WEB-BASED CURRICULUM FOR AN INTRODUCTORY AUTOMOTIVE TECHNOLOGY COURSE AT THE COMMUNITY COLLEGE LEVEL

by

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ABSTRACT

WEB-BASED CURRICULUM FOR AN INTRODUCTORY AUTOMOTIVE TECHNOLOGY COURSE AT THE COMMUNITY COLLEGE LEVEL

Joseph Alan Mulleary

Automotive Technology is a subject that encompasses eight different educational areas. Many students interested in automotive have no prior background when it comes to the subject, and they need foundational knowledge in order to ensure success in the program. This project includes the entire curriculum, developed for an introductory Automotive Technology course intended for the community college level. The course will provide a solid foundation into all areas of the trade. A quantitative survey was utilized in order to gain insight as to what topics should be covered during the course. This curriculum is designed as a hybrid, targeting students who live too far away from the school to regularly attend class in person, those who cannot normally attend classes due to their work schedule, and traditional students. It will include a combination of in-class and web-based labs and instruction. Students will be assessed on both the classroom and lab activities, although they will only receive one grade for the course. Specific tasks will be taught in accordance with National Automotive Technicians Education Foundation (NATEF).

ACKNOWLEDGEMENTS

Let me begin by saying that I had not intended to go back to school in order to pursue a Master's degree. Several years and lofty goals reinvigorated my educational pursuit. There were many important people that assisted me along the way, and I will forever be grateful for their willingness to stick by me during the journey.

My major professor Dr. Ann Diver-Stamnes really guided me along with curriculum development and taught me how to write academically. She provided me with inspiring words of wisdom and positive energy when it seemed like I was never going to complete my curriculum project. In addition, Ann was a great mentor. Her enthusiasm for teaching was unparalleled. I can only hope one day to be as dynamic of a teacher as she is.

I want to thank Dr. Eric Van Duzer for showing an interest in me and my work in Career and Technical Education (CTE). He taught me how to think critically when it came to all aspects of Education. Not only did he really help me get my quantitative survey off the ground, but he was integral in getting me to dial in the details. Eric was always a calm presence, and I looked forward to his feedback in classes. He has the keen ability to see a different angle that often times was unrecognizable through my lens of thinking.

My content expert and automotive mentor, Steve Berklite, has been a guiding light in my entering the field of education ever since being my automotive instructor

at Cerritos College. He was integral in me being accepted into the graduate program, and it is only fitting that he be a significant contributor to my completion. I have not only learned many automotive subjects from Steve, but he showed me in the process how to be a great instructor in the field of automotive technology. Steve displayed great professionalism, and it was evident by how students and colleagues respect him. I aspire to someday attain the same level of respect in the automotive community.

At this time I would also like to thank Dr. Cathleen Rafferty, who not only taught me about qualitative research, but more importantly all facets of teaching in higher education. That class was by far the most applicable course for me during the graduate program. I was so intimidated by the projects and being videotaped during the lesson plan, but I was able to learn so much about the art of actually conducting a classroom discussion. Cathleen, you are a teacher's teacher, and I will always remember the methods taught in your class. In fact, I plan to implement many of them in my inaugural semester as an instructor.

The support from my two colleagues in the Automotive Technology Department at College of the Redwoods, Mike Richards and Paul Hidy has been immeasurable. Mike has been a great mentor and taught me all about how to become an effective instructor, both in the classroom and lab setting. He also gave me the opportunity to co-teach a course with him and was able to provide great feedback in order to improve instruction. Paul has provided me with insights into curriculum development during the construction of my project. I was able to bounce many ideas

off of him and appreciate his willingness to assist me. His knowledge of instructional technology also helped steer me in the right direction when it came to the web-based components of the course.

I am lucky to have such great friends and family that have supported me throughout the process of completing my thesis and graduate degree. My Mom and Harold played such vital roles in my graduate pursuit and understood my reasons for going back to school when others simply did not. I love you guys! In particular, my Mom instilled a strong work ethic and determination in me that otherwise would have deterred my path of completion. She kept telling me to plug away at it and eventually I would reach my goal. Harold always treated me like his own son and supported my pursuits with cautionary optimism as we were so very different. He would be proud to know I have completed my thesis, although in his mind it was probably never even doubted. My Dad and Cathy played a great supporting role during my time in graduate school and for that I am grateful.

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CHAPTER ONE

INTRODUCTION

Students interested in an academic program at the college level need an introduction to the subject area. The introductory course should provide a foundation for the more advanced courses of study. At the same time, it should provide students with enough background of the subject area to steer them towards or away from that particular area of study.

While working as an instructional support specialist in an automotive technology department at a local community college, it did not take long to realize that the majority of students could benefit from an introductory course in automotive technology. Instead, students were able to enroll in eight of the ten courses our program offered, since only two required a prerequisite. At some point during each of the courses, I saw students who did not have the theoretical or hands-on background in order to be successful in the course in which they were enrolled. That was troubling. I could see these students wanted to be successful, yet the level of understanding with which they entered the course did not provide them with a strong chance of being successful.

I realized that some of these students may become overwhelmed and dropout of our program because they lack the prior foundational knowledge that students with automotive experience have. It has also made it difficult for the two instructors teaching the courses because they have to provide some foundation of basic concepts

that an introductory course normally provides. This means that instructors spend up to two weeks bringing their students up to speed with such aspects as safety and proper use of tools and equipment. Even with this overview, many students still do not have sufficient understanding of basic principles and hands-on practices of the trade. There were many situations in the lab aspect of the classes when this became apparent, although as instructors we did our best to take time and show students the proper processes they did not know.

The disparity among students is heightened due to the lack of an introductory course. We do not know what students' knowledge level of the subject is when they first take one of our courses. If we provided the foundation of knowledge needed in order to ensure a high level of success in our program with a prerequisite course, then instructors will know the knowledge base of students coming into their classes.

For my Master's project, I decided to address this issue and develop an introductory automotive technology course that would meet the needs of students interested in going into an automotive program. One of the first courses of action I took after researching the literature was surveying high school and community college automotive instructors at the California Automotive Teachers (CAT) Conference in the spring of 2009. Initially I was looking to deliver this course online, due to a lack of lab availability and a district wide push towards providing online courses. After collecting the data and analyzing the results of the survey, I realized that even an introductory course needed a hands-on component. At that point I

decided to create a hybrid course that incorporates a blend of face-to-face instruction, remote instruction, and web discussion along with many hands-on activities.

Chapter Two of the project provides a history of the community college system. It then looks into vocational education and the ways in which it has changed since its inception before shifting to an examination of Automotive Technology. The chapter concludes with a look into web-based courses in Career and Technical Education (CTE). Chapter Three focuses on my survey, program standards, articulation, a description of the course and the way in which it was conceptualized, and assessment. Chapter Four contains the content and lesson plans for the hybrid course I have developed, and Chapter Five presents conclusions and implications for future research.

CHAPTER TWO

LITERATURE REVIEW

Introduction

Web-based courses have gained in popularity since their inception into higher learning about a decade ago. Many students have become familiar with the option of taking web-based courses, especially those who do not have the time to fit a class into their busy schedules. One academic area that seems to be lacking in these types of courses is within the career and technical educational field. These disciplines are not only theory-based but often involve many hours of training in hands-on learning. While there is surely no substitute for hands-on training, there seems to be a niche market in academia that has not begun to be tapped.

Many students have academic interests beyond their major but often do not get a chance to take electives, such as courses within Automotive Technology. Others have the usual time constraints that make taking these courses difficult, while some actually try to register for them but cannot get in due to having a low priority level. A relatively small number of students are able to take classes with such a heavy hands-on component due to the school having a finite amount of tools and other necessary resources.

The literature review begins with a look into the history of the community college system, followed by an overview of the evolution of vocational programs with specific attention being placed on automotive technology. A review of

automotive technology programs which includes national learning objectives, articulation, and course content follows. The last section of the literature review offers a description of web-based courses along with insight into the rationale, benefits, challenges, and curriculum design involved with these types of courses. An examination of web-based instruction related to Career and Technical Education (CTE) is included.

History of Community College System

The history of the community college system in the United States can be traced all the way back to the late 1800s. The 1901 University Record of the University of Chicago (as cited in Diener, 1986) stated that in the late 1800s William Rainey Harper, the first President of the University of Chicago, believed that students should be separated based on the year they were in college. He felt freshmen and sophomores should be separate from the juniors and seniors and implemented the idea in 1892. Harper, in his Annual Report delivered in 1899 (as cited in Diener, 1986), recommended that an Associate degree be introduced to students completing their first two years of study in a specific discipline. It is not known exactly when the first junior college was established, but by the late 19th century there was much discussion surrounding the concept of this type of institution (Diener, 1986). As time went on, these terms became known as junior and senior college (Diener, 1986).

The community college movement.

The first two purposes of a junior college were to provide a general education and a transfer program (Diener, 1986). Some of the first junior colleges started as

technical and vocational institutions (Diener, 1986). During the first two decades of the 20th century there were four types of junior colleges consisting of two-year programs at a university, private junior colleges, 13th and 14th grades serving as an extension of public high schools, and normal schools which served to train teachers (Diener, 1986). Many people saw junior colleges as a way of making post-secondary education more efficient (Diener, 1986). The feeling was that many four-year colleges were underfunded, which degraded the quality of programs, and it was proposed that several of these institutions should downsize and focus on being two-year colleges (Diener, 1986).

Leonard V. Koos was a university professor and became an early proponent of the junior college movement (Diener, 1986). He felt junior colleges could help society by providing a solid general education that prior to the movement was restricted to the wealthy (Diener, 1986). In 1925 Koos stated in his book *The Junior College Movement* that junior colleges should be able to provide comparable instruction to that of universities, more assistance to students, and a general education that would set the foundation for both students moving on to universities and those ceasing their education after two years (Diener, 1986).

After the Depression, the main focus of junior colleges was to provide job training and vocational education (Diener, 1986). Junior colleges did not diversify until after World War II when they began accepting more minorities and women (Diener, 1986). During this time period, junior colleges accepted a wide range of

students and had to develop remedial programs to support the variance in students' academic level (Diener, 1986).

By 1950 one of the major goals of the community college was realized when barriers were removed for all Americans to be able to receive an education after high school (Pedersen, 2001). What really caused a large increase in enrollment during this time period were local high school graduates deciding to go to college in geographic areas where community colleges were recently established (Cohen & Brawer, 1982). At the end of the 1960s, all but 10 percent of Americans lived within commuting distance from a community college (Pedersen, 2001). In 1960, there were 678 community colleges nationwide, and that number nearly doubled by 1980 to 1,231 (Cohen & Brawer, 1982).

Evolution of Vocational Programs

Prior to the nineteenth century, an apprenticeship included general education in addition to instruction in a specific trade and was based upon a formal contract between the Master and apprentice which usually included room and board in addition to clothing (Gordon, 1999). Both boys and girls were in apprenticeships which lasted five to ten years, and most began at an early age such as eight or nine (Gordon, 1999). When the apprenticeship was complete, the Master had to decide whether or not the student was competent enough to practice the trade alone. If the review was positive, the person was granted permission to practice the trade alone, but if permission was not granted then the apprentice would not be allowed to

practice the trade and could only continue with the apprenticeship if the Master was willing to continue teaching (Gordon, 1999).

When the public elementary school system became more accessible during the 1800s in the United States, apprenticeships no longer needed to include general education (Gordon, 1999). After 1807, the Industrial Revolution changed the dynamic of apprenticeships, eliminating the role of Master for the apprentice and therefore diluting the depth of knowledge in the trades (Gordon, 1999). The use of automation due to machinery greatly simplified what a worker needed to know, and a decline in apprenticeships ensued (Diener, 1986; Gordon, 1999). Workers were being replaced by machines at an alarming rate causing a shift in the workforce (Gordon, 1999; Kleibard, 1999; Lazerson & Grubb, 1974).

The predecessor to modern vocational education came in the form of manual education, or learning by doing, in Europe during the 1800s (Gordon, 1999). During this time, schools were divided based upon social class (Gordon, 1999). The instruction was completely different for wealthy students compared to that of the students from the lower class (Gordon, 1999). One main component of education for the lower class was the involvement of manual training (Gordon, 1999). In 1880, two decades before the vocational education movement began people began to become critical of the public school system (Lazerson & Grubb, 1974). During the next two decades criticism grew surrounding the public educational system in the United States (Lazerson & Grubb, 1974). A concept of connecting school and society became the focus which led to the movement for manual education (Lazerson &

Grubb, 1974). This new form of education was expected to advance industry and act as a practical form of educating the poor (Lazerson & Grubb, 1974). Despite all of the hype surrounding manual education, it proved to not make a difference economically (Lazerson & Grubb, 1974).

When vocational education took over in the 1890s, it was for the purpose of training students for specific jobs (Lazerson & Grubb, 1974). Vocationalism raised important questions surrounding education, such as the purpose of schooling and obtaining different types of knowledge (Lazerson & Grubb, 1974). The vocational education movement began in the early 1900s (Lazerson & Grubb, 1974). The manual education movement was taken over by vocational education after only two decades of existence in the United States (Lazerson & Grubb, 1974).

Manual education had given a general hands-on overview of common trades but had no specific focus (Lazerson & Grubb, 1974). Two factors helped bring vocational education to the forefront in the 1890s (Lazerson & Grubb, 1974). First was the high dropout rate, and second was the idea it would help the economy become more efficient (Lazerson & Grubb, 1974). Vocational educators felt they had a solution to the dropout problem: they proposed a curriculum geared towards future employment and were confident it would enable the retention of children in schools due to the strong relevance toward their future endeavors (Lazerson & Grubb, 1974). Vocationalism grew quickly, and by 1910 a survey showed that 29 states had programs in place (Lazerson & Grubb, 1974).

Political support increased for vocational education from 1910 to1914 (Lazerson & Grubb, 1974). In 1914, Congress appointed the Commission on National Aid to Vocational Education in order to find out what was needed by programs (Lazerson & Grubb, 1974). The conclusion was that federal aid was necessary to meet the needs of vocational education nationwide (Lazerson & Grubb, 1974). Initially, the only schools receiving aid were public schools having students over the age of fourteen but not yet in college (Lazerson & Grubb, 1974). Federal aid was intended to serve as motivation for the states so each could develop its own programs (Lazerson & Grubb, 1974). From 1912 to1913, before federal funding was granted to programs, 6.9% of high school students were enrolled in industrial and trade courses (Lazerson & Grubb, 1974). World War I increased pressure for vocational training, and just before the U.S. entered the war in 1917, the Smith-Hughes Act was passed which provided federal aid to vocational education (Lazerson & Grubb, 1974). In 1917 to1918, federal aid totaled just over $1.6 million which came out to be just 27% of the national expenditures on vocational education (Lazerson & Grubb, 1974). In 1924 when federal aid was near its peak, 6.7% of high school students were in these courses. Before federal funding was granted to programs, 6.9% of high school students were enrolled in industrial and trade courses (Lazerson & Grubb, 1974). By 1925-1926 federal aid was just over $7 million or 24% nationwide (Lazerson & Grubb, 1974). Federal aid did not seem to spark an increased level of participation in full-time vocational courses (Lazerson & Grubb, 1974). By the year 1930, 13% of rural boys ages 15to 18 were involved in

agricultural education, 4.6% of urban boys were in trade and industrial courses, and 4.1% of girls were taking home economics (Lazerson & Grubb, 1974).

A review of the number of trade courses offered nationally based on demand was performed in 1924 by the Federal Board for Vocational Education following the end of the school year (Barlow, 1967). At the time 14 different trades were offered, and auto mechanics was second in popularity only to machine shop (Barlow, 1967). By 1929 auto mechanics had become the most popular trade according to the Federal Board for Vocational Education (Barlow, 1967). During the Depression, trade and industrial education programs saw declining enrollment which lasted through the year 1938 (Barlow, 1967).

By 1940 some changing trends were established in reference to trade and industrial education programs (Barlow, 1967). No longer were students entering these schools between the ages of 14 to16; rather they were more commonly enrolling at the age of 18 or older (Barlow, 1967). This shift in age for students beginning trade programs really sparked junior colleges and other types of post-secondary schools to offer these types of training programs (Barlow, 1967).

Before World War II, technical programs were developed to be applicable to a specific occupation based on the demands of industry, but after the war it became apparent that further development was needed in the area of vocational programs that were technical in nature (Barlow, 1967). In 1958 Congress passed a law called the National Defense Education Act which proved to be the precursor to the Vocational Education Act of 1963 (Barlow, 1967). The focal point of the law was to increase the

strength of our national defense, but it also served to expand other areas related to technical vocational programs (Barlow, 1967).

The Vocational Education Act of 1963 was extremely important in looking at the history of vocational education (Gordon, 1999; McClure, Chrisman, & Mock, 1985). It allotted $60 million in 1964, $118.5 million in 1965, $177.5 million in 1966, and $225.5 million each year after to states in order to provide vocational training to all age groups in need (McClure et al., 1985). This new law was seen as a milestone in vocational education and showed the federal government was indeed interested in vocational training. In order to keep funding aligned with meeting the industrial needs of the country, the law had a review system written in which would occur no less than every five years (McClure et al., 1985).

Prior to the law being passed in 1963, vocational enrollment nationwide for all educational levels was growing at a rate of 4% annually, but once the law passed that number grew to 14% the following year (McClure et al., 1985). After 1968 each state was required to use at least 25% of their allotment for training post-secondary students on a full-time basis, building vocational schools, or a combination or both (McClure et al., 1985).

Amendments were made to the original Vocational Education Act in 1968, and most of the changes pertained to postsecondary schools as the new law expanded what was considered vocational education (Gordon, 1999). Due to the changes, federal funds were able to be distributed to a more diverse population of those in need of proper training (Gordon, 1999). The Vocational Education Act was again

amended in 1976, and in 1984 it became known as the Carl D. Perkins Vocational Education Act (Gordon, 1999). This new law had two main components: the first was economic and sought to better prepare adults for becoming a productive member of the labor force, while the second attempted to provide equal footing for adults in vocational education (Gordon, 1999).

In 1990 there were more amendments to the law, and it was then called the Carl D. Perkins Vocational and Applied Technology Education Act (Gordon, 1999). There was a major shift at this time as towards whom the law was directed with a focus on better preparing the workforce (Gordon, 1999). The amendments included integrating vocational education with traditional academics and articulating programs such a Tech Prep which is discussed later in this review of the literature (Gordon, 1999).

The Carl D. Perkins Vocational-Technical Education Act was reauthorized in 1998 providing some leeway to states in how to effectively spend their allotment of these federal funds (Vaughan, 2000). This revision of the law defined vocational-technical education as programs offering students an opportunity to become employed in an occupation that does not require a four-year or advanced degree (U.S. Department of Education, 2002).

In 2006 Congress renewed legislation and changed the title of the law to be called the Carl D. Perkins Career and Technical Educational Improvement Act. Some of the changes during this reauthorization of the law sought to reinforce the link between secondary and postsecondary education while placing a focus on

academic achievement, and also to better track accountability of states and local government's use of funds (U.S. Department of Education, 2007).

Career and technical programs including automotive technology.

Vocational programs which are now called career and technical programs (CTE) can be divided into eight different areas including Agriculture, Business, Marketing, Family and Consumer Sciences, Trade and Industrial, Health Occupations, Technology, and Technical (Gordon, 1999). Each of these areas encompasses several subjects and a good example is how automotive technology falls within Trade and Industrial Education along with such trades as carpentry, metalworking, and welding (Gordon, 1999).

