# LMRT ARRT Practice Exam (Sample)

## Study Guide


**Everything you need from our exam experts!**

# Questions

1. **Which of the following is considered an observable short-term effect of radiation exposure?**

   **A. Fatigue**

   **B. Nausea**

   **C. Erythema**

   **D. Hair loss**

2. **The anode heel effect is most pronounced when using which size of imaging receptor (IR)?**

   **A. 8x10 in IR**

   **B. 10x12 in IR**

   **C. 14x17 in IR**

   **D. 16x20 in IR**

3. **What is produced when using high kVp resulting in low contrast?**

   **A. Short-scale contrast**

   **B. No contrast**

   **C. Long-scale contrast**

   **D. Medium contrast**

4. **What is the primary purpose of using a grid in radiography?**

   **A. To reduce patient movement**

   **B. To minimize scatter radiation reaching the detector**

   **C. To enhance image brightness**

   **D. To increase patient comfort**

5. **Free electrons for X-ray production are primarily derived from which component?**

   **A. Target**

   **B. Filament**

   **C. Glass envelope**

   **D. Anode**

**6. How does the use of a grid affect patient exposure during an imaging procedure?**

**A. Increases patient exposure**

**B. Decreases patient exposure**

**C. No effect on patient exposure**

**D. Eliminates patient exposure**

**7. Above 70 kVp, what percentage of X-ray photons are produced by the bremsstrahlung process?**

**A. 65%**

**B. 75%**

**C. 85%**

**D. 95%**

**8. What type of radiation is described as the radiation that exits the x-ray tube?**

**A. Scatter radiation**

**B. Primary radiation**

**C. Characteristic radiation**

**D. Remnant radiation**

**9. What material is the filament in an X-ray tube typically made from?**

**A. Gold**

**B. Tungsten**

**C. Carbon**

**D. Copper**

**10. A patient presenting with abrupt weakness on one side of the body may be experiencing what condition?**

**A. Stroke**

**B. Shock**

**C. Heart attack**

**D. Seizure**

# Answers

**1. C**
**2. C**
**3. C**
**4. B**
**5. B**
**6. A**
**7. C**
**8. B**
**9. B**
**10. A**

# Explanations

## 1. Which of the following is considered an observable short-term effect of radiation exposure?

**A. Fatigue**

**B. Nausea**

**C. Erythema**

**D. Hair loss**

**Erythema is the correct answer because it is a visible skin reaction resulting from radiation exposure, characterized by redness. This condition reflects the immediate effects of radiation, particularly at doses that can cause tissue damage. Observable effects, such as erythema, typically occur shortly after exposure at higher levels and are directly related to the damage to the skin's blood vessels and underlying tissues. Fatigue and nausea, while they can be experienced after radiation exposure, are more indirect and subjective effects that may not be readily observable by someone other than the affected individual. Hair loss can occur due to radiation exposure, but it generally represents a longer-term effect as it usually doesn't manifest until several weeks post-exposure after hair follicles are affected by the radiation. Thus, erythema distinctly stands out as an immediate, observable effect.**

## 2. The anode heel effect is most pronounced when using which size of imaging receptor (IR)?

**A. 8x10 in IR**

**B. 10x12 in IR**

**C. 14x17 in IR**

**D. 16x20 in IR**

**The anode heel effect refers to the phenomenon where x-ray intensity is greater on the cathode side of the x-ray beam than on the anode side. This effect is particularly significant with larger imaging receptors because the angle of the anode disperses x-rays more unevenly across the receptor. When using larger imaging receptors, such as a 14x17 inch IR, the anode heel effect becomes more pronounced because the longer dimension of the receptor allows for greater variance in x-ray intensity across the surface. The larger size captures a broader range of x-rays and thus is more likely to show the discrepancy in exposure levels due to the heel effect. In clinical practice, this characteristic can help radiographers make informed decisions about positioning and technique to ensure optimal image quality. In contrast, smaller-sized imaging receptors like the 8x10 inch or 10x12 inch IRs do not exhibit the heel effect as dramatically because their dimensions minimize the disparity in x-ray intensity. Furthermore, the 16x20 inch receptor, while still large, often falls under a similar category as 14x17 in terms of the anode heel effect, but tends to be less commonly used, which can affect overall observations in practice. Thus, the 14**

## 3. What is produced when using high kVp resulting in low contrast?

**A. Short-scale contrast**

**B. No contrast**

**C. Long-scale contrast**

**D. Medium contrast**

**Using high kilovolt peak (kVp) settings in radiography results in longer-scale contrast. High kVp techniques increase the penetrating power of the x-rays, allowing them to travel through denser anatomical structures. This leads to a greater range of gray shades on the radiographic image, as the differences in attenuation among various tissues become less pronounced. The term "long-scale contrast" refers to the gradual transition between shades of gray, providing a wider range of densities in the image. This is particularly useful in areas with minimal differences in tissue density, such as the abdomen, where soft tissues may not display significant contrast at lower kVp settings. In contrast, lower kVp would yield a shorter scale of contrast, as it would highlight the differences between tissues more sharply, resulting in a limited number of distinct shades. Thus, using high kVp produces long-scale contrast, making it the correct answer.**

## 4. What is the primary purpose of using a grid in radiography?

**A. To reduce patient movement**

**B. To minimize scatter radiation reaching the detector**

**C. To enhance image brightness**

**D. To increase patient comfort**

**The primary purpose of using a grid in radiography is to minimize scatter radiation reaching the detector. Scatter radiation occurs when x-rays interact with matter (such as the patient's tissue) and change direction, which can degrade the quality of the image by adding unwanted density and reducing contrast. A grid consists of a series of lead strips that are designed to absorb some of this scatter radiation while allowing the primary x-ray beam to pass through. When a grid is used, it helps to improve the contrast of the radiographic image, leading to clearer and more diagnostic results. Using a grid is particularly important for imaging thicker body parts or areas where significant scatter is expected. By effectively reducing this scatter, grids contribute to overall image quality, making it easier for healthcare providers to accurately diagnose conditions based on the radiographic findings. Understanding the role of the grid is crucial for radiologic technologists as it directly impacts patient care and the effectiveness of the imaging process.**

## 5. Free electrons for X-ray production are primarily derived from which component?

**A. Target**

**B. Filament**

**C. Glass envelope**

**D. Anode**

**Free electrons for X-ray production are primarily derived from the filament, which is a key component of the X-ray tube. The filament is heated, typically using an electric current, which causes it to emit electrons through a process known as thermionic emission. These free electrons are then accelerated towards the anode by a high-voltage potential difference applied across the tube, leading to the generation of X-rays upon impact with the target. The significance of the filament lies in its role in creating the electrons needed for X-ray generation, making it the primary source of these free electrons. This contrasts with the target, glass envelope, and anode, which serve different essential functions within the X-ray tube system. The target is where the electrons collide to produce X-rays, the glass envelope houses the components and maintains a vacuum, and the anode is the positive electrode that receives the electrons.**

## 6. How does the use of a grid affect patient exposure during an imaging procedure?

**A. Increases patient exposure**

**B. Decreases patient exposure**

**C. No effect on patient exposure**

**D. Eliminates patient exposure**

**The use of a grid in imaging procedures primarily serves to improve image quality by reducing the amount of scatter radiation that reaches the imaging receptor. When a grid is employed, it increases the overall image contrast by allowing only the direct (primary) radiation to pass through while absorbing scattered radiation. However, this comes at the cost of increasing the required radiation dose to achieve adequate exposure for high-quality images. Because grids absorb some of the primary radiation in addition to the scatter, the radiologic technologist must compensate by increasing the overall radiation dose to the patient to ensure that enough primary radiation reaches the image receptor for a properly exposed image. This means that while grids enhance the quality of the images produced, they also necessitate higher exposure levels for patients, which directly ties the use of grids to an increase in patient exposure during an imaging procedure.**

