Math-in-CTE Lesson Plan

Lesson Title: AT10-Frequency/Vibration		Lesson #		
Author(s):	Phone Number(s):	E-mail Address(es):		
Paul Jones	(207) 631-7085	pjones@rsu24.org		
David Minott	(603) 714-5638	<u>dminott@rsu1.org</u>		
Clark Porter	(207) 725-9441	<u>cporter@brunswick.k12.me.us</u>		
Occupational Area: Automotive Technology – Steering and Suspension				
CTE Concept(s): Using Frequency to Diagnose and Isolate Vibration Concerns				
Math Concepts: Using Algebraic manipulation, solve for the unknown value				
Lesson Objective: Cal	Calculate the circumference of the vibrating component			
Supplies Needed: Sirc	ometer/Reed-Tachometer, cern	String, Chalk, Tape measure, Prepared vehicle with a vibra		

THE "7 ELEMENTS"	TEACHER NOTES
	(and answer key)
1. Introduce the CTE lesson. Today, we are going to look into understanding vibration principles so we can better equip ourselves to accurately isolate, diagnose and repair vibration related customer concerns.	
The more we understand what a vibration is, the more we can accurately diagnose a vibration. We have the ability, with very inexpensive equipment, to measure a vibrations frequency in a vehicle to help isolate the source or component causing this vibration. We do this by taking this measured reading along with the speed at which the vehicle was traveling when the vibration was most prevalent and input this collected data into an algebraic equation.	
Ask: What is vibration?	Let the students respond to see what they think a vibration is. Do not necessarily define vibration at this time, but rather ask another question.
Has anyone ever, successfully, spun a basketball on their finger for any period of time or seen it done?	Some very important items have to be in place in order for that basketball to continue to spin on the tip of your finger.
Ask: What are those items that must be in place in order for that basketball to spin on the tip of your finger and to continue spinning?	Some answers you might hear are: There must be movement. It has to spin. There has to be a fixed, central point of rotation. It must be balanced. (Refer to question) Must be spinning on its axis
It must be balanced. What does this mean?	
What is balanced?	The object must be symmetrical, meaning it must be of equal weight, shape and consistency rotating about on a center point.
Let's say we stuck a wad of chewed bubble gum to one side of the basketball. What would happen?	It would have a wobble or an oscillation. It would be hard to continue to balance it on the tip of your finger on that same axis point as its center of gravity has

This can be stretched. If there is a driveline vibration in the vehicle, the driveline does not turn at the same speed as the tire/wheel assembly and the circumference is much smaller, therefore the Hz value will be much higher. Using a vehicle with a known vibration, or a bugged vehicle, test drive the vehicle and gather your reading with the sirometer. Obtain the rpm reading from the sirometer instead of the Hz reading. Find the rpm of the engine when the vibration is most prevalent, find the gear the transmission is in at the time the vibration is most prevalent (this may have to be done with a scan tool). Knowing these figures and ratios, use them to find the rotational speed of the driveshaft at the time the vibration occurs.	
Check this calculated figure to your sirometer reading to see if they are the same.	
6. Students demonstrate their understanding.	Review students measurements, data collection, findings,
Have vehicles in the shop with adequate room for them to measure the rolling diameter or circumference of a tire as described earlier in the lesson. Ensure they inflate the tire they will measure to the factory recommended pressure rating before taking the measurement. You may first have to demonstrate how this is done. Refer to the previous description in section 3 of this lesson plan under Circumference.	etc.
Using the formula, have them find the vibration frequency of that wheel assembly traveling at 40mph and at 60mph.	
It would be best for the students to do this on their own vehicle along with one parent or guardian. It is good to involve them in their training whenever possible.	
7. Formal assessment.	Ensure students have completed in full all documentation in its correct location.
The final assessment would be for them to determine if there is a vibration present, if there is, to obtain and collect all data and perform the repair which may be balance wheel assembly, then test drive to confirm repair.	
All this needs to be documented on a repair order	
See AT-10-WS4 (must be conformed to your schools info)	
Note: CSTS on the repair Order = Customer States	

NOTES: