

COMPREHENSIVE MOCK EXAM 16

Supplemental to: Clinical Ultrasound Board Review 2026-2027

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ARDMS SPI (Sonography Principles and Instrumentation) Examination, Inteleos -- 110 questions, single-best-answer, four options (A-D), domain-weighted per official ARDMS SPI Content Outline v17.3

Board-Review Questions

- 1.** A sonographer credentialed only in abdominal ultrasound is asked to independently perform and preliminarily assess a vascular duplex study. What does department policy typically require in this situation?

 - A.** Any credentialed sonographer may perform any exam type regardless of specific credentialing
 - B.** Only physicians, never sonographers, may hold any exam-specific credentialing
 - C.** The sonographer should not independently perform an exam type outside her specific modality credentialing
 - D.** Credentialing applies only to physicians reading the study, not to sonographers scanning it

- 2.** While scanning the abdomen for a specifically ordered gallbladder study, the sonographer notices an unrelated, clearly abnormal finding in the visualized lung base. What is the sonographer's professional obligation regarding this incidental finding?

 - A.** Document and communicate the finding through appropriate channels, even though it falls outside the ordered study
 - B.** Ignore any finding that falls outside the specific exam ordered entirely
 - C.** Only mention the finding if the patient happens to directly ask about it
 - D.** Delete the images showing the incidental finding to avoid any liability

- 3.** To maintain her registry credential, a sonographer completes a structured project analyzing and improving a specific aspect of her department's scanning protocol, separate from her routine continuing education credits. What is this type of activity called?

 - A.** A continuing medical education (CME) credit
 - B.** A practice quality improvement (PQI) project
 - C.** A tissue-mimicking phantom QA test
 - D.** A new-hire competency checklist

- 4.** When a physician gives a verbal order for an add-on ultrasound exam over the phone, the receiving staff member repeats the order back to the physician before ending the call, to confirm it was heard correctly. What is this practice called?

- A. Informed consent documentation**
- B. Read-back verification of a verbal order**
- C. A chaperone policy**
- D. Two-person medication verification**

5. After a wrong-patient imaging error occurs at a facility, the event triggers a formal internal review process and, depending on severity, external regulatory reporting, distinct from routine quality-improvement tracking. What category of event does this represent?

- A. A routine, fully expected minor variance requiring no special reporting**
- B. A simple billing discrepancy, unrelated to patient safety**
- C. A "never event" requiring formal review and possible regulatory reporting**
- D. A standard equipment maintenance log entry, unrelated to this event**

6. A department limits the maximum number of consecutive hours a sonographer may be scheduled to scan without a break, based on evidence that fatigue increases diagnostic error risk. What does this scheduling policy primarily address?

- A. Transducer disinfection classification**
- B. Electrical leakage-current safety**
- C. HIPAA-compliant image access control**
- D. Fatigue-related error risk through scheduling limits**

7. After a preliminary report is issued, a discrepancy is identified requiring the report to be amended. Facility policy requires a second, independent physician to review and co-sign the amended report before it is finalized. What does this dual sign-off primarily support?

- A. The Spaulding classification of the transducer used, an unrelated concept**
- B. Electrical leakage-current safety, an unrelated safety check**
- C. HIPAA-compliant image access control, an unrelated privacy concept**
- D. Quality assurance and accountability for amended/discrepant reports**

8. Between patients, in addition to disinfecting the transducer itself, staff also wipe down the exam table, bed rails, and keyboard with an appropriate cleaning agent. What does this broader room-cleaning practice address, distinct from transducer-specific disinfection?

- A.** The Spaulding classification, which applies specifically to the transducer
- B.** Electrical leakage-current safety, an unrelated concept
- C.** General environmental (room/surface) infection control beyond the transducer itself
- D.** HIPAA-compliant image access control, an unrelated concept

9. A facility protocol specifies that any abdominal aortic diameter measured above a defined threshold must be directly and immediately communicated to the ordering physician, rather than waiting for routine report turnaround. What does this represent?

- A.** A routine, non-urgent reporting pathway with standard turnaround
- B.** The Spaulding classification of the transducer, an unrelated concept
- C.** A standardized critical-value reporting threshold requiring expedited communication
- D.** HIPAA-compliant image access control, an unrelated privacy concept

10. A patient declines the sonographer's recommendation to obtain an additional view needed to fully evaluate a possible finding. The sonographer documents the discussion and the patient's decision in the medical record. What is this documentation called?

- A.** Informed-refusal documentation
- B.** A chaperone policy log
- C.** A tissue-mimicking phantom QA record
- D.** A two-person medication verification log

11. A non-sonographer emergency physician who performs brief bedside ultrasound to guide a procedure maintains a separate competency and credentialing pathway from the formal diagnostic ultrasound department's sonographer credentialing. What does this separate pathway apply to?

- A.** Formal diagnostic ultrasound department sonographers exclusively
- B.** Only physicians who interpret formal diagnostic ultrasound studies

- C. Point-of-care ultrasound (POCUS) users performing bedside, procedure-focused scanning
- D. Only biomedical engineers performing equipment maintenance

12. For bioeffects and output-reporting purposes, the transducer's actual output intensity at the face is mathematically reduced using an assumed tissue attenuation factor to estimate the intensity that would realistically reach a given depth in the body. What is this depth-adjusted estimate called?

- A. Spatial-peak temporal-average intensity measured at the transducer face itself
- B. Derated (in-situ) intensity, an attenuation-adjusted estimate of exposure at depth
- C. The half-value layer, an unrelated attenuation-depth measure
- D. The beam uniformity coefficient, an unrelated intensity-ratio metric

13. Given a known Doppler shift, transmitted frequency, and blood flow velocity, the Doppler equation can be algebraically rearranged to solve for one remaining unknown variable. What variable can be solved for using these three known values?

- A. The propagation speed of sound in tissue
- B. The Doppler angle (angle of insonation)
- C. The pulse repetition frequency
- D. The spatial pulse length

14. A signal-processing principle states that the product of a pulse's time duration and its frequency-domain bandwidth remains approximately constant, meaning a shorter pulse duration mathematically requires a proportionally wider bandwidth. What is this quantitative relationship called?

- A. The bandwidth-time product, relating pulse duration and bandwidth
- B. The Doppler equation, an unrelated velocity-frequency relationship
- C. The range (depth) equation, an unrelated distance-time relationship
- D. Snell's Law, an unrelated refraction-angle relationship

15. Even in a normal, non-turbulent vessel with laminar flow, a spectral Doppler waveform still displays a range of simultaneous velocities at any instant, rather than a single pure velocity line, because blood at the center of the lumen moves faster than blood near the vessel wall. What does this normal spectral width primarily reflect?

- A.** The normal velocity range across the lumen in laminar flow, not turbulence
- B.** A technically inadequate Doppler angle, an unrelated technical error
- C.** Spectral broadening specifically from turbulence, a distinct abnormal cause
- D.** Aliasing from an insufficient PRF, an unrelated sampling artifact

16. At a tissue interface with a 20% reflection coefficient, what percentage of the beam's energy is transmitted across the interface, assuming no additional absorption at the boundary itself?

- A.** 20% is transmitted, matching the reflection coefficient exactly
- B.** 80% is transmitted (100% minus the 20% reflected)
- C.** 120% is transmitted (100% plus the 20% reflected)
- D.** 0% is transmitted, since any reflection blocks all transmission

17. A sonographer selecting a transducer for a deep abdominal vessel must balance two competing needs: adequate penetration to reach the target depth, and the ability to detect the expected range of flow velocities without excessive aliasing. What does this combined decision illustrate?

- A.** That frequency selection depends only on depth, with no relevance to velocity range
- B.** That frequency selection depends only on expected velocity, with no relevance to depth
- C.** That Doppler exams never require any frequency trade-off considerations
- D.** That transmitted frequency selection may need to jointly balance penetration depth and Doppler velocity-detection range

18. Most diagnostic ultrasound uses a single transducer that both transmits the pulse and receives the returning echo (pulse-echo technique). A different, less common technique instead uses two separate transducers positioned on opposite sides of the tissue, one transmitting continuously and the other receiving. What is this alternative technique called?

- A.** Coded excitation, an unrelated pulse-encoding technique
- B.** Harmonic imaging, an unrelated nonlinear-propagation technique
- C.** Through-transmission, using two separate transmit/receive transducers
- D.** Spatial compounding, an unrelated multi-angle blending technique

19. A continuous wave has a frequency of 4 MHz and travels through a medium with a propagation speed of 1520 m/s. Using the standard formula, what is the approximate wavelength of this wave?

- A.** Approximately 0.6 mm, an incorrect application of the formula
- B.** Approximately 0.38 mm (speed divided by frequency)
- C.** Approximately 6080 mm, an incorrect application of the formula
- D.** Approximately 4 mm, an incorrect application of the formula

20. A system operates at a frame rate of 40 frames per second. Using the standard relationship, what is the approximate time represented by each individual displayed frame?

- A.** Approximately 40 milliseconds per frame, a miscalculated value
- B.** Approximately 4 milliseconds per frame, a miscalculated value
- C.** Approximately 25 milliseconds per frame (1 divided by frame rate)
- D.** Approximately 400 milliseconds per frame, a miscalculated value

21. When a Doppler signal is analyzed over only a short, finite time window, energy from a true single frequency can appear smeared across several adjacent frequency bins in the resulting spectral display, rather than as a single sharp line. What is this signal-processing artifact called?

- A.** Aliasing, an unrelated sampling-rate wraparound artifact
- B.** Spectral leakage, energy smearing across adjacent frequency bins
- C.** Spectral broadening from turbulence, a distinct abnormal-flow finding
- D.** Range ambiguity, an unrelated depth-related artifact

22. B-mode imaging pulses are typically short, broadband pulses (few cycles), while spectral Doppler pulses are typically longer, narrowband pulses (many cycles). What does this design contrast primarily reflect?

