Kidney Lab

Name : _____ Date:_____

For an organism to survive, it needs to remove metabolic wastes (**excretion)**, as well as maintain proper concentrations of various necessary materials. For example, human food consists of carbohydrates, fats, proteins, various salts, and water. As these materials are metabolized, certain waste products are produced, such as carbon dioxide, water, urea and related nitrogenous compounds, salt, and various minerals. If these waste materials remain in the body, they quickly upset the body's equilibrium **(homeostasis),** so they must be excreted rapidly and efficiently.

The kidneys are essential to maintaining **homeostasis** (keeping conditions inside the body relatively constant). All the blood in the body must pass through the kidneys, which filter and excrete **nitrogenous wastes** (ammonia, urea, and uric acid), as well as certain salts and water, from the body. This filtering process removes all of the waste products as well as the useful products in the blood. These products are collectively known as **urine.**

The filtering units in the kidneys are called **nephrons**. Each kidney contains over one million nephrons. Blood is carried to a tuft of capillaries know as the **glomerulus**. The glomerulus filters blood by **hydrostatic blood pressure, forcing** blood through the basement membrane and into the cavity of the glomular capsule, also known as **Bowman's capsule**. Blood cells and proteins, too large to be filtered through this membrane remain in the blood.

Once the filtrate has left the Bowman's capsule it enters the **renal tube** and is reabsorbed. About 99% of the water is reabsorbed into the blood, as well as all glucose, amino acids, and many salts. The kidney regulates homeostasis within the body through **reabsorption**. Additionally, the kidneys regulate the pH of the blood and maintain electrolytes (ionized particles) in the proper concentrations.

The body is able to filter approximately 180 litres of filtrate, but only excretes 1 to 1.5 litres of urine, conserving the amount of water loss and greatly concentrating the salts and other wastes in the urine. After reabsorption occurs, the waste, as urine, is expelled through the **ureters** to the **bladder**, where the urine is stored until it is excreted.

The function that the kidneys perform is so vital to a human's survival that total kidney failure can cause a person to die in a very short time. Fortunately, medical technology has developed a machine that serves as an artificial kidney known as **dialysis**, filtering out wastes and replenishing the body with "clean" blood. With only a few hours of dialysis a week, a person may live for years without functional kidneys while they wait for a suitable transplant to become available.

Materials

- Unfiltered simulated blood, 15ml
- 2 salt test strips
- Microscope
- Piece of string
- Dialysis tubing, 12 inches
- 1 eye dropper
- 1 cover slip
- squeeze bottle
- 250 mL beaker
- 1 microscopic slide
- disposable gloves
- eye dropper

Procedure:

1. Obtain a piece of dialysis tubing from the beaker of water. Tie one end of the tubing tightly with string.
2. Open the tubing by rubbing the untied end between your fingers. Pour 15ml of the simulated blood into the tubing and carefully tie a knot in the open end to form a bag. The bag represents the blood vessels that enter the kidney. Determine the initial salt content of the blood in the bag by dipping one of the test strips in the blood.
3. Fill a beaker with 200ml distilled water. Determine the initial salt content of the water in the beaker by dipping one of the test strips in the water. Wait 30 seconds, and then note any colour change. If there is no salt, the test strip will be pink; the presence of salt will make the test strip turn dark red/purple.
4. Record your findings in Table 1.
5. Rinse off the outside of the dialysis bag using the squeeze bottle of distilled water and place it in the beaker. Record the initial colour of the solution in the bag and of the water in the beaker.
6. Wait 30 minutes and then remove the bag from the cup. Record the colour of the solution in the bag and of the simulated urine in the cup in Table 1.
7. While you are waiting, view the simulated red blood cells. Place a drop of simulated blood on a microscope slide. Cover it with a cover slip and observe the slide under a microscope; first at low magnification, then at high magnification.
8. Record your observations
9. After 30 minutes, determine the salt content of the simulated urine in the beaker. Record your findings in Table 1.
10. Cut the top of the bag open. Determine the salt content of the blood in the bag.
11. Make a smear of the simulate urine from the beaker on a microscope slide. View it under the microscope to determine if any blood cells have passed through the simulated kidney.

