(TASK STATEMENT) PLAN AND INSTALL WATERING SYSTEMS

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Pipe Pumps Sprinklers Tools Electrical Small engines Wind Water jack	Determine water needs Design system Calculate material needs Determine proper pipe connections Select materials Gather tools Complete preparations Install system Test operate system Adjust system	Wear safety glasses Protective clothing Caution around electrical systems Care with fuel oil or gas Open ditches or trenches Working overhead

DECISIONS	CUES	ERRORS
Determine water needs Determine proper pipe connections	Terrain needs Water availability Cost considerations Proposed terrain use Municipal codes Blueprints Cost considerations Pressure load	Safety hazard Time and material waste Costly Ineffective system

(TASK STATEMENT) PLAN AND INSTALL WATERING SYSTEMS

SCIENCE	MATH – NUMBER SYSTEMS
	Using level and transite Measuring devices Addition and subtraction of whole numbers Reduction of fractions Addition and subtraction of decimal fractions Measures of length Measures of weight Measures (liquid and dry) Determination of area, perimeter and diagonals of quadrilaterals Determination of area and circumference of circles Use of arcs or chords in determining facts about a circle or its parts Ratio and proportion Measure with the Metric and English system and convert between them

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Manuals Warning signs	Read and interpret tables, charts and/or graphs

(TASK STATEMENT) MAINTAIN AND DISASSAMBLE WATERING SYSTEMS

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Tools Pipe Pumps Nozzles Measuring	Inspect system conponents Clean Service and adjust components Disassemble during non-use	Wear safety glasses Protective clothing Caution around electrical systems Care with fuel, oil, or gas Open ditches or trenches Working overhead
DECISIONS Implied - application of maintainance procedure Determine method of shut-down	**CUES** Season of year Cost considerations Weather Municipal codes	**ERRORS** Excessive wear Weather abuse Ineffective system

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(TASK STATEMENT) MAINTAIN AND DISASSEMBLE WATERING SYSTEMS

SCIENCE	MATH – NUMBER SYSTEMS
	Using level and transite Measuring devices Addition and subtraction of whole numbers Reduction of fractions Addition and subtraction of decimal fractions Measures of length Measures of weight Measures (liquid and dry) Determination of area, perimeter and diagonals of quadrilaterals Use of arcs or chords in determining facts about a circle or its parts Ratio and proportion Measure with the Metric and English system and convert between them

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Manual	Read and interpret tables, charts and/or graphs

Duty M Maintaining Trucks and Forklifts

1 Select trucks and forklifts
2 Maintain trucks and forklifts
3 Test operate trucks and forklifts

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(TASK STATEMENT) SELECT TRUCKS AND FORKLIFTS

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Manufacturer's specifications	Identify types of trucks and forklifts Select type needed	

DECISIONS	CUES	ERRORS
Determine type needed for specific tasks	Prior knowledge Company policy Type of task to be completed Cost consideration Proposed use	Costly Unable to handle assigned tasks

'ASK STATEMENT) SELECT TRUCKS AND FORKLIFTS

SCIENCE	MATH – NUMBER SYSTEMS

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Manual	Read and interpret tables, charts, and/or graphs

(TASK STATEMENT) MAINTAIN TRUCKS AND FORKLIFTS

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY -- HAZARD
Tools Trucks Forklifts Fuel Lubricants	Inspect equipment Clean equipment Lubricate Service and adjust components	Use caution around cleaning fluids Do not overheat plastic parts Do not use fuels around rubber parts
DECISIONS Implied - application of maintainance procedure	**CUES**	**ERRORS** Poor performance Loss of fuel and power Material waste Excessive wear

(TASK STATEMENT) MAINTAIN TRUCKS AND FORKLIFTS

SCIENCE

Simple machines used to gain mechanical advantage.
Work input, work output, friction and efficiency in simple machines
Effect of heating and cooling on expansion of materials
Fluids under pressure [Carburetor]
Composition of matter, including protons, neutrons, electrons, atoms, molecules, elements [Type of fluids or steam which will clean parts of engines (capatability of liquid)]
Transfer of heat from one body to another [Mufflers]
Resistance of materials to flow of electrical current [Plug points]
Effects of friction on work processes and product quality [Rusty parts overheating]
Relationship of force to distortion in an elastic body [Do not over tighten]

MATH – NUMBER SYSTEMS

Read and interpret charts, tables, and/or graphs
Measure with the Metric and English system and convert between them
Locate by approximation rational numbers and integers on the number line [Sizes of engines and parts]
Given a coding system, recognize and identify each unit involved by assigning necessary symbols, numerical or literal [Viscosity]
Given an instrument of measure, determine precision and/or accuracy, with respect to relative error and significant digits [Rules, gauges]

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Manual	Read and interpret tables, charts, and graphs

(TASK STATEMENT) TEST OPERATE TRUCKS AND FORKLIFTS

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Tools Trucks Forklifts Fuel Lubricants	Fuel Lubricate Start Test Perform test operations Adjust	Servicing and maintaining engines Identify engine types and needs Clean, service, and adjust an engine Fuel, start and test an engine Overhaul an engine
DECISIONS Determine proper setting of adjustments	**CUES** Gauges Manual Prior knowledge Proposed use of truck	**ERRORS** Poor performance Wasted time and materials

(TASK STATEMENT) TEST OPERATE TRUCKS AND FORKLIFTS

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage [Starters] Work input, work output, friction and efficiency in simple machines Effect of heating and cooling on expansion of materials [Exhaust - fuels] Effect of heating and cooling on state of matter [Carburation] Fluids under pressure [Carburation - ignition]	Locate by approximation rational numbers and integers on the number line Volume of lubricants and fuels

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Manual	Read and interpret tables, charts and/or graphs

Duty N Maintaining Tractors and Related Equipment

1 Identify tractors and types of equipment
2 Maintain tractors and related equipment
3 Test operate equipment with tractor

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(TASK STATEMENT) IDENTIFY TRACTORS AND TYPES OF EQUIPMENT

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Tractor Attached equipment Disk Grader Slip scraper Rock rake Post digger Vermeer spade Wagon Lift Loaders Spreaders Sprayers Planters Harvesters	Determine equipment needs Differentiate between types of machines Types of related machines Principles of operation Functions and use of equipment	

DECISIONS	CUES	ERRORS
Determine type needed for specific task	Prior knowledge Company policy Type of task to be completed Cost consideration Porposed use	Costly Unable to handle assigned tasks

(TASK STATEMENT) IDENTIFY TRACTORS AND TYPES OF EQUIPMENT

SCIENCE	MATH – NUMBER SYSTEMS
	Locate by approximation rational numbers integers on the number line [Determine engine size.

