



ASNT Level III Study Guide: Basic, second edition

Errata – 2nd Printing 02/15

The following text corrections pertain to the second edition of *ASNT Level III Study Guide: Basic*. Subsequent printings of the document will incorporate the corrections into the published text.

The attached corrected pages apply to the second printing 02/15. In order to verify the print run of your book, refer to the copyright page. Ebooks are updated as corrections are found.

Page	Correction
13	Table 6.3.1 A: the NDT Level for the Time of Flight Diffraction technique of the Ultrasonics method should be changed from I to <u>II</u> .
15	Entire NOTE under Inquiry 76-1 should be deleted: NOTE: Table 6.2.1 A from the 1975 edition of <i>SNT-TC-1A</i> corresponds with Table 6.3.1 A in the 2011 edition.
17	Response #1 to Inquiry 07-1 should read as: “See Inquiry 84-4, response 1 [<u>in <i>Interpreting SNT-TC-1A</i></u>] ...”
27	Response #1 to Inquiries 03-01 and 04-2 should read: “See Inquiry 91-4, Question 2 [<u>in <i>Interpreting SNT-TC-1A</i></u>] ...”
32	Question 31 should be changed as follows: Records substantiating <u>training and experience for qualification</u> are recommended to be kept on <u>a(n)</u> : a. daily or weekly basis. b. monthly or hourly basis. c. fractional yearly basis. d. fractional hourly basis. Answer “b” is still correct.
33	Question 39 should be changed as follows: In accordance with <i>SNT-TC-1A</i> , the NDT Level III shall <u>should</u> be responsible for:
33	Question 41 should be replaced as follows: Of the following personnel, who can administer the near distance, vision acuity examination using the reading card with Jaeger letters? a. An NDT Level II. b. The plant receptionist. c. An NDT Level III. d. The employee’s medical doctor. <u>How often should the near-vision acuity examination be administered?</u> a. <u>Semiannually.</u> b. <u>At five-year intervals.</u> c. <u>Annually.</u> d. <u>Once only, upon initial certification.</u>

The correct answer is still “c.”

35 In future printings, Question 54 will be moved under a new heading, Section 12.

52 Question 16 should be changed as follows:

~~Disadvantages of using a surface probe coil for the eddy current inspection of small diameter tubing include:~~
Which of the following is not a disadvantage of using a surface probe coil for the eddy current inspection of small-diameter tubing?

- a. Inability to detect small discontinuities.
- b. Liftoff variations effect.
- c. Inherent mechanical problems.
- d. Slow inherent speed.

Correct answer is “a.”

61 Question 22, answer “d” should be: the weld bead should be ground ~~flush with the plate surfaces~~ to remove surface irregularities.

Correct answer is still “d.”

65 In future printings, Question 7 will be moved to the section on Neutron Radiography.

76 Electromagnetic Testing, Question 16: answer should be “a.”

Magnetic Flux Leakage Testing, Question 1: answer should be “b.”

Thermal/Infrared Testing, Question 11: answer should be “b.”

Thermal/Infrared Testing, Question 18: answer should be “b.”

85 Question 2, answer “d” should be changed to: ~~Conductivity decreases at elevated temperatures.~~ The conductivity of an aluminum alloy is lower than that of pure aluminum.

Correct answer is still “d.”

Table 6.3.1 A: Recommended Initial Training and Experience Levels

Examination Method	NDT Level	Technique	Training Hours	Experience	
				Minimum Hours in Method	Total Hours in NDT
Acoustic Emission	I		40	210	400
	II		40	630	1200
Electromagnetic	I	AC Field Measurement	40	210	400
	II		40	630	1200
	I	Eddy Current	40	210	400
	II		40	630	1200
	I	Remote Field	40	210	400
	II		40	630	1200
Ground Penetrating Radar	I		8	60	120
	II		20	420	800
Guided Wave	I		40	240	460
	II		40	240	460
Laser Methods	I	Profilometry	8	70	130
	II		24	140	260
	I	Holography/ Shearography	40	210	400
	II		40	630	1200
Leak Testing	I	Bubble Testing	2	3	4
	II		4	35	65
	I	Pressure Change	24	105	200
	II		16	280	520
	I	Halogen Diode	12	105	200
	II		8	280	520
	I	Mass Spectrometer	40	280	520
	II		24	420	800
Liquid Penetrant	I		4	70	130
	II		8	140	270
Magnetic Flux Leakage	I		16	70	130
	II		12	210	400
Magnetic Particle	I		12	70	130
	II		8	210	400
Neutron Radiography	I		28	420	800
	II		40	1680	2400
Radiological	I	Radiographic	40	210	400
	II		40	630	1200
	I	Computed Radiography	40	210	400
	II		40	630	1200
	I	Computed Tomography	40	210	400
	II		40	630	1200
	I	Digital Radiography	40	210	400
	II		40	630	1200
Thermal/Infrared	I		32	210	400
	II		34	1260	1800
Ultrasonics	I		40	210	400
	II		40	630	1200
	II	Time of Flight Diffraction	40	160	N/A
	II	Phased Array	80	160	N/A
Vibration Analysis	I		24	420	800
	II		72	1680	2400
Visual	I		8	70	130
	II		16	140	270

a certification program in accordance with this document shall be considered as satisfying the criteria of Paragraph 6.2.1 and 6.3.” If documentation was not produced during such prior experience, an affidavit or other suitable testimony regarding such experience may be evaluated by the employer to aid in determining equivalence. This response applies to the 1975 edition and all prior editions of *SNT-TC-1A*.

Inquiry 76-1

Inquiry:

Table 6.2.1A contains the statement “Credit for experience may be gained simultaneously in two or more disciplines. The candidate must spend at least 25 percent of his work time on each discipline for which experience is being claimed.” Our question is this: Over what time period does the term “simultaneously” apply?

Response:

The employer’s written practice should specify the time period over which simultaneous experience shall be credited.

Inquiry 78-3

Inquiry:

With reference to the note in Table 6.2.1A, “Credit for experience may be gained simultaneously in two or more disciplines. The candidate must spend at least 25 percent of his work time on each discipline for which certification is being claimed,” is it intended that an individual being qualified in only one method could obtain the work time experience in 25 percent of the times tabulated in Table 6.2.1A?

Response:

No, an individual being qualified in only one method should spend at least 25 percent of his work time in that method and should obtain the total work time experience as recommended in consecutive months as though the remainder of his work time was spent in qualifying for other NDT methods simultaneously.

Inquiry 76-2

Inquiry:

1. For requalification of Level I and II NDT personnel, does Paragraph 6.2.1 imply that you must keep continuous records by the hour showing that the individual has continuously spent at least 25 percent of his work time working in each method to which qualified?

2. Because of the 25 percent used in the note to Table 6.2.1A, it has been implied that an individual at maximum could be qualified in only four methods and this would be true only if he could show that exactly 25 percent of his work time was spent in each of four methods. Was this the intent of *SNT-TC-1A*?

Response:

1. No. Table 6.2.1A applies only to initial experience required for qualification; it is not applicable to requalification.
2. No. The candidate may be qualified in as many methods as desired. The 25 percent work time experience only applies to the work time experience required for initial qualification in each level for each method. The 25 percent is not applicable and is not required for the individual to remain qualified in a particular method at a specific qualification level.

Inquiry 80-3

Inquiry:

A candidate spends 50 percent of his time performing radiography, 25 percent performing magnetic particle examinations, and the remaining 25 percent performing liquid penetrant examinations. At the end of a one-month period, assuming a 144-hour month, is Method A or Method B a correct computation of working time experience for certification to a Level I rating?

Method A: The candidate claims work time experience of 144 hours for each of the three methods.

Method B: The candidate claims work time experience of 72, 36 and 36 hours for radiography, magnetic particle and liquid penetrant, respectively.

Response:

... the method described in Method A is that intended by the document [*SNT-TC-1A*]. In other words, the examiner may claim full-time for all the NDT methods in which he works simultaneously. It is not intended that he claim time for work hours spent in work other than nondestructive testing.

Inquiry 80-6

Inquiry:

Table 6.2.1A for *SNT-TC-1A* provides: “credit for experience may be gained simultaneously in two or more disciplines. The candidate must spend at least 25 percent of this work time on each discipline for which experience is being claimed.” Does this statement mean (as it regards Level I PT) that if the candidate is already a qualified Level I or Level II radiographer, the one month work experience can be reduced to 44 hours?

edition of *SNT-TC-1A*, this same approach was used to divide Radiological Testing into four techniques. The table note 7.0 provides for reductions in training hours and experience based on additional RT certifications.