Automotive Technology

At the community college level, automotive technology programs are designed to provide a range of educational opportunities to students in specific areas that will be beneficial for those who are inclined to seek a career in the automotive industry (Erjavec, 2005). Some programs are sponsored by automakers such as General Motors, Ford, Chrysler, Honda, or Toyota and are called cooperative programs because it is where industry and education join together for a common goal (Erjavec, 2005). These are normally two year programs where half of the time is spent in school learning theory and the other half is spent out in the field working at a dealership (Erjavec, 2005). These institutions focus their attention on training students to specialize their skill set to one particular manufacturer, and after graduating from the program these students often go to work for those dealerships

(Erjavec, 2005). Other programs offer a general training program in which students do not focus on one particular car line (Cerritos College, 2008). At the end of the program students often work at independent automotive shops rather than at dealerships (Cerritos College, 2008). Regardless of what type of automotive technology program from which students graduate, the opportunities are vast and include working for a dealership, independent shop, franchise repair shop such as Midas, a fleet service company, an automotive manufacturer, an aftermarket company, an educational institution, or even as a government employee related to automotive (Erjavec, 2005).

There are 110 community colleges in the state of California, making it difficult for students to know which institutions offer high quality automotive technology programs (California Community Colleges System Office, 2008). A nationally standardized form of accrediting schools exists which is done by an organization called National Automotive Technicians Education Foundation (NATEF). Prior to 1983, there was no way of evaluating high school and community college Automotive Technology programs (NATEF, n.d.). When National Automotive Technicians Education Foundation (NATEF) was developed in 1983, it soon became the standard by which to evaluate Automotive Programs nationwide against very specific criteria from the automotive industry (NATEF, n.d.). The subject of Automotive Technology was categorized into eight major areas, therefore NATEF created eight areas by which to evaluate a school's program not including introductory courses that are often offered. These main areas are Engine Repair,

Automatic Transmission and Transaxle, Manual Drive Train and Axles, Suspension and Steering, Brakes, Electrical/Electronic Systems, Heating and Air Conditioning, and Engine Performance (NATEF, 2008). In the state of California alone there are 37 high schools and 40 community colleges that are NATEF certified (NATEF, n.d.).

National learning objectives.

Each of the eight automotive areas has specific objectives identified by NATEF called a task list. A task is defined by NATEF as "a psychomotor or cognitive entry-level learning activity consisting of one or more measureable steps accomplished through an instructor presentation, demonstration, visualization or a student application" (NATEF, 2008, p. 37). In order to educate in congruence with these objectives not only are they clearly stated by NATEF, but they are also prioritized into three groups based on the skill level required to complete them (NATEF, 2008). The first level requires 95% of those tasks to be taught during the course of instruction. The second level requires 80% of those tasks to be taught. And the last level only requires that 50% of those tasks must be taught during instruction.

The following is a summary of the objectives created by NATEF from each of the eight specific areas as they relate to Automotive Technology.

In Engine Repair students are expected to diagnosis concerns related to the engine and have the ability to remove and reinstall an engine, diagnose and repair both the cylinder head and valve train, diagnose and repair the engine block assembly, and diagnose and repair issues related to the lubrication and cooling system.

For the Automatic Transmission/Transaxles course, students are expected to learn how to diagnose issues related to both transmissions and transaxles, perform in-vehicle maintenance and repair of both transmissions and transaxles, and perform off-vehicle repair of both transmissions as well as transaxles.

In regard to Manual Drive Train and Axles, students are expected to diagnose issues with the drive train; diagnosis and repair of the clutch system; diagnose and repair the transmission and transaxle; diagnosis and repair of drive shaft, half shaft, universal, and constant-velocity joints; diagnose and repair the drive axle; and diagnosis and repair of both four-wheel drive and all-wheel drive systems.

In reference to Suspension and Steering, students are expected to diagnose suspension and steering systems in general, diagnose and repair the all aspects of the steering system, diagnose and repair problems related to the suspension system, service both the suspension and steering systems, diagnose wheel alignment issues as well as perform necessary adjustments and repairs to the system, and diagnose and repair both wheel and tire issues.

Students are taught a multitude of skills in the Brakes course such as how to diagnose brake systems in general, diagnose and repair of the hydraulic system, diagnose and repair issues pertaining to drum brake assembly, diagnose and repair disc brake issues, diagnose and repair of power assist units, diagnose and repair miscellaneous components related to the brake system, and diagnose and repair electronic brake components in addition to traction and stability control systems.

The objectives for Electrical/Electronic Systems include that students will be able to diagnose general problems with the electrical system; diagnose and service problems with the battery; diagnose and repair issues related to the starting system, charging system, lighting system, warning devices, gauges, driver information systems, horn and wiper/washer system, and all of the accessories on the vehicle.

Students taking Heating and Air Conditioning learn how to diagnose and repair the air conditioning system, the components in the refrigeration system, the engine cooling systems as well as heating and ventilation systems on the vehicle, the control systems of HVAC (heating ventilation and air conditioning), and the operating systems, and they must be capable of properly recovering, recycling, and handling the actual refrigerant used on today's vehicles.

The final category is called Engine Performance, and students learn how to diagnose general engine issues by performing tests on the vehicles engine; diagnose and repair the engine controls that are computerized; diagnose and repair issues related to air induction, fuel, and the exhaust system; diagnose and repair the emission control systems; and perform engine related services on the vehicle.

Articulation with high school coursework.

There are two main ways in which articulation is offered to Automotive Technology students, linking programs at the high school and community college level. The first is a federal program called Tech-Prep in which states are provided assistance in order to develop their programs for the purpose of providing an education that will lead to an associate degree or a two-year certificate at the

community college level (U.S. Department of Education, 2008). The other program that assists in the articulation between high schools and community colleges when it comes to Automotive Technology is from an organization called Automotive Youth Educational System (AYES). AYES works in conjunction with automotive manufacturers, automotive dealers, high schools, and community colleges to provide young people with both educational opportunities in Automotive Technology as well as career opportunities in the field (AYES, 2008).

Tech-Prep is a type of educational program that is often referred to as a 4+2, 3+2, or 2+2 structure in which students can begin as early as their freshmen year of high school in working towards an associate degree or a two-year certificate in a specific technical discipline (U.S. Department of Education, 2008). The 4+2 refers to four years of high school and two years of community college, the 3+2 design is three years of high school and two years of community college, and the 2+2 design denotes two years of high school and two years of community college (U.S. Department of Education, 2008). Tech-Prep education is very important in the school-to-work method of providing students with a tangible link between school and a career (U.S. Department of Education, 2008).

The Carl D. Perkins Vocational and Technical Education Act assists in propelling Tech-Prep education by providing federal funding to schools in the form of need-based grants (U.S. Department of Education, 2008). The Vocational and Technical Education Act requires Tech-Prep programs to meet several requirements in order to be eligible for monetary assistance: an articulation agreement between

participating high schools and community colleges; adoption of a 2+2, 3+2, or 4+2 system; a Tech-Prep curriculum; training in order for high schools and community colleges to be effective in the implementation of their curriculum; a recruitment process; equal access to all student populations; and services to prepare students (U.S. Department of Education, 2008).

The other central way articulation in Automotive Technology is achieved is through AYES which requires a great deal of commitment to participating schools, students, automotive dealers, and also instructors (Gray, 2000). This nonprofit organization was founded in 1995 by the General Motors Corporation as a method of promoting automotive careers to students in high school whereby they could receive job shadowing by working at an automotive dealership as a paid apprentice while still attending school (Gray, 2000).The goal is for students to then enroll in community college to complete their associate degree in Automotive Technology (Gray, 2000). In addition to General Motors, there have been many other automotive manufacturers that have joined AYES since its initiation (Gray, 2000). In fact, ten years after the inauguration of AYES, there were a total of 14 automotive manufacturers funding its programs nationwide encompassing 410 schools in 45 states (Association for Career and Technical Education, 2005). As of November, 2008, there are ten automotive manufacturers involved with AYES which include Honda, Toyota, BMW, Nissan, General Motors, Rolls Royce, Subaru, Mercedes-Benz, Mini, and Chrysler (AYES, 2008).

In order for AYES to be affiliated with a particular school, the school is required to become NATEF certified in at least four of the ASE areas which include Electrical, Engine Performance, Suspension & Steering, and Brakes (Gray, 2000). This ensures that affiliated schools are maintaining high standards of education. Two more prerequisites for a school to become associated with AYES are that there must be enough dealerships in the local vicinity willing to take on students as apprentices, and the school must be geographically located within 75 miles of another participating school for the purpose of assisting each other in implementing the program (Gray, 2000).

The dealers' role in AYES is crucial to its success. Students must be able to work as apprentices in a role in which they are shadowed by seasoned technicians (AYES, 2008). In addition, the dealer must provide assistance to students in purchasing a basic set of tools and be able to evaluate the students' progression during the course of their apprenticeship (Gray, 2000). There are several guidelines students have to follow in order to be an apprentice at a dealer. Students must agree to be on time to work, abide by shop rules which includes following safety guidelines, and complete all program related paperwork (Gray, 2000). They must also meet all of the academic criteria in accordance with the school they are attending (Gray, 2000).

Web-Based Course Offerings

The internet is a useful tool for spreading knowledge, and it can serve to help students reach their educational goals (Web-Based Education Commission, 2000).

As stated in the final report of the Web-Based Education Commission in 2000, "….nothing from an educational perspective has more potential to provide a more profound positive change in quality of life than access to web-based education" (MacLean, 2000, p.21). Web-based instruction demands participation by the students as opposed to passive learning which often occurs in traditional classrooms (Web-Based Education Commission, 2000). One characteristic of this type of technology that sets it apart is the fact it offers an interactive method of instruction (Web-Based Education Commission, 2000).

In order for web-based learning to become successful in reaching students, it must be easily accessed and inexpensive (Web-Based Education Commission, 2000). Broadband technology has increased access by providing a large amount of data transmission in order to enable the learner to navigate online in an expedient manner (Web-Based Education Commission, 2000).

Description of web-based education.

Web-based education falls into a larger category of instruction called distance education (Gunawardena & McIsaac, 2004). The definition of distance education has changed as technology itself has changed, but a few key elements have remained consistent (Gunawardena & McIsaac, 2004). As far back as 1980, experts identified six main aspects of distance education (Gunawardena & McIsaac, 2004). They were such things as a separation between teacher and student, the use of some form of technology to connect the teacher and student, individual instruction, a way of communicating back and forth, applicable instruction, and influence from a group of

educators, all of which are characteristics of web-based courses at the present time (Gunawardena & McIsaac, 2004). This type of learning is characterized by the fact that it can be accomplished from anywhere and at any time (Gunawardena & McIsaac, 2004).

Web-based courses started out as a way of offering courses to people who worked full-time or who had a difficult time making it to school for a variety of reasons (Benson, Johnson, Taylor, Treat, Shinkareva, & Duncan, 2005; Gunawardena & McIsaac, 2004; Zirkle & Guan, 2000). Due to the popularity of the internet and increased accessibility over the last decade or so, web-based education has become an ideal method of reaching populations in remote areas as well as having the potential to reach a larger audience than traditional classrooms (Gunawardena & McIsaac, 2004). Another common obstacle for people wanting to attend classes besides their geographic location and working full-time are family responsibilities (Zirkle & Guan, 2000). Before distance learning such as web-based courses was invented, potential students had to make compromises in order to take evening or weekend courses, and in some cases that was not even possible (Zirkle & Guan, 2000). Offering web-based courses can be used as a way of attracting a large segment of the student population to areas that are either dealing with low enrollment issues or to draw students towards areas that are in high demand in the workforce (Benson et al., 2005).

Benefits and challenges of web-based instruction.

When comparing web-based and traditional courses, it is clear there are some benefits to the web-based format, but there are also potential challenges with them as well if instructors do not make some key changes to the way they teach in comparison with traditional courses. Some main benefits come in the form of creativity, such as having a home page that is inviting to the students and including some biographical information that will allow a personal connection to be made early on with the students (Zirkle & Guan, 2000). Schools use many different software packages to facilitate web-based courses, and most of them offer a bulletin board feature where students and instructors can communicate back and forth (Zirkle & Guan, 2000). Another benefit that is often overlooked is the skills involved with using technology which will help students increase their marketability when looking for jobs after graduating (Zirkle & Guan, 2000).

Some challenges facing web-based instructors include keeping the course from being impersonal, offering a way for students to make presentations without them investing in new technology in order to do so, potential cheating, evaluating students (Zirkle & Guan, 2000).

Curriculum design.

A different approach is needed in designing the curriculum for a web-based course (Zirkle & Guan, 2000). Because there is no live teacher to offer a dynamic teaching experience, an audio aspect to the PowerPoint or presentation of material is helpful (Zirkle & Guan, 2000). Instructors need to keep their students interested and

involved in the course by having assignments and ongoing tasks to maintain connectivity (Zirkle & Guan, 2000). It is important in the delivery of web-based curriculum that no populations are excluded from being able to access the instruction (Web-Based Education Commission, 2000). Multiple methods can be utilized to eliminate barriers for instruction such as not only providing text and graphics but also voiced simulations and various combinations of curriculum delivery that will keep the attention of students who are easily distracted or become bored (Web-Based Education Commission, 2000).

Career and Technical Education (CTE).

There has not been a great deal of research of web-based CTE, but the vast majority came from a study performed in 2005 that focused on achievement in web-based in comparison with traditional CTE courses (Benson et al., 2005). The researchers found that over 76% of community colleges nationwide offer some type of distance learning in the CTE arena (Benson et al., 2005). There have been only a few studies in which the effectiveness of web-based CTE courses were compared to their traditional counterparts yielding results that showed no considerable difference (Benson et al., 2005). Although the study focused on only three community colleges and five CTE areas, some conclusions were still able to be made regarding the delivery of courses. The web-based CTE courses varied from simply having a text version of the normal course material to high quality audio and video (Benson et al., 2005). Skill development was accomplished by web-based tutorials, hands-on practice was performed in person, and real world experience was gained through

working in the field (Benson et al., 2005). Evaluations were performed by giving web-based tests (Benson et al., 2005).

Conclusion

Vocational education has played a key role in the history and development of community colleges throughout the United States. Over the course of time, this type of instruction, now referred to as Career and Technical Education (CTE), has evolved to become more aligned with traditional academics, yet it is still perceived as a lower form of education than its traditional counterparts (Mojkowski & Washor, 2007). There have been many laws pertaining to this type of education, but it is apparent the Carl Perkins Act along with its many revisions has been the catalyst for continued growth and change in terms of Career and Technical Education. A new technology emerged with the dawn of the internet and has somewhat recently found its way to the field of education. Web-based courses have proven to offer a convenient way of continuing one's education as long as there are no barriers to accessing a computer with high speed internet capabilities. Although there has been little research in web-based Career and Technical Education, there is plenty of potential for it to become an integral component of many different types of programs especially at the community college level. This aligns with the focus of this research project which seeks to answer the question: what would be the content of a community college web-based entry level Automotive Technology course?

The next chapter will explore the methods used to develop a web-based curriculum for an Automotive Technology course.

CHAPTER THREE

METHODOLOGY

Introduction

The curriculum developed for my web-based introductory Automotive Technology course, presented in Chapter Four, is a blend of quantitative data gathered from surveying automotive instructors and analyzing objectives outlined by an agency called National Automotive Technicians Education Foundation (NATEF). They are the accrediting agency for Automotive Technology programs. This chapter contains my rationale for creating the curriculum and outlines the process of its development. In this section I will include the reasoning I used to make decisions in regard to the inclusion of certain topics and the exclusion of others in the course. I offer an explanation of the many considerations in building this curriculum, in particular in light of the fact that the course is designed to serve as a prerequisite.

Initial Methodology

I compiled a list of topics essential to include in an introductory automotive course and then developed a quantitative survey whose results would provide me with more information so I could better understand how to develop the curriculum. The survey was administered at a California Automotive Teachers (CAT) conference in April 2009, and those surveyed were either high school or community college Automotive Technology instructors. The list included hand tools and shop equipment, shop safety, automotive maintenance, basics of electricity, engine basics,

lubrication systems, cooling systems, batteries, charging systems, and starting systems. I asked four questions regarding each of these topic areas and provided a Likert scale so the instructors surveyed could circle how important they perceived each topic to be. I intentionally used four options on the Likert scale in order to avoid having responses that were neutral. The four options on the Likert scale were not important, somewhat unimportant, somewhat important, and very important.

The first question was, “How important are each of the following in an entry level Automotive Technology course?” I asked this question in order to obtain a priority level of each of the topics in an introductory course.

The second question was, “Given a 16 week semester, how many weeks should be spent on each of the following topics for an online entry level Automotive Technology course? I listed four choices for this question: less than one week, one week, two weeks, and three weeks. I felt it was important to get an idea of how long to spend on a particular subject since I had no previous experience developing curriculum.

The third question was, “How effectively do you believe the following topics can be taught using web-based technology?” This question really opened the door for scrutiny regarding offering a hands-on course like this in an online format. The answer choices were: very ineffective, somewhat ineffective, somewhat effective, and very effective.

The fourth question was, “Which of the following have you found to be the most challenging for students to master?” All ten of the topics stated at the beginning

of this section were listed, and there were four options regarding answer choices. They were very challenging, somewhat challenging, somewhat easy, and very easy.

For the last two survey questions regarding topical information, a shift was made from using broad topics to specific theories or topics. They included: ohm's law, the four stroke engine cycle, vehicle identification number (VIN), preventive maintenance, measuring systems, fasteners, tool identification, service information, and series electrical circuits.

The fifth question was, "For each of the following, please indicate whether is it is an important concept for general education students who will only take this one automotive course." In this survey question I sought to narrow my focus regarding what specific topics should be covered since there could potentially be many people in the course who simply want to learn about how to better maintain their vehicle. The four possible responses were: not important, somewhat unimportant, somewhat important, and essential.

The last question I asked during the survey regarding course content was, "How important is it to teach the following concepts as part of a web-based introductory automotive course?" The four responses to choose from were: not necessary, somewhat unimportant, somewhat important, and essential.

Survey results and insights.

After collecting all of the data from the surveys, I had more insight for the course I wanted to develop. It was unanimous among the instructors surveyed that a web-based automotive course would need to have some hands-on aspects, even

though the design was that of an introductory course. Those surveyed strongly felt that in order for an introductory course to be effective, students need to be able to get some experience using tools and practicing safe methods of working in and around automobiles. I was also able to get a general consensus as to which specific topics should be covered in the course.

While attending the California Automotive Teachers conference, I found what I perceived to be an excellent textbook to use for teaching an introductory automotive course. The book is entitled *Auto Upkeep: Basic Car Care, Maintenance, and Repair,* and the authors designed the textbook to be both comprehensive and user-friendly. I decided to look through the book thoroughly since it seemed like a strong candidate to incorporate as a textbook for my course. After taking time to determine whether or not the book would be beneficial to students in my course, I decided there was more than enough useable material to use the book as my text.

Program Standards

The agency that oversees Automotive Technology programs nationwide is called NATEF. They keep up with industry trends and every three years update specific objectives for each of the eight areas within automotive. The eight areas are Brakes, Electrical/Electronic Systems, Engine Performance, Suspension & Steering, Automatic Transmissions/Transaxles, Engine Repair, Heating & Air Conditioning, and Manual Drive Train & Axles. Each area has very specific objectives which must be taught in order to follow the program standards, and there are three levels of objectives based on difficulty. The levels are P-1, P-2, and P-3 tasks. The P-1

objectives are the most basic, and 95% of them must be taught in accordance with NATEF guidelines. The P-2 tasks are a little more difficult, and 80% must be taught. The highest level tasks called P-3 objectives must be taught at a rate of at least 50%. Therefore, when developing a curriculum in Automotive Technology, curriculum authors need to follow NATEF guidelines in order to maintain their certification when it comes to program standards.

During the development of this introductory course, I took the program standards of NATEF into account in order to maintain their certification level and also to focus on teaching many of the P-1 objectives when it came to all eight areas of automotive. This would ensure that students were indeed learning the more basic tasks in this introductory course, and it would allow more time for the instructors to go more in depth in the advanced courses within the subject of Automotive Technology.

