College Medical and Health Techniques

Department Radiology technique

Physics of Computed Tomography

Second Semester

practical part- Experiment-1

Weeks 4: Window Width and Window Level

By

Prof.Dr.Raad Shaker Alnayli
Asses.Prof: Mahmoud Abdelhafez Kenawy

MS.c.Reem Taumu Yousif

2024-2025

⊞ Windowing

Windowing is the process in which the CT image grayscale of a particular image can be adjusted via the CT numbers; doing this will change the appearance of the picture to highlight particular structures (certain anatomy or pathology).

-This is typically done by the technologist or radiologist to better demonstrate certain anatomy or pathology.

*The **window width (WW)** is the range of the grayscale that can be displayed.

The window level (WL)**:** often also referred to as **window center**, is the midpoint of the range of the CT numbers displayed.

Upper and lower grey level calculation

When presented with a WW and WL one can calculate the upper and lower grey levels i.e. values over **x** will be white and values below **y** will be black

the upper grey level (x) is calculated via WL + (WW ÷ 2)

the lower grey level (y) is calculated via WL - (WW ÷ 2)

Window Width vs Window Level

Window Width (WW)

-300HU   0   +300HU

Window Level (WL)

Example: WW of 600 HU could mean the grayscale ranges from -300 HU to +300 HU, with a WL of 0 HU.
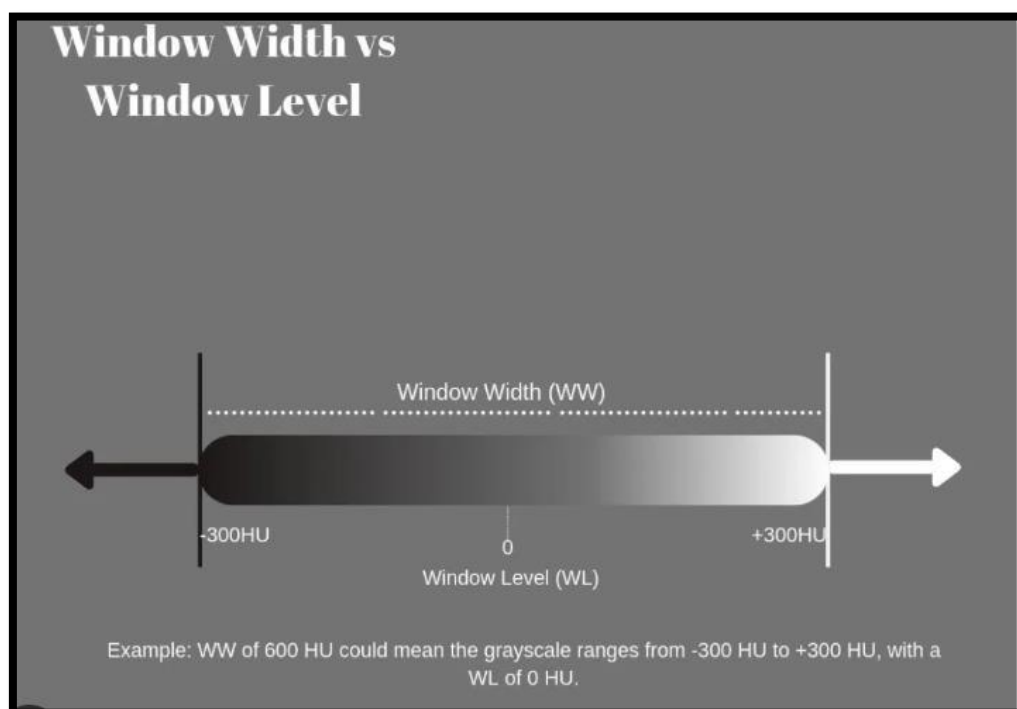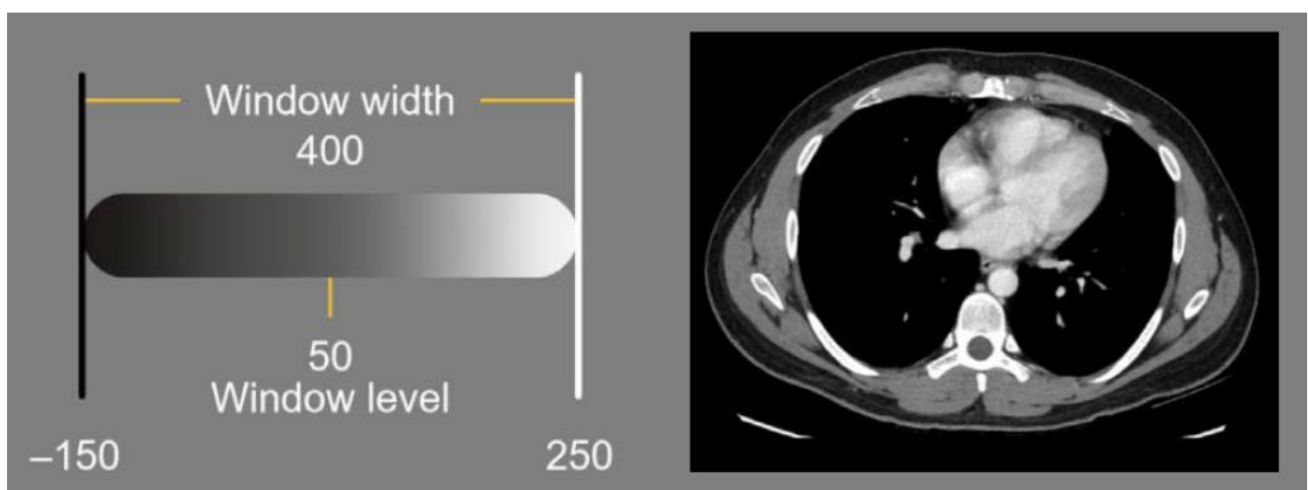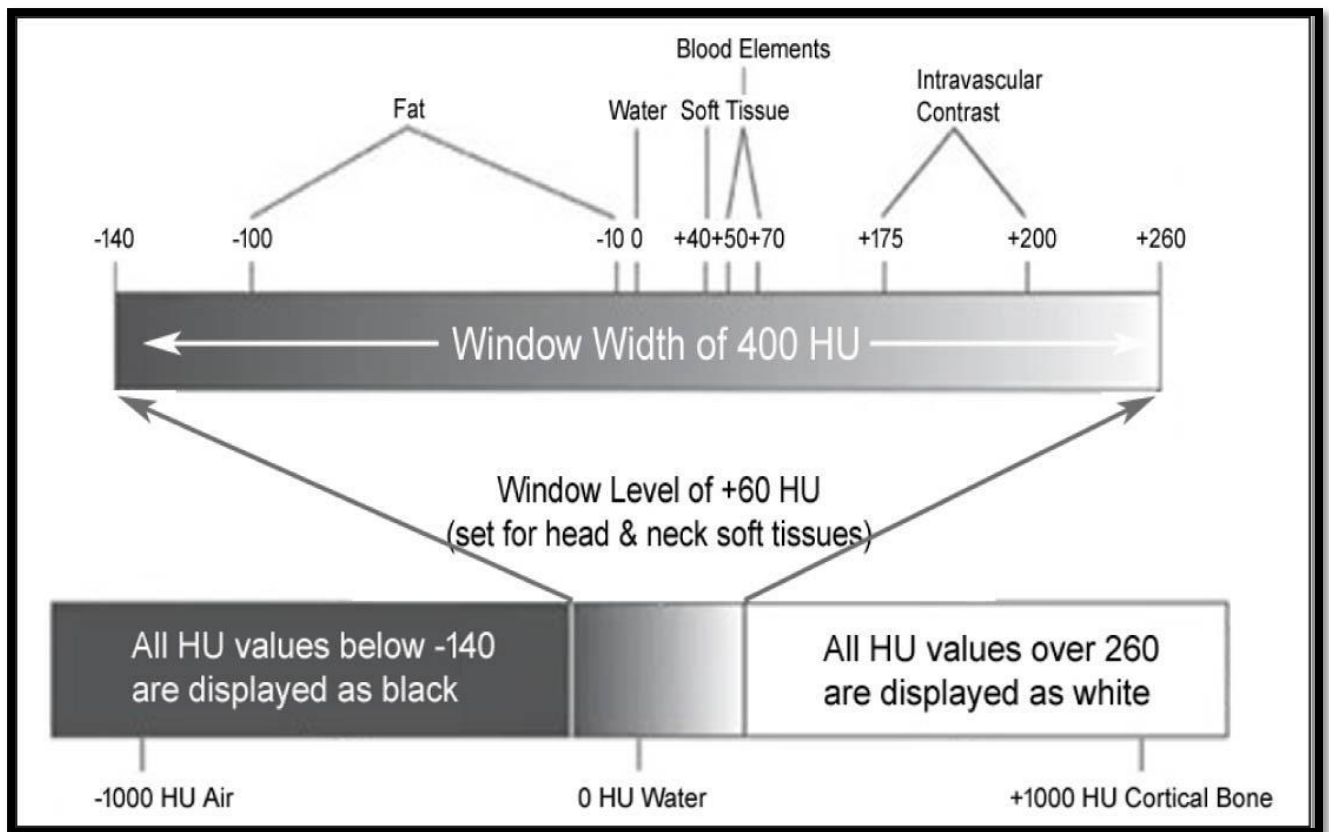
Figure (1)

