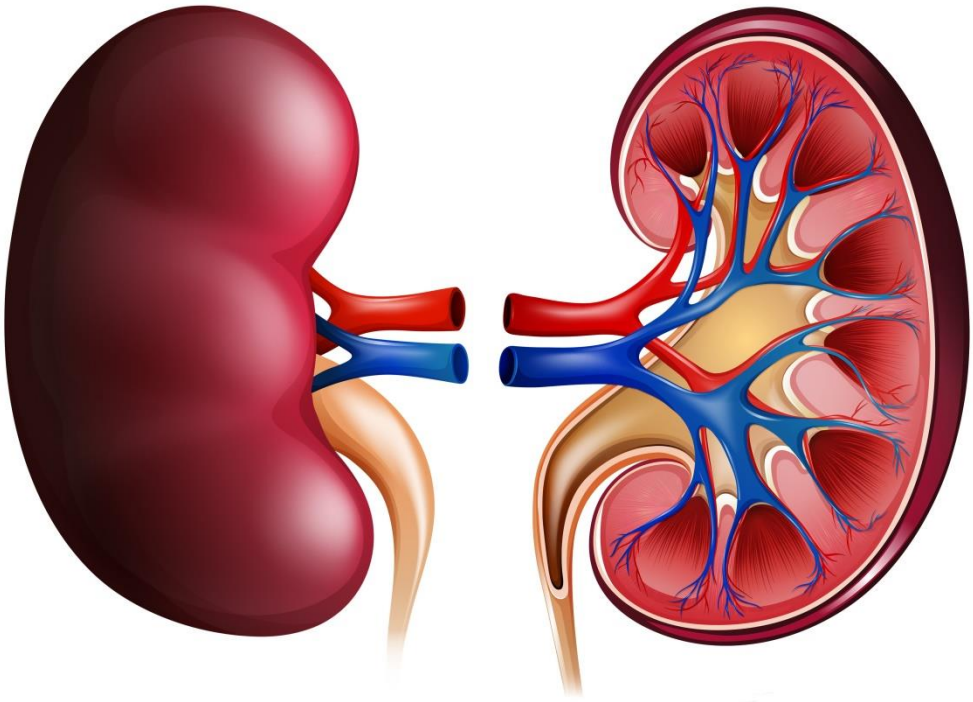
Inquiry Question
How do kidneys filter waste out of the bloodstream?

Name: _____ **Date:** _____



Excretion is the critical process of getting rid of waste products. There are many ways that waste is excreted from our bodies. Among these, the kidneys provide one of the most important ways. These are the main organs in the excretory system involved in filtering waste material that is dissolved in our bloodstream. Each kidney is a compact organ made of a network of blood vessels and collecting tubes, called nephrons. Your blood circulates through your entire body in about one minute and your kidneys filter your blood about 400 times a day.

Your kidneys have two very important jobs in your body which include: filtering waste from the blood and the production of urine to get rid of the waste. If this did not happen all of the toxins (bad stuff) would quickly build up in your body.

In this project you will filter different substances through a plastic window screen, different sized hardware cloth and poultry netting (or other material of your choosing). Your model will show how the thickness of a filter in the kidney is imperative in deciding what will be filtered out and what will stay within the bloodstream.

General Instructions
The goal of this project is to learn about the importance of filter thickness when considering how the kidney filters material out of the bloodstream.

Materials you'll need:

- The process description, journal and worksheet on the following pages
- Six inch square pieces of each of the following:
  - plastic window screening
  - hardware cloth (½" mesh)
  - hardware cloth (¼" mesh)
  - hardware cloth (1/8" mesh)
  - poultry netting (1" holes)
- 1-2 sheets of newspaper (to cover desk)
- 2 measuring cups or bowls (about 4 cups each)
- Large funnel (large enough to have a large pebble flow through the neck)
- ½ cup sand
- ½ cup small pebbles in various sizes from 1/8" to >1"
- ½ cup water
- Duct tape (to bind the screens, for safety)

Ideas and Hints:

- You can check with your school/teacher to see if they have supplies for this project.
- Otherwise, you can cheaply purchase different sizes of wire mesh from local supply or hardware stores or substitute other materials you may already have at home. The key is to have filters of varying sizes such as those listed previously.
- Follow the procedure and complete the worksheet and journal on the following pages.

Project submission:

You can either submit photos/video of your project (along with an explanation and/or steps of construction) or if you can drop-in to the school, you can present it to your teacher in-person. Be sure to carefully organize any data collected and include this so that any other student or teacher could reproduce your experiment and achieve the same results. The journal and worksheet should be included with your submission.

Kidney Filtering Model Ideas

Preparation

- Cut screening, poultry netting, and hardware cloth to the proper size.
- Bind the poultry netting and hardware cloth with duct tape to cover any sharp edges (see below).
- Assemble all necessary materials.

Procedures

1. Kidneys are a filtering system for the blood. Engineers design dialysis machines for people whose kidneys are not working properly. Write a few sentences about how the kidney functions under "I've Learned" on your journal sheet.

2. This activity is a model for how the kidney cleans the blood. Be clear that this is just a model and that the kidney does not actually filter solids, except for blood cells. The products filtered through the screens in the activity are meant to represent the waste products in the blood, which are excreted in urine. Urine contains glucose, sodium, potassium, bicarbonate, water, acid, blood cells, protein and urea (which makes urine yellow).

3. Mix the sand, pebbles, flour (optional) and water in the first measuring cup or bowl, as shown below.

4. Filter the water mixture through the funnel, poultry netting, different-sized hardware cloth, window screening and coffee filter (optional), from large-filter holes to small-filter holes (see below). The screening should be held over the second measuring cup/bowl. Pour the mixture from the full measuring cup/bowl onto the screen over the empty container and then back again, using a different screen each time.

5. Complete the “I’ve Observed” section of the Filtering System Journal.

6. Include a diagram of the urinary system and label the location of the kidneys, bladder, ureters and urethra. Write down these terms under the “Vocabulary” section of the Filtering System Journal.

7. Work through the Filtering Worksheet. Write down anything you have learned in your Filtering System Journal under the "I've Learned" section and write down any questions you may have in the "Questions I Have" section of your journal.

8. Take pictures of each step of your filtering process and submit them along with your journal and worksheet to your teacher.

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Kidney Filtering Activity – Filtering Worksheet

How Much Does the Kidney Filter?

The kidneys are almost as busy as the heart! They process 45 litres of blood per day and remove about 1.5 litres of waste per day. Over a lifetime that can really start to add up.

1) What if you wanted to find out how many litres of blood the kidneys processed in one year?

   You need to multiply the number of litres of blood the kidneys process in a day _____ and the number of days in one year _____ to get the number of litres of blood processed in one year.

   _____ x_____=_____litres of blood

2) What if you wanted to find out how many litres of waste the kidneys removed in one year?

   You need to multiply the number of litres of waste the kidneys removed in a day _____ and the number of days in one year _____ to get the number of litres of waste the kidneys remove in one year.

   _____ x_____=_____litres of waste

3) What if you lived to be one hundred years old? How many litres of blood will your kidneys have processed?

   _____ x_____=_____litres of blood

4) What if you lived to be one hundred years old? How many litres of waste will your kidneys have removed?

   _____ x_____=_____litres of waste

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Kidney Filtering Activity – Filtering System Journal

Vocabulary	**I've Learned**
I've Observed	**Questions I Have**

from: **Bioastronautics: Lesson 8, Kidney Filtering Activity – Filtering System Journal**