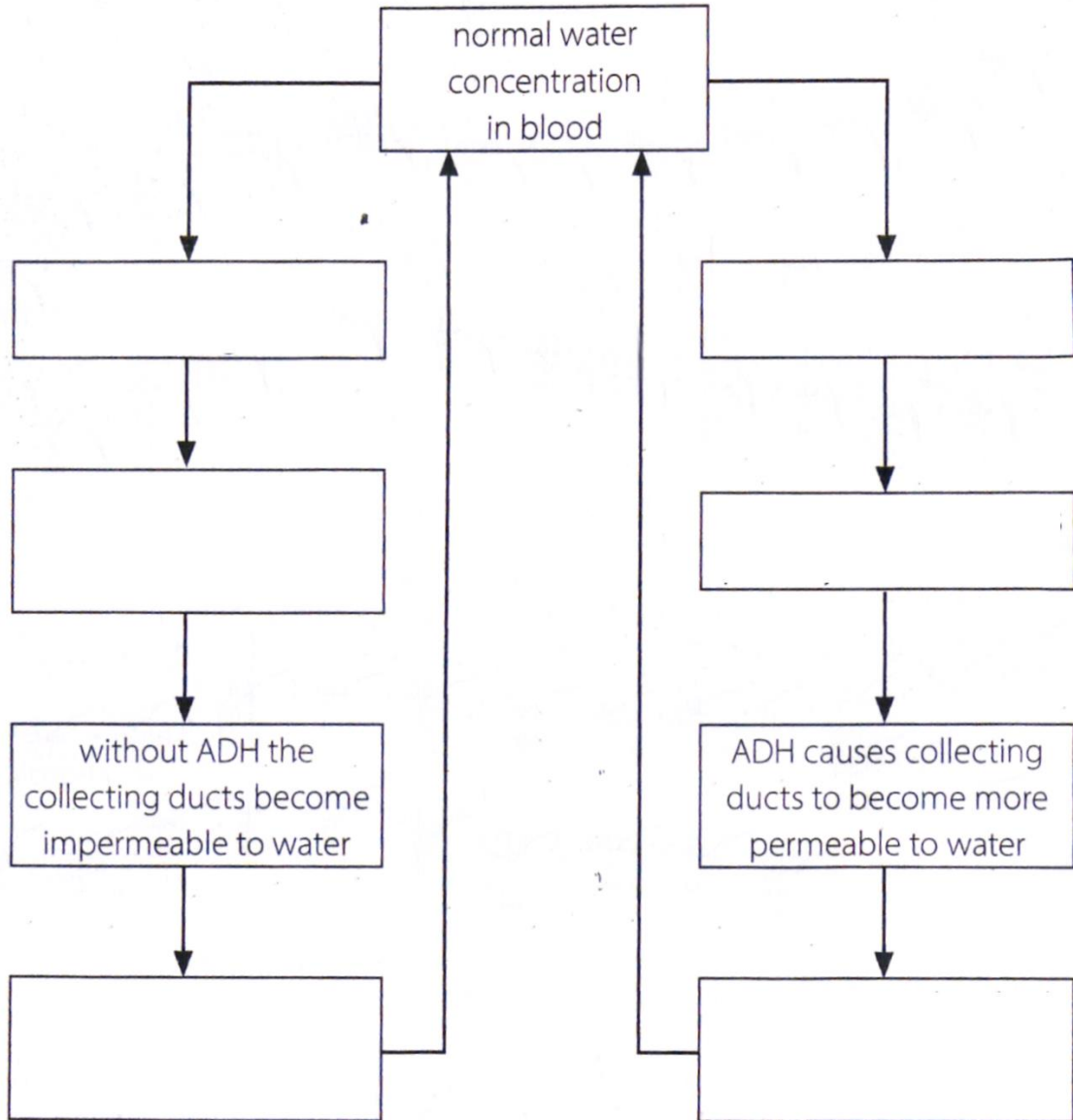
The hormone ADH (antidiuretic hormone) helps to _____
_____ **lost** from the body in the urine.

ADH makes the walls of the collecting ducts _____ to water so that they can _____ more water.

ADH is produced in the _____ (base of the brain)

⇒ Complete page 17 of your workbook using the Teachers guidelines slide 29.

» Activity 8: The role of ADH in controlling water levels in the body



⇒ Complete page 18 of your workbook using the Teachers guidelines slide 30 and 31.

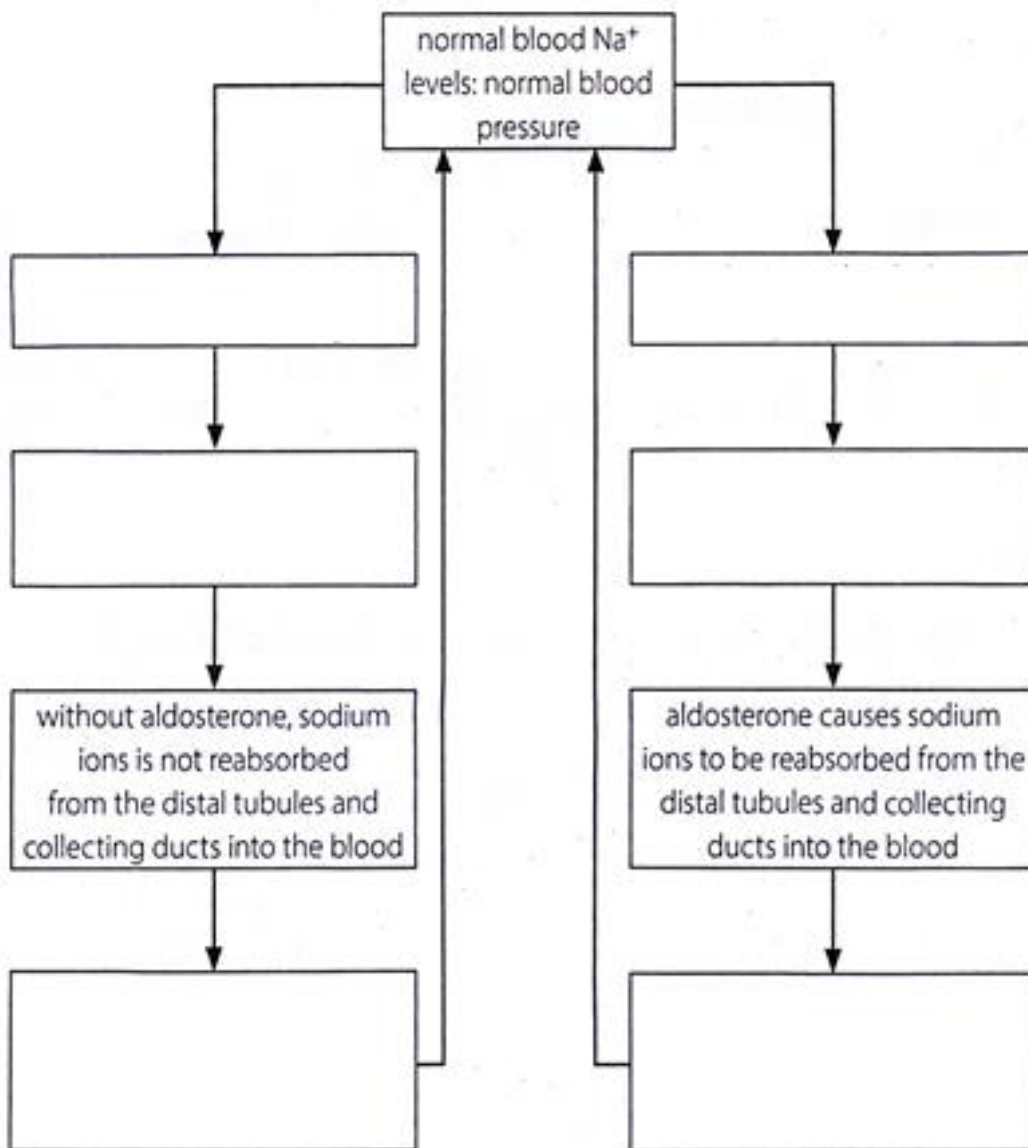
Role of the hormone Aldosterone

Aldosterone is a hormone which helps to maintain the _____, especially sodium, in the body fluids.

Aldosterone does this by causing sodium to be _____ from the _____ and _____.

Aldosterone is produced by the _____ (gland situated on top of the kidneys).

» Activity 9: The role of Aldosterone in controlling sodium levels and blood pressure in the body



HOW DO YOU FEEL ABOUT THE WORK OF DAY 6? 😊 or ☹️

IF YOU DO NOT FEEL COMFORTABLE WITH THE WORK, CONSIDER TO WORK THROUGH THE CONTENT AGAIN.

DAY 7:

⇒ Complete page 19 of your workbook using the Teachers guidelines slides 32 and 33.

