

**Technical and Professional
Education**

**Curriculum Content Frameworks for
Collision Repair
Technology**

**Curriculum Content Frameworks for
Collision Repair 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 Collision Repair 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.

Foreword

The curriculum content framework Collision Repair 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:

- Aircraft Pilot Training
- Auto Body Technology — Certified
- Auto Body Repair — Non-Certified
- Automotive Service Technology — Certified
- Automotive Servicing — Non-Certified
- Aviation Maintenance Technology
- Diesel Equipment Technology
- Small Engine Repair
- Career Role CIP Code – 47.0603
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Acknowledgments

The Collision Repair 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 Collision Repair 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 are 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 Department of Workforce Education access to their instructional frameworks.

University of Arkansas at Little Rock

Gretchen Watson

Laura Miller

Michael Gerfen

Russell Chevrolet

Brett Russell, General Manager

Darrell Hurt, Service Manager

Louis Mitchell, Body Shop Manager

AADA

Rick Keckler, V.P. Dealer Relations

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Introduction

About the Program

This guide has been developed for use in designing and implementing a competency-based program in Collision Repair Technology. The tasks in this guide are based on the ASE national standards for auto body repair and on the automotive collision technology competencies published by the Missouri Department of Elementary and Secondary Education, Division of Vocational Adult Education. In addition, the tasks have been validated for the auto body repair industry in Arkansas. Contents of the document are presented in three major sections.

About the Document

This document includes the following components:

- Section 1 contains a master task list for the Auto Body 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 Collision Repair and Refinish*. All tasks have been designated essential. Essential tasks are those that must be achieved by every student pursuing the completion of the Auto Body Technology program.
- Section 3 lists the Arkansas Standards of Learning for language arts, mathematics, and science that are reinforced by instruction in the Auto Body Technology program. Academic skills in these areas are necessary for the mastery of a number of tasks performed by auto body technicians on the job.

Program Description

494300 – Non-Structural Analysis/Damage Repair

494310 – Paint and Refinishing

494320 – Structural Analysis/Damage Repair

Students learn to repair the body and fenders of automobiles. Instruction in body preparation for painting and finishing is included. In some courses, all competencies have been identified as essential. Competencies selected as optional shall be identified as such. Locally added competencies should be included as conditions permit.

Master Duty/Tasks Listing
Collision Repair Service Technology
Non-Structural Analysis and Damage Repair
Painting and Refinishing
Structural Analysis and Damage Repair

National and state experts in the occupational field of Collision Repair Technology 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
Task:
A001: Identify government agencies regulating the auto body repair industry
A002: Identify general safety rules
A003: Use protective clothing and equipment
A004: Identify fire emergency procedures, including the proper use of fire protection equipment
A005: Use chemicals safely
A006: Identify environmental effects of chemicals
A007: Identify proper chemical disposal techniques
A008: Identify information on Material Safety Data Sheets (MSDS)
A009: Identify toxic substances and considerations in handling them
A010: Identify electrical safety procedures (including airbag and battery)
A011: Identify safe under-hood practices

DUTY B: Preparing for the Auto Body Repair Career
Task:
B001: Identify opportunities in the auto body repair field
B002: Identify the basic construction of the auto body
B003: Identify the purposes and goals of the student organization
B004: Participate in course activities sponsored by the student organization (e.g., meetings, programs, and other projects that require specialized skills and concepts)
DUTY C: Using Measurements and Mixtures
Task:
C001: Read a rule, fractional-inch, and metric
C002: Solve auto body-related problems involving volume and ratios
DUTY D: Using Tools and Equipment
Task:
D001: Demonstrate the safe use and maintenance of general hand tools
D002: Demonstrate the safe use and maintenance of specialized auto body repair hand tools
D003: Demonstrate the safe use and maintenance of electric and pneumatic hand tools
D004: Demonstrate the safe use and maintenance of electric, pneumatic, and hydraulic equipment (including proper lifting and jacking techniques)

DUTY E: Writing Damage Reports
Task:
E001: Diagnose and analyze damage
E002: Use collision manuals (including computer-generated estimating packages)
E003: Write a damage report in logical sequence
E004: Practice professional customer service
DUTY F: Welding Auto Body
Task:
F001: Identify auto body repair welding processes
F002: Use safety procedures in welding and cutting
F003: Set up equipment for metal inert gas (MIG) welding
F004: Prepare metal for MIG welding
F005: Construct MIG welds
F006: Perform destructive tests
F007: Weld high-strength steel
F008: Weld aluminum
F009: Identify cutting processes
F010: Set up and use equipment for cutting

DUTY G: Repairing Sheet Metal
Task:
G001: Analyze damage and develop repair plan
G002: Clean the exterior surface
G003: Rough out panel
G004: Use weld-on nail gun to repair sheet metal
G005: Describe method for shrinking panel
G006: Prepare surface and apply body filler
G007: Finish body filler
DUTY H: Replacing Body Panel
Task:
H001: Remove and replace welded-on nonstructural panels
H002: Remove and replace welded-on structural panels
H003: Remove and replace bolted-on nonstructural panels
H004: Section welded-on nonstructural panels
H005: Replace welded-on door panels and door intrusion barrier
H006: Replace bonded door panels
H007: Remove and replace steel and aluminum bumpers

H008: Replace energy absorbers
H009: Remove and replace soft fascia covers
H010: Apply corrosion protection
DUTY I: Repairing Plastic Panel
Task:
I001: Identify plastic types
I002: Clean and prepare exterior surfaces
I003: Analyze damage and plastic repair techniques
I004: Perform airless plastic repair
I005: Perform repairs with chemical adhesives
I006: Repair holes in SMC body panels
I007: Section SMC and fiberglass body panels
I008: Remove and replace complete SMC body panels
I009: Repair and retexture plastic parts
I010: Prepare repaired area for refinishing
I011: Reconstruct fiberglass panels and identify safety procedures

DUTY J:
Using Refinishing Equipment and Procedures

Task:

J001: Demonstrate safe painting practices and use of protective clothing and equipment

J002: Demonstrate use of refinishing equipment

J003: Use a paint gun with proper technique

J004: Identify surface preparation techniques

J005: Demonstrate appropriate sanding techniques

J006: Demonstrate appropriate masking techniques

J007: Demonstrate application procedures for undercoats

J008: Apply chip-resistant coating

J009: Demonstrate application procedures for topcoats

J010: Tint and blend color coat

J011: Mix and apply single-stage topcoat

J012: Mix and apply base coat/clear coat

J013: Mix and apply multistage systems

J014: Mix and apply refinish to flexible plastic parts

J015: Perform clear coat repair and detailing

J016: Identify paint defects and refinishing procedures
DUTY K: Repairing Exterior and Interior Molding and Trim
Task:
K001: Identify types and uses of fasteners, U.S. and metric, involved in repairing exterior and interior trim
K002: Remove and replace belt molding and trim
K003: Remove and replace adhesive-held molding and trim
K004: Replace exterior trim and moldings
K005: Remove and replace decals and stripes
K006: Identify interior components and trim
K007: Remove and replace seats
K008: Remove and reinstall seat belt components
K009: Remove and reinstall carpeting
K010: Remove and reinstall dash assembly
DUTY L: Diagnosing and Repairing Supplemental Restraint Systems
Task:
L001: Identify, inspect, and disarm supplemental restraint systems
L002: Diagnose supplemental restraint systems
L003: Replace supplemental restraint systems

DUTY M: Replacing Glass
Task:
M001: Identify vehicle glass and replacement procedures
M002: Remove and replace a reveal molding
M003: Remove and replace a gasket-type window or back glass
M004: Remove and replace glass with urethane sealants
M005: Remove and replace a door trim panel
M006: Remove and replace a lock cylinder
M007: Remove and replace a door glass
M008: Remove and replace a window regulator
M009: Identify procedures for inspecting, removing, reinstalling, and aligning convertible top and related mechanisms
M010: Service removable, manually or power-operated roof panel
DUTY N: Servicing Electrical Systems
Task:
N001: Identify electrical system components
N002: Service a battery
N003: Use a digital volt ohmmeter (DVOM)
N004: Diagnose and repair electrical accessories

N005: Inspect, adjust, and replace charging system
N006: Retain owner's settings on battery-stored memory devices (e.g., radio and seat positions)
DUTY O: Servicing Lighting Systems
Task:
O001: Service a taillight assembly
O002: Service a headlight assembly
O003: Service a retractable headlight assembly
O004: Aim headlights using mechanical aiming equipment
DUTY P: Servicing Engine Systems
Task:
P001: Remove and replace a radiator
P002: Remove, inspect, and replace belts
P003: Test antifreeze solution
P004: Service fan blades and clutches
P005: Check and service radiator and heater hoses
P006: Inspect and repair or replace auxiliary oil cooler
P007: Inspect and repair or replace fuel, exhaust, and emissions systems

DUTY Q: Diagnosing and Repairing Heating and Air Conditioning
Task:
Q001: Identify air conditioning system components and service procedures
Q002: Replace condenser
Q003: Remove and reinstall compressor
Q004: Test the system for leaks
Q005: Repair leaks in air conditioning systems
Q006: Check and service air conditioning hoses
Q007: Evacuate and charge system using vacuum pump or charging system
Q008: Inspect, flush, and replace heater components
DUTY R: Constructing and Repairing Frame Body and Unibody
Task:
R001: Identify vehicle frame construction and terminology
R002: Identify types of damage
R003: Interpret printed and electronic specification manuals
R004: Identify characteristics and uses of high strength steel
R005: Analyze damage, using tram and self-centering gauges

R006: Analyze damage, using universal measuring system
R007: Analyze damage, using dedicated measuring system
DUTY S: Making Vehicle Structural Repair
Task:
S001: Straighten and align structural damage
S002: Replace component parts
S003: Perform stress relief, using shock
S004: Perform stress relief, using heat
S005: Replace high strength steel
S006: Section component parts (including manufacturing and installing sectioning inserts)
S007: Remove and reinstall mechanical components
DUTY T: Diagnosing and Repairing Steering and Suspension
Task:
T001: Identify suspension systems
T002: Perform suspension quick checks
T003: Remove and reinstall suspension systems
T004: Service suspension systems
T005: Identify steering systems and components, including component specifications

T006: Inspect, repair, and replace steering components
T007: Service power steering system
T008: Service brake systems
T009: Inspect, diagnose, and repair causes of tire wear patterns
T010: Perform four-wheel alignment
T011: Remove and reinstall front drive trains
DUTY U: Detailing
Task:
U001: Apply decals and miscellaneous exterior trim
U002: Demonstrate polishing techniques
U003: Clean exterior and glass surfaces
U004: Perform interior detailing
U005: Clean body openings and other areas not painted
U006: Remove overspray

Task Definitions

National and state experts in the occupational field of Collision Repair Technology 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
Task:
<p>A001: Identify government agencies regulating the auto body repair industry</p> <p><i>Definition:</i> Process should include the following:</p> <ul style="list-style-type: none"> • identify and take necessary precautions with hazardous operations and materials according to federal, state, and local regulations (V.A.1) • identify personal health and safety hazards according to OSHA guidelines and the "Right to Know" Act (V.A.2) • present all descriptions in accordance with ASE standards <p>Process/Skill Questions:</p>
<p>A002: Identify general safety rules</p> <p><i>Definition:</i> Process should include the following:</p> <ul style="list-style-type: none"> • apply safety procedures associated with vehicle components and systems such as ABS, air bags, refrigerants, batteries, tires, oil, antifreeze, engine coolants, etc. (II.A.10) • identify working conditions and safety precautions in the auto body repair lab during vehicle repair • identify eye and hand safety precautions in compliance with federal, state, and local requirements • Present all descriptions in accordance with ASE standards <p>Process/Skill Questions</p>
<p>A003: Use protective clothing and equipment</p> <p><i>Definition:</i> Process should include the following:</p> <ul style="list-style-type: none"> • identify and take necessary precautions with hazardous operations and materials according to federal, state, and local regulations (V.A.1) • identify personal health and safety hazards according to OSHA guidelines and the "Right to Know" Act (V.A.2) • inspect spray environment to ensure compliance with federal, state, and local regulations,

and for cleanliness and safety hazards (V.A.3)

- select and use the NIOSH-approved personal sanding respirator; inspect condition and ensure fit and operation; perform proper maintenance in accordance with OSHA Regulation 1910.134 and applicable state and local regulations (V.A.4)
- select and use the NIOSH-approved (Fresh Air Make-up System) personal painting and refinishing respirator system; perform proper maintenance in accordance with OSHA Regulation 1910.134 and applicable state and local regulations (V.A.5)
- select and use the proper personal safety equipment for surface preparation; spray gun and related equipment operation; paint mixing, matching, and application; paint defects; and detailing (gloves, suits, hoods, eye and ear protection, etc.) (V.A.6)

Process/Skill Questions

A004: Identify fire emergency procedures, including proper use of fire protection equipment

Definition: Process should include the following:

- identify the different types of fires encountered in the auto body field (Class A, B, C, & D), along with the hazards, precautions, and appropriate type of extinguisher associated with each
- identify the fire emergency procedures in accordance with state and local government regulations and instructor's guidelines

Process/Skill Questions

A005: Use chemicals safely

Definition: Process should include the following:

- identify the different types of solvents, soaps, cleaning solutions, oils, greases, specialty additives, gases, and dusts encountered in the auto body field
- identify the correct use of and the hazards and precautions associated with each chemical in accordance with manufacturer's instructions, government regulations, and instructor guidelines

Process/Skill Questions

A006: Identify environmental effects of chemicals

Definition: Process should include the following:

- identify and apply environmental practices associated with vehicle components and systems such as substrates, fluids, refrigerants batteries, etc. (II.A.11)
- identify the EPA, OSHA, and NATEF regulations (A.7) and penalties associated with the misuse of those chemicals

Process/Skill Questions

A007: Identify proper chemical disposal techniques

Definition: Process should include the following:

- identify proper chemical disposal techniques as documented by EPA, OSHA, NATEF, and ASE regulations, local government regulations, and instructor’s guidelines

Process/Skill Questions

A008: Identify information on Material Safety Data Sheets (MSDS)

Definition: Process should include the following:

- collect required MSDS for all nine product identification areas, and store in an easily accessible area
- explain information on the MSDS

Process/Skill Questions

A009: Identify toxic substances and considerations in handling them

Definition: Process should include the following:

- identify toxic materials used during typical vehicle repair operations
- identify hazardous waste that might be generated during typical vehicle repair operations
- identify "Right to Know" laws and EPA regulations for handling toxic substances, as well as the importance of compliance with them
- identify toxic substances and handling considerations in accordance with government regulations and instructor’s guidelines

Process/Skill Questions

A010: Identify electrical safety procedures (including airbag and battery)

Definition: Process should include the following:

- identify potential electrical hazards during vehicle repair
- identify precautions during disabling of airbags, computerized features, and other electrical components
- identify electrical safety procedures in accordance with manufacturer’s instructions and instructor’s guidelines

Process/Skill Questions

A011: Identify safe under-hood practices

Definition: Process should include the following:

- describe basic types of under-hood safety practices required in the auto body field, along with the correct method of operation, the hazards (e.g., hazardous moving parts; thermal, chemical, and electrical hazards)
- discuss precautions associated with each in accordance with instructor’s guidelines

Process/Skill Questions

**DUTY B:
Preparing for the Auto Body Repair Career**

Task:

B001: Identify opportunities in the auto body repair field

Definition: Process should include the following:

- identify in written form a description of positions in the field of auto body repair, including local employment options for entry level auto body repair technicians

Process/Skill Questions

B002: Identify the basic construction of the auto body

Definition: Process should include the following:

