Chapter 37

1. When performing mobile radiography to demonstrate joint spaces, if you have to choose, it is

*most* important to keep the central ray:

a. perpendicular to the receptor plate

b. perpendicular to the anatomy

c. angled half-way between the anatomy and the receptor plate

d. horizontal

2. Which of the following approaches to radiographic technique is most recommend for mobile

radiography:

a. automatic exposure control (phototiming)

b. manual technique using technique charts

c. manual technique by memory

d. manual technique by word of mouth

3. During a mobile radiographic procedure, a 180 cm (6 ft) tall radiographer can use the

distance from the fingertips of the outstretched arm to the opposite axilla to estimate:

a. 180 cm (72”)

b. 150 cm (60”)

c. 125 cm (50”)

d. 100 cm (40”)

4. On a mobile radiographic unit, which of the following meters would indicate whether

sufficient electricity was being supplied to the machine from a wall outlet?

a. mA

b. kV

c. LV

d. mR

e. mAs

5. If an extremity must be radiographed at 50 inches (125 cm) SID because of traction devices,

use than the usual 40-inch (100-cm) technique:

a. 1 and ½ times more (or one “step” in mAs more)

b. 2 times more (or two “steps” in mAs more)

c. 3 times more (or three “steps” in mAs more)

d. 1/3 less (or one “step” in mAs less)

6. To achieve proper alignment of the x-ray tube during mobile procedures, radiographers must

position themselves:

a. behind the x-ray tube to evaluate lateral alignment

b. at right angles to the CR to evaluate cephalic/caudal alignment

c. at the greatest feasible distance to better see alignment

d. all of these

e. none of these

7. For a mobile AP chest radiograph to rule out fluid levels in the lungs, the patient is sitting at

an angle of 20 degrees from vertical (to the mid-coronal plane). The back of the bed is 10

degrees from vertical. The x-ray beam CR should be angled:

a. 10 degrees caudal

b. 20 degrees caudal

c. 30 degrees caudal

d. horizontal

8. On a mobile unit, increase one “step” in mAs for every increase in SID:

a. 12.5 cm (5”)

b. 25 cm (10”)

c. 38 cm (15”)

d. 50 cm (20”)

9. Regarding radiographic technique, a modern battery-powered constant-potential generator

(CPG) mobile unit requires at least when compared to a 3-phase, 6-pulse fixed unit

in the imaging department.

a. 8 kVp less

b. 8 kVp more

c. 15 kVp less

d. 15 kVp more

e. twice the mAs

10. In the digital age, what innovative software is strongly recommended for all mobile and

trauma x-ray procedures, because it allows the radiographer to work around the patient

“as they lie” without worrying about grid cut-off from angling, alignment and positioning

adaptations:

1. Grid-line suppression software
2. Image smoothing software
3. Virtual grid software
4. Frequency detail processing software

11. A photocathode is an electrical device which emits .

a. x-ray photons

b. light photons

c. electrons

d. thermions

12. Which of the following is the best way to improve the statistical quality of the fluoroscopic

image, reducing quantum noise, is to increase the:

a. brightness control on the TV monitor

b. x-ray tube current (mA)

c. contrast on the image intensifier

d. x-ray-to-light conversion efficiency

13. The central portion of the output screen on an image intensifier tube possesses greater:

a. distortion

b. aberrations

c. brightness

d. contrast

14. In the image intensifier tube, what electrical device changes the field of view (FOV) to

produce a magnified image?

a. photocathode

b. accelerating anode

c. electrostatic lens

d. beam splitter

15. For image intensifiers, there are two types of electrical devices that will change the level of

brightness to compensate for differences in part thickness and tissue density, the

automatic stabilization control and the:

a. tube current

b. automatic gain control

c. automatic quantum control

d. automatic phototimer

16. The area of a 30 cm circular input phosphor is approximately 707 square centimeters. The

area of a 2.5 cm output phosphor is about 5 square cm. For this image intensifier, the

change in fluoroscopic image brightness from *minification gain* alone would be:

