Title 7: Education K-12

Part 68: Transportation Distribution and Logistics, Career Pathway

Automotive Service Technician

Program CIP: 47.0604 – Transportation

Ordering Information

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Published by

Office of Vocational and Technical Education
Mississippi Department of Education
Jackson, MS 39205

Research and Curriculum Unit for Workforce Development
Mississippi State University
Mississippi State, MS 39762

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The Research and Curriculum Unit (RCU), located in Starkville, MS, as part of Mississippi State University, was established to foster educational enhancements and innovations. In keeping with the land grant mission of Mississippi State University, the RCU is dedicated to improving the quality of life for Mississippians. The RCU enhances intellectual and professional development of Mississippi students and educators while applying knowledge and educational research to the lives of the people of the state. The RCU works within the contexts of curriculum development and revision, research, assessment, professional development, and industrial training.

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Acknowledgments

The *Automotive Service Technology Curriculum Framework and Supporting Materials* was adopted by the Mississippi Board of Education on May 16, 2008. The following persons were serving on the state board at the time:

Dr. Hank M. Bounds, Executive Secretary
Mr. Claude Hartley, Chair
Mr. William Harold Jones, Vice Chair
Mr. Howell "Hal" N. Gage
Dr. O. Wayne Gann
Ms. Rebecca Harris
Mr. Charles McClelland
Ms. Sondra Parker Caillavet
Ms. Rosetta Richards
Dr. David Sistrunk

Mike Mulvihill, as Interim Associate Superintendent of Education for the Office of Vocational Education and Workforce Development at the Mississippi Department of Education, assembled an oversight committee to provide input throughout the development of the *Automotive Service Technology Curriculum Framework and Supporting Materials.* Members of this task force were as follows:

Dr. Kay Berry, Simpson County School District
Dr. Sam Bounds, Mississippi Association of School Superintendents
Ms. Beverly Brahan, Mississippi Association of Educators
Mr. David Campbell, Mississippi Association of Middle Level Educators
Ms. Tommye Dale Favre, Mississippi Department of Employment Security
Ms. Mary Hardy, Mississippi PTA
Dr. Anna Hurt, Mississippi Association of School Administrators
Mr. Jay Moon, Mississippi Manufacturers Association
Dr. Dean Norman, Center for Advanced Vehicular Systems Extension
Mr. Michael Ray, Western Line School District
Mr. George Schloegal, Hancock Bank
Ms. Charlene Sproles, Mississippi School Counselor Association
Mr. Mike Thomas, North American Coal Corporation
Mr. Pete Walley, Institutions of Higher Learning
Mr. Clarence Ward, Boys and Girls Clubs of the Gulf Coast
Dr. Debra West, State Board for Community and Junior Colleges

A special thanks is extended to the members of the *Automotive Service Technology Curriculum Framework and Supporting Materials* Professional Advisory Team. Members of this team include the following:

Dean Batton, Simpson County Vocational Center
Annie Covington, Coffeeville Public Schools
Linda Davis, Millsaps Vocational Center
Dave Ellison, Hinds Community College
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Scott Kolle, Research and Curriculum Unit
Rick McDonald, Mississippi Gulf Coast Community College
Ted Mangum, Jones County Vocational Center
Michael Myrick, Canton Career Center
Tommy Nance, Fowler Buick
Ray Orr, Itawamba Community College
Danny Owen, Tupelo Public Schools
Ben Pratt, Northeast Mississippi Community College
Rick Saucier, Hancock County Vo-Tech Center
Chad Smith, Smith Brothers Collision Repair
Dale Smith, Thomson Machinery
Cravin Turnage, Holly Springs Public Schools
Earl White, Mississippi Department of Education

Also, a special thanks is extended to the teachers who contributed teaching and assessment materials that are included in the framework and supporting materials. Members who contributed are as follows:

Dr. Paul Cuicchi, Starkville School District, Starkville, MS
John McGee, Starkville School District, Starkville, MS
Danny Owen, Tippah County School District, Ripley, MS
Nick Wages, Jackson County School District, Vancleave, MS
James Burrus, Panola County School District, Batesville, MS
Prentiss Fults, Hinds County School District, Raymond, MS
Kevin Hancock, Madison County School District, Madison, MS
Dale Henry, East Mississippi Community College, Mayhew, MS
Antoine Kimble, Oxford High School, Oxford, MS

Appreciation is also expressed to the following staff members at the Mississippi Department of Education who provided guidance and insight throughout the development process:

Sam Davis, Program Coordinator and Division Director, Office of Vocational Education and Workforce Development, Mississippi Department of Education, Jackson, MS
Bill McGrew, Division Director of Instructional Programs and Student Organizations, Office of Vocational Education and Workforce Development, Mississippi Department of Education
Chris Wall, Bureau Director of Instructional Programs and Student Organizations, Office of Vocational Education and Workforce Development, Mississippi Department of Education

Finally, standards in the *Automotive Service Technology Curriculum Framework and Supporting Materials* are based on the following:

Industry Standards

National Automotive Technicians Education Foundation was founded in 1983 as an independent, nonprofit organization with a single mission: To evaluate technician training programs against standards developed by the automotive industry and recommend qualifying programs for certification (accreditation) by ASE, the National Institute for Automotive Service Excellence. For more information, visit http://www.natef.org/. Reprinted with permission.

Academic Standards

Mississippi Department of Education Subject Area Testing Program

ACT College Readiness Standards

The College Readiness Standards are sets of statements intended to help students understand what is expected of them in preparation for the ACT. These standards are integrated into teaching and assessment strategies throughout the curriculum framework.

21st Century Skills and Information and Communication Technologies Literacy Standards

In defining 21st century learning, the Partnership for 21st Century Skills has embraced five content and skill areas that represent the essential knowledge for the 21st century: global awareness; civic engagement; financial, economic, and business literacy; learning skills that encompass problem-solving, critical-thinking, and self-directional skills; and Information and Communication Technology (ICT) literacy. Reprinted with permission.

National Educational Technology Standards for Students

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Preface

Secondary vocational–technical education programs in Mississippi are faced with many challenges resulting from sweeping educational reforms at the national and state levels. Schools and teachers are increasingly being held accountable for providing true learning activities to every student in the classroom. This accountability is measured through increased requirements for mastery and attainment of competency as documented through both formative and summative assessments.

The courses in this document reflect the statutory requirements as found in Section 37-3-49, Mississippi Code of 1972, as amended (Section 37-3-46). In addition, this curriculum reflects guidelines imposed by federal and state mandates (Laws, 1988, ch. 487, §14; Laws, 1991, ch. 423, §1; Laws, 1992, ch. 519, §4 eff. from and after July 1, 1992; Carl D. Perkins Vocational Education Act IV, 2007; and No Child Left Behind Act of 2001).

Automotive Service Executive Summary

Program Description

Automotive Service is a pathway for students in the Transportation career cluster. The following description is from the current Standard Course of Study for Career–Technical Education, Mississippi Department of Education.

Industry Certification

The Automotive Service pathway includes classroom and hands-on experiences that prepare students for employment or continuing education in the auto service industry. This program was written to incorporate the National Institute for Automotive Service Excellence (ASE) learning objectives/content and hours. Any student who successfully completes this program will be eligible to apply to obtain the ASE exams. ASE requires 2 years of employment before certificates are issued. Students receive 1 year of credit for completion of the secondary program. Students who take certifications before the 2-year requirement is met will be granted certifications after they complete 1 year of automotive employment. This is a national certification program recognized throughout the automotive service industry. Each district should implement a maximum student number due to the size of each lab.

Assessment

Students will be assessed using the Automotive Service MS-CPAS2 test. The MS-CPAS2 blueprint can be found at http://info.rcu.msstate.edu/services/curriculum.asp. If there are questions regarding assessment of this program, please contact the Transportation Instructional Design Specialists at the Research and Curriculum Unit at 662.325.2510.

Student Prerequisites

In order for students to be able to experience success in the Automotive Service pathway, the following student prerequisites are in place:

1. C or Higher in English (the previous year)
2. C or Higher in Math (last course taken, or the instructor can specify the math)
3. Instructor Approval

or

1. TABE Reading Score (eighth grade or higher)
2. Instructor Approval

or

1. Instructor Approval

Proposed Applied Academic Credit

Applied Mathematics content from the curriculum was aligned to the 2007 Mississippi Mathematics Framework Revised Academic Benchmarks. It is proposed that upon the completion of this program, students will earn 1/2 Applied Mathematics credit that can be used for graduation requirements.

Applied Physics content from the curriculum was aligned to the 2007 Mississippi Science Framework Revised Academic Benchmarks. It is proposed that upon the completion of this program (option 1 or option 2), students will earn 1/2 Applied Physics credit that can be used for graduation requirements.

The applied academic credit has *not* been approved by the Mississippi Commission on School Accreditation or by the State Board of Education. If there are questions regarding applied academic credit, please contact the Coordinator of Workforce Education at the Research and Curriculum Unit at 662.325.2510.

Licensure Requirements

A 966 educator license is required to teach the Automotive Service pathway courses. The requirements for the 966 licensure endorsement are listed below:

1. Applicant must have earned a 2-year college degree (associate's degree) or higher from an accredited institution of higher education.
2. Applicant must have 2 years of documented automotive service experience.
3. Applicant must enroll immediately in the Vocational Instructor Preparation (VIP) or the Redesign Education Program (REP).
4. Applicant must complete the individualized professional development plan (PDP) requirements of the VIP or REP prior to the expiration date of the 3-year vocational license.
5. Applicant must hold ASE certificates in brakes, electrical/electronics, engine performance, and steering and suspension.
6. Applicant must successfully complete an approved computer literacy certification exam.
7. Applicant must successfully complete a certification for an online learning workshop, module, or course that is approved by the Mississippi Department of Education.
8. The applicant must successfully complete an Automotive Service certification workshop, module, or course that is approved by the Mississippi Department of Education.

Professional Learning

The professional learning itinerary for the middle school or individual pathways can be found at http://rcu.redesign.edu. If you have specific questions about the content of each training session provided, you will need to contact the Research and Curriculum Unit at 662.325.2510 and ask for the Professional Learning Specialist.

Course Outline

This pathway provides options for local school districts to implement based on student needs and scheduling demand. The first option groups units into one-credit courses for a total of four Carnegie units. The second option groups units into two-credit courses. A description of each option is listed next.

Option 1

The Automotive Service pathway emphasizes industry-based content with time being allocated between lecture and lab activities. Safety is an integral part of every course and activity. The content is aligned with National Institute for Automotive Service Excellence (ASE) standards to ensure that programs can be recommended for certification by National Automotive Technicians Educational Foundation (NATEF). There are four courses in this option: Fundamentals I, Brakes, and Introduction to Electrical/Electronic Systems; Advanced Electrical/Electronic Systems; Engine Performance I; and Engine Performance II and Suspension/Steering Systems and Alternative Fuels. Courses should be scheduled so the student completes all courses in 2 years.

Course Description: Automotive Service Fundamentals I, Brakes, and Introduction to Electrical/Electronic Systems course contains an introduction, safety, measurement, and tool/technical references content. It also contains an introduction to brake systems: disc brakes, drum brakes, and antilock brakes. This course also contains an introduction to electrical/electronic systems information and terminology. The Basic Electrical/Electronic Systems course contains electrical/electronic system theory, battery systems, starting systems, and charging systems.

Course Description: Automotive Service Fundamentals II, The Advanced Electrical/Electronic Systems course contains information on lighting systems, concepts of gauges, warning devices, driver information systems, horn system, wiper/washer system, and accessories system diagnostic repair.

Course Description: Automotive Service Fundamentals III, The Engine Performance I courses contain information on safety, employability skills, basic automobile service, general engine components and theory of operation, concepts of computerized engine control systems, and ignition systems.

Course Description: Automotive Service Fundamentals IV, The Engine Performance II and Suspension/Steering Systems and Alternative Fuels courses contain information on fuel, air induction, and exhaust systems; concepts of emission control systems; concepts of engine service; general suspension/steering theory; steering system inspection, diagnosis, and repair; concepts of front, rear, and miscellaneous systems; and wheel/tire alignment concepts, alternative fuels general information for service and maintenance.

Automotive Service Fundamentals I (One Carnegie Unit) - Course Code: 997002

Unit		Title	Hours
1		Fundamentals I, Brakes, and Introduction to Electrical/Electronic Systems	89
2		Basic Electrical/Electronic Systems	51
			130

Note: The hours listed above are based on 140 hours of instruction for one Carnegie unit credit. ASE-certified programs are required to spend the following hours of instruction for the following units:

- Brakes and Electrical/Electronic Systems (135 hours)
- Basic Electrical/Electronic Systems (60 hours)

Automotive Service Fundamentals II (One Carnegie Unit) - Course Code: 997003

Unit		Title	Hours
3		Advanced Electrical/Electronic Systems	140
			140

Note: The hours listed above are based on 140 hours of instruction for one Carnegie unit credit. ASE-certified programs are required to spend the following hours of instruction for the following units:

- Advanced Electrical/Electronic Systems (140 hours)

Automotive Service Fundamentals III (One Carnegie Unit) - Course Code: 997004

Unit		Title	Hours
4		Engine Performance I	140
			140

Note: The hours listed above are based on 140 hours of instruction for one Carnegie unit credit. ASE-certified programs are required to spend the following hours of instruction for the following units:

- Engine Performance I (140 hours)

Automotive Service Fundamentals IV (One Carnegie Unit) - Course Code: 997005

Unit		Title	Hours
5		Engine Performance II	45
6		Suspension/Steering Systems and Alternative Fuels	95
			140

Note: The hours listed above are based on 140 hours of instruction for one Carnegie unit credit. ASE-certified programs are required to spend the following hours of instruction for the following units:

- Engine Performance II (80 hours)
- Steering and Suspension (95 hours)
- Safety will be reinforced and tested at the beginning of each course.

✓ Courses must be taken in order unless the instructor approves. Foundation knowledge in each course must be mastered to move to the next unit.

✓ Students must complete automotive courses with a score of 80/C or higher in classwork to advance to the next level.

✓ To effectively assess mastery respective to a course's instructional hours, the pathway blueprint will test units upon completion of their last hour of instruction.

Option 2

This Automotive Service pathway option also emphasizes industry-based content with time being allocated between lecture and lab activities. The content is aligned with National Institute for Automotive Service Excellence (ASE) standards to ensure that programs can be recommended for certification by National Automotive Technicians Educational Foundation (NATEF). The content is

divided into two courses. The content of the first course is Introduction, Safety, and Tools/Technical References, along with Basic Automotive Service, Brakes, Introduction to Electrical/Electronic Systems, and Basic Electrical/Electronic Systems. The second course content is Advanced Electrical/Electronic Systems, Steering and Suspension, and Engine Performance content. Safety is an integral part of every course and activity. A student must complete both courses to be a completer and to receive the 1/2 credit for physics and math.

Course Description: Automotive Service Technology I (Course CIP Code: 997000)
The Fundamentals, Brakes, and Introduction to Electrical/Electronic Systems course contains an introduction, safety, measurement, and tool/technical references content. It also contains an introduction to brake systems: disc brakes, drum brakes, and antilock brakes. This course also contains an introduction to electrical/electronic information and terminology. The Basic Electrical/Electronic Systems course contains electrical/electronic system theory, battery systems, starting systems, and charging systems. The Advanced Electrical/Electronic Systems course contains information on lighting systems, concepts of gauges, warning devices, driver information systems, horn system, wiper/washer system, and accessories system diagnostic repair.

Course Description: Automotive Service Technology II (Course CIP Code: 997001)
The Engine Performance I course contains information on safety, employability skills, basic automobile service, general engine components and theory of operation, concepts of computerized engine control systems, and ignition systems. The Engine Performance II and Steering and Suspension course contains information on fuel, air induction, and exhaust systems; concepts of emission control system; concepts of engine service; general suspension/steering theory; steering system inspection, diagnosis, and repair; concepts of front , rear, and miscellaneous systems; and wheel/tire alignment concepts; and alternative fuels general information for service and maintenance.

Automotive Service I (Two Carnegie Units) - Course Code: 997000

Unit		Title	Hours
1		Fundamentals I, Brakes, and Introduction to Electrical/Electronic Systems	89
2		Basic Electrical/Electronic Systems	51
3		Advanced Electrical/Electronic Systems	140
			280

Note: The hours listed above are based on 140 hours of instruction for one Carnegie unit credit. ASE-certified programs are required to spend the following hours of instruction for the following units:

- Brakes and Introduction to Electrical/Electronic Systems (135 hours)
- Basic Electrical/Electronic Systems (60 hours)
- Advanced Electrical/Electronic Systems (140 hours)

Automotive Service II (Two Carnegie Units) - Course Code: 997001

Unit		Title	Hours
4		Engine Performance I	140
5		Engine Performance II	45
6		Steering/Suspension and Alternative Fuels	95
			280

Note: The hours listed above are based on 140 hours of instruction for one Carnegie unit credit. ASE-certified programs are required to spend the following hours of instruction for the following units:

- Engine Performance I (140 hours)
- Engine Performance II (80 hours)
- Steering and Suspension (95 hours)

✓ Scheduling and operating more than one course in the same classroom/laboratory with the same teacher is not allowed.
✓ Students must complete the first year with a score of 80/C or higher in classwork to advance to the next level.
✓ To effectively assess mastery respective to a course's instructional hours, the pathway blueprint will test units upon completion of their last hour of instruction.

Research Synopsis

Data used to develop the Automotive Service Pathway were collected from a variety of sources including industry surveys and interviews; occupational employment projections; national standards; Mississippi Department of Education, institutions of higher learning, and community and junior college requirements; and state and national certification requirements. The pathway is designed to provide an overview of the automotive service area to prepare students for careers in occupations predicted to have a high number of available jobs in the next 10 years. These jobs are in the automotive service sector. Industry input was collected from automotive service businesses in the state of Mississippi to customize the pathway to meet the needs of Mississippi's employers. Employment projections were obtained from the Mississippi Economic Review and Outlook, Mississippi Department of Employment Security, and the *National Occupational Outlook Handbook*. Students who successfully master the curriculum should have the skills required to take the Automotive Service Excellence certification, which is based on industry-validated performance indicators. Students should also be prepared to enter programs for advanced education in the automotive fields. The pathway will articulate to automotive service programs offered in Mississippi's community and junior colleges.

Industry Job Data – Employment Projections 2004 to 2014 for Mississippi

Note: Compiled by Mississippi Department of Employment Security and Labor Market Information Department

Cleaners of Vehicles and Equipment	2,420	2,720	300	$8.55	$17,790
Automotive Service Technicians and Mechanics	7,420	8,650	320	$14.84	$30,870
Tire Repairers and Changers	980	1,070	50	$9.94	$20,670
Automotive Glass Installers	200	230	5	$13.94	$29,000

Industry Comments and Quotes

- One of the main areas of concern for the industry representatives is many current technicians are near retirement and there is a small number of young people interested in the automotive field.
- Many of the employers agree that the ASE standards are important and need to be taught through theory and hands-on application. Employers want employees to have the ASE certifications but realize that the students still need time on the job to complete the "hours worked in the field" requirement.
- Many employers compensate employees based on the number of certifications, and most employers encourage employees to obtain certification. Most employers have training programs available to allow employees to advance and obtain advanced certifications.
- Employers indicated that employees need to have customer service skills. They expect employees to prioritize and organize tasks that will enable the vehicle to return to service as soon as possible.

- Basic computer skills are needed because many businesses use computers for record keeping and warranty claims.

Articulation

S Automotive Service Tech	PS Automotive Tech	ATT 1213 - Brakes

Academic Integration

Academic skills mentioned included basic math, reading, and writing. Overall, the industry representatives agreed that Brakes, Steering/Suspension, Electrical/Electronics, and Engine Performance need to be taught in the high schools. These are the basic building blocks for advanced training. Content needs to be taught as theory with hands-on application.

Course Content

The National Automotive Technicians Education Foundation (NATEF) was founded in 1983 as an independent, non-profit organization with a single mission: To evaluate technician training programs using standards that were developed by the automotive industry and recommend qualifying programs for certification (accreditation) by ASE, the National Institute for Automotive Service Excellence. In 2004, the curriculum was strategically aligned to the standards to allow programs at a local level to become certified. The secondary programs were aligned with Brakes, Electrical/Electronic Systems, Suspension/Steering Systems and Alternative Fuels, and Engine Performance. Currently, there are five certified secondary programs in the state of Mississippi with more applying yearly.

- General brake system diagnosis
- Hydraulic brake diagnosis and repair
- Drum brake diagnosis and repair
- Disc brake diagnosis and repair
- Power assist unit diagnosis and repair
- Miscellaneous diagnosis and repair
- Antilock brake and traction control systems

- General electrical system diagnosis
- Battery diagnosis and service
- Starting system diagnosis and repair
- Charging system diagnosis and repair
- Lighting systems diagnosis and repair
- Gauges, warning devices, and driver information systems
- Horn and wiper/washer diagnosis and repair
- Accessories diagnosis and repair

- General suspension and steering systems diagnosis
- Steering systems diagnosis and repair
- Suspension systems diagnosis and repair
- Wheel alignment diagnosis, adjustment, and repair

- General engine diagnosis
- Computerized engine controls diagnosis and repair
- Ignition system diagnosis
- Fuel, air induction, and exhaust systems diagnosis and repair
- Emissions control systems diagnosis and repair
- Engine-related service

Blueprint

You will find the blueprint that corresponds to this document at http://redesign.rcu.msstate.edu/curriculum/.

Professional Organizations

Association for Supervision and Curriculum Development (ASCD)
1703 North Beauregard Street
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http://www.acteonline.org

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http://www.mascd.com

Mississippi Department of Education (MDE)
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http://www.mde.k12.ms.us/vocational/news/

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703-777-8810
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http://www.skillsusa.org/

Using This Document

Each secondary vocational–technical course consists of a series of instructional units that focus on a common theme. All units have been written using a common format, which includes the following components:

Unit Number and Title

Suggested Time on Task

An estimated number of clock hours of instruction that should be required to teach the competencies and objectives of the unit. A minimum of 140 hours of instruction is required for each Carnegie unit credit. The curriculum framework should account for approximately 75–80% of the time in the course.

Competencies and Suggested Objectives

A competency represents a general concept or performance that students are expected to master as a requirement for satisfactorily completing a unit. Students will be expected to receive instruction on all competencies. The suggested objectives represent the enabling and supporting knowledge and performances that will indicate mastery of the competency at the course level.

Suggested Teaching Strategies

This section of each unit indicates research-based strategies that can be used to enable students to master each competency. Emphasis has been placed on strategies that reflect active learning methodologies. Teachers should feel free to modify or enhance these suggestions based on needs of their students and resources available in order to provide optimum learning experiences for their students.

Suggested Assessment Strategies

This section indicates research-based strategies that can be used to measure student mastery. Examples of suggested strategies could include rubrics, class participation, reflection, and journaling. Again, teachers should feel free to modify or enhance these suggested assessment strategies based on local needs and resources.

Integrated Academic Topics, 21st Century Skills and Information and Communication Technology Literacy Standards, ACT College Readiness Standards, and Technology Standards for Students

This section identifies related academic topics as required in the Subject Area Testing Program (SATP) in Algebra I, Biology I, English II, and U.S. History from 1877, which are integrated into the content of the unit. Researched-based teaching strategies also incorporate ACT College Readiness standards. This section also identifies the 21st Century Skills and Information and Communication Technology Literacy skills. In addition, national technology standards for students are associated with the competencies, and suggested objectives for the unit are also identified.

References

A list of suggested references is provided for each unit. The list includes some of the primary instructional resources that may be used to teach the competencies and suggested objectives. Again, these resources are suggested, and the list may be modified or enhanced based on needs and abilities of students and on available resources.

Competency 1: Describe local program and vocational/career technical center policies and procedures. (DOK 1) ASB, ASE, AST, AEP

Suggested Objectives

a. Describe local program and vocational/career technical center policies and procedures including dress code, attendance, academic requirements, discipline, and transportation regulations. (DOK 1)

Suggested Teaching Strategies

- Using guided prompts, have students participate in a classroom discussion describing their history, experiences, and feelings about the automotive service industry. E1, CS1, CS2, CS3, CS4, CS5, T1
- What do you already know about automobile servicing and repairing?
  - What would our nation and world be like without automobile service technicians?
  - What are the major automotive businesses in your area?
  - What is SkillsUSA?
  - How are technology and automobiles integrated?
  - What skills or behavioral characteristics does this school/classroom expect from you? What skills or behavioral characteristics do employers and/or industries expect from you? How are they different? How are they the same?
- Display the classroom discipline plan, procedures, calendar, emergency information, and so forth in a prominent place. Review these important documents with students. Make sure students understand the proper emergency procedures. E1, CS1, CS2, CS5
- Administer a learning styles inventory to students. Use results from this inventory to differentiate instruction throughout the course.
- Designate one area of the classroom to list daily objectives and weekly assignments and/or expectations of students. Encourage students to write the weekly assignments in their Automotive Service Technology journals. E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6
- Divide students into two groups. Assign one of the following scenarios to each group. Have groups present a role-play for their assigned scenario. CS1, CS2, CS3, CS4, CS
  - Imagine a school or business without rules. What would a normal day be like? What would a normal class be like? How productive would your day be?
  - Imagine a school or business that has created a rule and a procedure for everything. What would a normal day be like? What would a normal class be like? How productive would your day be?

Suggested Assessment Strategies

- Ask the students a variety of questions related to the material displayed around the classroom. Students will answer the questions. Incorrect answers will be discussed by the class and corrected. The instructor will evaluate by monitoring student actions and responses for accuracy and clarity.

- The role-play will be evaluated by students answering questions about the topics presented and using the **Role-play or Skit Rubric**.
- Give a written test on local school rules and regulations. Have students complete a form verifying that they have received instructions on local school rules and policies. Parents should also sign to acknowledge rules and policies.
- Explain to students that journals are a collection of works gathered over time that demonstrate students' progress in learning and writing. Explain to students that they will build a journal throughout the 2-year program. Have students correct any errors to assignments and include them in their Automotive Service Technology journals. Give students the **Journal Rubric**, and review for understanding.

Competency 2: Describe employment opportunities and responsibilities. (DOK 1) ASB, ASE, AST, AEP

Suggested Objectives

a. Describe employment opportunities including potential earnings, employee benefits, job availability, place of employment, working conditions, and educational requirements. (DOK 1)
b. Describe basic employee responsibilities. (DOK 1)

Suggested Teaching Strategies

- Group activity: The students will interview three industry members from the automotive service sector or professionals related to the course and determine how science, math, writing, technology, and industry-specific knowledge work together in their daily careers. Divide the students into groups and provide bulletin board paper, construction paper, and tape, and have students work in collaborative groups to create a classroom chart and summaries of the quantitative data they received for their industry member interviews. Allow students to discuss their findings and expectations for the course. Students will record findings in their journals. The students will input the interview information into a word processing document. The students will use the writing process to summarize their information. E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, W1, W2, W3, W4, W5, CS1, CS2, CS3, CS4, CS5, T1, T2, T3, T4, T5, T6
- The students will develop a PowerPoint presentation regarding the interview information and present their findings to the class. E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, W1, W2, W3, W4, W5, T1, T2, T5, T6
- The students will use the Internet and other classroom resources to research employment opportunities, educational opportunities, and working conditions in the automotive service industry. The students will use the writing process to develop a summary report of their research. The students will present their findings and discuss the pros and cons of the findings. E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, W1, W2, W3, W4, CS1, CS2, CS3, CS4, CS5, T1, T2, T3, T4, T5, T6
- Invite a representative of a local human resources department to speak to the class regarding the job application process. After a classroom discussion, the students will record facts in their journals. E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6
- The students will complete a job application, letter of application, and resume. The students will participate in a mock job interview. Students will interview each other using questions that were developed from the classroom discussion. Students will record answers to the interview questions in their journals. E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, W1, W2, W3, W4, W5, CS1, CS2, CS3, CS4, CS5, T1, T2, T3, T4, T5, T6
- Ask the students questions based on the unit. Have students volunteer to answer. The instructor will monitor responses and participation. Clarify weak answers or wrong answers. Re-teach those areas. E1, E2, E3, E4, E5, E6

Suggested Assessment Strategies

- Evaluate the group activity using the **Group Participation Rubric**.
- The instructor will monitor classroom discussions for accuracy and clarity.
- Evaluate the interview summary using the **Interview Assessment Rubric**.
- Evaluate the resume using the **Resume Assessment Rubric**.
- Evaluate the letter of application using the **Letter of Application Rubric**.
- Evaluate the guest speaker presentation using the **Guest Speaker Activity Rubric**.
- Evaluate presentations using the **Presentation Assessment Rubric.**
- Evaluate the writing process using the **Written Report Rubric**.
- Evaluate the journal using the **Journal Rubric**.

Competency 3: Explore leadership skills and personal development opportunities provided students by student organizations to include SkillsUSA. (DOK 2) ASB, ASE, AST, AEP

Suggested Objectives

a. Demonstrate effective team-building and leadership skills. (DOK 2)
b. Practice appropriate work ethics. (DOK 2)

Suggested Teaching Strategies

- Use the SkillsUSA team-building CD to describe the purposes of the SkillsUSA organization and the activities and programs that support these purposes. Using the Internet, students will research the SkillsUSA Web site for more in-depth information. Each student will reflect on how the SkillsUSA organization will benefit him or her. Student reflections will be shared through classroom discussion. R1, R2, R3, R4, R5, R6, CS1, CS2, CS3, CS4, CS5, T1, T5, T6
- Students are divided into teams. Team leaders are assigned and rotated throughout the year. As tasks are assigned, the team works together to complete the task. These tasks are classroom or shop activities. The students brainstorm different activities that they will be able to work together as a team to complete. These are listed on the poster board and will be checked as activities are completed. E1, E2, E3, E4, E5, E6, W1, W2, W3, W4, W5, CS1, CS2, CS3, CS4, CS5
- Discuss scholarships that students can apply for. Provide students with the scholarship applications. Students will complete and submit applications. E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, W1, W2, W3, W4, W5

Suggested Assessment Strategies

- Monitor the class for participation.
- Evaluate the list of activities for those that are complete.
- Evaluate the tasks/job sheet using the **Job Sheet/Performance Rubric**.
- Scholarship applications will be evaluated for content.
- Evaluate team-building activities using the **Teamwork Checklist**.