A **large window width** means there is a **long grayscale** and the transition from **black to white will take longer**.

A **narrow window** width means the transition from **black to white will take place much faster**. Some examples of WW and WL are listed below:

WW of 2000 HU, with a WL of 0 HU, could mean the grayscale ranges from -1000 HU to +1000 HU.

WW of 100 HU, with a WL of +50 HU. could mean the grayscale only ranges from 0HU to +100 HU

WW of 600 HU, with a WL of 0 HU. Could mean the grayscale ranges from -300 HU to +300 HU
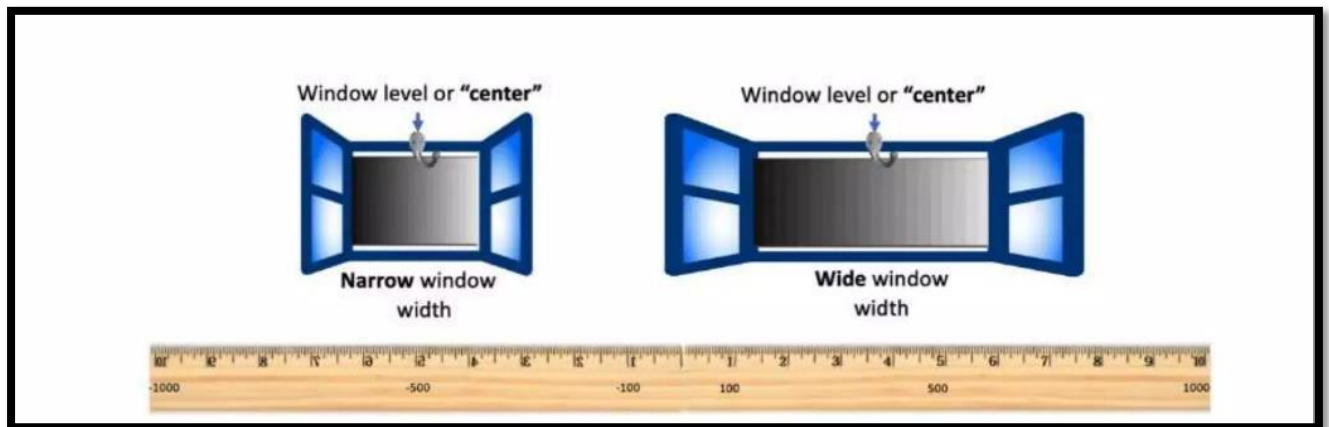

Displays **narrow** range of pixels	Displays **width** range of pixels
Best for stuff with similar attenuation values	Best for stuff with markedly different attenuation values
Soft tissues	Lungs
WW=50-350	WW=400-2000
If the WW decreases, the contrast increases.	if the WW increases, the contrast decreases.

If the abdomen is the area that is being imaged, it is important to **include a wide WW** in order to properly display the **various tissues and densities present in the anatomical area.** It is common for abdomen imaging to contain fat, bone, air, and fluid.

If the area being imaged contains structures of **similar densities**, **a narrow WW** should be utilized to properly display the differences between the structures with **similar attenuation**.

-The WL should be set so that it is **near the CT number** for the area of interest that is being imaged.

