

Course Outline

Transportation

REVISED: August/2017

Job Title

Emission Specialist

Career Pathway:

Systems Diagnostics and Service

Industry Sector:

Transportation

O*NET-SOC CODE:

49-3023.02

CBEDS Title:

Automotive Specialty, Other
Combinations

CBEDS No.:

5688

79-90-67

Auto Tech: Emission Control/2

Credits: 5

Hours: 90

Course Description:

This competency-based course is the second in a sequence of two designed to meet the Bureau of Automotive Regulation (BAR) licensing requirements for the Advanced Clean Air Course Program. It provides students with technical instruction and practical experience in emission control using sustainable and green vehicle technologies. Instruction includes classroom and workplace policies and procedures in accordance with federal, state, and local safety and environmental regulations. Emphasis is placed on the techniques in the following areas of emission control: NOx emissions, DSO, loaded mode emissions, catalytic converter, and BAR-97 EIS testing procedures for the Enhanced Area Program. It also teaches trade mathematics, resource management, and employability skills. The competencies in this course are aligned with the California High School Academic Content Standards and the California Career Technical Education Model Curriculum Standards.

Prerequisites:

Enrollment requires successful completion of the Auto Tech: Emission Control/1 (79-90-65) course.

NOTE: For Perkins purposes this course has been designated as a **capstone** course.

MEETS THE BUREAU OF AUTOMOTIVE REGULATION (BAR) STANDARDS FOR THE ADVANCED CLEAN AIR COURSE TO BECOME LICENSED AS ADVANCED EMISSION SPECIALIST.

This course cannot be repeated once a student receives a Certificate of Completion.



COURSE OUTLINE COMPETENCY-BASED COMPONENTS

A course outline reflects the essential intent and content of the course described. Acceptable course outlines have six components. (Education Code Section 52506). Course outlines for all apportionment classes, including those in jails, state hospitals, and convalescent hospitals, contain the six required elements:

(EC 52504; 5CCR 10508 [b]; Adult Education Handbook for California [1977], Section 100)

COURSE OUTLINE COMPONENTS

LOCATION

GOALS AND PURPOSES

Cover

The educational goals or purposes of every course are clearly stated and the class periods are devoted to instruction. The course should be broad enough in scope and should have sufficient educational worth to justify the expenditure of public funds.

The goals and purpose of a course are stated in the COURSE DESCRIPTION. Course descriptions state the major emphasis and content of a course, and are written to be understandable by a prospective student.

PERFORMANCE OBJECTIVES OR COMPETENCIES

pp. 7-13

Objectives should be delineated and described in terms of measurable results for the student and include the possible ways in which the objectives contribute to the student's acquisition of skills and competencies.

Performance Objectives are sequentially listed in the COMPETENCY-BASED COMPONENTS section of the course outline. Competency Areas are units of instruction based on related competencies. Competency Statements are competency area goals that together define the framework and purpose of a course. Competencies fall on a continuum between goals and performance objectives and denote the outcome of instruction.

Competency-based instruction tells a student before instruction what skills or knowledge they will demonstrate after instruction. Competency-based education provides instruction which enables each student to attain individual goals as measured against pre-stated standards.

Competency-based instruction provides immediate and continual repetition and In competency-based education the curriculum, instruction, and assessment share common characteristics based on clearly stated competencies. Curriculum, instruction and assessment in competency-based education are: explicit, known, agreed upon, integrated, performance oriented, and adaptive.

COURSE OUTLINE COMPETENCY-BASED COMPONENTS
(continued)

COURSE OUTLINE COMPONENTS	LOCATION
<p>INSTRUCTIONAL STRATEGIES</p> <p>Instructional techniques or methods could include laboratory techniques, lecture method, small-group discussion, grouping plans, and other strategies used in the classroom.</p> <p>Instructional strategies for this course are listed in the TEACHING STRATEGIES AND EVALUATION section of the course outline. Instructional strategies and activities for a course should be selected so that the overall teaching approach takes into account the instructional standards of a particular program, i.e., English as a Second Language, Programs for Adults with Disabilities.</p>	p. 16
<p>UNITS OF STUDY, WITH APPROXIMATE HOURS ALLOTTED FOR EACH UNIT</p> <p>The approximate time devoted to each instructional unit within the course, as well as the total hours for the course, is indicated. The time in class is consistent with the needs of the student, and the length of the class should be that it ensures the student will learn at an optimum level.</p> <p>Units of study, with approximate hours allotted for each unit are listed in the COMPETENCY AREA STATEMENT(S) of the course outline. The total hours of the course, including work-based learning hours (community classroom and cooperative vocational education) is listed on the cover of every CBE course outline. Each Competency Area listed within a CBE outline is assigned hours of instruction per unit.</p>	Cover pp. 7-13
<p>EVALUATION PROCEDURES</p> <p>The evaluation describes measurable evaluation criteria clearly within the reach of the student. The evaluation indicates anticipated improvement in performances as well as anticipated skills and competencies to be achieved.</p> <p>Evaluation procedures are detailed in the TEACHING STRATEGIES AND EVALUATION section of the course outline. Instructors monitor students' progress on a continuing basis, assessing students on attainment of objectives identified in the course outline through a variety of formal and informal tests (applied performance procedures, observations, and simulations), paper and pencil exams, and standardized tests.</p>	pp. 16-17
<p>REPETITION POLICY THAT PREVENTS PERPETUATION OF STUDENT ENROLLMENT</p> <p>After a student has completed all the objectives of the course, he or she should not be allowed to reenroll in the course. There is, therefore, a need for a statement about the conditions for possible repetition of a course to prevent perpetuation of students in a particular program for an indefinite period of time.</p>	Cover

ACKNOWLEDGMENTS

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CALIFORNIA CAREER TECHNICAL EDUCATION MODEL CURRICULUM STANDARDS

Transportation Industry Sector Knowledge and Performance Anchor Standards

1.0 Academics

Analyze and apply appropriate academic standards required for successful industry sector pathway completion leading to postsecondary education and employment. Refer to the Transportation academic alignment matrix for identification of standards.