Competency 4: Demonstrate the ability to follow verbal and written instructions and communicate effectively in on-the-job situations. (DOK 2) ASB, ASE, AST, AEP

Suggested Objectives

a. Demonstrate following verbal and written instructions. (DOK 2)
b. Practice following verbal and written instructions. (DOK 2)
c. Communicate effectively with customers, colleagues, and employers. (DOK 2)

Suggested Teaching Strategies

- The students will role-play a given situation. Students will choose to be a technician, a manager, a customer, or a parts specialist. The students will interact with each other in a variety of situations related to the workplace. After each skit, the class will discuss the situations: pros and cons of each and how each will relate to a successful business. Students will record the results in their journals. E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, W1, W2, W3, W4, W5, S1, S2, S3, M1, M2, M3, M4, M5, M6, M7, M8, CS1, CS2, CS3, CS4, CS5, T1, T2, T3, T4, T5, T6
- The daily job sheets are completed prior to class. Students acquire sheets upon entering class. Complete the task and the job sheet with the required information. As students complete tasks, monitor activities using the **Workplace Skills Weekly Checklist**. Any areas that need improvement will be identified and discussed for improvement. E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, W1, W2, W3, W4, W5, CS1, CS2, CS3, CS4, CS5

Suggested Assessment Strategies

- Evaluate journal activity using the **Journal Rubric**.
- Evaluate tasks weekly using the **Workplace Skills Weekly Checklist**.
- Evaluate the skit using the **Role-play or Skit Rubric**.
- Evaluate the tasks/job sheet using the **Job Sheet/Performance Rubric**.

Competency 5: Discuss the history of the automotive industry to include materials, terminology, and techniques. (DOK 1) ASB, ASE, AST, AEP

Suggested Objectives

a. Discuss terminology related to the automotive industry. (DOK 1)
b. Explain and demonstrate techniques used in the automotive industry. (DOK 1)
c. Explore the history of the automotive industry. (DOK 1)

Suggested Teaching Strategies

- Show the video "Disappearing Car Door" from http://www.youtube.com/watch?v=AAtkoje4-eM. Ask students questions about safety, how the door operates, and the service procedures for the door mechanism.
- Use the automotive history video (History channel.com) Ask students probing questions about the video, and allow for classroom discussion. E1, E2, E3, E4, E5, E6
- Have students use the Internet to search for four to five articles regarding automotive history. Students should work in groups and present their information to the class. E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, W1, W2, W3, W4, W5, CS1, CS2, CS3, CS4, CS5, T1, T3, T4, T5, T6

Suggested Assessment Strategies

- Monitor classroom discussion for clarity and content to students' answers.
- Evaluate the presentation using the **Presentation Assessment Rubric**.

Competency 6: Identify and describe general safety rules, components of an automobile, tools /

equipment, measurement practices, and fasteners for working in a shop/lab and industry. (DOK 1) ASB, ASE, AST, AEP

Suggested Objectives

a. Describe how to avoid on-site accidents. (DOK 1)
b. Explain the relationship between housekeeping and safety. (DOK 1)
c. Explain the importance of following all safety rules and company safety policies. (DOK 1)
d. Explain the importance of reporting all on-the-job injuries and accidents. (DOK 1)
e. Explain the need for evacuation policies and the importance of following them. (DOK 1)
f. Explain the employer's substances abuse policy and how it relates to safety. (DOK 1)
g. Explain the safety procedures when working near pressurized or high temperature. (DOK 1)
h. Measure the length of an object using a rule to the nearest 1/16 in. and 1 mm. (DOK 1)
i. Measure the inside diameter, outside diameter, and/or depth to the nearest 0.001 in. and nearest 0.1 mm, using precision measuring instruments (micrometers, calipers, and dial indicators). (DOK 1)
j. Locate service specifications and information, using both print and computerized service information references (VIN, certification, and calibration labels). (DOK 1)
k. Identify and demonstrate the safe and proper use of impact wrenches; drills; grinders; hydraulic presses; lifting and hoisting equipment; cleaning equipment; common hand tools including wrenches, sockets, pliers, screwdrivers, and striking tools; and other tools used in the automotive field. (DOK 1)
l. Organize and maintain a systematic storage system for hand and power tools. (DOK 1)
m. Identify the different types of bolts, nuts, and washers and describe their appropriate uses. (DOK 1)
n. Identify bolts by grade, diameter, length, and thread pitch. (DOK 1)
o. Identify and describe the use of various glues and sealants. (DOK 1)
p. Restore internal and external threads. (DOK 1)

NOTE: SAFETY IS TO BE TAUGHT AS AN ONGOING PART OF THE COURSE THROUGHOUT THE YEAR.

Suggested Teaching Strategies

- Show students videos demonstrating examples of accidents in the workplace (http://www.unitedstreaming.com). Pre-assess knowledge of safety by having each student write a summary of the safety violations present in the videos. E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, W1, W2, W3, W4, W5
- Divide students into groups based on learning styles, and assign each group a guideline for personal and laboratory safety (i.e., chemicals, fire, equipment, animals, and electrical) or general laboratory conduct. Have each group role-play, create a multimedia presentation or a rap song, or write a story to discuss the proper and improper procedures related to the guideline. E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, W1, W2, W3, W4, W5, CS1, CS2, CS3, CS4, CS5, T1, T2, T3, T4, T5, T6
- Use the guidelines provided for personal safety (i.e., clothing, jewelry, hair, eyes, and ears). Divide the students into pairs and assign each pair one of the guidelines. Each pair will demonstrate the "do's and don'ts" of the guideline. R1, R2, R3, R4, R5, R6, CS1, CS2, CS3, CS4, CS5
- Have an industry speaker present to the class the necessity of safety in the work environment. Have students use the writing process to develop a summary of the presentation. E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, W1, W2, W3, W4, W5

Suggested Assessment Strategies

- Required written tests will follow each section of guidelines for safety rules and procedures. When applicable, use the assessment tools found in the Blackboard Learning System.
- Student participation will be monitored by the instructor, and the written exam will be graded. The student must achieve 100% accuracy.
- The "do's and don'ts" exercise will be critiqued with a peer review (students in the class).
- Written exams will be graded for accuracy.
- Evaluate the writing process activity using the **Written Report Rubric**.

Competency 7: Identify and apply concepts regarding safety procedures and practices in and around automotive operations. (DOK 2) ASB, ASE, AST, AEP

Suggested Objectives

a. Inspect and care for personal protective equipment. (DOK 2)
b. Identify and explain the procedures for lifting heavy objects. (DOK 2)
c. Explain the function of the MSDS. (DOK 2)
d. Interpret the requirements of the MSDS. (DOK 2)
e. Explain the process by which fires start. (DOK 2)
f. Explain fire prevention of various flammable liquids. (DOK 2)
g. Explain the classes of fire and the types of extinguishers. (DOK 2)
h. Explain injuries when electrical contact occurs. (DOK 2)

Suggested Teaching Strategies

- Invite the local fire department to lead a fire safety lesson. Have students use fire extinguishers properly. Have students locate all fire extinguishers in the school. Have students determine and select the proper fire extinguisher for different types of fires. Using the writing process, the students will write two to four paragraphs regarding the presentation. CS1, CS2, CS3, CS4, CS5
- Divide the students into teams, and have them develop scenarios of hazards and accidents using the publications and the Internet. This will include tools, spills, working around welding, ladders or scaffolds, use of MSDS information, fires, and electrical situations. In a game-type situation, one team will read a scenario and the other teams will compete to be the first to provide the proper safety measures that should have been used to prevent the hazardous situation. Points will be awarded to the teams with the correct answers. E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, W1, W2, W3, W4, W5, M1, CS1, CS2, CS3, CS4, CS5, T1, T2, T3, T4, T5, T6

Suggested Assessment Strategies

- Evaluate the speaker's presentation using the **Guest Speaker Activity Rubric**.
- Evaluate the paragraphs using the **Written Report Rubric**.
- The teams will be rewarded according to the points earned from the game. This could be extra points, classroom privileges, and so forth.

Competency 8: Explore general brake systems and theories of operation. (DOK 3) ASB, PHY

Suggested Objectives

a. Complete a work order to include customer information, vehicle identifying information, customer concern, related service history, cause, and correction. (DOK 3)
b. Identify and interpret brake system concern; determine necessary action. (DOK 3)
c. Research applicable vehicle and service information, such as brake system operation, vehicle service history, service precautions, and technical service bulletins. (DOK 3)
d. Locate and interpret vehicle and major component identification numbers (VIN, vehicle certification labels, calibration details, and calibration decals). (DOK 3)
e. Identify and demonstrate the safe and proper use of common hand tools including wrenches, sockets, pliers, screwdrivers, striking tools, and so forth. (DOK 3)
f. Identify and demonstrate the safe and proper use of lifting and hoisting equipment. (DOK 3)
g. Identify and demonstrate the safe and proper use of cleaning equipment. (DOK 3)
h. Identify and demonstrate the safe and proper use of power equipment including impact wrenches, drills, grinders, and presses. (DOK 3)
i. Identify the different types of bolts, nuts, and washers, and describe their appropriate uses. (DOK 3)
j. Identify bolts by grade, diameter, length, and thread pitch. (DOK 3)
k. Identify different glues and sealants used in automotive service, and describe their appropriate uses. (DOK 3)
l. Restore internal and external threads. (DOK 3)
m. Locate service specifications and information, using both print and computerized service information references. (DOK 3)
n. Interpret and apply information to a specific job on a specific vehicle. (DOK 3)
o. Locate and interpret vehicle and major component identification numbers (VIN, certification, and calibration labels). (DOK 3)
p. Measure the length of an object using a rule to the nearest 1/16 in. and 1 mm. (DOK 3)
q. Measure the inside diameter, outside diameter, and/or depth to the nearest 0.001 in. and nearest 0.1 mm, using precision measuring instruments (micrometers, calipers, and dial indicators). (DOK 3)
r. Distinguish between accuracy and precision. (DOK 3)
s. Determine when an instrument is out of calibration. (DOK 3)
t. Determines factors that affect stopping distance? (DOK 3)
u. Define friction and which factors affect the size of the force of friction. (DOK 3)
v. Discuss kinetic energy and the work–energy theorem. (DOK 3)
w. Define work, and relate work as it applies to stopping a car in motion. (DOK 3)

Suggested Teaching Strategies

- Show students videos demonstrating examples of brake-related accidents (http://www.youtube.com/watch?v=LnQ77xVnazA).
- Ask students the following questions, and allow for classroom discussion:[E1, E2, E3, E4, E5, E6]
  - How important are brakes on a vehicle?
  - Why is it important that brakes operate properly?
- Use a video to introduce the brake system. Gauge classroom discussion to observe students reactions and comments.[E1, E2, E3, E4, E5, E6]
- Different parts of the brake system are displayed. The instructor will explain each part and discuss the function of that part. Students will be divided into groups. Each group will be given three to six parts of the system. Using text, manuals, and/or the Internet (Today's

Class), students will research each part for its function and location in the brake system. Groups will present their findings to the class. E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, W1, W2, W3, W4, W5, S1, M1, M2, CS1, CS2, CS3, CS4, CS5, T1, T3, T4, T5, T6

- Have students role-play a customer concern situation. Divide students into two groups: technicians and customers. Have technicians use appropriate graphic organizers (**Fact or Opinion**, **Step-by-Step Chart**, or the **Problem Solution Chart**) to evaluate a customer's concerns about a particular problem that relates to the current task being taught about an automobile. Have technicians determine the needed action. E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, W1, W2, W3, W4, W5, S1, M1, M2, CS1, CS2, CS3, CS4, CS5
- Have students discuss what they already know about brake systems. Have students work as a class to complete a KWL chart. In the "K" column, have students list information they currently know about brake systems. In the "W" column, have students brainstorm a list of things they want to learn about brake systems. Have students work in groups or as individuals to interview industry members to find answers to their "W" list. Have students return to the KWL chart and list everything they learned from the interviews in the "L" column. E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, W1, W2, W3, W4, W5, S1, M1, M2, CS1, CS2, CS3, CS4, CS5
- Discuss and demonstrate the safe and proper use and storage of tools and equipment.
- Review automotive supply catalogs and self-made pictures of tools and equipment that students will use in the program. The students will use the Internet to research availability and cost of a variety of items as they relate to brand name. Students will record results in their journals. E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, W1, W2, W3, W4, M1, M2, CS1, CS2, CS3, CS4, CS5, T1, T4, T5, T6
- Divide the students into groups by learning styles. Have groups demonstrate safety procedures and proper use and storage of tools and equipment. Assign a specific task to a group of students. Have the group make a list of the proper tools that will be required to complete the task and present their decisions to the class. E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, W1, W2, W3, W4, W5, M1, M2, CS1, CS2, CS3, CS4, CS5
- Using a variety of bolts, nuts, and washers, the students will match the appropriate pieces into a complete unit. Then the students will categorize each unit by grade, diameter, length, and thread pitch. E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, W1, W2, W3, W4, W5, S1, S2, M1, M2, CS1, CS2, CS3, CS4, CS5
- The students will be divided into groups; each group will choose a glue or sealant. Using text, manuals, and the Internet, the students will research the automotive use of the product, potential hazards (environmental), and the cost. Students will demonstrate how the product is applied in the appropriate amount and conditions. Students will record information about the glues and sealants in their journals. E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, W1, W2, W3, W4, W5, S1, S2, S3, CS1, CS2, CS3, CS4, CS5, T1, T4, T5, T6
- Ask the students probing questions about being able to find the appropriate information and specifications. E1, E2, E3, E4, E5, E6
  - Why it is important to have the correct information on a vehicle before repairs begin?
  - Why is it important to be able to locate information on vehicles?
- The instructor will review the text, Internet, manuals, and handouts for locating and applying information. Each student will locate specific information using text, Internet, manuals, and handouts for an assigned vehicle at school. E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, W1, W2, W3, W4, W5, T1, T4, T5, T6
- Using a job sheet for specifications, each student will record the required information from his or her vehicle or from neighbors. The **Job Sheet/Performance Rubric** will be given to students and reviewed for understanding. E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, W1, W2, W3, W4, W5, CS1, CS2,

CS3, CS4, CS5

- Ask students the following question: How good is your eye for measurement? E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, W1, W2, W3, W4, W5, M1, CS1, CS2, CS3, CS4, CS5, T1, T2, T3, T4, T5, T6
- Give students the following scenario:

  The distance from your nose to the outside of your fingertips is about 1 m. Estimate the distance between you and three objects in the room. Have each member in the class make a data table and record his or her estimates. Have each student verify his or her estimation and compare it with the real measurement. Lead a class discussion using the following prompts:
  - Were the estimates reasonably close?
  - Did one person consistently make accurate estimates?
- Explain the importance of proper measurement practices, display tools that are used for measurement, and demonstrate how using the techniques are important to the student's career path. The students will interview an industry representative and discuss the importance of measurement and specifications. Students will record the interview and present findings to the class. E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, W1, W2, W3, W4, W5, M1, CS1, CS2, CS3, CS4, CS5
- Demonstrate how to measure a given item using a variety of measuring instruments. Have students work in groups to measure given items and record the answers on a job sheet. E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, W1, W2, W3, W4, W5, M1, M2, CS1, CS2, CS3, CS4, CS5
- The students will practice converting units extensively (i.e., meters/sec to min/hr, cubic inches/day to liters/min). Using the Internet and other resource material, the students will compare units of measure regarding automobile manufacturers from around the world. Students will compose their findings and present them to the class. E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, W1, W2, W3, W4, W5, M1, M2, CS1, CS2, CS3, CS4, CS5, T1, T4, T5, T6
- Using the Today's Class Web site (http://www.todaysclass.com/index.aspx), the students will complete the assigned unit(s). E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, W1, W2, W3, W4, W5, S1, M1, M2, CS1, CS2, CS3, CS4, CS5, T1, T2, T3, T4, T5, T6
- The instructor will explain and demonstrate each task. The student will perform the task and complete the appropriate job sheet. The **Brake System Rubric** is an example rubric and can be changed for other tasks. W5, S1, M1, M2, CS1, CS2, CS3, CS4, CS5
- Give students an instrument that is precise but inaccurate. E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, W1, W2, W3, W4, W5, S1, M1, M2, CS1, CS2, CS3, CS4, CS5, T1, T2, T3, T4, T5, T6,
- Discuss how mechanics ensure that instruments are accurate, by having them periodically calibrated. E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, W1, W2, W3, W4, W5, S1, M1, M2, CS1, CS2, CS3, CS4, CS5, T1, T2, T3, T4, T5, T6,
- Ask students the following brake physics questions: E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, W1, W2, W3, W4, W5, S1, M1, M2, CS1, CS2, CS3, CS4, CS5, T1, T2, T3, T4, T5, T6
  - As V doubles, what happens to the stopping distance?
  - What happens to stopping distance as F normal decreases due to Hydraulic System = loss of brake fluid and therefore hydraulic pressure?
  - Discuss Pascal's principle and hydraulic systems.
  - Discuss the braking system on a car as a hydraulic system is a force multiplier.
  - Define Pressure = Force/Area. Dilate to tire pressure, hydraulic pressure, and atmospheric pressure. Discuss gauge.
  - Impulse – Momentum = Force x Time = Mass x (change in velocity).
  - Discuss how a seat belt stops an individual without damage to the person.
  - Discuss how force decreases as the time to stop an object increases. When an object stops its change in momentum is the same whether it stops quickly or slowly. If it

stops in a small time, the force required is large so the person could be damaged. (Demonstrate with egg and foam rubber and egg hitting a hand/surface.)

Suggested Assessment Strategies

- Assess student understanding during the classroom by observing contributions to class discussions.
- Monitor student participation in discussions using the **Group Participation Rubric**.
- Students evaluate each other's KWL project and presentation for content. Monitor activity and evaluate the KWL project for content, clarity, and length.
- Evaluate the tool identification test using the **Tool Identification Rubric**.
- Evaluate the journal information by allowing the students to exchange journals and review the information. Evaluate the journal using the **Journal Rubric**.
- Evaluate the bolt, nut, and washer activity using peer review.
- Evaluate the student responses to the questions. Review areas that were incorrect.
- Evaluate the task/job sheet using the **Job Sheet/Performance Rubric**.
- Evaluate the "locate specific activity" using the **Job Sheet/Performance Rubric**.
- Evaluate the classroom discussion making sure that students participate and observe the students for responses of understanding.
- Evaluate students' measurement problems for accuracy.
- Evaluate measurement activities using the **Measurement Rubric**. Assess students as they measure given items and record the measurements on a job sheet.
- Evaluate the Today's Class quiz(zes) (if applicable) for each unit and job sheet(s) (if applicable). The job sheets are printed and evaluated using the **Job Sheet/Performance Rubric**.
- Evaluate the task/job sheet using the **Brake System Rubric** or the **Job Sheet/Performance Rubric** for other tasks.
- Evaluate using the **Presentation Assessment Rubric**.
- Evaluate the accuracy and calibration exercises by observing the students throughout the process and their recording of information/measurements in their journals.
- Evaluate the brake physics by having students respond to questions and record questions and responses in their journals.

Competency 9: Apply concepts of hydraulic brake systems by performing inspection, diagnosis, and repair, if needed. (DOK 2) ASB, PRA4, PHY

Suggested Objectives

a. Diagnose pressure concerns in the brake system using hydraulic principles (Pascal's law). (DOK 2)
b. Measure brake pedal height; determine necessary action. (DOK 2)
c. Check master cylinder for internal and external leaks and proper operation; determine necessary action. (DOK 2)
d. Remove, bench bleed, and reinstall master cylinder. (DOK 2)
e. Diagnose poor stopping, pulling, or dragging concerns caused by malfunctions in the hydraulic system; determine necessary action. (DOK 2)
f. Inspect brake lines, flexible hoses, and fittings for leaks, dents, kinks, rust, cracks, bulging, or wear; tighten loose fittings and supports; determine necessary action. (DOK 2)
g. Fabricate and/or install brake lines (double flare and ISO types); replace hoses, fittings, and supports as needed. (DOK 2)

h. Select, handle, store, and fill brake fluids to proper level. (DOK 2)
i. Inspect, test, and/or replace metering (hold-off), proportioning (balance), pressure differential, and combination valves. (DOK 2)
j. Inspect, test, and/or replace components of brake warning light system. (DOK 2)
k. Bleed (manual, pressure, vacuum, or surge) brake system. (DOK 2)
l. Flush hydraulic system. (DOK 2)
m. Discuss floor jack as a type of hydraulic system employing Pascal's principle. (DOK 2)

Suggested Teaching Strategies

- Use a floor jack to lift a load (noting how you are able to lift the load). Examine the floor jack, and discuss the parts and function. E1, E2, E3, E4, E5, E6, S1
- Brake system activity: E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, W1, W2, W3, W4, W5, S1, M1, M2, CS1, CS2, CS3, CS4, CS5
  - Draw a brake system on the board. Have the students copy the brake system into their journals, and ask students to write a paragraph about the system.
  - Demonstrate a brake procedure. Throughout the demonstrations, have students record step-by-step procedures for each demonstration in their journals.
  - Have students work in pairs to practice the procedures for the assigned brake activity. Have one student review the step-by-step procedure while the other student completes the task. Next, have students switch roles.
- Discuss and show examples of different types of brake systems including their operating principles. Have students search the Magnolia database or the Internet for an article for each of the types of braking systems and summarize the article in their journals. E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, W1, W2, W3, W4, W5, S1, CS1, CS2, CS3, CS4, CS5, T1, T3, T4, T5, T6
- Provide students with a schematic of a brake system, and have them identify the parts of the system and trace the flow of fluids in the system. E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, S1, CS1, CS2, CS3, CS4, CS5
- Using the Today's Class Web site, the students will complete the assigned unit(s). E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, W1, W2, W3, W4, W5, S1, M1, M2, CS1, CS2, CS3, CS4, CS5, T1, T2, T3, T4, T5, T6
- Explain and demonstrate each task. The student will perform the task and complete the appropriate job sheet. E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, W1, W2, W3, W4, W5, S1, M1, M2, CS1, CS2, CS3, CS4, CS5

Suggested Assessment Strategies

- Students evaluate each other during the procedure and provide feedback. Monitor activity, and evaluate the students for accuracy.
- Evaluate each task or a group of tasks using the **Activity Performance Rubric**.
- Review the journal entries, and evaluate using the **Journal Rubric**.
- Evaluate the Today's Class quiz(zes) (if applicable) for each unit and job sheet(s) (if applicable). The job sheets are printed and evaluated using the **Job Sheet/Performance Rubric**.
- Evaluate the task/job sheet using the **Job Sheet/Performance Rubric**.
- Evaluate the journal using the **Journal Rubric**.

Competency 10: Apply concepts of disc brake systems by performing inspection, diagnosis, and repair, if needed. (DOK 2) ASB , PHY

Suggested Objectives

a. Diagnose poor stopping, noise, vibration, pulling, grabbing, dragging, or pedal pulsation concerns; determine necessary action. (DOK 2)
b. Remove caliper assembly from mountings; clean and inspect for leaks and damage to caliper housing; determine necessary action. (DOK 2)
c. Clean and inspect caliper mounting and slides for wear and damage; determine necessary action. (DOK 2)
d. Remove, clean, and inspect pads and retaining hardware; determine necessary action. (DOK 2)
e. Disassemble and clean caliper assembly; inspect parts for wear, rust, scoring, and damage; replace seal, boot, and damaged or worn parts. (DOK 2)
f. Reassemble, lubricate, and reinstall caliper, pads, and related hardware; seat pads, and inspect for leaks. (DOK 2)
g. Clean, inspect, and measure rotor with a dial indicator and a micrometer; follow manufacturer's recommendations in determining need to machine or replace. (DOK 2)
h. Remove and reinstall rotor. (DOK 2)
I. Refinish rotor off vehicle. (DOK 2)
j. Adjust calipers equipped with an integrated parking brake system. (DOK 2)
k. Install wheel, torque lug nuts, and make final checks and adjustments. (DOK 2)

Suggested Teaching Strategies

- Review the video at http://www.discount-trailer-parts.com/do-it-yourself-brakes.html, and lead a discussion dealing with brake system maintenance. Discuss safety when working with brakes, and identify the other components of the system and their function and operation. E1, E2, E3, E4, E5, E6
- Compose five to eight posters that represent the content material, pictorially or verbally. Use photographs, direct quotes from text, or other means to convey one idea per poster. Number each poster. Post the posters around the classroom or lab. Divide students into "touring groups" to fit the classroom space, age of students, and complexity of the material. Assign one group per poster as a starting point. Allow groups to spend 2 to 5 minutes at each poster, taking notes and/or discussing the idea presented. Rotate the groups until all groups have "toured" each poster. When students return to their seats, allow some time for discussion and reactions. E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, W1, W2, W3, W4, W5, S1, M1, M2, CS1, CS2, CS3, CS4, CS5
- Ask students to find solutions to the following situations: E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, W1, W2, W3, W4, W5, S1, M1, M2, CS1, CS2, CS3, CS4, CS5
- Predict/compute stopping distance or speed of car increase by factors of two, three, or four times.
- Compute gauge and absolute pressure when given various data sets.
- Have students complete a three-column chart poster to summarize learning. In the first column, have students list the most important facts to remember from this unit. In the second chart, have students list what is somewhat important from this unit. In the third column, have students list what is not important from this unit. E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, W1, W2, W3, W4, W5, S1, CS1, CS2, CS3, CS4, CS5
- Using the Today's Class Web site, the students will complete the assigned unit(s). E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, W1, W2, W3, W4, W5, S1, M1, M2, CS1, CS2, CS3, CS4, CS5, T1, T2, T3, T4, T5, T6
- Explain and demonstrate each task. The student will perform the task and complete the

appropriate job sheet. E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, W1, W2, W3, W4, W5, S1, M1, M2, CS1, CS2, CS3, CS4, CS5

Suggested Assessment Strategies

- Evaluate the discussion for content, clarity, and understanding.
- Evaluate the poster using the **Poster Rubric**.
- Evaluate the Today's Class quiz(zes) (if applicable) for each unit and job sheet(s) (if applicable). The job sheets are printed and evaluated using the **Job Sheet/Performance Rubric**.
- Evaluate the activity by having students record situations and results in their journals and using the **Journal Rubric**.

Competency 11: Apply concepts of drum brake systems by performing inspection, diagnosis, and repair, if needed. (DOK 3) ASB, PHY

Suggested Objectives

a. Diagnose poor stopping, noise, vibration, pulling, grabbing, dragging, or pedal pulsation concerns; determine necessary action. (DOK 3)
b. Remove, clean (using proper safety procedures), inspect, and measure brake drums; determine necessary action. (DOK 3)
c. Refinish brake drum. (DOK 3)
d. Remove, clean, and inspect brake shoes, springs, pins, clips, levers, adjusters/self-adjusters, other related brake hardware, and backing support plates; lubricate and reassemble. (DOK 3)
e. Remove, inspect, and install wheel cylinders. (DOK 3)
f. Pre-adjust brake shoes and parking brake before installing brake drums or drum/hub assemblies and wheel bearings. (DOK 3)
g. Install wheel, torque lug nuts, and make final checks and adjustments. (DOK 3)
h. Discuss torque = perpendicular X length of torque arm. (DOK 3)
I. Discuss the effect of length on the amount of torque extended and why an extension handle is used to increase torque. (DOK 3)

Suggested Teaching Strategies

- Divide students into four groups. Assign each group a component of the brake system. Students will research and discuss torque and how extension handles affect torque. Have groups become experts in their assigned area through researching the topic using texts, manuals, or the Internet. Have groups create a presentation and teach members of the class about their assigned component. E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, W1, W2, W3, W4, W5, S1, M1, M2, CS1, CS2, CS3, CS4, CS5, T1, T2, T3, T4, T5, T6
- Have students work in groups to examine case studies related to task(s), and have students recommend the needed action and record information in their journals. E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, W1, W2, W3, W4, W5, S1, CS1, CS2, CS3, CS4, CS5
- Using the Today's Class Web site, the students will complete the assigned unit(s). E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, W1, W2, W3, W4, W5, S1, M1, M2, CS1, CS2, CS3, CS4, CS5, T1, T2, T3, T4, T5, T6
- Explain and demonstrate each task. The student will perform the task and complete the appropriate job sheet. E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, W1, W2, W3, W4, W5, S1, M1, M2, CS1, CS2, CS3, CS4, CS5

Suggested Assessment Strategies

- Evaluate each task or a group of tasks using the **Activity Performance Rubric**.
- Evaluate the group using the **Group Presentation Rubric**.
- Evaluate the Today's Class quiz(zes) (if applicable) for each unit and job sheet(s) (if applicable). The job sheets are printed and evaluated using the **Job Sheet/Performance Rubric**.
- Evaluate the task/job sheet using the **Job Sheet/Performance Rubric**.

Competency 12: Apply concepts of power assist unit systems by performing inspection, diagnosis, and repair, if needed.(DOK 3) ASB, PRA4

Suggested Objectives

a. Test pedal-free travel with and without engine running; check power assist operation. (DOK 3)
b. Check vacuum supply (manifold or auxiliary pump) to vacuum-type power booster. (DOK 3)
c. Inspect the vacuum-type power booster unit for vacuum leaks; inspect the check valve for proper operation; determine necessary action. (DOK 3)
d. Inspect and test hydraulically assisted power brake system for leaks and proper operation; determine necessary action. (DOK 3)
e. Measure and adjust master cylinder pushrod length. (DOK 3)

Suggested Teaching Strategies

- Students are assigned a given complaint about power assist systems. Students will brainstorm all possible solutions to the complaint. Possible solutions are listed and students will research each possible solution to find if it is plausible or not. Reasons must be specific, and a cost analysis must accompany each possible solution. E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, W1, W2, W3, W4, W5, S1, M1, M2, CS1, CS2, CS3, CS4, CS5, T1, T3, T4, T5, T6
- Using the Today's Class Web site, the students will complete the assigned unit(s). E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, W1, W2, W3, W4, W5, S1, M1, M2, CS1, CS2, CS3, CS4, CS5, T1, T2, T3, T4, T5, T6
- Explain and demonstrate each task. The student will perform the task and complete the appropriate job sheet. E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, CS1, CS2, CS3, CS4, CS5

Suggested Assessment Strategies

- Evaluate solutions based on students' cost analysis/solution and accuracy of the estimate.
- Evaluate the Today's Class quiz(zes) (if applicable) for each unit and job sheet(s) (if applicable). The job sheets are printed and evaluated using the **Job Sheet/Performance Rubric**.
- Evaluate the task/job sheet using the **Job Sheet/Performance Rubric**.

