

**Technical and Professional
Education**

**Curriculum Content Frameworks for
Automotive Service
Technology**

**Curriculum Content Frameworks for
Automotive Service Technology
Developed by the
University of Arkansas at Little Rock**

**State of Arkansas
Department of Workforce Education**

NOTICE TO THE READER

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Preface

The Technical & Professional Education program continues to prepare students for employment and continuing education. To accomplish this preparation, teachers and employers have collaborated to modify individual programs to ensure that instruction is current and comprehensive. This document reflects essential competencies for program completers as well as All Aspects of the Automotive Service Technology Industry as required by the Carl D. Perkins Act. The Curriculum Content Frameworks for all Technical & Professional Education programs can be accessed through the Department of Workforce Education Web site.

Forward

The curriculum content framework *Automotive Service Technology* supports the course that prepares students for the following career roles, which in turn correspond to the CIP (Classification of Instructional Programs) codes listed below. The courses may be sequenced with a variety of career and technical courses to form a specialization to prepare students for careers and support additional education and training in the protective services industry.

The Transportation cluster of programs prepares students for careers in automotive service and repair, aviation maintenance, diesel equipment maintenance and repair, and small engine repair.

Programs within the Transportation cluster are listed as follows:

- Automotive Body Technology — Certified
- Automotive Service Technology — Certified
- Aviation Maintenance Technology
- Diesel Equipment Technology
- Small Engine Repair
- Career Role CIP Code – 47.0604
- O-NET 49-3023.XX

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The Automotive Services Technology curriculum content framework was produced by a team of program developers from the University of Arkansas at Little Rock. The framework was reviewed by a panel of experts in the field of automotive service technology. The format and content of the framework reflect the specific training needs within the state of Arkansas while maintaining the essential elements of ASE standards. The framework content and format is modeled after a document originally developed by a writing team under the auspices of the Virginia Department of Education. Grateful appreciation is expressed to the Virginia Department of Education and the Instructional Materials Laboratory, University of Missouri-Columbia for granting the Arkansas State's Department of Workforce Education access to their instructional frameworks.

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Introduction

About the Program

This framework has been developed for use in designing and implementing a competency-based program in Automotive Service Technology. The competencies in this guide are based on the Automotive Service Excellence (ASE) national standards for automotive service technology for (administered by the National Automotive Technicians Education Foundation, or NATEF) and are presented in three major sections.

About the Document

This document includes the following components:

- Section 1 contains a master duty/task list for the Automotive Service Technology program.
- Section 2 contains an analysis of each task, consisting of the task, task definition, and process/skill questions to evaluate acceptable performance. In parentheses beside many of the standards are codes beginning with Roman numerals (e.g., III.D.19) that refer to the 2002 edition of the NATEF Task List contained in the *ASE Program Certification Standards for Service and Repair*. All tasks have been designated essential. Essential tasks are those that must be achieved by every student pursuing the completion of the Automotive Services Technology program.
- Section 3 lists the Arkansas Standards of Learning for language arts, mathematics, and science that are reinforced by instruction in the Automotive Service Technology program. Academic skills in these areas are necessary for the mastery of a number of tasks performed by automotive service technicians on the job.

Program Description

494180 – Brakes

494190 – Electrical Systems

494200 – Engine Performance

494210 – Suspension and Steering

Students learn to repair fuel, electrical, brake, and suspension systems. Instruction is given also in the adjustment and repair of individual components.

Master Duty/Tasks Listing

Automotive Service Technology

Brakes
Electrical Systems
Engine Performance
Suspension and Steering

National and state experts in the occupational field of automotive service and repair have validated the duties and tasks in this section. Each is analyzed by identifying the following:

- a *duty/task statement*, which describes what the student is to do

DUTY A: Applying Safety Practices On The Job
TASK:
A001: Identify the safe use of chemicals.
A002: Identify the safe use and maintenance of hand tools.
A003: Identify the safe use and maintenance of power tools.
A004: Identify the safe use of protective clothing and equipment.
A005: Identify the safe use of fire protection equipment.
A006: Identify the safe use of shop equipment (including hydraulics).
A007: Identify safe under-hood practices.
A008: Follow Environmental Protection Agency (EPA), Occupational Safety and Health Act (OSHA), and National Automotive Technicians Educational Foundation/Automotive Service Excellence (NATEF/ASE) regulations.
DUTY B: Performing Shop Operations
TASK:
B001: Communicate with customers orally and in writing.

B002: Estimate time and cost for jobs, and order parts.
B003: Obtain appropriate repair information from shop manuals.
B004: Practice clean and orderly work habits.
DUTY C: Practicing Job And Career Basics
TASK:
C001: Identify basic functions and operations of vehicle mechanical components.
C002: Identify the duties of an automotive technician.
C003: Identify career opportunities in the automotive technology field.
C004: Identify the purposes and goals of the student organization.
C005: Participate in course activities sponsored by the student organization (e.g., meetings, programs, and other projects that require specialized skills and concepts).
DUTY D: Diagnosing General Electrical System Diagnosis
TASK:
D001: Check continuity in electrical circuits using test light and voltmeter, oscilloscope, and wiring diagrams.
D002: Check for shorts, opens, and grounds.
D003: Measure resistance in electrical circuits using an ohmmeter.
D004: Measure volts with a voltmeter or oscilloscope.
D005: Measure current with an ammeter.

DUTY E: Diagnosing And Servicing Battery
TASK:
E001: Clean and inspect battery clamps, cables, and connectors.
E002: Perform battery condition tests.
E003: Jump-start a vehicle.
E004: Charge and install a battery.
E005: Service and troubleshoot special battery applications (e.g., for electric car).
DUTY F: Diagnosing And Repairing Starting System
TASK:
F001: Diagnose and determine needed repair on starting system.
F002: Remove, clean, and inspect starter motor and components.
F003: Repair or replace starter motor components.
DUTY G: Diagnosing And Repairing Charging System
TASK:
G001: Diagnose and determine needed repair on charging system.
G002: Remove, clean, and inspect alternator.
G003: Repair or replace alternator components.
G004: Repair or replace charging system components.

DUTY H: Diagnosing And Repairing Lighting System
TASK:
H001: Diagnose and determine needed repair on lighting system.
H002: Diagnose and determine needed repair on complex lighting systems (e.g., fiber optics, twilight sentinels, remote sensors, global positioning systems).
H003: Repair or replace lights, sockets, wires, and switches.
DUTY I: Service Of Gauges, Warning Devices, And Drivers Information Systems
TASK:
I001: Diagnose and repair mechanical gauge and warning circuits.
I002: Diagnose digital and fiber optics gauges and warning circuits.
I003: Diagnose and repair electrical accessories (horn, wiper motor).
DUTY J: Diagnosing And Repairing Ignition System
TASK:
J001: Test engine performance using engine analyzer (and NATEF-recommended tools), and determine needed repairs.
J002: Inspect, repair, or replace primary ignition components.
J003: Inspect, repair, or replace secondary ignition components.
J004: Adjust ignition system to manufacturer's specifications.
J005: Perform on-board computer system diagnosis.
J006: Repair or replace computer system components.

DUTY K: Diagnosing And Repairing Fuel And Exhaust System
TASK:
K001: Diagnose and determine needed repairs on fuel system.
K002: Inspect, repair, or replace fuel supply component.
K003: Disassemble, clean, and inspect carburetors.
K004: Reassemble and adjust carburetor.
K005: Disassemble, clean, and inspect fuel injection components.
K006: Repair or replace fuel injection components.
K007: Adjust computer-controlled fuel systems (injection and carburetor).
K008: Diagnose and repair exhaust system problems (including emerging technology, such as noise cancellation devices), to meet manufacturer's specifications.
K009: Identify issues involved in alternative fuel (e.g., diesel fuel, compressed natural gas) and multi-fuel systems.
DUTY L: Diagnosing And Repairing Emission Control System
TASK:
L001: Diagnose and determine needed repairs on emission control systems (both basic and complex).
L002: Clean and inspect/replace PCV system components.
L003: Clean and inspect/replace spark timing controllers.
L004: Clean and inspect/replace idle speed controllers.
L005: Clean and inspect/replace exhaust gas recirculation.

L006: Clean and inspect/replace air management system.
L007: Clean and inspect/replace inlet air temperature control.
L008: Clean and inspect/replace intake manifold heat controls.
L009: Clean and inspect/replace fuel vapor controls.
DUTY M: Diagnosing And Repairing General Engine
TASK:
M001: Conduct performance test, and determine needed repair.
DUTY N: Diagnosing And Repairing Suspension And Steering System
TASK:
N001: Diagnose and determine needed repairs on steering system.
N002: Clean and inspect power and manual steering gear boxes.
N003: Reassemble, adjust, and install power/manual steering boxes.
N004: Clean/inspect power and manual rack and pinion steering.
N005: Reassemble/adjust/install power/manual rack and pinion.
N006: Inspect and repair steering columns (including new and emerging technologies such as fiber optics, pass codes, keys with microchip, air bag assemblies).
N007: Inspect and replace steering linkage components.
N008: Inspect, repair, and replace power steering pumps.

DUTY O: Diagnosing And Repairing Front Suspension System
TASK:
O001: Diagnose and determine needed repairs on conventional and electronic front suspension systems.
O002: Inspect and repair control arm and spring assemblies on conventional systems.
O003: Inspect and repair wheel spindles and bearings.
O004: Inspect and replace shock absorbers and stabilizer bars.
O005: Diagnose and determine needed repairs on MacPherson strut assemblies.
O006: Clean, inspect, and assemble MacPherson strut assemblies.
DUTY P: Diagnosing And Repairing Rear Suspension System
TASK:
P001: Diagnose and determine needed repairs on conventional and electronic rear suspensions.
P002: Inspect and replace shock and spring assemblies.
P003: Inspect and replace MacPherson strut assemblies.
P004: Inspect and repair suspension linkages and bushings.
DUTY Q: Diagnosing And Repairing Tire And Wheel Assemblies
TASK:
Q001: Diagnose steering and tire wear problems, and determine needed repairs.
Q002: Set correct alignment angles on front wheels.
Q003: Set correct camber and toe on rear wheels.

Q004: Rotate and balance tires and wheel assemblies.
DUTY R: Diagnosing And Repairing Hydraulic Brake System
TASK:
R001: Diagnose and determine needed repairs on hydraulic brake system.
R002: Inspect and repair or replace master cylinders and lines of the hydraulic system.
R003: Inspect and replace switching and valving devices.
DUTY S: Diagnosing And Repairing Drum Brakes
TASK:
S001: Diagnose and determine needed repairs on drum brake systems.
S002: Remove, clean, and inspect drum brake assemblies.
S003: Repair, replace, and adjust drum brake components.
DUTY T: Diagnosing And Repairing Disc Brakes
TASK:
T001: Diagnose and determine needed repairs on disc brake systems.
T002: Remove, clean, and inspect disc brake components.
T003: Repair, replace, and adjust disc brake components.
DUTY U: Diagnosing And Repairing Power-assist Brakes
TASK:
U001: Diagnose and determine needed repairs on power-assist brakes.

U002: Repair or replace power brake components.
U003: Repair or replace hydra-boost components.
U004: Check operation of anti-skid braking systems, and adjust or repair according to manufacturer's recommendations (including traction control).

Task Definitions

National and state experts in the occupational field of automotive service and repair have validated tasks in this section. Each task is analyzed by identifying the following:

- a *task definition* (criteria for acceptable performance), which explains what the student has to do to perform the task at the expected level of mastery
- *process/skill questions*, which assess student knowledge and performance.

Tasks are arranged by instructional duty area only. The placement of tasks into specific courses and the sequencing of tasks for instruction are local decisions based on student needs, employer demand, and school schedules.

DUTY A:

Applying Safety Practices On The Job

Task:

A001: Identify the safe use of chemicals. (A.1)

Definition: Identification should include correct use, hazards, and precautions associated with each solvents:

- soaps,
- cleaning solutions
- oils,
- greases,
- specialty additives,
- gasses,
- dusts

Process/Skill Questions:

A002: Identify the safe use and maintenance of hand tools. (A.2)

Definition: Identification includes hand tools (specialty tools, fasteners, and measuring tools) including correct use, hazards, precautions, and maintenance procedures associated with each common end wrenches:

- socket set components and wrenches
- screwdrivers
- styles of pliers
- hammers
- punches and chisels
- cutting tools (e.g., hack saw, tubing cutter, hand reamer, file)
- electrical system tools (e.g., volt/ohmmeter, dwell/tachometer, continuity light, timing light, remote starter switch)
- battery tools (e.g., cable puller, terminal and post cleaner, battery lifting or carrying strap)
- lubrication tools (e.g., transmission funnel, oil filter-removing tool, grease gun)
- miscellaneous tools (e.g., air nozzles, C-clamp, puller set, pressure gauge, screw extractor)
- automotive fasteners (e.g., taps, dies, nuts, bolts, studs)
- automotive measuring tools (e.g., outside and inside micrometers, plastigauge, dial indicator tool, feeler gauge, vernier caliper, depth micrometer).

Process/Skill Questions

A003: Identify the safe use and maintenance of power tools. (A.3)

Definition: Identification should include various types of power tools (including pneumatic and electric tools) including correct use, hazards, precautions, and maintenance procedures associated with each:

- air impact gun
- air hammer
- air ratchet
- air drill
- tire burnishing tool
- drop light
- electric drill

Process/Skill Questions

A004: Identify the safe use of protective clothing and equipment. (A.4)

Definition: Identification should include protective clothing and equipment or grooming/hygiene including correct use, hazards, and precautions associated with each, in accordance with manufacturers' instructions and government regulations concerning hazardous material and shop safety to include the following:

Protection of

- eyes,
- respiratory system,
- auditory functions,
- feet, hands, and body

Grooming/hygiene of

- hair length;
- loose clothing/jewelry;
- greasy hands, shoes, or clothing;
- dirty or scratched eye protection

Process/Skill Questions

A005: Identify the safe use of fire protection equipment. (A.5)

Definition: Identification should include different types of fires encountered in the automotive technology field (Class A, B, C, and D), along with the appropriate type of extinguisher, hazards, and precautions associated with each; and fire emergency procedures

Process/Skill Questions

A006: Identify the safe use of shop equipment (including hydraulics). (A.6)

Definition: Identification should include shop equipment including correct use, hazards, and precautions associated with each, in accordance with manufacturers' specifications:

- pneumatic equipment (e.g., tire machine, pneumatic jack)
- hydraulic equipment (e.g., floor jack, lift rack, hydraulic press, engine hoist)
- electrical equipment (e.g., wheel balancer, bench grinder, drill press, battery testers and chargers, ignition)
- analyzers, front-end alignment equipment)

Process/Skill Questions

A007: Identify safe under-hood practices.

Definition: Identification should include basic types of under-hood practices and precautions associated with each:

- correct method
- hazard avoidance (e.g., moving parts; thermal, chemical, and electrical)

Process/Skill Questions

A008: Follow Environmental Protection Agency (EPA), Occupational Safety and Health Act (OSHA), and National Automotive Technicians Educational Foundation/Automotive Service Excellence (NATEF/ASE) regulations. (A.7)

Definition: Following incorporates regulations and requirements of EPA, OSHA, NATEF/ASE, local ordinances and instructor's guidelines to include:

- use, storage and disposal of hazardous materials
- correct application
- training
- penalties

Process/Skill Questions

**DUTY B:
Performing Shop Operations**

Task:

B001: Communicate with customers orally and in writing. (B.1)

Definition: Communication should include oral/written communication presented in a clear, accurate, friendly, courteous, and otherwise professional manner, according to industry practice to include the following:

- greet the customer
- listen carefully to the customer
- write all required customer/vehicle information
- telephone customers before doing unapproved repairs
- write a repair order,
- describe repairs and charges in lay terms

Process/Skill Questions

B002: Estimate time and cost for jobs, and order parts. (B.2)

Definition: Estimation should include the following in accordance with industry practice:

- owner and vehicle information
- description of complaint and technician's diagnosis
- name/description/price of parts, hourly/total charges labor and outside work,
- sales tax, and total cost

Process/Skill Questions

B003: Obtain appropriate repair information from shop manuals. (B.3)

Definition: Access of information should include the following:

- identification of types of shop manuals (e.g., manufacturer, professional general, after-market specialty)
- format of manuals (e.g., printed, microfiche, compact disc)
- method of locating information (e.g., table of contents, index, special numbering systems)

Process/Skill Questions

B004: Practice clean and orderly work habits. (B.4)

Definition: Practice should include the following:

- neat and well-maintained office, storage, customer, shop and grounds areas
- clean, regularly maintained tools and equipment
- keep customer vehicle and vehicle contents clean
- orderly shop behavior (no running, horseplay, loud or careless speech)
- orderly work habits (organization and storage of materials and supplies)
- punctuality and management of work time
-

Process/Skill Questions

**DUTY C:
Practicing Job And Career Basics**

Task:

C001: Identify basic functions and operations of vehicle mechanical components.

Definition: Identification should include functions and operations of the following components:

- electrical system (e.g., battery, charging system, starter motor and circuit, lighting system, gauges and accessories)
- engine performance (e.g., ignition, fuel, exhaust, and emission control systems)
- engine repair (e.g., cylinder heads, valve trains, short block assembly, cooling system)
- suspension and steering (e.g., steering system, suspension system)
- brakes (e.g., hydraulic system, mechanical system, electronic system)
- manual drive train
- automatic transmission
- heating and air-conditioning.
-

Process/Skill Questions

C002: Identify the duties of an automotive technician.

