Life Science
WEEK 8

Our Body's Systems

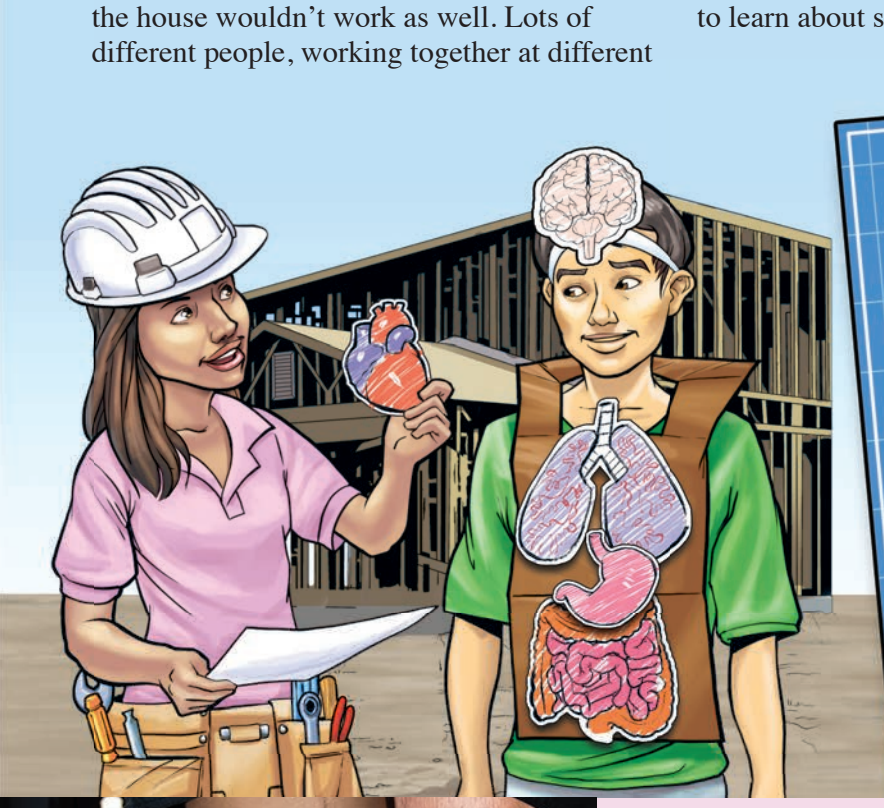
Science Studies Weekly
Exploration
GRADE 4