1. 141 times brighter
2. 712 times brighter
3. 3,535 times brighter
4. 0.007 times dimmer

17. The contrast generated by a fluoroscopic image intensifier tube typically deteriorates at a rate

of percent per year:

a. 2

b. 5

c. 10

d. 20

18. In the image intensifier tube, the reduction of brightness at the periphery of the output screen is referred to as:

a. veiling glare

b. distortion

c. contrast

d. vignetting

19. Operating the image intensifier tube in the mode can help reduce pincushion distortion:

a. magnified

b. glare

c. automatic brightness stabilization

d. automatic gain control

20. A digital photospot camera typically operates as a scan line system:

a. 525

b. 1024

c. 1050

d. 1080

21. For average patients, the back-up time recommended for the automatic exposure control for

fluoroscopic “spot-filming” is:

a. 1 second

b. 10 seconds

c. 15 seconds

d. 20 seconds

22. The mobile C-arm fluoroscopy unit requires the use of a dedicated or special surgery table.

Which type of table significantly reduces skin entrance exposure to the patient?

a. wood

b. titanium

c. glass fiber

d. carbon fiber

23. During image intensified fluoroscopy, proper collimation will reduce:

a. tube current

b. noise

c. frame rate

d. power required

24. The conventional fluoroscopic mA is usually about:

a. 50 to 100

b. 1 to 5

c. 100 to 600

d. 0.1 to 0.6

25. An insufficient amount of x-ray photons at the input phosphor would increase on the TV

monitor screen:

a. vignetting

b. contrast

c. noise

d. both b & c

e. all of the above

26. When a magnification mode is selected on an image intensifier, which of the following will

increase:

a. patient exposure

b. input phosphor size

c. resolution

d. both a & c

e. all fo the above

27. When the contrast knob on the TV monitor is used to increase the contrast electronically,

which of the following image characteristics also increases:

a. noise

b. brightness

c. lag

d. vignetting

28. Even when the radiologist properly positions the fluoro tower for spot-filming, these images

will have poor detail compared to regular overhead radiographs because of spot-filming’s

inherent:

a. large focal spots

b. poor receptor quality

c. long OID

d. short SID

29. For an image intensifier, the formula, *candela per square meter divided by milliroentgen per*

*second* describes the:

a. minifcation gain

b. flux gain

c. conversion factor

d. signal-to-noise ratio

30. The brightness of the image-intensified fluoroscopic image varies the kVp:

a. directly proportional to

b. inversely proportional to

c. by the square of

d. by the fifth power of

31. Quantum mottle shows up on the fluoroscopic TV monitor as:

a. scintillation

b. vignetting

c. pincushion distortion

d. veiling glare

32. On a mobile C-arm fluoroscopy unit, which lock would be used to re-center the image

intensifier more toward the patient’s head without changing the type of projection (PA):

a. transverse lock

b. longitudinal lock

c. 360-degree rotation lock

d. 180-degree rotation lock

33. In digital fluoroscopy, what function would be used to register a scout image and a contrast-

injected image in order to carry out high detail subtraction?

a. cine forward/reverse

b. C-time

c. pixel-shift

d. acquire

e. white-out

34. Which of the following combinations of image intensifier input phosphor size and display

matrix size would result in the sharpest image detail:

a. 7-inch input phosphor, 80 X 80 pixel matrix on display

b. 7-inch input phosphor, 100 X 100 pixel matrix on display

c. 9-inch input phosphor, 80 X 80 pixel matrix on display

d. 9-inch input phosphor, 100 X 100 pixel matrix on display

35. Changing from fluoroscopic mode to DF (digital fluoroscopy) mode can result in a net

savings in patient dose due primarily to:

1. Lower operating mA
2. Extremely short x-ray pulse times
3. Increased SID
4. Higher operating kVp

36. During DF, which of the following is defined as the time required for the x-ray tube to be

switched on:

1. Exposure time
2. Pulse time
3. Interrogation time
4. Extinction time

37. Advantages of the flat panel detector over the conventional image intensifier include:

a. Linear response to radiation

b. Less sensitivity to local magnetic fields

c. Less radiation to the patient

d. All of the above

e. None of the above

38. To help the radiologist or cardiologist steer a guidewire and/or catheter through blood

vessels, a subtracted image from a frame with maximum contrast agent opacification can

be overlaid on the most recent frames taken. This technique is called:

1. Roadmapping
2. Blurred mask subtraction
3. Subtraction angiography
4. DF interrogation

39. Operating modern fluoroscopy units in “enhanced image mode” or “enhanced contrast

mode” can result in:

1. Extreme mA levels
2. Excessive patient dose
3. Burns to the patient’s skin
4. All of the above
5. None of the above

40. During pulsed-progressive mode DF, by selecting a 3 ms pulse width instead of a 6 ms pulse

width:

1. Cuts patient dose in half
2. Doubles spot image sharpness
3. Forces the unit to increase the mA
4. Can result in too dim an image

41. A p-type transistor and an n-type transistor are stacked together to form an electronic gate

called a(n):

1. CCD
2. CMOS
3. MOSFET
4. TFT

42. Compared to a CCD, a CMOS:

a. consumes more power

b. has slower speed

c. is more expensive

d. has less sensitive surface area

43. The CMOS outputs \_\_\_\_\_\_\_\_\_\_ data down wires to exit the sensor device:

a. digital

b. analog

c. electromagnetic

d. continuous

44. For the *dynamic flat panel detector (DFPD),* the acquired electronic image:

* 1. Must pass through a recording device before display
  2. Must pass through an optic fiber bundle before display
  3. Must pass through an image intensifier tube before display
  4. Is sent directly to display

45. Of the various imaging systems for static imaging (discussed in Chapter 31), the way that a charge-coupled device or CCD (used for dynamic imaging functions) works is most similar to the :

a. phosphor of a conventional screen-film combination

b. phosphor of a CR photostimulable plate

c. del of a direct-conversion DR receptor

d. del of an indirect-conversion DR receptor

46. The charge-coupled devices (CCDs) used for medical fluoroscopy are about in size:

a. 0.1 mm

b. 1 mm

c. 1 cm

d. 2.5 cm (1”)

47. Within a CCD, when each “hole” reaches the bottom electrode, it creates a \_\_\_\_ on the

nearby capacitor:

* 1. Density
  2. Pixel value
  3. Negative charge
  4. Positive charge

48. Which of the following are distinct advantages of the CCD for medical fluoroscopy?

a. small size and flat shape

b. high detective quantum efficiency (DQE)

c. high spatial resolution

d. all of the above

49. In a charge-coupled device (CCD), when an x-ray strikes a crystal of silicon:

a. light is emitted

b. electrons are trapped

c. charge “holes” drift to an electrode

d. electrons drift to a negatively-charged electrode

50. The output phosphor of an image intensifier changes \_\_\_\_\_\_\_ energy into \_\_\_\_\_\_\_ energy.

a. light; electron

b. electron; light

c. x-ray; light

d. light; x-ray

1. A flat panel containing rows and columns of thousands of detector elements defines a(n):
   1. Phosphor plate
   2. Active matrix array
   3. CR reader
   4. CR cassette
2. In a typical 2.5 cm CCD designed for fluoroscopy, each pixel is only \_\_\_\_ in size:
   1. 14 microns
   2. 50 microns
   3. 100 microns
   4. 300 microns
3. The TFT (thin-film transistor) is just a *part* of a del in all the following EXCEPT:
   1. CMOS
   2. CCD
   3. Direct-conversion DR
   4. DFPD
4. Which of the following has a *continuous detection surface* overlying an AMA of TFTs:
   1. CMOS
   2. CCD
   3. Direct-conversion DR
   4. DFPD
5. Charge-coupled devices (CCDs) have:
   1. High spatial resolution
   2. High signal-noise ratio (SNR)
   3. Twice the frame rate of conventional TV cameras
   4. All the above
6. In a CMOS (complimentary metal oxide semiconductor), a p-type transistor and an n-type transistor are stacked together to form a(n):
   1. CCD
   2. Electronic gate
   3. MOSFET
   4. TFT
7. Which of the following reduces noise by combining data from previous and subsequent frames to the current frame:

a. Temporal averaging

1. Frame interpolation
2. High pulse intervals
3. Boost image
4. Due to the amount of electronics embedded within each del, which of the following has the lowest *fill factor:* 
   1. The AMA for DR
   2. CCD
   3. CMOS
   4. DFPD
5. In which of the following does each individual del have its own separate detection surface:
   1. The AMA for DR
   2. CMOS
   3. DFPD
   4. All of the above
6. In the CCD, each \_\_\_\_ in the underlying AMA becomes an individual del, resulting in higher sharpness when compared to CMOS or DR:
   1. Pixel
   2. Capacitor
   3. TFT (thin-film transistor)
   4. Detection surface
7. Within the CCD, the data flowing from the TFTs to the corner of the device is:
   1. Digital
   2. Analog
   3. Amplified
   4. Light
8. DFPDs (dynamic flat panel detectors) use the same type of detector elements as DR, only with:
   1. Smaller del size
   2. Larger del size
   3. Thicker dels
   4. Thinner dels
9. Similar to indirect-conversion DR, for *indirect-capture DFPD,* the dels are positioned under a(n)
   1. scintillation layer
   2. AMA of TFTs
   3. Light-dispersion filters
   4. X-ray filters
10. For DFPDs, compared to cesium iodide detectors, gadolinium detectors have:
    1. Greater expense
    2. The same spatial resolution
    3. Less spatial resolution
    4. More spatial resolution
11. Operating in the *dynamic mode,* a dual-use DFPD can “bin” together groups of 4 dels to form an effective pixel with dimensions of:
    1. 14 microns
    2. 100 microns
    3. 300 microns
    4. 1 mm
12. Typical indirect-conversion DFPD systems produce a resolution of about:
    1. 2.5 LP/mm
    2. 5 LP/mm
    3. 8 LP/mm
    4. 10 LP/mm
13. Although an image intensifier inherently produces twice the sharpness of a DFPD, the \_\_\_\_\_\_\_ that must be mounted atop the image intensifier brings the resolution back down to a level comparable to the DFPD:
    1. Lens and mirror system
    2. Spot filmer
    3. Fiber-optic coupler
    4. Output phosphor
14. Unlike an image intensifier, the DFPD:
    1. Has consistent sharpness regardless of the field-of-view (FOV) used
    2. Changes sharpness with changes in the FOV
    3. Requires technique increases at a smaller FOV
    4. Does not make different FOVs available
15. Within a DFPD, after each *frame,* a \_\_\_\_\_\_\_\_ below the detector “erases” any residual electrical charge that would result in a ghost image on the next frame:
    1. Magnetic flash system
    2. Electronic flash system
    3. LED (light-emitting diode) array
    4. Fluorescent light bulb
16. To prevent aliasing, grids for DFPDs have:
    1. Low frequency of grid lines
    2. High grid ratios
    3. Diagonal grid lines
    4. Perpendicular grid lines
17. Which of the following reduces patient dose during digital fluoroscopy:
    1. Use of *intermittent fluoroscopy*
    2. Allowing the 5-minute timer to emit its audible signal
    3. “Last-image hold”
    4. All of the above
18. During digital fluoroscopy, use of short bursts of radiation to produce individual image frames defines:
    1. Interpolation
    2. Pulsed fluoroscopy
    3. High-contrast fluoroscopy
    4. Intermittent fluoroscopy
19. To the human eye, *flicker* is apparent at frame rates below a threshold of:
    1. 12 frames per second (fps)
    2. 15 fps
    3. 20 fps
    4. 30 fps
20. During digital fluoroscopy, to reduce patient dose:
    1. Increase pulse width
    2. Use pulsed mode rather than continuous mode
    3. Increase frame rate
    4. Reset the 5-minute timer before it runs out
21. To achieve fast interrogation and extinction times during digital fluoroscopy, use:
    1. Single-phase generators
    2. 3-phase generators
    3. Low-frequency generators