- A.** B-mode and Doppler pulses are actually identical in duration and bandwidth
- B.** Doppler pulses are always shorter than B-mode pulses, contrary to the actual design
- C.** Pulse design has no bearing on whether resolution or frequency precision is favored
- D.** B-mode favors short broadband pulses (resolution); Doppler favors long narrowband pulses (frequency precision)

23. To convert a Doppler signal from its raw time-domain waveform into the frequency-domain spectral display shown on screen, the system applies a specific, standard mathematical algorithm. What is this algorithm called?

- A.** Snell's Law, an unrelated refraction-angle relationship
- B.** The range (depth) equation, an unrelated distance-time relationship
- C.** The fast Fourier transform (FFT), converting time-domain data to a spectrum
- D.** The Doppler equation, an unrelated velocity-frequency relationship

24. When expressing a ratio of two power (or intensity) values in decibels, the formula uses a multiplying factor of 10 ($10 \times \log$ of the ratio), while expressing a ratio of two amplitude (or pressure) values uses a multiplying factor of 20 ($20 \times \log$ of the ratio). What does this distinction reflect?

- A.** Power and amplitude ratios are always numerically identical regardless of formula
- B.** Two related but distinct decibel formulas exist depending on whether power/intensity or amplitude/pressure is being compared
- C.** Only the power-ratio formula is ever considered valid in ultrasound physics
- D.** Only the amplitude-ratio formula is ever considered valid in ultrasound physics

25. To reduce spectral leakage when analyzing a finite-duration Doppler signal segment, the system applies a mathematical tapering function to the edges of the analysis window before performing the frequency analysis. What is this type of tapering function called?

- A.** The range (depth) equation, an unrelated distance-time relationship
- B.** Snell's Law, an unrelated refraction-angle relationship
- C.** A window function (e.g., Hamming or Hanning), tapering the analysis window's edges
- D.** The Doppler equation, an unrelated velocity-frequency relationship

26. Grating lobes arise when an array's element spacing is too coarse relative to wavelength (insufficient spatial sampling), while Doppler aliasing arises when the pulse repetition frequency is too low relative to the Doppler shift (insufficient temporal sampling). What do these two artifacts illustrate together?

- A.** Spatial and temporal sampling are entirely unrelated physical concepts
- B.** Both artifacts share one principle: insufficient sampling relative to signal frequency
- C.** Grating lobes and Doppler aliasing are actually the same artifact, just renamed
- D.** Only temporal sampling can ever produce a sampling-related artifact

27. Averaging several independent, repeated measurements of the same signal improves the signal-to-noise ratio according to a specific mathematical relationship with the number of measurements averaged. What is this relationship?

- A.** SNR improves in direct proportion to the number of measurements averaged (N)
- B.** SNR improves proportionally to the square root of the number of measurements averaged (square root of N)
- C.** Averaging measurements has no effect on signal-to-noise ratio at all
- D.** SNR worsens as more measurements are averaged together

28. From front to back, a transducer element assembly consists of one or more matching layers, the piezoelectric element itself, and a backing (damping) material behind it. What is this complete front-to-back layered assembly called as a single named unit?

- A.** The acoustic stack
- B.** The kerf
- C.** The virtual apex

D. The near zone

29. A 256-element linear array uses only 64 adjacent elements at any given instant to transmit and receive a single scan line, then shifts which 64 elements are active for the next line. What is this active subset of elements called, as distinct from the array's total element count?

- A.** The active aperture, a subset of the total element count
- B.** The kerf, an unrelated inter-element gap
- C.** The virtual apex, an unrelated convex-array reference point
- D.** The dead zone, an unrelated near-field imaging limitation

30. Biomedical engineering trains staff to loosely coil, rather than tightly wind, a transducer cable when storing it between uses. What does this practice primarily prevent?

- A.** Excessive acoustic output drift over the transducer's lifetime
- B.** Electrical leakage-current hazards during patient contact
- C.** Internal wire damage and cable fatigue from tight coiling/kinking
- D.** Grating lobe artifacts during subsequent imaging

31. A small-footprint, high-frequency linear array is specifically designed for neonatal cranial imaging through the open fontanelle and for neonatal spinal imaging through the unossified posterior elements. What does this probe's design specifically take advantage of?

- A.** The neonatal skull's higher attenuation compared to an adult skull
- B.** An acoustic window created by the still-open fontanelle/unossified spine, avoiding fully ossified bone
- C.** A permanently fixed frequency incompatible with any adult application
- D.** The complete absence of any acoustic window requirement in neonates

32. During a prolonged scanning session, a transducer's actual center operating frequency can drift slightly as the probe warms from continuous use, distinct from its overall output-power stability. What does this specific drift affect?

- A.** The Spaulding disinfection classification, an unrelated concept
- B.** The kerf spacing between elements, an unrelated fixed dimension
- C.** The physical footprint dimensions, an unrelated fixed spec
- D.** The center operating frequency, drifting slightly with temperature

33. Before a new transducer model can be marketed, its patient-contact materials must pass a specific category of testing verifying they do not cause toxic or allergic tissue reactions. What is this testing called?

- A.** Electrical leakage-current testing
- B.** Acoustic output stability testing
- C.** Biocompatibility testing of patient-contact materials
- D.** Dead-element acceptability testing

34. Rather than electronically switching one shared set of elements between two operating frequencies, a transducer housing instead contains two entirely separate, physically distinct sets of piezoelectric elements, each dedicated to its own fixed frequency. How does this design differ from frequency-agile switching within a single shared element set?

- A.** It is functionally and physically identical to frequency-agile switching, just renamed
- B.** It uses two physically separate crystal element sets, rather than switching one shared set electronically
- C.** It eliminates the need for any frequency selection whatsoever
- D.** It requires the operator to physically swap probes to change frequency

35. Biomedical engineering maintains one designated transducer, kept solely for QA purposes and never used clinically, against which the acoustic output of newly acquired clinical transducers is compared during acceptance testing. What is this designated transducer called?

- A.** A duplex combination probe, a clinical rather than QA-only device
- B.** An intraoperative sterile probe, a clinical rather than QA-only device
- C.** A reference/calibration transducer used only for QA comparison

D. A micro-convex array probe, a clinical rather than QA-only device

36. Each new transducer ships with a manufacturer-provided document verifying its acoustic output was measured against equipment traceable to a national metrology standards laboratory. What is this document called?

- A.** An output calibration certificate, traceable to a standards lab
- B.** The Spaulding classification label, an unrelated disinfection concept
- C.** A warranty registration card, an unrelated commercial document
- D.** The disinfectant compatibility list, an unrelated cleaning document

37. A small-footprint, phased-array-style probe is specifically optimized for imaging a neonate's or infant's heart through a limited intercostal acoustic window, distinct from probes designed for neonatal cranial or adult cardiac imaging. What does this describe?

- A.** An adult cardiac phased array, unmodified for pediatric use
- B.** A neonatal cranial micro-convex probe, used through the fontanelle
- C.** A standard abdominal curvilinear probe
- D.** A pediatric cardiac micro-convex/phased-array probe for the infant intercostal window

38. A transducer contains a small embedded radio-frequency tag that the system can read wirelessly at short range to automatically identify the probe, without requiring direct electrical contact through the connector pins. How does this differ from the embedded connector-based identification chip used on many transducers?

- A.** It identifies the probe wirelessly at short range (RFID/NFC), rather than through direct electrical connector contact
- B.** It performs an identical function using an identical electrical-contact mechanism
- C.** It requires the probe to be physically plugged in for several minutes before identification completes
- D.** It eliminates the need for the system to identify the probe at all

39. During transducer manufacturing, quality control verifies that the beam's actual acoustic axis aligns precisely with the array's intended geometric centerline, rather than being skewed to one side. What does this verification check?

- A.** The transducer's fractional bandwidth specification, an unrelated ratio
- B.** The transducer's Curie point rating, an unrelated heat property
- C.** Acoustic axis alignment, matching the beam centerline to the array center
- D.** The transducer's effective radiating area, an unrelated surface spec

40. A transducer cable's outer jacket is reinforced with an aramid (Kevlar-type) fiber layer specifically to resist cuts and abrasion from repeated handling and contact with equipment surfaces. What does this reinforcement address?

- A.** Acoustic impedance matching at the transducer face
- B.** Electrical impedance matching to the system's receiver circuitry
- C.** Cable cut/abrasion resistance from repeated handling
- D.** The transducer's operating frequency range

41. For a procedure requiring a fully sterile field, such as certain vascular access procedures, the transducer is covered with a long sterile sheath extending well past the cable, rather than the simple, shorter probe cover used for routine non-sterile scanning. What does this distinction primarily reflect?

- A.** The level of sterility required by the specific procedure being performed
- B.** A difference in the transducer's operating frequency
- C.** A difference in the transducer's Curie point
- D.** A difference in the transducer's fractional bandwidth

42. A specialized endocavity transducer is designed for insertion into the rectum to image the prostate gland at close range, distinct from a transducer designed for transvaginal insertion. What does this probe's design primarily reflect?

- A.** An identical design to a transvaginal probe with no meaningful differences
- B.** A design intended exclusively for cardiac imaging

- C. A design intended exclusively for intraoperative surgical use
- D. A design and shape optimized specifically for transrectal insertion and prostate imaging

43. A specialized, small, high-frequency sterile transducer is designed for direct intraoperative contact with brain tissue during neurosurgical procedures, distinct from a general-purpose intraoperative probe used in abdominal or other surgery. What does this probe's design specifically optimize for?

- A. Maximum penetration depth for whole-body imaging
- B. High-resolution imaging of neural tissue during neurosurgery specifically
- C. Transvaginal insertion and pelvic imaging
- D. Long-range Doppler assessment of peripheral vessels

44. To maximize the signal-to-noise benefit of a coded excitation pulse, the receiver applies a specific signal-processing technique precisely matched to the known shape of the transmitted coded pulse. What is this receive-side processing technique called?

- A. Apodization, an unrelated aperture-weighting technique
- B. Dynamic aperture, an unrelated depth-based widening technique
- C. Matched filtering, matched to the known transmitted pulse shape
- D. Multiplexing, an unrelated channel-switching technique

45. Because most piezoelectric transducer elements contain lead-based ceramic (PZT), facilities must follow specific electronic-waste disposal regulations when a transducer reaches the end of its usable life, rather than discarding it as ordinary trash. What does this disposal requirement address?

- A. The transducer's acoustic output calibration
- B. Electronic-waste disposal regulations for lead-containing materials
- C. The transducer's Spaulding disinfection classification
- D. The transducer's biocompatibility rating

46. After the sonographer places calipers on the length, width, and height of the ovary, the system automatically applies the ellipsoid formula to calculate total ovarian volume. What software feature does this describe?

- A.** Automated ovarian volume calculation software
- B.** Automated testicular volume calculation software
- C.** Automated splenic index calculation software
- D.** Automated endometrial thickness measurement software

47. After the sonographer places calipers on the prostate's length, width, and height via transrectal imaging, the system automatically applies the ellipsoid formula to calculate total prostate volume. What software feature does this describe?

- A.** Automated ovarian volume calculation software
- B.** Automated testicular volume calculation software
- C.** Automated prostate volume calculation software
- D.** Automated common bile duct measurement software

48. After the sonographer measures the endometrial stripe thickness in a postmenopausal patient, the system compares the value to a normal threshold and flags the study if the measurement exceeds it. What software feature does this describe?

- A.** Automated ovarian volume calculation, an unrelated organ metric
- B.** Automated endometrial thickness measurement with threshold flag
- C.** Automated prostate volume calculation, an unrelated organ metric
- D.** Automated splenic index calculation, an unrelated organ metric

49. After the sonographer measures the common bile duct diameter, the system compares the value to a normal threshold and flags the study if the measurement suggests biliary ductal dilation. What software feature does this describe?

- A.** Automated ovarian volume calculation, an unrelated organ metric
- B.** Automated prostate volume calculation, an unrelated organ metric

- C. Automated endometrial thickness measurement, an unrelated structure
- D. Automated common bile duct diameter measurement with threshold flag

50. After the sonographer measures the main portal vein's diameter, the system stores the value and can compare it to a prior exam's measurement for surveillance purposes. What software feature does this describe?

- A. Automated portal vein diameter measurement and tracking
- B. Automated testicular volume calculation
- C. Automated splenic index calculation
- D. Automated endometrial thickness measurement

51. After the sonographer enters a breast lesion's specific sonographic features (margin, orientation, echogenicity), the structured reporting software suggests the most likely standardized assessment category, which the physician then confirms or overrides. What does this suggestion feature represent?

- A. Modality worklist integration, an unrelated scheduling feature
- B. Automated standardized-category suggestion from entered lesion features
- C. An ellipsoid volume formula, an unrelated organ-volume calculation
- D. A structured worksheet, without any feature-based suggestion

52. After the sonographer places calipers on the testicle's length, width, and height, the system automatically applies the ellipsoid formula to calculate total testicular volume. What software feature does this describe?

- A. Automated testicular volume calculation software
- B. Automated ovarian volume calculation software
- C. Automated prostate volume calculation software
- D. Automated splenic index calculation software

53. At any point during the exam, the sonographer can open a single panel listing every measurement and caliper placement made so far, without needing to scroll back through individual images. What is this panel called?

- A.** The color box boundary, an unrelated Doppler region-of-interest tool
- B.** The focal-zone position indicator, an unrelated focus-depth marker
- C.** An on-screen measurement-history summary panel
- D.** The biopsy guide-line, an unrelated needle-path overlay

54. When a returning patient's name is entered, the system automatically detects that a prior exam exists in the archive and prompts the sonographer to load it for side-by-side comparison. What does this automatic detection represent?

- A.** Modality worklist integration for initial scheduling only
- B.** DICOM lossy compression, an unrelated file-size technique
- C.** An ellipsoid volume formula, an unrelated calculation
- D.** Automatic prior-exam detection with a load-for-comparison prompt

55. The sonographer selects two previously saved cine loops from different points in the exam and plays them back simultaneously, side by side, synchronized in time. What is this playback feature called?

- A.** Automatic Doppler envelope tracing
- B.** Dual-window synchronized cine playback
- C.** A structured measurement worksheet
- D.** An ellipsoid volume formula

56. In the system settings, the operator can choose whether all linear measurements are displayed in centimeters or millimeters. What does this setting control?

- A.** The displayed measurement units (cm versus mm)
- B.** The transducer's operating frequency
- C.** The Doppler angle correction applied to velocity measurements

D. The persistence (frame-averaging) level

57. After the sonographer places calipers directly on the peak systolic and end-diastolic points of a spectral waveform, the system immediately calculates the resistive index from those two points, without requiring the operator to trace the entire waveform envelope. What does this represent?

- A.** Automatic Doppler envelope tracing across multiple full cycles
- B.** A structured report-generation template
- C.** Automated RI calculation from two calipers, without full envelope tracing
- D.** Automated ejection fraction calculation

58. As the sonographer moves a caliper near a visible tissue interface, the cursor automatically snaps to the nearest detected edge rather than requiring pixel-perfect manual placement. What does this snapping behavior represent?

- A.** Modality worklist integration, an unrelated scheduling feature
- B.** AI-assisted edge-snapping for more precise caliper placement
- C.** An ellipsoid volume formula, an unrelated organ-volume calculation
- D.** DICOM lossy compression, an unrelated file-size technique

59. A short text label in the corner of the screen continuously displays the name of the currently selected exam-type preset (such as "Abdomen" or "OB Second Trimester"). What is this on-screen element called?

- A.** The focal-zone position indicator, an unrelated focus-depth marker
- B.** An on-screen exam-type label matching the selected preset
- C.** The color box boundary, an unrelated Doppler region-of-interest tool
- D.** The depth-scale marker, an unrelated centimeter ruler

60. After the sonographer measures the spleen's length, width, and thickness, the system multiplies the three values together to calculate a single composite value used to assess splenomegaly, distinct from length alone. What is this composite value called?

- A.** The splenic length alone
- B.** The splenic resistive index
- C.** The splenic index (length x width x thickness)
- D.** The splenic ellipsoid volume using the 0.523 constant

61. While actively scanning a live view, the sonographer keeps a small thumbnail of a previously saved reference or road-map image visible in the corner of the screen for comparison. What is this feature called?

- A.** Cine-loop frame bookmarking, an unrelated manual-flagging feature
- B.** A live picture-in-picture reference-image thumbnail during scanning
- C.** An ellipsoid volume formula, an unrelated organ-volume calculation
- D.** A structured measurement worksheet, an unrelated data-entry feature

62. The system compares the operator's current TGC curve shape to a library of typical patterns for the selected exam type and displays a subtle warning if the curve deviates significantly, suggesting a possible gain-setting error. What does this warning address?

- A.** Electrical leakage-current safety, an unrelated safety check
- B.** The Spaulding classification of the transducer, an unrelated concept
- C.** An unusual TGC curve pattern possibly indicating a gain-setting error
- D.** HIPAA-compliant image access control, an unrelated privacy concept

63. After the sonographer traces a single spectral waveform, the system automatically calculates both the resistive index and the pulsatility index from that one traced envelope, rather than requiring two separate tracing steps. What does this represent?

- A.** Simultaneous RI and PI calculation from a single traced waveform
- B.** Automated ejection fraction calculation only
- C.** Automated aortic-valve-area calculation only
- D.** Automated carotid IMT measurement only

64. For a patient returning specifically to reassess one previously identified finding, the sonographer selects a shorter structured template requiring only the relevant images and measurements, rather than the full standard protocol used for a new, complete exam. What is this shorter template called?

- A.** A limited/focused-exam-specific structured template
- B.** The pediatric-preset MI/TI output cap, an unrelated safety interlock
- C.** A modality worklist entry, an unrelated scheduling feature
- D.** DICOM lossy compression, an unrelated file-size technique

65. When harmonic imaging mode is engaged, a small on-screen indicator shows which specific harmonic frequency is currently being used for image formation. What does this indicator display?

- A.** The Doppler angle correction currently applied
- B.** The specific active harmonic frequency currently in use
- C.** The current dynamic range setting
- D.** The current persistence level

66. After acquiring an umbilical cord Doppler waveform, the system automatically outlines the systolic and diastolic points across several cardiac cycles for the fetal umbilical artery, similar to adult vessel auto-tracing but applied to this fetal vessel specifically. What does this feature represent?

- A.** Automated carotid IMT measurement, an adult-vessel application
- B.** Automated aortic-valve-area calculation, an adult cardiac application
- C.** Automated fetal umbilical artery Doppler envelope auto-tracing
- D.** Automated ejection fraction calculation, an adult cardiac application

67. The operator adjusts a TGC curve to a shape she prefers for abdominal exams, then saves that specific curve shape so it automatically loads whenever the abdominal preset is selected in the future. What does this saved, recallable curve represent?

- A.** A tissue-specific propagation-speed preset, an unrelated depth-calculation setting
- B.** The pediatric-preset MI/TI output cap, an unrelated safety interlock

- C. A modality worklist entry, an unrelated scheduling feature
- D. A preset-specific, saved/recallable TGC curve shape

68. During a shear-wave elastography acquisition, a small on-screen countdown timer shows the operator how many more seconds the probe must remain still for the measurement to complete. What is this timer's purpose?

- A. To display the total exam duration elapsed so far
- B. To display the transducer's remaining battery charge
- C. The remaining time the probe must stay still during elastography
- D. To display the current frame rate in frames per second

69. During a trauma FAST exam, after the sonographer outlines areas of free fluid in each abdominal quadrant, the system provides a rough estimated total free-fluid volume based on the outlined areas. What does this estimate assist with?

- A. Automated ejection fraction calculation, an unrelated cardiac metric
- B. Automated carotid IMT measurement, an unrelated vascular metric
- C. Automated aortic-valve-area calculation, an unrelated cardiac metric
- D. A rough estimated free-fluid volume to help gauge the extent of hemoperitoneum

70. During an obstetric exam, a second monitor mounted for the patient and family to view mirrors the sonographer's screen, letting them see the fetal images in real time. What is this secondary display called?

- A. A patient/family-facing mirrored secondary display
- B. A biomedical-engineering multi-monitor QA configuration
- C. A structured report-generation template
- D. DICOM lossy compression

71. After the sonographer measures the pancreatic duct diameter, the system compares the value to a normal threshold and flags the study if the measurement suggests ductal dilation. What software feature does this describe?

- A.** Automated common bile duct measurement, a distinct biliary structure
- B.** Automated pancreatic duct diameter measurement with threshold flagging
- C.** Automated portal vein diameter measurement, a distinct vascular structure
- D.** Automated splenic index calculation, a distinct organ measurement

72. A clearly visible on-screen label indicates whether the system is currently displaying a live, continuously updating image or a single frozen frame. What is the primary purpose of this label?

- A.** To display the transducer's remaining battery charge
- B.** To indicate remaining elastography acquisition time
- C.** To clearly indicate frozen versus live acquisition status to the operator
- D.** To display the total elapsed exam duration

73. After the sonographer measures a first-trimester gestational sac and yolk sac, the system compares the values to established viability thresholds and flags the study if the measurements fall outside the expected range. What software feature does this describe?

- A.** Automated fetal umbilical artery Doppler auto-tracing, a distinct feature
- B.** Automated gestational/yolk sac size measurement with viability threshold flagging
- C.** Automated endometrial thickness measurement, a distinct structure
- D.** Automated ovarian volume calculation, a distinct structure

74. Rather than one continuous TGC slope control, a system offers several independent gain sliders, each controlling a discrete depth zone that can be adjusted separately from the others. How does this differ from a single continuous TGC slope?

- A.** Several independent, discrete depth zones adjustable separately, unlike one slope
- B.** It is functionally identical to a single continuous TGC slope in every respect

- C.** It eliminates the need for any depth-based gain compensation entirely
- D.** It only applies to Doppler modes, never to B-mode imaging

75. For a patient with a prior testicular volume measurement on file, the system automatically calculates the ratio of today's measured volume to the prior exam's volume, flagging a significant interval change. What does this ratio calculation represent?

- A.** Automated ejection fraction calculation, an unrelated cardiac metric
- B.** Automated aortic-valve-area calculation, an unrelated cardiac metric
- C.** An automated volume-ratio trend calculation comparing two exams over time
- D.** Automated carotid IMT measurement, an unrelated vascular metric

76. A small numeric readout on screen continuously displays the transducer face's current measured surface temperature during an extended scanning session. What is the primary purpose of this live readout?

- A.** To let the operator monitor the probe's live surface temperature during extended use
- B.** To display the transducer's remaining wireless battery charge
- C.** To display the current elastography acquisition countdown
- D.** To display the total elapsed exam duration

77. During a routine echocardiogram, a dilated coronary sinus is noted. Doppler tracing reveals an anomalous venous structure draining into the coronary sinus, running along the lateral left heart border. What congenital venous variant does this suggest?

- A.** A persistent left SVC, draining into the coronary sinus
- B.** A normal right superior vena cava variant, without abnormality
- C.** Superior vena cava syndrome from an obstructive process
- D.** A hepatic vein anomaly, an unrelated venous structure

78. On echocardiography, Doppler measures the peak velocity of a tricuspid regurgitant jet. Using this velocity in the simplified Bernoulli equation along with an estimated right atrial pressure, what can be calculated?

- A.** Left ventricular ejection fraction
- B.** An estimate of pulmonary artery systolic pressure
- C.** Aortic valve area via the continuity equation
- D.** Mitral valve area via pressure half-time

79. Color Doppler of the mitral valve shows a regurgitant jet, and its area and width at the narrowest point (vena contracta) are measured to help grade severity. What is being assessed?

- A.** Mitral regurgitation severity assessment
- B.** Mitral stenosis severity via pressure half-time
- C.** Aortic stenosis severity via peak velocity
- D.** Tricuspid regurgitation for pulmonary pressure estimation

80. Pulsed-wave Doppler of the descending thoracic aorta shows holodiastolic flow reversal, distinct from the normal minimal or absent diastolic flow expected at that location. What valvular abnormality does this suggest?

- A.** Mitral stenosis, an unrelated valve finding
- B.** Tricuspid regurgitation, an unrelated valve finding
- C.** Significant aortic regurgitation, causing diastolic reversal
- D.** Pulmonary stenosis, an unrelated valve finding

81. On echocardiography, color Doppler shows a small jet of flow crossing the interatrial septum during the cardiac cycle, and an agitated-saline contrast study confirms early right-to-left bubble passage. What does this evaluate?

- A.** Ventricular septal defect specifically
- B.** Aortic regurgitation

- C. Patent foramen ovale (interatrial shunt)
- D. Mitral regurgitation

82. A fetal echocardiogram identifies an irregular heart rhythm on grayscale imaging. M-mode is used to simultaneously record atrial and ventricular wall motion over time to characterize the rhythm. What is this M-mode application used for?

- A. Measuring umbilical artery resistance, an unrelated Doppler use
- B. Fetal heart rate/rhythm characterization for suspected arrhythmia
- C. Measuring amniotic fluid volume, an unrelated grayscale use
- D. Measuring the nuchal translucency, an unrelated first-trimester measure

83. An incidental finding on abdominal ultrasound shows a rounded, anechoic-appearing structure adjacent to the porta hepatis. Color Doppler reveals swirling arterial flow within it, connecting to the hepatic artery. What does this represent?

- A. A normal common bile duct
- B. A hepatic artery aneurysm
- C. A simple hepatic cyst
- D. Normal portal vein flow

84. An incidental finding shows focal, saccular dilation of the main portal vein, with swirling venous flow on color Doppler contained within the dilated segment. What does this represent?

- A. Portal vein thrombosis with absent flow
- B. Portal vein cavernous transformation
- C. A portal vein aneurysm
- D. Normal portal vein caliber

85. A patient with pancreatitis is found to have echogenic material filling the splenic vein, with absent flow on Doppler at that segment, and associated splenomegaly. What does this describe?

- A.** Normal splenic vein flow, without any abnormality present
- B.** Splenic vein thrombosis, a recognized pancreatitis complication
- C.** A splenic artery aneurysm, an unrelated arterial finding
- D.** Nutcracker syndrome, an unrelated renal-vein finding

86. A patient with atrial fibrillation develops sudden flank pain. Renal Doppler shows a wedge-shaped area with absent flow in the kidney, with normal flow in the surrounding parenchyma, and a filling defect in the main renal artery. What does this describe?

- A.** Chronic renal artery fibromuscular dysplasia
- B.** Nutcracker syndrome
- C.** Acute renal artery embolism causing renal infarction
- D.** Normal renal parenchymal perfusion throughout

87. A neonate with a history of a difficult delivery is found to have a heterogeneous adrenal mass on ultrasound. Doppler shows the mass is entirely avascular, and it decreases in size on follow-up imaging over subsequent weeks. What does this evolving avascular mass suggest?

- A.** A hypervascular adrenal adenoma
- B.** Wilms tumor arising from the adrenal gland
- C.** A normal adrenal gland with no abnormality
- D.** Neonatal adrenal hemorrhage, expected to resolve over time

88. Several weeks after a dilation and curettage procedure, a patient has persistent heavy bleeding. Ultrasound shows a focal area of the myometrium with markedly increased, disorganized, low-resistance color Doppler flow. What complication does this suggest?

- A.** A normal postpartum/post-procedure uterus
- B.** A simple endometrial polyp
- C.** Retained products of conception without vascular complication
- D.** A uterine arteriovenous malformation, an uncommon complication

89. A pregnant patient with a prior cesarean delivery is found on early ultrasound to have a gestational sac implanted within the lower uterine segment cesarean scar, with prominent peritrophoblastic color Doppler flow at the implantation site. What does this describe?

- A.** A normal intrauterine pregnancy
- B.** A normal cervical ectopic pregnancy unrelated to the prior scar
- C.** A cesarean scar ectopic pregnancy
- D.** A molar pregnancy

90. Following a first-trimester miscarriage, a patient has persistent bleeding. Ultrasound shows heterogeneous echogenic material within the endometrial cavity with increased color Doppler flow at its base. What does this describe?

- A.** A normal, empty postmiscarriage uterus
- B.** A cesarean scar ectopic pregnancy
- C.** Retained products, with vascularity at the implantation site
- D.** A normal endometrial stripe with no abnormality

91. Following fertility treatment, a patient develops abdominal distension. Ultrasound shows markedly enlarged ovaries with multiple large cysts and increased color Doppler flow, along with free pelvic fluid. What condition does this suggest?

- A.** Normal postovulatory ovaries
- B.** Ovarian torsion
- C.** A simple hemorrhagic cyst
- D.** Ovarian hyperstimulation syndrome

92. A patient presents with a painful, swollen labial mass. Ultrasound shows a complex cystic structure with a thick, hyperemic wall on color Doppler in the expected location of the Bartholin gland. What does this suggest?

- A.** A normal Bartholin gland
- B.** An ovarian cyst, an unrelated pelvic structure

- C. A simple, uninfected Bartholin cyst
- D. A Bartholin gland abscess, with hyperemic infected wall

93. Following blunt trauma to an erect penis with an audible crack and immediate detumescence, ultrasound with Doppler shows a discontinuity in the tunica albuginea with an adjacent hematoma. What does this describe?

- A. Penile fracture, tunical disruption with hematoma
- B. High-flow (arterial) priapism
- C. Low-flow (venous occlusive) priapism
- D. A normal post-traumatic examination

94. An infant is found to have an empty scrotum on one side. Ultrasound identifies a small testicle in the inguinal canal, and Doppler confirms the presence of arterial flow within it. What does this Doppler finding help establish?

- A. That the testicle has undergone torsion
- B. That the undescended (cryptorchid) testicle retains viable flow
- C. That the testicle is malignant
- D. That the testicle should be considered absent (anorchia)

95. A young girl presents with a groin swelling. Ultrasound identifies an avascular cystic structure tracking along the inguinal canal, distinct from a hernia containing bowel. What rare entity, analogous to a hydrocele in males, does this represent?

- A. A normal ovary in its typical pelvic location
- B. An inguinal lymph node, an unrelated structure
- C. A hydrocele of the canal of Nuck, a female inguinal fluid collection
- D. A Bartholin gland cyst, in an unrelated pelvic location

96. A patient with a groin bulge undergoes ultrasound, which shows bowel loops with visible peristalsis and normal wall Doppler flow protruding through the inguinal canal into the bulge. What does the presence of normal bowel-wall flow in this hernia content suggest?

- A.** That the herniated bowel is definitely non-viable and requires emergency surgery
- B.** That the herniated bowel segment currently retains viable blood flow
- C.** That this cannot be a true hernia at all
- D.** That the finding is unrelated to the inguinal canal

97. A patient on anticoagulation develops sudden abdominal wall pain and a palpable mass after a coughing fit. Ultrasound shows a heterogeneous collection within the rectus abdominis muscle, with Doppler showing no significant internal flow. What does this describe?

- A.** A rectus sheath hematoma
- B.** A normal rectus abdominis muscle
- C.** An inguinal hernia
- D.** A Bartholin gland abscess, an unrelated pelvic structure

98. A child presents with right lower quadrant pain mimicking appendicitis. Ultrasound shows a normal appendix but identifies several enlarged, hypervascular mesenteric lymph nodes in the same region. What does this combination suggest?

- A.** Mesenteric adenitis, a common appendicitis mimic in children
- B.** Acute appendicitis with a normal-appearing appendix, unrelated to the nodes
- C.** A normal finding requiring no further consideration
- D.** Testicular torsion, an unrelated organ system

99. A child with intermittent abdominal pain is found to have a "target sign" on ultrasound in the right side of the abdomen. Color Doppler of the involved bowel segment shows preserved wall flow. What does the presence of this Doppler flow help assess?

- A.** The presence of a normal, unaffected appendix
- B.** The child's renal resistive index value

- C. Bowel wall viability, an important prognostic factor
- D. The gallbladder wall thickness measurement

100. A child presents with a lateral neck mass anterior to the sternocleidomastoid muscle. Ultrasound shows a mostly cystic structure with a thin wall and no significant internal Doppler flow. Where in its developmental tract does this type of congenital cyst classically arise?

- A. Along the midline thyroglossal duct tract, an unrelated location
- B. Within the parotid gland itself, an unrelated structure
- C. Within a lymphatic malformation network, an unrelated entity
- D. Along a branchial cleft remnant (branchial cleft cyst)

101. A child presents with a midline neck mass that moves with tongue protrusion. Ultrasound shows a mostly cystic structure with no significant internal Doppler flow, located along the expected embryologic path between the tongue base and thyroid. What is this congenital cyst called?

- A. A thyroglossal duct cyst, arising along the midline tract
- B. A branchial cleft cyst, a lateral rather than midline structure
- C. A lymphatic malformation
- D. A Bartholin gland cyst, an unrelated pelvic structure

102. An adult presents with a slowly enlarging mass in the region of the parotid gland. Ultrasound shows a solid mass with increased internal color Doppler vascularity. What does this increased internal vascularity primarily raise concern for?

- A. A feature raising concern for possible malignancy
- B. Confirmation that the mass is a simple, benign cyst
- C. A normal finding in every parotid gland
- D. Complete absence of any blood flow to the gland

103. A patient presents with painful swelling below the jaw that worsens with eating. Ultrasound shows a dilated submandibular duct with an echogenic focus and posterior shadowing, and Doppler shows increased glandular vascularity. What does this combination suggest?

- A.** A normal submandibular gland with no abnormality
- B.** A parotid gland tumor, an unrelated salivary gland
- C.** A thyroglossal duct cyst, an unrelated congenital structure
- D.** Sialadenitis from an obstructing submandibular duct stone

104. During axillary ultrasound for breast cancer staging, a lymph node shows loss of its normal fatty hilum with diffuse cortical thickening and non-hilar (peripheral) color Doppler flow, rather than the normal centralized hilar flow pattern. What does this vascularity pattern suggest?

- A.** A pattern concerning for metastatic nodal involvement, not a reactive node
- B.** A normal, benign reactive lymph node pattern
- C.** Complete absence of any lymph node in that location
- D.** A finding unrelated to breast cancer staging

105. An athlete presents with sudden calf pain during exertion. Ultrasound shows a hypoechoic collection within the gastrocnemius muscle at the site of a fiber discontinuity, with Doppler showing peripheral hyperemia around the collection. What does this describe?

- A.** A normal, uninjured gastrocnemius muscle
- B.** A calf muscle tear with an associated hematoma
- C.** A Baker's cyst, an unrelated popliteal structure
- D.** Popliteal vein thrombosis, an unrelated venous finding

106. A patient with a known popliteal (Baker's) cyst develops sudden calf swelling and pain. Ultrasound shows the previously well-defined cyst is now poorly margined, with fluid tracking diffusely into the surrounding calf soft tissues. What does this describe?

- A.** A normal, unchanged Baker's cyst
- B.** Popliteal vein thrombosis, a distinct venous complication

- C. Rupture of the Baker's cyst, with fluid dissecting into the calf
- D. A popliteal artery aneurysm, an unrelated arterial finding

107. A patient with chronic heel pain undergoes ultrasound, which shows thickening of the plantar fascia at its calcaneal insertion with increased color Doppler flow within the thickened fascia. What does this increased vascularity suggest?

- A. A normal, healthy plantar fascia
- B. Active inflammation consistent with plantar fasciitis
- C. A calcaneal stress fracture, an unrelated bony finding
- D. Complete plantar fascia rupture with retraction

108. A patient with shoulder pain undergoes ultrasound, which shows fluid distending the subacromial-subdeltoid bursa with increased color Doppler flow in the adjacent bursal wall, along with a partial-thickness rotator cuff tear. What does the bursal hyperemia suggest?

- A. Active inflammatory bursitis associated with the rotator cuff pathology
- B. A normal, uninflamed bursa with no abnormality
- C. Complete absence of any rotator cuff pathology
- D. A ganglion cyst unrelated to the rotator cuff

109. A patient with wrist pain along the thumb side undergoes ultrasound, which shows thickening of the tendon sheath at the first dorsal compartment with increased color Doppler flow surrounding the tendons. What condition does this suggest?

- A. A normal, unaffected first dorsal compartment
- B. Carpal tunnel syndrome, an unrelated wrist compartment
- C. A ganglion cyst unrelated to the tendon sheath
- D. De Quervain's tenosynovitis, with peritendinous inflammatory hyperemia

110. A patient with hand numbness undergoes wrist ultrasound, which shows an enlarged median nerve at the carpal tunnel inlet with increased color Doppler flow within the nerve itself, along with surrounding synovial thickening. What does this combination of findings support?

- A.** A normal median nerve with no abnormality
- B.** De Quervain's tenosynovitis, an unrelated tendon compartment
- C.** Carpal tunnel syndrome, with nerve hyperemia and synovial thickening
- D.** A ganglion cyst unrelated to the median nerve

Answers

1. C. A sonographer should not independently perform, as her primary credentialed responsibility, an exam type outside her specific modality credentialing (such as vascular, if she is credentialed only in abdominal), since credentialing verifies competency in a specific exam category. Credentialing is exam-type-specific, applies to sonographers as well as physicians, and governs scanning responsibility, not only interpretation.

2. A. A sonographer has a professional obligation to document and communicate a clinically significant incidental finding through appropriate channels, even though it falls outside the specifically ordered exam, since patient safety takes priority over the narrow scope of the original order. Ignoring the finding, mentioning it only if asked, or deleting the images would all fail this basic patient-safety obligation.

3. B. A practice quality improvement (PQI) project is a structured activity analyzing and improving a specific aspect of practice, a distinct registry-maintenance requirement from routine CME coursework credits, phantom QA testing, or a new-hire competency checklist, which serve different purposes.

4. B. Read-back verification has the receiving staff member repeat a verbal order back to the ordering physician before ending the call, confirming it was heard and recorded correctly, a distinct safety practice from informed consent documentation, chaperone policy, or two-person medication verification, which address different safety concerns.

5. C. A wrong-patient imaging error is a recognized category of serious, reportable safety event ("never event") triggering formal internal review and, depending on severity, external regulatory reporting -- distinct from routine, expected minor variances, billing issues, or standard equipment maintenance logging.

6. D. Limiting consecutive scanning hours addresses fatigue-related error risk, based on evidence that fatigue increases the likelihood of diagnostic mistakes during prolonged scanning sessions. This

scheduling policy is unrelated to transducer disinfection classification, electrical safety, or HIPAA access control.

7. D. Requiring a second, independent physician to review and co-sign an amended report supports quality assurance and accountability specifically for discrepant or amended findings, helping ensure accuracy before the corrected report is finalized. This is unrelated to the Spaulding classification, electrical safety, or HIPAA access control.

8. C. Wiping down the exam table, bed rails, and keyboard between patients addresses general environmental (room/surface) infection control, distinct from the Spaulding-classification-based disinfection level applied specifically to the transducer itself. This broader room-cleaning practice is unrelated to electrical safety or HIPAA access control.

9. C. A standardized critical-value threshold (such as a defined large aortic diameter) requires expedited, direct communication to the ordering physician rather than routine report turnaround, a recognized patient-safety practice for time-sensitive findings. This is distinct from a routine non-urgent pathway, the Spaulding classification, or HIPAA access control.