Definition: Identification incorporates duties as follows:

- repair, overhaul, and service automobiles, buses, trucks, and other vehicles
- examine vehicles and discuss nature and extent of problems with customers or auto repair service estimators
- plan work procedures, use charts, technical manuals, and past experience
- raise vehicles, use hydraulic jack/hoist, to gain access to mechanical units bolted to underside of vehicle
- remove units, such as the engine, transmission, or differential
- disassemble rods, gears, valves, and bearings
- overhaul or replace carburetors, fuel injection systems, blowers, and generators
- rewire ignition systems, lights, and instrument panels
- realign and adjust brakes, align front end, repair/replace shock absorbers, and solder leaks in radiator
- replace/adjust headlights, install/repair accessories, such as radios, heaters, mirrors, and windshield wipers.

Process/Skill Questions

C003: Identify career opportunities in the automotive technology field.

Definition: Identification includes the following,:

- research careers in auto tech field, such as auto tech, repair shop supervisor, exhaust/emissions tech, tune-up tech, auto manufacturing plant tech , parts salvager, teacher, or trainer
- research types of employment opportunities available in the region.

Process/Skill Questions

C004: Identify the purposes and goals of the student organization.

Definition: Identification should include a statement of the purposes and the goals of the student organization (e.g., VICA), in accordance with the documentation of the organization and with instructor's guidelines.

Process/Skill Questions

C005: Participate in course activities sponsored by the student organization (e.g., meetings, programs, and other projects that require specialized skills and concepts).

Definition: Participation should include activities in accordance with the documentation of the organization, school and instructor guidelines to include the following:

- attend meetings
- take part in programs
- play an active role in projects requiring specialized skills and concepts

Process/Skill Questions

**DUTY D:
Diagnosing General Electrical System**

Task:

D001: Check continuity in electrical circuits, using test light and voltmeter, oscilloscope, and wiring diagrams.

Definition: Process should include the following:

- identify and interpret electrical/electronic system concerns; determine necessary action.(VI.A.1)
- research applicable vehicle and service information, such as electrical/electronic system operation, vehicle service history service precautions, and technical service bulletins. (VI.A.2)
- locate and interpret vehicle and major component identification numbers (VIN, vehicle certification labels, and calibration decals). (VI.A.3)
- diagnose electrical/electronic integrity for series, parallel and series-parallel circuits using principles of electricity (OHM's Law). (VI.A.4)
- check operation of parking brake indicator light system
- check operation of brake stop light system; adjust and service as needed
- use wiring diagrams during diagnosis of electrical circuit problems (VI.A.5)
- check electrical circuits with a testing light; determine needed repairs (VI.A.7)
- check continuity and resistances in electrical/electronic circuits and components with an ohmmeter; determine necessary action (VI.A.10)
- inspect and test fusible links, circuit breakers, and fuses; replace as needed (VI.A.14)
- inspect and test switches, connectors, relays, and wires of electrical/electronic circuits; repair or replace as needed (VI.A.15)
- repair wiring harnesses and connectors (VI.A.16)
- perform solder repair of electrical wiring. (VI.A.17)
- perform all procedures in accordance with ASE standards.

Process/Skill Questions

D002: Check for shorts, opens, and grounds.

Definition: Process should include the following:

- check electrical circuits with a digital multimeter; determine needed repairs (VI.A.7)
- check electrical circuits using fused jumper wires; determine needed repairs (VI.A.11)
- locate shorts, grounds, opens, and resistance problems in electrical/electronic circuits; determine needed repairs (VI.A.12)
- measure and diagnose the causes(s) of abnormal key-off battery drain; determine needed repairs. (VI.A.13)
- All procedures must be completed in accordance with ASE standards.

Process/Skill Questions

D003: Measure resistance in electrical circuits, using an ohmmeter.

Definition: Process should include the following:

- locate shorts, grounds, opens, and resistance problems in electrical/electronic circuits; determine needed repairs. (VI.A.12)
- complete procedures in accordance with ASE standards.

Process/Skill Questions

D004: Measure volts with a voltmeter or oscilloscope. (D.4)

Definition: Process should include the following:

- check operation of parking brake indicator light system (V.E.5)
- check operation of brake stop light system; adjust and service as needed (V.E.6)
- measure source voltage and perform voltage drop test in electrical/electronic circuits using a voltmeter; determine necessary action. (VI.A.8)
- check voltage and voltage drop in electrical/electronic circuits using a digital multimeter (DMM); determine needed repairs. (VI.A.6)
- complete procedures in accordance with ASE standards.

Process/Skill Questions

D005: Measure current with an ammeter. (D.5)

Definition: Process should include the following:

- check current flow in electrical/electronic circuits and components using an ammeter; determine needed repairs. (VI.A.9)
- complete procedures in accordance with ASE standards.

Process/Skill Questions

**DUTY E:
Diagnosing And Servicing Of A Battery**

Task:

E001: Clean and inspect battery clamps, cables, and connectors.

Definition: Process should include the following:

- perform slow/fast battery charge (VI.B.5)
- inspect and clean battery cables, connectors, clamps, and hold-downs; repair or replace as needed. (VI.B.6)
- complete all procedures in accordance with ASE standards.

Process/Skill Questions

E002: Perform battery condition tests.

Definition: Process should include the following:

- perform battery state-of-charge testing; determine needed service (VI.B.1)
- perform battery capacity (load, high-rate discharge) testing; confirm proper battery capacity for vehicle application; determine needed service. (VI.B.2)
- complete all procedures in accordance with ASE standards.

Process/Skill Questions

E003: Jump-start a vehicle.

Definition: Process should include the following:

- starting a vehicle, using jumper cables and a battery or auxiliary power supply. (VI.B.7)
- completed all procedures in accordance with ASE standards.

Process/Skill Questions

E004: Charge and install a battery.

Definition: Process should include the following:

- maintain or restore electronic memory functions (VI.B.3)
- inspect, clean, fill, and replace battery (VI.B.4)
- perform slow/fast battery charge. (VI.B.5)
- complete all procedures in accordance with ASE standards.

Process/Skill Questions

E005: Service and troubleshoot special battery applications (e.g., for electric car).

Definition: For electric car, process should include the following:

- clean batteries by mixing baking soda and water to neutralize the acid
- determine acid concentration by testing electrolyte for specific gravity
- test cells and complete battery for voltage level
- test main traction batteries for ground faults
- disconnect main traction batteries
- determine needed services.
- complete all procedures in accordance with manufacturers' standards. (Relevant ASE standards have not been established to date, but will be incorporated as they are established.)

Process/Skill Questions

**DUTY F:
Diagnosing And Repairing Starting Systems**

Task:

F001: Diagnose and determine needed repair on starting system.

Definition: Process should include the following:

- determine starter current draw tests; determine necessary action (VI.C.1)
- determine starter circuit voltage drop tests; determine necessary action (VI.C.2)
- inspect and testing starter relays and solenoids; replace as needed (VI.C.3)
- remove and install starter in a vehicle (VI.C.4)
- inspect and test switches, connectors, and wires of starter control circuits; perform necessary actions. (VI.C.5)
- differentiate between electrical and engine mechanical problems that cause a slow-crank condition (VI.C.6)
- complete all procedures in accordance with ASE standards.

Process/Skill Questions

F002: Remove, clean, and inspect starter motor and components.

Definition: Process should include the following:

- remove and install starter (VI.C.4)
- disassemble, clean, inspect, and test starter components; replace as needed.
- complete all procedures in accordance with ASE standards.

Process/Skill Questions

F003: Repair or replace starter motor components.

Definition: Process should include the following:

- remove and replace/reinstall starter. (VI.C.4)
- complete all procedures in accordance with ASE standards.

Process/Skill Questions

**DUTY G:
Diagnosing And Repairing Charging Systems**

Task:

G001: Diagnose and determine needed repair on charging system.

Definition: Process should include the following:

- perform charging system output test; determine necessary action (VI.D.1)
- diagnose charging system problems that cause an undercharge, no-charge or overcharge condition (VI.D.2)
- inspect and adjust or replace generator (alternator) drive belts, pulleys, and tensioners, check pulley and belt alignment; replace as needed (VI.D.3)
- remove, inspect and install generator (alternator) as needed. (VI.D.4)
- perform charging circuit voltage drop tests; determine necessary action. (VI.D.5)
- complete all procedures in accordance with ASE standards.

Process/Skill Questions

G002: Remove, clean, and inspect alternator.

Definition: Process should include the following:

- remove, inspect, and replace/reinstall alternator (VI.D.5)
- disassemble, clean, inspect, and test alternator components; replace as needed.
- complete all procedures in accordance with ASE standards.

Process/Skill Questions

G003: Repair or replace alternator components.

Definition: Process should include the following:

- remove, inspect, and replace/reinstall alternator (VI.D.5)
- disassemble, clean, inspect, and test alternator components; replace as needed.
- complete all procedures in accordance with ASE standards.

Process/Skill Questions

G004: Repair or replace charging system components.

Definition: Process should include the following:

- inspect and test voltage regulator; replace as needed.
- complete all procedures in accordance with ASE standards.

Process/Skill Questions

**DUTY H:
Diagnosing And Repairing Lighting Systems**

Task:

H001: Diagnose and determine needed repair on lighting system.

Definition: Process should include the following:

- diagnose brighter than normal, intermittent, dim, or no light operation (VI.E.1)
- inspect, replace, and aim headlights and bulbs (VI.E.2)
- inspect and diagnose incorrect turn signal or hazard light operation; repair or replace as needed. (VI.E.3)
- complete all procedures in accordance with ASE standards.

Process/Skill Questions

H002: Diagnose and determine needed repair on complex lighting systems (e.g., fiber optics, twilight sentinels, remote sensors, global positioning systems).

Definition: Process should include the following:

- diagnose, test, and replace twilight sentinel sensors and wiring
- diagnose, test, and replace satellite locator system components.
- complete all procedures in accordance with manufacturers' standards. (Relevant ASE standards have not been determined, but will be incorporated as established.)

Process/Skill Questions

H003: Repair or replace lights, sockets, wires, and switches.

Definition: Process should include the following:

- inspect, replace, and aim headlights and bulbs (VI.E.2)
- inspect and diagnose incorrect turn signal or hazard light operation; repair or replace as needed.(VI.E.3)

Process/Skill Questions

DUTY I:
Servicing Gauges, Warning Devices, And Drivers Information Systems

Task:

I001: Diagnose and repair mechanical gauge and warning circuits.

Definition: Process should include the following:

- inspect, test and replace oil temperature and pressure switches and sensors
- check operation of parking brake indicator light system
- check operation of brake stop light system; adjust and service as needed
- inspect and test gauges and gauge sending units for cause of intermittent, high, low or no gauge readings; replace as needed (VI.F.1)
- test gauge circuit voltage regulators (limiters); replace as needed
- inspect and test connectors, wires, and printed circuit boards of gauge circuits; repair or replace as needed (VI.F.2)
- diagnose cause of incorrect operation of warning devices and other driver information systems; determine necessary action (VI.F.3)
- diagnose intermittent, high, low or no readings on electronic instrument clusters
- inspect and test sensors, sending units, connectors, and wires of electronic instrument circuits; repair or replace as needed. (VI.F.4)
- complete all procedures in accordance with ASE standards.

Process/Skill Questions

I002: Diagnose digital and fiber optics gauges and warning circuits.

Definition: Process should include the following:

- inspect, testing, and replacing oil temperature and pressure switches and sensors (I.D.12)
- check operation of parking brake indicator light system (V.E.5)
- check operation of brake stop light system; adjust and service as needed (V.E.6)
- diagnose intermittent, high, low or no gauge readings (VI.F.1)
- test gauge circuit voltage regulators (limiters); replace as needed (VI.F.2)
- inspect and test gauges and gauge sending units; replace as needed (VI.F.2)
- inspect and test connectors, wires, and printed circuit boards of gauge circuits; repair or replace as needed (VI.F.2)
- diagnose incorrect operation of warning devices and other driver information systems (VI.F.3)
- diagnose intermittent, high, low or no readings on electronic instrument clusters
- inspect and test sensors, sending units, connectors, and wires of electronic instrument circuits; repair or replace as needed. (VI.F.4)
- complete all procedures in accordance with manufacturers' standards. (Relevant ASE standards have not been determined, but will be incorporated as established.)

[Note: Typically, digital and fiber optic gauges and warning circuits are not serviceable by the automotive service technician, but sent to special repair centers when servicing is required.]

Process/Skill Questions

I003: Diagnosing And Repairing Electrical Accessories (horn, wiper motor).

Definition: Process should include the following:

- diagnose incorrect horn operation; repair as needed (VI.G.1)
- diagnose incorrect wiper operation; diagnose wiper speed control and park problems; repair as needed (VI.G.2)
- diagnose incorrect windshield washer operation; repair as needed (VI.G.3)
- diagnose incorrect operation of motor-driven accessory circuits; repair as needed (VI.H.1)
- diagnose incorrect heated glass operation; repair as needed (VI.H.2)
- diagnose incorrect electric door and hatch/trunk lock operation; repair as needed (VI.H.3)
- diagnose incorrect operation of cruise control systems; repair as needed (VI.H.4)
- diagnose supplemental restraint system (SRS) problems; repair as needed (Note: Follow manufacturer's safety procedures to prevent accidental deployment) (VI.H.5)
- disarm and enable the airbag system for vehicle service (VI.H.6)
- diagnose radio static and weak, intermittent, or no radio reception; determine necessary action. (VI.H.7)
- remove and reinstall door panel. (VI.H.8)
- diagnose body electronic system circuits using a scan tool; determine necessary action. (VI.H.9)
- check for module communication errors using a scan tool. (VI.H.10)
- diagnose the cause of false, intermittent, or no operation of anti-theft system. (VI.H.11)
- complete all procedures in accordance with ASE standards.

Process/Skill Questions

**DUTY J:
Diagnosing And Repairing Ignition Systems**

Task:

J001: Test engine performance, using engine analyzer (and NATEF-recommended tools), and determine needed repairs. (J.1)

Definition: Testing and determining needed repairs should include the following:

- identify and interpret engine performance concern; determine necessary action (VIII.A.1)
- research applicable vehicle and service information, such as engine management system operation, vehicle service history, service precautions, and technical service bulletins (VIII.A.2)
- locate and interpret vehicle and major component identification numbers (VIN, vehicle certification labels, and calibration decals). (VIII.A.3)
- inspect engine assembly for fuel, oil, coolant, and other leaks; determine necessary action (VIII.A.4)
- diagnose unusual engine noise or vibration problems; determine necessary action (VIII.A.5)
- diagnose unusual exhaust color, odor, and sound; determine necessary action (VIII.A.6)

- perform engine absolute (vacuum/boost) manifold pressure tests; determine necessary action (VIII.A.7)
- perform cylinder power balance test; determine necessary action (VIII.A.8)
- perform cylinder compression test; determine necessary action (VIII.A.9)
- perform cylinder leakage test; determine necessary action (VIII.A.10)
- diagnose engine mechanical, electrical, electronic, fuel, and ignition problems with an oscilloscope and engine diagnostic equipment; determine necessary action (VIII.A.11)
- prepare 4 or 5 gas analyzer; inspect and prepare vehicle for test and obtain exhaust reading; interpret readings; determine necessary action (VIII.A.12)
- verify engine operating temperature; determine necessary action (VIII.A.13)
- perform cooling system pressure tests; check coolant condition; inspect and test radiator, pressure cap, coolant recovery tank, and hoses; perform necessary action (VIII.A.14)
- verify correct camshaft timing (VIII.A.15)
- retrieve and record stored OBD I diagnostic trouble codes; clear codes (VIII.B.1)
- retrieve and record stored OBD II diagnostic trouble codes; clear codes (VIII.B.2)
- diagnose the causes of emissions or drivability concerns resulting from malfunctions in the computerized engine control system with stored diagnostic trouble codes (VIII.B.3)
- diagnose emissions or drivability concerns resulting from malfunctions in the computerized engine control system with no stored diagnostic trouble codes; determine necessary action (VIII.B.4)
- check for module communication errors using a scan tool (VIII.B.5)
- inspect and test computerized engine control system sensors, powertrain control module (PCM), actuators, and circuits using a graphing multimeter (GMM)/digital storage oscilloscope (DSO); perform necessary action (VIII.B.6)
- obtain and interpret scan tool data (VIII.B.7)
- access and using electronic service information (ESI) to perform step-by-step diagnosis (VIII.B.8)
- diagnose drivability and emissions problems resulting from failures of interrelated systems (cruise control, security alarms, suspension controls, traction controls, A/C, automatic transmissions, non-OEM installed accessories, and similar systems); determine necessary action (VIII.B.9)
- complete all procedures in accordance with ASE standards.

Process/Skill Questions

J002: Inspect, repair, or replace primary ignition components. (J.2)

Definition: Process should include the following:

- access and using electronic service information to perform step by step diagnosis (ESI) (VIII.B.8)
- diagnose ignitions system related problems such as no-starting, hard-starting, engine misfire, poor drivability, spark knock, power loss, poor mileage, and emissions problems on vehicles with electronic ignition (distributor less) systems (VIII.C.1)
- diagnose ignition system related problems such as no-starting, hard-starting, engine misfire, poor drivability, spark knock, power loss, poor mileage, and emissions problems on vehicles with distributor ignition (DI) systems; determine necessary action (VIII.C.2)
- inspect and testing ignition primary circuit wiring and solid state components; repair or replace as needed (VIII.C.3)
- inspect and test distributor; service as needed (VIII.C.4)
- check and adjust (where applicable) ignition systems timing and timing advance/retard (VIII.C.7)
- inspect and testing ignition wiring harness and connectors; replace as needed
- inspect and test ignition system pick-up sensor or triggering devices; replace as needed (VIII.C.8)
- inspect and test ignition control module; replace as needed.
- complete all procedures in accordance with ASE standards.