Magnetic Flux Leakage is shown as a separate method.

Inquiry 77-4 points to consideration given in *SNT-TC-1A* to the initial establishment of a formal qualification and certification program. Paragraph 6.2 recognizes that prior to establishing a program and a written practice, the employer may have provided training as well as other essentials of qualifying NDT personnel without formal procedures. Hence, documentation of such activities could provide evidence of the equivalence of prior activities with those recommended in *SNT-TC-1A*. Paragraphs 6.3.2.1, 6.3.2.2 and 6.3.2.3 use the phrase “in an assignment at least comparable to that of an NDT Level II.” In other words, the experience can be “comparable to that of an NDT Level II” if documentation can be produced that evidences the comparability.

Inquiries 76-1 through 79-14 and 79-15, as presented in order above, all question in one way or another the intent underlying the note in Table 6.3.1 A, “Initial experience may be gained simultaneously in two or more methods if the candidate spends a minimum of 25 percent of his work time on each method for which certification is sought.”

In the 2011 edition of *SNT-TC-1A*, Table 6.3.1 B was removed, thus eliminating the “25% rule.” Table 6.3.1 A requires that experience be accumulated by hours rather than months and both minimum and total experience hours must be satisfied. See note 6.0.

Review Questions for Section 6

Based on the foregoing discussion, answer the questions on pp. 32-33.

Section 7: Training Programs

Section 7 (p. 3) of *SNT-TC-1A* (2011) is reprinted below in full:

7.0 Training Programs

- 7.1 Personnel being considered for initial certification should complete sufficient organized training. The organized training may include instructor led training, self-study, virtual instructor led training, computer based training or web based training. Computer based training and web based training should track hours and content of training with student examinations in accordance with 7.2. The sufficiently organized training shall be such as to ensure the student is thoroughly familiar with the principles and practices of the specified NDT method related to the level of certification desired and applicable to the processes to be used and the products to be tested. All training programs should be approved by the responsible NDT Level III.

- 7.2 The training program should include sufficient examinations to ensure understanding of the necessary information.
- 7.3 Recommended training course outlines and references for NDT Levels I, II, and III personnel, which may be used as technical source material, are contained in *ANSI/ASNT CP-105: Topical Outlines for Qualification of Nondestructive Testing Personnel*.
- 7.4 The employer who purchases outside training services is responsible for ensuring that such services meet the requirements of the employer’s written practice.

Inquiries for Section 7

Inquiry 07-1

Inquiry:

Per the 2001 edition of *SNT-TC-1A*, Paragraphs 7.1, 7.2, and 9.4.4, and Tables 6.3.1A and 6.3.1B:

1. Can computer or Web-based NDT training with associated electronic quizzes be used to satisfy the training requirements described in Paragraphs 7.1 and 7.2?
2. If so, how should an employer document that training hours meet the recommended hours listed in Tables 6.3.1A and 6.3.1B so they can comply with the “satisfactory completion” requirements required by Paragraph 9.4.4?

Response:

1. See Inquiry 84-4, response 1 [in *Interpreting SNT-TC-1A*]. Inquiry 84-4 addresses home-study (correspondence) courses, but the response is appropriate for both computer and Web-based training.
2. See Inquiry 84-4, response 2.

General Comments on Section 7

In the 2006 edition of *SNT-TC-1A*, the course outlines have been moved to another publication, *ANSI/ASNT CP-105: Topical Outlines for Qualification of Nondestructive Testing Personnel*. Traditionally, both *SNT-TC-1A* and *CP-189* have published the training course outlines as part of the respective documents. By moving the outlines from *SNT-TC-1A* and *CP-189* and publishing them in *CP-105*, the problem of having two sets of outlines out of sync due to different publication dates is eliminated and provides a common set of outlines for both *SNT-TC-1A* and *CP-189*.

In the 2011 edition of *SNT-TC-1A*, paragraph 7.1 was modified to clarify the use of alternative means for training such as computer and/or Web-based training. Guidance was also included to ensure that such training provides the user with contact hours, correlation to the applicable training outline and appropriate examinations.

Section 11: Interrupted Service

Section 11 (p. 7) of *SNT-TC-1A* (2011) is reprinted below in full:

11.0 Interrupted Service

- 11.1 The employer's written practice should include rules covering the types and duration of interrupted service that requires reexamination and recertification.
- 11.2 The written practice should specify the requirements for reexamination and/or recertification for the interrupted service.