- describe basic auto body construction, including differences in unibody, body over frame, and space frame

Process/Skill Questions

B003: Identify the purposes and goals of the student organization

Definition: Process should include the following:

- state the purposes and goals of student organizations (e.g., VICA) in accordance with documentation of the organization and with instructor guidelines

Process/Skill Questions

B004: Participate in course activities sponsored by the student organization (e.g., meetings, programs, and other projects that require specialized skills and concepts)

Definition: Process should include the following:

- attend meetings, take part in programs, and be involved in projects requiring specialized skills and concepts in accordance with the documentation of the organization and with school and instructor guidelines

Process/Skill Questions

**DUTY C:
Measuring And Mixing**

Task:

C001: Read a rule, fractional-inch and metric

Definition: Process should include the following:

- read a standard rule accurate to at least 1/16" and a metric rule accurate to 1 mm

Process/Skill Questions

C002: Solve auto body-related problems involving volume and ratios

Definition: Process should include the following:

- divide gallons into quarts and pints
- divide liters into milliliters
- use standard measures such as paint measures, sticks, and cups in determining ratio of mix of liquids
- solve problems in accordance with instructor-specified accuracies

Process/Skill Questions

**DUTY D:
Using Tools and Equipment**

Task:

D001: Demonstrate safe use and maintenance of general hand tools

Definition: Process should include the following:

- demonstrate correct use and maintenance procedures for various types of general hand tools encountered in the automotive field, such as various wrenches, socket set components, screwdrivers, styles of pliers, hammers, and punches and chisels
- describe hazards and precautions associated with each tool in accordance with manufacturer's instructions and government regulations

Process/Skill Questions

D002: Demonstrate safe use and maintenance of specialized auto body repair hand tools

Definition: Process includes the following:

- Demonstrate the correct use and maintenance of specialized hand tools (including fasteners and measuring tools), such as:
 - specialty cutting tools (e.g., hack saw, tubing cutter, hand reamer, file)
 - specialty electrical system tools (e.g., volt/ohmmeter, dwell/tachometer, continuity light, timing light, remote starter switch)
 - battery specialty tools (e.g., cable puller, terminal and post cleaner, battery lifting or carrying strap)
 - lubrication specialty tools (e.g., transmission funnel, oil filter-removing tool, grease gun)
 - other miscellaneous specialty 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)
- describe the hazards and precautions associated with each specialized tool in accordance with manufacturers' instructions and government regulations

Process/Skill Questions

D003: Demonstrate safe use and maintenance of electric and pneumatic hand tools

Definition: Process should include the following:

- demonstrate the correct use and maintenance of the various types of power tools (including pneumatic and electric tools) encountered in the auto body repair field, such as:
 - air hammer
 - air ratchet
 - air drill
 - tire burnishing tool
 - drop light
 - electric drill
 - air sander
 - cut off tools
 - air-powered shears
 - air chisel
 - air impact gun
- describe the hazards and precautions associated with each electric and pneumatic hand tool in accordance with manufacturer’s instructions and government regulations

Process/Skill Questions

D004: Demonstrate safe use and maintenance of electric, pneumatic, and hydraulic equipment (including proper lifting and jacking techniques)

Definition: Process should include the following:

- demonstrate the safe use and maintenance of different types of shop equipment encountered in the automotive field, such as:
 - 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)
 - frame equipment
 - plasma cutter
 - MIG welder
- describe the hazards and precautions associated with different types of shop equipment, in accordance with manufacturers’ specifications and instructor’s guidelines

Process/Skill Questions

**DUTY E:
Writing Damage Reports**

Task:

E001: Diagnose and analyze damage

Definition: Process should include the following:

- review damage report and analyze damage to determine appropriate methods for overall

repair; develop repair plan (II.A.1)

- determine the extent of direct and indirect damage and direction of impact; develop repair plan (II.B.1)
- complete all procedures in accordance with ASE standards

Process/Skill Questions

E002: Use collision manuals (including computer-generated estimating packages)

Definition: Process should include the following:

- identify the types of collision manuals (e.g., professional general, after-market specialty)
- identify the formats of manuals (e.g., printed, computer-generated estimating package, compact disc)
- demonstrate the methods of locating information in the various types of manuals (by using table of contents, index, special numbering systems)
- complete all procedures in accordance with instructor guidelines

Process/Skill Questions

E003: Write a damage report in logical sequence

Definition: Process should include the following:

- gather information necessary in developing a written damage report
 - greet the customer
 - listen carefully to the customer
 - write all required customer/vehicle information
 - telephone customer before making unapproved repairs
 - write a repair order
 - describe repair and charges to the customer in lay terms
- present oral and written communication in a clear, accurate, friendly, courteous, and professional manner according to industry practice and instructor guidelines
- follow the order of items as they appear in the collision manual:
 - owner and vehicle information
 - description of complaint and technician's diagnosis
 - name/description/price of needed parts
 - hourly/total charges for labor and outside work
 - sales tax
 - total cost
- complete the demonstration and report in accordance with industry practice and instructor guidelines

Process/Skill Questions

E004: Practice professional customer service

Definition: Process should include the following:

- present a courteous demeanor
- communicate clearly and concisely

- maintain a professional image
- uphold an honest and highly ethical standard

Process/Skill Questions

**DUTY F:
Welding Auto Body**

Task:

F001: Identify auto body repair welding processes

Definition: Process should include the following:

- identify processes involved in auto body welding, as well as weldable and nonweldable materials used in collision repair and refinish components (I.D.1)(II.E.1)
- identify processes in accordance with ASE standards

Process/Skill Questions

F002: Use safety procedures in welding and cutting

Definition: Process should include the following:

- identify weldable and nonweldable materials used in collision repair and refinish components (I.D.1)(II.E.1)
- weld and cut high-strength steel and other metals, using manufacturer’s procedures (I.D.2)(II.E.2)
- determine the correct welder type, electrode, wire type, diameter, and gas to be used in a specific welding situation (I.D.3)(II.E.3)
- set up welding equipment (I.D.4)(II.E.4)
- adjust the welder to “tune” for proper electrode stick out, voltage, polarity, flow rate, and wire-feed speed required for the material being welded (I.D.5)(II.E.5)
- store, handle, and install high-pressure gas cylinders (I.D.6)(II.E.6)
- determine work clamp (ground) location and attaching (I.D.7)(II.E.7)
- use the proper angle of gun to joint and direction of gun travel for type of weld being made in the flat, horizontal, vertical, and overhead positions (I.D.8)(II.E.8)
- protect adjacent panels, glass, vehicle interior, etc., from welding and cutting operations (I.D.9)(II.E.9)
- protect computers and other electronic control modules during welding procedures according to manufacturer’s specifications (I.D.10)(II.E.10)
- clean and prepare the metal for welding; assure good metal fit up, apply weld-through primer if necessary, and clamp as required (I.D.11)(II.E.11)
- determine the joint type (reinforced butt, lap, etc.) for weld being made according to manufacturer’s/industry specifications (I.D.12)(II.E.12)
- determine the type of weld (continuous, reinforced butt, plug, etc.) for each specific welding operation according to manufacturer’s/industry specifications (I.D.13)(II.E.13)
- perform the following welds: continuous, stitch, tack, plug, spot, reinforced butt, and lap joints (I.D.14)(II.E.14)
- perform squeeze-type resistance spot welding according to manufacturer’s/industry

specifications (II.E.15)

- perform destructive tests on each weld type (I.D.15)(II.E.16)
- identify the causes of spits and sputters, burn through, lack of penetration, porosity, incomplete fusion, excessive spatter, distortion, and waviness of bead; make necessary adjustments (I.D.16)(II.E.17)
- identify cause of contact tip burn back and failure of wire to feed; make necessary adjustments (I.D.17)(II.E.18)
- identify cutting process for different materials and locations in accordance with manufacturer's procedures; perform cutting operation (I.D.18)(II.E.19)
- complete all procedures in accordance with ASE standards

Process/Skill Questions

F003: Set up equipment for metal inert gas (MIG) welding

Definition: Process should include the following:

- determine the correct welder type, electrode, wire type, diameter, and gas to be used in a specific welding situation (I.D.3)(II.E.3)
- set up welding equipment (I.D.4)(II.E.4)
- adjust the welder to "tune" for proper electrode stick out, voltage, polarity, flow rate, and wire-feed speed required for the material being welded (I.D.5)(II.E.5)
- determine work clamp (ground) location and attaching (I.D.7)(II.E.7)
- use the proper angle of the gun to the joint and the direction of the gun travel for the type of weld being made in the flat, horizontal, vertical, and overhead positions (I.D.8)(II.E.8)
- identify the causes of spits and sputters, burn through, lack of penetration, porosity, incomplete fusion, excessive spatter, distortion, and waviness of bead; make necessary adjustments (I.D.16)(II.E.17)
- identify cause of contact tip burn back and failure of wire to feed; make necessary adjustments (I.D.17)(II.E.18)
- complete all procedures in accordance with ASE standards

Process/Skill Questions

F004: Prepare metal for MIG welding

Definition: Process should include the following:

- clean and prepare metal for welding; fit, align, and clamp as required (I.D.11)(II.E.11)
- complete process in accordance with ASE standards

Process/Skill Questions

F005: Construct MIG welds

Definition: Process should include the following:

- determine the joint type (reinforced-butt, lap, etc.) for weld being made according to manufacturer/industry specifications (I.D.12)(II.E.12)
- determine the type of weld (continuous, reinforced-butt, plug, etc.) for each specific welding operation according to manufacturer's/industry specifications (I.D.13)(II.E.13)

- perform the following welds: continuous, stitch, tack, plug, spot, reinforced butt, and lap joints (I.D.14)(II.E.14)
- complete all procedures in accordance with ASE standards

Process/Skill Questions

F006: Perform destructive tests

Definition: Process should include the following:

- perform destructive tests on each weld type (e.g., butt welds, lap and flange welds, plug welds, spot welds, and stitches) (I.D.15)(II.E.16)
- Destructive testing should include the following steps:
 - clamp base metal to table
 - apply force (e.g., chisel) until metal or weld breaks
 - ascertain quality of weld (if part of metal tears off with weld, fusion is complete; if metal separates from weld cleanly, the weld is too weak)
- complete all procedures in accordance with ASE standards

Process/Skill Questions

F007: Weld high-strength steel

Definition: Process should include the following:

- weld and cut high-strength steel and other metals (such as low-carbon steel), using manufacturer’s procedures (I.D.2)(II.E.2)
- complete all procedures in accordance with ASE standards

Process/Skill Questions

F008: Weld aluminum

Definition: Process should include the following:

- weld and cut high-strength steel and other metals, using manufacturer’s procedures (I.D.2)(II.E.2)
- determine the correct welder type, electrode, wire type, diameter, and gas to be used in a specific welding situation (I.D.3)(II.E.3)
- set up welding equipment (I.D.4)(II.E.4)
- adjust the welder to “tune” for proper electrode stick out, voltage, polarity, flow rate, and wire-feed speed required for the material being welded (I.D.5)(II.E.5)
- store, handle, and install high-pressure gas cylinders (I.D.6)(II.E.6)
- determine work clamp (ground) location and attaching (I.D.7)(II.E.7)
- complete all procedures in accordance with ASE standards

Process/Skill Questions

F009: Identify cutting processes

Definition: Process should include the following descriptions:

- weld and cut high-strength steel and other metals, using manufacturer's procedures (I.D.2)(II.E.2)
- store, handle, and install high-pressure gas cylinders (I.D.6)(II.E.6)
- identify cutting process for different materials and locations in accordance with manufacturer's procedures; perform cutting operation (I.D.18)(II.E.19)
- identify cutting processes in accordance with ASE standards

Process/Skill Questions

F010: Set up and use equipment for cutting

Definition: Process should include the following:

- weld and cut high-strength steel and other metals, using manufacturer's procedures (I.D.2)(II.E.2)
- store, handle, and install high-pressure gas cylinders (I.D.6)(II.E.6)
- identify cutting process for different materials and locations in accordance with manufacturer's procedures; perform cutting operation (I.D.18)(II.E.19)
- complete all procedures in accordance with ASE standards

Process/Skill Questions

**DUTY G:
Repairing Sheet Metal****Task:****G001: Analyze damage and develop repair plan**

Definition: Analysis should include the following:

- determine the locations of all suspension, steering, and power train component attaching points on the body (I.B.3)
- determine the extent of the direct and indirect damage and the direction of impact; plan the methods and sequence of repair (I.B.6)
- determine the extent of damage to structural steel body panels; repair or replace (I.B.17)
- review damage report, and analyze damage to determine appropriate methods for overall repair; develop repair plan (II.A.1)
- determine the extent of direct and indirect damage and direction of impact; develop repair plan (II.B.1)
- develop analysis and plan in accordance with ASE standards

Process/Skill Questions

G002: Clean the exterior surface

Definition: Process should include the following:

- remove corrosion protection, undercoatings, sealers, and other protective coatings necessary to perform repairs (II.A.8)
- soap and water wash entire vehicle; use appropriate cleaner to remove contaminants from those areas to be repaired (II.A.7)
- use a cloth to clean one 2' x 2' square at a time
 - apply silicone-free soap and water wash
 - apply solvent cleaner according to manufacturer's specifications for vehicle finish
 - wipe surface area with clean cloths or towels
- complete all procedures in accordance with ASE standards

Process/Skill Questions

G003: Rough out panel

Definition: Process should include the following:

- remove creases and dents; use power tools and hand tools to restore damaged areas to proper contours and dimensions (I.B.16)
- straighten and rough out contours of damaged panel to a surface condition for body filling or metal finishing, using power tools, hand tools, and stud welder (II.B.9)
- locate and reduce surface irregularities on a damaged body panel (II.C.2)
- demonstrate hammer and dolly techniques (II.C.3)
- complete all procedures in accordance with ASE standards

Process/Skill Questions

G004: Use weld-on nail gun to repair sheet metal

Definition: Process should include the following:

- straighten and rough out contours of damaged panel to a surface condition for body filling or metal finishing, using power tools, hand tools, and stud welder (II.B.9)
- weld cracked or torn steel body panels; repair broken welds (II.B.10)
- complete all procedures in accordance with ASE standards

Process/Skill Questions

G005: Describe method for shrinking panel

Definition: Description should include the following:

- use proper cold stress-relief methods (I.B.15)
- heat shrink stretched panel areas to proper contour (II.C.4)
- cold shrink stretched panel areas to proper contour (II.C.5)
- describe method in accordance with ASE standards

Process/Skill Questions

G006: Prepare surface and apply body filler

Definition: Process should include the following:

- remove all rust, paint, and dirt, using a 16-24 grit abrasive disk (open coat)

- mix body filler (II.C.6)
- apply body filler and cheese-grating during curing (II.C.7)
- complete all procedures in accordance with filler manufacturer’s directions and ASE standards

Process/Skill Questions

G007: Finish body filler

Definition: Process should include the following:

- rough and finish sand-cured body filler to contour (II.C.8)
- complete all procedures in accordance with ASE standards

Process/Skill Questions

**DUTY H:
Replacing Body Panel**

Task:

H001: Remove and replace welded-on nonstructural panels

Definition: Process should include the following:

- weld and cut high-strength steel and other metals, using manufacturer’s procedures (I.D.2)
- determine the extent of damage to aluminum body panels; repair, weld, or replace in accordance with manufacturer’s specifications (II.B.3)
- inspect, remove, and replace all vehicle mechanical and electrical components that may interfere with or be damaged during repair (II.A.5)
- protect panels and parts adjacent to repair area (II.A.6)
- inspect, remove, and replace bolted, bonded, and welded steel panel or panel assemblies (II.B.2)
- inspect, remove, replace, and align front fenders, headers, and other panels (II.B.8)
- cut out damaged sections of sheet steel body panels, and weld in replacements according to vehicle and industry specifications (II.B.12)
- replace door skins according to manufacturer’s procedures (II.B.13)
- replace intrusion beams in accordance with vehicle manufacturer’s specifications
- complete all procedures in accordance with ASE standards

Process/Skill Questions

H002: Remove and replace welded-on structural panels

Definition: Process should include the following:

- straighten and align front end sections (aprons, strut towers, upper and lower rails, steering, and suspension/power train mounting points, etc.) (I.B.13)
- remove and replace damaged sections of structural steel body panels in accordance with manufacturer’s specifications (I.B.18)

- weld and cut high-strength steel and other metals, using manufacturer's procedures (I.D.2)
- inspect, remove, and replace all vehicle mechanical and electrical components that may interfere with or be damaged during repair (II.A.5)
- inspect, remove, and replace bolted, bonded, and welded steel panel or panel assemblies (II.B.2)
- weld cracked or torn steel body panels and repair broken welds (II.B.10)
- complete all procedures in accordance with ASE standards

Process/Skill Questions

H003: Remove and replace bolted-on nonstructural panels

Definition: Process should include the following:

- inspect, remove, replace, and align hood, hood hinges, and hood latch (II.B.4)
- inspect, remove, replace, and align deck lid, lid hinges, and lid latch (II.B.5)
- inspect, remove, replace, and align doors, tailgates, hatches, lift gates, latches, hinges, and related hardware (II.B.6)
- check and align front fenders, headers, and other panels (II.B.8)
- diagnose and repair water leaks, dust leaks, and wind noise (II.B.17)
- complete all procedures in accordance with ASE standards

Process/Skill Questions

H004: Section welded-on nonstructural panels

Definition: Process should include the following:

- inspect, remove, and replace all vehicle mechanical and electrical components that may interfere with or be damaged during repair (II.A.5)
- cut out damaged sections of sheet steel body panels, and weld in replacements according to vehicle and industry specifications (II.B.12)
- complete all procedures in accordance with ASE standards

Process/Skill Questions

H005: Replace welded-on door panels and door intrusion barrier

Definition: Process should include the following:

- weld and cut high-strength steel and other metals, using manufacturer's procedures (I.D.2)
- inspect, remove, and replace all vehicle mechanical and electrical components that may interfere with or be damaged during repair (II.A.5)
- inspect, remove, and replace bolted, bonded, and welded steel panel or panel assemblies (II.B.2)
- replace door skins according to manufacturer's procedures (II.B.13)
- replace intrusion beams in accordance with vehicle manufacturer's specifications

- complete all procedures in accordance with ASE standards

Process/Skill Questions

H006: Replace bonded door panels

Definition: Process should include the following:

- inspect, remove, and replace all vehicle mechanical and electrical components that may interfere with or be damaged during repair (II.A.5)
- replace door skins according to manufacturer’s procedures (II.B.13)
- restore sealers, mastic, sound deadeners, and foam fillers (II.B.15)
- perform panel bonding (II.B.16)
- complete all procedures in accordance with ASE standards

Process/Skill Questions

H007: Remove and replace steel and aluminum bumpers

Definition: Process should include the following:

- inspect, remove, replace, and align bumper bars, covers, reinforcement guards, isolators, and mounting hardware (II.B.7)
- complete all procedures in accordance with ASE standards

Process/Skill Questions

H008: Replace energy absorbers

Definition: Process should include the following:

- inspect, remove, replace, and align bumper bars, covers, reinforcement guards, isolators, and mounting hardware (II.B.7)
- complete all procedures in accordance with ASE standards

Process/Skill Questions

H009: Remove and replace soft fascia covers

Definition: Process should include the following:

- inspect, remove, replace, and align bumper bars, covers, reinforcement guards, isolators, and mounting hardware (II.B.7)
- replace or repair rigid, semi-rigid, and flexible plastic panels according to vehicle and industry specifications (II.B.14)
- inspect, remove, and replace repairable plastics and other components that are recommended for off-vehicle repair (II.A.9)
- complete all procedures in accordance with ASE standards

Process/Skill Questions

H010: Apply corrosion protection

Definition: Process should include the following:

- restore corrosion protection to repaired or replaced frame areas (I.A.9)
- restore corrosion protection to repaired or replaced unibody structural areas (I.B.19)
- restore corrosion protection to repaired outer body panels (II.B.11)
- restore corrosion-resistant coatings, caulking, and seam sealers to all other repaired areas (V.B.20)
- complete all procedures in accordance with ASE standards

Process/Skill Questions

DUTY I: Repairing Plastic Panel

Task:

Task I001: Identify plastic types

Definition: Process should include the following:

- identify types of plastics to be repaired (i.e., thermoplastics and thermosetting plastics) (IV.1)
- identify types of plastics in accordance with ASE standards

Process/Skill Questions

I002: Clean and prepare exterior surfaces

Definition: Process should include the following:

- identify plastics repair procedures
- clean and repair surface of plastic parts in accordance with manufacturer/industry guidelines (IV.2)
- complete all procedures in accordance with ASE standards

Process/Skill Questions

I003: Analyze damage and plastic repair techniques

Definition: Process should include the following:

- identify types of plastics to be repaired (IV.1)
- identify types of plastics repair procedures; clean and repair the surface of plastic parts in accordance with manufacturer's procedures/industry guidelines (IV.2)
- analyze damage and plastic repair techniques in accordance with ASE standards

Process/Skill Questions

I004: Perform airless plastic repair

Definition: Process should include the following:

- repair plastic parts (e.g., urethane bumpers, filler panels) with airless welding (IV.3)
 - set temperature according to manufacturer's recommendation for plastic being welded
 - allow about three minutes for welder to reach set operating temperature
 - ensure that rod is compatible with plastic being welded
- complete all procedures in accordance with equipment manufacturer's instructions and ASE standards

Process/Skill Questions

I005: Perform repairs with chemical adhesives

Definition: Process should include the following:

- repair plastic parts with urethane or epoxy adhesives, using reinforcements if necessary (IV.4)
- complete all procedures in accordance with ASE standards

Process/Skill Questions

I006: Repair holes in SMC body panels

Definition: Process should include the following:

- repair holes and cuts in rigid and flexible plastic parts, using backing materials and adhesives (IV.5)
- complete all procedures in accordance with ASE standards

Process/Skill Questions

I007: Section SMC and fiberglass body panels

Definition: Process should include the following:

- remove damaged areas from rigid exterior sheet-molded-compound (SMC) panels and repair with partial panel (IV.7)
 - sand and clean back side of panel
 - bevel the mating edges of the new panel to a shallow taper to match the existing panel
 - apply the recommended adhesives (for SMC or fiberglass)
 - apply in a continuous bead 3/8"-1/2" in diameter all the way around the panel that is going to touch another part of the adjoining pieces
 - apply adhesive to the part to which the new panel is being attached
 - clamp into place
 - tighten the mill, and drill pad nuts securely
- complete all procedures in accordance with ASE standards

Process/Skill Questions

I008: Remove and replace complete SMC body panels

Definition: Process should include the following:

- replace bonded sheet-molded-compound (SMC) body panels; straighten or align panel supports (IV.8)
- complete all procedures in accordance with ASE standards

Process/Skill Questions

I009: Repair and retexture plastic parts

Definition: Process should include the following:

- repair and retexture plastic parts (IV.6)
- complete all procedures in accordance with ASE standards

Process/Skill Questions

I010: Prepare repaired area for refinishing

Definition: Process should include the following:

- identify the types of rigid, semi-rigid, or flexible plastic parts to be refinished; determine materials, preparation, and refinishing procedures (V.D.9)
- prepare repaired areas for refinishing (IV.9)
 - if already painted, finish part as metal panel
 - if bare plastics involved, apply plastic primer
- complete all procedures in accordance with ASE standards

Process/Skill Questions

I011: Reconstruct fiberglass panels, and identify safety procedures

Definition: Process should include the following:

- repair plastic parts with urethane or epoxy adhesives, using reinforcements if necessary (IV.4)
- repair holes and cuts in rigid and flexible plastic parts, using backing materials and adhesives (IV.5)
- remove damaged areas from rigid exterior sheet-molded-compound (SMC) panels; repair with partial panel (IV.7)
- complete all procedures in accordance with ASE standards

Process/Skill Questions

**DUTY J:
Using Refinishing Equipment and Procedures****Task:****J001: Demonstrate safe painting practices and use of protective clothing and equipment**

Definition: Process should include the following:

- identify and take necessary precautions with hazardous operations and materials according to federal, state, and local regulations (V.A.1)
- identify personal health and safety hazards according to OSHA guidelines and the "Right to Know" Act (V.A.2)
- inspect spray environment to ensure compliance with federal, state, and local regulations and for safety and cleanliness (V.A.3)
- select and use the NIOSH-approved personal sanding respirator; inspect condition and ensure fit and operation; perform proper maintenance in accordance with industry and manufacturer specifications (V.A.4)
- select and use the NIOSH-approved (Fresh Air Make-up System) personal painting/refinishing respirator system; perform proper maintenance in accordance with OSHA Regulation 1910.134 and applicable state and local regulations (V.A.5)
- select and use the proper personal safety equipment for surface preparation; spray gun and related equipment operation; paint mixing, matching, and application; paint defects; and detailing (gloves, suits, hoods, eye and ear protection, etc.) (V.A.6)
- complete all procedures in accordance with ASE standards

Process/Skill Questions

J002: Demonstrate use of refinishing equipment

Definition: Process should include the following:

- identify use of refinishing equipment
- inspect, clean, and determine condition of spray guns and related equipment (air hoses, regulators, air lines, air source, and spray environment) (V.C.1)
- check and adjust the operation of conventional spray gun
- check and adjust spray gun operation for HVLP (high-volume, low-pressure) or LVLP (low-volume, low-pressure) guns (V.C.2)
- set up (fluid needle, nozzle, and cap), adjust, and test spraying gun, using fluid, air, and pattern-control valves (V.C.3)
- complete all procedures in accordance with ASE standards

Process/Skill Questions

J003: Use a paint gun with proper technique

Definition: Process should include the following:

- inspect, clean, and determine condition of spray guns and related equipment (air hoses, regulators, air lines, air source, and spray environment) (V.C.1)
- check and adjust the operation of conventional spray gun
- check and adjust spray gun operation for HVLP (high-volume, low-pressure) or LVLP (low-volume, low-pressure) guns (V.C.2)
- set up (fluid needle, nozzle, and cap), adjust, and test spraying gun, using fluid, air, and pattern-control valves (V.C.3)
- apply finish, using appropriate spray technique (gun arc, gun angle, gun distance, gun speed, and spray pattern overlap) for finish being applied (V.D.3)
- apply selected product on test and let-down panel in accordance with manufacturer's

- recommendations; check for color match (V.D.4)
- complete all procedures in accordance with ASE standards

Process/Skill Questions

J004: Identify surface preparation techniques

Definition: Process should include the following:

- inspect, remove, store, and replace exterior trim and molding (V.B.1)
- soap and water wash entire vehicle; use appropriate cleaner to remove contaminants (V.B.2)
- inspect and identify substrate, type of finish, and surface condition; develop a plan for refinish, using a total product system (V.B.3)
- remove paint finish (V.B.4)
- remove paint from the damaged area of a body panel (II.C.1)
- apply suitable metal treatment or primer (V.B.7)
- identify surface preparation techniques in accordance with ASE standards

Process/Skill Questions

J005: Demonstrate appropriate sanding techniques

Definition: Process should include the following:

- dry or wet sand areas to be refinished (V.B.5)
- feather edge broken areas to be refinished (V.B.6)
- dry or wet sand area to which primer surface has been applied (V.B.12)
- dry sand area to which two-component finishing filler has been applied (V.B.13)
- scuff sand to remove nibs or imperfections from a sealer (V.B.18)
- complete all procedures in accordance with ASE standards

Process/Skill Questions

J006: Demonstrate appropriate masking techniques

Definition: Process should include the following:

- mask trim and protect other areas (e.g., moldings, glass, tires) that will not be refinished (V.B.8)
 - determine whether to remove or mask trim
 - allow space for paint buildup
 - select type and width of masking tape/paper
 - consider pressure-sensitive tapes when working on fresh paint or sharp edges
 - consider high quality masking paper for two-tone painting (to avoid bleed through)
 - apply tape by stretching and pleating it in sharp curves

Process/Skill Questions

J007: Demonstrate application procedures for undercoats

Definition: Process should include the following:

- identify undercoats
- mix primer, primer surfacer, or primer sealer (V.B.9)
- spray primer onto surface of repaired area (V.B.10)
- apply two-component finishing filler to minor surface imperfections (V.B.11)
- dry or wet sand area to which primer surface has been applied (V.B.12)
- dry sand area to which two-component finishing filler has been applied (V.B.13)
- remove dust from area to be refinished, including cracks or moldings or adjacent areas (V.B.14)
- clean area to be refinished, using a final cleaning solution (V.B.15)
- remove, with a tack rag, any dust or lint particles from the area to be refinished (V.B.16)
- apply suitable sealer to the area being refinished when sealing is needed or desirable (V.B.17)
- scuff sand to remove nibs or imperfections from a sealer (V.B.18)
- restore corrosion-resistant coatings, caulk, and seam sealers to repaired areas (V.B.20)
- complete all procedures in accordance with ASE standards

Process/Skill Questions

J008: Apply chip-resistant coating

Definition: Process should include the following:

- apply stone chip-resistant coating (V.B.19)
 - protect adjacent areas
 - apply aerosol coating, holding can 10"-16" from panel
 - adjust distance to match texture of original
 - apply coating lightly to prevent running and sagging
 - clean area after applying coating
- complete process in accordance with manufacturer's directions and with ASE standards

Process/Skill Questions

J009: Demonstrate application procedures for topcoats

Definition: Process should include the following:

- identify topcoats
- determine the type and color of paint already on vehicle by manufacturer's vehicle information label (V.D.1)
- shake, stir, reduce, catalyze, and strain paint according to manufacturer's procedures (V.D.2)
- apply selected product on test and let-down panel in accordance with manufacturer's recommendations; check for color match (V.D.4)
- identify and mix paint, using a formula (V.D.13)
- tint color, using formula to achieve a blendable match (V.D.15)

- complete all procedures in accordance with ASE standards

Process/Skill Questions

J010: Tint and blend color coat

Definition: Process should include the following:

- prepare adjacent panels for blending (V.B.21)
- determine the type and color of paint already on vehicle by manufacturer’s vehicle information label (V.D.1)
- shake, stir, reduce, catalyze, and strain paint according to manufacturer’s procedures (V.D.2)
- apply selected product on test and let-down panel in accordance with manufacturer’s recommendations; check for color match (V.D.4)
- apply single-stage topcoat for refinishing (V.D.5)
- apply multistage (tri-coat) coats for spot repair, panel blend, or overall refinish (V.D.12)
- identify and mix paint, using a formula (V.D.13)
- tint color, using formula to achieve a blendable match (V.D.15)
- identify alternative color formula to achieve a blendable match (V.D.16)
- complete all procedures in accordance with ASE standards

Process/Skill Questions

J011: Mix and apply single-stage topcoat

Definition: Process should include the following:

- shake, stir, reduce, catalyze, and strain paint according to manufacturer’s procedures (V.D.2)
- use spray technique (gun arc, gun angle, gun distance, gun speed, and spray pattern overlap) appropriate for finish being applied (V.D.3)
- apply selected product on test and let-down panel in accordance with manufacturer’s recommendations; check for color match (V.D.4)
- apply single-stage topcoat for refinishing (V.D.5)
- color sand, buff, and polish finishes where necessary (V.D.8)
- complete all procedures in accordance with ASE-based standards

Process/Skill Questions

J012: Mix and apply base coat/clear coat.

