Plumbing

Study Guide

Assessments:
3601 Plumbing Apprentice Technician

Aligned to NCCER National Standards

Endorsed by Central Oklahoma
Winnelson & Bemac Supply

Overview

This study guide is designed to help students prepare for the Plumbing Apprentice Technician assessment. It includes information about the assessment, the skill standards upon which the assessment is based, resources that can be used to prepare for the assessment, and test taking strategies.

Each of the four sections in this guide provides useful information for students preparing for the Plumbing Apprentice Technician assessment.

- CareerTech and Competency-Based Education: A Winning Combination
- Plumbing Apprentice Technician assessment
  - Assessment Information
  - Standards and Test Content
  - Sample Questions
  - Textbook/Curriculum Crosswalk
  - Abbreviations, Symbols, and Acronyms
- Strategies for Test Taking Success
- Notes

This assessment was developed and aligned with the National Center for Construction Education and Research (NCCER) Plumbing modules. NCCER develops standardized construction and maintenance curricula and assessments with portable credentials

The Plumbing Apprentice Technician assessment measures a student's ability to apply knowledge and skills in a plumbing career.

This study guide is endorsed by Central Oklahoma Winnelson (COW) and Bemac Supply. Central Oklahoma Winnelson (COW) is a wholesale plumbing company that has served the Oklahoma plumbing industry for over forty years. Acquired by Winsupply in 2000, COW is now part of the Winsupply of Companies that has over 550 locations nationwide. Bemac Supply is Southeast Oklahoma's leading plumbing and HVAC supplier, with locations in McAlester, Durant, Ada, and Idabel. Family-owned by the Ettner family for three generations, Bemac Supply has served McAlester and the surrounding region for over 75 years

CareerTech and Competency-Based Education: A Winning Combination

Competency-based education uses learning outcomes that emphasize both the application and creation of knowledge and the mastery of skills critical for success. In a competency-based education system, students advance upon mastery of competencies, which are measurable, transferable outcomes that empower students.

Career and technology education uses industry professionals and certification standards to identify the knowledge and skills needed to master an occupation. This input provides the foundation for development of curriculum, assessments and other instructional materials needed to prepare students for wealth-generating occupations and produce comprehensively trained, highly skilled employees demanded by the work force.

Tools for Success

CareerTech education relies on three basic instructional components to deliver competency-based instruction: skills standards, curriculum materials, and competency assessments.

Skills standards provide the foundation for competency-based instruction and outline the knowledge and skills that must be mastered in order to perform related jobs within an industry. Skills standards are aligned with national skills standards and/or industry certification requirements; therefore, a student trained to the skills standards is equally employable in local, state and national job markets.

Curriculum materials and textbooks contain information and activities that teach students the knowledge and skills outlined in the skills standards. In addition to complementing classroom instruction, curriculum resources include supplemental activities that enhance learning by providing opportunities to apply knowledge and demonstrate skills.

Certification Assessments test the student over material outlined in the skills standards and taught using the curriculum materials and textbooks. When used with classroom performance evaluations, written certification assessments provide a means of measuring occupational readiness.

Each of these components satisfies a unique purpose in competency-based education and reinforces the knowledge and skills students need to gain employment and succeed on the job.

Measuring Success

Evaluation is an important component of competency-based education. Pre-training assessments measure the student's existing knowledge prior to receiving instruction and ensure the student's training builds upon this knowledge base. Formative assessments administered throughout the training process provide a means of continuously monitoring the student's progress towards mastery.

Certification assessments provide a means of evaluating the student's mastery of knowledge and skills. Coaching reports communicate assessment scores to students and provide a breakdown of assessment results by standard area. The coaching report also shows how well the student has mastered skills needed to perform major job functions and identifies areas of job responsibility that may require additional instruction and/or training.

Plumbing Apprentice Technician Assessment Information

What is the Plumbing Apprentice Technician assessment?

The Plumbing Apprentice Technician assessment is an end-of-program assessment for students in a plumbing-related program. The assessment provides an indication of student mastery of basic knowledge and skills necessary for success in careers in plumbing.

How was the assessment developed?

The assessment was developed by the CareerTech Testing Center in alignment with NCCER National Craft Assessment and Certification Program Specifications. A committee of industry representatives and educators validated the modules covered on the assessment. The assessment content was developed and reviewed by a committee of subject matter experts.

Frequency: represents how often the task is performed on the job. Frequency rating scales vary for different occupations. The rating scale used in this publication is presented below:

1 = less than once a week 2 = at least once a week 3 = once or more a day

Criticality: denotes the level of consequence associated with performing a task incorrectly. The rating scale used in this publication is presented below:

1 = slight 2 = moderate 3 = extreme

What does the assessment cover?

Specifically, the test includes 70 multiple-choice test items over the following areas:

Introduction to the Plumbing Profession	3%	Steel Pipe & Fittings	6%
Plumbing Safety	7%	Identify, Install, & Service Fixtures and Valves	16%
Plumbing Tools	6%	Identify, Install, & Test Roof, Floor, Drains, & DWV Systems	17%
Plumbing Math Calculations	7%	Introduction to Water Distribution systems	1%
Read & Interpret Plumbing Drawings	7%	Install & Test Water Supply Piping	6%
Plastic Pipe & Fittings	6%	Install Water Heaters	1%
Copper Pipe & Fittings	7%	Fuel Gas & Oil Systems	6%
Cast-Iron Pipe & Fittings	4%		

What are the benefits of using the assessment?

Students receive a certificate for the assessment they pass. This certificate may be included in the student's portfolio and used to communicate the student's mastery of the subject matter to potential employers.

When should the assessment be taken?

The CareerTech Testing Center recommends that students take this assessment as soon as possible after receiving all standards-related instruction, rather than waiting until the end of the school year.

Is the assessment timed?

No. However, most finish the assessment within one hour.

Can students use a calculator on the assessment?

Students are allowed to use calculators and scratch paper on CTTC assessments; however, these items must be provided by the testing proctor and returned to the proctor before the student's exam is submitted for scoring. Calculator apps and cell phones and other devices may not be used on these assessments.

What accommodations can be made for students with Individualized Education Plans (IEPs)?

Accommodations are allowed for students with an Individualized Education Plan. Examples of allowable accommodations include:

- Extended time — This assessment is not timed; therefore, students may take as much time as needed to finish. The assessment must be completed in one testing session.
- Readers — A reader may be used to read the assessment to a student who has been identified as needing this accommodation.
- Enlarged text — Students needing this accommodation can activate this feature by clicking the AA icon in the upper right corner of the screen.

What can students expect on Test Day?

All CTTC assessments are web-based and delivered exclusively by a proctor in the school's assessment center. The proctor cannot be an instructor or anyone who was involved with the students during instruction.

Assessments are delivered in a question-by-question format. When a question is presented, the student can select a response or leave the question unanswered and advance to the next question. Students may also flag questions to revisit before the test is scored. All questions must be answered before the test can be submitted for scoring.

After the assessment is scored, the student will receive a score report that shows the student's score on the assessment and how the student performed in each standard area.

Can students retake the test?

Students may retake the test unless their school or state testing policies prohibit retesting. Students who can retest must wait at least three days between test attempts.

Standards and Test Content

Duty A: Introduction to the Plumbing Profession (2 questions)

CODE	TASK	F	C
A.01	Describe the history of the plumbing profession.	1	1
A.02	Identify the responsibilities of a person working in the construction industry.	2	3
A.03	State the personal characteristics of a professional.	1	1
A.04	Identify the stages of progress within the plumbing profession and its positive impact on society.	2	2
A.05	Demonstrate knowledge of state and local laws, rules, and statutes applicable to the plumbing profession.	3	3
A.06	Identify how green technology is incorporated into plumbing	1	1

Duty B: Plumbing Safety (5 questions)

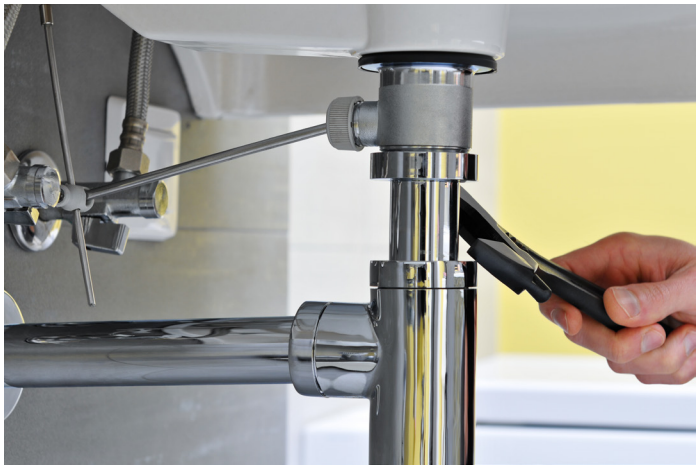
CODE	TASK	F	C
B.01	Describe the common unsafe acts and unsafe conditions that cause accidents.	2	3
B.02	Describe how to handle unsafe acts and unsafe conditions.	2	3
B.03	Explain how the cost of accidents and illnesses affects everyone on site.	1	1
B.04	Demonstrate the use and care of appropriate personal protective equipment.	2	3
B.05	Identify job-site hazardous work specific to plum	2	2
B.06	Demonstrate the proper use of ladders and scaffolds.	2	3
B.07	Demonstrate how to maintain power tools safely.	1	1
B.08	Explain how to work safely in and around confined spaces.	1	1
B.09	Explain how to work safely in and around a trench.	2	3
B.10	Describe and demonstrate knowledge of the Occupational Safety and Health Act (OSHA).	3	3

Duty C: Tools of the Plumbing Trade (4 questions)

CODE	TASK	F	C
C.01	Identify the basic hand and power tools used in the plumbing trade.	3	3
C.02	Demonstrate the proper use of plumbing tools.	2	2
C.03	Demonstrate the ability to know when and how to select the proper tool(s) for tasks.	3	3
C.04	Demonstrate the proper maintenance for caring for hand and power tools.	2	3
C.05	Describe the safety requirements for using plumbing tools.	3	3

Duty D: Plumbing Math Calculations (5 questions)

CODE	TASK	F	C
D.01	Add, subtract, multiply, and divide whole numbers	1	1
D.02	Add, subtract, multiply, and divide fractions	2	3
D.03	Add, subtract, multiply, and divide decimals	1	1
D.04	Convert decimals to percentages and percentages to decimals	1	1
D.05	Convert fractions to decimals and decimals to fractions	1	1
D.06	Recognize some of the basic shapes used in the construction industry, and apply basic geometry to measure them	2	3
D.07	Explain what the metric system is and how it is important in the plumbing trade	1	1
D.08	Recognize and use metric units of length, weight, volume, and temperature	1	1
D.09	Square various numbers and take square roots of numbers, with and without a calculator	1	1
D.10	Identify the parts of a fitting and use common pipe measuring techniques	2	3
D.11	Use fitting dimension tables to determine fitting allowances and thread makeup	2	3
D.12	Calculate end-to-end measurements using fitting allowances and thread makeup	2	3
D.13	Lay out square corners using the 3-4-5 method	1	1
D.14	Use a folding rule to find given angles	2	2
D.15	Calculate 22-1/2°, 45°, and 90° simple offsets	1	1
D.16	Calculate 22-1/2°, 45°, and 90° parallel offsets	2	3
D.17	Calculate rolling offsets using constants for the angled fittings	1	1
D.18	Use a calculator to find a square root	1	1
D.19	Calculate rolling offsets using a framing square	1	1
D.20	Calculate 45° offsets around obstruct	1	1



Duty E: Read and Interpret Plumbing Drawings (5 questions)

CODE	TASK	F	C
E.01	Identify pictorial (isometric and oblique), schematic, and orthographic drawings, and discuss how different views are used to depict information about objects.	2	2
E.02	Identify the basic symbols used in schematic drawings of pipe assemblies.	3	3
E.03	Explain the types of drawings that may be included in a set of plumbing drawings and the relationship among the different drawings.	2	3
E.04	Interpret plumbing-related information from a set of plumbing drawings	1	1
E.05	Sketch orthographic and schematic drawings.	1	1
E.06	Use an architect's scale to draw lines to scale and to measure lines drawn to scale.	3	3
E.07	Discuss how code requirements apply to certain drawings.	2	2
E.08	Interpret information from given site plans.	2	2
E.09	Verify dimensions shown on drawings and generate a Request for Information when you find discrepancies.	1	1
E.10	Locate plumbing entry points, walls, and chases.	2	2
E.11	Create an isometric drawing.	1	1
E.12	Perform a material takeoff for DWV and water supply systems from information shown on drawings.	2	3
E.13	Use cut sheets and floor plans to lay out fixture rough-ins.	1	1

Duty F: Plastic Pipe and Fittings (4 questions)

CODE	TASK	F	C
F.01	Identify types of materials and schedules of plastic piping.	2	3
F.02	Identify proper and improper applications of plastic piping.	2	2
F.03	Identify types of fittings and valves used with plastic piping.	2	2
F.04	Identify the various techniques used in hanging and supporting plastic piping.	3	3
F.05	Properly measure, cut, and join plastic piping.	3	3
F.06	Explain proper procedures for the handling, storage, and protection of plastic pipes	2	2

Duty G: Copper Pipe and Fittings (5 questions)

CODE	TASK	F	C
G.01	Identify the types of materials and schedules used with copper piping.	2	3
G.02	Identify the material properties, storage, and handling requirements of copper piping.	2	3
G.03	Identify the types of fittings and valves used with copper piping.	2	2
G.04	Identify the techniques used in hanging and supporting copper piping.	3	3
G.05	Properly measure, ream, cut, and join copper piping.	3	3
G.06	Identify the hazards and safety precautions associated with copper piping.	3	3

Duty H: Cast-Iron Pipe and Fittings (3 questions)

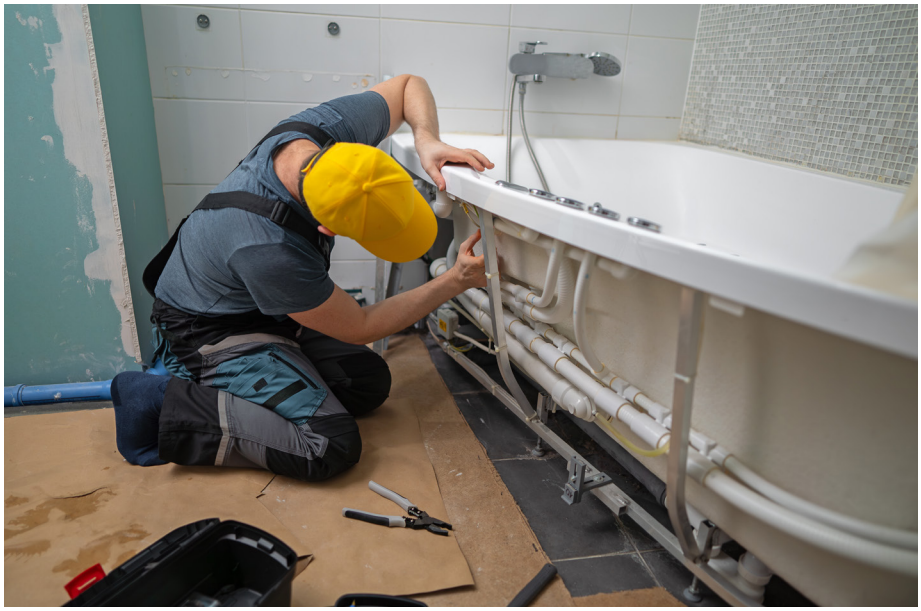
CODE	TASK	F	C
H.01	Identify the material properties, storage, and handling requirements of cast iron piping.	2	3
H.02	Identify the types of materials and schedules used in cast-iron piping.	1	1
H.03	Identify the types of fittings used with cast-iron piping.	2	3
H.04	Identify the various techniques used in handling and supporting cast-iron piping.	3	3
H.05	Properly measure, cut, and join cast-iron piping.	2	2
H.06	Identify the hazards and safety precautions associated with cast-iron piping	2	2