## 7. Above 70 kVp, what percentage of X-ray photons are produced by the bremsstrahlung process?

**A. 65%**

**B. 75%**

**C. 85%**

**D. 95%**

**When an X-ray tube operates above 70 kVp, the majority of X-ray photons are generated through the bremsstrahlung process, which translates to approximately 85% of the total X-ray photon production. Bremsstrahlung, or "braking radiation," occurs when high-energy electrons are decelerated or deflected by the electric field of the nuclei of the target material (typically tungsten) within the X-ray tube. As these fast-moving electrons come close to the nuclei, they lose energy, which is then emitted as X-ray photons. The efficiency of this process increases with the energy of the incoming electrons, leading to a higher percentage of X-ray production via bremsstrahlung at higher kVp levels. At lower kVp levels, a larger percentage of the X-rays created may come from characteristic radiation; however, as the kVp increases above 70, bremsstrahlung becomes the dominant mechanism for X-ray production. Consequently, at 70 kVp and higher, the contribution from bremsstrahlung to the overall X-ray output reaches around 85%, making this the accepted standard in X-ray physics for understanding how high-energy X-ray production predominantly occurs.**

## 8. What type of radiation is described as the radiation that exits the x-ray tube?

**A. Scatter radiation**

**B. Primary radiation**

**C. Characteristic radiation**

**D. Remnant radiation**

**The radiation that exits the x-ray tube is termed primary radiation. This refers specifically to the high-energy photons that are generated within the x-ray tube when electrons collide with the tungsten target. As these photons leave the tube, they are considered primary because they have not yet interacted with any material in the surrounding environment, such as the patient or the x-ray equipment. Primary radiation is essential for producing diagnostic images, as it forms the initial beam that ultimately contributes to the formation of the image on the x-ray detector. Understanding this concept is crucial for those working in radiologic technology because it highlights the starting point of the imaging process and emphasizes the importance of properly directing this primary beam. Other forms of radiation, like scatter radiation, refer to photons that have changed direction after interacting with matter, which can complicate imaging by introducing noise or reducing image quality. Characteristic radiation is a specific type of primary radiation that occurs at distinct energy levels when inner-shell electrons are knocked out of the atom and outer-shell electrons fill these vacancies, emitting photons at specific energies. Remnant radiation, on the other hand, is the radiation that exits the patient after the x-ray beam has passed through, leading to the captured image on the detector. Understanding these distinctions is important for**

## 9. What material is the filament in an X-ray tube typically made from?

**A. Gold**

**B. Tungsten**

**C. Carbon**

**D. Copper**

**The filament in an X-ray tube is typically made from tungsten due to several significant properties that are essential for the effective functioning of the tube. Tungsten has a very high melting point of approximately 3,422 degrees Celsius, making it highly suitable for withstanding the intense heat generated during the X-ray production process. When an electric current passes through the tungsten filament, it heats up and emits electrons through a process called thermionic emission. The efficiency of this process is crucial for generating X-rays effectively and safely. Additionally, tungsten has a high atomic number, which contributes to effective X-ray production when electrons collide with the target material in the tube. Other materials like gold, carbon, and copper do not exhibit the same combination of high melting point and efficiency for thermionic emission needed for X-ray tube filaments. Gold, while it has excellent conductive properties, does not provide the necessary durability under high-temperature conditions like tungsten does. Carbon, although present in some contexts within X-ray technology (like in certain target materials), does not have the required characteristics for filament use, and copper, while also a good conductor, lacks the high melting point necessary for this application. Thus, tungsten is the clear and most suitable choice for the filament material in X-ray**

## 10. A patient presenting with abrupt weakness on one side of the body may be experiencing what condition?

**A. Stroke**

**B. Shock**

**C. Heart attack**

**D. Seizure**

**A patient presenting with abrupt weakness on one side of the body is likely experiencing a stroke. Strokes occur when there is a disruption in the blood supply to the brain, which can be caused by either a blockage (ischemic stroke) or a burst blood vessel (hemorrhagic stroke). This disruption can lead to sudden neurological symptoms, including weakness or paralysis on one side of the body, also known as hemiparesis. The nature of the symptoms, particularly their sudden onset, distinguishes strokes from other conditions. For example, shock involves a state of inadequate blood flow to the organs, often presenting with different signs such as confusion, rapid pulse, and pale skin, rather than localized weakness. Heart attacks primarily affect the heart muscle and may present with chest pain, shortness of breath, and discomfort, but not specifically with one-sided weakness. Seizures can cause temporary weakness postictally (after the seizure), but they typically present with convulsions or altered consciousness rather than abrupt unilateral weakness. Therefore, abrupt onset of weakness on one side of the body is most indicative of a stroke.**