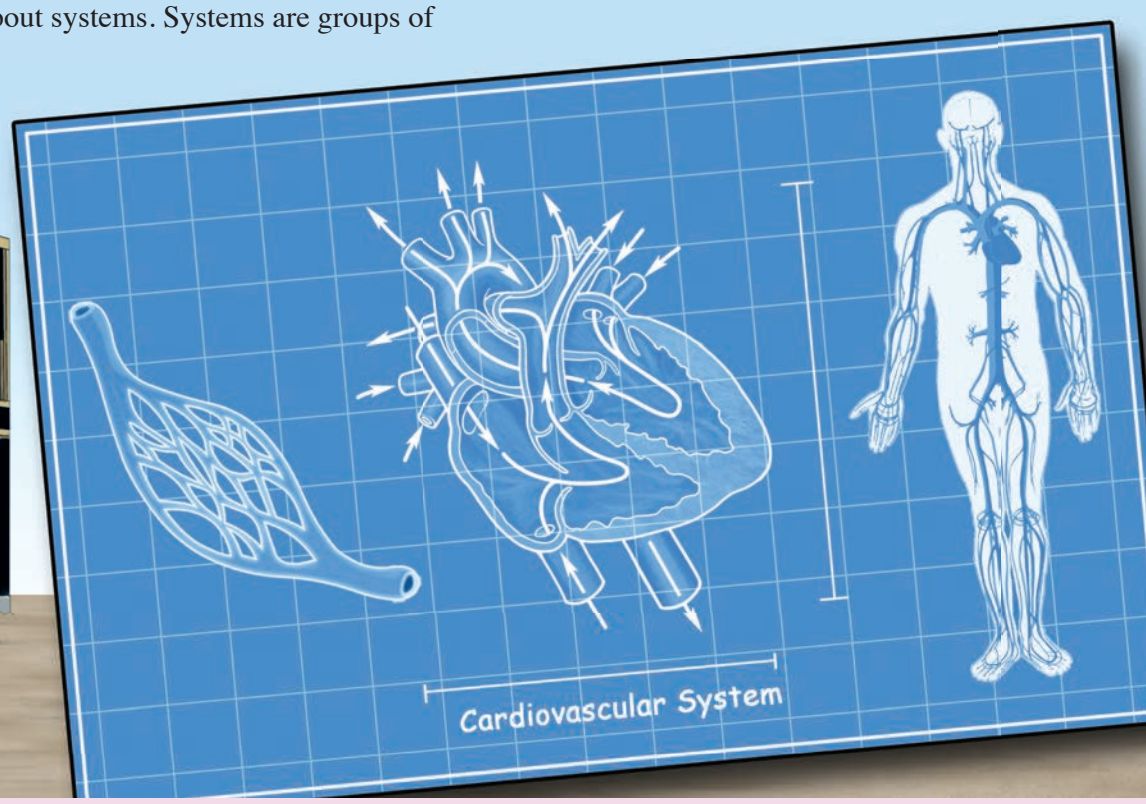
Systems That Keep You Running

Have you ever thought about what goes into building a house? It's a big job, and it requires many people who know how to do many different things. There are people who know how to pour cement. There are people who know how to build walls out of wood. There are people who know how to install plumbing. There are people who know about wiring and electricity. Every one of those people is important. If one of those jobs didn't get done, the house wouldn't work as well. Lots of different people, working together at different jobs—that's what makes a house!

Your body is kind of like that. Different groups of cells, tissues and organs all do different jobs, but they all work together to keep your body going. In past issues of Science Studies Weekly, you've read about cells. You've read about groups of cells that form tissues, and groups of tissues that form organs. This week, it's time to learn what happens when organs group together. It's time to learn about systems. Systems are groups of organs and tissues that work together to do the work of an organism.

This week, we're not just going to talk about any old organism. We're going to talk about you! What systems in your very own body are working to keep you running? Use the nerves (from your nervous system) to get the muscles in your hand (from the muscular system) to move the bones in your fingers (from your skeletal system) to turn the page.





STEM *Pick Up That Pencil? No Problem?*

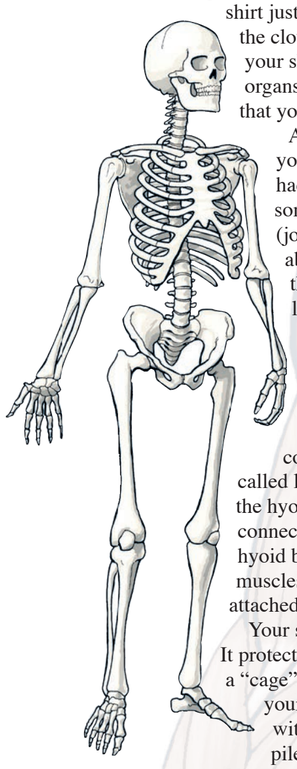
Do you stop and make a plan before you pick up a pencil or step down from a car? Probably not, but your brain and limbs do! They plan so quickly that you don't even realize it's happening. Motor planning, or planning and organizing movement, is something that we often take for granted—until we need more effort to do it. Sometimes people become injured and lose a limb. Others become very sick and can't move. Some people are born with a small "glitch" in their motor planning system called apraxia. If any of these things happen, people would need some help from a doctor or therapist who specializes in movement.

If we lose a limb, chances are we would have to use an artificial limb, or prosthesis. Mechanical engineers have been doing some amazing work in the last 20 years. They've invented lightweight, durable and sometimes even bionic, or super-strong, prostheses. Soldiers and accident victims who have lost an arm may even get one that has working fingers! People who receive artificial limbs have a lot of work to do before they can recapture a full and active lifestyle. But with the help of engineers, physicians, occupational therapists and physical therapists, they have an excellent chance!

It's All About Systems

The Skeleton Inside You

Throw a shirt on the floor, and it lies there in a big, cloth heap. But if you hang the same shirt on a clothes hanger, the top part of the shirt takes the shape of the hanger, while the rest of the shirt just hangs down straight. What the clothes hanger does for the shirt, your skeleton does for your muscles, organs, nerves and skin. It's a frame that your body hangs on.



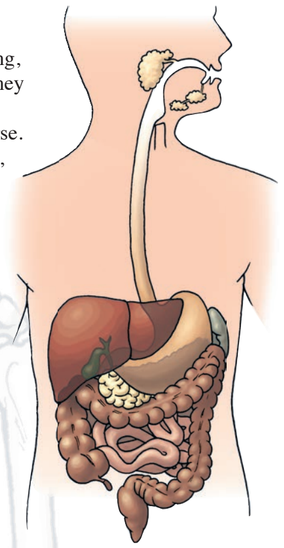
At the moment you were born, your skeleton (or skeletal system) had about 270 bones. Over time, some of your smaller bones fused (joined) together. Now, you have about 206 bones. And some of them are pretty amazing! The longest and heaviest bone in your body is the femur. It's the big bone between your knee and your hip. The smallest is the tiny stapes bone inside your ear.

Most of your bones are connected by flexible tissues called ligaments. But some bones, like the hyoid bone in your neck, aren't connected to any other bones at all. The hyoid bone is connected to nothing but muscles and ligaments. Your tongue is attached to it.

Your skeleton is an amazing thing. It protects your heart and lungs inside a "cage" made of rib bones. It protects your brain inside a sturdy skull. And without it, you'd be nothing but a pile on the floor, just like that shirt you forgot to hang up.

Where Does the Food Go?

You eat a sandwich and head off to play with your friends. You may never give the sandwich a second thought. But deep inside you, even while you're playing, the sandwich is on an amazing journey through your digestive system.



It starts with your mouth, of course. Your mouth breaks up the sandwich, using your teeth and your tongue. Muscles in your neck move the sandwich from your mouth down a long tube called the esophagus and into your stomach. Chemicals in your stomach break down the sandwich even more, into a kind of liquid mixture. From your stomach, the sandwich moves through your small intestine, kind of a long and wrinkly hose. That's where your pancreas, liver, and gallbladder go to work, helping break down the food into proteins, carbohydrates, fats, minerals and vitamins. At this point, you wouldn't recognize your sandwich at all. What used to be a sandwich is now just a thin, liquid mixture. The useful nutrients in that mixture are sent off to the bloodstream to keep your body running. The waste (the stuff your body can't use) keeps on moving. It passes through another wrinkly hose called the large intestine, and then leaves your body altogether. (Here's a hint on where it goes: Make sure you flush and wash your hands!)

Inside your body, your digestive system is all packed neatly between your head and your hips. But if you were to string all the stuff in your digestive system out in a line, it would be more than 25 feet long!

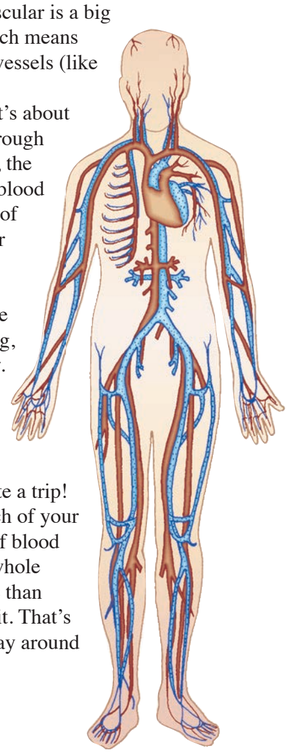
Don't Be Nervous

If you've ever felt pain or smelled something or heard a sound or even thought a thought, you've experienced the nervous system at work. Your nervous system is in charge of all of those things. It's made up of your brain, your spinal cord, and a huge network of nerves that run through your whole body. (That's why they call it the nervous system.) Nerves are long, thin bundles of tissue made of neurons. They work like telephone wires, carrying electrical messages full of information from your brain throughout your body and back again.

When you accidentally touch a hot stove, the nerves in your finger send electrical and chemical messages from nerve to nerve, all the way up your arm and to your brain. Your brain gets those messages, and tells your body to feel pain. Your brain also sends messages back through the nerves to your muscles, telling you to pull your finger away. Everything you see, hear, taste, smell, feel, think, or do is controlled by the nervous system. It's a good team: your brain, your spinal cord, and more than 45 miles of nerves.

The Heart of It All

Just as a car runs on gas, your body runs on nutrients and oxygen. Nutrients and oxygen need to be delivered all over the body. The nutrients come from your digestive system. The oxygen comes from your lungs. And for perfect delivery, count on the cardiovascular system. Cardiovascular is a big word with two parts—cardio which means heart and vascular which means vessels (like blood vessels).



Your heart sits in your chest. It's about the size of your clenched fist. Through the heart's four chambers (areas), the heart pumps blood through your blood vessels. You've felt the pumping of your heart if you've ever put your hand over your heart to feel your heartbeat. The beating of your heart is made by the motion of the heart's valves opening and closing, pushing blood through your body. On the way out from the heart, the blood carries nutrients and oxygen. On the way back to the heart, the blood picks up waste for the body to get rid of. It's quite a trip!

Imagine this: Every square inch of your skin contains more than 20 feet of blood vessels. But that's nothing. The whole body of an adult person has more than 60,000 miles of blood vessels in it. That's almost enough to travel all the way around the world twice!

In the Lab

Making Sense of Our Senses

Here's a fun experiment that you can do with your senses. It will show you that parts of your nervous system (like other systems in your body) work together. Here's what you need:

- 1 pear, sliced (in a bowl)
- 1 apple, sliced (in a bowl)
- 1 blindfold
- 1 chair

1. Ask for a volunteer who will allow himself or herself to be blindfolded. Have the volunteer sit in the chair, wearing the blindfold.
2. Ask another volunteer to hold a slice of pear directly beneath the nose of the blindfolded person.
3. Have a third volunteer gently feed an apple slice to the blindfolded person.
4. Ask the blindfolded person what he or she is eating. Much of the time, that person will name the fruit that he or she smells!

You can try the experiment with other fruits as well. It works best if the fruits that you use have similar textures (they feel about the same). Oranges and grapefruit have similar textures. So do pears and apples. So do cantaloupe and honeydew.

Here's how it works: Your sense of taste and your sense of smell are part of the same system—the nervous system. Nerves in your nose are sending messages at the same time that nerves in your mouth are sending them.

When you eat a slice of pizza, your nose smells it and sends a message through nerves to your brain that says, "Pizza." Your mouth tastes the pizza and sends a message to your brain that says, "Pizza." "Great," your brain says, "a slice of pizza!"

During this experiment, your nose is saying "pear," and your mouth is saying "apple." Sometimes your brain can't sort out the mixed signals.

Gertrude B. Elion (1918-1999)

Spotlight

It was 1933, and Gertrude Belle Elion was ready to enroll in college at only 15 years old! The problem was, she couldn't decide what to study. Her grandmother's death from cancer made the decision for her. Gertrude decided she wanted to find ways to cure serious diseases. It was difficult to go to school during the Great Depression, but Gertrude's grades were good, and she chose a school that would let her attend for free.

College wasn't her only challenge. In those days, most of the jobs in her field went to men. Gertrude finally took a job as a laboratory assistant, working for free! Gertrude Belle Elion was a hard worker, and she took every learning opportunity that came along. She learned chemistry, microbiology, virology, immunology and more. Before she was done, she had helped develop medicines to help cure leukemia, malaria, herpes, gout and other disorders. She developed drugs that are used to treat AIDS and to help organ transplants succeed.

In 1988, she was awarded the Nobel Prize, and in 1991 she was given the National Medal of Science—two of the highest honors a scientist can receive. Most importantly, she had reached the goals that she had set as a young woman. She had found ways to treat many serious diseases, bringing hope to people who needed help.

Are the body's systems completely separate from each other?

This Week's Question

None of the body's systems works very well without the others. Think of some of the connections between the systems. The heart is a muscle. That makes it a part of the muscular system. But it's also an important part of the cardiovascular system. In fact, it's the cardio in cardiovascular.

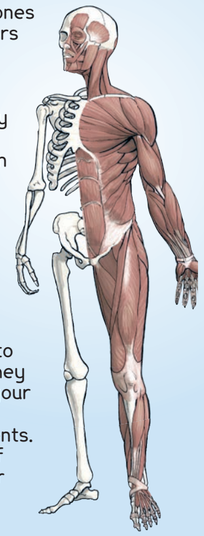
Muscles also have a connection with the skeletal system. Strong, flexible tendons connect muscles and bones. Bones and muscles work together to keep a body moving. Though it may not seem as if the bones are connected to the cardiovascular system, they are. Bone marrow (a darker-colored material inside of human bones) is the place where blood cells are manufactured.

The digestive system works with other systems too. Food couldn't get through the esophagus without the wavy motions of the muscles around it. No body system can stand alone. They all work together, keeping you going strong!

Muscles—the Real Movers

It's true your skeleton holds you up. But without your muscular system, you'd just stand in the corner like a statue. It takes muscles to move those bones around.

Muscles are made of tissues that can contract (get smaller) and then relax back to normal size. Muscle tissues are connected to your bones and to each other with flexible connectors called tendons. When muscles contract or relax, they move the bones or other muscles that are connected to them. Contract, relax, contract, relax, and away you go! The muscles in your body move your legs when you walk, your hand when you wave or write a letter, your mouth when you smile, your eyeballs when you look around, and much more.



Some muscles are called voluntary muscles. That means you can decide when they move. The muscles in your arms and legs are examples of voluntary muscles. But others are involuntary. That means you don't have to think about making them move or not. They just move on their own! The beating of your heart and the blinking of your eyes are examples of involuntary muscle movements. All together, muscles (more than 600 of them) make up about 40 percent of your body's weight.

Science, Then & Now

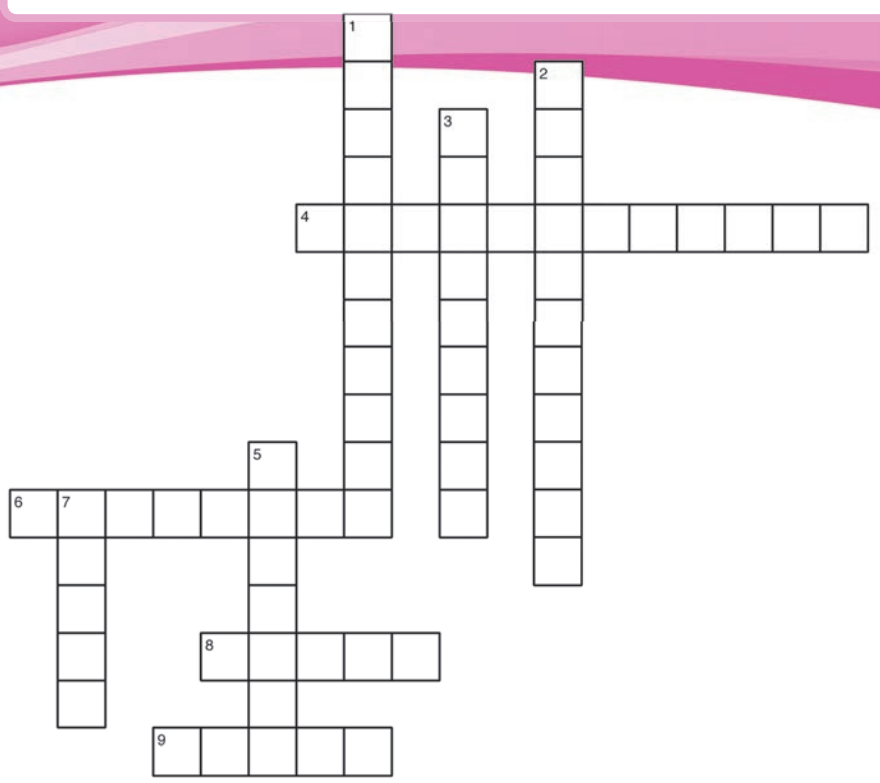
Blood Samples

Some of the first doctors in the world believed diseases were caused by poisons in a person's blood. To treat sick people, they would simply cut them open and drain out some blood. They believed that the disease would leave the body with the blood.

Some ancient doctors believed they should first try to get rid of the disease by making the patient vomit or sweat a lot. If that didn't work, then they cut people open and let the disease bleed out. This was called blood-letting. It was practiced by many doctors all the way up to the 1800s.

These days, scientists understand disease can strike any system of the body, not just the blood. And even diseases of the blood are treated with medicines and not by blood-letting. Today, very few diseases are treated by bleeding the patients. If a doctor takes your blood, it's usually just a small amount for testing.

