AOHS Health Careers Exploration

Lesson 8

Symptoms and Tests

Student Resources

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| Resource | Description |
| Student Resource 8.1 | Anticipation Guide: Diagnostic Tests |
| Student Resource 8.2 | Reading: Diagnostic Tests |
| Student Resource 8.3 | Observation: Diagnostic Images |
| Student Resource 8.4 | Analysis: Reading Blood Test Results |
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Student Resource 8.1

Anticipation Guide: Diagnostic Tests

Student Name:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date:\_\_\_\_\_\_\_\_\_\_\_

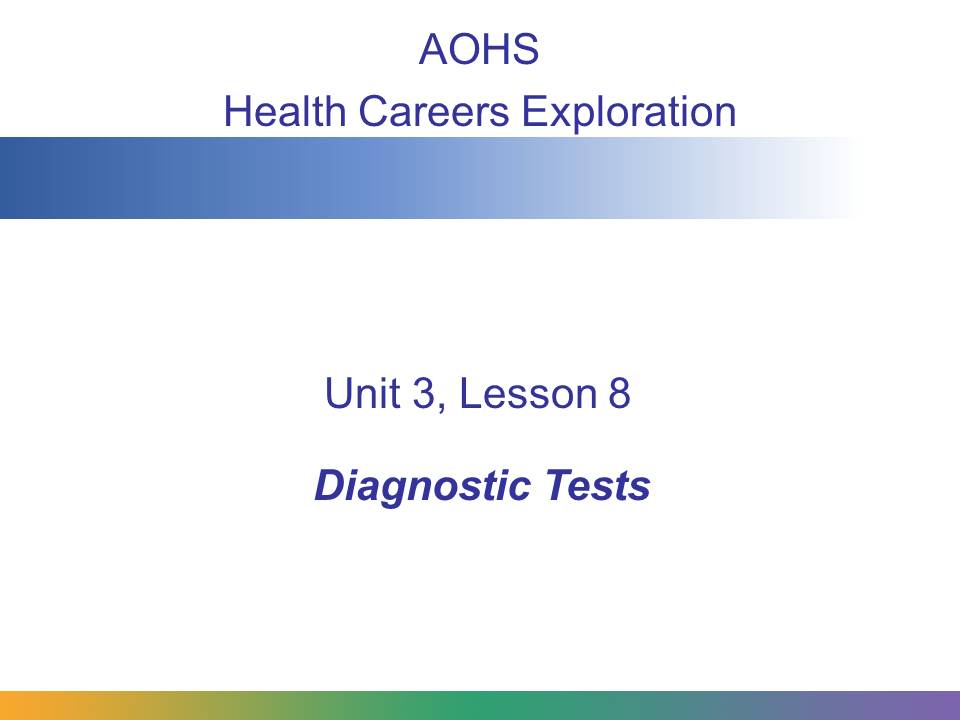
Directions: For each of the statements below, underline “I agree” if you think the statement is accurate or “I disagree” if you think it is not. Write one reason to explain your guess. You will fill in the “I learned” section later.

|  |  |
| --- | --- |
| There is one type of imaging that is the best way to produce an image of the inside of the body. | |
| My guess: | I agree I disagree |
| My reason: |  |
| I learned: |  |
| To get a proper magnetic resonance image, the patient has to lie perfectly still in a full-body-size magnet. | |
| My guess: | I agree I disagree |
| My reason: |  |
| I learned: |  |
| The best way to create an image of a baby before birth is using sound waves. | |
| My guess: | I agree I disagree |
| My reason: |  |
| I learned: |  |

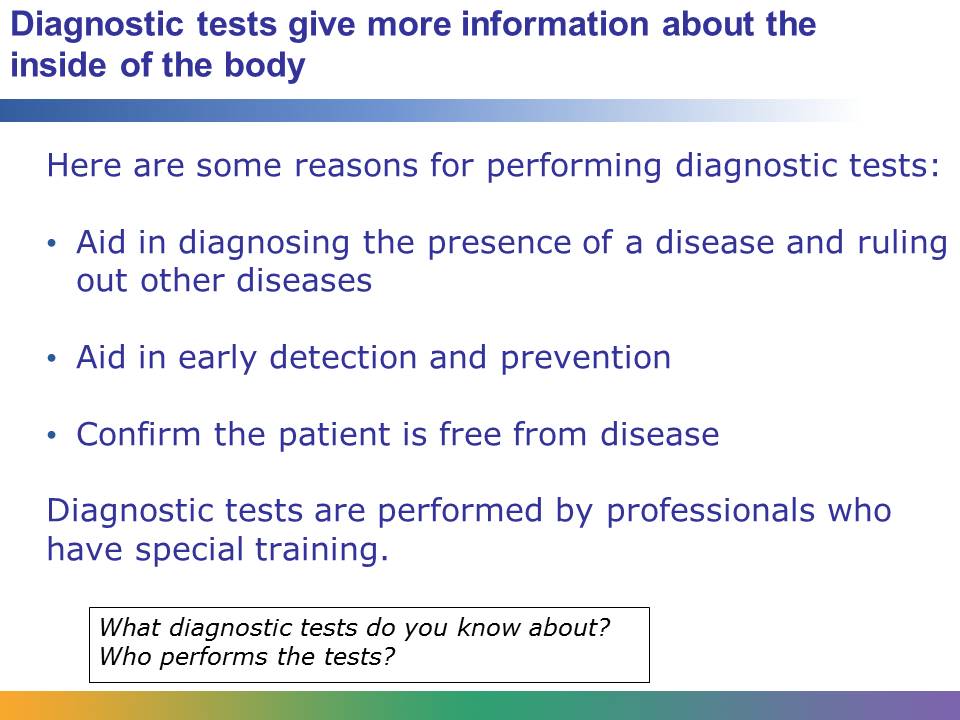
|  |  |
| --- | --- |
| The mammogram image test is only for women. | |
| My guess: | I agree I disagree |
| My reason: |  |
| I learned: |  |
| The bone density scan causes osteoporosis. | |
| My guess: | I agree I disagree |
| My reason: |  |
| I learned: |  |
| An electrocardiogram measures activities of the brain. | |
| My guess: | I agree I disagree |
| My reason: |  |
| I learned: |  |
| Every skin biopsy includes removing a sample of human tissue and examining it. | |
| My guess: | I agree I disagree |
| My reason: |  |
| I learned: |  |

Student Resource 8.2

Reading: Diagnostic Tests



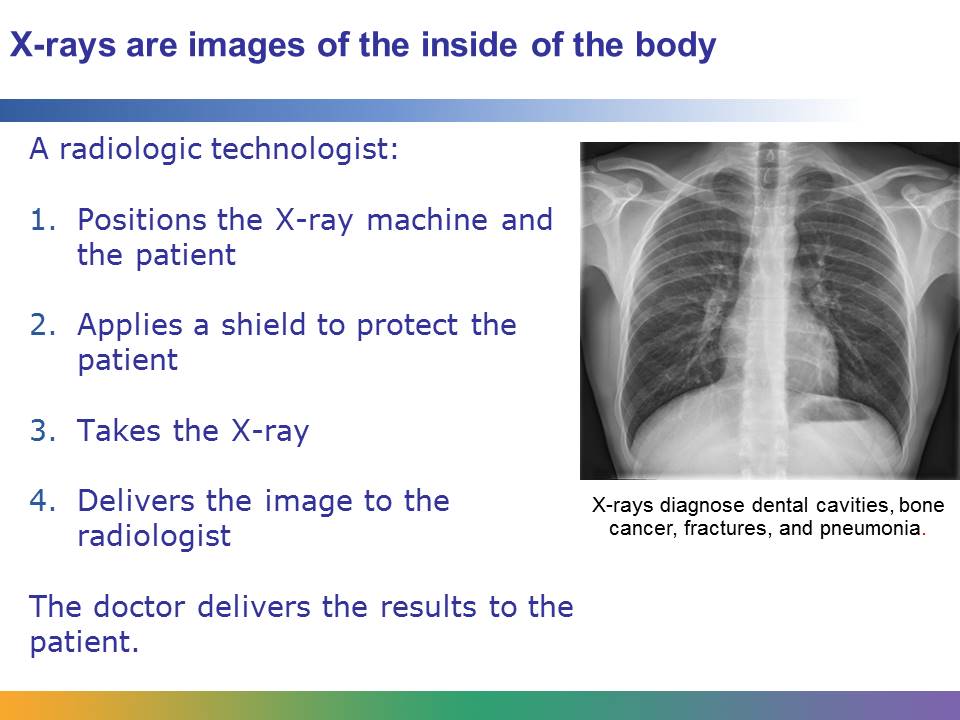
A medical test performed to help diagnose a patient or detect disease or illness is called a diagnostic test. In this presentation, you will learn about the purpose of common diagnostic tests, who performs them, and how they are performed.



