kVp and 15% Rule

Multiple Choice
Identify the choice that best completes the statement or answers the question.

_____ 1. A _____% increase in kV will increase radiation exposure   the same as doubling the mAs.
   a. 15
   b. 10
   c. 100
   d. 25

_____ 2. What type of radiographic contrast is produced with a high (120) kV technique?
   a. Low contrast, short scale
   b. High contrast, short scale
   c. Low contrast, long scale
   d. High contrast, long scale

_____ 3. The portion of useful image-forming x-rays is referred to as the _____.
   a. frequency
   b. MTF
   c. signal
   d. noise

_____ 4. As mAs is increased the signal to noise ratio is _____.
   a. decreased
   b. increased
   c. not affected
   d. doubled

_____ 5. With digital imaging, patient dose can be reduced by using higher _____ techniques.
   a. mAs
   b. kVp
   c. optical density
   d. contrast

_____ 6. DQE is _____.
   a. density quantum effect
   b. direct quantum efficiency
   c. detective quantum efficiency
   d. detective quantum energy

_____ 7. In order to reduce patient exposure, _____ kVp and _____ mAs should be used when possible.
   a. Lower, higher
   b. Higher, higher
   c. Higher, lower
   d. It makes no difference.

_____ 8. With film-screen imaging, what would be the appropriate change in mAs if the kVp were decreased by 15% and the radiographic exposure needed to be maintained?

a. Double the mAs
b. Halve the mAs
c. Use one fourth of the mAs
d. No change would be necessary.

____ 9. Making the digital image appear with low contrast, with many shades of gray, is done by
a. raising the window level
b. lowering the window level
c. increasing the window width (wide WW)
d. decreasing the window width (narrow WW)

____ 10. Making the digital image appear with high contrast, more black and white, is done by
a. raising the window level
b. lowering the window level
c. increasing the window width (wide WW)
d. decreasing the window width (narrow WW)

____ 11. Which of the following affect radiographic contrast?
a. Energy of the x-ray beam.
b. Anatomy being imaged.
c. Characteristics of the film.
d. All of the above.

____ 12. Increasing the kVp
a. increases the energy of the x-ray photons
b. increases the quantity of x-ray photons
c. increases the penetrating power of x-ray photons
d. all of the above

____ 13. When kVp is increased, exposure to the image receptor is increased with
a. film-screen imaging
b. digital imaging
c. A and B
d. none of the above

____ 14. With digital imaging, if the kVp is too high
a. the image brightness appears low (dark)
b. the image brightness appears appropriate
c. the image brightness appears high (light)
d. none of the above

____ 15. Too little remnant radiation caused by low kVp results in a digital image in which
a. the image brightness appears high (light)
b. the image brightness appears appropriate
c. quantum noise is visible
d. B and C

____ 16. The relationship between kVp and the quantity of remnant radiation is known as the
a. kVp-density rule

    b. 15% rule
    c. 115% rule
    d. kVp-quantity rule

____ 17. Increasing the kVp by 15% has the same effect as
    a. increasing the mAs by 15%
    b. doubling the mAs
    c. decreasing the mAs by 15%
    d. halving the mAs

____ 18. Which of the following exposure factors produces the same amount of remnant radiation as does 20 mAs at 70 kVp?
    a. 10 mAs @ 70 kVp.
    b. 10 mAs @ 80 kVp.
    c. 40 mAs @ 60 kVp.
    d. B and C.

____ 19. 100 kVp should be changed to _____ kVp to decrease the exposure to the IR by a factor of 2.
    a. 50
    b. 85
    c. 115
    d. none of the above

____ 20. To maintain the same amount of radiation reaching the IR, if the kVp is increased by 15% the mAs needs to
    a. remain the same
    b. be doubled
    c. be halved
    d. be decreased by a minimum of 30%

____ 21. When the intensities of radiation exiting the patient are very similar, the resulting film image has
    a. low contrast
    b. high contrast
    c. short-scale contrast
    d. A and C
    e. B and C

____ 22. When the intensities of radiation exiting the patient are very different from each other, the resulting film image has
    a. low contrast
    b. high contrast
    c. short-scale contrast
    d. A and C
    e. B and C

____ 23. _____ kVp results in the intensities of radiation exiting the patient being very _____.
    a. Low; similar
    b. Low; different
    c. High; different

d. A and C

____ 24. Low kVp produces _____ radiographic contrast and high kVp produces _____ radiographic contrast.
a. higher; higher
b. lower; lower
c. lower; higher
d. higher; lower

____ 25. Low kVp produces _____ radiographic contrast and high kVp produces _____ radiographic contrast.
a. long-scale; long-scale
b. long-scale; short-scale
c. short-scale; long-scale
d. short-scale; short-scale

____ 26. To adjust the kVp to produce the desired contrast level, the kVp must first be
a. as low as possible for radiation safety
b. as high as possible
c. high enough to penetrate the part
d. none of the above

____ 27. Using excessive kVp with a digital IR results in
a. increased scatter reaching the IR
b. decreased image contrast after computer adjustment
c. increased patient exposure
d. A and C
e. B and C

____ 28. Which technical factor is used to alter radiographic contrast?
a. mA
b. Exposure time
c. kVp
d. SID

____ 29. If the kVp is increased using the "15% rule," an 80-kVp exposure would change to which of the following?
a. 68 kVp
b. 92 kVp
c. 105 kVp
d. 160 kVp

____ 30. What is the major limitation in obtaining images of obese patients?
a. A strong enough table to hold the patient
b. Reduced resolution due to motion
c. Inadequate penetration of the body part
d. Inability to adjust the mAs high enough

____ 31. What is the single most important technical exposure adjustment that should be made when imaging an obese patient?
   a. Decreasing the kVp
   b. Increasing the kVp
   c. Decreasing the mAs
   d. Increasing the mAs

____ 32. Scatter radiation affects radiographic appearance by causing:
   a. increased distortion.
   b. increased recorded detail.
   c. decreased contrast.
   d. decreased density.

True/False
Indicate whether the statement is true or false.

____ 33. Radiographic contrast should change based on the anatomy being imaged.

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Answer Section

MULTIPLE CHOICE

1. ANS: A   PTS: 1   REF: 40
2. ANS: C   PTS: 1   REF: 40
3. ANS: C
   The portion of useful image-forming x-rays is referred to as the signal.

   PTS: 1   DIF: Moderate   REF: page 312   OBJ: Describe signal-to-noise ratio.
4. ANS: B
   As mAs is increased the signal to noise ratio is increased.

   PTS: 1   DIF: Moderate   REF: page 312
   OBJ: Understand the factors that affect SNR.
5. ANS: B
   With digital imaging, patient dose can be reduced by using higher kVp techniques.

   PTS: 1   DIF: Easy   REF: page 315
   OBJ: Understand how digital techniques can reduce patient dose.
6. ANS: C
   DQE is detector quantum efficiency.

   PTS: 1   DIF: Easy   REF: page 316   OBJ: Define DQE.
7. ANS: C
   Using a higher kVp and lower mAs is best, because the higher kVp provides more penetration, requiring less patient exposure.

   PTS: 1   OBJ: 14
8. ANS: A
   Decreasing the kVp by 15% would require two times the mAs in order to maintain film-screen image density.

   PTS: 1   OBJ: 6
9. ANS: C
   Increasing window width includes more shades of gray in the image, creating a low-contrast appearance.

   PTS: 1   REF: 104   OBJ: 17
10. ANS: D
    Decreasing window width includes fewer shades of gray in the image, making it more black and white.

    PTS: 1   REF: 104   OBJ: 17
11. ANS: D
    The energy, or quality, of the beam along with the tissues in the anatomy being imaged and the film characteristics determine radiographic contrast.