2.0 Communications

Acquire and accurately use Transportation sector terminology and protocols at the career and college readiness level for communicating effectively in oral, written, and multimedia formats.

3.0 Career Planning and Management

Integrate multiple sources of career information from diverse formats to make informed career decisions, solve problems, and manage personal career plans.

4.0 Technology

Use existing and emerging technology to investigate, research, and produce products and services, including new information, as required in the Transportation sector workplace environment.

5.0 Problem Solving and Critical Thinking

Conduct short, as well as more sustained, research to create alternative solutions to answer a question or solve a problem unique to the Transportation sector using critical and creative thinking, logical reasoning, analysis, inquiry, and problem-solving techniques.

6.0 Health and Safety

Demonstrate health and safety procedures, regulations, and personal health practices and determine the meaning of symbols, key terms, and domain-specific words and phrases as related to the Transportation sector workplace environment.

7.0 Responsibility and Flexibility

Initiate, and participate in, a range of collaborations demonstrating behaviors that reflect personal and professional responsibility, flexibility, and respect in the Transportation sector workplace environment and community settings.

8.0 Ethics and Legal Responsibilities

Practice professional, ethical, and legal behavior, responding thoughtfully to diverse perspectives and resolving contradictions when possible, consistent with applicable laws, regulations, and organizational norms.

9.0 Leadership and Teamwork

Work with peers to promote divergent and creative perspectives, effective leadership, group dynamics, team and individual decision making, benefits of workforce diversity, and conflict resolution as practiced in the SkillsUSA career technical student organization

10.0 Technical Knowledge and Skills

Apply essential technical knowledge and skills common to all pathways in the Transportation sector, following procedures when carrying out experiments or performing technical tasks.

11.0 Demonstration and Application

Demonstrate and apply the knowledge and skills contained in the Transportation anchor standards, pathway standards, and performance indicators in classroom, laboratory, and workplace settings, and through the SkillsUSA career technical student organization.

Transportation Pathway Standards

C. Systems Diagnostics and Service Pathway

The Systems Diagnostics and Service pathway prepares students for postsecondary education and employment in the transportation industry, which includes but is not limited to motor vehicles, rail systems, marine applications, and small-engine and specialty equipment.

Sample occupations associated with this pathway:

- ◆ Service Technician/Maintenance Worker/Shop Foreman
- ◆ Technical Writer
- ◆ Dispatcher
- ◆ Engineer
- ◆ Investigator/Inspector

- C1.0 Demonstrate the practice of personal and occupational safety and protecting the environment by using materials and processes in accordance with manufacturer and industry standards.
- C2.0 Practice the safe and appropriate use of tools, equipment, and work processes.
- C3.0 Use scientific principles in relation to chemical, mechanical, and physical functions for various engine and vehicle systems.
- C4.0 Perform and document maintenance procedures in accordance with the recommendations of the manufacturer.
- C5.0 Apply and understand appropriate business practices.
- C6.0 Demonstrate the application, operation, maintenance, and diagnosis of engines, including but not limited to two- and four-stroke and supporting subsystems.
- C7.0 Demonstrate the function, principles, and operation of electrical and electronic systems using manufacturer and industry standards.
- C8.0 Demonstrate the function and principles of automotive drivetrain, steering and suspension, brake, and tire and wheel components and systems in accordance with national industry standards.

CBE
Competency-Based Education

COMPETENCY-BASED COMPONENTS
for the Auto Tech: Emission Control/2 Course

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
<p>A. INTRODUCTION AND SAFETY</p> <p>Understand, apply, and evaluate classroom and workplace policies and procedures used in accordance with federal, state, and local safety and environmental regulations.</p> <p>(4 hours)</p>	<ol style="list-style-type: none"> 1. Review the scope and purpose of the course. 2. Review classroom policies and procedures. 3. Review classroom and workplace first aid and emergency procedures. 4. Review the different occupations in the Transportation Industry Sector which have an impact on the role of the auto technician. 5. Review the California Occupational Safety and Health Administration (Cal/OSHA) workplace requirements for auto technicians. 6. Review the impact of Environmental Protection Agency (EPA) legislation on Transportation Industry Sector practices in protecting and preserving the environment. 7. Review the impact of California Air Resources Board (ARB) legislation on Transportation Industry Sector practices in protecting and preserving the environment. 8. Review the Bureau of Automotive Repair (BAR) standards for safety and environmental protection. 9. Review and demonstrate the use of the Material Safety Data Sheet (MSDS) as it applies to the automotive industry. 10. Review the safety items required by federal, state, and local regulations. 11. Pass the safety exam with 100% accuracy. 	<p>Career Ready Practice: 1, 3, 6, 7</p> <p>CTE Anchor: Career Planning and Management: 3.4 Health and Safety: 6.1, 6.6, 6.7 Ethics and Legal Responsibilities: 8.2</p> <p>CTE Pathway: C1.1, C1.2, C1.3</p>
<p>B. RESOURCE MANAGEMENT REVIEW</p> <p>Review, apply, and evaluate the resource management principles and techniques in the auto repair and maintenance business.</p>	<ol style="list-style-type: none"> 1. Review the following: <ol style="list-style-type: none"> a. resources b. management c. sustainability 2. Review the management of the following resources in the auto repair and maintenance business: <ol style="list-style-type: none"> a. time b. materials c. personnel 3. Review specific examples of effective management of the following in the auto repair and maintenance business: <ol style="list-style-type: none"> a. time b. materials c. personnel 4. Review the benefits of effective resource management in the auto repair and maintenance business: 	<p>Career Ready Practice: 1, 2, 3, 5, 8</p> <p>CTE Anchor: Responsibility and Flexibility: 7.1, 7.4, 7.6</p> <p>CTE Pathway: C5.3</p>

