



Professional Ultrasound Services

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Midterm No. 1

1. Which of the following terms refers to regions of decreased particle density in a sound wave?
 - a. Refraction
 - b. Compression
 - c. Diffraction
 - d. Rarefaction

2. A higher frequency transducer will have _____ and _____ compared to a lower frequency transducer.
 - a. Shorter wavelength, more penetration
 - b. Longer wavelength, more penetration
 - c. Shorter wavelength, less penetration
 - d. Longer wavelength, less penetration

3. The absence of echo information distal to a structure that is highly reflective is called:
 - a. Posterior acoustic shadowing
 - b. Hyperattenuation
 - c. Posterior acoustic enhancement
 - d. Hypoechoic

4. A papilla is best described as:
 - a. A solid polyp
 - b. A solid irregularity of the inner surface of a cystic mass
 - c. nipple like protuberance into the lumen of a structure
 - d. A complex wall irregularity that produces critical angle artifact

5. The distance between areas of compression in an ultrasound wave is technically referred to as:
 - a. Period
 - b. Frequency
 - c. Amplitude
 - d. Wavelength

6. Period is best defined mathematically as:
 - a. A^2
 - b. $1 / \text{frequency}$
 - c. VF
 - d. λ/F

7. The primary mechanism by which absorption attenuates a sound beam is:
 - a. Rayleigh's scattering
 - b. Redirection of beam in many directions
 - c. Specular reflection
 - d. Conversion of sound energy in to heat

8. Scattering generally _____ sound beam energies.
 - a. Dissipates
 - b. Reflects
 - c. Diverges
 - d. Absorbs

9. Sonography reveals a sharply defined, highly echogenic focus within the parenchyma of the right lobe of the liver. There is a distinct posterior acoustic shadow associated with this focus. Which of the following represents a likely diagnosis?
 - a. Hepatic adenoma
 - b. Biliary tree calcification
 - c. Liver cyst
 - d. Portal vein thrombosis

10. Which of the following findings is not considered to be an advantage of real-time ultrasound imaging over static imaging?
 - a. Assessing fetal cardiac motion
 - b. Differentiating bowel from other masses
 - c. Differentiating a vascular structure from a cyst
 - d. Measuring the AP diameter of the aorta

11. A crystal that has symmetrically arranged molecules within its structural matrix is called:
 - a. Anisotropic
 - b. Piezoelectric
 - c. Lead zirconate titanate
 - d. Isotropic

12. In an ultrasound transducer, which of the following is not achieved by the damping material?
 - a. Removes excess electrical charges stored in transducer
 - b. Limits length of ultrasound pulse
 - c. Improves axial resolution
 - d. Increases receiving sensitivity of the crystal

13. The primary determinant of lateral resolution is:
 - a. Propagation speed structure being examined
 - b. Size of structure being imaged
 - c. Beam width
 - d. Transducer frequency

14. Which of the following imaging system controls does not adjust echo strength to account for the effects of attenuation?
 - a. Overall gain
 - b. Time gain compensation
 - c. Depth gain compensation
 - d. Post-processing

15. Which of the following units of measurement are not used to describe sound wave parameters?
 - a. joules
 - b. Hertz
 - c. μs
 - d. mm

16. Axial resolution is the ability to discriminate between two _____ aligned _____ the ultrasound beam.
 - a. Structures; along the primary axis of
 - b. Structures; at right angles to
 - c. Reflectors; along the main axis of
 - d. Reflectors; perpendicular to the main axis of

17. The process by which mechanical (sound) energy is converted into electrical energy is called
 - a. Sonography
 - b. Piezoelectric effect
 - c. Snell's effect
 - d. Huygen's principle
18. Which of the following transducer materials is synthetically produced?
 - a. Quartz
 - b. Tourmaline
 - c. Lead zirconate titanate
 - d. Rochelle salts
19. Which of the following findings is not considered to be an advantage of real-time ultrasound imaging over static imaging?
 - a. Diaphragmatic movement
 - b. Pulsations of blood vessels
 - c. Echogenic filling of the aorta
 - d. Abdominal organ excursion
20. If a 2 MHz ultrasound pulse travels 3cm in soft tissue, what is the total attenuation?
 - a. 6dB
 - b. 3dB
 - c. 0.5dB
 - d. 0.05dB
21. Scattered ultrasound energy is most useful in diagnostic applications by producing:
 - a. Imaging echoes
 - b. Doppler information
 - c. Real-time images
 - d. Increased transducer sensitivity
22. Which of the following is the best statement describing the amplitude of a sound wave??
 - a. The maximum increase in the pressure of a wave.
 - b. The maximum intensity of a sound wave.
 - c. The greatest difference in time between wave peaks.
 - d. The maximum time required to complete a single wave cycle.
23. Pressure is defined as:
 - a. Mass/unit volume
 - b. Force/unit volume
 - c. Energy/unit time
 - d. Distance/unit time
24. A structure that is a poor producer of imaging echoes is called:
 - a. Echopenic
 - b. Hyperechoic
 - c. Isoechoic
 - d. Echogenic
25. The reflection coefficient (the ratio of reflected to incident beam amplitude) at a specular interface is most closely related to:
 - a. The incident beam intensity
 - b. The average speed of sound in the medium
 - c. The average attenuation in the medium
 - d. The change in impedance at the interface