Competency 13: Apply concepts of miscellaneous systems by performing inspection, diagnosis, and repair, if needed. (DOK 2) ASB , PHY

Suggested Objectives

a. Diagnose wheel bearing noises, wheel shimmy, and vibration concerns; determine necessary action. (DOK 2)
b. Remove, clean, inspect, repack, and install wheel bearings, and replace seals; install hub and adjust wheel bearings. (DOK 2)

c. Check parking brake cables and components for wear, rusting, binding, and corrosion; clean, lubricate, or replace as needed. (DOK 2)
d. Check parking brake operation; determine necessary action. (DOK 2)
e. Check operation of parking brake indicator light system. (DOK 2)
f. Check operation of brake stoplight system; determine necessary action. (DOK 2)
g. Replace wheel bearing and race. (DOK 2)
h. Inspect and replace wheel studs. (DOK 2)
i. Remove and reinstall sealed wheel bearing assembly. (DOK 2)
j. Discuss ways to reduce friction by lubrication. Discuss rolling friction versus sliding friction. (DOK 2)

Suggested Teaching Strategies

- Have students compare and contrast the maintenance process of wheel bearings, lubrication, and the stoplight system. Have students develop and illustrate a timeline that shows the proper steps in the inspection and maintenance process that help to reduce friction.[E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, W1, W2, W3, W4, W5, S1, M1, M2, CS1, CS2, CS3, CS4, CS5]
- Using the Today's Class Web site, the students will complete the assigned unit(s).[E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, W1, W2, W3, W4, W5, S1, M1, M2, CS1, CS2, CS3, CS4, CS5, T1, T2, T3, T4, T5, T6]
- Explain and demonstrate each task. The student will perform the task and complete the appropriate job sheet.[E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, W1, W2, W3, W4, W5, CS1, CS2, CS3, CS4, CS5]

Suggested Assessment Strategies

- Students will evaluate the timeline using text, manuals, or the Internet for accuracy. Students will correct any inaccuracies and present them to the class. Evaluate the presentation using the **Presentation Assessment Rubric**.
- Evaluate the Today's Class quiz(zes) (if applicable) for each unit and job sheet(s) (if applicable). The job sheets are printed and evaluated using the **Job Sheet/Performance Rubric**.
- Evaluate the task/job sheet using the **Job Sheet/Performance Rubric**.

Competency 14: Apply concepts of antilock brake, traction control systems, and vehicle stability control systems by performing inspection, diagnosis, and repair, if needed. (DOK 3) [ASB, PHY]

Suggested Objectives

a. Identify and inspect antilock brake system (ABS) components; determine necessary action. (DOK 3)
b. Diagnose poor stopping, wheel lockup, abnormal pedal feel or pulsation, and noise concerns caused by the antilock brake system (ABS); determine necessary action. (DOK 3)
c. Diagnose antilock brake system (ABS) electronic control(s) and components using self-diagnosis and/or recommended test equipment; determine necessary action. (DOK 3)
d. Depressurize high-pressure components of the antilock brake system (ABS). (DOK 3)
e. Diagnose antilock brake system (ABS) braking concerns caused by vehicle modifications (tire size, curb height, final drive ratio, etc.). (DOK 3)
f. Identify traction control/vehicle stability control system components. (DOK 3)
g. Discuss why an ABS system is better in terms of the stopping friction in the disc brakes versus the sliding friction when the tires lock and skid with a lesser coefficient of friction. (DOK 3)

Suggested Teaching Strategies

- Divide students into groups based on their learning styles. Have each group create and act out a skit that presents a problem with a brake system. The students will discuss how an ABS system operates. When each group is finished, have the class brainstorm solutions to the brake system. The class should decide which solution is best. Once the skits have been performed, conduct a class discussion using the following probes:E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, W1, W2, W3, W4, W5, S1, CS1, CS2, CS3, CS4, CS5
    - Is the solution plausible?
    - What actions could have prevented the problem?
    - Have you ever had a conflict like this one? How did you resolve it?
- Have students write a reflective journal entry discussing a time that they had a problem and used effective conflict resolution skills to solve it.E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, W1, W2, W3, W4, W5, CS1, CS2, CS5
- Using the Today's Class Web site, the students will complete the assigned unit(s).E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, W1, W2, W3, W4, W5, S1, M1, M2, CS1, CS2, CS3, CS4, CS5, T1, T2, T3, T4, T5, T6
- Explain and demonstrate each task. The student will perform the task and complete the appropriate job sheet.E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, CS1, CS2, CS3, CS4, CS5

Suggested Assessment Strategies

- Evaluate classroom discussion for clarity.
- Evaluate the skit using the **Role-play or Skit Rubric**.
- Evaluate the Today's Class quiz(zes) (if applicable) for each unit and job sheet(s) (if applicable). The job sheets are printed and evaluated using the **Job Sheet/Performance Rubric**.
- Evaluate the task/job sheet using the **Job Sheet/Performance Rubric**.

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For additional references, activities, and Web resources, please refer to the Information and Computer Technology B.R.I.D.G.E. Web site: http://www.rcu.blackboard.com (available only to registered users).

Suggested Rubrics and Checklists

Activity Performance Rubric

Student Name _____ Date _____

Task to Be Performed_____

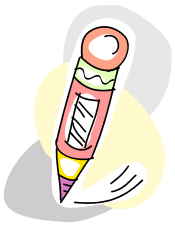
	Possible Points	Points Awarded
Safety	25	
Personal safety (glasses, clothing, etc.)		
Safe use of tool		
Safely performs the task		
Performance of the Task	50	
Follows the task instructions		
Performs the task efficiently		
Performs the task satisfactorily		
Lab Maintenance	25	
Area clean-up (clean and tidy)		
Area organization (before, during, and after the task)		
Total	100	

Comments for Deductions:

Poster Rubric

	Exemplary 4 Points	Accomplished 3 Points	Developing 2 Points	Beginning 1 Point	Score
Required Content	The poster includes all required content elements as well as additional information.	All required content elements are included on the poster.	All but one of the required content elements are included on the poster.	Several required content elements are missing.	
Labels	All items of importance on the poster are clearly labeled with labels that are easy to read.	Almost all items of importance on the poster are clearly labeled with labels that are easy to read.	Many items of importance on the poster are clearly labeled with labels that are easy to read.	Labels are too small to read, or no important items are labeled.	
Attractiveness	The poster is exceptionally attractive in terms of design, layout, and neatness.	The poster is attractive in terms of design, layout, and neatness.	The poster is acceptably attractive though it may be a bit messy.	The poster is distractingly messy or very poorly designed.	
Grammar	There are no grammatical or mechanical mistakes on the poster.	There are 1 to 2 grammatical or mechanical mistakes on the poster.	There are 3 to 4 grammatical or mechanical mistakes on the poster.	There are more than 4 grammatical or mechanical mistakes on the poster.	

Written Report Rubric



NAME: DATE: PERIOD:

	Exemplary 4 Points	Accomplished 3 Points	Developing 2 Points	Beginning 1 Point	Score
Content	Clear thesis and focus that remain apparent	Thesis and focus that remain apparent	Addresses subject matter with minimal support	Does not focus on topic	
Grammar	Correct and effective use of grammar and mechanics	Occasional errors in use of grammar and mechanics	Problems in use of grammar and mechanics	Repeated errors in use of grammar and mechanics	
Organization	Ideas flow smoothly and logically with clarity and coherence.	Logical order and appropriate sequencing of ideas with adequate transition	Some evidence of an organizational plan or strategy	Lacks organization	
				TOTAL	

Comments:

Presentation Assessment Rubric

NAME: **DATE:** **PERIOD:**

	Exemplary 4 points	Accomplished 3 points	Developing 2 points	Beginning 1 point	Score
Content	Clear, appropriate, and correct	Mostly clear, appropriate, and correct	Somewhat confusing, incorrect, or flawed	Confusing, incorrect, or flawed	
Clarity	Logical, interesting sequence	Logical sequence	Unclear sequence	No sequence	
Presentation	Clear voice and precise pronunciation	Clear voice and mostly correct pronunciation	Low voice and incorrect pronunciation	Mumbling and incorrect pronunciation	
Visual Aids	Attractive, accurate, and grammatically correct	Adequate, mostly accurate, and few grammatical errors	Poorly planned, somewhat accurate, and some grammatical errors	Weak, inaccurate, and many grammatical errors	
Length	Appropriate length	Slightly too long or short	Moderately too long or short	Extremely too long or short	
Eye Contact	Maintains eye contact, seldom looking at notes	Maintains eye contact most of time but frequently returns to notes	Occasionally uses eye contact but reads most of information	No eye contact because reading information	
				TOTAL	

Comments:

Group Participation Rubric

NAME: **DATE:** **PERIOD:**

	Beginning 1 point	Developing 2 points	Accomplished 3 points	Exemplary 4 points	Score
Group Discussions	Rarely contributed to discussions of the group	Contributed good effort to discussions of the group	Contributed great effort to discussions of the group	Contributed exceptional effort to discussions of the group	
On-task Behavior	Exhibited on-task behavior inconsistently	Exhibited on-task behavior some of the time	Exhibited on-task behavior most of the time	Exhibited on-task behavior consistently	
Helping Others	Did not assist other group members	Seldom assisted other group members	Occasionally assisted other group members	Assisted other group members	
Listening	Ignored ideas of group members	Seldom listened to ideas of group members	Occasionally listened to ideas of group members	Always listened to ideas of group members	

Role-play or Skit Rubric

NAME: DATE: PERIOD:

	Excellent 4 Points	Good 3 Points	Average 2 Points	Needs Improvement 1 Point	Score
Accuracy	All information was accurate.	Almost all information was accurate.	Most information was accurate.	Very little information was accurate.	
Role	Excellent character development; student contributed in a significant manner.	Good character development; student contributed in a cooperative manner.	Fair character development; student might have contributed.	Little or no character development; student did not contribute much at all.	
Knowledge Gained	Can clearly explain several ways in which his or her character "saw" things differently than other characters and can explain why	Can clearly explain several ways in which his or her character "saw" things differently than other characters	Can clearly explain one way in which his or her character "saw" things differently than other characters	Cannot explain any way in which his or her character "saw" things differently than other characters	
Props	Used several props and showed considerable creativity	Used one or two appropriate props that made the presentation better	Used one or two props that made the presentation better	Used no props to make the presentation better	
Required Elements	Included more information than required	Included all required information	Included most required information	Included less information than required	
				TOTAL	

Comments:

Resume Rubric

NAME: DATE: PERIOD:

	Excellent 25 Points	Well Done 20 Points	Meets Standards 15 Points	Beginning 10 Points	No Evidence 0 Points	Score
Format	Resume contains name, address, objective, education, experience, and references. All words are spelled correctly.	Contains at least six of the criteria; no more than two spelling errors	Contains at least five of the criteria; no more than four spelling errors	Contains minimal information; more than four spelling errors	Assignment was not submitted.	
Education	Education includes all schools attended, graduation dates, diploma/degree awarded, and major field of study.	Education includes three of the criteria.	Education includes two of the criteria.	Education includes one of the criteria.	Assignment was not submitted.	
Experience	Experience includes internships, entry-level jobs, and current position.	Experience includes two of the criteria.	Experience includes one of the criteria.	Experience includes current position only.	Assignment was not submitted.	
Factual	Contains factual names and dates and is believable	Resume is fairly believable with factual names or dates.	Resume has unrealistic dates or names.	Resume is unrealistic and contains conflicting information.	Assignment was not submitted.	

Letter of Application Rubric

NAME: DATE: PERIOD:

	Excellent 4 Points	Proficient 3 Points	Needs Improvement 2 points	Unsatisfactory 1 Point	Score
Layout/Design	Creatively designed, easily read, excellent business letter	Attractive, easy to read, good business letter	Appears busy or boring, difficult to read, needs improvement	Unattractive or inappropriate, very difficult to read, not acceptable	
Information, Style, Audience, and Tone	Accurate and complete information, very well written and presented	Well written and interesting to read	Some information provided but is limited or inaccurate	Poorly written, inaccurate, or incomplete	
Accurate Parts	Complete with all required parts	Some elements may be missing.	Most elements are missing or out of place.	Proper form for a letter not used	
Grammar, Punctuation, and Wording	Excellent presentation, style, grammar, and punctuation	Fair presentation, style, grammar, and punctuation	Missing information, inaccurate punctuation and/or grammar	Poor grammar, punctuation, and wording	
Following Directions and Guidelines	Always on task, always followed directions	Followed directions with some guidance	Required a good bit of extra guidance	Did not follow directions and did not ask for extra help	
				Total	

Comments:

Workplace Skills Weekly Checklist

NAME: DATE: PERIOD:

Behavior Skill	Never	Rarely	Most of the Time	Always
On Time and Prepared				
1. Arrives to class on time				
2. Brings necessary materials				
3. Completes homework				
Respects Peers				
1. Respects others' property				
2. Listens to peers				
3. Responds appropriately to peers				
4. Respects others' opinions				
5. Refrains from abusive language				
Respects Teachers/Staff				
1. Follows directions				
2. Listens to teacher and staff				
3. Accepts responsibility for actions				
Demonstrates Appropriate Character Traits				
1. Demonstrates positive character traits (kindness, trustworthy, and honesty)				
2. Demonstrates productive character traits (patient, thorough, and hardworking)				
3. Demonstrates a level of concern for others				
Demonstrates a Level of Concern for Learning				
1. Remains on task				
2. Allows others to remain on task				

Measurement Rubric

Rate the ability of the student to perform measurement tasks shown below using the following scale:

4 Proficient – Can perform consistently and independently with proficiency of an incumbent worker
3 Intermediate – Can perform the task but may require further practice to become as proficient as an incumbent worker
2 Introductory – Can perform the task but some coaching and further training are required.
1 Limited – Can perform the task with extensive coaching. Further training and practice are required.

Task	Rating
Safety procedures	
Understands how to measure	
Records measurements	

Comments:

Brake System Rubric

Rate the ability of the student to perform brake system diagnosis and repair tasks shown below using the following scale:

4 Proficient – Can perform consistently and independently with proficiency of an incumbent worker

3 Intermediate – Can perform the task but may require further practice to become as proficient as an incumbent worker

2 Introductory – Can perform the task but some coaching and further training are required.

1 Limited – Can perform the task with extensive coaching. Further training and practice are required.

Task	Rating
Identify and interpret brake system concern; determine necessary action.	
Research applicable vehicle and service information, such as brake system operation, vehicle service history, service precautions, and technical service bulletins.	
Locate and interpret vehicle and major component identification numbers (VIN, vehicle certification labels, calibration details, and calibration decals).	

Comments:

Journal Rubric

NAME: DATE: PERIOD:

CATEGORY	Excellent 4	Very Good 3	Satisfactory 2	Needs Work 1	SCORE
Writing Quality	There is a strong writing style and ability to express concepts learned. Excellent spelling, grammar, syntax, spelling, etc.	There is a good writing style and ability to express concepts learned. Very good grammar, syntax, spelling, etc.	There is a writing style that conveys meaning adequately. Some minor grammatical, syntax, and spelling errors	There is difficulty in expressing concepts. There is limited syntax. There are noticeable grammatical and spelling mistakes.	
Content	Clear and complete description of the activity is recorded. All major points are documented.	Very good description of the activity is recorded. Most major points are documented.	Good description of the activity is recorded. Some major points have been omitted.	Limited description of the activity is recorded. Very few major points are documented.	
Insight and Understanding	Definite insights into the implications of the activity are recorded. Awareness of complexity of issues and situations is present.	Some insight into the issue or situation is recorded. Some sense of complexity is present.	Insight is present from a more simplistic standpoint.	Only limited insight into the issue or situation is recorded.	
Application	Content of the activity is connected to the student's personal life and goals.	Content of the activity is connected to the field of automotive service.	Content of the activity is related to life in general.	Only limited connections are made between the content of the activity and the surrounding world.	
				Total Score	

Comments:

Job Sheet/Performance Rubric

Advanced (3 points)	Proficient (2 points)	Basic (1 point)	Unacceptable (0 points)
Student follows all safety regulations without prompting.	Student follows all safety regulations but may require limited reminders or prompting.	Student follows all or nearly all safety regulations but requires significant reminders.	Student does not follow most safety regulations.
Student properly diagnoses problem according to manufacturer guidelines and specifications within manufacturer-specified time limits.	Student properly diagnoses problem according to manufacturer guidelines and specifications but may take additional time.	Student properly diagnoses problem according to manufacturer guidelines and specifications with limited assistance.	Student's work is not performed to manufacturer guidelines and specifications.
Student quickly and accurately diagnoses problems and accurately determines causes of malfunction based on information obtained from resources.	Student accurately diagnoses problems and accurately determines causes of malfunction based on information obtained from resources.	Student diagnoses problem with limited assistance. With limited assistance, student determines causes of malfunction based on information obtained from resources.	Student is unable to diagnose problem.
Job Sheet includes all customer information, lists all requested repairs, and contains correct calculations with no items missing. Written report is accurate and complete and demonstrates thorough understanding of systems, how they operate, safety procedures, and importance of manufacturer recommendations.	Job Sheet includes customer information, lists requested repairs, and contains correct calculations but may include up to two errors or omissions. Written report is accurate and complete and demonstrates solid understanding of systems, how they operate, safety procedures, and importance of manufacturer recommendations.	Job Sheet includes customer information, lists requested repairs, and contains correct calculations but may include up to three errors or omissions. Written report is mostly accurate and complete and demonstrates understanding of types of systems, how they operate, safety procedures, and importance of manufacturer recommendations.	Job Sheet includes customer information, lists requested repairs, and contains correct calculations but may include up to four errors or omissions. Written report is inaccurate and/or incomplete or indicates limited to no understanding of types of systems, how they operate, safety procedures, and importance of manufacturer recommendations.

Tool Identification Rubric

Rate the ability of the student to perform tool identification tasks shown below using the following scale:

4 Excellent – Correct answers to all questions
3 Very Good – One of four incorrect
2 Satisfactory – Two of the four incorrect
1 Unsatisfactory – No correct answers

Task	Rating
Identify the tool	
Correct spelling	
Tool use	
Approximate cost	
Where the tool can be purchased	

Comments:

Teamwork Checklist

_____ Follows team leader's and/or supervisor's directions

_____ Accepts that others might be better at some tasks

_____ Displays positive attitude when working with others

_____ Recognizes that the work benefits the team/company and not the individual

_____ Works well with people who work at different speeds

_____ Accepts goals that are set by others

_____ Trusts others to perform their assignments

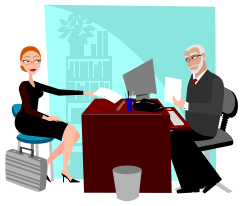
_____ Appreciates the work of others

NOTE: The Teamwork Checklist may be used throughout the program.

Guest Speaker Activity Rubric

CATEGORY	Excellent 4	Very Good 3	Satisfactory 2	Needs Work 1	SCORE
Listening Behavior	Student consistently minimizes/avoids behaviors that interfere with listening and attends to the speaker.	Student minimizes/ avoids behaviors that interfere with listening and attends to the speaker almost all of the time.	Some inappropriate behaviors that interfere with listening and attending to the speaker are noted.	Student seldom or never minimizes/avoids behaviors that interfere with listening and attending to the speaker.	
Note Taking	Student consistently takes notes that identify all of the main points made by the speaker.	Student notes identify most of the main points made by the speaker.	Student notes identify only one or two main points made by the speaker.	Student notes do not reflect main points made by the speaker.	
Questioning	Questions asked by the student are intended to expand on information provided by the speaker.	Questions asked by the student are intended to clarify information provided by the speaker.	Questions asked by the student cause the speaker to repeat information already presented.	No questions are asked by the student.	
				Total	

Interview Assessment Rubric



NAME: DATE: PERIOD:

	Excellent 4 Points	Good 3 Points	Needs Improvement 2 Points	Unacceptable 1 Point	Score
Body language Displays confidence					
Eye contact Maintains good eye contact with interviewer					
Introduction Provides a self-introduction					
Handshakes Extends hand and shakes firmly					
Dress Dressed appropriately for an interview, business attire					
Language Concise and grammatically correct					
Questions Asks appropriate questions, demonstrates a knowledge of the business					
Closure Responds appropriately					
				TOTAL	

Comments:

Group Presentation Rubric

	Exemplary 4 points	Accomplished 3 points	Developing 2 points	Beginning 1 point	Score
Content	Clear, appropriate, and correct	Mostly clear, appropriate, and correct	Somewhat confusing, incorrect, or flawed	Confusing, incorrect, or flawed	
Clarity	Logical, interesting sequence	Logical sequence	Unclear sequence	No sequence	
Presentation	Clear voice and precise pronunciation	Clear voice and mostly correct pronunciation	Low voice and incorrect pronunciation	Mumbling and incorrect pronunciation	
Visual Aids	Attractive, accurate, and grammatically correct	Adequate, mostly accurate, and few grammatical errors	Poorly planned, somewhat accurate, or some grammatical errors	Weak, inaccurate, or many grammatical errors	
Length	Appropriate length	Slightly too long or short	Moderately too long or short	Extremely too long or short	
Participation	Well-balanced participation by all group members	All group members have significant participation.	Most group members participate.	One main speaker with little participation from other group members	
Eye Contact	Maintains eye contact, seldom looking at notes	Maintains eye contact most of time but frequently returns to notes	Occasionally uses eye contact but reads most of information	No eye contact because reading information	

Step-by-Step Chart

Have students write the task that they are to accomplish in the task area. Then have students determine and write each step of their procedure with details.

Task:

Step 1:	Details:
Step 2:	Details:
Step 3:	Details:
Step 4:	Details:
Step 5:	Details:
Step 6:	Details:

KWL Chart

Purposes:

- To help students access prior knowledge through brainstorming
- To identify areas of student interest or concern
- To aid the teacher in planning lessons as well as checking for understanding
- To track student learning throughout the unit
- To identify areas for further student research/study

Process:

- Use this strategy prior to, during, or at the close of any unit of study. The process can be done individually, in small groups, or as a class activity.
- Post the charts or have students record their information in groups.
- During the brainstorming phase, emphasize getting lots of ideas rather than debating or discussing the ideas as they are generated. Debates, clarifications, and discussions of ideas occur once the brainstorming is over. Do not clarify any confusion or react in any way other than to record the data. Conflicting data may be recorded.
- During the lesson or unit of study, misconception, confusion, or curiosity should be addressed.

Sample Chart:

K	**W**	**L**
What do you already **K**now about the topic?	What do you **W**ant to learn about the topic?	What have you Learned about the topic?

Fact or Opinion

Have students writing their topic in the top rectangle. Have students add details to the fact or the opinion blocks:

Field Trip

Topic:

Fact:

Opinion:

Competency 1: Explore general electrical/electronic systems and theories of operation. (DOK 3)[ASE, PRA4, PHY]

Suggested Objectives

a. Complete work order to include customer information, vehicle identifying information, customer concern, related service history, cause, and correction. (DOK 3)
b. Identify and interpret electrical/electronic system concerns; determine necessary action. (DOK 3)
c. Research applicable vehicle and service information, such as electrical/electronic system operation, vehicle service history, service precautions, and technical service bulletins. (DOK 3)
d. Locate and interpret vehicle and major component identification numbers (VIN, vehicle certification labels, and calibration decals). (DOK 3)
e. Diagnose electrical/electronic integrity of series, parallel, and series–parallel circuits using principles of electricity (Ohm's law). (DOK 3)
f. Use wiring diagrams during diagnosis of electrical circuit problems. (DOK 3)
g. Demonstrate the proper use of a digital multimeter (DMM) during diagnosis of electrical circuit problems. (DOK 3)
h. Check electrical circuits with a test light; determine necessary action. (DOK 3)
i. Measure source voltage, and perform voltage drop tests in electrical/electronic circuits using a voltmeter; determine necessary action. (DOK 3)
j. Measure current flow in electrical/electronic circuits and components using an ammeter; determine necessary action. (DOK 3)
k. Check continuity and measure resistance in electrical/electronic circuits and components using an ohmmeter; determine necessary action. (DOK 3)
l. Check electrical circuits using fused jumper wires; determine necessary action. (DOK 3)
m. Locate shorts, grounds, opens, and resistance problems in electrical/electronic circuits; determine necessary action. (DOK 3)
n. Measure and diagnose the cause(s) of excessive key-off battery drain (parasitic draw); determine necessary action. (DOK 3)
o. Inspect and test fusible links, circuit breakers, and fuses; determine necessary action. (DOK 3)
p. Inspect and test switches, connectors, relays, solenoid solid state devices, and wires of electrical/electronic circuits; perform necessary action. (DOK 3)
q. Remove and replace terminal end from connector. (DOK 3)
r. Repair connectors and terminal ends. (DOK 3)
s. Perform solder repair of electrical wiring. (DOK 3)
t. Identify safety procedures and location of hybrid vehicle high-voltage circuit disconnect (service plug). (DOK 3)
u. Define current, resistance, and voltage, and discuss Ohm's law. (DOK 3)
v. Define and contrast series and parallel circuits; sketch series and parallel circuits. (DOK 3)
w. Define ground, short circuit, open circuit, and the resistance associated with short circuits and open circuits. (DOK 3)
x. Discuss the ground for an automobile and for a house. (DOK 3)
y. Discuss fuses and circuit breakers in parallel circuits where I total = I fuse = I, + I2, +I3. (DOK 3)

Suggested Teaching Strategies

- Have students write the answers to the following questions in their notebooks. After a period of time, ask students to switch notebooks and critique the answers. Students can share their answers and discuss each answer. Students can correct each answer and clarify points of confusion. E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, W1, W2, W3, W4, W5, CS1, CS2, CS3, CS4, CS5
    - What should I know and be able to do at the end of this unit or experience?
    - What do I already know that will be useful in learning this new material or working in this way?
    - How is this knowledge and how are these skills important in the world outside of school?
    - What are the important points?
- Relate electronic items that students have (cell phones, MP3, etc.) to types of electrical/electronic devices. Discuss how they are similar to the ones in automobiles. E1, E2, E3, E4, E5, E6, CS1, T1, T4
- Homemade lie detector or passion tester: Using a multimeter, ohm meter, or lab scope, have the students touch the leads (in the separate hands). Ask the students a true question and a lie to set a baseline. Ask the students a variety of questions about the multimeter's function and purpose. Watch the fun. E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, W1, W2, W3, W4, W5, S1, M1, CS1, CS2, CS3, CS4, CS5, T1, T3, T4, T5, T6
- Using the Today's Class Web site, the students will complete the assigned unit(s). E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, W1, W2, W3, W4, W5, S1, M1, M2, CS1, CS2, CS3, CS4, CS5, T1, T2, T3, T4, T5, T6
- Explain and demonstrate each task. The student will perform the task and complete the appropriate job sheet. The **Electrical/Electronic Rubric** is an example rubric and can be changed for other tasks. E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, CS1, CS2, CS3, CS4, CS5

Suggested Assessment Strategies

- Evaluate the class discussion for clarity and understanding of concepts.
- Evaluate the journal using the **Journal Rubric**.
- Evaluate the Today's Class quiz(zes) (if applicable) for each unit and job sheet(s) (if applicable). The job sheets are printed and evaluated using the **Job Sheet/Performance Rubric**.
- Evaluate the task/job sheet using the **Electrical/Electronic Rubric** or the **Job Sheet/Performance Rubric** for other tasks.

Competency 2: Apply concepts of battery systems by performing inspection, diagnosis, and repair, if needed. (DOK 3) ASE, , PHY

Suggested Objectives

a. Perform battery state-of-charge test; determine necessary action. (DOK 3)
b. Perform battery capacity test (or conductance test); confirm proper battery capacity for vehicle application; determine necessary action. (DOK 3)
c. Maintain or restore electronic memory functions. (DOK 3)
d. Inspect, clean, fill, and replace battery. (DOK 3)
e. Perform slow/fast battery charge. (DOK 3)
f. Inspect and clean battery cables, connectors, clamps, and hold-downs; repair or replace as needed. (DOK 3)

g. Inspect and clean battery cables, connectors, clamps, and hold-downs; repair or replace as needed. (DOK 3)
h. Start a vehicle using jumper cables and a battery or auxiliary power supply. (DOK 3)
i. Identify high-voltage circuits of electric or hybrid electric vehicle and related safety precautions. (DOK 3)
j. Identify hybrid vehicle auxiliary (12 V) battery service and repair and test procedures. (DOK 3)
k. Discuss terminal potential difference (TPD) and electromotive force (EMF) for a battery. TPD = EMF- IRB (discharging) TPD = EMF + IRB (charging). Using a voltmeter or automobile/truck voltmeter, determine the TPD of a battery switch when the switch is turned to on (without engine running), the TPD when the engine is starting (battery is discharging), and the TPD when the engine is running (battery is charging). (DOK 3)

Suggested Teaching Strategies

- Display two different physical sizes of fully charged batteries (motorcycle and car). Have students measure and record the reading on the job sheet. Ask students which has the highest voltage. E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, W1, W2, W3, W4, W5, S1, M1, M2, S1, CS2, CS3, CS4, CS5, T1, T3, T4, T5, T6
- Allow students to work in small groups to solve the following problem. Students will record findings in their journals. E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, W1, W2, W3, W4, W5, S1, M1, M2, CS1, CS2, CS3, CS4, CS5
  - Problem: A 9-V battery supplies power to a cordless curling iron with a resistance of 18 Ω. How much current is flowing through the curling iron?
- Using the Today's Class Web site, the students will complete the assigned unit(s). E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, W1, W2, W3, W4, W5, S1, CS1, CS2, CS3, CS4, CS5, T1, T2, T3, T4, T5, T6
- Explain and demonstrate each task. The student will perform the task and complete the appropriate job sheet. The **Boosting/Jumping Cable Rubric** is an example rubric and can be changed for other tasks. E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, CS1, CS2, CS3, CS4, CS5

Suggested Assessment Strategies

- Evaluate journals using the **Journal Rubric**.
- Solution: Visit http://www.grc.nasa.gov/WWW/K12/Sample_Projects/Ohms_Law/ohmslaw.html for the solution and more problems for students to solve.
- Evaluate the Today's Class quiz(zes) (if applicable) for each unit and job sheet(s) (if applicable). The job sheets are printed and evaluated using the **Job Sheet/Performance Rubric**.
- Evaluate the task/job sheet using the **Boosting/Jumping Cable Rubric** or the **Job Sheet/Performance Rubric** for other tasks.