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
(1 hour)	<ul style="list-style-type: none"> a. profitability b. sustainability c. company growth 5. Review the economic benefits and liabilities of managing resources in an environmentally responsible way.	
C. TRADE MATHEMATICS REVIEW Review, apply, and evaluate the mathematical requirements used in auto repair and maintenance.	<ol style="list-style-type: none"> 1. Review the practical applications of math in auto repair and maintenance. 2. Review and demonstrate problem-solving techniques involving whole number problems, using addition, subtraction, multiplication, and division. 3. Review and demonstrate problem-solving techniques involving various fraction problems, using arithmetic operations (addition, subtraction, multiplication, and division). 4. Review and demonstrate problem-solving techniques involving various decimal problems, using arithmetic operations. 5. Review and demonstrate techniques for changing fractions to decimals. 6. Review and demonstrate techniques for changing decimals to fractions. 7. Review the English system of measuring length. 8. Review the English system of measuring weight. 9. Review the English system of measuring volume or capacity. 10. Review the relationships between various English system linear units of measurement, such as inches, feet, yards, and miles. 11. Review the relationships between various English system units of volume or capacity, such as cups, pints, quarts, and gallons. 12. Review and demonstrate problem-solving techniques for various English system measuring problems, using arithmetic operations. 13. Review and demonstrate measuring techniques of various objects by using the English system measuring tools common to the trade. 14. Review the metric system of measuring length. 15. Review the metric system of measuring weight. 16. Review the metric system of measuring volume or capacity. 17. Review the relationships between various metric system linear units of measurement, such as millimeters, centimeters, and meters. 18. Review the relationships between various metric system units of weight such as milligrams, grams, and kilograms. 19. Review and demonstrate problem-solving techniques for various metric system measuring problems involving addition, subtraction, multiplication, and division. 20. Review and demonstrate measuring techniques of objects using metric system measuring tools common to the trade. 21. Review and demonstrate problem-solving techniques for geometric problems that apply to auto repair and maintenance. 22. Review and demonstrate problem-solving techniques for algebraic problems that apply to auto repair and maintenance. 23. Review and demonstrate problem-solving techniques using percentages. 	Career Ready Practice: 1, 5 CTE Anchor: Problem Solving and Critical Thinking: 5.2 CTE Pathway: C2.4, C2.7

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
(7 hour)	24. Review and demonstrate techniques for reading and interpreting graphs. 25. Review and demonstrate techniques for using a calculator.	
D. SERVICE MANUALS AND COMPUTER-BASED INFORMATION SYSTEMS REVIEW Understand, apply, and evaluate the contents of service manuals and computer-based information systems as important sources of reference to an auto technician. (2 hours)	1. Review the different types of service manuals. 2. Review the different types of information that can be found in service manuals such as specifications, troubleshooting charts, and repair information. 3. Review and demonstrate the use of service manuals. 4. Review and demonstrate the use of CD-ROM (compact disc) and web-based search engines in finding automotive technical information. 5. Review the advantages of using CD-ROM and web-based search engines over service manuals in finding automotive technical information.	Career Ready Practice: 1, 11 CTE Anchor: Communications: 2.3 Technology: 4.1, 4.2, 4.6 CTE Pathway: C2.6, C4.3
E. NITROGEN OXIDE (NO _x) EMISSIONS Understand, apply, and evaluate diagnostic and repair procedures for NO _x emissions. (5 hours)	1. Describe the properties of NO _x . 2. Describe the following causes of excessive NO _x emissions: <ol style="list-style-type: none"> lean air/fuel over-advanced timing inoperative emission components inadequate cooling 	Career Ready Practice: 1, 5, 10, 12 CTE Anchor: Communications: 2.3 Technology: 4.1 Problem Solving and Critical Thinking: 5.3, 5.4 Health and Safety: 6.6 Ethics and Legal Responsibilities: 8.2 Technical Knowledge and Skills: 10.1, 10.2 CTE Pathway: C1.1, C1.3, C2.1, C2.6, C3.7, C4.3, C6.3, C6.4

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
<p>F. DIGITAL STORAGE OSCILLOSCOPE (DSO)</p> <p>Understand, apply, and evaluate the set-up and operational techniques for the DSO and the oxygen sensor.</p> <p>(10 hours)</p>	<ol style="list-style-type: none"> 1. Discuss the features and functions of the different parts of the DSO and oxygen sensor. 2. Discuss and demonstrate the set-up and operational techniques for the DSO. 3. Analyze oxygen sensor waveform patterns. 4. Discuss and demonstrate the techniques used for forming a diagnostic approach. 	<p>Career Ready Practice: 1, 4</p> <p>CTE Anchor: Communications: 2.3 Problem Solving and Critical Thinking: 5.3 Health and Safety: 6.6 Responsibility and Flexibility: 7.7 Technical Knowledge and Skills: 10.1</p> <p>CTE Pathway: C1.1, C1.3, C2.1, C2.3, C4.3, C6.3</p>
<p>G. BAR'S DIAGNOSTIC FLOWCHART</p> <p>Understand, apply, and evaluate the parts/contents of the BAR's diagnostic flowchart.</p> <p>(5 hours)</p>	<ol style="list-style-type: none"> 1. Identify the parts and contents of a BAR's diagnostic flowchart worksheet. 2. Describe and demonstrate the proper documentation of diagnostic information gathered using BAR's diagnostic flowchart worksheet. 3. Describe and demonstrate the evaluation techniques for collected test data. 	<p>Career Ready Practice: 1, 3, 4, 11</p> <p>CTE Anchor: Communications: 2.3 Problem Solving and Critical Thinking: 5.3, 5.4 Technical Knowledge and Skills: 10.1</p> <p>CTE Pathway: C1.3, C2.6</p>

