Math-in-CTE Lesson Plan:
Manufacturing

Lesson Title:	**GMAW Shielding Gas Mix**	*Lesson 01*
Occupational Area:	Metal Fabrication	
CTE Concept(s):	GMAW Shielding Gas Mixtures	
Math Concepts:	Percents, Multiplying Whole Numbers	
Lesson Objective:	Students will be able to choose the proper shielding gas for wire and weld process	
Supplies Needed:	Handouts, Shielding gas cylinders, white board w/markers	

THE "7 ELEMENTS"	TEACHER NOTES (and answer key)
1. Introduce the CTE lesson.	
As we move on with the welding processes, we will be looking for students to be able to choose the correct shielding gas.	
The gauges as we learned earlier have a high- and a low-pressure side. The high-pressure side shows how much pressure is left in the cylinder, and the low-pressure side shows the amount of gas flow at the wire feed gun shielding the weld.	Show pressure gauge and cylinder on wire feed Demonstrate how cylinder is opened and gauge is adjusted
For the same reason it's important that you choose the right rod for a weld, it's important to use the correct shielding gas. Because of the wire we are using, we will be using a shielding gas that is 75% argon and 25% CO_2. The wire is an ER-70 solid wire. The shielding gas should have a flow of 30 to 40 CFH. These numbers are just starting points. Some of the shielding gases will require a higher or lower	Show wire feed charts for voltage and wire speed Show students where gases are labeled and percentages are given

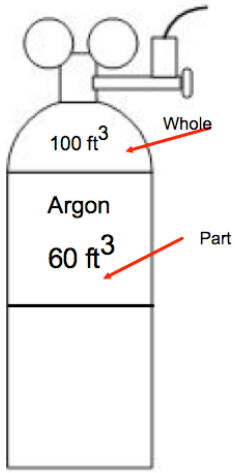
flow rate. Please consult your shielding gas flow charts.	
2. Assess students' math awareness as it relates to the CTE lesson. As I said, the shielding gas we use contains 75% Argon and 25% CO2... but what exactly does a percentage tell us? If you look at the word "per-cent" it has two parts. What comes to mind when you hear the word "per"? How about "cent" or "cents"? You probably learned how to **convert decimals and percentages** in your math class, but just in case your memory has become foggy try to use the meaning of percent to help you. Per → Divide Cent → 100 Example 28% would be 28/100 = 0.28 *467% would be 467/100 = 4.67* Sometimes we want to go backwards and convert a decimal to a percent. Any idea on how we could reverse the process? So what you're saying is: 0.73 would be 0.73 • 100 = 73 or 73% GOOD!	• Per can mean "for every" or "each" or "divide" in math. (Miles PER Gallon) • The most common answer would be 100 cents in a dollar but expect confusion with scent and sense. (Can be written on a white/black board if available.) Rather than multiply by 100, divide by 100. CTE Worksheet #1 (Questions and answers are paired)

Take a look at this worksheet and give it a try, I'm not going to judge you, so just do your best. Raise your hand if you got at least 2 right...3 right...etc	Use hand-raising to assess how students scored.
3. Work through the math example embedded in the CTE lesson. Here's another sheet I want you to take a look at. Look at the picture on the left. Notice the three pieces of the tank. The picture has a "whole" which tells us the number of cubic feet of gas contained within the cylinder. We've talked about the percents already. The last piece is called the "part" and basically tells us how many cubic feet of THAT gas are inside the cylinder. In this example, we know the amount of the whole and the percent but we need to find the part. A simple way to find the part is to multiply the % (as a decimal) by the whole. Within the first cylinder, how many cubic feet would be argon? (0.75)(100) = 75 ft3 How many cubic feet would be CO2? (0.25)(100) = 25 ft3 Try your luck with the three tanks on the right. I'll be nice and leave the formula for the part on the board.	CTE Worksheet # 2 1. Arg = 75 CO2 = 25 2. Arg = 170 CO2 = 30 3. Arg = 294 CO2 = 6 4. Arg = 320 CO2 = 60 O2 = 20 % • Whole = Part (On whiteboard) Emphasize the importance of converting to a decimal first.
4. Work through *related, contextual* math-in-CTE examples. Now if you really want to work your brain flip the paper over. What's different about this side than the other side?	CTE Worksheet #3 1. 600 ft^3 2. 350 ft^3, 150 ft^3 3. 87.5%, 12.5% Now we could be looking for the whole, part, OR percent.

Since we are taking this to a new level we need a new trick to help find the missing part. Does the picture on the board look familiar to anyone? It's probably pretty confusing so let me explain how it works:

If we have the tank on the board, we want to know what percentage of the whole the 60 ft^3 is.

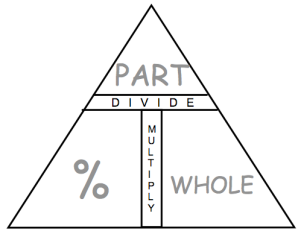
By using the pyramid, we know that we have the whole and we have the part. So in order to do this, we need to take the 60, put that into the slot on the top, and **substitute** the 100 for the whole.



The pyramid tells us to divide the part by the whole to get our percent.

Alright, I'm going to turn you loose. Try the three problems on the back-side. Use your pyramid, if you have questions

This may resemble the Ohm's Law pyramid or something used in a math class you've had.



Part ÷ Whole = Percent

60 ÷ 100 = Percent

= 0.60 or 60%

(Do substitutions on the board)

just raise your hand.	
5. Work through traditional math examples **There's one more way that you might see this. You guys all know what the Accuplacer** is right? I have a couple problems taken right off the Accuplacer I want you to try using the percentage pyramid. Before you just go taking off and doing this, let me give you a hint because there are no more pictures. Whenever you see the word "of," the whole comes RIGHT after it.	CTE Worksheet #4 The Accuplacer is the typical entrance exam for Community Colleges. Answers: 1. E 2. B 3. C 4. A 5. D 6. B 7. B 8. All of the Above
6. Students demonstrate their understanding. Alright, everyone come up and take a post-it note. Either you have a % written on your post-it or you have a capacity, written in cubic-feet. The first task applies only to people with a percentage. You have 15 seconds to pair up with someone that will make 100% with you. Your second task is to take your partnership and match-up with a capacity person. Once you are matched up your group will have 30 seconds to figure out exactly how many cubic-feet of each gas are contained in your group.	With 15 students: 10 % and 5 Capacities You can create groups of three as needed. Any time allowances can be changed to suit.
7. Formal assessment. Have students find and identify 5 cylinders located in the	

shop and explain the type of shielding gas. What percentages of gas are in each cylinder? How many cubic feet of each gas are in it? Students will setup and operate a wire feed with the proper shielding gas. Each student will test their weld to ensure that they have chosen the proper gas. Then with an incorrect shielding gas, the class as a whole will create a weld and test it.	It should become evident that the incorrect choice of shielding gas will result in a poor weld. *Extra Credit* Locate the extra cylinder that is not a shielding gas and identify what kind of gas(es) it contains, and what the fuel mixture is.

NOTES: