

**Technical and Professional
Education**

**Curriculum Content Frameworks for
Power Equipment Technology**

**Curriculum Content Frameworks for
Power Equipment 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 Power Equipment Industry as required by the Carl D. Perkins Act. The Curriculum Content Frameworks for all Technical & Professional Education programs can be accessed through the Department of Workforce Education Web site.

Forward

The curriculum content framework *Power Equipment 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.

- Small Engine Mechanic and Repair Technician
- CIP Code – 47.0606
- O-NET – 49-3053.XX

Acknowledgments

The Power Equipment Technology curriculum content framework was produced by a team of program developers from the University of Arkansas at Little Rock. A panel of experts in the field of Power Equipment reviewed the framework. The format and content of the framework reflect the specific training needs within the state of Arkansas. The framework content and format is modeled after a document originally developed by a writing team under the auspices of the Virginia Department of Education. Grateful appreciation is expressed to the Virginia Department of Education for granting the Arkansas State’s Department of Workforce Education access to their instructional frameworks.

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Introduction

About the Program

Power Equipment Technology I & II prepares students for careers in the Power Equipment industry. The course sequence focuses on duties and tasks performed by professionals in Power Equipment repair occupations, as well as pre-employment and employment skills.

About the Document

- Section 1 contains a master duty/task list for the Power Equipment Technology program.
- Section 2 contains an analysis of each task, consisting of the task, task definition, and process/skill questions to evaluate acceptable performance. All tasks have been designated essential. Essential tasks are those that must be achieved by every student pursuing the completion of the Power Equipment Technology program.
- Section 3 lists the Arkansas Standards of Learning for language arts, mathematics, and science that are reinforced by instruction in the Power Equipment Technology program. Academic skills in these areas are necessary for the mastery of a number of tasks performed by Power Equipment technicians on the job.

Course Descriptions

495400 – Power Equipment Technology I

495420 – Power Equipment Technology II

495410 - Power Equipment Technology Lab

Master Duty/Tasks Listing

Power Equipment Technology I

Power Equipment Technology II

National and state experts in the occupational field of Small Engine Repair have validated the duties and tasks in this section. Each is analyzed by identifying the following:

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

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| DUTY A: Applying Safety Practices on the Job |
| TASK: |
| A001: Identify the safe use of chemicals. |
| A002: Identify the safe use and maintenance of hand tools. |
| A003: Identify the safe use and maintenance of power tools. |
| A004: Identify the safe use and maintenance of specialized measuring tools. |
| A005: Identify the safe use of protective clothing and equipment. |
| A006: Identify the safe use of fire protection equipment. |
| A007: Identify the safe use of shop equipment. |
| A006: Follow Environmental Protection Agency (EPA), Occupational Safety and Health Act (OSHA), Material Safety Data Sheets (MSDS), safety standards and regulations. |
| DUTY B: Performing Shop Operations |
| Task: |
| B001: Read a shop manual. |
| B002: Maintain a time record for each shop job. |
| B003: Maintain a daily and weekly work schedule and assign individuals to job positions. |

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| B004: Determine economic feasibility of repair. |
| B005: Write a service order. |
| B006: Calculate labor cost using a flat rate manual. |
| B007: Identify work performed on work orders. |
| B008: Interpret parts lists and schematics using associated manuals, microfiche, and computer. |
| B009: Prepare warranty reports. |
| B010: Adhere to inventory controls |
| B011: Maintain a clean and orderly work area. |
| DUTY C: Identifying Fasteners and Their Uses |
| TASK: |
| C001: Identify type and grade of fasteners. |
| C002: Choose appropriate fastener for corresponding job. |
| C003: Repair damaged thread using a tap and die set. |
| DUTY D: Diagnosing and Repairing Fuel System |
| TASK: |
| D001: Diagnose and determine needed repair on fuel system. |
| D002: Remove and replace the fuel tank and fuel lines. |
| D003: Remove and replace the fuel filter systems. |

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| D004: Diagnose and determine needed repair on air cleaner system. |
| D005: Service foam-type air cleaner. |
| D006: Service dry element-type air cleaner. |
| D007: Disassemble, clean, and inspect diaphragm-type carburetor. |
| D008: Reassemble and adjust a diaphragm-type carburetor. |
| D019: Disassemble, clean, and inspect a float-type carburetor. |
| D010: Reassemble and adjust float-type carburetor. |
| D011: Disassemble, clean, and inspect fuel pump. |
| D012: Reassemble and install fuel pump. |
| D013: Clean crankcase breather |
| DUTY E: Diagnosing and Servicing General Electrical System |
| TASK: |
| E001: Read a multimeter. (VAO) |
| E002: Apply electrical theory. |
| E003: Service and repair DC electric starter/generator. |
| E004: Troubleshoot the charging circuit using a manufacturer's guide. |
| E005: Remove pulley and belt. |

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| E006: Replace starter/generator pulley assembly and belt. |
| E007: Remove and inspect alternator. |
| E008: Replace alternator components. |
| E009: Test and charge the battery. |
| E010: Repair and/or replace starter. |
| E011: Troubleshoot and repair starting circuit. |
| DUTY F: Diagnosing and Servicing Manual Starting System |
| TASK: |
| F001: Diagnose and determine needed repair on manual starting system. |
| F002: Replace starter spring. |
| F003: Replace a starter clutch if needed. |
| F004: Replace starter pawls. |
| F005: Replace a worn or defective cup. |
| F006: Replace starter rope. |

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| DUTY G: Diagnosing and Servicing Ignition System |
| TASK: |
| G001: Remove, inspect, adjust, and install sparkplugs. |
| G002: Remove, inspect, and replace the flywheel. |
| G003: Remove, inspect, and replace points and condenser system. |
| G004: Adjust armature air gap. |
| G005: Test and replace coil/magneto. |
| G006: Test and replace ignition wires. |
| G007: Test and replace safety switch. |
| DUTY H: Diagnosing and Repair 2 and 4-Cycle Engine |
| TASK: |
| H001: Apply 2 and 4-cycle engine theory. |
| H002: Diagnose and determine needed repair on 2 and 4-cycle engine components. |
| H003: Disassemble 2 and 4-cycle engine. |
| H004: Install piston. |
| H005: Install piston rings. |
| H006: Determine wear on internal engine parts using specialized tools. |
| H007: Ridge ream top of cylinder. |

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| H008: Bore and deglaze cylinder. |
| H009: Reassemble long block. |
| H010: Replace cylinder and cylinder head on 2 and 4 cycle engines |
| DUTY I: Diagnosing and Servicing Lawn Mower |
| Task: |
| I001: Adjust clutch controls (i.e., cables, rods, and springs). |
| I002: Inspect and service mower decks. |
| I003: Set height of cut. |
| I004: Lubricate mower. |
| I005: Grind and balance rotary blade. |
| I006: Diagnose needed repair for self-propelled drive system on walk behind mower. |
| I007: Inspect and service steering assembly. |
| I008: Replace and adjust drive trans and PTO (power take-off) belts. |
| I009: Replace and adjust throttle cable. |
| I010: Inspect and/or replace brake pad. |
| I011: Test the kill switch. |

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| DUTY J: Diagnosing and Servicing Chain Saw |
| Task: |
| K001: Diagnose needed repair on chain saw. |
| DUTY K: Troubleshoot cutter problem. |
| Task: |
| K001: Sharpen and adjust or replace chain. |
| K002: Set chain depth gauge. |
| K003: Check and adjust chain oiler. |
| K004: Lubricate bar nose sprocket. |
| K005: Inspect and replace worn sprocket and clutch. |
| DUTY L: Diagnosing and Servicing String Trimmer |
| Task: |
| L001: Diagnose needed repair on string trimmer. |
| L002: Conduct maintenance on shaft. |
| L003: Wind and trim cutter head. |
| DUTY M: Diagnosing and Servicing Cooling Systems |
| Task: |
| M001: Apply cooling system theory. |
| M002: Identify liquid cooling system components. |
| M003: Identify air-cooling system components. |

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| DUTY N: Diagnosing and Servicing Cooling Systems |
| Task: |
| N001: Apply governor system theory. |
| N002: Inspect, adjust, and replace pneumatic system |
| N003: Inspect, adjust, and replace mechanical system |
| DUTY O: Diagnosing and Servicing Exhaust Systems |
| Task: |
| O001: Apply exhaust system theory |
| O002: Diagnose common equipment problems in a damaged exhaust system, 2 & 4 cycle |
| O003: Identify cleaning procedures for exhaust ports and spark arrestor screens, 2 cycle |

Task Definitions

Power Equipment Technology I&II

National and state experts in the occupational field of Small Engine Repair have validated tasks in this section. Each task is analyzed by identifying the following:

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

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

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| DUTY A: Applying Safety Practices on the Job |
| Task: |
| <p>A001: Identify the safe use of chemicals</p> <p><i>Definition:</i> Identification should include the following:</p> <ul style="list-style-type: none"> • recognize chemical hazards in the lab (MSDS) • observe safety with hand and power tools <p>Process/Skill Questions:</p> |
| <p>A002: Identify the safe use and maintenance of hand tools.</p> <p><i>Definition:</i> Identification should include the following:</p> <ul style="list-style-type: none"> • explain safety procedures for use of hand tools • list procedures for maintenance of hand tools <p>Process/Skill Questions:</p> |
| <p>A003: Identify the safe use and maintenance of power tools</p> <p><i>Definition:</i> Identification should include the following:</p> <ul style="list-style-type: none"> • explain safety procedures for use of power tools • list procedures for maintenance of power tools <p>Process/Skill Questions:</p> |

A004: Identify the safe use and maintenance of specialized measuring tools

Definition: Identification should include the following:

- observe safety with specialized measuring tools (i.e. calipers, micrometers)
- maintain measuring tools within calibration specifications

Process/Skill Questions

A005: Identify the safe use of protective clothing and equipment

Definition: Identification should include the following:

- explain use of safety apparel (i.e. eye protection, ear protection, hand protection)
- observe all shop safety rules

Process/Skill Questions

A006: Identify the safe use of fire protection equipment

Definition: Identification should include the following:

- identify types of fire suppressant equipment and the type fires they suppress
- list locations of fire protection equipment
- recite evacuation plan

Process/Skill Questions

A007: Identify the safe use of shop equipment

Definition: Identification should include the following:

- explain safety procedures for use of power tools
- list procedures for maintenance of power tools

Process/Skill Questions

A008: Follow Environmental Protection Agency (EPA), Occupational Safety and Health Act (OSHA), Material Safety Data Sheets (MSDS), safety standards and regulations.

