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Question 1

Question Type: MultipleChoice

If the pulse repetition frequency is 3 kHz, what is the maximum Doppler shift that can be detected without aliasing?

Options:

A- 1.5 kHz

B- 3.0 kHz

C- 6.0 kHz

D- 9.0 kHz

Answer:

A

Explanation:

The maximum Doppler shift that can be detected without aliasing is determined by the Nyquist limit, which is half of the pulse repetition frequency (PRF). If the PRF is 3 kHz, the Nyquist limit is 32=1.523kHz=1.5kHz. Therefore, the maximum Doppler shift that can be detected without aliasing is 1.5 kHz. Aliasing occurs when the Doppler shift exceeds this limit, causing an incorrect representation of the velocity. Reference: ARDMS Sonography Principles and Instrumentation, Chapter on Doppler Principles.

Question 2

Question Type: **MultipleChoice**

Which feature is a characteristic of continuous wave Doppler?

Options:

A- Range specificity

B- Aliasing

C- Low thermal index

D- Dedicated transmit and receive crystals

Answer:

D

Explanation:

Continuous wave Doppler uses two crystals -- one for transmitting and one for receiving ultrasound waves continuously. This allows for the measurement of high velocities without aliasing, a common limitation in pulsed wave Doppler. However, continuous wave Doppler does not have range specificity, meaning it cannot precisely determine the depth from which the Doppler signal is returning. Reference: ARDMS Sonography Principles and Instrumentation, Chapter on Doppler Ultrasound.

Question 3

Question Type: MultipleChoice

What is the primary determining factor of the fundamental frequency for pulsed wave transducers?

Options:

A- Element thickness

B- Crystal diameter

C- Transducer type

D- Propagation speed

Answer:

A

Explanation:

The fundamental frequency of a pulsed wave transducer is primarily determined by the thickness of the piezoelectric element. The frequency is inversely proportional to the thickness of the element -- thinner elements produce higher frequencies, while thicker elements produce lower frequencies. This relationship is derived from the formula =2f=2dv, where f is the frequency, v is the propagation speed of sound in the piezoelectric material, and d is the thickness of the element. Reference: ARDMS Sonography Principles and Instrumentation, Chapter on Transducer Technology.

Question 4

Question Type: **MultipleChoice**

What produces increased attenuation within soft tissue?

Options:

A- Higher intensity of the ultrasound beam

B- Higher frequency of the ultrasound beam

C- Lower intensity of the ultrasound beam

D- Lower frequency of the ultrasound beam

Answer:

B

Explanation:

Attenuation refers to the reduction in the intensity of the ultrasound beam as it travels through tissue. Higher frequency ultrasound beams experience more attenuation because they are absorbed and scattered more than lower frequency beams. This is due to the fact that higher frequency waves have shorter wavelengths and interact more with the small particles in tissues, causing greater energy loss. Reference: ARDMS Sonography Principles and Instrumentation, Chapter on Ultrasound Physics and Instrumentation.

Question 5

Question Type: MultipleChoice

Which factor influences color flow imaging frame rate?

Options:

A- Filter selection

B- Dynamic range

C- Line density

D- Variance map selection

Answer:

C

Explanation:

The frame rate in color flow imaging is influenced by several factors, one of the most significant being line density. Line density refers to the number of ultrasound lines used to create an image. Increasing line density improves spatial resolution but requires more time to acquire each frame, thereby reducing the frame rate. Other factors such as filter selection, dynamic range, and variance map selection can affect the quality of the color flow image, but they do not have as direct an impact on frame rate as line density does. Reference: ARDMS Sonography Principles and Instrumentation, Chapter on Color Doppler Imaging.

Question 6

Question Type: MultipleChoice

The ability to resolve two separate reflectors perpendicular to the path of the beam describes which type of resolution?

Options:

A- Axial

B- Contrast

C- Lateral

D- Temporal

Answer:

C

Explanation:

Lateral resolution describes the ability of an ultrasound system to distinguish between two structures that are side by side (perpendicular to the path of the ultrasound beam). This type of resolution depends on the beam width; narrower beams provide better lateral resolution. As the ultrasound beam travels deeper into the tissue, it generally widens, which can reduce lateral resolution. Techniques such as focusing the beam can help improve lateral resolution at specific depths by narrowing the beam width.

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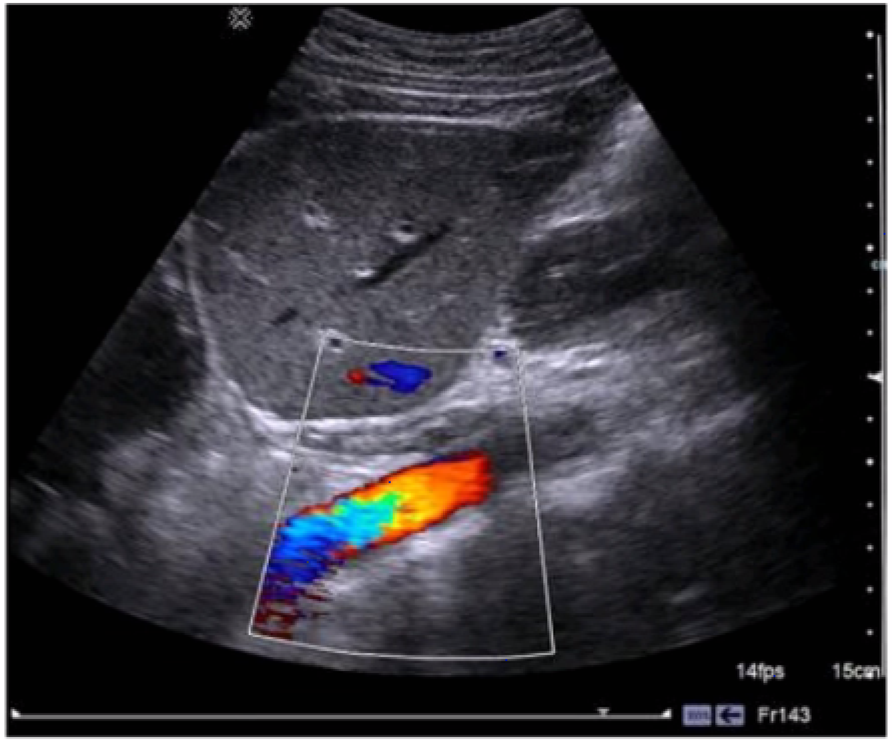
Question 7

Question Type: **MultipleChoice**

Which transducer was most likely used to create this image?



Options:

A- Curvilinear

B- Endocavity

C- Phased array

D- Linear array

Answer:

A

Explanation:

The image shown is typical of an abdominal ultrasound, which commonly utilizes a curvilinear transducer. Curvilinear transducers have a wider field of view at depth, making them ideal for imaging large structures within the abdomen. These transducers emit a curved beam, allowing for better penetration and a broader field of view, which is necessary for comprehensive abdominal examinations. The curvature of the image, the wide field of view, and the depth of penetration all suggest the use of a curvilinear transducer.

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Question 8

Question Type: **MultipleChoice**

Which will affect the gray-scale of a 2-D image?

Options:

A- Doppler gain

B- Depth of field

C- Pulse repetition frequency (PRF)

D- Dynamic range

Answer:

D

Explanation:

Dynamic range in ultrasound imaging affects the number of gray shades displayed in a 2-D image. Adjusting the dynamic range changes how echo signals are mapped to grayscale. A higher dynamic range means more shades of gray are displayed, providing a more detailed and softer image, which is useful for differentiating subtle tissue textures. Conversely, a lower dynamic range increases contrast by displaying fewer shades of gray, making the image appear more black and white. This adjustment is crucial for optimizing image quality based on the specific diagnostic needs.

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Question 9

Question Type: MultipleChoice

What happens to the Doppler shift when the angle is changed from 30 to 60 degrees?

Options:

A- No significant change

B- Loss of Doppler signal

C- Increases

D- Decreases

Answer:

D

Explanation:

The Doppler shift is directly related to the cosine of the angle between the ultrasound beam and the direction of blood flow. As the angle increases from 30 degrees to 60 degrees, the cosine of the angle decreases (cosine of 30 degrees is approximately 0.87, while cosine of 60 degrees is 0.5). Since the Doppler shift is proportional to the cosine of the angle, increasing the angle results in a decreased

Doppler shift. This means the measured blood flow velocities will appear lower at a 60-degree angle compared to a 30-degree angle.

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