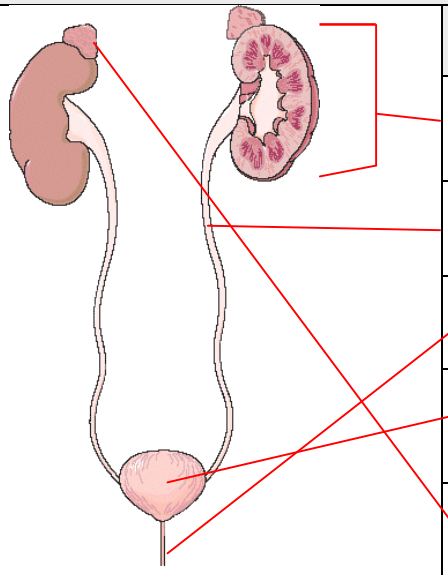
Section 3 Workbook (Unit 8 ANSWERS)

Urinary System

C13. Analyze the functional inter-relationships of the structures of the urinary system.

42. Draw lines to identify the following structures on the diagram and complete the table.

Urinary System		
	**Structure**	**Function**
	Kidney	**Produces urine. Removes water, wastes & foreign substances. It also maintains pH, & blood plasma volume.**
	ureter	**Conducts urine from the kidney pelvis to the urinary bladder by peristalsis**
	urethra	**Conducts urine from the urinary bladder to the outside of the body**
	urinary bladder	**Stores urine until urination occurs**
	Adrenal Gland	**Produces adrenalin**

43. Explain the urinary reflex (urination and the nervous system)

When the bladder has about 250 mL of urine, stretch receptors send sensory nerve impulses to the spinal cord. Motor nerve impulses from the spinal cord cause the urinary bladder to contract & sphincter muscles to relax. This allows urination to occur. (Brain controls it)