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
<p>H. LOADED MODE EMISSIONS</p> <p>Understand, apply, and evaluate the loaded mode emissions baselining techniques.</p> <p>(15 hours)</p>	<ol style="list-style-type: none"> 1. Formulate a diagnostic strategy of possible system(s) component(s) failures. 2. Describe and demonstrate the techniques for the inspection of major engine performance systems. 3. Describe and demonstrate a baseline emissions test using the BAR-97 EIS. 4. Describe and demonstrate the techniques for an after-repair emission/baseline test to confirm success of repairs. 	<p>Career Ready Practice: 1, 3, 4, 5, 10, 12</p> <p>CTE Anchor: Problem Solving and Critical Thinking: 5.2, 5.4 Technical Knowledge and Skills: 10.2</p> <p>CTE Pathway: C2.3, C4.2, C6.1</p>
<p>I. CATALYTIC CONVERTER</p> <p>Understand, apply, and evaluate the catalytic converter theory, operation, and efficiency testing procedures.</p> <p>(15 hours)</p>	<ol style="list-style-type: none"> 1. Describe the theory of oxidation and reduction-type catalytic conversion. 2. Describe the effects of the air/fuel mixture on the system's operation. 3. Describe and demonstrate the operational techniques for catalytic converters. 4. Describe and demonstrate the testing techniques to determine the efficiency of the catalytic converter(s). 	<p>Career Ready Practice: 1, 3, 4, 5, 10, 12</p> <p>CTE Anchor: Communications: 2.3 Problem Solving and Critical Thinking: 5.4 Health and Safety: 6.6 Ethics and Legal Responsibilities: 8.2 Technical Knowledge and Skills: 10.1</p> <p>CTE Pathway: C1.1, C1.3, C2.3</p>

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
<p>J. BAR-97 EIS FOR ENHANCED AREA PROGRAM</p> <p>Understand, apply, and evaluate the BAR-97 EIS testing procedures for the Enhanced Area Program.</p> <p>(20 hours)</p>	<ol style="list-style-type: none"> 1. Review the following: <ol style="list-style-type: none"> a. Enhanced Areas (California’s smoggiest regions) b. Enhanced Area Vehicles c. major chemical components of smog: <ol style="list-style-type: none"> i. NO_x (oxides of nitrogen) ii. HC (hydro carbons) iii. CO (carbon monoxide) 2. Review and describe the features and functions of the following parts of a BAR 97-EIS: <ol style="list-style-type: none"> a. 5-gas analyzer b. additional hardware c. software d. fuel cap tester e. dynamometer with safety restraints 3. Review and demonstrate the operational techniques for the BAR-97 EIS 4. Review and demonstrate the NO_x test techniques for the Acceleration Simulation Mode (ASM). 5. Review the features of the following motor vehicle exceptions to the BAR-97 ASM tests: <ol style="list-style-type: none"> a. full-time drive b. four-wheel drive c. all-wheel drive d. traction control e. specified heavy-duty trucks 6. Review the Automotive Service Excellence certification competencies in A6, A8 and L1 in order to operate the BAR-97 EIS. 7. Review the importance of the BAR-97 EIS as a diagnostic tool in pinpointing vehicle abnormalities. 	<p>Career Ready Practice: 1, 3, 4, 5, 12</p> <p>CTE Anchor: Problem Solving and Critical Thinking: 5.4 Health and Safety: 6.2, 6.5, 6.6, 6.7 Ethics and Legal Responsibilities: 8.1, 8.2 Technical Knowledge and Skills: 10.1</p> <p>CTE Pathway: C1.3, C1.4, C2.1, C2.2, C2.3</p>
<p>K. EMPLOYABILITY SKILLS REVIEW</p> <p>Understand, apply, and evaluate the employability skills required in auto repair and maintenance.</p>	<ol style="list-style-type: none"> 1. Review employer requirements for the following: <ol style="list-style-type: none"> a. punctuality b. attendance c. attitude toward work d. quality of work e. teamwork f. responsibility g. timeliness h. communication skills 2. Review the importance of the continuous upgrading of job skills through lifelong learning. 3. Review preprofessional and professional industry organizations and discuss the employability benefits of belonging. 4. Review the need to adapt to varied roles and responsibilities in the workplace. 5. Review the importance of personal integrity and ethical behavior in the workplace. 	<p>Career Ready Practice: 1, 2, 3, 5, 10, 11</p> <p>CTE Anchor: Communications: 2.1, 2.2, 2.3, 2.4 Career Planning and Management: 3.1, 3.2, 3.4, 3.6, 3.9 Responsibility and Flexibility: 7.2, 7.3, 7.4, 7.5, 7.7 Ethics and Legal Responsibilities: 8.3</p>

