

# **PLUMBING**

## Curriculum Content Frameworks

**Please note: All assessment questions will be taken from the knowledge portion of these frameworks.**

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# Curriculum Content Frameworks

## Plumbing

Grade Levels: 9-12  
Course Code: 494510

Prerequisite: None

Course Description: This instructional program prepares individuals to apply technical knowledge and skills to lay out, assemble, install, and maintain piping fixtures and piping, hot water, heating, cooling, and drainage systems.

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## Unit 1: Practicing Safety on the Plumbing Site

### Hours: 10

**Terminology:** Asbestos, Combustible, Decibel (dB), Hypothermia, Lockout, MSDS, National Fire Protection Association (NFPA) warning diamond, Permit-required confined space, 29 CFR Part 1926

<b>CAREER and TECHNICAL SKILLS</b>		<b>ACADEMIC and WORKPLACE SKILLS</b>			
What the Student Should be Able to Do		What the Instruction Should Reinforce			
Knowledge	Application	Skill Group	Skill	Description	
1.1 Define terminology related to hazardous materials	1.1.1 Use terms appropriately in context	Foundation	Reading	Applies/Understands technical words that pertain to the plumbing trade [1.3.6]	
			Writing	Applies/Uses technical words and concepts [1.6.4]  Uses words appropriately [1.6.21]	
1.2 Identify the chemical risks associated with plumbing occupations, referencing Material Safety Data Sheets	1.2.1 Prepare a list of common chemical hazards associated with the plumbing occupation (e.g., primers, acids, cement, flux, and pipe joint compound, as well as others listed on MSDS).	Foundation	Science	Analyzes environmental issues (ecology, pollution, waste management) [1.4.2]  Describes/Explains scientific principles related to plumbing [1.4.13]  Follows safety guidelines [1.4.15]	

## Unit 2: Introduction to Plumbing

### Hours: 5

Terminology: Appurtenances, Aqueduct, Backflow preventer, Code, Drain-waste-vent (DWV), Journeyman plumber, Polyvinyl chloride (PVC), Potable, Top-out, Underground rough-in

CAREER and TECHNICAL SKILLS What the Student Should be Able to Do		ACADEMIC and WORKPLACE SKILLS What the Instruction Should Reinforce			
Knowledge	Application	Skill Group	Skill	Description	
2.1 Define terminology related to safety in plumbing	2.1.1 Use terms appropriately in context	Foundation	Reading	Applies/Understands technical words that pertain to plumbing [1.3.6]	
			Writing	Applies/Uses technical words and concepts [1.6.4]  Uses words appropriately [1.6.21]	
2.2 Outline the historical development of plumbing	2.2.1 Relate the historical landmarks in the development of the plumbing trade, beginning with its origins (4000 B.C.)	Foundation	Reading	Comprehends written information for main ideas [1.3.7]	
	2.2.2 Relate the impact of Roman aqueducts on features of modern plumbing systems		Science	Observes health code/sanitation requirements [1.4.18]	
	2.2.3 Discuss sanitation problems of the Middle Ages		Speaking	Communicates a thought, idea, or fact in spoken form [1.5.5]	
	2.2.4 Discuss the development of modern sanitation systems		Writing	Summarizes written information [1.6.17]	
2.3 Describe the importance of plumbers in modern society	2.3.1 Depict ways that plumbing relates to sanitation and public health	Thinking	Reasoning	Comprehends ideas and concepts related to plumbing [4.5.2]	
	2.3.2 Demonstrate how improper plumbing and sanitation impacts environmental quality		Foundation	Science  Analyzes environmental issues (ecology, pollution, waste management) [1.4.2]  Describes/Explains scientific principles related to plumbing [1.4.13]  Observes health code/sanitation requirements [1.4.18]	

<b>CAREER and TECHNICAL SKILLS</b>			<b>ACADEMIC and WORKPLACE SKILLS</b>		
What the Student Should be Able to Do			What the Instruction Should Reinforce		
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2.4 Identify the functions of water supply systems	2.4.1 Discuss the importance of clean water and its relationship to human health and life span		Foundation	Science	Analyzes environmental issues (ecology, pollution, waste management) [1.4.2]
	2.4.2 Explain ways a residential water supply system can be contaminated				Describes/Explains scientific principles related to plumbing [1.4.13]
					Observes health code/sanitation requirements [1.4.18]
2.5 Identify the functions of sewage treatment systems	2.5.1 Describe the components in a residential sewage disposal system		Foundation	Science	Analyzes environmental issues (ecology, pollution, waste management) [1.4.2]
	2.5.2 Discuss environmental impacts of improper sewage discharge				Describes/Explains scientific principles related to plumbing [1.4.13]
					Observes health code/sanitation requirements [1.4.18]

## Unit 3: Using Math in Plumbing

### Hours: 7.5

Terminology: Back, Center, Centerline, Decimals, Face, Fitting allowance, Fractions, Schematic drawings, Thread makeup, Throat

CAREER and TECHNICAL SKILLS			ACADEMIC and WORKPLACE SKILLS		
What the Student Should be Able to Do			What the Instruction Should Reinforce		
Knowledge	Application		Skill Group	Skill	Description
3.1 Define terminology related to math application in plumbing	3.1.1	Use terms appropriately in context	Foundation	Reading	Applies/Understands technical words that pertain to plumbing [1.3.6]
				Writing	Applies/Uses technical words and concepts [1.6.4]  Uses words appropriately [1.6.21]
3.2 Identify various pipe dimensions and measurements	3.2.1	Demonstrate the ability to read a rule accurately to within +/- 1/32 inch	Foundation	Arithmetic/ Mathematics	Calculates measurements taken from measuring devices [1.1.9]  Follows specified dimensions on plan [1.1.24]  Uses common measuring devices/tools to measure plumbing materials [1.1.37]
	3.2.2	Show how to measure a pipe end-to-end, center-to-center, and face-to-face	Thinking	Reasoning	Comprehends ideas and concepts related to plumbing [3.4.2]  Pays close attention to details [3.4.8]
	3.2.3	Determine methods of sizing and specifying various types of pipe used in plumbing			
3.3 Select mathematical calculations related to plumbing, using feet and inches as the units of measure	3.3.1	Solve various mathematical calculations, using feet and inches	Foundation	Arithmetic/ Mathematics	Applies addition, subtraction, and division to real-world situations [1.1.1]  Applies mathematical principles related to plumbing [1.1.4]  Calculates different units of measurement [1.1.6]
	3.3.2	Perform various addition, subtraction, and conversion problems applicable to plumbing scenarios			

CAREER and TECHNICAL SKILLS What the Student Should be Able to Do			ACADEMIC and WORKPLACE SKILLS What the Instruction Should Reinforce		
Knowledge	Application		Skill Group	Skill	Description
3.4 Identify area and volume related to plumbing	3.4.1	Calculate the area of various shaped spaces	Foundation	Arithmetic/ Mathematics	Applies addition, subtraction, and division to real-world situations [1.1.1]
	3.4.2	Calculate the volume of various shaped spaces			Uses basic geometric symbols, terms, principles, and formulas [1.1.34]
	3.4.3	Calculate the volume of liquid that a round or square tank can hold			Uses calculator to solve mathematical problems [1.1.36]
3.5 Explain the concept of fitting allowance	3.5.1	Discuss reasons for fitting allowances used in plumbing	Foundation	Arithmetic/ Mathematics	Applies addition, subtraction, and division to real-world situations [1.1.1]
	3.5.2	Calculate the fitting allowance for various plumbing fittings	Thinking	Reasoning	Comprehends ideas and concepts related to plumbing [3.4.2]

## Unit 4: Interpreting Plumbing Construction Drawings

### Hours: 12.5

**Terminology:** Architect's scale, Computer-aided drafting (CAD), Construction drawing, Details, Elevation drawing, Fixture drawing, Isometric drawing, Plumbing drawing, Riser diagram, Specifications

