

COMPREHENSIVE MOCK EXAM 15

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. The matching layer's genuine thickness is typically designed to be approximately which of the following fraction of the wavelength within that layer?
 - A. One-half wavelength
 - B. One-quarter wavelength
 - C. A full, complete wavelength
 - D. Two full wavelengths

2. The matching layer's specific quarter-wavelength thickness genuinely serves which of the following purpose?
 - A. Maximizes reflection at the transducer face, concentrating energy inward
 - B. Genuinely eliminates the need for any backing material whatsoever
 - C. Optimizes constructive interference, maximizing genuine energy transmission
 - D. Increases the element's genuine resonant frequency beyond design specification

3. Backing material is genuinely designed with an acoustic impedance that is which of the following, relative to the piezoelectric element itself?
 - A. Genuinely identical to the element's own acoustic impedance exactly
 - B. Intermediate, between the element and air, to genuinely absorb energy
 - C. Genuinely identical to soft tissue's assumed acoustic impedance value
 - D. Genuinely irrelevant, since backing material has no impedance consideration

4. A beam's intensity is reduced to 50% of its original value at a depth of 3 cm for a specific tissue and frequency combination. If the beam continues the same relative reduction pattern, at what genuine depth will intensity reach 25% of the original value?
 - A. 6 cm, since a second half-value layer produces another 50% reduction
 - B. 4.5 cm, since 25% is genuinely halfway between 50% and 0%
 - C. 9 cm, since 25% is genuinely one-quarter of the original starting depth

D. 3 cm, since the half-value layer genuinely does not repeat with depth

5. The genuine frequency range typically used for diagnostic medical ultrasound imaging is approximately which of the following?

A. 20 Hz to 20,000 Hz, the genuine range of normal human hearing

B. Below 20 Hz, the genuine infrasound range specifically

C. Exactly 1 MHz, a genuinely fixed, universal diagnostic frequency

D. Approximately 2 MHz to 15 MHz, spanning most clinical applications

6. Ultrasound is genuinely defined as sound with a frequency which of the following relative to the upper limit of normal human hearing?

A. Genuinely below the upper limit of normal human hearing

B. Genuinely above the upper limit of normal human hearing (above 20 kHz)

C. Genuinely identical to the upper limit of normal human hearing

D. Ultrasound frequency has genuinely no defined relationship to human hearing

7. Standard precautions, as applied in a genuine clinical ultrasound setting, are genuinely applied to which of the following patient population?

A. Genuinely only patients with a confirmed, diagnosed infectious disease

B. Genuinely only patients undergoing an invasive ultrasound-guided procedure

C. Genuinely every patient, regardless of known or suspected infection status

D. Genuinely only patients specifically requesting additional precautions

8. Transmission-based precautions, distinct from standard precautions, are genuinely applied when which of the following is true?

A. Genuinely for every patient, identically to standard precautions always

B. Genuinely never, since standard precautions alone are always sufficient

- C. Genuinely only during a scheduled QA testing interval, unrelated to patients
- D. A specific, known or suspected infectious condition requires added precautions

9. A sonographer performing a genuine transvaginal exam should, prior to beginning, do which of the following regarding patient communication?

- A. Proceed directly without any genuine explanation of the exam itself
- B. Explain the exam only if the patient specifically requests an explanation
- C. Clearly explain the exam and obtain genuine patient understanding beforehand
- D. Defer all genuine explanation entirely to the referring physician instead

10. A transducer transmits at a fixed 5 MHz frequency into two different media with genuinely different propagation speeds. The wavelength within each medium will genuinely be which of the following?

- A. Genuinely identical in both media, since frequency remains fixed
- B. Genuinely different in each medium, since wavelength depends on speed
- C. Genuinely unpredictable without additional information about density
- D. Genuinely irrelevant to any calculation involving these two media

11. A sonographer compares two transmitted pulses: Pulse A has amplitude X, and Pulse B has amplitude 4X. Assuming intensity depends on amplitude squared, Pulse B's intensity relative to Pulse A's is genuinely which of the following?

- A. Genuinely 4 times greater, proportional directly to the amplitude ratio
- B. Genuinely unchanged, since intensity does not depend on amplitude at all
- C. Genuinely 8 times greater, an unrelated intermediate calculation
- D. Genuinely 16 times greater, since intensity depends on amplitude squared

12. Two identical beams have the identical total genuine power, but one beam is genuinely more tightly focused into a smaller cross-sectional area. The more tightly focused beam will genuinely have which of the following?

- A.** Genuinely greater intensity, since intensity is power divided by area
- B.** Genuinely identical intensity, since power is identical between beams
- C.** Genuinely lower intensity, since focusing spreads power over more area
- D.** Intensity is genuinely unrelated to focusing or cross-sectional area at all

13. A sonographer needs to estimate transmitted intensity at a boundary where reflected intensity has already been measured directly. Which genuine relationship allows this estimation without a separate transmission measurement?

- A.** Transmitted intensity is genuinely unrelated to reflected intensity at all
- B.** Transmitted intensity must genuinely be measured entirely independently
- C.** Reflected and transmitted intensity fractions genuinely sum to the total
- D.** Transmitted intensity is always genuinely double the reflected intensity

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

- A.** Water or simple fluid, a genuinely weakly attenuating medium
- B.** Typical soft tissue at a genuinely standard diagnostic frequency
- C.** Blood, a genuinely weakly attenuating fluid medium as well
- D.** Cortical bone, a genuinely dense, highly attenuating medium

15. A beam's intensity decreases from 1000 mW/cm² to 10 mW/cm² as it travels through tissue. What is the genuine attenuation expressed in decibels?

- A.** 10 decibels of total genuine attenuation
- B.** 100 decibels of total genuine attenuation
- C.** 20 decibels of total genuine attenuation
- D.** 2 decibels of total genuine attenuation

16. A sonographer reviewing intensity output specifications notes SPPA is genuinely reported as a higher value than SPTA for the identical exam. This difference most directly reflects which of the following?

- A.** SPPA and SPTA are genuinely measuring an entirely unrelated parameter
- B.** SPPA averages only over active pulse duration; SPTA over the full PRP
- C.** SPTA is genuinely always the larger value, contradicting this scenario
- D.** The two measures are genuinely identical and should never differ at all

17. A beam traveling in a medium with propagation speed 1400 m/s approaches a boundary with a genuinely faster medium at 1600 m/s. As the angle of incidence is increased from zero, total reflection will genuinely begin to occur at which of the following point?

- A.** At genuinely every angle, regardless of the specific speed values involved
- B.** At genuinely no angle, since a faster second medium prevents this outcome
- C.** Only at a genuine 90-degree angle of incidence specifically, not before
- D.** At the critical angle, once the refraction angle reaches genuinely 90 degrees

18. A sonographer observes a beam entering a second medium and notices the refracted beam has bent toward the normal, rather than away from it. This observation genuinely indicates which of the following about the second medium?

- A.** The second medium genuinely has a faster propagation speed than the first
- B.** The second medium genuinely has an identical propagation speed to the first
- C.** The second medium genuinely has a slower propagation speed than the first
- D.** Propagation speed genuinely cannot be inferred from this observation alone

19. Genuine echo texture arising from red blood cells within a vessel lumen, well below the ultrasound wavelength in size, is most directly produced by which of the following?

- A.** Specular reflection, from a genuinely large, smooth interface present
- B.** Refraction, at a genuinely oblique boundary within the vessel itself

- C. Absorption, converting genuine acoustic energy into heat within the vessel
- D. Rayleigh scattering, from structures genuinely much smaller than wavelength

20. A genuinely strong, mirror-like echo returned from a large, smooth organ capsule is most directly produced by which of the following?

- A. Specular reflection, from a genuinely large, smooth interface present
- B. Rayleigh scattering, from structures genuinely much smaller than wavelength
- C. Refraction, at a genuinely oblique boundary within that same structure
- D. Absorption, converting genuine acoustic energy into heat at that boundary

21. A pulse has a duration of 2 microseconds within a pulse repetition period of 1000 microseconds. What is the genuine duty factor for this specific setting?

- A. 50 percent, an unrelated intermediate calculation entirely
- B. 20 percent, an unrelated intermediate calculation entirely
- C. 0.2 percent, calculated as pulse duration divided by PRP
- D. 2 percent, an unrelated intermediate calculation entirely

22. A pulse contains 5 cycles at a wavelength of 0.3 mm. What is the resulting genuine spatial pulse length?

- A. 0.3 millimeters, equal to the wavelength value alone
- B. 5 millimeters, equal to the cycle count value alone
- C. 1.5 millimeters, the product of cycle count and wavelength
- D. 0.06 millimeters, an unrelated intermediate calculation entirely

23. Using a spatial pulse length of 1.5 mm, the genuine theoretical best-case axial resolution is approximately which of the following?

