

COMPREHENSIVE MOCK EXAM 11

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 decibel is genuinely a logarithmic unit used to compare which of the following?
 - A. Two intensity or power values relative to one another
 - B. Two genuine frequency values relative to one another
 - C. Two genuine distance values relative to one another
 - D. Two genuine time values relative to one another

2. A beam's intensity decreases from 100 mW/cm^2 to 1 mW/cm^2 as it travels through tissue. What is the genuine attenuation expressed in decibels?
 - A. 10 decibels of total genuine attenuation
 - B. 2 decibels of total genuine attenuation
 - C. 20 decibels of total genuine attenuation
 - D. 100 decibels of total genuine attenuation

3. Spatial peak temporal average (SPTA) intensity genuinely represents which of the following?
 - A. The genuine peak intensity at one instant, at the beam's weakest point
 - B. The intensity at the beam's most intense point, averaged over time
 - C. The intensity averaged spatially, at one single instant in time
 - D. The genuine minimum intensity anywhere within the entire beam

4. The near zone length (Fresnel zone length) is genuinely calculated using which of the following formula?
 - A. Propagation speed divided by the current transmitted frequency
 - B. Number of cycles multiplied by the genuine wavelength value
 - C. Element diameter squared, divided by four times the wavelength
 - D. Pulse repetition frequency divided by two, the Nyquist limit

5. Two transducers, genuinely identical except for element diameter, are compared for near zone length. The transducer with the genuinely larger element diameter will produce which of the following near zone length, all else equal?

- A. A genuinely longer near zone length, since diameter is squared in the formula
- B. A genuinely shorter near zone length, since a larger element shortens this zone
- C. An identical near zone length, since diameter does not affect this calculation
- D. A near zone length that only changes if frequency is also genuinely altered

6. Increasing transducer frequency, and thereby decreasing wavelength, all else held equal, has which of the following effect on near zone length?

- A. Increases near zone length, since wavelength sits in the denominator
- B. Decreases near zone length, since higher frequency shortens this zone
- C. Has no genuine effect on near zone length under any circumstance
- D. Only affects near zone length when element diameter also changes

7. A beam crosses an oblique boundary into a medium with a genuinely higher propagation speed than the first medium. The refracted beam genuinely bends in which direction relative to the normal?

- A. Toward the normal, since propagation speed genuinely increased
- B. Directly along the normal itself, regardless of the speed change
- C. Away from the normal, since propagation speed genuinely increased
- D. The beam does not genuinely bend under this specific condition

8. Beyond the critical angle of incidence, a beam crossing into a medium with genuinely higher propagation speed experiences which of the following?

- A. Total reflection, with no genuine transmission across the boundary
- B. Total transmission, with no genuine reflection at the boundary at all
- C. Equal genuine reflection and transmission, regardless of angle used

D. Complete absorption, with neither genuine reflection nor transmission

9. Intensity, a measure of genuine acoustic power concentration, is genuinely expressed in which of the following units?

A. Watts per square centimeter

B. Decibels per centimeter per megahertz

C. Meters per second, the standard propagation speed unit

D. Hertz, the standard genuine frequency unit

10. Prior to a genuinely invasive-adjacent ultrasound procedure, standard practice requires which of the following?

A. Proceeding directly without any genuine discussion of the procedure

B. Obtaining consent only if the patient specifically requests it first

C. Obtaining appropriate informed consent and documenting the discussion

D. Deferring all genuine consent discussion entirely to referring physician

11. For certain abdominal exams, positioning a patient in a genuine left lateral decubitus position primarily serves which of the following purpose?

A. Reduces the genuine transmitted frequency required for that exam

B. Repositions bowel gas or shifts organs to improve genuine visualization

C. Eliminates the genuine need for any further TGC adjustment at all

D. Automatically improves genuine axial resolution regardless of anatomy

12. During genuinely real-time scanning of a moving structure, excessive persistence risks which of the following consequence for the sonographer's live perception?

A. Improved genuine perception of rapid, real-time motion occurring

B. Blurred perception of rapid motion, from averaging sequential frames

- C. No genuine effect on real-time motion perception whatsoever
- D. Only affects perception when genuine color Doppler is also active

13. A transducer operates at 7.5 MHz. Using the standard assumed soft-tissue propagation speed, what is the approximate wavelength?

- A. 1.54 millimeters, an unrelated intermediate calculation entirely
- B. 0.75 millimeters, an unrelated intermediate calculation entirely
- C. 2.05 millimeters, an unrelated intermediate calculation entirely
- D. 0.21 millimeters, calculated as propagation speed divided by frequency

14. Of the following factors, which genuinely has the greatest direct influence on total attenuation experienced along a given beam path?

- A. The current pulse repetition frequency setting genuinely selected
- B. Both transmitted frequency and total path length traveled together
- C. The current dynamic range setting genuinely selected for the exam
- D. The current persistence setting genuinely selected for the exam

15. The reflection coefficient at a tissue boundary genuinely represents which of the following?

- A. The genuine propagation speed difference between the two tissues
- B. The current transmitted frequency selected for that specific exam
- C. The number of genuine cycles present within the transmitted pulse
- D. The fraction of incident intensity genuinely reflected at that boundary

16. At a tissue boundary with a genuinely large reflection coefficient, the corresponding fraction of intensity genuinely transmitted across that boundary is which of the following?

- A. Correspondingly small, since reflected and transmitted fractions sum to the total
- B. Correspondingly large, unrelated to the genuine reflected fraction present

- C. Always exactly equal to the genuine reflected fraction at that boundary
- D. Entirely independent of the genuine reflection coefficient at that boundary

17. Intensity is genuinely related to amplitude in which of the following ways?

- A. Intensity is genuinely proportional to amplitude squared
- B. Intensity is genuinely proportional to amplitude directly, linearly
- C. Intensity and amplitude are entirely unrelated acoustic parameters
- D. Intensity is genuinely inversely proportional to amplitude directly

18. If a transmitted pulse's amplitude is genuinely doubled, all else held equal, the resulting intensity does which of the following?

- A. Genuinely doubles as well, proportional directly to amplitude
- B. Remains entirely unchanged despite the amplitude change made
- C. Genuinely increases fourfold, since intensity depends on amplitude squared
- D. Genuinely decreases, since amplitude and intensity are inversely related

19. Power, distinct from intensity, is genuinely best described as which of the following?

- A. Acoustic energy concentrated specifically per unit cross-sectional area
- B. The genuine rate of acoustic energy transfer, without reference to area
- C. The genuine ratio of largest to smallest processable signal amplitude
- D. The genuine number of cycles present within a single transmitted pulse

20. Intensity is genuinely calculated as which of the following relationship?

- A. Power multiplied by the beam's genuine cross-sectional area
- B. Power divided by the current transmitted frequency selected
- C. Power divided by the beam's genuine cross-sectional area

D. Power multiplied by the current pulse repetition frequency selected

21. A transducer used for a semi-critical application (contacting mucous membranes) genuinely requires which of the following level of disinfection between patients?

A. No genuine disinfection is required for this specific use category

B. Low-level disinfection alone is genuinely sufficient for this category

C. Cleaning with plain water alone is genuinely sufficient for this category

D. High-level disinfection, appropriate to this specific use category

22. Positioning the display monitor at a genuinely appropriate height and distance primarily serves which of the following ergonomic purpose?

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

B. Reduces genuine neck and eye strain during prolonged scanning sessions

C. Genuinely eliminates the need for any further gain adjustment at all

D. Automatically improves genuine axial resolution regardless of setup

23. The cine loop (cine review) function genuinely allows a sonographer to do which of the following?

A. Genuinely acquire additional scan lines beyond the original acquisition

B. Permanently alter the genuine underlying acquired raw echo data itself

C. Genuinely eliminate the need for any further TGC adjustment at all

D. Review a short buffer of recently acquired frames after acquisition

24. M-mode imaging genuinely displays which of the following?

A. A genuine two-dimensional cross-sectional image updated continuously

B. A genuine three-dimensional volumetric rendering of the anatomy

C. A genuine spectral display of velocity information over time only

D. Motion of structures along a single scan line, plotted over time

25. M-mode's genuine advantage over standard two-dimensional imaging for assessing very rapid structural motion, such as a cardiac valve, is which of the following?

- A.** Genuinely improved lateral resolution compared to standard 2D imaging
- B.** Genuinely improved penetration depth compared to standard 2D imaging
- C.** Substantially higher genuine temporal resolution along that single line
- D.** Genuinely eliminates the need for any Doppler assessment whatsoever

26. Kerf, in an array transducer's genuine construction, refers to which of the following?

- A.** The genuine total number of elements present in the array itself
- B.** The overall genuine physical width of the entire transducer array
- C.** The genuine frequency at which the array's bandwidth is centered
- D.** The narrow space genuinely separating adjacent individual elements

27. Pitch, in an array transducer's genuine construction, is genuinely best described as which of the following?

- A.** The genuine total number of elements present in the array itself
- B.** The narrow space genuinely separating adjacent individual elements
- C.** The genuine center-to-center distance between adjacent elements
- D.** The overall genuine physical width of the entire transducer array

28. A broadband (broad-bandwidth) transducer genuinely provides which of the following advantage?

- A.** A genuinely fixed, single operating frequency with no adjustability
- B.** The ability to operate effectively across a genuine range of frequencies
- C.** Elimination of the genuine need for any matching layer whatsoever

D. A genuinely permanent, unchangeable focal depth for every application

29. A sonographer selecting a genuinely higher-frequency transducer for a superficial structure accepts which of the following direct trade-off?

- A.** Genuinely improved penetration depth at the cost of axial resolution
- B.** Genuinely improved axial resolution with no genuine trade-off at all
- C.** Genuinely improved frame rate at the cost of genuine lateral resolution
- D.** Genuinely reduced penetration depth in exchange for improved resolution

30. A sonographer selecting a genuinely lower-frequency transducer for a deep structure accepts which of the following direct trade-off?

- A.** Genuinely improved axial resolution at the cost of penetration depth
- B.** Genuinely reduced axial resolution in exchange for improved penetration
- C.** Genuinely improved frame rate at the cost of genuine penetration depth
- D.** No genuine trade-off exists between penetration depth and resolution

31. A sector (phased array) transducer's genuinely small footprint, combined with its genuinely wide far-field view, makes it well suited for which of the following scanning circumstance?

- A.** A genuinely wide, superficial field of view at a shallow depth only
- B.** Scanning through a genuinely narrow acoustic window with a deep target
- C.** Endocavitary applications exclusively, through a genuine narrow orifice
- D.** Applications genuinely requiring no electronic steering whatsoever

32. A genuinely damaged or non-functional individual element within an array transducer most directly risks which of the following image artifact?

- A.** A genuine, uniform improvement in overall image brightness throughout
- B.** A genuinely improved achievable frame rate compared to a fully intact array

- C. Complete, genuine loss of all image signal across the entire display
- D. A vertical dropout or streak artifact at that specific element's location

33. A QA technologist testing for a genuinely damaged transducer element would most directly look for which of the following on a uniformity phantom image?

- A. A genuinely uniform image with no visible variation anywhere at all
- B. A genuinely improved frame rate compared to the manufacturer's specification
- C. A vertical dropout or streak artifact at a genuinely specific location
- D. A genuinely improved achievable penetration depth beyond specification

34. Signal-to-noise ratio, as it pertains to genuine image quality, describes which of the following?

- A. The ratio between genuine axial and lateral resolution values
- B. The relationship between genuine signal strength and background noise
- C. The ratio between transmitted and received frequency values
- D. The relationship between frame rate and dynamic range settings

35. Which of the following genuinely improves signal-to-noise ratio without simply amplifying both signal and noise together?

- A. Increasing overall gain uniformly across the entire displayed image
- B. Increasing reject to its genuine maximum available setting
- C. Increasing dynamic range substantially beyond current settings
- D. Increasing persistence, averaging out genuine random noise

36. A sonographer selects a different gray map (postprocessing curve) for a specific exam type. This adjustment genuinely changes which of the following?

- A. The genuine acquired raw echo amplitude data itself
- B. The transmitted frequency selected for that specific exam

- C. The genuine achievable axial resolution for that exam
- D. How already-acquired amplitude values are mapped to displayed brightness

37. The freeze function, as distinct from cine loop review, genuinely provides which of the following?

- A. A buffer of multiple recently acquired frames for genuine review
- B. Genuinely additional true resolution beyond the original acquisition
- C. A single, static frame held for genuine measurement or documentation
- D. Automatic storage of every frame from throughout the entire exam

38. DICOM, as a standard relevant to ultrasound image management, primarily governs which of the following?

- A. The genuine transmitted frequency used for image acquisition itself
- B. The genuine propagation speed assumption used for calculations
- C. A standardized format for storing and transmitting medical images
- D. The genuine duty factor used during image acquisition itself

39. A sonographer increases focal zones from 1 to 3 for a single exam, all else held equal. What is the most direct genuine consequence?

- A. Frame rate genuinely triples, since three times the resolution is achieved
- B. Frame rate remains entirely unchanged despite the additional zones used
- C. Frame rate genuinely improves, since fewer total pulses are now needed
- D. Frame rate genuinely decreases, since additional pulses are now required

40. Standard two-dimensional grayscale imaging is genuinely known as which of the following mode?

- A. B-mode (brightness mode), displaying a genuine 2D cross-sectional image
- B. M-mode, displaying genuine motion along a single line over time instead

- C. A-mode, displaying genuine amplitude spikes along a single line instead
- D. Doppler mode exclusively, displaying only genuine velocity information

41. A sonographer applies write zoom to a 4 cm by 4 cm region of interest before acquisition, genuinely acquiring additional scan lines within that specific region. Compared to the original, unzoomed field of view, this technique genuinely provides which of the following?

- A. No genuine change in achievable resolution within that specific region
- B. Reduced genuine resolution within that specific region compared to before
- C. Improved genuine resolution within that specific region compared to before
- D. Genuinely improved penetration depth beyond the original acquisition

42. A sonographer applies electronic (pan) zoom to an already-acquired, previously unzoomed image. This technique genuinely provides which of the following?

- A. Magnification of existing data, without genuinely new resolution gained
- B. Genuinely new scan lines acquired specifically for that magnified region
- C. A completely new acquisition using genuinely different transducer elements
- D. Improved genuine penetration depth beyond the original acquisition

43. The TGC slope specifically controls which of the following?

- A. The genuine total number of TGC segments available on the console
- B. The genuine rate at which compensation increases with increasing depth
- C. The genuine overall gain applied uniformly regardless of depth involved
- D. The genuine dynamic range displayed across the entire image itself

44. A sonographer notices a specific mid-depth region appears genuinely brighter than both shallower and deeper regions, despite otherwise appropriate settings. Which control is most likely responsible?

- A. Overall gain, applied uniformly regardless of the genuine depth involved

- B.** Persistence, averaging sequential frames across the entire displayed image
- C.** An inappropriately set TGC slide positioned at that specific mid-depth
- D.** Dynamic range, narrowing the genuinely displayed range of values shown

45. A sonographer evaluating a lesion's genuine margin characteristics enables spatial compounding. This adjustment most directly improves genuine assessment of which of the following?

- A.** The lesion's genuine border definition, via reduced speckle noise
- B.** The lesion's genuine internal vascularity, via improved Doppler sensitivity
- C.** The lesion's genuine internal echogenicity pattern exclusively, alone
- D.** The lesion's genuine posterior acoustic enhancement pattern exclusively

46. A sonographer scanning a technically difficult, genuinely obese patient enables tissue harmonic imaging. This adjustment most directly addresses which of the following?

- A.** Genuinely improved achievable frame rate for this specific patient
- B.** Genuinely improved penetration depth beyond fundamental imaging alone
- C.** Genuinely eliminated need for any further TGC adjustment at all
- D.** Reduced near-field artifact and improved genuine border definition

47. A sonographer finds the current image displays genuinely excessive contrast, with subtly different tissues appearing nearly indistinguishable in brightness. Which adjustment is most directly appropriate?

- A.** Decrease overall gain applied uniformly across the entire displayed image
- B.** Increase dynamic range, allowing more genuine gray shade distinctions
- C.** Increase persistence, averaging additional sequential frames together
- D.** Decrease the current transmitted frequency for that specific exam

48. A sonographer finds the current image appears genuinely washed out, with insufficient contrast between adjacent structures. Which adjustment is most directly appropriate?

- A.** Increase overall gain applied uniformly across the entire displayed image
- B.** Increase persistence, averaging additional sequential frames together
- C.** Increase the current transmitted frequency for that specific exam
- D.** Decrease dynamic range, increasing genuine displayed contrast

49. A sonographer compares two systems: one with a 512 by 512 pixel matrix, another with a 1024 by 1024 pixel matrix, displaying the identical field of view. All else equal, which system genuinely provides finer displayed image detail?

- A.** The 512 by 512 system, since fewer pixels means each one is more precise
- B.** The 1024 by 1024 system, since more pixels represent the data more finely
- C.** Matrix size genuinely has no bearing on displayed image detail at all
- D.** Both systems provide genuinely identical displayed detail regardless of matrix

50. A sonographer needs to image a genuinely deep structure while maintaining adequate frame rate for real-time assessment. Which single adjustment most directly helps balance these two competing goals?

- A.** Increasing line density substantially for maximum genuine detail
- B.** Reducing line density to the minimum still diagnostically adequate
- C.** Increasing the number of focal zones substantially for genuine detail
- D.** Increasing persistence substantially to compensate for reduced detail

51. A pulse contains 2 cycles at a wavelength of 0.5 mm. What is the resulting spatial pulse length, and what does this value directly represent for genuine axial resolution?

- A.** 1.0 mm; a value genuinely unrelated to axial resolution under any circumstance
- B.** 0.25 mm; theoretical best-case axial resolution is genuinely double this value
- C.** 2.5 mm; a value genuinely unrelated to axial resolution in any way
- D.** 1.0 mm; theoretical best-case axial resolution is approximately half this value

52. A sonographer notices lateral resolution improves as a structure of interest is imaged closer to the transducer's genuine focal zone, then worsens again beyond it. This pattern most directly reflects which of the following?

- A.** Genuine beam width, which narrows toward the focal zone and widens beyond it
- B.** The current dynamic range setting, unrelated to the genuine focal zone location
- C.** The current persistence setting, unrelated to the genuine focal zone location
- D.** Genuine spatial pulse length, unrelated to the genuine focal zone location

53. A sonographer wants to genuinely maximize the system's ability to distinguish subtly different tissue echogenicities. Which combination of factors most directly supports this specific goal?

- A.** Sufficient dynamic range and adequate gray-scale bit depth together
- B.** Sufficient frame rate and adequate line density together instead
- C.** Sufficient axial resolution and adequate spatial pulse length together
- D.** Sufficient penetration depth and adequate transmitted frequency together

54. A sonographer needs genuinely accurate depiction of rapid structural motion over time. Which system characteristic most directly supports this specific goal?

- A.** Genuinely maximized axial resolution, regardless of any other factor
- B.** Genuinely maximized contrast resolution, regardless of any other factor
- C.** Genuinely maximized dynamic range, regardless of any other factor
- D.** Genuinely maximized frame rate (temporal resolution) specifically

55. A sonographer notices a cystic structure's genuine internal fluid appears artificially bright with echoes present that should genuinely be absent (anechoic). Which adjustment is most directly appropriate?

- A.** Decrease overall gain, appropriately reducing the amplification applied
- B.** Increase overall gain further still, regardless of the current setting
- C.** Increase persistence to average multiple sequential frames together

D. Increase dynamic range to display additional genuine gray shades

56. A sonographer notices persistent low-level background noise cluttering an otherwise adequate image despite appropriate overall gain. Which specific control most directly addresses this without affecting genuine stronger signal?

- A. Overall gain, applied uniformly regardless of the noise level present**
- B. Reject, eliminating low-level signal below a genuinely selected threshold**
- C. Persistence, averaging sequential frames across the entire displayed image**
- D. Dynamic range, narrowing the genuinely displayed range of values shown**

57. A sonographer is imaging a structure of interest located at a genuinely shallow depth, close to the transducer face. Appropriate focal zone placement for this specific structure is which of the following?

- A. Positioned at the genuinely deepest available depth regardless of structure**
- B. Positioned at or near that genuinely shallow depth specifically**
- C. Positioned at a fixed, standard mid-field depth for every genuine exam**
- D. Focal zone placement genuinely has no bearing on this specific scenario**

58. A sonographer notices the displayed image appears genuinely mirror-reversed compared to the expected anatomic orientation convention for that exam type. This is most directly consistent with which of the following?

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

59. A sonographer notices the current image appears genuinely grainy, with visible random speckle obscuring fine anatomic detail, despite adequate penetration. Which adjustment set is most directly appropriate?

- A.** Decrease the current imaging depth to a genuinely shallower setting
- B.** Increase overall gain substantially, regardless of the current setting
- C.** Decrease overall gain, or increase persistence, to reduce apparent noise
- D.** Increase the current transmitted frequency for improved genuine detail

60. During a genuine exam, a clinically important structure drifts to the extreme edge of the current display as the patient shifts position, becoming only partially visible. Which adjustment is most directly appropriate?

- A.** Reposition the transducer, or adjust the field of view, to recenter it
- B.** Increase overall gain to genuinely improve visibility of that structure
- C.** Increase persistence to genuinely average additional sequential frames
- D.** Increase dynamic range to display additional genuine gray shades

61. A sonographer's current image is simultaneously too dark, genuinely too noisy, and shows a structure of interest cut off at the display edge. Which of the following represents the most appropriate systematic approach?

- A.** Address each issue individually and systematically, in a logical sequence
- B.** Address genuinely only the noise issue, ignoring the other two problems
- C.** Address genuinely only the cut-off structure, ignoring the other two problems
- D.** Address genuinely only the darkness issue, ignoring the other two problems

62. A sonographer imaging a genuinely deep, technically difficult structure needs both improved penetration and adequate real-time frame rate simultaneously. Which combination of adjustments most directly supports both goals together?

- A.** Increased dynamic range combined with an increased color box size
- B.** A genuinely higher-frequency transducer combined with increased line density
- C.** Increased persistence combined with an increased number of focal zones
- D.** A genuinely lower-frequency transducer combined with reduced line density

- 63.** A reflector's motion produces a genuinely negative Doppler shift value. This sign convention genuinely indicates which of the following?
- A.** The reflector is genuinely moving toward the transducer
 - B.** The reflector is genuinely moving away from the transducer
 - C.** The reflector is genuinely stationary relative to the transducer
 - D.** The sign convention genuinely provides no directional information
- 64.** On a genuine color Doppler display using standard convention, red typically genuinely represents which of the following?
- A.** Flow genuinely moving away from the transducer, by fixed universal convention
 - B.** Flow genuinely at the Nyquist limit exclusively, regardless of direction
 - C.** Flow genuinely absent at that specific location on the display
 - D.** Flow genuinely moving toward the transducer, by common but adjustable convention
- 65.** Aliasing on a genuine color Doppler display characteristically appears as which of the following?
- A.** A gradual, genuinely smooth color transition through intermediate shades
 - B.** Complete, genuine absence of color signal at the aliased location
 - C.** A uniform, genuinely single-color display throughout the entire vessel
 - D.** An abrupt transition directly from one color extreme to the opposite extreme
- 66.** A sonographer notices genuinely predominant unidirectional flow within a vessel is displaying with significant color aliasing near the vessel's genuine center. Which adjustment is most directly appropriate as an initial step?
- A.** Decrease the current color gain setting substantially
 - B.** Increase the current wall filter setting substantially
 - C.** Shift the baseline to reallocate genuine display range toward that flow direction
 - D.** Decrease the current color box size substantially

- 67.** Selecting a genuinely higher scale (PRF) setting, all else held equal, most directly affects which of the following?
- A.** The maximum achievable sample volume depth, which genuinely decreases
 - B.** The current transmitted frequency, which genuinely increases as a result
 - C.** The current wall filter setting, which genuinely increases as a result
 - D.** The current dynamic range setting, which genuinely decreases as a result
- 68.** Spectral Doppler gain and color Doppler gain are genuinely which of the following?
- A.** Identical, genuinely controlled by a single, shared console setting
 - B.** Entirely unrelated to genuine signal amplification in either mode
 - C.** Only relevant when genuinely used together within a single exam
 - D.** Independently adjustable, each affecting only its own respective mode
- 69.** A vessel has a genuine internal diameter of 2 cm. What is its approximate genuine cross-sectional area, using the standard circular area formula?
- A.** Approximately 3.14 square centimeters, using pi times radius squared
 - B.** Approximately 2 square centimeters, equal to the diameter value alone
 - C.** Approximately 6.28 square centimeters, using pi times diameter alone
 - D.** Approximately 4 square centimeters, equal to the diameter squared alone
- 70.** A vessel with a genuine cross-sectional area of 3 square centimeters has a genuine mean velocity of 20 cm/s. What is the approximate genuine volume flow rate?
- A.** 6.7 mL/s, calculated as area divided by mean velocity
 - B.** 23 mL/s, calculated as area plus mean velocity together
 - C.** 60 mL/s, calculated as mean velocity multiplied by area
 - D.** 17 mL/s, an unrelated intermediate calculation entirely

71. Turbulent flow distal to a genuine focal vessel stenosis most directly arises from which of the following?

- A.** An excessively low wall filter setting allowing genuine noise through
- B.** An excessively high current pulse repetition frequency setting
- C.** An inappropriately narrow current color box size selected
- D.** Disrupted, disorganized flow patterns from the genuine stenotic segment

72. A spectral waveform obtained distal to a genuine proximal arterial stenosis shows a delayed, genuinely slowed systolic upstroke with a rounded peak. This pattern is genuinely known as which of the following?

- A.** A genuinely normal, healthy triphasic waveform pattern
- B.** A high-resistance waveform pattern, genuinely inconsistent with this description
- C.** A tardus parvus waveform, indicating genuine proximal stenosis
- D.** An artifact requiring no further genuine clinical consideration

73. A spectral waveform obtained distal to a genuine severe, long-segment arterial occlusion shows a markedly flattened, low-amplitude pattern with minimal genuine systolic-diastolic variation. This pattern is genuinely known as which of the following?

- A.** A genuinely normal, healthy triphasic waveform pattern
- B.** A tardus parvus waveform, genuinely inconsistent with this specific description
- C.** An artifact requiring no further genuine clinical consideration at all
- D.** A damped waveform, indicating genuine severe proximal disease

74. Duty factor for pulsed-wave Doppler is genuinely calculated using which of the following relationship?

- A.** Propagation speed divided by the current transmitted frequency selected
- B.** Pulse repetition frequency divided by two, the genuine Nyquist limit
- C.** Pulse duration divided by the current pulse repetition period

D. The current Doppler angle divided by the assumed propagation speed

75. A sonographer systematically working through aliasing correction options, in a genuinely appropriate order, should generally consider which of the following sequence?

A. Switch to CW Doppler first, before attempting any other genuine adjustment

B. Decrease wall filter first, before attempting any other genuine adjustment

C. Increase persistence first, before attempting any other genuine adjustment

D. Increase scale first, then shift baseline, then consider CW if still needed

76. At a genuine Doppler angle of 0 degrees (beam parallel to flow), the calculated Doppler shift is genuinely which of the following, all else held equal?

A. Genuinely at its theoretical minimum possible value for that flow

B. Genuinely at its theoretical maximum possible value for that flow

C. Genuinely zero, since cosine of 0 degrees equals zero exactly

D. Entirely unpredictable without genuinely more information provided

77. A sonographer notices color signal genuinely persisting briefly across an area after the transducer itself has moved, unrelated to genuine blood flow. This is most consistent with which of the following?

A. Genuine, accurate flow signal correctly tracking real blood movement

B. Aliasing, a frequency-domain artifact tied to the Nyquist limit specifically

C. Flash artifact, from genuine transducer or patient motion

D. Mirror image artifact, from reflection off a genuine strong reflector

78. For genuinely representative velocity measurement, the sample volume gate should generally be positioned at which of the following location within a vessel's lumen?

A. At or near the genuine center of the vessel lumen, where flow is typically fastest

B. At the genuine vessel wall itself, regardless of typical flow distribution

- C. Sample volume position genuinely has no bearing on measured velocity
- D. At the shallowest possible depth, regardless of the vessel's true location

79. A sonographer steers the color box angle to genuinely improve the Doppler angle for a vessel running parallel to the skin surface. This adjustment most directly addresses which of the following?

- A. Genuine axial resolution, unrelated to the current color box angle
- B. Genuine penetration depth, unrelated to the current color box angle
- C. Genuine frame rate, unrelated to the current color box steering angle
- D. Genuine Doppler angle accuracy, directly affected by beam steering

80. A sonographer calculating volume flow rate must genuinely use which specific velocity measure, rather than the single highest recorded value?

- A. Mean velocity, averaging the full genuine spectrum across the cardiac cycle
- B. Peak systolic velocity alone, the single highest recorded value
- C. End-diastolic velocity alone, the lowest genuinely recorded value
- D. The resistive index alone, a genuinely unitless calculated ratio

81. Compared to a genuine low-velocity venous exam, a typical high-velocity arterial exam generally uses which of the following wall filter setting?

- A. A genuinely higher wall filter setting, appropriate for higher velocities
- B. A genuinely lower wall filter setting, matching typical venous values instead
- C. Wall filter setting genuinely has no relevance to arterial exams at all
- D. The genuine lowest available wall filter setting, for cleanest arterial signal

82. A sonographer selects a genuinely larger sample volume gate size for a specific measurement. This choice most directly trades improved genuine sensitivity for which of the following?

- A. Genuinely improved range specificity compared to a smaller gate size

- B.** No genuine trade-off exists when selecting a larger gate size
- C.** Genuinely improved achievable frame rate compared to a smaller gate
- D.** Reduced genuine range specificity, capturing a wider depth range

83. A sonographer needs to measure a genuinely very high-velocity jet across a stenotic cardiac valve, where PW Doppler at any achievable scale would genuinely alias. Which mode is most appropriate?

- A.** Continuous-wave Doppler, since it has no genuine Nyquist limit at all
- B.** Color Doppler alone, without any genuine spectral component used
- C.** Power Doppler alone, since directional information is genuinely not needed
- D.** M-mode alone, without any genuine Doppler component whatsoever

84. A sonographer using a genuinely very high PRF at significant sample volume depth notices signal appearing to originate from an implausible depth. Increasing PRF further would most directly do which of the following to this specific artifact?

- A.** Genuinely resolve the artifact completely at any further PRF increase
- B.** Have no genuine effect on the artifact under any circumstance at all
- C.** Potentially worsen the artifact, since range ambiguity worsens with higher PRF
- D.** Automatically convert the artifact into genuine aliasing instead

85. A sonographer evaluating flow near a rib shadow observes an apparent duplicate flow signal on the opposite side of that strong reflective boundary, in a location with no expected anatomic vessel. This finding is most consistent with which of the following?

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

86. A sonographer wants to distinguish whether an unusual finding is aliasing or genuine turbulent flow rather than an artifact at all. Which observation would most directly support genuine turbulence over aliasing?

- A.** The waveform peak abruptly wraps from top to bottom of the display
- B.** The spectral window shows genuine filling-in with broadened width
- C.** The finding resolves immediately once scale is genuinely increased
- D.** The finding is genuinely confined to a single, discrete velocity value

87. A sonographer has already increased scale to its genuine maximum achievable value at the current depth, and aliasing persists. Which of the following is the most appropriate next step?

- A.** Switch to continuous-wave Doppler for this specific measurement
- B.** Continue increasing scale further, beyond the genuine achievable maximum
- C.** Decrease the current wall filter setting to its genuine minimum value
- D.** Increase persistence substantially to average additional sequential frames

88. A sonographer suspects mirror image artifact at a specific location. Which specific test most directly helps confirm this suspicion?

- A.** Increasing overall Doppler gain substantially at that specific location
- B.** Repositioning the transducer and observing whether the finding changes
- C.** Increasing the current pulse repetition frequency setting selected
- D.** Decreasing the current wall filter setting to its genuine minimum value

89. When encountering any genuinely unclear Doppler finding, applying a systematic, mechanism-based approach rather than an immediate assumption offers which of the following genuine advantage?

- A.** Correctly distinguishes genuine artifact from true pathology more reliably
- B.** Genuinely eliminates the need for any further clinical correlation at all
- C.** Automatically resolves every genuine artifact without further adjustment

D. Is genuinely relevant only when color Doppler is the mode being used

90. Spectral broadening observed just distal to a genuine focal stenosis most directly reflects which of the following underlying physical process?

- A.** A genuinely normal, laminar flow pattern unaffected by the stenosis present
- B.** Turbulent flow, from disrupted, disorganized flow at that specific location
- C.** An excessively high wall filter setting removing genuine flow signal present
- D.** A technical artifact requiring no further genuine clinical consideration

91. A sonographer knows the genuine Doppler shift, blood velocity, propagation speed, and Doppler angle, but needs to solve the equation for the original transmitted frequency instead. Which approach is genuinely correct?

- A.** The transmitted frequency can never genuinely be isolated in this equation
- B.** Multiply the Doppler shift directly by the assumed propagation speed alone
- C.** Divide velocity directly by the assumed propagation speed alone
- D.** Algebraically isolate the transmitted frequency term, then solve directly

92. Some systems allow a sonographer to adjust color write priority, determining whether color or grayscale signal displays when both are genuinely present at a pixel. Adjusting this setting toward grayscale priority would most directly affect which of the following?

- A.** Reduces genuine color display in favor of grayscale detail at that pixel
- B.** Has no genuine effect on the displayed image under any circumstance
- C.** Automatically increases the current color box size genuinely selected
- D.** Automatically decreases the current wall filter setting genuinely selected

93. As sample volume depth genuinely increases from 4 cm to 8 cm, the round-trip pulse travel time genuinely does which of the following, directly affecting achievable PRF?

- A.** Genuinely decreases, allowing achievable PRF to genuinely increase instead

- B.** Remains entirely unchanged, with no genuine effect on achievable PRF
- C.** Becomes genuinely unpredictable without further additional information
- D.** Genuinely doubles, directly decreasing the achievable PRF correspondingly

94. A sonographer measures velocity at a genuinely steep 75-degree angle, then repeats the measurement at a corrected 45-degree angle for the identical flow. Which of the following is most likely true of the two resulting measurements?

- A.** Both measurements are genuinely identical, since angle does not affect calculation
- B.** The 75-degree measurement is genuinely more accurate than the 45-degree one
- C.** Neither measurement is genuinely usable under any circumstance at all
- D.** The 45-degree measurement is genuinely more reliable than the steep one

95. A sonographer evaluating a genuinely very slow-flow state, such as a small perforator vein, should generally select which of the following wall filter approach?

- A.** A genuinely very low wall filter setting, to preserve this slow signal
- B.** A genuinely very high wall filter setting, for the cleanest signal possible
- C.** Wall filter setting genuinely has no relevance to this specific scenario
- D.** The genuine highest available wall filter setting, regardless of flow velocity

96. A sonographer encountering a genuinely ambiguous Doppler finding should generally avoid which of the following approach?

- A.** Identifying the likely underlying mechanism before applying any correction
- B.** Immediately concluding the finding is artifactual without any further check
- C.** Applying a targeted, mechanism-specific correction after genuine identification
- D.** Correlating the finding with genuine grayscale anatomy where appropriate

97. Laminar flow, as distinct from genuinely turbulent flow, is characterized by which of the following spectral appearance?

- A. Spectral broadening, with genuine filling-in of the spectral window present
- B. A narrow, genuinely well-defined spectral trace with a clear window
- C. An abrupt wraparound of the waveform peak from top to bottom instead
- D. A completely flat, genuinely featureless waveform throughout the cycle

98. A sonographer solving the Doppler equation confirms all variables (shift, transmitted frequency, propagation speed, and angle) before calculating velocity. Omitting the genuine angle term from this calculation would most directly produce which of the following?

- A. A genuinely inaccurate velocity calculation, since angle is a required term
- B. No genuine effect, since angle does not actually appear in the equation
- C. Automatic system correction for any genuinely omitted angle term
- D. A genuinely more accurate calculation than including the angle term

99. At a specific pixel within the color box, both grayscale echo signal and color Doppler signal are genuinely present simultaneously. Under typical default system configuration, which signal is genuinely displayed?

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

100. ALARA warrants particularly consistent, disciplined application in genuinely pediatric and obstetric exams primarily because of which of the following?

- A. Pediatric and obstetric tissue genuinely absorbs no acoustic energy at all
- B. These populations genuinely require exclusively higher output settings
- C. Developing tissue undergoing active differentiation warrants consistent care
- D. ALARA genuinely applies exclusively to these two populations specifically

101. A genuinely elevated Mechanical Index, all else held equal, most directly raises which of the following consideration?

- A.** A genuinely reduced need for careful transducer selection during the exam
- B.** A genuinely reduced need for appropriate patient positioning during the exam
- C.** A genuinely reduced need for image optimization during the exam itself
- D.** Genuinely elevated inertial cavitation potential, warranting ALARA attention

102. A QA technologist images a tissue-equivalent phantom's uniform background region specifically to check for which of the following?

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

103. Following a genuine major transducer repair or component replacement, QA testing should genuinely occur at which of the following time?

- A.** Only at the facility's genuinely next regularly scheduled testing interval
- B.** Promptly following that specific repair or replacement event itself
- C.** QA testing is genuinely unnecessary following a manufacturer repair
- D.** Only if a genuine clinical problem is subsequently suspected or reported

104. A QA technologist testing the minimum depth near the transducer face at which structures can first genuinely be resolved is specifically testing which of the following parameter?

- A.** Sensitivity (penetration), a genuinely separate QA parameter entirely
- B.** Dead zone, a near-field limitation close to the transducer face
- C.** Distance (caliper) accuracy, a genuinely separate QA parameter entirely
- D.** Axial resolution, a genuinely separate QA parameter entirely

105. A sonographer performing an obstetric exam selects 4D imaging specifically to assess genuine fetal facial movement in real time. This selection is most directly justified by which of the following?

- A.** 4D genuinely requires no transducer at all, unlike standard 2D imaging
- B.** 4D genuinely eliminates the need for any further gain adjustment at all
- C.** 4D genuinely provides improved penetration beyond standard 2D imaging
- D.** 4D provides real-time volumetric assessment a static 3D volume cannot

106. A matrix array transducer, compared to a mechanically swept 1D array used for 3D acquisition, genuinely provides which of the following distinct advantage?

- A.** A genuinely fixed, single, unchangeable focal depth for every application
- B.** Genuinely eliminates the need for any matching layer whatsoever
- C.** Exclusive, genuine use for continuous-wave Doppler applications only
- D.** Direct volumetric acquisition without any genuine mechanical sweeping

107. A sonographer evaluating a patient with suspected liver fibrosis selects shear wave elastography specifically because the referring clinician requested a genuine, trackable numeric value. Which characteristic of shear wave elastography genuinely justifies this specific selection?

- A.** It provides only a genuinely relative, qualitative color-coded map instead
- B.** It requires genuinely no transducer contact with the patient at all
- C.** It provides an absolute, quantitative stiffness value, suited to tracking
- D.** It genuinely eliminates the need for any grayscale correlation at all

108. A sonographer preparing for a contrast-enhanced exam confirms the Mechanical Index is deliberately kept low before microbubble injection. This precaution most directly protects against which of the following?

- A.** Genuinely improved microbubble signal with no other consequence at all
- B.** A genuinely reduced need for any further console adjustment at all
- C.** Automatic, genuine correction of the setting by the system itself

D. Destroying microbubbles via inertial cavitation, ending genuine signal

109. A QA technologist reviewing a single tissue-equivalent phantom's design notes it contains genuinely distinct target groups for resolution, distance, and sensitivity testing. This design genuinely enables which of the following?

- A.** Simultaneous assessment of multiple parameters within one testing session
- B.** Assessment of axial resolution exclusively, the phantom's sole true purpose
- C.** Assessment of distance accuracy exclusively, the phantom's sole true purpose
- D.** Assessment of sensitivity exclusively, the phantom's sole true purpose

110. A sonographer performing routine preventive maintenance, distinct from formal QA performance testing, would most directly perform which of the following task?

- A.** Running a formal, quantitative distance-accuracy test using a phantom
- B.** Running a formal, quantitative sensitivity test using a phantom
- C.** Physically inspecting the transducer face and cable for genuine damage
- D.** Running a formal, quantitative dead zone test using a phantom

Answers

1. A. A decibel is a logarithmic unit specifically used to compare two intensity or power values relative to one another, commonly used to express attenuation. Options B, C, and D describe unrelated comparisons.

2. C. Decibels are calculated as 10 times the base-10 logarithm of the intensity ratio: $10 \times \log_{10}(100/1) = 10 \times 2 = 20$ dB. Options A, B, and D each apply an incorrect calculation.

3. B. Spatial peak temporal average (SPTA) intensity represents the intensity at the beam's most intense spatial point, averaged over time, a key bioeffects-relevant intensity measure. Options A, C, and D each misstate this actual definition.

4. C. Near zone length is calculated as element diameter squared, divided by four times the wavelength ($NZL = D^2/4\lambda$), determining the transition from near to far field. Options A, B, and D describe unrelated calculations.

- 5. A.** Because diameter is squared in the near zone length formula, the transducer with the genuinely larger element diameter produces a correspondingly longer near zone length. Options B, C, and D each misstate this actual relationship.
- 6. A.** Because wavelength sits in the denominator of the near zone length formula, decreasing wavelength (by increasing frequency) genuinely increases near zone length. Options B, C, and D each misstate this actual relationship.
- 7. C.** When propagation speed increases in the second medium, the refracted beam bends away from the normal, a direct consequence of Snell's Law. Options A, B, and D each misstate this actual refraction behavior.
- 8. A.** Beyond the critical angle, when crossing into a medium with genuinely higher propagation speed, total reflection occurs, with no genuine transmission across the boundary. Options B, C, and D each misstate this actual critical-angle behavior.
- 9. A.** Intensity, a measure of acoustic power concentrated per unit area, is genuinely expressed in watts per square centimeter. Options B, C, and D describe units for unrelated parameters.
- 10. C.** Standard practice prior to a genuinely invasive-adjacent procedure requires obtaining appropriate informed consent and documenting that discussion in the patient's record. Options A, B, and D each describe an inappropriate or incomplete practice.
- 11. B.** Left lateral decubitus positioning for certain abdominal exams repositions bowel gas or shifts organs, genuinely improving visualization of structures that might otherwise be obscured. Options A, C, and D each misstate this actual clinical purpose.
- 12. B.** Excessive persistence, by averaging sequential frames together, genuinely blurs the sonographer's live perception of rapid, real-time motion as it is actually occurring. Options A, C, and D each misstate this actual consequence.
- 13. D.** Wavelength equals propagation speed divided by frequency: $1540 \text{ m/s} / 7,500,000 \text{ Hz} \approx 0.21 \text{ mm}$. Options A, B, and C each apply an incorrect calculation.
- 14. B.** Both transmitted frequency and total path length traveled together directly determine total attenuation, since attenuation accumulates with both increasing frequency and increasing distance. Options A, C, and D describe unrelated parameters.
- 15. D.** The reflection coefficient at a tissue boundary represents the fraction of incident intensity genuinely reflected at that specific boundary, determined by the impedance mismatch present. Options A, B, and C describe unrelated parameters.
- 16. A.** Because reflected and transmitted fractions of intensity genuinely sum to the total incident intensity, a large reflection coefficient necessarily corresponds to a correspondingly small transmitted fraction. Options B, C, and D each misstate this actual relationship.

- 17. A.** Intensity is genuinely proportional to amplitude squared, a direct mathematical relationship between these two acoustic parameters. Options B, C, and D each misstate this actual relationship.
- 18. C.** Because intensity is proportional to amplitude squared, doubling amplitude genuinely produces a fourfold increase in intensity ($2^2 = 4$). Options A, B, and D each misstate this actual relationship.
- 19. B.** Power is genuinely the rate of acoustic energy transfer, without reference to the cross-sectional area over which that energy is distributed, distinct from intensity. Options A, C, and D describe unrelated parameters.
- 20. C.** Intensity is genuinely calculated as power divided by the beam's cross-sectional area, concentrating the total power measure into an area-specific value. Options A, B, and D each apply an incorrect calculation.
- 21. D.** A transducer used for semi-critical applications, contacting mucous membranes, genuinely requires high-level disinfection between patients, appropriate to this specific use category and infection risk. Options A, B, and C each describe an inadequate disinfection level for this category.
- 22. B.** Positioning the display monitor at an appropriate height and distance genuinely reduces neck and eye strain during prolonged scanning sessions, a direct ergonomic benefit. Options A, C, and D each misstate this actual ergonomic purpose.
- 23. D.** The cine loop function allows a sonographer to review a short buffer of recently acquired frames after acquisition, useful for capturing a specific moment retrospectively. Options A, B, and C each misstate this actual function.
- 24. D.** M-mode imaging displays motion of structures along a single scan line, plotted over time, providing a genuinely detailed temporal record of that single line's changes. Options A, B, and C each misstate this actual display format.
- 25. C.** M-mode's substantially higher temporal resolution along a single scan line, compared to full two-dimensional imaging, makes it genuinely well suited to assessing very rapid structural motion such as cardiac valve movement. Options A, B, and D each misstate this actual advantage.
- 26. D.** Kerf refers to the narrow space genuinely separating adjacent individual elements within an array, created during manufacturing to electrically and mechanically isolate them. Options A, B, and C each misstate this actual construction feature.
- 27. C.** Pitch is genuinely the center-to-center distance between adjacent elements, encompassing both element width and kerf together, an important parameter for beam-forming characteristics. Options A, B, and D each misstate this actual definition.
- 28. B.** A broadband transducer genuinely provides the ability to operate effectively across a range of frequencies, offering flexibility for different penetration and resolution needs within a single transducer. Options A, C, and D each misstate this actual advantage.

- 29. D.** Selecting a genuinely higher-frequency transducer for a superficial structure accepts reduced penetration depth in exchange for the improved axial resolution higher frequency provides. Options A, B, and C each misstate this actual trade-off.
- 30. B.** Selecting a genuinely lower-frequency transducer for a deep structure accepts reduced axial resolution in exchange for the improved penetration depth lower frequency provides. Options A, C, and D each misstate this actual trade-off.
- 31. B.** A sector transducer's genuinely small footprint combined with a wide far-field view makes it well suited for scanning through a narrow acoustic window (such as an intercostal space) toward a genuinely deep target. Options A, C, and D describe scenarios better served by a different array type.
- 32. D.** A genuinely damaged or non-functional element typically produces a vertical dropout or streak artifact at that specific element's corresponding location on the display. Options A, B, and C each misstate this actual consequence.
- 33. C.** Testing for a damaged element on a uniformity phantom image would most directly reveal a vertical dropout or streak artifact at that specific element's location, a direct QA finding. Options A, B, and D each misstate what this specific test would reveal.
- 34. B.** Signal-to-noise ratio describes the relationship between genuine signal strength and background noise level, a key determinant of overall image clarity. Options A, C, and D describe unrelated ratios or relationships.
- 35. D.** Persistence improves signal-to-noise ratio by averaging out genuine random noise across sequential frames, unlike overall gain, which amplifies both signal and noise together equally. Options A, B, and C each misstate this actual improvement mechanism.
- 36. D.** A gray map (postprocessing curve) changes how already-acquired amplitude values are mapped to displayed brightness, a postprocessing adjustment applied after acquisition. Options A, B, and C each misstate this actual scope and timing.
- 37. C.** The freeze function provides a single, static frame held for genuine measurement or documentation, distinct from cine loop's buffer of multiple recent frames. Options A, B, and D each misstate this actual function.
- 38. C.** DICOM (Digital Imaging and Communications in Medicine) governs a standardized format for storing and transmitting medical images, enabling interoperability across systems. Options A, B, and D describe unrelated parameters.
- 39. D.** Additional focal zones require additional pulses per scan line, directly decreasing achievable frame rate as zone count increases from one to three. Options A, B, and C each misstate this actual relationship.

- 40. A.** Standard two-dimensional grayscale imaging is genuinely known as B-mode (brightness mode), displaying a real-time 2D cross-sectional image of the scanned anatomy. Options B, C, and D describe different, unrelated imaging modes.
- 41. C.** Write zoom, applied during acquisition, genuinely acquires additional scan lines within the specified region, providing genuinely improved resolution within that region compared to the original unzoomed acquisition. Options A, B, and D each misstate this actual improvement.
- 42. A.** Electronic (pan) zoom, applied to already-acquired data, provides magnification of that existing data without genuinely acquiring any new resolution. Options B, C, and D each misstate this actual limitation.
- 43. B.** The TGC slope specifically controls the genuine rate at which compensation increases with increasing depth, shaping the overall TGC curve's behavior across the image. Options A, C, and D describe unrelated TGC-adjacent parameters.
- 44. C.** A specific mid-depth region appearing genuinely brighter than surrounding regions, despite otherwise appropriate settings, is most likely caused by an inappropriately set TGC slide positioned at that exact mid-depth location. Options A, B, and D each describe a control that applies uniformly rather than at a specific depth.
- 45. A.** Spatial compounding, combining images from multiple beam angles, most directly improves genuine border definition through reduced speckle noise, aiding margin assessment. Options B, C, and D each describe an assessment that compounding does not primarily address.
- 46. D.** Tissue harmonic imaging reduces near-field artifact and improves border definition, a genuine benefit for technically difficult patients where superficial artifact commonly degrades image quality. Options A, B, and C each misstate this actual benefit.
- 47. B.** Increasing dynamic range allows more genuine gray shade distinctions to be displayed, directly addressing excessive contrast that makes subtly different tissues appear nearly indistinguishable. Options A, C, and D each describe an adjustment that does not address this specific contrast problem.
- 48. D.** Decreasing dynamic range increases genuine displayed contrast, directly addressing a washed-out image with insufficient contrast between adjacent structures. Options A, B, and C each describe an adjustment that does not address this specific contrast problem.
- 49. B.** A genuinely higher pixel matrix (1024 by 1024) represents the identical acquired data with finer spatial precision than a lower matrix (512 by 512), directly improving displayed image detail. Options A, C, and D each misstate this actual relationship.
- 50. B.** Reducing line density to the minimum still diagnostically adequate directly reduces the total pulses required per frame, helping maintain frame rate even at a genuinely deep imaging depth. Options A, C, and D each describe an adjustment that would further reduce, not help maintain, frame rate.

- 51. D.** Spatial pulse length equals cycles multiplied by wavelength ($2 \times 0.5 \text{ mm} = 1.0 \text{ mm}$), and theoretical best-case axial resolution is approximately half of this spatial pulse length value. Options A, B, and C each apply an incorrect calculation or relationship.
- 52. A.** Lateral resolution tracks genuine beam width, which narrows toward the focal zone (improving resolution) and widens again beyond it (worsening resolution), directly explaining this observed pattern. Options B, C, and D describe parameters unrelated to this specific focal-zone-dependent pattern.
- 53. A.** Sufficient dynamic range and adequate gray-scale bit depth together directly support the system's genuine ability to distinguish subtly different tissue echogenicities (contrast resolution). Options B, C, and D each describe factors supporting a different resolution type or capability.
- 54. D.** Genuinely maximized frame rate (temporal resolution) most directly supports accurate depiction of rapid structural motion over time, the specific capability this scenario requires. Options A, B, and C each describe a factor supporting a different, unrelated capability.
- 55. A.** Decreasing overall gain appropriately reduces amplification applied, directly addressing artificial internal echoes appearing within a structure that should genuinely be anechoic. Options B, C, and D each describe an adjustment that does not address, or would worsen, this specific finding.
- 56. B.** The reject control eliminates low-level noise signal below a genuinely selected threshold without affecting amplification applied to stronger, genuine signal above that threshold. Options A, C, and D each describe a control that would affect signal and noise together rather than isolating noise specifically.
- 57. B.** Positioning the focal zone at or near a genuinely shallow structure's specific depth directly maximizes lateral resolution achievable at that location. Options A, C, and D each describe an approach that does not optimize resolution at the structure's actual shallow depth.
- 58. C.** A mirror-reversed image compared to the expected anatomic convention is most directly consistent with the transducer marker being genuinely positioned opposite the intended scanning convention for that exam type. Options A, B, and D each describe an unrelated control that does not affect image orientation.
- 59. C.** Decreasing overall gain, or alternatively increasing persistence, reduces apparent random speckle noise, directly addressing a genuinely grainy image without sacrificing already-adequate penetration. Options A, B, and D each describe an adjustment that does not address genuine noise reduction.
- 60. A.** Repositioning the transducer, or adjusting the field of view, directly recenters a structure that has genuinely drifted to the extreme edge of the display following patient movement. Options B, C, and D each describe an adjustment that does not address the structure's actual off-center position.
- 61. A.** Addressing each issue individually and systematically, in a logical sequence, is the most appropriate approach when multiple genuine image-quality problems are present simultaneously, rather

than ignoring any of them. Options B, C, and D each describe an incomplete approach that ignores genuine remaining problems.

62. D. A genuinely lower-frequency transducer improves penetration through reduced attenuation, while reduced line density helps maintain adequate frame rate, together directly supporting both competing goals for this deep, technically difficult structure. Options A, B, and C each describe a combination that does not genuinely support both goals together.

63. B. A genuinely negative Doppler shift value, by standard sign convention, indicates the reflector is genuinely moving away from the transducer. Options A, C, and D each misstate this actual convention.

64. D. By common but adjustable convention, red typically represents flow genuinely moving toward the transducer, though this specific assignment can be reversed by the operator. Options A, B, and C each misstate this actual convention.

65. D. Aliasing on a color Doppler display characteristically appears as an abrupt transition directly from one color extreme to the opposite extreme, without the smooth intermediate transition a genuine velocity gradient would produce. Options A, B, and C each misstate this actual appearance.

66. C. Shifting the baseline reallocates the display's genuine vertical range toward the predominant flow direction, directly addressing aliasing occurring with genuinely predominant unidirectional flow. Options A, B, and D each describe an adjustment that does not address this specific aliasing pattern.

67. A. A genuinely higher scale (PRF) setting directly reduces the maximum achievable sample volume depth, since less time is available between pulses for genuinely deep echoes to return. Options B, C, and D each misstate this actual relationship.

68. D. Spectral Doppler gain and color Doppler gain are genuinely independently adjustable controls, each affecting only its own respective mode's amplification. Options A, B, and C each misstate this actual independence.

69. A. Circular area equals pi times radius squared; with a 2 cm diameter, radius is 1 cm, so area = $\pi \times 1^2 \approx 3.14$ square centimeters. Options B, C, and D each apply an incorrect calculation.

70. C. Volume flow rate equals mean velocity multiplied by cross-sectional area: $20 \text{ cm/s} \times 3 \text{ cm}^2 = 60 \text{ mL/s (cm}^3\text{/s)}$. Options A, B, and D each apply an incorrect calculation.

71. D. Turbulent flow distal to a genuine focal stenosis arises directly from disrupted, disorganized flow patterns produced by that specific stenotic segment. Options A, B, and C each describe an unrelated technical setting rather than this actual physical cause.

72. C. A delayed, genuinely slowed systolic upstroke with a rounded peak, obtained distal to a proximal stenosis, is genuinely known as a tardus parvus waveform, a specific and clinically meaningful pattern. Options A, B, and D each misstate this actual finding.