44. Urinary tract infections:

a) **Define:**

An infection of the urinary system

b) **Symptoms**

Pain, burning sensation, chills, fever, nausea, and vomiting

c) **Where do urinary tract infections occur?**

Commonly in the urethra and urinary bladder but can infect the kidneys too

d) **Causes of these infections?**

E. coli from the large intestine enter the urethra

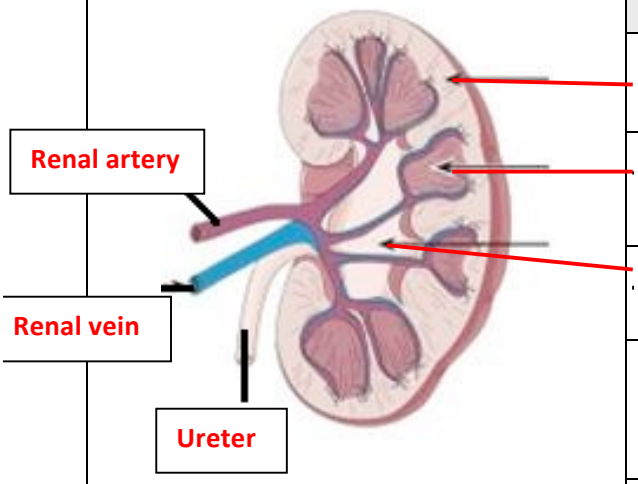
e) **Treatment?**

Antibiotics

f) **Tips to prevent infection are:**

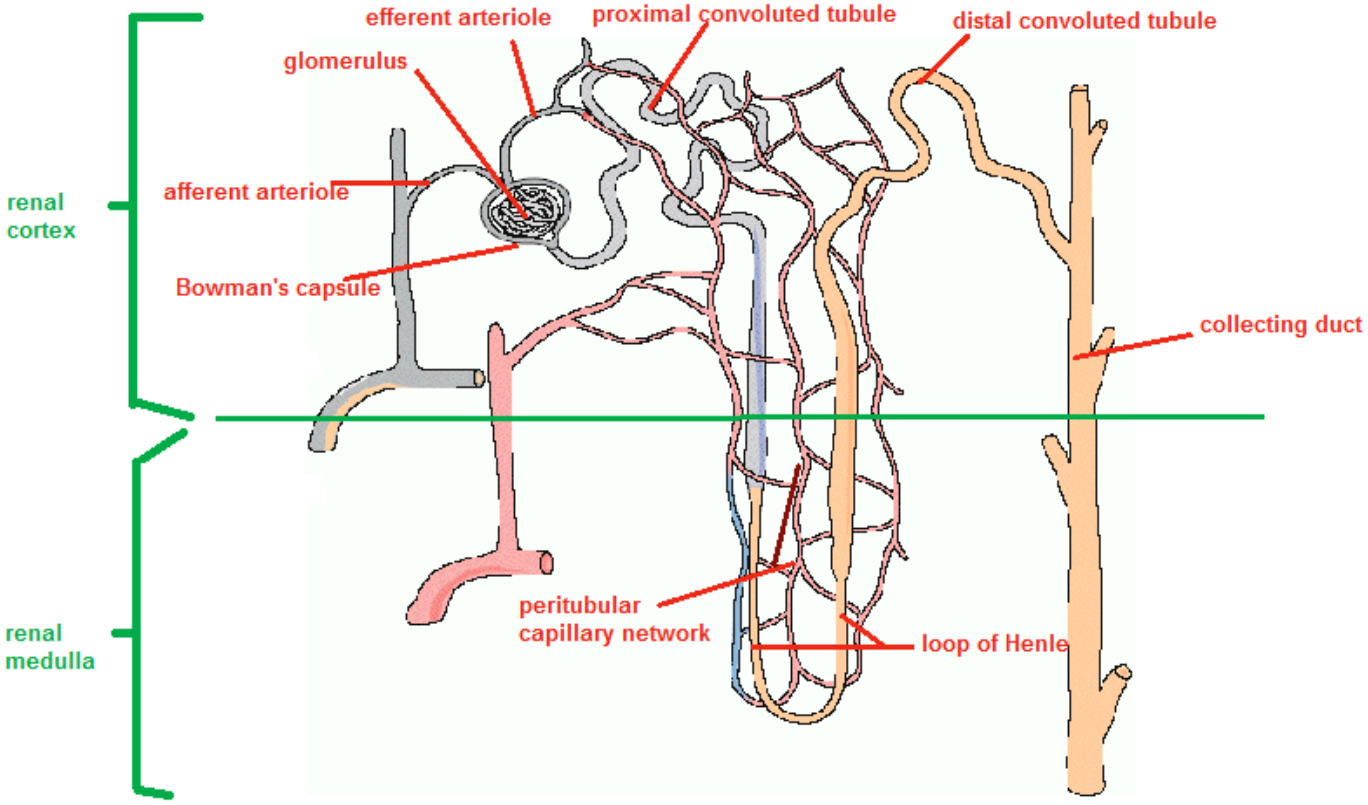
Drink lots of water, wash well (hygiene), urinate before and after sex, & wipe front to back

45. Label the structures on the diagram and complete the table.

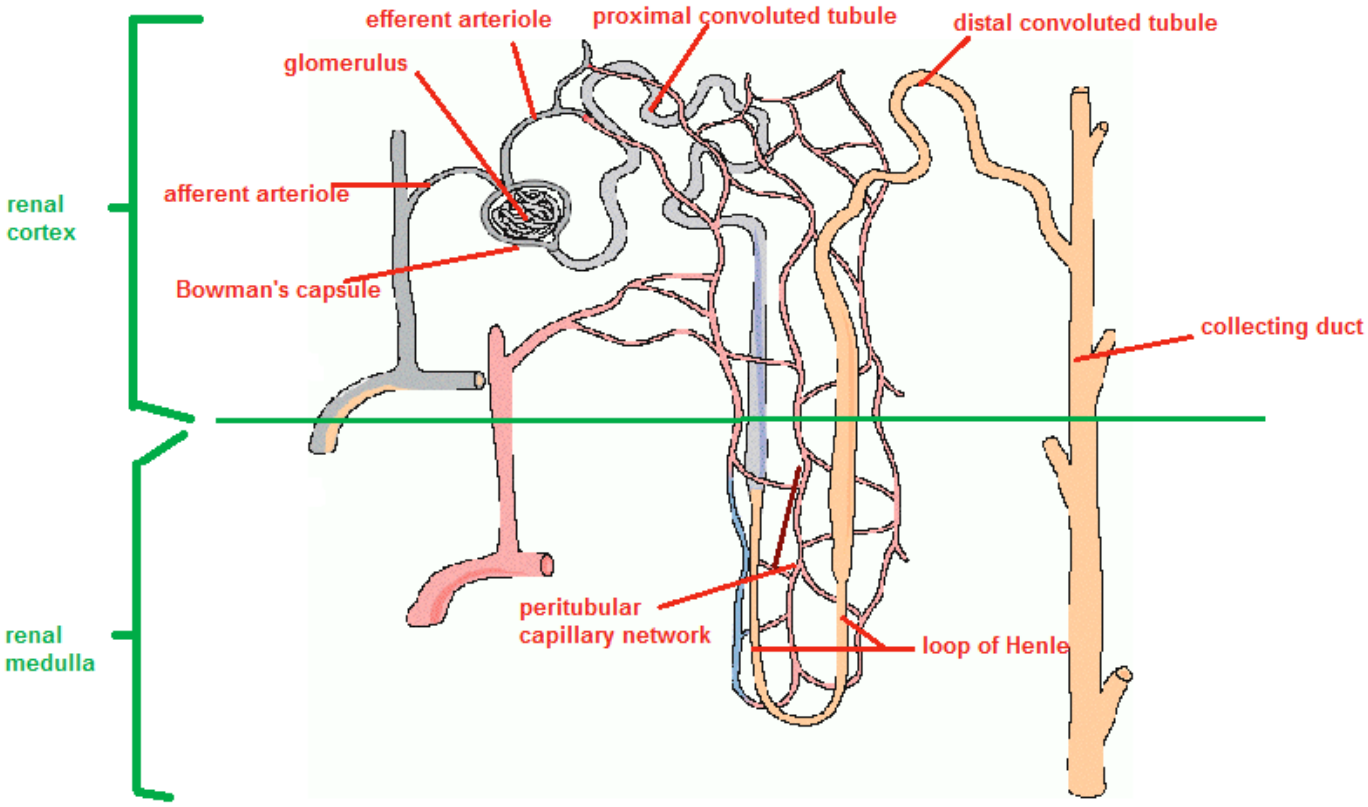
The Kidney		
	**Structure**	**Function**
	renal cortex	Filtration of blood plasma – receives nutrients and wastes from blood plasma
	renal medulla	Reabsorption of nutrients such as glucose, amino acids, salts and water (substances want to keep). And tubular secretion of substances still in excess
	renal pelvis	Collects the urine formed by the nephron and funnels it to the ureter.
	Renal artery and Vein	Renal artery brings blood to the kidney to be filtered and renal vein takes blood away from the kidney that has been filtered
	ureter	Conducts urine from the kidney pelvis to the urinary bladder by peristalsis

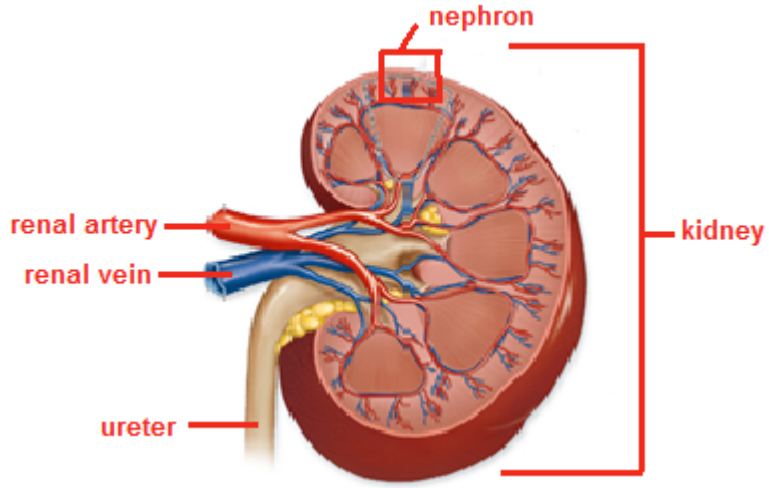
46. Complete the table and label these structures on the diagram of the nephron.