CAREER and TECHNICAL SKILLS		ACADEMIC and WORKPLACE SKILLS			
What the Student Should be Able to Do		What the Instruction Should Reinforce			
Knowledge	Application	Skill Group	Skill	Description	
4.1 Define terminology related to interpreting plumbing construction drawings	4.1.1 Use terms appropriately in context	Foundation	Reading	Applies/Understands technical words that pertain to plumbing [1.3.6]	
			Writing	Applies/Uses technical words and concepts [1.6.4]  Uses words appropriately [1.6.21]	
4.2 Identify specific plumbing fixtures depicted on plumbing construction drawings	4.2.1 Use standard fixtures on a residential construction drawing	Foundation	Reading	Applies/Understands technical words that pertain to plumbing [1.3.6]	
	4.2.2 Use standard fixtures on a commercial construction drawing			Identifies relevant details, facts, and specifications [1.3.16]  Interprets drawings to obtain factual information [1.3.17]	
4.3 Select items to create a fitting/material list	4.3.1 Construct a fitting/material list from construction drawings	Foundation	Arithmetic/ Mathematics	Calculates/Estimates plumbing [1.1.8]	
	4.3.2 Use the correct size pipe and fittings necessary to connect fixtures based on construction drawings		Reading	Applies/Understands technical words that pertain to plumbing [1.3.6]	
	4.3.3 Verify that plumbing fixture clearances meet code standards			Identifies relevant details, facts, and specifications [1.3.16]	
	4.3.4 Calculate the cost of plumbing materials for various rooms or jobs			Interprets drawings to obtain factual information [1.3.17]	

<b>CAREER and TECHNICAL SKILLS</b>			<b>ACADEMIC and WORKPLACE SKILLS</b>		
What the Student Should be Able to Do			What the Instruction Should Reinforce		
<b>Knowledge</b>	<b>Application</b>		<b>Skill Group</b>	<b>Skill</b>	<b>Description</b>
4.4 Identify isometric plumbing drawings	4.4.1	Explain notes and dimensions used on isometric plumbing drawings	Foundation	Reading	Identifies relevant details, facts, and specifications [1.3.16]
	4.4.2	Identify fixture and material symbols used on isometric plumbing drawings	Thinking	Reasoning	Comprehends ideas and concepts related to plumbing [4.5.2]
	4.4.3	Compare isometric plans to floor plans and other construction drawings			Sees relationship between two or more ideas, objects, or situations [4.5.5]

## Unit 5: Identifying Tools Used in Plumbing

### Hours: 7

Terminology: Amperage, Diameter, Electrical ground, Ferrous, Flux, Level, Miter, Plumb, Offset, Soldering

CAREER and TECHNICAL SKILLS What the Student Should be Able to Do			ACADEMIC and WORKPLACE SKILLS What the Instruction Should Reinforce		
Knowledge	Application	Skill Group	Skill	Description	
5.1 Define terminology related to identifying tools used in the plumbing industry	5.1.1 Use terms appropriately in context	Foundation	Reading	Applies/Understands technical words that pertain to plumbing [1.3.6]	
			Writing	Applies/Uses technical words and concepts [1.6.4]  Uses words appropriately [1.6.21]	
5.2 Identify hand tools used in plumbing	5.2.1 Demonstrate the uses for common hand tools in the plumbing industry	Foundation	Reading	Applies information and concepts derived from printed materials [1.3.3]	
	5.2.2 Demonstrate the uses for specialized hand tools in the plumbing industry			Applies information to job performance [1.3.4]	
	5.2.3 Use proper hand tools for specific tasks in the plumbing industry			Applies information to new situations [1.3.5]	
5.3 Select power tools used in plumbing	5.3.1 Demonstrate the uses for common power tools in the plumbing industry	Foundation	Reading	Applies information and concepts derived from printed materials [1.3.3]	
	5.3.2 Demonstrate uses for specialized power tools in the plumbing industry			Applies information to job performance [1.3.4]	
	5.3.3 Use proper power tools for specific tasks in the plumbing industry			Applies information to new situations [1.3.5]	

## Unit 6: Cutting and Joining Pipe

### Hours: 35

**Terminology:** Compression joint, Cutting PVC pipe, Drawn copper, Flare joint, Hub-and-spigot cast iron pipe, Joining PVC pipe, No-hub cast iron pipe, PVC pipe, Solvent weld on PVC, Sweat joint

<b>CAREER and TECHNICAL SKILLS</b>		<b>ACADEMIC and WORKPLACE SKILLS</b>			
What the Student Should be Able to Do		What the Instruction Should Reinforce			
Knowledge	Application	Skill Group	Skill	Description	
6.1 Define terminology related to cutting and joining pipe	6.1.1 Use terms appropriately in context	Foundation	Reading	Applies/Understands technical words that pertain to plumbing [1.3.6]	
			Writing	Applies/Uses technical words and concepts [1.6.4]	
				Uses words appropriately [1.6.21]	
6.2 Describe cutting a cast iron pipe	6.2.1 Cut cast iron pipe to length within +/- 1/16 inches  6.2.2 Demonstrate techniques to cut cast iron pipe square in a manner that prevents crushing	Foundation	Science	Applies knowledge to complete a practical task [1.4.3]	
6.3 Explain cutting and deburring copper tubing	6.3.1 Demonstrate cutting copper tubing with a tubing cutter to correct length within +/- 1/16 inches  6.3.2 Use a deburring tool on copper tubing according to industry guidelines	Foundation	Science	Applies knowledge to complete a practical task [1.4.3]	
6.4 Describe cutting plastic pipe with a PVC/ABS saw or approved cutter	6.4.1 Demonstrate cutting PVC/ABS pipe with approved cutting tool with end square and to correct length within +/- 1/16 inches  6.4.2 Cut a pipe with a hacksaw with end square and to correct length within +/- 1/16 inches  6.4.3 Deburr PVC/ABS pipe	Foundation	Science	Applies knowledge to complete a practical task [1.4.3]	

CAREER and TECHNICAL SKILLS What the Student Should be Able to Do			ACADEMIC and WORKPLACE SKILLS What the Instruction Should Reinforce		
Knowledge	Application	Skill Group	Skill	Description	
6.5 Explain the purpose of cutting and reaming steel pipe	6.5.1 Demonstrate cutting steel pipe to proper length within +/- 1/16 inches, using hand pipe cutters	Foundation	Science	Applies knowledge to complete a practical task [1.4.3]	
	6.5.2 Demonstrate cutting steel pipe to proper length within +/- 1/16 inches, using power pipe cutters				
	6.5.3 Discuss reaming steel pipe according to industry guidelines				
6.6 Describe how to join cast iron pipe using rubber-type seal and no-hub connectors	6.6.1 Align cast iron pipe to receive connector	Foundation	Science	Applies knowledge to complete a practical task [1.4.3]	
	6.6.2 Check to ensure band and seal are aligned prior to tightening connector				
	6.6.3 Check to ensure no-hub connector is torqued according to plumbing code				
6.7 Label a copper pipe (tubing) assembly with solder joints	6.7.1 Clean pipe using sandpaper or a wire brush	Foundation	Science	Applies knowledge to complete a practical task [1.4.3]	
	6.7.2 Apply flux with brush to fittings and pipe				
	6.7.3 Apply heat for solder according to industry guidelines				
	6.7.4 Apply solder to joint according to industry guidelines				
	6.7.5 Test piping assembly for leaks				
	6.7.6 Wipe excess flux from joint after assembly cools				

CAREER and TECHNICAL SKILLS		ACADEMIC and WORKPLACE SKILLS			
What the Student Should be Able to Do		What the Instruction Should Reinforce			
Knowledge	Application	Skill Group	Skill	Description	
6.8 Describe joining plastic pipe (tubing) to fittings using solvent method	6.8.1 Use various primer, cement, and solvent types for various piping materials	Foundation	Science	Applies knowledge to complete a practical task [1.4.3]	
	6.8.2 Apply primer/cement/solvent to pipe and fittings according to industry guidelines				
	6.8.3 Demonstrate inserting pipe and assembling joints according to industry guidelines				
	6.8.4 Test pipe assembly for leaks				
6.9 Describe how to join copper pipe (tubing) using compression fittings	6.9.1 Use various compression fittings for copper pipe	Foundation	Science	Applies knowledge to complete a practical task [1.4.3]	
	6.9.2 Clean compression fittings and pipe according to industry guidelines				
	6.9.3 Tighten compression fittings according to manufacturer's specifications				
	6.9.4 Test piping assembly for leaks				
6.10 Outline how to join copper pipe (tubing) to fittings using flare method	6.10.1 Select appropriate flare fitting for use on copper pipe	Foundation	Science	Applies knowledge to complete a practical task [1.4.3]	
	6.10.2 Use a flaring tool and block to prepare a flare joint on copper pipe				
	6.10.3 Clean fitting and pipe for a flare joint according to industry guidelines				
	6.10.4 Tighten flare fitting according to manufacturer's specifications				
	6.10.5 Test pipe assembly for leaks				