Definition: Process should include the following:

- apply base coat/clear coat for spot and panel blending or overall refinishing (V.D.6 and V.D.7)
- color sand, buff, and polish finishes where necessary (V.D.8)
- complete all procedures in accordance with ASE standards

Process/Skill Questions

J013: Mix and apply multistage systems

Definition: Process should include the following:

- apply multistage (tri-coat) coats for spot repair, panel blending, or overall refinishing (V.D.12)
- complete all procedures in accordance with ASE standards

Process/Skill Questions

J014: Mix and apply refinish to flexible plastic parts

Definition: Process should include the following:

- identify the types of rigid, semi-rigid, or flexible plastic parts to be refinished; determine the materials, preparation, and refinishing procedures (V.D.9)
- refinish rigid, semi-rigid, or flexible plastic parts (V.D.10)
- clean, condition, or refinish vinyl (e.g., upholstery, dashes, and tops) (V.D.11)
- complete all procedures in accordance with ASE standards

Process/Skill Questions

J015: Perform clear coat repair and detailing

Definition: Process should include the following:

- color sand, buff, and polish finishes where necessary (V.D.8)
- identify blistering (raising of the paint surface); determine the cause(s), and correct the condition (V.E.1)
- identify blushing (milky or hazy formation); determine the cause(s), and correct the condition (V.E.2)
- identify a dry spray appearance in the paint surface; determine the cause(s), and correct the condition (V.E.3)
- identify the presence of fish eyes (crater-like openings) in the finish; determine the cause(s), and correct the condition (V.E.4)
- identify lifting; determine the cause(s), and correct the condition (V.E.5)
- identify clouding (mottling and streaking in metallic finishes); determine the cause(s), and correct the condition (V.E.6)
- identify orange peel; determine the cause(s), and correct the condition (V.E.7)
- identify an overspray; determine the cause(s), and correct the condition (V.E.8)
- identify solvent popping in freshly painted surface; determine the cause(s), and correct the condition (V.E.9)
- identify sags and runs in paint surface; determine the cause(s), and correct the condition (V.E.10)
- identify sanding marks (sand-scratch swelling); determine the cause(s), and correct the condition (V.E.11)
- identify contour mapping (shrinking and splitting) while finish is drying; determine the cause(s), and correct the condition (V.E.12)
- identify color difference (off shade); determine the cause(s), and correct the condition (V.E.13)

- identify tape tracking; determine the cause(s), and correct the condition (V.E.14)
- identify low-gloss condition; determine the cause(s), and correct the condition (V.E.15)
- identify poor adhesion; determine the cause(s), and correct the condition (V.E.16)
- identify paint cracking (crow's feet or line-checking, micro-checking, etc.); determine the cause(s), and correct the condition (V.E.17)
- identify rust spots; determine the cause(s), and correct the condition (V.E.18)
- identify dirt in the paint surface; determine the cause(s), and correct the condition (V.E.19)
- identify water spotting; determine the cause(s), and correct the condition (V.E.20)
- identify finish damage caused by bird droppings, tree sap, and other nature-related causes; correct the condition (V.E.21)
- identify finish damage caused by airborne contaminants (acids, soot, and other industrial-related causes); correct the condition (V.E.22)
- identify die-back conditions (dulling of the paint film, showing haziness); determine the cause(s), and correct the condition (V.E.23)
- identify chalking (oxidation); determine the cause(s), and correct the condition (V.E.24)
- identify bleed through (staining); determine the cause(s), and correct the condition (V.E.25)
- identify pin holing; determine the cause(s), and correct the condition (V.E.26)
- identify buffing-related imperfections (swirl marks, wheel burns); correct the condition (V.E.27)
- identify pigment flotation (color change from film build); determine the cause(s) and correct the condition (V.E.28)
- measure mil thickness (V.E.29)
- complete all procedures in accordance with ASE standards and instructor guidelines

Process/Skill Questions

J016: Identify paint defects and refinishing procedures

Definition: Process should include the following:

- identify blistering (raising of the paint surface); determine the cause(s), and correct the condition (V.E.1)
- identify blushing (milky or hazy formation); determine the cause(s), and correct the condition (V.E.2)
- identify a dry spray appearance in the paint surface; determine the cause(s), and correct the condition (V.E.3)
- identify the presence of fish eyes (crater-like openings) in the finish; determine the cause(s), and correct the condition (V.E.4)
- identify lifting; determine the cause(s), and correct the condition (V.E.5)
- identify clouding (mottling and streaking in metallic finishes); determine the cause(s), and correct the condition (V.E.6)
- identify orange peel; determine the cause(s), and correct the condition (V.E.7)
- identify an overspray; determine the cause(s), and correct the condition (V.E.8)
- identify solvent popping in freshly painted surface; determine the cause(s), and correct the condition (V.E.9)

- identify sags and runs in paint surface; determine the cause(s), and correct the condition (V.E.10)
- identify sanding marks (sand-scratch swelling); determine the cause(s), and correct the condition (V.E.11)
- identify contour mapping (shrinking and splitting) while finish is drying; determine the cause(s), and correct the condition (V.E.12)
- identify color difference (off shade); determine the cause(s), and correct the condition (V.E.13)
- identify tape tracking; determine the cause(s), and correct the condition (V.E.14)
- identify low-gloss condition; determine the cause(s), and correct the condition (V.E.15)
- identify poor adhesion; determine the cause(s), and correct the condition (V.E.16)
- identify paint cracking (crow's feet or line-checking, micro-checking, etc.); determine the cause(s), and correct the condition (V.E.17)
- identify rust spots; determine the cause(s), and correct the condition (V.E.18)
- identify dirt in the paint surface; determine the cause(s), and correct the condition (V.E.19)
- identify water spotting; determine the cause(s), and correct the condition (V.E.20)
- identify finish damage caused by bird droppings, tree sap, and other nature-related causes; correct the condition (V.E.21)
- identify finish damage caused by airborne contaminants (acids, soot, and other industrial-related causes); correct the condition (V.E.22)
- identify die-back conditions (dulling of the paint film, showing haziness); determine the cause(s), and correct the condition (V.E.23)
- identify chalking (oxidation); determine the cause(s), and correct the condition (V.E.24)
- identify bleed through (staining); determine the cause(s), and correct the condition (V.E.25)
- identify pin holing; determine the cause(s), and correct the condition (V.E.26)
- identify buffing-related imperfections (swirl marks, wheel burns); correct the condition (V.E.27)
- identify pigment flotation (color change from film build); determine the cause(s), and correct the condition (V.E.28)
- measure mil thickness (V.E.29)
- complete all procedures in accordance with ASE standards and instructor guidelines

Process/Skill Questions

DUTY K:

Repairing Exterior and Interior Molding and Trim

Task:

K001: Identify types and uses of fasteners, U.S. and metric, involved in repairing exterior and interior

Definition: Process should include the following:

- identify types and uses of nuts, bolts, screws, rivets, and clips

- identify types and uses of fasteners in accordance with manufacturer's standards

Process/Skill Questions

K002: Remove and replace belt molding and trim

Definition: Process should include the following:

- inspect, remove, store, and replace exterior trim and moldings (II.A.2)
- complete all procedures in accordance with ASE standards

Process/Skill Questions

K003: Remove and replace adhesive-held molding and trim

Definition: Process should include the following:

- inspect, remove, store, and replace exterior trim and moldings (II.A.2)
- complete all procedures in accordance with ASE standards

Process/Skill Question

K004: Replace exterior trim and moldings

Definition: Process should include the following:

- inspect, remove, store, and replace exterior trim and moldings (II.A.2)
- locate and drill holes for molding and trim (L.3)
- complete all procedures in accordance with ASE standards

Process/Skill Questions

K005: Remove and replace decals and stripes

Definition: Process should include the following:

- inspect, remove, store, and replace decals and stripes (II.A.2)
- complete all procedures in accordance with ASE standards

Process/Skill Questions

K006: Identify interior components and trim

Definition: Process should include the following:

- describe interior components and trim
- describe process of inspecting, removing, and replacing interior trim and components (II.A.3)
- identify interior components in accordance with ASE standards

Process/Skill Questions

K007: Remove and replace seats

Definition: Process should include the following:

- inspect, remove, and replace interior trim and components (II.A.3)
- inspect, remove, and replace nonstructural body panels and components that may interfere with or be damaged during repair (II.A.4)
- remove and replace power seat, motors, linkages, cables, etc., checking operation (III.B.21)
- complete all procedures in accordance with ASE standards

Process/Skill Questions

K008: Remove and reinstall seat belt components

Definition: Process should include the following:

- inspect, remove, and replace seat belt and shoulder harness assembly and components in accordance with manufacturer's procedures (III.H.1.1)
- inspect restraint system mounting areas for damage; repair in accordance with manufacturer's procedures (III.H.1.2)
- verify proper operation of seat belt in accordance with manufacturer's procedures (III.H.1.3)
- remove, inspect, and replace track and drive assembly, lap retractor, torso retractor, inboard buckle-lap retractor, and knee bolster (blocker) in accordance with manufacturer's procedure (III.H.2.4)
- complete all procedures in accordance with ASE standards

Process/Skill Questions

K009: Remove and reinstall carpeting

Definition: Process should include the following:

- inspect, remove, store, and replace nonstructural body panels and components that may interfere with or be damaged during repair (II.A.4)
- complete all procedures in accordance with ASE standards

Process/Skill Questions

K010: Remove and reinstall dash assembly

Definition: Process should include the following:

- inspect, remove, store, and replace nonstructural body panels and components that may interfere with or be damaged during repair (II.A.4)
- inspect, test, repair, or replace heating, ventilating, and A/C vacuum components
- inspect, test, and repair heating, ventilating, and A/C ducts, doors, hoses, and outlets
- complete all procedures in accordance with ASE standards

Process/Skill Questions

**DUTY L:
Diagnosing and Repairing Supplemental Restraint Systems**

Task:

L001: Identify, inspect, and disarm supplemental restraint systems

Definition: Process should include the following:

- identify supplemental restraint systems
- disarm SRS in accordance with manufacturer's procedures (III.H.3.1)
- inspect, replace, and dispose deployed SRS modules in accordance with manufacturer's procedures (III.H.3.3)
- complete all procedures in accordance with ASE standards

Process/Skill Questions

L002: Diagnose supplemental restraint systems

Definition: Process should include the following:

- inspect and replace sensors and wiring in accordance with manufacturer's procedures; ensure sensor orientation (III.H.3.2)
- inspect, replace, and dispose of deployed SRS modules in accordance with manufacturer's procedures (III.H.3.3)
- complete all procedures in accordance with ASE standards

Process/Skill Questions

L003: Replace supplemental restraint systems

Definition: Process should include the following:

- inspect, replace, and dispose of deployed SRS modules in accordance with manufacturer's procedures (III.H.3.3)
- verify SRS is operational in accordance with manufacturer's procedures (III.H.3.4)
- complete all procedures in accordance with ASE standards

Process/Skill Questions

**DUTY M:
Replacing Glass**

Task:

M001: Identify vehicle glass and replacement procedures

Definition: Process should included the following:

- remove and replace fixed glass (heated and nonheated), using manufacturer's specifications/procedures and recommended materials (I.C.1)
- remove and replace modular glass, using manufacturer's specifications/procedures and recommended materials (I.C.2)

- identify vehicle glass in accordance with ASE standards

Process/Skill Questions

M002: Remove and replace a reveal molding

Definition: Process should include the following:

- remove and replace fixed glass (heated and nonheated), using manufacturer's specifications/procedures and recommended materials (I.C.1)
- remove and replace modular glass, using manufacturer's specifications/procedures and recommended materials (I.C.2)
- complete all procedures in accordance with ASE standards

Process/Skill Questions

M003: Remove and replace a gasket-type window or back glass

Definition: Process should include the following:

- remove and replace fixed glass (heated and nonheated), using manufacturer's specifications/procedures and recommended materials (I.C.1)
- remove and replace modular glass, using manufacturer's specifications/procedures and recommended materials (I.C.2)
- complete all procedures in accordance with ASE standards

Process/Skill Questions

M004: Remove and replace glass with urethane sealants

Definition: Process should include the following:

- remove and replace fixed glass (heated and nonheated), using manufacturer's specifications/procedures and recommended materials (I.C.1)
- remove and replace modular glass, using manufacturer's specifications/procedures and recommended materials (I.C.2)
- complete all procedures in accordance with ASE standards

Process/Skill Questions

M005: Remove and replace a door trim panel

Definition: Process should include the following:

- inspect, adjust, repair, or replace window regulators, run channels, glass, power mechanisms, and related controls (II.D.1)
- inspect, repair, or replace power-driven accessories and related controls (including electrically heated glass)
- complete all procedures in accordance with ASE standards

Process/Skill Questions

M006: Remove and replace a lock cylinder

Definition: Process should include the following:

- inspect, adjust, repair, or replace window regulators, run channels, glass, power mechanisms, and related controls (II.D.1)
- inspect, repair, or replace power-driven accessories and related controls (including electrically heated glass)
- remove and replace components of electric door and hatch/trunk lock; check operation (III.B.22)
- remove and replace components of keyless lock/unlock devices and alarm systems; check operation (III.B.23)
- complete all procedures in accordance with ASE standards

Process/Skill Questions

M007: Remove and replace a door glass

Definition: Process should include the following:

- inspect, adjust, repair, or replace window regulators, run channels, glass, power mechanisms, and related controls (II.D.1)
- inspect, repair, or replace power-driven accessories and related controls (including electrically heated glass)
- diagnose and repair water leaks, dust leaks, and wind noises; inspect, repair, and replace weather stripping (II.D.2)
- check operation of power side windows and power tailgate window (III.B.20)
- complete all procedures in accordance with ASE standards

Process/Skill Questions

M008: Remove and replace a window regulator

Definition: Process should include the following:

- inspect, adjust, repair, or replace window regulators, run channels, glass, power mechanisms, and related controls (II.D.1)
- inspect, repair, or replace power-driven accessories and related controls (including electrically heated glass)
- diagnose and repair water leaks, dust leaks, and wind noises; inspect, repair, and replace weather stripping (II.D.2)
- check operation of power side windows and power tailgate window (III.B.20)
- complete all procedures in accordance with ASE standards

Process/Skill Questions

M009: Identify procedures for inspecting, removing, reinstalling, and aligning convertible top and related mechanisms

Definition: Process should include the following:

- inspect, remove, reinstall, and align convertible top and related mechanisms (II.D.4)

- inspect roof bows and rails
- reinforce tears with backing patch
- remove rear seat and trim to access manually operated convertible top hardware
- check drive cables on electrically operated convertible top, and lubricate if needed
- check for dirty or damaged cables on electrically operated convertible top
- check for fluid leaks, switches on hydraulically operated convertible top
- identify procedures in accordance with ASE standards

Process/Skill Questions

M010: Service removable, manually or power-operated roof panel

Definition: Process should include the following:

- inspect, repair, or replace and adjust removable, manually or power-operated roof panel and hinges, latches, guides, handles, retainer, and controls of sunroofs (II.D.3)
- check tracks or channels
- check fuses, switches, and other electrical components (in power-operated panels)
- complete all procedures in accordance with ASE standards

Process/Skill Questions

**DUTY N:
Servicing Electrical Systems**

Task:

N001: Identify electrical system components

Definition: Process should include the following:

- inspect, test, and replace fusible links, circuit breakers, and fuses (III.B.4)
- identify programmable electrical/electronic components; record data for reprogramming before disconnecting battery (III.B.9)
- demonstrate the proper self-grounding procedures for handling electrical components (III.B.27)
- Identify electrical components in accordance with ASE standards

Process/Skill Questions

N002: Service a battery

Definition: Process should include the following:

- perform battery state-of-charge test; determine needed service (III.B.5)
- inspect, clean, and replace battery (III.B.6)
- dispose of batteries and battery acid according to local, state, and federal requirements (III.B.7)
- perform slow/fast battery charge in accordance with manufacturer's recommendations (III.B.8)
- identify programmable electrical/electronic components; record data for reprogramming before disconnecting battery (III.B.9)

- inspect, clean, and repair or replace battery cables, connectors, and clamps (III.B.10)
- complete all procedures in accordance with ASE standards

Process/Skill Questions

N003: Use a digital volt ohmmeter (DVOM)

Definition: Process should include the following:

- check voltages in electrical wiring circuits, using a DVOM (III.B.1)
- check continuity and resistance in electrical wiring circuits and components, using a DVOM (III.B.2)
- use a DVOM to repair electrical circuits, wiring, and connectors according to manufacturer's specifications (III.B.3)
- complete all procedures in accordance with ASE standards

Process/Skill Questions

N004: Diagnose and repair electrical accessories

Definition: Process should include the following:

- inspect, test, and repair or replace switches, relays, bulbs, sockets, connectors, and wires of all light circuits, including four-wire tail lamp/light systems (III.B.17)
- remove and replace horn(s); check operation (III.B.18)
- check operation of windshield wiper/washer system (III.B.19)
- check operation of power side windows and power tailgate window (III.B.20)
- remove and replace power seat, motors, linkages, cables, etc.; check operation (III.B.21)
- remove and replace components of electric door and hatch/trunk lock; check operation (III.B.22)
- remove and replace components of keyless lock/unlock devices and alarm systems; check operation (III.B.23)
- remove and replace components of electrical sunroof and convertible top; check operation (III.B.24)
- check operation of electrically heated mirrors, windshields, back lights, panels, etc.; repair as necessary (III.B.25)
- remove and replace components of power antenna circuits; check operation (III.B.26)
- complete all procedures in accordance with ASE standards

Process/Skill Questions

N005: Inspect, adjust, and replace charging system

Definition: Process should include the following:

- inspect alignment, adjust, and replace generator (alternator) driver belts, pulleys, and fans (III.B.11)
- remove and replace generator (alternator) (III.B.12)
- complete all procedures in accordance with ASE standards

Process/Skill Questions

N006: Retain owner's settings on battery-stored memory devices (e.g., radio and seat positions)

Definition: Process should include the following:

- identify programmable electrical/electronic components
- record owner's settings for reprogramming before disconnecting battery (III.8.9)
- reset owner's settings after completion of repairs
- complete all procedures in accordance with manufacturer's instructions and ASE standards

Process/Skill Questions

**DUTY O:
Servicing Lighting Systems**

Task:

O001: Service a taillight assembly

Definition: Process should include the following:

- remove and replace head lamp/light, parking/tail lamp/light, stop lamp/light, flashers, turn signals, and backup lamp/light; check operation (III.B.13)
- inspect, test, and repair or replace switches, relays, bulbs, sockets, connectors, and wires of all light circuits, including four-wire tail lamp/light systems (III.B.17)
- complete all procedures in accordance with ASE standards

Process/Skill Questions

O002: Service a headlight assembly

Definition: Process should include the following:

- remove and replace head lamp/light, parking/tail lamp/light, stop lamp/light, flashers, turn signals, and backup lamp/light; check operation (III.B.13)
- inspect, replace, and aim head lamp/light bulbs (III.B.14)
- complete all procedures in accordance with ASE standards

Process/Skill Questions

O003: Service a retractable headlight assembly

Definition: Process should include the following:

- check operation of retractable head lamp/light assembly (III.B.15)
- remove and replace motors, switches, relays, bulbs, sockets, connectors, and wires of all light circuits, including four-wire tail lamp/light systems (III.B.16)
- complete all procedures in accordance with ASE standards

Process/Skill Questions

O004: Aim headlights, using mechanical aiming equipment

Definition: Process should include the following:

- inspect, replace, and aim head lamp/light bulbs (III.B.14)
- complete all procedures in accordance with manufacturer's instructions and ASE standards

Process/Skill Questions

**DUTY P:
Servicing Engine Systems**

Task:

P001: Remove and replace a radiator

Definition: Process should include the following:

- inspect and replace engine cooling and heater system hoses and belts (III.E.1)
- inspect, remove, and replace radiator, pressure cap, coolant recovery system, and water pump (III.E.2)
- complete all procedures in accordance with ASE standards

Process/Skill Questions

P002: Remove, inspect, and replace belts

Definition: Process should include the following:

- inspect, adjust, and replace A/C compressor drive belts; check pulley alignment (III.D.11)
- inspect and replace engine cooling and heater system hoses and belts (III.E.1)
- complete all procedures in accordance with ASE standards

Process/Skill Questions

P003: Test antifreeze solution

Definition: Process should include the following:

- recover, refill, and bleed system with proper coolant, checking level of protection; leak test system, and dispose of materials in accordance with EPA specifications (III.E.3)
- complete all procedures in accordance with ASE standards

Process/Skill Questions

P004: Service fan blades and clutches

Definition: Process should include the following:

- remove and replace fan (both electrical and mechanical), fan pulley, fan clutch, and fan shroud (III.E.4)

- complete all procedures in accordance with ASE standards

Process/Skill Questions

P005: Check and service radiator and heater hoses

Definition: Process should include the following:

- inspect and replace engine cooling and heater system hoses and belts (III.E.1)
 - check for bugs and debris in radiator fins
 - check for cut heater and radiator hoses after collisions
 - check for soft spots in hoses
 - check for cracks, tears, and other causes of leaks
 - determine if extremely dirty radiators should be referred to radiator shop for cleaning
- complete all procedures in accordance with ASE standards

Process/Skill Questions

P006: Inspect and repair or replace auxiliary oil cooler

Definition: Process should include the following:

- inspect and repair or replace auxiliary oil coolers (III.E.5)
 - check oil levels
 - check all connections for leaks
 - check tank for leaks or dents that might lead to future leakage
 - remove, repair, replace cooler
- complete all procedures in accordance with ASE standards

Process/Skill Questions

P007: Inspect and repair or replace fuel, exhaust, and emissions systems

Definition: Process should include the following:

- remove, inspect, and replace exhaust pipes, mufflers, converters, resonators, tail pipes, and heat shields (III.G.1)
- remove, inspect, and replace fuel tank, fuel tank filter, fuel cap, fuel filler hose, quarter to body seal, and inertia switch; inspect and replace fuel lines and hoses; check fuel for contaminants (III.G.2)
- remove, inspect, and replace components of air injection systems (III.G.3)
- remove, inspect, and replace canister, filter, vent; purge lines of fuel vapor control systems (III.G.4)
- complete all procedures in accordance with ASE standards

Process/Skill Questions

**DUTY Q:
Diagnosing and Repairing Heating and Air Conditioning**

Task:

Q001: Identify air conditioning system components and service procedures

Definition: Process should include the following:

- identify and comply with environmental concerns relating to refrigerants and coolants (III.D.1)
- maintain and verify correct operation of certified refrigerant recovery and recharging equipment (III.D.2)
- locate and identify A/C system service ports (III.D.3)
- identify and recover refrigerant from A/C system (III.D.4)
- recycle refrigerant in accordance with EPA regulations (III.D.5)
- label and store refrigerant (III.D.6)
- test recycled refrigerant for noncondensable gases (III.D.7)
- inspect A/C condenser for air flow restrictions; clean and straighten fins (III.D.14)
- inspect and replace receiver/drier or accumulator/drier (III.D.16)
- inspect and replace evaporator
- inspect and repair A/C component wiring (III.D.17)
- identify A/C system components in accordance with ASE standards

Process/Skill Questions

Q002: Replace condenser

Definition: Process should include the following:

- maintain and verify correct operation of certified refrigerant recovery and recharging equipment (III.D.2)
- inspect, test, and replace A/C system condenser and mountings (III.D.15)
- complete all procedures in accordance with ASE standards

Process/Skill Questions

Q003: Remove and reinstall compressor

Definition: Process should include the following:

- remove and replace A/C compressor
- inspect and repair or replace A/C compressor mountings (III.D.12)
- complete all procedures in accordance with ASE standards

Process/Skill Questions

Q004: Test the system for leaks

Definition: Process should include the following:

- evacuate A/C system; check for leaks (III.D.8)

- recharge A/C system with refrigerant; perform leak test (III.D.9)
- complete all procedures in accordance with ASE standards

Process/Skill Questions

Q005: Repair leaks in air conditioning systems

Definition: Process should include the following:

- recharge A/C system with refrigerant; perform leak test (III.D.9)
- inspect and repair or replace A/C system mufflers, hoses, lines, fittings, and seals (III.D.13)
- complete all procedures in accordance with ASE standards

Process/Skill Questions

Q006: Check and service air conditioning hoses

Definition: Process should include the following:

- identify and recover refrigerant from A/C system (III.D.4)
- recycle refrigerant in accordance with EPA regulations (III.D.5)
- label and store refrigerant (III.D.6)
- test recycled refrigerant for noncondensable gases (III.D.7)
- evacuate A/C system; check for leaks (III.D.8)
- recharge A/C system with refrigerant, performing leak testing (III.D.9)
- inspect and repair or replace A/C system mufflers, hoses, lines, fittings, and seals (III.D.13)
- complete all procedures in accordance with ASE standards

Process/Skill Questions

Q007: Evacuate and charge system, using vacuum pump or charging system

Definition: Process should include the following:

- identify and recover refrigerant from A/C system (III.D.4)
- recycle refrigerant in accordance with EPA regulations (III.D.5)
- label and store refrigerant (III.D.6)
- test recycled refrigerant for noncondensable gases (III.D.7)
- evacuate A/C system; check for leaks (III.D.8)
- recharge A/C system with refrigerant; perform leak test (III.D.9)
- complete all procedures in accordance with ASE standards

Process/Skill Questions

Q008: Inspect, flush, and replace heater components

Definition: Process should include the following:

- inspect, test, and repair or replace heating, ventilating, and A/C vacuum components
- inspect, test, and repair heating, ventilating, and A/C ducts, doors, hoses, and outlets

- complete all procedures in accordance with ASE standards

Process/Skill Questions

**DUTY R:
Constructing and Repairing Frame Body and Unibody**

Task:

R001: Identify vehicle frame construction and terminology

Definition: Process should include the following:

- describe (using vehicle frame terminology) procedures involved in identifying misaligned or damaged steering, suspension, and power train components that can cause vibration, steering, and four-wheel alignment problems; realign or replace in accordance with vehicle manufacturer's specifications/procedures (I.B.1)
- diagnose and analyze unibody vehicle length, height, and width, using a tram gauge (I.B.2)
- determine the locations of all suspension, steering, and power train component attaching points on the body (I.B.3)
- diagnose and measure unibody vehicles, using a dedicated (fixture) measuring system (I.B.4)
- diagnose and measure unibody vehicles, using a universal measuring system (mechanical, electronic, laser) (I.B.5)
- determine the extent of the direct and indirect damage and the direction of impact, planning the methods and sequence of repair (I.B.6)
- identify vehicle frame construction and terminology in accordance with ASE standards

Process/Skill Questions

R002: Identify types of damage

Definition: Process should include the following:

- identify misaligned or damaged steering, suspension, and power train components that can cause vibration, steering, and four-wheel alignment problems; realign or replace in accordance with vehicle manufacturer's specifications/procedures (I.B.1)
- diagnose and analyze unibody vehicle length, height, and width, using a tram gauge (I.B.2)
- determine the locations of all suspension, steering, and power train component attaching points on the body (I.B.3)
- diagnose and measure unibody vehicles, using a dedicated (fixture) measuring system (I.B.4)
- diagnose and measure unibody vehicles, using a universal measuring system (mechanical, electronic, laser) (I.B.5)
- determine the extent of the direct and indirect damage and the direction of impact; plan the methods and sequence of repair (I.B.6)

- complete all procedures in accordance with ASE standards

Process/Skill Questions

R003: Interpret printed and electronic specification manuals

Definition: Process should include the following:

- identify misaligned or damaged steering, suspension, and power train components that can cause vibration, steering, and four-wheel alignment problems; realign or replace in accordance with vehicle manufacturer’s specifications/procedures (I.B.1)
- diagnose and analyze unibody vehicle length, height, and width, using a tram gauge (I.B.2)
- determine the locations of all suspension, steering, and power-train component attaching points on the body (I.B.3)
- diagnose and measure unibody vehicles, using a dedicated (fixture) measuring system (I.B.4)
- diagnose and measure unibody vehicles, using a universal measuring system (mechanical, electronic, laser) (I.B.5)
- determine the extent of the direct and indirect damage and the direction of impact; plan the methods and sequence of repair (I.B.6)
- complete all procedures in accordance with ASE standards

Process/Skill Questions

R004: Identify characteristics and uses of high-strength steel

Definition: Process should include the following:

- list the physical properties of high-strength steel
- describe the advantages of using high-strength steel in auto body construction
- list auto body parts typically made of high-strength steel
- explain repair procedures used on high-strength steel parts
- identify high-strength steel characteristics in accordance with ASE standards and instructor guidelines

Process/Skill Questions

R005: Analyze damage, using tram and self-centering gauges

Definition: Process should include the following:

- diagnose and measure structural damage, using tram and self-centering gauges according to industry specifications (I.A.1)
- diagnose and analyze unibody vehicle length, height, and width, using a tram gauge (I.B.2)
- determine the extent of the direct and indirect damage and the direction of impact; plan the methods and sequence of repair (I.B.6)

- complete all procedures in accordance with ASE standards

Process/Skill Questions

R006: Analyze damage, using a universal measuring system

Definition: Process should include the following:

- diagnose and measure unibody vehicles, using a universal measuring system (mechanical, electronic, laser) (I.B.5)
- determine the extent of the direct and indirect damage and the direction of impact; plan the methods and sequence of repair (I.B.6)
- complete all procedures in accordance with ASE standards

Process/Skill Questions

R007: Analyze damage, using a dedicated measuring system

Definition: Process should include the following:

- diagnose and measure unibody vehicles, using a dedicated (fixture) measuring system (I.B.4)
- determine the extent of the direct and indirect damage and the direction of impact; plan the methods and sequence of repair (I.B.6)
- complete all procedures in accordance with ASE standards

Process/Skill Questions

**DUTY S:
Making Vehicle Structural Repairs**

Task:

S001: Straighten and align structural damage

Definition: Process should include the following:

- attach frame-anchoring devices (I.A.2)
- straighten and align mash (collapse) damage (I.A.3)
- straighten and align sag damage (I.A.4)
- straighten and align sideways damage (I.A.5)
- straighten and align twist damage (I.A.6)
- straighten and align diamond frame damage (I.A.7)
- remove and replace damaged frame horns, side rails, cross members, and front or rear sections (I.A.8)
- attach body-anchoring devices (I.B.7)
- complete all procedures in accordance with ASE standards

Process/Skill Questions

S002: Replace component parts

Definition: Process should include the following:

- identify misaligned or damaged steering, suspension, and power-train components that can cause vibration, steering, and wheel alignment problems; align or replace in accordance with vehicle manufacturer's recommendations (I.A.11)
- identify misaligned or damaged steering, suspension, and power train components that can cause vibration, steering, and four-wheel alignment problems; realign or replace in accordance with vehicle manufacturer's specifications/procedures (I.B.1)
- complete all procedures in accordance with ASE standards