General Comments on Section 11

This section was not in editions of *SNT-TC-1A* before 2001; however, the subject of interrupted services was included in Paragraph 9.5 (Recertification) of the 1996 edition.

NOTE: There are no review questions for Section 11.

Section 12: Recertification

Section 12 (p. 7) of *SNT-TC-1A* (2011) is reprinted below in full:

12.0 Recertification

- 12.1 All levels of NDT personnel shall be recertified periodically in accordance with one of the following criteria:
 - 12.1.1 Evidence of continuing satisfactory technical performance.
 - 12.1.2 Reexamination in those portions of the examinations in Section 8 deemed necessary by the employer's NDT Level III.
- 12.2 The recommended maximum recertification intervals are 5 years for all certification levels. Certifications expire on the last day of the month of expiration.

General Comments on Section 12

This section was not in editions of *SNT-TC-1A* before 2001; however, this information was in Paragraph 9.5 (Recertification) of the 1996 edition. The only change beginning with the 2006 edition is the change in the recommended maximum certification interval to five years.

NOTE: There are no review questions for Section 12.

Inquiries for Section 12

Inquiry 03-01

Inquiry:

1. Regarding *SNT-TC-1A* (1984) Paragraph 9.7.1, what is considered proper "evidence of continuing satisfactory performance"?
2. Does this mean the certified individual shall maintain documentation of satisfactory performance?
3. How often should performance be documented?
4. *CP-189* (1991) indicates suspension should occur if duties are not performed during any consecutive 12-month period (Sec. 7.2). Is this implied in *SNT-TC-1A*?

Response:

1. Please reference Inquiry 91-4 Question 2 [in *Interpreting SNT-TC-1A*].
2. No.
3. *SNT-TC-1A* (1984) provides the user sufficient latitude under Paragraph 9.7.1 to identify specifically how they would evaluate "evidence of continuing satisfactory performance." The requirements should be documented in the employer's written practice.
4. There are no specific provisions in the 1984 *SNT-TC-1A* regarding interruption of NDT duties while continuing to work for the same employer. However, the employer must be satisfied with the proficiency of any individual at any level to handle work tasks. The employer has direct knowledge of the employee's prior performance and can best judge the need for reexamination as a function of duration of interrupted NDT service.

Inquiry 04-2

Inquiry:

1. Is it the intent of paragraph 12.1.1 that individuals who are re-certified based on "continuing satisfactory technical performance" must pass a new practical examination?
2. May a Level I or II individual be re-certified, based on "continuing satisfactory technical performance" without taking a new practical examination?

Response:

1. No. See Inquiry 91-4 Question 2 [in *Interpreting SNT-TC-1A*].
2. Yes. *SNT-TC-1A* provides the user sufficient latitude under Paragraph 9.7.1 to identify specifically how they would evaluate "evidence of continuing satisfactory performance." The requirements should be documented in the employer's written practice.

Section 5

24. In accordance with *SNT-TC-1A*, who is responsible for establishing a written practice for the control and administration of NDT personnel training, examination and certification?
- The NDT Level III.
 - The employer.
 - ASNT.
 - An appropriate regulatory authority.
25. The responsibility of each level of certification for determining the acceptability of materials or components:
- need not be described in the employer's written practice since those responsibilities are defined specifically in *SNT-TC-1A*.
 - should be described in the employer's written practice only if they are different from *SNT-TC-1A* recommendations.
 - should be described in the employer's written practice under all circumstances.
 - should be described in the employer's written practice if dictated by customer requirements.

Section 6

26. What factors are to be considered to ensure that a candidate for certification in NDT understands the principles and procedures involved?
- Training, experience and education.
 - Training, experience and prior certifications held.
 - Education, experience and percentage of time on the job doing NDT.
 - Training, experience and professional credentials.
27. As recommended in *SNT-TC-1A*, which of the following is true?
- Overtime cannot be considered in meeting the minimum experience.
 - Overtime can only be considered if the candidate is being qualified in more than one method simultaneously.
 - Overtime can be credited based on total hours.
 - SNT-TC-1A* does not currently provide a recommendation regarding overtime.

28. High school education is recommended as a minimum requirement for:
- Level III only.
 - Level II and Level III only.
 - none of the levels.
 - all three levels.
29. In Leak Testing, recommended work time experience and training:
- differs for each of four major techniques.
 - does not consider different techniques.
 - is listed for Levels II and III only.
 - is significantly greater than for Ultrasonic Testing.
30. It is recommended that the education and experience of a Level III candidate include:
- graduation from a 4-year university or college with a degree in engineering or science college or university plus 1 year's experience in NDT comparable to that of a Level II.
 - graduation from a 4-year college or university with a degree in NDT plus 3 months' experience in NDT comparable to that of a Level II.
 - 2 years' experience in NDT comparable to that of a Level II if a high school graduate.
 - 6 years' experience in NDT if the candidate did not graduate from high school.
31. Records substantiating **training and experience** for qualification are recommended to be kept on a(an):
- daily or weekly basis.
 - hourly basis.
 - fractional yearly basis.
 - fractional hourly basis.
32. For a person being qualified directly to Level II with no time at Level I, the recommended experience consists of:
- the time recommended for Level II.
 - the time recommended for Level III.
 - the sum of the times recommended for Level I and Level II.
 - not less than 6 months for any method.

33. In some cases, the training times recommended for Level I are greater than for Level II. Why?
- In preparing for qualification at Level I, the candidate should always receive more training than for Level II, regardless of the NDT method.
 - Some numbers in the table are erroneous.
 - Candidates for Level II generally have more formal education than those for Level I.
 - Some methods require more initial training at Level I because of differences in complexity and manipulative skills.
34. The recommended number of training hours in a particular method are:
- listed as a function of the candidate's education.
 - the same regardless of the candidate's education.
 - listed as a function of the candidate's experience.
 - reduced if the candidate is being qualified in more than one method simultaneously.

Section 7

35. It is recommended that a training program for qualification and certification purposes should include:
- one-on-one practical instruction by the Level III.
 - training applicable to all industries where the method is used.
 - examinations to verify that the training material has been comprehended.
 - a practical examination to verify that the training material has been comprehended.
36. Recommended training course outlines:
- are included in *CP-105* and must not be modified.
 - are included in the most recent editions of *SNT-TC-1A*.
 - are not available for visual and leak testing.
 - are included in *CP-105* for the methods listed.
37. Recommended training reference material:
- is available only through ASNT.
 - is available from a variety of sources.
 - can only include those references listed.
 - must be made available to each trainee.
38. The recommended training course outline includes:
- technical principles of the method.
 - review of API 1104 requirements.
 - review of ASTM guidelines.
 - review of interpretation requirements in ASME B31.3.

Section 8

39. In accordance with *SNT-TC-1A*, the NDT Level III **should** be responsible for:
- ensuring Level II personnel examine Level I personnel.
 - interpretation of all test results obtained by Level II personnel.
 - all questions to be used on examinations for Level I and Level II.
 - writing all company standard operating procedures.
40. Which of the following may conduct and grade examinations for Level I and Level II personnel?
- An NDT Level II.
 - A selected representative of the NDT Level III.
 - ASNT personnel because they offer examinations on a regular basis.
 - The company president.
41. **How often should the near-vision acuity examination be administered?**
- Semiannually.**
 - At five-year intervals.**
 - Annually.**
 - Once only, upon initial certification.**
42. As recommended in *SNT-TC-1A*, physical examination requirements are intended to be:
- the same for all methods.
 - the same for all employers.
 - related to each employer's specific needs.
 - as specified in applicable sections of the *ASME Boiler and Pressure Vessel Code*.

9. The penetration of eddy currents in a conductive material is decreased when the:
- test frequency or conductivity of the specimen is decreased.
 - test frequency is decreased or conductivity of the specimen is increased.
 - test frequency, conductivity of the specimen or permeability of the specimen is increased.
 - permeability of the specimen is decreased.
10. At a fixed test frequency, in which of the following materials will the eddy current penetration be greatest?
- Aluminum (35% IACS conductivity).
 - Brass (15% IACS conductivity).
 - Copper (95% IACS conductivity).
 - Lead (7% IACS conductivity).
11. A term used to describe the effect observed due to a change in the coupling between a test specimen and a flat probe coil when the distance of separation between them is varied is:
- fill factor.
 - edge effect.
 - end effect.
 - lift-off.
12. When testing with eddy currents, discontinuities will be most easily detected when the eddy currents are:
- coplanar with the major dimension of the discontinuity.
 - perpendicular to the major plane of the discontinuity.
 - parallel to the major dimension of the discontinuity.
 - 90 degrees out of phase with the current in the coil.
13. Which of the following discontinuities is easiest to detect with an eddy current test? (Assume that the area of the discontinuity is equal in all five choices listed.)
- A subsurface crack which lies parallel to the direction of the eddy current.
 - A discontinuity located in the center of a 51 mm (2 in.) diameter bar.
 - A radial crack that extends to the outer surface of a 51 mm (2 in.) diameter bar.
 - A subsurface radial crack located at a depth of 13 mm (0.5 in.) in a 51 mm (2 in.) diameter bar.
14. A term used to define the timing relationships involved in alternating current signals is:
- magnitude.
 - phase.
 - impedance.
 - time-gain correction.
15. The impedance of a test coil can be represented by the vector sum of:
- inductive reactance and resistance.
 - capacitive reactance and resistance.
 - inductive reactance and capacitive reactance.
 - inductive reactance, capacitive reactance and resistance.
16. Which of the following is not a disadvantage of using a surface probe coil for the eddy current inspection of small-diameter tubing?
- Inability to detect small discontinuities.
 - Lift-off variations effect.
 - Inherent mechanical problems.
 - Slow inherent speed.
17. The term “fill factor” applies to:
- a surface coil.
 - coaxial cable.
 - an encircling coil.
 - the ability to null an eddy current instrument.
18. Which of the following materials would be more likely used as a mounting material for a probe coil?
- Aluminum.
 - Plastic.
 - Copper.
 - Nonferromagnetic steel.
19. Which of the following is not a commonly used eddy current testing read-out mechanism?
- Signal generator.
 - Meter.
 - Cathode ray tube.
 - Strip-chart recorder.

13. Which of the following is an advantage of the dry technique over the wet technique?
- It is more sensitive for detecting fine surface cracks.
 - It is more capable of providing full surface coverage on irregularly shaped parts.
 - It is easier to use for field inspection with portable equipment.
 - It is faster when testing many small parts.
14. Fluorescent magnetic particles are used in preference to visible magnetic particles:
- when parts are big and bulky.
 - when working in the field.
 - if parts are for railroad applications.
 - to increase the speed and reliability of detecting very small discontinuities.
15. The most versatile type of magnetic particle equipment is:
- a field kit.
 - the stationary horizontal machine.
 - the mobile power unit.
 - the automatic machine.
16. Magnetic particle inspection methods are recognized as superior to liquid penetrant techniques when the:
- surfaces of the test object are corroded.
 - surface is anodized.
 - parts are painted.
 - part is made from austenitic steel.
17. When using direct current, an indication is detected. What is the next logical step to determine if the indication results from a surface or subsurface condition?
- Reinspect using the surge method.
 - Demagnetize and apply powder.
 - Reinspect at higher amperage.
 - Reinspect using alternating current.
18. A requirement to use magnetic particle testing on a part should also include:
- a fabrication and service manual.
 - a statement on the drawing that requires a magnetic particle test.
 - the procedure to be used and acceptance criteria.
 - the method of test and service conditions.
19. The statement that magnetic particle testing can be applied to plated and painted parts:
- is true regardless of the thickness of the coating.
 - may be true if flux densities are increased to compensate for the coating thickness.
 - is true only for circular magnetism.
 - is not true under any circumstances.
20. The best type of magnetizing current for inspection of fatigue cracks is:
- direct current.
 - alternating current.
 - half-wave direct current.
 - full-wave rectified direct current.
21. A star-shaped indication is seen on the cover pass of a weld. What type of discontinuity is indicated?
- Cooling crack.
 - Crater crack.
 - Slag inclusion.
 - Arc burn.
22. For maximum sensitivity in magnetic particle inspection of rough welds:
- the weld should be wire brushed to remove slag and scale.
 - standard test weldments should be used for comparison.
 - the weld bead should be coated with lacquer.
 - the weld bead should be ground to remove surface irregularities.