COMPETENCY AREAS AND STATEMENTS	MINIMAL COMPETENCIES	STANDARDS
(3 hours)	<ol style="list-style-type: none"> 6. Review customer service as a method of building permanent relationships between the organization and the client. 7. Review conflict resolution strategies for a variety of workplace situations. 8. Review ways to demonstrate respect for individual and cultural differences and for the attitudes and feelings of others. 9. Update list of potential employers through traditional and internet sources. 10. Review the role of electronic social networking in job search. 11. Finalize sample résumés and cover letters. 12. Review the importance of filling out a job application legibly, with accurate and complete information. 13. Review the common mistakes that are made on job applications. 14. Complete sample job application forms correctly. 15. Review the importance of enthusiasm in the interview and on a job. 16. Review the importance of appropriate appearance in the interview and on a job. 17. Review a career plan that builds on existing interests, skills, and abilities. 18. Review the informational materials, resources, and test knowledge needed to be successful in an interview. 19. Review and demonstrate appropriate interviewing techniques. 	<p>Leadership and Teamwork: 9.2, 9.6 Demonstration and Application: 11.5</p> <p>CTE Pathway: C5.3, C5.4, C5.5</p>
<p>L. ENTREPRENEURIAL SKILLS</p> <p>Understand, apply, and evaluate the process involved in becoming an entrepreneur in the auto repair and maintenance industry.</p> <p>(3 hours)</p>	<ol style="list-style-type: none"> 1. Define entrepreneurship. 2. Identify the necessary characteristics of successful entrepreneurs. 3. Describe the contributions of entrepreneurs to the auto repair and maintenance industry. 4. Explain the purpose and components of a business plan. 5. Examine personal goals prior to starting a business. 6. Evaluate sources of monetary investment in a business opportunity. 7. Describe various licensing requirements in the auto repair and maintenance business. 8. Develop a scenario depicting the student as the auto repair and maintenance business owner. 9. Differentiate between sustainable and green business practices and standard business practices. 	<p>Career Ready Practice: 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12</p> <p>CTE Anchor: Communications: 2.3, 2.4 Career Planning and Management: 3.4, 3.5, 3.7, 3.9 Responsibility and Flexibility: 7.6 Technical Knowledge and Skills: 10.3 Demonstration and Application: 11.3, 11.4</p> <p>CTE Pathway: C1.1, C5.3, C5.4, C5.5</p>

SUGGESTED INSTRUCTIONAL MATERIALS and OTHER RESOURCES

TEXTBOOKS

Bureau of Automotive Repair. Clean Air Car Course Student Materials Set. Bureau of Automotive Repair, 2008.

Duffy, James E. Modern Automotive Technology, 7th Edition. Goodheart-Willcox Publishing, 2009.

Halderman, James D. and James Linder. Automotive Fuel and Emissions Control Systems. Prentice Hall, 2008.

Horngren, Charles T. NATEF Correlated Task Sheets to Accompany Automotive Fuel and Emissions Control Systems. Prentice Hall Professional Technical Reference, 2008.

Tomita, A. Emissions reduction: NOx/Sox Suppression. Elsevier Science and Technology Books. 2008.

SUPPLEMENTAL BOOKS

Bureau of Automotive Repair. Laws and Regulations Relating to Automotive Repair Dealers and Smog Check Stations. California Department of Consumer Affairs, Bureau of Automotive Repair, 2009.

Bureau of Automotive Repair. Smog Check Inspection Procedures Manual. California Department of Consumer Affairs, Bureau of Automotive Repair, 2009.

Bureau of Automotive Repair. Write it Right Booklet: A Guide for Licensed Smog Check Stations. California Department of Consumer Affairs, Bureau of Automotive Repair, 2009.

RESOURCES

Employer Advisory Board members

Foundation Standards

<http://www.cde.ca.gov/ci/ct/sf/documents/transportation.pdf>

Automotive Retailing Today (ART) 8400 Westpark Dr., MS 2, McLean, VA 22102. Phone: (703) 556-8578.

Automotive Service Councils of America

One Capitol Mall, Suite 320

Sacramento, CA 95814

www.asca.com

Automotive Youth Educational Systems (AYES) 50 W. Big Beaver, Suite 145, Troy, MI 48084. Phone: (248) 526-1750. Fax: (248) 526-1751.

Field Representatives from the Bureau of Automotive Repair offices:

Culver City Branch (310) 410-0024

South El Monte (626) 575-6934

South El Monte HQ (626) 350-6494

Valencia

(661) 702-6600

National Automobile Dealers Association (NADA) Public Relations Dept., 8400 Westpark Dr., McLean, VA 22102-3591. Phone: (703) 821-7000.

National Automotive Technicians Education Foundation (NATEF) 101 Blue Seal Dr. SE, Suite 101, Leesburg, VA 20175. Phone: (703) 669-6650. Fax: (703) 669-6125.

www.natef.org

http://www.ed-foundation.org/html_pages/products_programs_services/natef_tools/non-structural_analysis/non-structural_analysis.shtml

National Institute for Automotive Service Excellence (ASE) 101 Blue Seal Dr. SE, Suite 101, Leesburg, VA 20175. Phone: (703) 669-6600.

SkillsUSA P.O. Box 3000, Leesburg, VA 20177-0300. Phone: (703) 777-8810. Fax: (703) 777-8999.

www.skillsusa.org

COMPETENCY CHECKLIST

TEACHING STRATEGIES and EVALUATION

METHODS AND PROCEDURES

- A. Lecture and discussion
- B. Demonstration using vehicles of early and late model years
- C. Multi-Sensory presentation
- D. Lab and shop work using early and late model year vehicles

EVALUATION

State requirements mandate that students complete all laboratory assignments from the Basic Clean Air Car Course student workbook in order to receive a state required course certificate.

A minimum of 68 hours of attendance must be completed by students before receiving a state required course certificate.

SECTION A – Introduction and Safety – Pass the safety test with 100% accuracy.

SECTION B – Resource Management Review – Pass all assignments and exams on resource management review with a minimum score of 80% or higher.

SECTION C – Trade Mathematics Review – Pass all assignments and exams on trade mathematics review with a minimum score of 80% or higher.

SECTION D – Service Manuals and Computer-Based Information Systems Review – Pass all assignments and exams on service manuals and computer-based information systems review with a minimum score of 80% or higher.

SECTION E – Nitrogen Oxide (NO_x) Emissions – Pass all assignments and exams on nitrogen oxide (NO_x) emissions with a minimum score of 80% or higher.

SECTION F – Digital Storage Oscilloscope (DSO) – Pass all assignments and exams on digital storage oscilloscope system (DSO) with a minimum score of 80% or higher.

SECTION G – BAR's Diagnostic Flowchart – Pass all assignments and exams on BAR's diagnostic flowchart with a minimum score of 80% or higher.

SECTION H – Loaded Mode Emissions – Pass all assignments and exams on loaded mode emissions with a minimum score of 80% or higher.

SECTION I – Catalytic Converter – Pass all assignments and exams on catalytic converter with a minimum score of 80% or higher.

SECTION J – BAR-97 EIS for Enhanced Area Program – Pass all assignments and exams on BAR-97 EIS for enhanced area program with a minimum score of 80% or higher.

SECTION K –Employability Skills Review – Pass all assignments and exams on employability skills review with a minimum score of 80% or higher.

SECTION L –Entrepreneurial Skills– Pass all assignments and exams on entrepreneurial skills with a minimum score of 80% or higher.

DEFINITIONS OF TERMS FOR A VEHICLE INSPECTION REPORT

%CO₂: Carbon Dioxide is a colorless, odorless gas which is a byproduct of most combustion processes and also of human respiration. It is the same gas found in soda pop. High levels of CO₂ in exhaust typically indicate greater engine efficiency; however, CO₂ is considered a greenhouse gas that may cause global warming. High or low levels of carbon dioxide emissions are not grounds for a vehicle failing the Smog Check; the measurement is meant as a diagnostic tool for technicians. CO₂ is measured in percent.

%O₂: Oxygen is a colorless, odorless gas necessary for life on the planet and also for engine combustion to occur. The atmosphere is comprised of approximately 21% oxygen. High levels of O₂ emissions can indicate a problem with the catalytic converter. High or low levels of O₂ emissions are not grounds for a vehicle failing the Smog Check; the measurement is meant as a diagnostic tool for technicians. O₂ is measured in percent.

Air Injection: Also known as the smog pump. Pumps air into the exhaust manifold to burn unburned fuels (hydrocarbons).

AVE: The average emissions for vehicles in the same Emissions Standards Category (ESC). ESCs are based on model year and whether the vehicle is a passenger car or a light-, medium-, or heavy-duty truck. The average emissions reading is meant as a guidepost for technicians when repairing vehicles that fail a Smog Check; it has no effect on the pass/fail result of the emissions test.

Acceleration Simulation Mode (ASM): This is the test type for vehicles operated on a dynamometer (treadmill like device) which simulates actual driving conditions.

Bureau of Automotive Repair (BAR): Part of the California Department of Consumer Affairs, the Bureau of Automotive Repair (BAR) is a consumer protection agency focused exclusively on automotive repair issues. BAR licenses auto repair dealers, Smog Check stations, and Smog Check technicians. BAR administers the Smog Check program, as required by law. BAR investigates complaints from consumers about auto repair establishments, and recovers millions of dollars for consumers each year. BAR is completely separate from the Department of Motor Vehicles and the Air Resources Board.

Catalytic Converter: Located between the exhaust manifold and the muffler, this device uses precious metals as a catalyst to turn hydrocarbons, carbon monoxide, oxygen, and oxides of nitrogen into carbon dioxide and water vapor.

Certification: Indicates whether your vehicle was manufactured to meet United States Environmental Protection Agency or more stringent California emissions standards.

Carbon Monoxide (CO%): Carbon Monoxide is a colorless, odorless gas that is fatal to many life forms in moderate concentrations. CO emissions are often the byproduct of an overly rich fuel mixture. Unhealthy levels of CO emissions result in a vehicle failing its Smog Check. CO is measured in percent.

Consumer Assistance Program (CAP): The Consumer Assistance Program is available at participating Gold Shield stations for motorists who need financial assistance (up to \$500) making repairs to their vehicle when it fails a biennial (every other year) Smog Check. [Click here](#) to learn more about the Consumer Assistance Program and to obtain an application.

Cylinders: The number of combustion cylinders in the engine (usually 4, 6, or 8).

Directed Vehicle: In order to comply with state law, the California Department of Consumer Affairs/Bureau of Automotive Repair (DCA/BAR) directs a portion of the vehicles registered in Enhanced Smog Check Areas to Test-Only and Gold Shield stations. These vehicles are called Directed Vehicles. Enhanced Areas are those parts of the state with "serious," "severe," or "extreme" ozone pollution problems.

DMV ID Number: A number used to locate the electronic smog certificate in the event it is electronically misfiled.

EGR Functional: During the Smog Check inspection, the technician performs a functional test of the EGR system per the vehicle manufacturer's instructions. This ensures the EGR system is operating as designed.

EGR Visual: As part of the Smog Check inspection, the technician performs a visual inspection of all emission components the vehicle is equipped with, including the EGR system. The technician visually inspects the EGR valve and associated plumbing for defects or modifications. The technician will either pass or fail the fuel cap visual test based on observations made during the test.

Emissions Control System (ECS): The Emissions Control System is any of a number of separate emissions control components which, together, reduce the level of pollutants emitted from a vehicle.

Emissions Inspection System (EIS): The EIS can be defined as the complete BAR97 system, the analyzer, dynamometer and peripheral devices.

Emission Standards Category (ESC): ESCs are the pass/ fail emission level cut points for a specific class of vehicles. For example, 1975 through 1978 trucks with a Gross Vehicle Weight Rating (GVWR) over 8500 pounds would have the same cut points, therefore, they are in the same ESC.

Emissions Test: The third of the three vital parts of the California Smog Check. This is where the emissions analyzer tests actual emissions from your vehicle, as measured at the tailpipe. Only the emissions test can label a car a [Gross Polluter](#). Emissions measured include Carbon Monoxide (CO), Carbon Dioxide (CO₂), Hydrocarbons (HC) and Oxygen (O₂). In California's most polluted urban areas (Enhanced Areas), the emissions test also measures levels of oxides of nitrogen (NO_x).

Engine Size: Measured in displacement of either cubic inches, cubic centimeters, or cubic liters.

Evaporative Emission Control System (EVAP): The EVAP system prevents raw gasoline from escaping the vehicle and evaporating into the atmosphere. As part of the inspection, the technician visually inspects the EVAP system and associated plumbing for defects or modifications. The technician will either pass or fail the EVAP system based on observations made during the test.

Exhaust: Usually either single (one pipe) or dual (two pipes).

Exhaust Gas Recirculation (EGR): The vehicle's Exhaust Gas Recirculation system reroutes exhaust gases back through the intake manifold to lower engine temperatures and, in so doing, reduces [NO_x](#) emissions. The EGR functional test is part of the two-speed idle (TSI) [test](#), but is not necessary for the ASM (BAR-97) [test](#) because that equipment tests for NO_x.

Fail: The level of harmful emissions from this vehicle, on this portion of the test, exceeds the range of what is reasonable for this model/engine combination, and is contributing to unhealthy air in California.

Fuelpipe Restrictor: A functional test of the fuel pipe restrictor is performed only on vehicles being initially registered in California. If the fuel pipe restrictor is oversized due to tampering, then the fuel pipe restrictor functional test fails.

Fuel EVAP Functional: A functional test of the evaporative emission control system is under development by the Bureau. Until the test is implemented, the technician will enter "non applicable" into the analyzer for this test.

Fuel Cap Integrity Test: Tests whether gasoline fumes can leak out from your tank around the cap. Gasoline fumes contain high levels of harmful pollutants, including benzene, a known carcinogen. Studies by the United States

Environmental Protection Agency show that around 30 percent of all the emissions from a vehicle are in the form of fuel evaporation, usually from the fuel tank.

Fuel Cap Visual Test: As part of a Smog Check inspection, the technician visually inspects the fuel tank cap for defects, (i.e. cracked or deteriorated rubber seal). The technician will either pass or fail the fuel cap visual test based on observations made during the test.

Fuel Evaporative Controls: Also known as the charcoal canister, this system stops vapors from the carburetor bowl and the gas tank from evaporating into the atmosphere.

Fuel Type: Only vehicles fueled by gasoline, natural gas, and propane are currently included in the Smog Check program. Light-duty diesel vehicles are excluded.

Functional Inspection: The second of the three vital parts of the California Smog Check. The functional check ensures the correct vehicle timing and [EGR System](#) function. The engine malfunction light is also part of the functional inspection. Emissions system defects identified during the functional inspection are considered unhealthy for the air and result in an overall Smog Check failure.

Gold Shield Dealer: The Gold Shield Dealer station sub-type is a new car dealer in a Basic or Change of Ownership area and has the ability to smog enhanced area cars that are to be sold in their program area.

Gold Shield Station: The Gold Shield Station type has met certain performance criteria and performs [CAP](#) repairs. As of late 2007, Gold Shield stations are authorized to perform initial inspections on Directed Vehicles.

GP: The emissions level, or "cut point," at which a vehicle fails as a [Gross Polluter](#). The emissions of a gross polluter are typically at least twice as high as those of an ordinary failing vehicle. Repairs on a Gross Polluter must be verified at a Test-Only or Gold Shield station. (Click here for Test-Only or Gold Shield [station listings](#)).

Gross Polluter: The emissions levels, or "cut points," established for the highest-polluting vehicles. The emissions of a Gross Polluter are typically at least twice as high as those of an ordinary failing vehicle. Repairs on a Gross Polluter must be verified at a Test-Only or Gold Shield station. (Click here for Test-Only or Gold Shield [station listings](#)).

Gross Vehicle Weight Rating (GVWR): Gross Vehicle Weight Rating is the weight of the vehicle plus the maximum load it is designed to carry. This differs from the vehicle's [Test Weight](#).

Hydrocarbons (HC) (PPM): Hydrocarbons are the component of fuels that produce energy. HC emissions from a vehicle are basically unburned fuel. High levels of HC emissions indicate incomplete fuel combustion, either the result of a misfire or of low engine compression. Unhealthy levels of HC emissions result in a vehicle failing its Smog Check. Hydrocarbons are measured in parts per million (PPM).

Ignition Timing: The timing of the spark relative to the operation of the valves and the placement of the piston in the cylinder. BTDC stands for "before top dead center" a reference to a mark on the main pulley on the front of the engine. For most engines, when the timing is set to 0 degrees TDC, the number one piston will fire at the very top of the stroke. For vehicles where the manufacturer specifies a timing setting, the Smog Check inspection allows plus or minus three degrees from that setting. For vehicles where the manufacturer specifies a timing range, the vehicle must be within that timing range. Advanced timing is when the spark fires before the piston has reached the top of the stroke. Retarded timing is when the spark fires after the piston has reached the top

Inspection Reason: Either biennial (in conjunction with a DMV registration renewal notice), change of ownership (selling a car), or initial (first time registered in California).

License: The California license plate number on your vehicle. This field is left blank when there is no license plate on the vehicle.

Make: The vehicle manufacturer's brand name.