Definition: Identification should include the following:

- list EPA regulation effecting your shop
- use OSHA publication to ensure a safe workplace
- state purpose and location of Material Safety Data Sheets

Process/Skill Questions

**DUTY B:
Performing Shop Operations**

Task:

B001: Read a shop manual.

Definition: Identification should include the following:

- explain location and purpose of each shop manual
- locate specific information in a timely manner

Process/Skill Questions

B002: Maintain a time record for each shop job.

Definition: Identification should include the following:

- explain function of time records
- compile a time record for a specific job

Process/Skill Questions

B003: Maintain a daily and weekly work schedule and assign individuals to job positions.

Definition: Identification should include the following:

- create a daily and weekly work schedule
- assign individuals to correct job positions based on certifications, training and experience

Process/Skill Questions

B004: Determine economic feasibility of repair.

Definition: Identification should include the following:

- assess cost considerations of repair versus replacement
- discuss cost considerations with a customer in a clear, concise manner

Process/Skill Questions

B005: Write a service order.

Definition: Identification should include the following:

- list all actions to be taken in a legible manner following the established format

Process/Skill Questions

B006: Calculate labor cost using a flat rate manual.

Definition: Identification should include the following:

- explain use of a flat rate manual
- use basic math skills to calculate labor cost

Process/Skill Questions

B007: Identify work performed on work orders.

Definition: Identification should include the following:

- follow procedures prescribed by shop for completing a work order
- list all completed tasks in a legible manner

Process/Skill Questions

B008: Interpret parts lists and schematics using associated manuals, microfiche, and computer

Definition: Identification should include the following:

- review use and organization of manual, microfiche or computer
- state basic function of listed parts
- identify superceded replacement parts
- understand basics of reading schematics

Process/Skill Questions

B009: Prepare warranty reports.

Definition: Identification should include the following:

- correctly format report using basic grammar and punctuation
- follow content requirements for warranty reports

Process/Skill Questions

B010: Adhere to inventory controls

Definition: Identification should include the following:

- review methods and purpose for inventory control
- discuss specific procedures used in shop

Process/Skill Questions

B011: Maintain a clean and orderly work area.

Definition: Identification should include the following:

- discuss contribution that a clean and orderly work area makes to safe work environment
- clear work area of all hazards (i.e. oil on floor, trip hazards)
- explain danger of using compressed air to clean dust and debris from work area

Process/Skill Questions

**DUTY C:
Identifying Fasteners and Their Uses**

Task:

C001: Identify type and grade of fasteners.

Definition: Identification should include the following:

- measure threads on a bolt using thread gauge
- explain how to read grade lines on head of bolts

Process/Skill Questions

C002: Choose appropriate fastener for corresponding job.

Definition: Identification should include the following:

- identify and discuss function of fasteners common to small engine repair
- verify selection of fastener

Process/Skill Questions

C003: Repair damaged thread using a tap and die set.

Definition: Identification should include the following:

- determine correct tap and die set for repair
- review procedures for repairing damaged threads

Process/Skill Questions

**DUTY D:
Diagnosing and Repairing Fuel System**

Task:

D001: Diagnose and determine needed repair on fuel system

Definition: Identification should include the following:

- review basic troubleshooting procedures followed for repair of fuel systems (i.e. gas cap, tank, hoses, filter, fuel, carburetor)

Process/Skill Questions

D002: Remove and replace the fuel tank and fuel lines.

Definition: Identification should include the following:

- review procedures listed in manufacture's repair manual

Process/Skill Questions

D003: Remove and replace the fuel filter systems.

Definition: Identification should include the following:

- review procedures listed in manufacture's repair manual
- confirm direction of fuel flow through filter

Process/Skill Questions

D004: Diagnose and determine needed repair on air cleaner system.

Definition: Identification should include the following:

- review basic troubleshooting procedures followed for repair of air cleaner system
- replace air filters per repair manual schedule

Process/Skill Questions

D005: Service foam-type air cleaner.

Definition: Identification should include the following:

- wash foam air cleaner with soap and water, dry, and oil; extract excess oil

Process/Skill Questions

D006: Service dry element-type air cleaner.

Definition: Identification should include the following:

- replace dry element air cleaners as required

Process/Skill Questions

D007: Disassemble, clean, and inspect diaphragm-type carburetor.

Definition: Identification should include the following:

- review procedures as listed in the Walbro, Zama, or Tillotson repair manuals

Process/Skill Questions

D008: Reassemble and adjust a diaphragm-type carburetor.

Definition: Identification should include the following:

- review reassembly procedures using appropriate repair manuals
- replace gaskets, diaphragms, needle and seal as require
- set fulcrum correctly
- replace gasket and diaphragm in correct sequence
- adjust settings as specified by manufacturer

Process/Skill Questions

D009: Disassemble, clean, and inspect a float-type carburetor.