- A. 3.0 millimeters, genuinely double the spatial pulse length value

- B.** 1.5 millimeters, genuinely identical to the spatial pulse length value
- C.** 4.5 millimeters, genuinely triple the spatial pulse length value
- D.** 0.75 millimeters, approximately half the spatial pulse length value

24. A sonographer experiencing genuine, recurring shoulder discomfort after scanning sessions should genuinely consider which of the following, among appropriate ergonomic adjustments?

- A.** Genuinely continuing the identical technique, since discomfort is expected
- B.** Genuinely gripping the transducer more firmly to improve overall control
- C.** Ignoring the discomfort entirely, since it will genuinely resolve on its own
- D.** Adjusting table height, transducer grip, and scanning position as needed

25. A sonographer completing genuine documentation after a pre-exam patient discussion should genuinely include which of the following?

- A.** Genuinely only the patient's name, with no further detail required at all
- B.** Genuinely no documentation is required if the discussion was brief
- C.** A genuine record reflecting the specific content of that discussion
- D.** Genuinely only a checkbox indicating a discussion generically occurred

26. A piezoelectric element genuinely vibrating in its primary thickness mode produces sound at a frequency most directly determined by which of the following?

- A.** The genuine total number of elements present within the array itself
- B.** The element's genuine thickness, inversely related to its resonant frequency
- C.** The genuine backing material's specific acoustic impedance value used
- D.** The genuine matching layer's specific thickness used in construction

27. Apodization, applied across an array transducer's genuine individual elements, refers to which of the following?

- A.** Genuinely increasing the total number of elements within the array itself
- B.** Genuinely eliminating the need for any matching layer whatsoever present
- C.** Weighting individual element excitation to genuinely reduce side/grating lobes
- D.** Genuinely converting a linear array into a curvilinear array physically

28. A 1.5D (multi-row) array transducer genuinely provides which of the following advantage over a standard 1D array?

- A.** A genuinely fixed, single, unchangeable focal depth for every application
- B.** Genuinely eliminates the need for any electronic focusing whatsoever
- C.** Exclusive, genuine use for continuous-wave Doppler applications only
- D.** Genuine partial electronic focusing in the elevational plane as well

29. A micro-convex transducer, compared to a standard curvilinear transducer, genuinely offers which of the following distinguishing characteristic?

- A.** A genuinely larger physical footprint than a standard curvilinear array
- B.** A genuinely narrower far-field view than a standard curvilinear array
- C.** Exclusive use for genuinely superficial imaging applications only
- D.** A genuinely smaller footprint with a comparatively wide field of view

30. A sonographer selecting a genuinely broadband transducer over a narrowband transducer for a specific exam gains which of the following advantage?

- A.** A genuinely fixed, single operating frequency with no adjustability at all
- B.** Genuinely eliminated need for any further frequency selection at all
- C.** Flexibility to operate effectively across a genuine range of frequencies
- D.** A genuinely permanent focal depth, unchangeable for every application

31. A sonographer notices a genuine vertical dropout artifact appears consistently at the identical lateral position across multiple different patients scanned with the same transducer. This finding most directly suggests which of the following?

- A.** A genuinely damaged or non-functional individual element within the array
- B.** A genuinely appropriate, expected pattern requiring no further action
- C.** An inappropriately selected imaging depth for these specific patients
- D.** An excessively high overall gain setting applied across these exams

32. A QA technologist confirms a transducer's genuine bandwidth specification matches the manufacturer's stated range. This verification most directly relates to which of the following capability?

- A.** The genuine total number of elements present within the array itself
- B.** The genuine kerf spacing between adjacent individual elements present
- C.** The genuine physical length of the entire transducer housing itself
- D.** The transducer's genuine ability to operate across multiple frequencies

33. A sonographer selecting a transducer for a combined superficial-to-deep imaging need would most directly benefit from which of the following characteristic?

- A.** A genuinely fixed, narrow bandwidth centered on one frequency only
- B.** A genuinely single-row, 1D array design exclusively, without exception
- C.** A genuinely broad bandwidth, spanning both higher and lower frequencies
- D.** A design genuinely requiring no electronic focusing capability at all

34. Speckle, the genuine granular texture pattern observed in ultrasound images, most directly arises from which of the following?

- A.** Genuine electronic noise from the receiver's own amplification circuitry
- B.** An excessively high overall gain setting applied to the current image
- C.** A genuinely damaged or malfunctioning individual transducer element

D. Coherent interference among echoes from sub-resolution scatterers

35. Speckle is genuinely best distinguished from random electronic noise by which of the following characteristic?

- A. Speckle is genuinely eliminated entirely by increasing overall gain**
- B. Speckle and random noise are genuinely identical, differing only in name**
- C. Random noise, unlike speckle, is genuinely eliminated by reject alone**
- D. Speckle is a genuine interference pattern, not random electronic noise**

36. Which of the following imaging technique genuinely helps reduce speckle's granular appearance?

- A. Spatial compounding, averaging genuinely multiple beam angles together**
- B. Increasing overall gain substantially, regardless of current setting used**
- C. Decreasing dynamic range substantially, narrowing the displayed range**
- D. Increasing the current transmitted frequency for improved genuine detail**

37. The beam former, within the pulse-echo instrumentation chain, genuinely performs which of the following function?

- A. Applies genuine timing delays across elements, combining signals for both transmit and receive**
- B. Converts the genuine final image into a permanent hard-copy printout**
- C. Physically dampens element ringing after the genuine initial excitation**
- D. Genuinely eliminates the need for any further signal processing at all**

38. Panoramic (extended field-of-view) imaging genuinely allows a sonographer to do which of the following?

- A. Genuinely improve axial resolution beyond what a single acquisition allows**
- B. View a genuinely larger anatomic region than a single static frame captures**
- C. Genuinely eliminate the need for any further transducer movement at all**

D. Automatically improve genuine penetration depth beyond standard imaging

39. Panoramic (extended field-of-view) imaging most directly risks which of the following if the transducer is genuinely moved too quickly during acquisition?

A. Genuine image distortion or misregistration within the combined image

B. Genuinely improved image quality from the faster acquisition speed

C. No genuine consequence, since speed does not affect this technique

D. Automatic, genuine correction applied by the system regardless of speed

40. Dynamic receive focusing, performed by the beam former during signal reception, genuinely allows which of the following?

A. A genuinely single, fixed focal depth for the entire receive process

B. Genuinely eliminating the need for any transmit focusing whatsoever

C. Physically moving the transducer element during signal reception itself

D. Continuously adjusting focus as echoes genuinely return from increasing depth

41. While speckle is often considered image noise, it is genuinely also recognized as which of the following?

A. Genuinely entirely without diagnostic value under any circumstance at all

B. Genuinely identical in origin and appearance to electronic noise always

C. A phenomenon genuinely unrelated to the actual tissue being imaged

D. A pattern that can genuinely carry some tissue-characterization information

42. A sonographer saves a completed exam to the facility's PACS system. This action most directly serves which of the following purpose?

A. Genuinely re-acquires additional scan lines beyond the original exam

B. Archives the images for genuine later retrieval, review, and comparison

- C. Genuinely eliminates the need for any further QA testing on that system
- D. Automatically improves genuine axial resolution for that specific exam

43. A sonographer enables both spatial compounding and tissue harmonic imaging simultaneously for a technically difficult exam. This combination most directly targets which of the following, together?

- A. Reduced speckle/artifact together with reduced near-field reverberation
- B. Genuinely improved frame rate exclusively, with no other combined benefit
- C. Genuinely improved penetration depth exclusively, with no other benefit
- D. Genuinely eliminated need for any further TGC adjustment at all

44. A system offers a genuine dynamic range setting adjustable between 40 dB and 80 dB. Selecting the genuinely higher 80 dB setting, compared to 40 dB, most directly provides which of the following?

- A. Genuinely fewer displayable gray shades across the identical image
- B. Genuinely identical displayable gray shades regardless of the setting used
- C. Genuinely more displayable gray shades, spanning a wider signal range
- D. Genuinely improved axial resolution specifically, unrelated to dynamic range

45. A sonographer reduces imaging depth from 15 cm to 10 cm for a specific exam, all else held equal. This adjustment most directly allows which of the following?