Process/Skill Questions

S003: Perform stress relief, using shock

Definition: Process should include the following:

- use proper cold stress-relief methods (I.B.15)
 - use facing hammer to apply blow flat to areas that are raised from stress
 - simultaneously apply pressure to reverse and relieve the stress
 - use a 2' x 4' block to distribute force onto area to help relieve stress
 - use a body spoon as required to distribute force over larger areas and cushion the hammer blow
- complete all procedures in accordance with ASE standards

Process/Skill Questions

S004: Perform stress relief, using heat

Definition: Process should include the following:

- identify heat limitations in frame repair (I.A.12)
- use proper heat stress-relief methods in high-strength steel (I.B.14)
 - straighten with hammers and dollies before attempting to shrink
 - analyze situation to determine whether heat stress-relief method is advisable
 - remove all paint and undercoating before attempting shrinking or stress relieving
 - use heat crayon to avoid overheating
 - complete heat shrinking in three minutes or less
- complete all procedures in accordance with manufacturer's guidelines and ASE standards

Process/Skill Questions

S005: Replace high-strength steel

Definition: Process should include the following:

- determine the extent of damage to structural steel body panels (I.B.17)
- remove and replace damaged sections of structural steel body panels in accordance with manufacturer's specifications (I.B.18)

- complete all procedures in accordance with ASE standards

Process/Skill Questions

S006: Section component parts (including manufacturing and installing sectioning inserts)

Definition: Process should include the following:

- straighten and align cowl assembly (I.B.8)
- straighten and align roof rails/headers and roof panels (I.B.9)
- repair or replace weakened or cracked frame members in accordance with vehicle manufacturer's recommendations/industry standards (I.A.10)
- straighten and align body openings, floor pans, and rocker panels (I.B.11)
- straighten and align quarter panels, wheelhouse assemblies, and rear body sections (including rails and suspension/power train mounting points, etc.) (I.B.12)
- remove and replace damaged sections of structural steel body panels in accordance with manufacturer's specifications (I.B.18)
- complete all procedures in accordance with ASE standards

Process/Skill Questions

S007: Remove and reinstall mechanical components

Definition: Process should include the following:

- align or replace vibration, steering, and wheel alignment problems in accordance with vehicle manufacturer's recommendations (I.A.11)
- remove and replace power steering pump; inspect pump mounts (III.A.4)
- remove and replace power steering gear (non-rack and pinion) (III.A.6)
- remove and replace power rack and pinion steering gear; inspect and replace mounting bushings and brackets; ensure proper mounting location (III.A.7)
- remove and replace idler arm and mountings (III.A.11)
- remove and replace steering linkage damper (III.A.13)
- remove and replace upper and lower control arms, arm bushings, shafts, and rebound bumpers (III.A.14)
- remove and replace front suspension system coil springs and spring insulators (silencers) (III.A.18)
- remove and replace rear suspension system coil springs and spring insulators (silencers)
- remove, replace, and align front and rear frame (cradles/stub) (III.A.29)
- complete all procedures in accordance with ASE standards

Process/Skill Questions

DUTY T:
Diagnosing and Repairing Steering and Suspension

Task:

T001: Identify suspension systems

Definition: Process should include the following:

- identify suspension system fasteners that should not be reused (III.A.1) and the procedures involved
 - inspect and replace shock absorbers (III.A.25)
 - inspect and replace air shock absorbers, load-leveling devices, air springs, and associated lines and fittings (III.A.26)
- identify suspension systems in accordance with ASE standards

Process/Skill Questions

T002: Perform suspension quick checks

Definition: Process should include the following:

- diagnose and repair:
 - vehicle wandering
 - pulling
 - hard steering
 - bump steering
 - memory steering
 - torque steering
 - steering return problems (III.A.36)
- complete all procedures in accordance with ASE standards

Process/Skill Questions

T003: Remove and reinstall suspension systems

Definition: Process should include the following:

- identify suspension system fasteners that should not be reused (III.A.1)
- inspect/replace pitman arm (III.A.9)
- inspect/replace relay (center link/intermediate) rod (III.A.10)
- remove/replace idler arm and mountings (III.A.11)
- remove/replace tie rod sleeves, clamps, and tie rod ends (III.A.12)
- remove/replace steering linkage damper (III.A.13)
- remove/replace upper and lower control arms (III.A.14)
- remove/replace upper and lower control arm bushings, shafts, and rebound bumpers (III.A.15)
- remove/replace upper and lower ball joints (III.A.16)
- remove/replace steering knuckle/spindle/hub assemblies (III.A.17)
- remove/replace front suspension system coil springs and spring insulators (III.A.18)
- inspect/replace/adjust front suspension system torsion bars; inspect mounts (III.A.19)

- inspect/replace stabilizer bar bushings, brackets, and links (III.A.20)
- inspect/replace MacPherson strut cartridge or assembly, upper bearing, and mount (III.A.21)
- remove/replace rear suspension system coil springs and spring insulators (silencers)
- inspect/remove/replace rear suspension system transverse links, control arms, stabilizer bars, bushings, and mounts (III.A.22)
- inspect/remove/replace rear suspension system leaf spring(s), leaf spring insulators (silencers), shackles, brackets, bushings, and mounts (III.A.23)
- inspect rear axle assembly for damage and misalignment (III.A.24)
- remove/replace/align front and rear frame (cradles/stub) (III.A.29)
- reinstall wheels and torque lug nuts according to manufacturer's specifications (III.A.52)
- complete all procedures in accordance with ASE standards

Process/Skill Questions

T004: Service suspension systems

Definition: Process should include the following:

- diagnose manual and power steering gear (non-rack and pinion) noises, binding, uneven turning effort, looseness, hard steering, and fluid leakage problems; determine needed repairs (III.A.32)
- diagnose power rack-and-pinion steering gear noises, vibration, looseness, hard steering, and fluid leakage problems; ensure proper mounting location; determine needed repairs (III.A.33)
- diagnose non-MacPherson front and rear suspension system noises and body sway problems; determine needed repairs (III.A.34)
- diagnose MacPherson strut suspension system noises and body sway problems; determine needed repairs (III.A.35)
- complete all procedures in accordance with ASE standards

Process/Skill Questions

T005: Identify steering systems and components, including component specs

Definition: Process should include the following:

- identify rack-and-pinion steering gear, inner tie rod ends, and bellows boots (III.A.2)
- identify power steering gear (non-rack and pinion) (III.A.6)
- identify steering systems and components in accordance with ASE standards

Process/Skill Questions

T006: Inspect, repair, and replace steering components

Definition: Process should include the following:

- inspect/replace rack-and-pinion steering gear, inner tie rod ends, and bellows boots (III.A.2)
- inspect/replace pitman arm (III.A.9)
- inspect/replace relay (center link/intermediate) rod (III.A.10)

- remove/replace idler arm and mountings (III.A.11)
- remove/replace tie rod sleeves, clamps, and tie rod ends (III.A.12)
- remove/replace steering linkage damper (III.A.13)
- remove/replace upper and lower control arms (III.A.14)
- remove/replace upper and lower control arm bushings, shafts, and rebound bumpers (III.A.15)
- remove/replace upper and lower ball joints (III.A.16)
- remove/replace steering knuckle/spindle/hub assemblies (III.A.17)
- remove/replace front suspension system coil springs and spring insulators (silencers) (III.A.18)
- inspect/replace/adjust front suspension system torsion bars; inspect mounts (III.A.19)
- inspect/replace stabilizer bar bushings, brackets, and links (III.A.20)
- inspect/replace MacPherson strut cartridge or assembly, upper bearing, and mount (III.A.21)
- diagnose steering column damage, looseness, and binding problems (including tilt mechanisms); determine needed repairs (III.A.30)
- inspect/replace steering shaft U-joint(s), flexible coupling(s), collapsible columns, and steering wheels (III.A.31)
- diagnose manual and power steering gear (non-rack and pinion) noises, binding, uneven turning effort, looseness, hard steering, and fluid leakage problems; determine needed repairs (III.A.32)
- diagnose power rack-and-pinion steering gear noises, vibration, looseness, hard steering, and fluid leakage problems; ensure proper mounting location; determine needed repairs (III.A.33)
- diagnose non-MacPherson front and rear suspension system noises and body sway problems
- determine needed repairs (III.A.34)
- diagnose MacPherson strut suspension system noises and body sway problems; determine needed repairs (III.A.35)
- diagnose vehicle wandering, pulling, hard steering, bump steering, memory steering, torque steering, and steering return problems; determine needed repairs (III.A.36)
- complete all procedures in accordance with ASE standards

Process/Skill Questions

T007: Service power steering system

Definition: Process should include the following:

- remove and replace power steering pump; inspect pump mounts (III.A.4)
- inspect and replace power steering hoses and fittings (III.A.5)
- remove and replace power steering gear (non-rack and pinion) (III.A.6)
- remove and replace power rack-and-pinion steering gear; inspect and replace mounting bushings and brackets; ensure proper mounting location (III.A.7)
- complete all procedures in accordance with ASE standards

Process/Skill Questions

T008: Service brake systems

Definition: Process should include the following:

- inspect brake lines and fittings for leaks, dents, kinks, rust, cracks, or wear; tighten loose fittings and supports; replace brake lines (double flare and ISO types), hoses, fittings, and supports (III.C.1)
- inspect flexible brake hoses for leaks, kinks, cracks, bulging, or wear; remove and replace hoses; tighten loose fittings and supports (III.C.2)
- select, handle, store, and install brake fluids; dispose of per federal, state, and local regulations (III.C.3)
- bleed (manual, pressure, vacuum, or surge) and/or flush hydraulic brake system in accordance with manufacturer's procedures (III.C.4)
- pressure test brake hydraulic system; determine needed repairs (III.C.5)
- adjust brake shoes; remove and reinstall brake drums or drum/hub assemblies and wheel bearings (III.C.6)
- reinstall wheel and torque lug nuts according to manufacturer's specifications (III.C.7)
- remove and reinstall caliper assembly (III.C.8)
- clean and inspect caliper mountings for wear and damage (III.C.9)
- check parking brake system operation (III.C.10)
- identify and replace ABS wheel speed sensor components according to manufacturer's specifications (III.C.11)
- depressurize ABS hydraulic system according to manufacturer's procedures (III.C.12)
- identify the proper procedures for handling brake dust (III.C.13)
- check for bent or damaged brake system components (III.C.14)
- complete all procedures in accordance with ASE standards

Process/Skill Questions

T009: Inspect, diagnose, and repair causes of tire wear patterns

Definition: Process should include the following:

- diagnose tire wear patterns; determine needed repairs (III.A.47)
- inspect tires; identify direction of rotation and location; check and adjust air pressure (III.A.48)
- diagnose wheel/tire vibration, shimmy, and tramp (wheel hop) problems; determine needed repairs (III.A.49)
- complete all procedures in accordance with ASE standards

Process/Skill Questions

T010: Perform four-wheel alignment

Definition: Process should include the following:

- inspect and replace rack-and-pinion steering gear, inner tie rod ends, and bellows boots (III.A.2)
- inspect and adjust (where applicable) steering linkage geometry (attitude/parallelism) (III.A.8)

- inspect and replace pitman arm (III.A.9)
- inspect and replace relay (center link/intermediate) rod (III.A.10)
- remove and replace idler arm and mountings (III.A.11)
- remove and replace tie rod sleeves, clamps, and tie rod ends (III.A.12)
- remove and replace steering linkage damper (III.A.13)
- remove and replace upper and lower control arms (III.A.14)
- remove and replace upper and lower control arm bushings, shafts, and rebound bumpers (III.A.15)
- remove and replace upper and lower ball joints (III.A.16)
- adjust front and rear wheel camber on suspension systems with camber adjustments (III.A.37)
- check front and rear wheel camber on adjustable and non-adjustable suspension systems; determine needed repairs (III.A.38)
- adjust caster on suspension systems with caster adjustments (III.A.39)
- check casters on adjustable and non-adjustable suspension systems; determine needed repairs (III.A.40)
- check and adjust front wheel toe; determine needed repairs (III.A.41)
- center steering wheel (III.A.42)
- identify toe-out-on-turns-related (turning radius) problems; determine needed repairs (III.A.43)
- identify SAI (steering axis inclination) KPI-related (king pin inclination) problems; determine needed repairs (III.A.44)
- check rear wheel toe; determine needed adjustment or repair
- identify thrust angle-related problems; determine needed repairs (III.A.45)
- check for front wheel setback; determine needed repairs (III.A.46)
- diagnose tire wear patterns; determine needed repairs (III.A.47)
- inspect tires; identify direction of rotation and location; check and adjust air pressure (III.A.48)
- measure wheel, tire, axle, and hub run-out; determine needed repairs (III.A.50)
- diagnose tire pull (lead) problems; determine corrective actions (III.A.51)
- complete all procedures in accordance with ASE standards

Process/Skill Questions

T011: Remove and reinstall front drive trains

Definition: Process should include the following:

- remove, replace, and adjust shift or clutch linkage as required (III.F.1)
- remove, replace, and adjust cables or linkages for throttle valve (TV), kick-down, and accelerator pedal (III.F.2)
- remove and replace electronic sensors, wires, and connectors (III.F.3)
- remove and replace power train assembly; inspect, replace, and align power train mounts (III.F.4)
- remove and replace front and/or rear drive axle assembly (III.F.5)
- measure and/or adjust half shaft position/angle

- remove, inspect, and replace front-drive half shafts and axle constant-velocity joints (CV) (III.F.6)
- inspect, remove, and replace front and rear drive shafts and universal joints (III.F.7)
- complete all procedures in accordance with ASE standards

Process/Skill Questions

**DUTY U:
Detailing**

Task:

U001: Apply decals and miscellaneous exterior trim

Definition: Process should include the following:

- apply decals, transfers, tapes, wood grains, pinstripes (painted and taped), and other trim (V.F.1)
 - wash surface with soap and water
 - solvent clean surfaces that are not newly painted
 - use heat gun to stretch decals in contoured areas
 - take precautions to prevent decal or transfer damage caused by overheating
- complete all procedures in accordance with ASE standards

Process/Skill Questions

U002: Demonstrate polishing techniques

Definition: Process should include the following:

- select appropriate polish for finish being buffed
- sand area before polishing, using 1500–2000 grit paper
- use a wool or foam pad for buffing; set buffer or polisher on slow speed
- buff base-coat clear coats within the first week after painting
- complete all procedures in accordance with material manufacturer’s directions and ASE standards

Process/Skill Questions

U003: Clean exterior and glass surfaces

Definition: Process should include the following:

- ascertain whether surfaces are glass or plastic
- select a high quality glass (or plastic) cleaner
- use clean towels according to manufacturer’s instructions
- remove paint overspray with razor blade after cleaning (for glass--not plastic--surfaces)
- complete all procedures in accordance with ASE standards

Process/Skill Questions

U004: Perform interior detailing

Definition: Process should include the following:

- clean interior, including seating, dashboard, windows, and carpet areas (V.F.3)
- complete all procedures in accordance with ASE standards

Process/Skill Questions

U005: Clean body openings and other areas not painted

Definition: Process should include the following:

- clean body openings (door jams and edges, windows, trunk) not painted (V.F.4)
- clean all body openings free of dust and paint overspray
- use caution to protect new finish adjacent to areas
- complete all procedures in accordance with ASE standards

Process/Skill Questions

U006: Remove overspray

Definition: Process should include the following:

- select clean buffing pads
- select chemicals and other supplies appropriate for finish
- buff or hand rub areas until overspray is removed
- take precautions to avoid damaging surfaces (V.F.5)
- complete all procedures in accordance with ASE standards