10. A. Informed-refusal documentation records the discussion and the patient's decision to decline a recommended additional view or exam, protecting both the patient's autonomy and the provider's medical-legal record. This is distinct from a chaperone log, a phantom QA record, or a medication-verification log, which document different processes entirely.

11. C. Point-of-care ultrasound (POCUS) users, such as emergency physicians performing brief bedside, procedure-focused scanning, maintain a separate competency and credentialing pathway from the formal diagnostic ultrasound department's sonographer credentialing, reflecting POCUS's different scope and purpose. This pathway does not apply exclusively to formal department sonographers, interpreting physicians, or biomedical engineers.

12. B. Derated (in-situ) intensity mathematically reduces the transducer's actual output intensity using an assumed tissue attenuation factor, providing a more realistic estimate of exposure at a given depth than the raw output intensity at the face alone, used for bioeffects and output-reporting purposes. Spatial-peak temporal-average intensity at the face, the half-value layer, and beam uniformity coefficient are related but distinct concepts, not this depth-adjusted derating.

13. B. With Doppler shift, transmitted frequency, and velocity all known, the Doppler equation can be algebraically rearranged to solve for the Doppler angle (angle of insonation), the remaining unknown variable. Propagation speed, PRF, and spatial pulse length are not variables solved for using this particular rearrangement.

14. A. The bandwidth-time product is a signal-processing invariant stating that pulse duration and frequency-domain bandwidth are inversely related in a roughly constant-product relationship, so a

shorter pulse duration mathematically requires proportionally wider bandwidth. The Doppler equation, range equation, and Snell's Law are unrelated formulas.

15. A. Even in normal laminar flow, blood velocity varies across the vessel lumen (fastest at the center, slower near the walls), so a spectral Doppler waveform normally displays a range of simultaneous velocities at any instant -- a normal physiologic finding, not a technical angle problem, turbulence-related spectral broadening, or aliasing from insufficient PRF.

16. B. Since reflected and transmitted energy must sum to 100% of the incident energy (assuming no additional absorption at the boundary itself), a 20% reflection coefficient means 80% of the energy is transmitted across the interface. The other calculations misapply this basic energy-conservation relationship.

17. D. Transmitted frequency selection for a deep vessel may need to jointly balance adequate penetration to reach the target depth against the ability to detect the expected Doppler velocity range without excessive aliasing, since these two considerations can pull frequency selection in different directions. Frequency selection is not governed by depth or velocity alone in isolation, and Doppler exams do commonly require this kind of trade-off consideration.

18. C. Through-transmission technique uses two separate transducers on opposite sides of the tissue, one continuously transmitting and the other receiving, distinct from the standard pulse-echo technique used by most diagnostic ultrasound, where a single transducer both transmits and receives. Coded excitation, harmonic imaging, and spatial compounding are unrelated single-transducer pulse-echo techniques.

19. B. Wavelength equals propagation speed divided by frequency: $1520 \text{ m/s} / 4,000,000 \text{ Hz} = 0.00038 \text{ m}$, or approximately 0.38 mm, consistent with typical diagnostic ultrasound wavelengths. The other values do not correctly apply this standard formula to the given speed and frequency.

20. C. Time per frame equals 1 divided by frame rate: $1 / 40 \text{ frames per second} = 0.025 \text{ seconds}$, or approximately 25 milliseconds per frame. The other values do not correctly apply this basic reciprocal relationship to the given frame rate.

21. B. Spectral leakage occurs when analyzing a signal over only a short, finite time window, causing energy from a true single frequency to smear across several adjacent frequency bins in the spectral display rather than appearing as a single sharp line -- a distinct signal-processing artifact from aliasing (a sampling-rate-related wraparound), turbulence-related spectral broadening, or range ambiguity (a depth-related artifact).

22. D. B-mode imaging prioritizes fine axial resolution, favoring short, broadband (few-cycle) pulses, while spectral Doppler prioritizes precise frequency-shift measurement, favoring longer, narrowband (many-cycle) pulses -- a fundamental design trade-off reflecting each mode's differing priorities. B-mode and Doppler pulses are not identical, Doppler pulses are typically longer (not shorter) than B-mode pulses, and pulse design is directly related to these competing priorities.

- 23. C.** The fast Fourier transform (FFT) is the standard mathematical algorithm used to convert a Doppler signal's raw time-domain waveform into the frequency-domain spectral display shown on screen. Snell's Law, the range equation, and the Doppler equation are unrelated formulas that do not perform this time-to-frequency-domain conversion.
- 24. B.** Two related but distinct decibel formulas exist: a factor of 10 for power/intensity ratios (since power is proportional to amplitude squared) and a factor of 20 for amplitude/pressure ratios, reflecting this underlying mathematical relationship between power and amplitude. Power and amplitude ratios are not numerically identical, and both formulas are valid, each for its respective quantity type.
- 25. C.** A window function, such as Hamming or Hanning, tapers the edges of the finite analysis window applied to a Doppler signal segment before frequency analysis, reducing spectral leakage that would otherwise result from an abruptly truncated window. The range equation, Snell's Law, and the Doppler equation are unrelated formulas, not this tapering technique.
- 26. B.** Grating lobes (from coarse element spacing relative to wavelength) and Doppler aliasing (from a PRF too low relative to the Doppler shift) both illustrate the same underlying principle: an artifact arising from insufficient sampling relative to the signal's spatial or temporal frequency, whether that sampling is in space (element spacing) or time (pulse repetition). Spatial and temporal sampling are related through this shared principle, the two artifacts are not literally the same phenomenon, and both spatial and temporal sampling can each independently produce their own artifact.
- 27. B.** Averaging N independent, repeated measurements of the same signal improves signal-to-noise ratio proportionally to the square root of N, a standard statistical relationship underlying techniques such as persistence (frame averaging) in ultrasound. SNR does not improve in direct proportion to N, is not unaffected by averaging, and does not worsen with more averaged measurements.
- 28. A.** The acoustic stack is the complete front-to-back layered assembly of a transducer element, comprising the matching layer(s), the piezoelectric element itself, and the backing material, functioning together as a single acoustic unit. The kerf, virtual apex, and near zone are distinct, unrelated transducer/beam-geometry concepts, not this layered assembly.
- 29. A.** The active aperture is the subset of an array's total elements actively used to transmit and receive a given scan line at any instant, distinct from the array's total element count; which specific elements form the active aperture typically shifts as the beam sweeps across the array. The kerf, virtual apex, and dead zone are unrelated concepts.
- 30. C.** Loosely coiling a transducer cable during storage prevents internal wire damage and cable fatigue that tight coiling or kinking can cause over repeated storage cycles, extending cable life. This practice is unrelated to acoustic output drift, electrical leakage-current hazards, or grating lobe artifacts.
- 31. B.** A neonatal cranial/spinal probe's design takes advantage of the acoustic window created by the still-open fontanelle and unossified posterior spinal elements in neonates, avoiding the near-total

reflection that fully ossified bone would otherwise cause. This is not explained by higher skull attenuation, a fixed adult-incompatible frequency, or an absence of any acoustic window requirement.

32. D. A transducer's actual center operating frequency can drift slightly with temperature as the probe warms during prolonged use, a distinct phenomenon from its overall output-power stability, disinfection classification, kerf spacing, or physical footprint dimensions, which are unrelated fixed specifications.

33. C. Biocompatibility testing verifies that a device's patient-contact materials do not cause toxic or allergic tissue reactions, a required regulatory testing category before a new transducer model can be marketed. Electrical leakage-current testing, acoustic output stability testing, and dead-element testing address different safety/performance concerns entirely.

34. B. This design uses two physically separate, distinct sets of piezoelectric elements, each dedicated to its own fixed frequency, rather than electronically switching a single shared element set between frequencies as in frequency-agile designs. The two approaches are not physically identical, this design does not eliminate frequency selection, and it does not require physically swapping the entire probe to change frequency.

35. C. A reference/calibration transducer is a designated probe kept solely for QA purposes, never used clinically, against which newly acquired clinical transducers' acoustic output is compared during acceptance testing. A duplex probe, intraoperative probe, and micro-convex array are clinical transducer types, not this QA-dedicated reference unit.

36. A. An acoustic output calibration certificate verifies a transducer's output was measured against equipment traceable to a national metrology standards laboratory, providing documented assurance of measurement accuracy. The Spaulding classification label, a warranty card, and a disinfectant compatibility list are unrelated documents.

37. D. A pediatric cardiac micro-convex/phased-array probe is specifically optimized for imaging a neonate's or infant's heart through a limited intercostal acoustic window, distinct from a neonatal cranial probe (used through the fontanelle), an unmodified adult cardiac probe, or a standard abdominal curvilinear probe, which are designed for different anatomic targets or patient sizes.

38. A. An RFID/NFC-based identification tag allows the system to identify the probe wirelessly at short range without requiring direct electrical contact through connector pins, distinct from the embedded connector-based identification chip that requires physical electrical connection. This wireless method does not require a lengthy wait before identification, and probe identification remains necessary in either approach.

39. C. Acoustic axis alignment verification confirms during manufacturing that the beam's actual acoustic axis precisely matches the array's intended geometric centerline, rather than being skewed, ensuring accurate beam steering and image geometry. Fractional bandwidth, the Curie point, and effective radiating area are unrelated transducer specifications.