By adjusting the WW, the contrast of the image can be changed.
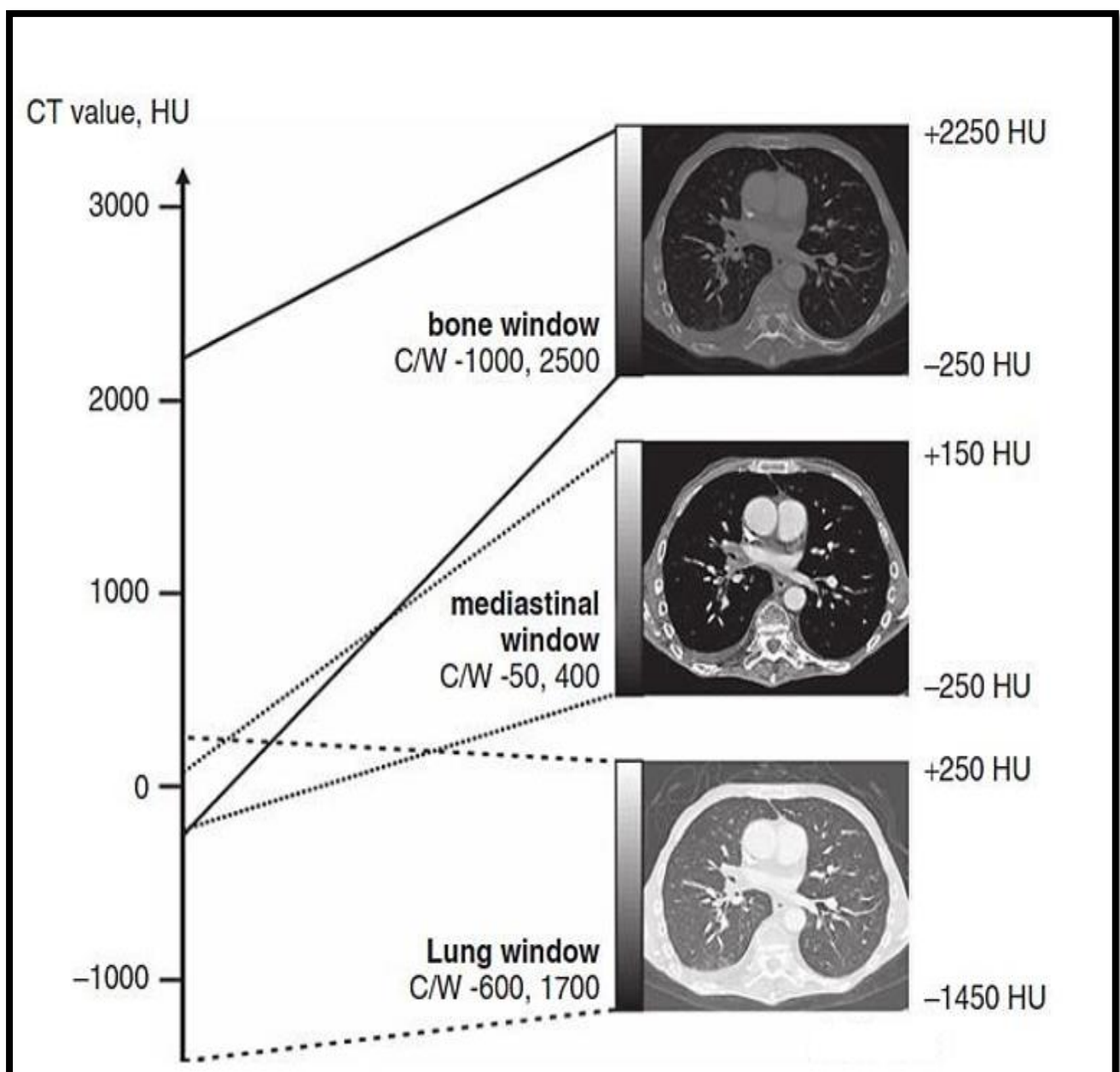
Scan type	Window Width(WW)	Window Level (WL)
Brain CT	80-100 HU	40 HU
Lung CT	1500HU	-600 HU
Bone CT	2000 HU	500 HU
Abdomen CT	400 HU	50 HU
Soft Tissue CT	350-400 HU	40-60 HU

Practical examples of Window Width's impact

a. " Brain Imaging (CT Brain Scan)

WW = 80 ،WL = 40

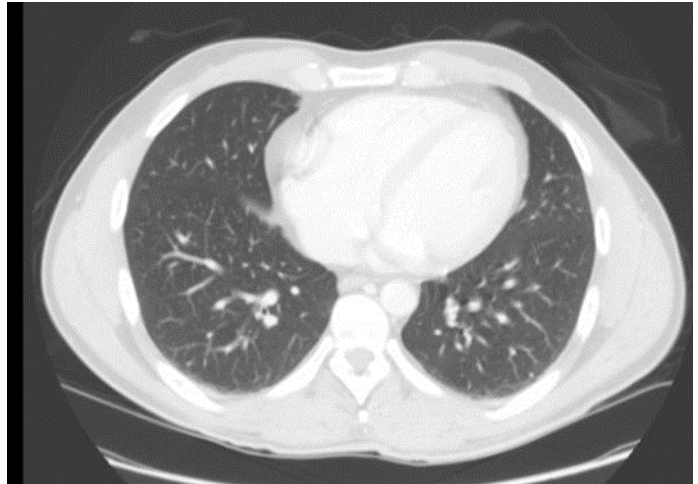This setting promotes the contrast between grey material and white material.

If WW is too wide, all structures will look the same grey, making the distinction difficult.

b. CT Chest Scan

WW = 1500 ،WL = -600

This setting allows to see the exact details of air tissue, which helps detect diseases such as pneumonia and cancer.
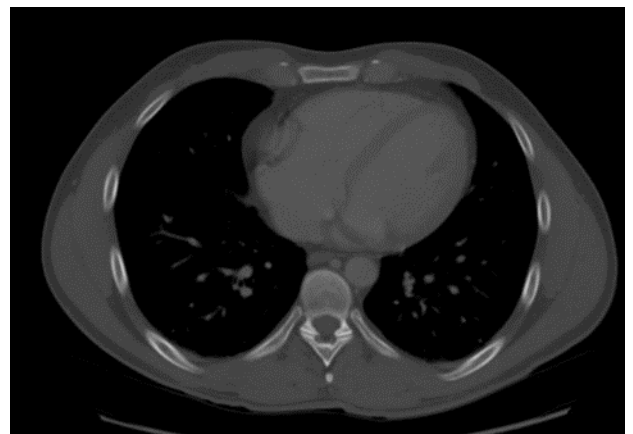
If WW is too tight, the doctor may not be able to see the differences between natural and diseased tissue.
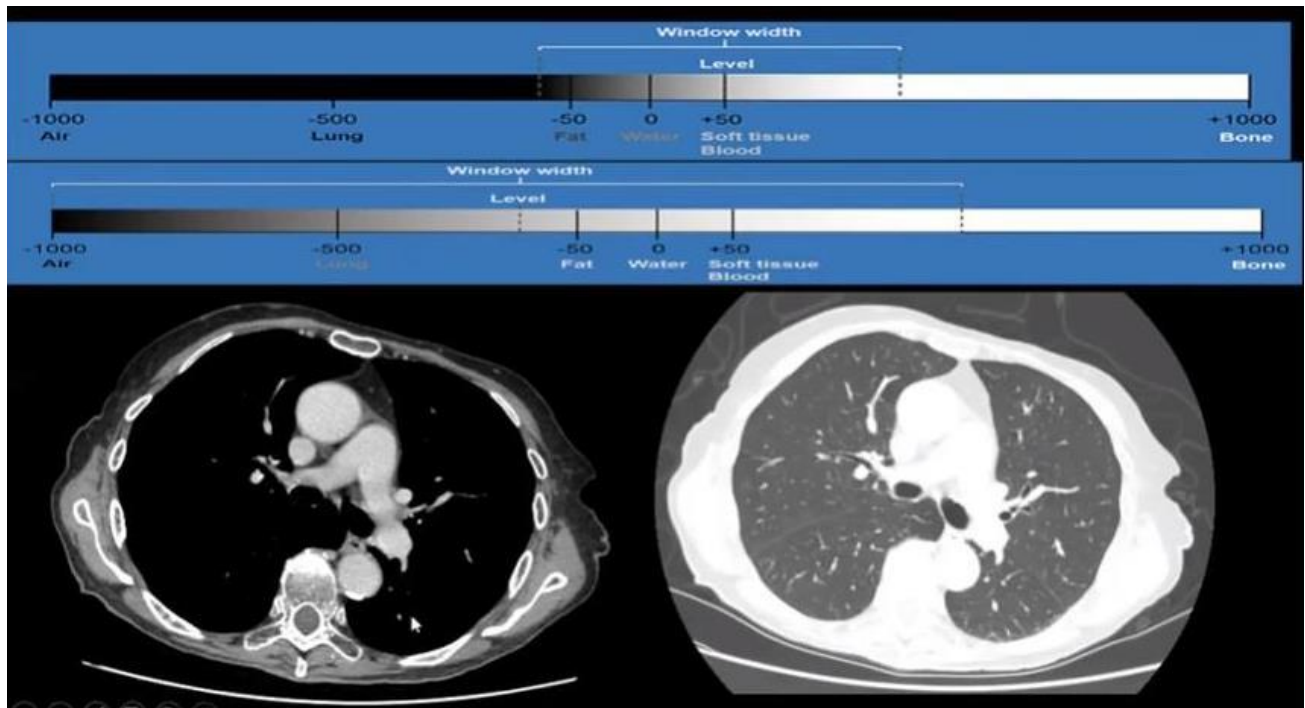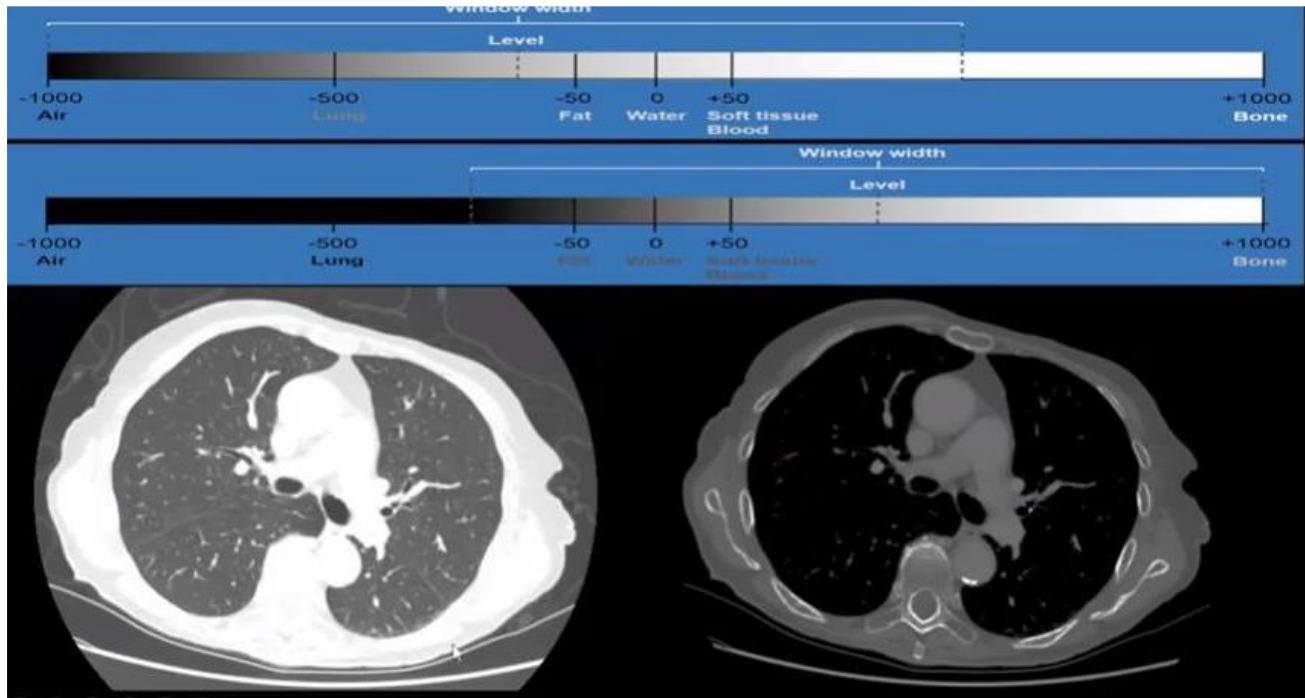
c. Bone Scan

WW = 2000 ،WL = 500

This setup is used to make the bones clear with minimal effect of the surrounding soft tissue.

a-The **contrast** is adjusted via the **window width** (WW).

b-*The **brightness** of the image is adjusted via the **window level** (WL).

Questions

1. Why is a gray scale necessary to display CT images?

2. What does the window width determine?

3. What happens to pixel values that are higher or lower than the range selected by the window width?

4. Provide an example of an area of anatomy that is best imaged with a wide window width. What is an area that is best visualized by a narrow width?

5. What does window level select?