- A. A genuinely higher achievable frame rate, since less time per pulse-echo cycle is needed
- B. A genuinely lower achievable frame rate, since more processing is now required
- C. No genuine change in achievable frame rate from this specific adjustment
- D. Frame rate change genuinely depends entirely on the current transmitted frequency

46. A sonographer scanning a uniform-appearing phantom notices the displayed image is genuinely not uniformly bright at all depths despite an intentionally uniform target. This finding most directly suggests which of the following?

- A. A genuinely appropriate, expected system behavior requiring no adjustment

- B.** An inappropriately selected transducer type for this specific phantom
- C.** TGC settings genuinely requiring adjustment to achieve uniform brightness
- D.** A genuinely damaged or malfunctioning individual transducer element

47. Reject, applied to grayscale imaging, and wall filter, applied to Doppler, genuinely share which of the following conceptual similarity?

- A.** Both genuinely eliminate low-level signal below a selected threshold
- B.** Both genuinely increase the transmitted frequency for that specific exam
- C.** Both genuinely eliminate the need for any further gain adjustment at all
- D.** Both genuinely have no relationship to noise reduction in either mode

48. A sonographer selects a genuinely different postprocessing gray map for an abdominal exam compared to a small-parts exam. This practice reflects which of the following principle?

- A.** Gray map selection is genuinely irrelevant to the type of exam performed
- B.** A genuinely single, universal gray map is always appropriate for every exam
- C.** Different exam types may genuinely benefit from different display curves
- D.** Gray map selection genuinely alters the underlying acquired data itself

49. A sonographer evaluating a structure with genuinely both cystic and solid components needs to genuinely distinguish these components clearly. Which combination of adjustments most directly supports this specific goal?

- A.** Maximize overall gain and minimize genuine dynamic range together
- B.** Appropriately balance gain, TGC, and dynamic range together for contrast
- C.** Maximize persistence and minimize genuine overall gain together
- D.** Maximize frame rate and minimize genuine line density together

50. A sonographer notices a finding that changes appearance when scanning technique is genuinely varied, while true anatomic structures remain consistent. This behavior pattern most directly suggests which of the following?

- A.** The finding is genuinely definitely true anatomic pathology, requiring no further test
- B.** The finding is genuinely unrelated to any imaging artifact whatsoever
- C.** The transducer is genuinely malfunctioning under every tested condition
- D.** The finding is likely a genuine imaging artifact, technique-dependent in nature

51. A sonographer notices genuinely inadequate frame rate for a real-time assessment. Which combination of settings, if genuinely reduced, would most directly help restore adequate frame rate?

- A.** Increase imaging depth and increase the number of focal zones together
- B.** Increase line density and increase persistence together simultaneously
- C.** Reduce imaging depth, line density, and focal zone count together
- D.** Increase overall gain and increase dynamic range together simultaneously

52. A sonographer applies genuinely excessive smoothing to an image, hoping to reduce noise. This adjustment most directly risks which of the following trade-off?

- A.** Genuinely improved fine anatomic detail, with no meaningful trade-off at all
- B.** Genuinely reduced fine anatomic detail, traded for reduced apparent noise
- C.** Genuinely improved axial resolution, unrelated to the smoothing applied
- D.** Genuinely improved frame rate, unrelated to the smoothing applied

53. A sonographer applies genuinely excessive edge enhancement to an image. This adjustment most directly risks which of the following?

- A.** Genuinely eliminating all real anatomic edges from the displayed image
- B.** Creating genuinely exaggerated or false-appearing edges not truly present
- C.** Genuinely improving axial resolution beyond the system's true capability

D. Genuinely eliminating the need for any further gain adjustment at all

54. A sonographer distinguishes reverberation artifact from comet tail artifact primarily based on which of the following characteristic?

A. Reverberation shows genuinely equally spaced parallel lines; comet tail shows a genuinely tapering, focused streak

B. The two artifacts are genuinely identical in appearance, differing only in name used

C. Reverberation genuinely occurs only in color Doppler; comet tail only in grayscale

D. Comet tail genuinely occurs only in color Doppler; reverberation only in grayscale

55. A sonographer distinguishes posterior shadowing from posterior enhancement primarily based on which of the following characteristic?

A. The two findings are genuinely identical in appearance, differing only in name

B. Shadowing genuinely occurs only in color Doppler; enhancement only in grayscale

C. Enhancement genuinely occurs only in color Doppler; shadowing only in grayscale

D. Shadowing shows genuinely reduced signal deep to a structure; enhancement shows genuinely increased signal

56. A sonographer distinguishes grayscale mirror image artifact from side lobe artifact primarily based on which of the following?

A. The two artifacts are genuinely identical in appearance, differing only in name

B. Mirror image genuinely requires no strong reflector; side lobe always does

C. Mirror image genuinely requires a strong reflector; side lobe arises from off-axis beam energy instead

D. Neither artifact is genuinely related to transducer or beam characteristics at all

57. A sonographer's systematic approach to recognizing any genuine grayscale artifact should genuinely include which of the following step?

- A.** Assuming every unusual finding is genuinely artifactual without further check
- B.** Assuming every unusual finding is genuinely pathologic without further check
- C.** Ignoring any unusual finding entirely, regardless of its actual appearance
- D.** Correlating the finding's genuine appearance with a known artifact mechanism

58. A sonographer aiming to genuinely optimize overall image quality should recognize that axial, lateral, contrast, and temporal resolution are genuinely which of the following?

- A.** Entirely independent, with genuinely no interaction among them at all
- B.** Genuinely identical concepts, differing only in the specific term used
- C.** Interrelated aspects, each optimized through genuinely different specific controls
- D.** Relevant only when Doppler, not grayscale, imaging is genuinely being used

59. A sonographer troubleshooting a suboptimal image should genuinely begin with which of the following general approach?

- A.** Randomly adjusting every available control until the image genuinely improves
- B.** Adjusting only overall gain, since every other control is genuinely secondary
- C.** Identifying the genuine specific problem first, then applying the targeted fix
- D.** Restarting the entire system, regardless of the genuine specific issue present

60. A sonographer imaging a technically difficult patient combines tissue harmonic imaging, spatial compounding, and appropriate TGC adjustment together. This comprehensive approach most directly reflects which of the following principle?

- A.** Multiple complementary techniques can genuinely be combined to optimize image quality together
- B.** Only a genuinely single technique should ever be applied at one time, never combined
- C.** Combining techniques genuinely always degrades image quality rather than improving it
- D.** Genuinely none of these three techniques have any real effect on image quality at all

- 61.** A sonographer notices unexpectedly non-uniform brightness during a genuine real-time exam, inconsistent with the actual anatomy present. This finding should genuinely prompt consideration of which of the following?
- A.** Genuinely ignoring the finding entirely, since anatomy always varies naturally
 - B.** Assuming the finding is genuinely a normal anatomic variant without further thought
 - C.** Increasing overall gain substantially, without genuinely considering the cause
 - D.** Both appropriate TGC adjustment and potential equipment-related causes
- 62.** Correctly recognizing a genuine imaging artifact, rather than mistaking it for true pathology, most directly serves which of the following clinical purpose?
- A.** Avoiding a genuinely inaccurate or misleading clinical interpretation of the exam
 - B.** Genuinely improving the transducer's true achievable penetration depth
 - C.** Genuinely eliminating the need for any further QA testing on that system
 - D.** Automatically improving genuine axial resolution for future exams
- 63.** Duplex Doppler genuinely refers to which of the following combination?
- A.** Color Doppler combined genuinely with power Doppler simultaneously
 - B.** Two-dimensional grayscale imaging combined with spectral Doppler
 - C.** Continuous-wave combined genuinely with pulsed-wave Doppler together
 - D.** Two entirely separate Doppler exams performed on genuinely different days
- 64.** Triplex mode genuinely refers to which of the following simultaneous combination?
- A.** Two-dimensional grayscale imaging combined with spectral Doppler alone
 - B.** Color Doppler combined genuinely with power Doppler simultaneously alone
 - C.** Two-dimensional grayscale, color Doppler, and spectral Doppler together
 - D.** Continuous-wave combined genuinely with pulsed-wave Doppler together

65. Operating in triplex mode, with all three display components genuinely active simultaneously, most directly risks which of the following?

- A.** A genuinely reduced achievable frame rate compared to a single mode alone
- B.** Genuinely improved axial resolution compared to a single mode alone
- C.** No genuine trade-off exists when combining these three modes together
- D.** Genuinely eliminated need for any further angle correction at all

66. A sonographer selects a genuinely lower frequency specifically for the Doppler component of a duplex exam, relative to the imaging frequency used. This choice most directly serves which of the following purpose?

- A.** Improved genuine penetration and sensitivity for the Doppler signal itself
- B.** Improved genuine axial resolution for the grayscale image component only
- C.** Genuinely eliminating the need for any wall filter adjustment at all
- D.** Automatically improving genuine frame rate for the entire duplex exam

67. Which of the following Doppler-based technique is genuinely considered angle-independent, unlike standard spectral Doppler velocity measurement?

- A.** Standard pulsed-wave spectral Doppler, requiring genuine angle correction
- B.** Power Doppler, detecting genuine signal amplitude rather than velocity
- C.** Continuous-wave Doppler, still genuinely requiring angle correction
- D.** Color Doppler velocity mapping, still genuinely requiring angle correction

68. Power Doppler's genuine angle independence for flow detection most directly results from which of the following?

- A.** It genuinely maps signal amplitude/energy rather than a direction-dependent shift
- B.** It genuinely uses a fixed 0-degree angle assumption for every single exam
- C.** It genuinely requires no transmitted pulse at all, unlike other Doppler modes

D. It genuinely eliminates the Doppler equation entirely from its calculation

69. Compared to typical genuine venous flow velocities, typical genuine arterial flow velocities in the same limb are generally which of the following?

A. Genuinely identical in typical velocity range between the two vessel types

B. Genuinely higher, reflecting the greater pressure driving arterial flow

C. Genuinely lower, reflecting reduced arterial pressure relative to venous

D. Velocity range genuinely cannot be meaningfully compared between vessel types

70. A sonographer performing a duplex exam first positions the sample volume cursor using the genuine grayscale image, then activates spectral Doppler. This sequence most directly reflects which of the following?

A. A genuinely unnecessary step that could be skipped without consequence

B. A step genuinely relevant only when color Doppler is also simultaneously active

C. Using grayscale anatomy to guide genuine, accurate sample volume placement

D. A step genuinely required only for continuous-wave Doppler specifically

71. A sonographer using triplex mode for a technically difficult exam notices genuinely inadequate frame rate. Which adjustment would most directly help restore adequate frame rate?

A. Increase the current color box size substantially, regardless of current need

B. Narrow the color box to the genuinely smallest diagnostically necessary area

C. Increase persistence substantially to compensate for the genuinely low frame rate

D. Increase overall gain substantially, unrelated to genuine frame rate at all

72. A sonographer evaluating a genuinely deep vessel selects a lower Doppler frequency than would typically be used for grayscale imaging of that same depth. This choice most directly reflects which of the following?

A. Prioritizing genuine Doppler penetration and sensitivity over resolution

- B.** Prioritizing genuine grayscale resolution over Doppler penetration instead
- C.** A choice genuinely unrelated to depth or penetration considerations at all
- D.** A choice genuinely required only for continuous-wave Doppler specifically

73. A sonographer needs to detect genuinely subtle flow within a small, deep structure, where directional information is not the primary clinical question. Which mode is most directly appropriate?

- A.** Standard color Doppler, for its genuine directional velocity mapping
- B.** Continuous-wave Doppler, for its genuinely unlimited velocity range
- C.** Standard spectral Doppler alone, without any genuine 2D component
- D.** Power Doppler, for its superior sensitivity to genuinely subtle flow

74. A system's current PRF setting is 6000 Hz. What is the genuine Nyquist limit for this specific setting?

- A.** 6000 Hz, equal to the current PRF setting itself
- B.** 12000 Hz, double the current PRF setting itself
- C.** 1500 Hz, one quarter of the current PRF setting
- D.** 3000 Hz, half of the current PRF setting

75. A vessel shows a peak systolic velocity of 70 cm/s and an end-diastolic velocity of 10 cm/s. What is the genuine resistive index at this site?

- A.** 0.14, calculated as EDV divided by PSV directly
- B.** 0.86, calculated as (PSV minus EDV) divided by PSV
- C.** 7.0, calculated as PSV divided by EDV directly
- D.** 1.0, calculated as PSV divided by the sum of PSV and EDV

76. A vessel shows a peak systolic velocity of 70 cm/s, an end-diastolic velocity of 10 cm/s, and a mean velocity of 30 cm/s. What is the genuine pulsatility index at this site?

- A.** 0.86, calculated as (PSV minus EDV) divided by PSV directly
- B.** 7.0, calculated as PSV divided by EDV directly
- C.** 2.0, calculated as (PSV minus EDV) divided by mean velocity
- D.** 0.43, calculated as mean velocity divided by PSV directly

77. A vessel with a genuine cross-sectional area of 1.5 square centimeters has a genuine mean velocity of 30 cm/s. What is the approximate genuine volume flow rate?

- A.** 20 mL/s, calculated as mean velocity divided by area directly
- B.** 31.5 mL/s, calculated as area plus mean velocity together directly
- C.** 0.05 mL/s, an unrelated intermediate calculation entirely
- D.** 45 mL/s, calculated as mean velocity multiplied by area

78. A vessel has a genuine internal diameter of 1 cm. What is its approximate genuine cross-sectional area?

- A.** Approximately 1 square centimeter, equal to the diameter value alone
- B.** Approximately 3.14 square centimeters, using pi times diameter alone
- C.** Approximately 2 square centimeters, equal to twice the diameter value
- D.** Approximately 0.79 square centimeters, using pi times radius squared

79. A sonographer measures identical flow at both a genuine 30-degree angle and a genuine 60-degree angle, without applying angle correction at either. Which measurement will genuinely display the higher raw, uncorrected velocity value?

- A.** The 60-degree measurement, since larger angles produce genuinely larger raw values
- B.** Both measurements will genuinely display an identical raw velocity value
- C.** The 30-degree measurement, since smaller angles produce genuinely larger raw shift
- D.** Neither measurement is genuinely usable without angle correction applied first

80. A sonographer's spectral trace shows genuinely absent flow signal in a vessel with confirmed patency on grayscale imaging, despite adequate overall gain. Which setting should genuinely be checked first?

- A.** The current transmitted frequency selected for this specific exam
- B.** The current dynamic range setting selected for this specific exam
- C.** The current persistence setting selected for this specific exam
- D.** The wall filter setting, potentially set too high for the genuine flow velocity present

81. A sonographer's color Doppler display shows genuinely excessive noise filling much of the vessel and surrounding tissue. Which combination of adjustments is most directly appropriate?

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

82. A sonographer evaluating genuinely predominant unidirectional flow notices the waveform is displayed compressed near the very top of the available range, with substantial unused space below. Which adjustment is most directly appropriate?

- A.** Increase overall gain uniformly across the entire spectral display
- B.** Increase persistence to average multiple sequential frames together
- C.** Shift the baseline downward, reallocating range toward that flow direction
- D.** Increase the current color box size genuinely selected on the display

83. A sonographer grading a genuine cardiac valve stenosis needs the true peak velocity across that stenotic jet, which exceeds any achievable PW Nyquist limit. Which mode provides the genuinely accurate measurement needed?

- A.** Pulsed-wave Doppler at the genuinely highest achievable scale setting
- B.** Color Doppler alone, without any genuine spectral component used

- C. Power Doppler alone, since directional information is genuinely not needed
- D. Continuous-wave Doppler, since it has no genuine Nyquist limit at all

84. A sonographer troubleshooting a suspected range ambiguity artifact at a genuinely deep sample volume location tries increasing PRF as a test. If the finding genuinely worsens with this increase, this response is most consistent with which of the following?

- A. Genuine aliasing, which would genuinely improve, not worsen, with increased PRF
- B. A genuinely normal, expected finding requiring no further clinical consideration
- C. Mirror image artifact, unrelated to genuine PRF adjustments of any kind
- D. Range ambiguity, which genuinely worsens as PRF increases further

85. A sonographer suspects mirror image artifact near a strong reflector and correlates carefully with grayscale anatomy at that same location. Finding no genuine anatomic structure corresponding to the suspicious signal most directly supports which of the following conclusion?

- A. The finding is genuinely a true, previously unrecognized anatomic vessel
- B. The finding is genuinely more likely mirror image artifact, not true anatomy
- C. The transducer is genuinely malfunctioning at this specific location
- D. No genuine conclusion can be drawn from this specific correlation step

86. A sonographer encountering an unusual Doppler finding that could genuinely represent aliasing, range ambiguity, or mirror image artifact should genuinely apply which of the following overall approach?

- A. Assume the most common artifact automatically applies without further testing
- B. Assume the finding is genuinely true pathology, without any further testing
- C. Ignore the finding entirely, since distinguishing artifacts is genuinely difficult
- D. Test each specific mechanism's targeted check, systematically, until identified

- 87.** A sonographer obtains a genuinely widened, filled-in spectral trace at a location immediately distal to a 70% diameter-reduction stenosis. This finding is most consistent with which of the following?
- A.** Turbulent flow, consistent with the genuine post-stenotic location and severity
 - B.** A genuinely normal, laminar flow pattern unaffected by this specific stenosis
 - C.** An excessively high wall filter setting removing genuine flow signal present
 - D.** A technical artifact requiring no further genuine clinical consideration at all
- 88.** A vessel is insonated at a genuine 30-degree angle with a 4 MHz transducer, producing a genuine 2.5 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 30 degrees directly
 - D.** The Doppler angle is genuinely irrelevant to this specific calculation
- 89.** A sonographer transitioning from evaluating a high-velocity artery to a low-velocity vein within the same exam should genuinely do which of the following regarding wall filter?
- A.** Decrease the wall filter setting appropriately for the genuinely lower venous velocities
 - B.** Maintain the genuinely identical arterial wall filter setting throughout both vessels
 - C.** Increase the wall filter setting further for the genuinely lower venous velocities
 - D.** Wall filter genuinely requires no adjustment when switching between vessel types
- 90.** The single most important principle for accurate angle correction is genuinely aligning the cursor with which of the following?
- A.** The genuine vessel wall's physical orientation, regardless of flow direction
 - B.** The genuine, actual direction of blood flow within the vessel itself
 - C.** The current color box's genuine border, regardless of flow direction present

D. The transducer's genuine physical orientation, regardless of vessel anatomy

91. The genuinely correct general sequence for addressing aliasing, when genuinely possible, is which of the following?

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

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

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

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

92. A sonographer trains a new colleague on Doppler artifact recognition and explains that no single artifact should ever be assumed present without confirmation. This teaching point most directly reflects which of the following practice?

A. Relying exclusively on the most statistically common artifact by default

B. Relying exclusively on patient history, without any imaging correlation

C. Concluding every unusual finding is genuinely true pathology by default

D. Applying a targeted, mechanism-specific verification test before concluding

93. The genuinely most reliable spectral characteristic for distinguishing turbulent from laminar flow is which of the following?

A. The genuine total duration of the cardiac cycle being currently assessed

B. The genuine color assigned to flow on a simultaneous color Doppler display

C. The genuine presence or absence of any measurable Doppler shift at all

D. The genuine width and clarity of the spectral window beneath the waveform

94. A sonographer describing an exam that genuinely combines grayscale imaging with spectral Doppler, without simultaneous color, would most accurately describe this as which of the following?

A. Duplex Doppler, the combination of grayscale imaging and spectral Doppler

B. Triplex mode, requiring all three display components simultaneously

- C.** Power Doppler mode exclusively, without any genuine grayscale component
- D.** Color Doppler mode exclusively, without any genuine spectral component

95. A sonographer referring to power Doppler by its genuine alternative name would most accurately use which of the following term?

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

96. The genuine principle behind selecting a lower frequency for the Doppler component of a duplex exam, relative to the imaging frequency, is genuinely which of the following?

- A.** Doppler frequency genuinely has no meaningful relationship to penetration at all
- B.** Lower frequency genuinely improves axial resolution for the Doppler component
- C.** Lower frequency genuinely eliminates the need for wall filter adjustment
- D.** Lower frequency genuinely improves penetration and sensitivity for Doppler signal

97. A sonographer notices that at a specific pixel within the color box, the system genuinely displays the color signal rather than the underlying grayscale echo also present there. This behavior reflects which of the following default system configuration?

- A.** Grayscale write priority, overriding color at every pixel by default
- B.** A configuration genuinely unique to that specific manufacturer only
- C.** A random, genuinely unconfigurable display behavior at every pixel
- D.** Color write priority, the standard default when both signals are present

98. A sonographer's comprehensive approach to Doppler optimization throughout an exam should genuinely include systematic attention to which of the following, together?

- A.** Only overall gain, since every other Doppler control is genuinely secondary

- B.** Only scale, since every other Doppler control is genuinely secondary
- C.** Angle, scale, gain, and wall filter, adjusted together as clinically needed
- D.** Default settings only, without any genuine adjustment throughout the exam

99. Correctly distinguishing a genuine Doppler artifact from true pathology most directly serves which of the following clinical purpose?

- A.** Genuinely improving the transducer's true achievable penetration depth
- B.** Genuinely eliminating the need for any further QA testing on that system
- C.** Automatically improving genuine axial resolution for future exams
- D.** Avoiding a genuinely inaccurate or misleading clinical interpretation of flow

100. A sonographer's scope of practice, as an ARDMS registrant, is genuinely defined by which of the following?

- A.** Genuinely unlimited practice, without any defined scope or boundary at all
- B.** Genuinely established professional and regulatory standards for the credential
- C.** Genuinely whatever the individual sonographer personally decides is appropriate
- D.** A scope genuinely identical across every credential ARDMS offers, without variation

101. A tissue-equivalent QA phantom's genuine material composition is specifically designed to mimic which of the following soft-tissue property?

- A.** Genuine propagation speed and attenuation characteristics of real soft tissue
- B.** Genuine electrical conductivity properties, unrelated to acoustic behavior
- C.** Genuine optical transparency, unrelated to any acoustic property at all
- D.** Genuine magnetic properties, entirely unrelated to ultrasound physics

102. A sonographer distinguishing thermal from mechanical bioeffects recognizes that thermal bioeffects genuinely arise from which of the following, unlike mechanical bioeffects?

- A.** Tissue genuinely absorbing acoustic energy and converting it into heat
- B.** Genuine cavitation, the pressure-driven behavior of gas bubbles in tissue
- C.** Genuine beam bending occurring at an oblique tissue boundary present
- D.** Genuine scattering from structures smaller than the ultrasound wavelength

103. A facility's QA program genuinely triggers additional testing, beyond the regular schedule, following which of the following event?

- A.** Genuinely only when a sonographer personally requests additional testing
- B.** Genuinely never, since the regular schedule alone is always sufficient
- C.** A major transducer repair or component replacement genuinely occurring
- D.** Genuinely only at the exact midpoint of the facility's annual calendar

104. A sonographer evaluating fetal facial movement chooses real-time volumetric imaging over a static volumetric acquisition. The clinical reasoning behind this specific choice most directly relates to which of the following?

- A.** Real-time volumetric imaging genuinely requires no transducer at all
- B.** Real-time volumetric imaging genuinely eliminates the need for gain adjustment
- C.** Genuine fetal motion during acquisition is best captured continuously, not statically
- D.** Real-time volumetric imaging genuinely provides improved penetration only

105. A sonographer evaluating a thyroid nodule for genuine stiffness characteristics, needing a specific numeric value to compare across follow-up 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

106. Microbubble contrast agents genuinely produce a dramatically enhanced ultrasound signal primarily because of which of the following?

- A.** A genuinely dramatic acoustic impedance mismatch compared to surrounding blood
- B.** Genuinely identical acoustic impedance to surrounding blood, aiding detection
- C.** A genuinely fixed, unchangeable size larger than typical red blood cells
- D.** Genuinely eliminating the need for any transmitted pulse whatsoever

107. A QA technologist identifies that a specific transducer's measured performance has genuinely crossed outside its established tolerance band. What is the technologist's genuinely correct next action?

- A.** Note the finding informally, without formally removing the transducer
- B.** Continue using the transducer clinically while monitoring the trend further
- C.** Wait for the next scheduled testing interval to confirm before acting
- D.** Formally remove the transducer from service pending correction and re-verification

108. A facility's policy requires extra care and consistency when applying ALARA during pregnancy-related exams specifically. The rationale behind this specific policy most directly relates to which of the following?

- A.** A regulatory requirement genuinely applying exclusively to obstetric exams alone, with no broader ALARA principle involved
- B.** Genuine embryonic and fetal tissue actively undergoing developmental differentiation
- C.** Obstetric transducers genuinely requiring higher output by design specification
- D.** Obstetric exams genuinely being exempt from standard ALARA principles entirely

109. A sonographer comparing a matrix array to a mechanically swept transducer for 3D acquisition notes the matrix array avoids a specific physical requirement the mechanical approach genuinely needs. What is this specific requirement?