Process/Skill Questions

J003: Inspect, repair, or replace secondary ignition components. (J.3)

Definition: Process should include the following:

- access and using electronic service information to perform step by step diagnosis (ESI) (VIII.B.8)
- inspect and testing ignition system secondary circuit wiring and components: replace as needed (VIII.C.5)
- inspect and test ignition coil(s); replace as needed. (VIII.C.6)
- complete all procedures in accordance with ASE standards.

Process/Skill Questions

J004: Adjust ignition system to manufacturer's specifications. (J.4)

Definition: Process should include the following:

- access and use electronic service information to perform step by step diagnosis (ESI) (VIII.B.8)
- check and adjust (where applicable) ignition systems timing and timing advance/retard. (VIII.C.7)
- complete all procedures in accordance with ASE standards.

Process/Skill Questions

J005: Perform on-board computer system diagnosis. (J.4)

Definition: Process should include the following:

- retrieve and record stored OBD I diagnostic trouble codes; clearing codes (VIII.B.1)
- retrieve and record stored OBD II diagnostic trouble codes; clearing codes (VIII.B.2)
- diagnose emissions or drivability problems resulting from failure of computerized engine controls with no diagnostic trouble codes stored; determine needed repairs (VIII.B.3)
- access and use electronic service information (ESI). (VIII.B.7) All procedures must be completed in accordance with ASE standards.

Process/Skill Questions

J006: Repair or replace computer system components. (J.6)

Definition: Process should include the following:

- retrieve and record stored OBD I and OBD II diagnostic trouble codes; clearing codes (VIII.B.1 & VIII.B.2)
- diagnose the causes of emissions or drivability problems resulting from failure of computerized engine control system with stored diagnostic trouble codes (VIII.B.4)
- access and using electronic service information to perform step by step diagnosis (ESI) (VIII.B.8)
- practice recommended precautions when handling static sensitive devices.
- complete all procedures in accordance with ASE standards.

Process/Skill Questions

**DUTY K:
Diagnosing And Repairing Fuel And Exhaust Systems**

Task:

K001: Diagnose and determine needed repairs on fuel system. (K.1)

Definition: Process should include the following:

- access and use electronic service information to perform step by step diagnosis (ESI) (VIII.B.8)
- diagnose hot or cold no-starting, hard starting, poor drivability, incorrect idle speed, poor idle, flooding, hesitation, surging, engine misfire, power loss, stalling, poor mileage, dieseling, and emissions problems on vehicles with carburetor-type fuel systems; determine needed action (VIII.D.1)
- diagnose hot or cold no-starting, hard starting, poor drivability, incorrect idle speed, poor idle, flooding, hesitation, surging, engine misfire, power loss, stalling, poor mileage, dieseling, and emissions problems on vehicles with injection-type fuel systems; determine needed action. (VIII.D.2)
- complete all procedures in accordance with ASE standards.

Process/Skill Questions

K002: Inspect, repair, or replace fuel supply component. (K.2)

Definition: Process should include the following:

- access and use electronic service information (ESI) to perform step by step diagnosis (VIII.B.7)
- inspect fuel tank and fuel cap; inspect and replace fuel lines, fittings, and hoses
- check fuel for contaminants and quality (VIII.D.3)
- inspect and test mechanical and electrical fuel pumps and pump control systems for pressure, regulation, and volume; perform necessary action (VIII.D.4)
- replace fuel filters (VIII.D.5)
- inspect and test fuel pressure regulation system and components of injection type fuel systems; perform necessary action
- inspect and test cold enrichment system components; adjust or replace as needed (VIII.D.6)
- remove, inspect, and test vacuum and electrical components and connections of fuel system; repair or replace as needed
- test the operation of turbocharger/supercharger systems; determine necessary action.
- complete all procedures in accordance with ASE standards.

Process/Skill Questions

K003: Disassemble, clean, and inspect carburetors. (K.3)

Definition: Process should include the following:

- access and use electronic service information for step by step diagnosis (ESI). (VIII.B.8)
- complete all procedures in accordance with ASE standards.

Process/Skill Question

K004: Reassemble And Adjust Carburetor

Definition: Process should include the following:

- access and use electronic service information (ESI) (VIII.B.7)
- adjust idle speed and fuel mixture (VIII.D.13) All procedures must be completed in accordance with ASE standards.

Process/Skill Questions

K005: Disassemble, clean, and inspect fuel injection components. (K.5)

Definition: Process should include the following:

- access and use electronic service information for step by step diagnosis (ESI). (VIII.B.8)
- remove, clean, and reinstall throttle body, air induction system, intake manifold and gaskets for vacuum leaks and/or unmetered air; adjust related linkages (VIII.D.7)
- inspect and testing fuel injectors; clean and replace. (VIII.D.8)
- complete all procedures in accordance with ASE standards.

Process/Skill Questions

K006: Repair or replace fuel injection components. (K.6)

Definition: Process should include the following:

- access and use electronic service information for step by step diagnosis (ESI). (VIII.B.8)
- inspect and test fuel injectors; clean and replace. (VIII.D.8)
- complete all procedures in accordance with ASE standards.

Process/Skill Questions

K007: Adjust computer-controlled fuel systems (injection and carburetor). (K.7)

Definition: Process should include the following:

- access and use electronic service information for step by step diagnosis (ESI). (VIII.B.8)
- inspect and test fuel pressure regulation system and components of injection-type fuel systems; adjust or replace as needed
- check/adjust idle speed and fuel mixture where applicable. (VIII.D.9,10)
- complete all procedures in accordance with ASE standards.

Process/Skill Questions

K008: Diagnose and repair exhausts system problems (include those involved with emerging technology, such as noise cancellation devices); repair exhaust systems to meet manufacturer's specifications. (K.8)

Definition: Process should include the following:

- access and use electronic service information for step by step diagnosis (ESI). (VIII.B.8)
- inspect exhaust manifold, exhaust pipes, mufflers, resonators, tail pipes, and heat shields; repair or replace as needed (VIII.D.11)
- perform exhaust system back-pressure test; determine necessary action. (VIII.D.12)
- test the operation of turbocharger/supercharger systems (VIII.D.13)
- complete all procedure in accordance with ASE standards.

Process/Skill Questions

K009: Identify issues involved in alternative fuel (e.g., diesel fuel, compressed natural gas) and multi-fuel systems.

Definition: Process should include the following:

- identify various alternative fuel vehicles
- describe the similarities between internal combustion engines (ICE), diesel engines, and compressed natural gas (CNG) engines
- identify government regulations on lowering emissions and ways that alternative fuel vehicles can help meet these standards
- research different types of alternative fuel vehicles
- explain the practical side of alternative fuel vehicles (e.g., for mass transit, commuter vehicles, mining)

describe the economic impact of alternative fuel vehicles.

- complete all procedures in accordance with ASE standards. [See ASE Program Certification Standards: Light/Medium Duty CNG/LPG.]

Process/Skill Questions

DUTY L:
Diagnosing And Repairing Emission Control Systems

Task:

L001: Diagnose and determine needed repairs on emission control systems (both basic and complex).

Definition: Process should include the following:

- access and use electronic service information for step by step diagnosis (ESI). (VIII.B.8)
- diagnose oil leaks, emissions, and drivability problems resulting from failure of the positive crankcase ventilation (PCV) system (VIII.E.1.1)
- inspect and test positive crankcase ventilation (PCV filter/breather cap, valve, tubes, orifices, and hoses; service or replace as needed) (VIII.E.1.2)
- diagnosis emissions and drivability problems caused by malfunctions in the exhaust gas recirculation (EGR) system; determine necessary action (VIII.E.2.1)
- inspect, test, service and replace components of the EGR system, including EGR tubing, exhaust passages, vacuum/pressure controls, filters and hoses,; perform necessary action (VIII.E.2.2)
- inspect and test electrical/electronic sensors, controls, and wiring of exhaust gas recirculation (EGR) systems; repair or replace as needed (VIII.E.2.3)
- diagnose emissions and drivability problems resulting from failure of the secondary air injection and catalytic converter systems (VIII.E.3.1)
- inspect and test mechanical components of secondary air injection systems; perform necessary action (VIII.E.3.2)
- inspect and test electrical/electronic sensors, controls, and wiring of exhaust gas recirculation (EGR) systems; perform necessary action (VIII.E.3.3)
- Inspect and test catalytic converter performance (VIII.E.3.4)
- diagnose emissions and drivability problems resulting from failure of the intake air temperature control systems (VIII.E.4.1)
- inspect and test components of intake air temperature control system; perform necessary action (VIII.E.4.2)
- diagnose emissions and drivability problems resulting from failure of early fuel evaporation control systems (VIII.E.5.1)
- inspect and test components of early fuel evaporation control system; perform necessary action (VIII.E.5.2)
- diagnose emissions and drivability problems resulting from failure of evaporative emissions control system (VIII.E.6.1)
- inspect and test components and hoses of evaporative emissions control system; replace as needed. (VIII.E.6.2)
- interpret evaporative emission related diagnostic trouble codes (DTCs); determine necessary action (VIII.E.6.3)
- complete all procedures in accordance with ASE standards.

Process/Skill Questions

L002: Clean and inspect/replace PCV system components.

Definition: Process should include the following:

- access and use electronic service information for step by step diagnosis (ESI). (VIII.B.8)
- complete all procedures in accordance with ASE standards.

Process/Skill Questions

L003: Clean and inspect/replace spark timing controllers.

Definition: Process should include the following:

- access and use electronic service information for step by step diagnosis (ESI). (VIII.B.8)
- complete all procedures in accordance with ASE standards.

Process/Skill Questions

L004: Clean and inspect/replace idle speed controllers.

Definition: Process should include the following:

- access and use electronic service information for step by step diagnosis (ESI). (VIII.B.8)
- complete all procedures in accordance with ASE standards.

Process/Skill Questions

L005: Clean and inspect/replace exhaust gas recirculation.

Definition: Process should include the following:

- access and use electronic service information for step by step diagnosis (ESI). (VIII.B.8)
- inspect and test positive crankcase ventilation (PCV filter/breather cap, valve, tubes, orifices, and hoses; service or replace as needed) (VIII.E.1.2)
- diagnose emissions and drivability problems caused by failure of the exhaust gas recirculation (EGR) system; determine necessary action (VIII.E.2.1)
- inspect and test valve, valve manifold, and exhaust passages of exhaust gas recirculation (EGR) systems; service or replace as needed
- inspect and test vacuum/pressure controls, filters, and hoses or exhaust gas recirculation (EGR) systems; service or replace as needed
- inspect and test electrical/electronic sensors, controls, and wiring of exhaust gas recirculation (EGR) systems; repair or replace as needed. (VIII.E.2.3)
- complete all procedures in accordance with ASE standards.

Process/Skill Questions

L006: Clean and inspect/replace air management system.

Definition: Process should include the following:

- access and use electronic service information for step by step diagnosis (ESI). (VIII.B.8)
- diagnose emissions and drivability problems resulting from failure of the secondary air injection and catalytic converter systems (VIII.E.3.1)
- inspect and test mechanical components of secondary air injection systems; service or replace as needed (VIII.E.3.2)
- inspect and test electrical/electronically-operated components and circuits of air injection systems; replace as needed (VIII.E.3.3)
- inspect and test components of catalytic converter systems; replace as needed. (VIII.E.3.4)
- All procedures must be completed in accordance with ASE standards.

Process/Skill Questions

L007: Clean and inspect/replace inlet air temperature control. (L.7)

Definition: Process should include the following:

- access and use electronic service information for step by step diagnosis (ESI). (VIII.B.8)
- inspect and test components of intake air temperature control systems; replace as needed. (VIII.E.4.2)
- complete all procedures in accordance with ASE standards.

Process/Skill Questions

L008: Clean and inspect/replace intake manifold heat controls. (L.8)

Definition: Process should include the following:

- access and use electronic service information for step by step diagnosis (ESI). (VIII.B.8)
- inspect and test components of early fuel evaporation control systems; service or replace as needed. (VIII.E.5.2)
- complete all procedures in accordance with ASE standards.

Process/Skill Questions

L009: Clean and inspect/replace fuel vapor controls.

Definition: Process should include the following;

- access and use electronic service information (ESI) (VIII.B.7)
- diagnose emissions and drivability problems resulting from failure of evaporative emissions control system (VIII.E.6.1)
- inspect and test components and hoses of evaporative emissions control system; replace as needed. (VIII.E.6.2)
- all procedures must be completed in accordance with ASE standards

Process/Skill Questions

**DUTY M:
Diagnosing And Repairing General Engine**

Task:

M001: Conduct performance test, and determine needed repairs. (M.1)

Definition: Process should include the following:

- interpret and verify complaint; determine needed repairs (I.A.1)
- inspect engine assembly for fuel, oil, coolant, and other leaks; determine needed repairs (I.A.2)
- listen to engine noises; determine needed repairs (I.A.3)
- diagnose the cause of excessive oil consumption, unusual engine exhaust color, odor, and sound; determine needed repairs (I.A.4)
- perform engine vacuum tests; determine needed repairs (I.A.5)
- perform cylinder power balance tests; determine needed repairs (I.A.6)
- perform cylinder compression tests; determine needed repairs (I.A.7)
- perform cylinder leakage tests; determine needed repairs. (I.A.8)
- complete all procedures in accordance with ASE standards.

Process/Skill Questions

**DUTY N:
Diagnosing And Repairing Suspension And Steering Systems**

Task:

N001: Diagnose and determine needed repairs on steering system.

Definition: Process should include the following:

- identify and interpret suspension and steering concerns; determine necessary action (IV.A.1)
- research applicable vehicle and service information, such as suspension and steering system operation, vehicle service history, service precautions, and technical service bulletins (IV.A.2)
- locate and interpret vehicle and major component identification numbers (VIN, vehicle certification labels, calibration decals). (IV.A.3)
- disable and enable supplemental restraint system (SRS) (IV.B.1)
- remove and replace steering wheel; center/time supplemental restraint system (SRS) coil in accordance with manufacturer's procedures (IV.B.2)
- diagnose steering column noises, looseness, and binding problems (including tilt mechanisms); determine needed repairs (IV.B.3)
- diagnose power non-rack and pinion steering gear binding, uneven turning effort, looseness, hard steering, and fluid leakage problems; determine needed repairs (IV.B.4)
- diagnose power rack and pinion steering gear vibration, looseness, and hard steering problems; determine needed repairs (IV.B.5)
- inspect manual and power steering fluid levels and condition (IV.B.10)

- diagnose power steering fluid leakage; determine needed repairs (IV.B.12)
- inspect, replace, and adjust power steering pump belt (IV.B.13)
- perform power steering system pressure testing; determine needed repairs
- inspect and replace power steering hoses and fittings (IV.B.16)
- test, diagnose, inspect, adjust, repair or replace components of electronically-controlled steering systems using a scan tool; determine necessary action. (IV.B.19)
- complete all procedures in accordance with ASE standards.

Process/Skill Questions

N002: Clean and inspect power and manual steering gear boxes.

Definition: Process should include the following:

- flush, fill, and bleed power steering system. (IV.B.11)
- complete all procedures in accordance with ASE standards.

Process/Skill Questions

N003: Reassemble, adjust, and install power/manual steering boxes.

Definition: Process should include the following:

- adjust manual/power non-rack and pinion worm bearing preload and sector lash.
- (IV.B.7)
- complete all procedures in accordance with ASE standards.

Process/Skill Questions

N004: Clean/inspect power and manual rack and pinion steering.

Definition: Process should include the following:

- remove and replace manual or power rack and pinion steering gear; inspect mounting bushings and brackets (IV.B.8)
- inspect and replace manual or power rack and pinion steering gear inner tie rod ends (sockets) and bellows boots (IV.B.9)
- flush, fill, and bleed power steering system. (IV.B.11)
- complete all procedures in accordance with ASE standards.

Process/Skill Questions

N005: Reassemble/adjust/install power/manual rack and pinion.

Definition: Process should include the following:

- disassemble, inspect, repair, and reassemble rack and pinion steering gear (IV.B.9)
- adjust manual or power rack and pinion steering gear.
- complete all procedures in accordance with ASE standards.

Process/Skill Questions

N006: Inspect and repair steering columns (including new and emerging technologies such as fiber optics, pass codes, keys with microchip, air bag assemblies).

Definition: Process should include the following:

- disable supplemental restraint system (SRS) in accordance with manufacturer's procedures (IV.B.1)
- inspect and replace steering shaft universal-joint(s), flexible couplings(s), collapsible column, lock cylinder mechanism, and steering wheel. (IV.B.6)
- complete all procedures in accordance with ASE standards.

Process/Skill Questions

N007: Inspect and replace steering linkage components. (R.7)

Definition: Process should include the following:

- inspect and replace manual or power rack and pinion steering gear inner tie rod ends (sockets) and bellows boots (IV.B.9)
- inspect and replace pitman arm, relay (centerlink/intermediate) rod, idler arm and mountings, and steering linkage damper (IV.B.17)
- inspect, replace, and adjust tie rod ends (sockets), tie rod sleeves, and clamps. (IV.B.18)
- complete all procedures in accordance with ASE standards.

Process/Skill Questions

N008: Inspect, repair, and replace power steering pumps. (R.8)

Definition: Process should include the following:

- flush, fill and bleed power steering system (IV.B.11)
- inspect, replace, and adjust power steering pump belt (IV.B.13)
- remove, inspect, and replace power steering pump, pump mounts, pump seals, and gaskets (IV.B.14)
- remove, inspect, and replace power steering pump pulley; check pulley and belt alignment (IV.B.15)
- perform power steering system pressure test; determine needed repairs.
- complete all procedures in accordance with ASE standards.