Competency 3: Apply concepts of starting systems by performing inspection, diagnosis, and repair, if needed. (DOK 3) ASE, , PHY

Suggested Objectives

a. Perform starter current draw and circuit voltage drop tests; determine necessary repair. (DOK 3)
b. Inspect and test the starter components, relays, and solenoids; determine necessary repair. (DOK 3)
c. Remove and install the starter. (DOK 3)
d. Inspect test switches, connectors, and wires of starter control circuits; perform necessary action. (DOK 3)

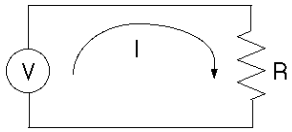
e. Differentiate between electrical and engine mechanical problems that cause slow-crank or no-crank conditions. (DOK 3)
f. Discuss terrestrial magnetism and electromagnetism using wire, nail, and battery. Discuss the solenoid as an electromagnet and how it engages the starter to the flywheel. (DOK 3)
g. Discuss why the starter must be disengaged from the flywheel when the car is running in terms of gear ratio and angular velocity in revolutions per minute. (DOK 3)

Suggested Teaching Strategies

- Using a starter, solenoid, and battery, operate the starter. Discuss the parts and the operation of each. Using the DVOM, the students will perform a voltage drop and amperage draw test on the circuits. Students will record measurements and diagnosis of the circuit on the job sheet. Once all students have completed the activity, each student will present his or her results to the class. Students will review, comment, and correct results and record results in their journals. E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, W1, W2, W3, W4, W5, S1, M1, M2, CS1, CS2, CS3, CS4, CS5, T1, T3, T4, T5, T6

- Have students use the Internet or classroom resources to gain a basic understanding of Ohm's law. Have students write the formula and sketch the drawing that represents the formula in their journals. Students can use classroom tools or a graphing calculator and presentation equipment to enter data related to various voltages and currents. They should graph the resulting resistances to demonstrate the relationship between them (Ohm's law) and record information in their journals. E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, W1, W2, W3, W4, W5, S1, S2, S3, M1, M2, CS1, CS2, CS3, CS4, CS5, T1, T3, T4, T5, T6

  o *Ohm's Law: V = I x R*
  V = Voltage
  I = Current
  R = Resistance



- Using the Today's Class Web site, the students will complete the assigned unit(s). E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, W1, W2, W3, W4, W5, S1, M1, M2, CS1, CS2, CS3, CS4, CS5, T1, T2, T3, T4, T5, T6
- Explain and demonstrate each task. The student will perform the task and complete the appropriate job sheet. E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, CS1, CS2, CS3, CS4, CS5

Suggested Assessment Strategies

- Evaluate the grade graphing activity using the **Journal Rubric.**
- Evaluate the Today's Class quiz(zes) (if applicable) for each unit and job sheet(s) (if applicable). The job sheets are printed and evaluated using the **Job Sheet/Performance Rubric**.
- Evaluate the task/job sheet using the **Job Sheet/Performance Rubric**.

Competency 4: Apply concepts of charging systems by performing inspection, diagnosis, and repair, if needed. (DOK 3) ASE,

Suggested Objectives

a. Perform a charging system test, and diagnose the cause or causes for the following: output, undercharging, no-charge, overcharge, and voltage drop; determine necessary repair. (DOK 3)
b. Remove, inspect, adjust, and **install** the generator (alternator) and components. (DOK 3)

Suggested Teaching Strategies

- Using the Internet, students will research the Web site "How stuff works" for charging systems. Students will discuss their findings and apply knowledge of charging systems to vehicles in their shop. They will record information in their journals. E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, W1, W2, W3, W4, W5, S1, M1, M2, CS1, CS2, CS3, CS4, CS5, T1, T3, T4, T5, T6
- Display the components of the charging system. Discuss each part and the function of each. Students will draw a picture and record a description of each part in their journals. Students will identify the parts on a vehicle. E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, W1, W2, W3, W4, W5, S1, M1, CS1, CS2, CS3, CS4, CS5
- Demonstrate the use of the multimeter and test light to measure continuity, voltage, amperage, and resistance. Have students practice making these measurements and recording their findings on a job sheet. Students will then combine all results and brainstorm why results are different. Students can perform the activity numerous times to replicate results. E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, W1, W2, W3, W4, W5, S1, M1, M2, CS1, CS2, CS3, CS4, CS5, T1, T3, T4, T5, T6
- Using the Today's Class Web site, the students will complete the assigned unit(s). E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, W1, W2, W3, W4, W5, S1, S2, S3, M1, M2, CS1, CS2, CS3, CS4, CS5, T1, T3, T4, T5, T6
- Explain and demonstrate each task. The student will perform the task and complete the appropriate job sheet. The **Charging System Rubric** is an example rubric and can be changed for other tasks. E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, CS1, CS2, CS3, CS4, CS5

Suggested Assessment Strategies

- Evaluate the journal using the **Journal Rubric**.
- Evaluate by observing the student identify each part of the charging system.
- Evaluate the multimeter activity for correct or incorrect answers. Students with incorrect answers review procedures and redo the exercise.
- Evaluate the Today's Class quiz(zes) (if applicable) for each unit and job sheet(s) (if applicable). The job sheets are printed and evaluated using the **Job Sheet/Performance Rubric**.
- Evaluate the task/job sheet using the **Charging System Rubric** or the **Job Sheet/Performance Rubric** for other tasks.

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For additional references, activities, and Web resources, please refer to the Information and Computer Technology B.R.I.D.G.E. Web site: http://www.rcu.blackboard.com (available only to registered users).

Suggested Rubrics and Checklists

Journal Rubric

NAME: DATE: PERIOD:

CATEGORY	Excellent 4	Very Good 3	Satisfactory 2	Needs Work 1	SCORE
Writing Quality	There is a strong writing style and ability to express concepts learned. Excellent spelling, grammar, syntax, spelling, etc.	There is a good writing style and ability to express concepts learned. Very good grammar, syntax, spelling, etc.	There is a writing style that conveys meaning adequately. Some minor grammatical, syntax, and spelling errors	There is difficulty in expressing concepts. There is limited syntax. There are noticeable grammatical and spelling mistakes.	
Content	Clear and complete description of the activity is recorded. All major points are documented.	Very good description of the activity is recorded. Most major points are documented.	Good description of the activity is recorded. Some major points have been omitted.	Limited description of the activity is recorded. Very few major points are documented.	
Insight and Understanding	Definite insights into the implications of the activity are recorded. Awareness of complexity of issues and situations is present.	Some insight into the issue or situation is recorded. Some sense of complexity is present.	Insight is present from a more simplistic standpoint.	Only limited insight into the issue or situation is recorded.	
Application	Content of the activity is connected to the student's personal life and goals.	Content of the activity is connected to the field of automotive service.	Content of the activity is related to life in general.	Only limited connections are made between the content of the activity and the surrounding world.	
				Total Score	

Comments:

Job Sheet/Performance Rubric

Advanced (3 points)	Proficient (2 points)	Basic (1 point)	Unacceptable (0 points)
Student follows all safety regulations without prompting.	Student follows all safety regulations but may require limited reminders or prompting.	Student follows all or nearly all safety regulations but requires significant reminders.	Student does not follow most safety regulations.
Student properly diagnoses problem according to manufacturer guidelines and specifications within manufacturer-specified time limits.	Student properly diagnoses problem according to manufacturer guidelines and specifications but may take additional time.	Student properly diagnoses problem according to manufacturer guidelines and specifications with limited assistance.	Student's work is not performed to manufacturer guidelines and specifications.
Student quickly and accurately diagnoses problems and accurately determines causes of malfunction based on information obtained from resources.	Student accurately diagnoses problems and accurately determines causes of malfunction based on information obtained from resources.	Student diagnoses problem with limited assistance. With limited assistance, student determines causes of malfunction based on information obtained from resources.	Student is unable to diagnose problem.
Job Sheet includes all customer information, lists all requested repairs, and contains correct calculations with no items missing. Written report is accurate and complete and demonstrates thorough understanding of systems, how they operate, safety procedures, and importance of manufacturer recommendations.	Job Sheet includes customer information, lists requested repairs, and contains correct calculations but may include up to two errors or omissions. Written report is accurate and complete and demonstrates solid understanding of systems, how they operate, safety procedures, and importance of manufacturer recommendations.	Job Sheet includes customer information, lists requested repairs, and contains correct calculations but may include up to three errors or omissions. Written report is mostly accurate and complete and demonstrates understanding of types of systems, how they operate, safety procedures, and importance of manufacturer recommendations.	Job Sheet includes customer information, lists requested repairs, and contains correct calculations but may include up to four errors or omissions. Written report is inaccurate and/or incomplete or indicates limited to no understanding of types of systems, how they operate, safety procedures, and importance of manufacturer recommendations.

Electrical/Electronic Rubric

Rate the ability of the student to perform electrical/electronic maintenance and repair tasks shown below using the following scale:

4 Proficient – Can perform consistently and independently with proficiency of an incumbent worker
3 Intermediate – Can perform the task but may require further practice to become as proficient as an incumbent worker
2 Introductory – Can perform the task but some coaching and further training are required.
1 Limited – Can perform the task with extensive coaching. Further training and practice are required.

Task	Rating
Complete work order to include customer information, vehicle identifying information, customer concern, related service history, cause, and correction.	
Identify and interpret electrical/electronic system concerns; determine necessary action.	
Research applicable vehicle and service information, such as electrical/electronic system operation, vehicle service history, service precautions, and technical service bulletins.	
Locate and interpret vehicle and major component identification numbers (VIN, vehicle certification labels, and calibration decals).	
Diagnose electrical/electronic concerns.	
Perform repair procedure.	

Comments:

Boosting/Jumping Cable Rubric

Rate the ability of the student to perform boosting/jumping cable tasks shown below using the following scale:

4 Proficient – Can perform consistently and independently with proficiency of an incumbent worker

3 Intermediate – Can perform the task but may require further practice to become as proficient as an incumbent worker

2 Introductory – Can perform the task but some coaching and further training are required.

1 Limited – Can perform the task with extensive coaching. Further training and practice are required.

Task	Rating
Can demonstrate proper procedure	
Can explain proper procedure	
Safety procedures	
Cable connection	
Cable disconnection	

Comments:

Charging System Rubric

Rate the ability of the student to perform charging system tasks shown below using the following scale:

4 Proficient – Can perform consistently and independently with proficiency of an incumbent worker

3 Intermediate – Can perform the task but may require further practice to become as proficient as an incumbent worker

2 Introductory – Can perform the task but some coaching and further training are required.

1 Limited – Can perform the task with extensive coaching. Further training and practice are required.

Task	Rating
Safety procedures	
Diagnose the cause or causes	
Perform charging system test	
Remove, inspect, adjust, and install the generator (alternator) and components	

Comments:

Competency 1: Explore lighting systems and theories of operation. (DOK 3) ASE, PHY

Suggested Objectives

a. Complete work order to include customer information, vehicle identifying information, customer concern, related service history, cause, and correction. (DOK 3)
b. Diagnose lighting system problems related to brighter than normal, intermittent, dim, or no light operation; determine necessary actions. (DOK 3)
c. Inspect, replace, and aim headlights and bulbs. (DOK 3)
d. Inspect and diagnose incorrect turn and hazard lighting systems; determine necessary actions. (DOK 3)
e. Identify system voltage and safety precautions associated with high-intensity discharge headlights. (DOK 3)
f. Discuss parabolic reflections such as headlights. (DOK 3)
g. Relate the location of the filament to high beam and low beam operation. (DOK 3)
h. Discuss rearview mirrors as convex mirrors and why objects appear smaller than they actually are. (DOK 3)
i. Discuss how "night view" device was on the interior rear-view mirror. (DOK 3)

Suggested Teaching Strategies

- Using a battery, headlights, and a switch and or dimmer switch. Discuss the circuits and components. Using a wiring diagram the students will wire the circuit and test. Results will be recorded on the job sheet. E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, W1, W2, W3, W4, W5, S1, S2, M1, M2, CS1, CS2, CS3, CS4, CS5, T1, T4, T5, T6
- Have students give an illustrated lecture to discuss the use of lighting systems and theories of operation in current year model vehicles. Field trip: Take students to a local dealer to view equipment and see a demonstration of diagnostic test equipment. Have students record information in their journals. E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, W1, W2, W3, W4, W5, S1, S2, M1, M2, CS1, CS2, CS3, CS4, CS5, T1, T3, T4, T5, T6
- Provide students with a set of electrical/electronic schematics or blueprints, and have students interpret these documents related to a customer complaint. Upon diagnosing the problem and a solution, the student will complete the job sheet to include a detailed written explanation of the problem, parts, labor, and the time required to complete the job. E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, W1, W2, W3, W4, W5, S1, S2, M1, M2, CS1, CS2, CS3, CS4, CS5, T1, T3
- Using the Today's Class Web site, the students will complete the assigned unit(s). E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, W1, W2, W3, W4, W5, S1, S2, M1, M2, CS1, CS2, CS3, CS4, CS5, T1, T2, T3, T4, T5, T6
- Explain and demonstrate each task. The student will perform the task and complete the appropriate job sheet. The **Headlight and Bulb Rubric** is an example rubric and can be changed for other tasks. E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, W1, W2, W3, W4, W5, S1, S2, M1, M2, CS1, CS2, CS3, CS4, CS5

Suggested Assessment Strategies

- Grade student's assignment to interpret an electrical/electronic schematic for accuracy.
- Have students insert artifacts about the problems and solutions from this competency into their journals. Evaluate the journal using the **Journal Rubric**.
- Evaluate the field trip using the **Field Trip Checklist**.

- Evaluate the Today's Class quiz(zes) (if applicable) for each unit and job sheet(s) (if applicable). The job sheets are printed and evaluated using the **Job Sheet/Performance Rubric**.
- Evaluate each task/job sheet using the **Job Sheet/Performance Rubric**.
- Evaluate the task/job sheet using the **Headlight and Bulb Rubric**.

Competency 2: Apply concepts of gauges, warning devices, and driver information systems by performing inspection, diagnosis, and repair, if needed. (DOK 3) ASE, PHY

Suggested Objectives

a. Inspect and test gauges and gauge sending units for cause of intermittent, high, low, or no gauge readings; determine necessary action. (DOK 3)
b. Inspect and test connectors, wires, and printed circuit boards of gauge circuits; determine necessary action. (DOK 3)
c. Diagnose the cause of incorrect operation of warning devices and other driver information systems; determine necessary action. (DOK 3)
d. Discuss blinker operation and wiper speed control in terms of capacitors and resistors. (DOK 3)

Suggested Teaching Strategies

- Using a vehicle, "bug" a system. The student will inspect and diagnose the system and record results on the performance job sheet. E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, W1, W2, W3, W4, W5, S1, S2, M1, M2, CS1, CS2, CS3, CS4, CS5, T1, T3
- On index cards, describe different parts and functions of gauges, warning devices, and driver information systems. Give a card to each student. Have students turn the cards over and identify the part that is being described. Divide students into two groups. Ask one group to stand and form a circle. When the circle is formed, have students face the outside of the circle. Have students from the second group stand facing students in the inside circle. Have students describe the part listed on the index card. Have partners identify the part. Have the outside circle move to the left until they have practiced identifying parts with everyone in the circle. E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, W1, W2, W3, W4, W5, S1, S2, S3, M1, M2, M3, M4, M5, M6, M7, M8, CS1, CS2, CS3, CS4, CS5, T1, T2, T3, T4, T5, T6
- Using the Today's Class Web site, the students will complete the assigned unit(s). E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, W1, W2, W3, W4, W5, S1, S2, M1, M2, CS1, CS2, CS3, CS4, CS5, T1, T2, T3, T4, T5, T6
- Explain and demonstrate each task. The student will perform the task and complete the appropriate job sheet. The **Gauge and Gauge Sending Unit Rubric** is an example rubric and can be changed for other tasks. E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, W1, W2, W3, W4, W5, S1, S2, M1, M2, CS1, CS2, CS3, CS4, CS5

Suggested Assessment Strategies

- Evaluate each task/job sheet using the **Job Sheet/Performance Rubric**.
- Have students draw or find pictures of the parts and write a description of their functions in their journals. Evaluate using the **Journal Rubric**.
- Evaluate the Today's Class quiz(zes) (if applicable) for each unit and job sheet(s) (if applicable). The job sheets are printed and evaluated using the **Job Sheet/Performance Rubric**.
- Evaluate the task/job sheet using the **Gauge and Gauge Sending Unit Rubric**.

Competency 3: Apply concepts of horn and wiper/washer systems by performing inspection, diagnosis, and repair, if needed. (DOK 3)[ASE,]

Suggested Objectives

a. Diagnose incorrect horn operation; determine necessary action. (DOK 3)
b. Diagnose incorrect wiper/washer operation; perform necessary action. (DOK 3)
c. Diagnose wiper speed control and park problems; perform necessary action. (DOK 3)

Suggested Teaching Strategies

- Using a vehicle, "bug" a system. The student will inspect and diagnose the system. Using the appropriate trouble-tree chart, the student will diagnose the problem and provide solutions. As a class, the students will debate the problem and solution exercise. They will record information on the performance job sheet.[E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, W1, W2, W3, W4, W5, S1, S2, M1, M2, CS1, CS2, CS3, CS4, CS5, T1, T4, T5, T6]
- Using a wiring schematic, have the students interpret and troubleshoot the assigned system, diagnose and determine the needed action, research appropriate electronic service information, and record information on the performance job sheet.[E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, W1, W2, W3, W4, W5, S1, S2, M1, M2, M3, CS1, CS2, CS3, CS4, CS5]
- Using the Today's Class Web site, the students will complete the assigned unit(s).[E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, W1, W2, W3, W4, W5, S1, S2, M1, M2, CS1, CS2, CS3, CS4, CS5, T1, T2, T3, T4, T5, T6]
- Explain and demonstrate each task. The student will perform the task and complete the appropriate job sheet.[E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, W1, W2, W3, W4, W5, S1, S2, M1, M2, CS1, CS2, CS3, CS4, CS5]

Suggested Assessment Strategies

- Evaluate the Today's Class quiz(zes) (if applicable) for each unit and job sheet(s) (if applicable). The job sheets are printed and evaluated using the **Job Sheet/Performance Rubric**.
- Evaluate each task/job sheet using the **Job Sheet/Performance Rubric**.

Competency 4: Apply concepts of accessories by performing inspection, diagnosis, and repair, if needed. (DOK 3)[ASE,]

Suggested Objectives

a. Diagnose and repair motor driven accessory circuits, air conditioner/ heater systems, heated accessories, electrical locks, radios, body electronics, communication systems, and anti-theft systems. (DOK 3)
b. Disarm and enable the air bag system for vehicle service. (DOK 3)
c. Diagnose body electronic system circuits using a scan tool; determine necessary action. (DOK 3)
d. Diagnose incorrect heated glass, mirror, or seat operation; determine necessary action. (DOK 3)

Suggested Teaching Strategies

- Using a wiring schematic, have the students interpret and troubleshoot the assigned system, diagnose and determine the needed action, research appropriate electronic service information, and record information on the performance job sheet.[E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, W1, W2, W3, W4, W5, S1, S2, M1, M2, CS1, CS2, CS3, CS4, CS5, T1, T4, T5, T6]
- Create two sets of index cards. One set should contain questions related to different

components and functions of accessory systems. The second set should contain the answers to questions. To challenge students, prepare more answer cards than question cards. Distribute answer cards to students. Place a stack of question cards face down in the middle or front of the room. Designate a student to turn over and read a question card. Have students check their answer cards and see if they have the correct answer. If a student thinks he or she has the correct answer, have that student read and defend his or her answer. If a match is made, the student with the answer turns over and reads the next question aloud. E1, E2, E3, E4, E5, E6, S1, S2, S3, M1, M2, CS1, CS2, CS3, CS4, CS5

- Using the Today's Class Web site, the students will complete the assigned unit(s). E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, W1, W2, W3, W4, W5, S1, S2, M1, M2, CS1, CS2, CS3, CS4, CS5, T1, T2, T3, T4, T5, T6
- Explain and demonstrate each task. The student will perform the task and complete the appropriate job sheet. E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, CS1, CS2, CS3, CS4, CS5

Suggested Assessment Strategies

- Monitor index card exercise for participation and accuracy.
- Evaluate each task/job sheet using the **Job Sheet/Performance Rubric**.
- Evaluate the Today's Class quiz(zes) (if applicable) for each unit and job sheet(s) (if applicable). The job sheets are printed and evaluated using the **Job Sheet/Performance Rubric**.

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For additional references, activities, and Web resources, please refer to the Information and Computer Technology B.R.I.D.G.E. Web site: http://www.rcu.blackboard.com (available only to registered users).

Suggested Rubrics and Checklists

Field Trip Checklist

_____ 1. The student arrived at the designated meeting place on time with all materials and supplies required for the field trip.

_____ 2 The student observed all safety rules and policies while traveling to and participating in the field trip.

_____ 3. The student demonstrated interest in the content of the field trip by paying attention to the exhibits and speakers, asking pertinent questions, and taking notes.

_____ 4. The student exhibited a positive attitude toward the events and activities of the field trip.

_____ 5. The student remained on task throughout the field trip.

_____ 6. The student exhibited cooperative workplace skills with other students throughout the field trip.

Headlight and Bulb Rubric

Rate the ability of the student to perform headlight and bulb tasks shown below using the following scale:

4 Proficient – Can perform consistently and independently with proficiency of an incumbent worker
3 Intermediate – Can perform the task but may require further practice to become as proficient as an incumbent worker
2 Introductory – Can perform the task but some coaching and further training are required.
1 Limited – Can perform the task with extensive coaching. Further training and practice are required.

Task	Rating
Safety procedures	
Complete work order to include customer information (vehicle identifying information, customer concern, and related service history).	
Inspect headlights and/or bulbs.	
Replace headlights and/or bulbs.	
Aim headlights and bulbs.	

Comments:

Gauge and Gauge Sending Unit Rubric

Rate the ability of the student to perform gauge and gauge sending unit tasks shown below using the following scale:

4 Proficient – Can perform consistently and independently with proficiency of an incumbent worker
3 Intermediate – Can perform the task but may require further practice to become as proficient as an incumbent worker
2 Introductory – Can perform the task but some coaching and further training are required.
1 Limited – Can perform the task with extensive coaching. Further training and practice are required.

Task	Rating
Safety procedures	
Complete work order to include customer information (vehicle identifying information, customer concern, and related service history).	
Inspect and test gauges and gauge sending units for cause of intermittent, high, low, or no gauge readings.	
Determine necessary action.	

Comments:

Job Sheet/Performance Rubric

Advanced (3 points)	Proficient (2 points)	Basic (1 point)	Unacceptable (0 points)
Student follows all safety regulations without prompting.	Student follows all safety regulations but may require limited reminders or prompting.	Student follows all or nearly all safety regulations but requires significant reminders.	Student does not follow most safety regulations.
Student properly diagnoses problem according to manufacturer guidelines and specifications within manufacturer-specified time limits.	Student properly diagnoses problem according to manufacturer guidelines and specifications but may take additional time.	Student properly diagnoses problem according to manufacturer guidelines and specifications with limited assistance.	Student's work is not performed to manufacturer guidelines and specifications.
Student quickly and accurately diagnoses problems and accurately determines causes of malfunction based on information obtained from resources.	Student accurately diagnoses problems and accurately determines causes of malfunction based on information obtained from resources.	Student diagnoses problem with limited assistance. With limited assistance, student determines causes of malfunction based on information obtained from resources.	Student is unable to diagnose problem.
Job Sheet includes all customer information, lists all requested repairs, and contains correct calculations with no items missing. Written report is accurate and complete and demonstrates thorough understanding of systems, how they operate, safety procedures, and importance of manufacturer recommendations.	Job Sheet includes customer information, lists requested repairs, and contains correct calculations but may include up to two errors or omissions. Written report is accurate and complete and demonstrates solid understanding of systems, how they operate, safety procedures, and importance of manufacturer recommendations.	Job Sheet includes customer information, lists requested repairs, and contains correct calculations but may include up to three errors or omissions. Written report is mostly accurate and complete and demonstrates understanding of types of systems, how they operate, safety procedures, and importance of manufacturer recommendations.	Job Sheet includes customer information, lists requested repairs, and contains correct calculations but may include up to four errors or omissions. Written report is inaccurate and/or incomplete or indicates limited to no understanding of types of systems, how they operate, safety procedures, and importance of manufacturer recommendations.

Journal Rubric

NAME: DATE: PERIOD:

CATEGORY	Excellent 4	Very Good 3	Satisfactory 2	Needs Work 1	SCORE
Writing Quality	There is a strong writing style and ability to express concepts learned. Excellent spelling, grammar, syntax, spelling, etc.	There is a good writing style and ability to express concepts learned. Very good grammar, syntax, spelling, etc.	There is a writing style that conveys meaning adequately. Some minor grammatical, syntax, and spelling errors	There is difficulty in expressing concepts. There is limited syntax. There are noticeable grammatical and spelling mistakes.	
Content	Clear and complete description of the activity is recorded. All major points are documented.	Very good description of the activity is recorded. Most major points are documented.	Good description of the activity is recorded. Some major points have been omitted.	Limited description of the activity is recorded. Very few major points are documented.	
Insight and Understanding	Definite insights into the implications of the activity are recorded. Awareness of complexity of issues and situations is present.	Some insight into the issue or situation is recorded. Some sense of complexity is present.	Insight is present from a more simplistic standpoint.	Only limited insight into the issue or situation is recorded.	
Application	Content of the activity is connected to the student's personal life and goals.	Content of the activity is connected to the field of automotive service.	Content of the activity is related to life in general.	Only limited connections are made between the content of the activity and the surrounding world.	
				Total Score	

Comments:

Competency 1: Identify and describe the major systems and components of an automobile. (DOK 2) ASB, ASE, AST, AEP , PHY

Suggested Objectives

a. Identify the major components of the following major systems and describe their purposes and/or functions:
   1. Power train(DOK 2)
   2. Chassis, steering, and suspension(DOK 2)
   3. Fuel(DOK 2)
   4. Electrical(DOK 2)
   5. Cooling(DOK 2)
   6. Exhaust(DOK 2)

b. Describe the operation of a four-stroke cycle engine. (DOK 2)
c. Discuss power as Work/Time = Force * Distance/Time. (DOK 2)
d. Relate speed to power; as V increases, power = work/time = energy/time also increases, so fuel consumption increases with the car's speed. (DOK 2)
e. Research/plot graph of fuel consumption miles per gallon versus speed. (DOK 2)
f. Describe the use of electronics and computer control in modern automobiles. (DOK 2)

Suggested Teaching Strategies

- Introduce job opportunities that are available in a dealership and ASE pay structures. Show a video on job opportunities, and display salary ranges for students to review. Relate higher salary, achievement of ASE certifications (more is better), and satisfactory job completion. Students will interview a practicing ASE-certified technician and others at the dealership. Students should present findings in class and record the findings in their journals. E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, W1, W2, W3, W4, W5,, M1, M2, CS1, CS2, CS3, CS4, CS5, T1, T4, T5, T6
- Students will view an automobile in which the parts and/or systems are identified; then they will complete a job sheet that identifies each part and system. E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, W1, W2, W3, W4, W5, M1, M2, CS1, CS2, CS3, CS4, CS5, T1, T4, T5, T6
- System to component match-up: Using manuals, textbooks, and Web sites, students will match parts and systems to the various automobile systems. E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, W1, W2, W3, W4, W5, M1, M2, CS1, CS2, CS3, CS4, CS5, T1, T4, T5, T6

Suggested Assessment Strategies

- Students will present the interview responses to the class. The class will discuss the responses. Evaluate journals using the **Journal Rubric**.
- Evaluate the task/job sheet using the **Major Components Rubric** or the **Job Sheet/Performance Rubric** for other tasks.
- Evaluate the match-up worksheet for accuracy.

Competency 2: Inspect and perform general maintenance (lubrication, oils, and fluids). (DOK 2) ASB, ASE, AST, AEP

Suggested Objectives

a. Discuss the importance of regularly scheduled maintenance procedures as outlined in the owner's manual and related to vehicle performance and longevity. (DOK 2)
b. Complete a work order and maintenance record for a given vehicle. (DOK 2)
c. Visually inspect the engine lubrication system for leaks, and determine needed repairs. (DOK 2)
d. Select proper lubricants and filters for lubrication service. (DOK 2)
e. Change engine oil and filter according to manufacturer's specifications and in accordance with disposal procedures. (DOK 2)
f. Perform a chassis and body lubrication. (DOK 2)
g. Inspect and service as needed other filters on the engine including air, fuel, PCV valve, crankcase vent filters, and so forth. (DOK 2)
h. Conduct a general preventive maintenance inspection of hoses and belts, fluid levels, wiper blades, headlights and accessory lights, tires, exhaust, shocks, and so forth; repair/replace/adjust as needed. (DOK 2)
i. Clean and service a battery including case, cables, and connections, and check electrolyte level (if applicable). (Maintain electronic memory functions while cleaning.). (DOK 2)

Suggested Teaching Strategies

- Inform the students of problems if maintenance schedules are not performed on an automobile. Step 1: Students are given an owner's manual from three vehicles; they will graph each procedure for each vehicle, time for each procedure, and total cost for parts, labor, and supplies. Step 2: Students will then take each procedure and estimate the cost of repairing or replacing the system if the maintenance procedures are not followed. Step 3: Students will debate their findings and draw conclusions. E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, W1, W2, W3, W4, W5, S1, M1, M2, CS1, CS2, CS3, CS4, CS5
- Assign a job sheet (repair order) for a preventive maintenance service. Student will complete the job sheet with all satisfactory information (parts and supplies used, labor, and proper disposal of hazardous waste and materials). E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, W1, W2, W3, W4, W5, S1, M1, M2
- MSDS sheets for items that are currently used in the shop are given to each student. Each student will receive a different MSDS sheet. Students review sheets, compare the topics on each MSDS sheet, and present their findings to the class using a PowerPoint presentation. E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, W1, W2, W3, W4, W5, S1, M1, M2, CS1, CS2, T1, T2, T3, T4, T5, T6
- Using the Today's Class Web site, the students will complete the assigned unit(s). E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, W1, W2, W3, W4, W5, S1, M1, M2, CS1, CS2, CS3, CS4, CS5, T1, T2, T3, T4, T5, T6
- Explain and demonstrate each task. The student will perform the task and complete the appropriate job sheet. The **Preventive Maintenance Rubric** is an example rubric and can be changed for other tasks.

Suggested Assessment Strategies

- Evaluate class discussion observing student reactions.
- Evaluate the debate using the **Debate Rubric**.
- Evaluate the task/job sheet using the **Preventive Maintenance Rubric** or the **Job Sheet/Performance Rubric** for other tasks.
- Evaluate the MSDS presentations using the **Presentation Assessment Rubric**.

Competency 3: Perform cooling system maintenance. (DOK 3) AEP , PHY

Suggested Objectives

a. Inspect and pressure test a cooling system for proper operation; repair and/or replace thermostats, thermostat gasket, hoses, radiator caps, and so forth as needed. (DOK 3)
b. Drain, flush, and refill a cooling system. (DOK 3)
c. Test condition and strength of antifreeze/coolant. (DOK 3)
d. Discuss freezing point depressions and boiling point elevation for covalent solutions such as sugar in water or ethylene glycol (antifreeze) in radiation. Research/plot freezing point depression versus percentage/volume of engine coolant. (DOK 3)

Suggested Teaching Strategies

- Students will analyze different freezing points of antifreeze. Using the graph of freezing points of the antifreeze, students will determine how much antifreeze/water to add to the system to obtain the proper mixture. Students will record steps of operation and information in their journals. E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, W1, W2, W3, W4, W5, S1, M1, M2
- Using the Today's Class Web site, the students will complete the assigned unit(s). E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, W1, W2, W3, W4, W5, S1, M1, M2, CS1, CS2, CS3, CS4, CS5, T1, T2, T3, T4, T5, T6
- Explain and demonstrate each task. The student will perform the task and complete the appropriate job sheet. The **Cooling System Service Rubric** is an example rubric and can be changed for other tasks. E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, CS1, CS2, CS3, CS4, CS5

Suggested Assessment Strategies

- Evaluate the journal using the **Journal Rubric**.
- Evaluate the task/job sheet using the **Cooling System Service Rubric** or the **Job Sheet/Performance Rubric** for other tasks.

Competency 4: Perform tire and wheel diagnosis and repair. (DOK 2) AST

Suggested Objectives

a. Diagnose and inspect tire wear and inflation; perform necessary actions. (DOK 2)
b. Diagnose and repair wheel/tire vibration, shimming, and noise. (DOK 2)
c. Rotate tires following manufacturer's specifications. (DOK 2)
d. Diagnose and repair vehicle pull (lead) problems. (DOK 2)
e. Remove, inspect, and repair tire and wheel assemblies. (DOK 2)

Suggested Teaching Strategies

- Discuss changing to custom rims and tires while keeping the same tire diameter. Examples of common tire sizes are given to each student. Students will calculate custom rims and tire size to match manufacturer's recommended sizes. E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, W1, W2, W3, W4, W5, S1, M1, M2, CS1, CS2, CS3, CS4, CS5
- Divide students into groups; copy the wear chart to a poster or notebook. Use the chart to inspect and evaluate tires and categorize each. E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, W1, W2, W3, W4, W5, S1, M1, M2, CS1, CS2, CS3, CS4, CS5
- Using the Today's Class Web site, the students will complete the assigned unit(s). E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, W1, W2, W3, W4, W5, S1, M1, M2, CS1, CS2, CS3, CS4, CS5, T1, T2, T3, T4, T5, T6
- Explain and demonstrate each task. The student will perform the task and complete the

appropriate job sheet. The **Tire and Wheel Diagnosis and Repair Rubric** is an example rubric and can be changed for other tasks.

Suggested Assessment Strategies

- Evaluate job sheet for accuracy (+/- 1/4) and procedure.
- Evaluate the poster using the **Poster Rubric**.
- Evaluate the task/job sheet using the **Tire and Wheel Diagnosis and Repair Rubric** or **the Job Sheet/Performance Rubric** for other tasks.

Competency 5: Explore general engine components and theories of operation. (DOK 2) AEP, PHY

Suggested Objectives

a. Complete work order to include customer information, vehicle identifying information, customer concern, related service history, cause, and correction. (DOK 2)
b. Identify and interpret engine performance concern; determine necessary action. (DOK 2)
c. Research applicable vehicle and service information, such as engine management system operation, vehicle service history, service precautions, and technical service bulletins. (DOK 2)
d. Locate and interpret vehicle and major component identification numbers (VIN, vehicle certification labels, and calibration decals). (DOK 2)
e. Inspect engine assembly for fuel, oil, coolant, and other leaks; determine necessary action. (DOK 2)
f. Diagnose abnormal engine noise or vibration concerns; determine necessary action. (DOK 2)
g. Diagnose abnormal exhaust color, odor, and sound; determine necessary action. (DOK 2)
h. Perform engine absolute (vacuum/boost) manifold pressure tests; determine necessary action. (DOK 2)
i. Perform cylinder power balance test; determine necessary action. (DOK 2)
j. Perform cylinder cranking compression tests; determine necessary action. (DOK 2)
k. Perform engine running compression test; determine necessary action. (DOK 2)
l. Perform cylinder leakage test; determine necessary action. (DOK 2)
m. Diagnose engine mechanical, electrical, electronic, fuel, and ignition concerns with an oscilloscope and/or engine diagnostic equipment; determine necessary action. (DOK 2)
n. Verify engine operating temperature; determine necessary action. (DOK 2)
o. Perform cooling system pressure tests; check coolant condition; inspect and test radiator, pressure cap, coolant recovery tank, and hoses; perform necessary action. (DOK 2)
p. Verify correct camshaft timing. (DOK 2)
q. Discuss operation of oscilloscope as plot of voltage versus time. (DOK 2)
r. Discuss frequency and period and their relationship as it relates to oscilloscope operations. (DOK 2)

Suggested Teaching Strategies

- Using the smart board, http://www.gmperformanceparts.com/, the students will build a variety of engines. Discuss the different component choices and the performance level of each. E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, W1, W2, W3, W4, W5, S1, S2, M1, M2, M3, CS1, CS2, CS3, CS4, CS5, T1, T4, T5, T6
- Show transparencies of the engine components, and have the students draw different parts and write a description of those parts. Engine components and definitions will be separated and divided among the students. Students will then match components and definitions. E1, E2,

E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, W1, W2, W3, W4, W5, S1, S2, M1, M2, CS1, CS2, CS3, CS4, CS5

- Discuss theories of operation, and show examples of different types of general engine components including their operating principles. Assign a theory of operation and a general engine component to each student. Have students search the Magnolia database for an article for each. Have students use information from their search to complete a Venn diagram to compare and contrast the different types of clutches. Have students summarize their Venn diagram and important components from the articles. E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, W1, W2, W3, W4, W5, S1, S2, M1, M2, CS1, CS2, CS3, CS4, CS5, T1, T4, T5, T6
- Using the Today's Class Web site, the students will complete the assigned unit(s). E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, W1, W2, W3, W4, W5, S1, M1, M2, CS1, CS2, CS3, CS4, CS5, T1, T2, T3, T4, T5, T6
- Explain and demonstrate each task. The student will perform the task and complete the appropriate job sheet. The **Engine Performance Cooling System Pressure Test Rubric**, the **Visual Inspection of the Exhaust System Checklist**, and the **Cranking Engine Cylinder Compression Test with the Throttle Closed Checklist** are examples of rubrics and checklists and can be changed for other tasks. E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, M1, M2, CS1, CS2, CS3, CS4, CS5

Suggested Assessment Strategies

- Evaluate class by observation. Students can write journal entries about engine options and comparisons of the different parts.
- Evaluate the component activity by asking the students what part they are in the engine, their location, and function in the engine. Switch parts and re-question.
- Evaluate the Today's Class quiz(zes) (if applicable) for each unit and job sheet(s) (if applicable). The job sheets are printed and evaluated using the **Job Sheet/Performance Rubric**.
- Evaluate the task/job sheet using the **Job Sheet/Performance Rubric**.
- Evaluate using the **Engine Performance Cooling System Pressure Test Rubric**.
- Evaluate using the **Visual Inspection of the Exhaust System Checklist**.
- Evaluate using the **Cranking Engine Cylinder Compression Test with the Throttle Closed Checklist.**

Competency 6: Apply concepts of computerized engine controls by performing inspection, diagnosis, and repair, if needed. (DOK 3) AEP

Suggested Objectives

a. Discuss theory and operation of engine controls. (DOK 3)
b. Retrieve, record, and clear stored diagnostic codes on OBD I and OBD II systems. (Clear codes when applicable.) (DOK 3)
c. Diagnose emissions and drivability concerns with stored and non-stored diagnostic trouble codes; determine necessary actions. (DOK 3)
d. Check for module communication (including CAN/BUS systems) errors, and interpret scan tool data. (DOK 3)
e. Inspect, test, and repair computerized engine control system sensors, power train control modules, actuators, and circuits using a graphing millimeter/digital storage oscilloscope. (DOK 3)
f. Access and use service information to perform step-by-step diagnosis. (DOK 3)
g. Obtain and interpret scan tool data. (DOK 3)

Suggested Teaching Strategies

- Discuss the history of computerized engine controls from pre-computer, OBD I, and OBD II. Divide the students into groups. Assign an engine control system to each group. Students should use text, manuals, and the Internet to research their control system. Moderate a debate on each system's advantages and disadvantages. Students should record information in their journals.[E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, W1, W2, W3, W4, W5, S1, S2, S3, M1, M2, M3, CS1, CS2, CS3, CS4, CS5, T1, T4, T5, T6]
- Using the Today's Class Web site, the students will complete the assigned unit(s).[E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, W1, W2, W3, W4, W5, S1, M1, M2, CS1, CS2, CS3, CS4, CS5, T1, T4, T5, T6]
- Explain and demonstrate each task. The student will perform the task and complete the appropriate job sheet. The **Diagnose the Causes of Emissions or Drivability Concerns Using Stored Diagnostic Trouble Codes Checklist** is an example and can be changed for other tasks.[E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, CS1, CS2, CS3, CS4, CS5]

Suggested Assessment Strategies

- Evaluate the debate using the **Debate Rubric**.
- Evaluate the Today's Class quiz(zes) (if applicable) for each unit and job sheet(s) (if applicable). The job sheets are printed and evaluated using the **Job Sheet/Performance Rubric**.
- Evaluate the task/job sheet using the **Job Sheet/Performance Rubric**.
- Evaluate the task using the **Diagnose the Causes of Emissions or Drivability Concerns Using Stored Diagnostic Trouble Codes Checklist**.

Competency 7: Apply concepts of ignition systems by performing inspection, diagnosis, and repair, if needed. (DOK 3)[AEP, PHY]

Suggested Objectives

a. Discuss theory and operation of ignition systems. (DOK 3)
b. Diagnose ignition-system-related problems on vehicles with electronic ignition (EI) systems; determine necessary action. (DOK 3)
c. Diagnose ignition-system-related problems on vehicles with distributor ignition (DI) systems; determine necessary action. (DOK 3)
d. Inspect and test ignition, primary and secondary circuit wiring, components, and pickup sensors or triggering devices; perform necessary action. (DOK 3)
e. Inspect, test, and service the distributor. (DOK 3)
f. Check and adjust ignition system timing advance/retard. (DOK 3)
g. Discuss electrostatic force F = k Q1Q2/d2 and resistance to puncture for air (30,000 V/cm). (DOK 3)
h. Discuss charging effects of points and the spark plug. (DOK 3)

Suggested Teaching Strategies

- Using an ignition system (simulator or vehicle), demonstrate how voltage "jumps" an air gap using a spark plug or an adjustable spark tester. Discuss primary and secondary systems. Divide the students into two groups. Assign each group a primary or secondary system. Students should use text, manuals, and the Internet to research their system. Moderate a debate on each system's advantages and disadvantages.[E1, E2, E3, E4, E5, E6, R1, R2, R3,

R4, R5, R6, W1, W2, W3, W4, W5, S1, S2, S3, M1, M2, CS1, CS2, CS3, CS4, CS5, T1, T4, T5, T6

- Using the Today's Class Web site, the students will complete the assigned unit(s). E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, W1, W2, W3, W4, W5, M1, M2, CS1, CS2, CS3, CS4, CS5, T1, T2, T3, T4, T5, T6
- Explain and demonstrate each task. The student will perform the task and complete the appropriate job sheet. The **Diagnose Ignition System Problems (Electronic Ignition System) Checklist** is an example and can be changed for other tasks. E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, CS1, CS2, CS3, CS4, CS5

Suggested Assessment Strategies

- Evaluate the debate by using the **Debate Rubric**.
- Evaluate the Today's Class quiz(zes) (if applicable) for each unit and job sheet(s) (if applicable). The job sheets are printed and evaluated using the **Job Sheet/Performance Rubric.**
- Evaluate the task/job sheet using the **Job Sheet/Performance Rubric** for other tasks.
- Evaluate the task using the **Diagnose Ignition System Problems (Electronic Ignition System) Checklist**.

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For additional references, activities, and Web resources, please refer to the Information and Computer Technology B.R.I.D.G.E. Web site: http://www.rcu.blackboard.com (available only to registered users).

Suggested Rubrics and Checklists

Major Components Rubric

Rate the ability of the student to identify major components using the following scale:

4 Proficient – Can perform consistently and independently with proficiency of an incumbent worker

3 Intermediate – Can perform the task but may require further practice to become as proficient as an incumbent worker

2 Introductory – Can perform the task but some coaching and further training are required.

1 Limited – Can perform the task with extensive coaching. Further training and practice are required.

Task - Student can properly identify and describe the purpose and function of the following systems.	**Rating**
Power train	
Chassis, steering, and suspension	
Fuel	
Electrical	
Cooling	
Exhaust	

Comments:

Preventive Maintenance Rubric

Rate the ability of the student to perform preventive maintenance tasks shown below using the following scale:

4 Proficient – Can perform consistently and independently with proficiency of an incumbent worker

3 Intermediate – Can perform the task but may require further practice to become as proficient as an incumbent worker

2 Introductory – Can perform the task but some coaching and further training are required.

1 Limited – Can perform the task with extensive coaching. Further training and practice are required.

Task	Rating
Safety procedures	
Conduct a general preventive maintenance, and discuss the repair/replace/adjust schedules.	
Inspection of hoses	
Inspection of belts	
Fluid levels	
Wiper blades	
Headlights	
Tires	
Exhaust	
Shocks	

Comments:

Cooling System Service Rubric

Rate the ability of the student to perform cooling system service tasks shown below using the following scale:

4 Proficient – Can perform consistently and independently with proficiency of an incumbent worker

3 Intermediate – Can perform the task but may require further practice to become as proficient as an incumbent worker

2 Introductory – Can perform the task but some coaching and further training are required.

1 Limited – Can perform the task with extensive coaching. Further training and practice are required.

Task	Rating
Safety procedures	
Inspect and pressure test a cooling system.	
Drain, flush, and refill a cooling system.	
Test condition and strength of antifreeze/coolant.	

Comments:

Tire and Wheel Diagnosis and Repair Rubric

Rate the ability of the student to perform tire and wheel diagnosis and repair tasks shown below using the following scale:

4 Proficient – Can perform consistently and independently with proficiency of an incumbent worker

3 Intermediate – Can perform the task but may require further practice to become as proficient as an incumbent worker

2 Introductory – Can perform the task but some coaching and further training are required.

1 Limited – Can perform the task with extensive coaching. Further training and practice are required.

Task	Rating
Safety procedures	
Diagnose and inspect tire wear and inflation.	
Diagnose and repair wheel/tire vibration, shimmying, and noise.	
Diagnose and repair vehicle pull (lead) problems.	
Rotate tires following manufacturer's specifications.	
Diagnose and repair vehicle pull (lead) problems.	
Remove, inspect, and repair tire and wheel assemblies.	

Comments:

Engine Performance Cooling System Pressure Test Rubric

Rate the ability of the student to perform engine performance cooling system pressure test tasks shown below using the following scale:

4 Proficient – Can perform consistently and independently with proficiency of an incumbent worker
3 Intermediate – Can perform the task but may require further practice to become as proficient as an incumbent worker
2 Introductory – Can perform the task but some coaching and further training are required.
1 Limited – Can perform the task with extensive coaching. Further training and practice are required.

Task	Rating
Safety procedures	
Check coolant condition	
Inspect radiator	
Test radiator	
Inspect pressure cap	
Inspect coolant recovery tank	
Inspect hoses	
Record measurements	

Comments:

Visual Inspection of the Exhaust System Checklist

CAUTION: Use an approved exhaust ventilation system, and all procedures will be according to manufacturer's recommendations.

Task	OK	Not OK
Safety procedures		
Complete work order		
Customer information		
Vehicle identifying information		
Customer concern		
Related service history		
Started cold engine		
Exhaust color(s)		
Exhaust sound(s)		
Exhaust odor(s)		
Warm idle		
Exhaust color(s)		
Exhaust sound(s)		
Exhaust odor(s)		
2,000 rpm		
Exhaust color(s)		
Exhaust sound(s)		
Exhaust odor(s)		

Comments:

Cranking Engine Cylinder Compression Test with the Throttle Closed Checklist

CAUTION: Use an approved exhaust ventilation system.

Task	OK	Not OK
Safety procedures		
Complete work order Customer information Vehicle identifying information Customer concern Related service history		
Cylinder First Reading Highest Reading 1 2 3 4 5 6 7 8		

Comments:

Diagnose the Causes of Emissions or Drivability Concerns Using Stored Diagnostic Trouble Codes Checklist

CAUTION: Use an approved exhaust ventilation system, and all procedures will be according to manufacturer's recommendations.

Task	OK	Not OK
Safety procedures		
Complete work order Customer information Vehicle identifying information Customer concern Related service history		
Is the system an OBD I or OBD II? Record results below.		
Connect the scan tool to connector. Check for stored diagnostic trouble codes. Record codes below.		

Comments:

Diagnose Ignition System Problems (Electronic Ignition System) Checklist

CAUTION: Use an approved exhaust ventilation system.

Task	OK	Not OK
Safety procedures		
Complete work order		
Customer information		
Vehicle identifying information		
Customer concern		
Related service history		
Identify ignition system concerns. Record below. No start, hard start, poor drivability, power loss, poor mileage, and so forth		
Student will research and record an appropriate procedure to identify the causes of the reported problem. Record below. The instructor will circle OK or Not OK to approve the procedure.	OK	Not OK
Record possible solutions.		

Comments:

Debate Rubric

CATEGORY	Excellent 4	Very Good 3	Satisfactory 2	Needs Work 1	SCORE
Information	All information was accurate and clear.	Most information was accurate and clear.	Most information was accurate but not completely thorough or clear.	Information was inaccurate or needed clarification.	
Rebuttal	All counterarguments were accurate, relevant, and strong.	Most counter-arguments were accurate, relevant, and strong.	All counterarguments were accurate and relevant, but some were weak.	Counterarguments were not accurate or relevant.	
Organization	All arguments were logical and clearly followed a premise.	Most arguments were logical and clearly followed a premise.	Arguments were logical but did not always follow a premise.	Arguments were not logical and/or did not follow a premise.	
Understanding of the Topic	The individual/team clearly understood the topic fully and presented in a convincing manner.	The individual/team clearly understood the topic fully and presented with ease.	The individual/team understood the main points of the topic and presented those well.	The individual/team did not exhibit an adequate understanding of the topic.	
Respect for Other Individual/Team	High respect was displayed in language, responses, and body expressions.	Good respect was displayed in language, responses, and body expressions.	Moderate respect was displayed in language, responses, and body expressions.	Language, responses, and body expressions were consistently disrespectful.	
				TOTAL	

Journal Rubric

NAME: DATE: PERIOD:

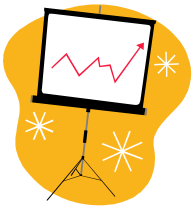
CATEGORY	Excellent 4	Very Good 3	Satisfactory 2	Needs Work 1	SCORE
Writing Quality	There is a strong writing style and ability to express concepts learned. Excellent spelling, grammar, syntax, spelling, etc.	There is a good writing style and ability to express concepts learned. Very good grammar, syntax, spelling, etc.	There is a writing style that conveys meaning adequately. Some minor grammatical, syntax, and spelling errors	There is difficulty in expressing concepts. There is limited syntax. There are noticeable grammatical and spelling mistakes.	
Content	Clear and complete description of the activity is recorded. All major points are documented.	Very good description of the activity is recorded. Most major points are documented.	Good description of the activity is recorded. Some major points have been omitted.	Limited description of the activity is recorded. Very few major points are documented.	
Insight and Understanding	Definite insights into the implications of the activity are recorded. Awareness of complexity of issues and situations is present.	Some insight into the issue or situation is recorded. Some sense of complexity is present.	Insight is present from a more simplistic standpoint.	Only limited insight into the issue or situation is recorded.	
Application	Content of the activity is connected to the student's personal life and goals.	Content of the activity is connected to the field of automotive service.	Content of the activity is related to life in general.	Only limited connections are made between the content of the activity and the surrounding world.	
				Total Score	

Comments:

Poster Rubric

	Exemplary 4 Points	Accomplished 3 Points	Developing 2 Points	Beginning 1 Point	Score
Required Content	The poster includes all required content elements as well as additional information.	All required content elements are included on the poster.	All but one of the required content elements are included on the poster.	Several required content elements are missing.	
Labels	All items of importance on the poster are clearly labeled with labels that are easy to read.	Almost all items of importance on the poster are clearly labeled with labels that are easy to read.	Many items of importance on the poster are clearly labeled with labels that are easy to read.	Labels are too small to read, or no important items are labeled.	
Attractiveness	The poster is exceptionally attractive in terms of design, layout, and neatness.	The poster is attractive in terms of design, layout, and neatness.	The poster is acceptably attractive though it may be a bit messy.	The poster is distractingly messy or very poorly designed.	
Grammar	There are no grammatical or mechanical mistakes on the poster.	There are 1 to 2 grammatical or mechanical mistakes on the poster.	There are 3 to 4 grammatical or mechanical mistakes on the poster.	There are more than 4 grammatical or mechanical mistakes on the poster.	

Presentation Assessment Rubric



NAME: DATE: PERIOD:

	Exemplary 4 points	Accomplished 3 points	Developing 2 points	Beginning 1 point	Score
Content	Clear, appropriate, and correct	Mostly clear, appropriate, and correct	Somewhat confusing, incorrect, or flawed	Confusing, incorrect, or flawed	
Clarity	Logical, interesting sequence	Logical sequence	Unclear sequence	No sequence	
Presentation	Clear voice and precise pronunciation	Clear voice and mostly correct pronunciation	Low voice and incorrect pronunciation	Mumbling and incorrect pronunciation	
Visual Aids	Attractive, accurate, and grammatically correct	Adequate, mostly accurate, and few grammatical errors	Poorly planned, somewhat accurate, and some grammatical errors	Weak, inaccurate, and many grammatical errors	
Length	Appropriate length	Slightly too long or short	Moderately too long or short	Extremely too long or short	
Eye Contact	Maintains eye contact, seldom looking at notes	Maintains eye contact most of time but frequently returns to notes	Occasionally uses eye contact but reads most of information	No eye contact because reading information	
				TOTAL	

Comments:

Job Sheet/Performance Rubric

Advanced (3 points)	Proficient (2 points)	Basic (1 point)	Unacceptable (0 points)
Student follows all safety regulations without prompting.	Student follows all safety regulations but may require limited reminders or prompting.	Student follows all or nearly all safety regulations but requires significant reminders.	Student does not follow most safety regulations.
Student properly diagnoses problem according to manufacturer guidelines and specifications within manufacturer-specified time limits.	Student properly diagnoses problem according to manufacturer guidelines and specifications but may take additional time.	Student properly diagnoses problem according to manufacturer guidelines and specifications with limited assistance.	Student's work is not performed to manufacturer guidelines and specifications.
Student quickly and accurately diagnoses problems and accurately determines causes of malfunction based on information obtained from resources.	Student accurately diagnoses problems and accurately determines causes of malfunction based on information obtained from resources.	Student diagnoses problem with limited assistance. With limited assistance, student determines causes of malfunction based on information obtained from resources.	Student is unable to diagnose problem.
Job Sheet includes all customer information, lists all requested repairs, and contains correct calculations with no items missing. Written report is accurate and complete and demonstrates thorough understanding of systems, how they operate, safety procedures, and importance of manufacturer recommendations.	Job Sheet includes customer information, lists requested repairs, and contains correct calculations but may include up to two errors or omissions. Written report is accurate and complete and demonstrates solid understanding of systems, how they operate, safety procedures, and importance of manufacturer recommendations.	Job Sheet includes customer information, lists requested repairs, and contains correct calculations but may include up to three errors or omissions. Written report is mostly accurate and complete and demonstrates understanding of types of systems, how they operate, safety procedures, and importance of manufacturer recommendations.	Job Sheet includes customer information, lists requested repairs, and contains correct calculations but may include up to four errors or omissions. Written report is inaccurate and/or incomplete or indicates limited to no understanding of types of systems, how they operate, safety procedures, and importance of manufacturer recommendations.

Competency 1: Apply concepts of fuel, air induction, and exhaust systems by performing inspection, diagnosis, and repair, if needed. (DOK 2)[AEP, PHY]

Suggested Objectives

a. Discuss theory and operation of fuel systems. (DOK 2)
b. Diagnose drivability problems related to fuel systems; determine necessary action. (DOK 2)
c. Replace components related to fuel systems; make required adjustments. (DOK 2)
d. Test electronic fuel, air induction, and fuel-delivery components and circuits; determine necessary action. (DOK 2)
e. Inspect and test the exhaust systems; determine and perform necessary action. (DOK 2)
f. Discuss the causes of atmospheric pressure (weight of the air above a location) and the effect of altitude on pressure and automotive performance. (DOK 2)

Suggested Teaching Strategies

- Using a gallon of gas, discuss how much air it takes to burn the gallon of gas (9,000 gallons of air).[E1, E2, E3, E4, E5, E6, S1, S2, S3, M1, M2, CS1, CS2, CS3, CS4, CS5]
- Using 15 cups of the same size (14 empty cups and 1 full cup of gas), discuss air–fuel ratio, barometric pressure, and engine load. Allow the students to adjust the ratio of full and empty cups under a variety of operating conditions.[E1, E2, E3, E4, E5, E6, S1, S2, S3, M1, M2, CS1, CS2, CS3, CS4, CS5]
- Using the three systems (fuel, exhaust systems, and air induction), discuss the integration of these systems. Using an engine, pose questions to the students. Students will record the questions in their journals and during the class discussion will analyze changes in each system.
- Using the Today's Class Web site, the students will complete the assigned unit(s).[E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, W1, W2, W3, W4, W5, S1, M1, M2, CS1, CS2, CS3, CS4, CS5, T1, T2, T3, T4, T5, T6]
- Explain and demonstrate each task. The student will perform the task and complete the appropriate job sheet. The **Exhaust Gas Diagnostic Checklist** is an example checklist and can be changed for other tasks.[E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, CS1, CS2, CS3, CS4, CS5]

Suggested Assessment Strategies

- Evaluate class discussions by observing the students.
- Evaluate journals using the **Journal Rubric**.
- Evaluate the Today's Class quiz(zes) (if applicable) for each unit and job sheet(s) (if applicable). The job sheets are printed and evaluated using the **Job Sheet/Performance Rubric**.
- Evaluate the task/job sheet using the **Exhaust Gas Diagnostic Checklist** or the **Job Sheet/Performance Rubric** for other tasks.
- Evaluate each task/job sheet using the **Job Sheet/Performance Rubric**.

Competency 2: Apply concepts of emissions control systems by performing inspection, diagnosis, and repair, if needed. (DOK 3)[AEP]

Suggested Objectives

a. Discuss theory and operation of emissions control systems. (DOK 3)
b. Diagnose emissions control system; determine necessary action. (DOK 3)
c. Inspect, clean, and replace positive crankcase ventilation (PCV) system components. (DOK 3)
d. Inspect, clean, and replace electrical/electronic components of the exhaust gas recirculation (EGR) system. (DOK 3)
e. Inspect and replace the air management system. (DOK 3)

Suggested Teaching Strategies

- Atmospheric pressure: Fill a Ziploc bag with air from the classroom, and quiz the students on the contents of the bag. Discuss the five gases that an automobile emits and the consequences. Have students use the Internet to research emission standards in five different parts of the world. Students will graph or chart the standards, list sources, and write a summary paragraph regarding the findings.[E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, W1, W2, W3, W4, W5, S1, S2, S3, M1, M2, M3, M4, M5, CS1, CS2, CS3, CS4, CS5, T1, T2, T3, T4, T5, T6]
- Quiz the students on the seven systems. After all systems have been named, divide students into groups and assign a system to the group. The groups will draw and label the system, and groups will present a system to the class. Students will test each system on a vehicle, diagnose the problem, provide a solution, and complete the job sheet.[E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, W1, W2, W3, W4, W5, S1, M1, M2, CS1, CS2, CS3, CS4, CS5]
- Using a vehicle and a schematic (under hood or manual), the student will trace and locate emission components and complete the job sheet.[E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, W1, W2, W3, W4, W5, S1, M1, M2, CS1, CS2, CS3, CS4, CS5]
- Using the Today's Class Web site, the students will complete the assigned unit(s).[E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, W1, W2, W3, W4, W5, M1, M2, CS1, CS2, CS3, CS4, CS5, T1, T4, T5, T6]
- Explain and demonstrate each task. The student will perform the task and complete the appropriate job sheet. The **Positive Crankcase Ventilation Checklist** is an example checklist and can be changed for other tasks.[E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, CS1, CS2, CS3, CS4, CS5]

Suggested Assessment Strategies

- Evaluate the graph or chart for accuracy.
- Evaluate the summary paragraph using the **Reflective Writing Rubric**.
- Evaluate each task/job sheet using the **Job Sheet/Performance Rubric**.
- Evaluate trace and locate activity by observation. Question students for understanding. If student is unclear, repeat instructions and pair with another student.
- Evaluate the Today's Class quiz(zes) (if applicable) for each unit and job sheet(s) (if applicable). The job sheets are printed and evaluated using the **Job Sheet/Performance Rubric**.
- Evaluate the task/job sheet using the **Positive Crankcase Ventilation Checklist** or the **Job Sheet/Performance Rubric** for other tasks.

Competency 3: Apply concepts of engine service by performing inspection, diagnosis, and repair, if needed. (DOK 3)[AEP,]

Suggested Objectives

a. Remove and replace the timing belt; verify correct camshaft timing. (DOK 3)
b. Perform cylinder cranking compression and leakage test. (DOK 3)
c. Describe common parts failures and wear points in a four-cycle engine. (DOK 3)
d. Diagnose unusual engine noise and vibrations, and determine needed actions. (DOK 3)
e. Diagnose unusual exhaust color, odor, and sound; determine needed repairs. (DOK 3)
f. Perform engine running compression test; determine necessary action. (DOK 3)
g. Identify hybrid vehicle internal combustion engine service precautions. (DOK 3)

Suggested Teaching Strategies

- Using an engine on a stand, students will disassemble the engine; the class will use the Internet, manuals, and text to research procedures, specifications, and locations of the components. Students will complete the job sheet and will properly assemble the components to specifications. E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, W1, W2, W3, W4, W5, S1, M1, M2, CS1, CS2, CS3, CS4, CS5, T1, T4, T5, T6
- Using a compression gauge, students will perform a compression test and graph results. E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, W1, W2, W3, W4, W5, M1, M2, CS1, CS2, CS3, CS4, CS5
- Using the Today's Class Web site, the students will complete the assigned unit(s). E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, W1, W2, W3, W4, W5, S1, S2, S3, M1, M2, CS1, CS2, CS3, CS4, CS5, T1, T2, T3, T4, T5, T6
- Explain and demonstrate each task. The student will perform the task and complete the appropriate job sheet. The **Replace Timing Belt Checklist** is an example checklist and can be changed for other tasks. E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, CS1, CS2, CS3, CS4, CS5

Suggested Assessment Strategies

- Evaluate each task/job sheet using the **Job Sheet/Performance Rubric**.
- Evaluate student participation in the steps involved in the process.
- Evaluate the compression graph for accuracy.
- Evaluate the Today's Class quiz(zes) (if applicable) for each unit and job sheet(s) (if applicable). The job sheets are printed and evaluated using the **Job Sheet/Performance Rubric**.
- Evaluate the task/job sheet using the **Replace Timing Belt Checklist** or the **Job Sheet/Performance Rubric** for other tasks.

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For additional references, activities, and Web resources, please refer to the Information and Computer Technology B.R.I.D.G.E. Web site: http://www.rcu.blackboard.com (available only to registered users).

Suggested Rubrics and Checklists

Exhaust Gas Diagnostic Checklist

CAUTION: Use an approved exhaust ventilation system, and all procedures will be according to manufacturer's recommendations.

Task	OK	Not OK
Safety procedures		
Complete work order to include customer information, vehicle identifying information, customer concerns, and related service history.		
Connect the exhaust gas analyzer.		
Warm up and calibrate (set to zero) the exhaust gas analyzer.		
Start the engine, and allow it to reach normal operating temperature.		
Record readings from the exhaust gas analyzer below. Compare readings to proper specifications.		
Turn off the engine, and disconnect the exhaust gas analyzer.		
Determine action to correct any problems.		

Comments:

Journal Rubric

NAME: DATE: PERIOD:

CATEGORY	Excellent 4	Very Good 3	Satisfactory 2	Needs Work 1	SCORE
Writing Quality	There is a strong writing style and ability to express concepts learned. Excellent spelling, grammar, syntax, spelling, etc.	There is a good writing style and ability to express concepts learned. Very good grammar, syntax, spelling, etc.	There is a writing style that conveys meaning adequately. Some minor grammatical, syntax, and spelling errors	There is difficulty in expressing concepts. There is limited syntax. There are noticeable grammatical and spelling mistakes.	
Content	Clear and complete description of the activity is recorded. All major points are documented.	Very good description of the activity is recorded. Most major points are documented.	Good description of the activity is recorded. Some major points have been omitted.	Limited description of the activity is recorded. Very few major points are documented.	
Insight and Understanding	Definite insights into the implications of the activity are recorded. Awareness of complexity of issues and situations is present.	Some insight into the issue or situation is recorded. Some sense of complexity is present.	Insight is present from a more simplistic standpoint.	Only limited insight into the issue or situation is recorded.	
Application	Content of the activity is connected to the student's personal life and goals.	Content of the activity is connected to the field of automotive service.	Content of the activity is related to life in general.	Only limited connections are made between the content of the activity and the surrounding world.	
				Total Score	

Comments:

Reflective Writing Rubric

	4	3	2	1
Writing Structure	Sentences and paragraphs are complete, well constructed, and of varied structure.	All sentences are complete and well constructed (no fragments and no run-ons). Paragraphing is generally done well.	Most sentences are complete and well constructed. Paragraphing needs some work.	There are many sentence fragments or run-on sentences, OR paragraphing needs lots of work.
Content	The writing contains a description of all components of the communication process.	The writing contains a description of three components of the communication process.	The writing contains a description of two components of the communication process.	The writing contains a description of one component of the communication process.
Content Accuracy	The writing contains at least three accurate examples of types of communication.	The writing contains at least two accurate examples of types of communication.	The writing contains at least one accurate example of types of communication.	The writing contains no examples of types of communication.
Content Understanding	Ideas are expressed in a clear and organized fashion.	Ideas are expressed in a pretty clear manner, but the organization could be better.	Ideas are somewhat organized but are not very clear.	The writing seems to be a collection of unrelated sentences.

Positive Crankcase Ventilation Checklist

CAUTION: Use an approved exhaust ventilation system, and all procedures will be according to manufacturer's recommendations.

Task	OK	Not OK
Safety procedures		
Complete work order to include customer information, vehicle identifying information, customer concern, and related service history.		
Inspect PCV system components.		
Clean PCV system components.		
Replace PCV system components.		
Determine action to correct any problems.		

Comments:

Replace Timing Belt Checklist

CAUTION: Use an approved exhaust ventilation system, and all procedures will be according to manufacturer's recommendations.

Task	OK	Not OK
Safety procedures		
Complete work order to include customer information, vehicle identifying information, customer concern, and related service history.		
Remove and replace the timing belt.		
Verify correct camshaft timing.		
Clean tools and shop area.		

Comments:

Job Sheet/Performance Rubric

Advanced (3 points)	Proficient (2 points)	Basic (1 point)	Unacceptable (0 points)
Student follows all safety regulations without prompting.	Student follows all safety regulations but may require limited reminders or prompting.	Student follows all or nearly all safety regulations but requires significant reminders.	Student does not follow most safety regulations.
Student properly diagnoses problem according to manufacturer guidelines and specifications within manufacturer-specified time limits.	Student properly diagnoses problem according to manufacturer guidelines and specifications but may take additional time.	Student properly diagnoses problem according to manufacturer guidelines and specifications with limited assistance.	Student's work is not performed to manufacturer guidelines and specifications.
Student quickly and accurately diagnoses problems and accurately determines causes of malfunction based on information obtained from resources.	Student accurately diagnoses problems and accurately determines causes of malfunction based on information obtained from resources.	Student diagnoses problem with limited assistance. With limited assistance, student determines causes of malfunction based on information obtained from resources.	Student is unable to diagnose problem.
Job Sheet includes all customer information, lists all requested repairs, and contains correct calculations with no items missing. Written report is accurate and complete and demonstrates thorough understanding of systems, how they operate, safety procedures, and importance of manufacturer recommendations.	Job Sheet includes customer information, lists requested repairs, and contains correct calculations but may include up to two errors or omissions. Written report is accurate and complete and demonstrates solid understanding of systems, how they operate, safety procedures, and importance of manufacturer recommendations.	Job Sheet includes customer information, lists requested repairs, and contains correct calculations but may include up to three errors or omissions. Written report is mostly accurate and complete and demonstrates understanding of types of systems, how they operate, safety procedures, and importance of manufacturer recommendations.	Job Sheet includes customer information, lists requested repairs, and contains correct calculations but may include up to four errors or omissions. Written report is inaccurate and/or incomplete or indicates limited to no understanding of types of systems, how they operate, safety procedures, and importance of manufacturer recommendations.

Competency 1: Explore general suspension and steering systems and theories of operation. (DOK 3)[AST]

Suggested Objectives

a. Complete work order to include customer information, vehicle identifying information, customer concern, related service history, cause, and correction. (DOK 3)
b. Identify and interpret suspension and steering concern; determine necessary action. (DOK 3)
c. Research applicable vehicle and service information, such as suspension and steering system operation, vehicle service history, service precautions, and technical service bulletins. (DOK 3)
d. Locate and interpret vehicle and major component identification numbers (VIN, vehicle certification labels, and calibration decals). (DOK 3)

Suggested Teaching Strategies

- Take students on field trips to two front-end alignment facilities. Students will record customer–technician relationship, observe diagnosis, equipment usage, and correction of the problem. Classes will exchange findings and critique/compare the content of the two trips. Students will present their findings.[E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, W1, W2, W3, W4, W5, CS1, CS2, CS3, CS4, CS5]
- Using the time and labor guide/estimation software, students will determine the estimate (parts, supplies, and labor) for the procedure. Using a number of jobs per day figure, they will estimate for minutes, hours, or days.[E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, W1, W2, W3, W4, W5, S1, S2, S3, M1, M2, CS1, CS2, CS3, CS4, CS5, T1, T2]
- Mark up parts for profit and availability: Given a specific list of components, students will research components' cost, availability, and markup percentages, and they will use a spreadsheet program to graph the amount of profit for an average job.[E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, W1, W2, W3, W4, W5, S1, M1, M2, CS1, CS2, CS3, CS4, CS5, T1, T2, T3, T4, T5, T6]
- Using the Today's Class Web site, the students will complete the assigned unit(s).[E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, W1, W2, W3, W4, W5, S1, S2, S3, M1, M2, CS1, CS2, CS3, CS4, CS5, T1, T2, T3, T4, T5, T6]
- Explain and demonstrate each task. The student will perform the task and be evaluated using the **Job Sheet/Performance Rubric**. The **Suspension and Steering Job Sheet** is an example job sheet and can be changed for other tasks.[E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, CS1, CS2, CS3, CS4, CS5]

Suggested Assessment Strategies

- Evaluate the field trip using the **Field Trip Checklist**.
- Evaluate the presentation using the **Presentation Assessment Rubric**.
- Evaluate the time and labor guide exercise for accuracy.
- Evaluate the spreadsheet for accuracy.
- Evaluate the Today's Class quiz(zes) (if applicable) for each unit and job sheet(s) (if applicable). The job sheets are printed and evaluated using the **Job Sheet/Performance Rubric**.
- Evaluate each task/job sheet using the **Job Sheet/Performance Rubric**.
- Evaluate the task/job sheet using the **Suspension and Steering Job Sheet**.

Competency 2: Apply concepts of steering systems by performing inspection, diagnosis, and repair, if

needed. (DOK 2)[AST]

Suggested Objectives

a. Disable and enable supplemental restraint system (SRS). (DOK 2)
b. Diagnose steering column noises, looseness, and binding concerns (including tilt mechanisms); determine necessary action. (DOK 2)
c. Diagnose power steering gear (non-rack-and-pinion) binding, uneven turning effort, looseness, hard steering, noise, and fluid leakage concerns; determine necessary action. (DOK 2)
d. Diagnose power steering gear (rack and pinion) binding, uneven turning effort, looseness, hard steering, noise, and fluid leakage concerns; determine necessary action. (DOK 2)
e. Inspect steering shaft universal joint(s), flexible coupling(s), collapsible column, lock cylinder mechanism, and steering wheel; perform necessary action. (DOK 2)
f. Adjust manual or power non-rack-and-pinion worm bearing preload and sector lash. (DOK 2)
g. Inspect and replace manual or power rack and pinion steering gear inner tie rod ends (sockets) and bellows boots. (DOK 2)
h. Determine proper power steering fluid type; inspect fluid level and condition. (DOK 2)
i. Flush, fill, and bleed power steering system. (DOK 2)
j. Diagnose power steering fluid leakage; determine necessary action. (DOK 2)
k. Remove, inspect, replace, and adjust power steering pump belt. (DOK 2)
l. Remove and reinstall power steering pump. (DOK 2)
m. Remove and reinstall power steering pump pulley; check pulley and belt alignment. (DOK 2)
n. Inspect and replace power steering hoses and fittings. (DOK 2)
o. Inspect and replace Pitman arm, relay (centerlink/intermediate) rod, idler arm and mountings, and steering linkage damper. (DOK 2)
p. Inspect, replace, and adjust tie rod ends (sockets), tie rod sleeves, and clamps. (DOK 2)
q. Test and diagnose components of electronically controlled steering systems using a scan tool; determine necessary action. (DOK 2)
r. Identify hybrid vehicle power steering system electrical circuits and service and safety precautions. (DOK 2)

Suggested Teaching Strategies

- Case study activity: Have the students research the Web site www.carcomplaints.com/ for steering system complaints for three different vehicle year models. Students should compare the problems for the three vehicles and possible solutions and record information in their journals.[E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, W1, W2, W3, W4, W5, S1, S2, S3, M1, M2, CS1, CS2, CS3, CS4, CS5, T1, T4, T5, T6]
- Using the Today's Class Web site, the students will complete the assigned unit(s).[E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, W1, W2, W3, W4, W5, M1, M2, CS1, CS2, CS3, CS4, CS5, T1, T2, T3, T4, T5, T6]
- Explain and demonstrate each task. The student will perform the task and will be evaluated using the **Job Sheet/Performance Rubric**. The **Flush, Fill, and Bleed Power Steering System Job Sheet** is an example rubric and can be changed for other tasks.[E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, CS1, CS2, CS3, CS4, CS5]

Suggested Assessment Strategies

- Evaluate the case study using the **Case Study Rubric**.
- Evaluate the Today's Class quiz(zes) (if applicable) for each unit and job sheet(s) (if

applicable). The job sheets are printed and evaluated using the **Job Sheet/Performance Rubric**.

- Evaluate each task/job sheet using the **Job Sheet/Performance Rubric**.
- Evaluate the task/job sheet using the **Flush, Fill, and Bleed Power Steering System Job Sheet**.

Competency 3: Apply concepts of front, rear, and miscellaneous suspension systems by performing inspection, diagnosis, and repair, if needed. (DOK 3)[AST, PHY]

Suggested Objectives

a. Diagnose short- and long-arm suspension system noises, body sway, and uneven riding height concerns; determine necessary action. (DOK 3)
b. Diagnose strut suspension system noises, body sway, and uneven riding height concerns; determine necessary action. (DOK 3)
c. Remove, inspect, and install upper and lower control arms, bushings, shafts, and rebound bumpers. (DOK 3)
e. Remove, inspect, and install strut rods (compression/tension) and bushings. (DOK 3)
f. Remove, inspect, and install upper and/or lower ball joints. (DOK 3)
g. Remove, inspect, and install steering knuckle assemblies. (DOK 3)
h. Remove, inspect, install, and adjust suspension system torsion bars; inspect mounts. (DOK 3)
i. Remove, inspect, and install stabilizer bar bushings, brackets, and links. (DOK 3)
j. Remove, inspect, and install strut cartridge or assembly, strut coil spring, insulators (silencers), and upper strut bearing mount. (DOK 3)
k. Lubricate suspension and steering systems. (DOK 3)
l. Remove, inspect, and install coil springs and spring insulators. (DOK 3)
m. Remove, inspect, and install transverse links, control arms, bushings, and mounts. (DOK 3)
n. Remove, inspect, and install leaf springs, leaf spring insulators (silencers), shackles, brackets, bushings, and mounts. (DOK 3)
o. Remove, inspect, and install strut cartridge or assembly, strut coil spring, and insulators (silencers). (DOK 3)
p. Inspect, remove, and replace shock absorbers. (DOK 3)
q. Remove, inspect, and service or replace front- and rear-wheel bearings. (DOK 3)
r. Test and diagnose components of electronically controlled suspension systems using a scan tool; determine necessary action. (DOK 3)
s. Discuss simple harmonic motion in spring/mass systems, frequency, and resonance. Discuss damping, and criticize damping by shock absorbers. (DOK 3)
t. Discuss “washboard” ruts on gravel roads as a result of resonant oscillation by car/spring system. (DOK 3)

Suggested Teaching Strategies

- Scavenger hunt: Given a list of components, the students will search and identify the list in a given amount of time. Students will explain the purpose of each component and where it is located on a vehicle.[E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, W1, W2, W3, W4, W5, M1, M2, CS1, CS2, CS3, CS4, CS5]
- Using the Today’s Class Web site, the students will complete the assigned unit(s).[E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, W1, W2, W3, W4, W5, M1, M2, M3, CS1, CS2, CS3, CS4, CS5, T1, T2, T3, T4, T5, T6]
- Explain and demonstrate each task. The student will perform the task and will be evaluated

using the **Job Sheet/Performance Rubric**. The **Inspect, Remove, and Replace Shock Absorbers Job Sheet** is an example job sheet and can be changed for other tasks.[E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, M1, M2, CS1, CS2, CS3, CS4, CS5]

Suggested Assessment Strategies

- Evaluate the scavenger hunt by observing the students as the exercise progresses. Knowledge areas in which students appear lost or weak will be reviewed. Students will redo the exercise.
- Evaluate each task/job sheet using the **Job Sheet/Performance Rubric**.
- Evaluate the Today's Class quiz(zes) (if applicable) for each unit and job sheet(s) (if applicable). The job sheets are printed and evaluated using the **Job Sheet/Performance Rubric**.
- Evaluate the task/job sheet using the **Inspect, Remove, and Replace Shock Absorbers Job Sheet**.

Competency 4: Apply concepts of wheel/tire alignment by performing inspection, diagnosis, and repair, if needed. (DOK 2)[AST, PRA4]

Suggested Objectives

a. Diagnose vehicle wander, drift, pull, hard steering, bump steer, memory steer, torque steer, and steering return concerns; determine necessary action. (DOK 2)
b. Perform pre-alignment inspection; perform necessary action. (DOK 2)
c. Measure vehicle riding height; determine necessary action. (DOK 2)
d. Check and adjust front- and rear-wheel camber; perform necessary action. (DOK 2)
e. Check and adjust caster; perform necessary action. (DOK 2)
f. Check and adjust front wheel toe and center steeling wheel. (DOK 2)
g. Check toe-out-on-turns (turning radius); determine necessary action. (DOK 2)
h. Check SAI (steering axis inclination) and included angle; determine necessary action. (DOK 2)
i. Check and adjust rear-wheel toe. (DOK 2)
j. Check rear-wheel thrust angle; determine necessary action. (DOK 2)
k. Check for front-wheel setback; determine necessary action. (DOK 2)
l. Check front cradle (subframe) alignment; determine necessary action. (DOK 2)
m. Diagnose tire wear patterns; determine necessary action. (DOK 2)
n. Inspect tires; check and adjust air pressure. (DOK 2)
o. Diagnose wheel/tire vibration, shimmy, and noise; determine necessary action. (DOK 2)
p. Rotate tires according to manufacturer's recommendations. (DOK 2)
q. Measure wheel, tire, axle, and hub runout; determine necessary action. (DOK 2)
r. Diagnose tire pull (lead) problem; determine necessary action. (DOK 2)
s. Balance wheel and tire assembly (static and dynamic). (DOK 2)
t. Dismount, inspect, and remount tire on wheel. (DOK 2)
u. Reinstall wheel; torque lug nuts. (DOK 2)
v. Inspect tire and wheel assembly for air loss; perform necessary action. (DOK 2)
w. Repair tire using internal patch. (DOK 2)

Suggested Teaching Strategies

- Using a vehicle on a lift with incorrect alignment, discuss alignment procedures and labor

rates for this service. Students will observe and record the alignment procedures to correct the problems. Using the vehicle, each student will perform alignment procedures and complete the job sheet. E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, W1, W2, W3, W4, W5, M1, M2, CS1, CS2, CS3, CS4, CS5

- Place a flat washer between the wheel and the hub to simulate lateral runout; the student will diagnose and repair and complete the job sheet. E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, W1, W2, W3, W4, W5, M1, M2, CS1, CS2, CS3, CS4, CS5,
- Install lug nuts improperly on the appropriate vehicle with no center hub to simulate radial runout; the student will diagnose and repair and complete the job sheet. E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, W1, W2, W3, W4, W5, M1, M2, CS1, CS2, CS3, CS4, CS5,
- Using the Today's Class Web site, the students will complete the assigned unit(s). E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, W1, W2, W3, W4, W5, S1, S2, M1, M2, CS1, CS2, CS3, CS4, CS5, T1, T2, T3, T4, T5, T6
- Explain and demonstrate each task. The student will perform the task and complete the appropriate job sheet. The **Inspect Tires; Check and Adjust Air Pressure Job Sheet** is an example job sheet and can be changed for other tasks. E1, E2, E3, E4, E5, E6, R1, R2, R3, R4, R5, R6, W1, W2, W3, W4, W5, S1, S2, M1, M2, CS1, CS2, CS3, CS4, CS5

Suggested Assessment Strategies

- Evaluate the journal using the **Journal Rubric**.
- Evaluate the Today's Class quiz(zes) (if applicable) for each unit and job sheet(s) (if applicable). The job sheets are printed and evaluated using the **Job Sheet/Performance Rubric**.
- Evaluate the task/job sheet using the **Job Sheet/Performance Rubric**.
- Evaluate the task/job sheet using the **Inspect Tires; Check and Adjust Air Pressure Job Sheet**.

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For additional references, activities, and Web resources, please refer to the Information and Computer Technology B.R.I.D.G.E. Web site: http://www.rcu.blackboard.com (available only to registered users).

Suggested Rubrics and Checklists

Field Trip Checklist

_____ 1. The student arrived at the designated meeting place on time with all materials and supplies required for the field trip.

_____ 2 The student observed all safety rules and policies while traveling to and participating in the field trip.

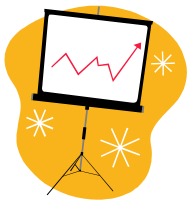
_____ 3. The student demonstrated interest in the content of the field trip by paying attention to the exhibits and speakers, asking pertinent questions, and taking notes.

_____ 4. The student exhibited a positive attitude toward the events and activities of the field trip.

_____ 5. The student remained on task throughout the field trip.

_____ 6. The student exhibited cooperative workplace skills with other students throughout the field trip.

Presentation Assessment Rubric



NAME: DATE: PERIOD:

	Exemplary 4 points	Accomplished 3 points	Developing 2 points	Beginning 1 point	Score
Content	Clear, appropriate, and correct	Mostly clear, appropriate, and correct	Somewhat confusing, incorrect, or flawed	Confusing, incorrect, or flawed	
Clarity	Logical, interesting sequence	Logical sequence	Unclear sequence	No sequence	
Presentation	Clear voice and precise pronunciation	Clear voice and mostly correct pronunciation	Low voice and incorrect pronunciation	Mumbling and incorrect pronunciation	
Visual Aids	Attractive, accurate, and grammatically correct	Adequate, mostly accurate, and few grammatical errors	Poorly planned, somewhat accurate, and some grammatical errors	Weak, inaccurate, and many grammatical errors	
Length	Appropriate length	Slightly too long or short	Moderately too long or short	Extremely too long or short	
Eye Contact	Maintains eye contact, seldom looking at notes	Maintains eye contact most of time but frequently returns to notes	Occasionally uses eye contact but reads most of information	No eye contact because reading information	
				TOTAL	

Comments:

Case Study Rubric

NAME: DATE: PERIOD:

	Excellent 4 Points	Accomplished 3 Points	Needs Improvement 2 Points	Unsatisfactory 1 Point	Score
Comprehension	Shows complete understanding of the issues and grasps implications beyond the immediate issue	Asks for more details to clarify understanding of the issue	Shows partial understanding of the issue but does not ask for clarification	Resists attempts to get clarification	
Strategizing	Develops realistic strategies that provide a satisfactory conclusion	Chooses appropriate strategies that may satisfy	Shows evidence of strategy that may or may not satisfy	Needs assistance to choose a strategy	
Innovation	Devises more than one resolution to the problem	Offers a solution	Offers a solution with a limited point of view	Shows some understanding of the problem	
Communication	Convincingly communicates resolution	Explains solution so others can understand	Conveys an opinion	Unsure of how to explain	
				TOTAL	

Comments:

Journal Rubric

NAME: DATE: PERIOD:

CATEGORY	Excellent 4	Very Good 3	Satisfactory 2	Needs Work 1	SCORE
Writing Quality	There is a strong writing style and ability to express concepts learned. Excellent spelling, grammar, syntax, spelling, etc.	There is a good writing style and ability to express concepts learned. Very good grammar, syntax, spelling, etc.	There is a writing style that conveys meaning adequately. Some minor grammatical, syntax, and spelling errors	There is difficulty in expressing concepts. There is limited syntax. There are noticeable grammatical and spelling mistakes.	
Content	Clear and complete description of the activity is recorded. All major points are documented.	Very good description of the activity is recorded. Most major points are documented.	Good description of the activity is recorded. Some major points have been omitted.	Limited description of the activity is recorded. Very few major points are documented.	
Insight and Understanding	Definite insights into the implications of the activity are recorded. Awareness of complexity of issues and situations is present.	Some insight into the issue or situation is recorded. Some sense of complexity is present.	Insight is present from a more simplistic standpoint.	Only limited insight into the issue or situation is recorded.	
Application	Content of the activity is connected to the student's personal life and goals.	Content of the activity is connected to the field of automotive service.	Content of the activity is related to life in general.	Only limited connections are made between the content of the activity and the surrounding world.	
				Total Score	

Comments:

Suspension and Steering Job Sheet

CAUTION: Use an approved exhaust ventilation system, and all procedures will be according to manufacturer's recommendations.

Task	OK	Not OK
Safety procedures		
Complete work order to include customer information, vehicle identifying information, customer concern, and related service history.		
Identify suspension and steering concerns.		
Interpret suspension and steering concerns.		
Determine necessary action that addresses concerns.		
Clean tools and shop area.		

Comments:

Flush, Fill, and Bleed Power Steering System Job Sheet

CAUTION: Use an approved exhaust ventilation system, and all procedures will be according to manufacturer's recommendations.

Task	OK	Not OK
Safety procedures		
Complete work order to include customer information, vehicle identifying information, customer concern, and related service history.		
Flush power steering system.		
Fill power steering system.		
Bleed power steering system.		
Determine necessary action that addresses concerns.		
Clean tools and shop area.		

Comments:

Inspect, Remove, and Replace Shock Absorbers Job Sheet

CAUTION: Use an approved exhaust ventilation system, and all procedures will be according to manufacturer's recommendations.

Task	OK	Not OK
Safety procedures		
Complete work order to include customer information, vehicle identifying information, customer concern, and related service history.		
Inspect the shock absorbers.		
Remove the shock absorbers.		
Replace the shock absorbers.		
Determine necessary action that addresses concerns.		
Clean tools and shop area.		

Comments:

Inspect Tires; Check and Adjust Air Pressure Job Sheet

CAUTION: Use an approved exhaust ventilation system, and all procedures will be according to manufacturer's recommendations.

Task	OK	Not OK
Safety procedures		
Complete work order to include customer information, vehicle identifying information, customer concern, and related service history.		
Inspect the tires.		
Check the air pressure.		
Adjust the air pressure.		
Determine necessary action that addresses concerns.		
Clean tools and shop area.		

Comments:

Job Sheet/Performance Rubric

Advanced (3 points)	Proficient (2 points)	Basic (1 point)	Unacceptable (0 points)
Student follows all safety regulations without prompting.	Student follows all safety regulations but may require limited reminders or prompting.	Student follows all or nearly all safety regulations but requires significant reminders.	Student does not follow most safety regulations.
Student properly diagnoses problem according to manufacturer guidelines and specifications within manufacturer-specified time limits.	Student properly diagnoses problem according to manufacturer guidelines and specifications but may take additional time.	Student properly diagnoses problem according to manufacturer guidelines and specifications with limited assistance.	Student's work is not performed to manufacturer guidelines and specifications.
Student quickly and accurately diagnoses problems and accurately determines causes of malfunction based on information obtained from resources.	Student accurately diagnoses problems and accurately determines causes of malfunction based on information obtained from resources.	Student diagnoses problem with limited assistance. With limited assistance, student determines causes of malfunction based on information obtained from resources.	Student is unable to diagnose problem.
Job Sheet includes all customer information, lists all requested repairs, and contains correct calculations with no items missing. Written report is accurate and complete and demonstrates thorough understanding of systems, how they operate, safety procedures, and importance of manufacturer recommendations.	Job Sheet includes customer information, lists requested repairs, and contains correct calculations but may include up to two errors or omissions. Written report is accurate and complete and demonstrates solid understanding of systems, how they operate, safety procedures, and importance of manufacturer recommendations.	Job Sheet includes customer information, lists requested repairs, and contains correct calculations but may include up to three errors or omissions. Written report is mostly accurate and complete and demonstrates understanding of types of systems, how they operate, safety procedures, and importance of manufacturer recommendations.	Job Sheet includes customer information, lists requested repairs, and contains correct calculations but may include up to four errors or omissions. Written report is inaccurate and/or incomplete or indicates limited to no understanding of types of systems, how they operate, safety procedures, and importance of manufacturer recommendations.

Student Competency Profile
Automotive Service Technology

Student's Name: _____

This record is intended to serve as a method of noting student achievement of the competencies in each unit. It can be duplicated for each student and can serve as a cumulative record of competencies achieved in the course.

In the blank before each competency, place the date on which the student mastered the competency.

Unit 1: Fundamentals I, Brakes and Introduction to Electrical/Electronic Systems

_____ 1 Describe local program and vocational/career technical center policies and procedures. (DOK 1)

_____ 2 Describe employment opportunities and responsibilities. (DOK 1)

_____ 3 Explore leadership skills and personal development opportunities provided students by student organizations to include SkillsUSA. (DOK 2)

_____ 4 Demonstrate the ability to follow verbal and written instructions and communicate effectively in on-the-job situations. (DOK 2)

_____ 5 Discuss the history of the automotive industry to include materials, terminology, and techniques. (DOK 1)

_____ 6 Identify and describe general safety rules, components of an automobile, tools / equipment, measurement practices, and fasteners for working in a shop/lab and industry. (DOK 1)

_____ 7 Identify and apply concepts regarding safety procedures and practices in and around automotive operations. (DOK 2)

_____ 8 Explore general brake systems and theories of operation. (DOK 3)

_____ 9 Apply concepts of hydraulic brake systems by performing inspection, diagnosis, and repair, if needed. (DOK 2)

_____ 10 Apply concepts of disc brake systems by performing inspection, diagnosis, and repair, if needed. (DOK 2)

_____ 11 Apply concepts of drum brake systems by performing inspection, diagnosis, and repair, if needed. (DOK 3)

_____ 12 Apply concepts of power assist unit systems by performing inspection, diagnosis, and repair, if needed. (DOK 3)

_____ 13 Apply concepts of miscellaneous systems by performing inspection, diagnosis, and repair, if needed. (DOK 2)

_____ 14 Apply concepts of antilock brake, traction control systems, and vehicle stability control systems by performing inspection, diagnosis, and repair, if needed. (DOK 3)

Unit 2: Basic Electrical/Electronic Systems

1 Explore general electrical/electronic systems and theories of operation. (DOK 3)

2 Apply concepts of battery systems by performing inspection, diagnosis, and repair, if needed. (DOK 3)

3 Apply concepts of starting systems by performing inspection, diagnosis, and repair, if needed. (DOK 3)

4 Apply concepts of charging systems by performing inspection, diagnosis, and repair, if needed. (DOK 3)

Unit 3: Advanced Electrical/Electronic Systems

1 Explore lighting systems and theories of operation. (DOK 3)

2 Apply concepts of gauges, warning devices, and driver information systems by performing inspection, diagnosis, and repair, if needed. (DOK 3)

3 Apply concepts of horn and wiper/washer systems by performing inspection, diagnosis, and repair, if needed. (DOK 3)

4 Apply concepts of accessories by performing inspection, diagnosis, and repair, if needed. (DOK 3)

Unit 4: Engine Performance I

1 Identify and describe the major systems and components of an automobile. (DOK 2)

2 Inspect and perform general maintenance (lubrication, oils, and fluids). (DOK 2)

3 Perform cooling system maintenance. (DOK 3)

4 Perform tire and wheel diagnosis and repair. (DOK 2)

5 Explore general engine components and theories of operation. (DOK 2)

6 Apply concepts of computerized engine controls by performing inspection, diagnosis, and repair, if needed. (DOK 3)

7 Apply concepts of ignition systems by performing inspection, diagnosis, and repair, if needed. (DOK 3)

Unit 5: Engine Performance II

1 Apply concepts of fuel, air induction, and exhaust systems by performing inspection, diagnosis, and repair, if needed. (DOK 2)

2 Apply concepts of emissions control systems by performing inspection, diagnosis, and repair, if needed. (DOK 3)

3 Apply concepts of engine service by performing inspection, diagnosis, and repair, if needed. (DOK 3)

Unit 6: Suspension/Steering Systems and Alternative Fuels

1 Explore general suspension and steering systems and theories of operation. (DOK 3)

2 Apply concepts of steering systems by performing inspection, diagnosis, and repair, if needed. (DOK 2)

_____	3	Apply concepts of front, rear, and miscellaneous suspension systems by performing inspection, diagnosis, and repair, if needed. (DOK 3)
_____	4	Apply concepts of wheel/tire alignment by performing inspection, diagnosis, and repair, if needed. (DOK 2)

Recommended Tools and Equipment

CAPITALIZED ITEMS

1. Student tool kit to include a toolbox that is appropriate for the amount of tools (1 kit per 2 students)
    a. Adjustable wrenches, 6 in. and 12 in. (2)
    b. Allen wrench sets—standard (0.050 in.–3/8 in.) and metric (2 mm–7 mm) (1 set)
    c. Brake spoon (1)
    d. Chisels-cape (5/16 in.) and cold (3/8 in. and 3/4 in.) (1)
    e. Claw type pickup tool (1)
    f. Combination wrench set—standard (1/4 in.–1 in.) and metric (7 mm–19 mm) (1)
    g. Continuity test light (12 V) (1)
    h. Feeler gauge (blade type) 0.002 in. –040 in. and 0.006 mm–0.70 mm (1)
    i. Hack saw (1)
    j. Hammer—16-oz ball-peen (1)
    k. Hammer—plastic tip (1)
    l. Ignition wrench set—US and metric (1)
    m. Magnetic pickup tool (1) with light
    n. Pliers—combination 6 in., locking jaw, needle nose, side cutting, and slip joint (water pump) (1 set)
    o. Punches—center, brass drift, pin (1/8 in., 3/16 in., 1/4 in., 5/16 in.), and taper (3/8 in., 1/2 in., 5/8 in.) (1 set)
    p. Scrapers—carbon 1 in. and gasket 1 in. (1 each)
    q. Screwdrivers—standard (stubby, 6 in., 9 in., 12 in., and offset) and Phillips (stubby #1, #2; 6-in. #1, #2; 12-in. #3) (1 set)
    r. Screw starters—standard and Phillips (1 set)
    s. Socket set—1/4-in. drive; 1/4-in.–1/2-in. standard sockets, 1/4-in. –1/2-in. deep sockets, 6-mm–12-mm standard sockets, 6-mm–12-mm deep sockets, flex/universal type handle, 3-in. and 6-in. extensions, ratchet (1 set each)
    t. Socket set—3/8-in. drive; 5/16-in. –3/4-in. standard sockets; 3/8-in. –3/4-in. deep sockets; 9-mm–19-mm standard sockets; 9-mm–19-mm deep sockets; 3-in., 6-in., 12-in., and 18-in. extensions; flex head ratchet; ratchet; speed handle; universal joint; spark plug sockets 5/8 in. and 13/16 in. (1 set each)
    u. Socket set—1/2-in. drive; 7/16-in. –1 1/8-in. standard sockets; 7/16-in. –1 1/8-in. deep sockets; 10-mm–25-mm standard sockets; 10-mm–25-mm deep sockets; 3-in.,6-in., and 12-in. extensions; flex/universal type handle, ratchet (1 set)
    v. Spark plug feeler gauge (gap tool) (1 set each)
2. Four-post alignment lift/alignment machine with accessories (1 per program)
3. Wheel balancer (1 per program)
4. Tire mounting machine (1 per program)
5. On-the-car brake lathe with accessories (1 per program)
6. OBD II trainer/operator's manual (1 per program)
7. ABS/TCS trainer/operator's manual (1 per program)
8. Brake lathe with disc service attachments (1 per program)
9. Air compressor with regulator and hoses (1 per program)

10. Fuel injection service center (1 per program)
11. Hydraulic press with adapters (25 ton) (1 per program)
12. Air bag trainer/operator's manual (1 per program)
13. Power steering and transmission fluid exchanger (1 per program)
14. Interval wiper/washer trainer faulted/operator's manual (1 per program)
15. Computer scan tool/engine analyzer (hand-held) on-board diagnostics (2 per program)
16. Pressure washer (1 per program)
17. Twin post lift (2 per program)
18. Refrigerant recovery/recycling machine (R-12) (1 per program)
19. Refrigerant recovery/recycling machine (HFC-134a) (1 per program)
20. Headlight aimer and / or screen (1 per program)
21. Power seat trainer faulted/operator's manual (1 per program)
22. Two wheel brake trainer/operator's manual (1 per program)
23. Engine performance troubleshooting trainer (3 per program) with software for engine control fundamentals software, engine control systems operation software, engine control diagnostic fundamentals software
24. Engine coolant (recovery/recycle/exchanger) (1 per program)
25. Master puller set (1 per program)
26. Parts cleaning tank (1 per program)
27. Injector/fuel pump trainer/operator's manual (1 per program)
28. Charging system trainer faulted/operator's manual (1 per program)
29. Remote tire pressure sensor locator with accessories (1 per program)
30. Lighting system trainer faulted/operator's manual (1 per program)
31. Horn/alarm trainer faulted/operator's manual (1 per program)
32. Instrument panel trainer faulted/operator's manual (1 per program)
33. 3/4-in. drive socket and impact set (2 per program)
34. Power windows trainer faulted/operator's manual (1 per program)
35. Audio trainer faulted/operator's manual (1 per program)
36. Starting system trainer faulted/operator's manual (1 per program)
37. Transmission jack (2 per program)
38. Power door locks trainer faulted/operator's manual (1 per program)
39. Asbestos containment/removal device (1 per program)
40. Battery/starter/charging system tester (1 per program)
41. Fuel contaminant tester with accessories (1 per program)
42. EVAP leak detector with accessories—smoke or nitrogen (1 per program)
43. Troubleshooting trainer (10 per program)
44. Dual trace lab scope with accessories (1 per program)
45. 3/4-in. air impact wrench (1)
46. Ball joint press (1 per program)
47. Brake bleeder, pressure (1 per program)
48. Electrical system analyzer (1 per program)
49. Steel top workbenches with vises (10 per program)
50. Vacuum/pressure gauge set (2 per program)
51. Fault board trainer (10 per program)
52. Automotive electricity trainer/operator's manual (10 per program) with automotive electricity software (1 per student program)

53. Automotive electronics trainer/operator's manual (10 per program) with automotive electronics software /operator's manual (1 per student program)
54. Hoist(s); engine (1 per program)
55. Waste oil receptacle (1 per program)

NON-CAPITALIZED ITEMS

1. Ultraviolet leak detection device (1 per program)
2. Electronic leak device (1 per program)
3. Hand-held vacuum pump (3 per program)
4. Automotive technology operator's manual (1 per program)
5. Floor jack (1 1/2-ton minimum capacity) (3 per program)
6. Twist steel drill bit set (1/64 in.–1 in.) (2 sets per program)
7. 3/8-in. drive impact sockets (US and metric) (3 sets of each per program)
8. 3/8-in. drive flexible socket set (US and metric) (3 sets of each per program)
9. 1/2-in. drive impact sockets (US and metric) (3 sets of each per program)
10. Battery charger (2 per program)
11. Cooling system pressure tester (1 per program)
12. Air chisel with various bits (1 per program)
13. Constant velocity joint CV service set (1 per program)
14. Starter, battery, tester troubleshooting software / operator's manual (1 per student computer)
15. Engine control system troubleshooting software / operator's manual (1 per student computer)
16. Brake disc micrometer (1 per program)
17. Brake drum micrometer (1 per program)
18. Torque wrench set (4 per program)
19. Cylinder leakage tester (1 per program)
20. Front-wheel-drive engine support fixture (2 per program)
21. Fuel system pressure gauge with adapters (1 per program)
22. Spark plug thread tap set (1 per program)
23. Digital multimeter with various lead sets Fluke 87 or equivalent (10 per program)
24. Dial indicator with flex arm and clamp base (2 per program)
25. Grinder, hand and/or angle, air or electric (3 per program)
26. Valve spring tester (1 per program)
27. Steering column special tool set (1 per program)
28. Tach/dwell meter (1 per program)
29. Spring/strut compressor tool (1 per program)
30. 3/8-in. drive air ratchet (3 per program)
31. 3/8-in. drive impact wrench (1 per program)
32. 1/2-in. drive air impact wrench (3 per program)
33. Compression tester (3 per program)
34. Brake shoe adjusting gauge (1 per program)
35. Manifold gauge set (R12 and 134a) (1 per program)
36. Screw extractor set (1 per program)
37. Bearing packer (1 per program)
38. Power steering pump pulley special tool set (1)
39. Injector pulse tester (1 per program)

40. Drill—1/2-in. variable speed (electric, cordless or air) (4 per program)
41. 1/2-in. DRIVE deep impact sockets (30, 32, 36 mm) (1 set per program)
42. Valve spring compressor (1 per program)
43. Bench or pedestal grinder (2 per program)
44. Belt tensioner gauge (1 per program)
45. Floor creeper (10 per program)
46. Electric heat gun (2)
47. Thread repair insert kit (1 per program)
48. Tubing cutter and flaring set—double lap and ISO (1 per program)
49. Timing advance light (4 per program)
50. Universal joint tools (1 per program)
51. Drip pans (6 per program)
52. Files—coarse 6 in. and 12 in., fine 6 in. and 12 in., half-round 12 in., and round 6 in. and 12 in. (2 sets per program)
53. Screwdriver set—Posidrive7 #1–#4 (1 set per program)
54. Drill—3/8-in. variable speed (electric, cordless, or air) (4 per program)
55. Inner tie rod end tool set (1 per program)
56. Vernier calipers (0–6 in. and 0–125 mm) (1 set per program)
57. Wheel weight pliers (2 per program)
58. Drain pans (6 per program)
59. Brake spring pliers (6 per program)
60. Bearing/seal driver set (1)
61. Air conditioner service port adapter set (1 per program)
62. Flare nut (tubing wrenches) 3/8 in.–3/4 in. (5 per program)
63. Flare nut (tubing wrenches) 10 mm–17 mm (5 per program)
64. Axle support stands—screw type (2 per lift)
65. Booster starter (2 per program)
66. Gear lube dispenser (2 per program)
67. Outside micrometers (0–1 in., 1–2 in., 2–3 in., 3–4 in., 4–5 in.) (5 sets per program)
68. Tap and die set (US and metric) (1 set each per program)
69. Hammer-dead blow plastic mallet (5 per program)
70. Screwdriver set—Torx7 T-8–T-55 (2 sets per program)
71. Axle stands (6 sets per program)
72. Trouble/work lights, fluorescent and incandescent (10 per program)
73. Tube quick disconnect tool set (1 per program)
74. Tubing bender (1)
75. Pitman arm puller (1 per program)
76. Tie rod puller (1 per program)
77. Brake cylinder clamps (1 per program)
78. Door panel tools (4)
79. Jumper cables (3 sets per program)
80. Hand grease gun (1)
81. Pry bars—rolling head and straight (5 per program)
82. Brake pedal holder (1 per program)
83. Brake spring installers (6 per program)
84. OBD II to C3I cable (1 per program)
85. Extension cords (4 per program)

86. Drag link tool (1 per program)
87. Connector pick tool set (1 per program)
88. Seat covers (10 per program)
89. Soldering gun (1 per program)
90. Oxygen sensor socket (1 per program)
91. Battery terminal pliers (5 per program)
92. Battery terminal puller (5 per program)
93. Hood prop (3 per program)
94. Oil filter wrench(es) (1 set per program, various sizes)
95. Snap ring pliers set—external and internal (1 set per program)
96. Shock absorber tools (1 per program)
97. Wheel chocks (1 pair per stall)
98. Wire and terminal repair kit (4 per program)
99. Air blow gun (OSHA approved) (5 per program)
100. Pliers-hose clamp (5 per program)
101. Fender covers (10 per program)
102. Full face shields (6 per program)
103. Pinch off pliers (1 per program)
104. Spark tester (1 per program)
105. Remote starter switch (1 per program)
106. Sending unit socket set (1 per program)
107. Battery hydrometer (1)
108. Battery post cleaner (5 per program)
109. Flashlight (1 per toolbox) (5 per program)
110. Soldering iron (25-W pencil type) (1 per program)
111. Spark plug boot puller (5 per program)
112. Antifreeze tester (4 per program)
113. Static strip (4 per program)
114. Oil can pump type (1 per program)
115. Valve core removal tool (2 per program)
116. Tire inflation chuck (1 per tool box)

It is recommended that instructors have access to the following items:

1. Online automotive resource material (ALLDATA, Mitchell, Shop Keys, etc.)
2. Cart, AV (for TV–VCR) (1)
3. TV–VCR (1)
4. DVD player
5. Digital camera with accessories
6. Interactive display board with accessories
7. Computers (15 per program) to network with printer with word processing, Excel
8. Laptop (2 per program)
9. Digital scanner with optical character recognition (OCR) (1)
10. Cart, AV, for overhead projector (1)
11. Data projector

Appendix A: 21st Century Skills Standards

CLS1 Flexibility and Adaptability
CLS2 Initiative and Self-direction
CLS3 Social and Cross-cultural Skills
CLS4 Productivity and Accountability
CLS5 Leadership and Responsibility

Today's life and work environments require far more than thinking skills and content knowledge. The ability to navigate the complex life and work environments in the globally competitive information age requires students to pay rigorous attention to developing adequate life and career skills.

CS 1 Flexibility and Adaptability

- Adapting to varied roles and responsibilities
- Working effectively in a climate of ambiguity and changing priorities

CS 2 Initiative and Self-direction

- Monitoring one's own understanding and learning needs
- Going beyond basic mastery of skills and/or curriculum to explore and expand one's own learning and opportunities to gain expertise
- Demonstrating initiative to advance skill levels toward a professional level
- Defining, prioritizing, and completing tasks without direct oversight
- Utilizing time efficiently and managing workload
- Demonstrating commitment to learning as a lifelong process

CS 3 Social and Cross-cultural Skills

- Working appropriately and productively with others
- Leveraging the collective intelligence of groups when appropriate
- Bridging cultural differences and using differing perspectives to increase innovation and the quality of work

CS 4 Productivity and Accountability

- Setting and meeting high standards and goals for delivering quality work on time
- Demonstrating diligence and a positive work ethic (e.g., being punctual and reliable)

CS 5 Leadership and Responsibility

- Using interpersonal and problem-solving skills to influence and guide others toward a goal
- Leveraging strengths of others to accomplish a common goal
- Demonstrating integrity and ethical behavior
- Acting responsibly with the interests of the larger community in mind

Appendix B: Academic Standards

PHYSICS

PHY 1. Apply inquiry-based and problem-solving processes and skills to scientific investigations.

a. Use current technologies such as CD-ROM, DVD, Internet, and online data search to explore current research related to a specific topic. (DOK 3)
b. Clarify research questions, and design laboratory investigations. (DOK 3)
c. Demonstrate the use of scientific inquiry and methods to formulate, conduct, and evaluate laboratory investigations (e.g., hypotheses, experimental design, observations, data analyses, interpretations, and theory development). (DOK 3)
d. Organize data to construct graphs (e.g., plotting points, labeling x-axis and y-axis, and creating appropriate titles and legends for circle, bar, and line graphs), draw conclusions, and make inferences. (DOK 3)
e. Evaluate procedures, data, and conclusions to critique the scientific validity of research. (DOK 3)
f. Formulate and revise scientific explanations and models using logic and evidence (data analysis). (DOK 3)
g. Collect, analyze, and draw conclusions from data to create a formal presentation using available technology (e.g., computers, calculators, SmartBoard, CBLs, etc.). (DOK 3)

PHY2. Develop an understanding of concepts related to forces and motion.

a. Use inquiry to investigate and develop an understanding of the kinematics and dynamics of physical bodies. (DOK 3)
    - Vector and scalar quantities
    - Vector problems (solved mathematically and graphically)
    - Vector techniques and free-body diagrams to determine the net force on a body when several forces are acting on it
    - Relations among mass, inertia, and weight
b. Analyze, describe, and solve problems by creating and utilizing graphs of one-dimensional motion (e.g., position, distance, displacement, time, speed, velocity, acceleration, and the special case of freefall). (DOK 2)
c. Analyze real-world applications to draw conclusions about Newton's three laws of motion. (DOK 2)
d. Apply the effects of the universal gravitation law to graph and interpret the force between two masses, acceleration due to gravity, and planetary motion. (DOK 2)
    - Situations where g is constant (falling bodies)
    - Concept of centripetal acceleration undergoing uniform circular motion

- Kepler's third law
- Oscillatory motion and the mechanics of waves

PHY3. Develop an understanding of concepts related to work and energy.

a. Explain and apply the conservation of energy and momentum. (DOK 2)
    - Concept of work and applications
    - Concept of kinetic energy, using the elementary work–energy theorem
    - Concept of conservation of energy with simple examples
    - Concepts of energy, work, and power (qualitatively and quantitatively)
    - Principles of impulse in inelastic and elastic collisions
b. Analyze real-world applications to draw conclusions about mechanical potential energy (the energy of configuration). (DOK 3)
c. Apply the principles of impulse, and compare conservation of momentum and conservation of kinetic energy in perfectly inelastic and elastic collisions. (DOK 1)
d. Investigate and summarize the principles of thermodynamics. (DOK 2)
    - How heat energy is transferred from higher temperature to lower temperature until equilibrium is reached
    - Temperature and thermal energy as related to molecular motion and states of matter
    - Problems involving specific heat and heat capacity
    - First and second laws of thermodynamics as related to heat engines, refrigerators, and thermal efficiency
e. Develop the kinetic theory of ideal gases, and explain the concept of Carnot efficiency. (DOK 2)

PHY4. Discuss the characteristics and properties of light and sound.

a. Describe and model the characteristics and properties of mechanical waves. (DOK 2)
    - Simple harmonic motion
    - Relationships among wave characteristics such as velocity, period, frequency, amplitude, phase, and wavelength
    - Energy of a wave in terms of amplitude and frequency
    - Standing waves and waves in specific media (e.g., stretched string, water surface, air, etc.)
b. Differentiate and explain the Doppler effect as it relates to a moving source and to a moving observer. (DOK 1)
c. Explain the laws of reflection and refraction, and apply Snell's law to describe the relationship between the angles of incidence and refraction. (DOK 2)
d. Use ray tracing and the thin lens equation to solve real-world problems involving object distance from lenses. (DOK 2)
e. Investigate and draw conclusions about the characteristics and properties of electromagnetic waves. (DOK 2)

PHY5. Apply an understanding of magnetism, electric fields, and electricity.

a. Analyze and explain the relationship between electricity and magnetism. (DOK 2)
    - Characteristics of static charge and how a static charge is generated
    - Electric field, electric potential, current, voltage, and resistance as related to Ohm's law
    - Magnetic poles, magnetic flux and field, Ampère's law and Faraday's law
    - Coulomb's law
b. Use schematic diagrams to analyze the current flow in series and parallel electric circuits, given the component resistances and the imposed electric potential. (DOK 2)
c. Analyze and explain the relationship between magnetic fields and electrical current by induction, generators, and electric motors. (DOK 2)

PHY6. Analyze and explain concepts of nuclear physics.

a. Analyze and explain the principles of nuclear physics. (DOK 1)
    - The mass number and atomic number of the nucleus of an isotope of a given chemical element
    - The conservation of mass and the conservation of charge
    - Nuclear decay
b. Defend the wave-particle duality model of light, using observational evidence. (DOK 3)
    - Quantum energy and emission spectra
    - Photoelectric and Compton effects

PRE-ALGEBRA

PRA1. Apply concepts and perform basic operations using real numbers in real-world contexts.

a. Define, classify, and order rational and irrational numbers and their subsets. (DOK 1)
b. Formulate and solve standard and real-life problems involving addition, subtraction, multiplication, and division of rational numbers. (DOK 2)
c. Apply the concepts of greatest common factor (GCF) and least common multiple (LCM) to monomials with variables. (DOK 2)
d. Simplify and evaluate expressions using order of operations, and use real number properties to justify solutions. (DOK 2)
e. Explain the rules of exponents related to multiplication and division of terms with exponents. (DOK 2)
f. Recognize and appropriately use exponential and scientific notation. (DOK 1)
g. Explain and use the inverse relationship between square roots and squares. (DOK 2)

PRA2. Apply properties to simplify algebraic expressions and solve linear equations and inequalities, and apply principles of graphing.

a. Simplify and evaluate numerical and algebraic expressions. (DOK 1)
b. Apply properties of real numbers with an emphasis on the distributive properties of multiplication over addition and subtraction. (DOK 1)

c. Solve and check equations and inequalities using one variable. (DOK 2)
d. Model inequalities (and their solutions) on a number line. (DOK 1)
e. Graph linear equations and nonlinear equations ($y = x^2$) using multiple methods including t-tables and slope-intercept. (DOK 2)
f. Given a linear graph, identify its slope as positive, negative, undefined, or zero, and interpret slope as rate of change. (DOK 2)
g. Determine slope, x-intercept, and y-intercept from a graph and/or equation in slope-intercept or standard form. (DOK 1)
h. Add, subtract, and multiply monomials and binomials. (DOK 1)
i. Predict characteristics of a graph given an equation or t-table. (DOK 2)

PRA3. Identify and apply geometric principles to polygons, angles, and two- and three-dimensional figures.

a. Locate and identify angles formed by parallel lines cut by a transversal(s) (e.g., adjacent, vertical, complementary, supplementary, corresponding, alternate interior, and alternate exterior). (DOK 1)
b. Find missing angle measurements for parallel lines cut by a transversal(s) and for a vertex of a polygon. (DOK 1)
c. Explain the Pythagorean theorem, and apply it to solve routine and non-routine problems. (DOK 3)
d. Solve real-world and non-routine problems involving congruent and similar figures. (DOK 3)
e. Use two-dimensional representations (nets) of three-dimensional objects to describe objects from various perspectives. (DOK 2)

PRA4. Understand measurable attributes of objects, and apply various formulas in problem-solving situations.

a. Solve real-world application problems that include length, area, perimeter, and circumference using standard measurements. (DOK 2)
b. Develop, analyze, and explain methods for solving problems involving proportions, such as scaling and finding equivalent ratios. (DOK 3)
c. Use formulas and/or appropriate measuring tools to find length and angle measures (to appropriate levels of precision), perimeter, area, volume, and surface area of polygons, circles, spheres, cones, pyramids, and composite or irregular figures. (DOK 1)

PRA5. Interpret, organize, and make predictions about a variety of data using concepts of probability.

a. Use a given mean, mode, median, and range to summarize and compare data sets including investigation of the different effects that change in data values have on these measures. (DOK 2)
b. Select the appropriate measures of central tendency for a particular purpose. (DOK 2)
c. Make and list conjectures by calculating probability for experimental or simulated contexts. (DOK 3)
d. Construct and interpret scatterplots to generalize trends from given data sets. (DOK 3)

TRANSITION TO ALGEBRA

TTA1. Understand relationships between numbers and their properties, and perform operations fluently.

a. Compare and contrast the subsets of real numbers. (DOK 1)
b. Simplify and evaluate expressions using the order of operations, and use real number properties to justify solutions. (DOK 2)
c. Express, interpret, and compute numbers using scientific notation in meaningful contexts. (DOK 1)
d. Apply the concept of greatest common factor (GCF) and least common multiple (LCM) to monomials with variables. (DOK 2)
e. Use the inverse relationship to develop the concept of roots and perfect squares. (DOK 2)

TTA2. Understand, represent, and analyze patterns, relations, and functions.

a. Given a literal equation, solve for a specified variable of degree one. (DOK 1)
b. Explain and illustrate how changes in one variable may result in a change in another variable. (DOK 2)
c. Solve and check multi-step equations and inequalities, including distributive property, variables on both sides, and rational coefficients. (DOK 2)
d. Use real-world data to express slope as a rate of change. (DOK 2)
e. Graph solutions to linear inequalities. (DOK 2)
f. Write linear equations given slope and y-intercept or two points. (DOK 2)
g. Identify domain, range, slope, and intercepts of functions. (DOK 1)
h. Develop generalizations to characterize the behaviors of graphs (linear, quadratic, and absolute value). (DOK 2)
i. Classify and determine the degree of a polynomial, and arrange polynomials in ascending or descending order of a variable. (DOK 1)
j. Apply ratios, and use proportional reasoning to solve real-world algebraic problems. (DOK 2)
k. Add, subtract, multiply, and divide polynomial expressions. (DOK 1)
l. Analyze the relationship between x and y values, and determine whether a relation is a function. (DOK 2)

TTA3. Understand geometric principles of polygons, angles, and figures.

a. Apply the Pythagorean theorem to solve problems. (DOK 2)
b. Apply proportional reasoning to determine similar figures and find unknown measures. (DOK 2)

TTA4. Demonstrate and apply various formulas in problem-solving situations.

a. Solve real-world problems involving measurements (i.e., circumference, perimeter, area, volume, distance, temperature, etc.). (DOK 2)
b. Explain and apply the appropriate formula to determine length, midpoint, and slope of a segment in a coordinate plane (i.e., distance formula and Pythagorean theorem). (DOK 2)

TTA5. Interpret data.

a. Construct graphs, make predictions, and draw conclusions from tables, line graphs, and scatter plots. (DOK 3)
b. Use a given mean, mode, median, and range to summarize and compare data sets including investigation of the different effects that change in data have on these measures of central tendency, and select the appropriate measures of central tendency for a given purpose. (DOK 2)

c. Calculate basic probability of experiments and simulations to make and test conjectures about results. (DOK 3)

ALGEBRA I

ALG1-1. Understand relationships between numbers and their properties, and perform operations fluently.

a. Apply properties of real numbers to simplify algebraic expressions, including polynomials. (DOK 1)
b. Use matrices to solve mathematical situations and contextual problems. (DOK 2)

ALG1-2. Understand, represent, and analyze patterns, relations, and functions.

a. Solve, check, and graph multi-step linear equations and inequalities in one variable, including rational coefficients in mathematical and real-world situations. (DOK 2)
b. Solve and graph absolute value equations and inequalities in one variable. (DOK 2)
c. Analyze the relationship between *x* and *y* values, determine whether a relation is a function, and identify domain and range. (DOK 2)
d. Explain and illustrate how a change in one variable may result in a change in another variable and apply to the relationships between independent and dependent variables. (DOK 2)
e. Graph and analyze linear functions. (DOK 2)
f. Use algebraic and graphical methods to solve systems of linear equations and inequalities in mathematical and real-world situations. (DOK 2)
g. Add, subtract, multiply, and divide polynomial expressions. (DOK 1)
h. Factor polynomials by using greatest common factor (GCF), and factor quadratics that have only rational roots. (DOK 1)
i. Determine the solutions to quadratic equations by using graphing, tables, completing the square, the quadratic formula, and factoring. (DOK 1)
j. Justify why some polynomials are prime over the rational number system. (DOK 2)
k. Graph and analyze absolute value and quadratic functions. (DOK 2)
l. Write, graph, and analyze inequalities in two variables. (DOK 2)

ALG1-3. Understand how algebra and geometric representations interconnect and build on one another.

a. Apply the concept of slope to determine if lines in a plane are parallel or perpendicular. (DOK 2)
b. Solve problems that involve interpreting slope as a rate of change. (DOK 2)

ALG1-4. Demonstrate and apply various formulas in problem-solving situations.

a. Solve real-world problems involving formulas for perimeter, area, distance, and rate. (DOK 2)
b. Explain and apply the appropriate formula to determine length, midpoint, and slope of a segment in a coordinate plane (i.e., distance formula and Pythagorean theorem). (DOK 2)
c. Represent polynomial operations with area models. (DOK 2)

ALG1-5. Represent, analyze, and make inferences based on data with and without the use of technology.

a. Draw conclusions and make predictions from scatterplots. (DOK 3)
b. Use linear regression to find the line of best fit from a given set of data. (DOK 3)

Appendix C: ACT College Readiness Standards

English

E1 Topic Development in Terms of Purpose and Focus

- Identify the basic purpose or role of a specified phrase or sentence.
- Delete a clause or sentence because it is obviously irrelevant to the essay.
- Identify the central idea or main topic of a straightforward piece of writing.
- Determine relevancy when presented with a variety of sentence-level details.
- Identify the focus of a simple essay, applying that knowledge to add a sentence that sharpens the focus or to determine if an essay has met a specified goal.
- Delete material primarily because it disturbs the flow and development of the paragraph.
- Add a sentence to accomplish a fairly straightforward purpose such as illustrating a given statement.
- Apply an awareness of the focus and purpose of a fairly involved essay to determine the rhetorical effect and suitability of an existing phrase or sentence or to determine the need to delete plausible but irrelevant material.
- Add a sentence to accomplish a subtle rhetorical purpose such as to emphasize, to add supporting detail, or to express meaning through connotation.
- Determine whether a complex essay has accomplished a specific purpose.
- Add a phrase or sentence to accomplish a complex purpose, often expressed in terms of the main focus of the essay.

E2 Organization, Unity, and Coherence

- Use conjunctive adverbs or phrases to show time relationship in simple narrative essays (e.g., then, this time, etc.).
- Select the most logical place to add a sentence in a paragraph.
- Use conjunctive adverbs or phrases to express straightforward logical relationships (e.g., first, afterward, and in response).
- Decide the most logical place to add a sentence in an essay.
- Add a sentence that introduces a simple paragraph.
- Determine the need for conjunctive adverbs or phrases to create subtle logical connections between sentences (e.g., therefore, however, and in addition).
- Rearrange the sentences in a fairly uncomplicated paragraph for the sake of logic.
- Add a sentence to introduce or conclude the essay or to provide a transition between paragraphs when the essay is fairly straightforward.
- Make sophisticated distinctions concerning the logical use of conjunctive adverbs or phrases, particularly when signaling a shift between paragraphs.
- Rearrange sentences to improve the logic and coherence of a complex paragraph.
- Add a sentence to introduce or conclude a fairly complex paragraph.
- Consider the need for introductory sentences or transitions, basing decisions on a thorough understanding of both the logic and rhetorical effect of the paragraph and essay.

E3 Word Choice in Terms of Style, Tone, Clarity, and Economy

- Revise sentences to correct awkward and confusing arrangements of sentence elements.
- Revise vague nouns and pronouns that create obvious logic problems.
- Delete obviously synonymous and wordy material in a sentence.
- Revise expressions that deviate from the style of an essay.
- Delete redundant material when information is repeated in different parts of speech (e.g., alarmingly startled).
- Use the word or phrase most consistent with the style and tone of a fairly straightforward essay.
- Determine the clearest and most logical conjunction to link clauses.
- Revise a phrase that is redundant in terms of the meaning and logic of the entire sentence.
- Identify and correct ambiguous pronoun references.
- Use the word or phrase most appropriate in terms of the content of the sentence and tone of the essay.
- Correct redundant material that involves sophisticated vocabulary and sounds acceptable as conversational English (e.g., “an aesthetic viewpoint” versus “the outlook of an aesthetic viewpoint”).
- Correct vague and wordy or clumsy and confusing writing containing sophisticated language.
- Delete redundant material that involves subtle concepts or that is redundant in terms of the paragraph as a whole.

E4 Sentence Structure and Formation

- Use conjunctions or punctuation to join simple clauses.
- Revise shifts in verb tense between simple clauses in a sentence or between simple adjoining sentences.
- Determine the need for punctuation and conjunctions to avoid awkward-sounding sentence fragments and fused sentences.
- Decide the appropriate verb tense and voice by considering the meaning of the entire sentence.
- Recognize and correct marked disturbances of sentence flow and structure (e.g., participial phrase fragments, missing or incorrect relative pronouns, or dangling or misplaced modifiers).
- Revise to avoid faulty placement of phrases and faulty coordination and subordination of clauses in sentences with subtle structural problems.
- Maintain consistent verb tense and pronoun person on the basis of the preceding clause or sentence.
- Use sentence-combining techniques, effectively avoiding problematic comma splices, run-on sentences, and sentence fragments, especially in sentences containing compound subjects or verbs.
- Maintain a consistent and logical use of verb tense and pronoun person on the basis of information in the paragraph or essay as a whole.
- Work comfortably with long sentences and complex clausal relationships within sentences, avoiding weak conjunctions between independent clauses and maintaining parallel structure between clauses.

E5 Conventions of Usage

- Solve such basic grammatical problems as how to form the past and past participle of irregular but commonly used verbs and how to form comparative and superlative adjectives.
- Solve such grammatical problems as whether to use an adverb or adjective form, how to ensure straightforward subject–verb and pronoun–antecedent agreement, and which preposition to use in simple contexts.
- Recognize and use the appropriate word in frequently confused pairs such as there and their, past and passed, and led and lead.
- Use idiomatically appropriate prepositions, especially in combination with verbs (e.g., long for and appeal to).
- Ensure that a verb agrees with its subject when there is some text between the two.
- Ensure that a pronoun agrees with its antecedent when the two occur in separate clauses or sentences.
- Identify the correct past and past participle forms of irregular and infrequently used verbs, and form present-perfect verbs by using "have" rather than "of."
- Correctly use reflexive pronouns, the possessive pronouns "its" and "your," and the relative pronouns "who" and "whom."
- Ensure that a verb agrees with its subject in unusual situations (e.g., when the subject–verb order is inverted or when the subject is an indefinite pronoun).
- Provide idiomatically and contextually appropriate prepositions following verbs in situations involving sophisticated language or ideas.
- Ensure that a verb agrees with its subject when a phrase or clause between the two suggests a different number for the verb.

E6 Conventions of Punctuation

- Delete commas that create basic sense problems (e.g., between verb and direct object).
- Provide appropriate punctuation in straightforward situations (e.g., items in a series).
- Delete commas that disturb the sentence flow (e.g., between modifier and modified element).
- Use commas to set off simple parenthetical phrases.
- Delete unnecessary commas when an incorrect reading of the sentence suggests a pause that should be punctuated (e.g., between verb and direct object clause).
- Use punctuation to set off complex parenthetical phrases.
- Recognize and delete unnecessary commas based on a careful reading of a complicated sentence (e.g., between the elements of a compound subject or compound verb joined by "and").
- Use apostrophes to indicate simple possessive nouns.
- Recognize inappropriate uses of colons and semicolons.
- Use commas to set off a nonessential/nonrestrictive appositive or clause.
- Deal with multiple punctuation problems (e.g., compound sentences containing unnecessary commas and phrases that may or may not be parenthetical).
- Use an apostrophe to show possession, especially with irregular plural nouns.
- Use a semicolon to indicate a relationship between closely related independent clauses.
- Use a colon to introduce an example or an elaboration.

Math

M1 Basic Operations and Applications

- Perform one-operation computation with whole numbers and decimals.
- Solve problems in one or two steps using whole numbers.
- Perform common conversions (e.g., inches to feet or hours to minutes).
- Solve routine one-step arithmetic problems (using whole numbers, fractions, and decimals) such as single-step percent.
- Solve some routine two-step arithmetic problems.
- Solve routine two-step or three-step arithmetic problems involving concepts such as rate and proportion, tax added, percentage off, and computing with a given average.
- Solve multi-step arithmetic problems that involve planning or converting units of measure (e.g., feet per second to miles per hour).
- Solve word problems containing several rates, proportions, or percentages.
- Solve complex arithmetic problems involving percent of increase or decrease and problems requiring integration of several concepts from pre-algebra and/or pre-geometry (e.g., comparing percentages or averages, using several ratios, and finding ratios in geometry settings).

M2 Probability, Statistics, and Data Analysis

- Calculate the average of a list of positive whole numbers.
- Perform a single computation using information from a table or chart.
- Calculate the average of a list of numbers.
- Calculate the average, given the number of data values and the sum of the data values.
- Read tables and graphs.
- Perform computations on data from tables and graphs.
- Use the relationship between the probability of an event and the probability of its complement.
- Calculate the missing data value, given the average and all data values but one.
- Translate from one representation of data to another (e.g., a bar graph to a circle graph).
- Determine the probability of a simple event.
- Exhibit knowledge of simple counting techniques.*
- Calculate the average, given the frequency counts of all the data values.
- Manipulate data from tables and graphs.
- Compute straightforward probabilities for common situations.
- Use Venn diagrams in counting.*
- Calculate or use a weighted average.
- Interpret and use information from figures, tables, and graphs.
- Apply counting techniques.
- Compute a probability when the event and/or sample space is not given or obvious.
- Distinguish between mean, median, and mode for a list of numbers.
- Analyze and draw conclusions based on information from figures, tables, and graphs.
- Exhibit knowledge of conditional and joint probability.

M3 Numbers: Concepts and Properties

- Recognize equivalent fractions and fractions in lowest terms.
- Recognize one-digit factors of a number.

- Identify a digit's place value.
- Exhibit knowledge of elementary number concepts including rounding, the ordering of decimals, pattern identification, absolute value, primes, and greatest common factor.
- Find and use the least common multiple.
- Order fractions.
- Work with numerical factors.
- Work with scientific notation.
- Work with squares and square roots of numbers.
- Work problems involving positive integer exponents.*
- Work with cubes and cube roots of numbers.*
- Determine when an expression is undefined.*
- Exhibit some knowledge of the complex numbers.†
- Apply number properties involving prime factorization.
- Apply number properties involving even/odd numbers and factors/multiples.
- Apply number properties involving positive/negative numbers.
- Apply rules of exponents.
- Multiply two complex numbers.†
- Draw conclusions based on number concepts, algebraic properties, and/or relationships between expressions and numbers.
- Exhibit knowledge of logarithms and geometric sequences.
- Apply properties of complex numbers.

M4 Expressions, Equations, and Inequalities

- Exhibit knowledge of basic expressions (e.g., identify an expression for a total as b + g).
- Solve equations in the form x + a = b, where a and b are whole numbers or decimals.
- Substitute whole numbers for unknown quantities to evaluate expressions.
- Solve one-step equations having integer or decimal answers.
- Combine like terms (e.g., 2x + 5x).
- Evaluate algebraic expressions by substituting integers for unknown quantities.
- Add and subtract simple algebraic expressions.
- Solve routine first-degree equations.
- Perform straightforward word-to-symbol translations.
- Multiply two binomials.*
- Solve real-world problems using first-degree equations.
- Write expressions, equations, or inequalities with a single variable for common pre-algebra settings (e.g., rate and distance problems and problems that can be solved by using proportions).
- Identify solutions to simple quadratic equations.
- Add, subtract, and multiply polynomials.*
- Factor simple quadratics (e.g., the difference of squares and perfect square trinomials).*
- Solve first-degree inequalities that do not require reversing the inequality sign.*
- Manipulate expressions and equations.
- Write expressions, equations, and inequalities for common algebra settings.
- Solve linear inequalities that require reversing the inequality sign.
- Solve absolute value equations.
- Solve quadratic equations.

- Find solutions to systems of linear equations.
- Write expressions that require planning and/or manipulating to model a situation accurately.
- Write equations and inequalities that require planning, manipulating, and/or solving.
- Solve simple absolute value inequalities.

M5 Graphical Representations

- Identify the location of a point with a positive coordinate on the number line.
- Locate points on the number line and in the first quadrant.
- Locate points in the coordinate plane.
- Comprehend the concept of length on the number line.*
- Exhibit knowledge of slope.*
- Identify the graph of a linear inequality on the number line.*
- Determine the slope of a line from points or equations.*
- Match linear graphs with their equations.*
- Find the midpoint of a line segment.*
- Interpret and use information from graphs in the coordinate plane.
- Match number line graphs with solution sets of linear inequalities.
- Use the distance formula.
- Use properties of parallel and perpendicular lines to determine an equation of a line or coordinates of a point.
- Recognize special characteristics of parabolas and circles (e.g., the vertex of a parabola and the center or radius of a circle).†
- Match number line graphs with solution sets of simple quadratic inequalities.
- Identify characteristics of graphs based on a set of conditions or on a general equation such as $y = ax2 + c$.
- Solve problems integrating multiple algebraic and/or geometric concepts.
- Analyze and draw conclusions based on information from graphs in the coordinate plane.

M6 Properties of Plane Figures

- Exhibit some knowledge of the angles associated with parallel lines.
- Find the measure of an angle using properties of parallel lines.
- Exhibit knowledge of basic angle properties and special sums of angle measures (e.g., 90°, 180°, and 360°).
- Use several angle properties to find an unknown angle measure.
- Recognize Pythagorean triples.*
- Use properties of isosceles triangles.*
- Apply properties of 30°-60°-90°, 45°-45°-90°, similar, and congruent triangles.
- Use the Pythagorean theorem.
- Draw conclusions based on a set of conditions.
- Solve multi-step geometry problems that involve integrating concepts, planning, visualization, and/or making connections with other content areas.
- Use relationships among angles, arcs, and distances in a circle.

M7 Measurement

- Estimate or calculate the length of a line segment based on other lengths given on a geometric figure.
- Compute the perimeter of polygons when all side lengths are given.
- Compute the area of rectangles when whole number dimensions are given.
- Compute the area and perimeter of triangles and rectangles in simple problems.
- Use geometric formulas when all necessary information is given.
- Compute the area of triangles and rectangles when one or more additional simple steps are required.
- Compute the area and circumference of circles after identifying necessary information.
- Compute the perimeter of simple composite geometric figures with unknown side lengths.*
- Use relationships involving area, perimeter, and volume of geometric figures to compute another measure.
- Use scale factors to determine the magnitude of a size change.
- Compute the area of composite geometric figures when planning or visualization is required.

M8 Functions

- Evaluate quadratic functions, expressed in function notation, at integer values.
- Evaluate polynomial functions, expressed in function notation, at integer values.†
- Express the sine, cosine, and tangent of an angle in a right triangle as a ratio of given side lengths.†
- Evaluate composite functions at integer values.†
- Apply basic trigonometric ratios to solve right-triangle problems.†
- Write an expression for the composite of two simple functions.†
- Use trigonometric concepts and basic identities to solve problems.†
- Exhibit knowledge of unit circle trigonometry.†
- Match graphs of basic trigonometric functions with their equations.

Notes

- Students who score in the 1–12 range are most likely beginning to develop the knowledge and skills assessed in the other ranges.
- Standards followed by an asterisk (*) apply to the PLAN and ACT mathematics tests only.
- Standards followed by a dagger (†) apply to the ACT mathematics test only.

Reading

R1 Main Ideas and Author's Approach

- Recognize a clear intent of an author or narrator in uncomplicated literary narratives.
- Identify a clear main idea or purpose of straightforward paragraphs in uncomplicated literary narratives.
- Infer the main idea or purpose of straightforward paragraphs in uncomplicated literary narratives.
- Understand the overall approach taken by an author or narrator (e.g., point of view and kinds of evidence used) in uncomplicated passages.
- Identify a clear main idea or purpose of any paragraph or paragraphs in uncomplicated passages.
- Infer the main idea or purpose of straightforward paragraphs in more challenging passages.

- Summarize basic events and ideas in more challenging passages.
- Understand the overall approach taken by an author or narrator (e.g., point of view and kinds of evidence used) in more challenging passages.
- Infer the main idea or purpose of more challenging passages or their paragraphs.
- Summarize events and ideas in virtually any passage.
- Understand the overall approach taken by an author or narrator (e.g., point of view and kinds of evidence used) in virtually any passage.
- Identify clear main ideas or purposes of complex passages or their paragraphs.

R2 Supporting Details

- Locate basic facts (e.g., names, dates, and events) clearly stated in a passage.
- Locate simple details at the sentence and paragraph level in uncomplicated passages.
- Recognize a clear function of a part of an uncomplicated passage.
- Locate important details in uncomplicated passages.
- Make simple inferences about how details are used in passages.
- Locate important details in more challenging passages.
- Locate and interpret minor or subtly stated details in uncomplicated passages.
- Discern which details, though they may appear in different sections throughout a passage, support important points in more challenging passages.
- Locate and interpret minor or subtly stated details in more challenging passages.
- Use details from different sections of some complex informational passages to support a specific point or argument.
- Locate and interpret details in complex passages.
- Understand the function of a part of a passage when the function is subtle or complex.

R3 Sequential, Comparative, and Cause–Effect Relationships

- Determine when (e.g., first, last, before, or after) or if an event occurred in uncomplicated passages.
- Recognize clear cause–effect relationships described within a single sentence in a passage.
- Identify relationships between main characters in uncomplicated literary narratives.
- Recognize clear cause–effect relationships within a single paragraph in uncomplicated literary narratives.
- Order simple sequences of events in uncomplicated literary narratives.
- Identify clear relationships between people, ideas, and so forth in uncomplicated passages.
- Identify clear cause–effect relationships in uncomplicated passages.
- Order sequences of events in uncomplicated passages.
- Understand relationships between people, ideas, and so forth in uncomplicated passages.
- Identify clear relationships between characters, ideas, and so forth in more challenging literary narratives.
- Understand implied or subtly stated cause–effect relationships in uncomplicated passages.
- Identify clear cause–effect relationships in more challenging passages.
- Order sequences of events in more challenging passages.
- Understand the dynamics between people, ideas, and so forth in more challenging passages.
- Understand implied or subtly stated cause–effect relationships in more challenging passages.
- Order sequences of events in complex passages.

- Understand the subtleties in relationships between people, ideas, and so forth in virtually any passage.
- Understand implied, subtle, or complex cause–effect relationships in virtually any passage.

R4 Meaning of Words

- Understand the implication of a familiar word or phrase and of simple descriptive language.
- Use context to understand basic figurative language.
- Use context to determine the appropriate meaning of some figurative and nonfigurative words, phrases, and statements in uncomplicated passages.
- Use context to determine the appropriate meaning of virtually any word, phrase, or statement in uncomplicated passages.
- Use context to determine the appropriate meaning of some figurative and nonfigurative words, phrases, and statements in more challenging passages.
- Determine the appropriate meaning of words, phrases, or statements from figurative or somewhat technical contexts.
- Determine, even when the language is richly figurative and the vocabulary is difficult, the appropriate meaning of context-dependent words, phrases, or statements in virtually any passage.

R5 Generalizations and Conclusions

- Draw simple generalizations and conclusions about the main characters in uncomplicated literary narratives.
- Draw simple generalizations and conclusions about people, ideas, and so forth in uncomplicated passages.
- Draw generalizations and conclusions about people, ideas, and so forth in uncomplicated passages.
- Draw simple generalizations and conclusions using details that support the main points of more challenging passages.
- Draw subtle generalizations and conclusions about characters, ideas, and so forth in uncomplicated literary narratives.
- Draw generalizations and conclusions about people, ideas, and so forth in more challenging passages.
- Use information from one or more sections of a more challenging passage to draw generalizations and conclusions about people, ideas, and so forth.
- Draw complex or subtle generalizations and conclusions about people, ideas, and so forth, often by synthesizing information from different portions of the passage.
- Understand and generalize about portions of a complex literary narrative.

Science

S1 Interpretation of Data

- Select a single piece of data (numerical or non-numerical) from a simple data presentation (e.g., a table or graph with two or three variables or a food web diagram).
- Identify basic features of a table, graph, or diagram (e.g., headings, units of measurement, or axis labels).
- Select two or more pieces of data from a simple data presentation.
- Understand basic scientific terminology.

- Find basic information in a brief body of text.
- Determine how the value of one variable changes as the value of another variable changes in a simple data presentation.
- Select data from a complex data presentation (e.g., a table or graph with more than three variables or a phase diagram).
- Compare or combine data from a simple data presentation (e.g., order or sum data from a table).
- Translate information into a table, graph, or diagram.
- Compare or combine data from two or more simple data presentations (e.g., categorize data from a table using a scale from another table).
- Compare or combine data from a complex data presentation.
- Interpolate between data points in a table or graph.
- Determine how the value of one variable changes as the value of another variable changes in a complex data presentation.
- Identify and/or use a simple (e.g., linear) mathematical relationship between data.
- Analyze given information when presented with new, simple information.
- Compare or combine data from a simple data presentation with data from a complex data presentation.
- Identify and/or use a complex (e.g., nonlinear) mathematical relationship between data.
- Extrapolate from data points in a table or graph.
- Compare or combine data from two or more complex data presentations.
- Analyze given information when presented with new, complex information.

S2 Scientific Investigation

- Understand the methods and tools used in a simple experiment.
- Understand the methods and tools used in a moderately complex experiment.
- Understand a simple experimental design.
- Identify a control in an experiment.
- Identify similarities and differences between experiments.
- Understand the methods and tools used in a complex experiment.
- Understand a complex experimental design.
- Predict the results of an additional trial or measurement in an experiment.
- Determine the experimental conditions that would produce specified results.
- Determine the hypothesis for an experiment.
- Identify an alternate method for testing a hypothesis.
- Understand precision and accuracy issues.
- Predict how modifying the design or methods of an experiment will affect results.
- Identify an additional trial or experiment that could be performed to enhance or evaluate experimental results.

S3 Evaluation of Models, Inferences, and Experimental Results

- Select a simple hypothesis, prediction, or conclusion that is supported by a data presentation or a model.
- Identify key issues or assumptions in a model.
- Select a simple hypothesis, prediction, or conclusion that is supported by two or more data presentations or models.

- Determine whether given information supports or contradicts a simple hypothesis or conclusion and why.
- Identify strengths and weaknesses in one or more models.
- Identify similarities and differences between models.
- Determine which model(s) is/are supported or weakened by new information.
- Select a data presentation or a model that supports or contradicts a hypothesis, prediction, or conclusion.
- Select a complex hypothesis, prediction, or conclusion that is supported by a data presentation or model.
- Determine whether new information supports or weakens a model and why.
- Use new information to make a prediction based on a model.
- Select a complex hypothesis, prediction, or conclusion that is supported by two or more data presentations or models.
- Determine whether given information supports or contradicts a complex hypothesis or conclusion and why.

Writing

W1 Expressing Judgments

- Show a little understanding of the persuasive purpose of the task, but neglect to take or to maintain a position on the issue in the prompt.
- Show limited recognition of the complexity of the issue in the prompt.
- Show a basic understanding of the persuasive purpose of the task by taking a position on the issue in the prompt, but do not maintain that position.
- Show a little recognition of the complexity of the issue in the prompt by acknowledging, but only briefly describing, a counterargument to the writer's position.
- Show understanding of the persuasive purpose of the task by taking a position on the issue in the prompt.
- Show some recognition of the complexity of the issue in the prompt by doing the following:
    - Acknowledging counterarguments to the writer's position
    - Providing some response to counterarguments to the writer's position
- Show clear understanding of the persuasive purpose of the task by taking a position on the specific issue in the prompt and offering a broad context for discussion.
- Show recognition of the complexity of the issue in the prompt by doing the following:
    - Partially evaluating implications and/or complications of the issue
    - Posing and partially responding to counterarguments to the writer's position
- Show clear understanding of the persuasive purpose of the task by taking a position on the specific issue in the prompt and offering a critical context for discussion.
- Show understanding of the complexity of the issue in the prompt by doing the following:
    - Examining different perspectives
    - Evaluating implications or complications of the issue
    - Posing and fully discussing counterarguments to the writer's position

W2 Focusing on the Topic

- Maintain a focus on the general topic in the prompt through most of the essay.
- Maintain a focus on the general topic in the prompt throughout the essay.

- Maintain a focus on the general topic in the prompt throughout the essay, and attempt a focus on the specific issue in the prompt.
- Present a thesis that establishes focus on the topic.
- Maintain a focus on discussion of the specific topic and issue in the prompt throughout the essay.
- Present a thesis that establishes a focus on the writer's position on the issue.
- Maintain a clear focus on discussion of the specific topic and issue in the prompt throughout the essay.
- Present a critical thesis that clearly establishes the focus on the writer's position on the issue.

W3 Developing a Position

- Offer a little development, with one or two ideas; if examples are given, they are general and may not be clearly relevant; resort often to merely repeating ideas.
- Show little or no movement between general and specific ideas and examples.
- Offer limited development of ideas using a few general examples; resort sometimes to merely repeating ideas.
- Show little movement between general and specific ideas and examples.
- Develop ideas by using some specific reasons, details, and examples.
- Show some movement between general and specific ideas and examples.
- Develop most ideas fully, using some specific and relevant reasons, details, and examples.
- Show clear movement between general and specific ideas and examples.
- Develop several ideas fully, using specific and relevant reasons, details, and examples.
- Show effective movement between general and specific ideas and examples.

W4 Organizing Ideas

- Provide a discernible organization with some logical grouping of ideas in parts of the essay.
- Use a few simple and obvious transitions.
- Present a discernible, though minimally developed, introduction and conclusion.
- Provide a simple organization with logical grouping of ideas in parts of the essay.
- Use some simple and obvious transitional words, though they may at times be inappropriate or misleading.
- Present a discernible, though underdeveloped, introduction and conclusion.
- Provide an adequate but simple organization with logical grouping of ideas in parts of the essay but with little evidence of logical progression of ideas.
- Use some simple and obvious, but appropriate, transitional words and phrases.
- Present a discernible introduction and conclusion with little development.
- Provide unity and coherence throughout the essay, sometimes with a logical progression of ideas.
- Use relevant, though at times simple and obvious, transitional words and phrases to convey logical relationships between ideas.
- Present a somewhat developed introduction and conclusion.
- Provide unity and coherence throughout the essay, often with a logical progression of ideas.
- Use relevant transitional words, phrases, and sentences to convey logical relationships between ideas.
- Present a well-developed introduction and conclusion.

W5 Using Language

- Show limited control of language by doing the following:
    - Correctly employing some of the conventions of standard English grammar, usage, and mechanics but with distracting errors that sometimes significantly impede understanding
    - Using simple vocabulary
    - Using simple sentence structure
    - Correctly employing some of the conventions of standard English grammar, usage, and mechanics but with distracting errors that sometimes impede understanding
    - Using simple but appropriate vocabulary
    - Using a little sentence variety, though most sentences are simple in structure
    - Correctly employing many of the conventions of standard English grammar, usage, and mechanics but with some distracting errors that may occasionally impede understanding
    - Using appropriate vocabulary
    - Using some varied kinds of sentence structures to vary pace
    - Correctly employing most conventions of standard English grammar, usage, and mechanics, with a few distracting errors but none that impede understanding
    - Using some precise and varied vocabulary
    - Using several kinds of sentence structures to vary pace and to support meaning
    - Correctly employing most conventions of standard English grammar, usage, and mechanics, with just a few, if any, errors
    - Using precise and varied vocabulary
    - Using a variety of sentence structures to vary pace and to support meaning

Appendix D: 2005 Automotive Service Program Standards[1]

Automotive Service Brakes

ASB For every task in Brakes, the following safety requirement must be strictly enforced: Comply with personal and environmental safety practices associated with clothing; eye protection; hand tools; power equipment; proper ventilation; and the handling, storage, and disposal of chemicals/materials in accordance with local, state, and federal safety and environmental regulations.

- General Brake Systems Diagnosis
- Hydraulic System Diagnosis and Repair
- Drum Brake Diagnosis and Repair
- Disc Brake Diagnosis and Repair
- Power Assist Units Diagnosis and Repair
- Miscellaneous (Wheel Bearings, Parking Brakes, Electrical, Etc.) Diagnosis and Repair
- Antilock Brake and Traction Control Systems

Automotive Service Electrical/Electronics

ASE For every task in Electrical/Electronic Systems, the following safety requirement must be strictly enforced: Comply with personal and environmental safety practices associated with clothing; eye protection; hand tools; power equipment; proper ventilation; and the handling, storage, and disposal of chemicals/materials in accordance with local, state, and federal safety and environmental regulations.

- General Electrical System Diagnosis
- Battery Diagnosis and Service
- Starting System Diagnosis and Repair
- Charging System Diagnosis and Repair
- Lighting Systems Diagnosis and Repair
- Gauges, Warning Devices, and Driver Information Systems Diagnosis and Repair
- Horn and Wiper/Washer Diagnosis and Repair
- Accessories Diagnosis and Repair

Automotive Suspension/Steering

AST For every task in Suspension and Steering, the following safety requirement must be strictly enforced: Comply with personal and environmental safety practices associated with clothing; eye protection; hand tools; power equipment; proper ventilation; and the handling, storage, and disposal of chemicals/materials in accordance with local, state, and federal safety and environmental regulations.

- General Suspension and Steering Systems Diagnosis

[1] *ASE/NATEF 2005 Automotive Service Program Standards*. Retrieved December 3, 2007, from http://www.natef.org

- Steering Systems Diagnosis and Repair
- Suspension Systems Diagnosis and Repair
- Wheel Alignment Diagnosis, Adjustment, and Repair
- Wheel and Tire Diagnosis and Repair

Automotive Engine Performance

AEP For every task in Engine Performance, the following safety requirement must be strictly enforced: Comply with personal and environmental safety practices associated with clothing; eye protection; hand tools; power equipment; proper ventilation; and the handling, storage, and disposal of chemicals/materials in accordance with local, state, and federal safety and environmental regulations.

- General Engine Diagnosis
- Computerized Engine Controls Diagnosis and Repair
- Ignition System Diagnosis and Repair
- Fuel, Air Induction, and Exhaust Systems Diagnosis and Repair
- Emissions Control Systems Diagnosis and Repair
- Engine-related Service

Appendix E: National Educational Technology Standards for Students

T1 Creativity and Innovation
T2 Communication and Collaboration
T3 Research and Information Fluency
T4 Critical Thinking, Problem Solving, and Decision Making
T5 Digital Citizenship
T6 Technology Operations and Concepts

T1 Creativity and Innovation

Students demonstrate creative thinking, construct knowledge, and develop innovative products and processes using technology. Students do the following:

a. Apply existing knowledge to generate new ideas, products, or processes
b. Create original works as a means of personal or group expression
c. Use models and simulations to explore complex systems and issues
d. Identify trends and forecast possibilities

T2 Communication and Collaboration

Students use digital media and environments to communicate and work collaboratively, including at a distance, to support individual learning and contribute to the learning of others. Students do the following:

a. Interact, collaborate, and publish with peers, experts, or others employing a variety of digital environments and media
b. Communicate information and ideas effectively to multiple audiences using a variety of media and formats
c. Develop cultural understanding and global awareness by engaging with learners of other cultures
d. Contribute to project teams to produce original works or solve problems

T3 Research and Information Fluency

Students apply digital tools to gather, evaluate, and use information. Students do the following:

a. Plan strategies to guide inquiry
b. Locate, organize, analyze, evaluate, synthesize, and ethically use information from a variety of sources and media
c. Evaluate and select information sources and digital tools based on the appropriateness to specific tasks
d. Process data and report results

T4 Critical Thinking, Problem Solving, and Decision Making

Students use critical-thinking skills to plan and conduct research, manage projects, solve problems, and make informed decisions using appropriate digital tools and resources. Students do the following:

a. Identify and define authentic problems and significant questions for investigation
b. Plan and manage activities to develop a solution or complete a project

c. Collect and analyze data to identify solutions and/or make informed decisions
d. Use multiple processes and diverse perspectives to explore alternative solutions

T5 Digital Citizenship

Students understand human, cultural, and societal issues related to technology and practice legal and ethical behavior. Students do the following:

a. Advocate and practice safe, legal, and responsible use of information and technology
b. Exhibit a positive attitude toward using technology that supports collaboration, learning, and productivity
c. Demonstrate personal responsibility for lifelong learning
d. Exhibit leadership for digital citizenship

T6 Technology Operations and Concepts

Students demonstrate a sound understanding of technology concepts, systems, and operations. Students do the following:

a. Understand and use technology systems
b. Select and use applications effectively and productively
c. Troubleshoot systems and applications
d. Transfer current knowledge to learning of new technologies