DOCUMENT RESUME

ED 107 971 CE 004 184

AUTHOR Hall, Charles W.; Emory, Harold L.
TITLE An Analysis of the Machine Trades Occupation.
INSTITUTION Ohio State Dept. of Education, Columbus. Div. of Vocational Education.; Ohio State Univ., Columbus. Trade and Industrial Education Instructional Materials Lab.
SPONS AGENCY Office of Education (DHEW), Washington, D.C.
PUB DATE [75]
NOTE 253p.; For related documents, see CE 004 160-183, CE 004 185-206, CE 004 263-268, and CE 004 425-427

EDRS PRICE MF-$0.76 HC-$13.32 PLUS POSTAGE
DESCRIPTORS Communication Skills; *Job Analysis; Knowledge Level; *Machine Tool Operators; *Machinists; *Occupational Information; Safety; Skill Analysis; Skill Development; Skilled Occupations; *Task Analysis; Task Performance; Work Attitudes

ABSTRACT

The general purpose of the occupational analysis is to provide workable, basic information dealing with the many and varied duties performed in the machine trades occupation. The document opens with a brief introduction followed by a job description. The bulk of the document is presented in table form. Fifteen 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: maintaining machinery; performing bench operations, precision and semi-precision measurements, and heat treating operations; operating pedestal grinder; and setting up and operating cut off saws, drill presses, lathes, shapers and slotters, vertical and horizontal milling machines, surface grinder, universal grinder, tool and cutter grinder, arbor press, and electrical discharge machine. (BP)

Occupational Analysis

MACHINE TRADES

Instructional Materials Laboratory
Trade and Industrial Education
The Ohio State University

5197

AN ANALYSIS OF THE MACHINE TRADES OCCUPATION

Developed By

harles W. Hall
nstructor, Machine Trades
aul C. Hayes Technical School
rove City, Ohio

Harold L. Emory
Instructor, Machine Shop
Pike County J.V.S.
Piketon, Ohio

Occupational Analysis
E.P.D.A. Sub Project 73402
June 1, 1973 to December 30, 1974
Director: Tom L. Hindes
Coordinator: William L. Ashley

The Instructional Materials Laboratory
Trade and Industrial Education
The Ohio State University

"The activity which is the subject of this report was supported in whole or in part by the U.S. Office of Education, Department of Health, Education, and Welfare. However, the opinions expressed herein do not reflect the position or policy of the U.S. Office of Education, and no official endorsement by the U.S. Office of Education should be inferred."

TABLE OF CONTENTS

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

In the last few years outstanding advances have been made in the machine trades area. The technical knowledge and new machining processes have been a boom to the modern day machine shop. With all the advances made some basic skills exist that existed many years ago. In this occupational analysis the participants have analyzed many of the basic tasks important for a beginning machinist to perform.

This occupational analysis was drawn up to provide a list of the duties, tasks, science, math, and technical knowledge of the tools and equipment used in the machinists' trade.

ACKNOWLEDGMENT

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.

Rollin M. Barber, Psychology
The Ohio State University
Columbus, Ohio

Jodi Beittel, Communications
Columbus, Ohio

Diana L. Buckeye, Mathematics
University of Michigan
Avon Lake, Ohio

Rick Fien, Chemistry
The Ohio State University
Beachwood, Ohio

N.S. Gidwani, Chemistry
Columbus Technical Institute
Columbus, Ohio

Bruce A. Hull, Biology
The Ohio State University
Columbus, Ohio

Donald L. Hyatt, Physics
Worthington High School
Worthington, Ohio

Glenn Mann, Communications
Columbus, Ohio

Jerry McDonald, Physical Sciences
Columbus Technical Institute
Reynoldsburg, Ohio

Colleen Osinski, Psychology
Columbus Technical Institute
Columbus, Ohio

David Porteous, Communications
University of Connecticut
Colchester, Connecticut

James A. Sherlock, Communications
Columbus Technical Institute
Columbus, Ohio

Jim VanArsdall, Mathematics
Worthington High School
Worthington, Ohio

Lillian Yontz, Biology
The Ohio State University
Caldwell, Ohio

Acknowledgment is extended to the following I.M.L. staff members for their role in conducting the workshops; editing, revising, proofing and typing the analyses.

Faith Justice	Research Associate
Sheila Nelson	Administrative Assistant
Marsha Opritza	Editorial Consultant
Rita Buccilla	Typist
Peg Bushelman	Typist
Carol Fausnaugh	Typist
Mindy Fausnaugh	Typist
Rita Hastings	Typist
Carol Hicks	Typist
Sue Holsinger	Typist
Barbara Hughes	Typist
Carol Marvin	Typist
Patti Nye	Typist
Kathy Roediger	Typist
Mary Salay	Typist

Job Description

A machinist works with metals and metal removal to form parts of a predetermined size and shape as indicated by a blueprint or shop sketch. This is accomplished through the proper setup and use of precision measuring tools, lathes, drills, milling machines, grinders, metal cutting saws, shapers, heat treating equipment, hand tools and other specialized machinery found in today's machine shops.

