NAME:HIRA GUL
ID NO: 14949
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QUESTION NO:4

Answer:

DEFINITIONS:

1: COLLIMATOR FILTRATION:

- A collimation is a metallic barrier with an aperture in the middle used to restrict the size of x-ray beam and the volume of the tissue irradiated.
- Filtration involves removal of unwanted radiation while leaving the wanted radiation undiminished.

2: **IMAGE CONTRAST:**

- Contrast is the difference in density or difference in the degree of grayness between areas of the radiographic image.

3: APERTURE DIAPHRAGM:

- It is the simplest type of beam restricting device.
- It consists of a sheet of lead with a hole in the center that determines the size and shape of the beam and attaches directly to the x-ray tube.

QUESTION NO:5

Answer:

1: **COMPTON SCATTERING:**

Definition:

- X-rays throughout the diagnostic range can undergo an interaction with outer shell electrons that not only scatters the x rays but reduces its energy and ionizes the atom as well.
- This interaction is called **compton scattering.**

COMPTON ELECTRON:

- In compton scattering the incident x- ray interacts with an outer shell electron and ejects it from the atom thereby ionizes the atom.
- The ejected electron is called a compton electron.
- The energy of the Compton scattered x-ray is equal to the difference between the energy of the incident x-ray and the energy of the ejected electron.

→The probability of Compton scattering is inversely proportional to the x-ray energy 1/E and independent of atomic number.

→In general the probability of Compton scattering decreases as x-ray energy increases.

- Compton scattering reduces image contrast.

2: PHOTOELECTRIC EFFECT:

Definition:

- X-rays in the diagnostic range also undergo ionizing interactions with inner-shell electrons.
- The x-ray is not scattered,but it is totally absorbed.
- This process is called **photoelectric effect.**

PHOTOELECTRIC ELECTRON:

- The electron removed from the atom is called a photoelectron and escapes with kinetic energy equal to the difference between the energy of the incident x-ray and the binding energy of the electron.
- The probability of the probability of the photoelectric effect is inversely proportional to the third power of x-ray energy (1/E)3.
- A photoelectric interaction cannot occur unless the incident x-ray has energy equal to or greater than the electron binding energy.
- The probability of photoelectric effect is directly proportional to the third power of the atomic number of the absorbing material.

QUESTION NO:1

Definition:

1: Characteristics radiation:

- Characteristic X-rays are emitted when outer-shell electrons fill a vacancy in the inner shell of an atom, releasing X-rays in a pattern that is "characteristic" to each element.
- Characteristic X-rays are produced when an element is bombarded with high-energy particles, which can be photons, electrons or ions (such as protons).
- When the incident particle strikes a bound electron (the target electron) in an atom, the target electron is ejected from the inner shell of the atom.
- After the electron has been ejected, the atom is left with a vacant energy level, also known as a core hole.
- Outer-shell electrons then fall into the inner shell, emitting quantized photons with an energy level equivalent to the energy difference between the higher and lower states.
- Each element has a unique set of energy levels, and thus the transition from higher to lower energy levels produces X-rays with frequencies that are characteristic to each element.

2: BREMSSTRAHLUNG RADIATION:

- Bremsstrahlung is a German word from bremsen "to brake" and Strahlung "radiation" i.e "braking radiation" or "deceleration radiation" is electromagnetic radiation produced by the deceleration of a charged particle when deflected by another charged particle, typically an electron by an atomic nucleus.
- The moving particle loses kinetic energy, which is converted into radiation (i.e a photon), thus satisfying the law of conservation of energy.
- The term is also used to refer to the process of producing the radiation.
- Bremsstrahlung has a continuous spectrum, which becomes more intense and whose peak intensity shifts toward higher frequencies as the change of the energy of the decelerated particles increases
- .Bremsstrahlung emitted from plasma is sometimes referred to as free-free radiation.

- This refers to the fact that the radiation in this case is created by charged particles that are free; i.e not part of an ion, atom or molecule, both before and after the deflection (acceleration) that caused the emission.

QUESTION NO:2

Answer:

Factors that affect the x-ray quantity:

- X-ray photon quantity refers to the number of photons produced during an exposure.

1:kvp

- beam quantity is approximately proportional to the square of the tube potential
- 3: Generator type/voltage waveform:
- reducing ripple increases beam quantity

2:beam filtration:

- increasing filtration reduces beam quantity

3:distance from the beam: inverse square law.

- 4:beam quantity is directly proportional to current

5:exposure time (seconds):

- beam quantity is directly proportional to exposure time

6:anode material:

- beam quantity is directly proportional to the atomic number (Z) of the anode material.

QUESTION NO:3

Answer:

- Contrast is the difference in density or difference in the degree of grayness between areas of the radiographic image.
- The radiographic contrast depends on the following three factors:

1:***SUBJECT CONTRAST***

- it refers to the difference in the intensity transmitted through the different parts of an object.
- For example, in an intraoral radiograph, enamel will attenuate x-rays more than dentin. Subject contrast is affected by the following factors:

2: ***THICKNESS DIFFERENCE.***

- Ifthe x-ray beam is attenuated by 2 different thicknesses of the same material, the thicker part will attenuate more x-rays than the thinner part.1,4,5,12

3:***DENSITY DIFFERENCE***:

- This is also known as the mass per unit volume.
- It is the most important factor contributing to subject contrast. A higher density material will attenuate more x-rays than a lower density material.5,6,10,11

4:***ATOMIC NUMBER DIFFERENCE***:

- A higher atomic number material will attenuate more x-rays than a lower atomic number material.2,6,7

5:***RADIATION QUALITY***:

- it has a great effect on subject contrast.

- A lower kVp will make the x-ray beam less penetrating.
- This will result in a greater difference in attenuation between the different parts of the subject, leading to higher contrast. A higher kVp will make the x-ray beam more penetrating.
- This will result in less difference in attenuation between the different parts of the subject, leading to lower contrast.1,3,4,12

1:Receptor Contrast:

- it refers to the ability of a receptor to show adequately the information that the photons transmitted through the subject.
- In conventional radiography, the contrast depends on the size of the grains, the development time, the concentration and temperature of the developing solution, and overall film density.2,47,12 As conventional film use has been reduced, we will not discuss the details of these factors.

- In digital imaging, contrast depends on the bit-depth of the receptor. Bit-depth refers to the number of possible grey values that can be stored in an image.
- The higher the bit-depth, the more gray values it can store.
- The simplest image, a 1-bit image, can only show two colors, black and white.
- That is because 1-bit can only store one of two values, 0 (white) and 1 (black). An 8-bit image can store 256 possible gray values, while a 12-bit image can display 4096 gray values.1,4,9

Factors that Affect Radiographic Contrast: Scatter radiation will decrease the contrast of the radiograph; however, collimation can counterbalance this effect.

End of paper…!!