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Table 1

	Colour		Salt Content	
Time	**Dialysis Tubing**	**Beaker**	**Dialysis Tubing**	**Beaker**
Start				
After 30 Minutes				

DISCUSSION:

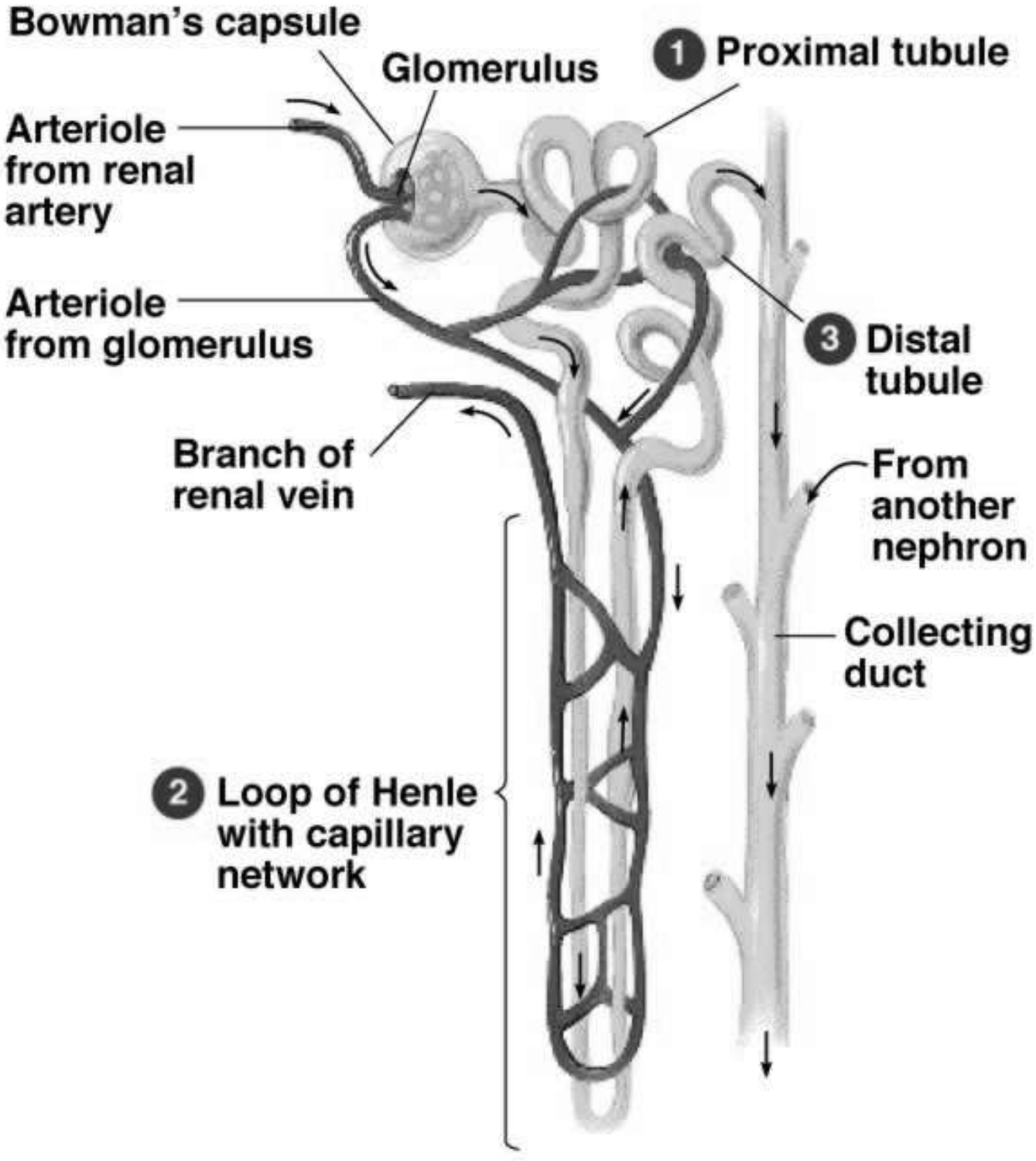
1. What changes took place in the dialysis bag and in the beaker?

2. What substances remained in the dialysis bag? What substances entered the water in the beaker? Were any "blood cells" detected in the simulated urine after 30 minutes of dialysis?

3. What is urea?

4. Where are water and minerals reabsorbed back into the bloodstream

5. Describe how ADH regulates water reabsorption.


Bowman's capsule
Glomerulus
1 Proximal tubule
Arteriole from renal artery
Arteriole from glomerulus
3 Distal tubule
Branch of renal vein
From another nephron
Collecting duct
2 Loop of Henle with capillary network
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