**OALCF Task Cover Sheet**

**Task Title:** Formulas in Plumbing

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| **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 InformationB: Communicate Ideas and InformationC: Understand and Use Numbers | **Task Group(s):**A1: Read continuous textB2: Write continuous textC3: Use measures |
| **Level Indicators:**A1.2: Read texts to locate and connect ideas and informationB2.1: Write brief texts to convey simple ideas and factual informationC3.2: Use measures to make one step calculationsC3.3: 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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**Task Title:** Formulas in Plumbing

**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?

1. 1½" pipe
2. 2" pipe
3. 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

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**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?

**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**

D2 - Diameter of larger pipe squared

d2 - diameter of smaller pipe squared

N - number of smaller pipes

 N = D2 ÷ d2

**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 M2 the pressure on the base of the cube will be 9800 N or 9.8 kPa per 1.0 m2.

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*](http://www.plumbinghelp.ca/plumbing_math_specific_gravity.php) *(SG) must be factored in)*

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| Example: Find the pressure in water at a depth of 150m.P = 9.8 x 150P= 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 ÷ 9.8Depth= 2.48 m |

**Task Title:** Formulas in Plumbing

**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 = 14.76 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

## Task Title: Formulas in Plumbing

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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)
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**This task:** was successfully completed\_\_\_ needs to be tried again\_\_\_

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| Learner Comments |
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#### Instructor (print) Learner Signature