

COMPREHENSIVE MOCK EXAM 13

Supplemental to: Ultrasound Physics Board Review 2026-2027

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ARDMS SPI (Sonography Principles and Instrumentation) Exam — 110 questions, single-best-answer multiple choice, domain-weighted per the official V24.1 blueprint (23% Perform Ultrasound Examinations / 7% Manage Transducers / 26% Optimize Sonographic Images / 34% Apply Doppler Concepts / 10% Clinical Safety & QA)

Board-Review Questions

1. A system uses 8-bit gray-scale depth for its display. How many genuine distinct gray levels can this system display?
 - A. 8 distinct gray levels total
 - B. 16 distinct gray levels total
 - C. 256 distinct gray levels total
 - D. 1024 distinct gray levels total

2. A system upgrades from 6-bit to 8-bit gray-scale depth. This change genuinely provides which of the following?
 - A. Fewer genuine displayable gray levels than before the upgrade
 - B. More genuine displayable gray levels, improving contrast resolution
 - C. No genuine change in displayable gray levels at all after upgrading
 - D. Genuinely improved axial resolution specifically, unrelated to bit depth

3. A beam traveling in a medium with propagation speed 1450 m/s strikes a boundary with a genuinely faster medium at 1540 m/s. As the angle of incidence increases to the critical angle, the refracted beam travels genuinely along which of the following path?
 - A. Directly back into the first medium, reflected entirely at that boundary
 - B. Straight through the boundary, genuinely unaffected by it at all
 - C. Along the boundary itself, at a genuine 90-degree refraction angle
 - D. Directly perpendicular to the boundary, into the genuine second medium

4. Beyond the critical angle, further increasing the angle of incidence genuinely produces which of the following?
 - A. A genuinely decreasing amount of total reflection compared to the critical angle
 - B. Transmission that genuinely increases progressively beyond the critical angle
 - C. No further genuine change, since transmission was already entirely blocked

D. Continued total reflection, with no genuine transmission occurring at all

5. Huygens' principle genuinely describes which of the following?

A. The mathematical relationship between frequency and genuine wavelength

B. The genuine attenuation coefficient assumed for standard soft tissue

C. The Doppler shift genuinely produced by a moving reflector specifically

D. Each point on a wavefront acting as a source of genuine secondary wavelets

6. When two genuine sound waves arrive in phase, aligning their genuine peaks and troughs, the resulting combined wave amplitude is which of the following?

A. Genuinely greater than either individual wave, from constructive interference

B. Genuinely smaller than either individual wave, from destructive interference

C. Genuinely identical to a single wave, with no combined effect at all

D. Entirely unpredictable without genuinely more information provided

7. When two genuine sound waves arrive genuinely out of phase, with one wave's peak aligning with the other's trough, the resulting combined wave amplitude is which of the following?

A. Genuinely greater than either individual wave, from constructive interference

B. Entirely unpredictable without genuinely more information provided

C. Genuinely reduced compared to either individual wave, from destructive interference

D. Entirely identical to a single wave, with no combined effect at all

8. Comparing attenuation across different media, which of the following genuinely produces the least attenuation per centimeter?

A. Bone, a genuinely dense, highly attenuating medium

B. Lung tissue, containing genuinely significant air content

C. Water or simple fluid, a genuinely weakly attenuating medium

D. Highly attenuating soft tissue at a genuinely high frequency

9. As transmitted frequency genuinely increases, which specific attenuation mechanism becomes genuinely more dominant, relative to the others?

A. Absorption, converting genuinely more acoustic energy into heat

B. Reflection, at genuinely every tissue interface encountered along the path

C. Refraction, at genuinely every oblique tissue boundary encountered

D. None of the individual mechanisms genuinely change with frequency at all

10. Following a standardized scanning protocol for a specific exam type primarily serves which of the following purpose?

A. Genuinely eliminates the need for any sonographer clinical judgment at all

B. Ensures genuinely consistent, complete image acquisition across exams

C. Genuinely improves the transducer's true achievable penetration depth

D. Automatically improves genuine axial resolution regardless of anatomy

11. A sonographer completes a genuine patient exam and, before touching any equipment surface, moves directly to greet the next patient without washing hands. This sequence violates which of the following practice?

A. A genuinely optional courtesy, with no real infection control implication

B. A practice genuinely relevant only when visible contamination is present

C. A practice genuinely required only for immunocompromised patients specifically

D. Hand hygiene genuinely required both before and after every patient contact

12. Proper transducer storage between uses genuinely requires which of the following?

A. Genuinely submerging the entire transducer, including the connector, in fluid

B. Storing the transducer genuinely coiled tightly with the cable kinked sharply

- C. Storing the transducer in a manner genuinely protecting the lens and cable
- D. Genuinely no specific storage consideration is required for transducers

13. The Curie point of a piezoelectric material genuinely refers to which of the following?

- A. The genuine resonant frequency at which the element is genuinely cut
- B. The genuine temperature above which piezoelectric properties are permanently lost
- C. The genuine acoustic impedance value of the piezoelectric material itself
- D. The genuine thickness at which the element produces its optimal frequency

14. Exceeding a piezoelectric element's Curie point during genuine sterilization or storage most directly risks which of the following?

- A. Genuinely improved image quality from the genuine heat exposure itself
- B. Permanent, genuine loss of the element's piezoelectric properties
- C. Genuinely improved axial resolution from the genuine heat exposure itself
- D. No genuine risk whatsoever from exceeding this specific temperature

15. Lead zirconate titanate (PZT) is genuinely significant in transducer construction because it is which of the following?

- A. The genuine backing material used to dampen element ringing specifically
- B. The genuine matching layer material reducing impedance mismatch specifically
- C. A commonly used genuine piezoelectric ceramic material itself
- D. The genuine acoustic lens material focusing the elevational plane specifically

16. A transducer operates at 10 MHz. Using the standard assumed soft-tissue propagation speed, what is the approximate genuine wavelength?

- A. 1.54 millimeters, an unrelated intermediate calculation entirely
- B. 0.5 millimeters, an unrelated intermediate calculation entirely

- C. 0.31 millimeters, an unrelated intermediate calculation entirely
- D. 0.154 millimeters, calculated as propagation speed divided by frequency

17. Amplitude is genuinely expressed in which of the following units?

- A. Hertz, the standard unit for genuine frequency measurement
- B. The same units as the specific acoustic variable itself being measured
- C. Seconds, the standard unit for genuine time measurement
- D. Watts per square centimeter, the standard unit for genuine intensity

18. A sonographer distinguishing power from intensity recognizes that power genuinely lacks reference to which of the following, unlike intensity?

- A. The genuine transmitted frequency used for a specific exam
- B. The genuine propagation speed assumed for that specific medium
- C. The genuine cross-sectional area over which energy is distributed
- D. The genuine rate at which acoustic energy is being transferred

19. Spatial peak temporal average (SPTA) and spatial peak pulse average (SPPA) intensity genuinely differ in which of the following way?

- A. SPTA and SPPA are genuinely identical values, differing only in name used
- B. SPPA is genuinely averaged over an entire exam; SPTA is genuinely instantaneous
- C. SPTA is averaged over the full pulse repetition period; SPPA over pulse duration alone
- D. Neither measure is genuinely relevant to bioeffects considerations at all

20. A boundary reflects 90 percent of incident intensity. A sonographer calculating the corresponding transmitted fraction should genuinely apply which of the following principle?

- A. Transmitted fraction is genuinely unrelated to the reflected fraction at all
- B. Reflected and transmitted fractions genuinely sum to 100 percent of the total

- C.** Transmitted fraction is genuinely always double the reflected fraction present
- D.** Transmitted fraction cannot genuinely be calculated without additional data

21. Prior to using a transducer cover containing latex, standard practice genuinely requires which of the following?

- A.** Screening the patient for a genuine latex allergy beforehand
- B.** No genuine screening is required regardless of the cover material used
- C.** Screening is genuinely required only for pediatric patients specifically
- D.** Screening is genuinely required only after a reaction has already occurred

22. Documentation of a genuine pre-exam patient discussion, including risks and alternatives where relevant, primarily serves which of the following purpose?

- A.** Genuinely eliminates all professional liability regardless of outcome
- B.** Is genuinely optional if the sonographer personally recalls the discussion
- C.** Creates a genuine, verifiable record of the discussion that actually occurred
- D.** Automatically improves genuine image quality for that specific exam

23. For genuine lower extremity venous duplex evaluation, positioning a patient in a genuine slight reverse Trendelenburg position primarily serves which of the following purpose?

- A.** Genuinely reduces the transmitted frequency required for that exam
- B.** Eliminates the genuine need for any further TGC adjustment at all
- C.** Promotes genuine venous distension, improving visualization and assessment
- D.** Automatically improves genuine axial resolution regardless of positioning

24. The minimum frame rate genuinely required for a human observer to perceive continuous, smooth motion rather than discrete individual images is generally which of the following?

- A.** Approximately 1 to 2 frames per second is genuinely sufficient for this

- B.** Approximately 5 frames per second is genuinely sufficient for this
- C.** Frame rate genuinely has no bearing on perceived motion smoothness at all
- D.** Approximately 15 to 20 frames per second or higher is generally needed

25. Which of the following is genuinely NOT a characteristic property of a sound wave itself, unlike frequency, wavelength, period, and amplitude?

- A.** Frequency, genuinely a fundamental property of the wave itself
- B.** Wavelength, genuinely a fundamental property of the wave itself
- C.** Period, genuinely a fundamental property of the wave itself
- D.** Acoustic impedance, a genuine property of the medium, not the wave itself

26. A 1-3 composite piezoelectric material, used in some modern transducers, genuinely combines piezoelectric ceramic with which of the following?

- A.** A genuine polymer material, improving flexibility and acoustic coupling
- B.** A genuine second layer of matching material, doubled for improved output
- C.** A genuine second layer of backing material, doubled for improved damping
- D.** A genuinely separate metal housing, unrelated to the element itself

27. A single transducer capable of genuinely operating at multiple selectable frequencies most directly relies on which of the following underlying characteristic?

- A.** A genuinely fixed, single resonant frequency with no adjustability at all
- B.** A genuinely separate physical element dedicated to each selectable frequency
- C.** A broadband (broad-bandwidth) design, genuinely spanning a range of frequencies
- D.** A genuinely mechanical component that physically changes element thickness

28. A sonographer selects the harmonic frequency setting on a genuinely multi-frequency transducer, rather than its fundamental frequency. This selection most directly relies on which of the following transducer characteristic?

- A.** A genuinely fixed, narrow bandwidth centered on a single frequency only
- B.** A genuinely broad bandwidth, spanning both fundamental and harmonic frequencies
- C.** A genuinely separate physical element dedicated exclusively to harmonics
- D.** A genuinely mechanical adjustment that physically changes the element itself

29. A sonographer needs to access a structure through a narrow physical orifice while maintaining close proximity to the target anatomy. Which transducer design characteristic most directly supports this specific clinical need?

- A.** A genuinely small physical footprint combined with a curved array face
- B.** A genuinely large physical footprint combined with a flat array face
- C.** A genuinely wide field of view exclusively at a shallow depth only
- D.** A design genuinely requiring no electronic focusing capability at all

30. A sonographer selecting between a genuinely higher-frequency and a genuinely lower-frequency endocavitary transducer for the identical application weighs which of the following trade-off?

- A.** Genuinely improved frame rate against genuinely reduced axial resolution
- B.** Genuinely improved dynamic range against genuinely reduced contrast resolution
- C.** Genuinely improved resolution against genuinely reduced penetration depth
- D.** No genuine trade-off exists between these two specific frequency options

31. A genuinely intermittent or inconsistent image dropout, appearing and disappearing as a cable is genuinely flexed or moved, most directly suggests which of the following?

- A.** A genuinely appropriate, expected system behavior requiring no further action
- B.** An excessively high overall gain setting, unrelated to the genuine cable itself
- C.** An inappropriately selected transducer type for the current specific exam
- D.** A genuinely damaged or intermittently faulty cable or connector

- 32.** A QA technologist testing overall image uniformity across a transducer's genuine full width would most directly use which of the following testing approach?
- A.** A genuine distance-accuracy target group, testing caliper measurement precision
 - B.** A genuinely uniform phantom background region, scanned across the full width
 - C.** A genuine dead-zone target group, testing near-field resolving capability
 - D.** A genuine sensitivity target group, testing maximum penetration depth
- 33.** A transducer's genuine bandwidth is most directly related to which of the following characteristic?
- A.** The genuine total number of elements present within the array itself
 - B.** The genuine kerf spacing between adjacent individual elements
 - C.** The genuine range of frequencies the element can effectively transmit and receive
 - D.** The genuine physical length of the entire transducer housing itself
- 34.** Reverberation artifact genuinely appears as which of the following?
- A.** A single, genuinely bright echo present at one specific depth only
 - B.** Complete, genuine absence of signal beyond a strong reflector present
 - C.** Multiple, genuinely equally spaced parallel echoes at increasing depth
 - D.** A genuinely smooth, gradual fading of signal with increasing depth
- 35.** Reverberation artifact genuinely arises from which of the following mechanism?
- A.** Sound genuinely scattering from structures smaller than the wavelength
 - B.** Sound genuinely bouncing repeatedly between two strong, parallel reflectors
 - C.** Sound genuinely refracting at a single oblique tissue boundary present
 - D.** Sound genuinely absorbed completely by a single highly attenuating structure
- 36.** Posterior acoustic shadowing genuinely appears as which of the following?

- A.** A genuinely bright band of increased signal deep to a specific structure
- B.** A genuinely dark band of reduced or absent signal deep to a structure
- C.** Multiple, genuinely equally spaced parallel echoes at increasing depth
- D.** A genuine duplicate structure appearing on the opposite side of a reflector

37. Posterior acoustic shadowing most directly results from which of the following?

- A.** A structure genuinely transmitting sound with minimal genuine attenuation
- B.** A structure producing genuinely no reflection at its anterior surface at all
- C.** A structure genuinely strongly attenuating or reflecting the beam
- D.** A structure genuinely positioned outside the current field of view entirely

38. Which of the following structures would most likely produce genuine posterior acoustic shadowing?

- A.** A simple, genuinely fluid-filled cyst with uniform internal content
- B.** A genuinely homogeneous, low-attenuation soft tissue mass present
- C.** A structure with genuinely identical acoustic impedance to surrounding tissue
- D.** A genuine gallstone or calcified structure, strongly attenuating sound

39. Posterior acoustic enhancement genuinely appears as which of the following?

- A.** A genuinely dark band of reduced or absent signal deep to a structure
- B.** Multiple, genuinely equally spaced parallel echoes at increasing depth
- C.** A genuine duplicate structure appearing on the opposite side of a reflector
- D.** A genuinely bright band of increased signal deep to a specific structure

40. Posterior acoustic enhancement most directly results from which of the following?

- A.** A structure genuinely strongly attenuating the beam more than surrounding tissue
- B.** A structure genuinely attenuating the beam less than surrounding tissue

- C. A structure producing genuinely no reflection at its anterior surface at all
- D. A structure genuinely positioned outside the current field of view entirely

41. Which of the following structures would most likely produce genuine posterior acoustic enhancement?

- A. A simple, genuinely fluid-filled cyst with uniform internal content
- B. A genuine gallstone or calcified structure, strongly attenuating sound
- C. Cortical bone, a genuinely dense, highly attenuating structure present
- D. Lung tissue, containing genuinely significant air content present

42. A sonographer imaging the liver near the diaphragm observes an apparent duplicate liver-like structure appearing genuinely above the diaphragm, within the expected lung field. This finding is most consistent with which of the following?

- A. A genuine, second distinct structure genuinely present within the lung field
- B. Reverberation artifact, from sound bouncing between two parallel reflectors
- C. Posterior acoustic shadowing, deep to the genuine diaphragm itself
- D. Grayscale mirror image artifact, from reflection off the strong diaphragm

43. A sonographer troubleshooting an apparent duplicate structure adjacent to a strong reflector concludes the finding is genuinely artifactual rather than anatomic. Which specific physical process most directly explains this type of finding?

- A. Sound genuinely scattering from structures smaller than the wavelength present
- B. An excessively high overall gain setting applied to the current image
- C. Sound genuinely absorbed completely by a single highly attenuating structure
- D. The strong reflector genuinely redirecting sound back toward already-imaged tissue

44. Side lobe (or grating lobe) artifact in grayscale imaging genuinely appears as which of the following?

- A.** A genuine echo displayed at an incorrect position, from off-axis energy
- B.** Complete, genuine absence of signal beyond a strong reflector present
- C.** A genuinely bright band of increased signal deep to a specific structure
- D.** A genuinely smooth, gradual fading of signal with increasing depth

45. Comet tail (ring down) artifact genuinely appears as which of the following?

- A.** A genuinely dark band of reduced signal deep to a specific structure
- B.** A tapering, genuinely bright, focused streak deep to a strongly reflective source
- C.** A genuine duplicate structure on the opposite side of a reflector present
- D.** Multiple, genuinely equally spaced parallel echoes at increasing depth

46. Comet tail artifact most directly arises from which of the following source?

- A.** A small, genuinely highly reflective source, such as a metallic or crystalline focus
- B.** A genuinely large, smooth, homogeneous fluid collection present
- C.** A genuinely diffuse, low-level scattering source spread across a wide area
- D.** A genuinely absent or missing reflective source at that specific location

47. A sonographer observes an unexpected finding and needs to distinguish genuine pathology from a genuine imaging artifact. Which of the following approaches is most directly appropriate?