- 40. C.** An aramid (Kevlar-type) fiber-reinforced cable jacket resists cuts and abrasion from repeated handling and contact with equipment surfaces, extending cable service life. This is unrelated to acoustic impedance matching at the face, electrical impedance matching to the receiver, or the transducer's operating frequency range.
- 41. A.** Whether a long sterile sheath or a simple, shorter probe cover is used reflects the level of sterility required by the specific clinical procedure being performed, with fully sterile-field procedures requiring more extensive draping than routine non-sterile scanning. This distinction is unrelated to operating frequency, the Curie point, or fractional bandwidth.
- 42. D.** A transrectal probe's design and shape are specifically optimized for rectal insertion and close-range prostate imaging, distinct from a transvaginal probe's design for vaginal insertion and pelvic imaging. It is not identical to a transvaginal probe, and is not designed exclusively for cardiac or intraoperative surgical use.
- 43. B.** An intraoperative neurosurgical probe is specifically optimized for high-resolution imaging of neural tissue during direct brain contact in neurosurgical procedures, a distinct purpose from maximizing whole-body penetration depth, transvaginal pelvic imaging, or long-range peripheral vascular Doppler assessment.
- 44. C.** Matched filtering applies receive-side signal processing specifically matched to the known shape of the transmitted coded pulse, maximizing the signal-to-noise benefit that coded excitation is designed to achieve. Apodization, dynamic aperture, and multiplexing are distinct, unrelated transducer/beamforming techniques.
- 45. B.** Because most piezoelectric elements contain lead-based ceramic (PZT), end-of-life transducer disposal must follow specific electronic-waste regulations for lead-containing materials rather than ordinary trash disposal, an environmental/regulatory compliance requirement. This is unrelated to acoustic output calibration, the Spaulding classification, or biocompatibility rating.
- 46. A.** Automated ovarian volume calculation applies the ellipsoid formula to placed length/width/height calipers on the ovary, a specific clinical auto-measurement distinct from testicular volume, splenic index, or endometrial thickness calculations, which apply to different structures.
- 47. C.** Automated prostate volume calculation applies the ellipsoid formula to placed length/width/height calipers via transrectal imaging, distinct from ovarian volume, testicular volume, or common bile duct measurements, which apply to different structures.
- 48. B.** Automated endometrial thickness measurement with threshold flagging compares the measured stripe thickness to a normal postmenopausal threshold and flags the study if exceeded, distinct from ovarian volume, prostate volume, or splenic index calculations.

- 49. D.** Automated common bile duct diameter measurement with threshold flagging compares the measured diameter to a normal threshold and flags the study if biliary dilation is suggested, distinct from ovarian volume, prostate volume, or endometrial thickness calculations.
- 50. A.** Automated portal vein diameter measurement and tracking stores the measured value and allows comparison to a prior exam for surveillance purposes, distinct from testicular volume, splenic index, or endometrial thickness calculations, which apply to different structures.
- 51. B.** An automated standardized-category suggestion feature analyzes entered lesion features (margin, orientation, echogenicity) and suggests the most likely assessment category, which the physician then confirms or overrides -- a distinct feature from simple modality worklist integration, the ellipsoid volume formula, or a worksheet without feature-based suggestion capability.
- 52. A.** Automated testicular volume calculation applies the ellipsoid formula to placed length/width/height calipers on the testicle, distinct from ovarian volume, prostate volume, or splenic index calculations, which apply to different structures.
- 53. C.** An on-screen measurement-history summary panel lists every measurement and caliper placement made during the exam in one consolidated view, distinct from the color box, focal-zone indicator, or biopsy guide-line, which serve different on-screen purposes.
- 54. D.** Automatic prior-exam detection identifies that a returning patient has an existing archived exam and prompts the sonographer to load it for side-by-side comparison, distinct from modality worklist integration (which pulls scheduling data in before the exam), DICOM compression, or the ellipsoid volume formula.
- 55. B.** Dual-window synchronized cine playback plays two previously saved cine loops from different points in the exam simultaneously and in synchronized time, distinct from automatic Doppler envelope tracing, a structured measurement worksheet, or the ellipsoid volume formula.
- 56. A.** The measurement-units setting controls whether linear measurements are displayed in centimeters or millimeters, a display-format choice distinct from transducer frequency, Doppler angle correction, or the persistence level, which control unrelated parameters.
- 57. C.** This describes automated RI calculation performed directly from two placed calipers (peak systolic and end-diastolic points) without requiring the operator to trace the entire waveform envelope across multiple cycles, a distinct shortcut feature from full multi-cycle envelope tracing, a report template, or ejection fraction calculation.
- 58. B.** AI-assisted edge-snapping automatically moves the caliper cursor to the nearest detected tissue interface as the operator positions it, improving measurement precision without requiring pixel-perfect manual placement -- distinct from modality worklist integration, the ellipsoid volume formula, or DICOM compression.

- 59. B.** An on-screen exam-type label continuously displays the name of the currently selected preset (such as "Abdomen" or "OB Second Trimester"), a distinct on-screen element from the focal-zone indicator, color box boundary, or depth-scale marker, which convey different information.
- 60. C.** The splenic index is calculated by multiplying length, width, and thickness together, providing a single composite value used to assess splenomegaly, distinct from length alone, the splenic resistive index (an unrelated Doppler parameter), or the ellipsoid volume formula (which uses a different constant and calculation).
- 61. B.** A live picture-in-picture reference-image thumbnail keeps a previously saved image visible in a corner of the screen while the operator continues actively scanning a live view, distinct from cine-loop bookmarking, the ellipsoid volume formula, or a structured measurement worksheet.
- 62. C.** A TGC-curve-deviation warning compares the operator's current TGC shape to typical patterns for the selected exam type, flagging a significant deviation that may indicate a gain-setting error -- distinct from electrical leakage-current safety, the Spaulding classification, or HIPAA access control.
- 63. A.** Simultaneous RI and PI calculation from a single traced waveform derives both the resistive index and pulsatility index from one tracing pass, rather than requiring two separate tracing steps, distinct from ejection fraction, aortic-valve-area, or carotid IMT calculations, which apply to different structures/values.
- 64. A.** A limited/focused-exam-specific structured template requires only the relevant images and measurements for reassessing one previously identified finding, a shorter alternative to the full standard protocol used for a new, complete exam -- distinct from the pediatric MI/TI cap, a modality worklist entry, or DICOM compression.
- 65. B.** An active-harmonic-frequency indicator shows which specific harmonic frequency is currently being used for image formation when harmonic imaging mode is engaged, distinct from the Doppler angle correction, dynamic range setting, or persistence level, which are unrelated display/processing parameters.
- 66. C.** Automated fetal umbilical artery Doppler envelope auto-tracing outlines systolic and diastolic points across several cardiac cycles specifically for this fetal vessel, analogous to adult vessel auto-tracing but applied in the obstetric context, distinct from carotid IMT, aortic-valve-area, or ejection fraction calculations, which are adult applications.
- 67. D.** A preset-specific, saved/recallable TGC curve automatically loads the operator's preferred curve shape whenever a specific exam-type preset is selected, distinct from a tissue-specific propagation-speed preset, the pediatric MI/TI cap, or a modality worklist entry, which address different settings entirely.
- 68. C.** An elastography acquisition countdown timer indicates the remaining time the probe must stay still for a valid shear-wave measurement to complete, distinct from total exam duration, battery charge, or frame-rate display, which convey different information.

- 69. D.** A rough estimated free-fluid volume calculation, based on outlined fluid areas in each abdominal quadrant during a trauma FAST exam, helps gauge the extent of hemoperitoneum, distinct from ejection fraction, carotid IMT, or aortic-valve-area calculations, which apply to entirely different clinical scenarios.
- 70. A.** A patient/family-facing mirrored secondary display lets the patient and family view the sonographer's screen in real time during an obstetric exam, distinct from a biomedical-engineering QA multi-monitor configuration (operator-facing, not patient-facing), a report template, or DICOM compression.
- 71. B.** Automated pancreatic duct diameter measurement with threshold flagging compares the measured value to a normal threshold and flags ductal dilation if suggested, distinct from common bile duct, portal vein, or splenic index measurements, which apply to different structures.
- 72. C.** A frozen-versus-live status label clearly indicates to the operator whether the system is displaying a continuously updating live image or a single static frozen frame, distinct from battery charge, elastography countdown, or total exam duration, which convey different information.
- 73. B.** Automated gestational/yolk sac size measurement with viability threshold flagging compares first-trimester measurements to established viability thresholds and flags values outside the expected range, distinct from fetal umbilical artery auto-tracing, endometrial thickness, or ovarian volume calculations.
- 74. A.** Multi-zone independent TGC adjustment allows several discrete depth zones to be adjusted separately from one another, rather than relying on a single continuous slope control, offering more granular gain control across depth. It is not functionally identical to a single continuous slope, does not eliminate depth-based gain compensation, and applies to B-mode as well as Doppler imaging.
- 75. C.** An automated volume-ratio trend calculation compares today's measured volume to a prior exam's stored value and flags a significant interval change, distinct from ejection fraction, aortic-valve-area, or carotid IMT calculations, which apply to different clinical values entirely.
- 76. A.** A live probe-surface-temperature readout lets the operator monitor the transducer's current measured surface temperature during extended scanning sessions, distinct from a wireless battery indicator, an elastography countdown, or a total exam-duration timer, which display different information.
- 77. A.** A persistent left superior vena cava is a congenital venous anomaly in which an embryonic left-sided vena cava fails to regress, draining into the coronary sinus and causing its dilation, distinct from a normal right SVC variant, SVC syndrome (an obstructive process), or a hepatic vein anomaly.
- 78. B.** Tricuspid regurgitant jet velocity, applied to the simplified Bernoulli equation along with an estimated right atrial pressure, is the standard echocardiographic method for estimating pulmonary

artery systolic pressure -- distinct from ejection fraction, aortic valve area (calculated via the continuity equation), or mitral valve area (via pressure half-time).

79. A. Measuring the regurgitant jet's area and vena contracta width on color Doppler is a standard method for grading mitral regurgitation severity, distinct from mitral stenosis severity (assessed via pressure half-time), aortic stenosis severity (assessed via peak velocity), or tricuspid regurgitation (used for pulmonary pressure estimation, not mitral valve assessment).

80. C. Holodiastolic flow reversal in the descending thoracic aorta reflects significant aortic regurgitation, in which blood flows backward from the aorta into the left ventricle during diastole, detectable downstream in the descending aorta. This finding is not explained by mitral stenosis, tricuspid regurgitation, or pulmonary stenosis, which involve different valves and flow patterns.