Name _____



ACROSS

4. There are 60,000 miles of these in an adult human.
6. There are four of these in a human heart.
8. A newborn baby has about 270 of these, while an adult has 206.
9. another word for joined

DOWN

1. tiny blood vessels just underneath your skin
2. There are 45 miles of this in an adult human.
3. a long tube leading from your mouth to your stomach
5. cells that make up nerves
7. a bone in your neck not connected to any other bones

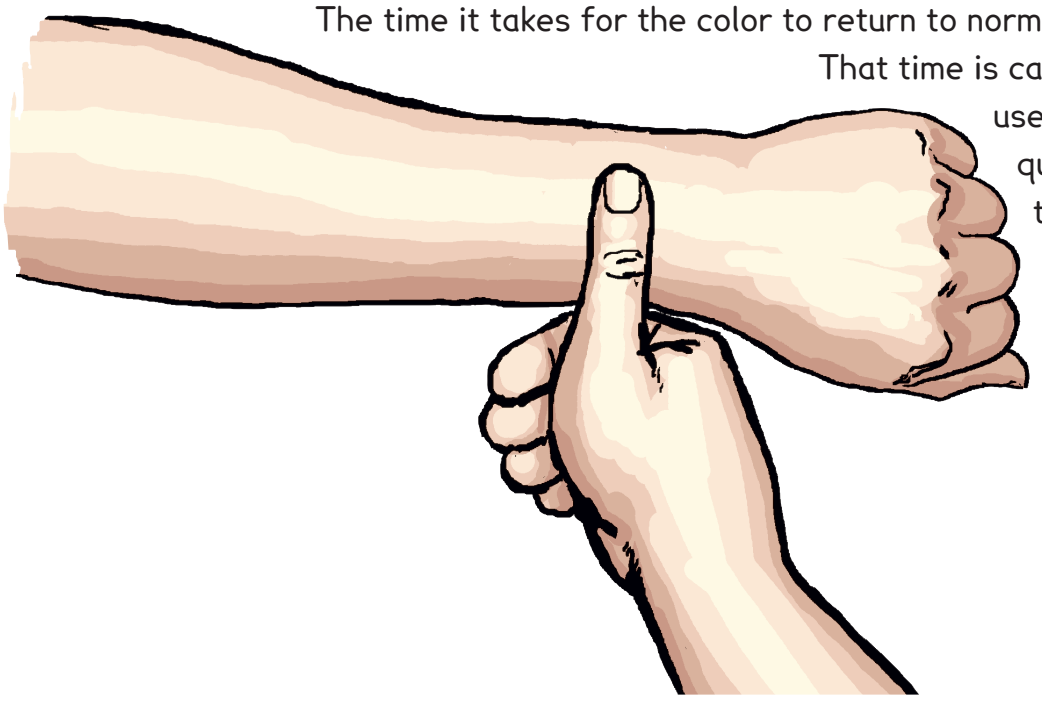
Blood Vessels in Action

Mini-Lab

You read in this week's issue of Science Studies Weekly about the cardiovascular system. That's the system that keeps blood pumping around your body. You even read that in every square inch of skin on your body there are more than 20 feet of blood vessels. Many of those blood vessels are capillaries, tiny blood vessels that branch out just under your skin. Here's a simple way to see those blood vessels in action.

With your right thumb, press hard for a moment on the back of your left wrist. You only have to hold it there for a second or two. When you take your thumb away, for just a moment you'll see a pale spot on your wrist. When you pressed on your wrist, you stopped the blood flow to that spot for a moment. That's why it's pale. If you watch, the spot will return to its normal color again, usually within a few seconds.

The time it takes for the color to return to normal is the time it takes for the blood to return. That time is called the capillary refill rate. Doctors sometimes use the capillary refill rate to tell if someone needs quick medical attention. A capillary refill rate of two seconds or less is normal. If it takes more than two seconds, the blood isn't flowing the way it should. That person may need medical help!



Let's Investigate

Did you know that every day you carry around six of the best tools for investigating science questions? You were born with them, in fact. Five of the tools are your senses. You know how important it is for scientists to observe things carefully, of course. You also need your hearing for investigations in sound and your sense of touch for investigating properties of objects, like texture and hardness. Tasting and smelling can also be part of scientific investigations. Many food companies hire special tasters to test their products. All day they smell and taste yummy things like popcorn and soup and ice cream. Have you figured out what other investigation tool you carry around all the time? It's your brain, of course!

As you read this week's lesson, circle or highlight all proper nouns with any color pen or highlighter. This will help you find some of the crossword answers and get ready for this week's test.