

2016 Radiology Questionnaire

"X-Ray production made easy"

It was 1895 in Germany when Wilhelm Conrad Roentgen discovered ionizing radiation, also known as x-rays. This won him the Nobel Prize in Physics in 1901. He gave us the ability to see inside the body, without using surgery. Remember the technology at the turn of the century was still very archaic. Time has passed and innovation brought us to the modern digital age of medicine. Let us go step by step as to how this amazing feat had its humble beginnings in the world of medicine.

It all began in the cathode ray tube (CRT) known as the Crooke's tube. This is a glass container, housing a wire cathode and copper anode under high pressure. Roentgen applied a current to the wire cathode (negative) at one end, which sent charged electrons over to the target anode (positive). Negative electrons are attracted to the positive metal target. When the electrons hit the target, they are attracted to the nucleus of the atoms in the copper, they slow down and lose energy. Remember electrons are negatively charged and the nucleus of an atom is positively charged. This loss of energy is the production of x-rays. There are two types of radiation produced, Characteristic and Bremsstrahlung. Bremsstrahlung is German for "braking radiation". These two types of radiation contribute to the creation of your image.

Now that we know the basics of x-ray production we can apply it to the principles we use today. We know that x-rays come out of the x-ray machine from the Anode. Then what happens... hopefully they are heading for the body part intended, pass through, and form an image. For our purposes, the foot and ankle are the intended body part. The foot and ankle are comprised of 26 bones, 33 joints and over 100 muscles, ligaments and tendons. Let us not forget the blood vessels, nerves, soft tissue and skin. When x-rays pass through all these different densities they create different contrasts on your image. Finding the right balance of kVp and mAs will lead you to an optimal diagnostic image.

Kilovolt potential (kVp) is the penetrating ability of the primary beam to penetrate an object. The voltage is applied to the cathode so it can send the electrons racing over to the anode. Milliamperage (mA) is the factor that controls the amount of radiation emitted from the anode. The reason we would adjust our factors would be to maximize image quality known as radiographic contrast. Radiographic contrast is the visible differentiation between bony structures and tissue opacities. You can actually see this on a radiograph by noting the many shades of gray.

In today's modern x-ray machines, we still have a cathode and an anode but they have been given a makeover. Cathodes have more tightly bound wires that form a filament that can withstand very high voltages compared to 1895. Anodes are angled to permit a focal spot for the electrons. They are now made of tungsten and molybdenum and spin at a rate of about 3,500 rpm, with a copper rotor. These are much more efficient due to the metals high atomic number and high melting point. Over 120 years later, we are still using the x-ray technology that was begun by W.C. Roentgen.

2016 Radiology Questions

Please choose the best answer

1. In what year did Wilhelm Roentgen discover ionizing radiation.
 - a. 1888
 - b. 1895
 - c. 1900
 - d. 1865

2. What was the name of the glass vacuum tube that housed the first x-ray tube.
 - a. Wilhelm
 - b. Radioactive
 - c. Kilovolt potential
 - d. Crooke's tube

3. Which of the following cannot be found in an x-ray tube.
 - a. Image
 - b. Copper
 - c. Anode
 - d. Cathode

4. The nucleus of an atom has which type of charge
 - a. Positive
 - b. Negative
 - c. Neutral

5. Wilhelm C. Roentgen was awarded the Nobel Peace Prize in 1901
 - a. True
 - b. False

6. What type of radiation is also known as "braking radiation"
 - a. Characteristic
 - b. Bremsstrahlung
 - c. Scatter
 - d. Attenuation

7. The production of x-rays is basically from
 - a. The loss of energy from the electron
 - b. The negatively charged atom
 - c. The voltage applied to the Anode
 - d. The number of protons in the atom

8. Which of the following contribute to radiographic contrast
 - a. Muscles
 - b. Bones
 - c. Soft tissue
 - d. All of the above

9. The factor that controls the amount of radiation emitted from the x-ray tube
 - a. kVp
 - b. time
 - c. mA
 - d. Copper

10. The factor that controls the ability of the primary x-ray beam to penetrate an object
 - a. kVp
 - b. time
 - c. mA
 - d. Copper

11. The voltage is applied to which part of the Crooke's tube
 - a. Anode
 - b. Cathode
 - c. Copper Target
 - d. Glass

12. Rotating angled Anodes are made up of
 - a. Molybdenum
 - b. Tungsten
 - c. Copper
 - d. All of the above

13. The filament can be found in
 - a. Anode
 - b. Electron beam
 - c. Cathode
 - d. Focal Spot

14. Tungsten and Molybdenum have a
 - a. High atomic number and low melting point
 - b. High atomic number and high melting point
 - c. Low atomic number and high melting point
 - d. Low atomic number and low melting point

15. The focal spot is found on what part of the x-ray tube
 - a. Cathode
 - b. Crooke's Tube
 - c. Glass tube
 - d. Anode