Math-in-CTE Lesson Plan Template

Lesson Title: Cutting Fluids		Lesson #
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Occupational Area: Metal Trades		
CTE Concept(s): Coolant – Mixing proper ratios		
Math Concepts: Volume – Proportion - Conversions		
Lesson Objective:	Cutting Fluid Concentration	
Supplies Needed:	Machining Fundamentals chapter 9,Machinery's Handbook	

THE "7 ELEMENTS"	TEACHER NOTES (and answer key)
1. Introduce the CTE lesson. The importance (need) for cutting fluids. Why: cooling, surface finish, lubricating, surface protection, chip evacuation Types: mineral oils, emulsifiable oils, chemical/semi-chemical, gaseous fluids	**Cooling:** Maintain consistent work piece and tool temperature. **Surface Finish:** Ability to run higher speeds/feeds – better finish and more production. **Lubrication:** Less tool wear – longer tool life – more precision. **Surface Protection:** Rust inhibitor. **Chip Evacuation:** Allows for higher speeds/feeds – eliminates chip "binding". **Types:** Refer to Text chapter 9 – depends on machine process and materials being machined.

Application of fluids: flooding, misting, through tool	**Application:** Refer to chapter 9 – depends on the machine and materials being machined.
Evaluation of concentration: Manufacturers recommended concentration. Loss due to evaporation and spillage.	**Evaluation of concentration:** Each manufacturer has limits on the concentration dependant on the machining process. They also give standard evaporation rates (the water evaporates but the coolant concentrate does not, over time there will be less of a more concentrated coolant). Spillage is the coolant that ends up on the floor or wiped away with hands and rags. Spillage does not change the concentrate levels.
Tramp oils and contaminants: machine oils metal chips	Tramp Oils and contaminants: Are the way and spindle oils that leak into the coolant system. There are also oils and rust inhibitors that are on the metals when they are shipped. Contaminants are the chips primarily. These effect on the ph levels of the coolant and if not maintained will allow bacterial growth. Note: High ratios have less lubricating properties and may not be efficient. Low ratios have tendencies to foam (air bubbles). Air in the coolant does allow efficient cooling.
2. Assess students' math awareness as it relates to the CTE lesson.	
Ratios/Proportions	How many students in the room? Of them how many have brown hair? (similar problems to create ratios)
Conversion: linear, liquid	12 inches in 1 foot
Terms: What size is it? = measurements How big is it? = volume or "space within" How much will it hold? = capacity	128 oz. in one gallon

Volume - Capacity (liquid measure) Maintain unit of measure	1 cubic ft. = 7.48 gal. Keep in mind that units remain consistent (make sure you're adding oz. with oz.).
3. Work through the math example *embedded* in the CTE lesson. Calculating mixture, mixing in a 5 gal. pail 30:1 Measure 15 inches on the side of the pail. How many ½ inches are there in 15 inches? One of the 30 half inches is oil and the other 29 are water. Total volume, the % of that volume to be concentrate: A rectangular tank that is 2 ft. long, 1 ft. wide, 6 in. high will have a volume of 1728 cubic inches or one cubic foot. The capacity of one cubic foot is 7.48 gal. or 957.44 oz. To get a 20:1 mix, the percentage of coolant will be 5% of 957.44 oz., which is 47.87 oz. Subtract 5% from the total capacity. 957-48=909	The 5 gal. pail example shows how to create a linear proportion. Worksheet showing example: Refer to Machinery's Handbook page 2566 for conversions and equivalents. Multiply length, width, and height to find volume. Calculations may be done in inches or feet. If using inches convert to cubic feet before converting to volume. Multiply the number of cubic feet by 957.44 to find ounces. A 20:1 mix means out of 20 parts 1 part will be concentrate, or 1/20th of the mixture. This will be easier converting to a decimal (%) 5%. At this point it is acceptable to round the numbers to the whole numbers.

4. Work through *related, contextual* math-in-CTE examples. Find the volume of Cylindrical tanks A five gallon pail has a capacity of? What is the volume of a 5 gallon pail? Convert to the volume to capacity. Why isn't it 5 gallons?	Find the volume of then convert to capacity Remind students of definitions, capacity and volume. Using these Multiply (π)(radius sq.) (height). Explain liquids in a container need headspace or room for expansion. Workbook: Practical Problems in Mathematics unit 27
5. Work through *traditional math* examples. Volumes of basic and irregular shapes Ratio and proportion	Worksheet: 2 Answer Key:

6. Students demonstrate their understanding.	
7. Formal assessment. How many gallons of mixed coolant do we need in the shop? How many gallons of concentrate do we need in the shop, mixing a 40:1 ratio? **How much does it cost?**	Find total gallons each machine requires. Find the sum of all machines.

NOTES: