ARDMS SPI EXAM QUESTIONS AND ANSWERS

Which gain will increase the risk of bioeffects?

a. transmit

b. receive

c. gain

d. overall gain ✓✓a. transmit

Which of the following is considered the memory of an ultrasound instrument?

a. pulser

b. transducer

c. receiver

d. beam former

e. digital scan converter

f. display monitor ✓✓e. digital scan converter

Spectral broadening suggest:

a. laminar flow

b. turbulent flow

c. flow away from the transducer

d. flow towards the transducer ✓✓b. turbulent flow

With pulse wave Doppler axial resolution: ✓✓degrades

What color is usually use in color flow Doppler variance map to indicate turbulent flow?

✓✓green

Doppler high pass filter eliminates: ✓✓high amplitude signals; low velocity flow

The Doppler wall filter is considered a: ✓✓high pass filter

The Nyquist Limit is equal to:

a. propagation speed x frequency

b. propagation speed/ wavelength

c. PRF/2

d. 4xV^2 ✓✓c. PRF/2

Multiple echoes, equally spaced originating from a gas bubble is called:

a. comet tail

b. ring down

c. slice thickness artifact

d. multipath ✓✓b. ring down

An increase in red blood cell velocity will_____the Doppler Shift:

a. increase

b. decrease

c. not change

d. cannot be predicted ✓✓a. increase

The primary advantage of CW Doppler is:

a. range resolution

b. range discrimination

c. range ambiguity

d. range gating

e. absence of sampling rate ✓✓e. absence of sampling rate

The range for ultrasound begins:

a. 20 Hz

b. 20,000 Hz

c. 2 MHz

d. 15 MHz ✓✓b. 20,000 Hz (useful frequency range for clinical imaging is 2MHz-10MHz)

Which instrument control affects the amplitude (dB) of the outgoing signal:

a. gain

b. receiver gain

c. TGC

d. transmit gain

e. overall gain ✓✓d. transmit gain; amplitude can be affected by the sonographer

Which of the following is used to convert Doppler shift information into color:

a. high PRF

b. fast Fourier transform

c. autocorrelation

d. time interval histogram ✓✓c. autocorrelation

b is incorrect because fast Fourier transform is the method used to process conventional Doppler shift information but is too slow a method for color Doppler

Pulse repetition frequency ✓✓Number of pulses that an ultrasound system transmits into the body each second. Hz. Typically 4-15 KHz. PRF and depth of a view are inversely related: When system is imaging deeper, the pulse repetition frequency is lower.

Also the number of pulses created each second

The best way to increase the near field length of an ultrasound beam is to: ✓✓increase transducer diameter

The range of frequencies produced by a damped PZT element is called:

a. fundamental frequencies

b. Q Factor

c. near field

d. bandwith ✓✓d. bandwidth

The percentage of time that the ultrasound instrument is emitting ultrasound is called:

a. PRF

b. pulse duration

c. pulse repetition period

d. duty factor ✓✓d. duty factor; the maximum value is 1, the minimum is 0

The unit of duty factor is:

a. Hz

b. mm

c. ms

d. unitless ✓✓d. unitless

Quality Factor= Fundamental frequency/ bandwidth ✓✓This allows doses of different types of radiation to be compared for their biological effects.

Clinical imaging transducers are: ✓✓wide bandwidth; low q factor

Power/area= ✓✓Intensity

Increasing wavelength will _____frequency.

a. increase

b. decrease

c. not change

d. cannot be predicted. ✓✓b. decrease

All of the following directly affect frame rate except:

a. depth of penetration

b. field of view

c. number of focuses

d. line density

e. beam width ✓✓e. beam width

A reflection will occur at the boundary of two media if the acoustic impedences of the two media are:

a. equal

b. different

c. unchanged

d. cannot be predicted ✓✓b. different

A mechanical transducer utilizes:

a. transmit focus

b. receive focus

c. fixed focus

d. dynamic aperture focusing ✓✓c. fixed focus; sonographer cannot determine the location of # of foci. mechanical transducer uses cross sectional imaging, rotating wheel, wobbler, oscillating mirror

The transducer frequency is primarily determined by the transducer element:

a. diameter

b. thickness

c. propagation speed

d. type ✓✓b. thickness

A strongly focused transducer implies a:

a. short focal length; decreased beam divergence

b. medium focal length; increased beam divergence

c. long focal length; no beam divergenc

d. short focal length; increased beam divergence ✓✓d. short focal length; increased beam divergence

B-mode displays reflector:

a. amplitude and distance

b. amplitude and velocity

c. power and direction

d. depth and speed ✓✓a. amplitude and distance

An increase in the number of pixels on the display will improve: ✓✓detail resolution

Propagation speed is determined by:

a. frequency

b. harmonics

c. bandwidth

d. bulk modulus ✓✓d. bulk modulus

Increasing transmit gain increases everything except: ✓✓frequency

The correct depth placement of reflectors depends primarily upon:

a. frequency

b. period

c. power

d. propagation speed ✓✓d. propagation speed

Which of the following will increase the color flow jet area displayed?

a. increase color gain

b. increase velocity scale

c. increase frequency ✓✓a. increase color gain

Increasing propagation speed: ✓✓air, soft tissue, bone

The most common type of transducer used in echo is: ✓✓sector phased array

Decibels are the units for all of the following except:

a. amplitude

b. transmit gain

c. gain

d. attenuation

e. TGC

f. dynamic range

e. intensity ✓✓e. intensity= mW/cm2

What are the four acoustic variables: ✓✓1. temperature, density, particle motion, pressure

Frequency is ✓✓Cycles per second (Hz)

not affected by sonographer

increase frequency; decrease depth

Pulse duration ✓✓period (ms) x # of cycles in a pulse

Wavelength ✓✓the length of one cycle

wavelength= propagation speed/ frequency

1.54/3MHz= .5mm

An increase in packet size will _____the frame rate ✓✓Decrease

The range for audible sound is: ✓✓20 Hz- 20kHz

The wavelength of a 1MHz transducer is: ✓✓1.54/1= 1.54mm

The average speed of sound in soft tissue is: ✓✓1540m/s; 1.54km/s; 1.54mm/us

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a. increase in image brightness

b. increase in output power

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Reject eliminates: ✓✓low amplitude signals

There have been no proven biological effects for unfocused transducers for intensities below:

✓✓100mW/cm2 SPTA

The primary cause of attenuation of ultrasound in soft tissue is caused by: ✓✓absorption

Resolution artifact ✓✓When two structures parallel to the ultrasound beam are displayed as one reflector.

Damping does not decrease: ✓✓bandwidth

Spectral Broadening ✓✓The widening of the doppler shift spectrum. Meaning the increase of the range of doppler shift frequencies present, owing to a broader range of flow speeds encountered by the sound beam.

Refraction ✓✓Change in direction of a wave when it changs speed as in travels from one material to another. The change in the direction of sound as it crosses a boundary.

autocorrelation ✓✓used to convert Doppler shift information into color.

PRF ✓✓Pulse Repetition Frequency. The rate at which pulses are transmitted, given in hertz or pulses per second; reciprocal of pulse-repetition time.

Period ✓✓the time

per cycle 1-10usec

Period Calculation ✓✓1/frequency

1/5MHz= .2

How do you decrease period? ✓✓Increase frequency

Impedance ✓✓the opposition of sound propagation

The unit for impedance? ✓✓Rayls

ARDMS SPI EXAM QUESTIONS AND CORRECT ANSWERS|AGRADE

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d. 4xV^2 - ANSWER>> c. PRF/2

What are the four acoustic variables: - ANSWER>> 1. temperature, density, particle motion, pressure

Frequency is - ANSWER>> Cycles per second (Hz)

not affected by sonographer

increase frequency; decrease depth

Pulse duration - ANSWER>> period (ms) x # of cycles in a pulse

Wavelength - ANSWER>> the length of one cycle

wavelength= propagation speed/ frequency

1.54/3MHz= .5mm

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The range for audible sound is: - ANSWER>> 20 Hz- 20kHz

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Period - ANSWER>> the time per cycle

1-10usec

Period Calculation - ANSWER>> 1/frequency

1/5MHz= .2

How do you decrease period? - ANSWER>> Increase frequency

Impedance - ANSWER>> the opposition of sound propagation

The unit for impedance? - ANSWER>> Rayls

ARDMS SPI Study Guide Question And Answers

In soft tissue, if the frequency of a wave is increased the Propagation Speed (PS) will... Correct Answer: Remain the Same because stiffness and density affect Propagation Speed.