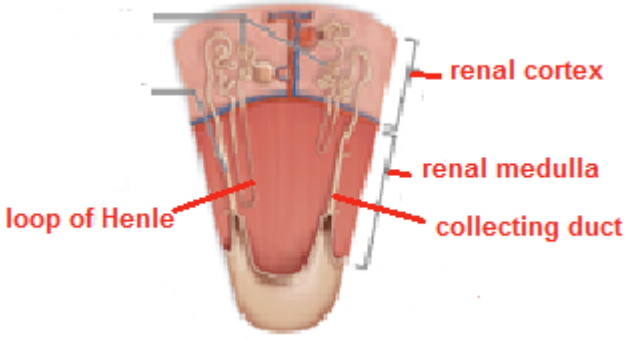
The Nephron	
Structure	**Function**
glomerulus	**Site where pressure filtration occurs. Smaller substances, good and bad, leave the glomerulus plasma and enter the nephron (Bowman's capsule) and water too.**
Bowman's capsule	**Receives the substances of the blood plasma from the glomerulus. Start of the nephron (functional unit of the kidney).**
afferent arteriole	**Increases the blood pressure as the blood enters the glomerulus so pressure filtration can occur**
efferent arteriole	**Conducts thicker blood (because lost water & substances) from glomerulus to the peritubular capillary network.**
peritubular capillary network	**Surrounds the nephron and allows for the exchange of wastes and nutrients between the blood and nephron (in both directions). Returns water and nutrients that enter the nephron to the circulatory system.**
proximal convoluted tubule	**Site of selective reabsorption where water, most glucose, amino acids, other nutrients & required salts are transported from nephron filtrate to blood plasma**
distal convoluted tubule	**Site of tubular secretion where any excess substances in blood (creatinine, drugs, antibiotics, H+) still enter the filtrate (movement from blood to nephron).**
collecting duct	**Site where water can be reabsorbed to concentrate the urine in the filtrate. Regulates blood volume and pH.**
loop of Henle	**Site where water and salts can be reabsorbed from the filtrate into the peritubular capillary network.**
Renal Cortex	**Filtration of blood plasma – receives nutrients and wastes from blood plasma**
Renal Medulla	**Reabsorption of nutrients such as glucose, amino acids, salts and water (substances want to keep). And tubular secretion of substances still in excess.**



47. Label the following diagram where indicated. Shade in the nephron & colour the blood vessels.







48. List the pathway of a red blood cell from the aorta to the inferior vena cava through the nephron.

Aorta → renal artery → afferent arteriole → glomerulus → efferent arteriole → peritubular capillary network → renal venule → renal vein → inferior vena cava

49. Describe how these processes contribute to the formation of urine.

a) pressure filtration

- **It is the movement of small substance from the glomerulus (with small pores) into the Bowman's capsule due to high blood pressure in the glomerulus.**
- **Substances such as amino acids, salts, nitrogenous wastes, glucose, water, nutrients, and other ions move into the Bowman's capsule.**
- **The larger substances such as proteins, red blood cells, white blood cells and platelets remain in the blood in the glomerulus.**

b) selective reabsorption

- **This occurs in the proximal convoluted tubule.**
- **It involves the active transport of glucose, amino acids, and some salts from the filtrate in the nephron, to the blood plasma in the peritubular capillary network (PCN).**
- **Water is also reabsorbed and follows the salt passively**

c) tubular excretion

- **This occurs in the distal convoluted tubule.**
- **It involves the active transport of excess substances from the blood plasma in the peritubular capillary network into the nephron filtrate.**
- **Excess substances such as H+, drugs, creatinine, antibiotics (penicillin), and pesticides.**

d) Describe the reabsorption of water in the nephron.

- **Water reabsorption occurs mainly at the loop of Henle and the collecting duct of the nephron.**
- **The nephron pumps out salt & urea into the renal medulla to make it hypertonic to the filtrate to draw water out of the nephron by osmosis. Remember tonicity!!**
- **The blood in the peritubular capillary network is hypertonic as well and water moves from the descending *loop of Henle* into these capillaries by osmosis. (This loss of water concentrates the filtrate / urine in the nephron)**
- **The *collecting duct* is permeable to water when the hormone ADH (antidiuretic hormone) reaches it. (This loss of water concentrates the filtrate / urine in the nephron).**
- **The water leaves the collecting duct due to the saltiness (tonicity) of the renal medulla.**

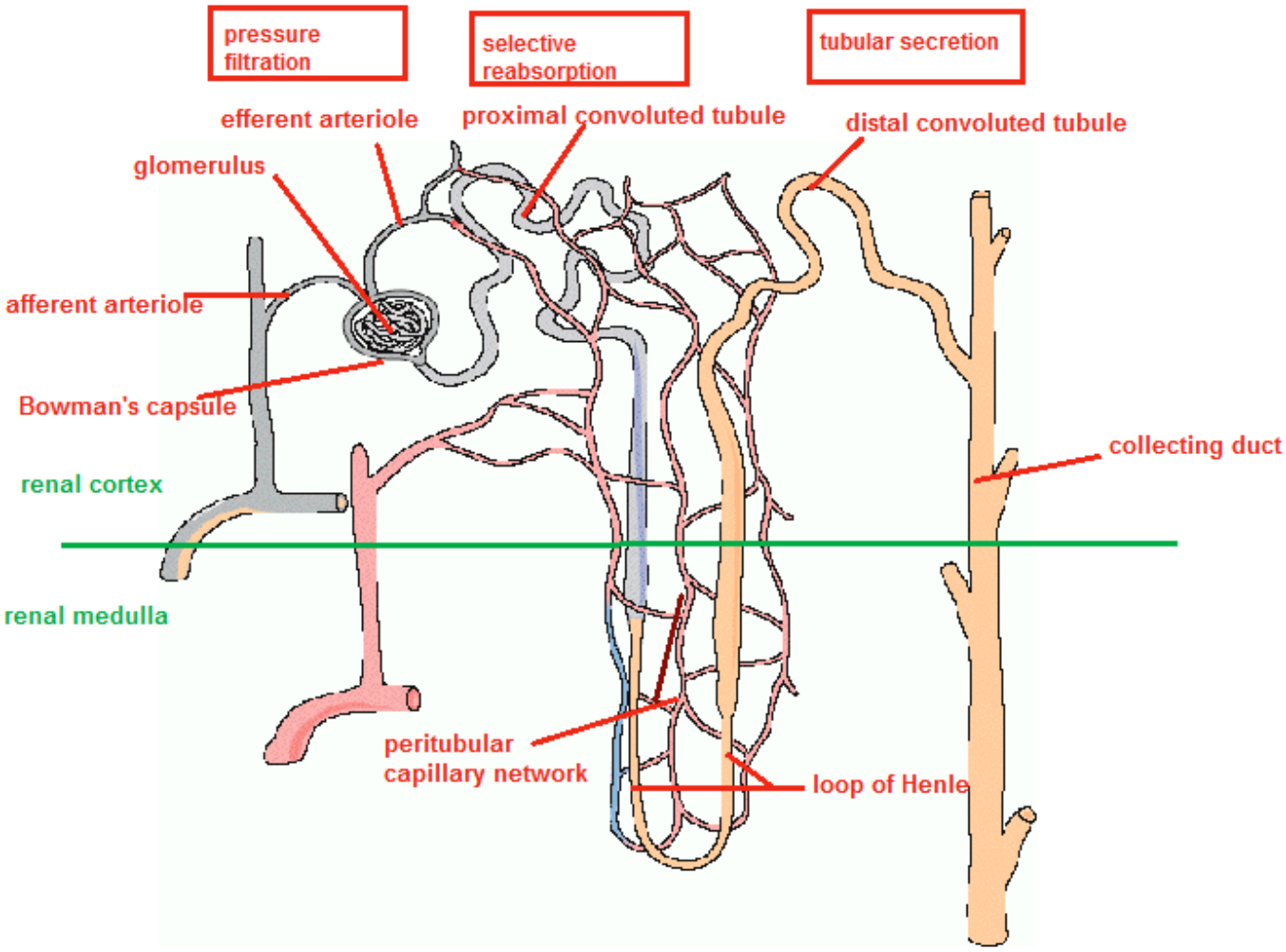
Certain carrier proteins actively transport amino acids, glucose, penicillin, histamines, bicarbonate ions, and creatinine during urine formation.