26. The reduction in the amplitude and intensity of a sound beam as a function of the distance it travels through a medium is referred to by the term:
- Impedance
 - Reflection
 - Scatter
 - Attenuation
27. The highest speed of sound would be recorded through which body structure:
- Lung
 - Bone
 - Muscle
 - Blood
28. Which of the following sonographic characteristics is not typically associated with a simple cyst?
- Heterogeneous texture
 - Smooth borders
 - Anechoic lumen
 - Posterior acoustic enhancement
29. The overall reduction in intensity of a sound beam as it travels through soft tissue is called:
- Absorption
 - Attenuation
 - Reflection
 - Scattering
30. How will switching from a 2.5MHz transducer to a 5MHz transducer change the ultrasound beam?
- Decrease wavelength
 - Increase wavelength
 - Decrease velocity
 - Increase velocity
31. Which of the following factors most strongly influences the speed of sound in liver tissue?
- Transducer frequency
 - Transmitted beam intensity
 - Liver size
 - Liver tissue stiffness
32. Sound is a type of _____ energy.
- Light
 - Quantum
 - Mechanical
 - Electromagnetic
33. Sonography reveals a well-circumscribed, hypoechoic mass within the walls of the uterus. There is no posterior acoustic enhancement. Which of the following diagnoses is least likely correct?
- Nabothian cyst
 - Uterine fibroid
 - Uterine sarcoma
 - Endometrial polyp

34. Real-time imaging is an automated _____ imaging process.
- A-mode
 - B-mode
 - M-mode
 - TM-Mode
35. The component of an ultrasound transducer that stops excessive "ringing" if the crystal is:
- Matching layers
 - Insulation ring
 - Damping material
 - Facing material
36. Lateral resolution is the ability to discriminate between two _____ aligned _____ the ultrasound beam.
- Structures; along the primary axis of
 - Structures; at right angles to
 - Reflectors; along the main axis of
 - Reflectors; perpendicular to the main axis of
37. Gain controls on an ultrasound imaging system are primarily used to:
- Adjust echo brightness to compensate for attenuation
 - Increase/decrease amplitude of emitted sound wave
 - Increase/decrease intensity of emitted sound wave
 - Adjust sound beam frequency/wavelength to improve image resolution
38. High resolution real-time ultrasound imaging of a patient's right breast reveals the present of a focal anechoic mass lesion with smooth, sharp borders and obvious posterior acoustic enhancement. Which of the following diagnoses is most likely?
- Fibrocystic disease
 - Solid ductal cell carcinoma
 - Breast cyst
 - Microcalcifications
39. The information stored and displayed in the pixels that comprise a sonographic image are usually provided by:
- Image artifacts
 - The sonographer
 - Scattered energies
 - Reflected echoes
40. The bending away of the sound beam from incident angle is called:
- Refraction
 - Reflection
 - Divergence
 - Diffraction
41. If the stiffness of a tissue increases, the speed of sound (propagation speed) will:
- Increase
 - Decrease
 - Remain constant
42. A lower frequency transducer will _____ but _____ than a higher resolution transducer.
- Penetrate better, provide lower quality images
 - Penetrate better, provide higher quality images
 - Penetrate less, provide higher quality images
 - Penetrate less, provide equal quality images