Process/Skill Questions

SkillsUSA/HOSA

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

A006: Define the customer

Definition: Process should include the following:

- Differentiate between external and internal customers
- Discuss factors that contribute to poor customer relationships

Process/Skill Questions

A007: Recognize the 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 a personal plan to overcome barriers to listening

Process/Skill Questions

A009: Participate in a shadowing activity

Definition: Process should include the following:

- Summarize the experience of the job shadowing activity

Process/Skill Questions

A010: Identify the components of an employment portfolio

Definition: Process should include the following:

- Identify the 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

<p>DUTY B: Civic, Social, and Business Awareness</p>
<p>Task:</p>
<p>B001: Measure/modify short-term goals</p> <p><i>Definition:</i> Process should include the following:</p> <ul style="list-style-type: none"> • Discuss steps to pursue short-term goal(s) <p>Process/Skill Questions</p>
<p>B002: Identify stress sources</p> <p><i>Definition:</i> Process should include the following:</p> <ul style="list-style-type: none"> • List personal sources of stress • Discuss techniques to cope with individual sources of stress <p>Process/Skill Questions</p>
<p>B003: Select characteristics of a positive image</p> <p><i>Definition:</i> Process should include the following:</p> <ul style="list-style-type: none"> • Discuss actions and traits that lead to a positive image • Discuss actions and traits that lead to a negative image <p>Process/Skill Questions</p>
<p>B004: Demonstrate awareness of government, professional organizations, and trade unions</p> <p><i>Definition:</i> Process should include the following:</p> <ul style="list-style-type: none"> • Identify the state governor, legislators, and senators • Identify professional organizations pertaining to specific career areas <p>Process/Skill Questions</p>
<p>B005: Apply team skills to a group project</p> <p><i>Definition:</i> Process should include the following:</p> <ul style="list-style-type: none"> • Form a team to develop a class project <p>Process/Skill Questions</p>
<p>B006: Observe and critique a meeting</p> <p><i>Definition:</i> Process should include the following:</p> <ul style="list-style-type: none"> • Attend a formal meeting held within the community • Critique the attended meeting <p>Process/Skill Questions</p>

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 an 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 the 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 career goals

Process/Skill Questions

B014: Assemble your employment portfolio

Definition: Process should include the following:

- Develop an 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 the responsibilities of managers and supervisors

Process/Skill Questions

B016: Recognize safety issues

Definition: Process should include the following:

- Discuss the 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

Curriculum Frameworks

Purpose

This section of the framework contains material to help instructors in technical and professional programs reinforce basic skills in the areas of Reading and Writing, Mathematics, 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 always have 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, and 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 Career and Technical Education 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 Career and Technical Education 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 career and technical 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 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 allow the instructor to set the tone for the material. This method 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 people to find out the top five 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.)

- 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 and has collected data from this work with Arkansas employers. 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 U.S. military, and 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.
- The U.S. Department of Labor (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 Web site at www.dol.gov.
- The 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.
- The 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 Career and Technical Education Classroom

Note:

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

Objective	Classroom Applications to Industry
<p><i>Present</i> <i>Review, and discuss</i> Master 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 two examples of workplace materials* on students' reading level.</p> <p>With the first, allow students to read information and then answer brief recall questions. 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</p>

	visually? Discuss learning styles and impact on the job.
<i>Follow, give oral instructions</i>	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.
<i>Follow, give written instructions</i>	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, identify technical vocabulary</i>	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.
Identify, 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: symbols, abbreviations, acronyms. Classify each one and write in the meaning.
Understand, use rules of grammar, usage, spelling, punctuation	Identify the missing punctuation marks, misspelled words, and incorrect use of

	<p>grammar from workplace materials*.</p> <p>Correct the mistakes.</p>
<i>Discuss</i> uses and purposes of a variety of workplace communication tools	Find examples of a business letter, memo, report, brochure, proposal, schematic, map, and diagram.
<i>Duplicate</i> process demo by instructor	Using a workplace process, demonstrate steps to complete and have students perform individually or in groups.
<i>Notice, apply</i> word analysis techniques	Using workplace materials*, identify prefixes, suffixes, or roots that indicate meaning (e.g. therma = heat). ¹
<i>Match</i> 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.
<i>Read</i> for main ideas and details	Use a graphic organizer ¹ to show main ideas and supporting details.
<i>Distinguish</i> 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.
<i>Distinguish</i> between rows and columns	Using charts or tables from workplace materials*, discuss the reasons for this format.
<i>Identify</i> a cell as a block where a row and column intersect	Identify the quantity in a particular cell.
<i>Select, use</i> appropriate resources and reference tools	<p>Explain the uses for the following: dictionary, thesaurus, almanac, atlas, card catalog, encyclopedia.</p> <p>List reasons for choosing one reference tool over another.</p> <p>Use reference tools to answer questions related to industry or current events.</p>
<i>Paraphrase</i> written or oral material into summary form	Using workplace materials*, determine the best way to condense or shorten the

	<p>material so as to give an overview to a layperson.</p> <p>Using a set of guidelines appropriate to students' level in length and detail, summarize the information into bullet points.</p>
<i>Interpret, fill out/complete forms and records</i>	<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 a partner.</p> <p>Create a form or document to be used in a workplace process.</p>
<i>Use, develop a process for remembering details</i>	<p>Use pneumatic devices to organize and remember details. Pneumatic devices¹ include Semantic Maps, Thought Webs, and other creative tools to organize thinking.</p>
<i>Proofread, correct mistakes in written drafts</i>	<p>Using a newspaper article, locate and mark mistakes in grammar, punctuation, or usage.</p> <p>Correct mistakes in written drafts.</p>
<i>Examine different types of writing used in the workplace (reports, memos, brochures, logs, blueprints, formulas, etc.)</i>	<p>Gather samples of workplace materials*. Identify each by type.</p> <p>Compare and contrast the difference between:</p> <ul style="list-style-type: none"> • audience (who the document is written for) • length • background information/education needed to understand material • level of detail • organization and layout of the document
<i>Understand the writing process</i>	<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>
<p><i>Identify, create</i> sentences of different types</p>	<p>Using workplace materials*, find sentences of varying types. Examples include simple sentences (subject + predicate) and complex sentences (subject + predicate including clauses).</p> <p>Write sentences, paragraphs, or essays using sentences of different types (e.g., write a two-paragraph summary of today’s lesson).</p>
<p><i>Identify, use</i> 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, use correctly</i> 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/her 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 five words per week. Award bonus points.</p>
<p><i>Identify, use correctly</i> 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/her 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 sources.</p>
<p><i>Identify, use</i> 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). Examples --</p> <p>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 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>Have students write the instructions for disassembly.</p>
Cross-reference materials to compare information	Using more than one source document, compare the information given.
Interpret reasoning behind rules or regulations	Using workplace materials*, make a list of possible reasons or justifications for a safety guideline, regulation, etc.
Show contrasts between approaches	<p>Given a workplace scenario, write a brief approach to solving the problem. (Working in groups would be beneficial.)</p> <p>Compare and contrast each approach from the perspective of a worker, manager, supervisor.</p>

<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 two or more partners related to industry, show or explain how they are interrelated (e.g., explain the relationship between social workers and hospitals).
Given examples of emergency situations, identify a real-world course of action	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 preventive 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 Career and Technical Education 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, apply</i> problem-solving process</p>	<p>Define the problem What is being asked?</p> <p>Decide on a type of solution. Multi-step or single-step question?</p>

	<p>Try any of these:</p> <ul style="list-style-type: none"> Estimate an answer Draw a diagram Find a pattern 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>Locate information you need.</p> <ul style="list-style-type: none"> • Do you have all the components? <p>Get missing information.</p> <ul style="list-style-type: none"> • You may need to perform some other calculations <p>Calculate.</p> <ul style="list-style-type: none"> • Look at the answer. How should the remainder be expressed? <p>Check the solution.</p> <ul style="list-style-type: none"> • Is it reasonable?
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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.</p> <p>Example: $0.4445 \underline{\quad} 0.4455 > \text{ or } <$</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</p>

	<p>Assurance Technician who works on the line in a manufacturing plant may need to use numbers through the ten-thousandths decimal place.</p> <p>Take a series of sample measurements, and round them to the nearest decimal place identified by the instructor.</p>
<i>Estimate numbers</i>	<p>The skill of making close estimations is tied to understanding accuracy. Discuss real-life situations in which 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 in which 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>	<p>Understand, at a level of complexity appropriate to your industry and to students' ability levels, basic principles of addition, subtraction, multiplication, and division.</p>

<p>Perform problems that require an understanding of the order of operations</p>	<p>Using workplace materials*, make a list of 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>Understand the relationship between decimals, fractions, and percentages</p>	<p>Make a table comparing fractions, decimals, and percentages.</p>
<p>Compute with fractions, decimals, and percentages, and show an understanding of the relationship between them</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: <ul style="list-style-type: none"> 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. $\frac{10}{20} + \frac{2}{20} + \frac{8}{20} = \frac{20}{20}$ ▪ Convert the fractions to a whole number. (Total answer equals one

	<p>class' worth of answers.)</p> $\frac{10}{20} + \frac{2}{20} + \frac{8}{20} = \frac{20}{20} = 1$ <ul style="list-style-type: none"> ▪ Convert the fractions to percentages. <p>$\frac{10}{20}$ means 10 divided by 20 = 0.50</p> <p>Move the decimal two places to the right. 0.50 = 50%</p> <p>$\frac{2}{20}$ means 2 divided by 20 = 0.10</p> <p>0.10 = 10%</p> <p>$\frac{8}{20}$ means 8 divided by 20 = 0.40</p> <p>0.40 = 40%</p> <p>50% + 10% + 40% = 100% Notice the totals add to 100%.</p> <p>So, $\frac{20}{20} = 1 = 100\%$</p> <p>Using workplace materials*, calculate work-related questions using fractions, decimals, and percentages.</p> <p>Calculate shipping costs for Internet purchases (such as music from amazon.com).</p>
Solve formulas and equations	<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
Obtain squares and square roots	<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 two common answers to 32 (answer = 9, not 6).</p>

	How would an incorrect value affect the work on the job?
<i>Convert units of measure:</i> Recognize components of measuring systems (U.S. and metric) for length	Discuss industry measures and terms relating to length.
<i>Convert units of measure:</i> Recognize components of measuring systems (U.S. and metric) for mass/weight	Discuss industry measures and terms relating to mass/weight.
<i>Convert units of measure:</i> Recognize components of measuring systems (U.S. and metric) for volume	Discuss industry measures and terms relating to volume.
Measure with a certain degree of accuracy	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	
Solve word problems	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.
Select/apply mathematical formulas	Review a set of math formulas and then a list of sample problems. Decide which formula(s) apply to each problem.
Understand the importance of time in the workplace	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.
Recognize components of time systems (clocks and calendars)	<ul style="list-style-type: none"> • a.m. and p.m. • Leap year • Military time
Discuss, identify, understand terms relating to measuring time	Discuss the units of time measurement and time vocabulary: second, minute, hour, day,

	week, month, year, leap year, fiscal year, quarter, annual, biannual, etc.
Understand that time can be expressed in terms of equivalencies	<p>Show the time equivalencies using fractions. For example:</p> $1 \frac{1}{2} \text{ days} = \underline{\hspace{2cm}} \text{ hours}$ $\begin{array}{rcl} 1 \text{ day} & = & 24 \text{ hours} \\ + \frac{1}{2} \text{ day} & = & +12 \text{ hours} \\ \hline 1 \frac{1}{2} \text{ days} & = & 36 \text{ hours} \end{array}$
Compute time conversions	<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
Calculate ratio and proportion	<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 the class has three children, how many children will there be altogether? Write the ratios.)</p>
Apply geometry principles: Use formulas for measuring shapes of two dimensions	<p>Determine the formulas that apply to two dimensions: perimeter, area, surface area. Find the perimeter of the classroom. Discuss the 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. Review that all areas are expressed in terms of square units (square inches, square miles, etc.).</p>

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

	competitions.
Calculate measurements taken from measuring devices	Add, subtract, multiply, and divide measurement numbers by plugging them into formulas.
Perform/prepare an inventory	Use a sample group of items to prepare an inventory. Review inventory vocabulary terms. Discuss the math processes that would apply to the inventory process.
DATA ANALYSIS AND DISPLAY	
Recognize types of visual representations	<ul style="list-style-type: none"> • Charts • Graphs • Tables
Interpret charts, graphs, and tables	Answer simple questions about charts, graphs and tables. <i>Solve</i> multistep problems involving the correlation of graphs and tables.
Collect/record data	As appropriate to industry, practice sampling methods. Discuss safety precautions for sampling. Visit OSHA at the Department of Labor Web site for more details. Practice collecting and recording sample data from your industry (such as measurements taken using a micrometer). Compare class answers. Find the range of answers (maximum and minimum). Find the average. Discuss an acceptable range of answers (\pm), and graph the results showing the number that fell inside and outside the acceptable range.
Review and apply principles of probability	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 s/he can tell me the

	probability of choosing the number correctly.”)
Use probability models to predict chance events	<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. Compare the two probabilities.</p>
Calculate and interpret statistics	<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>
Interpret plans/blueprints	<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>
Construct charts and tables	<p>Discuss chart types and chart vocabulary.</p> <p>Using workplace or sample data from the class, construct tables and charts. 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>

ACADEMIC STANDARDS FOR SCIENCE
Strategies for Reinforcement
in the Career and Technical Education 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

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, and discover the cost to employers to educate adult workers • Researching the topic of adult literacy
<p>Perform 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>Apply scientific method of inquiry</p>	<p>Identify the steps of the scientific method.</p> <p>Conduct experiments.</p> <p>Understand the following terminology:</p> <ul style="list-style-type: none"> • Conclusions vs. inferences • Variables • Replications • Samples/sample size
<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</p>

	<p>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/mod3.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>
<i>Use scientific instruments to measure aspects of the environment</i>	Gather data on time, length, mass, pressure, volume, acceleration, or other measurables using instruments from the job.
<i>Demonstrate an understanding of data</i>	<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>
<i>Identify the seven basic S I (Systeme International) units</i>	<p>Length: meter, m</p> <p>Mass: kilogram, kg</p> <p>Time: second, s</p> <p>Electric current: ampere, A</p> <p>Temperature: Kelvin, K</p> <p>Amount of substance: mole, mol</p> <p>Luminous intensity: candela, cd</p>

	For a dictionary of units, see http://www.ex.ac.uk/cimt/dictunit/dictunit.htm
<i>Identify S I (Systeme International) Derived units</i>	Choose units appropriate to your industry (hertz, ohm, volt, watt, etc.). Create a picture dictionary demonstrating the concepts.
<i>Review relevant theories, laws, and models</i>	As relating to your industry, discuss important theories, laws, and models.
<i>Use reference tools to solve problems</i>	Use scientific reference tools (such as the Periodic Table of Elements) to learn more about specific industry concepts.
<i>Practice safe lab procedures</i>	Handle equipment with care. Demonstrate safety and first aid procedures. Identify harmful substances.
PHYSICAL SCIENCE	
<i>Understand the cyclical nature of systems</i>	Show, demonstrate, model, track the cycles of any of the following systems: <ul style="list-style-type: none"> • Growth and decay • Food webs • Weather • Water
<i>Analyze/classify matter according to type</i>	Identify types of matter (solids, liquids, gases). Which types are predominantly used in your area of industry?
<i>Explain the concepts of work and power</i>	Identify machines used in industry. Identify how energy levels change when work or power is increased/decreased. Identify fuel sources used in your industry. Discuss internal and external combustion. Create a model demonstrating the uses of levers and pulleys.

