

Ultrasound Physics Vocabulary Quiz

Part 2: System Components, Image Processing & Hemodynamics

Chapters 9–18 | Edelman, *Understanding Ultrasound Physics*, 4th Ed.

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Student Name: _____

Date: _____

Instructions: Read each definition or description carefully. Select the **one best answer** (A, B, C, or D) that matches the term described. Write your answer in the space provided after each question.

Chapter 9: Transducers

1. The piezoelectric crystal within the transducer that converts electrical energy to sound and vice versa. Its thickness determines the frequency of pulsed-wave sound, and it is one-half wavelength thick.

- A. Matching Layer
- B. Active Element
- C. Backing Material
- D. Beam Former

Answer: _____

2. The critical temperature above which a piezoelectric material permanently loses its piezoelectric properties. Transducers must not be autoclaved or exposed to extreme heat.

- A. Curie Temperature
- B. Acoustic Insulator
- C. Thermal Index
- D. Demodulation

Answer: _____

Chapter 10: Sound Beams & Focusing

3. The distance from the transducer face to the focus (the narrowest point of the beam). Determined by crystal diameter and frequency: larger diameter and higher frequency yield a longer value.

- A. Near Field
- B. Beam Divergence
- C. Far Field
- D. Focal Length

Answer: _____

4. Additional areas of sound energy created by single-element transducers that radiate at angles off the main beam axis, degrading image quality by creating false echoes.

- A. Grating Lobes
- B. Focal Zone
- C. Side Lobes
- D. Beam Divergence

Answer: _____

5. The third dimension of image resolution, dealing with the beam's thickness perpendicular to the imaging plane. It is typically the worst of the three resolution types and creates volume averaging artifacts.

- A. Axial Resolution
- B. Lateral Resolution
- C. Slice Thickness
- D. Focal Point

Answer: _____

Chapters 11–12: Displays & Arrays

6. A display format where returning echoes are shown as upward spikes on a graph, with the x-axis representing depth and the y-axis representing echo strength. The oldest and simplest display mode.

- A. B-Mode
- B. M-Mode
- C. A-Mode
- D. Bistable Display

Answer: _____

7. A display that shows the changing position of reflectors over time by repeatedly interrogating a single scan line. The x-axis represents time and the y-axis represents depth. Commonly used for cardiac imaging.

- A. A-Mode
- B. B-Mode
- C. Bistable Display
- D. M-Mode

Answer: _____

8. A transducer built on a curved surface that produces a wider, fan-shaped field of view than a flat linear array. Commonly used for abdominal imaging.

- A. Linear Sequential Array
- B. Vector Array
- C. Convex Array
- D. Annular Phased Array

Answer: _____

9. A method of focusing the beam using electronic time delays applied to multiple array elements. Unlike lens or curved crystal focusing, it is adjustable by the sonographer.

- A. External Focusing
- B. Internal Focusing
- C. Mechanical Steering
- D. Electronic Focusing

Answer: _____

10. The application of time delays during reception so that returning echoes from different depths are properly aligned, improving lateral resolution across the entire image. It can occur at many depths simultaneously.

- A. Dynamic Aperture
- B. Electronic Steering
- C. Dynamic Receive Focusing
- D. Phasing

Answer: _____

Chapter 13: Temporal Resolution & Frame Rate

11. The number of complete images produced per second by the ultrasound system. It is determined by imaging depth, number of pulses per image, and sector size.

- A. Temporal Resolution
- B. Line Density
- C. Pulse Repetition Frequency
- D. Frame Rate

Answer: _____

12. The spacing between scan lines in an image. A higher value means more pulses per image, which improves spatial detail but reduces frame rate and temporal resolution.

- A. Frame Rate
- B. Field of View
- C. Line Density
- D. Pixel

Answer: _____

Chapters 14–16: System Components & Instrumentation

13. The first receiver function, where every returning signal is made larger by an identical amount. Adjustable by the sonographer, it changes overall image brightness but does not improve signal-to-noise ratio.

- A. Compensation
- B. Output Power
- C. Preamplification
- D. Amplification

Answer: _____

14. Also called Time Gain Compensation (TGC) or Depth Gain Compensation (DGC), this receiver function selectively amplifies signals from deeper structures more than shallow ones to correct for attenuation.

- A. Amplification
- B. Reject
- C. Compensation
- D. Compression

Answer: _____

15. The fifth receiver function, which eliminates low-level signals (noise and weak echoes) below a chosen threshold from the image. Adjustable by the sonographer.

- A. Compression
- B. Demodulation
- C. Wall Filter
- D. Reject

Answer: _____

16. Sophisticated electronics that coordinate the complex timing of phase delays for array transducers, controlling both the steering direction and focal depth of the sound beam.

- A. Pulser
- B. Receiver
- C. Scan Converter
- D. Beam Former

Answer: _____

17. The ratio of the largest to the smallest signal that a system component can handle, reported in decibels. A wide value means many shades of gray (low contrast); a narrow value means few shades (high contrast).

- A. Signal-to-Noise Ratio
- B. Compression
- C. Bit Depth
- D. Dynamic Range

Answer: _____

Chapter 15: Image Processing

18. The smallest building block of a digital image. Each one stores a brightness value, and more of them in an image means greater spatial detail.

- A. Bit
- B. Scan Converter
- C. Voxel
- D. Pixel

Answer: _____

19. Magnifying an image during data acquisition by rescanning only the region of interest. It improves detail because the same number of pixels covers a smaller area. This is a preprocessing function.

- A. Read Magnification
- B. Postprocessing
- C. Write Magnification
- D. Persistence

Answer: _____

20. Displaying information from multiple previous frames averaged with the current frame to reduce noise and create a smoother image. Higher values reduce noise but can blur moving structures.

- A. Spatial Compounding
- B. Postprocessing
- C. Preprocessing
- D. Persistence

Answer: _____

Chapter 17: Harmonics

21. A frequency exactly twice the transmitted (fundamental) frequency, generated as sound travels through tissue. Imaging with this frequency creates cleaner images because it does not form at the skin surface or in side lobes.

- A. Fundamental Frequency
- B. Contrast Agents
- C. Tissue Harmonics
- D. Nonlinear Behavior

Answer: _____

22. Gas-filled bubbles (1 to 10 micrometers) injected intravenously that produce strong echoes due to nonlinear oscillation. They resonate and vibrate in the sound field, producing powerful harmonic signals.

- A. Tissue Harmonics
- B. Enhancement
- C. Contrast Agents
- D. Scattering

Answer: _____

Chapter 18: Hemodynamics

23. The principle that flow rate (volume per unit time) must remain the same at all points in a closed system: $A_1 V_1 = A_2 V_2$. Clinically used to calculate the area of stenotic heart valves.

- A. Bernoulli's Principle
- B. Poiseuille's Law
- C. Range Equation
- D. Continuity Equation

Answer: _____

24. A measure of a fluid's internal "thickness" or resistance to flow, influenced by hematocrit (the percentage of red blood cells). Higher values mean more energy is lost as blood flows.

- A. Density
- B. Stiffness
- C. Resistance
- D. Viscosity

Answer: _____

25. An abnormal narrowing of a blood vessel or heart valve. According to the continuity equation, blood velocity increases through the narrowing; according to Bernoulli's principle, pressure drops within it.

- A. Aneurysm
- B. Occlusion
- C. Stenosis
- D. Turbulent Flow

Answer: _____

Score:

/ 25

Percentage:

%

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