CAREER and TECHNICAL SKILLS			ACADEMIC and WORKPLACE SKILLS		
What the Student Should be Able to Do			What the Instruction Should Reinforce		
Knowledge	Application		Skill Group	Skill	Description
6.11 Explain how to join plastic pipe (tubing) to fittings using crimp ring method	6.11.1	Determine tools to use with crimp ring method of joining plastic pipe	Foundation	Science	Applies knowledge to complete a practical task [1.4.3]
	6.11.2	Discuss uses for crimp ring fittings for copper pipe			
	6.11.3	Clean fittings and pipe according to industry guidelines			
	6.11.4	Install crimp ring according to manufacturer's specifications			
	6.11.5	Test pipe assembly for leaks			
6.12 Describe how to join plastic pipe (tubing) to fittings using clamp/insert fittings method	6.12.1	Determine tools to use with clamp/insert fitting method	Foundation	Science	Applies knowledge to complete a practical task [1.4.3]
	6.12.2	Discuss uses for clamp/insert fitting for copper pipe			
	6.12.3	Clean clamp/insert fittings and pipe according to industry guidelines			
	6.12.4	Install clamp/insert fitting according to manufacturer's specifications			
	6.12.5	Test pipe assembly for leaks			

CAREER and TECHNICAL SKILLS		ACADEMIC and WORKPLACE SKILLS		
What the Student Should be Able to Do		What the Instruction Should Reinforce		
Knowledge	Application	Skill Group	Skill	Description
6.13 State how to join pipe with flexible sleeve couplings	6.13.1 Clean fitting and pipe to receive flexible sleeve couplings according to industry guidelines	Foundation	Science	Applies knowledge to complete a practical task [1.4.3]
	6.13.2 Discuss uses for flexible sleeve couplings for copper pipe			
	6.13.3 Install and torque flexible sleeve couplings according to industry guidelines			
	6.13.4 Test pipe assembly for leaks			
6.14 Explain how to thread steel pipe with power-driven thread cutter	6.14.1 Set up and install dies for threading steel pipe with power-driven thread cutter	Foundation	Science	Applies knowledge to complete a practical task [1.4.3]
	6.14.2 Apply correct procedure to produce pipe with typical threads			
	6.14.3 Clean and deburr threads on steel pipe threaded with power-driven thread cutter			
6.15 Outline how to thread steel pipe using hand thread cutter and oilers	6.15.1 Demonstrate setting up and installing dies for threading steel pipe with hand thread cutter and oiler	Foundation	Science	Applies knowledge to complete a practical task [1.4.3]
	6.15.2 Create a pipe with typical threads			
	6.15.3 Clean and deburr threads on steel pipe threaded with hand thread cutter and oilers			
6.16 Name the steps involved in joining pipe of dissimilar materials	6.16.1 Discuss methods and situations to connect pipe of dissimilar materials	Foundation	Science	Applies knowledge to complete a practical task [1.4.3]
	6.16.2 Join pipe of dissimilar materials			
	6.16.3 Test pipe assembly for leaks			

## Unit 7: Supporting and Hanging Pipe

### Hours: 7

Terminology: Anchor, Clevis hanger, Pipe riser clamp, Threaded drop-in anchor/fastener

CAREER and TECHNICAL SKILLS What the Student Should be Able to Do			ACADEMIC and WORKPLACE SKILLS What the Instruction Should Reinforce		
Knowledge	Application	Skill Group	Skill	Description	
7.1 Define terminology related to supporting and hanging pipe	7.1.1 Use terms appropriately in context	Foundation	Reading	Applies/Understands technical words that pertain to plumbing [1.3.6]	
			Writing	Applies/Uses technical words and concepts [1.6.4]  Uses words appropriately [1.6.21]	
7.2 Identify types of anchors and straps for commercial plumbing applications	7.2.1 Use various types of anchors and straps used in attaching and hanging plumbing (including expansion anchors, inserts, Red Head anchors, clevis hangers, split-ring hangers, beam clamps, riser clamps, wire hooks, perforated straps, and tube straps)	Foundation	Reading	Analyzes and applies what has been read to specific task [1.3.2]  Comprehends written specifications, and applies them to a task [1.3.9]	
	7.2.2 Explain plumbing code requirements associated with the use of hangers and anchors				
7.3 Label parts used to install backing and ledger supports for plumbing fixtures	7.3.1 Cut back and ledger to correct size, using appropriate material to fit snugly in space	Foundation	Reading	Analyzes and applies what has been read to specific task [1.3.2]	
	7.3.2 Install backing and ledger supports properly positioned and level			Applies information to job performance [1.3.4]	
	7.3.3 Check assembly for solid attachment to frame of structure			Uses appropriate materials and techniques as specified [1.3.20]	

CAREER and TECHNICAL SKILLS			ACADEMIC and WORKPLACE SKILLS		
What the Student Should be Able to Do			What the Instruction Should Reinforce		
Knowledge	Application	Skill Group	Skill	Description	
7.4 Describe the installation of pressure pipe, using various supports, including wire pipe hooks, tube talon, or tube straps	7.4.1 Discuss reasons for spacing guidelines with various hangers 7.4.2 Install space hangers according to manufacturer's guidelines for a specific application 7.4.3 Install pressure pipe, using various supports	Foundation	Reading	Analyzes and applies what has been read to specific task [1.3.2]  Comprehends written specifications, and applies them to a task [1.3.9]	
7.5 Match DWV (drainage, waste, and vent) pipewith various types of supports (e.g., perforated strap, pipe hooks, and riser clamps)	7.5.1 Discuss reasons for accurate grade (slope) for DWV pipe 7.5.2 Use grade DWV pipe according to code and industry guidelines 7.5.3 Install appropriate supports for DWV pipe	Thinking	Decision Making	Comprehends ideas and concepts related to plumbing [4.2.2]	
7.6 Describe the correct installation of pipe sleeves through a concrete or masonry wall	7.6.1 Install a pipe sleeve through a concrete or masonry wall 7.6.2 Correctly caulk a pipe sleeve	Thinking	Reasoning	Extracts rules or principles from written information [4.5.4]	

## Unit 8: Installing Waste and Soil Pipes

### Hours: 7

Terminology: Building sewer, Cleanout, Drainage fitting, DWV system, Elevation, Grade, Interceptor, P-trap, Sanitary fitting, Stack

<b>CAREER and TECHNICAL SKILLS</b>		<b>ACADEMIC and WORKPLACE SKILLS</b>			
What the Student Should be Able to Do		What the Instruction Should Reinforce			
Knowledge	Application	Skill Group	Skill	Description	
8.1 Define terminology related to the installation of waste and soil pipes	8.1.1 Use terms appropriately in context	Foundation	Reading	Applies/Understands technical words that pertain to plumbing [1.3.6]	
			Writing	Applies/Uses technical words and concepts [1.6.4]	
				Uses words appropriately [1.6.21]	
8.2 Outline a procedure for roughing-in a DWV (drainage, waste, and vent) pipe assembly of PVC/ABS piping	8.2.1 Discuss the elements in a DWV system to include water closet, lavatory, bathtub, shower, kitchen or bar sink, and washing machine	Thinking	Creative Thinking	Creates new design by applying specified criteria [4.1.3]	
	8.2.2 Rough-in a DWV pipe assembly for kitchen, bathroom, or laundry room installation				
8.3 Describe how to calculate and set waste and soil pipes	8.3.1 Calculate slope for plumbing runs	Thinking	Decision Making	Accepts responsibility for decision [4.2.1]	
	8.3.2 Discuss techniques and instruments used for setting level and slope for waste and soil pipe		Problem Solving	Demonstrates logical reasoning in reaching a conclusion [4.4.2]	
	8.3.3 Install waste and soil pipes according to measurements for level and slope in accordance with plumbing code				

<b>CAREER and TECHNICAL SKILLS</b>		<b>ACADEMIC and WORKPLACE SKILLS</b>			
What the Student Should be Able to Do		What the Instruction Should Reinforce			
<b>Knowledge</b>	<b>Application</b>	<b>Skill Group</b>	<b>Skill</b>	<b>Description</b>	
8.4 Describe how to install a water closet flange	8.4.1 Lay out the measurements for installation of a water closet flange	Thinking	Creative Thinking	Creates new design by applying specified criteria [4.1.3]	
	8.4.2 Inspect pipe layout in accordance with plumbing code, manufacturer's specifications blueprints, and ADA (Americans with Disabilities Act)			Finds new ways of dealing with existing problems/situations [4.1.5]	
8.5 Explain the purpose of a back flow valve	8.5.1 Determine situations in which back flow prevention devices should be used	Foundation	Reading	Analyzes and applies what has been read to specific task [1.3.2]	
	8.5.2 Describe the purpose for a back flow valve	Personal Management	Responsibility	Accepts responsibility for position [3.4.1]	
	8.5.3 Discuss installation techniques for a back flow valve			Maintains a high level of concentration in completion of a task [3.4.7]	
	8.5.4 Discuss the consequences of faulty installation of a back flow valve	Thinking	Knowing how to Learn	Pays close attention to details [3.4.8]	
8.6 Describe how a drainage system standing water/air leak test works	8.6.1 Water/air leak test a drainage system according to the plumbing code	Foundation	Science	Applies new knowledge and skills to plumbing [4.3.1]	
	8.6.2 Perform a drainage system water/air leak test according to industry guidelines			Locates appropriate learning resources to acquire or improve knowledge and skills [4.3.3]	
				Acquires and processes scientific data [1.4.1]	
				Applies/Uses scientific method [1.4.6]	

