# MI 132: Unit 6
# Part I
# Image Quality and Characteristics

RHSHS Medical Imaging Program
2022-2023

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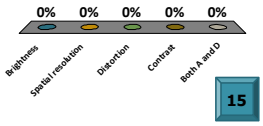
## Visibility of the anatomic structures is accomplished by balancing:

A. Brightness
B. Spatial resolution
C. Distortion
D. Contrast
★ E. Both A and D

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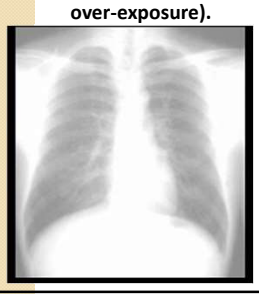
2

## Brightness

**#2 - Define brightness and describe its importance to image quality. Explain how image quality is affected by gross exposure errors (gross under- and gross over-exposure).**



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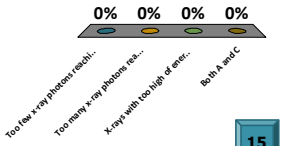
## Quantum noise is a result of:

A. Too few x-ray photons reaching the IR
B. Too many x-ray photons reaching the IR
C. X-rays with too high of energy reaching the IR
D. Both A and C

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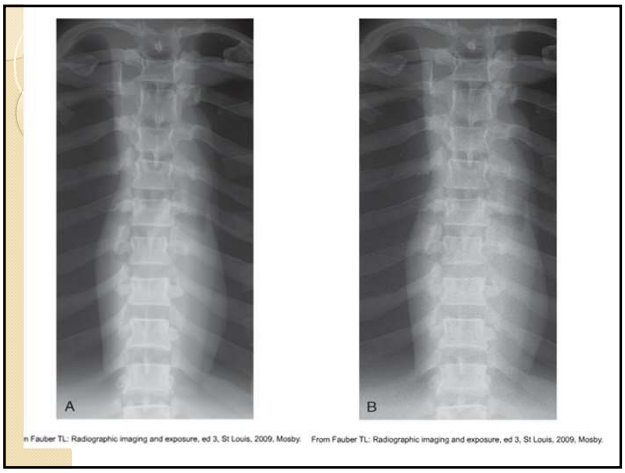


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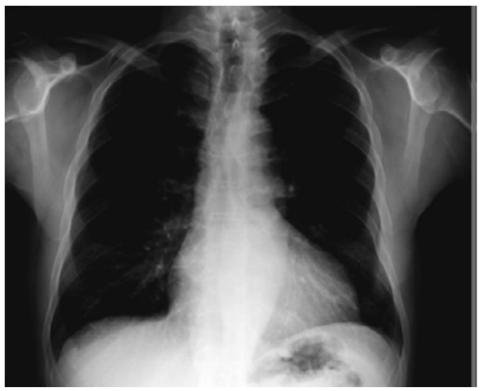

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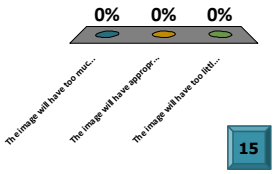
With digital imaging, how will brightness appear if the image was slightly over-exposed?

A. The image will have excessive brightness which cannot be fixed by post-processing
B. The image will have appropriate brightness after processing
C. The image will have too insufficient brightness which cannot be fixed by post-processing

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## Exposure Indicator

#3 - Define exposure indicator and how it is used in radiology.

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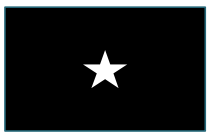
## Contrast

#4 - Differentiate between contrast **(radiographic contrast)** and subject contrast. Explain how they relate to one another.



= High Contrast

= Low Contrast

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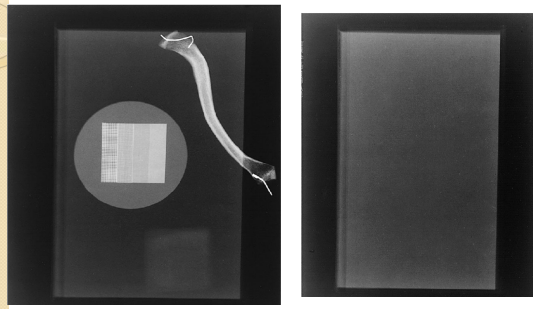



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## *Contrast and Grayscale*

**Grayscale -** The *range* of all those different brightness levels on one image

High contrast
Short grayscale

Low contrast
Long grayscale

The more shades of gray (differing brightnesses), the longer the grayscale.

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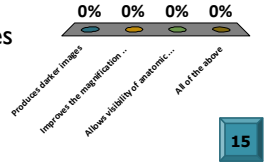
## Radiographic contrast:

A. Produces darker images
B. Improves the magnification of the image
C. Allows visibility of anatomic structures
D. All of the above

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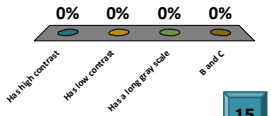
## A radiograph that has brightness levels very similar to each other:

A. Has high contrast
B. Has low contrast
C. Has a long gray scale
★ D. B and C

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## Subject Contrast

#4 (cont.) - Differentiate between contrast (radiographic contrast) and **subject contrast**. Explain how they relate to one another.

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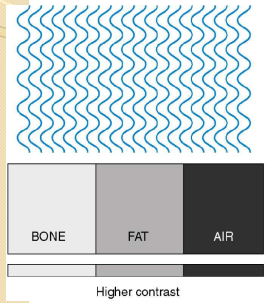
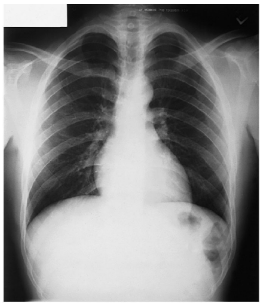
## Absorption Characteristics of Tissue





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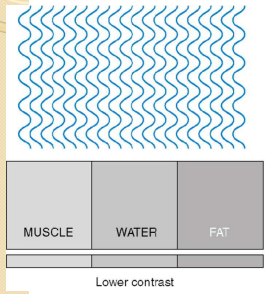
## Absorption Characteristics of Tissue



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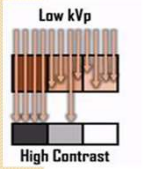
## Quality of Beam & Subject Contrast

#5 - Explain how the quality of the x-ray beam affects subject contrast.

- Decreased kVp




iNCREASE ABSORPTION
LESS TRANSMISSION
GREATER DIFF ABS
INC SUBJECT CONTRAST

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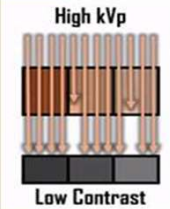
## Quality of Beam & Subject Contrast

- Increased kVp

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Low subject contrast
Less absorption; more transmission
Less differential absorption

Film/Screen
Low radiographic contrast image
Long gray scale

High subject contrast
More absorption; less transmission
More differential absorption

Film/Screen
High radiographic contrast
Short gray scale

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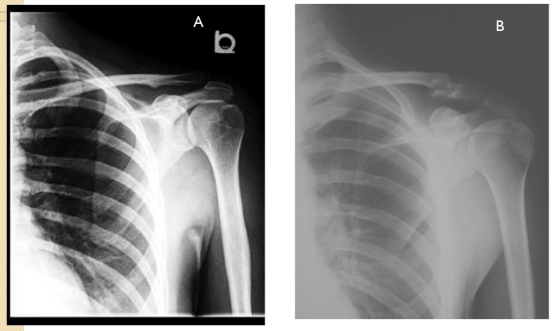
High/Low radiographic contrast image
Short/Long gray scale

High/Low subject contrast
More/Less absorption; more/less transmission
More/Less differential absorption

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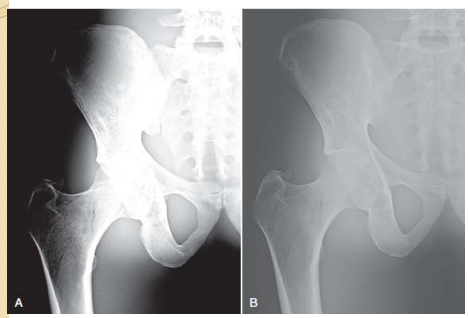
High/Low radiographic contrast image
Short/Long gray scale

