Instructor's Manual

to Accompany

Refrigeration and Air Conditioning Technology

9th Edition

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Preface

Refrigeration and Air Conditioning Technology, 9th Edition, provides coverage of the instructional material in a practical form. Many service tips, procedures, diagnostic charts, and reference materials makes the text a valuable tool even after the students complete their training and become field technicians. This Instructor's Manual was prepared to help the instructor use the text and its supplements package. The manual also helps instructors develop either individual course materials or a complete curriculum.

Part I of the Instructor's Manual follows the unit sequence of the text. The following are included for each unit when appropriate:

- Short description of material covered in text
- Unit Objectives
- Safety Checklist
- Answers to textbook Review Questions
- Special notes to instructors for Exercises requiring malfunctioning equipment
- Answers to questions in Lab Exercises

Part II contains the Lecture Outlines; Part III contains the Correlation Guide.

ADDITIONAL SUPPLEMENTS

Video DVD Set

A seven-DVD video set addressing over 120 topics covered in the text is available. Each DVD will contain four 20-minute videos. To order the seven-DVD set, reference ISBN: 978-1-111-64451-2.

MindTap

MindTap is well beyond an eBook, a homework solution or digital supplement, a resource center website, a course delivery platform, or a Learning Management System. MindTap is a new personal learning experience that combines all your digital assets—readings, multimedia, activities, and assessments—into a singular learning path to improve student outcomes.

Instructor Site

An Instructor Companion website containing supplementary material is available. This site contains an Instructor's Manual, teaching tips, syllabus, lecture outline, an image gallery of text figures, unit presentations done in PowerPoint, Content Validation Grids, and testing powered by Cognero. ***Cengage Learning Testing Powered by Cognero is a flexible, online system that allows you to:***

- author, edit, and manage test bank content from multiple Cengage Learning solutions
- create multiple test versions in an instant
- deliver tests from your LMS, your classroom, or wherever you want

Contact Cengage Learning or your local sales representative to obtain an instructor account.

To access an Instructor Companion Website from SSO Front Door:

1. Go to http://login.cengage.com and log in using the instructor e-mail address and password.
2. Enter author, title, or ISBN in the **Add a title to your bookshelf** search.
3. Click **Add to my bookshelf** to add instructor resources.
4. At the Product page, click the **Instructor Companion site** link.

Delmar Online Training Simulation: HVAC

Delmar Online Training Simulation: HVAC is a 3D immersive simulation that offers a rich learning experience and mimics field performance. To address the critical area of Electricity, it offers a learning path from basic electrical concepts to real-world electrical troubleshooting. This innovative product includes dynamic interactive wiring diagrams in two modes: an open sand-box mode for exploration and experimentation, and a tutorial mode where the proper sequencing required for sound electrical practice is provided. Both modes are supported by an adaptive question engine. Learning electrical theory, and trying and testing sound electrical practice prepares the student for life-like, simulated exposure to faults with the HVAC equipment that follows. It also challenges learners to master diagnostic and troubleshooting skills across seven pieces of HVAC equipment found in the industry—Gas Furnace, Oil Furnace, Gas Boiler, Split Residential A/C, Commercial A/C, Heat Pumps, and Commercial Walk-in Freezers. Soft skills are also included within the Simulation.

To create successful learning outcomes, the Delmar Online Training Simulation: HVAC offers approximately 200 scenarios, which allow students to troubleshoot and build diagnostic and critical thinking skills. Two modes within the simulation promote incremental

learning: Training Mode and Challenge Mode. Training Mode has fixed scenarios to aid in familiarizing the user with the equipment, the problem needing attention, and the capabilities of the simulation. Challenge Mode has randomized scenarios within three levels: Beginner, Intermediate, and Advanced. Both modes require learners to diagnose a fault or faults and perform the repair successfully while materials and labor costs are tracked. An integrated digital badging system helps students track their progress and adds additional engagement and motivation. Simulation-based videos teach students key troubleshooting concepts as well as familiarize them with the simulation. The instructional design allows for full open engagement, so students do not have artificial guardrails leading them to a conclusion.

Combining sound instructional design with top-quality computer immersive technology, learners develop critical thinking skills and apply them to real-world customer service calls in a simulated, 3D, life-like setting. This performance simulation complements live training practice by reinforcing good habits, and even presenting scenarios that are impractical (dangerous, expensive, etc.) to create in labs or in a residence.