DATE:

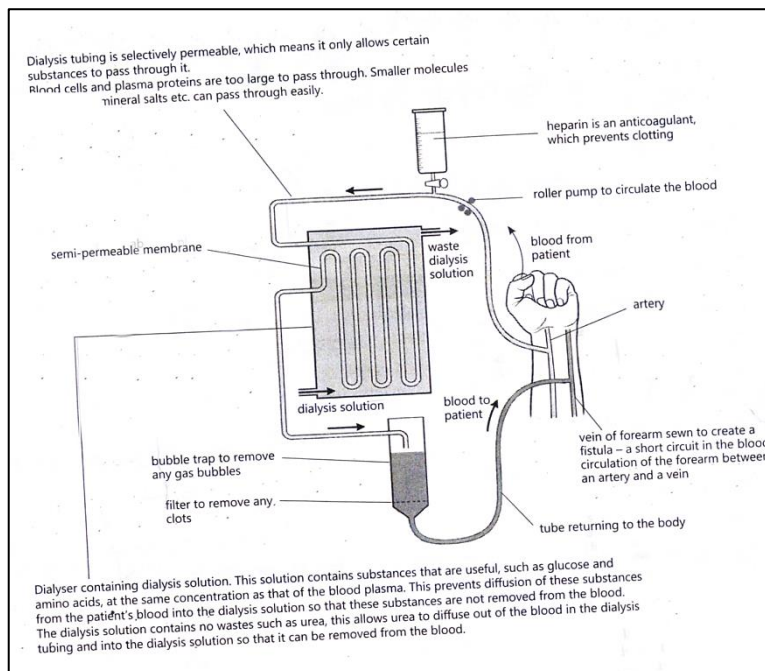
(5) Dialysis and kidney transplants

When a person's kidneys stop working or because of infection or disease the person needs:

- _____
- _____

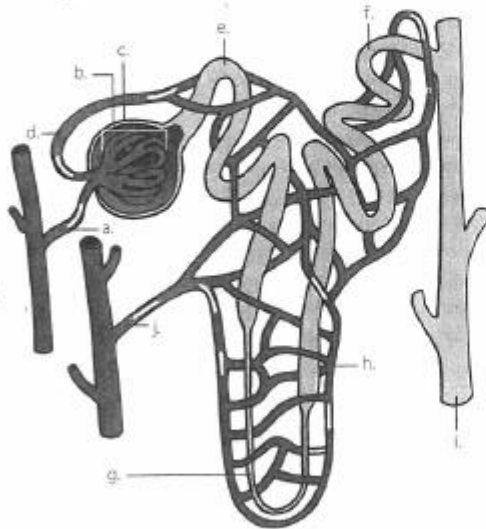
A person can survive with one kidney but when both are damaged then the above treatments or measures are necessary.

Diagram showing how a dialysis machine works



»Activity 10: Test yourself: Urinary system

- Select the correct term from the two given in brackets:
 - The organs responsible for filtering the blood are the (kidneys/nephrons).
 - The liquid in the nephrons is known as (urine/filtrate).
 - Urine is temporarily stored in the (collecting ducts/bladder).
 - The tube which carries urine away from the bladder is known as the (urethra/ureter).
 - The kidneys are protected by a capsule of (fibrous connective tissue/adipose tissue).
 - Urine leaves the body during the process of (excretion/urination).
 - Filtered blood leaves the kidney via the (renal artery/renal vein).
 - Renal pyramids are found in the (renal cortex/renal medulla).
- The diagram below shows the structure of a nephron. Provide labels for the parts marked a. to j. (8)

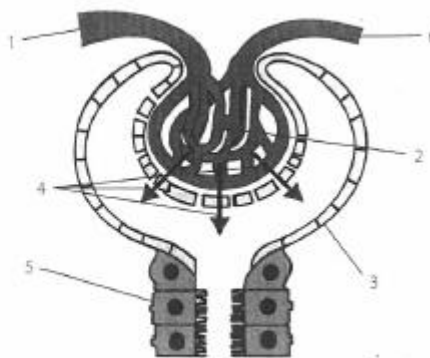


[10]

- Study the diagram on the next page and then answer the questions which follow.
 - What process takes place here? (1)
 - In what region of the kidney does this structure occur? (not *nephron*) (1)

- Give the number and name of the structure in which:
 - the blood is under high pressure (4)
 - the filtrate is first formed. (4)
- Name four of the substances which are represented by the arrows. (4) [10]

- Using your knowledge of kidney functioning, explain clearly why:
 - the filtrate contains glucose but the urine of a non-diabetic person does not normally contain glucose (4)
 - urine tests can determine whether a person has been taking drugs (5)
 - mammals that live in the desert have particularly well-developed loops of Henle. (8)



[17]

[Total marks: 45]

Activity 10: My mark _____ out of 45.

END OF DAY 7

HOW DO YOU FEEL ABOUT THE WORK OF DAY 7? 😊 or 😞

IF YOU DID NOT RECEIVE 50% FOR ACTIVITY 10, CONSIDER WORKING THROUGH THE CONTENT AGAIN.

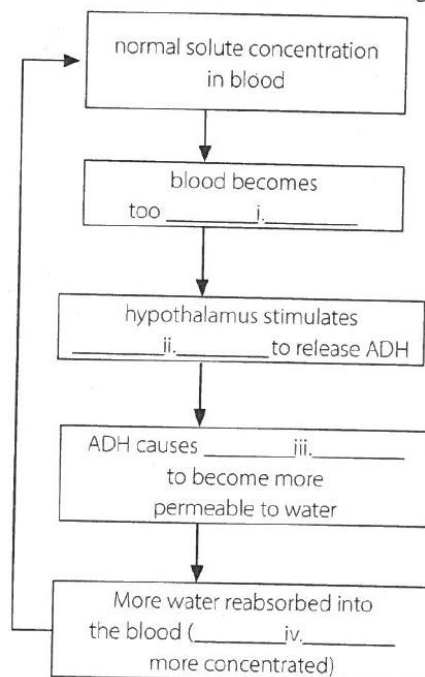
DAY 8:

»Activity 11: Test yourself: Homeostatic control of water and salts

DATE:

1. Give the word or term for each description:
 - a. the homeostatic control of the balance of water and solutes in the body
 - b. the hormone responsible for controlling the amount of water in urine
 - c. the hormone responsible for controlling the amount of sodium in urine
 - d. the general name for any substance that increases urination
 - e. the gland/s that secretes ADH
 - f. the gland/s that secretes aldosterone
 - g. the portion of the brain responsible for the sensation of thirst
 - h. the process whereby substances in a liquid can be separated by means of a semi-permeable membrane
 - i. the word used for any person who provides an organ of their body for someone who needs it
 - j. the process whereby a transplanted organ is attacked by a person's immune system. (10)

2. Look at the flow chart below, which shows the role of ADH in controlling the water balance in the body. Write down i. to iv., and next to each, write the word or term missing from the flow chart.



3. Draw a flow chart showing the role of aldosterone when sodium levels in the body fluids drop too low. (14)
4. Explain why: (5)
- too much salt (NaCl) in the diet can lead to high blood pressure (3)
 - low blood pressure limits kidney functioning (3)
 - the level of ADH will rise in your bloodstream if you have not had enough water to drink (3)
 - consuming an excessive amount of alcohol can lead to dehydration. (4) [15]
5. Consider a person with chronic kidney failure who has to undergo dialysis. (2)
- Name two likely causes of his/her chronic kidney failure. (2)
 - Explain how waste substances such as urea but not large protein molecules will be removed from the person's blood during dialysis. (4)
 - Give two reasons why it would be preferable for this person to have a kidney transplant, instead of dialysis. (2)
 - Explain why it would be preferable for the transplanted kidney to come from the person's son, rather than from an unrelated donor. (4) [12]

[Total marks: 55]

Activity 11: My mark _____ out of 55.

END OF DAY 8

HOW DO YOU FEEL ABOUT THE WORK OF DAY 8?



or



IF YOU DID NOT RECEIVE 50% FOR ACTIVITY 11, CONSIDER WORKING THROUGH THE CONTENT AGAIN.

DAY 9:

⇒Use the completed “My workbook”, the Teacher’s guidelines and page 241 – 260 in your textbook to complete the terminology list below.

DATE:

- 1.2** Give the correct biological term for each of the following descriptions. Write only the term next to the question number (1.2.1–1.2.15).
- 1.2.1 The process by means of which the body eliminates metabolic waste products.
 - 1.2.2 The tube that connects the urinary bladder with the exterior.
 - 1.2.3 The network of capillary blood vessels in Bowman’s capsule.
 - 1.2.4 The functional and structural unit of the human kidney.
 - 1.2.5 A cup-shaped structure in the kidney that contains a glomerulus and leads to a kidney tubule.
 - 1.2.6 The first tubular component of a nephron following Bowman’s capsule in the human kidney.
 - 1.2.7 The hairpin-like segment of the tubular component of a kidney nephron that is situated between the proximal and distal tubules.
 - 1.2.8 The hormone produced in the hypothalamus that increases the permeability of the collecting ducts of the kidney to water.
 - 1.2.9 The movement of essentially protein-free plasma across the wall of a Malpighian body as a result of a pressure gradient.
 - 1.2.10 The name given to the specialised epithelial cells with split pores that occur on the inner wall of Bowman’s capsule.
 - 1.2.11 The region of the kidney in which Malpighian bodies are located.
 - 1.2.12 The regulation of the water content in the body fluids by the kidney.
 - 1.2.13 The segment of the loop of Henle that is almost impermeable to water.
 - 1.2.14 The region of the kidney where renal pyramids are found.
 - 1.2.15 The tube along which urine is transported from the kidney to the urinary bladder.

Terminology: My mark _____ out of 15.

END OF DAY 9

HOW DO YOU FEEL ABOUT THE WORK OF DAY 9? 😊 or 😞

IF YOU DID NOT RECEIVE 70% FOR THE TERMINOLOGY, CONSIDER WORKING THROUGH THE CONTENT AGAIN.

END OF TOPIC 8