Answers to Review Questions

Acoustic Emission Testing

1b 2d 3d 4c 5a 6c 7a 8b 9d 10a

Electromagnetic Testing

1c 2a 3b 4c 5a 6a 7d 8c 9c 10d 11d 12b 13c 14b
 15a 16a 17c 18b 19a 20d 21d 22b 23a 24a 25b 26a 27a

Leak Testing

1d 2d 3d 4c 5c 6c 7a 8c 9b 10c

Liquid Penetrant Testing

1b 2d 3a 4d 5d 6b 7b 8a 9d 10b 11c 12b 13a 14c
 15b 16b 17a 18a 19c 20b 21c 22c 23b 24c 25b

Magnetic Flux Leakage Testing

1b 2d 3c 4c 5a 6b 7c 8c 9a 10c 11a 12d

Magnetic Particle Testing

1c 2c 3b 4c 5b 6b 7d 8b 9a 10c 11a 12c 13c 14d
 15b 16c 17d 18c 19b 20b 21b 22d

Neutron Radiographic Testing

1c 2d 3d 4d 5b 6a 7b 8d 9c 10c 11c 12c 13d 14b
 15c 16b 17b 18a 19a 20b 21a 22b 23b 24b 25c 26d 27d

Radiographic Testing

1a 2d 3b 4b 5d 6c 7c 8a 9d 10c 11c 12c 13a 14c
 15b 16d 17d 18d 19b 20b 21c 22a 23d 24c 25d 26b 27a 28c

Thermal/Infrared Testing

1b 2a 3b 4b 5d 6a 7c 8d 9b 10a 11b 12b 13a 14a
 15c 16b 17a 18b 19d 20a 21b

Ultrasonic Testing

1d 2d 3d 4c 5b 6d 7a 8b 9b 10b 11c 12c 13d 14b
 15d 16d 17a 18b 19d 20d 21a 22c 23d 24b 25b 26c 27d 28a
 29d 30b 31d 32d

Visual Testing

1b 2d 3a 4c 5c 6b 7c 8b 9b 10d 11b 12d 13b 14d
 15b 16a 17d 18a 19d

6. By which of the following processes is most of the world's steel produced?
- Bessemer converter.
 - Electric furnace.
 - Open hearth.
 - Basic oxygen.
7. An undesirable byproduct of steel-making processes is:
- coke.
 - low-carbon steel.
 - low-alloy steel.
 - slag.
8. A steel with 40 points of carbon contains:
- 40% carbon.
 - 4% carbon.
 - 0.4% carbon.
 - 0.04% carbon.
9. Low-carbon steel contains approximately:
- 0.6 to 2.5% carbon.
 - 0.06 to 0.25% carbon.
 - 0.5 to 1.6% carbon.
 - 5 to 16% carbon.
10. Corrosion-resistant steels having relatively high percentages of nickel and chromium are called:
- wrought iron.
 - low-alloy steels.
 - stainless steels.
 - nonferrous steels.
11. Austenitic stainless steels are paramagnetic; this means that:
- alternating current must be used when using the magnetic particle testing method.
 - the steel is very dense and, relative to other steels, difficult to penetrate with X-rays.
 - ultrasonics is the logical NDT method to choose because of the coarse-grained nature of a paramagnetic material.
 - the material has a very low permeability.
12. Which of the following is an advantage of cast steel over wrought steels?
- Cast steels usually have higher mechanical properties than wrought steels.
 - Cast steels have more isotropic properties than wrought steels.
 - Cast steels are more corrosion-resistant than wrought steels.
 - Cast steels cannot be heat-treated, and are thus less expensive to produce than wrought steels.

Chapter 6: "Nonferrous Metals and Plastics"

1. Which of the following nonferrous metals is the most important structural material?
- Copper alloys.
 - Nickel alloys.
 - Zinc alloys.
 - Aluminum alloys.
2. Which of the following statements is true regarding the electrical conductivity of aluminum alloys?
- Most aluminum alloys are in the range of 70% to 96% IACS.
 - Clad aluminum takes on the conductivity of the base metal.
 - Each basic wrought aluminum alloy has a conductivity distinct from any other.
 - The conductivity of an aluminum alloy is lower than that of pure aluminum.
3. The heat treatment of aluminum for the purpose of hardening and strengthening:
- is not possible with aluminum alloys because they contain no carbon and cannot undergo allotropic changes.
 - can produce tensile strengths equivalent to some carbon steels.
 - requires the use of special furnaces and is rarely done as a practical application.
 - requires that iron and carbon be alloyed for the best results.