

## DR Introduction

### Multiple Choice

Identify the choice that best completes the statement or answers the question.

- \_\_\_ 1. Photoconductors are materials that:
- produce light when absorbing x-rays.
  - produce x-rays when absorbing light.
  - absorb light and produce electric charges.
  - absorb x-rays and produce electrical charges.
- \_\_\_ 2. A device that includes a photosensitive array and small pixels that convert light into electrical charges is known as a \_\_\_\_\_ transistor.
- thin-field
  - field-effect
  - thin-film
  - field-energy
- \_\_\_ 3. Flat-panel detectors that use indirect conversion technology convert:
- electrical signals to light.
  - light to x-rays.
  - x-rays to electrical signals.
  - x-rays to visible light.
- \_\_\_ 4. Indirect conversion in flat-panel detectors is a \_\_\_\_-step process.
- one
  - two
  - three
  - four
- \_\_\_ 5. The type of flat-panel detector that uses thin films of silicon integrated with arrays of photodiodes is known as a(n):
- CsI detector.
  - charge-coupled device.
  - CMOS.
  - amorphous silicon detector.
- \_\_\_ 6. CsI detectors use:
- rare-earth scintillators.
  - thin crystalline needles.
  - miniature cameras.
  - specialized pixel sensors.
- \_\_\_ 7. In CsI detectors:
- there is very little light spread.
  - crystalline needles block light from the detector.
  - x-rays are converted into an electrical signal.
  - light spread causes resolution to decrease.

- \_\_\_ 8. Which statement best describes a charge-coupled device (CCD)?
- It is the oldest direct conversion technology that is still in use today.
  - It is the oldest direct conversion technology with limited use today.
  - It is the oldest indirect conversion technology that is no longer used in medical imaging.
  - It is the oldest indirect conversion technology used in a variety of image capture applications.
- \_\_\_ 9. Which of the following statements about scintillators is true?
- All scintillators absorb the same amount of x-ray photons.
  - The amount of x-rays absorbed depends on the type of scintillator.
  - Structured phosphors produce more light spread.
  - Unstructured phosphors are more efficient.
- \_\_\_ 10. \_\_\_\_\_ can be removed from the Bucky and is used on the tabletop or a stretcher.
- Full panel digitizer
  - Flat-panel detector
  - Folding pixel detector
  - Failure to properly digitize
- \_\_\_ 11. The \_\_\_\_\_ array is divided into square detector elements (DEL).
- ADC
  - IP
  - TFT
  - SNR
- \_\_\_ 12. The indirect conversion detector uses:
- A scintillator
  - A photodetector
  - Amorphous selenium
  - A and B
- \_\_\_ 13. Which of the following is the sequence of events, from beginning to end, for production of a DR image using direct conversion detectors?
- Image matrix is formed in computer.
  - Charge is briefly stored in TFT array.
  - Exit radiation is converted to electrical charge.
  - Electronic signal goes to ADC.
- 3, 4, 1, 2
  - 4, 2, 3, 1
  - 2, 4, 3, 1
  - 3, 2, 4, 1
- \_\_\_ 14. The ability of the detector to accurately capture the variety of photon intensities in the remnant radiation is:
- Pixel depth
  - Dynamic range
  - ALARA
  - Pixel sensitivity
- \_\_\_ 15. Overexposing a digital image receptor may result in a quality image, but:
- Quantum noise will be visible.

- b. The SNR will be poor.
  - c. The ALARA principle has not been followed.
  - d. The system will not last as long as expected.
- \_\_\_ 16. Having a higher DQE indicates a potentially
- a. lower patient dose
  - b. higher patient dose
  - c. similar patient dose
- \_\_\_ 17. The role of mAs in digital imaging includes
- a. being the controlling factor of density
  - b. determining the quantity of radiation and patient dose
  - c. selecting optimum mAs to provide sufficient quanta to expose the receptor and avoid excessive noise
  - d. A and B
  - e. B and C

**True/False**

*Indicate whether the statement is true or false.*

- \_\_\_ 1. The quality of the CR latent image will remain the same for up to 6 hours after exposure.
- A. True
  - B. False
- \_\_\_ 2. Both CR and DR are electronic detectors that combine image capture and image readout.
- A. True
  - B. False
- \_\_\_ 3. The DR system does not require a separate reader unit.
- A. True
  - B. False
- \_\_\_ 4. With an FPD, electrical charges from each DEL are read out separately.
- A. True
  - B. False
- \_\_\_ 5. Exit radiation is converted to visible light with the direct conversion detector.
- A. True
  - B. False
- \_\_\_ 6. The dynamic range of a digital imaging system is significantly larger than a film-screen system.
- A. True
  - B. False
- \_\_\_ 7. Because digital imaging has a large dynamic range, significantly lower than necessary x-ray exposure will still result in a quality image.
- A. True
  - B. False