## Unit 9: Components of a Water Distribution System

### Hours: 7

Terminology: Back flow preventer, Check valve, Curb box, Hammer arrestor, Pressure regulator valve, Pressure relief valve, Service line, Vacuum breaker, Water supply fixture unit (WSFU), Water table

<b>CAREER and TECHNICAL SKILLS</b>		<b>ACADEMIC and WORKPLACE SKILLS</b>					
What the Student Should be Able to Do		What the Instruction Should Reinforce					
Knowledge	Application	Skill Group	Skill	Description			
9.1 Define terminology related to the components of a water distribution system	9.1.1 Use terms appropriately in context	Foundation	Reading	Applies/Understands technical words that pertain to plumbing [1.3.6]			
			Writing	Applies/Uses technical words and concepts [1.6.4]  Uses words appropriately [1.6.21]			
9.2 Describe procedures and materials used to install a building's water service	9.2.1 Discuss the components in a building's water service	Foundation	Reading	Applies information to job performance [1.3.4]			
	9.2.2 Use procedures for installing a building's water meter			Comprehends written specifications, and applies them to a task [1.3.9]			
	9.2.3 Identify various types of main shutoff valves (e.g., gate, ball, butterfly)			Draws conclusions from what is read [1.3.12]			
	9.2.4 Use procedures for installing main shutoff valves for a building			Thinking	Interprets drawings to obtain factual information [1.3.17]		
	9.2.5 Explain advantages of various types of main shutoff valves				Decision Making	Considers risks when making a decision [4.2.3]	
	9.2.6 Shut off and turn on the water supply to a building				Reasoning	Uses logic to draw conclusions from available information [4.5.6]	

CAREER and TECHNICAL SKILLS		ACADEMIC and WORKPLACE SKILLS			
What the Student Should be Able to Do		What the Instruction Should Reinforce			
Knowledge	Application	Skill Group	Skill	Description	
9.3 Describe the installation of a water distribution system	9.3.1 Demonstrate installation procedures for hard-drawn copper, CPVC (chlorinated polyvinyl chloride), and PEX (cross-linked polyethylene) components in a water distribution system	Thinking	Reasoning	Applies rules and principles to a new situation [4.5.1]  Extracts rules or principles from written information [4.5.4]	
	9.3.2 Install water system components according to construction drawings, manufacturer's specifications, and plumbing code				
	9.3.3 Lay out pipe for a residential water distribution system				
	9.3.4 Rough-in water supply components for a washing machine, lavatory, kitchen sink, tank-type water closet, and a bathtub or shower				
9.4 Explain how air pressure and water pressure tests are conducted	9.4.1 Discuss procedures for an air pressure leak test of a pipe assembly	Thinking	Reasoning	Extracts rules or principles from written information [4.5.4]	
	9.4.2 Discuss procedures for a water pressure leak test of a pipe assembly				
	9.4.3 Perform an air pressure leak test on a pipe assembly				
	9.4.4 Perform a water pressure leak test on a pipe assembly				
9.5 Describe how to insulate water supply lines	9.5.1 Discuss various insulating materials designed for water supply lines	Foundation	Reading	Analyzes and applies what has been read to a specific task [1.3.2]	
	9.5.2 Demonstrate procedures for installing various insulating materials on water supply lines	Thinking	Reasoning	Determines which conclusions are correct when given a set of facts and a set of conclusions [4.5.3]	
	9.5.3 Discuss advantages and disadvantages of pipe insulating materials				
	9.5.4 Insulate a water supply line				

<b>CAREER and TECHNICAL SKILLS</b>		<b>ACADEMIC and WORKPLACE SKILLS</b>			
What the Student Should be Able to Do		What the Instruction Should Reinforce			
<b>Knowledge</b>	<b>Application</b>	<b>Skill Group</b>	<b>Skill</b>	<b>Description</b>	
9.6 List examples of nail guard protection for pipe	9.6.1 Mark locations where nail guards should be installed for plumbing protection 9.6.2 Determine size requirements for various nail guard installations 9.6.3 Install nail guards	Thinking	Reasoning	Determines which conclusions are correct when given a set of facts and a set of conclusions [4.5.3]	

## Unit 10: Installing Plumbing Fixtures and Equipment

### Hours: 5

Terminology: Diverter, Fixture, Flood level rim, Flushometer, Flush valve, Hose bibb, Lavatory, Vent pipe, Vitrified porcelain

CAREER and TECHNICAL SKILLS What the Student Should be Able to Do			ACADEMIC and WORKPLACE SKILLS What the Instruction Should Reinforce		
Knowledge	Application	Skill Group	Skill	Description	
10.1 Define terminology related to installing plumbing fixtures and equipment	10.1.1 Use terms appropriately in context	Foundation	Reading	Applies/Understands technical words that pertain to plumbing [1.3.6]	
			Writing	Applies/Uses technical words and concepts [1.6.4]  Uses words appropriately [1.6.21]	
10.2 Outline how to install and trim out a lavatory	10.2.1 Discuss procedures for installing a wall-hung lavatory	Foundation	Reading	Comprehends written specifications, and applies them to a task [1.3.9]	
	10.2.2 Install a countertop lavatory			Follows written directions [1.3.13]	
	10.2.3 Install a lavatory fixture and faucet			Reads and follows instructions to operate technical equipment [1.3.19]	
	10.2.4 Inspect a lavatory installation to ensure it is secure, level, and plumb				
	10.2.5 Install the water supply to a lavatory, and check for leaks				

CAREER and TECHNICAL SKILLS		ACADEMIC and WORKPLACE SKILLS			
What the Student Should be Able to Do		What the Instruction Should Reinforce			
Knowledge	Application	Skill Group	Skill	Description	
10.3 Describe how to install and trim out a kitchen sink	10.3.1 Discuss procedures for installing a double kitchen sink	Foundation	Reading	Comprehends written specifications, and applies them to a task [1.3.9]  Follows written directions [1.3.13]  Reads and follows instructions to operate technical equipment [1.3.19]	
	10.3.2 Measure and verify the cutout for a sink is correct for size of sink unit				
	10.3.3 Install a kitchen sink fixture and kitchen faucet according to manufacturer's specifications				
	10.3.4 Perform inspection to verify sink is level				
	10.3.5 Verify solid fit and appropriate seal at rim and countertop				
10.4 Explain how to install and trim out a water closet	10.4.1 Discuss procedures for installing a water closet	Foundation	Reading	Comprehends written specifications and applies them to a task [1.3.9]  Follows written directions [1.3.13]  Reads and follows instructions to operate technical equipment [1.3.19]	
	10.4.2 Install a water closet fixture				
	10.4.3 Install water control mechanisms for a water closet				
	10.4.4 Inspect to verify installation is secure, level, and plumb	Thinking	Knowing how to Learn	Applies new knowledge and skills to plumbing [4.3.1]	
	10.4.5 Inspect to verify water closet wax ring has been installed correctly				
	10.4.6 Demonstrate how to install a water supply to water closet, and check for leaks				Problem Solving

<b>CAREER and TECHNICAL SKILLS</b>		<b>ACADEMIC and WORKPLACE SKILLS</b>			
What the Student Should be Able to Do		What the Instruction Should Reinforce			
<b>Knowledge</b>	<b>Application</b>	<b>Skill Group</b>	<b>Skill</b>	<b>Description</b>	
10.5 Describe installation of a garbage disposal	10.5.1 Discuss the installation procedures of a garbage disposal in a kitchen sink	Foundation	Reading	Comprehends written specifications, and applies them to a task [1.3.9]	
	10.5.2 Install a garbage disposal, and check for leaks according to manufacturer's specifications			Follows written directions [1.3.13]	
		Thinking	Knowing how to Learn	Reads and follows instructions to operate technical equipment [1.3.19]	
				Problem Solving	Applies new knowledge and skills to plumbing [4.3.1]
				Draws conclusions from observations, evaluates conditions, and gives possible solutions [4.4.5]	
10.6 Outline how to install an automatic dishwasher	10.6.1 Discuss how to set the dishwasher in the cabinet space, plumb and trim, and verify attachment of dishwasher to cabinet	Foundation	Reading	Comprehends written specifications, and applies them to a task [1.3.9]	
	10.6.2 Install dishwasher drain according to installation instructions and plumbing code			Follows written directions [1.3.13]	
	10.6.3 Install a water supply to dishwasher according to installation instructions and plumbing code			Reads and follows instructions to operate technical equipment [1.3.19]	
	10.6.4 Inspect cabinet installation, water supply, and drain for leaks			Comprehends ideas and concepts related to plumbing [4.4.1]	
		Thinking	Problem Solving	Draws conclusions from observations, evaluates conditions, and gives possible solutions [4.4.5]	