Articulation

Another consideration in the development of this course is to eventually articulate it with the local high schools. If students coming into our program have already taken some automotive courses in high school, then they would not be required to take our introductory Automotive Technology course. I want to ensure that the students who take this introductory course are new to the subject of Automotive Technology since it will be designed to challenge those students.

Course Description

This course provides an introduction to the subject of automotive technology. It focuses on the theory, diagnosis, and repair of modern vehicles. Topics include safety, basic tools, repair facilities, maintenance, electrical, lubrication, fuel, cooling, ignition, suspension & steering, brakes drivetrain, exhaust & emissions, alternative fuels, and accessories. The lab portion of the course requires extensive use of basic hand tools, vehicle lifts, electronic test equipment, and diagnostic procedures common to modern automotive applications. The course is designed to serve as a prerequisite in order to prepare students for more advanced courses in automotive technology. It is also designed to bridge the gap between students' automotive knowledge out of high school and the increased expectations at the college level.

Assessment

Students will be assessed both on classroom and lab activities. Each will be worth 50% of their entire grade for the course, and there will be a total of 1000 points possible for the course. In the classroom I will be using five formal assessments. There will be a safety quiz and three tests each worth 50 points, and a comprehensive final exam worth 100 points. The remaining points for classroom work will come from study questions from each of the 16 chapters, each worth 10 points, and from 40 points of class participation.

In the lab students will have three major tasks to accomplish. The first one is a performance assessment called Tool Identification, and it is worth 40 points. Students will be tested on their ability to identify different types of automotive tools

commonly used in the trade. The second task involves a Vehicle Identification Number (VIN) write-up in which students will choose a particular vehicle to research and will be worth 50 points. The last assignment is called “Choosing a Repair Facility,” and it will also be worth 50 points. During the course of the semester, there will be 25 labs, some of which will be done in person, and each will be worth 8 points. The remaining 160 points will be accrued using 8 web discussions throughout the semester in which students will be expected to contribute to the week’s discussion and respond to someone else’s post on the discussion board.

The following chapter presents the content of the curriculum.

CHAPTER 4

CONTENT

Chapter 4 consists of a hybrid Introductory Automotive Technology course curriculum designed for the community college level. The entire curriculum follows. To avoid double pagination, the page numbering reflects the curriculum's placement within this project.

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AT 1: Introduction to Automotive Technology Fall 2010
Joe Mulleary

Class Location:	AT 121
Time:	Mon. and Wed. 8:30am-12:40pm
Office Hours:	AT 123, Tues. 3:30pm-5:00pm or by appointment
Telephone	(707) 273-8168
Email:	Joe-Mulleary@Redwoods.edu

Course Description

This course will provide an introduction to the subject of automotive technology. It will focus on the theory, diagnosis, and repair of modern automotive vehicles. Topics will include safety, basic tools, repair facilities, maintenance, electrical, lubrication, fuel, cooling, ignition, suspension & steering, brakes, drivetrain, exhaust & emissions, alternative fuels, and accessories. The lab portion of the course will require extensive use of basic hand tools, vehicle lifts, electronic test equipment, and diagnostic procedures common to modern automotive applications. The course is designed to serve as a prerequisite in order to prepare students for more advanced courses in automotive technology. It is also designed to bridge the gap between student's automotive knowledge out of high school and the increased expectations at the college level.

Text and References

Gray, M.E. & Gray, L.E. (2007). Auto Upkeep: Basic Car Care, Maintenance, and Repair, 2nd Edition (both text and workbook)

Student Contribution

Each student will spend time reading assigned material, preparing reports, and studying for tests as necessary outside of normal class time. Attendance is critical in this course. Students will be expected to participate in all lectures and lab activities involving this course. In addition, students will be responsible for all material presented in this course regardless of class attendance.

Special Notes/Policies

- Students with special needs are encouraged to notify me so we can make arrangements based on the Disabled Students Support Services (DSPS) recommendations. They are located on campus in building T20, behind the bookstore, and can be contacted at 476-4280.

- Students are responsible to act in accordance with College of the Redwoods Catalog regarding academic integrity.
- Please contact me by phone or email if you will be not be able to make it to class.
- Both the Classroom Text and Workbook are required at every class session and will be necessary in order to perform all tasks and activities.
- Cell phones or other electronic devices must be turned off or on silent during the classroom and lab portion of the course. If you must use your device for emergency purposes then please notify me before class begins.

Course Evaluation

Your performance objectives, exams, and laboratory activities will be translated into points and from there to grades. There are 1000 possible points, 500 from the classroom portion of the course, and 500 from the lab portion of the course. The following breakdown shows how many points correspond to each letter grade:

1000 - 900 = A
899 - 800 = B
799 - 700 = C
699 - 600 = D
599 - 500 = F

Classroom Points Breakdown		**Lab Points Breakdown**	
Safety Quiz	= 50pts	Tool Identification	= 40pts
Test #1	= 50pts	Analysis of VIN	= 50pts
Test #2	= 50pts	"Choosing a Repair Facility"	= 50pts
Test #3	= 50pts	25 Labs (each worth 8pts)	=200pts
Final Exam	=100pts	8 Web Discussions	
16 Ch's of Study		(20pts each)	=160pts
Questions (10pts each)	=160pts		
Class Participation	= 40pts		
Classroom Total	=500pts	Lab Total	=500pts

Course Schedule

The class meets for two lecture hours and six lab hours per week. The student will be provided with a course calendar. Laboratory activity sheets will be provided as necessary.

Course Attendance Policy

Attendance will be taken promptly at the start of each class session and you will be marked present if you are in your seat at that time. Students arriving within the first

five minutes will be marked tardy all others will be marked absent. Additionally, students leaving lab early will be marked absent that day. Students will be allowed two absences per semester. Being tardy twice will equal one absence. There will be a fifty point deduction from your semester total for each absence and a deduction of five points for each tardy beyond the semester allowance. There are no excused absences.

Instructors Teaching Philosophy

I believe in combining traditional classroom education with a hands-on learning environment, which is the optimal approach for the automotive program. I want to encourage students in the field of Automotive Technology to increase their critical thinking capabilities and become accustomed to working in a team atmosphere. We prepare the students by simulating a work style environment in the lab portion of the class. The detailed aspects of current methods in the field are aligned with the curriculum in order to instill students with productive and efficient work habits. It is essential to use performance-based assessment in the career and technical areas and the course content is structured in such a way that it can be accurately measured. If students can walk away from our program having both the theory and ability to apply their knowledge in a real world environment, then those of us involved in the education process can feel confident they are prepared for a successful career in the field.

As an educator, I also feel that students in the technical areas should be challenged to complete their general education, both to broaden their potential for career growth and to enable them to continue their education someday at the university level, if they choose. Today's global economy is changing rapidly and I feel the key to success in the industry consists of having both the education and work experience to be marketable throughout ones career.

Course Objectives

Upon successful completion of this course the student should be able to perform the following tasks in accordance with the National Automotive Technicians Education Foundation (NATEF). All tasks are rated as a P-1, P-2, or P-3 based on their level of difficulty. Since this is an introductory course we will be focusing on the P-1 level tasks, but there will be a few P-2 level tasks students are expected to complete.

A. General System Diagnosis

1. Complete work order to include customer information, vehicle identifying information, customer concern, related service history, cause, and correction. P-1

2. Identify and interpret system concern; determine necessary action. P-1

3. Research applicable vehicle and service information, vehicle service history, service precautions, and technical service bulletins. P-1

4. Locate and interpret vehicle and major component identification numbers. P-1

B. Electrical Systems

1. Demonstrate the proper use of a digital multimeter (DMM) during diagnosis of electrical circuit problems, including: source voltage, voltage drop, current flow, and resistance. P-1

2. Check electrical circuits with a test light; determine necessary action. P-2

3. Perform battery state-of-charge test; determine necessary action. P-1

4. Perform battery capacity test; confirm proper battery capacity for vehicle application; determine necessary action. P-1

5. Inspect, clean, fill, and/or replace battery, battery cables, connectors, clamps, and hold-downs. P-1

6. Perform battery charge. P-1

7. Start a vehicle using jumper cables or an auxiliary power supply. P-1

8. Perform charging system output test; determine necessary action. P-1

9. Inspect, adjust, or replace generator (alternator) drive belts, pulleys, and tensioners; check pulley and belt alignment. P-1

C. Engine Repair

1. Perform oil and filter change. P-1

2. Inspect, replace, and adjust drive belts, tensioners, and pulleys; check pulley and belt alignment. P-1

3. Perform cooling system pressure test; check coolant condition; inspect and test radiator, pressure cap, coolant recovery tank, and hoses; determine necessary action. P-1

D. Engine Performance

1. Interpret diagnostic trouble codes (DTCs) and scan tool data related to the emissions control system. Determine necessary action. P-1

2. Check fuel pressure on a fuel injected system P-1

3. Replace fuel filters. P-2

4. Inspect, test and service positive crankcase ventilation (PCV) filter/breather cap, valve, tubes, orifices and hoses; perform necessary action. P-2

E. Heating and Air Conditioning

1. Inspect and replace A/C compressor drive belts, pulleys, and tensioners; determine necessary action. P-1

2. Inspect A/C condenser for airflow restrictions; perform necessary action. P-1

F. Suspension and Steering

1. Identify and interpret suspension and steering concerns; determine necessary action. P-1

2. Lubricate suspension and steering systems. P-2

3. Inspect tire condition; identify tire wear patterns; check and adjust air pressure; determine necessary action. P-1

4. Rotate tires according to manufacturer's recommendations. P-1

5. Reinstall wheel; torque lug nuts. P-1

G. Brakes

1.	Inspect brake lines, flexible hoses, and fittings for leaks, dents, kinks, rust, cracks, bulging or wear; tighten loose fittings and supports; determine necessary action.	P-1
2.	Select, handle, store, and fill brake fluid to proper level.	P-1
3.	Remove, clean, inspect, and measure brake drums; determine necessary action.	P-1
4.	Install wheel, torque lug nuts, and make final checks and adjustments	P-1
5.	Remove, inspect, and replace pads and retaining hardware; Determine necessary action.	P-1
6.	Remove and reinstall rotor.	P-1

H. Manual Drive Train and Axles

1.	Inspect, service, and replace shafts, yokes, boots, and CV joints.	P-1

Course Calendar: Fall 2010

Week #	Date	Assignment Due	Lecture Topic
Week 1	Aug 23	None	Introduction to course; Safety Around the Automobile
Lab Activity #1- Shop Orientation			
	Aug 25	Ch.5 Text; Ch.5 Workbook Study Questions (p.30)	Safety Around the Automobile (cont'd); Safety Quiz
Lab Activity #2- Shop Safety			
Week 2	Aug 30	Ch.6 Text	Basic Tools
Lab Activity #3- Proper use of tools			
	Sept 1	Ch.6 Workbook Study Questions (p.34) and Activity Journal (p.36)	Discussion of tools and preparation for lab quiz
Tool Identification Quiz			
Week 3	Sept 6	LABOR DAY (NO CLASS)	
	Sept 8	Ch.1 Text, Ch.1 Workbook Study Questions (p.8)	How Cars Work
Perform VIN analysis on your own vehicle.			
Week 4	Sept 13	Ch.4 Text, VIN Write-up	Repair Facilities
Lab Activity #4- Use Mitchell On-Demand online database to find labor times and repair information related to your vehicle.			
	Sept 15	Ch.4 Workbook Activities: Choosing a Repair Facility (pp.25-26), and Ch.4 Study Questions (p.24)	Repair Facilities (cont'd)
Choosing a Repair Facility: Complete the Activity Journal on p.28 of the Workbook. You will have a chance to complete pp.25-26 of the Workbook using online resources during the lab.			

Week #	Date	Assignment Due	Lecture Topic
Week 5	Sept 20	Ch.8 Text	Fluid Level Check

Lab Activity #5- Perform fluid level checks on your own vehicle, and complete Activity Journal (p.50) in Workbook.

	Sept 22	Ch.8 Workbook Study Questions (p.46), and Ch.10 Text	Lubrication System

Lab Activity #6- Change engine oil and filter in your vehicle and document your findings in the Activity Journal (p.68) of the Workbook.

Week 6	Sept 27	Ch.10 Workbook Study Questions (p.64); Ch.9 Text	Test #1 Electrical System

Lab Activity #7- Perform tests on battery shown in Ch.9 of Workbook and document findings (p.56).

	Sept 29	Ch.9 Workbook Study Questions (p.52)	Electrical System (cont'd)

Lab Activity #8- Perform tests on charging system in Ch.9 of Workbook and document findings (p.60).

Week 7	Oct 4	Ch.11 Text	Fuel System

Lab Activity #9- Locate and perform an air filter and fuel filter change on your vehicle. Do Activity Journal (p.74) of Workbook.

	Oct 6	Ch.11 Workbook Study Questions (p.70), and Activity Journal (p.74)	Fuel System (cont'd)

Lab Activity #10- Check fuel pressure of a fuel injected vehicle and document findings compared to the manufacturer's specifications. Also inspect fuel system for leaks or damage to the lines from the fuel pump to the engine.

Week 8	Oct 11	Ch.12 Text	Climate Control

Lab Activity #11- Inspect the vehicles Heating Ventilation and Air Conditioning (HVAC) system and complete (p.78) in Workbook.

	Oct 13	Ch.12 Workbook Study Questions (p.76)	Cooling System

Lab Activity #12- Inspect and test the cooling system using a refractometer, test strips, and a pressure tester. Document your findings in the Workbook (p.84).

Week #	Date	Assignment Due	Lecture Topic
Week 9	Oct 18	Ch.13 Text	Ignition System

Lab Activity #13- Remove spark plugs from your vehicle and check their gap compared to specifications. Make necessary adjustments and reinstall the spark plugs.

	Oct 20	Ch.13 Workbook Study Questions (p.86)	Ignition System

Lab Activity #14- Inspect and test spark plug wires on your vehicle for excessive resistance. Complete the Activity Journal on p.90 of the Workbook.

Week 10	Oct 25	Ch.14 Text	Suspension, Steering

Lab Activity #15- Identify the steering system of your vehicle and perform an inspection with the vehicle lifted in the air. Grease any locations that have zerk fittings. Also inspect the springs for cracks or breaks and perform a bounce test with the vehicle on the ground. Complete Activity Journal on p.94 of Workbook in order to document your findings.

	Oct 27	Ch.14 Workbook Study Questions (p.92)	Tires

Lab Activity #16- Check the tire pressure and measure the tread depth of all four of your tires. Complete the Activity Journal on p.98 of Workbook.

Week 11	Nov 1	Ch.15 Text	Test # 2 Braking System

Lab Activity #17- Inspect master cylinder and hydraulic brake lines for leaks or cracks. Perform a brake inspection on vehicle and determine the condition of the brakes. Document your findings in Activity Journal on p.102 of Workbook.

	Nov 3	Ch. 15 Workbook Study Questions (p.100)	Braking System (cont'd)

Lab Activity #18- Replace the brake linings on your vehicle if necessary. One of the shop vehicles can be used for this exercise if you do not want to use your own vehicle. Torque all bolts to specification and write what work you performed on a repair order provided by instructor.

Week 12	Nov 8	Ch.16 Text	Drivetrain

Lab Activity #19- Determine your vehicle's drivetrain system. Lift vehicle and inspect system for leaks or any other problems such as cracked CV boots. Complete Activity Journal on p.106 in Workbook.

Week #	Date	Assignment Due	Lecture Topic
Week 12	Nov 10	Ch.16 Workbook Study Questions (p.104)	Drivetrain (cont'd)

Lab Activity #20- Remove and replace a half shaft from one of our shop vehicles that is front wheel drive (FWD). Use a repair order to document your work and include torque specifications as well as repair procedures.

Week 13	Nov 15	Ch.17 Text	Exhaust and Emissions

Lab Activity #21- Inspect the exhaust system on your vehicle and draw a diagram of the system. Looks for cracks or leaks during your inspection and test system using a smoke machine. Document your findings on a repair order.

	Nov 17	Ch.17 Workbook Study Questions (p.108)	Exhaust and Emissions (cont'd)

Lab Activity #22- Look under the hood of your vehicle for the Vehicle Emission Control Information (VECI) label and determine what emission systems it is equipped with. Visually inspect each of those systems and note if the "check engine" light is illuminated on the instrument cluster. Use a scan tool to retrieve any Diagnostic Trouble Codes (DTC's) stored in the Powertrain Control Module (PCM). Use Mitchell On-Demand to assist in the troubleshooting process for specific codes. Document your findings.

Week 14	Nov 22	Ch.18 Text	Alternative Fuels

Lab Activity #23- Complete the Activity Journal on p.114 in the Workbook by comparing and contrasting your vehicle to a hybrid.

	Nov 24	Ch.18 Workbook Study Questions (p.112); Ch.19 Text	Accessories

Lab Activity #24- Identify what accessories your vehicle came with. Inspect their operation and determine if they are functioning properly. Write your findings on a repair order.

Week 15	Nov 29	Ch.19 Workbook Study Questions (p.116)	Test #3

Lab Activity #25- Open lab will be offered in which students will be able to complete various maintenance items on their own vehicle if necessary. This lab is optional and the last lab of the semester.

	Dec 1	None	Review for Final Exam
Week 16 Exam	Dec 6	None	Comprehensive Final

Shop Orientation
Day #1

Assumed Prior Knowledge: This will be the first formal automotive training for students who have no educational background in Automotive Technology. Therefore, it is assumed they have no prior automotive knowledge.

Time: 1 hour lecture, 1 hour lab activity

Materials:

- Auto Upkeep 2nd Edition textbook and workbook
- Pen or Pencil
- Notebook

Objectives: Students will become oriented with both the classroom and automotive shop, learning where the tools and equipment are located. They will learn about what is expected of them in order to participate in lab activities, such as wearing safety glasses and closed toed shoes.

Procedure:

1. Introduce myself as the instructor and go over the syllabus with the students covering the layout of the course.
2. Discuss how the course is a hybrid with some of the labs being done in person and some of them being performed remotely, after watching a lab video provided.
3. Tell students that they will need a basic set of tools, floor jack and jack stands, tire pressure gauge, a tread depth gauge, and a multimeter in order to be able to complete lab activities remotely during the course of the semester.
4. Give the students a short break, about 15 minutes, before going into the lab.
5. We will all go to the lab and I will give the students an orientation to the shop.

Assignments Due:

1. None

Lab #1: Shop Orientation

Today will be an introduction to the automotive shop. We will cover many things you will need to know in order to be successful as a student in the lab environment of our courses. This will include the use of our computers and specifically the programs Mitchell On-Demand and Identfix, the location of tools and equipment, etc.

Tools:

None

NATEF Tasks:

None

Grading:

There will be no official lab activity for today, but students who participate will be given full credit of 8 points for the orientation to the lab.

Shop Safety
Day #2

Assumed Prior Knowledge: Students are expected to have a general idea about the layout of the shop, and are expected to have read chapter 5 in the text.

Time: 1 hour lecture, 1 hour lab activity

Materials:

- Auto Upkeep 2nd Edition textbook and workbook
- Pen or Pencil
- Notebook
- Safety glasses
- Computer with internet access

Objectives: Students will understand the importance of shop safety and be capable of performing lab activities in a safe manner while working at home. Also, students will be expected to pass the Safety Quiz with a score of 70% or better.

Procedure:

1. Students will watch Video #1 that corresponds to the lab activity.
2. They will complete the Workbook study questions for Chapter 5.
3. Also, they will complete the Safety Quiz.

Assignments Due:

1. Safety Quiz and submit it to the instructor online by 11pm.
2. Chapter 5 reading in the text.
3. Workbook study questions in Chapter 5.

Lab #2: Shop Safety

Today's lab will cover shop safety, and we will cover all aspects involved while working in an automotive shop environment. Students will need to watch video #1 in order to complete this lab. I will be covering how to properly use an automotive lift, a floor jack and jack stands, fire extinguishers, the eye wash station, and MSDS information.