Process/Skill Questions

**DUTY O:
Diagnosis And Repair Of Front Suspension Systems**

Task:

O001: Diagnose and determine needed repairs on conventional and electronic front suspension systems.

Definition: Process should include the following:

- diagnose short and long arm suspension system noises, body sway, and uneven riding height problems; determine needed repairs (IV.C.1.1)
- diagnose MacPherson strut suspension system noises, body sway, and uneven riding height problems; determine needed repairs (IV.C.1.2)
- remove, inspect, replace, and adjust strut (compression/tension) rods and bushings (IV.C.1.4)
- remove, inspect, replace, and adjust suspension system torsion bars; inspect mounts (IV.C.1.8)
- remove, inspect, and install strut cartridge or assembly, strut coil spring, insulators (silencers), and upper strut bearing mount (IV.C.1.10)
- measure vehicle riding height; determine needed repairs. (IV.D.4)
- complete all procedures in accordance with ASE standards.

Process/Skill Questions

O002: Inspect and repair control arm and spring assemblies on conventional systems.

Definition: Process should include the following:

- diagnose short and long arm suspension system noises, body sway, and uneven riding height problems; determine needed repairs (IV.C.1.1)
- remove, inspect, and replace upper and lower control arms, bushings, shafts, and rebound bumpers (IV.C..3)
- remove, inspect, replace, and adjust strut (compression/tension) rods and bushings (IV.C.1.4)
- remove, inspect, and replace upper and lower ball joints on short and long arm

- suspension systems (IV.C.1.5)
- remove, inspect, and replace short and long arm suspension system coil springs and spring insulators (IV .C.1.7)
- remove inspect, replace, and adjust suspension system torsion bars; inspect mounts (IV.C.1.8)
- remove, inspect, and replace stabilizer bar bushings, brackets, and links (IV.C.1.9)
- lubricate suspension and steering systems (IV.C.1.11)
- remove, inspect, and replace coil springs and spring insulators (IV.C.2.1)
- remove, inspect, and replace transverse links, control arms, bushings, and mounts (IV.C.2.2)
- inspect, remove, and replace shock absorbers. (IV.C.3.1)
- complete all procedures in accordance with ASE standards.

Process/Skill Questions

O003: Inspect and repair wheel spindles and bearings.

Definition: Process should include the following:

- diagnose short and long arm suspension system noises, body sway, and uneven riding height problems; determine needed repairs (IV.C.1.1)
- remove, inspect, and replace steering knuckle assemblies (IV.C.1.6)
- lubricate suspension and steering systems (IV.C.1.11)
- remove, inspect, and service or replace front and rear wheel bearings (IV.C.3.2)
- reinstall wheel, torque lug nuts, and make final checks and adjustments (V.C.7)
- remove, clean, inspect, repack, and reinstall wheel bearings and replace seals; reinstalling hub and adjusting wheel bearings. (V.F.2)
- complete all procedures in accordance with ASE standards.

Process/Skill Questions

O004: Inspect and replace shock absorbers and stabilizer bars.

Definition: Process should include the following:

- remove, inspect, and replace stabilizer bar bushings, brackets, and links (IV.C.1.9)
- inspect, remove, and replace shock absorbers. (IV.C.3.1)
- complete all procedures in accordance with ASE standards.

Process/Skill Questions

O005: Diagnose and determine needed repairs on MacPherson strut assemblies.

Definition: Process should include the following:

- diagnose short and long arm suspension system noises, body sway, and uneven riding height problems; determine needed repairs (IV.C.1.1)
- remove, inspect, and replace ball joints on MacPherson strut suspension systems
- remove, inspect, and replace MacPherson strut cartridge or assembly, strut coil spring, insulators, and upper strut bearing mount. (IV.C.1.10)
- complete all procedures in accordance with ASE standards.

Process/Skill Questions

O006: Clean, inspect, and assemble MacPherson strut assemblies.

Definition: Process should include the following:

- diagnose short and long arm suspension system noises, body sway, and uneven riding height problems; determine needed repairs (IV.C.1.1)
- remove, inspect, and replace ball joints on MacPherson strut suspension systems
- remove, inspect, and replace MacPherson strut cartridge or assembly, strut coil spring, insulators, and upper strut bearing mount (IV.C.1.10)
- lubricate suspension and steering systems. (IV.C.1.11)
- complete all procedures in accordance with ASE standards.

Process/Skill Questions

**DUTY P:
Diagnosing And Repairing Rear Suspension Systems**

Task:

P001: Diagnose and determine needed repairs on conventional and electronic rear suspensions.

Definition: Process should include the following:

- remove, inspect, and replace steering knuckle assemblies (IV.C.1.6)
- remove, inspect, and replace coil springs and spring insulators (IV.C.2.1)
- remove, inspect, and replace transverse links, control arms, bushings, and mounts (IV.C.2.2)
- test and diagnose components of electronically controlled suspension systems using a scan tool; determine necessary action. (IV.C.3.3)
- complete all procedures in accordance with ASE standards.

Process/Skill Questions

P002: Inspect and replace shock and spring assemblies.

Definition: Process should include the following:

- remove, inspect, and replace coil springs and spring insulators (IV.C.2.1)
- remove, inspect, and replace transverse links, control arms, bushings, and mounts (IV.C.2.2)
- inspect, remove, and replace shock absorbers. (IV.C.3.1)
- complete all procedures in accordance with ASE standards.

Process/Skill Questions

P003: Inspect and replace MacPherson shock assemblies.

Definition: Process should include the following:

- diagnose short and long arm suspension system noises, body sway, and uneven riding height problems; determine needed repairs (IV.C.1.1)
- diagnose MacPherson strut suspension system noises, body sway, and uneven riding height problems; determine needed repairs (IV.C.1.2)
- remove, inspect, and replace ball joints on MacPherson strut suspension systems
- remove, inspect, and replace MacPherson strut cartridge or assembly, strut coil spring, insulators, and upper strut bearing mount (IV.C.1.10)
- remove, inspect, and replace MacPherson strut cartridge or assembly, strut coil spring, and insulators (silencers). (IV.C.2.4)
- complete all procedures in accordance with ASE standards.

Process/Skill Questions

P004: Inspect and repair suspension linkages and bushings.

Definition: Process should include the following:

- remove, inspect, and replace transverse links, control arms, bushings, and mounts (IV.C.2.2)
- remove, inspect, and replace leaf springs, leaf spring insulators (silencers), shackles, brackets, bushings, and mounts. (IV.C.2.3)
- complete all procedures in accordance with ASE standards.

Process/Skill Questions

**DUTY Q:
Diagnosing And Repairing Tire And Wheel Assemblies**

Task:

Q001: Diagnose steering and tire wear problems, and determine needed repairs. (U.1)

Definition: Process should include the following:

- differentiate between steering and suspension concerns using principles of steering geometry (caster, camber, toe, etc) (IV.D.1)
- diagnose short and long arm suspension system noises, body sway, and uneven riding height problems; determine needed repairs (IV.C.1.1)
- diagnose vehicle wander, drift, pull, hard steering, bump steer, memory steer, torque steer, and steering return problems; determine needed repairs (IV.D.2)
- perform pre-alignment inspection; perform necessary action (IV.D.3)
- measure vehicle riding height; determine needed repairs (IV.D.4)
- check for front wheel setback; determine needed repairs (IV.D.13)
- check front cradle (sub-frame) alignment; determine needed repairs (IV.D.14)
- diagnose tire wear patterns; determine needed repairs (IV.E.1)
- inspect tires; check and adjust air pressure (IV.E.2)
- diagnose wheel/tire vibration, shimmy, and noise problems; determine needed repairs (IV.E.3)
- measure wheel, tire, axle, and hub runout; determine needed repairs (IV.E.5)
- diagnose tire pull (lead) problem; determine corrective actions (IV.E.6)
- dismount inspect, repair, and remount tire on wheel. (IV.E.8)
- complete all procedures in accordance with ASE standards.

Process/Skill Questions

Q002: Set correct alignment angles on front wheels. (U.2)

Definition: Process should include the following:

- measure vehicle riding height; determine needed repairs (IV.D.4)
- check and adjust front and rear wheel camber; determine needed repairs (IV.D.5)
- check and adjust caster; determine needed repairs (IV.D.6)
- check and adjust front wheel toe; adjust as needed (IV.D.7)
- center steering wheel (IV.D.8)
- check toe-out-on-turns (turning radius); determine needed repairs (IV.D.9)
- check SAI (steering axis inclination) and included angle; determine needed repairs. (IV.D.10)
- complete all procedures in accordance with ASE standards.

Process/Skill Questions

Q003: Set correct camber and toe on rear wheels. (U.3)

Definition: Process should include the following:

- check and adjust front and rear wheel camber; determine needed repairs (IV.D.5)
- check and adjust rear wheel toe (IV.D.11)
- check rear wheel thrust angle; determine needed repairs. (IV.D.12)
- complete all procedures in accordance with ASE standards.

Process/Skill Questions

Q004: Rotate and balance tires and wheel assemblies. (U.4)

Definition: Process should include the following:

- check and adjust rear wheel toe (IV.D.11)
- check rear wheel thrust angle; determine needed repairs (IV.D.12)
- inspect tires; check and adjust air pressure (IV.E.2)
- rotate tires according to manufacturer's recommendations (IV.E.4)
- balance wheel and tire assembly (static and dynamic) (IV.E.7)
- dismount, inspect, repair, and remount tire on wheel (IV.E.8)
- reinstall wheel; torque lug nuts. (IV.E.9)
- inspect and repair tire (IV.E.10)
- complete all procedures in accordance with ASE standards.

Process/Skill Questions

**DUTY R:
Diagnosing And Repairing Hydraulic Brake Systems**

Task:

R001: Diagnose and determine needed repairs on hydraulic brake system. (V.1)

Definition: Process should include the following:

- identify and interpret brake system concern; determine necessary action (V.A.1)
- research applicable vehicle and service information such as brake system operation, vehicle service history, service precautions, and technical service bulletins (V.A.2)
- locate and interpret vehicle and major component identification numbers (VIN, vehicle certification labels, calibration decals) (V.A.3)
- diagnose pressure concerns in the brake system using hydraulic principles (Paschal's Law) (V.B.1)
- measure and adjust pedal pushrod length and brake pedal height (V.B.2)
- diagnose poor stopping, pulling or dragging caused by problems in the hydraulic system; determine needed repairs. (V.B.5)
- complete all procedures in accordance with ASE standards.

Process/Skill Questions

R002: Inspect and repair or replace master cylinders and lines of the hydraulic system. (V.2)

Definition: Process should include the following:

- measure and adjust pedal pushrod length and brake pedal height (V.B.2)
- check master cylinder for internal and external leaks and proper operation; determine needed repairs (V.B.3)
- remove, bench bleed, and replace master cylinder (V.B.4)
- inspect brake lines, flexible hoses, and fittings for leaks, dents, kinks, rust, cracks, bulging or wear; tighten loose fittings and supports (V.B.6)
- fabricate and installing brake lines (double flare and ISO types); replace hoses, fittings, and supports as needed (V.B.7)
- select, handle, store, and install brake fluids to proper level (V.B.8)
- bleed (manual, pressure, vacuum or surge) brake system (V.B.12)
- flush hydraulic system. (V.B.13)
- complete all procedures in accordance with ASE standards.

Process/Skill Questions

R003: Inspect and replace switching and valving devices. (V.3)

Definition: Process should include the following:

- remove, bench bleed, and replace master cylinder (V.B.4)
- inspect, test, and replace metering (hold-off), proportioning (balance), pressure differential, and combination valves (V.B.9)
- inspect, test, replace, and adjust height (load) sensing proportioning valve (V.B.10)
- inspect, test, and replace components of brake warning light system (V.B.11)
- check operation of parking brake indicator light system (V.F.5)
- check operation of brake stop light system; adjust and service as needed. (V.F.6)
- complete all procedures in accordance with ASE standards.

Process/Skill Questions

DUTY S:
Diagnosing And Repairing Drum Brakes

Task:

S001: Diagnose and determine needed repairs on drum brake systems. (W.1)

Definition: Process should include the following:

- diagnose poor stopping, noise, pulling, grabbing, dragging or pedal pulsation problems; determine needed repairs (V.C.1)
- diagnose wheel bearing noises, wheel shimmy, and vibration problems; determine needed repairs (V.F.1)
- remove, clean, inspect, repack, and reinstall wheel bearings and replace seals; reinstall hub and adjust wheel bearings (V.F.2)
- check parking brake operation; adjust as needed. (V.F.4)
- complete all procedures in accordance with ASE standards.

Process/Skill Questions

S002: Remove, clean, and inspect drum brake assemblies. (W.2)

Definition: Process should include the following:

- remove, clean (using proper safety procedures), inspect, and measure brake drums; service or replace as needed (V.C.2)
- mount brake drum on lathe; machine braking surface (V.C.3)
- remove, clean, and inspect brake shoes, springs, pins, clips, levers, adjusters/self-adjusters, other related brake hardware, and back support plates; lubricate and reassemble (V.C.4)
- remove, clean, inspect, repack, and reinstall wheel bearings and replace seals; reinstall hub and adjust wheel bearings (V.F.2)
- check parking brake cables and components for wear, rusting, binding, and corrosion; clean, lubricate, and replace as needed (V.F.3)
- check parking brake operation; adjust as needed (V.F.4)
- replace wheel bearing and race. (V.F.7)
- complete all procedures in accordance with ASE standards.

Process/Skill Questions

S003: Repair, replace, and adjust drum brake components. (W.3)

Definition: Process should include the following:

- remove and reinstall wheel cylinders (V.C.5)
- pre-adjust brake shoes and parking brake before installing brake drums or drum/hub assemblies and wheel bearings (V.C.6)
- reinstall wheel, torque lug nuts, and make final checks and adjustments (V.C.7)
- remove, clean, inspect, repack, and reinstall wheel bearings and replace seals; reinstall hub and adjust wheel bearings (V.F.2)
- check park brake cables and components for wear, rusting, binding, and corrosion; clean, lubricate, and replace as needed (V.F.3)
- check parking brake operation; adjust as needed. (V.FE.4)
- complete all procedures in accordance with ASE standards.

Process/Skill Questions

**DUTY T:
Diagnosing And Repairing Disc Brakes**

Task:

T001: Diagnose and determine needed repairs on disc brake systems. (X.1)

Definition: Process should include the following:

- diagnose poor stopping, noise, pulling, grabbing, dragging or pedal-pulsation-caused problems; determine needed repairs (V.D.1)
- diagnose wheel bearing noises, wheel shimmy, and vibration problems; determine needed repairs (V.F.1)
- check parking brake cables and components for wear, rusting, binding, and corrosion; clean, lubricate, and replace as needed (V.F.3)
- check parking brake operation; adjust as needed. (V.F.4)
- complete all procedures in accordance with ASE standards.

Process/Skill Questions

T002: Remove, clean, and inspect disc brake components. (X.2)

Definition: Process should include the following:

- diagnose poor stopping, noise, pulling, grabbing, dragging or pedal pulsation concerns; determine necessary action (V.D.1)
- remove caliper assembly from mountings; clean and inspect for leaks and damage to caliper housing (V.D.2)
- clean and inspect caliper mounting and slides for wear and damage (V.D.3)
- remove, clean, and inspect pads and retaining hardware; determine needed service (V.D.4)
- disassemble and clean caliper assembly; inspect parts for wear, rust, scoring, and damage; replace seal, boot, and damaged or worn parts (V.D.5)
- clean, inspect, and measure rotor with a dial indicator and a micrometer; follow manufacturer's recommendations in determining need to machine or replace (V.D.7)
- remove and replace rotor (V.D.8)
- remove, clean, inspect, repack, and reinstall wheel bearings and replace seals; reinstall hub and adjust wheel bearings (V.F.2)
- check parking brake cables and components for wear, rusting, binding, and corrosion; clean, lubricate, and replace as needed (V.F.3)
- check parking brake operation; adjust as needed (V.F.4)
- replace wheel bearing and race. (V.F.7)
- complete all procedures in accordance with ASE standards.

Process/Skill Questions

T003: Repair, replace, and adjust disc brake components. (X.3)

Definition: Process should include the following:

- reassemble, lubricate, and reinstall caliper, pads, and related hardware (V.D.6)
- refinish rotor according to manufacturer's recommendations (V.D.9)
- adjust calipers with integrated parking brake system (V.D.10)
- fill master cylinder with recommended fluid and seat pads; inspect caliper for leaks
- reinstall wheel, torque lug nuts, and make final checks and adjustments (V.D.11)
- remove, clean, inspect, repack, and reinstall wheel bearings and replace seals; reinstall hub and adjust wheel bearings (V.F.2)
- check parking brake cables and components for wear, rusting, binding, and corrosion; clean, lubricate, and replace as needed (V.F.3)
- check parking brake operation; adjust as needed. (V.F.4)
- complete all procedures in accordance with ASE standards.

Process/Skill Questions

**DUTY U:
Diagnosing And Repairing Power-Assisted Brakes**

Task:

U001: Diagnose and determine needed repairs on power-assist brakes. (Y.1)

Definition: Process should include the following:

- test pedal-free travel with and without engine running; check power assist operation (V.E.1)
- check vacuum supply (manifold or auxiliary pump) to vacuum-type power booster. (V.E.2)
- complete all procedures in accordance with ASE standards.

