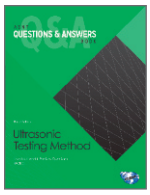

ASNT Questions & Answers Book: Ultrasonic Testing Method, third edition

Errata – 1st Printing 07/15

The following text corrections pertain to the third edition of *ASNT Questions & Answers Book: Ultrasonic Testing Method*. Subsequent printings of the document will incorporate the corrections into the published text.

These corrections apply to the first printing 10/14. In order to verify the print run of your book, refer to the copyright page. E-books are updated as corrections are found.

LEVEL I

Page

16 Question 134 answer d. should be changed to read:
d. UT Signals may overlap with the multiples of the backwall echoes. ~~initial pulse signal~~.

LEVEL II

Page

25 Question 41 should be changed to read:
41. In straight (normal) beam contact testing, which of the following would NOT result in a reduction in the back-surface reflection amplitude? ~~could indicate:~~

37 Question 144, answer b should be rewritten as follows:
~~b. fast enough to ensure that the smallo rejectable discontinuity will be deteeted.~~
b. immaterial as the pulse repetition rate does not affect the ability to detect indications regardless of size.

38 For clarity, Question 156, answer a., should be changed to read: a. density and elasticity.

40 In Question 173, replace both instances of "a 51 mm (2 in.) indication" with an 80% FSH indication.

41 The reference in Question 178 should be changed to A.275, 277-278.

43 The answer key should be corrected as follows:
10d, 41a, 143a

LEVEL III

Page

45 Question 4 answer a. should be changed to read: a. 0.001-1 V.

46 Question 14 should be changed to read: 14. ~~Notches~~ Side-drilled holes are frequently used as reference reflectors for:

47 For clarity, Question 18 should be changed to read:
18. Based upon wave theory and ignoring attenuation losses, the echo amplitude of a finite reflector is:

Catalog #2028
Book printed 10/14
Errata created 08/15

131. To vary or change the wavelength of sound being used to test a part, change the:

a. sound wave frequency.
b. diameter of the transducer.
c. electrical pulse voltage.
d. pulse repetition rate.

B.5

132. Ultrasonic vibrations are commonly used to:

a. support findings after visual inspection.
b. characterize grain structure.
c. detect discontinuities in multilayered structures having air gaps between layers.
d. perform volumetric examinations of ferrous and nonferrous materials.

B.1, 2

133. Which of the following has the longest fresnel zone?

a. 13 mm (0.5 in.) diameter 1 MHz.
b. 13 mm (0.5 in.) diameter 2.25 MHz.
c. 28.5 mm (1.125 in.) diameter 1 MHz.
d. 38 mm (1.5 in.) diameter 2 MHz.

A.210; B.47-48

134 When contact testing, if the ultrasonic instrument is set with an excessively high pulse repetition frequency:

a. the screen trace becomes too light to see.
b. the time-baseline becomes distorted.
c. the initial pulse disappears.
d. UT signals may overlap with the multiples of the backwall echoes.

A.187

135. The advantages of immersion testing include:

a. portability.
b. reduced equipment needed.
c. low equipment and maintenance costs.
d. adaptability for automated scanning.

F.258

136. Longitudinal wave velocity in water is approximately one-fourth the velocity in aluminum or steel. Therefore, the minimum water path should be:

a. four times the test piece thickness.
b. one-half the test piece thickness.
c. one-fourth the test piece thickness plus 6 mm (0.25 in.).
d. one-half the test piece thickness plus 6 mm (0.25 in.)

A.262; F.258

137. In immersion testing, a wetting agent is added to the water to:

a. adjust the viscosity.
b. help eliminate the formation of air bubbles.
c. prevent cloudiness.
d. aid in technician comfort.

B.62

138. The formula used to determine the fundamental resonant frequency is:

a. $F = V/T$.
b. $F = V/2T$.
c. $F = T/V$.
d. $F = VT$.

A.478

139. If frequency is increased, wavelength:

a. decreases (becomes shorter).
b. increases (becomes longer).
c. remains the same but velocity increases.
d. remains the same but velocity decreases.