Tools:

None

NATEF Tasks:

None

Grading:

Students will be assessed on the Activity Journal on page 32 of the Workbook. Complete questions 1-5, but do not bother sketching an overhead view of the shop as question 6 states. The assignment will be worth 8 points.

Week #1: Study Questions

Chapter 5: Safety Around the Automobile

1. Why is it important to "think safety" while working on an automobile?

2. What things should you be able to locate in a garage, shop or laboratory facility?

3. What safety equipment is required when working on vehicles?

4. Why do you need to be extremely cautious around electric fans?

5. What is the procedure for jacking up a vehicle?

6. What are the three most common types of automotive lifts? How are they different?

7. How are fire extinguishers classified? What type of fire extinguisher should you have in an automotive shop?

8. What is the procedure to lift a vehicle on a two-post lift?

9. What is the procedure to lift a vehicle on a four-post lift?

10. What should you do if a vehicle starts to fall off an automotive lift?

Fall 2010

Safety Quiz

1. Technician A says always push a wrench toward you for best control and safety. Technician B says to always use a box-end wrench or a 6-point socket to break loose a tight bolt or nut. Who is correct?

a. A only
b. B only
c. Both A and B
d. Neither A nor B

2. Ear protection should be worn if the sound around you requires that you raise your voice. This is when the sound level measured in decibels (dB) is higher than:

a. 110 dB
b. 100 dB
c. 95 dB
d. 90 dB

3. If safety shoes are not available to use in the lab such as steel-toed shoes, which of the following is the next best option in terms of safety?

a. Tennis Shoes
b. Leather-topped shoes
c. Sandals
d. Vans

4. Technician A says when lifting a unit-body vehicle on a hoist it is recommended to use pinch weld seams as lifting points. Technician B says that most new vehicles have a triangle symbol indicating the recommended lift points. Who is correct?

a. A only
b. B only
c. Both A and B
d. Neither A nor B

5. Technician A says when using a floor jack to lift a vehicle it is safe to work underneath using a creeper. Technician B says when using a floor jack to lift a vehicle you must always use jack stands when working underneath. Who is correct?

a. A only
b. B only
c. Both A and B
d. Neither A nor B

6. Technician A says when jump starting a vehicle the last connection made is to the ground post on the stalled vehicles battery. Technician B says when jump starting a vehicle the last connection made is to an engine block ground of the starting vehicle. Who is correct?

a. A only
b. B only
c. Both A and B
d. Neither A nor B

7. There are four classes of fire extinguishers. Technician A says that a Class A fire extinguisher is used only on electrical fires. Technician B says a Class B fire extinguisher is designed for use on flammable liquids and greases, including gasoline, oil, thinners, and solvents. Who is correct?

a. A only
b. B only
c. Both A and B
d. Neither A nor B

8. Technician A says that proper disposal of oily shop cloths involves placing them in an enclosed container in order to prevent a fire. Technician B says that oily shop cloths can only ignite from an open flame; therefore it is acceptable to dispose of them in a regular trash can. Who is correct?

a. A only
b. B only
c. Both A and B
d. Neither A nor B

9. Technician A says it is okay to mix brake fluid with engine oil for the purpose of recycling. Technician B says to collect brake fluid in a separate container from other fluids. Who is correct?

a. A only
b. B only
c. Both A and B
d. Neither A nor B

10. Technician A says a vehicle should be centered on the lift so the weight is equally distributed while being hoisted. Technician B says the vehicle should be raised about a foot off the floor and checked for stability before being raised overhead. Who is correct?

a. A only
b. B only
c. Both A and B
d. Neither A nor B

11. Technician A says SAE standard bolts are identified by their major diameter and the number of threads per inch. Technician B says metric bolts are also measured by their major diameter and the number of threads per inch. Which is correct?

a. A only
b. B only
c. Both A and B
d. Neither A nor B

12. Technician A says metric bolts use a numeric designation on the bolt head to indicate tensile strength. Technician B says a metric bolt classed as a 10.9 has an approximate tensile strength of 130,000 psi. Who is correct?

a. A only
b. B only
c. Both A and B
d. Neither A nor B

13. When referring to torque, Technician A says that 5 lb-ft is equal to 50 lb-in. Technician B says that 60 lb-in equals 5 lb-ft. Who is correct?

a. A only
b. B only
c. Both A and B
d. Neither A nor B

14. Technician A says locking pliers are often referred to as VISE-GRIPS. Technician B says Channel Locks and VISE-GRIPS are the same thing. Who is correct?

a. A only
b. B only
c. Both A and B
d. Neither A nor B

15. Technician A says the highest grade of SAE standard bolt is designated as a Grade 8. Technician B says a Grade 8 bolt has eight lines on the bolt head to designate its tensile strength. Who is correct?

a. A only
b. B only
c. Both A and B
d. Neither A nor B

16. Technician A says when replacing a bolt on a steering, suspension, or brake component always use a non-graded bolt. Technician B says that as long as the replacement bolt is the same size the grade of the bolt does not matter. Who is correct?
a. A only
b. B only
c. Both A and B
d. Neither A nor B

17. Technician A says a typical open-ended wrench has the same size on both ends. Technician B says the box-end of a combination wrench usually is angled 15 degrees in order to allow for clearance of nearby objects. Who is correct?
a. A only
b. B only
c. Both A and B
d. Neither A nor B

18. Technician A says when using an impact wrench you should always use a black impact socket. Technician B says it is considered good practice to use a chrome six point socket when using an impact wrench. Who is correct?
a. A only
b. B only
c. Both A and B
d. Neither A nor B

19. Technician A says the right-to-know laws were first published by OSHA in 1983. Technician B says under these laws employees have a right to know when the materials they use at work are considered to be hazardous. Who is correct?
a. A only
b. B only
c. Both A and B
d. Neither A nor B

20. Technician A says that asbestos is considered hazardous waste if the fibers are airborne. Technician B says asbestos is considered hazardous waste if it has been wetted down. Who is correct?
a. A only
b. B only
c. Both A and B
d. Neither A nor B

Proper Use of Tools
Day #3

Assumed Prior Knowledge: Students are expected to have read Chapter 6 in the text, which would provide foundational knowledge regarding basic automotive tools.

Time: 1 hour lecture, 1 hour lab activity

Materials:

- Auto Upkeep 2nd Edition textbook and workbook
- Pen or Pencil
- Notebook
- Computer with internet access

Objectives: Students will be able to identify and understand how to properly use the vast majority of the tools that are located inside the toolboxes used in the automotive shop.

Procedure:

1. Students will watch Video #2 that corresponds to the lab activity.
2. They will be encouraged to prepare for the Tool Identification quiz next class meeting.
3. Complete the Study Questions on page 34, and the Activity Journal questions 1-4 on page 36 of the Workbook.

Assignments Due:

1. Chapter 6 reading in the text.

Lab #3: Proper Use of Tools

This lab will focus on the proper use of tools while in the lab and will include video #2. Each student will be working with many different tools in automotive, and I will be demonstrating how to use many of the tools in the large Snap-On and Craftsman boxes. Students who watch the lab video online will receive full credit since there will be no written documentation of work performed. At the end of this lab, you should feel comfortable knowing how to properly use all of the tools in both the Snap-On and Craftsman toolboxes. There will be a quiz next class on tool identification.

Tool Identification

Day #4

Assumed Prior Knowledge: Students should be familiar with basic automotive tools that are discussed in Chapter 6 of the text and that were covered in Video #2.

Time: 1 hour lecture, 1.5 hour lab activity

Materials:

- Auto Upkeep 2nd Edition textbook and workbook
- Pen or Pencil
- Notebook
- Safety Glasses

Objectives: Students will be able to demonstrate their ability to identify the forty tools that are displayed on a workbench by writing the name of the tool that corresponds with the proper number identification label.

Procedure:

1. We will be discussing any questions the students have pertaining to Chapter 6 in the text or from Video #2.
2. The format of the Tool Identification quiz will be covered.
3. Tools that will be used for the quiz will be spread out between four workbenches.
4. Students will be called in to the lab four at a time to take the Tool Identification quiz. There will be only one student to each bench.
5. There will be a five minute time limit to list the tool name that corresponds with its identification label, and the quiz will take a total of twenty minutes.
6. Once the students have completed the quiz they must not return to the classroom so the possibility of cheating can be eliminated.

Assignments Due:

1. Chapter 6 Workbook study questions.
2. The Activity Journal in Chapter 6 of the Workbook.

Week #2: Study Questions

Chapter 6: Basic Tools

1. Sketch a drawing to illustrate the difference between an open-end and box-end wrench.

2. If a 6-point wrench is less likely to strip a fastener, when would you need a 12-point wrench?

3. What is the most common ratchet size?

4. What specialty tool can be used to test voltage, resistance, and amperage in a circuit?

5. What tool could be used to cut an exhaust pipe?

6. What are the two types of measurement systems commonly used?

7. What is the function of an air gauge?

8. What are two common types of screwdrivers? How do you know what type of screwdriver tip to use?

9. If you only had one wrench in your toolbox, what type would it be?

10. Why is it important to use the correct tool?

Tool Identification Quiz

Note:

The following tools will be laid out on the workbenches in the lab, and students will be expected to name each of the following tools. Each properly identified tool is worth 1 point, and there are a total of 40 points possible for the quiz.

1. Combination Wrench
2. Impact Wrench
3. Jack Stands
4. Adjustable Wrench
5. Ratchet
6. Universal Joint
7. Driver Extension
8. 6-Point Socket
9. Deep Well Socket
10. Spark Plug Socket
11. Impact Socket
12. Slip Joint Pliers
13. Locking Pliers
14. Groove Joint Pliers
15. Needle Nose Pliers
16. Diagonal Pliers
17. Phillips Screwdriver
18. Flat Head Screwdriver
19. Ball Peen Hammer
20. Rubber Mallet
21. Pry Bar
22. Tread Depth Gauge
23. Clicker Style Torque Wrench
24. Feeler Gauge Set
25. ¼” to 3/8” adapter
26. Outside Micrometer
27. Multimeter
28. Wire Strippers
29. Battery Brush
30. Battery Terminal Puller
31. Hydraulic Floor Jack
32. Battery Terminal Spreader
33. Band Oil Filter Wrench
34. Breaker Bar
35. Grease Gun
36. Machinist File
37. Cold Chisel
38. Punch
39. Hacksaw
40. Spark Plug Gauge

VIN Analysis

Day #5

Assumed Prior Knowledge: Students should be familiar with the material covered in Chapter 1 of the text on How Cars Work.

Time: 1 hour lecture, 1 hour lab activity

Materials:

- Auto Upkeep 2nd Edition textbook and workbook
- Pen or Pencil
- Notebook
- Safety Glasses

Objectives: Students will begin to understand about the Vehicle Identification Number (VIN). They will learn that certain digits have a universal designation while others mean something specific to that manufacturer.

Procedure:

1. Students will begin the process of performing a VIN analysis on a vehicle of their choice.
2. They can use both Mitchell On-Demand and Identifix in order to research VIN information for the vehicle chosen for the assignment.
3. Students are expected to participate in the Web Discussion this week outside of class time.

Assignments Due:

1. Chapter 1 reading in the text.
2. Workbook study questions on page 8.
3. Web Discussion #1 post and response to someone else's post.

Week #3: Study Questions

Chapter 1: Introduction and How Cars Work?

1. What was the earliest self-powered road vehicle?

2. Who was credited with the world's first motorcar?

3. How do cars work?

4. How are cars classified?

5. What is the difference between a manufacturer and make?

6. What does the acronym VIN represent?

7. What two units of measurement are used to classify engine sizes?

8. What is an engine configuration? List several examples.

9. What is the difference between a gasoline and diesel engine? What are the strokes in a four-stroke internal combustion engine?

10. Why is it a good idea to know the size of your vehicle's engine?

Analysis of VIN

Each student will be required to analyze an actual vehicle for this lab activity. Based on the information in our text and by utilizing online resources, what specific information did you find about your vehicles identification number (VIN)? I want you to be as detailed as possible and perform a complete breakdown of the entire seventeen digit number. You are not required to use websites that charge in order to access specific information, but you are encouraged to research the internet to find information. You are allowed to choose any year, make, and model vehicle, but it may be easier to find more detailed information on newer vehicles that use the standard seventeen digit number.

Tools:

Computer and Internet access.

NATEF Tasks:

1. Locate and interpret vehicle and other major component identification numbers.

Grading:

This assignment will be worth 50 points and will be assessed using the scoring rubric on the following page:

	(1)	(3)	(5)	
What does the first character of the VIN identify?	Completes the task but only minimally.	Completes the task and provides some detail.	Completes the task in an in-depth fashion.	Points out of 5, then multiply by two for total.
What does the second character identify?	Identifies the VIN digit only but does not indicate what it signifies.	Identifies the VIN digit and provides some detail about the second digit.	Identifies the VIN digit and clearly articulates details about second digit.	Points out of 5, then multiply by two for total.
What do the fourth through the eighth characters identify about your vehicle?	Identifies the VIN digits only but does not indicate what they signify.	Identifies the VIN digits and provides some detail about the fourth through eighth digits.	Identifies the VIN digits and clearly articulates details about them.	Points out of 5, then multiply by two for total.
What does the tenth character identify?	Identifies the VIN digit only but does not indicate what it signifies.	Identifies the VIN digit and provides some detail about the tenth digit.	Identifies the VIN digit and clearly articulates details about the tenth digit.	Points out of 5, then multiply by two for total.
What does the eleventh character identify?	Identifies the VIN digit only but does not indicate what it signifies.	Identifies the VIN digit and provides some detail about the eleventh digit.	Identifies the VIN digit and clearly articulates details about the eleventh digit.	Points out of 5, then multiply by two for total.

Web Discussion #1: Week 3

At the beginning of this week, I will pose a question to the students in the class online using whichever web interface the college uses. Chapter 1 will be the focus for this week and this is the question I will pose to the students:

The VECI (Vehicle Emission Control Information) label provides specific information pertaining to the vehicle such as the model year, size of engine, and type of engine. What are some other reasons why vehicle manufacturers use a VECI label? Please post on the forum and respond to someone else's post within the discussion board.

This assignment will be 20 points total, 10 points for posting to the forum and another 10 points for responding to someone else's post.

Mitchell On-Demand

Day #6

Assumed Prior Knowledge: Students are expected to have read Chapter 4 in the text. They also should have a basic idea of how to use the automotive database Mitchell On-Demand from prior class meetings, although we will get more in-depth today.

Time: 15 min video, 45 min lab activity

Materials:

- Auto Upkeep 2nd Edition textbook and workbook
- Pen or Pencil
- Notebook
- Computer with access to Mitchell On-Demand

Objectives: Students will become proficient at using Mitchell On-Demand, since it is a database we use quite often in the automotive shop.

Procedure:

1. Students will watch Video #3 that corresponds to the lab activity.
2. They will then complete Lab Activity #4 which includes documenting their findings.

Assignments Due:

1. Chapter 4 reading in the text.
2. VIN Analysis write-up.

Lab #4: Using Mitchell On-Demand

This lab will focus on the usage of an online database commonly used in the automotive repair industry called Mitchell On-Demand. Students will learn how to access technical information related to the vehicle on which they are working. The four main categories of Mitchell are repair, estimating, TSB/recalls, and maintenance. Each of these categories offers specific information related to the vehicle being worked on, so as a user you are required to know how to access the information you need.

The repair tab is the most commonly used and provides such things as torque specifications to electrical schematics. This is where you go when you are looking to actually fix the vehicle and need diagnostic information. The estimating tab allows the user to find labor times and estimated parts costs for just about all repairs related to a specific year, make, and model vehicle. This is beneficial information even if you do not intent to work on your own vehicle because it will give you an idea what the going rate is for specific repairs. TSB refers to technical service bulletins, and these are common failures related to a specific year, make, and model that product engineers have found and provide necessary diagnostic aids and fixes for. This is the first place to go if your vehicle is not functioning properly, and you want to see if there is a pattern failure applicable. Sometimes these fixes include replacing components with updated ones, and other times the vehicles can be fixed without replacing parts. This tab also provides recall information which is when the government steps in and forces the manufacturer to replace defective components or to make a necessary fix based upon issues related to safety. The last category is maintenance. This is where you can access very basic information related to service intervals as well as fluid capacities for the vehicle.

Tools:

Computer with Mitchell On-Demand.

NATEF Task:

None

Grading:

The assignment requires you to choose a vehicle. There are four criteria, each worth 2 points, and each will be individually assessed as follows:

1. Using the repair tab, find the schematic for the starting system and print it. Also, find the torque specification for the wheel lug nuts.

2. In the estimator section, find out the labor time for replacing the starter motor and see how much the replacement part will cost. Document your findings.
3. Find any technical service bulletins or recalls related to the starting system and write a brief description of each.

4. Use the maintenance tab to see what type of engine and transmission is recommended as well as the capacity of each fluid. Document your findings.

Choosing a Repair Facility

Day #7

Assumed Prior Knowledge: Students are expected to have read Chapter 4 in the text.

Time: 1 hour lecture, 1 hour lab activity

Materials:

- Auto Upkeep 2nd Edition textbook and workbook
- Pen or Pencil
- Notebook
- Computer with access to the internet

Objectives: Students will understand what to look for when choosing a repair facility. They will also be proficient in being able to search online for repair facilities that meet their requirements as a consumer.

Procedure:

1. Discuss what the lab activity is going to consist of today, since students will be partnering up in order to complete today's assessment.
2. Divide the class into groups of two for the day.
3. Have each of the two group members interview each other based on Procedure 1 on page 25 of the Workbook.
4. Next, each group member must go to the websites listed in the Workbook on pages 25-27 and perform the second part of the assignment individually.
5. Complete the Activity Journal on page 28 of the Workbook.
6. Finish completing the Choosing a Repair Facility assignment before the end of the lab.

Assignments Due:

1. Choosing a Repair Facility
2. Chapter 4 study questions
3. The Activity Journal on page 28 of the Workbook

Choosing a Repair Facility

Using your workbook for the class, complete the activity on pages 25-26, using the computers in the lab. You can interview other students in the class in order to get their perspective on choosing a repair facility. Make sure to turn your workbook in at the end of the lab.

Tools:

Computer with Internet access.

NATEF Task:

None

Grading:

This lab assignment is worth 50 points and will be assessed using the following scoring rubric:

	(1)	**(3)**	**(5)**	
Interview three adults with driving experience.	Conducted only one interview and documented findings.	Conducted two interviews and documented findings.	Conducted three detailed interviews and documented findings.	Points out of 5, then multiply by two for total.
Research on ASE website	Researched website but provided no detail of findings.	Researched website and documented the characteristics of a Blue Seal Shop.	Met all other requirements, and also printed a list of local Blue Seal Shops.	Points out of 5, then multiply by two for total.
Research on AAA website	Researched website but provided no detail of findings.	Researched website and documented AAA approved auto repair benefits.	Met all of the requirements, and also printed a list of local AAA approved facilities.	Points out of 5, then multiply by two for total.
Research on Motorist website.	Researched website but provided no detail of findings.	Researched website, watched video on How to Pick a Repair Shop, and listed	Met all of the requirements and also printed a list of local Motorist approved	Points out of 5, then multiply by two for total.

		examples from video.	facilities.	
Compare responses from the four sources above. Did any facilities meet all of the criteria?	Answered the question but was not thorough in documentation.	Compared responses and documented them regarding facilities meeting criteria.	Detailed in comparing all sources to achieve an answer to question.	Points out of 5, then multiply by two for total.

Week #4: Study Questions

Chapter 4: Repair Facilities

1. What does it mean when a technician is ASE certified?

2. What are AAA Approved Auto Repair facility characteristics?

3. What are examples of an ASE technician's Code of Ethics?

4. What is the purpose of the Better Business Bureau?

5. What are different types of service facilities?

6. What is the difference between an estimate and a repair invoice?

7. What types of warranties are available on new vehicles?

8. Why might a chain warranty be better than an independent repair facility warranty?

9. What does it mean when a warranty is pro-rated?

10. Why do some repair facilities offer community education programs?

Fluid Level Checks

Day #8

Assumed Prior Knowledge: Students are expected to have read Chapter 8 in the text in order to become familiar with how different fluids in the vehicle are properly checked.