\_\_\_ 8. With digital imaging, mAs does not control image brightness

## DR Introduction Answer Section

### MULTIPLE CHOICE

1. ANS: D                   PTS: 1                   REF: 86  
OBJ: Define a TFT flat-panel digital image detector.
2. ANS: C                   PTS: 1                   REF: 86  
OBJ: Define a TFT flat-panel digital image detector.
3. ANS: D                   PTS: 1                   REF: 87  
OBJ: Describe the construction of direct and indirect TFT flat-panel detector systems.
4. ANS: B                   PTS: 1                   REF: 87  
OBJ: Differentiate between direct and indirect image capture.
5. ANS: D                   PTS: 1                   REF: 88  
OBJ: Differentiate between direct and indirect image capture.
6. ANS: B                   PTS: 1                   REF: 88                   OBJ: Describe a CsI detector.
7. ANS: A                   PTS: 1                   REF: 89                   OBJ: Describe a CsI detector.
8. ANS: D                   PTS: 1                   REF: 100                  OBJ: Explain the function of a CCD.
9. ANS: B                   PTS: 1                   REF: 102                  OBJ: Describe the components of a CCD.
10. ANS: B  
The detector system is usually dedicated to a single room and is permanently mounted in the table or upright Bucky system, but flat-panel digital detectors are also available as mobile IRs.  
  
PTS: 1                   OBJ: 3
11. ANS: C  
The thin-film transistor (TFT) array is divided into square detector elements (DEL).  
  
PTS: 1                   OBJ: 2
12. ANS: D  
A detector that is the indirect conversion type uses a scintillator (to convert x-rays to light) and a photodetector. Amorphous selenium is found in the direct conversion type detector.  
  
PTS: 1                   OBJ: 6
13. ANS: D  
With DR imaging, exit radiation is converted to an electrical charge which is briefly stored in the TFT array. The electronic signal then goes to the ADC to be digitized, and the digital information is used to form the image matrix.  
  
PTS: 1                   OBJ: 3
14. ANS: B  
Dynamic range describes how well the detector can capture small to large photon intensities.  
  
PTS: 1                   OBJ: 7
15. ANS: C  
Overexposing the image receptor means that the patient was overexposed, going against the ALARA principle.

- PTS: 1                    OBJ: 2
16. ANS: A  
A higher DQE (within limits) indicates that a lower exposure can be used to produce an optimal image, potentially reducing patient dose.
- PTS: 1                    REF: 165                    OBJ: 7
17. ANS: E  
The mAs no longer controls density of the image, but still determines the quantity of radiation exposing the patient. An optimum mAs should be selected to provide sufficient quanta to expose the receptor and avoid excessive noise.
- PTS: 1                    REF: 166                    OBJ: 8

### TRUE/FALSE

1. ANS: F  
Exposed CR IPs should be processed within 1 hour after exposure to prevent latent image deterioration.
- PTS: 1                    OBJ: 3
2. ANS: F  
Only DR combines image capture and readout. CR requires the image to go through a separate reader unit following image capture.
- PTS: 1                    OBJ: 3
3. ANS: T  
The DR system sends the digital signal directly to the computer.
- PTS: 1                    OBJ: 3
4. ANS: T  
With the flat-panel detector, each DEL has its own capacitor to store the electrical charge which will then be read out separately.
- PTS: 1                    OBJ: 2
5. ANS: F  
Exit radiation is converted directly to an electrical signal with direct conversion detectors. Light is only involved with indirect conversion detectors.
- PTS: 1                    OBJ: 6
6. ANS: T  
As compared to film-screen, one of the key advantages to digital imaging is its wide dynamic range.
- PTS: 1                    OBJ: 7
7. ANS: F  
Digital imaging still requires sufficient exposure to produce a quality image. Too low of an exposure will result in an image with significant quantum noise.
- PTS: 1                    OBJ: 7
8. ANS: T

Although mAs still controls the quantity of radiation produced, it no longer controls image density or brightness.

PTS: 1

REF: 166

OBJ: 7