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Manual Specification plates	

(TASK STATEMENT) MAINTAIN TRACTORS AND RELATED EQUIPMENT

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Tractor and related equipment Lubrication Fuels Hand tools Testing equipment Jacks	Check oil pressures Check tire pressures Service equipment Repair equipment Parts of tractor and equipment	
DECISIONS Implied-application of procedure	**CUES**	**ERRORS** Poor performance Loss of fuel and power Material waste Excessive wear

(TASK STATEMENT) MAINTAIN TRACTORS AND RELATED EQUIPMENT

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines Effect of heating and cooling on expansion of materials Effect of heating and cooling on state of matter Fluids under pressure [Carburetor] Composition of matter, including protons, neutrons, electrons, atoms, molecules, elements [Type of fluids or steam which will clean parts of engines (compatability of liquid)] Transfer of ehat from one body to another [Mufflers] Resistance of materials to flow of electrical current [Plug points] Effects of friction on work processes and product quality [Rusty parts overheating] Relationship of force to distortion in an elastic body [Do not over tighten]	Read and interpret charts, tables, and/or graphs Measure with the Metric and English system and convert between them Locate by approximation rational numbers and integers on the number line [Sizes of engines and parts] Given an instrument of measure, determine precision and/or accuracy, with respect to relative error and significant digits [Rules, gauges] Volume of liquid fuels Given a coding system, recognize and identify each unit involved by assigning necessary symbols, numerical or literal [Viscosity]

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Manual	

(TASK STATEMENT) TEST OPERATE EQUIPMENT WITH TRACTOR

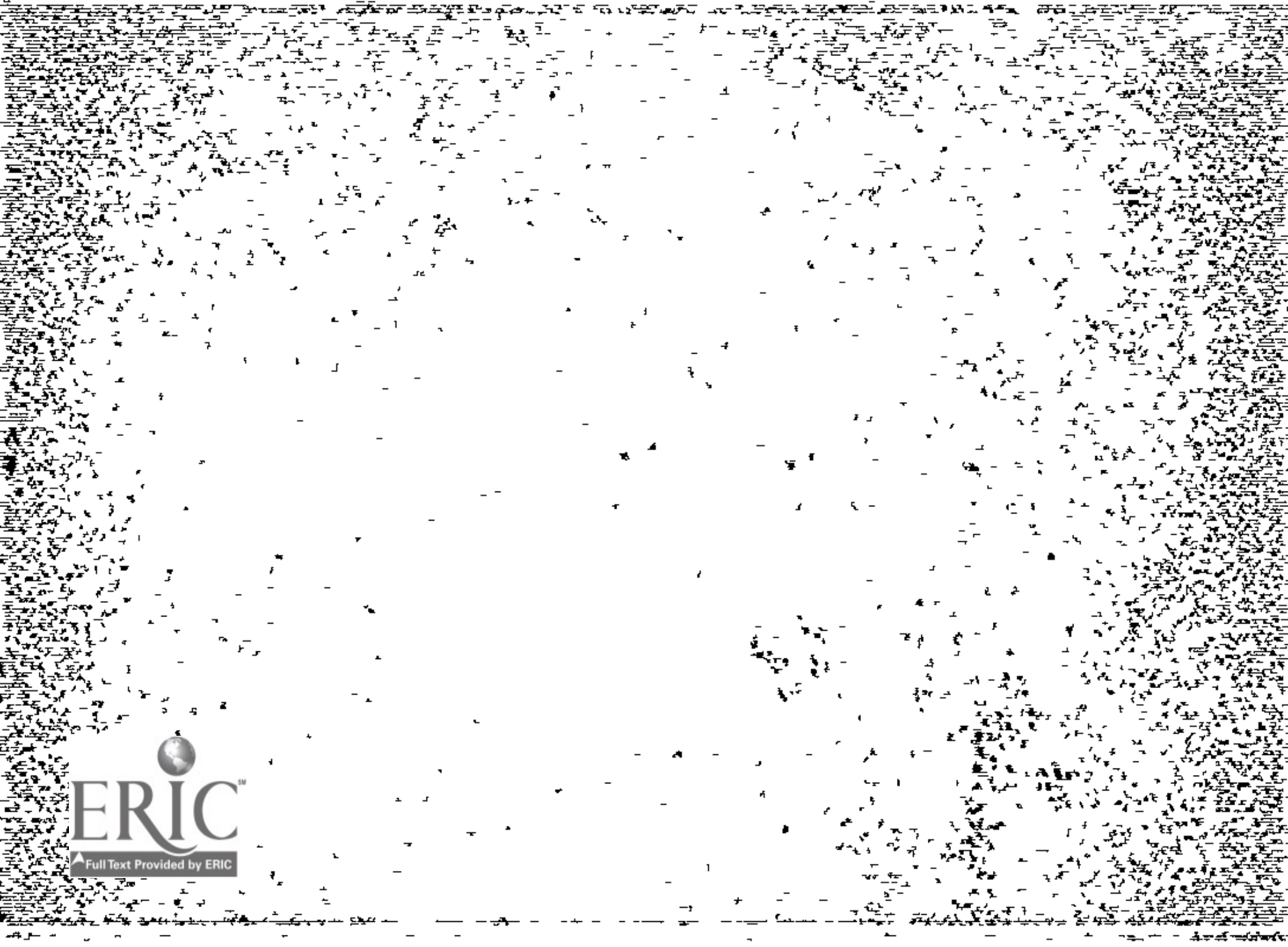
TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Tractor Attached equipment Disk Grader Slip scraper Rock rake Post digger Vermeer spade Wagon Lift Loaders Spreaders Sprayers Planters Harvesters	Hitch to tractor Connect power take off Connect hydraulic Hook-up belts Type of tractors Starting/stopping Tire slippage Tractor weights Tractor speed Towing Operation procedures	Do not touch moving belts, shafts, or pulleys Protective clothing Care with fuel
DECISIONS Determine proper seting of adjustments	**CUES** Gauges Manual Prior knowledge Proposed use of truck	**ERRORS** Poor performance Wasted time and materials

ASK STATEMENT) TEST OPERATE EQUIPMENT WITH TRACTOR

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage [Starters] Work input, work output, friction and efficiency in simple machines Effect of heating and cooling on expansion of materials [Exhaust - fuels] Effect of heating and cooling on state of matter [Carburation] Fluids under pressure [Carburation - ignition]	Locate by approximation rational numbers and integers on the number line Volume of lubricants and fuels

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Manual	Read and interpret tables, charts and/or graphs



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ABSTRACT

The general purpose of the occupational analysis is to provide workable, basic information dealing with the many and varied duties performed in the horticulture equipment and services occupation. The document opens with a brief introduction followed by a job description. The bulk of the document is presented in table form. Fourteen duties are broken down into a number of tasks and for each task a two-page table is presented, showing on the first page: tools, equipment, materials, objects acted upon; performance knowledge (related also to decisions, cues and errors); safety--hazard; and on the second page: science; math--number systems; and communications (performance modes, examples, and skills and concepts). The duties include: fitting, repairing, and using shop tools and equipment; servicing and maintaining engines, hydraulics, and turf equipment; installing, servicing, and maintaining an electrical system; maintaining water systems, tree and shrub equipment, artificial environment controls, trucks and forklifts, and tractors and related equipment; maintaining and testing steam generators; testing and caring for spraying and spreading equipment; installing, testing and caring for irrigation and sprinkler systems; and carpentry and masonry maintenance and construction. (BP)

Occupational Analysis

HORTICULTURE EQUIPMENT OPERATOR AND MECHANIC

Instructional Materials Laboratory
Trade and Industrial Education
The Ohio State University

5111

AN ANALYSIS OF THE HORTICULTURE EQUIPMENT AND SERVICES OCCUPATION

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Director: Tom L. Hindes
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The Instructional Materials Laboratory
Trade and Industrial Education
The Ohio State University

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FOREWORD

The occupational analysis project was conducted by The Instructional Materials Laboratory, Trade and Industrial Education, The Ohio State University in conjunction with the State Department of Education, Division of Vocational Education pursuant to a grant from the U.S. Office of Education.

The Occupational Analysis project was proposed and conducted to train vocational educators in the techniques of making a comprehensive occupational analysis. Instructors were selected from Agriculture, Business, Distributive, Home Economics and Trade and Industrial Education to gain experience in developing analysis documents for sixty-one different occupations. Representatives from Business, Industry, Medicine, and Education were involved with the vocational instructors in conducting the analysis process.

