

Thermal & Infrared Testing Method Questions & Answers Book

Supplement to
Recommended Practice No. SNT-TC-1A
Book J

Levels I, II and III
Review Questions



The American Society for
Nondestructive Testing Inc. **Documents**
Nondestructive Testing Inc. **Documents Sharing Hub**

Thermal & Infrared Testing Method Questions & Answers Book

Supplement to
Recommended Practice No. SNT-TC-1A
Book J

Levels I, II and III
Review Questions



Documents

The American Society for
Nondestructive Testing, Inc. Document Sharing Hub

Published by
The American Society for Nondestructive Testing, Inc.
1711 Arlingate Lane
PO Box 28518
Columbus, OH 43228-0518
www.asnt.org

No part of this book may be reproduced or transmitted in any form, by means electronic or mechanical including photocopying, recording, or otherwise, without the expressed prior written permission of the publisher.

Copyright © 2010 by The American Society for Nondestructive Testing, Inc. ASNT is not responsible for the authenticity or accuracy of information herein. Products or services that are advertised or mentioned do not carry the endorsement or recommendation of ASNT.

IRRSP, *NDT Handbook*, *The NDT Technician* and www.asnt.org are trademarks of The American Society for Nondestructive Testing, Inc. ACCP, ASNT, *Level III Study Guide*, *Materials Evaluation*, *Nondestructive Testing Handbook*, *Research in Nondestructive Evaluation* and *RNDE* and are registered trademarks of The American Society for Nondestructive Testing, Inc.

ASNT Mission Statement:

ASNT exists to create a safer world by promoting the profession and technologies of nondestructive testing.

ISBN-13: 978-1-57117-197-9 (print)

ISBN-13: 978-1-57117-302-7 (ebook)

Printed in the United States of America

first printing 01/10

ebook 06/13

second printing with corrections 10/13

Errata, if available for this printing, may be obtained from ASNT's web site: www.asnt.org.

Contents

Acknowledgments	iv
Recommended References	v
Reference Usage	vi
Level I Questions	1
Level II Questions	7
Level III Questions	15

Acknowledgments

Thank you to Terry Clausing, Drysdale & Associates, Inc., and Rob Spring, Snell Group, for writing and coordinating this edition of *Supplement to Recommended Practice SNT-TC-1A (Q & A Book) Infrared and Thermal Testing Method*.

Thank you also to the following contributors who assisted with the peer review of this book:

Doug Burleigh	Alberto F. Reyna
Patrick L. Cerny	Bob Rogers
Jacky C.H. Chen	Dave Ronzani
Babu S.K.	Daniel R. Ryan
Grace Liang	Dan Simon
Kathryn M. Lee	Kris Krumreich Simmons
Bernie Lyon	Jeffrey G. Thompson
Scott Miller	Raymond HO Fook Wing
Gary Orlove	Werner Yzelman
Philip Raw	John Zabita
K. Ravindran	

Cynthia M. Leeman
Educational Materials Supervisor

Recommended References

Thermal and Infrared Testing Method

The following references were used in formulating the questions contained in this book.

References

- A. Maldague, X.P.V., tech. ed., Patrick O. Moore, ed. *Nondestructive Testing Handbook*, third edition: Volume 3, *Infrared and Thermal Testing*. Columbus, OH: The American Society for Nondestructive Testing, Inc. 2001.
- B. Incropera, F.P., and David P. Dewitt. *Fundamentals of Heat and Mass Transfer*, 5th Edition. Hoboken, NJ: John Wiley & Sons. 2001.
- C. Guyer, E.C. *Handbook of Applied Thermal Design*. Philadelphia, PA: Taylor & Francis. 1999.
- D. Holman, J.P. *Experimental Methods for Engineers*. Boston, MA. McGraw-Hill. 2001.
- E. Holst, G.C. *Testing and Evaluation of Infrared Imaging Systems*. Maitland, FL. JCD Pub. Co. 1993.
- F. Kaplan, H. *ASNT LIII Study Guide: Infrared and Thermal Testing Method*. Columbus, OH. The American Society for Nondestructive Testing, Inc. 2001.
- G. ASTM C 1060, "Standard Practice for Thermographic Inspection of Insulation Installations in Envelope Cavities of Frame Buildings." *Annual Book of ASTM Standards*. West Conshohocken, PA; American Society for Testing and Materials. Most recent edition.
- H. ASTM E 1153, "Standard Test Method for Efficacy of Sanitizers Recommended for Inanimate Non-Food Contact Surfaces." *Annual Book of ASTM Standards*. West Conshohocken, PA; American Society for Testing and Materials. Most recent edition.
- I. ASTM E 2582, "Standard Practice for Infrared Flash Thermography of Composite Panels and Repair Patches Used in Aerospace Applications." *Annual Book of ASTM Standards*. West Conshohocken, PA; American Society for Testing and Materials. Most recent edition.
- J. *Recommended Practice No. SNT-TC-1A: Personnel Qualification and Certification in Nondestructive Testing*. Columbus, OH. The American Society for Nondestructive Testing, Inc. Most recent edition.

Each question found in this book contains letter(s) and page number(s) in bold type immediately following the answers. For example,

5. The first law of thermodynamics states:
 - a. energy moving into a body equals the energy leaving a body if it is at steady state
 - b. energy moves from areas of high temperature to areas of low temperature
 - c. energy moves from cooler areas to warmer areas
 - d. energy moving out of a body equals the energy transmitting through the body.

B.13

In this example, the letter "B" refers to Reference B in the list provided above and 13 is the specific page in the reference where the answer to the question can be found.

Reference Usage

Reference A: Total = 114
Level I 27
Level II 40
Level III 47

Reference B: Total = 10
Level I 2
Level II 4
Level III 4

Reference C: Total = 15
Level I 12
Level II 2
Level III 1

Reference D: Total = 8
Level I 5
Level II 2
Level III 1

Reference E: Total = 4
Level I 2
Level II 1
Level III 1

Reference F: Total = 1
Level I 0
Level II 0
Level III 1

Reference G: Total = 3
Level I 0
Level II 3
Level III 0

Reference H: Total = 3
Level I 1
Level II 2
Level III 0

Reference I: Total = 6
Level I 0
Level II 0
Level III 6

Level I Questions

Thermal and Infrared Testing Method

1. One calorie is equivalent to how much heat energy?
 - a. raising the temperature of 1 lb of water 1 °F
 - b. raising the temperature of 1 g of water 1 °C
 - c. raising the temperature of 1 lb of water 1 °C
 - d. raising the temperature of 1g of water 1 °F

A.26
2. Which of the following is incorrect?
 - a. $0\text{ }^{\circ}\text{C} = 32\text{ }^{\circ}\text{F}$
 - b. $-40\text{ }^{\circ}\text{C} = -40\text{ }^{\circ}\text{F}$
 - c. $^{\circ}\text{C} = 32 + (9/5 \times ^{\circ}\text{F})$
 - d. $100\text{ }^{\circ}\text{C} = 212\text{ }^{\circ}\text{F}$

A.27
3. Newton's Law of convective cooling states that:
 - a. the rate of heat loss is proportional to the heat capacity of the body and its surface area
 - b. the rate of cooling is inversely proportional to the temperature
 - c. the rate of heat loss is inversely proportional to the temperature of the body
 - d. the rate of heat loss of a body is proportional to the difference in temperature between the body and its fluid surroundings.

A.54
4. The second law of thermodynamics states:
 - a. energy moving into a body equals the energy leaving a body if it is at steady state
 - b. energy moves from areas of high temperature to areas of low temperature
 - c. energy moves from cooler areas to warmer areas
 - d. energy moving out of a body equals the energy transmitting through the body

D.355
5. The first law of thermodynamics states:
 - a. when energy moving into a body plus any internal energy generated equals the energy leaving a body, that body is in a steady state condition
 - b. energy moves from areas of high temperature to areas of low temperature
 - c. energy moves from cooler areas to warmer areas
 - d. energy moving out of a body equals the energy transmitting through the body.

B.13
6. Which of the following temperature scales is considered an absolute scale?
 - a. Fahrenheit
 - b. Boltzmann
 - c. Celsius
 - d. kelvin

D.356

7. Which of the following temperature scales is considered to be a relative scale?
- Rankine
 - Boltzmann
 - Celsius
 - kelvin
- D.356
8. For every degree on the Celsius temperature scale how many degrees are on the Fahrenheit scale?
- 5/9 - 32
 - 1.8
 - 32
 - 100
- D.356
9. The material property that relates to the rate that heat flows through a solid material is called:
- thermal conductivity
 - convective efficiency
 - conductive efficiency
 - emissive conductivity
- B.4
10. A micron is a unit of:
- length
 - wave amplitude
 - temperature
 - roughness
- A.33
11. A micron is a unit of measure that is:
- one thousandth of a meter
 - one thousand thousandth of an inch
 - one millionth of a meter
 - one millionth of an inch
- A.33
12. Which material below is transmissive to long wave (8-14 μm) infrared radiation?
- polyethylene film
 - glass
 - rubber
 - human skin
- A.292
13. You are inspecting an energized 440 V electrical three-phase fused disconnect. The fuse caps on the fuses are copper and appear cooler than the fuse cardboard bodies. What is probably the reason?
- the fuse caps are emitting the coolness inside themselves
 - the fuse caps are radiating less energy and reflecting the cooler room temperatures
 - the fuse bodies are actually warmer than the fuse caps
 - the fuse bodies are reflecting your body's warmth
- A.36
14. Emittance of a surface may vary with which of the following?
- thermal conductance
 - angle of view
 - thermal resistance
 - coefficient of convective heat transfer
- A.298
15. A low sloped roof is inspected in the early evening after a sunny day. Wet absorbent roof insulation appears warmer than the dry insulation because:
- the wet insulation is a better emitter of thermal radiation
 - the wet insulation is more reflective than the dry insulation
 - the dry insulation cools off slower than the wet insulation
 - the wet insulation cools off slower than the dry insulation
- A.57
16. Which of the following equations is used to calculate the amount of radiant energy emitted from a surface?
- $R + A + T = 1$
 - $Q = \sigma \epsilon T^4$
 - $\mu\text{m} = b/T$ absolute
 - $E = mc^2$
- A.38; D.9