43. The most appropriate transducer for performing a sonogram on a large patient's abdomen will be:
- 5.0MHz sector
 - 2.5MHz sector
 - 5.0MHz linear array
 - 7.0MHz curvilinear probe
44. The range of ultrasound frequencies used in medical diagnosis is typically:
- 1 – 10 MHz
 - 20, - 20,000 Hz
 - 3.5 and 5.0 MHz
 - > 20 KHz
45. A Hyperattenuative structure is one that appears:
- Isoechoic with surrounding tissue
 - Anechoic with posterior acoustic enhancement
 - Less echogenic than adjacent tissue
 - More echogenic than adjacent tissue
46. Intensity is defined as:
- Mass/unit volume
 - Force/unit volume
 - Energy/unit area
 - Distance/unit time
47. The distribution of sound wave energy over an area is referred to as:
- Spatial
 - Temporal
 - Resolution
 - Inertial
48. Propagation speed is _____ in tissues that are more dense.
- Slower
 - Faster
 - Not changed
49. Which of the following most accurately represents the rate of sound attenuation in human soft tissue?
- 1 Mz/cm/sec
 - 1 cm/sec/MHz
 - 1 dB/sec/MHz
 - 1dB/cm/MHz
50. The shape of the outline or boundaries of a structure is called its:
- Histology
 - Lumen
 - Contour
 - Geography
51. Electronic real-time ultrasound imaging probes sweep the beam through the body by using:
- Oscillating mirrors
 - Rotating transducer crystals
 - Timing circuits
 - Bells and whistles

52. The physical mechanism that results in actual loss of energy from a sound beam is:
- Scattering
 - Divergence
 - Absorption
 - Diffraction
53. A structure images with ultrasound that contains areas of increased echogenicity, decreased echogenicity and has cystic and solid components may be described as:
- Irregular
 - Loculated
 - Homogenous
 - Complex
54. The velocity of ultrasound in human soft tissue is presumed to be approximately:
- 1540 cm/s
 - 1540 m/s
 - 1.54 m/s
 - 0.0154 m/s
55. The speed at which an ultrasound beam travels through tissue such as liver depends primarily on:
- Frequency and wavelength of the sound beam
 - Amplitude and intensity of the sound beam
 - Stiffness and density of the transducer's piezoelectric element
 - Stiffness and density of liver tissue
56. Which of the following is a mathematically correct variant of the wave formula?
- $V = F/W$
 - $F = W/V$
 - $F = V/W$
 - $W = VF$
57. A higher frequency transducer will have _____ and _____ compared to a lower frequency transducer.
- Less resolution, more penetration
 - Less Resolution, less penetration
 - Better resolution, more penetration
 - Better resolution, less penetration
58. An anatomical structure that produces enough reflected sound information to produce a two dimensional sonographic image is said to be:
- Echogenic
 - Anechoic
 - Echogenic
 - Hyperattenuative
59. A mass that contains homogenous, uniform low-level echoes and does not exhibit posterior acoustic enhancement is most likely:
- Cystic
 - Solid
 - Complex
 - Mixed
60. The time required for the completion of a single wave cycle is its:
- Period
 - Frequency
 - Amplitude
 - Wavelength

61. The best definition of the strength of a mechanical wave is:
- Intensity
 - Compressibility
 - Stiffness
 - Amplitude
62. When two waves occur at the same time and in the same place, which phenomenon will likely result?
- Rayleigh scattering
 - Constructive interference
 - Damping
 - Destructive interference
63. The mathematical expression of ultrasound attenuation is called the:
- Absorption rate
 - Attenuation
 - Attenuation coefficient
 - Attenuation reciprocal
64. Which of the following terms would not be appropriately used in describing the sonographic contour of a structure?
- Well-defined
 - Smooth
 - Ill-defined
 - Complex
65. Which of the following findings is not considered to be an advantage of real-time ultrasound imaging over static imaging?
- Obtaining multiple measurements of a structure
 - Demonstrating organ motion
 - Performing a quick anatomical survey
 - Reducing overall examination time
66. The primary determinant of axial resolution is:
- Propagation speed structure being examined
 - Size of structure being imaged
 - Beam width
 - Transducer frequency
67. The unit of measurement of acoustic impedance is the:
- Joule
 - Rayl
 - Watt
 - Erg
68. The velocity of ultrasound in human soft tissue most closely approximates:
- 1540 cm/sec
 - 6.5cm/ μ s
 - 6.5 μ s/cm
 - 13.0 μ s/cm
69. The bending of a sound beam into a specific geometric shape by an aperture is called:
- Refraction
 - Reflection
 - Divergence
 - Diffraction