B.5

140. The variable in distance amplitude calibration block construction is the:

a. drilled hole size.
b. drilled hole point angle.
c. metal distance above the drilled hole.
d. angle of the drilled hole to block longitudinal axis.

B.39-40, 105-106; F.264

35. In a B-scan display, the length of a screen indication from a discontinuity is related to:

a. a discontinuity's thickness as measured parallel to the ultrasonic beam.
b. the discontinuity's length in the direction of the transducer travel.
c. the horizontal baseline elapsed time from left to right.
d. the vertical and horizontal directions representing the area over which the transducer was scanned.

B.27

36. Which circuit triggers the pulser and sweep circuits in an A-scan display?

a. Receiver-amplifier.
b. Power supply.
c. Clock.
d. Damping.

F.242

37. On an A-scan display, the *dead zone*, refers to the:

a. distance contained within the near field.
b. area outside the beam spread.
c. distance covered by the front-surface pulse width and recovery time.
d. area between the near field and the far field.

F.267

38. On an A-scan display, what represents the intensity of a reflected beam?

a. Echo pulse width.
b. Horizontal screen location.
c. Signal brightness.
d. Signal amplitude.

A.179

39. Of the following scan types, which one can be used to produce a recording of discontinuitiy areas superimposed over a plan view of the test piece?

a. A-scan.
b. B-scan.
c. C-scan.
d. D-scan.

C.19

40. In immersion testing in a small tank, a manually operated manipulator is used to:

a. manipulate the pulser/receiver unit and the display.
b. set the proper transducer angle.
c. set the proper index function.
d. set the proper bridge distance.

A.413-414

41. In straight (normal) beam contact testing, which of the following would NOT result in a reduction in the back-surface reflection amplitude?

a. the usage of a high-viscosity couplant.
b. a discontinuity that is normal to the beam.
c. a near-surface discontinuity that cannot be resolved from the main bang (initial pulse).
d. a coarse-grain material.

A.205

42. A 152 mm (6 in.) diameter rod is being inspected for centerline cracks. The A-scan presentation for one complete path through the rod is as shown in Figure 2. The alarm gate should:

a. be used between points A and E.
b. be used at point D only.
c. be used between points B and D.
d. not be used for this application.

B.36-37

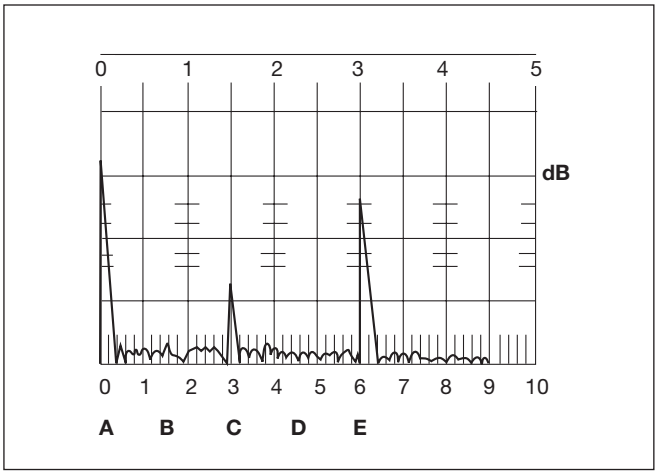

Figure 2.

140. A discontinuity that occurs during the casting of molten metal which may be caused by the splashing, surging, interrupted pouring, or the meeting of two streams of metal coming from different directions is called:

a. a burst.
b. a cold shut.
c. flaking.
d. a blowhole.

B.128

141. The ratio between the wave speed in one material and the wave speed in a second material is called:

a. the acoustic impedance of the interface.
b. Young's modulus.
c. Poisson's ratio.
d. refractive index.

A.564

142. The expansion and contraction of a magnetic material under the influence of a changing magnetic field is referred to as:

a. piezoelectricity.
b. refraction.
c. magnetostriction.
d. rarefaction.

A.116

143. The ratio of stress to strain in a material within the elastic limit is called:

a. Young's modulus.
b. the impedance ratio.
c. Poisson's ratio.
d. refractive index.

A.319, 482

144. When setting up for an ultrasonic inspection, the pulse repetition rate of the instrument must be:

a. low enough so that transmitted waves will not interfere with reflected signals.
b. immaterial as the pulse repetition rate does not affect the ability to detect indications regardless of size.
c. slow enough to allow the instrument display to refresh with each pulse.
d. fast enough for the operator to be able to rely on the discontinuity alarm instead of constantly watching the screen.

A.187

145. The factor that determines the amount of reflection at the interface of two dissimilar materials is:

a. the index of rarefaction.
b. the frequency of the ultrasonic wave.
c. Young's modulus.
d. the acoustic impedance.

A.262, 556

146. A quartz crystal cut so that its major faces are parallel to the Z and Y axes and perpendicular to the X axis is called:

a. a Y-cut crystal.
b. an X-cut crystal.
c. a Z-cut crystal.
d. a ZY-cut crystal.

A.558

147. The equation describing wavelength in terms of velocity and frequency is:

a. wavelength = velocity × frequency.
b. wavelength = z (frequency × velocity).
c. wavelength = velocity ÷ frequency.
d. wavelength = frequency + velocity.

A.37; D.2

148. When an ultrasonic beam reaches the interface of two dissimilar materials, it can be:

a. 100% reflected.
b. 100% absorbed.
c. partially reflected and refracted, but not absorbed.
d. partially reflected, refracted, and transmitted.

A.54, 221, 237 Fig.7

149. When inspecting aluminum by the immersion method using water for a couplant, the following information is known:
velocity of sound in water = 1.49×10^5 cm/s,
velocity of longitudinal waves in aluminum = 6.32×10^5 cm/s, and angle of incidence = 5°.
The angle of refraction for longitudinal waves is approximately:

a. 22°
b. 18°
c. 26°
d. 16°

A.46, 52-53; D.6

150. Of the piezoelectric materials listed below, the most efficient sound transmitter is:

a. lithium sulfate.
b. quartz.
c. barium titanate.
d. silver oxide.

B.46; F.255

151. Of the piezoelectric materials listed below, the most efficient sound receiver is:

a. lithium sulfate.
b. quartz.
c. barium titanate.
d. silver oxide.

F.255

152. The most commonly used method of producing shear waves in a test part when inspecting by the immersion method is by:

a. transmitting longitudinal waves into a part in a direction perpendicular to its front surface.
b. using two crystals vibrating at different frequencies.
c. using a Y-cut quartz crystal.
d. angulating the search tube to the proper angle.

F.258

153. Beam divergence is a function of the dimensions of the crystal and the wavelength of the beam transmitted through a medium, and it:

a. increases if the frequency or crystal diameter decreases.
b. decreases if the frequency or crystal diameter decreases.
c. increases if the frequency increases and crystal diameter decreases.
d. decreases if the frequency increases and crystal diameter decreases.

B.47, 49

154. The wavelength of an ultrasonic wave is:

a. directly proportional to velocity and frequency.
b. directly proportional to velocity and inversely proportional to frequency.
c. inversely proportional to velocity and directly proportional to frequency.
d. equal to the product of velocity and frequency.

D.2

155. The fundamental frequency of a piezoelectric crystal is primarily a function of the:

a. length of the applied voltage pulse.
b. amplifying characteristics of the pulse amplifier in the instrument.
c. thickness of the crystal.
d. material testing.

B.47; E.223

156. Acoustic velocities of materials are primarily due to the material's:

a. density and elasticity.
b. material thickness.
c. temperature.
d. acoustic impedance.

D.2; G.13

157. Inspection of castings is often impractical because of:

a. extremely small grain structure.
b. coarse grain structure.
c. uniform flow lines.
d. uniform velocity of sound.

B.129; F.190

167. Reflection indications from a weld area being inspected by the angle beam technique may represent:

a. porosity.
b. backwall.
c. initial pulse.
d. hot tears.

B.134-142

168. During a test using A-scan equipment, strong indications that move at varying rates across the screen in the horizontal direction appear. It is impossible to repeat a particular screen pattern by scanning the same area. A possible cause of these indications is:

a. porosity in the test part.
b. an irregularly shaped crack.
c. a blowhole.
d. electrical interference.

F.246

169. In an A-scan presentation, position along the horizontal baseline indicates:

a. a square wave pattern.
b. a sweep line.
c. a marker pattern.
d. elapsed time.

B.26

170. The greatest amount of attenuation losses take place at:

a. 1 MHz
b. 2.25 MHz
c. 5 MHz
d. 10 MHz

B.15

171. Waves that travel around gradual curves with little or no reflection from the curve are called:

a. transverse waves.
b. surface waves.
c. shear waves.
d. longitudinal waves.

B.12-13

172. To evaluate and accurately locate discontinuities after scanning a part with a paintbrush transducer, it is generally necessary to use a:

a. transducer with a smaller crystal.
b. scrubber.
c. grid map.
d. crystal collimator.

B.51

173. An ultrasonic instrument has been calibrated to obtain an 80% FSH indication from a 2 mm (0.08 in.) diameter flat-bottom hole located 76 mm (3 in.) from the front surface of an aluminum reference block. When testing an aluminum forging, an 80% FSH indication is obtained from a discontinuity located 76 mm (3 in.) from the entry surface. The reflective area of this discontinuity is probably:

a. the same as the area of the 2 mm (0.08 in.) flat-bottom hole.
b. greater than the area of the 2 mm (0.08 in.) flat-bottom hole.
c. slightly less than the area of the 2 mm (0.08 in.) flat-bottom hole.
d. about one-half the area of the 2 mm (0.08 in.) flat-bottom hole.

F.262

174. As the impedance ratio of two dissimilar materials increases, the percentage of sound coupled through an interface of such materials:

a. decreases.
b. increases.
c. is not changed.
d. may increase or decrease.

F.234

175. Lower frequency sound waves are *not* generally used for pulse echo testing of thinner materials because of:

a. the rapid attenuation of low frequency sound.
b. incompatible wavelengths.
c. poor near-surface resolution.
d. fraunhofer field effects.

F.234

176. In immersion testing, the accessory equipment to which the search cable and the transducer are attached is called a:

a. crystal collimator.
b. scrubber.
c. jet-stream unit.
d. search tube or scanning tube.

B.123

177. In general, discontinuities in wrought products tend to be oriented:

a. randomly.
b. in the direction of grain flow.
c. at right angles to the entry surface.
d. at right angles to the grain flow.

B.126

178. In immersion testing of round bars, the back surface contour may result in:

a. loss of back reflection.
b. additional indications following the direct back surface reflection.
c. inability to distinguish the actual distance to the back-surface reflection.
d. false indications of discontinuities near the back surface.

A.275, 277-278

179. In contact testing, discontinuities near the entry surface cannot always be detected because of:

a. the far-field effect.
b. attenuation.
c. the dead zone.
d. refraction.

A.204; B.58

180. In cases where the diameter of tubing being inspected is smaller than the diameter of the transducer, what can be used to confine the sound beam to the proper range of angles?

a. A scrubber.
b. A collimator.
c. An angle plane angulator.
d. A jet-stream unit.

A.290-291

181. Which of the following is more likely to limit the maximum scanning speed in immersion testing?

a. The frequency of the transducer.
b. Viscous drag problems.
c. The pulse repetition rate of the test instrument.
d. The persistency of the ultrasonic instrument display.

A.403

182. The property of certain materials to transform electrical energy to mechanical energy and vice versa is called:

a. mode conversion.
b. piezoelectric effect.
c. refraction.
d. impedance matching.

A.60; B.45

183. Surface waves energy levels are concentrated at what depth below the surface?

a. 25 mm (1 in.).
b. 102 mm (4 in.).
c. 1 wavelength.
d. 4 wavelengths.

A.39

184. To prevent the appearance of the second front surface indication before the first back reflection when inspecting aluminum by the immersion method (water is used as a couplant), it is necessary to have a minimum of at least 25 mm (1 in.) of water for every _____ of aluminum.

a. 51 mm (2 in.)
b. 102 mm (4 in.)
c. 152 mm (6 in.)
d. 203 mm (8 in.)

F.258

185. Increasing the length of the pulse used to activate the transducer will:

a. increase the strength of the ultrasound but decrease the resolving power of the instrument.
b. increase the resolving power of the instrument.
c. have no effect on the test.
d. decrease the penetration of the sound wave.

B.36

195. Which of the following modes of vibration are quickly dampened out when testing by the immersion method?

a. Longitudinal waves.
b. Shear waves.
c. Transverse waves.
d. Surface waves.

B.157

196. Which ultrasonic test frequency would probably provide the best penetration in a 30 cm (12 in.) thick specimen of coarse-grained steel?

a. 1 MHz
b. 2.25 MHz
c. 5 MHz
d. 10 MHz

B.47

197 A quartz crystal cut so that its major faces are parallel to the Z and Y axes and perpendicular to the X axis is called:

a. a Y-cut crystal.
b. an X-cut crystal.
c. a Z-cut crystal.
d. a ZY-cut crystal.

A.558

Answers

1d	2b	3b	4c	5c	6b	7c	8b	9c	10d	11b	12b	13c	14c
15b	16c	17b	18a	19a	20c	21a	22a	23c	24a	25b	26c	27a	28b
29b	30c	31a	32c	33a	34b	35b	36c	37c	38d	39c	40b	41a	42c
43a	44a	45c	46b	47a	48c	49c	50d	51b	52a	53a	54a	55b	56c
57b	58b	59c	60d	61c	62d	63a	64c	65b	66d	67c	68d	69b	70b
71b	72c	73b	74a	75b	76a	77a	78c	79b	80c	81b	82d	83b	84a
85c	86d	87a	88d	89a	90d	91a	92a	93a	94b	95a	96c	97b	98c
99d	100a	101d	102c	103d	104b	105b	106a	107a	108c	109a	110a	111b	112d
113b	114a	115a	116d	117d	118c	119a	120b	121b	122d	123b	124a	125d	126b
127a	128b	129d	130a	131c	132a	133a	134c	135a	136b	137b	138c	139d	140b
141d	142c	143a	144a	145d	146b	147c	148d	149a	150c	151a	152d	153a	154b
155c	156a	157b	158d	159d	160b	161a	162c	163b	164a	165b	166a	167a	168d
169d	170d	171b	172a	173b	174a	175c	176d	177b	178a	179c	180b	181c	182b
183c	184b	185a	186a	187b	188b	189c	190d	191c	192a	193c	194d	195d	196a
197b													

LEVEL III
Review Questions

1. In an ultrasonic test system where signal amplitudes are displayed, an advantage of a frequency-independent attenuator over a continuously variable gain control is that the:

   a. pulse shape distortion is less.
   b. signal amplitude measured using the attenuator is independent of frequency.
   c. dynamic range of the system is decreased.
   d. effect of amplification threshold is avoided.

   A.86

2. An amplifier in which received echo pulses must exceed a certain threshold voltage before they can be indicated might be used to:

   a. suppress amplifier noise, unimportant scatter echoes, or small discontinuity echoes that are of no consequence.
   b. provide a display with nearly ideal vertical linearity characteristics.
   c. compensate for the unavoidable effects of material attenuation losses.
   d. provide distance-amplitude correction automatically.

   G.176

3. The output voltage from a saturated amplifier is:

   a. 180° out of phase from the input voltage.
   b. lower than the input voltage.
   c. nonlinear with respect to the input voltage.
   d. below saturation.

   G.176, 182

4. The transmitted pulse at the output of the pulser usually has a voltage of 100 to 1000 V, whereas the voltages of the echoes at the input of the amplifier are on the order of:

   a. 0.001-1 V
   b. 1-5 V
   c. 10 V
   d. 50 V

   G.174-176

5. The intended purpose of the adjustable calibrated attenuator of an ultrasonic instrument is to:

   a. control transducer damping.
   b. increase the dynamic range of the instrument.
   c. broaden the frequency range.
   d. attenuate the voltage applied to the transducer.

   A.86

6. Which of the following might result in increased transmission of ultrasound within a coarse-grained material?

   a. Perform the examination with a smaller diameter transducer.
   b. Perform the examination after a grain-refining heat treatment.
   c. Change from a contact examination to an immersion examination.
   d. Change from a longitudinal to a transverse wave.

   B.129

7. The term that is used to determine the relative transmittance and reflectance of ultrasonic energy at an interface is called:

   a. acoustic attenuation.
   b. interface refraction.
   c. acoustic impedance ratio.
   d. acoustic frequency.

B.16

8. In a forging, discontinuities associated with nonmetallic inclusions can most accurately be described as being:

   a. oriented parallel to the major axis.
   b. parallel to the minor axis.
   c. aligned with forging flow lines.
   d. oriented at approximately 45° to the forging direction.

G.340

9. The preferred method of ultrasonically inspecting a complex-shaped forging:

   a. is an automated immersion test of the finished forging using an instrument containing a calibrated attenuator in conjunction with a C-scan recorder.
   b. combines thorough inspection of the billet prior to forging with a careful inspection of the finished part in all areas where the shape permits.
   c. is a manual contact test of the finished part.
   d. is an automated immersion test of the billet prior to forging.

F.504

10. When maximum sensitivity is required from a transducer:

    a. a straight beam unit should be used.
    b. large-diameter crystals are required.
    c. the piezoelectric element should be driven at its fundamental resonant frequency.
    d. the bandwidth of the transducer should be as large as possible.

A.61-62

11. The sensitivity of an ultrasonic test system:

    a. depends on the transducer, pulser, and amplifier used.
    b. decreases as the frequency is increased.
    c. increases as the resolution increases.
    d. is not related to mechanical damping or the transducer.

B.46-47, 56

12. The ability of a test system to separate the back surface echo and the echo from a small discontinuity just above this back surface:

    a. depends primarily upon the pulse length generated from the instrument.
    b. is not related to the surface roughness of the part under inspection.
    c. is primarily related to the thickness of the part under inspection.
    d. is usually improved by using a larger diameter transducer.

A.183

13. Transducer sensitivity is most often determined by:

    a. calculations based on frequency and thickness of the piezoelectric element.
    b. the amplitude of the response from an artificial discontinuity.
    c. comparing it to a similar transducer made by the same manufacturer.
    d. determining the ringing time of the transducer.

B.102-104, 106

14. Side-drilled holes are frequently used as reference reflectors for:

    a. distance-amplitude calibration for shear waves.
    b. area-amplitude calibration.
    c. thickness calibration of plate.
    d. determining near-surface solutions.

A.194-198

15. Notches provide good reference discontinuities when a UT examination is conducted to primarily detect discontinuities such as:

a. porosity in rolled plate.
b. inadequate penetration at the root of a weld.
c. weld porosity.
d. internal inclusions.

A.197-198

16. The difference between a compression and shear wave is:

a. quantitative measure.
b. relative particle vibration direction.
c. qualitative measure.
d. amplitude.

B.10-12; G.7

17. The particle motion for rayleigh waves is usually described as:

a. sinusoidal.
b. circular.
c. elliptical.
d. shear.

A.45; B.66; C.1-2

18. Based upon wave theory and ignoring attenuation losses, the echo amplitude of a finite reflector is:

a. directly proportional to the distance to the reflector.
b. inversely proportional to the distance to the reflector.
c. directly proportional to the square of the diameter of the circular reflector.
d. inversely proportional to the square of the diameter of the circular reflector.

G.97

19. The rate generator in B-scan equipment will invariably be directly connected to the:

a. display intensity circuit.
b. pulser circuit.
c. RF amplifier circuit.
d. horizontal sweep circuit.

B.3, 79-82

20. In A-scan equipment, the RF pulser output voltage is normally in the range of:

a. 1-10 V.
b. 10-100 V.
c. 100-1000 V.
d. 1000-3000 V.

B.79

21. When contact testing, an increase in tightness of a shrink fit to a hollow shaft will cause the ratio of the back reflection to the metal-to-metal interface reflection to:

a. increase.
b. decrease.
c. remain unchanged.
d. not be predicted as the response is material-dependent.

G.475

22. The frequency that can best distinguish the difference between a large planar discontinuity and four stacked (multiple-layered) laminations in rolled plate is:

a. 0.5 MHz
b. 1 MHz
c. 2.25 MHz
d. 5 MHz

B.85