What is the audible range? Correct Answer: 20-20,000Hz

>20,000Hz=Ultrasound

Frequency is measured in Correct Answer: Hertz (Hz) is

Cycles per Second

Not affected by sonographer

Increase Frequency; Decrease Depth

A period is the length of time it takes for Correct Answer: one complete wavelength to pass a fixed point

PRP is determined by Correct Answer: Transmit time and receive time.

Period is measured in Correct Answer: Time (μs)

When the sonographer changes the imaging depth what parameters are changed? Correct Answer: PRP, PRF, Duty Factor

What is duty factor? Correct Answer: The percentage or fraction of time that the system is transmitting a pulse (Time Sound is ON or ON-Time).

Propagation Speed in SOFT TISSUE Correct Answer: 1.54 mm/μs (1540 m/sec)

Unit of measurement for Pulse Duration, Duty Factor, PRP, and Period Correct Answer: Time, (μs)

Pulse duration is determined by Correct Answer: Sound Source Only

Pulse Duration is controlled by Correct Answer: the ultrasound system and transducer

Pulse Duration Formula Correct Answer: pulse duration (μs) = # cycles in pulse/frequency(MHz)

PD= Number of cycles in Pulse/ Frequency(Hz)

Spatial Pulse Length (SPL) (measurement) Correct Answer: The distance that a pulse occupies in space from the start to the end of a pulse.

(mm)

Typical values for spatial pulse length in soft tissue. Correct Answer: 0.1 to 1.0 mm

Spatial pulse length is determined by Correct Answer: sound source and medium

Spatial Pulse Length is directly proportional to Correct Answer: the Number of Cycles in the Pulse

and

the Wavelength

(Directly Proportional means that increased SPL will increase both the number of cycles in the pulse and the wavelength if increased).

Spatial pulse length is inversely proportional to Correct Answer: Frequency (MHz)

(Inversely Proportional means that increased SPL will lower frequency. This is because axial resolution is better with lower frequency)

Pulse Duration (PD) Correct Answer: The actual time from the start of a pulse to the end of that pulse; a single transmit, talking, or "on" time.

Time the pulse is on typically measured in (ms).

Pulse Length Correct Answer: The distance of the pulse start to end or the duration or length of

a single pulse

Pulse Length is typically measured in (mm).

the ability of an object to resist compression and relates to the hardness of a medium? Correct Answer: Stiffness.

Think:

↑ Stiffness ↑ Speed

↓ Density ↑ Speed

An increase in pulse repetition frequency would lead to: Correct Answer: Increasing pulse repetition frequency, increases duty factor.

↑ PRF ↑ Duty Factor

Which of the following would have the highest propagation speed? Correct Answer: Bone has the highest propagation speed, at 2000-4000 m/s.

What has the lowest propagation speed? Correct Answer: air technically has the lowest propagation speed at 300 m/s

Which has the Slowest Propagation Speed? Water

Soft Tissue Bone

Lung tissue Correct Answer: Lung Tissue

As imaging depth increases, the pulse repetition frequency (PRF) must: Correct Answer: Decrease

As imaging depth increase, pulse repeition freqency (PRF) decreases.

↑ Imaging Depth ↓ PRF

What describes the amount of refraction that occurs at an interface? Correct Answer: Snell's law

Refraction: the redirection of the transmitted sound beam

Snell's law describes the angle of transmission at an interface based on the angle of incidence and the propagation speeds of the two media.

Pressure is typically expressed in: Correct Answer: Pascals (Pa)

The typical range of frequency for diagnostic ultrasound imaging is Correct Answer: 1-20 Mhz is the typical range of frequency for diagnostic ultrasound imaging.

The attentuation coefficient in soft tissue is equal to: Correct Answer: Attentuation Coeffcient = 1/2 (one half of the frequency in soft tissue)

The attentuation coeffcient (in dB/cm) is the rate at which sound is attentuated per unit depth.

Micro is denoted as: Correct Answer: Micro is denoted as millionth (μ)

What is described as the distance over which one cycle occurs? Correct Answer: Wavelength is distance over which one cycle occurs, or the distance from the beginning of one cycle to the end of the same cycle.

Remember, it asks for distance over which one cycle occurs.

Stiffness and propagation speed are Correct Answer: Directly Related Also

remember:

↑ Stiffness ↑ Speed

↓ Density ↑ Speed

Areas of high pressure and density are referred to as: Correct Answer: Compressions

What type of wave is sound? Correct Answer: Mechanical and Longitudinal Wave

The frequency ranges for ultrasound are: Correct Answer: Ultrasound frequency is 20 to 20,000 Hz

The speed of sound in soft tissue is Correct Answer: Speed of sound in soft tissue is 1540 m/s

Which transducer fires the elements in groups? Correct Answer: Linear sequenced array fires the elements in groups

The units for wavelength is Correct Answer: Wavelength units are (Millimeters)

Enhancement is caused by Correct Answer: Weakly attenuating structures

The wavelength in a material having a propagation speed of 1.5 mm/μs employing a transudcer frequency of 5.0 MHz is: Correct Answer: 0.3 mm

wavelength = c/f

1.5 mm/μs / 5 MHz = 0.3 mm

An ultrasound transducer converts Correct Answer: Electrical energy into Mechanical energy and vice versa

Lowest attenuation to highest Correct Answer: bone, muscle, fat, air

If frequency doubles, what happens to the wavelength? Correct Answer: Wavelength is decreased by 1/2

Frequency and Wavelength are: Correct Answer: Inversely related

What happens to intensity if the amplitude of a signal is halved? Correct Answer: Amplitude halved will result in intensity quartered

amplitude = intensity2

Ultrasound pulses contain a range of frequencies called Correct Answer: bandwidth

How is time related to frequency Correct Answer: inversely

What describes the percentage of time that sound is on? Correct Answer: Duty factor is the percentage of time the sound is being transmitted

A 3 dB gain would indicate an increase in intensity by: Correct Answer: Two Times

3 dB results in doubling of intensity (or power)

The intensity of the ultraosund beam is usually greater at the focal zone because of Correct Answer: the smaller beam diameter

Attenuation denotes Correct Answer: Progressive weakening of the sound beam as it travels

Which of the following has the lowest intensity Correct Answer: SATA is the lowest of the intensities

What is the definition of the beam uniformity ratio? Correct Answer: Beam Uniformity Ratio =

Spatial peak / Spatial average

Continuous wave Doppler has a duty factor of Correct Answer: 100%

CW Doppler is always transmitting sound making it's duty factor 100%

The spatial pulse length is defined as: Correct Answer: the product of the wavelength and the number of cycles in a pulse?

SPL = wavelength x cycles

What term and philosophy relates the amount of exposure time for the sonographer and patient during a diagnostic ultrasound examination? Correct Answer: ALARA
- As Low As Reasonably Achievable

What term is defined as the body's pathologic response to illness, trauma or severe physiologic or emotional stress? Correct Answer: Shock

The inertia of the medium describes its: Correct Answer: Density.

Inertia is described by Newton's principle - an object at rest will stay at rest. An object in motion stays in motion, unless acted on by an outside force.

Greatest attenuation would occur at: Correct Answer: long distance with high frequency

A 3MHz sound beam travels through two media. It attenuates 5 dB in medium A and 6 dB in medium B. Correct Answer: Total attentuation is 11 dB

Attenuation simply adds up as sound travels.

What would you do to create a wave with the highest possible intensity? Correct Answer: Highest intensity would occur with a short distance and low frequency.

Lowest Attenuation is found at Correct Answer: lowest frequency, with the shortest path length.

What results in the most attenuation? Correct Answer: most attenuation occurs at the high frequency and long distance.

Which media has the greatest attenuation and the slowest speed? Correct Answer: Air

Air > Bone & Lung > Soft Tissue > Water

What type of wave is sound? Correct Answer: Mechanical and Longitudinal wave

The speed of sound in soft tissue: Correct Answer: 1540 m/s

The unit for wavelength: Correct Answer: Distance (mm)

Enhancement is caused by: Correct Answer: weakly attenuating structures

Lowest attenuating to highest attenuation Correct Answer: Fat-Muscle-Bone-Air

List propagation speed from lowest to highest Correct Answer: Air-Fat-Muscle- Bone

Which of these media has the lowest attenuation and the greatest speed?

bone
tendon
lung fat
air Correct Answer: Bone

Air > Bone & Lung > Soft Tissue > Water

Bone is more stiff than air

(remember ↑ stiffness, ↑ speed)

What describes the physics of refraction mathematically? Correct Answer: Snell's Law

What is a reflection arising from a rough boundary? Correct Answer: Non-specular

Specular reflection is from a smooth reflector (like mirrors). They return in one direction.

Whereas, non-specular is diffuse or scatter, reflection from a rough boundary.