- A.** Assume the finding is genuinely artifactual without any further evaluation
- B.** Assume the finding is genuinely pathologic without any further evaluation
- C.** Ignore the finding entirely, since most unusual findings are genuinely artifacts
- D.** Reposition the transducer or angle and observe whether the finding persists

48. A sonographer observes a genuinely thin, curved shadow specifically at the lateral edge of a rounded structure, distinct from a genuine posterior shadow beneath it. This edge-specific shadow most directly arises from which of the following?

- A.** Genuine strong attenuation, identical to the mechanism producing posterior shadowing
- B.** A genuinely damaged or malfunctioning transducer element at that specific location
- C.** Refraction of the beam at the structure's genuinely curved edge
- D.** Reverberation, from sound bouncing between two genuinely parallel reflectors

49. A sonographer notices the far field of an image appears genuinely brighter than expected, with the near field appearing appropriately set. Which control is most likely responsible?

- A.** Overall gain, applied genuinely uniformly regardless of the depth involved
- B.** Time gain compensation (TGC), specifically at the affected far-field depth
- C.** Persistence, averaging sequential frames across the entire displayed image
- D.** Dynamic range, narrowing the genuinely displayed range of values shown

50. A sonographer wants genuinely improved differentiation between a lesion and adjacent normal parenchyma with genuinely similar echogenicity. Which combination of adjustments most directly supports this specific goal?

- A.** Increase overall gain and increase persistence together simultaneously
- B.** Decrease dynamic range and increase overall gain together simultaneously
- C.** Increase frame rate and decrease the current transmitted frequency together
- D.** Adjust dynamic range and select an appropriate gray map together

51. A sonographer needs to image a genuinely deep pelvic structure in real time while a patient exhibits genuine bowel peristalsis. Maintaining adequate frame rate for this specific scenario most directly requires which of the following?

- A.** Minimizing line density and imaging depth to what is genuinely necessary
- B.** Maximizing line density and imaging depth for genuinely maximum detail
- C.** Maximizing the number of focal zones for genuinely maximum detail
- D.** Maximizing persistence to compensate for genuinely reduced frame rate

52. A sonographer troubleshooting genuine near-field reverberation artifact enables tissue harmonic imaging. This adjustment most directly helps because harmonic signal is genuinely which of the following?

- A.** Generated deeper within tissue, avoiding genuine superficial reverberation sources
- B.** Generated exclusively at the transducer face itself, unrelated to tissue depth
- C.** Genuinely unrelated to reverberation artifact reduction in any way whatsoever
- D.** Only relevant to genuine Doppler-based artifacts, not grayscale artifacts

53. A sonographer notices genuine edge-shadowing artifact obscuring a portion of a structure's margin. Enabling spatial compounding most directly helps address this because compounding genuinely does which of the following?

- A.** Genuinely eliminates all attenuation-based artifacts, including true posterior shadowing
- B.** Increases the current transmitted frequency, reducing genuine edge artifact
- C.** Increases persistence substantially, reducing genuine edge artifact directly
- D.** Combines multiple beam angles, reducing angle-dependent artifacts like this

54. A sonographer notices low-level noise cluttering the image at a specific depth, while stronger genuine signal at that same depth remains appropriately displayed. Which control most directly addresses this without affecting the genuine stronger signal?

- A.** TGC, adjusted specifically at that affected depth only
- B.** Overall gain, applied genuinely uniformly regardless of depth involved
- C.** Reject, eliminating low-level signal below a genuinely selected threshold
- D.** Persistence, averaging sequential frames across the entire displayed image

55. A sonographer compares a stored image at a genuinely low matrix resolution against the same anatomy at a genuinely higher matrix resolution. The higher-resolution image will genuinely display which of the following?

- A.** Finer genuine displayed detail, since more pixels represent the identical data
- B.** Coarser genuine displayed detail, since more pixels compete for the same space

- C. Genuinely identical displayed detail, since matrix size does not affect detail
- D. Genuinely improved axial resolution specifically, unrelated to matrix size

56. A structure of clinical interest extends from a genuinely shallow depth down to a genuinely moderate depth within the same image. A sonographer optimizing focal zone placement for this entire structure should genuinely do which of the following?

- A. Select a single focal zone at only the genuinely shallowest point present
- B. Select multiple focal zones spanning that structure's genuine depth range
- C. Select a single focal zone at only the genuinely deepest point present
- D. Recognize that focal zone selection is genuinely irrelevant in this case

57. A sonographer's image simultaneously shows genuine reverberation artifact and a separately identified region of genuine posterior enhancement. Which of the following represents the most appropriate approach?

- A. Assume both findings are genuinely identical in mechanism and origin
- B. Address genuinely only the reverberation, ignoring the enhancement entirely
- C. Address genuinely only the enhancement, ignoring the reverberation entirely
- D. Recognize each as distinct, and correlate each with its actual likely cause

58. A sonographer applies write zoom to a genuinely small region before acquisition, then compares the result to simply enlarging the identical original image without write zoom. The write-zoomed region genuinely shows which of the following?

- A. Genuinely improved true resolution, from additional scan lines acquired
- B. Genuinely identical resolution to the simply enlarged original image
- C. Genuinely reduced resolution compared to the simply enlarged original image
- D. Genuinely improved penetration depth beyond the original acquisition

59. A sonographer notices the displayed image orientation appears genuinely inconsistent with the standard sagittal-plane scanning convention for that specific exam. This is most directly consistent with which of the following?

- A.** An excessively high overall gain setting applied to the current image
- B.** An inappropriately narrow dynamic range setting currently selected
- C.** The transducer marker genuinely positioned inconsistent with the intended convention
- D.** An excessively high persistence setting applied to sequential frames

60. A sonographer observes a finding that disappears when the transducer angle is genuinely changed, while genuine anatomic structures remain visible and unchanged. This behavior most directly suggests which of the following?

- A.** The finding is genuinely anatomic pathology, unrelated to transducer angle
- B.** The finding is genuinely unrelated to any imaging artifact whatsoever
- C.** The transducer is genuinely malfunctioning at every angle tested
- D.** The finding is likely a genuine imaging artifact, angle-dependent in nature

61. A sonographer visualizing a metallic needle during a genuine guided procedure observes multiple, genuinely equally spaced parallel echo lines deep to the needle. This finding is most consistent with which of the following?

- A.** Reverberation artifact, from sound bouncing between the needle's parallel surfaces
- B.** Posterior acoustic enhancement, deep to the genuinely metallic needle
- C.** A genuine duplicate needle, anatomically distinct from the original
- D.** Grayscale mirror image artifact, from reflection off a distant strong reflector

62. A sonographer's overall approach to optimizing image quality throughout an exam should genuinely prioritize which of the following sequence?

- A.** Adjusting only overall gain, since every other control is genuinely secondary
- B.** Systematically adjusting depth, focus, gain, and TGC together, as clinically needed

- C. Adjusting only dynamic range, since every other control is genuinely secondary
- D. Adjusting only persistence, since every other control is genuinely secondary

63. Color variance mode, distinct from standard color velocity mapping, genuinely displays which of the following?

- A. The genuine mean velocity detected at each specific pixel location
- B. The genuine peak systolic velocity detected at each specific location
- C. The genuine direction of flow relative to the transducer exclusively
- D. The genuine variation (turbulence) present within the detected flow

64. Color variance mode is genuinely most useful for identifying which of the following?

- A. A genuinely simple, laminar flow pattern within a healthy vessel
- B. The genuine direction of flow relative to the transducer specifically
- C. The genuine absolute peak velocity value at a specific location
- D. Areas of genuine turbulent flow, such as distal to a stenosis

65. A sonographer aligns the Doppler beam genuinely perpendicular to blood flow, at a full 90-degree angle. The system's calculated velocity output under this specific condition would genuinely be which of the following?

- A. Genuinely the highest possible value the system could report for that flow
- B. Genuinely zero, since the calculated shift itself is zero at this angle
- C. Genuinely identical to the true velocity, regardless of angle used
- D. Entirely dependent on the current wall filter setting selected instead

66. A sonographer attempting Doppler measurement at a genuine 90-degree angle would most likely obtain which of the following result?

- A. A genuinely accurate, reliable velocity measurement at this specific angle

- B.** A genuinely overestimated velocity measurement at this specific angle
- C.** A genuinely underestimated but still usable velocity measurement
- D.** No genuinely usable Doppler signal at all, since the shift is zero

67. A sonographer notices genuine noise filling the spectral window beneath an otherwise clear waveform, despite adequate genuine signal strength. Which control is most likely responsible?