    4. High-frequency generators
22. During digital fluoroscopy, a frame rate of 15 frames per second can be used *without flicker* IF:
    1. mA is increased
    2. kVp is increased
    3. high resolution is essential
    4. frames are interpolated by the computer between actual exposure frames
23. Which of the following is an indication of the mA being used during each exposure pulse:
    1. Pulse width
    2. Pulse height
    3. Pulse interval
    4. Frame rate
24. Which of the following is inversely related to frame rate:
    1. Instantaneous dose
    2. Pulse height
    3. Pulse interval
    4. Pulse width
25. During pulsed fluoroscopy, to avoid noise in the image, the shorter the pulse width, the:
    1. Greater the pulse interval required
    2. Higher the kVp required
    3. Higher the mA required
    4. Longer the exposure time required
26. A higher than usual frame rate is required for:
    1. Short pulse intervals
    2. Lower mA
    3. Lower kVp
    4. Organs that are expected to move
27. Multiply the pulse height by the pulse width to obtain an indication of:
    1. Total patient dose for the procedure
    2. Instantaneous dose
    3. Average dose rate for the procedure
    4. Technique used
28. During pulsed fluoroscopy, which of the following is NOT recommended for saving patient dose:
    1. High contrast ratio
    2. Field size restriction
    3. High conversion gain
    4. Boost image
29. Compared to early “open” fluoroscopy, the invention of the *image intensifier* in the 1940s dramatically reduced:
    1. mA required
    2. patient dose
    3. operator dose
    4. all of the above
30. To intensify the incoming image, the image intensifier tube must first convert it into an electron beam that can be:
    1. Focused
    2. Accelerated
    3. Both of the above
    4. Neither of the above
31. The light image from an image intensifier is transmitted to a digital recording device through:
    1. Copper wires
    2. Coaxial cables
    3. An optical lens and mirror system
    4. A bundle of optic fibers
32. dFor image quality, the KEY difference between a CCD and a CMOS is that the CCD:
    1. has a continuous detection surface not obstructed by electronics
    2. has processing capability within each del
    3. uses TFTs, whereas the CMOS does not
    4. use amorphous selenium rather than amorphous silicon
33. Which of the following is a functional difference between a CCD and a CMOS:

a. The way x-rays are absorbed

b. The way light is absorbed

c. The way electrical charge is stored

d. The way data is read off the chip

1. Compared to the CCD, CMOS has better:
   1. Speed
   2. Conversion efficiency
   3. Economy
   4. All of the above
2. Which of the following DFPD scintillation materials can be formed into rod-shaped crystals to reduce light dispersion and improve sharpness:
   1. Barium fluorochloride
   2. Gadolinium oxysulfide
   3. Cesium iodide
   4. Indium tin oxide
3. Advantages of DFPDs over image intensifiers include:
   1. Freedom from distortion
   2. Lower grid ratios may be used
   3. Lower power requirements
   4. All of the above
4. During DF, which of the following is defined as the time required for the x-ray tube to be

switched on:

* 1. Exposure time
  2. Pulse time
  3. Interrogation time
  4. Extinction time

1. During pulsed-progressive mode DF, selecting a 3 ms pulse width instead of a 6 ms pulse width:
   1. Cuts patient dose in half
   2. Doubles spot image sharpness
   3. Forces the unit to increase the mA
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2. Which of the following reduces noise by combining data from previous and subsequent frames to the current frame:
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