Duty I: Steel Pipe and Fittings (4 questions)

CODE	TASK	F	C
I.01	Recognize proper applications of steel pipe.	2	2
I.02	Identify the types of fittings and valves used with steel pipe.	1	1
I.03	Identify the various techniques used in hanging and supporting steel pipe.	3	3
I.04	Identify the material properties, storage, and handling requirements of steel pipe.	2	3
I.05	Properly measure, cut, groove, thread, and join steel pipe.	3	3
I.06	Identify the hazards and safety precautions associated with steel pipe.	1	1

Duty J: Identify, Install, and Service Fixtures and Valves (11 questions)

CODE	TASK	F	C
J.01	Identify the basic types of materials used in the manufacture of plumbing fixtures.	1	1
J.02	Discuss common types of sinks, lavatories, and faucets.	1	1
J.03	Identify and discuss common types of bathtubs, bath-shower modules, shower stalls, and shower baths.	1	1
J.04	Discuss common types of toilets, urinals, and bidets.	3	3
J.05	Identify and describe common types of drinking fountains and water coolers.	3	3
J.06	Discuss common types of appliances such as garbage disposals and domestic dishwashers.	3	3
J.07	Identify the basic types of valves.	1	1
J.08	Select a valve for a specific application based on pressure ratings, materials, and sizing requirements.	1	1
J.09	Demonstrate the ability to install and service various types of valves.	2	2
J.10	Identify the pre-installation techniques to follow when installing fixtures and valves.	2	3
J.11	Demonstrate the ability to install bathtubs, shower stalls, valves, and faucets.	2	3
J.12	Demonstrate the ability to install water closets and urinals.	3	3
J.13	Demonstrate the ability to install lavatories, sinks, and pop-up drains.	3	3
J.14	Demonstrate how to test and protect fixtures.	3	3
J.15	Identify common repair and maintenance requirements for piping systems, fixtures, and appliances.	1	1
J.16	Identify the proper procedures for repairing and maintaining piping systems, fixtures, and appliances.	3	3



Duty K: Identify, Install & Test Roof, Floor, Drains, & DWV System (12 questions)

CODE	TASK	F	C
K.01	Explain how waste moves from a fixture through the drain system to the environment.	1	1
K.02	Identify the major components of a drainage system and describe their functions.	3	3
K.03	Identify the different types of traps and their components, explain the importance of traps, and identify the ways that traps can lose their seals.	2	2
K.04	Identify the various types of DWV fittings and describe their applications.	3	3
K.05	Identify significant code and health issues, violations, and consequences related to DWV systems.	3	3
K.06	Develop a material takeoff from a given set of plans.	3	3
K.07	Use plans and fixture rough-in sheets to determine location of fixtures and route of the plumbing.	2	3
K.08	Demonstrate the ability to install a building sewer and drain.	2	3
K.09	Locate the stack within the structure.	1	1
K.10	Demonstrate the ability to install a DWV system using appropriate hangers and correct grade.	1	1
K.11	Demonstrate the ability to modify structural members using the appropriate tools without weakening the structure.	2	3
K.12	Demonstrate the ability to test a DWV system.	3	3
K.13	Use a builder's level, transit level, or a laser level to set the elevation of a floor or area drain.	3	3
K.14	Install a roof, floor, and area drain.	3	3
K.15	Install waterproof membranes and flashing for a shower pan.	3	3

Duty L: Introduction to Water Distribution Services (1 question)

CODE	TASK	F	C
L.01	Describe the process by which water is distributed in municipal, residential, and private water systems.	1	1
L.02	Identify the major components of a water distribution system, and describe the function of each component.	2	2
L.03	Explain the relationships between components of a water distribution system	2	2

Duty M: Install and Test Water Supply Piping (4 questions)

CODE	TASK	F	C
M.01	Develop a material takeoff from a given set of plans.	2	3
M.02	Use plans and fixture rough-in sheets to determine the location of fixtures and the route of the water supply piping.	2	3
M.03	Demonstrate the ability to locate and size a water meter.	2	2
M.04	Demonstrate the ability to locate a water heater, water softener, and hose bibbs.	1	1
M.05	Demonstrate the ability to install a water distribution system using appropriate hangers.	1	1
M.06	Demonstrate the ability to safely size and install a water service line and provide for water hammer protection.	2	3
M.07	Demonstrate the ability to test a water supply system.	3	3
M.08	Demonstrate the ability to insulate pipe and to protect it from freezing.	2	3

Duty N: Install Water Heaters (1 question)

CODE	TASK	F	C
N.01	Describe the basic operation of water heaters.	1	1
N.02	Identify and explain the functions of the basic components of water heaters.	2	2
N.03	Install various types water heaters.	1	1
N.04	Describe the safety hazards associated with water heaters.	2	2

Duty O: Fuel Gas and Oil Systems (4 questions)