- A.** An inappropriately low wall filter setting, unrelated to this specific finding
- B.** Excessive spectral Doppler gain, introducing genuine noise into the display
- C.** An inappropriately narrow current color box size genuinely selected
- D.** An inappropriately high current pulse repetition frequency setting

68. Power Doppler is genuinely also known by which of the following alternative terminology?

- A.** Velocity mode, since it genuinely displays directional velocity information
- B.** Spectral mode, since it genuinely displays a spectral waveform trace
- C.** Energy (amplitude) mode, since it genuinely displays signal amplitude
- D.** Variance mode, since it genuinely displays flow turbulence specifically

69. A sonographer obtains a genuinely aliased spectral trace at a genuinely steep 85-degree Doppler angle. Correcting the angle toward a more appropriate value, all else held equal, would most directly affect the genuine calculated shift in which of the following way?

- A.** The calculated shift would genuinely remain completely unchanged
- B.** The calculated shift would become genuinely completely unpredictable
- C.** The calculated shift would genuinely decrease further from its current value
- D.** The calculated shift would genuinely increase, since cosine increases as angle decreases

70. A sonographer encountering an unexpected Doppler finding first identifies whether the issue is genuinely frequency-domain, depth-domain, or angle-related in nature. This initial step most directly reflects which of the following approach?

- A.** A systematic, mechanism-based troubleshooting approach
- B.** An entirely random, trial-and-error troubleshooting approach
- C.** An approach genuinely relevant only to grayscale artifacts, not Doppler
- D.** An approach that genuinely requires no further action after this step

71. A sonographer needs range-specific velocity information at a genuinely known, moderate depth, with velocities well within an achievable Nyquist limit. Which mode is most appropriate for this specific scenario?

- A.** Continuous-wave Doppler, providing genuine range resolution for this need
- B.** Pulsed-wave Doppler, providing genuine range-specific information needed
- C.** Power Doppler alone, without any genuine spectral component used
- D.** Color Doppler alone, without any genuine spectral component used

72. A sonographer selects a genuinely large sample volume gate for a small, deep vessel with genuinely low flow. This choice most directly risks which of the following?

- A.** Genuinely improved range specificity for this specific small vessel
- B.** No genuine consequence for this specific clinical scenario at all
- C.** Genuine signal contamination from adjacent structures near the small vessel
- D.** Genuinely improved achievable frame rate for this specific scenario

73. A sonographer steers the color box to improve a genuinely steep 80-degree angle down to a more favorable 50-degree angle for an identical vessel. This adjustment most directly improves which of the following?

- A.** Genuine axial resolution, unrelated to the current Doppler angle used
- B.** Genuine Doppler angle accuracy and resulting velocity measurement reliability
- C.** Genuine frame rate, unrelated to the current Doppler angle used
- D.** Genuine penetration depth, unrelated to the current Doppler angle used

74. A sonographer performing a combined arterial and venous exam of the same limb should genuinely expect to do which of the following regarding wall filter?

- A.** Use a genuinely identical wall filter setting for both vessel types
- B.** Use wall filter genuinely only for the arterial portion of the exam
- C.** Adjust wall filter appropriately between the two genuinely different flow types
- D.** Wall filter genuinely has no relevance to either vessel type in this exam

75. A vessel shows a peak systolic velocity of 45 cm/s and an end-diastolic velocity of 5 cm/s. What is the genuine resistive index at this site?

- A.** 0.11, calculated as EDV divided by PSV directly
- B.** 9.0, calculated as PSV divided by EDV directly
- C.** 0.89, calculated as (PSV minus EDV) divided by PSV
- D.** 1.0, calculated as PSV divided by the sum of PSV and EDV

76. A vessel shows a peak systolic velocity of 45 cm/s, an end-diastolic velocity of 5 cm/s, and a mean velocity of 20 cm/s. What is the genuine pulsatility index at this site?

- A.** 0.89, calculated as (PSV minus EDV) divided by PSV directly
- B.** 9.0, calculated as PSV divided by EDV directly
- C.** 0.44, calculated as mean velocity divided by PSV directly
- D.** 2.0, calculated as (PSV minus EDV) divided by mean velocity

77. A sonographer evaluating a genuinely healthy, resting peripheral artery obtains a waveform with a sharp systolic peak and genuine brief early diastolic reversal. This finding is most consistent with which of the following?

- A.** A genuinely abnormal, pathologic high-resistance waveform requiring concern
- B.** A genuinely normal, expected high-resistance peripheral arterial waveform
- C.** A genuinely abnormal, pathologic low-resistance waveform requiring concern

D. An artifact requiring no further genuine clinical consideration at all

78. A sonographer evaluating the internal carotid artery obtains a waveform with continuous, genuinely substantial forward diastolic flow. This finding is most consistent with which of the following?

A. A genuinely abnormal, pathologic high-resistance waveform requiring concern

B. A genuinely normal, expected low-resistance waveform for this specific vessel

C. A genuinely abnormal finding requiring immediate further workup regardless

D. An artifact requiring no further genuine clinical consideration at all

79. A vessel with a genuine cross-sectional area of 2 square centimeters has a genuine mean velocity of 25 cm/s. What is the approximate genuine volume flow rate?

A. 12.5 mL/s, calculated as area divided by mean velocity directly

B. 27 mL/s, calculated as area plus mean velocity together directly

C. 0.08 mL/s, an unrelated intermediate calculation entirely

D. 50 mL/s, calculated as mean velocity multiplied by area

80. A vessel has a genuine internal diameter of 1.5 cm. What is its approximate genuine cross-sectional area?

A. Approximately 1.5 square centimeters, equal to the diameter value alone

B. Approximately 4.7 square centimeters, using pi times diameter alone

C. Approximately 1.77 square centimeters, using pi times radius squared

D. Approximately 2.25 square centimeters, equal to the diameter squared alone

81. A system's current PRF setting is 8000 Hz. What is the genuine Nyquist limit for this specific setting?

A. 8000 Hz, equal to the current PRF setting itself

B. 16000 Hz, double the current PRF setting itself

- C. 2000 Hz, one quarter of the current PRF setting
- D. 4000 Hz, half of the current PRF setting

82. A sonographer reviewing a printed spectral Doppler tracing notices the waveform's peak is genuinely missing from the top edge and reappears along the bottom edge of the trace. This specific printed pattern most directly indicates which of the following?

- A. A gradual, genuinely smooth decline in peak systolic velocity over time
- B. Aliasing, evidenced by this genuine wraparound appearance on the trace
- C. A completely flat, genuinely featureless waveform throughout the cycle
- D. Complete, genuine absence of any waveform signal at that specific point

83. A sonographer using a genuinely very high PRF while sampling at a genuinely very deep sample volume location notices an anatomically implausible signal depth. Reducing PRF at this specific depth would most directly do which of the following to this finding?

- A. Genuinely worsen the finding further at any reduced PRF value
- B. Have no genuine effect on the finding under any circumstance at all
- C. Likely resolve the finding, since range ambiguity requires a lower PRF fix
- D. Automatically convert the finding into genuine aliasing instead

84. A sonographer evaluating the subclavian artery near the pleural surface observes a genuine duplicate arterial signal appearing on the opposite side of that strong reflective boundary. This finding is most consistent with which of the following?

- A. A genuine second, anatomically distinct artery at that specific location
- B. Mirror image artifact, from reflection off the pleura's strong surface
- C. Range ambiguity, a depth-domain artifact distinct from this mechanism
- D. Aliasing, a frequency-domain artifact distinct from this mechanism

85. A sonographer's spectral trace shows both genuine low-velocity venous signal loss and genuine background noise cluttering the display simultaneously. Which combination of adjustments most directly addresses both issues together?

- A.** Increase wall filter and increase gain together simultaneously
- B.** Decrease persistence and increase the current color box size together
- C.** Increase the current pulse repetition frequency setting alone
- D.** Decrease wall filter and appropriately adjust gain together

86. A vessel is insonated at a genuine 45-degree angle with a 5 MHz transducer, producing a genuine 3 kHz Doppler shift, with propagation speed assumed at 1540 m/s. Which of the following approaches correctly solves for genuine blood flow velocity?

- A.** Divide the Doppler shift directly by twice the transmitted frequency alone
- B.** Multiply the Doppler shift by the assumed propagation speed alone
- C.** Rearrange the Doppler equation, substituting cosine of 45 degrees directly
- D.** The Doppler angle is genuinely irrelevant to this specific calculation

87. A sonographer performing an arterial exam with a genuinely very low wall filter setting notices excessive genuine low-frequency noise from vessel wall motion cluttering the spectral trace. Which adjustment is most directly appropriate?

- A.** Decrease the current pulse repetition frequency setting selected instead
- B.** Decrease overall spectral gain substantially, regardless of current setting
- C.** Increase persistence substantially to average additional sequential frames
- D.** Increase the wall filter setting, appropriate for this arterial vessel type

88. A sonographer observes aliasing with genuinely predominant unidirectional flow, and scale is already near its genuine achievable maximum for the current depth. Which combination of adjustments is most directly appropriate as a next step?

- A.** Increase persistence and decrease the current wall filter setting together
- B.** Decrease overall gain and increase the current color box size together

- C. Shift the baseline, and consider CW Doppler if aliasing genuinely persists
- D. Increase the current pulse repetition frequency setting alone, indefinitely

89. A sonographer is uncertain whether a finding represents aliasing, range ambiguity, or mirror image artifact. Which of the following represents the most appropriate systematic approach?

- A. Test each specific mechanism in turn, using the corresponding targeted check
- B. Assume the finding is genuinely aliasing, since this is the most common artifact
- C. Assume the finding is genuinely mirror image, since this is easiest to test
- D. Switch to an entirely different imaging modality without further review

90. A sonographer notices spectral broadening genuinely present throughout an entire vessel segment, not just distal to a focal narrowing. This diffuse pattern most directly suggests which of the following?

- A. A genuinely diffuse, rather than focal, disease process affecting that segment
- B. A genuinely normal finding, since diffuse broadening is always benign
- C. A technical artifact requiring no further genuine clinical consideration
- D. An excessively high wall filter setting removing genuine flow signal

91. A sonographer notices genuine color flash artifact appearing with patient motion during a specific exam. Adjusting which of the following controls would most directly help reduce this specific artifact?

- A. Increasing the current wall filter setting, unrelated to this specific artifact
- B. Increasing overall spectral gain, unrelated to this specific artifact
- C. Increasing the current color box size, unrelated to this specific artifact
- D. Decreasing color persistence, reducing genuine motion-related artifact

92. A sonographer evaluating a genuinely tortuous vessel finds the Doppler angle changes meaningfully at different points along its course. Appropriate technique for this specific scenario genuinely requires which of the following?

- A. Using a genuinely single, fixed angle correction for the entire vessel course

- B.** Ignoring genuine angle correction entirely for this specific tortuous vessel
- C.** Using continuous-wave Doppler exclusively for this entire tortuous vessel
- D.** Re-correcting the angle at each genuinely distinct point along the course

93. A sonographer using power Doppler for a genuinely motion-prone exam, such as pediatric abdominal imaging, should genuinely anticipate which of the following?

- A.** Power Doppler is genuinely immune to motion-related artifact entirely
- B.** Power Doppler's genuine sensitivity to motion may produce flash artifact
- C.** Power Doppler genuinely cannot be used for pediatric patients at all
- D.** Power Doppler genuinely requires no technique adjustment for this scenario

94. A sonographer adjusts overall 2D (grayscale) gain during a duplex exam. This adjustment most directly affects which of the following?

- A.** The genuine spectral Doppler trace display exclusively, not the grayscale image
- B.** The genuine color Doppler display exclusively, not the grayscale image
- C.** Both the grayscale and Doppler displays genuinely identically, together
- D.** The genuine grayscale image display specifically, independent of Doppler gain

95. A sonographer's overall approach to Doppler assessment throughout an exam should genuinely prioritize which of the following?

- A.** Systematic optimization of angle, scale, gain, and wall filter as clinically needed
- B.** Adjusting only overall gain, since every other Doppler control is genuinely secondary
- C.** Adjusting only scale, since every other Doppler control is genuinely secondary
- D.** Using default settings throughout, without any genuine adjustment at all

96. The single most reliable general principle for distinguishing a genuine Doppler artifact from true pathology is which of the following?

- A.** Assuming every unusual finding is genuinely artifactual by default
- B.** Assuming every unusual finding is genuinely pathologic by default
- C.** Never attempting any further verification once a finding is observed
- D.** Identifying the likely mechanism, then applying a targeted, verifying test

97. The single most reliable spectral finding for distinguishing genuinely laminar from genuinely turbulent flow is which of the following?

- A.** The genuine presence or absence of any measurable Doppler shift at all
- B.** The genuine width and clarity of the spectral window beneath the waveform
- C.** The genuine color assigned to flow on a simultaneous color Doppler display
- D.** The genuine total duration of the cardiac cycle being assessed

98. When solving the Doppler equation for any single unknown variable, the genuinely correct general approach is which of the following?

- A.** Guessing a reasonable value, then genuinely checking it against the display
- B.** Ignoring the Doppler angle entirely, regardless of which variable is unknown
- C.** Algebraically isolating that specific unknown variable, then solving directly
- D.** Using only the transmitted frequency, genuinely without any other variable

99. Standard color Doppler display convention genuinely gives priority to which signal at a pixel where both grayscale and color are genuinely present simultaneously?

- A.** Grayscale signal is genuinely always displayed by default, overriding color
- B.** Color signal is generally given genuine display priority by default
- C.** Neither signal is genuinely displayed if both are present simultaneously
- D.** Display priority is genuinely random and cannot be meaningfully configured

100. A sonographer performing an exam near lung or bowel, structures genuinely containing gas, should genuinely anticipate which of the following bioeffects consideration?

- A.** Genuinely reduced mechanical bioeffects risk, since gas blocks cavitation
- B.** Genuinely no bioeffects consideration whatsoever near these structures
- C.** Genuinely reduced thermal bioeffects risk specifically near these structures
- D.** Genuinely elevated mechanical bioeffects risk, from additional cavitation nuclei

101. An accredited ultrasound facility genuinely maintains a documented QA program primarily to satisfy which of the following?

- A.** A genuinely optional internal preference, with no external requirement at all
- B.** A requirement genuinely relevant only to newly opened facilities specifically
- C.** A requirement genuinely relevant only to research-focused facilities specifically
- D.** Accreditation body requirements defining documented QA personnel responsibilities

102. Extended field-of-view 3D acquisition, combining multiple genuine sub-volumes into one larger volume, most directly risks which of the following if patient or transducer motion occurs during acquisition?

- A.** Genuinely improved volumetric accuracy from the additional motion present
- B.** No genuine consequence, since motion is genuinely accounted for automatically
- C.** Genuine stitching artifact or misalignment between the combined sub-volumes
- D.** Automatic, genuine correction of any motion by the acquisition software

103. A sonographer performing a later-gestation obstetric exam, where fetal bone is genuinely at the beam's focus, should reference which of the following Thermal Index sub-type?

- A.** TIB (bone thermal index), appropriate since bone is genuinely at the focus
- B.** TIS (soft tissue thermal index), appropriate only when bone is genuinely absent
- C.** TIC (cranial thermal index), appropriate only for genuine transcranial applications

D. No Thermal Index sub-type is genuinely relevant once bone has ossified

104. A sonographer comparing the Thermal Index and Mechanical Index on the console should genuinely understand which of the following distinction?

- A.** Both indices genuinely reflect the identical underlying bioeffect category
- B.** TI reflects genuine heating potential; MI reflects genuine cavitation potential
- C.** TI reflects genuine cavitation potential; MI reflects genuine heating potential
- D.** Neither index is genuinely relevant to real clinical bioeffects considerations

105. ALARA is genuinely best understood as which of the following, applied throughout a genuine exam?

- A.** A continuously reassessed practice, weighing benefit against genuine exposure risk
- B.** A single setting applied once, genuinely fixed for the entire exam duration
- C.** A requirement relevant genuinely only to obstetric exams specifically
- D.** A fixed numeric threshold that must genuinely never be exceeded at all

106. A QA technologist scanning a phantom's genuinely uniform background region across a transducer's full width is most directly testing for which of the following?

- A.** Genuine distance accuracy, verified against the phantom's known distances
- B.** Genuine dead zone depth, near the transducer face specifically
- C.** Genuine sensitivity, at the phantom's deepest, lowest-contrast targets
- D.** Genuine uniformity of response, revealing a damaged or faulty element

107. A sonographer's daily equipment checklist includes wiping down the transducer and visually inspecting the cable, separate from any scheduled phantom-based testing. This checklist genuinely represents which of the following category of activity?

- A.** A formal, quantitative axial resolution test, genuinely requiring a phantom
- B.** A formal, quantitative sensitivity test, genuinely requiring a phantom

- C. A formal, quantitative distance-accuracy test, genuinely requiring a phantom
- D. Preventive maintenance, genuinely distinct from formal QA performance testing

108. A sonographer needing a genuine, trackable numeric stiffness value across serial exams should select which of the following elastography technique?

- A. Strain elastography, providing only a genuinely relative, qualitative map
- B. Shear wave elastography, providing an absolute, quantitative value
- C. Neither technique genuinely provides any quantitative output at all
- D. Standard B-mode imaging alone, without any elastography technique

109. A sonographer preparing for a contrast-enhanced exam should genuinely confirm which of the following before microbubble injection?

- A. That the Mechanical Index is deliberately set low but genuinely non-zero
- B. That the Mechanical Index is genuinely set to its absolute maximum value
- C. That the Mechanical Index setting is genuinely irrelevant to this specific exam
- D. That wall filter, not Mechanical Index, is the genuinely relevant setting here

110. A QA test result falls meaningfully outside established tolerance for a specific transducer. The most appropriate response is genuinely which of the following?

- A. Continue clinical use unchanged, since a single result rarely reflects concern
- B. Remove that transducer from clinical service until corrected and re-verified
- C. Document the result with no further genuine corrective action taken at all
- D. Increase the testing interval to encounter this specific result less often

Answers

1. **C.** An 8-bit system can genuinely display 2 to the 8th power, or 256, distinct gray levels. Options A, B, and D each apply an incorrect calculation.
2. **B.** Upgrading from 6-bit (64 levels) to 8-bit (256 levels) genuinely provides more displayable gray levels, directly improving the system's contrast resolution capability. Options A, C, and D each misstate this actual improvement.
3. **C.** At the critical angle, the refraction angle reaches genuinely 90 degrees, meaning the refracted beam travels along the boundary itself rather than into the second medium. Options A, B, and D each misstate this actual critical-angle behavior.
4. **D.** Beyond the critical angle, total reflection continues, with no genuine transmission occurring across the boundary at any angle steeper than critical. Options A, B, and C each misstate this actual behavior.
5. **D.** Huygens' principle describes how each point on a wavefront genuinely acts as a source of secondary wavelets, which combine to form the next wavefront, a foundational wave-propagation concept. Options A, B, and C describe unrelated concepts.
6. **A.** Sound waves arriving genuinely in phase, with aligned peaks and troughs, combine through constructive interference, producing a resulting amplitude genuinely greater than either individual wave. Options B, C, and D each misstate this actual interference outcome.
7. **C.** Sound waves arriving genuinely out of phase, with a peak aligning with a trough, combine through destructive interference, producing a resulting amplitude genuinely reduced compared to either individual wave. Options A, B, and D each misstate this actual interference outcome.
8. **C.** Water or simple fluid is genuinely a weakly attenuating medium, producing the least attenuation per centimeter among the options listed. Options A, B, and D each describe a medium or condition producing genuinely greater attenuation.
9. **A.** As transmitted frequency genuinely increases, absorption becomes genuinely more dominant relative to other attenuation mechanisms, converting proportionally more acoustic energy into heat. Options B, C, and D each misstate this actual frequency-dependent relationship.
10. **B.** A standardized scanning protocol ensures genuinely consistent, complete image acquisition across exams, supporting reliable comparison and interpretation. Options A, C, and D each misstate this actual purpose.
11. **D.** Hand hygiene is genuinely required both before and after every patient contact, a sequence this scenario directly violates by skipping the step between patients. Options A, B, and C each mischaracterize this actual, universal requirement.

- 12. C.** Proper transducer storage genuinely requires protecting the lens and cable from physical damage, avoiding kinking, crushing, or exposure to inappropriate conditions. Options A, B, and D each describe an inappropriate storage practice.
- 13. B.** The Curie point genuinely refers to the temperature above which a piezoelectric material's piezoelectric properties are permanently lost, a critical thermal limit for transducer elements. Options A, C, and D each misstate this actual definition.
- 14. B.** Exceeding a piezoelectric element's Curie point risks permanent, genuine loss of that element's piezoelectric properties, potentially rendering the transducer non-functional. Options A, C, and D each misstate this actual risk.
- 15. C.** Lead zirconate titanate (PZT) is genuinely significant because it is a commonly used piezoelectric ceramic material itself, forming the active element in many diagnostic transducers. Options A, B, and D describe unrelated transducer components.
- 16. D.** Wavelength equals propagation speed divided by frequency: $1540 \text{ m/s} / 10,000,000 \text{ Hz} = 0.154 \text{ mm}$. Options A, B, and C each apply an incorrect calculation.
- 17. B.** Amplitude is genuinely expressed in the same units as the specific acoustic variable actually being measured (such as pressure or density), since it represents that variable's variation from average. Options A, C, and D describe units for unrelated parameters.
- 18. D.** Power is genuinely the rate of acoustic energy transfer without reference to the cross-sectional area over which that energy is distributed, the specific factor that distinguishes it from intensity. Options A, B, and D describe unrelated parameters, not the actual distinguishing factor.
- 19. C.** SPTA is genuinely averaged over the full pulse repetition period (including the silent listening interval), while SPPA is averaged over the pulse duration alone, a genuinely different averaging window. Options A, B, and D each misstate this actual distinction.
- 20. B.** Because reflected and transmitted fractions of intensity genuinely sum to 100 percent of the total incident intensity, this principle allows the transmitted fraction to be calculated directly from the reflected fraction. Options A, C, and D each misstate this actual principle.
- 21. A.** Standard practice genuinely requires screening the patient for a genuine latex allergy before using a transducer cover containing latex, avoiding a potentially serious allergic reaction. Options B, C, and D each describe an inadequate or inappropriate approach.
- 22. C.** Documenting a genuine pre-exam discussion creates a genuine, verifiable record of that discussion, supporting both patient care continuity and professional accountability. Options A, B, and D each misstate this actual purpose.

- 23. C.** Reverse Trendelenburg positioning promotes genuine venous distension for lower extremity venous evaluation, improving visualization and the ability to assess genuine vein compressibility. Options A, B, and D each misstate this actual clinical purpose.
- 24. D.** Approximately 15 to 20 frames per second or higher is generally needed for a human observer to perceive continuous, smooth motion rather than discrete individual images, related to the visual system's genuine flicker-fusion threshold. Options A, B, and C each misstate this actual requirement.
- 25. D.** Acoustic impedance is genuinely a property of the medium through which sound travels, not a property of the wave itself, distinct from frequency, wavelength, period, and amplitude, which are all genuine wave properties. Options A, B, and C each describe a genuine property of the wave itself.
- 26. A.** A 1-3 composite piezoelectric material genuinely combines piezoelectric ceramic with a polymer material, improving flexibility and acoustic coupling compared to a solid ceramic element alone. Options B, C, and D each misstate this actual composite construction.
- 27. C.** A single transducer operating at multiple selectable frequencies genuinely relies on a broadband design, spanning a range of frequencies rather than a single fixed resonant frequency. Options A, B, and D each misstate this actual underlying characteristic.
- 28. B.** Selecting a harmonic frequency setting on a multi-frequency transducer genuinely relies on that transducer's broad bandwidth, spanning both the fundamental frequency and its genuine harmonic frequencies. Options A, C, and D each misstate this actual characteristic.
- 29. A.** A genuinely small physical footprint combined with a curved array face directly supports accessing a structure through a narrow orifice while remaining close to the target anatomy, characteristic of an endocavitary transducer design. Options B, C, and D describe characteristics that do not support this specific clinical need.
- 30. C.** Selecting between higher and lower frequency for an endocavitary transducer weighs genuinely improved resolution against genuinely reduced penetration depth, the same fundamental frequency trade-off established elsewhere. Options A, B, and D each misstate this actual trade-off.
- 31. D.** An intermittent image dropout that changes as a cable is genuinely flexed strongly suggests a genuinely damaged or intermittently faulty cable or connector, a mechanical rather than settings-related issue. Options A, B, and C each misstate this actual likely cause.
- 32. B.** Testing overall image uniformity across a transducer's full width genuinely uses a uniform phantom background region, scanned across that width to reveal any localized dropout. Options A, C, and D describe genuinely different, unrelated QA testing approaches.
- 33. C.** A transducer's genuine bandwidth is most directly related to the range of frequencies that element can effectively transmit and receive, a key characteristic distinguishing narrowband from broadband designs. Options A, B, and D describe unrelated transducer characteristics.