Process/Skill Questions

U002: Repair or replace power brake components. (Y.2)

Definition: Process should include the following:

- check vacuum supply (manifold or auxiliary pump) to vacuum-type power booster (V.E.2)
- inspect the vacuum-type power booster unit for vacuum leaks; inspect the check valve for proper operation; repair or replace parts as needed. (V.E.3)
- complete all procedures in accordance with ASE standards.

Process/Skill Questions

U003: Repair or replace hydra-boost components. (Y.3)

Definition: Process should include the following:

- inspect and test hydro-boost system and accumulator for leaks and proper operation; determine necessary action (V.E.4)
- test pressure output of system
- check fluid level in system
- disassemble hydra-boost unit
- replace parts, such as pump, hoses, and control valves
- reassemble/reinstall hydro-boost unit
- complete all procedures in accordance with manufacturers' standards. (Relevant ASE standards have not been established to date, but will be incorporated once they are established.)

Process/Skill Questions

U004: Check operation of anti-skid braking systems, and adjust or repair according to manufacturer's recommendations (including traction control). (Y.4)

Definition: Process should include the following:

- identify and inspect anti-lock brake system (ABS) hydraulic, electrical, and mechanical components (V.G.1)
- diagnose poor stopping, wheel lock-up, abnormal pedal feel or pulsation, and noise problems caused by the anti-lock brake system (ABS); determine needed repairs (V.G.2)
- observe anti-lock brake system (ABS) warning light(s) at startup; determine if further diagnosis is needed
- diagnose anti-lock brake system (ABS) electronic control(s) and components using self-diagnosis and/or recommended test equipment; determine needed repairs (V.G.3)
- depressurize high pressure components of the anti-lock brake system (ABS) following manufacturer's recommended safety procedures (V.G.4)
- fill the anti-lock brake system (ABS) master cylinder with recommended fluid following manufacturer's procedures; inspect system for leaks
- bleed the anti-lock brake system's (ABS) front and rear hydraulic circuits following manufacturer's procedures (V.G.5)
- perform a fluid pressure (hydraulic boost) diagnosis on the high pressure anti-lock brake system (ABS); determine needed repairs
- remove and install anti-lock brake system (ABS) electrical/electronic/hydraulic components following manufacturer's procedures and specifications (V.G.6)
- test, diagnose, and service anti-lock brake system (ABS) speed sensors, toothed ring (tone wheel), and circuits using a graphing multimeter (GMM)/digital storage oscilloscope (DSO) (includes output signal, resistance, shorts to voltage/ground, and frequency data) following manufacturer's recommended procedures (V.G.7)
- diagnose anti-lock brake system (ABS) braking concerns caused by vehicle modifications (tire size, curb height, final drive ratio, etc.). (V.G.8)
- identify traction control system components (V.G.9)
- complete all procedures in accordance with ASE standards.

Process/Skill Questions

SkillsUSA

DUTY A: Self - Improvement
Task:
A001: Complete a self-assessment and identify individual learning styles <i>Definition:</i> Process should include the following: <ul style="list-style-type: none">• Identify and list individual strengths.• Identify and list areas in need of improvement. Process/Skill Questions
A002: Discover self-motivation techniques and establish short-term goals <i>Definition:</i> Process should include the following: <ul style="list-style-type: none">• Develop a list of short-term goals.• Discuss ways to change or improve lifestyle appearance and behavior. Process/Skill Questions
A003: Determine individual time-management skills <i>Definition:</i> Process should include the following: <ul style="list-style-type: none">• Prepare and keep a time journal.• Discuss ways to improve time management skills. Process/Skill Questions
A004: Define future occupations <i>Definition:</i> Process should include the following: <ul style="list-style-type: none">• Search internet for career opportunities within specified fields of study.• Prepare presentation on a specified career area. Process/Skill Questions
A005: Develop awareness of cultural diversity and equity issues <i>Definition:</i> Process should include the following: <ul style="list-style-type: none">• Research a tradition modeled by individual's family.• Develop personal philosophy statements regarding gender equity. Process/Skill Questions

A006: Define the customer

Definition: Process should include the following:

- Differentiate between External and Internal customers
- Discuss factors which contribute to poor customer relationships.

Process/Skill Questions

A007: Recognize benefits of doing a community service project

Definition: Process should include the following:

- Discuss and list ways to become involved in the community
- Develop a community service project.

Process/Skill Questions

A008: Demonstrate effective communication with others

Definition: Process should include the following:

- Identify and list personal barriers to listening.
- Develop personal plan to overcome barriers to listening.

Process/Skill Questions

A009: Participate in a shadowing activity

Definition: Process should include the following:

- Summarize experience of job shadowing activity.

Process/Skill Questions

A010: Identify the components of an employment portfolio

Definition: Process should include the following:

- Identify parts of a portfolio
- Design a personal employment portfolio

Process/Skill Questions

A011: List proficiency in program competencies

Definition: Process should include the following:

- Complete an interpersonal competency assessment.

Process/Skill Questions

**DUTY B:
Civic, Social and Business Awareness**

Task:

B001: Measure/modify short-term goals

Definition: Process should include the following:

- Discuss steps to pursue short-term goal(s)

Process/Skill Questions

B002: Identify stress sources

Definition: Process should include the following:

- List personal sources of stress.
- Discuss techniques to cope with individual sources of stress.

Process/Skill Questions

B003: Select characteristics of a positive image

Definition: Process should include the following:

- Discuss actions and traits that lead to a positive image.
- Discuss actions and traits that lead to a negative image.

Process/Skill Questions

B004: Demonstrate awareness of government, professional organizations and trade unions

Definition: Process should include the following:

- Identify state governor, legislators, and senators.
- Identify professional organizations pertaining to specific career areas.

Process/Skill Questions

B005: Apply team skills to a group project

Definition: Process should include the following:

- Form a team to develop a class project.

Process/Skill Questions

B006: Observe and critique a meeting

Definition: Process should include the following:

- Attend a formal meeting held within the community
- Critique the attended meeting.

Process/Skill Questions

B007: Demonstrate business meeting skills

Definition: Process should include the following:

- List and discuss the basic rules to ensure an orderly and business-like meeting

- Role-play appropriate meeting skills

Process/Skill Questions

B008: Demonstrate social etiquette

Definition: Process should include the following:

- Role-play appropriate social behavior
- Differentiate between good and bad manners.

Process/Skill Questions

B009: Complete survey for employment opportunities

Definition: Process should include the following:

- Gather information on a particular employment opportunity of interest.
- Conduct internet search of a specific career area.

Process/Skill Questions

B010: Review a professional journal and develop a 3 to 5 minute presentation

Definition: Process should include the following:

- Develop a presentation on the content, purpose, and distribution of a particular professional journal

Process/Skill Questions

B011: Identify customer expectations

Definition: Process should include the following:

- List and discuss customer expectations.
- Discuss consequences of unmet customer expectations.

Process/Skill Questions

B012: Complete a job application

Definition: Process should include the following:

- Obtain a job application from various businesses in the community
- Conduct a mock job interview.

Process/Skill Questions

B013: Identify a mentor

Definition: Process should include the following:

- Define mentor.
- Discuss ways in which a mentor can help an individual meet their career goals.

Process/Skill Questions

B014: Assemble your employment portfolio

Definition: Process should include the following:

- Develop employment portfolio

Process/Skill Questions

B015: Explore supervisory and management roles in an organization

Definition: Process should include the following:

- Examine an organizational chart
- Discuss responsibilities of managers and supervisors

Process/Skill Questions

B016: Recognize safety issues

Definition: Process should include the following:

- Discuss safety issues within a given career area

Process/Skill Questions

B017: Evaluate your proficiency in program competencies

Definition: Process should include the following:

- Define task and competency
- List competencies associated with a specified career area.

Process/Skill Questions

Academic Reinforcement For Technical And Professional Curriculum Frameworks

Purpose

This section of the framework contains material to help instructors in technical and professional programs to reinforce basic skills in the areas of Reading and Writing, Math and Science. The technical portion of this guide takes a more direct approach by using specific duty and task listings, but changes in the academic section lead in a more general direction. The reason for this is simple: all good instructors do not teach in the same way. However, all good instructors share the trait of being able to connect their material to everyday life. For example, understanding concepts related to heat, are important for cosmetology students as well as lathe operators in manufacturing plants. However, each program will probably take a different approach in the amount of detail and examples relating to heat concepts. Both groups require basic science knowledge of principles relating to heat, but the application of the principles will be different.

Basic Skills: The Content Areas

Included in this guide are materials to support basic skills in Reading and Writing, Mathematics, and Science. The overall approach taken here is a move toward problem-solving skills. By problem-solving, we mean the ability to take information and use it for a purpose: to take action, make decisions, predict outcomes, suggest improvements. Another term for these thinking skills is a general “literacy.”

Literacy skills have always been in demand in the workplace. A quick review of workplace training programs and other literature regarding adult education demonstrates that the need for a literate workforce is still one of the most pressing problems employers face today. Indeed, many employers (from small- and medium-sized businesses to Fortune 500 companies) have spent hundreds of millions of dollars on in-house basic skills training programs.

What constitutes a literate workforce? There are many definitions for literacy and hundreds of tests that measure it, but when employers are asked what they're looking for in potential new hires, the answers are general: they want individuals who can read and write; show up on time; think and solve problems, and keep their personal lives in order (that is, don't bring a drinking problem into the workplace).

Viewed in this way, the words "literacy" and "literate" are good terms for what educators are trying to instill in their students, the future workforce. The more common definition (being able to read and write) is certainly appropriate but the additional definitions (knowledgeable, educated, well-informed) are also apt. It is this broad term, "literate," that we use to guide instructors on what to cover in the classroom. No matter which vocational-technical area is being focused on, no matter how technical the terminology is, instructors are given the task of helping students take information, break it down into necessary parts, process details, and be able to come away with an understanding of some sort. This is "literacy", and the process is the same for every subject area-- teaching students how to think and solve problems.

Format

Each section includes a two-column table. Skills are listed on the left side; suggestions for implementing these skills into the curriculum are listed on the right side. Each suggestion is written in such a way that it can be tailored to most vocational-technical programs.

Using The Guide

This guide was prepared with four concepts in mind:

- The instructor is *aware of the need* for students to improve their basic skills.
- The instructor is the *best-qualified person* to decide how to include this material in the classroom or lab. The students' abilities and needs should drive the instructor in deciding how to use, expand, or modify these topics.
- The instructor *already has curriculum that works* for his or her students. Therefore, the suggestions for reinforcing basic skills
 - must be easy to implement
 - must stand alone

- do not need to be taught in a particular order
 - must be open-ended enough to be useful for any technical/vocational program.
- ***Time is limited.*** Unless there are quick ways to reinforce basic skills, changes to the curriculum will not be made. Teaching basic skills in the context of technical material will help students make connections that are more memorable, and will require no additional lesson planning. Just as instructors incorporate updates in technical knowledge, they can add basic skills concepts as well. Adding a few concepts at a time will help students perform better in the lab as well as on tests and evaluations.

Methods

The following methods may help instructors decide how to increase basic skill knowledge:

- *Collaborative projects*- how could a joint project between regular education teachers and vocational instructors reinforce concepts for both programs?
- *Outside assignments*- would students benefit from an outside assignment explaining how a basic math (science, reading) concept ties to a process in the lab?
- *Extra credit*- students needing extra credit can research outside topics and turn in a short summary of material
- *“Need-to-know” assignments*- Students prepare a bulleted list of the basic concepts in science they need to know in order to correctly perform ____ operation in the lab.
- *Question of the Day*- a few daily math problems for students to answer at the beginning of class allows the instructor to set the tone for the material. It also gives students an immediate goal when they enter the classroom and teaches them to stay on task. Bonus points may be awarded at the end of the week, quarter, semester, etc.
- *Two-minute Oral Presentations*- students who need to practice speaking skills can be asked to give a two-minute oral presentation at the end of class summarizing the main points for the day. Or, a two-minute presentation at the beginning of class can recap the material from a previous class.
- *Connecting with Workers*- students can poll parents, friends, area employers or other persons to find out the top 5 basic science skills needed on the job.

- *Direct Questioning*- include a few basic knowledge questions in a presentation. Award points to groups based on correct answers.

Resources

In creating the Academic Reinforcement material for the technical and professional frameworks, we used a number of source documents and resources.

- The English Language Arts, Science, and Mathematics components of the *Curriculum Improvement Project* by Dr. Willard Daggett were consulted to ensure that the top-ranked skills in those areas would be reflected in the academic support material. The English Language Arts and Science components have many linkages to the material included here. (The higher-level math skills such as trigonometry were not included in this document.)
- Data from work with Arkansas employers- the Workplace Skills Enhancement Program (WSEP) at the University of Arkansas at Little Rock (UALR) has completed many training projects and job profiles for employers in Arkansas. Our constant contact with workers and employers provides a tremendous amount of data that we use in designing customized training programs and in working on projects such as curriculum frameworks. Also, the staff of WSEP has experience teaching in Arkansas public schools, the US military, and the Job Corps.
- Additionally, other groups within UALR (the Labor Education Program, the Institute for Economic Advancement and the College of Business) provide resources regarding health and safety information, labor unions and their role in the workplace, computer and information technology and other training and outreach program data.
- US Department of Labor- the US DOL has many online documents and publications that support workers and issues regarding the workplace. (Work by Philippi and Greenan, 1988 on workplace skills was especially helpful.) Visit the website at www.dol.gov.
- Occupational Safety and Health Administration (OSHA) provides online and other resources for instructors and professionals. For topics relating to safety and health, visit www.osha.gov.

- Multistate Academic and Vocational Curriculum Consortium (MAVCC) is an organization that develops competency-based curriculum. For more on MAVCC see www.mavcc.org.

ACADEMIC STANDARDS FOR READING AND WRITING

Strategies for Reinforcement in the Vocational-Technical Classroom

Note:

* indicates industry-related materials, handouts, notes, etc.

Objective	Classroom Applications to Industry
<p><i>Present,</i> <i>Review and Discuss,</i> <i>Master</i> the list of skills employers want for the workplace regarding reading and writing.</p>	<p>Use the list of skills employers want to introduce students to the requirements of the workplace.</p> <p>Depending on students' ability levels, any of the following methods may be used to increase their understanding of the concepts:</p> <ul style="list-style-type: none"> • Discussion • Interviewing parents or other adults in the workplace about the skills required • Interviewing employers about the skills in terms of importance • Identifying workplace situations in which certain skills become more important than others • Researching adult education programs to learn why deficits in these areas must be remediated, and the cost spent yearly on these programs • Researching the topic of adult literacy
<p><i>Answer</i> simple comprehension or recall questions from a lecture or from written material.</p>	<p>Provide 2 examples of workplace materials* on students' reading level.</p> <p>With the first, allow students to read information and then answer brief recall questions.</p> <p>With the second example, read aloud the material but do not give a handout. Ask brief recall questions.</p> <p>Compare the differences...how do students retain information better—orally or visually? Discuss learning styles and impact on the job.</p>
<p><i>Follow,</i> <i>Give</i> oral instructions.</p>	<p>Using instructions for a hands-on task, have students give <u>oral</u> instructions to a partner or group. Rate the effectiveness of the speaker.</p>

<i>Follow,</i> Give written instructions.	Using a short list of instructions for a hands-on task, have students give <u>written</u> instructions to a partner or group. Rate the effectiveness of the speaker.
Show the difference between relevant and irrelevant details.	Using a copy of workplace materials*, students underline relevant or important details in red, irrelevant or less important details in blue.
Sort objects based on x number of criteria.	Using workplace materials*, sort a group of objects based on characteristics identified by instructor (e.g., by color, shape, defect, or a combination of these).
<i>Recognize,</i> Identify technical vocabulary.	Using workplace materials*, highlight technical vocabulary terms. Create a class dictionary of industry-related technical vocabulary. Students may add illustrations or diagrams. Each student receives a copy of the final product. Emphasize skills such as alphabetical order, guidewords, prefixes, suffixes, and pronunciation guides.
Read aloud.	Read aloud from workplace materials* in groups or individually.
<i>Identify,</i> Explain symbols, abbreviations and acronyms relevant to subject area.	Using workplace materials*, highlight symbols, abbreviations, and acronyms. Create a table with one column for each of symbols, abbreviations, acronyms. Classify each one and write in the meaning.
Understand, Use rules of grammar, usage, spelling, punctuation.	Identify the missing punctuation mark, misspelled word, incorrect use of grammar from workplace materials*. Correct the mistakes.
<i>Discuss</i> <u>uses and purposes</u> of a variety of workplace communication tools.	Find examples of a business letter, memo, report, brochure, proposal, schematic, map, and diagram.
Duplicate process demo by instructor	Using a workplace process, demonstrate steps

	to complete and have students perform individually or in groups.
<i>Notice,</i> Apply word analysis techniques.	Using workplace materials*, identify prefixes, suffixes, or roots that indicate meaning (e.g. therma = heat) ¹
Match parts from photographs or diagrams to actual objects.	Using workplace materials*, follow a sequence of pictures or diagrams to build, create, or copy an item or process.
Read for main ideas and for details.	Use a graphic organizer ¹ to show main ideas and supporting details.
Distinguish between fact, opinion, and inference.	Collect examples of materials based on fact or opinion/inference. Ask students to underline key terms that indicate the presence of facts or opinions.
Distinguish between rows and columns; identify a cell as a block where a row and column intersect.	Using charts or tables from workplace materials*, discuss the reasons for this format. Identify the quantity in a particular cell.
<i>Select,</i> Use appropriate resources and reference tools.	Explain the uses for the following: Dictionary, Thesaurus, Almanac, Atlas, Card Catalog, Encyclopedia. List reasons for choosing one reference tool over another. Use reference tools to answer questions related to industry or current events.
Paraphrase written or oral material into summary form.	Using workplace materials*, determine the best way to condense or shorten the material so as to give an overview to a layperson. Using a set of guidelines appropriate to students' level in length and detail, summarize the information into bullet points.