When time-of-flight is measured, we can determine the _____? Correct Answer: Reflector Depth

A sound pulse travels from the transducer to location A, reflects off of it, and returns to the transducer in 130 μs.

How deep is location A? Correct Answer: Location A is 10 cm from the transducer

Total travel distance would be 20 cm

Which of the following would be considered the narrowest part of a sound beam? Correct Answer: The focus is the narrowest part of the beam

Which of the following is the part of the transducer that stops the ringing of the element? Correct Answer: The damping material helps stop the ringing of the transducer

Along with image depth, which of the following also determines the frame rate? Correct Answer: Image depth and the number of lines per frame determines the frame rate.

Which type of resolution is an accurate representation of moving structures? Correct Answer: Temporal resolution, also known as frame rate, is the ability to display moving structures in real time.

What type of transducer that utilizes elements arranged in a concentric pattern? Correct Answer: The annular array transducer ultilizes elements arranged in concentric rings

What transducer would be considered an advantage of linear array over a phased array transducer? Correct Answer: The linear array has a wider near field of view compared to a phased array transducer

Mechanical Transducers: Correct Answer: Have moving parts Uses a motor

to steer the beam

Most transducers are no longer mechanical May be focused with a lens or phased focuses

Along with crystal diameter, the divergence in the far field is also determined by...
Correct Answer: Frequency

and crystal diameter determines the divergence in the far field

What would cause an increase in frame rate? Correct Answer: Decreasing the imaging depthwould increase the frame rate

When you decrease the imaging depth it can work faster (increase frame rate) because it doesn't have to go as deep.

The diameter of the beam in the Fresnel zone/near zone does what? Correct Answer: Decreases

Which resolution is best in the clinical imaging? Correct Answer: Axial resolution is best in imaging

will increase the near zone length? Correct Answer: A large crystal diameter with high frequency would increase the near zone length

What will decrease beam divergence in the far field? Correct Answer: A large crystal diameter and high frequency would decrease the beam divergence in the far field

Imaging transducers have Correct Answer: Imaging transducers have low quality factors and wide bandwidiths.

What is the speed of a wave with a wavelength of 3 m and a frequency of .1 Hz?
Correct Answer: 0.3 m/s

wave speed= frequency x wavelength

Wavelength and Frequency are Correct Answer: inversely proportional to each other

How do you calculate the speed of a wave given the wavelength and frequency? Correct Answer: Frequency (Hz) x wavelength (distance)= Wave Speed

What is the speed of a wave with a frequency of 2 Hz and a wavelength of 87 m? Correct Answer: 174 m/s

2Hz x 87m= 174m/s

speed of a wave: frequency x wavelength

The _____of a wave is the number of wavelengths that pass a fixed point in a second. Correct Answer: frequency

Frequency is the number of wavelengths that pass a fixed point in a second

A sound wave is traveling in the body and propagates from muscle to air. What percentage of the sound wave is most likely reflected at the muscle-air boundary? Correct Answer: 75%

Which of the following lists is in decreasing order? Correct Answer: Mega, kilo, deca, milli, nano

The conversion of sound energy to heat Correct Answer: Absorption

Acoustic Speckle Correct Answer: the interference pattern caused by scatterers that produces the granular appearance of tissue on a sonographic image

Acoustic Variables Correct Answer: changes that occur within a medium as a result of sound traveling through that medium

Amplitude Correct Answer: The maximum or minimum deviation of an acoustic variable from the average value of that variable; the strength of the reflector

Attenuation Correct Answer: A decrease in the amplitude and intensity of the sound beam as sound travels through tissue.

Attenuation Coefficient Correct Answer: The rate at which sound is attenuated per unit depth

Axial Resolution Correct Answer: The ability to accurately identify reflectors that are arranged parallel to the ultrasound beam

Backscatter Correct Answer: Scattered sound waves that make their way back to the transducer and produce an image on the display

Beam Uniformity Ratio Correct Answer: The ratio of the center intensity to the average spatial intensity; also referred to as the SP/SA factor or beam uniformity coefficient

Capacitive Micromachined Ultrasound Transducers Correct Answer: Technology used to create comparable transducer technology to piezoelectric materials

Compression Correct Answer: An area in the sound wave of high pressure and density

Continuous Wave Correct Answer: Sound that is continuously transmitted

Damping Correct Answer: The process of reducing the number of cycles of each pulse in order to improve axial resolution

Decibels Correct Answer: A unit that establishes a relationship or comparison between two values of power, intensity, or amplitude

Density Correct Answer: Mass per unit volume

Directly Related Correct Answer: Relationship that implies that if one variable decreases, the other also decreases or if one variable increases, the other also increases;

also referred to as Directly Proportional

Distance Correct Answer: How far apart objects are

AKA vibration or displacement

Duty Factor Correct Answer: The percentage of time that sound is actually being produced

Elasticity Correct Answer: The ability of a material to bounce back after being disturbed

Frequency (Hz) Correct Answer: The number of cycles per second

Half-Intensity Depth Correct Answer: the depth at which sound has lost half of its intensity

Half Intensity Depth is also called Correct Answer: Half-Value Layer Thickness

Hertz (Hz) Correct Answer: A unit of frequency

Hydrophone Correct Answer: a device used to measure the output intensity of the transducer

Impedence Correct Answer: the resistance to the propagation of sound through a medium.

Inertia Correct Answer: Newton's principle that states that an object at rest stays at rest and an object in motion stays in motion, unless acted on by an outside force.

Intensity Correct Answer: the power of a wave divided by the area over which it is spread; the energy per unit area

Intensity Reflection Coefficient (IRC) Correct Answer: The percentage of sound reflected at an interface.

The percentage of the sounds intensity that is reflected when sound hits a boundary or tissue

Interface is the dividing line between 2 different media.

Intensity Transmission Coefficient (ITC) Correct Answer: The percentage of sound transmitted at an interface

-or-

The percentage of intensity that continues forward after beam strikes an interface

Interface Correct Answer: The dividing line between two different media

Inversely Related Correct Answer: Relationship that implies that if one variable decreases, the other increases or if one variable increases, the other decreases; also referred to as inversely proportional

Longitudinal Wave Correct Answer: Waves in which the molecules of the medium vibrate back and forth in the same direction that the waves are traveling.

Medium Correct Answer: Any form of matter; Solid, Liquid, or Gas

Non-specular Reflectors Correct Answer: Reflectors that are smaller than the wavelength of the incident beam

Which gain will increase the risk of bioeffects? Correct Answer: Transmit

What is considered the memory of an ultrasound instrument? Correct Answer: Digital Scan Converter

Spectral Broadening Suggests Correct Answer: Turbulent Flow

What happens to axial resolution with Pulse Wave Doppler Correct Answer: Axial Resolution Degrades when using Pulse Wave Doppler

What color is usually used in Color Flow Doppler variance map to indicate turbulent flow? Correct Answer: Green

A Doppler (high pass filter) eliminates? Correct Answer: high amplitude signals, low velocity flow

The Doppler wall filter is considered a: Correct Answer: High Pass Filter

The Nyquist Limit is equal to: Correct Answer: PRF/2

Pulse Repetition Frequency divided by two

Multiple echoes, equally spaced originating from a gas bubble is called Correct Answer: Ring Down

An increase in red blood cell velocity will_____Doppler Shift: Correct Answer: Increase

increase in rbc velocity increases Doppler shift

The primary advantage of CW Doppler is: Correct Answer: Absence of Sampling Rate

The range for ultrasound begins: Correct Answer: at 20,000Hz or 20KHz

(Useful Frequency Range for Clinical Imaging is 2MHz-10MHz)

Which instrument control affects the amplitude (db) of the outgoing signal? Correct Answer: Transmit Gain;

Amplitude can be affected by the sonographer

What is used to convert Doppler shift information into color? Correct Answer: Autocorrelation

What is used to process conventional Doppler shift information but is too slow of a method for Color Doppler? Correct Answer: Fast Fourier transform

Pulse Repetition Frequency Correct Answer: The number of pulses that an ultrasound system transmits into the body each second.

Unit: Hz. Typically 4-15 KHz.

PRF and Depth of View are inversely related.

When the system is imaging deeper, the pulse repetition frequency is lower, as well as, the number of pulses created each second.

What is the best way to increase the near field length of an ultrasound beam? Correct Answer: Increase Transducer Diameter

What is the range of frequencies produced by a dampened PZT element? Correct Answer: bandwidth

What is bandwidth? Correct Answer: range of frequencies in a pulse

The percentage of time that the ultrasound instrument is emitting ultrasound is called? Correct Answer: Duty Factor

The maximum value is 1, the minimum is 0

What is the unit of Duty Factor? Correct Answer: Duty Factor is Unit-less

If the ultrasound is produced as a continuous wave (CW), the duty factor will have a value of 1. With Pulsed Wave the whole value of On-Time is fractioned.