- 34. C.** Reverberation artifact genuinely appears as multiple, equally spaced parallel echoes at increasing depth, a direct visual signature of this specific mechanism. Options A, B, and D each describe a pattern inconsistent with genuine reverberation.
- 35. B.** Reverberation artifact arises from sound genuinely bouncing repeatedly between two strong, parallel reflectors, with each bounce producing an additional, progressively deeper echo. Options A, C, and D describe unrelated mechanisms.
- 36. B.** Posterior acoustic shadowing genuinely appears as a dark band of reduced or absent signal deep to a specific structure, directly reflecting reduced sound reaching that deeper region. Options A, C, and D describe patterns inconsistent with genuine shadowing.
- 37. C.** Posterior acoustic shadowing most directly results from a structure genuinely strongly attenuating or reflecting the beam, leaving little genuine sound energy to reach structures beyond it. Options A, B, and D each misstate this actual mechanism.
- 38. D.** A genuine gallstone or calcified structure, strongly attenuating sound, would most likely produce genuine posterior acoustic shadowing. Options A, B, and C describe structures unlikely to produce this specific finding.
- 39. D.** Posterior acoustic enhancement genuinely appears as a bright band of increased signal deep to a specific structure, directly reflecting relatively greater sound energy reaching that deeper region. Options A, B, and C describe patterns inconsistent with genuine enhancement.
- 40. B.** Posterior acoustic enhancement most directly results from a structure genuinely attenuating the beam less than surrounding tissue, allowing relatively more sound energy to reach structures beyond it. Options A, C, and D each misstate this actual mechanism.
- 41. A.** A simple, genuinely fluid-filled cyst with uniform internal content, having low attenuation, would most likely produce genuine posterior acoustic enhancement. Options B, C, and D describe structures unlikely to produce this specific finding.
- 42. D.** An apparent duplicate structure appearing above the diaphragm, within the lung field, is characteristic of grayscale mirror image artifact, from reflection off the strong diaphragm surface. Options A, B, and C each describe an unrelated finding or mechanism.
- 43. D.** A strong reflector genuinely redirecting sound back toward already-imaged tissue is the physical process underlying grayscale mirror image artifact, producing a false duplicate structure. Options A, B, and C describe unrelated mechanisms.
- 44. A.** Side lobe (or grating lobe) artifact genuinely appears as an echo displayed at an incorrect position on the display, from genuine off-axis acoustic energy being misattributed to the main beam's path. Options B, C, and D describe patterns inconsistent with this specific artifact.

- 45. B.** Comet tail (ring down) artifact genuinely appears as a tapering, bright, focused streak extending deep to a strongly reflective source. Options A, C, and D describe patterns inconsistent with genuine comet tail artifact.
- 46. A.** Comet tail artifact most directly arises from a small, genuinely highly reflective source, such as a metallic fragment or crystalline focus, producing a resonance-related tapering streak. Options B, C, and D describe sources unlikely to produce this specific finding.
- 47. D.** Repositioning the transducer or angle and observing whether the finding persists is the most directly appropriate approach to distinguish genuine pathology from a genuine imaging artifact, since many artifacts are angle-dependent while genuine anatomy is not. Options A, B, and C each describe an inappropriate approach that skips this genuinely necessary verification.
- 48. C.** A thin, curved shadow specifically at a structure's lateral edge, distinct from true posterior shadowing beneath it, most directly arises from refraction of the beam at that structure's genuinely curved edge, a well-recognized edge-shadowing phenomenon. Options A, B, and D each misstate this actual mechanism.
- 49. B.** Time gain compensation, adjusted specifically at the affected far-field depth, directly addresses a far field appearing genuinely brighter than expected while the near field remains appropriately set. Options A, C, and D each describe a control that applies uniformly rather than at a specific depth.
- 50. D.** Adjusting dynamic range and selecting an appropriate gray map together directly supports genuinely improved differentiation between structures with similar echogenicity, both parameters directly governing contrast resolution. Options A, B, and C each describe a combination that does not directly address this specific contrast goal.
- 51. A.** Minimizing line density and imaging depth to what is genuinely necessary directly reduces the pulses required per frame, helping maintain adequate frame rate for real-time assessment of a genuinely deep, moving structure. Options B, C, and D each describe an adjustment that would further reduce, not help maintain, frame rate.
- 52. A.** Tissue harmonic imaging generates its signal deeper within tissue, genuinely avoiding the superficial sources that commonly produce near-field reverberation artifact in fundamental frequency imaging. Options B, C, and D each misstate this actual mechanism and relevance.
- 53. D.** Spatial compounding combines multiple beam angles, genuinely reducing angle-dependent artifacts such as edge shadowing by averaging information from angles where the artifact does not occur. Options A, B, and C each misstate this actual benefit and mechanism.
- 54. C.** The reject control eliminates low-level signal below a genuinely selected threshold without affecting stronger, genuine signal above that threshold, directly addressing depth-specific noise without disturbing real signal. Options A, B, and D each describe a control that would affect signal and noise together rather than isolating noise specifically.

- 55. A.** A genuinely higher matrix resolution represents the identical acquired data with finer spatial precision than a lower matrix resolution, directly improving displayed image detail. Options B, C, and D each misstate this actual relationship.
- 56. B.** Multiple focal zones spanning the structure's genuine depth range provide optimized resolution across that full range, appropriate when a single structure extends across shallow to moderate depths. Options A, C, and D each describe an approach leaving part of the depth range suboptimally focused.
- 57. D.** Recognizing reverberation and posterior enhancement as genuinely distinct artifacts, each correlated with its own actual likely cause, is the appropriate approach when both are simultaneously present. Options A, B, and C each describe an inappropriate approach that conflates or ignores one of the two genuine findings.
- 58. A.** Write zoom, applied during acquisition, genuinely acquires additional scan lines within the specified region, providing genuinely improved true resolution compared to simply enlarging an already-acquired, unzoomed image. Options B, C, and D each misstate this actual improvement.
- 59. C.** An image orientation genuinely inconsistent with the standard sagittal-plane convention for a specific exam is most directly consistent with the transducer marker being positioned inconsistent with that intended convention. Options A, B, and D each describe an unrelated control that does not affect image orientation.
- 60. D.** A finding that disappears with a genuine change in transducer angle, while true anatomic structures remain unchanged, most directly suggests the finding is a genuine imaging artifact, since most artifacts are angle-dependent while real anatomy is not. Options A, B, and C each misstate this actual behavior pattern.
- 61. A.** Multiple, genuinely equally spaced parallel echo lines deep to a metallic needle are characteristic of reverberation artifact, from sound bouncing between the needle's genuinely parallel reflective surfaces. Options B, C, and D each describe an unrelated finding or mechanism.
- 62. B.** Systematically adjusting depth, focus, gain, and TGC together, as clinically needed throughout an exam, represents the appropriate comprehensive approach to image optimization, rather than relying on any single control in isolation. Options A, C, and D each describe an incomplete, single-control approach.
- 63. D.** Color variance mode genuinely displays the variation (turbulence) present within detected flow, adding this information atop or instead of standard velocity mapping. Options A, B, and C describe outputs of other, standard color Doppler modes.
- 64. D.** Color variance mode is genuinely most useful for identifying areas of genuine turbulent flow, such as distal to a stenosis, since it specifically highlights flow variation rather than mean velocity or direction alone. Options A, B, and C describe scenarios or outputs unrelated to variance mode's specific purpose.

- 65. B.** At a genuinely perpendicular 90-degree angle, the calculated Doppler shift is zero, so the system's calculated velocity output under this specific condition would genuinely also be zero. Options A, C, and D each misstate this actual outcome.
- 66. D.** Because the calculated shift is genuinely zero at a 90-degree angle, no genuinely usable Doppler signal would be obtained at this specific angle. Options A, B, and C each misstate this actual practical consequence.
- 67. B.** Excessive spectral Doppler gain introduces genuine noise into the display, including within the spectral window, independent of genuine underlying signal strength. Options A, C, and D describe controls not primarily responsible for this specific finding.
- 68. C.** Power Doppler is genuinely also known as energy (amplitude) mode, since it displays signal amplitude rather than directional velocity information. Options A, B, and D describe unrelated or incorrect alternative terminology.
- 69. D.** Correcting the angle toward a smaller value genuinely increases cosine, and therefore increases the calculated Doppler shift for the identical true velocity, since cosine increases as angle decreases toward zero. Options A, B, and C each misstate this actual mathematical relationship.
- 70. A.** Identifying whether an issue is genuinely frequency-domain, depth-domain, or angle-related reflects a systematic, mechanism-based troubleshooting approach, rather than a random or unstructured one. Options B, C, and D each misstate this actual approach.
- 71. B.** Pulsed-wave Doppler provides genuine range-specific information at a known, moderate depth, appropriate when velocities remain well within an achievable Nyquist limit. Options A, C, and D each describe a mode lacking the specific range-resolving capability this scenario requires.
- 72. C.** A genuinely large sample volume gate for a small, deep vessel risks genuine signal contamination from adjacent structures, since the larger gate captures a wider area than the small vessel itself. Options A, B, and D each misstate this actual risk.
- 73. B.** Steering the color box toward a more favorable angle directly improves genuine Doppler angle accuracy, and consequently the reliability of the resulting velocity measurement. Options A, C, and D describe parameters unrelated to this specific angle-steering adjustment.
- 74. C.** Because arterial and venous flow genuinely differ substantially in velocity, wall filter should be appropriately adjusted between the two vessel types within the same combined exam. Options A, B, and D each misstate this actual clinical practice.
- 75. C.** Resistive index equals (peak systolic velocity minus end-diastolic velocity) divided by peak systolic velocity: $(45-5)/45 \approx 0.89$. Options A, B, and D each apply an incorrect formula.
- 76. D.** Pulsatility index equals (peak systolic velocity minus end-diastolic velocity) divided by mean velocity: $(45-5)/20 = 2.0$. Options A, B, and C each apply an incorrect formula.