50. Describe the components of urine.

- **Urine = glomerular filtration, substances that were reabsorbed into the blood and substances secreted into the filtrate.**
- **Urine is composed of nitrogenous wastes (uric acid & urea), excess salts and ions, some water, H+, creatinine, drugs, antibiotics like penicillin, and excess vitamins.**

- **You should *NEVER* see formed elements (RBC, WBC, and platelets) or proteins in the urine. If these are detected it means there is a problem with the kidneys.**

51. In each box, name the process that occurs to produce urine and label all the indicated structures



52. Describe how the kidneys maintain blood pH.

- **Kidneys maintain the acid – base balance of the blood.**
- **They do this by monitoring and controlling the levels of H+ ions and HCO_3^- ions (bicarbonate ions).**
- **The kidneys will excrete H+ or reabsorb bicarbonate ions to maintain pH of the blood. Sodium bicarbonate regulates blood pH at the distal convoluted tubule.**

53. Compare urea and glucose content of blood in the renal artery with that of the renal vein and explain the differences.

- **Renal artery = has high levels of urea and glucose since it has not been processed by the kidney yet.**
- **Renal vein = has low levels of urea and high levels of glucose still because virtually all of the glucose is reabsorbed during selective reabsorption but the urea is a nitrogenous waste that your body wants to get rid of and therefore does not reabsorb as much of it back into the blood plasma.**
    - **If high levels of glucose are found in the urine this can be an indication of diabetes**

54. Identify the source gland(s) for antidiuretic hormone (ADH).

ADH is made by the hypothalamus but it is stored and secreted from the posterior pituitary gland.

55. Describe how the hypothalamus, posterior pituitary gland, ADH, and the nephron achieve homeostasis of water levels in the blood.

- The hypothalamus makes ADH. ADH is then stored and released from the posterior pituitary gland when water levels in the blood are low and you are dehydrated. ADH is controlled by negative feedback.

DEHYDRATION:

- When you are dehydrated, the kidneys reabsorb most of the water from the filtrate. This occurs because the blood passes through the hypothalamus. This allows the hypothalamus to detect a low concentration of water in the blood and cause the posterior pituitary gland to release ADH.
- ADH travels through the blood to the collecting duct. The collecting duct becomes permeable to water in response to ADH which allows water to be reabsorbed into the peritubular capillary network (PCN) to increase the concentration of water which increases the blood volume. Once the blood volume is at normal levels, negative feedback occurs which prevents the release of ADH.

TOO MUCH WATER or HIGH WATER CONCENTRATION IN BLOOD:

- When the hypothalamus detects a high concentration of water and prevents the posterior pituitary gland from releasing ADH. With no ADH present, the collecting duct is impermeable to water and the water remains in the filtrate to become part of urine that is eliminated from the body.

uterine and ovarian cycles stop