Reading Hospital School of Health Sciences
Medical Imaging Program

MI132 – Imaging Principles and Equipment
Unit 4 Study Guide
2021-2022

This study guide is recommended to be completed but is not required. If you want faculty to review your answers, please go to Edvance360: Class MI 132 Assignment Dropbox. You can upload your document there. This must occur by 12:00 PM the day prior to the exam.

1. What are the two target interactions that can produce x-rays?

2. How is a bremsstrahlung x-ray produced?

3. What influences the amount of energy a bremsstrahlung photon possesses?

4. What determines the energy of a photon produced during characteristic interactions?

5. How are characteristic x-rays produced?

6. For characteristic x-rays to be produced, the filament electron needs to have kinetic energy **less than / greater than** the binding energy of the target atom electron.

7. The primary beam mostly consists of **bremsstrahlung / characteristic** x-ray photons.

8. What is the energy of a characteristic x-ray photon in a tungsten target if the K-shell is ionized and the vacancy is filled by an M-shell electron?

9. If a 75 keV filament electron enters the tungsten atom with 60 keV of energy and exits the atom with 40 keV of energy, how much energy does the x-ray photon possess?

10. K-characteristic x-rays require a kVp setting of at least _____ kVp. Why?

11. What percentage of the target interactions is converted to x-rays? What percentage of target interactions is converted to heat?

12. Heat is created by the process of _____. This means that the filament electron had a kinetic energy **less than / greater than** the binding energy of the target atom electron.

13. **List and <u>explain</u>** the four factors that affect x-ray beam quantity.

14. **List and <u>explain</u>** the two factors that affect x-ray beam quality.

15. Increasing x-ray beam **quantity / quality** will increase patient dose.

16. A _____ increase in kVp is the same as doubling mAs.

17. What is the purpose of filtration?

18. What are examples of inherent and added filtration? What is the typical amount of inherent filtration in a diagnostic x-ray tube?

19. What is the total filtration in a diagnostic x-ray tube?

20. Increasing filtration results in **hardening / softening** of the x-ray beam.

21. What is the purpose of compensating filters? Explain how a wedge and Ferlic filter might be used.

22. X-rays that are **more / less** penetrating have a higher quality. These x-rays will be more likely to strike the image receptor and appear **black / white** on the image.

23. What is the best way to measure x-ray beam quality?

24. If the original intensity of an exposure was 50 mGy, how many HVL's would it take to reduce the intensity to 12.5 mGy?

25. What is the difference between the primary and remnant beams? What makes up the remnant beam?

26. Explain what is meant by the characteristic emission spectrum being a discrete spectrum and the bremsstrahlung emission spectrum being a continuous spectrum.

27. The average primary beam photon energy has energy of about _____ of the kVp.

28. What determines the maximum possible energy of an x-ray photon that exits the x-ray tube?

29. What is the only factor that affects the energy of the characteristic emission spectrum?

30. If the kVp was set at 75 kVp, most x-ray photons making up the primary beam will have an energy of _____ keV.

31. How will a lower atomic number target material affect quantity and quality of brems and characteristic x-rays? What affect will this have on the continuous and discrete emission spectrum? (amplitude and position)

32. If a radiographic technique in a tungsten target at 70 kVp/80 mAs is changed to 70 kVp/100 mAs, how will quantity and quality of brems and characteristic x-rays be affected? What affect will this have on the continuous and discrete emission spectrum? (amplitude and position)

33. If a radiographic technique in a tungsten target at 70 kVp/80 mAs is changed to 80 kVp/80 mAs, how will quantity and quality of brems and characteristic x-rays be affected? What affect will this have on the continuous and discrete emission spectrum? (amplitude and position)

34. If additional filtration is placed into the path of the primary beam, how will quantity and quality of brems and characteristic x-rays be affected? What affect will this have on the continuous and discrete emission spectrum? (amplitude and position)

35. If you used a three-phase generator instead of a high frequency generator, how would quantity and quality of brems and characteristic x-rays be affected? What affect will this have on the continuous and discrete emission spectrum? (amplitude and position)

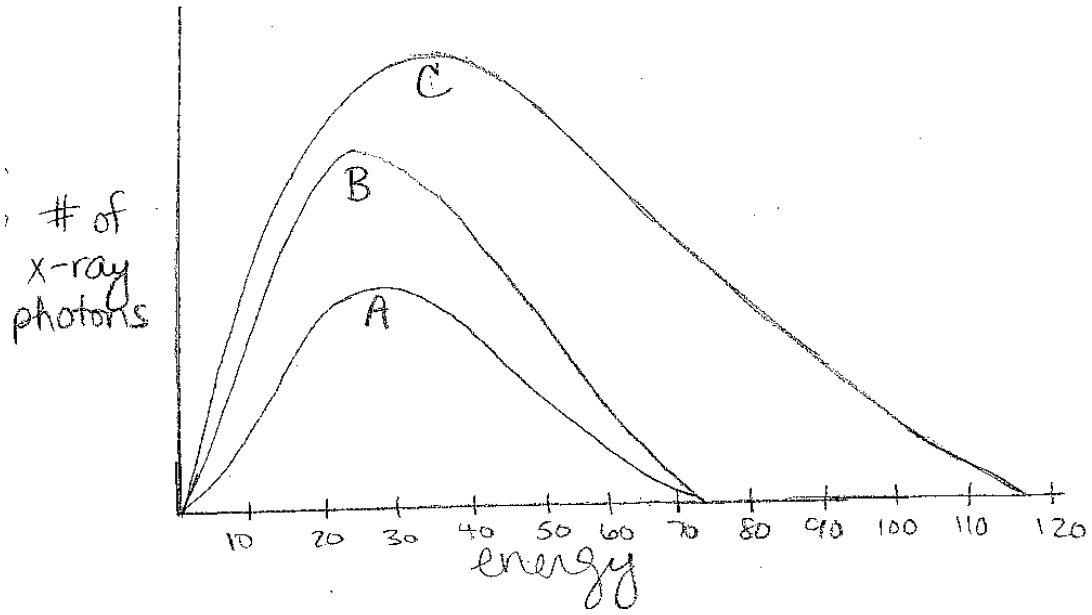
36. Using the emission spectrums below:
    a. Which were produced at the same kVp setting?

    b. Between A and B, which represents the highest mA setting with all other factors remaining the same?

    c. Which represents the most penetrating beam?

    d. What is the maximum photon energy of emission spectrum C?

    e. What is the average photon energy of emission spectrum C?


# of x-ray photons
C
B
A
10
20
30
40
50
60
70
80
90
100
110
120
energy