CODE	TASK	F	C
O.01	Identify the major components of the following fuel systems and describe the function of each component: • Natural gas • LPG • Fuel oil	3	3
O.02	Identify the physical properties of each type of fuel.	2	2
O.03	Identify the safety precautions and potential hazards associated with each type of fuel and system.	3	3
O.04	Properly connect appliances to the fuel gas system.	2	3
O.05	Apply local codes to various fuel gas systems.	2	2
O.06	Design, size, purge, and test fuel gas systems.	3	3

Sample Questions

_____ 1. How many 2" pipes are required to equal the volume capacity of a 6" pipe?

a. 2
b. 5
c. 7
d. 9

_____ 2. Dielectric unions are used to _____.

a. ground metallic pipe
b. connect plastic to copper pipe
c. prevent shocks
d. prevent corrosion

_____ 3. When using a fitting, how many hand turns are allowed on a piece of black iron pipe if it has properly cut threads?

a. 1 ½
b. 2 ½
c. 3 ½
d. 4 ½

_____ 4. The NPS refers to _____.

a. nominal thread taper
b. pipe size
c. threads per inch
d. wall thickness

_____ 5. Which federal agency determines the standards for indoor air quality?

a. ASHRAE
b. DOT
c. EPA
d. SMACNA

_____ 6. Compressed oxygen and acetylene cylinders should be stored in a(n) _____.

a. horizontal position
b. area separated by a concrete wall
c. common area
d. unchained rack

_____ 7. Using a 1/4" scale, 1/8 represents _____.

a. 6"
b. 8"
c. 1'
d. 8'

_____ 8. According to Table 308.5 of the IPC, the recommended horizontal spacing of ABS pipe is every _____.

a. 4'
b. 5'
c. 10'
d. 12'

_____ 9. According to Section 303 of the IPC, what materials require third-party testing?

a. backflow prevention devices
b. plumbing appliances
c. plumbing fixtures
d. water distribution system safety devices

Sample Questions — Key

1. How many 2" pipes are required to equal the volume capacity of a 6" pipe?

   a. 2 — Wrong, but plausible
   b. 5 — Wrong, but plausible
   c. 7 — Wrong, but plausible
   d. 9 — Correct

2. Dielectric unions are used to _____.

   a. ground metallic pipe — Incorrect by definition
   b. connect plastic to copper pipe — Incorrect by definition
   c. prevent shocks — Incorrect by definition
   d. prevent corrosion — Correct

3. When using a fitting, how many hand turns are allowed on a piece of black iron pipe if it has properly cut threads?

   a. 1 ½ — Wrong, but plausible
   b. 2 ½ — Wrong, but plausible
   c. 3 ½ — Correct
   d. 4 ½ — Wrong, but plausible

4. The NPS refers to _____.

   a. nominal thread taper — Incorrect by definition
   b. pipe size — Correct
   c. threads per inch — Incorrect by definition
   d. wall thickness — Incorrect by definition

5. Which federal agency determines the standards for indoor air quality?

   a. ASHRAE — Correct
   b. DOT — Incorrect by definition
   c. EPA — Incorrect by definition
   d. SMACNA — Incorrect by definition

6. Compressed oxygen and acetylene cylinders should be stored in a(n) _____.

a.	horizontal position	Wrong, but plausible
b.	area separated by a concrete wall	Correct
c.	common area	Wrong, but plausible
d.	unchained rack	Wrong, but plausible

7. Using a 1/4" scale, 1/8 represents _____.

a.	6"	Correct
b.	8"	Wrong, but plausible
c.	1'	Wrong, but plausible
d.	8'	Wrong, but plausible

8. According to Table 308.5 of the IPC, the recommended horizontal spacing of ABS pipe is every _____.

a.	4'	Correct
b.	5'	Wrong, but plausible
c.	10'	Wrong, but plausible
d.	12'	Wrong, but plausible

9. According to Section 303 of the IPC, what materials require third-party testing?

a.	backflow prevention devices	Requires certification
b.	plumbing appliances	Requires certification
c.	plumbing fixtures	Correct
d.	water distribution system safety devices	Requires certification

Curricula Crosswalk

Crosswalk to National Center for Construction Education and Research Modules and Multistate Academic and Vocational Curriculum Consortium (MAVCC) Curriculum Residential Plumbing

The following crosswalk is intended for guidance purposes only. It does not represent all curricula or resource materials that may be used for plumbing programs. It is intended as a reference for curriculum planning and mapping the standards to available curricula.

Curriculum/Resource Titles:

1) MAVCC – Residential Plumbing
2) NCCER – Plumbing Level 1
3) NCCER – Plumbing Level 2
4) NCCER – Plumbing Level 4

For more information about MAVCC or CIMC curricula, please go to **www.okcimc.com**.

Module Name — Objective	Unit/Module
Introduction to the Plumbing Profession	1) Unit 1, 4 2) Module 02101
1. Describe the history of the plumbing profession	2) Module 02101
2. Identify the responsibilities of a person working in the construction industry	2) Module 02101
3. State the personal characteristics of a professional	1) 1A 2) Module 02101
4. Identify the stages of progress within the plumbing profession and its positive impact on society	2) Module 02101
5. Demonstrate knowledge of state and local laws, rules, and statutes applicable to the plumbing profession	1) 4C 2) Module 02101
6. Identify how green technology is incorporated into plumbing	2) Module 02101
Plumbing Safety	1) Unit 3 2) Module 02102
1. Describe the common unsafe acts and unsafe conditions that cause accidents	1) Unit 3A 2) Module 02102
2. Describe how to handle unsafe acts and unsafe conditions	1) Unit 3A 2) Module 02102
3. Explain how the cost of accidents and illnesses affects everyone on site	2) Module 02102
4. Demonstrate the use and care of appropriate personal protective equipment	1) Unit 3A 2) Module 02102
5. Identify job-site hazardous work specific to plumbers	1) Unit 3A 2) Module 02102

