Worksheet - Density- Other Factors – ANSWER KEY

1. What is the relationship between dose and distance?

The dose is inversely proportional to the square of the distance. If the SID is increased, the dose is decreased. $I = 1/d^2$

2. What does FFD stand for?

Focus to film distance. Another word for SID.

3. Does the focal spot size influence the density of an image?

No it does not, it has no direct effect on the density of an image. Some technique limitations exist with a given focal spot size

4. What is the formula for the inverse square law?

$$\frac{I_1}{I_2} = \frac{(d_2)^2}{(d_1)^2}$$

5. What is the formula for the density maintenance formula?

$$\frac{mAs_1}{mAs_2} = \frac{(SID_1)^2}{(SID_2)^2}$$

6. What is another name for the density maintenance formula?

Square formula

7. What is the relationship between distance and density maintenance?

It is directly proportional to the square of the distance. If SID is increased, density is decreased. In order to maintain the original density, mAs must be increased also.

8. What does OID stand for?

Object to Image distance.

9. How can OID affect radiographic density?

When OID is increased, less scatter from the body part reaches the IR, which results in less density. Increased OID = Decreased density.

10. What situations would require the use of the density maintenance formula?

Portables, fitting larger parts onto a receptor, and patient condition. Any situation where the tech is unable to use the standard SID for the image.

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MRT Program – APPH 226

11. Meet Slim Jim.

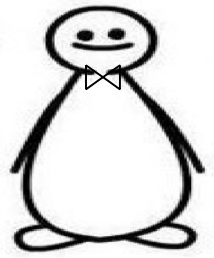


a. What classification would his body habitus fall under?

His body habitus would be classified as hyposthenic, as he is tall and lanky. b. At a glance, would a technologist need to make any changes to the technical factors if a manual technique was being used for his hip x-ray? If yes, what adjustment should be made?

As hips are an area that can vary greatly in size, there would need to be a reduction in technique for his hip. Most likely the tech would choose to modify the mAs.

12. Meet Emma Pear.



a. What classification would her body habitus fall under? ***Her body habitus would be hypersthenic, as she is quite large through the torso***

b. Based on her appearance, if a manual technique was being used, what modifications would need to be made for a wrist xray?

For a wrist x-ray, a very minor modification would be required, if any at all. When you look at her arms, there isn't a significant size difference there. If you had to modify something, it would be with the mAs.

c. What about for an abdominal x-ray? If yes, what adjustment should be made? Are there any other factors to consider?

For an abdomen x-ray, the technique will need to be increased, based on the thickness of her torso. The tech will likely choose to increase the mAs as opposed to the kVp. A consideration is the composition of the area. What might be going on in her abdomen, is it air, is it fluid? That will affect the technique settings as well.

13. A **constructive** pathology will increase the **radiopacity** of tissue.

14. A **destructive** pathology will increase the **radiolucency** of tissue.

15. Why is differential absorption, differential?

The beam is not absorbed to the same degree over the entire area irradiated. Different attenuation by the anatomy in the beam.

16. How is beam attenuation defined? What does it consist of?

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When the primary beam passes through tissue and loses some of its energy. This consists of absorption, scattering and photon transmission.

17. What are scatter interactions?

Compton and Coherent

18. What are absorption interactions?

Photoelectric, Pair production and photodisintegration – any interaction where the initial xray photon disappears.

19. Are differential absorption and exponential attenuation the same thing?

No. Differential absorption describes how different tissues absorb different amounts of the xray beam. Exponential attenuation describes that x-rays are attenuated exponentially through tissue. So for every increment of thickness, a certain percentage of the beam is decreased.

20. Why is scatter radiation such a big deal?

Degrades image, contributes to patient dose, and if it leaves the patient, it contributes to the dose of anyone near the exposure.

21. When the kVp is **increased**, the total number of interactions in the body are **decreased.**

22. What is a latent image?

The image that occurs immediately after exposure but before processing.

23. Why is there a difference in intensity of the x-ray beam when the SID is changed? How is radiographic density affected?
The same number of photons are covering a larger area. Like the flashlight demo. With an increased SID, the photons are more spread out, which will result in decreased radiographic density because there are fewer photons reaching the IR. The opposite is true, with a decreased SID, intensity is increased and radiographic density is also increased

24. Calculate the new mAs for each scenario

Initial mAs	Initial SID	New SID	New mAs

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50	180 cm	100 cm	**15.4**
2.5	100 cm	130 cm	**4.2**
250	110cm	150 cm	**464.9**

25. The original exposure is 40 mAs at a distance of 72 inches. The new exposure will be taken at a distance of 60 inches. To maintain the radiographic density, what will the new mAs be?

$$\frac{mAs_1}{(SID_1)^2} = \frac{mAs_2}{(SID_2)^2}$$

$$\frac{40}{(72)^2} = \frac{}{(60)^2}$$

$$mAs_2 = 27.8$$

26. If the intensity of the beam at 100 cm is 80 mR, what would the distance be for the intensity to be 125 mR?

$$\frac{I_1}{I_2} = \frac{(d_2)^2}{(d_1)^2}$$

$$\frac{80}{125} = \frac{(d_2)^2}{(100)^2}$$

$$d_2 = 80 \text{ cm}$$

27. The original exposure is 75 mAs at a distance of 50 inches. The new exposure will be taken at a distance of 40 inches. What will the new mAs be to double the radiographic density?

$$\frac{mAs_1}{(SID_1)^2} = \frac{mAs_2}{(SID_2)^2}$$

$$\frac{75}{(50)^2} = \frac{}{(40)^2}$$

$$mAs_2 = 48$$

To double the radiographic density, the mAs needs to be doubled.
48 mAs x 2 = 96 mAs

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