CAREER and TECHNICAL SKILLS		ACADEMIC and WORKPLACE SKILLS			
What the Student Should be Able to Do		What the Instruction Should Reinforce			
Knowledge	Application	Skill Group	Skill	Description	
10.7 Describe installation of a water heater	10.7.1 Discuss code considerations for installation of an electric water heater	Foundation	Reading	Comprehends written specifications, and applies them to a task [1.3.9]	
	10.7.2 Discuss code considerations for installation of a natural gas water heater			Follows written directions [1.3.13]	
	10.7.3 Install an electric water heater			Reads and follows instructions to operate technical equipment [1.3.19]	
	10.7.4 Install a natural gas water heater	Thinking	Problem Solving	Comprehends ideas and concepts related to plumbing [4.4.1]	
	10.7.5 Inspect plumbing installation for leaks and appropriate water supply			Draws conclusions from observations, evaluates conditions, and gives possible solutions [4.4.5]	
10.8 Describe how to trim out a tub and shower valve	10.8.1 Discuss the installation of a tub and shower valve	Foundation	Reading	Comprehends written specifications, and applies them to a task [1.3.9]	
	10.8.2 Install a tub and shower valve			Follows written directions [1.3.13]	
	10.8.3 Inspect to verify valve installation is straight, neat, and to manufacturer's specifications	Thinking	Problem Solving	Reads and follows instructions to operate technical equipment [1.3.19]	
	10.8.4 Inspect installation for leaks and appropriate water supply			Comprehends ideas and concepts related to plumbing [4.4.1]	
10.9 Outline installation of an outside water faucet	10.9.1 Discuss installation of an outside water	Foundation	Reading	Comprehends written specifications, and applies them to a task [1.3.9]	
	10.9.2 Inspect installation for leaks and appropriate water supply			Follows written directions [1.3.13]	
		Thinking	Problem Solving	Reads and follows instructions to operate technical equipment [1.3.19]	
				Comprehends ideas and concepts related to plumbing [4.4.1]	
				Draws conclusions from observations, evaluates conditions, and gives possible solutions [4.4.5]	

## Unit 11: Servicing and Repairing Plumbing Fixtures and Equipment

### Hours: 5

Terminology: Seat washer

CAREER and TECHNICAL SKILLS		ACADEMIC and WORKPLACE SKILLS			
What the Student Should be Able to Do		What the Instruction Should Reinforce			
Knowledge	Application	Skill Group	Skill	Description	
11.1 Define terminology related to servicing and repairing plumbing fixtures and equipment	11.1.1 Use terms appropriately in context	Foundation	Reading	Applies/Understands technical words that pertain to plumbing [1.3.6]	
			Writing	Applies/Uses technical words and concepts [1.6.4]  Uses words appropriately [1.6.21]	
11.2 Describe how to replace and adjust water control mechanisms for a water closet	11.2.1 Discuss procedures to replace water control mechanisms in a water closet	Foundation	Reading	Comprehends written specifications, and applies them to a task [1.3.9]	
	11.2.2 Replace a water control mechanism			Follows written directions [1.3.13]	
	11.2.3 Adjust the water control mechanisms			Reads and follows instructions to operate technical equipment [1.3.19]	
	11.2.4 Inspect installation for leaks, and verify proper function of water control mechanisms	Thinking	Problem Solving	Comprehends ideas and concepts related to plumbing [4.4.1]	
11.3 Outline replacement of a water closet flush valve	11.3.1 Discuss the removal and installation of a water closet flush valve	Foundation	Reading	Comprehends written specifications, and applies them to a task [1.3.9]	
	11.3.2 Remove and install a water closet flush valve			Follows written directions [1.3.13]	
	11.3.3 Replace a water closet tank gasket			Reads and follows instructions to operate technical equipment [1.3.19]	
	11.3.4 Inspect installation for leaks and appropriate water supply	Thinking	Problem Solving	Comprehends ideas and concepts related to plumbing [4.4.1]  Draws conclusions from observations, evaluates conditions, and gives possible solutions [4.4.5]	

CAREER and TECHNICAL SKILLS		ACADEMIC and WORKPLACE SKILLS			
What the Student Should be Able to Do		What the Instruction Should Reinforce			
Knowledge	Application	Skill Group	Skill	Description	
11.4 Identify how to troubleshoot, repair, or replace automatic flushing devices	11.4.1 Inspect to verify correct operation of an automatic flushing device	Thinking	Problem Solving	Comprehends ideas and concepts related to plumbing [4.4.1]	
	11.4.2 Service an automatic flushing device			Draws conclusions from observations, evaluates conditions, and gives possible solutions [4.4.5]	
	11.4.3 Install an automatic flushing device in an existing fixture			Revises plan of action indicated by findings [4.4.9]	
11.5 Describe how to operate a plumbing drain auger	11.5.1 Discuss how to operate a plumbing drain auger	Foundation	Reading	Comprehends written specifications, and applies them to a task [1.3.9]	
	11.5.2 Use an auger to clean a drain			Follows written directions [1.3.13]  Reads and follows instructions to operate technical equipment [1.3.19]	
11.6 Describe how to remove and replace a fixture trap	11.6.1 Discuss the procedure for removing and replacing a plumbing fixture trap	Foundation	Reading	Comprehends written specifications, and applies them to a task [1.3.9]	
	11.6.2 Remove and replace a plumbing fixture trap			Follows written directions [1.3.13]	
	11.6.3 Set a trap level with respect to seal			Reads and follows instructions to operate technical equipment [1.3.19]	
	11.6.4 Inspect installation for leaks	Thinking	Problem Solving	Comprehends ideas and concepts related to plumbing [4.4.1]	
11.7 Explain the repair or replacement of a washer-type faucet	11.7.1 Remove and replace a washer in a washer-type faucet	Foundation	Reading	Comprehends written specifications, and applies them to a task [1.3.9]	
	11.7.2 Replace a washer-type faucet			Follows written directions [1.3.13]	
	11.7.3 Check installation for leaks and appropriate water supply	Thinking	Problem Solving	Reads and follows instructions to operate technical equipment [1.3.19]  Comprehends ideas and concepts related to plumbing [4.4.1]	

<b>CAREER and TECHNICAL SKILLS</b> What the Student Should be Able to Do		<b>ACADEMIC and WORKPLACE SKILLS</b> What the Instruction Should Reinforce		
<b>Knowledge</b>	<b>Application</b>	<b>Skill Group</b>	<b>Skill</b>	<b>Description</b>
11.8 Describe repair or replacement of washerless faucets	11.8.1 Discuss removal and replacement of a washerless faucet (e.g., ball type, cartridge type, or ceramic disk type)	Foundation	Reading	Comprehends written specifications, and applies them to a task [1.3.9]  Follows written directions [1.3.13]  Reads and follows instructions to operate technical equipment [1.3.19]
	11.8.2 Remove and replace a ball, cartridge, or disk in a washerless faucet			
	11.8.3 Remove and replace a washerless faucet	Thinking	Problem Solving	Comprehends ideas and concepts related to plumbing [4.4.1]
	11.8.4 Inspect installation for leaks and appropriate water supply			
11.9 Describe how to repair or replace a shower diverter valve	11.9.1 Remove and replace a shower diverter valve	Foundation	Reading	Comprehends written specifications, and applies them to a task [1.3.9]  Follows written directions [1.3.13]  Reads and follows instructions to operate technical equipment [1.3.19]
	11.9.2 Inspect installation for leaks and appropriate water supply			
		Thinking	Problem Solving	Comprehends ideas and concepts related to plumbing [4.4.1]
11.10 Explain how to replace a bathtub waste and overflow pipe	11.10.1 Remove and replace a bathtub waste and overflow pipe	Foundation	Reading	Comprehends written specifications, and applies them to a task [1.3.9]  Follows written directions [1.3.13]  Reads and follows instructions to operate technical equipment [1.3.19]
	11.10.2 Inspect installation for leaks			
		Thinking	Problem Solving	Comprehends ideas and concepts related to plumbing [4.4.1]

CAREER and TECHNICAL SKILLS What the Student Should be Able to Do		ACADEMIC and WORKPLACE SKILLS What the Instruction Should Reinforce		
Knowledge	Application	Skill Group	Skill	Description
11.11 Describe how to replace a bathtub shower arm and shower head	11.11.1 Replace a bathtub shower arm and shower head  11.11.2 Inspect installation for leaks and appropriate water supply	Foundation  Thinking	Reading  Problem Solving	Comprehends written specifications, and applies them to a task [1.3.9]  Follows written directions [1.3.13]  Reads and follows instructions to operate technical equipment [1.3.19]  Comprehends ideas and concepts related to plumbing [4.4.1]
11.12 State standard troubleshooting problems pertaining to a garbage disposal	11.12.1 Discuss troubleshooting a garbage disposal  11.12.2 Discuss causes for failure of garbage disposals  11.12.3 Remove and replace a garbage disposal	Thinking	Problem Solving	Comprehends ideas and concepts related to plumbing [4.4.1]  Draws conclusions from observations, evaluates conditions, and gives possible solutions [4.4.5]  Revises plan of action indicated by findings [4.4.9]
11.13 Describe key troubleshooting areas when determining whether to repair/replace a gas or electric water heater	11.13.1 Discuss the causes for failure of electric water heaters  11.13.2 Explain the causes for failure of gas water heaters  11.13.3 Troubleshoot water heater malfunctions, i.e., failure to heat, no pilot light, leaks, thermostat control  11.13.4 Remove and replace a gas water heater  11.13.5 Remove and replace an electric water heater  11.13.6 Remove and replace gas or electric water heater	Thinking	Problem Solving	Comprehends ideas and concepts related to plumbing [4.4.1]  Draws conclusions from observations, evaluates conditions, and gives possible solutions [4.4.5]  Revises plan of action indicated by findings [4.4.9]

<b>CAREER and TECHNICAL SKILLS</b> What the Student Should be Able to Do		<b>ACADEMIC and WORKPLACE SKILLS</b> What the Instruction Should Reinforce		
<b>Knowledge</b>	<b>Application</b>	<b>Skill Group</b>	<b>Skill</b>	<b>Description</b>
11.14 Describe how to thaw frozen water pipes	11.14.1 Discuss safe procedures for thawing frozen water pipes	Foundation	Science	Describes/Explains scientific principles related to plumbing [1.4.13]
	11.14.2 Thaw frozen pipes using standard cautionary steps	Personal Management	Integrity/Honesty/Work Ethic	Follows safety guidelines [1.4.15] Complies with safety and health rules in a given work environment [3.2.2]
11.15 Identify procedures to install a plumbing repair coupling	11.15.1 Explain situations in which plumbing repair couplings may be used	Foundation	Reading	Comprehends written specifications, and applies them to a task [1.3.9]
	11.15.2 Install a plumbing repair coupling			Follows written directions [1.3.13]
	11.15.3 Inspect installation for leaks	Thinking	Problem Solving	Reads and follows instructions to operate technical equipment [1.3.19] Comprehends ideas and concepts related to plumbing [4.4.1]

## Unit 12: Career and Technical Student Organizations (SkillsUSA/HOSA)

**Hours: 12**

Terminology: Assess, Assessment, Behavior, Business meeting skills, Career, Competency, Critique, Cultural diversity, Customer, Equity issue, Expectation, Government, Image, Interview, Job application, Journal, Management, Mentor, Organizational chart, Parliamentary procedure, Portfolio, Presentation, Professional organization, Résumé, Self-motivation, Short-term goals, Stress, Task, Trade union

CAREER and TECHNICAL SKILLS			ACADEMIC and WORKPLACE SKILLS		
What the Student Should be Able to Do			What the Instruction Should Reinforce		
Knowledge	Application	Skill Group	Skill	Description	
12.1 Define terminology related to student organizations	12.1.1 Use terms appropriately in context	Foundation	Reading	Applies/Understands technical words that pertain to student organizations [1.3.6]	
			Writing	Applies/Uses technical words and concepts [1.6.4]  Uses words appropriately [1.6.21]	
12.2 Outline a self-assessment, and identify individual learning styles	12.2.1 Show individual strengths	Interpersonal	Leadership	Conveys attitudes and values of group to others [2.4.3]	
	12.2.2 Show areas in need of improvement	Thinking	Problem Solving	Identifies possible reasons for problem [4.4.6]	
12.3 Describe self-motivation techniques, and establish short-term goals	12.3.1 Prepare a list of short-term goals	Personal Management	Self-esteem	Develops/Initiates a plan for self-improvement [3.12.4]	
	12.3.2 Discuss ways to change or improve lifestyle, appearance, and behavior	Thinking	Creative Thinking	Identifies new goals and objectives [4.1.8]	
12.4 Give examples of individual time-management skills	12.4.1 Prepare and maintain a time journal	Foundation	Writing	Prepares a complex document in a concise manner [1.6.12]	
	12.4.2 Outline ways to improve time-management skills	Thinking	Problem Solving	Devises and implements a plan of action to resolve problem [4.4.3]  Recognizes/Defines problem [4.4.8]	
12.5 Predict future occupations	12.5.1 Research the Internet to explore career opportunities in specified fields of study	Foundation	Reading	Draws conclusions from what is read [1.3.12]	
			Writing	Summarizes written information [1.6.17]	
	12.5.2 Prepare a presentation on a specified career area	Personal Management	Career Awareness, Development, and Mobility	Explores career opportunities [3.1.6]	
		Thinking	Creative Thinking	Prepares presentation based on subject research, interviews, surveys [4.1.10]	

CAREER and TECHNICAL SKILLS What the Student Should be Able to Do			ACADEMIC and WORKPLACE SKILLS What the Instruction Should Reinforce		
Knowledge	Application	Skill Group	Skill	Description	
12.6 Identify the customer	12.6.1 Differentiate between external and internal customers	Interpersonal	Customer Service	Recognizes effects of positive/negative attitudes on customers [2.3.7]	
	12.6.2 Identify factors that contribute to poor customer relationships	Thinking	Decision Making	Shows initiative and courtesy in meeting and working with customers [2.3.8] Evaluates information/data to make best decision [4.2.5]	
12.7 Identify the benefits of doing a community service project	12.7.1 Outline ways to become involved in the community	Foundation	Speaking	Organizes ideas, and communicates oral messages to listeners [1.12.7]	
	12.7.2 Develop a community service project	Interpersonal	Teamwork	Contributes to group with ideas, suggestions, and effort [2.6.2]	
12.8 Describe effective communication with others	12.8.1 Note personal barriers to listening	Thinking	Problem Solving	Recognizes/Defines problem [4.4.8]	
	12.8.2 Relate a personal plan to overcome barriers to listening			Revises plan of action indicated by findings [4.4.9]	
12.9 Give locations for a shadowing activity	12.9.1 Summarize and relate an experience of job shadowing activity	Interpersonal	Leadership	Encourages/Motivates members of a group or team [2.4.6]	
12.10 Identify the components of an employment portfolio	12.10.1 Present parts of a portfolio	Foundation	Writing	Completes form accurately [1.6.7]	
	12.10.2 Compile a personal employment portfolio for an interview			Composes and creates documents – letters, manuals, reports, proposals, graphs, flow charts, etc. [1.6.8]	
12.11 List proficiency in program competencies	12.11.1 Construct an interpersonal competency assessment	Foundation	Writing	Analyzes data, summarizes results, and makes conclusions [1.6.2]	
12.12 Describe how to measure/modify short-term goals	12.12.1 Discuss how to pursue short-term goals	Thinking	Creative Thinking	Identifies new goals and objectives [4.1.8]	
12.13 Identify stress sources	12.13.1 Prepare a list of personal stress sources	Foundation	Writing	Communicates thoughts, ideas, or facts in written form in a clear, concise manner [1.6.6]	
	12.13.2 Outline techniques to cope with individual sources of stress	Thinking	Problem Solving	Demonstrates logical reasoning in reaching a conclusion [4.4.2]	