Module Name — Objective	Unit/Module
6. Demonstrate the proper use of ladders and scaffolds	2) Module 02102
7. Demonstrate how to maintain power tools safely	2) Module 02102
8. Explain how to work safely in and around confined spaces	2) Module 02102
9. Explain how to work safely in and around a trench	2) Module 02102
10. Describe and demonstrate knowledge of the Occupational Safety and Health Act (OSHA)	1) Unit 3A 2) Module 02102
Tools of the Plumbing Trade	1) Unit 1, 2 2) Module 02103
1. Identify the basic hand and power tools used in the plumbing trade	1) Unit 1B, 2B 2) Module 02103
2. Demonstrate the proper use of plumbing tools	1) Unit 1B, 2B 2) Module 02103
3. Demonstrate the ability to know when and how to select the proper tool(s) for tasks	1) Unit 1B, 2B 2) Module 02103
4. Demonstrate the proper maintenance for caring for hand and power tools	1) Unit 1B, 2B 2) Module 02103
5. Describe the safety requirements for using plumbing tools	1) Unit 1B, 2B 2) Module 02103
Plumbing Math Calculations	1) Unit 1, 5 2) Module 02104 3) Module 02201
1. Add, subtract, multiply, and divide whole numbers	2) Module 02104
2. Add, subtract, multiply, and divide fractions	1) Unit 1C 2) Module 02104
3. Add, subtract, multiply, and divide decimals	1) Unit 1C 2) Module 02104
4. Convert decimals to percentages and percentages to decimals	1) Unit 1C 2) Module 02104
5. Convert fractions to decimals and decimals to fractions	1) Unit 1C 2) Module 02104
6. Recognize some of the basic shapes used in the construction industry, and apply basic geometry to measure them	1) Unit 1C 2) Module 02104
7. Explain what the metric system is and how it is important in the plumbing trade	1) Unit 5C 2) Module 02104
8. Recognize and use metric units of length, weight, volume, and temperature	1) Unit 5C 2) Module 02104
9. Square various numbers and take square roots of numbers, with and without a calculator	2) Module 02104
10. Identify the parts of a fitting and use common pipe-measuring techniques	1) Unit 5C 2) Module 02104
11. Use fitting dimension tables to determine fitting allowances and thread makeup	1) Unit 5C 2) Module 02104

Module Name — Objective	Unit/Module
12. Calculate end-to-end measurements using fitting allowances and thread makeup	1) Unit 5C 2) Module 02104
13. Lay out square corners using the 3-4-5 method	2) Module 02201
14. Use a folding rule to find given angles	1) Unit 1C 2) Module 02201
15. Calculate 22-1/2°, 45°, and 90° simple offsets	2) Module 02201
16. Calculate 22-1/2°, 45°, and 90° parallel offsets	2) Module 02201
17. Calculate rolling offsets using constants for the angled fittings	2) Module 02201
18. Use a calculator to find a square root	2) Module 02201
19. Calculate rolling offsets using a framing square	2) Module 02201
20. Calculate 45° offsets around obstructions	2) Module 02201
Read and Interpret Plumbing Drawings	1) Unit 1, 2, 3 2) Module 02105 3) Module 02202
1. Identify pictorial (isometric and oblique), schematic, and orthographic drawings, and discuss how different views are used to depict information about objects	1) Unit 1C, 2C 2) Module 02105
2. Identify the basic symbols used in schematic drawings of pipe assemblies	1) Unit 1C, 2C 2) Module 02105
3. Explain the types of drawings that may be included in a set of plumbing drawings and the relationship among the different drawings	1) Unit 1C, 2C 2) Module 02105
4. Interpret plumbing-related information from a set of plumbing drawings	2) Module 02105
5. Sketch orthographic and schematic drawings	2) Module 02105
6. Use an architect's scale to draw lines to scale and to measure lines drawn to scale	1) Unit 1C, 2C 2) Module 02105
7. Discuss how code requirements apply to certain drawings	2) Module 02105
8. Interpret information from given site plans	3) Module 02202
9. Verify dimensions shown on drawings and generate a Request for Information when you find discrepancies	3) Module 02202
10. Locate plumbing entry points, walls, and chases	3) Module 02202
11. Create an isometric drawing	1) Unit 2C 3) Module 02202
12. Perform a material takeoff for DWV and water supply systems from information shown on drawings	1) Unit 1C 3) Module 02202
13. Use cut sheets and floor plans to lay out fixture rough-ins	1) Unit 3C 3) Module 02202
Plastic Pipe and Fittings	1) Unit 1, 2, 3, 4, 5 2) Module 02106
1. Identify types of materials and schedules of plastic piping	2) Module 02106
2. Identify proper and improper applications of plastic piping	1) Unit 5D 2) Module 02106