Time: 15 min video, 1 hour lab activity

Materials:

- Auto Upkeep 2nd Edition textbook and workbook
- Pen or Pencil
- Notebook
- Computer with access to the internet

Objectives: Students will learn how to properly check the fluids in their vehicle.

Procedure:

1. Students will watch Video #4.
2. Then they will perform Lab Activity #5 and complete the Activity Journal on page 50 of the Workbook.
3. Students should read Web Discussion #2 and begin to think about how to respond to the prompt.

Assignments Due:

1. Chapter 8 reading in the text.
2. Activity Journal on page 50 of the Workbook

Lab #5: Fluid Level Checks

Perform the fluid level checks in procedures 1-9 in chapter 8 of the workbook. If you have any questions ask your instructor. Complete the Activity Journal on page 50 of the Workbook.

Tools:

Safety glasses, chemical resistant gloves (optional), and basic hand tools.

NATEF Task:

None

Objective:

You will be able to safely and accurately check all of the fluid levels in your vehicle.

Grading:

Each fluid level check will be worth 1 point, and there will be a maximum of 8 points possible for the lab. Some of the fluid level checks may not apply to your vehicle. Only perform the fluid level checks that do relate to the vehicle you are using for this lab activity.

Week #5: Study Questions

Chapter 8: Fluid Level Check

1. What functions do various fluids provide to vehicle components?

2. What is the process to check engine oil?

3. What is the color of clean oil? What is the color of dirty oil?

4. What is the process to check automatic transmission fluid?

5. What is the color of clean automatic transmission fluid?

6. What is the process to check antifreeze (coolant) level?

7. What are the two common types of antifreeze? What is the difference between them?

8. What is the common color for windshield washer fluid?

9. What are some safety precautions when handling brake fluid?

10. What is the process to check power steering fluid?

Engine Oil & Filter Change

Day #9

Assumed Prior Knowledge: Students are expected to have Chapter 10 in the text which discusses the lubrication system, and discusses the process of performing an oil and filter change.

Time: 15 min video, 1 hour lab activity

Materials:

- Auto Upkeep 2nd Edition textbook and workbook
- Pen or Pencil
- Notebook
- Computer with access to the internet
- Engine oil
- Oil filter
- Floor jack
- Jack Stands
- Ratchet with correct size socket for oil drain bolt.

Objectives: Students will learn how to perform an oil and filter change on their own vehicle.

Procedures:

1. Students will watch Video #5.
2. Perform Lab Activity #6 and complete the Activity Journal on page 68 of the Workbook.

Assignments Due:

1. Chapter 8 Workbook study questions on page 46.
2. Chapter 10 reading in the text.
3. Activity Journal on page 68 of the Workbook.
4. Web Discussion #2 post and response to someone else's post.

Lab #6: Oil Maintenance

Change the engine oil and filter in your vehicle or perform another oil related service needed in order to maintain your vehicle. Reference chapter 10 in the Workbook on pages 65-68 if you are unsure about any step in the process. Document your findings on page 68 in the Activity Journal.

Tools:

Safety glasses, wrench for oil pan drain plug, oil drain pan, funnel, jack and jack stands, and wheel chocks.

NATEF Tasks:

1. Perform oil and filter change.

Grading:

Students will be given a maximum of 8 points on the lab activity. There will be four criteria, each worth 2 points, that will be assessed during this lab and they are:

1. Safely lift the vehicle.
2. Drain the oil and replace the oil filter.
3. Refill the engine with fresh oil.
4. Make sure there are no leaks, and the fluid level is correct.

Web Discussion #2: Week 5

What types of challenges did you face when performing the various fluid level checks for your own vehicle? If you were unable to perform any of them, please list them and what year make and model you were using. Someone else within the class may be able to assist you. Please post on the forum and respond to someone else's post within the discussion board.

This assignment will be 20 points total, 10 points for posting to the forum and another 10 points for responding to someone else's post.

Battery Testing

Day #10

Assumed Prior Knowledge: Students are expected to have read Chapter 9 in text on the electrical system.

Time: 2 hours lecture, 2 hours lab

Materials:

- Auto Upkeep 2nd Edition textbook and workbook
- #2 Pencil
- Notebook
- Scantron

Objectives: Students will learn how to test batteries by applying the theoretical knowledge they have learned in a lab setting.

Procedure:

1. Take Test #1
2. Class discussion about Chapter 9
3. Perform Lab Activity #7
4. Students should read Web Discussion #3 and begin to think about how to respond.

Assignments Due:

1. Chapter 10 Workbook study questions on page 64
2. Chapter 9 reading in the text
3. Lab Activity #7 and the Activity Journal on page 56 of the Workbook

Week #6: Study Questions Part One

Chapter 10: Lubrication System

1. What will oil do within an engine?
2. How does engine oil get dirty?
3. What does API stand for and what does it rate?
4. What does SAE stand for and what does it rate?
5. What is a common price for a quart of conventional oil?
6. Why is it not recommended to overfill the engine with oil?
7. What is one advantage and one disadvantage of synthetic oils?
8. How often should the oil and filter be changed?
9. What does an oil filter do?
10. Which oil is more viscous, 5W30 or 20W50?

Test #1

1. Two technicians are discussing the correct sequence of the four-stroke engine cycle. Technician A states the sequence is: Intake, Power, Compression, Exhaust. Technician B states the sequence is: Intake, Compression, Power, Exhaust. Which is correct?

a. Technician A only
b. Technician B only
c. Both are correct
d. Neither is correct

2. Technician A says that common compression ratios for a spark ignition engine are between 8:1 and 12:1. Technician B says that common compression ratios for a compression ignition engine range from 16:1 to 20:1. Who is correct?

a. Technician A only
b. Technician B only
c. Both are correct
d. Neither is correct

3. Two technicians are discussing power transfer in a gasoline powered vehicle. Technician A says the reciprocating motion of the pistons is converted to rotary motion of the crankshaft. Technician B says the reciprocating motion of the pistons converts chemical energy of fuel into kinetic energy. Who is correct?

a. Technician A only
b. Technician B only
c. Both are correct
d. Neither is correct

4. Technician A says the vehicle emission control information (VECI) label under the hood also provides the production date of the vehicle in terms of the month and year. Technician B states the vehicle certification label inside the driver's door provides the model year of the vehicle. Who is correct?

a. Technician A only
b. Technician B only
c. Both are correct
d. Neither is correct

5. Technician A says that the Vehicle Identification Number (VIN) is only located on the left side of the dash. Technician B says that the VIN is located on the vehicle certification label inside the driver's doorjamb in addition to the dash. Who is correct?

a. Technician A only
b. Technician B only
c. Both are correct
d. Neither is correct

6. Technician A says when choosing a repair facility consumers should look for one where technicians are ASE certified. This ensures that they have two or more years of related experience and also have passed a certification test. Technician B says when choosing a repair facility consumers should look for places that have been approved by the American Automobile Association (AAA). Who is correct?

a. Technician A only
b. Technician B only
c. Both are correct
d. Neither is correct

7. Technician A says that most repair facilities charge labor rates based on either flat rate time or actual time. Technician B says that most repair facilities charge labor rates based on either flat rate time or book time. Who is correct?

a. Technician A only
b. Technician B only
c. Both are correct
d. Neither is correct

8. Two technicians are discussing the pros and cons between dealerships, independent repair facilities, and specialized repair facilities. Technician A states as a consumer it is often better to go to a dealership when your vehicle is under warranty or if you want someone with factory training working on your vehicle. Technician B states that you can sometimes save on repair costs by taking your vehicle to a specialized repair facility because they often do high volume work in a specific area such as brakes or tires. Who is correct?

a. Technician A only
b. Technician B only
c. Both are correct
d. Neither is correct

9. Technician A states after a vehicle is out of the factory bumper-to-bumper warranty any issue with the vehicle is the customers' financial responsibility. Technician B states even if the vehicles factory bumper-to-bumper warranty has expired, the powertrain warranty could still cover repair costs. Who is correct?

a. Technician A only
b. Technician B only
c. Both are correct
d. Neither is correct

10. There are many different types of warranties when it comes to the vehicle repair industry. Technician A states certified used car warranties and extended warranties on used vehicles are the same thing. Technician B states you can only get automotive batteries and tires warrantied at the facility where they were replaced. Who is correct?

a. Technician A only
b. Technician B only
c. Both are correct
d. Neither is correct

11. What is the best possible choice of tools to use when attempting to loosen a fastener that is very tight without rounding the head of the fastener?

a. 6" Crescent wrench
b. 10" box-end twelve-point wrench
c. 12" adjustable wrench
d. 10" box-end six-point wrench

12. Technician A states never to use a non-impact socket while using an electric or air powered wrench. Technician B says it is okay to use a non-impact socket while using an air powered tool as long as it is a six-point socket. Who is correct?

a. Technician A only
b. Technician B only
c. Both are correct
d. Neither is correct

13. Technician A says locking pliers and Channellocks are the same tool. Technician B says Vise-Grips and adjustable pliers are the same tool. Who is correct?

a. Technician A only
b. Technician B only
c. Both are correct
d. Neither is correct

14. Technician A says when using a floor jack to lift a vehicle it is necessary to use jack stands while working under the vehicle. Technician B says as long as you use wheel chocks and use the floor jack while on a flat surface it is not necessary to use jack stands. Who is correct?

a. Technician A only
b. Technician B only
c. Both are correct
d. Neither is correct

15. Two technicians are discussing precision measuring tools. They both agree that calipers, feeler gauges, micrometers, and dial indicators are all fall into this category. Technician A says that calipers are a versatile tool for measuring but not extremely precise. Technician B says a micrometer is very precise at measuring the diameter of objects. Who is correct?

a. Technician A only
b. Technician B only
c. Both are correct
d. Neither is correct

16. Technician A states that engine oil performs several jobs in addition to lubricating. It also cools, cleans, and seals the components of the engine internally. Technician B states you should not add oil until the dipstick reads at the bottom of the crosshatch area.

a. Technician A only
b. Technician B only
c. Both are correct
d. Neither is correct

17. Technician A states that you should normally check the fluid in an automatic transmission while the vehicle is at normal operating temperature and with the gear selector in the park position. Technician B states when reading the dipstick of an automatic transmission the bottom of the crosshatch area means that the transmission is one quart low on fluid. Who is correct?

a. Technician A only
b. Technician B only
c. Both are correct
d. Neither is correct

18. Technician A says the fluid level in a manual transmission should be checked with the vehicle off. Technician B says that a manual transmission can take many different types of fluid so it is important to check the owner's manual for specifications.

a. Technician A only
b. Technician B only
c. Both are correct
d. Neither is correct

19. Technician A says antifreeze and coolant is the same thing. Technician B says antifreeze is the product that is added to water in order to make coolant. Who is correct?

a. Technician A only
b. Technician B only
c. Both are correct
d. Neither is correct

20. Technician A says that there are several types of brake fluid but DOT 4 is the most common type. Technician B says vehicles with a manual transmission and a hydraulic clutch usually use DOT 4 brake fluid. Who is correct?

a. Technician A only
b. Technician B only
c. Both are correct
d. Neither is correct

21. Two technicians are discussing batteries and proper maintenance. Technician A says that in a lead acid battery electrolyte is a mixture of sulfuric acid and distilled water. Technician B says maintenance batteries require occasion fluid level checks and sometimes require sulfuric acid to be added into the cells.

a. Technician A only
b. Technician B only
c. Both are correct
d. Neither is correct

22. Technician A says engine oil lubricates, cools, cleans, and seals the many internal components of the engine. Technician B says engine oil reduces blow-by gases by sealing between the pistons and cylinder wall. Who is correct?

a. Technician A only
b. Technician B only
c. Both are correct
d. Neither is correct

23. Two technicians are discussing engine oil ratings. Technician A says multigrade oils are best used when operating a vehicle in a wide range of climates because they have been tested at both 0°F and at 210°F. Technician B says the "W" after a rating, such as 10W30, stands for weight of the oil.

a. Technician A only
b. Technician B only
c. Both are correct
d. Neither is correct

24. Technician A says when selecting the proper oil for your vehicle you should consult the owner's manual to ensure proper viscosity. Technician B says you should also make sure the bottle of oil has an API rating of SM. This means that it conforms to the most current standards used in the industry.

a. Technician A only
b. Technician B only
c. Both are correct
d. Neither is correct

25. Technician A states one of the advantages of using synthetic oil is that it flows well at extremely cold temperatures in addition to providing better protection at very high temperatures. Technician B states most manufacturer warranties extend oil change intervals when synthetic oils are used.

a. Technician A only
b. Technician B only
c. Both are correct
d. Neither is correct

Lab #7: Battery Activity

Perform tests on your vehicles battery as shown in Chapter 9 of the Workbook on pages 53-55. Document your findings on page 56 in the Activity Journal.

Tools:

Safety glasses, basic hand tools, a digital multimeter, battery load tester, battery hydrometer, wire brush, battery terminal cleaner, battery terminal spreader, battery terminal puller, parts cleaning brush, and a mixing cup.

NATEF Tasks:

1. Perform battery state-of-charge test; determine necessary action.
2. Perform battery capacity test; confirm proper battery capacity for vehicle application; determine necessary action.
3. Inspect, clean, fill, and/or replace battery, battery cables, connectors, clamps, and hold-downs.

Grading:

Students will be given a maximum of 8 points on the lab activity. Each of the four NATEF tasks is worth 2 points for this lab. In order to get all 8 points, you will need to complete the Activity Journal.

Charging System

Day #11

Assumed Prior Knowledge: Students will have read Chapter 9 in the text on the electrical system, and begin to understand how batteries and the charging system are interrelated.

Time: 15 min video, 1 hour lab activity

Materials:

- Auto Upkeep 2nd Edition textbook and workbook
- Pen or pencil
- Notebook
- Computer with access to the internet
- Digital multimeter with inductive amperage probe
- Basic hand tools
- Safety glasses

Objectives: Students will learn how to test a vehicles charging system using basic tools and equipment.

Procedure:

1. Watch Video #6
2. Perform Lab Activity #8 and complete the Activity Journal on page 60 of the Workbook

Assignments Due:

1. Chapter 9 Workbook study questions on page 52
2. Web Discussion #3 post and response to another post

Week #6: Study Questions Part Two

Chapter 9: Electrical System

1. What is electricity?

2. What is electrical voltage?

3. What is electrical current and how is it different from voltage?

4. What is the purpose of the battery?

5. What does a starter do?

6. How does an automotive battery get recharged?

7. What is an ohm? What is the relationship between voltage, current, and resistance?

8. How is the cold-cranking rating different from a cranking-rating?

9. Why should you not bypass a fuse?

10. What could cause a fuse to blow?

Lab #8: Charging System

The focus of this lab is to perform an output test of the alternator and to replace the drive belt on the same vehicle. Students will need to use their Workbook and follow the instructions on pages 57-59 in Chapter 9. Document your findings on page 60 in the Activity Journal.

Tools:

Safety glasses, basic hand tools, and a digital multimeter with an inductive amperage probe.

NATEF Tasks:

1. Perform charging system output test; determine necessary action.
2. Inspect, adjust, or replace generator (alternator) drive belts, pulleys, and tensioners; check pulley and belt alignment.

Grading:

Students will be given a maximum of 8 points for the lab activity. Testing the alternator will be worth 2 point and belt replacement will also be worth 2 points. The documentation of your findings will be worth 4 points.

Web Discussion #3: Week 6

Did you encounter any problems with the charging system of your vehicle? If so, what were the issues and how did you go about fixing them? Please post on the forum and respond to someone else's post within the discussion board.

This assignment will be 20 points total, 10 points for posting to the forum and another 10 points for responding to someone else's post.

Air Filter & Fuel Filter Change

Day #12

Assumed Prior Knowledge: Students should have read Chapter 11 in the text on the fuel system.

Time: 1 hour lecture, 1 hour lab activity

Materials:

- Auto Upkeep 2nd Edition textbook and workbook
- Pen or pencil
- Notebook
- Basic hand tools
- Safety glasses
- Fuel filter
- Air filter
- Drain pan
- Hydraulic Lift

Objectives: Students will learn how to replace the air filter, PCV valve, and fuel filter on their own vehicle.

Procedure:

1. Class discussion on Chapter 11 in the text on the fuel system.
2. Perform Lab Activity #9 and complete the Activity Journal on page 74 of the Workbook.
3. Students should read Web Discussion #4 and begin to think about how to respond.

Assignments Due:

1. Chapter 11 read in the text
2. Lab Activity #9 and the Activity Journal on page 74 of the Workbook

Lab #9: Air Filter, PCV Valve, and Fuel Filter Replacement

The purpose of this lab activity is to become familiar with fuel system components and the methods by which you would inspect and, if needed, replace them. Students will need to perform the five tasks on pages 71-74 of the Workbook and document findings in the Activity Journal on page 74.

Tools:

Safety glasses, basic hand tools, drain pan, jack and jack stands, and wheel chocks.

NATEF Tasks:

1. Inspect, test and service positive crankcase ventilation (PCV) filter/breather cap, valve, tubes, orifices and hoses; perform necessary action.
2. Replace fuel filters.

Grading:

Four tasks in Chapter 11 of the Workbook will be assessed. The only task you will not need to perform is replacing the CCV filter since many vehicles no longer have this kind of filter. Therefore, each of the tasks will be worth 2 points, and the maximum score on the lab is 8 points.

Fuel Pressure Check
Day #13

Assumed Prior Knowledge: Students are expected to have read Chapter 11 in the text on the fuel system.

Time: 1 hour lecture, 1 hour lab activity

Materials:

- Auto Upkeep 2nd Edition textbook and workbook
- Pen or pencil
- Notebook
- Basic hand tools
- Fuel pressure tester
- Safety glasses
- Drain pan
- Hydraulic lift

Objectives: Students will learn how to check the fuel pressure on their fuel injected vehicle.

Procedure:

1. Class discussion of Chapter 11 on the fuel system
2. Perform Lab Activity #10 and complete the Activity Journal on page 74 of the Workbook

Assignments Due:

1. Chapter 11 Workbook study questions on page 70
2. Web Discussion #4 post and response to another post

Week #7: Study Questions

Chapter 11: Fuel System

1. What is the purpose of the fuel system?

2. What does the pump do and where might it be found on an automobile?

3. What do the letters PCV represent?

4. What do the letters CCV represent?

5. How often should air filters be changed?

6. What are common octane ratings of gasoline sold at the pump?

7. What causes an engine to knock or ping?

8. What are oxygenates?

9. What is ultra-low sulfur diesel?

10. How can you improve the fuel economy of your automobile?

Lab #10: Fuel Pressure Testing

This lab involves fuel pressure testing of a multi-port fuel injected vehicle.

Tools:

Safety glasses, chemical resistant gloves (optional), basic hand tools, and fuel pressure test kit.

NATEF Tasks:

1. Check fuel pressure on a fuel injected system.

Grading:

Each student will be assessed on this task based on four basic criteria and each will be worth 2 points. This lab activity will be worth a maximum of 8 points.

1. Use Mitchell On-Demand to find the fuel pressure specifications for your vehicle.
2. Find out how to properly hook-up a fuel pressure gauge to your vehicle. Connect the gauge to the fuel system being tested.
3. Turn the key on with the engine off and document the fuel pressure. Follow the manufacturer's testing procedure because often there are also idle specifications as well as when the engine is running at about 1500rpm.
4. Document your findings and note whether or not the fuel system tested was within specifications.

Web Discussion #4: Week 7

The fuel filter is an inexpensive, yet important, component of the fuel system. If a fuel filter is restricted, what do you think it would cause to the fuel system of a fuel injected vehicle? Please explain your rationale. At the same time, the induction system, where the air is drawn into the engine is also very important in order for an engine to run efficiently. What do you think would happen if the air filter was restricting air flow to a computer controlled engine? Do you think it would run better or worse than a vehicle with a restricted fuel filter? Please explain your answer. Please post on the forum and respond to someone else's post within the discussion board.