<b>CAREER and TECHNICAL SKILLS</b>		<b>ACADEMIC and WORKPLACE SKILLS</b>		
What the Student Should be Able to Do		What the Instruction Should Reinforce		
<b>Knowledge</b>	<b>Application</b>	<b>Skill Group</b>	<b>Skill</b>	<b>Description</b>
12.14 Identify characteristics of a positive image	12.14.1 List behaviors and traits that lead to a positive image	Foundation	Reading	Determines what information is needed [1.3.10]
	12.14.2 Note behaviors and traits that lead to a negative image	Personal Management	Self-esteem	Comprehends the importance of a positive self-concept [3.12.1]  Develops/Initiates a plan for self-improvement [3.12.4]
		Thinking	Decision Making	Identifies pros and cons to assist in decision-making process [4.2.7]
			Problem Solving	Demonstrates logical reasoning in reaching a conclusion [4.4.2]
12.15 Describe how team skills can be applied to a group project	12.15.1 Form a team to develop a class project	Interpersonal	Teamwork	Works effectively with others to reach a common goal [2.6.6]
12.16 Outline how to observe and critique a meeting	12.16.1 Attend a formal meeting held in the community	Foundation	Writing	Composes and creates documents – letters, manuals, reports, proposals, graphs, flow charts, etc. [1.6.8]
	12.16.2 Prepare a critique of the meeting attended	Interpersonal	Customer Service	Shows initiative and courtesy in meeting and working with customers [2.3.8]
12.17 List business meeting skills	12.17.1 Relate the basic rules required to ensure an orderly and business-like meeting	Foundation	Speaking	Organizes ideas, and communicates oral messages to listeners [1.12.7]
	12.17.2 Demonstrate with role-playing appropriate meeting skills	Interpersonal	Leadership	Conveys attitudes and values of group to others [2.4.3]  Influences group behavior [2.4.8]
12.18 Outline a survey for employment opportunities	12.18.1 Compile information on a particular employment opportunity of interest	Foundation	Writing	Presents own opinion in written form in a clear, concise manner [1.6.14]
	12.18.2 Perform an Internet search of a specific career area	Personal Management	Career Awareness, Development, and Mobility	Develops skills to locate, evaluate, and interpret career information [3.1.4]
12.19 Select a professional journal for review, and develop a three- to five-minute presentation	12.19.1 Prepare a presentation on the content, purpose, and distribution of a particular professional journal	Foundation	Writing	Prepares a complex document in a concise manner [1.6.12]

CAREER and TECHNICAL SKILLS		ACADEMIC and WORKPLACE SKILLS		
What the Student Should be Able to Do		What the Instruction Should Reinforce		
Knowledge	Application	Skill Group	Skill	Description
12.20 Identify customer expectations	12.20.1 List customer expectations 12.20.2 Discover the consequences of unmet customer expectations	Interpersonal	Customer Service	Applies human relations skills in real-life situations [2.3.1]  Recognizes effects of positive/negative attitudes on customers [2.3.7]  Works with customers to satisfy their expectations [2.3.9]
12.21 List parts of a job application	12.21.1 Prepare a job application from various businesses in the community 12.21.2 Demonstrate a mock job interview	Foundation	Reading  Speaking  Writing	Determines what information is needed [1.3.10]  Communicates a thought, idea, or fact in spoken form [1.5.5]  Uses verbal language and other cues, such as body language, appropriate in style, tone, and level of complexity to the audience and the occasion [1.5.14]  Completes form accurately [1.6.7]
12.22 Outline your employment portfolio	12.22.1 Construct a personal employment portfolio	Foundation	Writing	Composes and creates documents – letters, manuals, reports, proposals, graphs, flow charts, etc. [1.6.8]  Produces neat, legible document from typewriter or computer [1.6.15]  Summarizes written information [1.6.17]  Uses language, style, organization, and format appropriate to subject matter, purpose, and audience [1.6.19]
12.23 Identify supervisory and management roles in an organization	12.23.1 Prepare an organizational chart 12.23.2 Outline the responsibilities of managers and supervisors	Foundation  Interpersonal  Thinking	Writing  Leadership  Creative Thinking	Produces neat, legible document from typewriter or computer [1.6.15]  Helps an individual or group challenge existing procedures, policies, or authority [2.4.7]  Develops visual aids to create audience interest [4.1.4]

<b>CAREER and TECHNICAL SKILLS</b> What the Student Should be Able to Do		<b>ACADEMIC and WORKPLACE SKILLS</b> What the Instruction Should Reinforce		
<b>Knowledge</b>	<b>Application</b>	<b>Skill Group</b>	<b>Skill</b>	<b>Description</b>
12.24 Outline safety issues	12.24.1 Research safety issues within a given career area	Foundation	Reading	Identifies relevant details, facts, and specifications [1.3.16]
			Science	Follows safety guidelines [1.4.15]
		Personal Management	Integrity/Honesty/ Work Ethic	Follows established rules, regulations, and policies [3.2.5]

# Glossary

## Unit 1: Practicing Safety on the Plumbing Site

1. Asbestos — fibrous, fire-resistant substance used in pipe insulation; now banned by the federal government
2. Combustible — air or materials that can explode and cause a fire
3. Decibel (dB) — measure of sound loudness; the higher the decibel, the louder and more damaging the sound
4. Hypothermia — life-threatening condition caused by exposure to very cold temperatures
5. Lockout — placement of a lockout device on an energy-isolating device so equipment cannot be operated until device is removed
6. MSDS — Material Safety Data Sheet
7. National Fire Protection Association (NFPA) warning diamond — four-colored diamond label placed on containers or doors to alert as to specific hazards; numbers in the three colored sections range from 0 (least severe hazard) to 4 (most severe hazard); the fourth (white) section is left blank and is used only to denote special fire fighting measures/hazards
8. Permit-required confined space — confined space that has actual hazards; hazards could be atmospheric, physical, electrical, or mechanical
9. 29 CFR Part 1926 — Title 29 Code of Federal Regulations, Part 1926; published by the Occupational Safety and Health Administration (OSHA); covers OSHA standards for the construction industry

## Unit 2: Introduction to Plumbing

1. Appurtenances — accessories or apparatus
2. Aqueduct — a man-made channel used to carry water
3. Back flow preventer — a device that prevents nonpotable water from entering the potable supply system
4. Code — requirement published by the state to establish minimum standards for various types of construction
5. Drain-waste-vent (DWV) — pipe system that combines sanitary drainage with venting
6. Journeyman plumber — plumber who has successfully completed a plumbing apprenticeship training program
7. Polyvinyl chloride (PVC) — a thermoplastic material used in tubing for cold water systems
8. Potable — water that is safe for cooking and drinking
9. Top-out — another term used for *above grade rough-in*
10. Underground rough-in — the phase of a plumbing project during which the plumber locates all supply and waste connections from the building systems to public utilities and establishes where these systems will enter and leave the building

## Unit 3: Using Math in Plumbing

1. Back — part of the fitting opposite to the side with an opening or face
2. Center — a point exactly halfway between two other points or surfaces
3. Centerline — on a drawing, a line that shows the center of an object
4. Decimals — parts of a whole number divided into tenths
5. Face — the open end of a fitting where a pipe is joined
6. Fitting allowance — the distance from the end of pipe that goes into a fitting to the center of the fitting; also called *takeoff*
7. Fractions — parts of a whole number
8. Schematic drawings — simple, single-line representations (drawings) of pipes and fittings
9. Thread makeup — the distance that a pipe screws into a fitting
10. Throat — the part of the fitting where another pipe or fitting is threaded in

## Unit 4: Interpreting Plumbing Construction Drawings

1. Architect's scale — a specialized ruler used in making measurements for architectural drawings; used in the United States to produce drawings with reduced or enlarged ratios of one foot; may be flat or shaped with a cross-section of an equilateral triangle
2. Computer-aided drafting (CAD) — sophisticated computer design program that allows designers to create drawings in two or three dimensions
3. Construction drawing — drawing that shows the design, location, and dimensions of a building and its various components
4. Details — sections of construction drawings that are enlarged to make them clearer
5. Elevation drawing — drawing of a structure showing a side, front, or back view
6. Fixture drawing — drawing that shows the components of a fixture in detail
7. Isometric drawing — a pictorial drawing that creates a three-dimension illusion of an object; all horizontal lines are at a 30-degree angle
8. Plumbing drawing — construction drawing that shows locations of fixtures and pipe runs and gives size and type of pipe to run
9. Riser diagram — a drawing that shows vertical and horizontal piping along with sizes and a riser number that refers back to the full set of plumbing drawings
10. Specifications — written requirements included with the drawings or blueprints of a construction project; provide more details or descriptions of the technical standards that must be met during construction