Module Name — Objective	Unit/Module
3. Identify types of fittings and valves used with plastic piping	1) Unit 3D, 4D 2) Module 02106
4. Identify the various techniques used in hanging and supporting plastic piping	1) Unit 1D, 3D 2) Module 02106
5. Properly measure, cut, and join plastic piping	1) Unit 3D 2) Module 02106
6. Explain proper procedures for the handling, storage, and protection of plastic pipes	1) Unit 2D 2) Module 02106
Copper Pipe and Fittings	1) Unit 1, 3, 4 2) Module 02107
1. Identify the types of materials & schedules used with copper piping	1) Unit 3D 2) Module 02107
2. Identify the material properties, storage, and handling requirements of copper piping	2) Module 02107
3. Identify the types of fittings and valves used with copper piping	1) Unit 3D, 4D 2) Module 02107
4. Identify techniques used in hanging & supporting copper pipe	1) Unit 1D, 4D 2) Module 02107
5. Properly measure, ream, cut, and join copper piping	1) Unit 3D 2) Module 02107
6. Identify the hazards & safety precautions associated with copper piping	2) Module 02107
Cast-Iron Pipe and Fittings	1) Unit 5D 2) Module 02108
1. Identify the material properties, storage, and handling requirements of cast iron piping	1) Unit 3D 2) Module 02108
2. Identify the types of materials and schedules used in cast-iron piping	1) Unit 3D 2) Module 02108
3. Identify the types of fittings used with cast-iron piping	1) Unit 3D, 4D 2) Module 02108
4. Identify the various techniques used in handling and supporting cast-iron piping	1) Unit 1D 2) Module 02108
5. Properly measure, cut, and join cast-iron piping	1) Unit 3D, 4D 2) Module 02108
6. Identify the hazards and safety precautions associated with cast-iron piping	2) Module 02108
Steel Pipe and Fittings	1) Unit 1, 2, 3, 4, 5 2) Module 02109
1. Recognize proper applications of steel pipe	1) Unit 3D, 5D 2) Module 02109
2. Identify the types of fittings and valves used with steel pipe	1) Unit 3D, 5D 2) Module 02109
3. Identify the various techniques used in hanging and supporting steel pipe	1) Unit 1D 2) Module 02109

Module Name — Objective	Unit/Module
4. Identify the material properties, storage, and handling requirements of steel pipe	1) Unit 4D 2) Module 02109
5. Properly measure, cut, groove, thread, and join steel pipe	1) Unit 3D 2) Module 02109
6. Identify the hazards and safety precautions associated with steel pipe	2) Module 02109
Identify, Install, and Service Fixtures and Valves	1) Unit 1, 2, 3 2) Module 02110 3) Module 02207, 02208 5) Module 02407
1. Identify the basic types of materials used in the manufacture of plumbing fixtures	2) Module 02110
2. Discuss common types of sinks, lavatories, and faucets	1) Unit 3F 2) Module 02110
3. Identify and discuss common types of bathtubs, bath-shower modules, shower stalls, and shower baths	2) Module 02110
4. Discuss common types of toilets, urinals, and bidets	2) Module 02110
5. Identify and describe common types of drinking fountains and water coolers	2) Module 02110
6. Discuss common types of appliances such as garbage disposals and domestic dishwashers	2) Module 02110
7. Identify the basic types of valves	1) Unit 2D 3) Module 02207
8. Select a valve for a specific application based on pressure ratings, materials, and sizing requirements	1) Unit 2D 3) Module 02207
9. Demonstrate the ability to install and service various types of valves	3) Module 02207
10. Identify the pre-installation techniques to follow when installing fixtures and valves	1) Unit 3F 3) Module 02208
11. Demonstrate the ability to install bathtubs, shower stalls, valves, and faucets	1) Unit 3F 3) Module 02208
12. Demonstrate the ability to install water closets and urinals	1) Unit 1F, 3F 3) Module 02208
13. Demonstrate the ability to install lavatories, sinks, and pop-up drains	1) Unit 3F 3) Module 02208
14. Demonstrate how to test and protect fixtures	1) Unit 3F 3) Module 02208
15. Identify common repair and maintenance requirements for piping systems, fixtures, and appliances	5) Module 02407
16. Identify the proper procedures for repairing and maintaining piping systems, fixtures, and appliances	1) Unit 1F, 2G 5) Module 02407

Module Name — Objective	Unit/Module
Identify, Install & Test Roof, Floor, Drains & DWV Systems	1) Unit 1, 2, 3, 4, 5 2) Module 02112 3) Module 02204, 02205
1. Explain how waste moves from a fixture through the drain system to the environment	1) Unit 1D 2) Module 02112
2. Identify the major components of a drainage system and describe their functions	1) Unit 1D, 3F, 4C 2) Module 02112
3. Identify the different types of traps and their components, explain the importance of traps, and identify the ways that traps can lose their seals	1) Unit 2F 2) Module 02112
4. Identify the various types of DWV fittings and describe their applications	1) Unit 1F, 3D, 3F 2) Module 02112
5. Identify significant code and health issues, violations, and consequences related to DWV systems	1) Unit 1D, 1F, 3E, 3F, 4C 2) Module 02112
6. Develop a material takeoff from a given set of plans	1) Unit 5D 3) Module 02204
7. Use plans and fixture rough-in sheets to determine location of fixtures and route of the plumbing	1) Unit 3C 3) Module 02204
8. Demonstrate the ability to install a building sewer and drain	1) Unit 1D 3) Module 02204
9. Locate the stack within the structure	1) Unit 1D 3) Module 02204
10. Demonstrate the ability to install a DWV system using appropriate hangers and correct grade	1) Unit 4C 3) Module 02204
11. Demonstrate the ability to modify structural members using the appropriate tools without weakening the structure	1) Unit 3C 3) Module 02204
12. Demonstrate the ability to test a DWV system	1) Unit 1D, 4E 3) Module 02204
13. Use a builder's level, transit level, or a laser level to set the elevation of a floor or area drain	1) Unit 1C 3) Module 02205
14. Install a roof, floor, and area drain	1) Unit 1D 3) Module 02205
15. Install waterproof membranes and flashing for a shower pan	1) Unit 3F 3) Module 02205
Introduction to Water Distribution Services	1) Unit 1, 2 2) Module 02112
1. Describe the process by which water is distributed in municipal, residential, and private water systems	1) Unit 2D 2) Module 02112
2. Identify the major components of a water distribution system, and describe the function of each component	1) Unit 2D 2) Module 02112
3. Explain the relationships between components of a water distribution system	1) Unit 1F 2) Module 02112

Module Name — Objective	Unit/Module
Install and Test Water Supply Piping	1) Unit 1, 2 3) Module 02206
1. Develop a material takeoff from a given set of plans	3) Module 02206
2. Use plans and fixture rough-in sheets to determine the location of fixtures and the route of the water supply piping	3) Module 02206
3. Demonstrate the ability to locate and size a water meter	3) Module 02206
4. Demonstrate the ability to locate a water heater, water softener, and hose bibbs	1) Unit 2D 3) Module 02206
5. Demonstrate the ability to install a water distribution system using appropriate hangers	1) Unit 1D, 2D 3) Module 02206
6. Demonstrate the ability to safely size and install a water service line and provide for water hammer protection	1) Unit 2D 3) Module 02206
7. Demonstrate the ability to test a water supply system	1) Unit 2D 3) Module 02206
8. Demonstrate the ability to insulate pipe and to protect it from freezing	1) Unit 2D 3) Module 02206
Install Water Heaters	1) Unit 2 3) Module 02209
1. Describe the basic operation of water heaters	3) Module 02209
2. Identify and explain the functions of the basic components of water heaters	3) Module 02209
3. Install various types water heaters	1) Unit 2D 3) Module 02209
4. Describe the safety hazards associated with water heaters	1) Unit 2D 3) Module 02209
Fuel Gas and Oil Systems	1) Unit 2, 4 3) Module 02211
1. Identify the major components of fuel systems and describe the function of each component	1) Unit 4E 3) Module 02211
2. Identify the physical properties of each type of fuel	3) Module 02211
3. Identify the safety precautions and potential hazards associated with each type of fuel and system	1) Unit 4E 3) Module 02211
4. Properly connect appliances to the fuel gas system	3) Module 02211
5. Apply local codes to various fuel gas systems	1) Unit 2D 3) Module 02211
6. Design, size, purge, and test fuel gas systems	1) Unit 2D, 4E 3) Module 02211

Abbreviations, Symbols and Acronyms

The following is a list of abbreviations, symbols, and acronyms used in the Plumbing study guide and on the Plumbing Apprentice Technician assessment.

°	Degree
°F	Degree Fahrenheit
’	Foot/feet
”	Inch/inches
ABS	Acrylonitrile Butadiene Styrene
ASTM	American Society for Testing and Materials
BOCA	Building Officials and Code Administrators
BTU	British Thermal Unit
CPT	Control Power Transformer
CPVC	Chlorinated Polyvinyl Chloride
CSST	Corrugated Stainless Steel Tubing
DWV	Drain, Waste, & Vent
ft^2	Feet Squared
HAZCOM	Hazard Communication
IMC	International Mechanical Code
IPC	International Plumbing Code
lb	Pound/Pounds
LPG	Liquefied Petroleum Gas
MSHA	Mine Safety and Health Administration
NCCER	National Center for Construction Education and Research
NIOSH	National Institute for Occupational Safety and Health
OSHA	Occupation Safety and Health Act
PB	Polybutylene
PEX	Crosslinked Polyethylene
psi	Pounds per square inch
PRV	Pressure Relief Valve
PSV	Pressure Safety Valve
PVC	Polyvinyl Chloride
QMI	Quantified Meter Index
SDS	Safety Data Sheet
STM	Strength of Tensile Material
t/p	Temperature and Pressure
WC	Water Column

Test Taking Strategies

This section of the study guide contains valuable information for testing success and provides a common-sense approach for preparing for and performing well on any test.

General Testing Advice

1. Get a good night's rest the night before the test — eight hours of sleep is recommended.
2. Avoid junk food and "eat right" several days before the test.
3. Do not drink a lot or eat a large meal prior to testing.
4. Be confident in your knowledge and skills!
5. Relax and try to ignore distractions during the test.
6. Focus on the task at hand — taking the test and doing your best!
7. Listen carefully to the instructions provided by the exam proctor. If the instructions are not clear, ask for clarification.

Testing Tips

1. Read the entire question before attempting to answer it.
2. Try to answer the question before reading the choices. Then, read the choices to determine if one matches, or is similar, to your answer.
3. Do not change your answer unless you misread the question or are certain that your first answer is incorrect.
4. Answer questions you know first, so you can spend additional time on the more difficult questions.
5. Check to make sure you have answered every question before you submit the assessment for scoring — unanswered questions are marked incorrect.

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