- 73. D.** A markedly flattened, low-amplitude waveform with minimal systolic-diastolic variation, distal to a severe, long-segment occlusion, is genuinely known as a damped waveform. Options A, B, and C each misstate this actual finding.
- 74. C.** Duty factor for pulsed-wave Doppler is genuinely calculated as pulse duration divided by the current pulse repetition period, the same general duty factor relationship established for pulsed imaging. Options A, B, and D each apply an incorrect calculation.
- 75. D.** A systematic, appropriate correction sequence genuinely proceeds by increasing scale first, then shifting baseline if flow is predominantly unidirectional, then considering continuous-wave Doppler if aliasing still persists. Options A, B, and C each describe an inappropriate or out-of-sequence first step.
- 76. B.** At a genuine 0-degree angle, cosine equals 1, its genuine maximum possible value, producing the theoretically maximum calculated Doppler shift for that flow. Options A, C, and D each misstate this actual relationship.
- 77. C.** Color signal genuinely persisting briefly after transducer motion, unrelated to actual blood flow, is characteristic of flash artifact, from genuine patient or transducer motion. Options A, B, and D each describe an unrelated finding or mechanism.
- 78. A.** Positioning the sample volume gate at or near the genuine center of the vessel lumen, where flow is typically fastest, provides the most representative velocity measurement for that vessel. Options B, C, and D each describe an inappropriate or dismissive positioning approach.
- 79. D.** Steering the color box angle directly affects genuine Doppler angle accuracy relative to a vessel running parallel to the skin surface, a targeted adjustment for this specific geometric challenge. Options A, B, and C each describe a parameter unrelated to color box steering.
- 80. A.** Volume flow rate calculations genuinely require mean velocity, averaging the full velocity spectrum across the cardiac cycle, rather than the single highest peak systolic value alone. Options B, C, and D each describe a measure that does not support genuine volume flow calculation.
- 81. A.** A typical high-velocity arterial exam generally uses a genuinely higher wall filter setting, appropriate for the higher velocities typically present, compared to a low-velocity venous exam. Options B, C, and D each misstate this actual clinical consideration.
- 82. D.** A genuinely larger sample volume gate captures signal across a wider depth range, improving sensitivity at the cost of reduced range specificity, the direct trade-off for this choice. Options A, B, and C each misstate this actual trade-off.
- 83. A.** Continuous-wave Doppler has no genuine Nyquist limit, making it appropriate for measuring a genuinely very high-velocity jet that would exceed any achievable PW scale setting. Options B, C, and D each describe a mode lacking the specific capability this scenario requires.

- 84. C.** Range ambiguity genuinely worsens with a higher PRF, since a higher PRF increases the likelihood that a subsequent pulse is transmitted before the prior pulse's true-depth echo has fully returned. Options A, B, and D each misstate this actual relationship.
- 85. B.** An apparent duplicate flow signal on the opposite side of a strong reflective boundary such as a rib 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.
- 86. B.** Genuine turbulence is supported by spectral broadening with filling-in of the spectral window, a pattern distinct from aliasing's abrupt wraparound appearance. Options A, C, and D each describe a finding more consistent with aliasing or an unrelated pattern rather than genuine turbulence.
- 87. A.** When scale is already at its genuine maximum achievable value and aliasing persists, switching to continuous-wave Doppler avoids the Nyquist limitation entirely for that specific measurement. Options B, C, and D each describe an inappropriate or ineffective next step at this specific stage.
- 88. B.** Repositioning the transducer and observing whether the apparent finding changes character directly helps confirm or rule out suspected mirror image artifact. Options A, C, and D each describe an action that does not directly test for this specific artifact.
- 89. A.** A systematic, mechanism-based approach more reliably distinguishes genuine artifact from true pathology than an immediate, unverified assumption in either direction. Options B, C, and D each misstate or overstate this actual advantage.
- 90. B.** Spectral broadening just distal to a genuine focal stenosis directly reflects turbulent flow, from disrupted, disorganized flow patterns at that specific location. Options A, C, and D each describe a finding inconsistent with this actual physical process.
- 91. D.** Solving the Doppler equation for the original transmitted frequency requires algebraically isolating that specific term and solving directly, using the other known variables. Options A, B, and C each describe an approach that does not correctly isolate the transmitted frequency term.
- 92. A.** Adjusting color write priority toward grayscale reduces genuine color display in favor of grayscale detail at pixels where both signals are genuinely present simultaneously. Options B, C, and D each misstate this actual effect.
- 93. D.** Round-trip pulse travel time genuinely doubles as sample volume depth doubles from 4 cm to 8 cm, directly decreasing the maximum achievable PRF correspondingly. Options A, B, and C each misstate this actual depth relationship.
- 94. D.** The 45-degree measurement is genuinely more reliable than the steep 75-degree measurement, since angle correction becomes increasingly unreliable as the angle approaches 90 degrees, where cosine changes most rapidly. Options A, B, and C each misstate this actual accuracy relationship.

- 95. A.** A genuinely very slow-flow state, such as a small perforator vein, requires a genuinely very low wall filter setting to preserve that slow-velocity signal without inadvertently removing it. Options B, C, and D each misstate this actual clinical consideration.
- 96. B.** Immediately concluding a finding is artifactual without any further check should generally be avoided, since genuine pathology must remain a real possibility until systematically ruled out. Options A, C, and D each describe an appropriate, not inappropriate, component of a systematic approach.
- 97. B.** Laminar flow is characterized by a narrow, genuinely well-defined spectral trace with a clear spectral window, distinct from turbulent flow's broadened, filled-in appearance. Options A, C, and D each describe a pattern inconsistent with genuine laminar flow.
- 98. A.** Omitting the genuine angle term from the Doppler equation produces a genuinely inaccurate velocity calculation, since angle is a required term directly affecting the calculated result via its cosine value. Options B, C, and D each misstate this actual consequence.
- 99. C.** Standard default system configuration generally gives color Doppler signal genuine display priority at a pixel where both grayscale and color signal are present simultaneously. Options A, B, and D each misstate this actual default configuration.
- 100. C.** Developing tissue undergoing active differentiation in pediatric and obstetric patients warrants the same disciplined ALARA practice applied to every patient, with particular consistency given this population's genuine developmental stage. Options A, B, and D each misstate this actual consideration.
- 101. D.** A genuinely elevated Mechanical Index directly raises inertial cavitation potential, warranting active ALARA attention to balance diagnostic benefit against this genuine bioeffects risk. Options A, B, and C describe unrelated considerations.
- 102. A.** Imaging a phantom's uniform background region checks for genuine uniformity of response across the field, revealing a damaged or non-functional element as a localized dropout or streak. Options B, C, and D describe genuinely different QA parameters, not this specific uniformity check.
- 103. B.** QA testing should genuinely occur promptly following a major repair or component replacement, since such events can meaningfully change performance in ways a fixed calendar schedule alone would not catch promptly. Options A, C, and D each describe an inappropriate or delayed testing approach.
- 104. B.** Testing the minimum depth near the transducer face at which structures can first genuinely be resolved is specifically the dead zone test, a near-field QA parameter. Options A, C, and D describe genuinely separate QA parameters.
- 105. D.** 4D imaging provides real-time volumetric assessment that a static 3D volume cannot, directly justifying its selection for assessing genuine fetal facial movement occurring during acquisition. Options A, B, and C each misstate this actual justification.

106. D. A matrix array's true two-dimensional grid of elements enables direct volumetric acquisition without any genuine mechanical sweeping, a distinct advantage over a mechanically swept 1D array requiring physical movement. Options A, B, and C each misstate this actual advantage.

107. C. Shear wave elastography provides an absolute, quantitative stiffness value, genuinely well suited to tracking a specific numeric value across serial exams, directly justifying its selection when a clinician requests a trackable value. Options A, B, and D each misstate this actual capability.

108. D. Keeping Mechanical Index deliberately low protects against destroying microbubbles via inertial cavitation, which would both end the genuine detectable contrast signal and pose a genuine bioeffects concern. Options A, B, and C each misstate or dismiss this actual protective purpose.

109. A. A phantom containing genuinely distinct target groups for each parameter enables simultaneous assessment of multiple performance measures within one testing session. Options B, C, and D each incorrectly restrict the phantom to a single parameter.

110. C. Preventive maintenance, distinct from formal QA performance testing, genuinely involves physical inspection tasks such as checking the transducer face and cable for damage, rather than quantitative phantom-based measurement. Options A, B, and D each describe a formal QA performance test rather than a preventive maintenance task.