The project was conducted in three phases. Phase one involved the planning and development of the project strategies. The analysis process was based on sound principles of learning and behavior. Phase two was the identification, selection and orientation of all participants. The training and workshop sessions constituted the third phase. Two-week workshops were held during which teams of vocational instructors conducted an analysis of the occupations in which they had employment experience. The instructors were assisted by both occupational consultants and subject matter specialists.

The project resulted in producing one hundred two trained vocational instructors capable of conducting and assisting in a comprehensive analysis of various occupations. Occupational analysis data were generated for sixty-one occupations. The analysis included a statement of the various tasks performed in each occupation. For each task the following items were identified: tools and equipment; procedural knowledge; safety knowledge; concepts and skills of mathematics, science and communication needed for successful performance in the occupation. The analysis data provided a basis for generating instructional materials, course outlines, student performance objectives, criterion measures as well as identifying specific supporting skills and knowledge in the academic subject areas.

PREFACE

This task analysis was undertaken with the understanding that it was complimenting the other eight horticulture areas.

The areas covered should allow instruction in any area of maintenance of tools or equipment. This can be used to suppliment the instruction in other areas as needed or to be taught as an individual unit on mechanical skills.

The tasks are arranged so units can be pulled on identifying, maintaining, overhauling, or test operating.

No serious depth was attempted as each teacher will know how much time he or she wants to spend and to what depth he or she wants to go.

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We wish to acknowledge the valuable assistance rendered by the following subject matter specialists. They provided input to the vocational instructors in identifying related skills and concepts of each respective subject matter area and served as training assistants in the analysis process during the two-week workshops.

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JOB DESCRIPTION

The horticulture equipment operator performs maintenance troubleshooting, overhauling, and fabrication of equipment related to the horticulture industry. The equipment might be shop tools (testing equipment), engines electrical, hydraulics, water systems, carpentry and masonry, steam generators, turf cutters, tree and shrub equipment, mechanical environment controls, spray and spreading tools, irrigation systems, trucks and forklifts, and tractors and their related equipment.

Duty A Fitting, Repairing, and Using Shop Tools and Equipment

1 Identify and select tools
2 Sharpen and repair tools
3 Measure tolerances
4 Utilize fasteners
5 Clean and store tools
6 Operate shop tools

//

(TASK STATEMENT) IDENTIFY AND SELECT TOOLS

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Small shop tools; wrenches, hammers, saws, etc Power drills Grinders Steam cleaner Welders Engine tools Specialized equipment	Identify tools Adjust and maintain tools	Proper dress and grooming Safety glasses Fire equipment Cleanliness Fuel storage Panic switches Hand safety signals Special safety equipment Stand on rubber when welding
DECISIONS	**CUES**	**ERRORS**
Determine tools needed for specific tasks Use of tools Function of tools and equipment Given a coding system, recognize and identify each unit involved by assigning necessary symbols, numerical or literal [Codes,on welding rods]	Prior knowledge Company policy Industrial codes and standards Type of task to be completed	Incompleted task Excessive wear or breakage of tools Incorrect completion Wasted time

(TASK STATEMENT) IDENTIFY AND SELECT TOOLS

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage [Mechanical advantage] Work input, work output, friction and efficiency in simple machines [Friction in tools] Effect of heating and cooling on expansion of materials [Steam expansion] Fluids under pressure [Steam under pressure] Centrifugal forces developed by bodies in rotation [Centrifugal force; grinders] Transfer of heat from one body to another [Welding] Resistance of materials to flow of electrical current [Welding] Inertia and momentum [Smaller hammer may be better] Read and interpret charts, tables, and/or graphs	Measure with the Metric and English system and convert be between them [Micrometer] Given an instrument of measure, determine precision and/or accuracy, with respect to relative error and significant [Rules, calipers, etc.] Measure pressure Compare and contrast rational numbers Linear measure (wrenches, bits)

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading Writing	Manuals Record keeping	Comprehension Classification Terminology Logic

(TASK STATEMENT) SHARPEN AND REPAIR TOOLS

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Small shop tools Power drills Grinders Steam cleaners Welders Engine tools Specialized equipment	Gather tools Inspect tools Sharpen and/or repair	Safety glasses Care around cutting edges When using electrical tools stand on rubber pads Do not lay down running tools
DECISIONS	**CUES**	**ERRORS**
Determine if tool needs sharpened or repaired Methods of sharpening Procedure to sharpen Can the tool be repaired or thrown away	Industry standards Methods available Type of tools	Hard to cut Poor condition tools Ineffective tools Hazardous tools

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(TASK STATEMENT) SHARPEN AND REPAIR TOOLS

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage [Wedge, cutting angle] Work input, work output, friction and efficiency in simple machines [Efficiency of machine] Effect of heating and cooling on state of matter [Grinding] Centrifugal forces developed by bodies in rotation [Grinding] Centripetal forces developed by bodies in rotation [Grinding] Transfer of heat from one body to another [Welding] Resistance of materials to flow of electrical current [Welding] Inertia and momentum [Power tools] Effects of friction on work processes and product quality [Grinding] Resistance of materials to change in shape [Sharpening]	Read and interpret charts, tables, and/or graphs Measures of length [Length] Measures of temperature [Heat treating]

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Manuals	Comprehension, Instruction, Description of mechanism

(TASK STATEMENT) MEASURE TOLERANCES

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Micrometers Rules Depth gauge Square Calipers Meters Gauges Scales	Gather measuring instruments Set instrument to measure the tolerance Use instrument to measure tolerance of tool	Do not drop measuring devices
DECISIONS Determine tolerance to the set Determine which instrument to use to measure the tolerance	**CUES** Master engineering guides for machines Company policy Blueprints Industrial standards Prior knowledge Tool guide manual Company policy	**ERRORS** Incomplete task Material and time waste Ruin tool or machine

(TASK STATEMENT) MEASURE TOLERANCES

	MATH – NUMBER SYSTEMS
MATH–NUMBER SYSTEMS (CON'T) a right circular cone [Area of odd shapes] Reading and interpreting charts, tables, and/or graphs Measure with the Metric and English system and convert between them Given an instrument of measure, determine precision and/or accuracy, with respect to relative error and significant digits [Rules and gauges]	Addition and subtraction of whole numbers Reduction of fractions Addition and subtraction of proper/improper fractions Addition and subtraction of decimal fractions Rounding off decimals and whole numbers Measures of length Measure of time and speed Measures of weight Liquid and dry measures [Volume and weight] Manipulation of formula involving three factors [Figuring equation] Determination of area, perimeter and diagonals of polygons with more than 4 sides, Determination of area, perimeter and diagonals of quadrilaterals, Determination of area and circumferance of circles, Determination of area and volume of rectangular, cube and right triangular prisms, Determination of lateral area, total area and volume of

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Charts Graphs Manuals	Comprehension, Instructions, Detail/ Inference, Description of mechanism, Definition, Terminology

(TASK STATEMENT) UTILIZE FASTENERS

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Threads Bolts Screws Nuts Washers Snap rings Keys Nails Rivets Cotter pins Bluing	Assemble objects to be fastened Fasten the objects	Proper use of tools Use of safety glasses
DECISIONS Determine proper fastener	**CUES** Prior knowledge Type of task Equipment manual Safety standards	**ERRORS** Hazardous equipment Material and equipment waste and ruin Incompleted task Improper completion

(TASK STATEMENT) UTILIZE FASTENERS

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage [Screws, bolts] Work input, work output, friction and efficiency in simple machines [Force] Effect of heating and cooling on expansion of materials [Heat treating] Effects of friction on work processes and product quality [Friction on bolts causing heat] Relationship of force to distortion in an elastic body [Rivets] Arrangement of molecules, atoms and ions and the effect on structure and strength of materials [Riveting] Resistance of materials to change in shape [Riveting] Read and interpret charts, tables, and/or graphs [Size and parts charts]	Measures of length [Length of fasteners] Measure with the Metric and English system and convert between them Given an instrument of measure, determine precision and/or accuracy with respect to relative error, and significant digits [Measuring length and diameter]

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Manuals	Comprehension, Description of mechanism, Definition, Terminology, Instructions

(TASK STATEMENT) CLEAN AND STORE TOOLS

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARDS
Steam cleaners Solvents Brushes Power drills Scrapers Wire brush Steel wool	Assemble tools to be cleaned Assemble proper and appropriate cleaning instruments and products Clean tools Store tools	Proper use of cleaning fluids Use of safety glasses Care around steam

DECISIONS	CUES	ERRORS
Determine proper cleaning method for each tool	Type of tool Type of material Company policy Industrial standards Manufacturer's suggested usage of cleaning products	Improper cleaning Excessive wear on tools Waste of employee time Safety hazard (possible)

(TASK STATEMENT) CLEAN AND STORE TOOLS

SCIENCE	MATH – NUMBER SYSTEMS
Effect of heating and cooling on expansion of materials [Solvents next to heat] Effect of heating and cooling on state of matter [Steam on plastic] Fluids under pressure [Steam] Centrifugal forces developed by bodies in rotation [Grinders] Centripetal forces developed by bodies in rotation [Buffers] Transfer of heat from one body to another [Steam cleaning] Inertia and momentum [Buffers] Effects of friction on work processes and product quality [Ignite parts from friction]	

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Manuals	Comprehension, Description of mechanism, Definition, Terminology, Instructions

(TASK STATEMENT) OPERATE SHOP TOOLS

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Small shop tools Power drills Grinders Steam cleaner Welders Small engine tools Specialized tools	Gather tools Observe and inspect tools Learn function of tools Learn various procedures in which tools are used Learn mechanical make-up of tool from blueprints	Use of safety glasses Caution around moving equipment Fire extinguishers Protective clothing
DECISIONS	**CUES**	**ERRORS**
Determine proper tool to use Determine proper set-up for tools Determine proper maintainance and storage of tools	Type of task Availability of tool Prior knowledge Equipment manual Company policy Energy needs of tools Safety needs of tools Prior knowledge Company policy Industrial standards Observation of tool's condition Safety considerations Company policy	Poorly maintained tools/abused tools Material waste/incompleted task

(TASK STATEMENT) OPERATE SHOP TOOLS

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines Effect of heating and cooling on expansion of materials [Welding] Fluids under pressure [Steam] Centrifugal forces developed by bodies in rotation [Grinders - drills] Centripetal forces developed by bodies in rotation [Grinders - drills] Transfer of heat from one body to another [Welding] Resistance of materials to flow of electrical current [Welding] Motion resulting from two or more forces acting on a point in a body [Hammering - drilling] Effects of friction on work processes and product quality [Bolt removal]	Measure with the Metric and English system and convert between them Locate by approximation rational numbers and integers on the number line [Differentiate sizes] Given an instrument of measure, determine precision and/or accuracy with respect to relative error, and significant digits [Rules, gauges]

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Work orders	Comprehension, Read and interpret charts, tables, and/or graphs

Duty B **Servicing and Maintaining Engines**

1 Identify engine types and needs
2 Clean, service, and adjust an engine
3 Fuel, start, and test an engine
4 Overhaul engines

(TASK STATEMENT) IDENTIFY ENGINE TYPES AND NEEDS

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Small gas engines 4 cycle engines 2 cycle engines Wankel engines Large equipment Diesels Gas engines V-8 Straight 6	Observe engine Make identification Maintain engine	

DECISIONS	CUES	ERRORS
Determine type of engine Determine model of engine Determine engine needs	Observation of engine parts Prior knowledge Engine manual Prior knowledge Engine manual Safety requirements Energy requirements Mechanical standards	Improper identification

(TASK STATEMENT) IDENTIFY ENGINE TYPES AND NEEDS

SCIENCE	MATH – NUMBER SYSTEMS
	Locate by approximation rational numbers and integers on the number line [Determine engine sizes]

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Manuals Specification plates	Comprehension, Description of mechanism, Definition, Terminology, Instructions

(TASK STATEMENT) CLEAN, SERVICE, AND ADJUST AN ENGINE

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Oil Gas Gauges Brushes Engine tools Operator's manual Solvents Model engines	Inspect engine Clean engine Service and adjust Carburetor Fuel strainer Breathers Spark plugs Change oil Service and/or check other engine components	Use caution around cleaning fluids Do not overheat plastic parts Do not use fuels around rubber parts
DECISIONS	**CUES**	**ERRORS**
Implied - application of maintainance procedure	Type of engine Sound, sight, smell while running	Poorly running engine Loss of engine fuel and power Material waste Excessive engine wear

(TASK STATEMENT) CLEAN, SERVICE, AND ADJUST AN ENGINE

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines Effect of heating and cooling on expansion of materials Effect of heating and cooling on state of matter Fluids under pressure [Carburetor] Composition of matter, including protons, neutrons, electrons, atoms, molecules, elements [Type of fluids or steam which will clean parts of engines (compatability of liquid)] Transfer of heat from one body to another [Mufflers] Resistance of materials to flow of electrical current [Plug points] Effects of friction on work processes and product quality [Rusty parts overheating] Relationship of force to distortion in an elastic body [Do not over tighten]	Read and interpret charts, tables, and/or graphs Measure with the Metric and English system and convert between them Locate by approximation rational numbers and integers on the number line [Sizes of engines and parts] Given an instrument of measure, determine precision and/or accuracy, with respect to relative error and significant digits [Rules, gauges] Volume of liquid fuels Given a coding system, recognize and identify each unit involved by assigning necessary symbols, numerical or literal [Viscosity]

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Read	Manual, charts, tables, and/or graphs	Comprehension, Detail/Inference, Description of mechanism, Definition Terminology, Instructions

(TASK STATEMENT) FUEL, START, AND TEST AN ENGINE

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Engines and related equipment Gas Oil Grease Water Funnel Gas can Fire extinguisher	Fuel engine in proper manner for engine type Lubricate engine in proper manner for engine type Start engine Test engine with gauges Adjust engine	Stay clear of moving parts Keep engines lubricated Properly dispose of solvents Do not fuel while engine running Do not fuel while engine is hot Avoid spilling fuels
DECISIONS Determine proper setting of engine adjustments	**CUES** Gauges Motor manual Prior knowledge	**ERRORS** Poor engine performance Wasted time and materials

TASK STATEMENT) FUEL, START, AND TEST AN ENGINE

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage [Starters] Work input, work output, friction and efficiency in simple machines Effect of heating and cooling on expansion of materials [Exhaust - fuels] Effect of heating and cooling on state of matter [Carburation] Fluids under pressure [Carburation - ignition]	Locate by approximation rational numbers and integers on the number line Volume of lubricants and fuels

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Read	Manuals	Directions, Safety precaution, Comprehension, Description of mechanism, Terminology, Definition

(TASK STATEMENT) OVERHAUL ENGINE

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Mechanical tools necessary for engine overhaul Mechanical supplies Overhaul manuals	Inspect engine Disassemble engine Repair or replace major running parts Reassemble Check remaining parts Adjust engine to performance standards	Use the tools properly Properly torque necessary bolts
DECISIONS	**CUES**	**ERRORS**
Determine if additional maintainance is required on the remaining parts Determine which major running parts require repair or replacement	Prior knowledge Measuring devices Motor manual Observation of part Prior knowledge Cost considerations Industrial procedure	Engine failure Poor performance Wasted time and materials

(TASK STATEMENT) OVERHAUL ENGINES

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines Effect of heating and cooling on expansion of materials Effect of heating and cooling on state of matter Magnetic fields of force [Magnets] Fluids under pressure [Carburation] Transfer of energy from one form to another [Electrical system] Transfer of heat from one body to another [Exhaust] Resistance of materials to flow of electrical current [Spark plug] Inertia and momentum [Flywheel] Effects of friction on work processes and product quality [Bearings] Chemistry of combustion Properties of oils	Measurement of parts and tolerances Locate by approximation rational numbers and integers on the number line [Part sizes] Given an instrument of measure, determine precision and/or accuracy, with respect to relative error and significant digits [Rules, micrometer] Read and interpret charts, tables, and /or graphs Measure with the Metric and English system and convert between them

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Manuals	Comprehension, Description of mechanism, Definition, Terminology, Instructions

Duty C Installing, Servicing, and Maintaining an Electrical System

1 Outline and plan a wiring system
2 Install,service, and replace parts of a wiring system

(TASK STATEMENT) OUTLINE AND PLAN A WIRING SYSTEM

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Pencil Paper Rule Tape	Select materials Determine electrical needs Design wiring drawings Calculate material needs Calculate voltage needs Determine proper electrical connections Select materials	Always work on a dead electrical system

DECISIONS	CUES	ERRORS
Determine electrical needs Determine proper electrical connections	Personal preference Safety standards Industrial requirements Municipal codes Reference wiring diagram Municipal codes Cost considerations Voltage load	Safety hazard Wiring fails Time and material waste

(TASK STATEMENT) OUTLINE AND PLAN AN WIRING SYSTEM

SCIENCE	MATH – NUMBER SYSTEMS
Ohm's Law	Wire sizes Addition and subtraction of whole numbers [Number of parts] Measures of length [Length of wire needed] Given a coding system, recognize and identify each unit involved by assigning necessary symbols, numerical or literal

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COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Electrical codes	Recognize and identify each unit involved by assigning necessary symbols, numerical or literal

(TASK STATEMENT) INSTALL, SERVICE, AND REPLACE PARTS OF A WIRING SYSTEM

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Hand tools Switches Wire Boxes Solder Meters	Inspect wiring system and motors Determine if repair or replacement is necessary Repair or replace components of electrical system	Turn off electricity at fuse block
DECISIONS	**CUES**	**ERRORS**
Determine if repair or replacement is necessary	Cost considerations Safety Municipal codes Industrial requirements	Safety hazard Time and material waste Incompleted task Poorly completed task

(TASK STATEMENT) INSTALL, SERVICE, AND REPLACE PARTS OF A WIRING SYSTEM

SCIENCE	MATH – NUMBER SYSTEMS
Effect of heating and cooling on expansion of materials [Heat of flow in small wire] Resistance of materials to flow of electrical current Ohm's Law	Measures of length [Wire length and size] Read and interpret charts, tables, and/or graphs Measure with the Metric and English system and convert between them Given an instrument of measure, determine precision and/or accuracy, with respect to relative error and significant digits [Using rules and meters]

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Wiring diagrams Electrical codes	Recognize and identify each unit involved by assigning necessary symbols, numberical or literal

Duty D Servicing and Maintaining Hydraulics

1 Identify and test operate hydraulics
2 Service pumps and parts

(TASK STATEMENT) IDENTIFY AND TEST OPERATE HYDRAULICS

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Rotary pumps Vane pumps Reciprocating pumps Centrifugal pump Lines, gasket seals, fittings, cylinders Valves Break away couplings Coolers Tanks Hoses Piston pump	Observe system Identify system Connect system Test system Adjust system Operate system	Be careful of high pressure Stay away from moving parts Potential explosion

DECISIONS	CUES	ERRORS
Determine type of system Determine proper connection of system components Determine final adjustments	Prior knowledge Observation of components Manuals Prior knowledge Safety considerations Reference manuals Industrial standards Proposed use of system Prior knowledge Test results Safety standards Standard procedure	Incompleted task Dangerous conditions Waste of materials and time Inefficient system

TASK STATEMENT) IDENTIFY AND TEST OPERATE HYDRAULICS

SCIENCE	MATH – NUMBER SYSTEMS
Pascal's Law Effect of heating and cooling on expansion of materials [Temperature of oil] Effect of heating and cooling on state of matter [Viscosity] Fluids unde· pressure [Hydraulic pressure, properties of hydraulic fluids] Transfer of heat from one body to another [Hydraulic co-valents] Effects of friction on work processes and product quality [Heat of friction]	Work input, work output, friction and efficiency in simple machines [Hydraulics efficiency] Fluids under pressure [Read gauges] Measure with the Metric and English system and convert between them Given an instrument of measure, determine precision and/or accuracy, with respect to relative error and significant digits [Gauges]

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Manuals	Comprehension, Description of mechanism, Terminology, Definition, Instructions

(TASK STATEMENT) SE :CE PUMPS AND PARTS

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TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Pumps Orbit motors Lines Gaskets Seals Fittings Cylinders Valves Oils Couplings Filters Tools Testing equipment	Observe pumps and parts Determine what maintainance is necessary Perform maintainance	Wear safety glasses Proper use of tools Properly dispose of lubricants
DECISIONS	**CUES**	**ERRORS**
Determine necessary maintainance Determine proper procedure for maintainance	Observation of parts Cost considerations Performance of parts Safety considerations Industrial standards Prior knowledge Type of maintainance Cost consideration	Unnecessary wear Breakdown Cost

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(TASK STATEMENT) SERVICE PUMPS AND PARTS

SCIENCE	MATH – NUMBER SYSTEMS
Oil Viscosity Work input, work output, friction and efficiency in simple machines [Efficiency] Effect of heating and cooling on expansion of materials [Heat of expansion] Fluids under pressure [Hydraulic pressure]	Liquid and dry measures [Volume] Read and interpret charts, tables, and/or graphs Measure with the Metric and English system and convert between them

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Manual	Read and interpret tables, charts, and/or graphs

Duty E Maintaining Water Systems

1 Select equipment and supplies for watering system
2 Install plumbing
3 Repair and clean plumbing equipment

(TASK STATEMENT) SELECT EQUIPMENT AND SUPPLIES FOR WATERING SYSTEM

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Pipe Fittings Valves Washers Faucets Seats	Determine type of water system Determine material needs Select type of material	

DECISIONS	CUES	ERRORS
Determine type of system Determine material needs Select type of materials	Customer instructions Personal needs Municipal codes Industrial requirements Type of system Municipal codes Safety considerations Cost consideration Safety standards Features of material Municipal code	Ineffective system Costly

(TASK STATEMENT) SELECT EQUIPMENT AND SUPPLIES FOR WATERING SYSTEM

SCIENCE	MATH – NUMBER SYSTEMS
Effect of heating and cooling on expansion of materials [Hot v. cold water] Fluids under pressure [Water pressure]	Measures of length [Length of pipe] Measures of temperature [Water temperature] Liquid and dry measures [Water volume] Determination of perimeter and diagonals for pipe runs Measure with the Metric and English system and convert between them Determination of area, perimeter and diagonals of quadrilaterals

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Plumbing codes Blueprints	Read and interpret charts, tables, and/or graphs

(TASK STATEMENT) INSTALL PLUMBING

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Pipe wrenches Pipe vices Cutters Reams Stock and dies Taps Joint compound Cutting oil Valves Washers Seats Fittings Faucets	Gather materials Complete preparations Install system	Do not lift heavy loads Use caution with cutting tools Do not step on round pipe Use safety glasses Use care when working overhead or pits or trenches
DECISIONS Determine proper method of installation	**CUES** Cost considerations Municipal codes Safety standards Type of system Industrial standards	**ERRORS** Ineffective system Costly Safety hazard

(TASK STATEMENT) INSTALL PLUMBING

SCIENCE	MATH – NUMBER SYSTEMS
Effect of heating and cooling on expansion of materials [Hot v. cold water] Fluids under pressure [Water pressure]	Measures of length [Length of pipe] Determination of area, perimeter and diagonals of quadrilaterals [Determine perimeter and diagonals for pipe runs]

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Plumbing code Blueprints Warning signs	Read and interpret charts, tables, and/or graphs

(TASK STATEMENT) REPAIR AND CLEAN PLUMBING EQUIPMENT

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Pipe wrenches Pipe vices Cutters Reams Stock and die Taps Joint compound Cutting oil Valves Washers Seats Fittings Faucets	Inspect equipment Gather tools Clean/repair equipment	Use caution around cleaning acids Use caution when thawing pipe

DECISIONS	CUES	ERRORS
Determine if equipment needs repair or cleaning Determine materials needed for repair or cleaning Determine method of cleaning/repairing	Observation of equipment condition Industrial standards Safety considerations Municipal codes Observation of equipment Reference manuals Safety considerations Municipal codes Industrial standards Methods available Type of equipment Type of repair needed	Poor condition equipment Hazardous Costly

(TASK STATEMENT) REPAIR AND CLEAN PLUMBING EQUIPMENT

SCIENCE	MATH – NUMBER SYSTEMS
Effect of heating and cooling on expansion of materials [Hot v. cold water] Fluids under pressure [Water pressure]	Measures of length [Length of parts or components] Measures of temperature [Water temperature] Measure with the Metric and English system and convert between them

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Plumbing code Work orders	Read and interpret charts, tables, and/or graphs

Duty F Carpentry and Masonry Maintenance and Construction

1 Read and interpret blueprints
2 Select lumber and other building materials
3 Construct necessary structures
4 Clean and store equipment for masonry and construction

(TASK STATEMENT) READ AND INTERPRET BLUEPRINTS

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Blueprint Level Rule Paper and pencil String Stakes Measuring wheel	Gather blueprints Read blueprints Apply knowledge gained from reading Base decisions on this knowledge	
DECISIONS	**CUES**	**ERRORS**
Determine how to apply knowledge gained from reading	Training Application of procedure	Improper construction Hazardous conditions

(TASK STATEMENT) READ AND INTERPRET BLUEPRINTS

SCIENCE	MATH – NUMBER SYSTEMS
	Addition and subtraction of whole numbers [Component lengths] Addition and subtraction of proper and improper fractions [Component lengths] Measures of length [Length of materials] Determination of area, perimeter and diagonals of quadrilaterals [Figuring board feet, areas "i.e." cubic feet] Measure with the Metric and English system and convert between them

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Blueprints	Read and interpret charts, tables, and/or graphs Given a coding system, recognize and identify each unit involved by assigning necessary symbols, numerical or literal

(TASK STATEMENT) SELECT LUMBER AND OTHER BUILDING MATERIALS

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Bill of materials	Determine type of construction Determine material needs Select type of materials	

DECISIONS	CUES	ERRORS
Determine type of construction	Blueprints Instructions Municipal codes Industrial requirements	Costly Ugly Unsafe
Determine material needs	Type of construction Safety considerations Aesthetic considerations Municipal codes	
Select type of material	Material features Cost considerations Safety standards Material features Aesthetics	

(TASK STATEMENT) SELECT LUMBER AND OTHER BUILDING MATERIALS

SCIENCE	MATH – NUMBER SYSTEMS
	Figuring board feet, stress

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Bill of materials	Detail/Inference, Logic

(TASK STATEMENT) CONSTRUCT NECESSARY STRUCTURES

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY -- HAZARD
Hand tools typical to the carpentry and masonry trades Lumber Concrete	Gather materials and tools Purchase supplies needed Complete preparations Build structures	Use caution with tools Do not lift heavy loads

DECISIONS	CUES	ERRORS
Determine proper structure	Type of task Cost considerations Safety blueprints Industrial standard Codes	Hazardous condition Waste of materials Aesthetically poor
Determine best method of construction of structure	Type of task Proposed use of structure Safety requirements Cost and time considerations	

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(TASK STATEMENT) CONSTRUCT NECESSARY STRUCTURES

SCIENCE	MATH – NUMBER SYSTEMS
	Measures of length [Length of components] Figuring board feet

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Blueprints Bill of materials	Read and interpret charts, tables, and/or graphs

(TASK STATEMENT) CLEAN AND STORE EQUIPMENT FOR MASONRY AND CONSTRUCTION

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Hand tools typical to the carpentry and masonry trades Lumber Concrete	Assemble equipment to be cleaned Assemble proper and appropriate cleaning instruments and products Clean equipment in proper method Store equipment in proper place	Use caution around cleaning fluids Do not lift heavy loads
DECISIONS	**CUES**	**ERRORS**
Determine proper cleaning method for equipment	Type of equipment Type of material to be cleaned from equipment Company policy Industrial standards Manufacturer's suggested usage of cleaning products	Improper cleaning Excessive wear Waste of time and materials Safety hazard

(TASK STATEMENT) CLEAN AND STORE EQUIPMENT FOR MASONRY AND CONSTRUCTION

SCIENCE	MATH – NUMBER SYSTEMS

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Equipment manuals	Comprehension, Instructions, Description of mechanism

Duty G Maintaining and Testing Steam Generators

1 Identify steam generators
2 Test operate the generators
3 Maintain generators

(TASK STATEMENT) IDENTIFY STEAM GENERATORS

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Manuals	Observe steam generator Make identification	

DECISIONS	CUES	ERRORS
Determine type of generator	Observation of generator parts Prior knowledge Manuals	Improper identification
Determine model of generator	Observation of generator parts Prior knowledge Manuals	

(TASK STATEMENT) IDENTIFY STEAM GENERATORS

SCIENCE	MATH – NUMBER SYSTEMS
Effect of heating and cooling on expansion of materials [Heating water causing steam] Fluids under pressure [Steam pressure]	Measures of temperature [Temperature] Liquid and dry measures [Liquid measure]

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Manuals	Comprehension, Description of mechanism, Definition

(TASK STATEMENT) TEST OPERATE THE GENERATOR

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Steam generator Materials to be heated	Fuel generator in proper manner Lubricate generator in proper manner Start Test with gauges and devices Perform test operations Adjust	Use caution around live steam (burns) Possible fire hazard

DECISIONS	CUES	ERRORS
Determine proper setting of generator adjustments	Gauges Prior knowledge Manual	Poor performance Wasted time and material

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(TASK STATEMENT) TEST OPERATE THE GENERATOR

SCIENCE	MATH – NUMBER SYSTEMS
Effect of heating and cooling on state of matter [Heat water and create steam] Fluids under pressure [Steam pressure]	Work input, work output, friction and efficiency in simple machines [Work output] Measures of temperature [Temperature] Liquid and dry measures [Liquid measure, volume] Measure pressure

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Manuals	Read and interpret charts, tables, and/or graphs

(TASK STATEMENT) MAINTAIN GENERATORS

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Steam generators Tools necessary for maintainance	Inspect generator Clean generator Lubricate Service and adjust components	Always work on a cold generator Disconnect all electrical hookups Never refuel while hot or running

DECISIONS	CUES	ERRORS
Implied - application of maintainance procedure		Poor performance Loss of fuel and power Material waste Excessive wear

(TASK STATEMENT) MAINTAIN GENERATORS

SCIENCE	MATH – NUMBER SYSTEMS
Fluids under pressure [Steam pressure]	Measures of temperature [Temperature] Liquid and dry measures [Liquid measure]

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Manuals	Comprehension, Description of mechanism, Definition, Terminology

Duty H Servicing and Maintaining Turf Equipment

1 Select and identify equipment for maintaining turf
2 Test, operate, and adjust equipment for maintaining turf

(TASK STATEMENT) SELECT AND IDENTIFY EQUIPMENT FOR MAINTAINING TURF

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Mowers Rollers Aerators Mulchers Thatchers Sod cutters Lawn rakes Tillers Sweeper Tractor Hand tools Rakes Hoes Shovel Edgers	Identify equipment Adjust and maintain equipment	Stay away from moving parts
DECISIONS Determine equipment needed for specific tasks	**CUES** Prior knowledge Company policy Industrial standards Type of task to be completed Geography of terrain Season of the year	**ERRORS** Incompleted task Incorrect completion Waste time and materials Excessive wear or breakage

TASK STATEMENT) SELECT AND IDENTIFY EQUIPMENT FOR MAINTAINING TURF

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines [Work output] Centrifugal forces developed by bodies in rotation [Rotary mowers and reel mowers] Motion resulting from two or more forces acting on a point in a body [Pushing equipment]	Measures of weight [Size of mower in relation to lawn damage] Liquid and dry measures [Fuel capacity]

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Manuals	Read and interpret charts, tables, and/or graphs

(TASK STATEMENT) TEST OPERATE AND ADJUST EQUIPMENT FOR MAINTAINING TURF

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY HAZARD
Hand tools for making adjustment Mowers Aerators Mulchers Thatchers Sod cutters Lawn rakes Tillers Sweeper Tractor Hand tools Rakes Hoes Shovel Edgers	Fuel Lubricate Start Test Perform test operations Adjust	Remove spark plug wire before working under a mower Tip engines properly to prevent lubricant damage or spillage Stay away from moving parts
DECISIONS Determine proper setting of adjustments	**CUES** Gauges Manual Prior knowledge Proposed use of turf	**ERRORS** Poor performance Wasted time and materials

TASK STATEMENT) TEST OPERATE AND ADJUST EQUIPMENT FOR MAINTAINING TURF

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Centrifugal forces developed by bodies in rotation Inertia and momentum Effect of friction on work processes and product quality	Measure with the Metric and English system and convert between them Given an instrument of measure, determine precision and/or accuracy, with respect to relative error and significant digits [Engine adjustment] Wrench and screwdriver sizes

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Manuals	Read and interpret tables, charts, and/or graphs

Duty I Maintaining Tree and Shrub Equipment

1 Identify and select equipment for maintaining trees and shrubs
2 Sharpen and service equipment for maintaining trees and shrubs
3 Test the operation of equipment

(TASK STATEMENT) IDENTIFY AND SELECT EQUIPMENT FOR MAINTAINING TREES AND SHRUBS

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TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY -- HAZARD
Vermeer spade Hand tools Spade Shovel Hand trowel Hoses Bull dozer Back hoe Trember Chains Lift truck	Identify equipment Adjust and maintain equipment	

DECISIONS	CUES	ERRORS
Determine equipment needed for specific tasks	Prior knowledge Company policy Industrial standards Type of task to be completed Season of year Geography of terrain	Incompleted task Incorrect completion Waste time and materials Excessive wear or breakage

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(TASK STATEMENT) IDENTIFY AND SELECT EQUIPMENT FOR MAINTAINING TREES AND SHRUBS

SCIENCE	MATH -- NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines [Work output] Motion resulting from two or more forces acting on a point in a body [Pushing equipment]	Measures of weight [Size of equipment needed] Liquid and dry measures [Fuel capacity]

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Manual	Read and interpret charts, tables, and/or graphs

(TASK STATEMENT) SHARPEN AND SERVICE EQUIPMENT FOR MAINTAINING TREES AND SHRUBS

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Vermeer spade Hand tools Spade Shovel Hand trowel Hoses Bull dozer Back hoe Trember Chains Lift truck	Inspect equipment Gather tools Service/sharpen tools	Use caution around cutting edge Use safety glasses

DECISIONS	CUES	ERRORS
Determine if equipment needs service or sharpening Determine tools and materials needed for servicing/sharpening Determine method of servicing	Observation of equipment condition Observation of performance Industrial standards Safety considerations Observation of equipment Reference manuals Safety considerations Industrial standards Methods available Type of equipment Type of servicing needed	Poor condition equipment Hazardous Costly

(TASK STATEMENT) SHARPEN AND SERVICE EQUIPMENT FOR MAINTAINING TREES AND SHRUBS

SCIENCE	MATH – NUMBER SYSTEMS
Fuels Viscosity Capacity Simple machines used to gain mechaincal advantage Centrifugal forces developed by bodies in rotation Transfer of heat from one body to another Effects of friction on work processes and product quality Resistance of materials to change in shape	Measures of weight [Sizes of tools and containers] Measure with the Metric and English system and convert between them Given an instrument of measure, determine precision and/or accuracy, with respect to relative error and significant digits [Adjustment]

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Manuals	Read and interpret charts, tables, and/or graphs

(TASK STATEMENT) TEST THE OPERATION OF EQUIPMENT

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Vermeer spade Hand tools Spade Hand trowel Hoses Bull dozer Back hoe Trember Chains Sift truck	Fuel equipment Lubricate all components Start unit Test operation Perform test operations Adjust	Keep away from moving parts Fire hazard Protective clothing
DECISIONS	**CUES**	**ERRORS**
Determine proper setting of adjustments	Gauges Manual Prior knowledge Proposed use of turf	Poor performance Wasted time and materials

TASK STATEMENT) TEST THE OPERATION OF EQUIPMENT

SCIENCE	MATH – NUMBER SYSTEMS
Fuels Viscosity Capacity Simple machines used to gain machanical advantage Centrifugal forces developed by bodies in rotation Transfer of heat from one body to another Effects of friction on work processes and product quality Resistance of materials to change in shape	Measure with the Metric and English system and convert between them Given an instrument of measure, determine precision and/or accuracy, with respect to relative error and significant digits [Engine adjustments] Wrench and screwdriver size

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Manuals	Read and interpret charts, tables, and/or graphs

Duty J Maintaining Mechanical Controls of Artificial Plant Environment

1 Identify controls
2 Maintain controls
3 Test operating controls

(TASK STATEMENT) IDENTIFY CONTROLS

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Wiring Plumbing Monitoring Mechanical	Identify controls Adjust and maintain controls	

DECISIONS	CUES	ERRORS
Determine controls needed for specific tasks	Prior knowledge Company policy Industrial standards Geography of terrain Season of the year	Incompleted task Incorrect completion Waste time and materials Excessive wear or breakage

(TASK STATEMENT) IDENTIFY CONTROLS

SCIENCE	MATH – NUMBER SYSTEMS
Ohm's Law Simple machines used to gain mechanical advantage	Measures of length [Length of parts] Determination of area, perimeter and diagonals of quadrilaterals [Size of building]

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COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Manuals	Read and interpret tables, charts, and/or graphs

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(TASK STATEMENT) MAINTAIN CONTROLS

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY -- HAZARD
Wiring Plumbing Monitoring devices Hand tools	Inspect controls Clean controls Lubricate Service and adjust components	Unhook electrical connections before working on it Wear protective clothing
DECISIONS Implied - application of maintainance procedure	**CUES**	**ERRORS** Poor performance Loss of fuel and power Material waste Excessive wear

(TASK STATEMENT) MAINTAIN CONTROLS

SCIENCE	MATH – NUMBER SYSTEMS
Work input, work output, friction and efficiency in simple machines [Work output]	Calibrate thermostats

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Manual Electrical code	Read and interpret tables, charts, and/or graphs

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(TASK STATEMENT) TEST OPERATING CONTROLS

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Wiring Plumbing Monitoring devices Hand tools	Fuel Lubricate Start Test Perform test operations Adjust	Do not work on open switch boxes
DECISIONS Determine proper setting of adjustments	**CUES** Gauges Manual Prior knowledge Proposed use of turf	**ERRORS** Poor performance Wasted time and materials

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(TASK STATEMENT) TEST OPERATING CONTROLS

SCIENCE	MATH – NUMBER SYSTEMS
Effect of temperature and moisture on plants	Addition and subtraction of whole numbers Reduction of fractions Addition and subtraction of decimal fractions Measure of time and speed Measures of temperature [Temperature] Liquid and dry measures Determination of area, perimeter and diagonals of quadrilaterals Determination of area and circumference of circles Use of arcs or chords in determining facts about a circle or its parts Ratio and proportion Measure with the Metric and English system and convert between them

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Operators manual	Read and interpret tables, charts and/or graphs

Duty K Testing and Caring for Spraying and Spreading Equipment

1 Identify sprayers and spreaders
2 Maintain and clean sprayers and spreaders
3 Test operate sprayers and spreaders

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(TASK STATEMENT) IDENTIFY SPRAYERS AND SPREADERS

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Spreaders Sprayers Tools	Observe sprayers and spreaders Make identification Maintain sprayers and spreaders	

DECISIONS	CUES	ERRORS
Determine type of sprayers and spreaders	Observation of sprayer and spreader parts Prior knowledge Sprayer and spreader manual	Improper identification
Determine sprayers and spreaders needs	Prior knowledge Sprayer and spreader manual Safety requirements Energy requirements Mechanical standards	
Determine model of engine	Observation of sprayer and spreader parts Prior knowledge Sprayer and spreader manual	

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(TASK STATEMENT) IDENTIFY SPRAYERS AND SPREADERS

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage [Pumps] Fluids under pressure [Pressure]	Liquid and dry measures

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Manuals	Read and interpret tables, charts and/or graphs

(TASK STATEMENT) MAINTAIN AND CLEAN SPRAYERS AND SPREADERS

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Spreaders Sprayers Chemicals and fertilizers Measuring devices Tools	Inspect sprayers and spreaders Clean sprayers and spreaders Lubricate Service and adjust components	Use caution around chemicals Properly dispose of all chemicals Wear protective clothing
DECISIONS Implied - application of maintainance procedure	**CUES**	**ERRORS** Poor performance Loss of fuel and power Material waste Excessive wear

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TASK STATEMENT) MAINTAIN AND CLEAN SPRAYERS AND SPREADERS

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage [Pumps] Fluids under pressure [Pressure]	Measures of length Liquid and dry measures Ratio and proportion Measure with the Metric and English system and convert between them Calibrating sprayers and spreaders: Addition and subtraction of whole numbers Reduction of fractions Addition and subtraction of decimal fractions Measure of time and speed Measures of weight Determination of area and circumference of circles Determination of area, perimeter and diagonals of quadrilaterals Use of arcs or chords in determining facts about a circle or its parts

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COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Manual	Read and interpret tables, charts and/or graphs

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(TASK STATEMENT) TEST OPERATE SPRAYERS AND SPREADERS

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Sprayers Spreaders Chemicals and fertilizers Measuring devices Tools	Fuel sprayers and spreaders in proper manner Lubricate sprayers and spreaders in proper manner Start Test with gauges and devices Perform test operations Adjust	Wear eye safety equipment Use proper clothing Properly dispose of chemicals
DECISIONS	**CUES**	**ERRORS**
Determine proper setting of sprayers and spreaders adjustments	Gauges Prior knowledge Manual	Poor performance Wasted time and materials

TASK STATEMENT) TEST OPERATE SPRAYERS AND SPREADERS

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage [Pumps] Fluids under pressure [Pressure]	Liquid and dry measures Calibrating sprayers and spreaders Measures of length Ratio and proportion Measure with the Metric and English system and convert between them Calibrating sprayers and spreaders Addition and subtraction of whole numbers Reduction of fractions Additionaand subtraction of decimal fractions Measure of time and speed Measures of weight Determination of area and circumference of circles Determination of area, perimeter and diagonals of quadrilaterals Use of arcs and chords in determining facts about a circle or its parts

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Manual Warning signs	Read and interpret tables, charts and/or graphs

Duty L Installing, Testing, and Caring for Irrigation and Sprinkling Systems

1 Identify water and soil conservation practices
2 Identify sprinkler systems
3 Plan and install watering systems
4 Maintain and disassemble watering systems

(TASK STATEMENT) IDENTIFY WATER AND SOIL CONSERVATION PRACTICES

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TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Pencil Paper Soils maps Soil testing apparatus Surveying apparatus: Transite Level Rules	Inspect terrain Gain knowledge of possible conservation practices Identify these practices	Do not damage delicate equipment Use caution around soil testing chemical
DECISIONS	**CUES**	**ERRORS**
Implies - application of research procedure		Improper identification

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(TASK STATEMENT) IDENTIFY WATER AND SOIL CONSERVATION PRACTICES

SCIENCE	MATH – NUMBER SYSTEMS
Composition of matter, including protons, neutrons, electrons, atoms, molecules, elements [Soil composition, water absorption, water movement]	Using level and transite Measuring devices Addition and subtraction of whole numbers Reduction of fractions Addition and subtraction of decimal fractions Measures of length Measure of time and speed Measures of weight Measures (liquid and dry) Determination of area, perimeter and diagonals of quadrilaterals Determination of area and circumference of circles Use of arcs or chords in determining facts about a circle or its parts Ratio and proportion Measure with the Metric and English system and convert between them

COMMUNICATIONS		
PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Soil conservation guides	Read and interpret charts, tables, and/ graphs

(TASK STATEMENT) IDENTIFY SPRINKLER SYSTEM

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Irrigation manuals Manufacturer's specifications	Inspect terrain Gain knowledge of possible sprinkler systems Identify these systems	
DECISIONS Implied - application of research procedure	**CUES**	**ERRORS** Improper identification

(TASK STATEMENT) IDENTIFY SPRINKLER SYSTEM

SCIENCE	MATH – NUMBER SYSTEMS
	Using level and transite Measuring devices: Addition and subtraction of whole numbers Reduction of fractions Addition and subtraction of decimal fractions Measures of length Measure of time and speed Measures of weight Liquid and dry measures Determination of area, perimeter and diagonals of quadrilaterals Determination of area and circumference of circles Use of arcs or chords in determining facts about a circle or its parts Ratio and proportion Measure with the Metric and English system and convert between them

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Manufacturer's specifications	Read and interpret tables, charts and/or graphs