This assignment will be 20 points total, 10 points for posting to the forum and another 10 points for responding to someone else's post.

HVAC Inspection

Day #14

Assumed Prior Knowledge: Students are expected to have read Chapter 12 in the text.

Time: 15 min video, 1 hour lab activity

Materials:

- Auto Upkeep 2nd Edition textbook and workbook
- Pen or pencil
- Notebook
- Computer with access to the internet
- Safety glasses

Objectives: Students will learn how to properly inspect a vehicles HVAC system.

Procedure:

1. Watch Video #7
2. Perform Lab Activity #11 and complete the Activity Journal on page 78 of the Workbook

Assignments Due:

1. Chapter 11 read in the text
2. Lab Activity #11 and the Activity Journal on page 78 of the Workbook

Lab #11: HVAC System Inspection

This lab will focus on helping you become familiar with and inspect Heating Ventilation & Air Conditioning (HVAC) components. Document your findings on page 78 of the Activity Journal.

Tools:

Safety glasses.

NATEF Tasks:

1. Inspect and replace A/C compressor drive belts, pulleys, and tensioners; determine necessary action.
2. Inspect A/C condenser for airflow restrictions; perform necessary action.

Grading:

Each of the tasks will be worth 4 points and a maximum of 8 points will be awarded for completing this lab activity.

Cooling System Testing

Day #15

Assumed Prior Knowledge: Students should have read Chapter 12 in the text which provides a solid theoretical background of the cooling system.

Time: 1 hour lecture, 1 hour lab activity

Materials:

- Auto Upkeep 2nd Edition textbook and workbook
- Pen or pencil
- Notebook
- Safety glasses
- Refractometer
- Cooling system pressure tester
- Cooling system test strips

Objectives: Students will learn how to test the cooling system of a vehicle using a cooling system pressure tester, cooling system test strips, and a refractometer.

Procedure:

1. Class discussion on the cooling system portion of Chapter 12 in the text.
2. Perform Lab Activity #12 and then complete the Activity Journal on page 84 of the Workbook.

Assignments Due:

1. Chapter 12 Workbook study questions on page 76.
2. Lab Activity #12 and the Activity Journal on page 84 of the Workbook

Week #8: Study Questions

Chapter 12: Cooling System and Climate Control

1. What does the cooling system do within an engine?

2. What is the purpose of a radiator?

3. What is the purpose of a thermostat?

4. Why do automobiles have coolant recovery tanks?

5. Why should you mix a 50/50 blend of water and antifreeze?

6. How do you get heat in your automobile when it is cold outside?

7. What is the purpose of the cabin air filter?

8. How are drive belts part of the cooling system?

9. How often should antifreeze be serviced?

10. What should you do if water is dripping on the interior floorboards when the A/C is on?

Lab #12: Cooling System Testing

This lab will consist of both an inspection and thorough testing of the cooling system. Document your findings in the Workbook on page 84 of the Activity Journal.

Tools:

Safety glasses, basic hand tools, cooling system pressure tester, coolant test strips, and a refractometer.

NATEF Tasks:

1. Perform cooling system pressure test; check coolant condition; inspect and test radiator, pressure cap, coolant recovery tank, and hoses; determine necessary action.

Grading:

The assignment will be worth 2 points for each of the following four tasks:

1. Test coolant using both a refractometer and test strips.
2. Pressure test the cooling system
3. Pressure test the radiator cap
4. Inspect the cooling system components while the pressure tester is connected to check for leaks.

Spark Plug Removal & Replacement

Day #16

Assumed Prior Knowledge: Students should have read Chapter 13 in the text on the ignition system.

Time: 1 hour lecture, 2 hours lab activity

Materials:

- Auto Upkeep 2nd Edition textbook and workbook
- Pen or pencil
- Notebook
- Safety glasses
- Basic hand tools
- Spark plug socket
- Spark plug gauge

Objectives: Students will learn how remove and replace the spark plugs on a vehicle, while also making necessary adjustments to the gap in accordance to manufacturers specifications.

Procedure:

1. Class discussion on Chapter 13 in the text on the ignition system.
2. Perform Lab Activity #13
3. Students should read Web Discussion #5 and begin to think about how to respond.

Assignments Due:

1. Chapter 13 read in the text
2. Lab Activity #13

Lab #13: Spark Plug Removal & Replacement

This lab activity will focus on the removal, inspection, and replacement of spark plugs on your vehicle. Document your findings in the Workbook on page 90 of the Activity Journal.

Tools:

Safety glasses, spark plug socket, digital multimeter, spark plug gap gauge, spark plug wire removing tool, fender cover, and basic hand tools.

NATEF Tasks:

None

Grading:

This lab will be assessed on the following four criteria and each will have a value of 2 points:

1. Removal of spark plugs.
2. Check and adjust the plug gap as needed.
3. Inspect the plugs condition and determine whether or not to replace them.
4. Re-install spark plugs.

Spark Plug Wire Testing

Day #17

Assumed Prior Knowledge: Students will have read Chapter 13 in the text and have a basic understanding of the ignition system.

Time: 15 min video, 1 hour lab activity

Materials:

- Auto Upkeep 2nd Edition textbook and workbook
- Pen or pencil
- Notebook
- Computer with access to the internet
- Safety glasses
- Basic hand tools
- Digital multimeter

Objectives: Students will learn how to check the resistance of spark plug wires compared to manufacturer specifications.

Procedure:

1. Watch Lab Video #8
2. Perform Lab Activity #14 and complete the Activity Journal on page 90 of the Workbook.

Assignments Due:

1. Chapter 13 Workbook study questions on page 86
2. Lab Activity #14 and the Activity Journal on page 90 of the Workbook
3. Web Discussion #5 post and response to another post

Week #9: Study Questions

Chapter 13: Ignition System

1. What is the purpose of the ignition system?

2. How has the ignition system evolved over time?

3. What is the purpose of an ignition coil?

4. What do spark plugs do?

5. How is the battery part of the ignition system?

6. What is an advantage of having an electronic (distributorless) ignition system?

7. What is the purpose of an ignition module?

8. How often should spark plugs be changed?

9. What is anti-seize compound and where can it be used?

10. Why do some engines use crankshaft and camshaft sensors?

Lab #14: Spark Plug Wire Inspection & Testing

This lab activity will focus on both how to inspect and test spark plug wires.

Tools:

Safety glasses, digital multimeter, spark plug wire removing tool, fender cover, and basic hand tools.

NATEF Tasks:

None

Grading:

You will be assessed on the following four criteria. Each will be worth 2 points, and the assignment will be worth 8 points:

1. Remove spark plug wires.
2. Visually inspect spark plug wires.
3. Test spark plug wires using a digital multimeter for resistance compared to specifications.
4. Reinstall the spark plug wires in their correct location.

Web Discussion #5: Week 9

The condition of the spark plugs is a good indicator of how things are within the combustion chamber of each cylinder of an engine. How was the condition of the spark plugs you removed to inspect on your vehicle? If there was any abnormal wear, were you able to determine the cause? Did anyone notice that their spark plugs were in good condition but the spark plug wires showed excessive resistance? What would excessive resistance do to the ignition system? Please post on the forum and respond to someone else's post within the discussion board.

This assignment will be 20 points total, 10 points for posting to the forum and another 10 points for responding to someone else's post.

Suspension/Steering Identification & Inspection

Day #18

Assumed Prior Knowledge: Students should have Chapter 14 of the text read, and have a basic understanding of the different steering and suspension systems used on today's vehicles.

Time: 15 min video, 1 hour lab activity

Materials:

- Auto Upkeep 2nd Edition textbook and workbook
- Pen or pencil
- Notebook
- Computer with access to the internet
- Floor jack and jack stands
- Wheel chocks
- Safety glasses
- Grease gun

Objectives: Students will learn how to properly identify the steering and suspension systems on their vehicle. They will be able to visually inspect the systems to identify and problems, such as leaks or other issues. Also, students will learn how to grease the zerk fittings of the steering and suspension system.

Procedure:

1. Watch Video #9.
2. Perform Lab Activity #15 and complete the Activity Journal on page 94 of the Workbook.
3. Students should read Web Discussion #6 and begin to think about how to respond.

Assignments Due:

1. Lab Activity #15 and the Activity Journal on page 94 of the Workbook

Lab #15: Steering & Suspension Inspection

During this lab, you will be inspecting the steering system and suspension of your vehicle. Once you are finished, complete the Activity Journal on page 94 of your Workbook.

Tools:

Safety glasses, grease gun, jack and jack stands, and wheel chocks.

NATEF Tasks:

1. Identify and interpret suspension and steering concern; determine necessary action.
2. Lubricate suspension and steering systems.

Grading:

Students will be required to document their work. The lab activity will be assessed based on the following four criteria, and each will be worth 2 points:

1. Properly identify the type of steering system of your vehicle.
2. Inspect the steering system and document your findings.
3. Grease any areas of the suspension that have a zerk fitting.
4. Check the power steering fluid level

Tires Activity

Day #19

Assumed Prior Knowledge: Students should have Chapter 14 of the text read and have basic understanding about tires.

Time: 15 min video, 1 hour lab activity

Materials:

- Auto Upkeep 2nd Edition textbook and workbook
- Pen or pencil
- Notebook
- Computer with access to the internet
- Floor jack and jack stands
- Wheel chocks
- Safety glasses
- Air pressure gauge
- Tire tread depth gauge
- Socket for wheel lug nuts
- Breaker bar to remove wheel lug nuts
- Torque wrench

Objectives: Students will learn how to check tire pressure and measure tread depth.

Procedure:

1. Watch Video #10
2. Perform Lab Activity #16 and complete the Activity Journal on page 98 of the Workbook

Assignments Due:

1. Chapter 14 Workbook study questions on page 92
2. Lab Activity #16 and the Activity Journal on page 98 of the Workbook
3. Web Discussion #6 post and response to another post

Week #10: Study Questions

Chapter 14: Suspension, Steering, and Tires

1. What is the purpose of the steering system?

2. What is the purpose of the suspension system?

3. What do shocks do?

4. How are shocks different than struts?

5. What is used to reduce the effort needed to steer an automobile?

6. What do the letters UTQG represent? What are the three UTQG ratings?

7. Why is it important to torque lug nuts?

8. How often should tires be rotated?

9. Why is it not recommended to fix a tire's sidewall?

10. What can cause a tire to wear excessively?

Lab #16: Tire Inspection and Maintenance

This lab will focus solely on tires, and students will be both inspecting and rotating them. Document your findings on page 98 of the Activity Journal in the Workbook.

Tools:

Safety glasses, jack and jack stands, tread depth gauge, tire pressure gauge, torque wrench, basic hand tools, and access to an air compressor.

NATEF Tasks:

1. Inspect tire condition; identify tire wear patterns; check and adjust air pressure; determine necessary action.
2. Rotate tires according to manufacturer's recommendations.
3. Reinstall wheel; torque lug nuts.

Grading:

Students will be assessed on the following four basic criteria of the lab, and each will be worth 2 points:

1. Inspect tires and determine what is causing any uneven wear.
2. Check and adjust air pressure in the tires based upon the specifications on the tire placard.
3. Rotate the tires.
4. Reinstall the wheels and torque the lug nuts to specification.

Web Discussion #6: Week 10

Did the vehicle you inspected for tire wear show signs of excessive wear? If so, what can you contribute the wear to based on what you know from Chapter 14 in the text. How is tire wear related to the suspension and steering system of the vehicle? Please post on the forum and respond to someone else's post within the discussion board.

This assignment will be 20 points total, 10 points for posting to the forum and another 10 points for responding to someone else's post.

Brake Inspection

Day #20

Assumed Prior Knowledge: Students should have Chapter 15 of the text read about the braking system. They should also be prepared to take a test on Chapter's 9, 11, 12, 13, and 14.

Time: 1 hour lecture, 1 hour lab

Materials:

- Auto Upkeep 2nd Edition textbook and workbook
- #2 pencil
- Notebook
- Scantron
- Safety glasses
- Hydraulic lift
- Depth gauge
- Socket for wheel lug nuts
- Breaker bar to remove wheel lug nuts
- Torque wrench

Objectives: Students will learn how to inspect the braking system for leaks or cracks in the lines. They will also become familiar with how to properly inspect the brake linings on a vehicle.

Procedure:

1. Take Test #2
2. Discussion on Chapter 15 of the text
3. Perform Lab Activity #17 and complete the Activity Journal on page 102 of the Workbook
4. Students should read Web Discussion #7 and begin to think about how to respond.

Assignments Due:

1. Chapter 15 of the text read
2. Lab Activity #18 and the Activity Journal on page 102 of the Workbook

Lab #17: Brake Inspection

This lab will consist of performing a brake inspection in order to determine the condition of the brakes. Document your findings on page 102 of the Activity Journal in the Workbook.

Tools:

Safety glasses, torque wrench, jack and jack stands, wheel chocks, machinist rule, fender cover, basic hand tools.

NATEF Tasks:

1. Inspect brake lines, flexible hoses, and fittings for leaks, dents, kinks, rust, cracks, bulging or wear; tighten loose fittings and supports; determine necessary action.
2. Select, handle, store, and fill brake fluid to proper level.
3. Remove, clean, inspect, and measure brake drums; determine necessary action.
4. Install wheel, torque lug nuts, and make final checks and adjustments.

Grading:

Students will be assessed on the following four basic criteria of the lab, and each will be worth 2 points:

1. Inspect the master cylinder and hydraulic brake lines for leaks or cracks.
2. Perform a brake inspection on all four wheels.
3. Determine the condition of the brakes.
4. Install the tires and torque the lug nuts to specification.

Test #2

1. Technician A says voltage is described as the quantity of electrons through a conductor. Technician B says amperage is the electrical pressure pushing electrons. Who is correct?

a. Technician A only
b. Technician B only
c. Both are correct
d. Neither is correct

2. Technician A states Ohm's Law is a formula that shows the relationship between voltage, current, and resistance. Technician B states the letter "E" represents current and "I" represents voltage in the formula. Who is correct?

a. Technician A only
b. Technician B only
c. Both are correct
d. Neither is correct

3. Two technicians are discussing automotive battery ratings. Technician A says cold cranking amps (CCA) is the amount of current the battery can deliver at 0°F for 30 seconds. Technician B says cranking amps (CA) is the amount of current the battery can deliver at 32°F for 15 seconds. Who is correct?

a. Technician A only
b. Technician B only
c. Both are correct
d. Neither is correct

4. Technician A states to never recharge a battery that has a low electrolyte level or is frozen. Technician B states some automotive batteries are maintenance-free and have a hydrometer built into the case. Who is correct?

a. Technician A only
b. Technician B only
c. Both are correct
d. Neither is correct

5. The state of charge of an automotive battery is being discussed. If the voltage of the battery is 12.2 V, what is the state of charge of that particular battery?

a. 100%
b. 75%
c. 50%
d. 25%

6. Technician A states that the charging system converts chemical energy to electrical energy to mechanical energy. Technician B states the starting system converts mechanical energy to electrical energy to chemical energy. Who is correct?

a. Technician A only
b. Technician B only
c. Both are correct
d. Neither is correct

7. Technician A says the most efficient fuel mixture in an engine is a 14.7:1 ratio of fuel to air. Technician B says the most efficient fuel mixture in an engine is a 14.7:1 ratio of air to fuel. Who is correct?

a. Technician A only
b. Technician B only
c. Both are correct
d. Neither is correct

8. Two technicians are discussing fuel injection systems. Technician A states in a throttle body injection system, there is usually one fuel injector used to supply fuel to all of the cylinders. Technician B states in port injection systems there is one fuel injector per cylinder. Who is correct?

a. Technician A only
b. Technician B only
c. Both are correct
d. Neither is correct

9. Technician A states the higher the octane rating of gasoline, the more the fuel resists detonation under pressure. Technician B states it takes a lower temperature and less engine compression to ignite a fuel with a higher octane rating.

a. Technician A only
b. Technician B only
c. Both are correct
d. Neither is correct

10. Two technicians are discussing the main types of diesel fuel, #1 and #2. Technician A says #1 has a tendency to gel in real cold climates. Technician B says #2 is often used when the ambient temperature is real low. Who is correct?

a. Technician A only
b. Technician B only
c. Both are correct
d. Neither is correct

11. Technician A says the thermostat is referred to as the brain of the cooling system. Technician B says most thermostats open between 160-170°F. Who is correct?

a. Technician A only
b. Technician B only
c. Both are correct
d. Neither is correct

12. Two technicians are discussing cooling system components. Technician A says electric fans can turn on even when the engine is shut off. Technician B says water pumps often have a “weep” hole that is intentionally engineered into the pump in order to signal when the internal seals have failed. Who is correct?

a. Technician A only
b. Technician B only
c. Both are correct
d. Neither is correct

13. Technician A states that one of the functions of coolant is to lubricate the water pump. Technician B states in extreme cold weather it is good to use up to 90% coolant. Who is correct?

a. Technician A only
b. Technician B only
c. Both are correct
d. Neither is correct

14. Technician A says that coolant does not flow through the heater core until the thermostat opens. Technician B says it is normal to sometimes notice a sweet smell while inside the passenger compartment when the heater is on. Who is correct?

a. Technician A only
b. Technician B only
c. Both are correct
d. **Neither is correct**

15. Two technicians are discussing air conditioning systems. Technician A says the orifice tube changes the refrigerant from a higher pressure liquid to a low pressure liquid. Technician B says the accumulator prevents liquid refrigerant from entering the A/C compressor. Who is correct?

a. Technician A only
b. Technician B only
c. Both are correct
d. Neither is correct

16. Which of the following is **NOT** a reason why a vehicle will not start?

a. Corroded distributor cap
b. Faulty ignition module
c. A bad spark plug wire
d. Moisture on ignition components

17. Technician A says new vehicles do not use ignition coils. Technician B says some new vehicles have eliminated spark plug wires. Who is correct?

a. Technician A only
b. Technician B only
c. Both are correct
d. Neither is correct

18. Technician A says to always use anti-seize when installing new spark plugs. Technician B says the vehicle emission control information (VECI) label shows the spark plug gap specification for the engine.

a. Technician A only
b. Technician B only
c. Both are correct
d. Neither is correct

19. Two technicians are discussing vehicle suspension. Technician A says a bounce test is a good method to test the shocks, struts, or springs. Technicians B says that a vehicle fails the bounce test if it cycles more than once.

a. Technician A only
b. Technician B only
c. Both are correct
d. Neither is correct

20. Technician A states when inspecting shocks look for oil leakage because that is a sign they should be replaced. Technician B states worn shocks can increase the body roll of the vehicle.

a. Technician A only
b. Technician B only
c. Both are correct
d. Neither is correct

21. Technician A says leaf springs are a structural part of the suspension system. Technician B says some vehicles use struts at each wheel. Who is correct?

a. Technician A only
b. Technician B only
c. Both are correct
d. Neither is correct

22. Which of the following is **NOT** true regarding struts on a vehicle?

a. If one strut is defective then they should all be replaced on the vehicle.
b. They eliminate the need to have springs and shocks at each wheel.
c. Saves weight
d. Struts are a structural component of the suspension and steering system.

23. Two technicians are discussing steering systems. Technician A says most small cars use a parallelogram system. Technician B says most rear wheel drive vehicles use a rack and pinion system. Who is correct?

a. Technician A only
b. Technician B only
c. Both are correct
d. Neither is correct

24. Technician A says that a tires traction rating represents its ability to grip the road on a wet surface. Technician B says the highest traction rating is an “A”. Who is correct?

a. Technician A only
b. Technician B only
c. Both are correct
d. Neither is correct

25. Technician A says the legal limit for tread depth on an automobile tire is 2/32”. Technician B says there are different methods for rotating tires and it is best to consult the owner’s manual to determine the suggested pattern.

a. Technician A only
b. Technician B only
c. Both are correct
d. Neither is correct

Brake Lining Replacement

Day #21

Assumed Prior Knowledge: Students should have read Chapter 15 in the text on braking system. They will have a basic understanding of the components involved from the previous brake inspection lab activity.

Time: 1 hour lecture, 1 hour lab activity

Materials:

- Auto Upkeep 2nd Edition textbook and workbook
- Pen or pencil
- Notebook
- Safety glasses
- Computer with access to Mitchell On-Demand
- Hydraulic lift
- Basic hand tools
- Socket for wheel lug nuts
- Breaker bar to remove wheel lug nuts
- Torque wrench
- Specialty brake tools

Objectives: Students will learn how to replace the brake linings on their own vehicle, and become familiar with the tools involved to perform the job.

Procedure:

1. Class discussion on Chapter 15 in the text on the braking system
2. Perform Lab Activity #18 and document your work on a repair order

Assignments Due:

1. Chapter 15 Workbook study questions on page 100
2. Lab Activity #18 and documentation of repair
3. Web Discussion #7 post and response to another post

Week #11: Study Questions

Chapter 15: Braking System

1. What is the purpose of the braking system?

2. How is a disc brake system different than a drum brake system?

3. What does brake fluid do?

4. What do the letters ABS represent?

5. What are the benefits of antilock brakes?

6. Why does the parking brake use a mechanical linkage instead of a fluid linkage?

7. What can cause brake rotors to warp?

8. If you hear a high pitch squeal that goes away every time you apply your brakes, what might this indicate?

9. What happens if the wheels lockup when braking?

10. What is electronic stability control?

Lab #18: Brake Lining Replacement

Choose a vehicle on which to replace the brake linings. It can be your own vehicle or one of our shop vehicles. Torque all fasteners to specification and document your work on a repair order provided by the instructor.

Tools:

Safety glasses, torque wrench, jack and jack stands, wheel chocks, fender cover, basic hand tools.

NATEF Tasks:

1. Remove, inspect, and replace pads and retaining hardware; determine necessary action.
2. Remove and reinstall rotor.

Grading:

Students will be assessed on the following four basic criteria of the lab, and each will be worth 2 points:

1. Replace the brake linings that need replacing.
2. Inspect the rotors and/or drums to determine if they need to be resurfaced or replaced.
3. Torque all of the fasteners to specification.
4. Refill the master cylinder to the proper fill line.

Web Discussion #7: Week 11

Based on what you now know about automotive braking systems now, should you top-off the master cylinder in order to ensure maximum braking capability? Why or why not? Please post on the forum and respond to someone else's post within the discussion board.

This assignment will be 20 points total, 10 points for posting to the forum and another 10 points for responding to someone else's post.

Drivetrain Inspection

Day #22

Assumed Prior Knowledge: Students should have read Chapter 16 in the text on the drivetrain.

Time: 1 hour lecture, 1 hour lab activity

Materials:

- Auto Upkeep 2nd Edition textbook and workbook
- Pen or pencil
- Notebook
- Safety glasses
- Hydraulic lift
- Basic hand tools
- Grease gun

Objectives: Students will be able to determine their vehicles drivetrain system and perform a basic inspection on its components.

Procedure:

1. Class discussion on Chapter 16 in the text on the drivetrain.
2. Perform Lab Activity #19 and complete the Activity Journal on page 106
3. Students should read Web Discussion #8 and begin to think about how to respond.

Assignments Due:

1. Chapter 16 of the text read
2. Lab Activity #19 and the Activity Journal on page 106

Lab #19: Drivetrain

The purpose of this lab activity is for you to learn about the drivetrain system in your vehicle. Lift the vehicle and inspect the system for leaks or any other problems such as cracked CV boots. Complete the Activity Journal on page 106 of the Workbook.

Tools:

Safety glasses, jack and jack stands, wheel chocks, grease gun, and basic hand tools.

NATEF Tasks:

None

Grading:

Students will be assessed on the following four basic criteria of the lab and each will be worth 2 points:

1. Determine the vehicle's drivetrain system.
2. Check the transmission fluid level (manual or automatic)
3. Inspect the rubber boots on the CV joints.
4. Grease any zerk fittings in the drivetrain such as on the driveshaft.

Half Shaft Removal & Replacement

Day #23

Assumed Prior Knowledge: Students should have Chapter 16 of the text read on drivetrain and have a basic idea of the process involved in the lab activity.

Time: 1 hour lecture, 2 hour lab activity

Materials:

- Auto Upkeep 2nd Edition textbook and workbook
- Pen or pencil
- Notebook
- Safety glasses
- Computer with access to Mitchell On-Demand
- Hydraulic lift
- Basic hand tools
- Axle nut impact socket
- Impact wrench (1/2" drive)
- Replacement cotter pins
- Torque wrench (1/2" drive)
- Ball peen hammer
- Pry bar
- Wire (to hang brake caliper out of the way)

Objectives: Students will learn how to remove and replace a half shaft on a front wheel drive vehicle using manufacturer torque specifications.

Procedure:

1. Class discussion about Chapter 16 in the text and what will be happening in the lab.
2. Perform Lab Activity #20 and document your work using a repair order.

Assignments Due:

1. Chapter 16 Workbook study questions on page 104
2. Lab Activity #20 and documentation of repair
3. Web discussion
4. Web Discussion #8 post and response to another post

Week #12: Study Questions

Chapter 16: Drivetrain

1. What is the purpose of the drivetrain system?

2. What are gears?

3. What does a drive shaft do?

4. What does a clutch do in a manual transmission?

5. What are four drivetrain systems (configurations)?

6. What would be a symptom of a worn CV joint?

7. How is an all-wheel drive vehicle different from a four-wheel drive vehicle?

8. What causes a front-wheel drive vehicle to have better traction than a rear-wheel drive vehicle?

9. What color is automatic transmission fluid?

10. What are benefits of a continuously variable transmission when compared to an automatic transmission?

Lab # 20: Half Shaft Removal and Replacement

In this lab, you will remove and replace a half shaft from a front wheel drive (FWD) vehicle. It can either be from your own vehicle, if it FWD, or from one of our fleet of vehicles. Use a repair order to document your work and include torque specifications as well as repair procedures.

Tools:

Safety glasses, hydraulic lift, impact wrench, correct impact socket for axle nut removal, wire to hang brake caliper out of the way, ball peen hammer, pry bar, and basic hand tools.

NATEF Tasks:

1. Inspect, service, and replace shafts, yokes, boots, and CV joints.

Grading:

Students will be assessed on the following two basic criteria, and each will be worth 4 points:

1. Properly remove and replace half shaft from a FWD vehicle.
2. Torque all fasteners to specification.

Web Discussion #8: Week 12

This week you have not only inspected the CV boots and axles of a front-wheel drive vehicle, but you have had the opportunity to remove and replace an axle shaft as well. Did you notice that the two axle shafts are different lengths? Which side is longer on the vehicle you were working on? Do you think different length axle shafts can cause torque steer under hard acceleration? If so, do you think the vehicle would have a tendency to pull towards the side with the longer or shorter axle shaft? Explain your reasoning. Please post on the forum and respond to someone else's post within the discussion board.

This assignment will be 20 points total, 10 points for posting to the forum and another 10 points for responding to someone else's post.

Exhaust Inspection

Day #24

Assumed Prior Knowledge: Students should have read Chapter 17 in the text on exhaust and emissions. This will provide them a basic understanding of the system.

Time: 1 hour lecture, 1 hour lab activity

Materials:

- Auto Upkeep 2nd Edition textbook and workbook
- Pen or pencil
- Notebook
- Safety glasses
- Hydraulic lift
- Basic hand tools
- Rubber mallet
- Smoke machine

Objectives: Students will learn how to properly inspect an exhaust system for cracks and leaks using a smoke machine.

Procedure:

1. Class discussion on Chapter 17 in the text on the exhaust and emission system
2. Perform Lab Activity #21 and document your work on a repair order

Assignments Due:

1. Chapter 17 in the text read
2. Lab Activity #21 and documentation of work

Lab #21: Exhaust System Inspection

This lab will focus on the inspection of your exhaust system. It will include both a visual inspection and actually testing the system for leaks using a smoke machine. Document your findings on a repair order and include a drawn diagram of the exhaust system.

Tools:

Safety glasses, rubber mallet, wheel chocks, hydraulic lift, and a smoke machine.

NATEF Tasks:

None

Grading:

Students will be assessed on the following two basic criteria, and each will be worth 4 points:

1. Perform a visual inspection of the exhaust system.
2. Use the smoke machine to confirm any suspected leaks or to ensure the integrity of the system.

Emission System

Day #25

Assumed Prior Knowledge: Students should have read Chapter 17 of the text on exhaust and emissions in order to gain a better understanding of the components involved.

Time: 1 hour lecture, 1 hour lab activity

Materials:

- Auto Upkeep 2nd Edition textbook and workbook
- Pen or pencil
- Notebook
- Computer with access to Mitchell On-Demand
- Safety glasses
- Scan tool

Objectives: Students will learn how to locate and interpret the Vehicle Emission Control Information (VECI) label. They will also have an opportunity to use a scan tool in order to access Diagnostic Trouble Code (DTC) information pertaining to their own vehicle.

Procedure:

1. Class discussion on Chapter 17 and the emission system
2. Perform Lab Activity #22 and document your work

Assignments Due:

1. Chapter 17 Workbook study questions on page 108
2. Lab Activity #22 and documentation of work

Week #13: Study Questions

Chapter 17: Exhaust and Emissions System

1. What is the purpose of the exhaust system?

2. What is the purpose of the emissions system?

3. What do the exhaust manifolds do?

4. What is the purpose of the muffler?

5. What do the letters EGR represent and what does the EGR do?

6. What does an oxygen sensor do?

7. What is the purpose of an evaporative emissions control canister?

8. What causes smog?

9. What may be the problem if your vehicle is excessively loud?

10. What is the purpose of an exhaust hanger?

Lab #22: Vehicle Emission Control Information (VECI)

In this lab you will learn about the VECI label and the information that it shows pertaining to the vehicles emission system. You will also look to see if the vehicle has a “check engine light” illuminated and retrieve the diagnostic trouble codes (DTC) stored in the powertrain control module (PCM) using a scan tool. Use Mitchell On-Demand to assist in the troubleshooting process of the codes stored. Document your findings.

Tools:

Safety glasses, and scan tool with appropriate connector for data link connector.

NATEF Tasks:

1. Interpret diagnostic trouble codes (DTCs) and scan tool data related to the emissions control system. Determine necessary action.

Grading:

Students will be assessed on the following two basic criteria, and each will be worth 4 points:

1. Find the VECI label under the hood and determine what emission systems your vehicle is equipped with.
2. Use a scan tool to see if there are any stored DTCs in the powertrain control module (PCM).

Hybrid Technology

Day #26

Assumed Prior Knowledge: Students should have read Chapter 18 in the text on alternative fuels to become familiar with hybrid technology.

Time: 1 hour lecture, 30 min lab activity

Materials:

- Auto Upkeep 2nd Edition textbook and workbook
- Pen or pencil
- Notebook
- Computer with access to Mitchell On-Demand
- Safety glasses

Objectives: Students will be able to make an informed decision

Procedure:

1. Class discussion about Chapter 18 of the text on alternative fuels
2. Lab Activity #23 and complete the Activity Journal on page 114 of the Workbook

Assignments Due:

1. Chapter 18 in the text read
2. Lab Activity #23 and the Activity Journal on page 114

Lab #23: Conventional vs. Hybrid

In this lab activity you will compare and contrast your own vehicle to a hybrid. Complete the Activity Journal on page 114 of the Workbook.

Tools:

None

NATEF Tasks:

None

Grading:

Students will be assessed solely on the completion of the Activity Journal on page 114 since there are no hands-on lab activities associated with this lab. The lab is worth 8 points.

Accessories

Day #27

Assumed Prior Knowledge: Students should have read Chapter 19 in the text on accessories.

Time: 1 hour lecture, 1 hour lab activity

Materials:

- Auto Upkeep 2nd Edition textbook and workbook
- Pen or pencil
- Notebook
- Computer with access to Mitchell On-Demand
- Safety glasses

Objectives: Students will learn the basics about how the accessories function in their vehicle.

Procedure:

1. Complete chapter 18 Workbook study questions on page 112
2. Perform Lab Activity #24 and document your findings on a repair order

Assignments Due:

1. Chapter 19 in the text read
2. Chapter 18 Workbook study questions on page 112
3. Lab Activity #24 and documentation

Week #14: Study Questions

Chapter 18: Alternative Fuels and Designs

1. Why are alternative fueled vehicles necessary?

2. What is biodiesel?

3. What is a flex-fuel vehicle? How is a flex-fuel vehicle different from a bi-fuel vehicle?

4. What is a hybrid vehicle?

5. What is the benefit of a plug-in hybrid?

6. Why are some hybrids classified as mild hybrids?

7. Why are pure all-electric vehicles more practical for short range driving?

8. How is hydrogen used in a fuel cell to power an electric motor?

9. What is the difference between a renewable and non-renewable resource?

10. What factors are commonly considered when choosing alternatives?

Lab #24: Accessories

In this lab activity you will be expected to identify the accessories your vehicle came with. Inspect their operation and determine if they are functioning properly. Document your findings on a repair order.

Tools:

None

NATEF Tasks:

None

Grading:

Students will be assessed on the following two basic criteria, and each will be worth 4 points:

1. Identify the accessories of your vehicle.
2. Determine if they are functioning properly.

Open Lab

Day #28

Assumed Prior Knowledge: Students should have prepared to take a test on Ch's 15-19.

Time: 1 hour lecture, 2 hour lab activity

Materials:

- Auto Upkeep 2nd Edition textbook and workbook
- #2 pencil
- Scantron
- Notebook
- Computer with access to Mitchell On-Demand
- Safety glasses
- Basic hand tools
- Various specialty tools if needed (depending on activity)

Objectives: Students will have access to the auto shop lab to perform any maintenance needed on their vehicle.

Procedure:

1. Take Test #3
2. Perform Lab Activity #25 (optional)

Assignments Due:

1. Chapter 19 Workbook study questions on page 116

Week #15: Study Questions

Chapter 19: Automotive Accessories

1. What is the benefit to using floor mats?

2. When are engine heaters necessary?

3. What is an electronic key fob?

4. What is a GPS receiver?

5. What is OnStar?

6. When are wheel lock lug nuts commonly used?

7. Why are towing mirrors sometimes necessary?

8. What is the trailer bike controller?

9. How are trailer hitches classified?

10. Why is it important to use trailer safety chains?

Test #3

1. What is a common type of brake system used on vehicles today?

a. Regenerative brakes
b. Four wheel drums
c. Front disc, rear drum
d. Front drum, rear disc

2. Technician A says a squeal that goes away when you depress the brakes is usually caused by a wear indicator on one of the brake pads. Technician B says some vehicles use electrical wear indicators on the brake pads. Who is correct?

a. Technician A only
b. Technician B only
c. Both are correct
d. Neither is correct

3. Technician A says if a pulsation is noticed when the brakes are applied then the drums or rotors could be warped. Technician B says drums and rotors can only be warped if lug nuts are over tightened. Who is correct?

a. Technician A only
b. Technician B only
c. Both are correct
d. Neither is correct

4. Technician A says a wheel cylinder converts the fluid pressure in the brake lines to the mechanical motion of the pads against the drums. Technician B says hydraulic pressure in the brake caliper is converted into mechanical pressure on the brake shoes.

a. Technician A only
b. Technician B only
c. Both are correct
d. Neither is correct

5. Technician A states if a vehicle only has ABS on two wheels then it is normally on the front wheels. Technician B states moisture absorbed in the brake fluid will reduce the boiling point of the fluid. Who is correct?

a. Technician A only
b. Technician B only
c. Both are correct
d. Neither is correct

6. Technician A says all manual transmissions use heavy gear oil as their lubricating fluid. Technician B says both manual and automatic transmissions use filters to clean the fluid since there is so much friction heat generated internally. Who is correct?

a. Technician A only
b. Technician B only
c. Both are correct
d. Neither is correct

7. Technician A says transmissions can be manual, automatic, or continuously variable. Technician B says continuously variable transmissions (CVTs) are being used more often on passenger cars since they offer several advantages. Who is correct?

a. Technician A only
b. Technician B only
c. Both are correct
d. Neither is correct

8. What drivetrain component allows the wheels to rotate at different speeds?

a. Driveshaft
b. Differential
c. U-Joint
d. Constant Velocity Joint

9. Technician A states when a clutch is engaged the engine is driving the transmission. Technician B states when the clutch is engaged the transmission is disconnected from the rotational motion of the engine's crankshaft. Who is correct?

a. Technician A only
b. Technician B only
c. Both are correct
d. Neither is correct

10. Technician A states four-wheel drive (4WD) vehicles use a front differential, rear differential, and a transfer case. Technician B states all-wheel drive (AWD) vehicles using a symmetrical system utilize a transaxle, rear differential, and wheel speed sensors to determine power transfer to the wheels. Who is correct?

a. Technician A only
b. Technician B only
c. Both are correct
d. Neither is correct

11. Which of the following will NOT cause a catalytic converter to fail?

a. Overusing fuel additives
b. Rich fuel mixture
c. Lean fuel mixture
d. Engine misfiring

12. Which three harmful gases are converted by the catalytic converter?

a. NOx, CO2, HC
b. HC, CO, N
c. HC, CO, NOx
d. H2O, CO2, N

13. Technician A says the positive crankcase ventilation (PCV) system is designed to reduce nitrogen oxide emissions by diluting the air-fuel mixture with the exhaust gases. Technician B says the exhaust gas recirculation (EGR) system is designed to remove the effects of blow-by gases by recirculating water vapor and unburned fuel back into the intake. Who is correct?

a. Technician A only
b. Technician B only
c. Both are correct
d. Neither is correct

14. Technician A says the upstream oxygen sensor(s) monitor the combustion chamber efficiency. Technician B says the downstream oxygen sensor(s) monitor the combustion chamber efficiency. Who is correct?

a. Technician A only
b. Technician B only
c. Both are correct
d. Neither is correct

15. Technician A states that federal law requires the catalytic converter and PCM to be covered for 8 years/80,000 mile warranty on 1995 and newer vehicles. Technician B states that federal law only requires the catalytic converter be covered for 8 years/80,000 mile warranty on 1995 and newer vehicles. Who is correct?

a. Technician A only
b. Technician B only
c. Both are correct
d. Neither is correct

16. Which of the following is NOT and advantage of biodiesel?

a. It works as a cleaning solvent in the fuel system
b. It reduces pollution emissions compared with petrodiesel
c. It gels around 32-40°F
d. Has an increased lubricating ability.

17. Technician A says a flex-fuel vehicle is the same as a bi-fuel vehicle. Technician B says flex-fuel vehicles can run on up to 85% ethanol. Who is correct?

a. Technician A only
b. Technician B only
c. Both are correct
d. Neither is correct

18. What is the main advantage of a hybrid vehicle when compared to a mild hybrid vehicle?

a. Regenerative braking
b. The ability to shut down at stops and restart upon acceleration
c. Provide additional power during acceleration
d. Propelling the vehicle using only the electric motor

19. Technician A says an engine burning hydrogen instead of gasoline is 25% more efficient. Technician B says a hydrogen fuel cell vehicle is an electric vehicle that gets its energy from hydrogen gas. Who is correct?

a. Technician A only
b. Technician B only
c. Both are correct
d. Neither is correct

20. Technician A says a bi-fuel vehicle is a vehicle that has multiple sources of power. Technician B says a hybrid vehicle is a vehicle that has multiple sources of power. Who is correct?

a. Technician A only
b. Technician B only
c. Both are correct
d. Neither is correct

21. Two technicians are discussing GPS systems. Technician A says three satellites are needed in order to get precise latitude and longitude readings. Technician B says five satellites are required to obtain latitude, longitude, and accurate altitude. Who is correct?

a. Technician A only
b. Technician B only
c. Both are correct
d. Neither is correct

22. Which of the following is a negative impact of using a remote starter?

a. On a hot day the vehicle can be cool from the use of A/C
b. When the vehicle idles too long unnecessary pollution is created
c. On a cold day the defrost can clear a windshield
d. The heater can be on so the inside of the vehicle is comfortable in the morning

23. Technician A says automotive manufacturers try very hard to rustproof vehicles during the manufacturing process. Technician B says most vehicles have a corrosion perforation warranty that applies to surface rust. Who is correct?

a. Technician A only
b. Technician B only
c. Both are correct
d. Neither is correct

24. Technician A says most vehicles don't have an undercoating from the manufacturer so it is important to get one aftermarket. Technician B says most vehicles come with an undercoating, which is a rustproof coating, from the manufacturer. Who is correct?

a. Technician A only
b. Technician B only
c. Both are correct
d. Neither is correct

25. Technician A states there are four types of trailer wiring plugs having a 4, 5, 6, or 7 pole plug. Technician B states there are five common trailer hitch classifications. Who is correct?

a. Technician A only
b. Technician B only
c. Both are correct
d. Neither is correct

Lab #25: Open Lab

This is the last lab of the semester, and students will be able to complete various maintenance items on their own vehicle if necessary. This lab is optional, but students are encouraged to use the time to work on their own vehicle in any way they choose.

Tools:

Safety glasses, hand tools, and whatever else applies to the specific job being performed.

NATEF Tasks:

None

Grading:

This lab will be worth 8 points, and proper documentation of repair work is required to receive full credit.

Final Exam Review

Day #29

Assumed Prior Knowledge: Students should have all of the Chapters read that were covered during the semester.

Time: 1 hour lecture, no lab activity

Materials:

- Auto Upkeep 2nd Edition textbook and workbook
- Pen or pencil
- Notebook

Procedure:

1. Review for Final Exam

Assignments Due:

1. None

Final Exam

Day #30

Assumed Prior Knowledge: Students should have reviewed all of the chapters covered during the course of the semester and all of the lecture notes.

Time: 2 hours

Materials:

- Scantron
- #2 pencil

Procedure:

1. Take Final Exam

Assignments Due:

1. None

Final Exam

1. Technician A states Ohm's Law is a formula that shows the relationship between voltage, current, and resistance. Technician B states the letter "E" represents current and "I" represents voltage in the formula. Who is correct?

a. Technician A only
b. Technician B only
c. Both are correct
d. Neither is correct

2. The state of charge of an automotive battery is being discussed. If the voltage of the battery is 12.2 V, what is the state of charge of that particular battery?

a. 100%
b. 75%
c. 50%
d. 25%

3. Two technicians are discussing fuel injection systems. Technician A states in a throttle body injection system, there is usually one fuel injector used to supply fuel to all of the cylinders. Technician B states in port injection systems there is one fuel injector per cylinder. Who is correct?

a. Technician A only
b. Technician B only
c. Both are correct
d. Neither is correct

4. Technician A states that the charging system converts chemical energy to electrical energy to mechanical energy. Technician B states the starting system converts mechanical energy to electrical energy to chemical energy. Who is correct?

a. Technician A only
b. Technician B only
c. Both are correct
d. Neither is correct

5. Technician A states that one of the functions of coolant is to lubricate the water pump. Technician B states in extreme cold weather it is good to use up to 90% coolant. Who is correct?

a. Technician A only
b. Technician B only
c. Both are correct
d. Neither is correct

6. Two technicians are discussing cooling system components. Technician A says electric fans can turn on even when the engine is shut off. Technician B says water pumps often have a “weep” hole that is intentionally engineered into the pump in order to signal when the internal seals have failed. Who is correct?

a. Technician A only
b. Technician B only
c. Both are correct
d. Neither is correct

7. Which of the following is **NOT** a reason why a vehicle will not start?

a. Corroded distributor cap
b. Faulty ignition module
c. A bad spark plug wire
d. Moisture on ignition components

8. Which of the following is **NOT** true regarding struts on a vehicle?

a. If one strut is defective then they should all be replaced on the vehicle.
b. They eliminate the need to have springs and shocks at each wheel.
c. Saves weight
d. Struts are a structural component of the suspension and steering system.

9. Technician A says to always use anti-seize when installing new spark plugs. Technician B says the vehicle emission control information (VECI) label shows the spark plug gap specification for the engine.

a. Technician A only
b. Technician B only
c. Both are correct
d. Neither is correct

10. Two technicians are discussing automotive battery ratings. Technician A says cold cranking amps (CCA) is the amount of current the battery can deliver at 0°F for 30 seconds. Technician B says cranking amps (CA) is the amount of current the battery can deliver at 32°F for 15 seconds. Who is correct?

a. Technician A only
b. Technician B only
c. Both are correct
d. Neither is correct

11. Technician A says voltage is described as the quantity of electrons through a conductor. Technician B says amperage is the electrical pressure pushing electrons. Who is correct?

a. Technician A only
b. Technician B only
c. Both are correct
d. Neither is correct

12. Technician A states the higher the octane rating of gasoline, the more the fuel resists detonation under pressure. Technician B states it takes a lower temperature and less engine compression to ignite a fuel with a higher octane rating.

a. Technician A only
b. Technician B only
c. Both are correct
d. Neither is correct

13. Technician A says the most efficient fuel mixture in an engine is a 14.7:1 ratio of fuel to air. Technician B says the most efficient fuel mixture in an engine is a 14.7:1 ratio of air to fuel. Who is correct?

a. Technician A only
b. Technician B only
c. Both are correct
d. Neither is correct

14. Technician A says the thermostat is referred to as the brain of the cooling system. Technician B says most thermostats open between 160-170°F. Who is correct?

a. Technician A only
b. Technician B only
c. Both are correct
d. Neither is correct

15. Technician A says that coolant does not flow through the heater core until the thermostat opens. Technician B says it is normal to sometimes notice a sweet smell while inside the passenger compartment when the heater is on. Who is correct?

a. Technician A only
b. Technician B only
c. Both are correct
d. **Neither is correct**

16. Two technicians are discussing vehicle suspension. Technician A says a bounce test is a good method to test the shocks, struts, or springs. Technician B says that a vehicle fails the bounce test if it cycles more than once.

a. Technician A only
b. Technician B only
c. Both are correct
d. Neither is correct

17. Technician A says new vehicles do not use ignition coils. Technician B says some new vehicles have eliminated spark plug wires. Who is correct?

a. Technician A only
b. Technician B only
c. Both are correct
d. Neither is correct

18. Technician A states if a vehicle only has ABS on two wheels then it is normally on the front wheels. Technician B states moisture absorbed in the brake fluid will reduce the boiling point of the fluid. Who is correct?

a. Technician A only
b. Technician B only
c. Both are correct
d. Neither is correct

19. Technician A says a squeal that goes away when you depress the brakes is usually caused by a wear indicator on one of the brake pads. Technician B says some vehicles use electrical wear indicators on the brake pads. Who is correct?

a. Technician A only
b. Technician B only
c. Both are correct
d. Neither is correct

20. Technician A says a wheel cylinder converts the fluid pressure in the brake lines to the mechanical motion of the pads against the drums. Technician B says hydraulic pressure in the brake caliper is converted into mechanical pressure on the brake shoes.

a. Technician A only
b. Technician B only
c. Both are correct
d. Neither is correct

21. Technician A says if a pulsation is noticed when the brakes are applied then the drums or rotors could be warped. Technician B says drums and rotors can only be warped if lug nuts are over tightened. Who is correct?

a. Technician A only
b. Technician B only
c. Both are correct
d. Neither is correct

22. Technician A states when a clutch is engaged the engine is driving the transmission. Technician B states when the clutch is engaged the transmission is disconnected from the rotational motion of the engine's crankshaft. Who is correct?

a. Technician A only
b. Technician B only
c. Both are correct
d. Neither is correct

23. Technician A says transmissions can be manual, automatic, or continuously variable. Technician B says continuously variable transmissions (CVTs) are being used more often on passenger cars since they offer several advantages. Who is correct?

a. Technician A only
b. Technician B only
c. Both are correct
d. Neither is correct

24. Technician A says all manual transmissions use heavy gear oil as their lubricating fluid. Technician B says both manual and automatic transmissions use filters to clean the fluid since there is so much friction heat generated internally. Who is correct?

a. Technician A only
b. Technician B only
c. Both are correct
d. Neither is correct

25. Technician A states four-wheel drive (4WD) vehicles use a front differential, rear differential, and a transfer case. Technician B states all-wheel drive (AWD) vehicles using a symmetrical system utilize a transaxle, rear differential, and wheel speed sensors to determine power transfer to the wheels. Who is correct?

a. Technician A only
b. Technician B only
c. Both are correct
d. Neither is correct

26. Technician A says the positive crankcase ventilation (PCV) system is designed to reduce nitrogen oxide emissions by diluting the air-fuel mixture with the exhaust gases. Technician B says the exhaust gas recirculation (EGR) system is designed to remove the effects of blow-by gases by recirculating water vapor and unburned fuel back into the intake. Who is correct?

a. Technician A only
b. Technician B only
c. Both are correct
d. Neither is correct

27. Which of the following will NOT cause a catalytic converter to fail?

a. Overusing fuel additives
b. Rich fuel mixture
c. Lean fuel mixture
d. Engine misfiring

28. Technician A states that federal law requires the catalytic converter and PCM to be covered for 8 years/80,000 mile warranty on 1995 and newer vehicles. Technician B states that federal law only requires the catalytic converter be covered for 8 years/80,000 mile warranty on 1995 and newer vehicles. Who is correct?

a. Technician A only
b. Technician B only
c. Both are correct
d. Neither is correct

29. Which three harmful gases are converted by the catalytic converter?

a. NOx, CO2, HC
b. HC, CO, N
c. HC, CO, NOx
d. H2O, CO2, N

30. Technician A says the upstream oxygen sensor(s) monitor the combustion chamber efficiency. Technician B says the downstream oxygen sensor(s) monitor the combustion chamber efficiency. Who is correct?

a. Technician A only
b. Technician B only
c. Both are correct
d. Neither is correct

31. Technician A says a bi-fuel vehicle is a vehicle that has multiple sources of power. Technician B says a hybrid vehicle is a vehicle that has multiple sources of power. Who is correct?

a. Technician A only
b. Technician B only
c. Both are correct
d. Neither is correct

32. Which of the following is NOT and advantage of biodiesel?

a. It works as a cleaning solvent in the fuel system
b. It reduces pollution emissions compared with petrodiesel
c. It gels around 32-40°F
d. Has an increased lubricating ability.

33. Technician A says an engine burning hydrogen instead of gasoline is 25% more efficient. Technician B says a hydrogen fuel cell vehicle is an electric vehicle that gets its energy from hydrogen gas. Who is correct?

a. Technician A only
b. Technician B only
c. Both are correct
d. Neither is correct

34. What is the main advantage of a hybrid vehicle when compared to a mild hybrid vehicle?

a. Regenerative braking
b. The ability to shut down at stops and restart upon acceleration
c. Provide additional power during acceleration
d. **Propelling the vehicle using only the electric motor**

35. Technician A says a flex-fuel vehicle is the same as a bi-fuel vehicle. Technician B says flex-fuel vehicles can run on up to 85% ethanol. Who is correct?

a. Technician A only
b. Technician B only
c. Both are correct
d. Neither is correct

36. Two technicians are discussing the correct sequence of the four-stroke engine cycle. Technician A states the sequence is: Intake, Power, Compression, Exhaust. Technician B states the sequence is: Intake, Compression, Power, Exhaust. Which is correct?

a. Technician A only
b. Technician B only
c. Both are correct
d. Neither is correct

37. Technician A says the vehicle emission control information (VECI) label under the hood also provides the production date of the vehicle in terms of the month and year. Technician B states the vehicle certification label inside the driver's door provides the model year of the vehicle. Who is correct?

a. Technician A only
b. Technician B only
c. Both are correct
d. **Neither is correct**

38. Two technicians are discussing power transfer in a gasoline powered vehicle. Technician A says the reciprocating motion of the pistons is converted to rotary motion of the crankshaft. Technician B says the reciprocating motion of the pistons converts chemical energy of fuel into kinetic energy. Who is correct?

a. Technician A only
b. Technician B only
c. Both are correct
d. Neither is correct

39. There are many different types of warranties when it comes to the vehicle repair industry. Technician A states certified used car warranties and extended warranties on used vehicles are the same thing. Technician B states you can only get automotive batteries and tires warrantied at the facility where they were replaced. Who is correct?

a. Technician A only
b. Technician B only
c. Both are correct
d. Neither is correct

40. Technician A says that most repair facilities charge labor rates based on either flat rate time or actual time. Technician B says that most repair facilities charge labor rates based on either flat rate time or book time. Who is correct?

a. Technician A only
b. Technician B only
c. Both are correct
d. Neither is correct

41. Technician A says when using a floor jack to lift a vehicle it is necessary to use jack stands while working under the vehicle. Technician B says as long as you use wheel chocks and use the floor jack while on a flat surface it is not necessary to use jack stands. Who is correct?

a. Technician A only
b. Technician B only
c. Both are correct
d. Neither is correct

42. Technician A states never to use a non-impact socket while using an electric or air powered wrench. Technician B says it is okay to use a non-impact socket while using an air powered tool as long as it is a six-point socket. Who is correct?

a. Technician A only
b. Technician B only
c. Both are correct
d. Neither is correct

43. What is the best possible choice of tools to use when attempting to loosen a fastener that is very tight without rounding the head of the fastener?

a. 6” Crescent wrench
b. 10” box-end twelve-point wrench
c. 12” adjustable wrench
d. 10” box-end six-point wrench

44. Technician A states that you should normally check the fluid in an automatic transmission while the vehicle is at normal operating temperature and with the gear selector in the park position. Technician B states when reading the dipstick of an automatic transmission the bottom of the crosshatch area means that the transmission is one quart low on fluid. Who is correct?

a. Technician A only
b. Technician B only
c. Both are correct
d. Neither is correct

45. Technician A states that engine oil performs several jobs in addition to lubricating. It also cools, cleans, and seals the components of the engine internally. Technician B states you should not add oil until the dipstick reads at the bottom of the crosshatch area.

a. Technician A only
b. Technician B only
c. Both are correct
d. Neither is correct

46. Technician A says antifreeze and coolant is the same thing. Technician B says antifreeze is the product that is added to water in order to make coolant. Who is correct?

a. Technician A only
b. Technician B only
c. Both are correct
d. Neither is correct

47. Two technicians are discussing engine oil ratings. Technician A says multigrade oils are best used when operating a vehicle in a wide range of climates because they have been tested at both 0°F and at 210°F. Technician B says the “W” after a rating, such as 10W30, stands for weight of the oil.

a. Technician A only
b. Technician B only
c. Both are correct
d. Neither is correct

48. Technician A states one of the advantages of using synthetic oil is that it flows well at extremely cold temperatures in addition to providing better protection at very high temperatures. Technician B states most manufacturer warranties extend oil change intervals when synthetic oils are used.

a. Technician A only
b. Technician B only
c. Both are correct
d. Neither is correct

49. Two technicians are discussing batteries and proper maintenance. Technician A says that in a lead acid battery electrolyte is a mixture of sulfuric acid and distilled water. Technician B says maintenance batteries require occasion fluid level checks and sometimes require sulfuric acid to be added into the cells.

a. Technician A only
b. Technician B only
c. Both are correct
d. Neither is correct

50. Technician A says engine oil lubricates, cools, cleans, and seals the many internal components of the engine. Technician B says engine oil reduces blow-by gases by sealing between the pistons and cylinder wall. Who is correct?

a. Technician A only
b. Technician B only
c. Both are correct
d. Neither is correct

CHAPTER FIVE

CONCLUSIONS

This curriculum is designed as a hybrid course to provide students with an introduction to automotive technology at the community college level. The course is sixteen weeks long and designed for use in a semester system. Students are expected to meet both the in-class and online requirements to be successful in the course. This class will meet in person for half of the class meetings, while the other half are performed by the student remotely using online instructional materials and lab videos provided by the instructor. Students are required to purchase certain tools in order to perform the labs remotely. When the class meets in person, students are provided with all tools necessary to complete the labs.

Assessment for the course will be performed by both classroom and lab assignments and activities. There is one performance assessment in class, one safety quiz, two written assignments, three exams, and a comprehensive final exam. In addition, students are also expected to read the chapters covered in the text, complete weekly study questions, activity journals in the Workbook based on the labs, and seven web discussions throughout the semester.

Offering an introductory automotive technology course will be invaluable to an automotive department for many reasons. Many students have no prior experience or knowledge when it comes to the subject of automotive technology. Therefore, if no introductory course is offered, students interested in automotive technology are

forced to jump into a class that is too advanced for their current level of understanding in the subject area. When this happens, instructors are forced to teach content that does not belong in an advanced class which can be frustrating to those students who already have the foundational knowledge of the subject. The knowledge level of the students in this case varies so much that basic concepts have to be covered that are normally included in the curriculum of an introductory course. Specific tasks are covered in accordance to NATEF standards and are divided into three categories, based on their difficulty. Many of the basic tasks can be covered in this introductory course which provides a foundational understanding of the subject for students. This method of curriculum development also allows the more advanced courses to cover more material since they will no longer have to cover material that is considered introductory level.

The course may also make the content available to a wide population of prospective students in more remote areas who would not normally be able to take the class due to the time and financial constraints they would face in commuting to the school on a weekly basis.

Limitations of the Curriculum

There are some limitations to this course. Since the course design is a hybrid, students will need to have a vehicle to work on for many of the lab assignments that will be performed remotely. For most students this will not pose as a problem, but there may be some students who are interested in learning about automotive technology who do not have access to a vehicle. Another potential limitation is that

not all students have access to a computer and the internet outside of school. Approximately half of the class meetings will not be in person, and students will need to have computer and internet access in order to complete the assignments. Another limitation is that students are required to purchase some basic tools and equipment in order to complete the lab assignments at home. This could be financially difficult for some students, while others may already have access to these tools at home. The last known limitation is that this hybrid class format could be challenging to students will various learning disabilities when it comes to both the online and remote hands-on aspect of the course.

Implications for Further Research

This curriculum needs to be tested at the community college level to see how effective a hybrid automotive technology course can be for students new to the subject. Traditional courses in automotive technology are successful, but there is no research involving hybrid or purely online automotive courses. Schools are always looking at ways to increase enrollment, and online courses have great potential to do that. This is a seamless transition for many academic areas, but courses in Career and Technical Education always have the hands-on component that is difficult to duplicate online. The next best method to teach a course that must involve hands-on training is to combine that with some online instruction, as in this hybrid curriculum.

Hybrid courses can vary in their percentage of online versus classroom instruction, and there are many factors that will determine this. One of them is the availability of the automotive shop, since there are a limited number of courses one

school can provide due to the time needed in the lab. The percentage of students traveling from a far distance can also influence how often they should be required to meet on campus when the class is designated as a hybrid. The curriculum will also dictate how many classes will need to be held in person versus remotely. In an introductory course, there will need to be instruction on safety and proper tool usage before students are expected to perform tasks on their own without direct contact with the instructor. Specialty equipment will also determine which labs can be held remotely because students can only be expected to purchase some basic tools and equipment.

I think some further research should focus on computer-based training to supplement some of the hands-on training offered when it comes to an introductory automotive technology course. Computer based training can either focus on more of the theoretical concepts of automotive, or it could actually provide simulations to the hands-on learning that goes on in a lab environment. The time spent in the lab portion of the class could potentially be used more effectively if students had practice beforehand performing a specific task in a computer simulation. On the other hand, instructors might be able to use computer-based training as a classroom supplement to reinforce concepts discussed in class.

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