70. Attenuation is _____ related to frequency of the sound beam.
- Directly
 - Inversely
 - Not
71. Endovaginal sonography of a 28yo asymptomatic patient demonstrates a well-circumscribed mass in the area adjacent to the uterus (adnexa). This mass has smooth borders, a heterogeneous internal architecture, and demonstrates good posterior acoustic enhancement. What is it?
- Normal muscle
 - A calcified dermoid
 - Normal urinary bladder
 - Normal ovary
72. The presence of multiple, linear echoes appearing parallel to a strongly reflective surface close to the face of the transducer represent:
- Reverberation artifact
 - Refraction artifact
 - Posterior acoustic enhancement
 - Not enough gel on the patient's skin
73. a transducer crystal above the Curie point may cause:
- Loss of piezoelectric properties
 - Melting
 - Sterilization
 - Improved axial resolution
74. Lateral resolution is best defined as:
- Clearly seeing two small structures lateral to each other
 - Ability to display two small echoes at a right angle to beam angle
 - Differentiating between two (or more) lateral tissue planes in an organ
 - Ability to display two small echoes along the beam path
75. Temporal intensity may refer to the energy distribution over:
- Matter
 - Anti-matter
 - Space
 - Time
76. Attenuation results in _____ in amplitude of a sound beam.
- Decrease
 - Increase
 - No change
77. Wavelength is measured in units of:
- Distance
 - Time
 - Velocity
 - Intensity
78. Velocity is _____ related to compressibility:
- Directly
 - Inversely
 - Not

79. Scattering occurs:
- Upon encountering a large, smooth interface
 - When the sound beam is absorbed
 - When the sound encounters a structure smaller than one wavelength
 - After reflecting off a strong interface, like a gallstone
80. Axial resolution is most directly related to:
- Wavelength
 - Velocity
 - Acoustic impedance
 - Structure size
81. Real-time sonography probes that produce image motion by oscillating the transducer are called:
- Phased sector probes
 - Mechanical sector probes
 - Phased linear array probes
 - Sequential linear array probes
82. Higher frequency transducers are not typically used for deeply located anatomical structures because:
- Higher frequencies are attenuated more rapidly
 - Higher frequencies are attenuated less rapidly
 - Higher frequencies produce more reflections
 - Higher frequencies produce fewer reflections
83. The overall appearance of an anatomic organ or pathologic structure is referred to as its:
- Histology
 - Morphology
 - Echogenicity
 - Geography
84. Which of the following is not a function of the facing materials placed between the transducer crystal and the patient's skin?
- Decrease acoustic mismatch between crystal and skin
 - Improve lateral resolution
 - Protect patient from electrical shock
 - Facilitate entry of ultrasound into the body
85. As transducer frequency increase; axial resolution:
- Increases
 - Decreases
 - Does not change
86. The best unit of measurement for ultrasound wavelength is:
- Hertz
 - cm³
 - g
 - mm
87. The uniform spreading out of a sound beam as it propagates is:
- Refraction
 - Reflection
 - Divergence
 - Diffraction

88. A change in _____ between two media is the most common cause of refraction:
- Velocity
 - Density
 - Thickness
 - Smoothness of surface
89. The time it takes for a single wave to pass a given point in space is called its:
- Wavelength
 - Phase
 - Amplitude
 - Period
90. A structure having similar echogenicity compared to an adjacent structure is said to be:
- Anechoic
 - Hypoechoic
 - Hyperechoic
 - Isoechoic
91. Proper handling and care of an ultrasound imaging probe includes all of the following except:
- Regular examination of cable for breaks or frayed insulation
 - Heat sterilizing prior to biopsy procedures
 - Holding in both hands when carrying across room
 - Careful seating in proper transducer holder when not in use
92. Higher frequency ultrasound transducers produce _____ lateral resolution than lower frequency sound beams.
- Worse
 - Better
 - No change in
93. The combining form piezo- means:
- Pressure
 - Power
 - Force
 - Energy
94. Damping material in an ultrasound transducer is usually made of:
- Silicon
 - PZT
 - Quartz
 - Epoxy
95. Which of the following represents the wave formula?
- $F = VW$
 - $V = FW$
 - $F = W/V$
 - $V = F/W$
96. The relative increase in echogenicity behind a structure that easily transmits ultrasound is called:
- Hyperattenuation
 - Posterior acoustic enhancement
 - Hyperechoic
 - Posterior acoustic shadowing

97. A transducer is best defined as:
- The hand held component of an ultrasound machine
 - Linear, convex, sector, vector or endovaginal
 - A quartz crystal
 - A device that converts one form of energy into another
98. A shorter ultrasound pulse length produces:
- Higher intensity
 - Better axial resolution
 - Stronger reflection
 - Decrease spatial intensity
99. Which of the following factors does not appreciably affect axial resolution:
- Transducer frequency
 - Ultrasound beam wavelength
 - Time gain compensation
 - Pulse length
100. Which of the following units is not a measurement of velocity?
- Miles/hour
 - Cm/s
 - $\mu\text{s}/\mu\text{m}$
 - cycles/s