PTS: 1   REF: 108   OBJ: 6

12. ANS: D
Increasing kVp produces more photons with greater energy (more penetrating).

PTS: 1   REF: 119-120   OBJ: 7

13. ANS: C
When kVp is increased, the amount of remnant radiation goes up, increasing exposure to all types of image receptors.

PTS: 1   REF: 121   OBJ: 7

14. ANS: B
With digital imaging, overexposure (whether caused by excessive mAs or kVp) results in an image with appropriate brightness because the computer makes the required adjustments.

PTS: 1   REF: 121   OBJ: 7

15. ANS: D
Insufficient remnant radiation (caused by low mAs or kVp) results in a digital image that has appropriate brightness (because of computer adjustment) but has quantum noise.

PTS: 1   REF: 121   OBJ: 7

16. ANS: B
The 15% rule represents the relationship between kVp and the quantity of radiation reaching the image receptor.

PTS: 1   REF: 122   OBJ: 8

17. ANS: B
Increasing the kVp by 15% has the same effect on the amount of radiation reaching the IR as does doubling the mAs.

PTS: 1   REF: 122   OBJ: 8

18. ANS: D
Fifteen percent of 70 kVp is approximately 10 kVp. Therefore using 10 mAs (one half of the mAs) at 80 kVp and using 40 mAs (two times the mAs) at 60 kVp produces the same amount of remnant radiation.

PTS: 1   REF: 122   OBJ: 8

19. ANS: B
To decrease the exposure to the IR by a factor of 2, the kVp must be reduced by 15%; 15% of 100 is 15, so 100 minus 15 is 85 kVp.

PTS: 1   REF: 122   OBJ: 8

20. ANS: C
Increasing the kVp by 15% doubles the radiation reaching the IR, so to maintain the original amount of exit radiation, the mAs needs to be halved.

PTS: 1   REF: 122   OBJ: 8

21. ANS: A

When the intensities of radiation exiting the patient are very similar, the resulting film image has low contrast (many shades of gray).

PTS: 1　　　　　REF: 123　　　　　OBJ: 7

22. ANS: E
Using a low kVp results in a greater variation of x-ray intensities exiting the patient, producing a high or short-scale contrast image.

PTS: 1　　　　　REF: 123　　　　　OBJ: 7

23. ANS: B
Low kVp results in the intensities of radiation exiting the patient being very different from each other.

PTS: 1　　　　　REF: 123　　　　　OBJ: 7

24. ANS: D
Low kVp produces higher radiographic contrast and high kVp produces lower radiographic contrast.

PTS: 1　　　　　REF: 123　　　　　OBJ: 7

25. ANS: C
Low kVp produces short-scale (high) radiographic contrast and high kVp produces long-scale (low) radiographic contrast.

PTS: 1　　　　　REF: 123　　　　　OBJ: 7

26. ANS: C
To manipulate the kVp to change radiographic contrast, it first must be at a level high enough to penetrate the anatomy.

PTS: 1　　　　　REF: 124　　　　　OBJ: 7

27. ANS: D
Using kVp that is too high results in more scatter reaching the IR as well as increased and unnecessary patient exposure. The image contrast will be adjusted by the computer to an appropriate level.

PTS: 1　　　　　REF: 123　　　　　OBJ: 7

28. ANS: C　　　　　PTS: 1　　　　　REF: Page 129
29. ANS: B　　　　　PTS: 1　　　　　REF: Page 129
30. ANS: C　　　　　PTS: 1　　　　　REF: Page 128
31. ANS: B　　　　　PTS: 1　　　　　REF: Page 128
32. ANS: C　　　　　PTS: 1　　　　　REF: Page 111

TRUE/FALSE

33. ANS: T
Different amounts of contrast are used for different anatomic areas.

PTS: 1　　　　　REF: 108　　　　　OBJ: 6