MAX: The maximum allowable emissions for the particular make, model, and year of vehicle. Vehicles with emissions that exceed this level, or "cut point," fail the emissions portion of the Smog Check. There are separate cut points for vehicles failing at ordinary vs. [Gross Polluter](#) levels.

MEAS: The amount of each specific pollutant measured during the emissions test of the vehicle.

Model: The vehicle manufacturer's model name.

Model-Year: The vehicle manufacturer's model year for your vehicle. Not necessarily the year the vehicle was built.

NO (PPM): Oxides of nitrogen (more commonly called NOx) are odorless gases that help form smog, and give smog its characteristic brown color. NO is produced when temperatures in the combustion chambers exceed 2500 degrees Fahrenheit. Excessive engine temperatures could be caused by a lean fuel mixture, by retarded timing, by carbon buildup inside the combustion chamber, or by a malfunctioning engine cooling system. The function of the [EGR System](#) is to reduce NO. Unhealthy levels of NO emissions result in a vehicle failing its Smog Check. NO is measured in parts per million (PPM).

Odometer: The number of miles on your vehicle as reported by the technician based on his or her reading of your vehicle's odometer.

Oxygen Sensor: A device located in the exhaust manifold or exhaust pipe which compares the level of oxygen in the ambient air to the level of oxygen in the exhaust stream and sends a signal to the vehicle's onboard computer, which adjusts the fuel mix accordingly.

Parts Per Million (PPM): This is a unit of measurement for both Oxides of Nitrogen and Hydrocarbons which are measured by the BAR97 emissions analyzer.

Pass: The level of harmful emissions from this vehicle, on this portion of the test, is within the range of what is reasonable for this model/engine combination. Thank you for doing your part to improve our air quality to healthy levels in California.

Positive Crankcase Ventilation (PCV): Positive Crankcase Ventilation removes gases blown around the pistons and rings from the engine crankcase, and reroutes them through the intake manifold to be burnt again.

Regular Test and Repair: The Regular Test and Repair Station type performs inspections and repairs all types of vehicles. This station type does not have the ability to certify directed (Test Only) vehicles or vehicles with emissions in the [gross polluter](#) range.

Revolutions Per Minute (RPM): Revolutions per minute is a measurement of engine speed. Engine turning speed typically does not correspond to the speed of the vehicle.

RepairTech Name / Number: The name of the licensed Smog Check technician who repaired the vehicle, if applicable or known.

Smog Check Certificate Number: This is the number of the electronic certificate sent to the Department of Motor Vehicles (DMV) which allows the owner to complete his or her registration. The Vehicle Inspection Report is proof of the vehicle passing a Smog Check.

Software Version / EIS Number: The BAR-certified version of the software that the emissions analyzer unit used during the test, and the unique identification number for the analyzer unit.

State: The state where the vehicle is registered.

Station Number: The license number of the Smog Check station where the test was performed.

System Malfunction Light: Also known as the "check engine light," this early warning signal in the vehicle cabin indicates engine problems. Such problems could cause serious performance or engine problems for the vehicle if not checked and repaired, and could lead to excessive amounts of pollution being emitted during certain driving conditions which may not be detected during a Smog Check.

Technician Name / Number: The name of the licensed Smog Check technician who performed the test, and his/her individual license number.

Test: The Acceleration Simulation Mode (BAR-97) test measures vehicle emissions levels at 15 mph and 25 mph with driving conditions simulated by the dynamometer, a treadmill-like device. The two-speed idle (TSI or BAR-90) test measures the emissions levels of a stationary vehicle at two engine idle speeds.

Test Only: The Test Only station type has the ability to test and certify all vehicles, though it cannot perform any repairs.

Test Weight: The actual weight of your vehicle as measured during the Smog Check.

Thermostatic Air Cleaner: Draws warm air into a cold engine to help fuel vaporize before burning. This system is important before the engine warms up, to improve cold drivability and cold-engine emissions reductions.

Transmission: Either manual (3-, 4-, 5-, or 6-speed) or automatic.

Type: Vehicles eligible for the Smog Check program include passenger cars, light-duty trucks and heavy-duty trucks.

Vacuum Lines to Sensors/Switches: A visual inspection of the vacuum lines to the sensors and switches in all of the emission control systems on the vehicle is performed. The technician will either pass or fail these components based on observations made during the test.

Vehicle Identification Number (VIN): Your vehicle's unique identification number, usually 17 digits but sometimes less. Typically found on the top of the dash just inside the windshield on the driver's side, or on a plate/sticker in the driver's side door jamb. The BAR code on your DMV registration renewal also contains this number. Contact the DMV if the VIN on your vehicle does not match the VIN on your registration form.

Visual Inspection: The first of the three vital parts of the California Smog Check. The visual inspection checks for missing, disconnected, or visibly damaged emissions-system components, including the catalytic converter, the thermostatic air cleaner, the heat riser and the smog pump. Emissions system defects identified during the visual inspection are considered unhealthy for the air and result in an overall Smog Check failure.

VLT Record #: Your vehicle's record on the Bureau of Automotive Repair's Vehicle Lookup Table (VLT). The table contains specific information for each vehicle model and engine combination available. Information from the VLT regarding your vehicle's weight and aerodynamic resistance allows the Smog Check emissions analyzer to correctly set the resistance on the dynamometer (a treadmill-like device used to test vehicles in the smoggiest urban areas of the state).

Wiring to Sensors/Switches: A visual inspection of the wiring to the sensors and switches in all of the emission control systems on the vehicle is performed. The technician will either pass or fail these components based on observations made during the test.

Statement for Civil Rights

All educational and vocational opportunities are offered without regard to race, color, national origin, gender, or physical disability.