Definition: Identification should include the following:

- review disassembly procedures using appropriate repair manuals
- check for carburetor oxidation and faulty float

Process/Skill Questions

D010: Reassemble and adjust float-type carburetor.

Definition: Identification should include the following:

- review reassembly procedures using appropriate repair manuals
- check float level according to repair manual after reassembly

Process/Skill Questions

D011: Disassemble, clean, and inspect fuel pump.

Definition: Identification should include the following:

- review procedures using the appropriate repair manuals
- identify type fuel pump
- determine condition and repair or replace as required

Process/Skill Questions

D012: Reassemble and install fuel pump.

Definition: Identification should include the following:

- review reassembly procedures to ensure sequence of assembly using appropriate repair manuals

Process/Skill Questions

D013: Clean crankcase breather

Definition: Identification should include the following:

- assess condition and clean or replace as required

Process/Skill Questions

**DUTY E:
Diagnosing and Servicing General Electrical System**

Task:

E001: Read a multimeter

Definition: Identification should include the following:

- understand function of all switch settings (i.e. AC, DC, OHMs, AMPs, Volts)
- discuss correct placement of probes

Process/Skill Questions

E002: Apply electrical theory.

Definition: Identification should include the following:

- explain Ohms Law and associated formula
- diagram Ohms Law using a triangle
- discuss structure of atom

Process/Skill Questions

E003: Service and repair DC electric starter/generator.

Definition: Identification should include the following:

- check field with a V.O.A. Meter
- clean commutator and check brushes
- check for shorts in armature using a growler

Process/Skill Questions

E004: Troubleshoot the charging circuit using a manufacturer's guide.

Definition: Identification should include the following:

- define symbols used in circuit design
- review basic troubleshooting methodology
- discuss function of charging circuits
- review elements of a charging circuit

Process/Skill Questions

E005: Remove pulley and belt.

Definition: Identification should include the following:

- review removal procedures using the appropriate repair manual

Process/Skill Questions

E006: Replace starter/generator pulley assembly and belt.

Definition: Identification should include the following:

- review replacement procedures using the appropriate repair manual

Process/Skill Questions

E007: Remove and inspect alternator.

Definition: Identification should include the following:

- review procedures for inspecting alternator

Process/Skill Questions

E008: Replace alternator components.

Definition: Identification should include the following:

- check diodes using a V.O.A. Meter for continuity of Ohms
- replace diodes as required

Process/Skill Questions

E009: Test and charge the battery.

Definition: Identification should include the following:

- check battery fluid levels
- determine battery charge using load tester or hydrometer
- charge good battery using correct voltage

Process/Skill Questions

E010: Repair and/or replace starter.

Definition: Identification should include the following:

- list the basic elements of a starter and their functions
- check and repair starter using a repair manual

Process/Skill Questions

E011: Troubleshoot and repair starting circuit.

Definition: Identification should include the following:

- check battery, key switch, solenoid, and starter motor using a V.O.A. according to repair manual
- check all wires and connections for shorts or grounds

Process/Skill Questions

**DUTY F:
Diagnosing and Servicing Manual Starting System**

TASK:

F001: Diagnose and determine needed repair on manual starting system.

Definition: Identification should include the following:

- diagnose and repair a manual starter using the appropriate repair manual
- check handle, rope, spring and recoil mechanism

Process/Skill Questions

F002: Replace starter spring.

Definition: Identification should include the following:

- remove starter spring according to repair manual
- install new spring per repair manual

Process/Skill Questions

F003: Replace a starter clutch if needed.

Definition: Identification should include the following:

- state function of a starter clutch
- list components of a starter clutch
- review replacement of a starter clutch using the appropriate repair manual

Process/Skill Questions

F004: Replace starter pawls.

Definition: Identification should include the following:

- state function of the starter pawls
- review procedures for replacement of the starter pawls using the appropriate repair manual

Process/Skill Questions

F005: Replace a worn or defective cup.

Definition: Identification should include the following:

State function of a starter cup

- remove starter cup from flywheel
- torque cup nut per repair manual using a torque wrench

Process/Skill Questions

F006: Replace starter rope.

Definition: Identification should include the following:

- review procedures for replacing the starter rope per the repair manual

Process/Skill Questions

**DUTY G:
Diagnosing and Servicing Ignition System**

TASK:

G001: Remove, inspect, adjust, and install sparkplugs.

Definition: Identification should include the following:

- use appropriate tool for removal of spark plug
- inspect electrodes for wear and correct gap

Process/Skill Questions

G002: Remove, inspect, and replace the flywheel.

Definition: Identification should include the following:

- remove flywheel using correct puller
- inspect and reinstall flywheel in accordance with repair manual
- attach flywheel nut and torque in accordance with repair manual

Process/Skill Questions

G003: Remove, inspect, and replace points and condenser system

Definition: Identification should include the following:

- review procedures used to remove, inspect, and install the correct points and condenser list in the engine manufacture's repair manual

Process/Skill Questions

G004: Adjust armature air gap.