Imagine that on a routine visit to his primary care physician a patient mentions that for several months he has been having increasing problems falling asleep. The patient chalks up his problems to stress at work, but the doctor wants to rule out various sleep disorders. The doctor recommends that the patient see a specialist. The specialist orders an electroencephalogram (EEG) for the patient, which will monitor the patient’s brain waves and give more information about his condition.

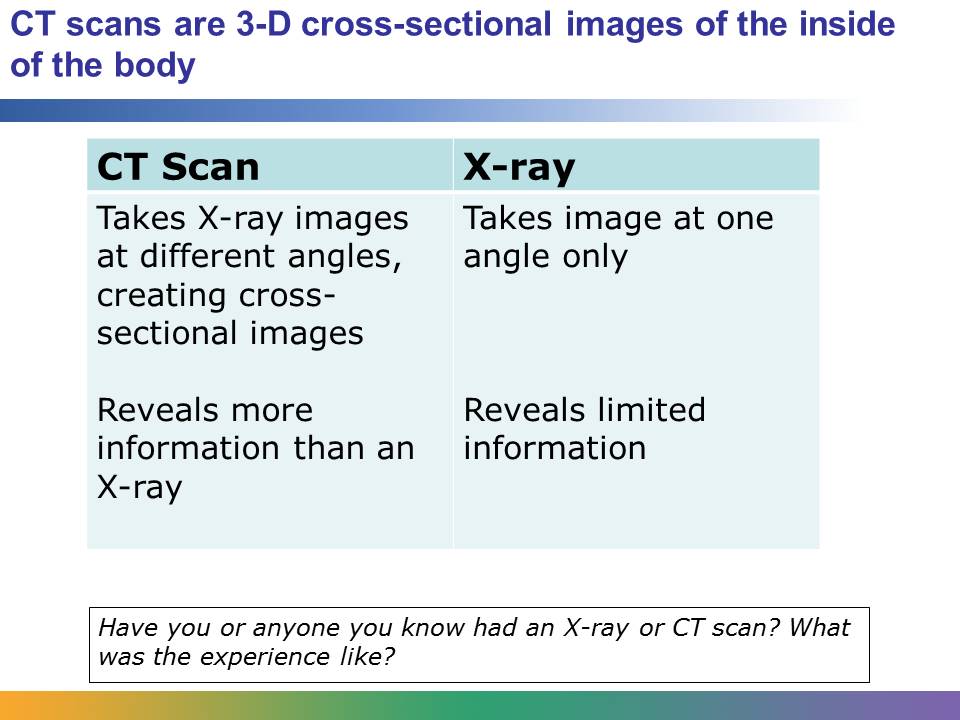
An EEG is one type of diagnostic test. Diagnostic tests give physicians more information about what is happening inside a patient’s body. They are tests performed by professionals who have specific training in operating machines and conducting the procedures necessary to do the test.

Diagnostic tests are important to help health care professionals diagnose diseases, but they are also extremely important in early detection and prevention. People in various age groups or with certain medical histories are routinely given diagnostic tests, even if they don’t have any symptoms of being ill. For example, an older man who has heart disease in his family will likely routinely be given diagnostic tests to monitor the health of his heart. Diagnostic tests are also given to confirm that a patient is free from disease. For example, a cancer survivor may be given routine diagnostic tests to confirm that he or she is still cancer free.



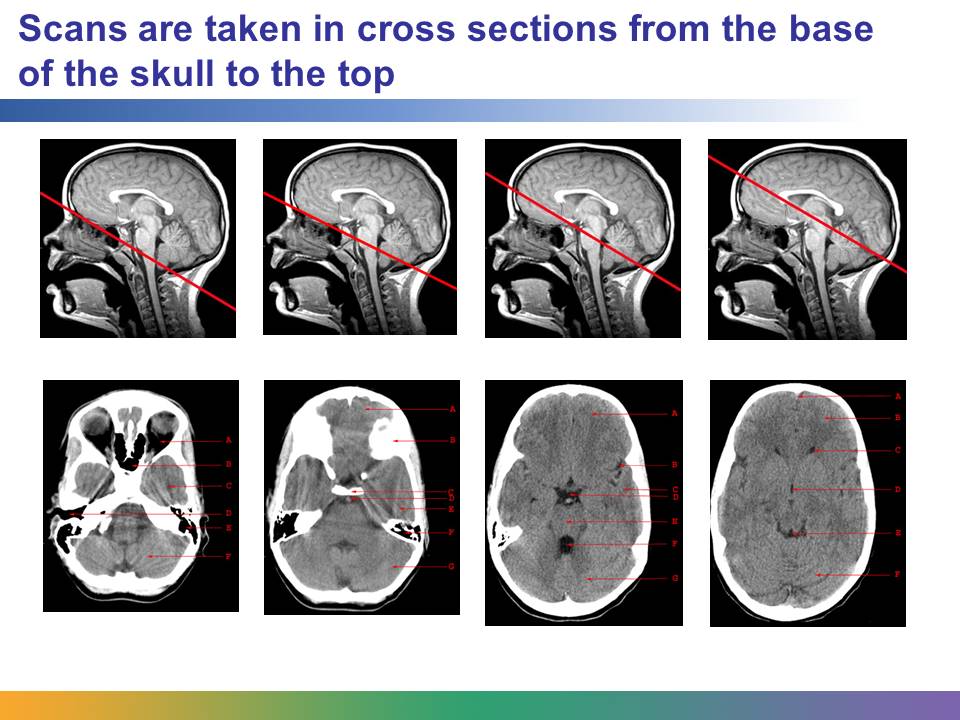
An X-ray is a common diagnostic test. It is used to produce images of the inside of the body and diagnose an array of problems that include dental cavities, arthritis, bone cancer, and lung infections, like pneumonia. X-rays are performed at doctors’ and dentists’ office and at hospitals. In an emergency room, X-rays may be used to determine problems like broken or fractured bones or swallowed objects.

An X-ray is a fast, safe, and painless procedure. A small burst, or ray, of radiation passes through the body and records an image of a body part on film or a specialized plate. A radiologic technologist performs an X-ray. First, the technologist will position the body appropriately. Then he or she will make sure that the X-ray equipment is at the correct height and angle. The technologist will protect the patient from unnecessary radiation exposure by using a special shield. After the image is taken, the technologist will make sure that the image develops properly, and he or she will deliver it to a radiologist. The radiologist will interpret the results and given them to the patient’s doctor. The doctor will deliver the results to the patient. In an emergency room, the results of an X-ray can be obtained in just a few minutes.



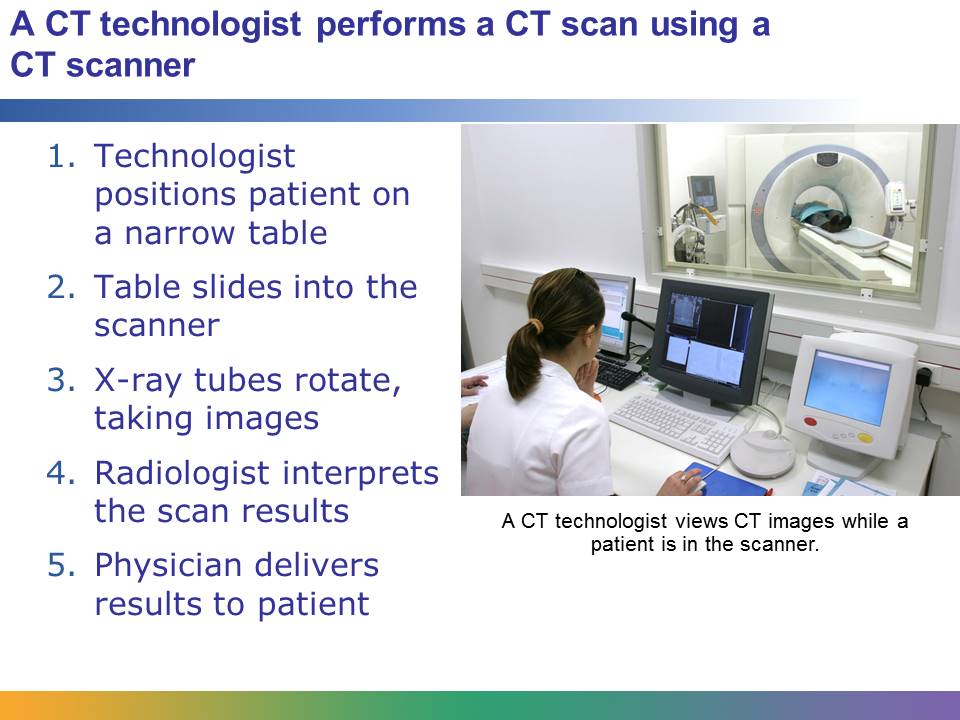
Like X-rays, computerized tomography scans, which are also called CT or CAT scans, take images of the inside of the body. But unlike X-rays, CT scans take many X-rays from different angles. A CT scan creates a cross-sectional image of the inside of the body.

CT scans are often compared to a loaf of bread. A physician can look at one slice, or part of the image, or he or she can put them together to create a 3-D image of the patient’s body. In this way, CT scans give much more information than X-rays. CT scans are frequently used to look for internal injuries after a car accident, to identify the location of a tumor or blood clot, or to detect signs of cancer and heart disease.



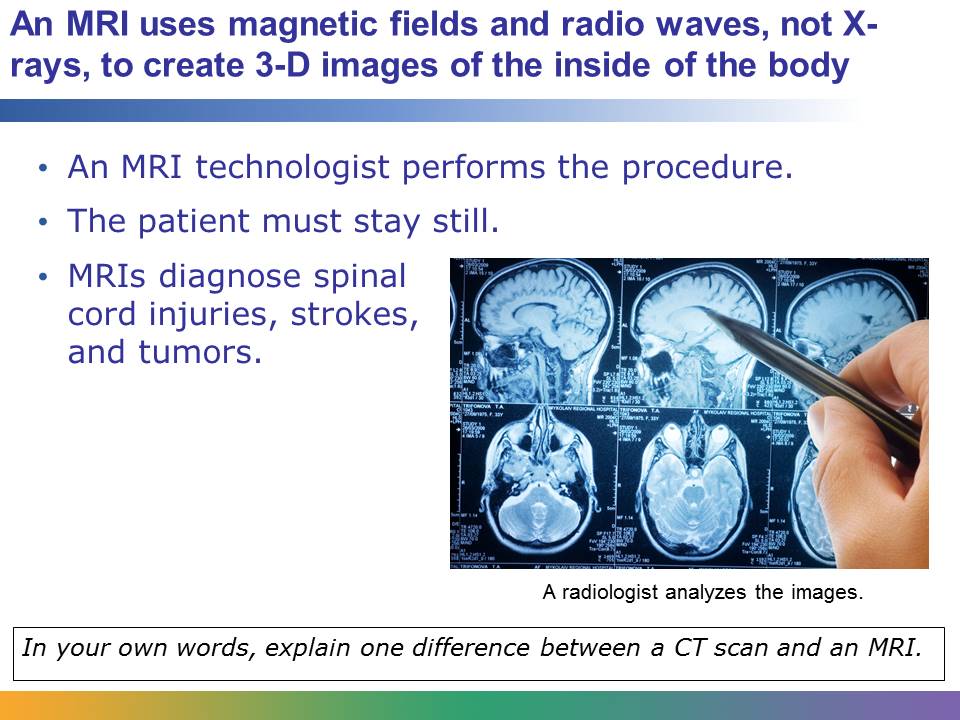
The red lines in the top row of images show the angle at which each cross section image was taken. The bottom row shows what the actual image of each slice looks like.

Images courtesy of <http://www.med-ed.virginia.edu/courses/rad/headct/>. The images are included under fair-use guidelines of Title 17, US Code. Copyrights belong to respective owners.



Like X-rays, CT scans are painless procedures. They are usually performed in a hospital or an outpatient facility. A CT technologist performs the procedure using a CT scanner. The technologist positions the patient on a narrow table. Sometimes the technologist uses straps or pillows to help the patient stay in the proper position. For the scan to be effective, the patient must stay still. Then the table slides into the large hole of the scanner, which is often described as an upright doughnut hole. Inside the machine, X-ray tubes rotate around the patient’s body. These tubes take various images. During the procedure, the technologist is in another room viewing the images on a monitor. The patient inside the machine is able to communicate with the technologist through an intercom.

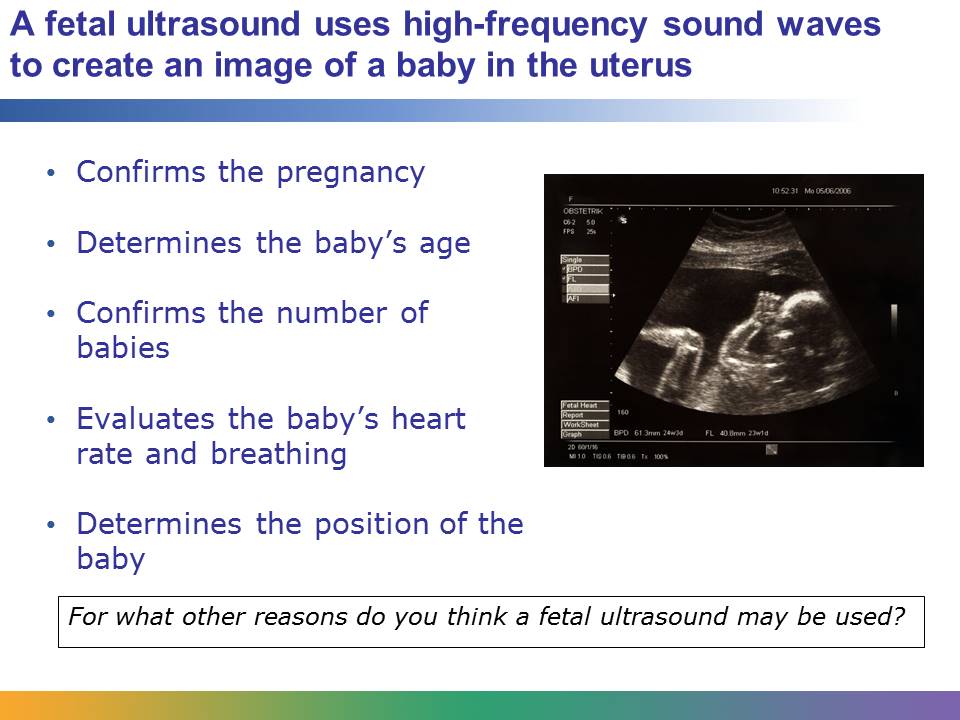
After the images are taken, a radiologist will interpret the results and submit them to a physician. Then the physician will deliver the results to the patient.



Like a CT scan, magnetic resonance imaging, or MRI, creates detailed images of organs and tissues, but an MRI machine doesn’t use X-rays. An MRI machine is a huge, tube-shaped magnet. It uses magnetic fields and radio waves to create high-resolution, cross-sectional 3-D images. It is used to diagnose a number of problems including spinal cord injuries, multiple sclerosis, stroke, damage caused by a heart attack, plaque in the blood vessels, and tumors on internal organs like the uterus, prostate, liver, and spleen.

An MRI is suited for examining soft tissue such as ligament and tendon injury, spinal cord injury, and brain tumors, while a CT scan is better suited for bone injuries, lung and chest imaging, and detecting cancers. CT scans are widely used in emergency rooms because the procedure takes less than 5 minutes. An MRI can take 30 minutes or more, and it costs more than a CT scan.

An MRI technologist performs the procedure. The MRI technologist has a patient lie on a table, which slides into the MRI machine, a tunnel that is open on both ends. During the procedure, the technologist monitors the images from another room. The procedure usually takes less than an hour. The procedure is painless, but the patient must stay still during the procedure. If the technologist is creating images of the patient’s brain, the patient may be asked to do simple actions inside the MRI machine, like tap his or her fingers or speak. As for other imaging tests, a radiologist will analyze the images and give the analysis to the patient’s physician, and the physician will deliver the results to the patient.

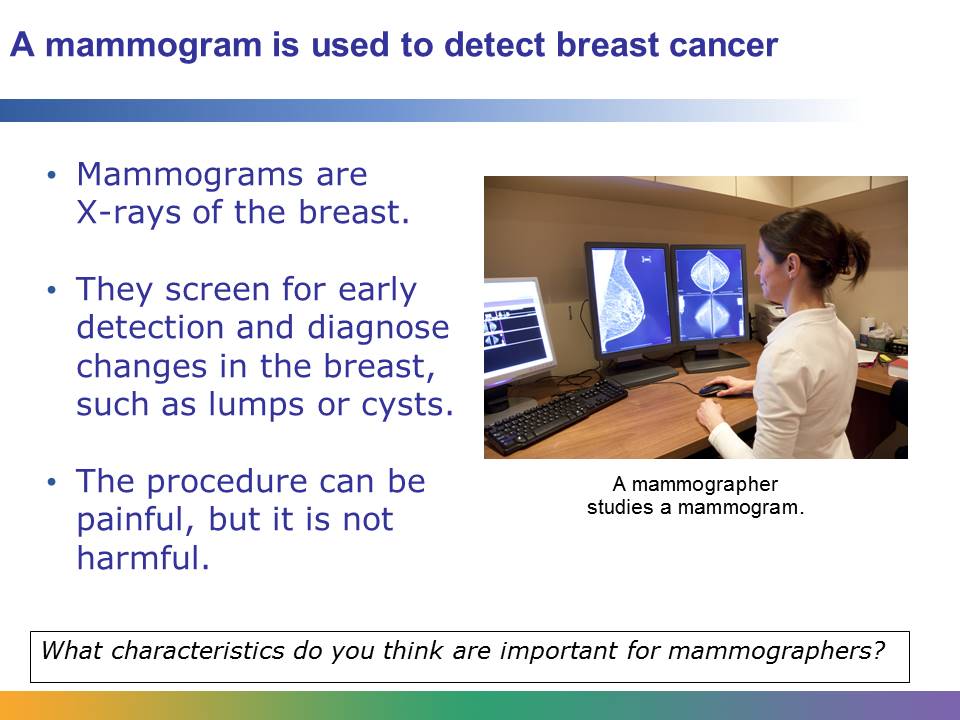


A fetal ultrasound, or a sonogram, uses high-frequency sound waves to create an image of a baby in a woman’s uterus. These images are used by the woman’s physician to evaluate the baby’s growth and development and to track the progress of the pregnancy. The ultrasound can be performed at any point during the pregnancy. It is used for a variety of reasons, including to confirm a pregnancy, to determine the baby’s gestational age, to confirm the number of babies, to evaluate the heart rate and breathing of the baby, and to determine the position of the baby before delivery.

An ultrasound is also used for other diagnostic purposes, such as to scan the gallbladder, liver, or lymph nodes.

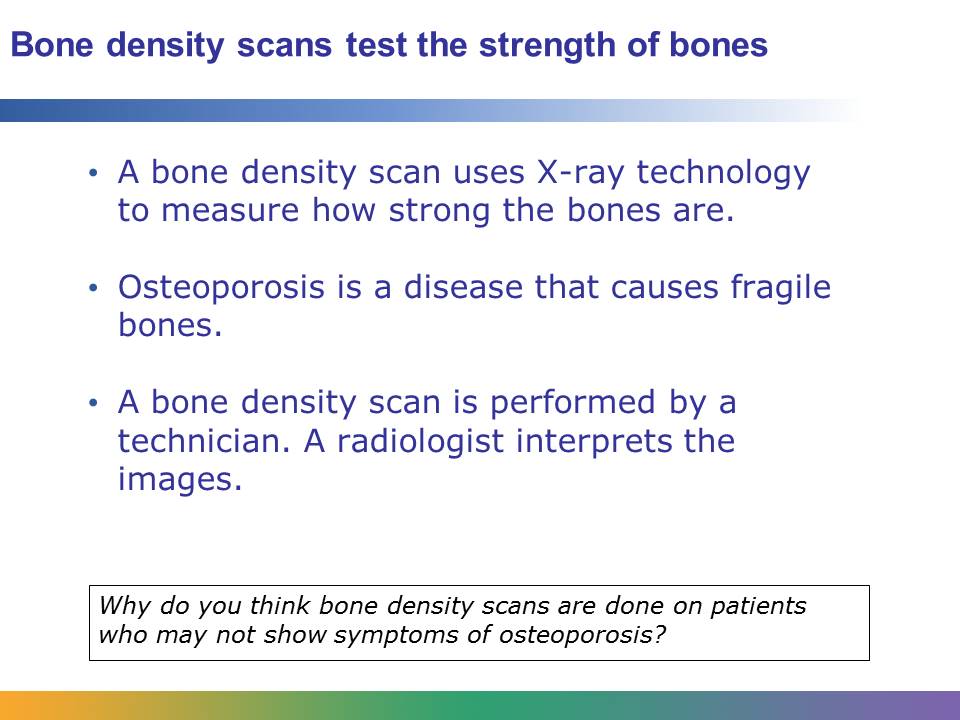


A sonographer performs the fetal ultrasound. First, the sonographer explains the procedure to the pregnant woman and asks her to lie down on the exam table. The procedure is not painful. Then the sonographer applies a special gel to the woman’s abdomen. The sonographer moves a transducer, a small device that sends out sound waves, across the abdomen. The sound waves are converted into a gray image of the baby on the monitor. Both the patient and the sonographer can see the images. The sonographer will likely point out to the woman the different parts of the baby, as they may be hard to decipher. Depending on the stage of development, the woman may be able to see her baby’s face, hands, and even fingers. The sonographer stores and prints the images. He or she may take measurements of the baby based on the images. The sonographer delivers the images to the woman’s physician, who will give the woman the results.



A mammogram is an X-ray image of a breast. It is used to detect tumors and other abnormalities in the breast. There are two main types of mammography: screening mammography and diagnostic mammography. Screening mammography is used for early breast cancer detection. It is used for patients who have no signs or symptoms of breast cancer. The frequency at which women receive screening mammograms is determined by their age and their risk factors for breast cancer. Diagnostic mammography is used to investigate suspicious changes in the breast, such as lumps or pain.

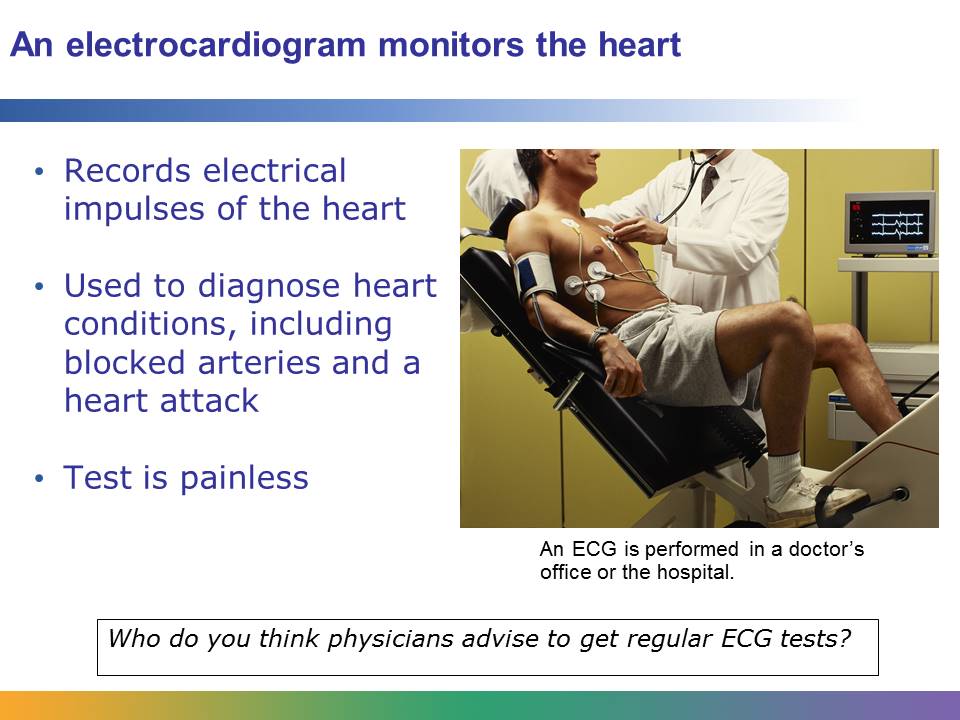
A mammographer performs the procedure. The mammographer explains the procedure and then helps position the patient, who will stand up at the mammography machine. During a mammogram, the patient’s breasts are compressed between two firm surfaces. The patient must stay still. An X-ray captures an image of the breast. The procedure can be uncomfortable or briefly painful, but it is not harmful. The mammographer will check the quality of the images and retake them if they are not clear. The procedure usually takes less than 30 minutes. A physician will deliver the results of the test to the patient.



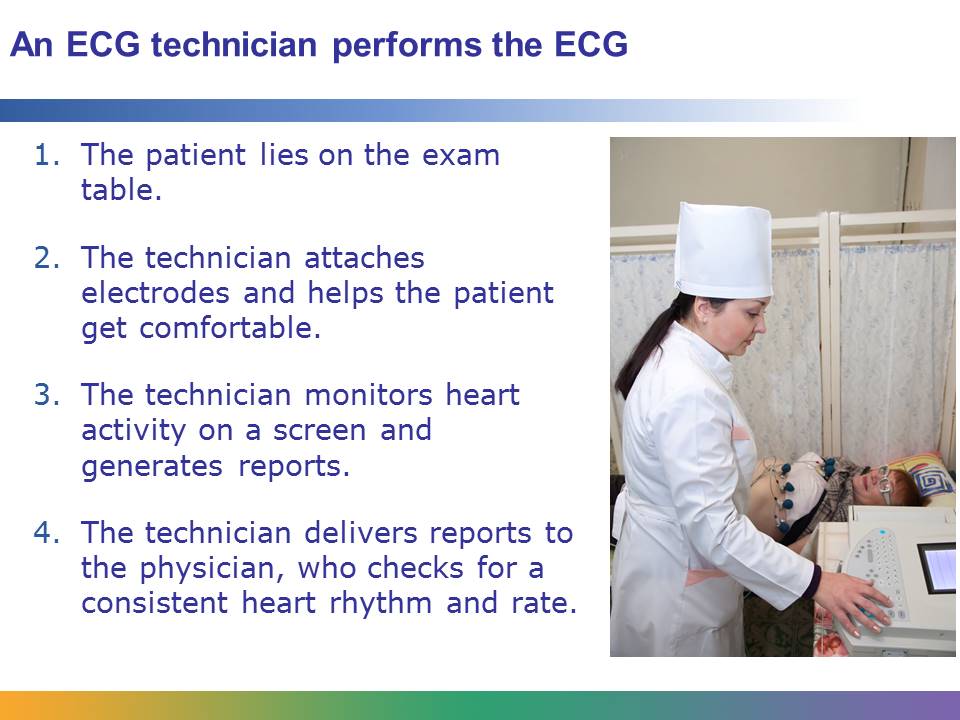
Osteoporosis is a disease that causes bones to become fragile and more likely to break. In the past, osteoporosis could only be detected after a patient broke a bone and the bones were already weak. But now bone density scans make it possible to know how at risk the patient is for the condition.

The bone density scan, or bone densitometry, uses X-ray technology to measure the thickness and strength of bones. The X-rays measure the amount of calcium and other minerals that are in a segment of a bone, usually the spine, hip, or forearm. A patient with strong bones will have a high mineral content.

The procedure is fast and painless. It is performed by a technician who is trained in bone density scans. The technician positions the patient on a padded platform. As with other diagnostic imaging tests, the patient must stay still. A mechanical arm, or detector, passes over the patient’s body, generating images on a computer monitor. A radiologist interprets the images, and then a physician delivers the results to the patient.



An electrocardiogram, or ECG or EKG, is used to monitor the heart. It records the electrical impulses generated by cells in the upper-right chambers of the heart. Physicians use the reports created by an ECG to diagnose heart conditions, including irregularities in heart rhythm, problems with the heart valves, blocked arteries in the heart, or a heart attack. An ECG is a painless test. It is typically done in the doctor’s office or in the hospital.

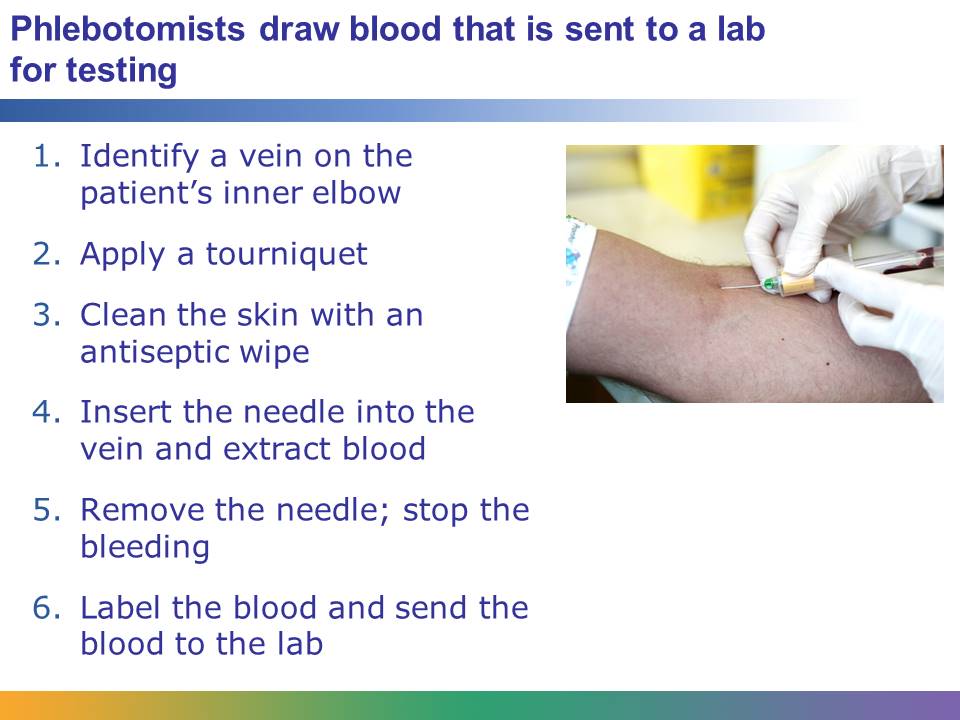


An ECG is performed by an ECG technician. First, the technician asks the patient to lie on the exam table. Then he or she uses a gel to attach 12 to 15 electrodes (small, flat metal discs) to the patient’s arms, legs, and chest. The technician may shave parts of the body where the electrodes will be placed. It’s important that the patient is warm and comfortable, because moving or shivering will interfere with the test. The technician monitors the heart’s activity on the screen for a few minutes, then she generates a report that will be analyzed by the patient’s physician. The physician looks for a consistent heart rhythm. The physician also looks for a heart rate that is between 50 and 100 beats per minute. If there are abnormalities, the physician will use the information to try to diagnose the problem.



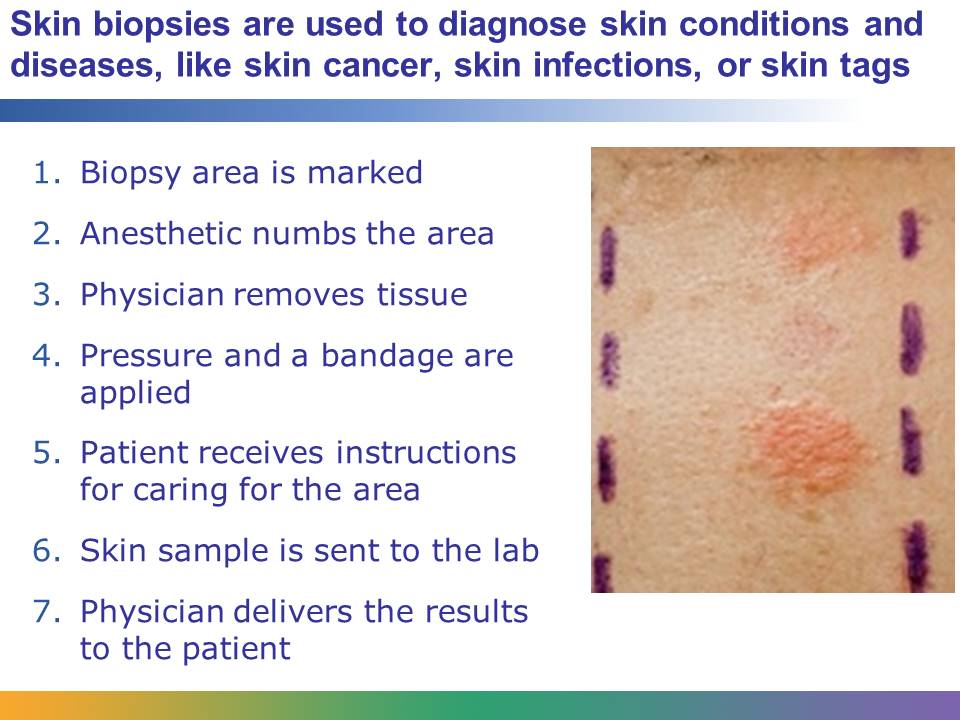
An electroencephalogram, or EEG, detects the electrical activity in the brain. It is one of the main diagnostic tests for epilepsy and other disorders such as inflammation of the brain, sleep disorders, brain tumors, memory impairment, and stroke. It can also be used to confirm brain death in a patient who is in a persistent coma.

An EEG is a painless procedure performed by an EEG technician. First, the technician marks the patient’s scalp. These marks indicate where the electrodes will be attached. Then the technician scrubs the spots. The technician attaches the electrodes to the scalp using a special adhesive. Wires attached to the electrodes are connected to an instrument that records the patient’s brain waves on a small computer. The patient is asked to relax during the test, which typically takes 30 to 60 minutes. Depending on what is being measured, the technician may ask the patient to do small tasks during the test, such as breathe deeply or look at a picture. After the test, the technician removes the electrodes and delivers the reports to the physician, who reviews them and then delivers the results to the patient.



Physicians order blood tests for a number of reasons, ranging from confirming a pregnancy or a disease, like HIV, to checking how the body is responding to a type of medication.

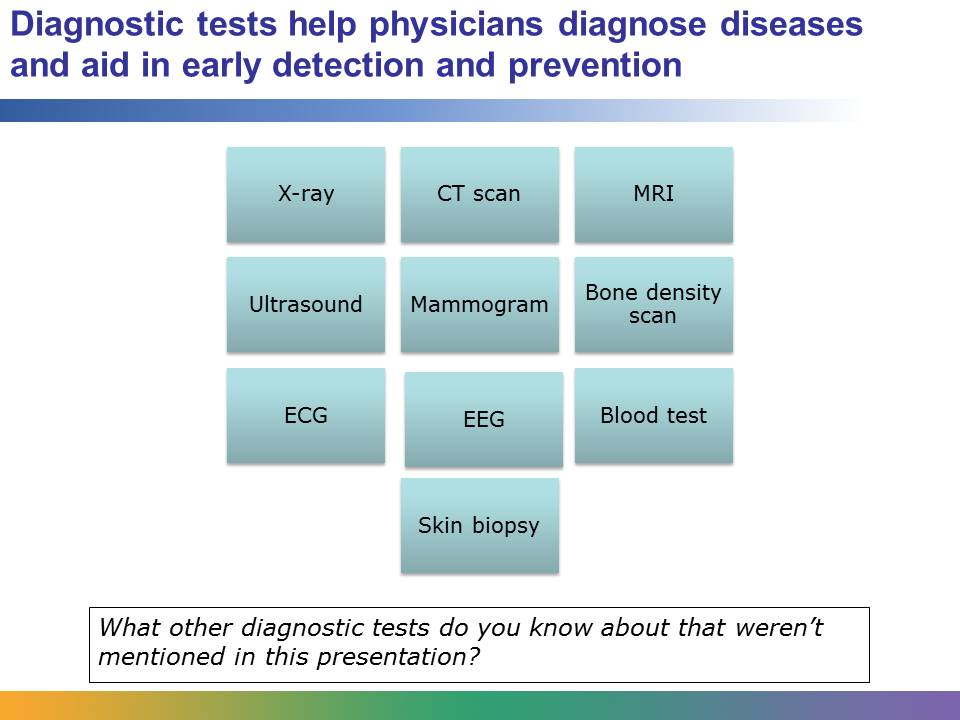
A phlebotomist performs blood tests. First, the phlebotomist asks the patient to be seated in a comfortable position and expose the inside of the elbow. The vein in the inside of the elbow is used most frequently for blood sampling. Then the phlebotomist places a tourniquet, or a tight band, around the patient’s upper arm, making the vein fill with blood. The phlebotomist cleans the skin over the vein using an antiseptic wipe and then inserts a needle into the vein. A syringe is connected to the needle. The phlebotomist takes the required amount of blood and then removes the needle. The phlebotomist applies a piece of cotton to the area where the needle was inserted to stop the bleeding. Finally, he or she applies labels to the containers of blood, which is then analyzed in a lab. The results are sent to the patient’s physician, and the physician delivers the results to the patient.



A physician uses a skin biopsy to diagnose certain skin conditions and diseases, including skin cancers, skin infections, blistering skin disorders, or skin tags, which are a benign tumor or growth. A skin biopsy removes cells or skin samples from the surface of the body.

Physicians perform skin biopsies. First, depending on the location of the biopsy, a physician may ask the patient to undress and change into a clean gown. Then the area of the skin that will be biopsied is marked. The physician applies a local anesthetic to numb the area so that the patient doesn’t feel pain during the biopsy.

There are different types of biopsy procedures. For the simplest procedure, the shave biopsy, the physician uses a sharp tool, double-edged razor, or scalpel to cut a sample of the skin. Then the physician applies pressure to stop the bleeding and topical medication and a bandage. Next, he or she gives the patient instructions on how to keep the area clean. All biopsies will likely cause scarring, but some scars will eventually fade. The physician sends the sample to the lab. Depending on the test, the results could take weeks or days. When the results are complete, the physician delivers them to the patient.



Diagnostic tests help physicians diagnose diseases and aid in early detection and prevention. The tests also confirm that a patient is free from disease. The technicians and technologists who perform diagnostic tests play an important role in caring for the patient.

Student Resource 8.3

Observation: Diagnostic Images

Student Name:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date:\_\_\_\_\_\_\_\_\_\_\_

Directions: Write your observations in the right-hand column for each diagnostic image as your teacher projects the image. Your observations may include ideas about which body part the image shows and if you see anything unusual or abnormal about the image.

|  |  |
| --- | --- |
| Image | Observations |
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Student Resource 8.4

Analysis: Reading Blood Test Results

Student Names:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date:\_\_\_\_\_\_\_\_\_\_\_

Directions: Below is a patient’s lab report for a blood test that tests renal function. A doctor uses this test to assess how a patient’s kidneys are functioning and to see if the patient is at risk for kidney disease. The results are shown in a renal panel. Review the information in the report, and then answer the questions below the report.

|  |  |
| --- | --- |
| **Greenstone Labs**  **Physician:** Yee, Janet, M.D.  **Patient:** Hart, Gregory K.  **DOB:** 12/2/51  **Sex:** M  **Patient ID:** 34569JT21  **Collection Date:** 3/8/11  **Collection Time:** 1345  **Fasting:** N | **Renal Panel**  **Results Reference Range**  Bun/creat ratio 24.2 10.0–28.0  Sodium 143 135–145  Potassium 5.4 3.5–5.2  Chloride 105 96–110  Carbon dioxide 27 19–31  Albumin 4.1 3.3–4.9  Calcium 9.5 8.3–10.4  Phosphorus 3.6 2.5–4.5 |

1. What is the patient’s first name?
2. What is the doctor’s last name?
3. DOB stands for “date of birth.” How old is the patient?
4. Is the patient a man or a woman?
5. The collection date says when the blood was drawn. What month was the blood drawn?
6. Sometimes patients are required to fast, or not eat, before they have blood drawn. Did this patient have to fast?
7. A doctor uses this test to assess how a patient’s kidneys are functioning and to see if the patient is at risk for kidney disease. A renal panel tests different components in the patient’s blood, like chloride and sodium. What are two other components that are tested?
8. The results are shown in the results column. What was the result for phosphorus?
9. On a blood test, doctors look for results that fall outside of the normal reference range. For example, this patient’s results show 143 for sodium, and the reference range for sodium is 135–145. The patient’s results are within the normal reference range. Did the result for carbon dioxide fall in the normal reference range for this patient?
10. Did the result for potassium fall in the normal reference range for this patient?
11. Based on this blood test, do you think the doctor will suspect that the patient is at risk for kidney disease? Explain your answer.

Student Resource 8.5

Reference Sheets: Diagnostics

Sonographer (Diagnostic Medical Sonographer)

Pathway: Diagnostics

**A special view**

Marta was nervous. What if the sonogram showed that something was wrong? When Louisa came into the exam room, Marta expressed her concerns. Louisa patiently explained the procedure so that Marta knew what to expect. Then Louisa spread a special gel on the skin of Marta’s abdomen.

Louisa gently ran the transducer, which transmits sound waves, across the skin. An image of the fetus appeared on the viewing screen. Marta relaxed immediately; she could see her baby moving its arms.”

Louisa took several images of the baby. She decided which images to give to Marta’s doctor. She printed one of the images and gave it to Marta to share with her husband. Then, as she wiped off the gel, she explained that Marta’s physician would be in shortly to discuss the results of the fetal ultrasound.

**Generating images of the body**

Louisa is a sonographer. Sonographers operate the equipment used to perform sonography, or ultrasonography, which is the use of sound waves to generate images of the inside of the body. A physician interprets the images. Sonographers are responsible for explaining the procedure to a patient, selecting appropriate equipment settings, and performing the procedure. When doing the procedure, they are responsible for looking for subtle visual cues that indicate abnormalities. They must decide which images to electronically store and show to the physician. Depending on the policies of the medical office, they may conduct a preliminary analysis of the findings. Sonographers also keep patient records, maintain equipment, and prepare work schedules. Most sonographers are employed by hospitals, but they also work in the offices of physicians and medical and diagnostic laboratories.

Louisa used the sonograph to track the growth and health of a fetus, which is a common use of sonographs. The procedure is called a fetal ultrasound. The technology is also used to diagnose and treat other medical conditions. Abdominal sonography is used to create images of the liver, kidneys, gallbladder, spleen, and pancreas when looking for tumors and other abnormalities. Neurosonography is used to create images of the brain.

**Qualities and skills**

Sonographers must be able to explain procedures to patients who, like Marta, may be nervous, so excellent communication and interpersonal skills are necessary. Also, good hand-eye coordination is important for capturing quality images.

**I think this would be a great career for me. What do I have to do to make it happen?**

Sonographers receive education and training in vocational-technical institutions, two-year colleges, or four-year universities. Coursework includes classes in anatomy, physiology, instrumentation, basic physics, patient care, and medical ethics. The American Registry for Diagnostic Medical Sonography (ARDMS) certifies each person who passes an exam. According to the US Department of Labor, in 2013 the mean annual wage was $67,170.

**How can I prepare now?**

Focus on your mathematics, health, and science courses. Also, consider volunteering at a hospital or outpatient clinic.

Cardiographic Technician (EKG Technician)

Pathway: Diagnostics

**On a treadmill**

“Congratulations, Matthew. I see in your chart that your 60th birthday is tomorrow,” Darnell said.

“I don’t feel a day over 30,” Matthew said with a wink as he rolled up his sleeve for Darnell to take his blood pressure. Darnell explained the procedure for a treadmill stress test. Matthew got on the treadmill, and Darnell connected him to an ECG monitor, which traces electrical impulses transmitted by the heart. He took a baseline reading. Then he turned on the treadmill, and Matthew began walking. Darnel closely monitored Matthew’s heart performance on the screen. He gradually increased the treadmill’s speed to see the effect it would have on Matthew’s heart as he exerted more effort. When the test was over, Darnell asked Matthew to wait in the exam room for the physician who would discuss the results of the test with him.

**Measuring the health of the heart**

Darnell is a cardiographic technician. Cardiographic technicians specialize in electrocardiography, or ECG or EKG. (ECG and EKG are different names for the same thing.) Cardiographic technicians are one type of cardiovascular technicians whose primary role is to help physicians diagnose and treat problems of the heart and blood vessels. Technicians like Darnell attach electrodes to the patient's chest, arms, and legs. Then they manipulate switches on an ECG machine to obtain a reading. They print out a report that is interpreted by a physician. ECGs are done before surgery and as part of routine exams for older patients or patients with a history of heart problems.

For a treadmill stress test, technicians are responsible for recording the patient's medical history, explaining the procedure, connecting the patient to an ECG monitor, and obtaining a baseline reading and resting blood pressure. They are responsible for monitoring the heart’s performance while the patient is on the treadmill, as Darnell did.

In addition to interacting with patients, they schedule appointments, review patient files, and operate and care for testing equipment.

**Qualities and skills**

Cardiographic technicians must feel comfortable working with machines and technology. They also must be able to follow detailed instructions. One part of their job is being able to put patients at ease and explain procedures clearly to patients. Most technicians work in hospitals. According to the US Department of Labor, the mean annual salary in 2013 was $53,990.

**This seems like an interesting career. What do I have to do to make it happen?**

Most cardiographic technicians earn an associate’s degree for entry-level employment, and then they receive on-the-job training from an ECG supervisor or cardiologist. This training takes about four to six weeks. A one-year certification program can be an alternative to on-the-job training. Many technicians already work in the health care field and become technicians to add a new skill to their skill set. Most employers require credentialing, which is available from Cardiovascular Credentialing International (CCI) and the American Registry of Diagnostic Medical Sonographers (ARDMS).

**How can I prepare now?**

Focus on your mathematics, health, and science courses. Being able to carefully follow instructions is a major part of the job, so practice developing your attention to detail now.

Phlebotomist

Pathway: Diagnostics

**The blood test**

Caitlin had been experiencing extreme fatigue. Her doctor wanted to rule out anemia and other conditions, so he ordered blood tests.

Fernando greeted Caitlin when she walked into the lab. He asked her to take a seat. Then he explained the steps he would take to draw blood. Caitlin said that the sight of needles made her queasy, so Fernando gently suggested that she look away. Caitlin rolled up her sleeve. Fernando applied a tourniquet to Caitlin’s arm and then disinfected the area where he would be drawing blood. He skillfully inserted the needle and drew the amount of blood needed to perform the tests Caitlin’s doctor had ordered. He withdrew the needle, applied a small bandage, and unwrapped the tourniquet.

“Wow, I barely felt a thing,” Caitlin said, turning back around to face him. Fernando informed Caitlin that her doctor would contact her with the results. As she left, Fernando began to label the blood samples.

**Extracting blood**

Fernando is a phlebotomist. Phlebotomists are trained to extract blood from a vein for testing. They are responsible for prepping the patient and drawing blood as painlessly and efficiently as possible. Then they are responsible for correctly labeling the samples. They are trained to handle any complications that may occur during the procedure, such as improperly drawn blood or patient stress. They are also responsible for processing and analyzing the samples using sophisticated lab equipment. Phlebotomists usually work in hospitals, commercial laboratories, physician's offices, blood banks, pharmaceutical firms, research institutions, and public health clinics.

**Qualities and skills**

Successful phlebotomists are calm and have excellent listening skills. Many people, like Caitlin, feel nervous around needles and blood, and part of the phlebotomist’s job is putting them at ease. Working with blood puts phlebotomists at risk for exposure to a variety of diseases, so astute attention to lab safety procedures is of the utmost importance. They must also be skilled at performing tasks with their hands.

**I think I’d excel at this job. What do I have to do to make it happen?**

Phlebotomists take different education routes. Many participate in a formal phlebotomy program, which typically lasts four to eight months, in addition to completing an associate’s or bachelor’s degree. Some receive on-the-job training. Certification as a phlebotomist is available through several national credentialing agencies. According to the Bureau of Labor Statistics, the average salary in 2013 was $31,410.

**How can I prepare now?**

Lab safety is an important part of the job, so focus now on developing the skills needed to adhere to procedures and policies during labs in your science classes.

Radiologic Technologists/Technicians (X-ray, CT, MRI, Mammogram)

Pathway: Diagnostics

**A painful fall**

The emergency room physician ordered an X-ray for Robert’s wrist. He had taken a bad fall while skateboarding and was in pain. Emma explained the procedure for an X-ray to Robert. She asked him to remove his watch and ring. She carefully positioned him on the exam table. Then she shielded Robert’s body with lead-containing covers so he wouldn’t be exposed to radiation. She focused the X-ray source at the proper height and angle above Robert’s wrist and placed the film holder in the correct position. She exposed Robert’s wrist to the beam. Then she set the equipment controls so that the image would develop properly. Finally, she removed the film to take to the radiologist and told Robert that the doctor would be in shortly to discuss the results.

**Taking images**

Emma is a radiologic technologist. Radiologic technologists and technicians obtain radiographs, or X-rays, for diagnostic purposes. They are responsible for preparing patients for radiologic examinations, which includes explaining the procedure. They position patients on exam tables and position equipment correctly to obtain the best image possible. They take the image and set the equipment controls to make sure that the film develops properly. One important part of their job is protecting themselves, their coworkers, and the patients from unnecessary exposure to radiation, so they are responsible for using radiation-protection devices appropriately. They also prepare work schedules, keep patient records, and maintain equipment. Most radiologic technologists work in hospitals.

Many radiologic technologists have specialties. Technologists who specialize in computed tomography are called CT technologists. CT scans produce cross-sectional X-rays of an area of a body, and these X-rays are used to make a three-dimensional image. Radiologic technologists who specialize in MRI are called MRI technologists. MRI also creates three-dimensional images using giant magnets and radio waves. Technologists who specialize in mammography are called mammographers. They produce images of the inside of the breast.

**Qualities and skills**

Radiologic technologists must follow physicians' orders carefully and accurately, so they are people who pay attention to details and know how to follow instructions. They also work well on a team. Since they must operate complicated equipment, they also must have mechanical ability.

**I think I’d thrive at the job. What do I need to do to make it happen?**

There are different educational paths to becoming a radiologic technologist or technician. Many professionals earn an associate’s degree or participate in a certificate program that takes about two years. Programs typically provide both classroom and clinical instruction in anatomy and physiology, patient care procedures, radiation physics, radiation protection, principles of imaging, medical terminology, positioning of patients, medical ethics, radiobiology, and pathology. Licensing varies from state to state. Many employers prefer to hire professionals who have received certification from the American Registry of Radiologic Technologists (ARRT). According to the US Department of Labor, the mean annual wage in 2013 was $56,760.

**How can I prepare now?**

Focus on your mathematics, physics, chemistry, and biology classes. Since safety is such a critical part of the job, develop skills that will help you follow instructions precisely.

Radiologist

Pathway: Diagnostics

**Viewing the X-ray**

The X-ray technician asked Lupe to look at the X-ray of the patient’s chest. The patient had been showing symptoms of pneumonia, including coughing up green mucus, fever, and shortness of breath, so the patient’s physician had ordered a chest X-ray. Lupe examined the X-ray that the technician had delivered to her. Indeed, the X-ray confirmed that the patient had a lung infection. Lupe wrote a brief report and then conferred with the patient’s physician. They discussed the best treatment for the patient, and then the physician went to deliver the diagnosis to the patient.

**Making the analysis**

Lupe is a radiologist. Radiologists are physicians who specialize in radiology. It is their responsibility to analyze and interpret diagnostic imagery, like X-rays, CT scans, or MRIs. They confer with the patient’s physician to diagnose the patient and agree on an appropriate course of treatment. Many radiologists have subspecialties, which means that they focus on a type of radiology, such as neuropathology, emergency trauma, or head and neck.

**Qualities and skills**

Radiologists work closely with technicians, physicians, and other health care professionals; they must enjoy working as part of a team. They often supervise workers in the radiology department, so they need leadership skills and an interest in keeping up with advances in technology.

**I think I’d excel at this job. What do I have to do to make it happen?**

Radiologists, like other physicians, must have a bachelor’s degree and graduate from a four-year medical school. They must also pass a licensing exam and complete at least four years of residency. In addition, most radiologists are certified by either the American Board of Radiology or the American Osteopathic Board of Radiology. According to the job site Simply Hired, the average annual radiologist salary in 2013 was $99,000.

**How can I prepare now?**

Medical school is a vigorous and challenging experience. Academically prepare yourself by taking advanced classes, increasing your reading skills, and striving for a high GPA. Look for a summer internship or volunteer work at a health care facility.

Student Resource 8.6

Matching: Choosing the Right Diagnostic Career

Student Names:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Date:\_\_\_\_\_\_\_\_\_\_\_

Directions: Below are descriptions of five high school graduates. Read each description below and then choose a diagnostic career that you think would be a good match for each person. There are no right or wrong answers, but you should have good reasons to back up your choices. Write your reasons for each of your choices..

**Jayden** graduated from high school with a 3.4 GPA. He didn’t enroll in college, but he would like to enroll in a certificate program that will help him land a job in health care. In high school, Jayden enjoyed his science classes the most. For the science fair one year he worked on a project about radiation and won third place for it. Jayden was very proud of that project. He also knows what it takes to be an effective member of a team. He played football for his junior and senior year. He’s also great at fixing machines and equipment. If something like the toaster or the DVD player breaks in his house, his parents always charge him with the task of fixing it. Working with equipment can be dangerous, so Jayden always takes precautionary measures.

What diagnostic career do you think would be a good fit for Jayden?

List two reasons why.

**Diego** is taking science classes at the community college in his town. After he earns his associate’s degree, he’s hoping to get an entry-level job in health care and receive training on the job. In high school and college, he finds himself focusing the hardest on the lab classes. He enjoys the process of working with his hands and following step-by-step instructions. Diego also knows that he wants his career to involve working directly with people. He thinks he’s a good listener. People have always told him that he has a cool and calm demeanor, which he thinks makes people feel at ease around him.

What diagnostic career do you think would be a good fit for Diego?

List two reasons why.

**Mia** is enrolled in community college. After she gets her associate’s degree, she’d like to get a job that requires on-the-job training or a one-year certificate program. Mia knows that she wants to work in health care, but she gets squeamish around blood, so she knows that a job in an emergency room would not be a good fit for her. Mia is fascinated by cutting-edge technology. She’s intrigued by machines that are helping doctors diagnose diseases in the early stages. Mia thinks that these machines are saving people’s lives. Mia knows that she is going to be expected to contribute financially to her family, so she’s hoping that once she’s established in her career she will make at least $40,000 a year.

What diagnostic career do you think would be a good fit for Mia?

Give two reasons why.

**Brianna** is attending a state college. Brianna has spent her summers volunteering at a clinic that provides services for young mothers and their children. Brianna’s grandmother was a midwife who delivered hundreds of babies. Brianna sees herself following in her grandmother’s footsteps and pursuing a career in women’s health. Brianna is also athletic. She played on the volleyball team, and her coach always said that she had excellent hand-eye coordination.

What diagnostic career do you think would be a good fit for Brianna?

Give two reasons why.

**Amir** graduated from high school with a 3.9 GPA. He applied and was accepted into a prestigious four-year private college. He enjoys academics and has the stamina and drive to meet the demanding expectations of his professors. Amir has always wanted to be a doctor, but he’s also interested in technology. Amir is considering taking premed classes and applying for medical school, but if he goes that route, he knows that he’d want to do work involved with cutting-edge technology.

What career do you think would be a good fit for Amir?

Give two reasons why.