<p><i>Interpret,</i> <i>Fill out/complete forms and records.</i></p>	<p>Using workplace materials*, answer basic questions (e.g., summarize the list of parts from an inventory).</p> <p>Using blank forms or documents, fill in details. Pay close attention to directions. Students critique work with partner.</p> <p>Create a form or document to be used in a workplace process.</p>
<p><i>Use,</i> <i>Develop a process for remembering details.</i></p>	<p>Use pneumatic devices to organize and remember details. Pneumatic devices¹ include Semantic Maps, Thought Webs, and other creative tools to organize thinking.</p>
<p><i>Proofread,</i> <i>Correct mistakes in written drafts.</i></p>	<p>Using a newspaper article, locate and mark mistakes in grammar, punctuation, or usage.</p> <p>Correct mistakes in written drafts.</p>
<p><i>Examine different types of writing used in the workplace (reports, memos, brochures, logs, blueprints, formulas, etc).</i></p>	<p>Gather samples of workplace materials*. Identify each by type.</p> <p>Compare and contrast the difference between audience, (who the document is written for) length, background information/education needed to understand material, level of detail, organization and layout of the document.</p>
<p><i>Understand the writing process.</i></p>	<p>In order to apply the writing process, create a workplace communication tool to be used for a specific purpose.</p> <p>Prewrite: Brainstorm, gather facts, or do research to create a <u>business letter, memo, report, brochure, proposal, schematic, map, or diagram.</u></p> <p>Identify the audience.</p>

	<p>Determine the purpose of the document.</p> <p>Write: Create a first draft.</p> <p>Revise and Edit: Make changes to ensure accuracy.</p> <p>Look at the writing from a different point of view.</p> <p>Shorten or make more concise where possible.</p> <p>Use white space, bold print and other formatting details to make the document easy-to-read.</p> <p>Publish: Decide on the best format for the final copy (size, type of material, layout, graphics, etc.)</p> <p>Publish the final draft.</p>
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<p><i>Identify,</i> Create sentences of different types.</p>	<p>Using workplace materials*, find sentences of varying types. Examples include Simple Sentences (subject + predicate) Complex Sentences (subject + predicate including clauses).</p> <p>Write sentences, paragraphs, or essays using sentences of different types (e.g., write a 2-paragraph summary of today's lesson).</p>
<p><i>Identify,</i> Use contractions correctly.</p>	<p>Using workplace materials*, locate contractions (e.g., isn't, I'll).</p> <p>Identify misuses of contractions.</p> <p>Write a short list of directions relating to an industry process and use as many contractions as possible.</p>
<p><i>Identify,</i> Use correctly commonly misspelled words.</p>	<p>Using a list of commonly misspelled words¹, locate errors in the media (newspaper articles, Internet sites, magazines.)</p> <p>Ask each student to identify his problem words from the list.</p> <p>Attempt to incorporate problem words into class activities (e.g., add them to a list of work instructions).</p> <p>Give short weekly quizzes focusing on 5 words per week. Award bonus points.</p>
<p><i>Identify,</i> Use correctly the English irregular verbs.</p>	<p>From a list of irregular verbs, review the uses of each.</p> <p>Ask each student to identify his problem irregular verbs from the list.</p> <p>Attempt to incorporate problem verbs into class activities, such as making a collection of mistakes from print.</p>
<p><i>Identify,</i> Use Signal Words and other cues to improve writing.</p>	<p>Use a list of Signal Words¹ and discuss their purpose in writing (signal words are words that raise a flag to a reader to pay attention.)</p>

	<p>Examples: Signal Words showing emphasis: Most of all, It should be noted, Of course</p> <p>Signal Words showing a conclusion: Lastly, In summary, Finally</p> <p>Identify common signal words in workplace writing, especially in sequenced lists.</p> <p>Write a list of work instructions using signal words.</p>
Identify components of workplace documents such as blueprints, schematics, floor plans, and other industry-related documents.	Label the parts of a workplace document.
Place steps in proper sequence.	Using a list of steps or pictures cut them apart so that students can place them in the proper order.
Analyze cause and effect.	Experiment with cause and effect in the classroom (e.g., change the sequence of events in a process).
Determine missing information.	<p>Locate the information that is missing from a problem and explain why the problem cannot be solved without it.</p> <p>To reinforce concepts, use a completed problem and remove the important details. Ask students if they can identify what's missing.</p>
Differentiate between tools used for a job.	Given a list of tools and a list of functions, identify the most efficient tool for each task.
Assemble or disassemble objects.	<p>From a list of oral or written instructions, assemble an object or complete a process.</p> <p>Students write the instructions for disassembly.</p>
Cross-reference materials to compare information.	Using more than one source document, compare the information given.

<i>Interpret reasoning behind rules or regulations.</i>	Using workplace materials*, make a list of possible reasons or justifications for a safety guideline, regulation, etc.
<i>Show contrasts between approaches.</i>	Given a workplace scenario, write a brief approach to solving the problem. (Working in groups would be beneficial.) Compare and contrast each approach from the perspective of a worker, manager, supervisor.
<i>Organize data in a new format.</i>	Using workplace materials*, organize the information into a new format.
<i>Prove a rule or method's sufficiency.</i>	Perform an experiment to determine how much tolerance is acceptable in a case study, (e.g., find the range of drops of red dye sufficient to match the standard red color used in latex paint).
<i>Show relationships between two or more systems.</i>	Using 2 or more partners related to industry, show or explain how they are interrelated (e.g., explain the relationship between social workers and hospitals).
<i>Given examples of emergency situations, identify real world course of action.</i>	Using an emergency situation common to your industry, outline a step-by-step plan for action.
<i>Identify variables that affect the outcome of a process.</i>	Experiment with or predict variables that affect the outcomes for a process (e.g., weather patterns that adversely affect a process, such as building a road).
<i>Infer situations that meet guidelines when complete information is not available.</i>	Given a policy or industry standard that has debatable interpretations, list possible situations that can arise that do not have clear solutions in the policy. Discuss or debate the issues.
<i>Compare finished products to a set of guidelines.</i>	Compare a set of objects to a set of guidelines (e.g., analyze a batch of parts and document how they do or do not meet a set of Quality Assurance guidelines).

	List any discrepancies (parts that do not meet guidelines) and categorize them by type (e.g., burns, holes, etc).
<i>Identify preventative measures for maintenance of a system.</i>	List the needed routine maintenance to keep a system working properly.
<i>Predict new standards or rules that may become necessary in the future.</i>	Identify recent areas of change or development in your industry. Discuss potential future needs or developments that may occur (e.g., potential need for better training requirements for airport personnel).
<i>Improve a process by streamlining (locating waste) or decreasing lost time.</i>	Examine a process in industry in step-by-step detail. Suggest ways to decrease time needed or make the process more efficient. Isolate the cause of failure in a process by performing an experiment.
<i>Prepare a model explaining a concept.</i>	Build, draw, or create a model that explains a concept (e.g., show a need for environmental standards for water or air pollution).

¹ Fry, Edward; Kress, Jacqueline; Fountoukidis, Dona. *Reading Teacher's Book of Lists*, 4th ed. ISBN 0-13-028185-9.

ACADEMIC STANDARDS FOR MATHEMATICS

Strategies for Reinforcement in the Vocational-Technical Classroom

Note:

* indicates industry-related materials, handouts, notes, etc.

Topics Listing

- Problem Solving
- Operations and Calculations
- Applications
- Data Analysis and Display

Objectives	Classroom Applications to Industry
<p><i>Present</i> <i>Review and Discuss</i> Master the list of skills employers want for the workplace regarding mathematics.</p>	<p>Use the list of skills employers want to introduce students to the requirements of the workplace.</p> <p>Depending on students' ability levels, any of the following methods may be used to increase their understanding of the concepts:</p> <ul style="list-style-type: none"> • Discussion • Interviewing parents or other adults in the workplace about the skills required • Interviewing employers about the skills in terms of importance • Identifying workplace situations in which certain skills become more important than others • Researching adult education programs to learn why deficits in these areas must be remediated, and the cost spent yearly on these programs • Researching the topic of adult literacy
PROBLEM SOLVING	
<p><i>Examine</i> Apply problem-solving process.</p>	<p>Define the problem What is being asked? Decide on a type of solution Multi-step or single-step question? Try any of these: Estimate an answer Draw a diagram Find a pattern</p>

	<p> Guess and check Logical Reasoning Make a graph Make an organized list Make a table Solve a simpler problem Use a simulation Work backwards Write an equation </p> <p> Locate information you need Do you have all the components? </p> <p> Get missing information May need to perform some other calculations </p> <p> Calculate Look at the answer. How should the remainder be expressed? </p> <p> Check the solution Is it reasonable? </p>
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OPERATIONS AND CALCULATIONS

<p><i>Read, write, and count numbers.</i></p>	<p>Read and write numbers (especially focus on very large and very small numbers where mistakes are common).</p> <p>Give a weekly quiz asking students to compare and sequence numbers. Example: 0.4445 ___ 0.4455 > or <</p> <p>Put these in order from smallest to largest: 0.66, 0.677, 0.67</p>
<p><i>Round numbers.</i></p>	<p>Discuss your industry's use of decimals.</p> <p>Identify the place values needed to adequately perform a job. For example, a Quality Assurance Technician who works on the line in a manufacturing plant may need to use numbers through the ten-thousandths decimal place.</p>

	Take a series of sample measurements, and round them to the nearest decimal place identified by the instructor.
<i>Estimate numbers.</i>	<p>The skill of making close estimations is tied to understanding accuracy. Discuss real-life situations where estimation is used.</p> <p>Discuss the practice of estimation before calculation. Regular practice in estimating before calculating will teach students where they make errors and will increase their estimation skills.</p> <p>Discuss work situations where estimation skills are required, and possible consequences of making estimation errors (for example, is an estimate appropriate for inventory purposes? For ordering supplies?)</p>
<i>Compute averages.</i>	<p>Discuss averages in general terms. Calculate the average temperature, average rainfall or precipitation, average number of students per class, and other relevant examples.</p> <p>Using workplace materials*, calculate a series of averages. For example:</p> <ul style="list-style-type: none"> • Take 10 different measurements of a piece of pipe using a micrometer. • Compare the measurements. • Find the average of all the measurements. • Compare the average to the smallest and largest measurement. • Discuss the effects on quality...when is an average an acceptable benchmark measurement?
<i>Calculate with whole numbers: perform one-step problems with basic operations.</i>	Understand, at a level of complexity appropriate to your industry and to students' ability levels, basic principles of addition, subtraction, multiplication, and division.
<i>Perform problems that require an</i>	Using workplace materials*, make a list of

<p>understanding of the order of operations.</p>	<p>situations or problems that need more than one step to perform them.</p> <p>If the procedures (add, subtract, multiply, divide, etc) are on the same level of importance, such as adding or subtracting, then the order of operations will not impact the way the problem is solved.</p> <p>If a problem requires more than one level of operation to solve (example, dividing and adding), work the problem correctly by performing the division part first and then the addition.</p> <p>Rework the problem using addition first. Compare the answers.</p> <p>Discuss the importance of reasoning skills to verify that an answer makes sense.</p>
<p><i>Understand the relationship between decimals, fractions and percents.</i></p>	<p>Make a table comparing fractions, decimals, and percents.</p>
<p><i>Compute with fractions, decimals, and percents, and show understanding of the relationship between them.</i></p>	<p>Create sample problems using fractions that relate to everyday situations.</p> <ul style="list-style-type: none"> ▪ Poll the class on interesting topics (favorite food). Convert whole numbers to fractions. Votes- Pizza- 10 Salad- 2 BBQ- 8 <p>$10+2+8 = 20$ (recognize denominator value)</p> <p>$\frac{10}{20}$ Pizza $\frac{2}{20}$ Salad $\frac{8}{20}$ BBQ</p> <ul style="list-style-type: none"> ▪ Add the fractions. <p>$\frac{10}{20} + \frac{2}{20} + \frac{8}{20} = \frac{20}{20}$</p> <ul style="list-style-type: none"> ▪ Convert fraction to whole number. (Total answers equal 1 class's worth of answers.)

	$\frac{10}{20} + \frac{2}{20} + \frac{8}{20} = \frac{20}{20} = 1$ <ul style="list-style-type: none"> ▪ Convert fractions to percents. $\frac{10}{20}$ <p>means 10 divided by 20 = 0.50</p> <p>0.50 = 50%</p> $\frac{2}{20}$ <p>means 2 divided by 20 = 0.10</p> <p>0.10 = 10%</p> $\frac{8}{20}$ <p>means 8 divided by 20 = 0.40</p> <p>0.40 = 40%</p> $50\% + 10\% + 40\% = 100\%$ <p>Notice the totals add to 100%.</p> $\text{So, } \frac{20}{20} = 1 = 100\%$ <p>Using workplace materials*, calculate work-related questions using fractions, decimals, and percents.</p> <p>Calculate shipping costs for internet purchases (such as music from amazon.com).</p>
<p>Solve formulas and equations.</p>	<p>Understand, at a level of complexity appropriate to your industry and to students' ability levels, basic principles of equations.</p> <ul style="list-style-type: none"> ▪ Work left to right ▪ Use order of operations ▪ Place numbers on one side, variables on the other side
<p>Obtain squares and square roots.</p>	<p>Review the methods for calculating squares, square roots, cubes, and cube roots. Use industry-related formulas to demonstrate examples.</p> <p>Compare the difference between the 2 common answers to 3^2 (answer = 9, not 6).</p>

	How would an incorrect value affect the work on the job?
Convert units of measure: <i>Recognize components of measuring systems (US and metric) for length.</i>	Discuss industry measures and terms relating to length.
Convert units of measure: <i>Recognize components of measuring systems (US and metric) for mass/weight.</i>	Discuss industry measures and terms relating to mass/weight.
Convert units of measure: <i>Recognize components of measuring systems (US and metric) for volume.</i>	Discuss industry measures and terms relating to volume.
<i>Measure with a certain degree of accuracy.</i>	Estimate measurements. Using workplace materials* and tools, take measurements of work-related and classroom items. Depending on ability level, students may measure to the nearest foot, inch, centimeter, etc.
APPLICATIONS	
<i>Solve word problems.</i>	Help students feel more comfortable with word problems by placing simpler problems in word problem form; or take concepts students have already mastered and ask them to write word problems for each other to solve.
<i>Select/apply mathematical formula.</i>	Review a set of math formulas and then a list of sample problems. Decide which formula(s) apply to each problem.
<i>Understand the importance of time in the workplace.</i>	Using workplace materials*, make a list of workplace scenarios that require using time correctly, such as keeping a time card, or heating a liquid solution for 20 minutes.
<i>Recognize components of time systems (clocks and calendars).</i>	AM and PM Leap Year Military time

<p><i>Discuss,</i> <i>Identify,</i> <i>Understand</i> terms relating to measuring time.</p>	<p>Discuss the units of time measurement and time vocabulary: second, minute, hour, day, week, month, year, leap year, fiscal year, quarter, annual, biannual, etc.</p>
<p><i>Understand that time can be expressed in terms of equivalencies.</i></p>	<p>Show the time equivalencies using fractions. For example: $1 \frac{1}{2}$ days = ___ hours</p> $\begin{array}{rcl} 1 \text{ day} & = & 24 \text{ hours} \\ + \frac{1}{2} \text{ day} & = & +12 \text{ hours} \\ \hline 1 \frac{1}{2} \text{ days} & = & 36 \text{ hours} \end{array}$
<p><i>Compute time conversions.</i></p>	<p>Make a table that shows the equivalencies of time units.</p> <p>Compute conversion problems at the appropriate level of difficulty. Examples include:</p> <ul style="list-style-type: none"> • Convert minutes to hours • Convert hours to days • Convert seconds to years.
<p><i>Calculate ratio and proportion.</i></p>	<p>Review fractions when discussing ratio and proportion.</p> <p>Draw common classroom items to scale by finding a conversion rate (1 foot equals 1 inch).</p> <p>Make predictions using ratios. (If each student in class has 3 children, how many children will there be all together? Write the ratios.)</p>
<p><i>Apply geometry principles: Use formulas for measuring shapes of 2 dimensions.</i></p>	<p>Determine the formulas that apply to 2 dimensions: perimeter, area, surface area, etc.</p> <p>Find perimeter of classroom. Discuss perimeter of objects that are not shaped as perfect squares. How does this change the formula for perimeter?</p> <p>Find the area of the tiles on the floor. Find the area of the classroom.</p>

	Review that all areas are expressed in terms of square units (square inches, square miles, etc)
Apply geometry principles: Use formulas for measuring shapes of 3 dimensions.	Review the formulas that apply to 3 dimensions of objects: volume. Find the volume of common objects such as soda cans, pizza boxes, etc. Review that volume is expressed in cubic units. Discuss industry-specific needs for these formulas; for example, find the volume of a tank or silo.
Define terms relating to money.	Understand, at a level of complexity appropriate to your industry and to students' ability levels, basic principles relating to money. For more advanced students, include terms and principles of economics, finance, or statistics.
Perform one-step problems involving money.	Make change. Count up (rather than backwards) to make change.
Perform multiple-step problems using money.	Calculate gross and net earnings. Calculate <ul style="list-style-type: none"> ▪ Interest ▪ Sales tax ▪ Percent off ▪ Sale price ▪ Profit percentages Perform banking transactions.
Perform business-related financial activities.	At a level of complexity appropriate to your industry and to students' ability levels, solve income/expense problems, prepare budgets, etc.
Use a calculator to perform computations.	Identify appropriate activities that can be performed using a calculator (calculators

	<p>allow students to concentrate on problem-solving strategies.</p> <p>Award prizes for weekly activities or competitions.</p>
Calculate measurements taken from measuring devices.	Add, subtract, multiply and divide measurement numbers by plugging them into formulas.
Perform/prepare an inventory.	<p>Use a sample group of items to prepare an inventory.</p> <p>Review inventory vocabulary terms.</p> <p>Discuss the math processes that would apply to the inventory process.</p>
DATA ANALYSIS AND DISPLAY	
Recognize types of visual representations.	<p>Charts</p> <p>Graphs</p> <p>Tables</p>
Interpret charts, graphs and tables.	<p>Answer simple questions about charts, graphs and tables.</p> <p><i>Solve</i> multi-step problems involving the correlation of graphs and tables.</p>
Collect/record data.	<p>As appropriate to industry, practice sampling methods. Discuss safety precautions for sampling. Visit OSHA at the Department of Labor website for more details.</p> <p>Practice collecting and recording sample data from your industry (such as measurements taken using a micrometer). Compare class answers.</p> <p>Find the range of answers (maximum and minimum). Find the average.</p> <p>Discuss an acceptable range of answers (\pm), and graph the results showing the number that fell inside and outside the acceptable range.</p>

<p><i>Review and apply principles of probability.</i></p>	<p>Use real-life examples that are highly motivating to direct the students' attention to probability principles. (Example, "I am thinking of a number between 1 and 50. The person who guesses the number will receive that many bonus points if she can tell me the probability of choosing the number correctly.")</p>
<p>Use probability models to predict chance events.</p>	<p>Calculate <u>theoretical probability</u> of an event (e.g., the probability of rolling a 5 on a die is 1/6).</p> <p>Find <u>empirical probability</u> of an event by performing repeated experiments.</p> <p>Compare the 2 probabilities.</p>
<p><i>Calculate and interpret statistics.</i></p>	<p>Identify the importance of using statistics correctly. Bring examples of statistics from the news or media and analyze them: are they ambiguous? Are they correct? What data is the advertisement trying to get the public to see?</p> <p>For a humorous look at statistics, see <i>How to Lie with Statistics</i> by Huff and Geis.</p>
<p><i>Interpret plans/blueprints.</i></p>	<p>Review vocabulary and terms for plans, blueprints and schematics.</p> <p>Build a plan or blueprint one layer at a time, starting with the basic identifying information.</p> <p>Add layers of wax paper or other transparent drawing material on top of the first layer that allows each layer to be viewed individually, or the entire drawing as a whole.</p>
<p><i>Construct charts and tables.</i></p>	<p>Discuss chart types and chart vocabulary.</p> <p>Using workplace or sample data from the class, construct tables and charts.</p>

	<p>For a daily example, consult <i>USA Today</i> online and look for the snapshots section that shows a graph of some sort. Ask weekly bonus questions about the data.</p> <p>Challenge students to bring in examples of charts and graphs containing errors.</p>
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ACADEMIC STANDARDS FOR SCIENCE

Strategies for Reinforcement in the Vocational-Technical Classroom

Note:

* indicates industry-related materials, handouts, notes, etc.

Topics Listing

General Science- topics not specific to a content area

Physical Science- Mechanics and Physics
Energy and Waves
Thermodynamics
Electromagnetism
Chemistry
Optics

Life Science- Cell biology
Evolution
Genetics and Heredity
Human and Animal Development

Anatomy Ecology
Viruses
Bacteria
Plants

Earth Science- Earth in space
Solar System/Astronomy
Atmosphere and weather
Oceans and water
Earth resources

Note:

* indicates industry-related materials, handouts, notes, etc.

Objective

Classroom Applications to Industry

GENERAL SCIENCE	
<p><i>Present,</i> <i>Review and Discuss,</i> Master the list of skills employers want for the workplace regarding science skills.</p>	<p>Use the list of skills employers want to introduce students to the requirements of the workplace.</p> <p>Depending on students' ability levels, any of the following methods may be used to increase their understanding of the concepts:</p> <ul style="list-style-type: none"> • Discussion • Interviewing parents or other adults in the workplace about the skills required • Interviewing employers about the skills in terms of importance • Identifying workplace situations in which certain skills become more important than others • Researching adult education programs to learn why deficits in these areas must be remediated; find out the cost to employers to educate adult workers • Researching the topic of adult literacy
<p><i>Perform</i> computations as required to solve problems.</p>	<p>Use the metric system to convert units of measure.</p> <p>Round numbers to correct number of significant figures.</p> <p>Determine percentage of error.</p> <p>Understand validity, reliability, accuracy, and precision.</p>
<p><i>Apply</i> scientific method of inquiry.</p>	<p>Identify the steps of the scientific method.</p> <p>Conduct experiments.</p> <p>Understand the following terminology: Conclusions vs inferences Variables Replications Samples/sample size</p>

<p>Investigate science history as it applies to industry.</p>	<p>In groups, research topics in science pertaining to your industry. Have students assign roles for each member of the group.</p> <p>Present findings in report format, or in oral presentations.</p> <p>Investigate science ethics.</p> <p>Recognize the processes available for accountability in industry. For example, OSHA has a Safety and Health Program Assessment Worksheet whereby employers can be rated for safety issues. See http://www.osha.gov/SLTC/safetyhealth_ecat/mo d3.htm</p> <p>[Note: Safety and Health is a mandatory subject of bargaining when a workplace is unionized; in both unionized and non-unionized workplaces, an employer cannot create and dominate workplace safety committees (see the National Labor Relations Act).]</p>
<p>Use scientific instruments to measure aspects of the environment.</p>	<p>Gather data on time, length, mass, pressure, volume, acceleration or other measureables using instruments from the job.</p>
<p>Demonstrate an understanding of data.</p>	<p>List the processes involved in gathering data.</p> <p>Suggest ways that data can be grouped or organized.</p> <p>Collect specimens.</p> <p>Show how data can be represented (graphically, charts and diagrams, etc)</p> <p>Construct a model to depict a basic concept.</p>
<p>Identify the seven basic S I (Systeme International) units.</p>	<p>Length- meter- m Mass- kilogram- kg Time- second- s Electric current- ampere- A</p>

	<p>Temperature- Kelvin- K Amount of substance- mole- mol Luminous intensity- candela- cd</p> <p>Dictionary of units- see http://www.ex.ac.uk/cimt/dictunit/dictunit.htm</p>
Identify S I (Systeme International) Derived units.	<p>Choose units appropriate to your industry (hertz, ohm, volt, watt, etc).</p> <p>Create a picture dictionary demonstrating the concepts.</p>
Review relevant theories, laws and models.	<p>As relating to your industry, discuss important theories, laws and models.</p>
Use reference tools to solve problems.	<p>Use scientific reference tools (such as the Periodic Table of Elements) to learn more about specific industry concepts.</p>
Practice safe lab procedures.	<p>Handle equipment with care.</p> <p>Demonstrate safety and first aid procedures.</p> <p>Identify harmful substances.</p>
PHYSICAL SCIENCE	
Understand the cyclical nature of systems.	<p>Show, demonstrate, model, track the cycles of any of the following systems: Growth and decay Food webs Weather Water</p>
Analyze/classify matter according to type.	<p>Identify types of matter (solids, liquids, gases). Which types are predominantly used in your area of industry?</p>
Explain the concepts of work and power.	<p>Identify machines used in industry.</p> <p>Identify how energy levels change when work or power is increased/decreased.</p> <p>Identify fuel sources used in your industry.</p> <p>Discuss internal and external combustion.</p>

	Create a model demonstrating the uses of levers and pulleys.
<i>Be familiar with concepts of motion.</i>	<p>Measure acceleration and deceleration</p> <p>Understand the relationship between speed and velocity by performing experiments.</p> <p>Recognize waves and vibrations as a type of motion.</p> <p>Understand action and reaction.</p> <p>Review laws pertaining to motion.</p>
<i>Understand concepts related to force.</i>	<p>Show the need for balance of forces acting on an object.</p> <p>Observe centrifugal and centripetal forces in action.</p> <p>Show how friction is created and must be accounted for in using and preserving equipment.</p> <p>Create a chart showing types of lubricants needed in a factory and schedule of maintenance.</p> <p>Understand, at a level of complexity appropriate to your industry and to students' ability levels, basic principles of inertia.</p> <p>Show the relationship between pressure, mass, and weight.</p>
<i>Understand and apply principles relating to the atom.</i>	<p>Understand that atoms have a positive, negative or neutral charge. (Classify protons, electrons, and neutrons.)</p> <p>Identify ions.</p>
<i>Investigate forms of and changes in energy.</i>	<p>Discuss how energy is measured.</p> <p>Observe changes in energy relationships.</p> <p>Identify catalysts and reactants.</p>

	<p>Identify sources of kinetic and potential energy in your industry.</p>
<p><i>Discuss, apply principles of electricity and electric currents.</i></p>	<p>Identify types of circuits and switches.</p> <p>Show the difference between direct and alternating currents. Give examples of the best/most efficient use of each.</p> <p>Determine how electricity is measured, and solve problems using these terms. (Example, use Ohm's law to calculate current, resistance, and voltage.)</p> <p>Identify good conductors and insulators, and how to choose them.</p> <p>Understand grounding and create a visual display of grounding safety practices. Include the threat of static electricity.</p> <p>Show the uses of a vacuum tube by building a model.</p> <p>Compare the following ways of generating electricity: Hydroelectricity Motors Solar Power Steam/nuclear Transformers Incandescent (Light) Show the implications for your industry.</p> <p>As appropriate to your industry, identify electrochemical energy sources (cells, electrodes, batteries) and the processes of oxidation and reduction.</p>
<p><i>Be familiar with sound waves.</i></p>	<p>Compare how sound waves travel between liquids, solids, and air.</p> <p>Examine different types (lengths) of sound waves. Examine decibels safe for human hearing. Identify safety precautions for industry regarding sound tolerance.</p>

	<p>Be able to use correctly the terms below as they relate to your industry. (For example, ask students to write a short essay explaining a demonstration from class and include the following terms):</p> <p>Amplification Audible range Frequency Acoustics Resonance Speed</p>
<i>Be familiar with principles of heat.</i>	<p>Differentiate between the 3 types of heat transfer (conduction, convection, radiation).</p> <p>Understand that substances expand and contract due to heating and cooling</p> <p>Identify purpose and types of insulations used.</p> <p>Differentiate between heat and temperature.</p>
<i>Investigate and apply concepts relating to temperature.</i>	<p>Use the temperature scales; convert between Celsius and Fahrenheit.</p>
<i>Explain the concepts of magnetism.</i>	<p>Understand that currents create magnetic fields.</p> <p>Identify materials that are good conductors, and the properties that make them such.</p> <p>Understand electromagnetic forces present in earth.</p>
<i>Investigate/apply chemical properties.</i>	<p>Differentiate between acids and bases. Find pH for substances used in industry.</p> <p>Identify substances used in your industry and classify them by type.</p> <p>Name the major drugs, fertilizers, or additives used in your industry. Define and state examples of chemical reactions.</p> <p>Be familiar with solutions used in your industry. Compare saturated and unsaturated solutions. Determine whether a solution is soluble or insoluble.</p>

	Explain solute and solvent.
<i>Investigate forms of and changes in matter.</i>	<p>Compare and contrast physical and chemical changes.</p> <p>Discuss the types of physical or chemical changes that take place in your industry, from processing raw materials to manufacturing.</p>
<i>Understand and apply concepts relating to the elements.</i>	<p>Examine the 4 elements that make up 99% of living organisms (Hydrogen (H), Oxygen (O), Nitrogen (N), and Carbon (C)).</p> <p>Element Groups: Alkali Metals Alkaline Earth Metals Transition Metals Other Metals Metalloids Non-Metals Halogens Noble Gases Rare Earth Elements</p>
<i>Be familiar with principles of light.</i>	<p>Discuss light as a form of energy.</p> <p>Describe types of lighting systems.</p> <p>Examine the light spectrum and note the relative smallness of visible light.</p> <p>Define reflection and refraction.</p> <p>Explain how light carries information (by lasers) and show examples of the impact on technology/industry.</p> <p>Identify types of lenses.</p>
<i>Be familiar with principles of color.</i>	<p>Diagram the main parts of the eye involved in seeing color (rods, cones).</p> <p>Use prisms to split light into the visible spectrum. Briefly explore color blindness. What precautions should colorblind persons take regarding workplace safety?</p>

	Define situations in which colorblindness impacts a worker's ability to do his job.
LIFE SCIENCE	
<i>Explain the presence of cells as the identifier of all living organisms.</i>	<p>Examine the cells of organic material used in your industry, using books, the internet, or a microscope.</p> <p>Recognize that cells divide or replicate to promote growth of an organism.</p> <p>Examine the parts of a cell. Compare the cell to a machine...how do the parts function and rely on each other?</p> <p>Give example of one-celled and multiple-celled organisms.</p> <p>Review the classification system of all organisms (Kingdom, Phylum, etc).</p> <p>Create a circle graph or pie chart (totaling 100%) showing the relationship (in numbers) between the groups of organisms: Bacteria Fungi Viruses Insects Plants Vertebrates Invertebrates</p> <p>Compare some of the cell processes (active and passive transport) to the processes in your industry.</p>
<i>Understand the progress of evolution of organisms.</i>	Recognize how a species will adapt to better fit in its environment over time.
<i>Explain the role of genetics in human development.</i>	<p>Understand, at a level of complexity appropriate to your industry and to students' ability levels, basic principles of heredity, including:</p> <ul style="list-style-type: none"> • Half of an individual's genes are contributed by each parent • Traits that are inherited are either dominant or recessive from the parent(s)

	<ul style="list-style-type: none"> • Cell division by mitosis versus meiosis • Disabilities are caused either by genetic/inherited conditions (such as Down's Syndrome) or in accidents occurring after birth, such as brain damage due to a car accident or a stroke
<i>Investigate/apply</i> principles of human development.	<p>Describe the life cycle of humans and other animals.</p> <p>Use the concept of human development to explain the need for understanding foundation skills in your area. (For example, children do not run before they walk.) Use this concept to explain other events that occur in a natural order in your industry.</p>
<i>Explore</i> additional concepts pertaining to humans and other animals.	<p>Give examples of ways organisms adapt to their environment.</p> <p>As relating to industry, review the concepts of:</p> <p>Aging Immune system Skin and Tissues Blood and hemoglobin Disease</p>
<i>Compare/contrast</i> the differences between sexual and asexual reproduction.	<p>Determine instances when understanding the concepts of sexual reproduction are important for your industry.</p> <p>Highlight the effects of unsafe working practices on unborn fetuses, or the dangers present for pregnant individuals working in industry.</p>
<i>Show</i> a general understanding of the importance of health.	<p>Explore the cost of lost wages and worker's compensation in the past year due to health problems.</p> <p>Research the most common health problems among workers (workers with safe jobs; workers with most hazards to health, etc)</p>
<i>Investigate</i> the food cycle.	<p>Identify food chains, food webs, food pyramids.</p> <p>Show how changes to the food cycle affect the</p>

	<p>environment and affect man.</p> <p>Name the food groups.</p>
<p><i>Understand</i> nutrition and the body's need for a diet that provides vitamins and minerals.</p>	<p>Show an understanding of body systems (circulatory, nervous, digestive, etc) as they relate to industry.</p> <p>Identify deficient vitamins and minerals among a particular population (American workers, workers in specific environments, workers who do not go outdoors, or who always work outdoors) and the health risks associated with job types (office work, mining work, etc.)</p>
<p><i>Observe</i> health code/sanitation requirements.</p>	<p>Research the development of health code and sanitation requirements, including OSHA.</p> <p>Compare/contrast workplaces of 1850, 1900, 1950, 2000 regarding health and safety.</p> <p>Discuss the most common workplace violations of health requirements and present in a graphic format (e.g., maps, charts).</p> <p>Discuss potential effects of ignoring health requirements.</p> <p>After identifying workplace hazards, create several plans to treat the problem. Debate the benefits of each.</p> <p>To avoid the threat of employers choosing ineffective means of ensuring safety on the job, locate MSDS sheets, first aid stations, personal protective equipment, worker's compensation claims offices/paperwork, etc.</p> <p>Using workplace materials*, locate the section on safety regulations. Ask students to rank order the items. Debate the importance of each. Determine the threat of ignoring regulations. Research which regulations are often disregarded.</p> <p>Explore proactive measures students can take to extend their health.</p> <p>Understand the importance of mental health in</p>

	addition to physical health.
<i>Investigate/apply</i> principles of anatomy and physiology.	<p>As relating to your industry, explore issues relating to anatomy and physiology.</p> <p>Skeletal system- study the bones of the arm, hand, and neck. Research carpal-tunnel syndrome.</p> <p>Fractures- identify the types of fractures and those most common to your line of work. Learn how to prevent falls.</p>
<i>Understand</i> basic principles of Ecology.	<p>Define ecology.</p> <p>Identify 5 major ways in which man interacts with the environment, especially as relating to your industry.</p> <p>Discuss the effectiveness of the media as compared to pro-science groups (such as Greenpeace) on the public's awareness of important environmental issues.</p> <p>Identify any areas of concern regarding waste/waste management in your industry.</p> <p>Show the difference between a niche, community, habitat, and ecosystem.</p> <p>Give examples of herbivores, carnivores, and omnivores. How does your industry use and serve each group?</p> <p>Understand predators' effects on food chains. Identify predators of industry.</p> <p>Explain the process of decomposition and decay. How does industry interfere with or interrupt these processes?</p>
<i>State</i> the differences between viruses and bacteria.	<p>Define viruses and bacteria.</p> <p>Explore viral and bacterial threats present in the workplace. How can they be prevented? How can they be treated?</p> <p>State the benefits of viruses and bacteria.</p>

	Explain the recent increased resistance to drugs and antibiotics.
<i>Understand</i> basic concepts relating to plants.	Describe the interchange of oxygen and carbon dioxide between plants. Contrast to the way humans exchange oxygen and carbon dioxide. As relating to industry, review the concepts of: Fertilization Parts of plant, and functions of each Effects of temperature on plants Need for water and light Photosynthesis
EARTH SCIENCE	
<i>Recognize</i> earth's position in the universe.	As relating to your industry, identify relevant topics regarding Asteroids Comets Stars Galaxies Identify planets in the solar system. Compare and contrast earth to other planets. Create a model showing the relative size of earth within our solar system. Use mathematical relationships to make sure the scale is correct (earth is the size of ___ so the sun should be the size of ___). How do the phases of the moon and sun affect the hemispheres?
<i>Investigate</i> history of the earth.	Identify geological, chemical and other methods of determining the age of an object. Demonstrate that fossils and rocks are indicators of previous eras. As a class, create a timeline indicating the age of the earth. Include the various ages (Ice Age, etc) and the length of each. Make sure the timeline is drawn to scale.

	<p>Assign each Age to a group and research the following:</p> <p>Weather</p> <p>Major events at beginning and end of age</p> <p>Organisms living during this time</p> <p>Factors that made the Age unique</p>
<i>Investigate physical characteristics of the earth.</i>	<p>Label/model the components of the earth.</p> <p>Understand, at a level of complexity appropriate to your industry and to students' ability levels, basic principles of gravity.</p> <p>Solve problems of longitude, latitude and time zones.</p> <p>Create a model of the ratio of land and water on earth.</p>
<i>Investigate physical forces acting on the earth.</i>	<p>Examine erosion and depletion of nonrenewable resources.</p> <p>Identify natural disasters such as hurricanes and earthquakes. Research the effects of a past disaster on a specific industry.</p> <p>Understand, at a level of complexity appropriate to your industry and to students' ability levels, basic principles of plate tectonics (the earth's surface is broken into large plates; movements of these plates over time causes earthquakes and other geologic activity).</p>
<i>Explain the basic components of earth's rotation.</i>	<p>Understand that the earth spins on its axis at an angle of 23 ½ degrees</p> <p>Identify the period of one complete rotation as a day; longer cycles of rotations identify the seasons.</p> <p>Discuss time zones.</p>
<i>Identify the earth's atmosphere and its components.</i>	<p>Identify the main elements in the earth's atmosphere (nitrogen and oxygen).</p> <p>Identify layers of the atmosphere, and the ozone layer.</p>

	Explain concepts of air pressure.
Understand basic principles of the solar system.	Demonstrate how the sun strikes the earth at different angles depending on location.
Demonstrate the relationship between climate and weather.	<p>Identify the factors that create weather.</p> <p>Show how landscape features are affected by changes in climate or weather.</p> <p>Identify the greenhouse effect. How does industry contribute to it?</p> <p>Describe the relationship between altitude and weather.</p> <p>Understand that changes in the weather may be seen as fronts that are put in motion by the jet stream.</p> <p>Identify types of precipitation.</p> <p>Differentiate between types of clouds.</p> <p>Understand the effect of winds, wind speeds, and impacts on vegetation.</p>
Learn and apply concepts relating to the oceans.	<p>Label the major oceans and seas.</p> <p>Determine the elements in ocean water (nearly all elements are present).</p> <p>Identify or draw the structural components of the ocean floor.</p> <p>Explain the relationship between the moon and the tides.</p> <p>Explore ways the ocean is used for power and business.</p>
Investigate principles of water.	<p>Identify the parts of the water cycle and the effects of the processes involved.</p> <p>Define water's chemical properties water is the universal solvent water has a neutral ph of 7</p>

	<p>chemically, water is one atom of oxygen bound to two atoms of hydrogen)</p> <p>Measure salinity. Which industries rely heavily on water?</p> <p>Define water's physical properties water is the only natural substance that exists as solid, liquid, and gas water's surface has a high density water has a high tolerance for heat (heat index) water's weight water as a coolant specific gravity</p>
<i>Investigate conservation of physical and natural resources.</i>	<p>As relating to your industry, discuss or debate the issues of Allocation of resources Recovering resources Best/worst methods of using resources</p> <p>Compare/contrast renewable and nonrenewable resources.</p> <p>Note the important developments in your industry regarding mineral, soil, water, and wildlife conservation.</p> <p>Discuss alternative sources of energy as relating to your industry.</p>
<i>Investigate issues regarding scientific technology.</i>	<p>As relating to your industry, discuss the uses of technology. What are the newest developments?</p> <p>What effects does the technology have on our society? Political system?</p> <p>Discuss the role of economics on technology.</p>
<i>Apply science principles/laws to environmental issues.</i>	<p>Discuss how mankind alters the earth and environment through use of resources and technology, pollution.</p>

Crosswalk to Skills USA

Automotive Services

Student organization information correlates to course content. Student organization activities enable students to apply and practice competencies as they master them. Automotive Service Technology course curriculum correlates to the SkillsUSA Automotive Service Technology contest.

Purpose

To evaluate each contestant's preparation for employment and to recognize outstanding students for excellence and professionalism in the field of automotive service technology.

Clothing Requirement

Official SkillsUSA light blue work shirt and navy pants, black or brown leather work shoes, and safety glasses with side shields or goggles. (Prescription glasses can be used only if they are equipped with side shields. If not, they must be covered with goggles.) To purchase official work clothes, contact Midwest Trophy Manufacturing Co. Inc. by calling 1-800-324-5996 or order online at: <http://www.mwtrophy.com/vica/index.html>.

Eligibility

Open to active SkillsUSA members enrolled in career and technical programs with automotive technician or automotive service technology as the occupational objective.

Equipment and Materials

1. Supplied by the technical committee:
 - a. All necessary tools and equipment for the contest
 - b. Safety glasses
 - c. All necessary service publications for the contestants
 - d. All necessary information and furnishings for judges and technical committee

Scope of the Contest

The scope of the contest will be consistent with the automotive technician task list outlined in guidelines published by the National Institute for Automotive Service Excellence (ASE) and the National Automotive Technicians Education Foundation (NATEF).

1. Contestants will demonstrate their ability to perform jobs or skills selected from the standards mentioned above as determined by the SkillsUSA Championships technical committee. Committee membership includes: AAA Auto Club of Missouri, America East Marketing Inc., American Honda Motor Co. Inc., Automotive Service Association, Chrysler Corp., Fel-Pro Inc., General Motors Corp., Kent-Moore Tool Division, SPX Corp., MAC Tools, NAPA Hand and Service Tools, National Institute for Automotive Service Excellence, S&S Service Center Inc., Snap-on Inc., Standard Motor Parts, and Toyota Motor Sales, USA.

2. Major Areas of the Contest

- a. Inspecting, repairing and replacing cooling, heating and air conditioning components and systems (postsecondary only)
- b. Identifying, checking, servicing and repairing electrical systems and components including: charging, lighting, ignition, cranking accessories and electronic components
- c. Measuring and adjusting wheel alignment
- d. Diagnosing, servicing and repairing steering and suspension
- e. Diagnosing, servicing and repairing brake systems
- f. Performing task-related to engine overhauls, adjustments and component parts replacement
- g. Analyzing exhaust emissions, testing and re-placing emission components
- h. Diagnosing, servicing and repairing fuel systems
- i. Performing tasks related to transmissions, differentials and universal joints
- j. Demonstrating merchandise and business practices
- k. Demonstrating ability to read and use service publications
- l. Completing a written test developed by Auto-motive Service Excellence
- m. Demonstrating safe and proper usage of industry equipment (scan tools, multi-meters, timesert thread repair, soldering tools and hand tools)
- n. Demonstrating safe and proper use of tools and equipment Note: Work stations consist of a vehicle, and/or simulators, components and service publications. Some or all

of the secondary (high school) work stations may be different than the postsecondary work stations.

3. Contestants will take a written test administered by the National Institute for Automotive Service Excellence.

4. Contestants will be tested on a variety of vehicles commonly assembled in the United States. This will include both domestic and import vehicles.

5. Contestants will be judged on safety, quality, ability to follow instructions and procedures, accuracy (in comparison with factory specifications), workman-ship and other skills representative of the trades identified by industry leaders. Time limits will be assigned for each task, but no bonus points will be awarded for early completion.

6. The judging criteria and the points assigned will be determined by the difficulty of the task assigned. *136 SkillsUSA Championships Technical Standards (2002–2004)*

7. A total of eight to 15 stations will be assigned. Each station must be broken down into specific task criteria and separate steps based on the task. For example:

Station # 1 Wire test and repair segments Identify faulty circuit = x points

Repair condition = x points

Assemble/retest = x points

Resistor board tests = x points

Compare values to specs = x points

Workmanship = x points

Safety practices = x points

8. Each station will have the same point total assigned to it, except the written test, which is limited to 5 percent of the total contest points.

9. Stations and equipment to be used in the national competition will be published by April 15 each year. To view and print this publication, go to www.skillsusa.org/april.html.. *Sponsored by Goodheart-Willcox Publisher 137*

ITEMS EVALUATED

(Technical committee members based on the difficulty of the task will assign Points)

Operation

Written test

CLOTHING PENALTY (minus 0 to 5 percent of total points)

Note: An Oral Professional Assessment will be included. Points to be determined by national technical committee..138 *SkillsUSA Championships Technical Standards (2002–2004)*.
Sponsored by Goodheart-Willcox Publisher 139

Arkansas's All Aspects of Industry

Defining “All Aspects”

All aspects of an industry include, with respect to a particular industry that a student is preparing to enter, planning, management, finance, technical and production skills, underlying principles of technology, labor and community issues, health and safety, and environmental issues related to that industry. Planning is examined at the level of both an individual business and the overall industry. Planning elements might include:

- Developing strategic plans — mission, vision, goals, objectives, and/or a plan of action
- Working with planning tools such as surveys, market research, and competitive analysis
- Anticipating needs for staffing and major purchases of equipment and supplies
- Developing plans for training and upgrading of staff
- Forecasting market trends
- Developing business plans for entrepreneurial ventures.

Management addresses methods typically used to manage enterprises over time within the industry, as well as methods for expanding and diversifying workers' tasks and broadening worker involvement in decisions. Key elements of management might include:

- Using an organization chart to explain how a corporate chain of command works
- Providing input for strategic plans and communicating the company's vision and mission statements
- Leading employees in carrying out strategic plans and action plans
- Evaluating employee performance
- Anticipating technology and other major purchasing needs
- Ensuring equity and access for employees
- Resolving conflicts
- Developing job descriptions and written policies/procedures
- Identifying recruitment procedures, training opportunities, methods of evaluation, and retention strategies
- Working with professional associations and community outreach efforts.

Finance examines ongoing accounting and financial decisions and different methods for raising capital to start or expand enterprises. Finance functions might include:

- Developing budgets
- Preparing financial statements
- Analyzing and managing financial transactions and records
- Implementing payroll procedures
- Determining and paying taxes
- Identifying indirect wage costs (benefits, FICA, insurance, worker's compensation)
- Making loans and granting credit to customers
- Developing graphs and charts related to company finances
- Identifying and implementing methods of sustaining profitability of a business
- Managing 401K plans
- Identifying sources of capital

Technical and Production Skills cover specific production techniques and alternative methods for organizing the production work, including methods that diversify and rotate workers' jobs. Technical and production skills that an employee should have to succeed in a business or industry might include:

- Developing and upgrading job-specific skills
- Using troubleshooting and problem-solving techniques
- Analyzing information to make decisions
- Identifying and implementing quality assurance techniques
- Employing communication skills such as writing, listening, speaking, and reading
- Participating in team efforts
- Implementing projects and new techniques
- Demonstrating basic computer skills; employing time management techniques in completing projects and assigned tasks
- Demonstrating ethical behavior and work ethic.

Underlying Principles of Technology provide an integrated study across the curriculum of the mathematical, scientific, social, and economic principles that underlie the industry's technology.

Principles of technology that an employee should know might be demonstrated by:

- Exhibiting proficiency in mathematical and scientific functions related to new and emerging technologies
- Continuously upgrading job skills needed to implement new technologies
- Participating in industry certification programs
- Cross-training to enhance one's value to the organization and to enhance job promotion opportunities
- Understanding and adhering to ethical issues related to technologies.

Labor Issues examine worker rights and responsibilities, labor unions and labor history, and methods for expanding workers' roles. Labor issues might include:

- Understanding and implementing worker rights and responsibilities
- Working with labor unions
- Keeping abreast of local, state, and federal legislation affecting employee and employer rights and responsibilities
- Negotiating and settling worker disputes
- Identifying certification requirements for specific jobs
- Analyzing the impact of labor agreements on business operations.

Community Issues explore the impact of the industry on the community and the community's impact on and involvement with the industry. Concepts of business and community relations might include:

- Developing and working with community outreach projects
- Participating on advisory committees and community organizations
- Working with professional associations
- Developing and implementing public relations plans
- Participating in community service projects.

Health, Safety, and Environmental Issues examine these concepts in relation to both the workers and the larger community. Concepts related to health, safety, and the environment might include:

- Identifying and implementing federal, state, and local regulations related to the health and safety of employees
- Understanding and strictly adhering to federal, state, and local environmental regulations related to the business
- Identifying job-specific health hazards and safety issues
- Identifying and implementing basic safety and first aid training techniques for emergencies such as personal illness or injury, tornadoes, fires, nuclear accidents, floods, and incidences of employee-rape or violent behavior
- Communicating safety regulations and plans to employees

Working with selected community groups to implement safety programs.

Automotive Technology Framework Cross Reference

Brakes

Unit 1	Safety and First Aid	Duty(s): A
Unit 2	Hydraulic System Diagnosis and Repair	Duty(s): V
Unit 3	Drum Brake Diagnosis and Repair	Duty(s): W
Unit 4	Disc Brake Diagnosis and Repair	Duty(s): X
Unit 5	Power Assist Units Diagnosis and Repair	Duty(s): Y
Unit 6	Miscellaneous (Wheel Bearing, Parking Brakes, Electrical, Etc.) Diagnosis and Repair	Duty(s): V, W, X, Y
Unit 7	Anti-lock Brake Systems	Duty(s): Y
Unit 8	Customer Relations	Duty(s): B
Unit 9	The VICA Student Organization	Duty(s): A, B

Steering and Suspension

Unit 1	Safety and First Aid	Duty(s): A
Unit 2	Steering Systems Diagnosis and Repair	Duty(s): S, T
Unit 3	Suspension Systems Diagnosis and Repair (Front)	Duty(s): S
Unit 4	Suspension Systems Diagnosis and Repair (Rear)	Duty(s): T
Unit 5	Suspension Systems Diagnosis and Repair (Misc. Ser.)	Duty(s): R
Unit 6	Wheel Alignment Diagnosis, Adjustment and Repair	Duty(s): U
Unit 7	Wheel and Tire Diagnosis and Repair	Duty(s): U
Unit 8	Customer Relations	Duty(s): B
Unit 9	The VICA Student Organization	Duty(s): A, B

Electrical/Electronic Systems

Unit 1	Safety and First Aid	Duty(s): A
Unit 2	General Electrical Systems Diagnosis	Duty(s): D
Unit 3	Battery Diagnosis and Repair	Duty(s): E
Unit 4	Starting System Diagnosis and Repair	Duty(s): F
Unit 5	Charging System Diagnosis and Repair	Duty(s): G
Unit 6	Lighting System Diagnosis and Repair	Duty(s): H
Unit 7	Gauges, Warning Devices, and Driver Information Systems Diagnosis and Repair	Duty(s): I
Unit 8	Horn and Wiper/Washer Diagnosis and Repair	Duty(s): D
Unit 9	Accessories Diagnosis and Repair	Duty(s): D
Unit 10	Customer Relations	Duty(s): B
Unit 11	The VICA Student Organization	Duty(s): A, B

Engine Performance

Unit 1	Safety and First Aid	Duty(s): A
Unit 2	General Engine Diagnosis	Duty(s): J,K,L
Unit 3	Computerized Engine Controls Diagnosis and Repair	Duty(s): J
Unit 4	Ignition System Diagnosis and Repair	Duty(s): J
Unit 5	Fuel, Air Induction, and Exhaust Diagnosis and Repair	Duty(s): K
Unit 6	Emissions Control Systems Diagnosis and Repair (PVC)	Duty(s): L
Unit 7	Emissions Control Systems Diagnosis and Repair (STC)	Duty(s): L
Unit 8	Emissions Control Systems Diagnosis and Repair (ISC)	Duty(s): L
Unit 9	Emissions Control Systems Diagnosis and Repair (EGR)	Duty(s): L
Unit 10	Emissions Control Systems Diagnosis and Repair (EGT)	Duty(s): L
Unit 11	Emissions Control Systems Diagnosis and Repair (IATC)	Duty(s): L
Unit 12	Emissions Control Systems Diagnosis and Repair (IMT)	Duty(s): L
Unit 13	Emissions Control Systems Diagnosis and Repair (EVC)	Duty(s): L
Unit 14	Engine Related Service	Duty(s): J,K,L
Unit 15	Customer Relations	Duty(s): B
Unit 16	The VICA Student Organization	Duty(s): A,B