High/Low subject contrast
More/Less absorption; more/less transmission
More/Less differential absorption



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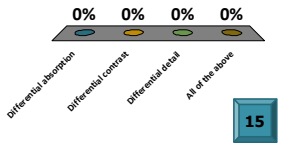
## The range of brightness levels is a result of the tissue's:

A. Differential absorption
B. Differential contrast
C. Differential detail
D. All of the above

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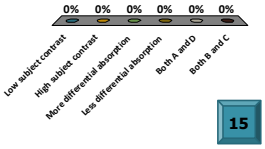
## Increasing kVp will result in:

A. Low subject contrast
B. High subject contrast
C. More differential absorption
D. Less differential absorption
E. Both A and D
F. Both B and C

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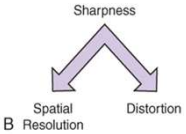
## Sharpness




B

- Spatial Resolution
- Distortion

***Key is to minimize unsharpness by maximizing spatial resolution while minimizing distortion

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## Spatial Resolution

#6 - What is spatial resolution?

a. Identify how motion affects spatial resolution? What can be done to reduce motion?

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## Distortion – Size vs Shape

#7 - Differentiate between size and shape distortion.

a. Identify two factors that affect size distortion.

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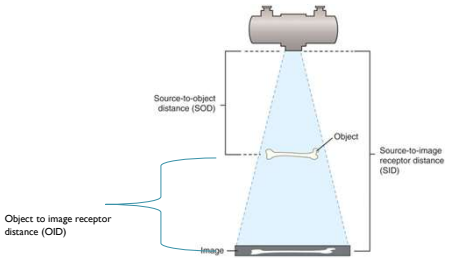
## Distortion – Size



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## Distortion – Size vs Shape

#7 - Differentiate between size and shape distortion.

b. Identify and define the two different ways shape distortion can appear radiographically.
c. Identify what causes shape distortion to occur.

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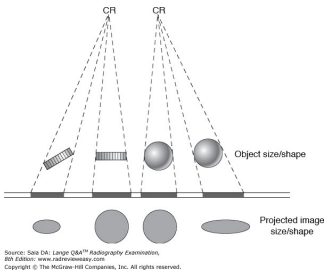
## Shape Distortion



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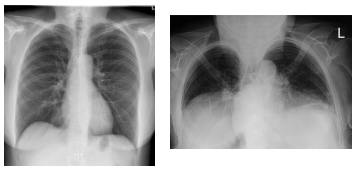
## Shape Distortion

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## Shape Distortion

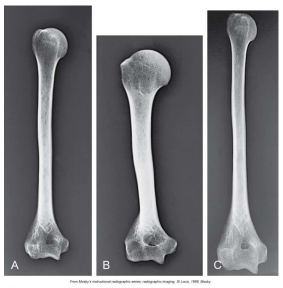


Fig. 9-35. **Shape Distortion. A,** No distortion. **B,** Foreshortened. **C,** Elongated.

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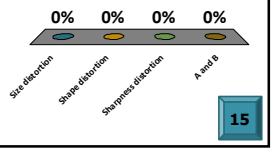
An increase in the image size of an object compared with its true, or actual, size, is called:

A. Size distortion
B. Shape distortion
C. Sharpness distortion
D. A and B

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## More Items Affecting Image Quality

- Scatter
- Noise
- Artifacts
- SNR (*to be covered in Image Acquisition*)
- CNR (*to be covered in Image Acquisition*)

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## Scatter (Fog)

#8 - How does scatter affect image quality?

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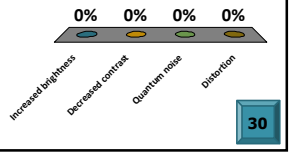
## Increased scatter reaching the IR results in:

A. Increased brightness
B. Decreased contrast
C. Quantum noise
D. Distortion

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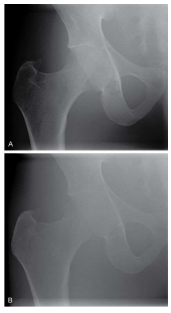
## Scatter (Fog)





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## Quantum Noise

#9 - Explain what causes quantum noise and how quantum noise affects image quality.

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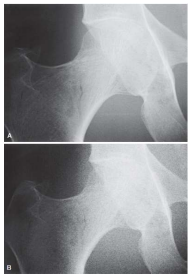
## Quantum Noise





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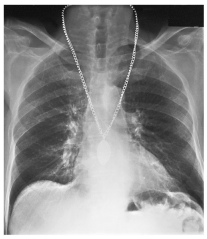
## Image Artifacts

- An artifact is any unwanted item on an image
- Artifacts are detrimental because they make visibility of anatomic information difficult or impossible.





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- What do you think about image quality?

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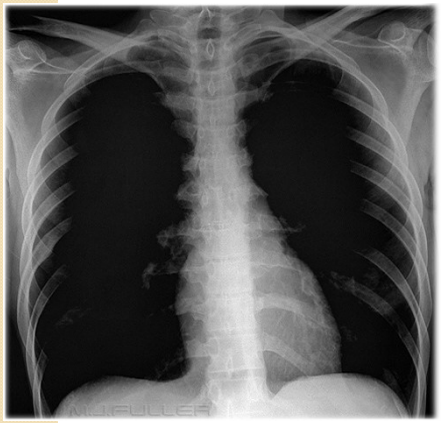

- What do you think about image quality?

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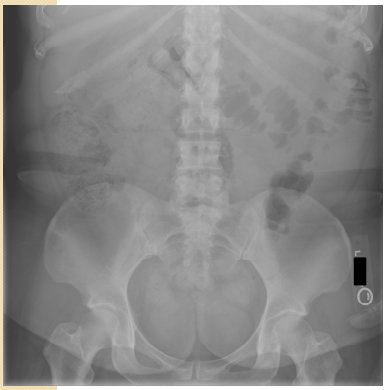

- What do you think about image quality?

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- What do you think about image quality?

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- What do you think about image quality?

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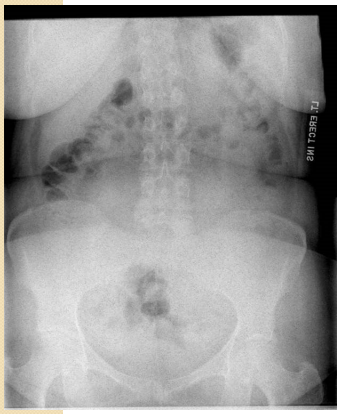

- What do you think about image quality?

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- What do you think about image quality?

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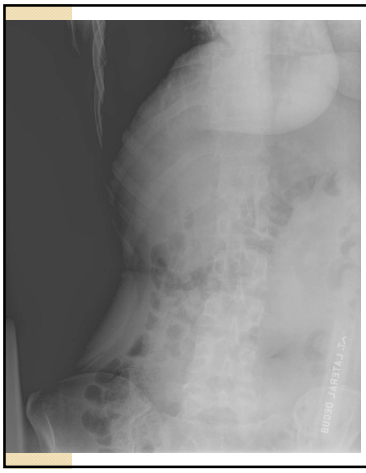

- What do you think about image quality?

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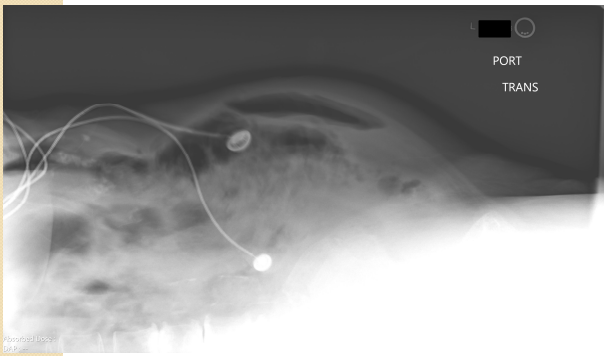
- What do you think about image quality?

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## On to PART 2!!

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