The Nature of Sound

Chapter 1 Pre-Lecture Worksheet | Educator Resource

Review of Sonographic Vocabulary Terms

Match each term with its definition. Enter the corresponding letter.

Key Terms

_____ 1. velocity

_____ 2. frequency

_____ 3. wavelength

_____ 4. wave phase

_____ 5. period

_____ 6. amplitude

_____ 7. power

_____ 8. intensity

_____ 9. spatial intensity

_____ 10. temporal intensity

A. rate at which acoustic energy is transferred per unit area

B. particular stage, or point, of advancement of a single cycle at a single point in time

C. measure of acoustic intensity at a particular time or averaged over time

D. speed at which a wave travels through a medium

E. the length that a wave occupies in space

F. measure of acoustic intensity at a particular location or averaged across the beam

G. the number of waves, or cycles, passing a single point over a given period of time

H. length of time it takes to complete a single cycle

I. the rate at which energy is transferred into a medium by the propagating acoustic wave front

J. the strength of the pressure in a sound wave

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Fill in the Blanks

Name: _____ Date: _____

1. Waves carry _____ , not matter, from one place to another.
2. In longitudinal waves particle motion continues _____ as the propagation of the incident energy.
3. In transverse waves particle motion is _____ to the direction of the incident energy.
4. The distance that each particle moves from equilibrium is primarily a function of the _____ of the incident sound beam.
5. The three parameters that interact in a manner that directly apply to medical ultrasound imaging applications are _____ , _____ , _____ .
6. Various tissues in the human body transmit ultrasound at various velocities; velocity being determined by _____ .
7. The speed of a sound wave through a medium depends primarily upon the _____ and _____ of the medium itself.
8. A rule of thumb posits that the denser media, the _____ the propagation speed.
9. Stiffness is directly related to propagation speed, i.e., as stiffness increases, speed _____ .
10. The more cycles passing the same point over the same period of time, the _____ the frequency.

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Fill in the Blanks continued

Type your answers into the shaded fields. Save your completed copy.

11. In the realm of audible sound, frequency is often referred to as _____ .

12. The human ear can detect frequencies in the range of approximately _____ .

13. The most frequently used frequencies in routine clinical ultrasound imaging applications are approximately _____ .

14. _____ is the particular stage, or point, of advancement in a cycle measured from some arbitrary point of origin.

15. If two waves of equal strength superimpose in phase, the resulting wave will be _____ .

16. This type of positive wave superimposition is known as _____ .

17. If two waves superimpose out-of-phase, there is a net loss of energy in the resultant wave. This is known as _____ .

18. _____ is the time from the beginning of one cycle to the beginning of the next cycle.

19. Period is the reciprocal of frequency and therefore is _____ proportional to it.

20. _____ is the difference between the average and the maximum value of an acoustic variable.

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Fill in the Blanks continued

Type your answers into the shaded fields. Save your completed copy.

21. Amplitude is determined by the _____ , and it changes as it travels through a medium.

22. _____ is defined as the rate at which energy is transferred into a medium by the propagating acoustic wavefront.

23. Mathematically, power is proportional to the _____ of a wave squared.

24. Intensity is a measure of the amount of energy transferred per unit of _____ per unit _____ .

25. Spatial intensity is a function of both the _____ and the _____ of the insonated area.

26. In the near field of an acoustic field, the spatial intensity is relatively _____ .

27. In the focal zone of an acoustic field, spatial intensity is _____ than in either near or far field.

28. Spatial peak intensity (SP) is measured along the _____ at the narrowest point.

29. Spatial average intensity (SA) is the average intensity in the sound beam and is usually measured at the _____ .

30. The amount of spread of an ultrasound beam in space can be described and is called the _____ .

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Fill in the Blanks continued

Type your answers into the shaded fields. Save your completed copy.

31. The point in time when the intensity reaches its maximum value is called _____ .

32. The ON time of a transducer is called its _____ .

33. _____ is the ratio of a force acting on the surface of an object.

34. Acoustic forces vibrate human soft tissue out of a _____ .

35. As an acoustic wave propagates through a medium, it creates _____ variations in pressure.

36. The variation in pressure between the point of maximum compression _____ and maximum rarefaction _____ is called _____ .

37. _____ is the ability of a material to return to its normal shape after being stretched or compressed.

38. _____ is a measure of the relative volume change of a medium in response to a pressure change.

39. The more matter confined to a given volume, the _____ the density.

40. _____ is the distance that a body has moved after being impinged upon by a force.

The Nature of Sound

Chapter 1 Worksheet Answer Key | Educator Resource

Review of Sonographic Vocabulary Terms

Correct matching letters are shown in green.

Key Terms

D	1. velocity
G	2. frequency
E	3. wavelength
B	4. wave phase
H	5. period
J	6. amplitude
I	7. power
A	8. intensity
F	9. spatial intensity
C	10. temporal intensity

A. rate at which acoustic energy is transferred per unit area

B. particular stage, or point, of advancement of a single cycle at a single point in time

C. measure of acoustic intensity at a particular time or averaged over time

D. speed at which a wave travels through a medium

E. the length that a wave occupies in space

F. measure of acoustic intensity at a particular location or averaged across the beam

G. the number of waves, or cycles, passing a single point over a given period of time

H. length of time it takes to complete a single cycle

I. the rate at which energy is transferred into a medium by the propagating acoustic wave front

J. the strength of the pressure in a sound wave

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Chapter 1 Worksheet Answer Key | Educator Resource

Fill in the Blanks

Name: Date:

1. Waves carry **energy** , not matter, from one place to another.
2. In longitudinal waves particle motion continues **along the same direction** as the propagation of the incident energy.
3. In transverse waves particle motion is **at right angles** to the direction of the incident energy.
4. The distance that each particle moves from equilibrium is primarily a function of the **strength (amplitude)** of the incident sound beam.
5. The three parameters that interact in a manner that directly apply to medical ultrasound imaging applications are **frequency** , **velocity** , **wavelength** .
6. Various tissues in the human body transmit ultrasound at various velocities; velocity being determined by **the medium itself** .
7. The speed of a sound wave through a medium depends primarily upon the **density** and **stiffness** of the medium itself.
8. A rule of thumb posits that the denser media, the **slower** the propagation speed.
9. Stiffness is directly related to propagation speed, i.e., as stiffness increases, speed **increases** .
10. The more cycles passing the same point over the same period of time, the **higher** the frequency.

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Chapter 1 Worksheet Answer Key | Educator Resource

Fill in the Blanks continued

Answers appear in worksheet order and are shown in green.

11. In the realm of audible sound, frequency is often referred to as **pitch** .

12. The human ear can detect frequencies in the range of approximately **20 - 20,000 Hz** .

13. The most frequently used frequencies in routine clinical ultrasound imaging applications are approximately **2-20 MHz** .

14. **phase** is the particular stage, or point, of advancement in a cycle measured from some arbitrary point of origin.

15. If two waves of equal strength superimpose in phase, the resulting wave will be **twice as strong as the initial wave** .

16. This type of positive wave superimposition is known as **constructive interference** .

17. If two waves superimpose out-of-phase, there is a net loss of energy in the resultant wave. This is known as **destructive interference** .

18. **period** is the time from the beginning of one cycle to the beginning of the next cycle.

19. Period is the reciprocal of frequency and therefore is **inversely** proportional to it.

20. **amplitude** is the difference between the average and the maximum value of an acoustic variable.

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Chapter 1 Worksheet Answer Key | Educator Resource

Fill in the Blanks continued

Answers appear in worksheet order and are shown in green.

21. Amplitude is determined by the **the sound source** , and it changes as it travels through a medium.

22. **power** is defined as the rate at which energy is transferred into a medium by the propagating acoustic wavefront.

23. Mathematically, power is proportional to the **amplitude** of a wave squared.

24. Intensity is a measure of the amount of energy transferred per unit of **time** per unit **area** .

25. Spatial intensity is a function of both the **quantity of energy** and the **volume** of the insonated area.

26. In the near field of an acoustic field, the spatial intensity is relatively **low** .

27. In the focal zone of an acoustic field, spatial intensity is **substantially higher** than in either near or far field.

28. Spatial peak intensity (SP) is measured along the **central beam** at the narrowest point.

29. Spatial average intensity (SA) is the average intensity in the sound beam and is usually measured at the **transducer face** .

30. The amount of spread of an ultrasound beam in space can be described and is called the **beam uniformity ratio** .

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Chapter 1 Worksheet Answer Key | Educator Resource

Fill in the Blanks continued

Answers appear in worksheet order and are shown in green.

31. The point in time when the intensity reaches its maximum value is called **temporal peak intensity** .

32. The ON time of a transducer is called its **duty factor** .

33. **Pressure** is the ratio of a force acting on the surface of an object.

34. Acoustic forces vibrate human soft tissue out of a **resting state** .

35. As an acoustic wave propagates through a medium, it creates **cyclical or alternating** variations in pressure.

36. The variation in pressure between the point of maximum compression **maxima** and maximum rarefaction **minima** is called **peak-to-peak pressure** .

37. **elasticity** is the ability of a material to return to its normal shape after being stretched or compressed.

38. **compressibility** is a measure of the relative volume change of a medium in response to a pressure change.

39. The more matter confined to a given volume, the **greater** the density.

40. **particle displacement** is the distance that a body has moved after being impinged upon by a force.