## Unit 5: Identifying Tools Used in Plumbing

1. Amperage — a measure of electrical current
2. Diameter — distance across the center of a circle
3. Electrical ground — a conductive connection that provides a path for electrical current to pass from component to earth
4. Ferrous — containing iron
5. Flux — a water-soluble substance that facilitates the fusion of metals and helps prevent surface oxidation during welding, brazing, and soldering; also called *soldering paste*
6. Level — straight on a horizontal plane
7. Miter — surface forming the beveled end or edge of a piece where a joint is made by cutting two pieces at an angle, then fitting them together
8. Plumb — straight on a vertical plane
9. Offset — a combination of elbows or bends that brings one section of pipe out of line but into a line parallel with another section
10. Soldering — a method of joining metals or sealing joints using solder and heat

## Unit 6: Cutting and Joining Pipe

1. Compression joint — method of connection in which tightening a threaded nut squeezes a compression ring to seal the joint
2. Cutting PVC pipe — cutting PVC with appropriate pipe cutters, handsaw, or power saw equipped with a carbide or abrasive blade
3. Drawn copper — tubing produced by pulling the tube through dies to reduce its diameter; drawing process hardens the copper and makes it rigid
4. Flare joint — a fitting in which one end of each tube to be joined is flared outward using a special tool; the flared tube ends mate with the threaded flare fitting and are secured to the fitting with flare nuts
5. Hub-and-spigot cast iron pipe — pipe that has a bell at one end where the spigot of the next piece of pipe slides in to form a joint
6. Joining PVC pipe — ream, chamfer edges to remove burrs, then use mechanical fittings, ring-tight gaskets, bell and spigot, heat fusion, and solvent
7. No-hub cast iron pipe — cast iron pipe with no enlargement or bell on either end
8. PVC pipe — rigid polyvinylchloride, high impact-strength pipe
9. Solvent weld on PVC — clean, prime, and use appropriate solvent cement to bond pipe and fittings
10. Sweat joint — pipe joint made by applying solder to the joint and heating it until it flows into the joint

## Unit 7: Supporting and Hanging Pipe

1. Anchor — a fastening device often made out of metal; used to attach pipes to walls, ceilings, and floors
2. Clevis hanger — an iron, or link in a chain, bent into the form of a horseshoe, stirrup, or letter U, with holes in the ends to receive a bolt or pin
3. Pipe riser clamp — a vertical extension of pipe hanger that provides support for pipe and tubing
4. Threaded drop-in anchor/fastener — designed for anchoring into concrete; drop the anchor into the predrilled hole in concrete; a setting tool expands the anchor into concrete; most commonly used in concrete ceilings, walls, or floors; different sizes of anchors are rated for different weights or spreads between anchors

## Unit 8: Installing Waste and Soil Pipes

1. Building sewer — that part of the drainage system that extends from the end of the building drain and conveys its discharge to a public sewer, private sewer, individual sewage disposal system, or other point of disposal
2. Cleanout — an access point to all parts of the drainage system for the removal of blockages
3. Drainage fitting — any of a variety of fittings used in the DWV system to remove waste from a building
4. DWV system — a pipe system that combines sanitary drainage with venting
5. Elevation — the height above an established reference point, such as a grade reference point on a construction drawing
6. Grade — the slope of a horizontal run of pipe (also referred to as *slope*, *percent of grade*)
7. Interceptor — a device designed and installed so as to separate and retain deleterious, hazardous, or undesirable matter from normal waste while permitting normal sewage or liquid waste to discharge into the drainage system by gravity
8. P-trap — a P-shaped trap that provides a water seal in a waste or soil pipe; used mostly at sinks and lavatories
9. Sanitary fitting — a fitting used to connect DWV branches to the main DWV system and serve as a cleanout
10. Stack — a general term for any vertical line, including offsets of soil, waste, vent, or inside conductor pipe; does not include vertical fixture and vent branches that do not extend through the roof or that pass through not more than two stories before being reconnected to the vent stack or stack vent

## Unit 9: Components of a Water Distribution System

1. Back flow preventer — a potable device that prevents nonpotable water from entering a freshwater supply system
2. Check valve — a valve that allows liquid to flow in only one direction; pressure within the line keeps the valve open; closure of the valve is automatically activated by the reversal of flow or by the weight of the disk mechanism
3. Curb box — a cylindrical casing placed in the ground over the curb stop into which a special key can be inserted to turn off the curb stop; also referred to as a *buffalo box*
4. Hammer arrestor — a device installed in a pipe system to absorb hydraulic shock waves and eliminate water hammer, a loud thumping that results when the flow of water is suddenly stopped
5. Pressure regulator valve — used to reduce water pressure in a building; activated by changes in pressure within the system
6. Pressure relief valve — normally used for liquid service; as pressure increases, it slowly opens, and as pressure decreases, it slowly closes
7. Service line — another term for *feeder line*
8. Vacuum breaker — a type of back flow preventer that inhibits back flow caused by low pressure in a water supply system
9. Water supply fixture unit (WSFU) — a design factor to determine the load that different plumbing fixtures produce on the supply side of a plumbing system
10. Water table — the distance below the ground's surface at which the soil becomes saturated

## Unit 10: Installing Plumbing Fixtures and Equipment

1. Diverter — a device that redirects the flow of water, as in a combination shower and bath fitting; when the diverter is engaged, water flows through the showerhead instead of through the spigot
2. Fixture — a device that receives water from a water supply line; common fixtures include sinks, shower stalls, and toilets
3. Flood level rim — the edge of the receptor or fixture that water overflows
4. Flushometer — a device that discharges a pre-determined quantity of water to fixtures for flushing purposes and is closed by direct water pressure or other mechanical means; also referred to as a *flushometer valve*
5. Flush valve — a device located at the bottom of a tank for flushing water closets and similar fixtures
6. Hose bibb — a faucet with a threaded outlet used to connect a hose; usually located on the outside of a building
7. Lavatory — a basin designed for installation in bathrooms and other locations; primarily for washing the hands and face
8. Vent pipe — a pipe or pipes installed to provide a flow of air to or from a drainage system or to provide circulation of air within such a system to protect trap seals from siphonage and back pressure; also referred to as a *vent system*
9. Vitrified porcelain — a mixture of fine clay, quartz, feldspar, and silica that is heated to 2,600 degrees Fahrenheit (1,426 degrees Celsius) to create a nonporous, glass-like finish; also referred to as *china*

## **Unit 11: Servicing and Repairing Plumbing Fixtures and Equipment**

1. Seat washer — a disk that fits at the end of the valve stem and is used to regulate the flow of water through a faucet

## Unit 12: Career and Technical Student Organizations (SkillsUSA/HOSA)

1. Assess — to determine the value, significance, or extent; to judge
2. Assessment — a tool used to determine value, significance, or extent
3. Behavior — the actions one takes; how one conducts oneself
4. Business meeting skills — the ability for individuals who share a common ground (occupational, work, trade, or organizational) to conduct a methodical and systematic meeting
5. Career — a chosen pursuit; the general course of progression of one's working life
6. Competency — the knowledge that enables one to comprehend and complete a task
7. Critique — a critical review or commentary
8. Cultural diversity — integrated existence of ethnic groups based on their values, beliefs, and behavior patterns (social, educational, economic, religious, and artistic values)
9. Customer — one who buys goods or services
10. Equity issue — a point of matter affecting the justice and fairness for all concerned
11. Expectation — eager anticipation; to look forward to the probable occurrence or appearance of something
12. Government — the agency or apparatus through which a governing individual or body functions and exercises authority
13. Image — the public's opinion or concept of something
14. Interview — a formal, in-person meeting in which the assessment of the qualifications of an applicant are demonstrated/determined
15. Job application — a form or document used by an employer when hiring prospective employees
16. Journal — a personal record of occurrences, experiences, or reflections kept on a regular basis
17. Management — the person or people who control or direct a business or other enterprise
18. Mentor — a wise or trusted counselor or teacher
19. Organizational chart — a chart that reflects the structure through which individuals cooperate systematically to conduct business
20. Parliamentary procedure — a body of rules governing a meeting

21. Portfolio — a portable case for holding materials — such as photographs, drawings, or other materials — that represent a person's work
22. Presentation — a performance; a formal introduction; the process of offering for consideration or display
23. Professional organization — a service provider utilizing a business relationship that allows outsourcing of human resources tasks, mainly for small to mid-sized businesses that do not have the need or resources for a dedicated human resources department; the concept is virtually unknown outside of the United States
24. Résumé — a brief account of one's professional or work experience and qualifications often submitted with a job application
25. Self-motivation — to take action, move forward of one's own volition
26. Short-term goals — goals or targets that are reachable within a short or brief period of time
27. Stress — an extreme pressure, strain, or difficulty
28. Task — a function to be performed
29. Trade union — a labor union, especially one limited in membership to people in the same trade