Definition: Identification should include the following:

- describe use of x-ray film or microfiche between the flywheel and coil to set air gap

Process/Skill Questions

G005: Test and replace coil/magneto.

Definition: Identification should include the following:

- using a spark tester discuss what to look for in spark color
- replace coil in the absence of spark

Process/Skill Questions

G006: Test and replace ignition wires.

Definition: Identification should include the following:

- check Ohms in spark plug wires using a V.O.A. meter per guidance for repair manual

Process/Skill Questions

G007: Test and replace safety switch.

Definition: Identification should include the following:

- check Ohms on safety switches using a V. O. A. meter
- define N.O. and N.C.

Process/Skill Questions

DUTY H:
Diagnosing and Repair 2 and 4-Cycle Engine

TASK:

H001: Apply 2 and 4-cycle engine theory.

Definition: Identification should include the following:

- discuss 2 and 4 cycle engine theory
- list the cycles in sequence for both type engines
- explain use of needle bearings in 2 cycle engines
- discuss relationship between crank shaft revolutions and cycles
- explain purpose for oil/gas mixture

Process/Skill Questions

H002: Diagnose and determine needed repair on 2 and 4-cycle engine components

Definition: Identification should include the following:

- use troubleshooting chart to diagnose and determine needed repair
- interview equipment owner as part of troubleshooting process

Process/Skill Questions

H003: Disassemble 2 and 4-cycle engine.

Definition: Identification should include the following:

- review disassembly process as described in repair manual

Process/Skill Questions

H004: Install piston.

Definition: Identification should include the following:

- describe procedure for installing a piston in a cylinder

Process/Skill Questions

H005: Install piston rings.

Definition: Identification should include the following:

- describe function of a ring expander
- list sequence for installing piston rings on a piston
- review procedure for installing piston rings on a piston

Process/Skill Questions

H006: Determine wear on internal engine parts using specialized tools.

Definition: Identification should include the following:

- explain function and use of inside and outside micrometers
- describe procedure for measuring internal wear of engine parts

Process/Skill Questions

H007: Ridge ream top of cylinder.

Definition: Identification should include the following:

- explain function and use of a ridge reamer
- describe procedure for removing the ridge from top of a cylinder

Process/Skill Questions

H008: Bore and deglaze cylinder

Definition: Identification should include the following:

- review procedures for boring or deglazing a cylinder as listed in repair manual
- determine involvement of a machine shop as required

Process/Skill Questions

H009: Reassemble long block.

Definition: Identification should include the following:

- replace connecting rods
- install a crankshaft
- install a camshaft
- install oil seals and gaskets
- install valve train components

Process/Skill Questions

H010: Replace cylinder and cylinder head on 2 and 4 cycle engines

Definition: Identification should include the following:

- review procedures for replacing cylinder and cylinder heads per repair manual

Process/Skill Questions

DUTY I
Diagnosing and Servicing Lawnmowers

Task:

I001: Adjust clutch controls (i.e., cables, rods, and springs).

Definition: Identification should include the following:

- describe function of clutch controls
- review procedures for adjusting clutch controls as listed in repair manual

Process/Skill Questions

I002: Inspect and service mower decks.

Definition: Identification should include the following:

- check deck for holes, rust, and bent hangers using diagrams from repair manual

Process/Skill Questions

I003: Set height of cut.

Definition: Identification should include the following:

- describe mechanism used to adjust cutting height
- review procedures for adjusting cut height as listed in repair manual

Process/Skill Questions

I004: Lubricate mower.

Definition: Identification should include the following:

- describe function of zerk fittings
- list location of zerk fittings
- use appropriate repair manual to locate fittings

Process/Skill Questions

I005: Grind and balance rotary blade.

Definition: Identification should include the following:

- list safety equipment used while sharpening a blade
- describe safety procedures for a grinder
- describe grinding procedure
- explain procedure for balancing rotary blade

Process/Skill Questions

I006: Diagnose needed repair for self-propelled drive system on walk behind mower

Definition: Identification should include the following:

- describe function of components of self-propelled drive system
- inspect primary components of a self-propelled drive system
 - gears
 - belt
 - idler pulley
- perform required maintenance in accordance with repair manual

Process/Skill Questions

I007: Inspect and service steering assembly.

Definition: Identification should include the following:

- list components of steering assembly
- explain function of steering components
- review servicing procedures for steering assembly per repair manual

Process/Skill Questions

I008: Replace and adjust drive trans and PTO (power take-off) belts.

Definition: Identification should include the following:

- describe function of PTO belts
- determine correct replacement belt per repair manual as required
- adjust belt tension in accordance with repair manual

Process/Skill Questions

I009: Replace and adjust throttle cable.

Definition: Identification should include the following:

- review throttle cable adjustment in accordance with repair manual
- select correct throttle cable from parts manual
- review throttle cable replacement and adjustment procedures in accordance with repair manual

Process/Skill Questions

I010: Inspect and/or replace brake pad.

Definition: Identification should include the following:

- review standards for brake pad wear and replacement
- describe procedures for brake pad replacement

Process/Skill Questions

I011: Test the kill switch.

