# Chapter 34

1. The only prominent disadvantage of the liquid crystal display (LCD) monitor is related to its:

a. compactness

b. image sharpness

c. reflective glare

d. veiling glare

e. viewing angle

2. The liquid crystal display (LCD) operates on the principle of:

a. light emission by incandescence

b. light emission by stimulated fluorescence

c. light emission by phosphorescence

d. the polarization of light

3. To block out *all* light, place:

a. a polarizing lens horizontally

b. a polarizing lens vertically

c. two polarizing lenses perpendicular to each other

d. two polarizing lenses parallel to each other

4. The molecules of a *nematic* liquid crystal material:

a. flow like a liquid

b. have a linear, thread-like shape

c. tend to keep their axes aligned

d. all of the above

e. b & c only

5. The *pixels* of a liquid crystal display (LCD) screen are made up of:

a. phosphor crystals

b. the intersections of transparent, flat wires

c. the junctions of thin copper wires behind the screen

d. light-emitting diodes (LEDs)

e. TFTs

6. In a liquid crystal display (LCD) screen, in order to shut a pixel “off” so that it appears dark:

a. electrical current is applied to the pixel

b. electrical current is blocked from reaching the pixel

c. an LED is energized behind the pixel

d. two fluorescent bulbs behind the screen are shut off

7. Most of the thickness of an LCD monitor is due to the:

a. fluorescent bulbs required for backlighting

b. Plastic filters used to disperse the light evenly

c. Electronic boards

d. Polarizing screens with nematic liquid crystal between them

8. For a passive-matrix LCD, such as might be used in a wrist-watch or calculator, the source of

light is:

a. fluorescent bulbs behind the LCD panel

b. LEDs behind the LCD panel

c. room lighting reflected from a mirror surface behind the LCD panel

d. no light source is needed

9. For an active-matrix LCD, light from fluorescent bulbs or LEDs is able to pass through the

LCD panels when the nematic crystals in between them are:

a. all aligned parallel

b. twisted 90 degrees

c. twisted 180 degrees

d. electrically charged

10. For an LCD, the more voltage that is applied to a particular pixel, the the nematic liquid

crystals are:

a. less twisted

b. more twisted

c. less electrically charged

d. less magnetically charged

11. For an active-matrix LCD, much higher brightness and continuity, and much faster response

and refresh times for acquired image frames must be provided than a passive-matrix LCD

can supply. To achieve this in the active-matrix LCD, each pixel has its own:

a. LED

b. TFT

c. CRT

d. signal plate

12. For dynamic (motion) image displays, what is defined as the time required for an image

display system to reconstruct the next frame?

a. refresh time

b. response time

c. interrogation time

d. reconstruction time

13. Through digital processing, additional frames for a dynamic image can be interpolated and

inserted between the acquired frames to smooth out motion. For LCD displays, this is

made possible by their extremely high:

a. response rates

b. refresh rates

c. charge rates

d. signal-to-noise ratio

e. microprocessor speed

14. A 5-megapixel LCD screen presents much higher than a 3-megapixel LCD:

a. brightness

b. contrast

c. resolution

d. viewing angle

e. response rate

15. For display monitors, the *response* time is the time required for a(n):

a. pixel to change brightness

b. next frame to be reconstructed

c. next field to be reconstructed

d. information for a frame to arrive at the monitor from the TV camera or CCD

16. Compared to other display systems, the displayed contrast for LCDs is relatively poor due to

their inability to:

1. Produce true black
2. Achieve uniform sharpness
3. Warm up quickly
4. Cope with temperature changes

17. The brightness and contrast of an electronically displayed radiographic image should

NEVER be adjusted by using:

1. Window level
2. Window width
3. Display monitor controls
4. Special operator features such as perceptual tone scaling

18. On a display monitor, by zooming in repeatedly on a high-resolution image, at some level of

magnification it is certain that \_\_\_\_\_\_\_\_ will occur:

1. Halo effect artifacts
2. Aliasing artifacts
3. Flicker
4. Vignetting
5. Exposure artifacts

19. Radiographers must be cautious about discarding or “correcting” what appear to be low-

resolution images on screening monitors prior to submitting them for diagnosis because:

1. Class 2 display monitors do not have the inherent resolution of radiologists’ monitors
2. Radiographers are not qualified to screen radiographic images
3. Screening monitors have larger matrices than radiologists’ monitors
4. The field-of-view (FOV) is not the same as the radiologists’ monitor

20. Although computer experts define a pixel as a dimensionless point, for a typical LCD display

monitors we must define a pixel as a small:

1. Square or rectangle with dimensions
2. Square or rectangle without dimensions
3. Circle with dimensions
4. Circle without dimensions

21. On the LCD display monitors used by radiographers, we define a pixel as the smallest screen

element that can represent all \_\_\_\_\_\_\_\_\_

1. Details in the image
2. Frequency layers of the image
3. Gray levels in the dynamic range
4. Subpixels within the pixel

22. For a typical LCD display monitor, each pixel consists of:

a. three subpixels with 6 segments each

b. two subpixels with three segments each

c. two subpixels with two segments each

d. no subpixels; Each pixel is the smallest physical element in the screen

23. Because the subpixels can be treated by the computer as separately addressed elements for a

monochrome (black-and-white) display monitor, we obtain \_\_\_\_\_ the spatial resolution

of a color display monitor.

1. One-half
2. One-third
3. Two times
4. Three times

24. The \_\_\_\_\_\_\_\_ displayed by each subpixel in an LCD can be controlled by varying the degree

of voltage (or amperage) applied:

1. Sharpness
2. Contrast
3. Darkness
4. Magnification

25. The dynamic range of the image display system is usually that of the computer image

processing system:

a. much more than

b. much less than

c. the same as

d. unrelated to

26. By far, the weakest link in the entire radiographic imaging chain is the:

a. x-ray machine

b. image receptor

c. digital processing computer

d. display monitor

1. Polarizing lenses use \_\_\_\_\_\_ molecules of iodine which act as a grid to filter light:
   1. Block
   2. Chain
   3. Liquid
   4. Nematic
2. For an LCD monitor, the smaller the *dot pitch,* the:
   1. Larger the pixels
   2. Lower the magnification
   3. Lower the brightness
   4. Higher the inherent spatial resolution (sharpness)
3. For a polarizing lens, which of the following will be blocked:
   1. Light waves parallel to the iodine molecules
   2. Light waves perpendicular to the iodine molecules
   3. X-rays parallel to the iodine molecules
   4. X-rays perpendicular to the iodine molecules
4. When a *Class 1 monitor* (having pixels of 0.1 mm) is used, it is possible in the digital age for some procedures that the limiting factor for image spatial resolution (sharpness) becomes:
   1. The focal spot
   2. Digital processing
   3. The SID
   4. The IR
5. The brightness of light emitted from a source such as an LCD best defines:
   1. Dot pitch
   2. Intensity
   3. Luminance
   4. Illuminance
6. For light emitted isotropically in all directions from a source, one *candela* generates one

*lumen* of light intensity per .

a. pixel

b. square centimeter

c. steradian

d. sphere

1. Excessive reflected light from the surface of a monitor screen reduces the apparent visual \_\_\_\_\_ of an image displayed on an LCD monitor:
   1. Contrast
   2. Density
   3. Sharpness
   4. Inherent SNR
2. At 25 lux, the maximum ambient lighting in a radiologist’s reading room while images are being diagnosed should be less than \_\_\_\_\_ of the typical lighting for offices in general:

a. 3/4

b. ½

c. 1/4

d. 1/10

1. In terms of energy emitted, one lumen is equal to about 0.0015 \_\_\_\_ of power per steradian:
   1. Ohms
   2. Amps
   3. Volts
   4. Watts
2. The device (provided by many manufacturers of display monitors) designed to directly

measure luminance, or the light intensity emitted from a display monitor, is the:

a. densitometer

b. photometer

c. lux inflector

d. SMPTE test device

1. Read-out from a photometer may be in:
   1. Lumens
   2. Candela per square meter
   3. Either of the above
   4. Neither of the above
2. For their display monitors, radiologists generally prefer a brightness level of:
   1. 250 lumens
   2. 500-600 lumens
   3. 800 lumens
   4. 250 candela
3. When you touch the face of an LCD monitor screen, you are directly touching its:
   1. Filters
   2. Pixels
   3. LEDs
   4. Circuits
4. In each pixel of an LCD monitor screen, under normal conditions (without electrical charge applied), the “threads” of liquid crystals tend to line up with:
   1. The pixel wires
   2. The iodine molecules in the polarizing lens
   3. The magnetic poles of the iodine molecules
   4. Scratches in the surface of the electrodes
5. In an LCD monitor, when an electrical charge *is* applied to a pixel, the nematic crystals align:
   1. Parallel to each other
   2. Parallel to iodine chain molecules in the polarizing lens
   3. Parallel to scratches in the electrodes
   4. Perpendicular to scratches in the electrodes
6. In an LCD monitor pixel, *without* any twisting effect on the nematic crystals, the pixel is depicted as a \_\_\_\_\_ spot in the displayed image:
   1. Light
   2. Medium gray
   3. Dark
7. For medical imaging applications, the most common arrangement to provide lighting in an LCD monitor is:
   1. A reflective surface backing
   2. LED’s placed behind the screen
   3. Fluorescent bulbs placed behind the screen
   4. Fluorescent bulbs placed to the side of the screen
8. In an LCD monitor, *input lag* is caused by:
   1. Excessive response time
   2. Excessive refresh time
   3. Too much digital processing within the LCD
   4. All of the above
9. Truly *dead* pixels appear as:
   1. Permanent light spots
   2. Light spots on one image only
   3. Permanent dark spots
   4. Dark spots on one image only
10. An LCD display monitor should be replaced if there are more than:
    1. 15 bad pixels overall
    2. 3 bad pixels within a 1 cm circle
    3. 3 bad pixels adjacent to each other
    4. Any of the above
11. Compared to other display systems, the displayed contrast for LCDs is relatively poor due to their inability to:
    1. Produce true black
    2. Achieve uniform sharpness
    3. Warm up quickly
    4. Cope with temperature changes
12. For the output of an LCD, brightness is:
    1. Time-dependent
    2. Temperature-dependent
    3. Both of the above
    4. Neither of the above
13. Which of the following units is best applied to a count of the number of light photons from a computer screen passing through one square centimeter at a distance of 12 inches from the screen, on their way to the human eye:

a. candela

b. lumens

c. lux

d. watts

1. Excessive reflected light reduces the apparent visual \_\_\_\_ of an image displayed on an LCD monitor:
   1. Contrast
   2. Density
   3. Sharpness
   4. Inherent SNR
2. The most appropriate unit for illuminance from ambient room lighting is the:
   1. Lux
   2. Lumen
   3. Candela
   4. Candela per square meter
3. On the LCD display monitors used by radiographers, we define a pixel as the smallest screen element that can represent all \_\_\_\_\_\_\_\_\_:
   1. Details in the image
   2. Frequency layers of the image
   3. Gray levels in the dynamic range
   4. Subpixels within the pixel
4. For a typical LCD display monitor, each pixel consists of:

a. three subpixels with 6 segments each

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d. no subpixels; Each pixel is the smallest physical element in the screen

1. The photometer uses \_\_\_\_\_\_\_\_ to generate electrical current and display a read-out for emitted light intensity:
   1. Characteristic interactions
   2. Thompson interaction
   3. The photoelectric effect
   4. The Compton effect
2. Which of the following describes illuminance:

a. the intensity of light from other sources striking a surface

b. the intensity of light per area passing through space

c. the total intensity of light emitted in all directions from a source

d. the brightness of a particular portion of a radiographic image

1. The display monitor is typically much more limited in \_\_\_\_ than the digital processing system of the computer:
   1. Resolution
   2. Dynamic range
   3. Both of the above
   4. Neither of the above