81. C. A color Doppler jet crossing the interatrial septum, confirmed by early right-to-left bubble passage on an agitated-saline contrast study, evaluates for a patent foramen ovale, an interatrial shunt. This is distinct from a ventricular septal defect (a different septal location), aortic regurgitation, or mitral regurgitation, which involve different structures.

82. B. Fetal M-mode simultaneously records atrial and ventricular wall motion over time, allowing characterization of an irregular fetal heart rhythm suspected on grayscale imaging -- a distinct application from umbilical artery resistance assessment, amniotic fluid volume measurement, or nuchal translucency measurement, which address different aspects of fetal evaluation.

83. B. A rounded structure near the porta hepatis with swirling arterial Doppler flow connecting to the hepatic artery describes a hepatic artery aneurysm, distinct from a normal bile duct (which would show no flow), a simple hepatic cyst (avascular), or normal portal venous flow (a different vessel and flow pattern).

84. C. Focal, saccular dilation of the main portal vein with contained swirling venous flow describes a portal vein aneurysm, distinct from portal vein thrombosis (which shows absent, not swirling, flow), cavernous transformation (a network of small collaterals rather than one dilated segment), or a normal portal vein caliber.

85. B. Echogenic material filling the splenic vein with absent Doppler flow, in a patient with pancreatitis and splenomegaly, describes splenic vein thrombosis, a recognized pancreatitis complication from adjacent inflammation. This is distinct from normal splenic vein flow, a splenic artery aneurysm (an arterial, not venous, finding), or nutcracker syndrome (an unrelated renal vein finding).

86. C. A wedge-shaped area of absent renal flow with a renal artery filling defect, in a patient with atrial fibrillation (a source of cardioembolism), describes acute renal artery embolism causing renal infarction. This is distinct from chronic fibromuscular dysplasia (a different, gradual arterial process), nutcracker syndrome (a venous finding), or normal parenchymal perfusion.

- 87. D.** A heterogeneous, entirely avascular adrenal mass that decreases in size over subsequent weeks, following a difficult delivery, is characteristic of neonatal adrenal hemorrhage, which typically resolves spontaneously over time. This is not consistent with a hypervascular adenoma, Wilms tumor (a renal, not adrenal, malignancy), or a normal gland given the described mass and evolution.
- 88. D.** A focal area of markedly increased, disorganized, low-resistance flow within the myometrium following a dilation and curettage procedure suggests a uterine arteriovenous malformation, an uncommon but recognized post-procedural complication that can cause significant bleeding. This is not a normal postprocedural uterus, a simple polyp (which would not show this disorganized flow pattern), or retained products without this vascular complication.
- 89. C.** A gestational sac implanted within a prior cesarean scar, with prominent peritrophoblastic vascularity at that specific site, describes a cesarean scar ectopic pregnancy, a distinct and clinically important implantation-site abnormality. This is not a normal intrauterine pregnancy, an unrelated cervical ectopic, or a molar pregnancy, which have different sonographic appearances.
- 90. C.** Heterogeneous echogenic material within the endometrial cavity with increased vascularity at its base, following a miscarriage, describes retained products of conception, with the vascularity indicating residual trophoblastic tissue rather than simple clot. This is not a normal empty uterus, a cesarean scar ectopic (a different implantation-site finding), or a normal endometrial stripe.
- 91. D.** Markedly enlarged ovaries with multiple large cysts, increased vascularity, and free pelvic fluid following fertility treatment is characteristic of ovarian hyperstimulation syndrome, a recognized complication of ovulation induction. This is not consistent with normal postovulatory ovaries, ovarian torsion (which would show absent, not increased, flow), or a simple hemorrhagic cyst alone.
- 92. D.** A complex cystic structure with a thick, hyperemic wall in the Bartholin gland location, in a patient with pain and swelling, describes a Bartholin gland abscess, with wall hyperemia reflecting the infectious/inflammatory process. This is not a normal gland, an unrelated ovarian cyst, or a simple, uninfected cyst, which would not show this hyperemic wall pattern.
- 93. A.** A discontinuity in the tunica albuginea with an adjacent hematoma, following blunt trauma to an erect penis with an audible crack and immediate detumescence, describes a penile fracture. This is distinct from high-flow or low-flow priapism (different mechanisms involving cavernosal flow abnormality rather than tunical disruption) and is clearly not a normal post-traumatic exam given the described findings.
- 94. B.** Confirming arterial flow within an undescended (cryptorchid) testicle establishes that it retains viable blood flow, important information for surgical planning (orchiopexy versus orchiectomy). This Doppler finding does not indicate torsion (which would show absent, not present, flow), malignancy, or that the testicle should be considered absent.

- 95. C.** An avascular cystic structure tracking along the female inguinal canal, distinct from a hernia containing bowel, describes a hydrocele of the canal of Nuck, a rare embryologic remnant analogous to a male hydrocele. This is not a normally located ovary, an inguinal lymph node, or a Bartholin gland cyst, which occurs in a different anatomic location.
- 96. B.** Normal Doppler flow within the wall of herniated bowel indicates that segment currently retains viable blood flow, reassuring information distinct from a non-viable, strangulated segment (which would show absent flow). This finding does not itself confirm non-viability requiring emergency surgery, does not negate the diagnosis of a true hernia, and is directly relevant to (not unrelated to) the inguinal hernia being evaluated.
- 97. A.** A heterogeneous, largely avascular collection within the rectus abdominis muscle, occurring after a coughing fit in an anticoagulated patient, describes a rectus sheath hematoma, a recognized complication in this clinical setting. This is not a normal muscle, an inguinal hernia (a different anatomic process), or a Bartholin gland abscess, an unrelated pelvic structure.
- 98. A.** Enlarged, hypervascular mesenteric lymph nodes with a normal-appearing appendix describe mesenteric adenitis, a common, usually self-limited appendicitis mimic in children, often following a viral illness. This is distinct from appendicitis with a normal appendix (which would not explain the clinical picture), a normal finding (given the enlarged hypervascular nodes described), or testicular torsion, an unrelated organ system.
- 99. C.** Preserved color Doppler flow within the bowel wall at the site of a "target sign" (intussusception) is an important prognostic factor supporting bowel viability, distinct from assessing appendix appearance, renal resistive index, or gallbladder wall thickness, which are unrelated structures and parameters.
- 100. D.** A congenital cystic neck mass located anterior to the sternocleidomastoid muscle, without significant internal flow, classically arises along the remnant of a branchial cleft (branchial cleft cyst), a lateral neck structure distinct from the midline thyroglossal duct tract, the parotid gland, or a lymphatic malformation network.
- 101. A.** A midline neck cyst that moves with tongue protrusion, located along the developmental path between the tongue base and thyroid, is classically a thyroglossal duct cyst -- distinct from a branchial cleft cyst (a lateral, not midline, structure), a lymphatic malformation, or a Bartholin gland cyst, an unrelated pelvic structure.
- 102. A.** Increased internal color Doppler vascularity within a solid parotid mass is a feature that raises concern for possible malignancy, prompting further evaluation such as biopsy, rather than confirming a benign simple cyst (which would be avascular), representing a normal finding in every gland, or indicating a complete absence of blood flow.

103. D. A dilated submandibular duct with an echogenic, shadowing focus (a stone) and increased glandular vascularity, in a patient with pain worsened by eating, describes sialadenitis from an obstructing submandibular duct stone. This is not a normal gland, an unrelated parotid tumor, or a thyroglossal duct cyst, a different congenital midline structure.

104. A. Loss of the normal fatty hilum, diffuse cortical thickening, and non-hilar (peripheral) vascularity in an axillary lymph node are features concerning for metastatic nodal involvement during breast cancer staging, distinct from the normal centralized hilar flow pattern of a benign reactive node. This is not a normal reactive pattern, does not indicate absence of a node, and is directly relevant to breast cancer staging.

105. B. A hypoechoic collection at a site of muscle fiber discontinuity, with peripheral hyperemia, following sudden exertional calf pain describes a calf muscle tear with an associated hematoma. This is not a normal uninjured muscle, a Baker's cyst (a distinct popliteal fluid collection), or popliteal vein thrombosis, an unrelated venous finding.

106. C. A previously well-defined Baker's cyst that becomes poorly margined with fluid tracking diffusely into the surrounding calf soft tissues describes cyst rupture, a recognized complication that can mimic deep vein thrombosis clinically. This is not a normal unchanged cyst, popliteal vein thrombosis (a distinct venous process, though it can mimic this presentation clinically), or a popliteal artery aneurysm, an unrelated arterial finding.

107. B. Thickening of the plantar fascia at its calcaneal insertion with increased internal Doppler flow suggests active inflammation consistent with plantar fasciitis, distinct from a normal healthy fascia, a stress fracture (an unrelated bony process), or complete fascia rupture with retraction, a different, more severe finding.

108. A. Fluid distending the subacromial-subdeltoid bursa with increased wall vascularity, alongside a partial-thickness rotator cuff tear, suggests active inflammatory bursitis associated with the underlying cuff pathology. This is not a normal uninflamed bursa, does not indicate complete absence of cuff pathology (the opposite is described), and is not a ganglion cyst, an unrelated cystic structure.

109. D. Thickening of the first dorsal compartment tendon sheath with increased peritendinous color Doppler flow, in a patient with radial-sided wrist pain, describes De Quervain's tenosynovitis, an inflammatory process of the thumb-side wrist tendons. This is not a normal compartment, is unrelated to the separate carpal tunnel compartment, and is not a ganglion cyst.

110. C. An enlarged median nerve with increased internal Doppler flow and surrounding synovial thickening at the carpal tunnel inlet supports a diagnosis of carpal tunnel syndrome, with the hyperemia and thickening reflecting the underlying inflammatory/compressive process. This is not a normal median nerve, is unrelated to the separate first dorsal compartment (De Quervain's), and is not a ganglion cyst.