Definition: Identification should include the following:

- check Ohms on kill switch using a V.O.A. meter

Process/Skill Questions

**DUTY J:
Diagnosing and Servicing Chain Saw**

Task:

J001: Diagnose needed repair on chain saw.

Definition: Identification should include the following:

- use troubleshooting chart to determine required repair in accordance with repair manual

Process/Skill Questions

**DUTY K:
Troubleshoot cutter problem.**

Task:

K001: Sharpen and adjust or replace chain.

Definition: Identification should include the following:

- explain chain pitch
- determine size of chain pitch
- determine type file or sharpening stone to be used
- describe sharpening process

Process/Skill Questions

K002: Set chain depth gauge.

Definition: Identification should include the following:

- file depth gauge to a round point

Process/Skill Questions

K003: Check and adjust chain oiler.

Definition: Identification should include the following:

- describe purpose of chain oiler
- list elements to be checked
- adjust chain oiler in accordance with repair manual

Process/Skill Questions

K004: Lubricate bar nose sprocket.

Definition: Identification should include the following:

- describe purpose of nose sprocket
- list which chain saw bars require nose sprocket lubrication

Process/Skill Questions

K005: Inspect and replace worn sprocket and clutch.

Definition: Identification should include the following:

- review inspection procedures in repair manual
- review replacement procedures for sprocket and clutch in repair manual

Process/Skill Questions

**DUTY L:
Diagnosing and Servicing String Trimmer**

Task:

L001: Diagnose needed repair on string trimmer.

Definition: Identification should include the following:

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Process/Skill Questions

L002: Conduct maintenance on shaft.

Definition: Identification should include the following:

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Process/Skill Questions

L003: Wind and trim cutter head.

Definition: Identification should include the following:

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Process/Skill Questions

**DUTY M:
Diagnosing and Servicing Cooling Systems**

Task:

M001: Apply cooling system theory.

Definition: Identification should include the following:

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-

Process/Skill Questions

M002: Identify liquid cooling system components.

Definition: Identification should include the following:

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- - radiator
 - water pump
 - inlet hoses
 - thermostat

Process/Skill Questions

M003: Identify air-cooling system components.

Definition: Identification should include the following:

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- - fly wheel fins
 - air baffles
 - engine fins
 - oil

Process/Skill Questions

**DUTY N:
Diagnosing and Servicing Governor Systems**

Task:

N001: Apply governor system theory.

Definition: Identification should include the following:

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Process/Skill Questions

N002: Inspect, adjust, and replace pneumatic system

Definition: Identification should include the following:

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Process/Skill Questions

N003: Inspect, adjust, and replace mechanical system

Definition: Identification should include the following:

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Process/Skill Questions

**DUTY O:
Diagnosing and Servicing Exhaust Systems**

Task:

O001: Apply exhaust system theory

Definition: Identification should include the following:

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Process/Skill Questions

O002: Diagnose common equipment problems in a damaged exhaust system

Definition: Identification should include the following:

-
-
- manual

Process/Skill Questions

O003: Identify cleaning procedures for exhaust ports and spark arrestor screens on 2 cycle engine

Definition: Identification should include the following:

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-
-

Process/Skill Questions

SkillsUSA

Task Definitions

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

A006: Define the customer

Definition: Process should include the following:

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

Process/Skill Questions

A007: Recognize benefits of doing a community service project

Definition: Process should include the following:

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

Process/Skill Questions

A008: Demonstrate effective communication with others

Definition: Process should include the following:

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

Process/Skill Questions

A009: Participate in a shadowing activity

Definition: Process should include the following:

- Summarize experience of job shadowing activity.

Process/Skill Questions

A010: Identify the components of an employment portfolio

Definition: Process should include the following:

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

Process/Skill Questions

A011: List proficiency in program competencies

Definition: Process should include the following:

- Complete an interpersonal competency assessment.

Process/Skill Questions

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

Task:

B001: Measure/modify short-term goals

Definition: Process should include the following:

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

Process/Skill Questions

B002: Identify stress sources

Definition: Process should include the following:

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

Process/Skill Questions

B003: Select characteristics of a positive image

Definition: Process should include the following:

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

Process/Skill Questions

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

Definition: Process should include the following:

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

Process/Skill Questions

B005: Apply team skills to a group project

Definition: Process should include the following:

- Form a team to develop a class project.

Process/Skill Questions

B006: Observe and critique a meeting

Definition: Process should include the following:

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

Process/Skill Questions

B007: Demonstrate business meeting skills

Definition: Process should include the following:

- List and discuss the basic rules to ensure an orderly and business-like meeting
- Role-play appropriate meeting skills

Process/Skill Questions

B008: Demonstrate social etiquette

Definition: Process should include the following:

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

Process/Skill Questions

B009: Complete survey for employment opportunities

Definition: Process should include the following:

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

Process/Skill Questions

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

Definition: Process should include the following:

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

Process/Skill Questions

B011: Identify customer expectations

Definition: Process should include the following:

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

Process/Skill Questions

B012: Complete a job application

Definition: Process should include the following:

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

Process/Skill Questions

B013: Identify a mentor

Definition: Process should include the following:

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

Process/Skill Questions

B014: Assemble your employment portfolio

Definition: Process should include the following:

- Develop employment portfolio

Process/Skill Questions

B015: Explore supervisory and management roles in an organization

Definition: Process should include the following:

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

Process/Skill Questions

B016: Recognize safety issues

Definition: Process should include the following:

- Discuss safety issues within a given career area

Process/Skill Questions

B017: Evaluate your proficiency in program competencies

Definition: Process should include the following:

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

Process/Skill Questions

Technical And Professional Curriculum Frameworks

Purpose

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

Basic Skills: The Content Areas

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

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

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

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

Format

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

Using The Guide

This guide was prepared with four concepts in mind:

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

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

Methods

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

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

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

Resources

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

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

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

ACADEMIC STANDARDS FOR READING AND WRITING

Strategies for Reinforcement in the Vocational-Technical Classroom

Note:

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

| Objective | Classroom Applications to Industry |
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| <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 2 examples of workplace materials* on students' reading level.</p> <p>With the first, allow students to read information and then answer brief recall questions.</p> <p>With the second example, read aloud the material but do not give a handout. Ask brief recall questions.</p> <p>Compare the differences...how do students retain information better—orally or visually? Discuss learning styles and impact on the job.</p> |
| <p><i>Follow,</i> Give oral instructions.</p> | <p>Using instructions for a hands-on task, have students give <u>oral</u> instructions to a partner or group. Rate the effectiveness of the speaker.</p> |

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

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

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

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

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

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

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

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

ACADEMIC STANDARDS FOR MATHEMATICS

Strategies for Reinforcement in the Vocational-Technical Classroom

Note:

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

Topics Listing

Problem Solving
 Operations and Calculations
 Applications
 Data Analysis and Display

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

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| | <p> Guess and check Logical Reasoning Make a graph Make an organized list Make a table Solve a simpler problem Use a simulation Work backwards Write an equation </p> <p> Locate information you need Do you have all the components? </p> <p> Get missing information May need to perform some other calculations </p> <p> Calculate Look at the answer. How should the remainder be expressed? </p> <p> Check the solution Is it reasonable? </p> |
| OPERATIONS AND CALCULATIONS | |
| <p><i>Read, write, and count numbers.</i></p> | <p>Read and write numbers (especially focus on very large and very small numbers where mistakes are common).</p> <p>Give a weekly quiz asking students to compare and sequence numbers. Example: 0.4445 ___ 0.4455 > or <</p> <p>Put these in order from smallest to largest: 0.66, 0.677, 0.67</p> |
| <p><i>Round numbers.</i></p> | <p>Discuss your industry's use of decimals.</p> <p>Identify the place values needed to adequately perform a job. For example, a Quality Assurance Technician who works on the line in a manufacturing plant may need to use numbers through the ten-thousandths decimal place.</p> |

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

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

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

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

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

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

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

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

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

ACADEMIC STANDARDS FOR SCIENCE

Strategies for Reinforcement in the Vocational-Technical Classroom

Note:

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

Topics Listing

General Science- topics not specific to a content area

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

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

Anatomy Ecology
Viruses
Bacteria
Plants

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

Note:

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

Objective

Classroom Applications to Industry

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

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

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

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

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

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

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

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

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

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

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

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

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

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| | Explain concepts of air pressure. |
| <i>Understand</i> basic principles of the solar system. | Demonstrate how the sun strikes the earth at different angles depending on location. |
| <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 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> |
| <i>Learn and apply</i> concepts relating to the oceans. | <p>Label the major oceans and seas.</p> <p>Determine the elements in ocean water (nearly all elements are present).</p> <p>Identify or draw the structural components of the ocean floor.</p> <p>Explain the relationship between the moon and the tides.</p> <p>Explore ways the ocean is used for power and business.</p> |
| <i>Investigate</i> principles of water. | <p>Identify the parts of the water cycle and the effects of the processes involved.</p> <p>Define water's chemical properties water is the universal solvent water has a neutral ph of 7</p> |

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

Crosswalk to Skills USA POWER EQUIPMENT TECHNOLOGY

Purpose

To evaluate each contestant's preparation for employment and recognize outstanding students for excellence and professionalism in engine and equipment diagnostics, overhaul and repair of both liquid and air-cooled engines and related power equipment. First, refer to General Regulations, Page 9.

Clothing Requirement

Official SkillsUSA light blue work shirt and navy pants, black or brown leatherwork 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 small air-cooled engine repair or power equipment-related repair programs with that as its occupational objective.

Equipment and Materials:

- Supplied by the technical committee:
 - All necessary engines, engine parts, work stations, test stands, power equipment, gasoline, oil and all basic hand tools as well as necessary specialty tools
 - Industry manuals, including service and repair instruction manuals
 - All necessary information and furnishings for judges and technical committee
- Supplied by the contestant:
 - Precision measuring tools (to measure cylinder bore, crankshaft journals, etc.)
 - V.O.A. meter capable of reading 10 amps, DC
 - Tachometer capable of reading up to 12,000 rpm (for two-cycle power units)
 - Ignition tester (to check spark) capable of testing the various manufacturers

Scope of the Contest

The contest will cover engine component identification, engine operation diagnosis, failure analysis, and repair and testing of engines and related power equipment.

Contestants will visit a series of testing stations. The stations will test the contestant's knowledge of various operating systems. Component identification and repair, troubleshooting, and other aspects of the small engine repair business will be covered.

Contestants will take a written test as part of the contest orientation meeting before the skill portion. The test could cover manufacturer's engines, parts identification, ordering and/or related equipment. There will also be the possibility of additional written portions during the day of the skill event.

Contestants should have knowledge of two-cycle and four-cycle engines, 2 through 20 horsepower, and of both L-head and overhead valve design as well as both single and twin cylinder design.

Contestants will demonstrate their ability to perform jobs or skills selected from the following list of competencies as determined by the SkillsUSA Championships technical committee. Committee membership includes: Briggs & Stratton Corp.; Generac Products; Kohler Co.; Tecumseh Products Corp.; and Sears, Roebuck and Co.

- Ignition
 - Disassemble ignition system
 - Inspect and test ignition components
 - Check coil/ignition module output
 - Test and repair/replace electronic ignition components
 - Reassemble ignition system
 - Test equipment related switches and harnesses
- Fuel System
 - Inspect, service, repair and adjust carburetor
 - Inspect, clean and replace filters

- Check fuel tank, valves and lines
- Inspect and service/repair fuel pumps
- Test equipment-related fuel tanks, lines and related systems
- Governor
 - Disassemble, inspect, service and reassemble governor
- Starter System
 - Inspect starter system
 - Disassemble, service and adjust starting system
 - Reassemble starting system
 - Test and troubleshoot wiring schematics of power-related equipment
- Cooling System
 - Inspect, test and troubleshoot both liquid and air-cooled cooling systems of both engines and equipment.
- Lubricating System
 - Inspect and service lubrication system
 - Check oil level and/or fuel/oil mixture
- Valve and Ports
 - Inspect and service valve train components
 - Check and clean ports
 - Check and adjust valves. *240 SkillsUSA Championships Technical Standards (2002–2004)*
- Exhaust System
 - Inspect and service exhaust components
- Engine Block Components
 - Disassemble engine
 - Inspect and determine ring end gap
 - Inspect and measure crankshaft and connecting rod bearing journals
 - Inspect and measure cylinders, piston and rings
 - Recondition or replace internal parts
 - Correct torque of critical fasteners
 - Replace gaskets and/or sealants

- Reassemble engine
- Test running adjustments
- Diagnostic Tests
 - Test crankcase vacuum
 - Diagnose and correct vacuum/breather problems
 - Test compression and/or leakdown
 - Diagnose and correct compression problems
- Failure Analysis
 - Analyze failed engine components to determine failure cause
 - Determine best method to repair failure
 - Estimate cost of repair
- Shop Procedures
 - Use of proper techniques in the care and use of tools and equipment
 - Demonstrate ability to work accurately with precision instruments
 - Use proper safety procedures
 - Demonstrate ability to use service manuals and/or bulletins
 - Perform tasks within assigned time limits
 - Give a verbal response to a customer and/or customer-related problematic question
- Business Operation
 - Demonstrate ability to look up part numbers
 - Prepare shop repair ticket
 - Prepare a warranty claim
 - Prepare a parts and labor invoice
 - Calculate costs accurately
- Power Equipment Operation
 - Understand and operate equipment within equipment manufacturer's guidelines
 - Isolate engine from transmission and/or attachments
 - Prep equipment for delivery. *Sponsored by Goodheart-Willcox Publisher 241*

Note: An Oral Professional Assessment will be included. Points to be determined by national technical committee..242 *SkillsUSA Championships Technical Standards (2002–004)*. Sponsored by Goodheart-Willcox Publisher 243

Arkansas's All Aspects of Industry

Defining “All Aspects”

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Working with selected community groups to implement safety programs.

Small Engine Repair Framework Cross Reference

Small Engine Repair I

| | | |
|---------------|--------------------------------------|---------------------|
| Unit 1 | Safety | Duty(s): A |
| Unit 2 | Tools and Equipment | Duty(s): B |
| Unit 3 | Small Gas Engine Theory | Duty(s): H |
| Unit 4 | Engine Systems | Duty(s): H |
| Unit 5 | Bar and Chain Mechanism | Duty(s): J |
| Unit 6 | Bar Service | Duty(s): J |
| Unit 7 | Chain Service | Duty(s): J |
| Unit 8 | The VICA Student Organization | Duty(s): A,B |

Small Engine Repair II

| | | |
|---------------|--------------------------------------|---------------------|
| Unit 1 | Service and Maintenance | Duty(s): I |
| Unit 2 | Troubleshooting | Duty(s): |
| Unit 3 | Engine Overhaul | Duty(s): |
| Unit 4 | Hydraulic Systems | Duty(s): |
| Unit 5 | Brake Systems | Duty(s): |
| Unit 6 | Transmissions and Transaxles | Duty(s): |
| Unit 7 | Steering and Alignment | Duty(s): |
| Unit 8 | Equipment Drive Systems | Duty(s): |
| Unit 9 | The VICA Student Organization | Duty(s): A,B |