What is Q-factor or Quality Factor? Correct Answer: The "Q factor" describes the bandwidth of the sound emanating from a transducer

Transducer Q Factor (Q = Quality) is associated with two characteristics of the crystal

- purity of their sound and
- length of time the sound persists

(Unitless measurement)

Fundamental Frequency(Hz)/Bandwidth(range of frequency in the pulse)

The unit of duty factor is: Correct Answer: Unitless

Clinical imaging transducers are: Correct Answer: Wide bandwidth; Low Q factor

Wide range of frequencies in the pulse and short period of time that the sound is emitted (pulsed wave)

Power/Area= Correct Answer: Intensity

Increasing wavelength will_____frequency? Correct Answer: Decrease

Beam Properties Correct Answer: The ultrasound beam propagates as a longitudinal wave from the transducer surface into the propagation medium, and exhibits two distinct beam patterns: - a slightly converging beam out to a distance specified by the geometry and frequency of the transducer (the near field), and - a diverging beam beyond that point (the far field).

Does Beam Width directly affect frame rate? Correct Answer: No:

The following directly affect frame rate:

Depth of Penetration

Field of View Number of

Focuses and Line

Density

What affects frame rate? Correct Answer: Depth of Penetration, Field of View, Number of Focuses, and Line Density.

Frame Rate= Number of Frames/Second

When will a reflection occur at the boundary of two media? Correct Answer: If the acoustic impedances of the tow media are different.

Snell's Law Correct Answer: Describes the relationship between the angles and the velocities of the waves.

When an ultrasonic wave passes through an interface between two materials at an oblique angle, and the materials have different indices of refraction, both reflected and refracted waves are produced

In ultrasound, Snell's Law

is a formula used to describe the relationship between the angles of incidence and refraction, when referring to light or other waves passing through a boundary between two different isotropic media.

The ratio of the sine of the angle of incidence to the sine of the angle of refraction is a constant, for a given frequency.

The Angle of Incidence Correct Answer: Refers to the angle of deviation from a perpendicular line to the surface of the tissue

Therefore, the desired orthogonal(perpendicular) incident wave in ultrasound should be considered to have an angle of incidence of zero.

When the angle of incidence is greater, fewer sound waves are reflected back to the transducer resulting in a more hypoechoic (darker) image with less clarity.

The optimal reflection with the most sound waves occurs when the angle of incidence approaches zero and is virtually perpendicular (orthogonal) to the tissue of interest.

Law of Reflection Correct Answer: the angle of incidence is equal to the angle of reflection

Mechanical Transducers utilize what kind of focusing? Correct Answer: Fixed Focusing:

Sonographers cannot determine the location of # of foci.

Mechanical Transducers use Cross-Sectional imaging, rotating wheel, wobbler, and oscillating mirror.

The transducer frequency is primarily determined by the transducer element's what? Correct Answer: Thickness

For pulsed transducers..the main or center frequency of the transducer is determined by the thickness and the propagation speed of the piezoelectric material.

PZT is also called Correct Answer: Ceramic, Active Element, or Crystal

A strongly focused transducer implies a: Correct Answer: Short focal length and Increased Beam Divergence

B-mode displays reflector: Correct Answer: Amplitude and Distance

An increase in the number of pixels on the display will improve: Correct Answer: Detail Resolution

Propagation speed is determined by Correct Answer: Medium only - density and stiffness of media

Bulk Modulus describes the change in the material's volume under external stress.

Increasing transmit gain increases everything except: Correct Answer: Frequency

Gain is a receiving function

•Does not impact how much energy is transmitted to patient (i.e. power)

The correct depth placement of reflectors depends primarily upon: Correct Answer: Propagation Speed

What will increase the color flow jet area displayed? Correct Answer: Increasing Color Gain

Increasing Propagation Speed Correct Answer: air: 330 m/sec fat: 1450

m/sec

water: 1480 m/sec

soft tissue: 1540 m/sec liver:

1550 m/sec

kidney: 1560 m/sec

blood: 1570 m/sec

muscle: 1580 m/sec

bone: 4080 m/sec

The most common type of transducer used in echo is: Correct Answer: Sector Phased Array