<p><i>Be familiar with concepts of motion</i></p>	<p>Measure acceleration and deceleration. Understand the relationship between speed and velocity by performing experiments. Recognize waves and vibrations as a type of motion.</p> <p>Understand action and reaction. Review laws pertaining to motion.</p>
<p><i>Understand concepts related to force</i></p>	<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>
<p><i>Understand and apply principles relating to the atom</i></p>	<p>Understand that atoms have a positive, negative, or neutral charge. Classify protons, electrons, and neutrons. Identify ions.</p>
<p><i>Investigate forms of and changes in energy</i></p>	<p>Discuss how energy is measured.</p> <p>Observe changes in energy relationships. 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 discuss 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:</p> <ul style="list-style-type: none"> • Hydroelectricity • Motors • Solar power • Steam/nuclear • Transformers • Incandescent (light) <p>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.</p> <p>Examine decibels safe for human hearing.</p> <p>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> <ul style="list-style-type: none"> • Amplification • Audible range • Frequency

	<ul style="list-style-type: none"> • Acoustics • Resonance • Speed
<i>Be familiar with principles of heat</i>	<p>Differentiate between the three 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>	Use the temperature scales; convert between Celsius and Fahrenheit.
<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.</p> <p>Define and state examples of chemical reactions.</p> <p>Be familiar with solutions used in your industry.</p> <p>Compare saturated and unsaturated solutions.</p> <p>Determine whether a solution is soluble or insoluble.</p> <p>Explain solute and solvent.</p>
<i>Investigate forms of and changes in matter</i>	Compare and contrast physical and chemical

	<p>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 four elements that make up 99% of living organisms [hydrogen (H), oxygen (O), nitrogen (N), and carbon (C)].</p> <p>Element groups:</p> <ul style="list-style-type: none"> • Alkali metals • Alkaline earth metals • Transition metals • Other metals • Metalloids • Nonmetals • Halogens • Noble gases • Rare earth elements
<i>Be familiar with principles of light</i>	<p>Discuss light as a form of energy. Examine the light spectrum and note the relative smallness of visible light.</p> <p>Describe types of lighting systems.</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.</p> <p>Briefly explore color blindness. What precautions should colorblind people take regarding workplace safety?</p> <p>Define situations in which colorblindness impacts a worker's ability to do his/her job.</p>

LIFE SCIENCE

<p><i>Explain the presence of cells as the identifier of all living organisms</i></p>	<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 examples 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:</p> <ul style="list-style-type: none">• Bacteria• Fungi• Viruses• Insects• Plants• Vertebrates• Invertebrates <p>Compare some of the cell processes (active and passive transport) with the processes in your industry.</p>
<p><i>Understand the progress of evolution of organisms</i></p>	<p>Recognize how a species will adapt to better fit in its environment over time.</p>
<p><i>Explain the role of genetics in human development</i></p>	<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)• Cell division by mitosis vs. 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	Describe the life cycle of humans and other animals. 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.
<i>Explore</i> additional concepts pertaining to humans and other animals	Give examples of ways organisms adapt to their environment. As relating to industry, review the concepts of: <ul style="list-style-type: none"> • Aging • Immune system • Skin and Tissues • Blood and hemoglobin • Disease
<i>Compare/contrast</i> the differences between sexual and asexual reproduction	Determine instances when understanding the concepts of sexual reproduction are important for your industry. Highlight the effects of unsafe working practices on unborn fetuses or the dangers present for pregnant women working in industry.
<i>Show</i> a general understanding of the importance of health	Explore the cost of lost wages and worker's compensation in the past year due to health problems. Research the most common health problems among workers (workers with safe jobs; workers with most hazards to health, etc.).
<i>Investigate</i> the food cycle	Identify food chains, food webs, food pyramids. Show how changes to the food cycle affect the environment and humans. Name the food groups.
<i>Understand</i> nutrition and the body's need for	Show an understanding of body systems (circulatory, nervous, digestive, etc.) as they

<p>a diet that provides vitamins and minerals</p>	<p>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 those 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, and 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 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 addition to physical health.</p>
<p><i>Investigate/apply</i> principles of anatomy and physiology</p>	<p>As relating to your industry, explore issues relating to anatomy and physiology.</p>

	<p>Study the skeletal system--the bones of the arm, hand, and neck. Research carpal-tunnel syndrome.</p> <p>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 five major ways in which people interact with the environment, especially as relating to your industry.</p> <p>Discuss the effectiveness of the media as compared with 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. 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> <p>Explain the recent increased resistance to drugs and antibiotics.</p>
<i>Understand</i> basic concepts relating to plants	<p>Describe the interchange of oxygen and carbon dioxide between plants. Contrast it with the way humans exchange oxygen and carbon dioxide.</p>

	<p>As relating to industry, review the concepts of:</p> <ul style="list-style-type: none"> • Fertilization • Parts of a plant and functions of each • Effects of temperature on plants • Need for water and light • Photosynthesis
EARTH SCIENCE	
<i>Recognize earth's position in the universe</i>	<p>As relating to your industry, identify relevant topics regarding:</p> <ul style="list-style-type: none"> • Asteroids • Comets • Stars • Galaxies <p>Identify the planets in the solar system. Compare and contrast earth with other planets.</p> <p>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 ____).</p> <p>How do the phases of the moon and sun affect the hemispheres?</p>
<i>Investigate the history of the earth</i>	<p>Identify geological, chemical, and other methods of determining the age of an object.</p> <p>Demonstrate that fossils and rocks are indicators of previous eras.</p> <p>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. Assign each age to a group and research the following:</p> <ul style="list-style-type: none"> • Weather • Major events at beginning and end of age • Organisms living during this time • Factors that made the age unique
<i>Investigate physical characteristics of the earth</i>	Label/model the components of the earth.

	<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</i> physical forces acting on the earth	<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; movement of these plates over time causes earthquakes and other geologic activity).</p>
<i>Explain</i> the basic components of earth's rotation	<p>Understand that the earth spins on its axis at an angle of 23 ½ degrees. 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</i> the earth's atmosphere and its components	<p>Identify the main elements in the earth's atmosphere (nitrogen and oxygen).</p> <p>Identify layers of the atmosphere and ozone layer. Explain concepts of air pressure.</p>
<i>Understand</i> basic principles of the solar system	<p>Demonstrate how the sun strikes the earth at different angles depending on location.</p>
<i>Demonstrate</i> 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</p>

	<p>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>
<p><i>Learn and apply concepts relating to the oceans</i></p>	<p>Label the major oceans and seas. 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>
<p><i>Investigate principles of water</i></p>	<p>Identify the parts of the water cycle and the effects of the processes involved.</p> <p>Define water's chemical properties:</p> <ul style="list-style-type: none"> • Water is the universal solvent • Water has a neutral pH of 7 • Chemically, water is one atom of oxygen bound to two atoms of hydrogen <p>Measure salinity. Which industries rely heavily on water?</p> <p>Define water's physical properties:</p> <ul style="list-style-type: none"> • 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)

	<ul style="list-style-type: none"> • Water's weight • Water as a coolant • Specific gravity
<i>Investigate conservation of physical and natural resources</i>	<p>As relating to your industry, discuss or debate the issues of:</p> <ul style="list-style-type: none"> • Allocation of resources • Recovering resources • Best/worst methods of using resources <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? What effects does the technology have on our society? Political system? Discuss the role of economics on technology.</p>
<i>Apply science principles/laws to environmental issues</i>	<p>Discuss how humankind alters the earth and environment through pollution and the use of resources and technology.</p>

Crosswalk to SkillsUSA Collision Repair Technology

SkillsUSA, the co-curricular student organization for Trade and Industrial Education, provides many opportunities through its program of work for students to apply the knowledge, skills, and processes learned in a variety of courses. A correlation of the Collision Repair technical contest to selected tasks/competencies in Arkansas' Collision Repair Technology courses is provided as a supplement to this framework.

Purpose

To evaluate each contestant's preparation for employment and to recognize outstanding students for excellence and professionalism in the field of collision repair 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 programs with collision repair technology as the occupational objective

Equipment and Materials *(Supplied by the technical committee)*

- Basic equipment of an auto body and refinishing laboratory
- Materials for metal-working phase:
 - Identical panels or fenders to be repaired
 - Plastic filler
 - Various grits of sandpaper
- Materials for painting phase:
 - Solvent surface cleaning material
 - Solvents for thinning various primers
 - Solvents for thinning various paints
 - Tack rags
 - Strainers and mixing paddles

- Sealers
- Paint
- Primer
- Clear coats
- Materials for plastic repair phase:
 - Cleaning solvent
 - Plastic repair material
 - Mixing boards and spreaders
 - Abrasive discs and sheets
 - Plastic car parts
 - Clamps
- Materials for estimating phase:
 - Vehicle owner's name and address
 - Scratch pads
 - Estimate sheets
 - Estimate books
 - Calculator
 - Parts price list for car involved
 - Wrecked vehicle (if necessary)
- All necessary information and furnishings for judges and technical committee

Equipment and materials *(Supplied by the contestant)*

- Body file
- Flat and pick hammers
- General-purpose dolly
- Air sander
- Spray gun
- Metal grinder
- Cartridge-type respirator (charcoal-filtered)
- Welding goggles
- Welding gloves
- Other special tools as approved by the technical committee
- Safety glasses

Scope of the Contest

Contestants will demonstrate their ability to perform tasks selected from the following list of competencies as determined by the SkillsUSA Championships technical committee. Committee membership includes: 3M Co., Akzo Nobel Coatings Co. Automotive Division, The Martin-Senour Co., BC Marketing, Chief Automotive Systems Inc., DeVilbiss Automotive Refinishing Products, DuPont Co., Fox Valley Technical College, I-CAR Technical Center, Miller Light Industrial Products, Mitchell International, National Institute for Automotive Service Excellence, Oklahoma State University, PPG Industries Inc., SATA Spray Equipment, Snap-on Inc., State Farm Insurance, Texas State Technical College, and Toyota Motor Sales, USA, Inc.

- Metalwork and Welding:
 - Fill and smooth depressed areas with body filler
 - Fill depressed areas with body solder
 - Pick, file, and finish metal
 - Weld frames and frame horns
 - Shrink damaged metal areas
 - Weld vehicle body parts
 - Weld assorted sizes and thicknesses of metal with oxygen-acetylene equipment
 - Weld assorted sizes and thicknesses of sheet metal with GMAW (MIG) welding equipment
 - Weld assorted sizes and thicknesses of plastic with plastic welding equipment and products

- Trim and Accessories:
 - Replace locks and latches
 - Remove, replace, adjust power window control units
 - Remove and replace grills and bumpers
 - Remove and replace seat and shoulder belts. *154 SkillsUSA Championships Technical Standards (2002–2004)*
 - Repair manual seat tracks
 - Repair or replace window raising and lowering mechanisms
 - Replace molding and hardware

- Plastic Repair:
 - Make cosmetic surface repairs with plastic car parts
 - Surface preparation
 - Mixing and applying repair material
 - Blocking and feather edging

- Painting and Refinishing:
 - Remove paint and rust
 - Clean and prepare repaired surfaces for painting
 - Mask sections and parts
 - Apply corrosion materials
 - Apply primer surfacer
 - Mix paint to factory specifications
 - Regulate air and adjust paint gun
 - Demonstrate spot repair, panel repair, and overall refinishing techniques
 - Paint with a variety of products, including single-stage and base-coat systems
 - Paint metal and plastic parts
 - Finish painted surfaces
 - Heat dry painted surfaces

- Removing and Installing Glass:
 - Adjust or align windows in doors
 - Remove damaged glass and install re-placement
 - Seal leaks around windshield and rear window

- Unitized Body and Conventional Frame Alignment:
 - Determine control points in vehicle structure, suspension, and steering
 - Gauge and measure the vehicle structure
 - Diagram needed repairs for center, front, and rear sections of a vehicle
 - Write an analysis of the needed repairs, including order of repairs
 - Identify components of the most common suspension and steering systems
 - Identify and explain function of alignment angles for suspension and steering alignment
 - Measure and diagnose vehicle frame and body damage using self-centering gauges, tram gauge, and datum line gauges

- Body Repair and Replacement:
 - Align hood and deck panels
 - Remove and install fenders, body panels, and door
 - Remove and install weld-in panels
 - Remove and replace bumpers
 - Repair/replace fiberglass panel
 - Straighten deformed sheet metal
 - Remove and replace plastic guards and panels

- Cost Estimating:
 - Estimate cost for repairing damaged vehicle, using repair-estimating manuals

- Miscellaneous items:
 - Contestants will be provided instruction sheets for each phase of the contest
 - Judges will stop contestants at the end of the time allowed for each phase of the contest and will rate contestants accordingly. Contestants, however, may stop whenever they have completed a phase.
 - Contestants will be required to complete a written and estimating test as part of the contest orientation prior to the official contest time.

Items Evaluated

- Metal working: Safety
- Proper use of tools
- Metal straightening
- Use of filling material
- Overall appearance
- Welding: Safety
- Oxygen/acetylene
- GMAW (MIG)

- Plastic welding
- Frame/body analysis: Safety
- Suspension/steering parts identification
- Steering geometry and alignment
- Use of frame/body manuals
- Body measurements

- Painting: Safety
- Surface preparation
- Primer operation
- Sealer or adhesion promoter application
- Color application
- Clear application
- Overall spray gun operation
- Final appearance
- Plastic repair: Safety
- Surface preparation
- Feather edging
- Block sanding
- Plastic identification
- General knowledge test
- Estimating:
- Vehicle identification
- Estimate written legibly
- List of parts in logical sequence
- Time involved in repairing
- Parts and materials cost
- Estimate completed
- Final figure
- Written test (ASE)

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. 156 *SkillsUSA Championships Technical Standards (2002–004)*. Sponsored by Goodheart-Willcox Publisher 157

Hand tools: A contestant may request permission to use a hand tool or other equipment not on this list from the technical committee. Permission may or may not be granted, but the request must be made the day before the start of the practical contest.

Arkansas' 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-rage or violent behavior
- Communicating safety regulations and plans to employees
- Working with selected community groups to implement safety programs

Collision Repair Technology Framework Cross Reference

Painting and Refinishing

Unit 1	Safety Precautions	Duty(s): A
Unit 2	Surface Preparation	Duty(s): J
Unit 3	Spray Gun and Related Equipment Operation	Duty(s): J
Unit 4	Paint Mixing, Matching and Applying	Duty(s): C, J
Unit 5	Solving Paint Application Problems	Duty(s): C
Unit 6	Finish Defects, Causes, and Cures	Duty(s): J
Unit 7	Final Detail	Duty(s): K, U
Unit 8	Customer Relations	Duty(s): B
Unit 9	VICA Student Organization	Duty(s): A

Nonstructural Analysis and Damage Repair

Unit 1	Preparation	Duty(s): G
Unit 2	Outer Body Panel Repair, Alignment, and Replacement	Duty(s): G, H, K
Unit 3	Metal Finishing and Body Filling	Duty(s): G
Unit 4	Movable Glass and Hardware	Duty(s): M
Unit 5	Metal Welding and Cutting	Duty(s): F
Unit 6	Customer Relations	Duty(s): B
Unit 7	VICA Student Organization	Duty(s): A

Structural Analysis and Damage Repair

Unit 1	Frame Inspection and Repair	Duty(s): E, R, S
Unit 2	Unibody Inspection, Alignment, and Repair	Duty(s): E, K, R, S
Unit 3	Fixed Glass	Duty(s): M
Unit 4	Metal Welding and Cutting	Duty(s): F
Unit 5	Customer Relations	Duty(s): B
Unit 6	VICA Student Organization	Duty(s): A