OALCF Tasks for the Apprenticeship Goal Path: Prepared for the Project, *Developing Best Practices for Increasing, Supporting and Retaining Apprentices in Northern Ontario (2014)*

OALCF Task Cover Sheet

Task Title: Formulas in Plumbing

Learner Name:	
Date Started:	**Date Completed:**
Successful Completion: Yes___ No___	
Goal Path: Employment___ Apprenticeship✓ Secondary School___ Post Secondary___ Independence___	
Task Description: Using formulas to calculate pipe ratios and determining water pressure in water tanks.	
Competency: A: Find and Use Information B: Communicate Ideas and Information C: Understand and Use Numbers	**Task Group(s):** A1: Read continuous text B2: Write continuous text C3: Use measures
Level Indicators: A1.2: Read texts to locate and connect ideas and information B2.1: Write brief texts to convey simple ideas and factual information C3.2: Use measures to make one step calculations C3.3: Use measures to make multi-step calculations; use specialized measuring tools	
Performance Descriptors: see chart on last page	
Materials Required: • Pen and paper • Calculator - optional • Attached document - Formulas Used in Plumbing	

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Learner Information and Tasks

Plumbers must be able to use formulas to determine the amount of force exerted on water tanks and understand the volume capacity of pipes being used. Read the document **Formulas used in Plumbing**

Task 1: Determine the number of pipes required to equal the volume capacity of a 6" pipe for the following pipe sizes. What type of pattern emerges?

a) 1½" pipe

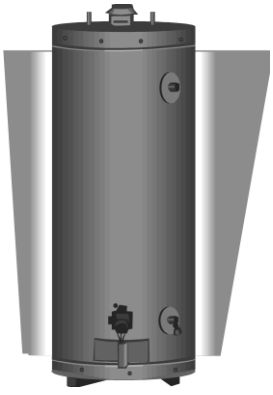
b) 2" pipe

c) 3" pipe

Task 2: What does kPa stand for and how is it defined?

Task 3: There are 2 tanks to be installed. Determine the amount of pressure for each tank.

1.5 metre depth tank



6 metre depth tank

Task 4: You have a tank that is only .5 meters in depth. Determine the pressure for this tank.

Task 5: There is a pressure gauge on a tank that reads 41.6 kPa. What is the depth of the water in the tank?

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Formulas used in Plumbing

Pipe Size Capacity Ratio

An important plumbing concept is to understand the ratio between pipe size and volume output. For example; how many one inch pipes would it take to provide the same volume of water as a two inch pipe?

The formula below is used to find the capacity of larger pipes in relation to smaller pipes, however, this does not take into consideration the friction loss.

Pipe Size Ratio Formula

D^2 - Diameter of larger pipe squared
d^2 - diameter of smaller pipe squared
N - number of smaller pipes

$N = D^2 \div d^2$

Example: How many 1 ½" pipes would be required to provide the volume of one 3" pipe?

N = (3x3) ÷ (1.5 x 1.5)

N = 4 Four 1 ½" pipes are needed

Finding Pressure in Depths of Water

The importance of pressurized systems is the pressure exerted by water. Water pressures are directly related to both the height (depth) and density of water. Pressure is defined as the amount of force acting (pushing) on a unit area.

The term Kpa (kilopascals) is a measure of force per unit area, defined as one Newton per square metre.

A cubic meter of water has a mass of 1000 kg. The force acting downward will be 1000 x 9.8 or 9800 Newton. As this force is acting on 1.0 M^2 the pressure on the base of the cube will be 9800 N or 9.8 kPa per 1.0 m^2.

It follows that at a depth of 2.0 m the pressure will be 2 x 9.8 or 19.6 kPa and 3.0 m it will be 3 x 9.8 or 29.4 kPa. Therefore, to find the pressure in water simply multiply 9.8 by the depth in meters. Remember that the result of this calculation will give you kilopascals.

Formula

Pressure (P) = 9.8 x depth (m) = kPa
P = 9.8 x depth (m) x SG = kPa *(If working with substances other than water their specific gravity (SG) must be factored in)*

Example: Find the pressure in water at a depth of 150m. P = 9.8 x 150 P= 1470 kPa	Example 2: If a pressure gauge on a non pressurized tank reads 24.3 kPa, how many meters of water are there in the tank? Depth= 24.3 ÷ 9.8 Depth= 2.48 m

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Answer Sheet

Task 1: Determine the number of pipes required to equal the volume capacity of a 6" pipe for the following pipe sizes. What type of pattern emerges?

1 ½" pipe

(6 x 6) ÷ (1.5 x 1.5) = 36 ÷ 2.25 = **16**

2" pipe

(6 x 6) ÷ (2 x 2) = 36 ÷ 4 = **9**

3" pipe

(6 x 6) ÷ (3 x 3) = 36 ÷ 9 = **4**

The pattern that emerges is the larger the pipe size the fewer required

Task 2: What does kPa stand for and how is it defined?

Kilopascal

It is a measure of force per unit area, defined as one newton per square meter.

Task 3: There are 2 tanks to be installed. Determine the amount of pressure for each.

1.5 metre depth tank	6 metre depth tank
1.5 x 9.8 = 14.7	6 x 9.8 = 58.8
14.7 kPa	**58.8 kPa**

Task 4: You have a tank that is only .5 meters in depth, determine the pressure for this tank.

.5 x 9.8 = **4.9** 4.9 kPa of pressure

Task 5: There is a pressure gauge on a tank that reads 41.6 kPa, what is the depth of the water in the tank?

41.6 ÷ 9.8 = **4.24 m** 4.24 m in depth

Literacy Northwest
Regional Literacy & Basic Skills Network

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	Performance Descriptors	Needs Work	Completes task with support from practitioner	Completes task independently
A1.2	• scans text to locate information			
	• locates multiple pieces of information in simple texts			
	• makes low-level inferences			
	• follows the main events of descriptive, narrative and informational texts			
B2.1	• writes simple texts to request, remind or inform			
	• conveys simple ideas and factual information			
C3.2	• calculates using numbers expressed as whole numbers, fractions, decimals, percentages and integers			
	• understands and uses ratio and proportion			
	• interprets and represents area and volume using symbols and abbreviations (e.g. m3)			
	• chooses and performs required operation(s); may make inferences to identify required operation(s)			
	• selects appropriate steps to solutions			
	• interprets, represents and converts measures using whole numbers, decimals, percentages, ratios and simple, common fractions (e.g. ½, ¼)			
C3.3	• calculates using numbers expressed as whole numbers, fractions, decimals, percentages and integers			
	• understands and uses formulas for finding the perimeter, area and volume of non-rectangular, composite shapes			

	• manages unfamiliar elements (e.g. context, content) to complete tasks			
	• chooses and performs required operations; makes inferences to identify required operations			
	• selects appropriate steps to solutions from among options			
	• interprets, represents and converts measures using whole numbers, decimals, percentages, ratios and fractions			
	• uses strategies to check accuracy (e.g. estimating, using a calculator, repeating a calculation, using the reverse operation)			

This task: was successfully completed___ needs to be tried again___

Learner Comments

_____ _____

Instructor (print) **Learner Signature**