- A.** A genuinely fixed, single, unchangeable focal depth for every application
- B.** Genuinely no matching layer requirement at all for either transducer type

- C. Physical movement of transducer elements to sweep across the volume
- D. Exclusive, genuine use restricted to continuous-wave Doppler applications

110. A facility's daily equipment checklist, completed by sonographers before each shift, includes wiping the transducer and checking for visible cable damage. This checklist is genuinely categorized as which of the following?

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

Answers

- 1. B.** The matching layer's thickness is typically designed to be approximately one-quarter wavelength within that layer, optimizing constructive interference for energy transmission. Options A, C, and D each apply an incorrect fraction.
- 2. C.** The matching layer's quarter-wavelength thickness optimizes constructive interference between reflections within the layer, maximizing genuine energy transmission into the patient. Options A, B, and D each misstate this actual purpose.
- 3. B.** Backing material is genuinely designed with an intermediate acoustic impedance, between the element and air, allowing it to genuinely absorb energy and dampen ringing rather than reflecting it back into the element. Options A, C, and D each misstate this actual design consideration.
- 4. A.** The half-value layer genuinely repeats with depth: a second half-value layer beyond the first produces another 50% reduction, taking the remaining 50% down to 25% of the original value, at a total depth of 6 cm. Options B, C, and D each misapply this actual repeating relationship.
- 5. D.** Diagnostic medical ultrasound imaging genuinely uses frequencies of approximately 2 MHz to 15 MHz, spanning the range needed for most clinical applications from deep abdominal to superficial imaging. Options A, B, and C each misstate this actual clinical frequency range.
- 6. B.** Ultrasound is genuinely defined as sound with a frequency above the upper limit of normal human hearing, conventionally above approximately 20 kHz. Options A, C, and D each misstate this actual definition.

- 7. C.** Standard precautions are genuinely applied to every patient, regardless of known or suspected infection status, forming the baseline infection control approach for all clinical encounters. Options A, B, and D each misstate this actual universal application.
- 8. D.** Transmission-based precautions are genuinely applied specifically when a known or suspected infectious condition requires precautions added beyond the baseline standard precautions. Options A, B, and C each misstate this actual, condition-specific application.
- 9. C.** A sonographer should clearly explain a transvaginal exam and obtain genuine patient understanding before beginning, respecting patient autonomy and supporting informed participation. Options A, B, and D each describe an inappropriate or incomplete communication practice.
- 10. B.** Because wavelength genuinely depends on propagation speed for a fixed frequency, the identical 5 MHz transmission will produce genuinely different wavelengths in the two media with different speeds. Options A, C, and D each misstate this actual relationship.
- 11. D.** Because intensity is proportional to amplitude squared, a fourfold amplitude increase genuinely produces a sixteenfold intensity increase ($4^2 = 16$). Options A, B, and C each misapply this actual relationship.
- 12. A.** Because intensity equals power divided by cross-sectional area, the more tightly focused beam, concentrating identical power into a smaller area, genuinely has greater intensity at that location. Options B, C, and D each misstate this actual relationship.
- 13. C.** Because reflected and transmitted intensity fractions genuinely sum to the total incident intensity, transmitted intensity can be estimated directly once reflected intensity is known, without a separate measurement. Options A, B, and D each misstate this actual relationship.
- 14. D.** Cortical bone, a genuinely dense, highly attenuating medium, produces the greatest attenuation per centimeter among the options listed. Options A, B, and C each describe a medium producing genuinely less attenuation.
- 15. C.** Decibels are calculated as 10 times the base-10 logarithm of the intensity ratio: $10 \times \log_{10}(1000/10) = 10 \times 2 = 20$ dB. Options A, B, and D each apply an incorrect calculation.
- 16. B.** SPPA is averaged only over the active pulse duration, while SPTA is averaged over the full pulse repetition period including the silent listening interval, so SPPA genuinely reports a higher value for the identical exam. Options A, C, and D each misstate this actual relationship.
- 17. D.** At the critical angle, the refraction angle reaches genuinely 90 degrees, and beyond that specific angle of incidence, total reflection begins to occur. Options A, B, and C each misstate this actual critical-angle behavior.

- 18. C.** A beam bending toward the normal genuinely indicates the second medium has a slower propagation speed than the first, a direct consequence of Snell's Law. Options A, B, and D each misstate this actual inference.
- 19. D.** Genuine echo texture from red blood cells, well below the ultrasound wavelength in size, is most directly produced by Rayleigh scattering, redirecting sound in many directions from these small structures. Options A, B, and C describe unrelated mechanisms.
- 20. A.** A genuinely strong, mirror-like echo from a large, smooth organ capsule is most directly produced by specular reflection, characteristic of a large, smooth interface relative to wavelength. Options B, C, and D describe unrelated mechanisms.
- 21. C.** Duty factor equals pulse duration divided by pulse repetition period: $2 / 1000 = 0.002$, or 0.2 percent. Options A, B, and D each apply an incorrect calculation.
- 22. C.** Spatial pulse length equals cycles multiplied by wavelength: $5 \times 0.3 \text{ mm} = 1.5 \text{ mm}$. Options A, B, and D each apply an incorrect or incomplete calculation.
- 23. D.** Theoretical best-case axial resolution is approximately half of the spatial pulse length: $1.5 \text{ mm} / 2 = 0.75 \text{ mm}$. Options A, B, and C each misapply this actual relationship.
- 24. D.** Adjusting table height, transducer grip, and scanning position as needed represents an appropriate, genuinely evidence-based ergonomic response to recurring shoulder discomfort. Options A, B, and C each describe an inappropriate response that would not address, or would worsen, this discomfort.
- 25. C.** Documentation of a pre-exam discussion should genuinely include a record reflecting the specific content of that discussion, supporting both patient care continuity and professional accountability. Options A, B, and D each describe inadequate or incomplete documentation.
- 26. B.** A piezoelectric element's primary thickness-mode vibration produces sound at a resonant frequency most directly determined by that element's thickness, with thinner elements resonating at higher frequencies. Options A, C, and D describe unrelated or secondary factors.
- 27. C.** Apodization weights individual element excitation across the array, genuinely reducing side and grating lobes by tapering the amplitude contribution of elements toward the array's edges. Options A, B, and D each misstate this actual technique.
- 28. D.** A 1.5D (multi-row) array provides genuine partial electronic focusing in the elevational plane, beyond the fixed acoustic-lens focusing of a standard 1D array. Options A, B, and C each misstate this actual advantage.
- 29. D.** A micro-convex transducer genuinely offers a smaller physical footprint combined with a comparatively wide field of view, useful where access is limited but a broad view is still needed. Options A, B, and C each misstate this actual distinguishing characteristic.

- 30. C.** A broadband transducer provides genuine flexibility to operate effectively across a range of frequencies, an advantage over a narrowband transducer limited to a fixed operating frequency. Options A, B, and D each misstate this actual advantage.
- 31. A.** A vertical dropout artifact consistently appearing at the identical lateral position across multiple patients most directly suggests a genuinely damaged or non-functional individual element within that specific transducer's array. Options B, C, and D each misstate this actual likely cause.
- 32. D.** Confirming bandwidth specification directly relates to the transducer's genuine ability to operate across multiple frequencies, a key characteristic distinguishing broadband from narrowband designs. Options A, B, and C describe unrelated transducer characteristics.
- 33. C.** A genuinely broad bandwidth, spanning both higher and lower frequencies, most directly benefits a combined superficial-to-deep imaging need, allowing frequency selection appropriate to each depth. Options A, B, and D each describe a characteristic that does not support this specific combined need.
- 34. D.** Speckle genuinely arises from coherent interference among echoes returning from sub-resolution scatterers within tissue, producing the characteristic granular texture. Options A, B, and C describe unrelated causes.
- 35. D.** Speckle is genuinely a coherent interference pattern arising from tissue structure itself, fundamentally distinct from random electronic noise originating in the receiver circuitry. Options A, B, and C each misstate this actual distinction.
- 36. A.** Spatial compounding, averaging multiple beam angles together, genuinely helps reduce speckle's granular appearance by combining angle-dependent interference patterns. Options B, C, and D each describe an adjustment that does not address speckle specifically.
- 37. A.** The beam former applies genuine timing delays across array elements, combining their signals coherently for both transmit focusing/steering and receive signal combination. Options B, C, and D describe functions of unrelated components.
- 38. C.** Panoramic (extended field-of-view) imaging allows viewing a genuinely larger anatomic region than a single static frame captures, by combining sequential images as the transducer moves. Options A, B, and D each misstate this actual capability.
- 39. A.** Moving the transducer too quickly during panoramic acquisition risks genuine image distortion or misregistration within the combined image, since accurate stitching depends on consistent, controlled motion. Options B, C, and D each misstate this actual risk.
- 40. D.** Dynamic receive focusing continuously adjusts focus as echoes genuinely return from increasing depth, optimizing lateral resolution throughout the receive process rather than at a single fixed depth. Options A, B, and C each misstate this actual capability.

- 41. D.** Speckle, while often considered noise, is also genuinely recognized as a pattern that can carry some tissue-characterization information, since its specific texture relates to underlying tissue microstructure. Options A, B, and C each dismiss or misstate this nuanced recognition.
- 42. B.** Saving a completed exam to PACS archives the images for genuine later retrieval, review, and comparison, a core function of medical image management systems. Options A, C, and D each misstate this actual purpose.
- 43. A.** Combining spatial compounding and tissue harmonic imaging together targets reduced speckle/artifact (from compounding) together with reduced near-field reverberation (from harmonic imaging), complementary benefits for a technically difficult exam. Options B, C, and D each misstate this actual combined benefit.
- 44. C.** A genuinely higher dynamic range setting (80 dB versus 40 dB) allows more displayable gray shades, spanning a wider genuine signal amplitude range. Options A, B, and D each misstate this actual relationship.
- 45. A.** Reducing imaging depth directly reduces the time required for each pulse-echo cycle, allowing a genuinely higher achievable frame rate. Options B, C, and D each misstate this actual relationship.
- 46. C.** Non-uniform brightness across an intentionally uniform phantom target most directly suggests TGC settings genuinely requiring adjustment to achieve appropriate, uniform compensation across depth. Options A, B, and D each misstate this actual likely cause.
- 47. A.** Reject (grayscale) and wall filter (Doppler) genuinely share the conceptual similarity of eliminating low-level signal below a selected threshold, applied to their respective signal types. Options B, C, and D each misstate this actual shared characteristic.
- 48. C.** Selecting different postprocessing gray maps for different exam types reflects the genuine principle that different exam types may benefit from different display curves, tailored to their specific diagnostic needs. Options A, B, and D each misstate this actual principle.
- 49. B.** Appropriately balancing gain, TGC, and dynamic range together directly supports genuine contrast distinction between cystic and solid components with differing echogenicity. Options A, C, and D each describe a combination that does not directly address this specific contrast goal.
- 50. D.** A finding that genuinely changes appearance with varied scanning technique, while true anatomy remains consistent, most directly suggests the finding is likely a genuine imaging artifact, technique-dependent in nature. Options A, B, and C each misstate this actual behavior pattern.
- 51. C.** Reducing imaging depth, line density, and focal zone count together directly reduces the total pulses required per frame, the most direct way to restore adequate frame rate when genuinely inadequate. Options A, B, and D each describe an adjustment that would further reduce, not restore, frame rate.

- 52. B.** Genuinely excessive smoothing reduces fine anatomic detail as a direct trade-off for reduced apparent noise, since smoothing blurs both noise and genuine fine structure together. Options A, C, and D each misstate this actual trade-off.
- 53. B.** Genuinely excessive edge enhancement risks creating exaggerated or false-appearing edges not genuinely present in the actual anatomy, a direct consequence of over-applying this postprocessing function. Options A, C, and D each misstate this actual risk.
- 54. A.** Reverberation shows genuinely equally spaced parallel lines from repeated bouncing between reflectors, while comet tail shows a genuinely tapering, focused streak from a small, highly reflective source, a key distinguishing visual characteristic. Options B, C, and D each misstate this actual distinction.
- 55. D.** Posterior shadowing shows genuinely reduced signal deep to a strongly attenuating or reflecting structure, while posterior enhancement shows genuinely increased signal deep to a weakly attenuating structure, opposite visual findings. Options A, B, and C each misstate this actual distinction.
- 56. C.** Grayscale mirror image artifact genuinely requires a strong reflector to produce its duplicate-structure appearance, while side lobe artifact arises from genuinely off-axis beam energy being misattributed to the main beam's path, a distinct mechanism. Options A, B, and D each misstate this actual distinction.
- 57. D.** Correlating a finding's genuine appearance with a known artifact mechanism is a genuinely necessary step in a systematic approach to artifact recognition, rather than assuming either pathology or artifact by default. Options A, B, and C each describe an inappropriate, non-systematic approach.
- 58. C.** Axial, lateral, contrast, and temporal resolution are genuinely interrelated aspects of overall image quality, each optimized through different specific controls (frequency/SPL, beam width/focus, dynamic range/gray shades, and frame rate respectively). Options A, B, and D each misstate this actual interrelationship.
- 59. C.** Identifying the genuine specific problem first, then applying the corresponding targeted fix, is the appropriate general troubleshooting approach, rather than random adjustment or reliance on a single control. Options A, B, and D each describe an inappropriate, unsystematic approach.
- 60. A.** Combining tissue harmonic imaging, spatial compounding, and appropriate TGC adjustment together reflects the genuine principle that multiple complementary techniques can be combined to optimize image quality together, rather than relying on any single technique in isolation. Options B, C, and D each misstate this actual principle.
- 61. D.** Unexpectedly non-uniform brightness inconsistent with actual anatomy should genuinely prompt consideration of both appropriate TGC adjustment and potential equipment-related causes (such as a damaged element), rather than dismissing the finding. Options A, B, and C each describe an inappropriate, dismissive response.

- 62. A.** Correctly recognizing a genuine imaging artifact, rather than mistaking it for true pathology, directly serves the clinical purpose of avoiding a genuinely inaccurate or misleading clinical interpretation of the exam. Options B, C, and D each misstate this actual clinical purpose.
- 63. B.** Duplex Doppler genuinely refers to two-dimensional grayscale imaging combined with spectral Doppler, allowing anatomic guidance for Doppler sample placement. Options A, C, and D each misstate this actual combination.
- 64. C.** Triplex mode genuinely refers to two-dimensional grayscale, color Doppler, and spectral Doppler operating together simultaneously. Options A, B, and D each misstate this actual three-component combination.
- 65. A.** Operating all three triplex components simultaneously genuinely requires additional pulses for each, directly reducing achievable frame rate compared to a single mode alone. Options B, C, and D each misstate this actual trade-off.
- 66. A.** Selecting a genuinely lower Doppler frequency improves penetration and sensitivity for the Doppler signal specifically, since lower frequency experiences less attenuation with depth. Options B, C, and D each misstate this actual purpose.
- 67. B.** Power Doppler is genuinely considered angle-independent for flow detection, since it maps signal amplitude rather than a direction-dependent Doppler shift value. Options A, C, and D each describe a mode still genuinely requiring angle consideration.
- 68. A.** Power Doppler's angle independence results from mapping genuine signal amplitude/energy rather than a direction-dependent shift, unlike modes that calculate a genuine velocity value from the Doppler equation. Options B, C, and D each misstate this actual mechanism.
- 69. B.** Typical arterial flow velocities are genuinely higher than typical venous flow velocities in the same limb, reflecting the greater pressure driving arterial flow compared to lower-pressure venous return. Options A, C, and D each misstate this actual comparison.
- 70. C.** Positioning the sample volume cursor using grayscale anatomy first allows genuine, accurate placement guided by visible structure, before activating spectral Doppler at that confirmed location. Options A, B, and D each misstate this actual purpose.
- 71. B.** Narrowing the color box to the genuinely smallest diagnostically necessary area directly reduces the pulses required per frame, helping restore adequate frame rate in triplex mode. Options A, C, and D each describe an adjustment that does not directly restore frame rate.
- 72. A.** Selecting a lower Doppler frequency for a genuinely deep vessel prioritizes penetration and sensitivity for the Doppler signal over the finer resolution higher frequency would provide but with reduced depth capability. Options B, C, and D each misstate this actual prioritization.

- 73. D.** Power Doppler's superior sensitivity to genuinely subtle flow makes it well suited for detecting flow within a small, deep structure where directional information is not the primary clinical question. Options A, B, and C each describe a mode less suited to this specific low-flow priority.
- 74. D.** The Nyquist limit equals PRF divided by two: $6000 / 2 = 3000$ Hz. Options A, B, and C each apply an incorrect calculation.
- 75. B.** Resistive index equals (peak systolic velocity minus end-diastolic velocity) divided by peak systolic velocity: $(70-10)/70 \approx 0.86$. Options A, C, and D each apply an incorrect formula.
- 76. C.** Pulsatility index equals (peak systolic velocity minus end-diastolic velocity) divided by mean velocity: $(70-10)/30 = 2.0$. Options A, B, and D each apply an incorrect formula.
- 77. D.** Volume flow rate equals mean velocity multiplied by cross-sectional area: $30 \text{ cm/s} \times 1.5 \text{ cm}^2 = 45 \text{ mL/s}$. Options A, B, and C each apply an incorrect calculation.
- 78. D.** Circular area equals pi times radius squared; with a 1 cm diameter, radius is 0.5 cm, so area = $\pi \times 0.5^2 \approx 0.79$ square centimeters. Options A, B, and C each apply an incorrect calculation.
- 79. C.** Because cosine increases as angle decreases toward zero, the smaller 30-degree angle produces a genuinely larger raw Doppler shift, and thus a higher raw uncorrected velocity display, for the identical true flow. Options A, B, and D each misstate this actual relationship.
- 80. D.** Absent flow signal despite confirmed vessel patency and adequate gain most likely reflects a wall filter set too high for the genuine flow velocity present, inadvertently removing real signal. Options A, B, and C describe settings less directly responsible for this specific finding.
- 81. B.** Decreasing color gain and appropriately adjusting color wall filter together directly addresses genuinely excessive color noise filling the vessel and surrounding tissue. Options A, C, and D each describe a combination that does not directly address this specific noise problem.
- 82. C.** Shifting the baseline downward reallocates the display's vertical range toward the predominant flow direction, directly addressing a waveform genuinely compressed near the top with unused space below. Options A, B, and D each describe an adjustment that does not address this specific display allocation problem.
- 83. D.** Continuous-wave Doppler has no genuine Nyquist limit, providing the accurate peak velocity measurement needed for a stenotic jet exceeding any achievable PW scale setting. Options A, B, and C each describe a mode lacking the specific capability this scenario requires.
- 84. D.** Range ambiguity genuinely worsens as PRF increases further, since a higher PRF increases the likelihood a subsequent pulse is transmitted before the prior pulse's true-depth echo has fully returned. Options A, B, and C each misstate this actual relationship or dismiss the genuine finding.

- 85. B.** Finding no genuine anatomic structure corresponding to a suspicious signal near a strong reflector more directly supports mirror image artifact as the explanation, rather than a true, previously unrecognized vessel. Options A, C, and D each misstate or dismiss this actual correlation finding.
- 86. D.** Testing each specific mechanism's targeted check, systematically, until the finding is genuinely identified, is the appropriate overall approach when multiple artifacts are genuinely possible explanations. Options A, B, and C each describe an inappropriate, assumption-based or dismissive approach.
- 87. A.** A genuinely widened, filled-in spectral trace immediately distal to a significant stenosis is the classic Doppler signature of post-stenotic turbulent flow. Options B, C, and D each describe a finding inconsistent with this specific post-stenotic turbulent pattern.
- 88. 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 30-degree angle used. Options A, B, and D each describe an approach that omits a genuinely necessary variable or misapplies the equation.
- 89. A.** Decreasing the wall filter setting appropriately for the genuinely lower venous velocities is necessary when transitioning from a high-velocity artery to a low-velocity vein within the same exam, to avoid removing genuine venous signal. Options B, C, and D each misstate this actual necessary adjustment.
- 90. B.** The single most important principle for accurate angle correction is genuinely aligning the cursor with the actual direction of blood flow within the vessel itself, not with the vessel wall or an unrelated reference. Options A, C, and D each describe an incorrect alignment reference.
- 91. B.** The genuinely correct general sequence for addressing aliasing proceeds by increasing scale first, then shifting baseline if flow is predominantly unidirectional, then considering CW Doppler if aliasing still persists. Options A, C, and D each describe an inappropriate or out-of-sequence first step.
- 92. D.** Applying a targeted, mechanism-specific verification test before concluding is the practice this teaching point reflects, avoiding unverified assumptions in either direction. Options A, B, and C each describe an inappropriate, assumption-based shortcut.
- 93. D.** The genuine width and clarity of the spectral window beneath the waveform is the most reliable spectral characteristic for distinguishing laminar (narrow, clear window) from turbulent (broadened, filled-in window) flow. Options A, B, and C describe findings less directly diagnostic of this specific distinction.
- 94. A.** An exam combining grayscale imaging with spectral Doppler, without simultaneous color, is most accurately described as duplex Doppler, the two-component combination. Options B, C, and D each misstate this actual terminology.

- 95. C.** Power Doppler's genuine alternative name is energy (amplitude) mode, since it displays signal amplitude rather than directional velocity information. Options A, B, and D describe unrelated or incorrect alternative terminology.
- 96. D.** The genuine principle behind selecting a lower Doppler frequency relative to imaging frequency is that lower frequency genuinely improves penetration and sensitivity for the Doppler signal specifically. Options A, B, and C each misstate this actual principle.
- 97. D.** This behavior reflects color write priority, the standard default system configuration that displays color signal over grayscale when both are genuinely present at the same pixel. Options A, B, and C each misstate this actual default configuration.
- 98. C.** A comprehensive approach to Doppler optimization genuinely includes systematic attention to angle, scale, gain, and wall filter together, adjusted as clinically needed throughout the exam. Options A, B, and D each describe an incomplete or inappropriate approach.
- 99. D.** Correctly distinguishing a genuine Doppler artifact from true pathology directly serves the clinical purpose of avoiding a genuinely inaccurate or misleading clinical interpretation of flow. Options A, B, and C each misstate this actual clinical purpose.
- 100. B.** A sonographer's scope of practice as an ARDMS registrant is genuinely defined by established professional and regulatory standards specific to that credential, not by unlimited individual discretion. Options A, C, and D each misstate this actual definition.
- 101. A.** A tissue-equivalent QA phantom's material composition is specifically designed to mimic real soft tissue's genuine propagation speed and attenuation characteristics, so QA measurements genuinely reflect real clinical performance. Options B, C, and D describe unrelated, non-acoustic properties.
- 102. A.** Thermal bioeffects genuinely arise from tissue absorbing acoustic energy and converting it into heat, distinct from mechanical bioeffects' cavitation-based mechanism. Options B, C, and D describe unrelated mechanisms or the mechanical bioeffect mechanism itself.
- 103. C.** A major transducer repair or component replacement genuinely triggers additional QA testing beyond the regular schedule, since such events can meaningfully change performance in ways the fixed schedule alone would not catch promptly. Options A, B, and D each describe an inappropriate or arbitrary trigger.
- 104. C.** Genuine fetal motion occurring during acquisition is best captured continuously through real-time volumetric imaging, since a static volume cannot represent that ongoing motion. Options A, B, and D each misstate this actual clinical reasoning.
- 105. B.** Shear wave elastography provides an absolute, quantitative stiffness value, genuinely well suited to comparing a specific numeric value across follow-up exams, unlike strain elastography's relative, qualitative output. Options A, C, and D each misstate this actual capability.

106. A. Microbubble contrast agents produce a dramatically enhanced signal primarily because of their genuinely dramatic acoustic impedance mismatch compared to surrounding blood, producing much stronger reflection. Options B, C, and D each misstate this actual mechanism.

107. D. The technologist's genuinely correct next action is formally removing the transducer from service pending correction and re-verification, since a tolerance-band crossing indicates genuine risk requiring immediate action. Options A, B, and C each describe an inappropriately delayed or incomplete response.

108. B. The rationale relates to genuine embryonic and fetal tissue actively undergoing developmental differentiation, warranting the same disciplined ALARA practice applied to every patient, with particular consistency. Options A, C, and D each misstate this actual rationale.

109. C. A matrix array avoids the physical movement of transducer elements needed to sweep across the volume, since its true two-dimensional grid enables direct electronic volumetric acquisition instead. Options A, B, and D each misstate this actual distinguishing requirement.

110. C. A daily checklist involving physical inspection tasks, completed before each shift, is genuinely categorized as preventive maintenance, distinct from formal, phantom-based QA performance testing. Options A, B, and D each describe a formal QA performance test rather than this specific preventive maintenance activity.