PART I Instructor's Guide

Unit 1

Heat, Temperature, and Pressure

This unit covers temperature, methods of measuring and transferring heat, and discussions pertaining to molecular motion, sensible heat, latent heat, and specific heat. It also discusses atmospheric pressure and test instruments such as gauges used to measure pressure.

OBJECTIVES

After studying this unit, the student should be able to:

- define temperature.
- make conversions between the Fahrenheit and Celsius scales.
- describe molecular motion at absolute zero.
- define the British thermal unit.
- describe heat flow between substances at different temperatures.
- explain the transfer of heat by conduction, convection, and radiation.
- describe sensible heat, latent heat, and specific heat and provide examples of each.
- state atmospheric pressure at sea level and explain why it varies at different elevations.
- describe the purpose and operation of a barometer.
- explain inches of Mercury, psig, and psia as they apply to pressure measurements.
- convert absolute pressures to gauge pressures and vice versa.
- convert pressure readings in inches of Mercury to absolute pressures and vice versa.

SAFETY CHECKLIST

- Heating, ventilation, air-conditioning and refrigeration technicians are often exposed to very high and very low temperatures. Be sure to wear gloves and other appropriate pieces of personal protection equipment (PPE) to reduce the chances of getting injured.
- Many fluids that are used by the HVACR technicians are under pressure. Be sure to transport all pressure vessels vertically and be sure they are properly secured.
- Make certain that all tanks are properly capped to prevent accidental releases from the tanks.
- Make certain all test instruments are properly calibrated and fully operational to ensure accurate pressure and temperature readings.
- Make certain to properly store all test instruments when not in use to prevent damage.
- Make certain all test instruments are properly calibrated and fully operational to ensure accurate pressure and temperature readings.

UNIT 1 ANSWERS TO REVIEW QUESTIONS

1. B Answer can be found in 1.1, 1.2
2. D Answer can be found in 1.2
3. A Answer can be found in 1.2
4. A Answer can be found in 1.2
5. C Answer can be found in 1.2
6. B Answer can be found in 1.3
7. D Answer can be found in 1.3
8. C Answer can be found in 1.4
9. A Answer can be found in 1.7
10. C Answer can be found in 1.8
11. B Answer can be found in 1.5
12. A Answer can be found in 1.6
13. D Answer can be found in 1.9
14. B Answer can be found in 1.12
15. A Answer can be found in 1.2
16. C Answer can be found in 1.2
17. B Answer can be found in 1.13
18. A Answer can be found in 1.13
19. D Answer can be found in 1.13
20. C Answer can be found in 1.13
21. A Answer can be found in 1.12
22. B Answer can be found in 1.3
23. C Answer can be found in 1.3
24. D Answer can be found in 1.11
25. B Answer can be found in 1.11

COMPLETED TEMPERATURE CONVERSION CHART FROM EXERCISE 1-1

(Bolded values in parentheses represent the items that were to be filled in by the student.)

Fahrenheit	Celsius	Rankine	Kelvin
(−460)	**(−273)**	0	**(0)**
32	**(0)**	**(492)**	**(273)**
(212)	100	**(672)**	**(373)**
(140)	**(60)**	600	**(333)**
(−460)	**(−273)**	**(0)**	0
200	**(93)**	**(660)**	**(366)**
(−360)	**(−218)**	100	**(55)**
(122)	50	**(582)**	**(323)**
(81)	**(27)**	**(541)**	300
(32)	0	**(492)**	**(273)**
150	**(66)**	**(610)**	**(339)**
(−410)	**(−246)**	50	**(27)**
(−40)	−40	**(420)**	**(233)**
−40	**(−40)**	**(420)**	**(233)**
212	**(100)**	**(672)**	**(373)**
(212)	**(100)**	**(672)**	373
(−460)	−273	**(0)**	**(0)**
(212)	**(100)**	672	**(373)**
5	**(−15)**	**(465)**	**(258)**
(441)	**(227)**	**(901)**	500

ANSWERS TO QUESTIONS IN EXERCISE 1-1

1. D.
2. C.
3. A.
4. A.
5. A.
6. C.

ANSWERS TO QUESTIONS IN EXERCISE 1-2

1. A.
2. C.
3. A.
4. A.
5. A.
6. C.