- 77. B.** A sharp systolic peak with genuine brief early diastolic reversal is the normal, expected high-resistance pattern for a healthy peripheral artery under resting conditions. Options A, C, and D each misstate this actual normal finding.
- 78. B.** Continuous, genuinely substantial forward diastolic flow is the normal, expected low-resistance pattern for the internal carotid artery, a vessel supplying an organ requiring constant perfusion. Options A, C, and D each misstate this actual normal finding.
- 79. D.** Volume flow rate equals mean velocity multiplied by cross-sectional area: $25 \text{ cm/s} \times 2 \text{ cm}^2 = 50 \text{ mL/s}$. Options A, B, and C each apply an incorrect calculation.
- 80. C.** Circular area equals pi times radius squared; with a 1.5 cm diameter, radius is 0.75 cm, so area = $\pi \times 0.75^2 \approx 1.77$ square centimeters. Options A, B, and D each apply an incorrect calculation.
- 81. D.** The Nyquist limit equals PRF divided by two: $8000 / 2 = 4000 \text{ Hz}$. Options A, B, and C each apply an incorrect calculation.
- 82. B.** A waveform peak genuinely missing from the top edge and reappearing along the bottom edge is the classic printed signature of aliasing on a spectral Doppler tracing. Options A, C, and D describe patterns inconsistent with this specific wraparound appearance.
- 83. C.** Because range ambiguity genuinely requires a lower PRF for correction, reducing PRF at the affected depth would likely resolve this specific finding. Options A, B, and D each misstate this actual expected response.
- 84. B.** A duplicate arterial signal appearing on the opposite side of a strong reflective boundary such as the pleura is characteristic of mirror image artifact, from sound reflecting off that specific strong reflector. Options A, C, and D each describe an unrelated finding or mechanism.
- 85. D.** Decreasing wall filter addresses genuine low-velocity venous signal loss, while appropriately adjusting gain addresses genuine background noise, together resolving both issues present simultaneously. Options A, B, and C each describe a combination that does not directly address both issues.
- 86. C.** Solving the Doppler equation for velocity requires rearranging it algebraically and substituting the measured shift, transmitted frequency, propagation speed, and cosine of the actual 45-degree angle used. Options A, B, and D each describe an approach that omits a genuinely necessary variable or misapplies the equation.
- 87. D.** Increasing the wall filter setting is appropriate for an arterial exam, directly addressing excessive low-frequency noise from vessel wall motion that a genuinely too-low setting failed to remove. Options A, B, and C each describe an adjustment that does not directly address this specific finding.
- 88. C.** Shifting the baseline reallocates display range for predominantly unidirectional flow, and considering CW Doppler if aliasing genuinely persists addresses velocities still exceeding the achievable

PW limit even at maximum scale. Options A, B, and D each describe an adjustment that does not directly address this specific scenario.

89. A. Testing each specific mechanism in turn, using the corresponding targeted check for aliasing, range ambiguity, and mirror image respectively, is the appropriate systematic approach when genuinely uncertain among these three possibilities. Options B, C, and D each describe an inappropriate assumption-based or dismissive approach.

90. A. Spectral broadening present throughout an entire vessel segment, rather than isolated distal to a focal narrowing, more directly suggests a genuinely diffuse disease process affecting that broader segment. Options B, C, and D each misstate or dismiss this actual clinical implication.

91. D. Decreasing color persistence reduces the genuine motion-related artifact (flash) that results from averaging sequential frames across genuine patient or transducer motion. Options A, B, and C describe controls not primarily responsible for reducing this specific artifact.

92. D. A genuinely tortuous vessel with a changing course requires re-correcting the Doppler angle at each genuinely distinct point along that course, since a single fixed correction would not remain accurate throughout. Options A, B, and C each describe an inappropriate approach for this specific scenario.

93. B. Power Doppler's genuine sensitivity to motion may produce flash artifact, a consideration a sonographer should genuinely anticipate for a motion-prone exam such as pediatric abdominal imaging. Options A, C, and D each misstate this actual consideration.

94. D. Overall 2D (grayscale) gain specifically affects the grayscale image display, independent of Doppler gain settings, which are separately and independently adjustable. Options A, B, and C each misstate this actual independence.

95. A. Systematic optimization of angle, scale, gain, and wall filter as clinically needed represents the appropriate comprehensive approach to Doppler assessment, rather than relying on any single control in isolation. Options B, C, and D each describe an incomplete or inappropriate approach.

96. D. Identifying the likely mechanism, then applying a targeted, verifying test, is the single most reliable general principle for distinguishing genuine artifact from true pathology, rather than assuming either by default. Options A, B, and C each describe an inappropriate, non-systematic approach.

97. B. The genuine width and clarity of the spectral window beneath the waveform is the single most reliable spectral finding for distinguishing laminar (narrow, clear window) from turbulent (broadened, filled-in window) flow. Options A, C, and D describe findings less directly diagnostic of this specific distinction.

98. C. Algebraically isolating the specific unknown variable, then solving directly using the other known values, is the genuinely correct general approach for any Doppler equation calculation. Options A, B, and D each describe an inappropriate or incomplete approach.

- 99. B.** Standard color Doppler display convention generally gives color signal genuine display priority at a pixel where both grayscale and color are genuinely present simultaneously. Options A, C, and D each misstate this actual standard convention.
- 100. D.** Gas-containing structures such as lung or bowel genuinely introduce additional cavitation nuclei into the field, elevating mechanical bioeffects risk near these specific structures. Options A, B, and C each misstate this actual consideration.
- 101. D.** Accreditation bodies genuinely require documented QA programs with defined personnel responsibilities, a requirement facilities maintain to satisfy these external accreditation standards. Options A, B, and C each misstate this actual requirement's scope and source.
- 102. C.** Motion during extended field-of-view 3D acquisition risks genuine stitching artifact or misalignment between the combined sub-volumes, since accurate combination depends on consistent positioning throughout acquisition. Options A, B, and D each misstate this actual risk.
- 103. A.** TIB (bone thermal index) is appropriate when bone is genuinely at or near the beam's focus, consistent with later-gestation obstetric imaging once fetal bone has ossified sufficiently. Options B, C, and D each describe an inappropriate sub-type for this specific scenario.
- 104. B.** The Thermal Index reflects genuine heating potential from tissue absorption, while the Mechanical Index reflects genuine cavitation potential from mechanical bioeffects, two genuinely distinct bioeffect categories. Options A, C, and D each misstate this actual distinction.
- 105. A.** ALARA is genuinely best understood as a continuously reassessed practice, weighing diagnostic benefit against genuine exposure risk throughout an exam, not a single fixed setting or numeric threshold. Options B, C, and D each mischaracterize ALARA's actual, ongoing application.
- 106. D.** Scanning a phantom's uniform background region across a transducer's full width is most directly testing for genuine uniformity of response, revealing a damaged or faulty element as a localized dropout. Options A, B, and C describe genuinely different QA parameters.
- 107. D.** A daily checklist involving physical inspection tasks, separate from phantom-based testing, genuinely represents preventive maintenance, distinct from formal QA performance testing. Options A, B, and C each describe a formal, quantitative QA test rather than this specific preventive maintenance activity.
- 108. B.** Shear wave elastography provides an absolute, quantitative stiffness value, genuinely suited to tracking a specific numeric value across serial exams, unlike strain elastography's relative, qualitative output. Options A, C, and D each misstate or dismiss this actual capability.
- 109. A.** Confirming the Mechanical Index is deliberately set low but genuinely non-zero, before microbubble injection, balances preserving microbubble integrity against maintaining detectable contrast

signal. Options B, C, and D each describe an inappropriate or dismissive approach to this specific confirmation.

110. B. A QA result meaningfully outside established tolerance indicates genuine risk regardless of subjective image appearance, so the appropriate response is removing the affected transducer from service until corrected and re-verified. Options A, C, and D each describe an inappropriate response that fails to address the genuine underlying concern.