In all duties and operations, accuracy, proper tools usage, and safety are practiced. Blueprint reading, sequence of operation, and applied math are necessary skills to a successful machinist.

Duty A Maintaining Machinery

1 Diagnose trouble in malfunctioning machine
2 Disassemble defective section of machine
3 Repair defective parts of machine
4 Replace parts in machine
5 Test machine for performance after repair

(TASK STATEMENT) DIAGNOSE TROUBLE IN MALFUNCTIONING MACHINE

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
All equipment and machinery listed under duties Tachometer Volt-ampmeter Operator's manual Machine parts listed Assembly drawings	Sub-tasks Determine malfunctioning area Isolate defective part Determine corrective procedures	Shut off power Electrical shock Avoid open gear trains Cuts and bruises Test electrical circuits correctly Damaged equipment Electric shock
DECISIONS	**CUES**	**ERRORS**
Determine whether to repair or replace defective part	Extent of damage to part Cost of replacement	Improper use of test equipment

ASK STATEMENT) DIAGNOSE TROUBLE IN MALFUNCTIONING MACHINE

SCIENCE	MATH – NUMBER SYSTEMS
Effects of friction on work processes and product quality [Recognize effect of friction on parts] Transfer of heat from one body to another [Recognize heat source] Composition of matter, including protons, neutrons, atoms, electrons, molecules, elements Arrangement of molecules, atoms and ions and the effect on structure and strength of materials [Metal fatigue] Effect of heating and cooling on expansion of materials Fluids under pressure [Understanding hydraulics] Inertia and momentum [Of machine] Motion resulting from two or more forces acting on a point in a body [Recognize the effects of forces] Relationship of force to distortion in an elastic body Resistance of materials to change in shape Centrifugal forces developed by bodies in rotation Resistance of materials to flow of electrical current [Recognize short circuits]	Given an instrument of measure, determine precision, and/or accuracy with respect to relative error, tolerance, and significant digits. (Measuring other than linear, square, and cubic) [Ampmeter] Measure of time and speed (example: time-seconds, minutes, etc.; speed-feet per minute, R.P.M., etc.)

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Speaking	Recommendation report	Inductive reasoning, trade terminology, clarity of expression, and appropriate diction
Reading	Operation manuals	Detail and inference, comprehension, logic, description of mechanism, definition, and instructions

(TASK STATEMENT) DISASSEMBLE DEFECTIVE SECTION OF MACHINE

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
All equipment and machinery listed under duties Wrenches Parts lists Assembly drawings Drop cord Gear puller	Turn off power Refer to assembly drawing Select tools for disassembly Remove defective part	Correct use of wrenches Damage to wrenches Cuts or bruises Turn power off Electrical shock Getting caught in moving parts
DECISIONS	**CUES**	**ERRORS**
Select proper tools for disassembly	Area of machine being disassembled	Failure to shut off power Incorrect disassembly procedures

14

ASK STATEMENT) DISASSEMBLE DEFECTIVE SECTION OF MACHINE

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines [Using simple hand tools] Relationship of force to distortion in an elastic body Arrangement of molecules, atoms and ions and the effect on structure and strength of materials Resistance of materials to change in shape [Recognize strength of components] Effect of heating and cooling on expansion of materials (Change of dimensions) [Beneficial use of heat and cold for removal]	Measure with the Metric and English system and convert between them Given a coding system, recognize and identify each unit involved by assigning necessary symbols, numerical or literal [Determine wrench size]

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Operation manuals	Comprehension, trade terminology, detail inference, description of mechanism, definition, instructions

15

(TASK STATEMENT) REPAIR DEFECTIVE PARTS OF MACHINE

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
All equipment and machinery listed under duties Wrenches Assembly drawings Parts list Safety glasses	Identify proper size of part Identify proper fit of part Identify proper usage of precision measuring tools Identify proper repair procedures	Safe operation of equipment Cuts and abrasions Eye injury Burns
DECISIONS	**CUES**	**ERRORS**
Determine when and how to repair defective parts	Type of defects Methods of repairing defects	Incorrect repair procedures

ASK STATEMENT) REPAIR DEFECTIVE PARTS OF MACHINE

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines [Simple handtools] Arrangement of molecules, atoms and ions and the effect on structure and strength of materials Resistance of materials to change in shape [Material required] Effect of heating and cooling on expansion of materials [Welding] Fluids under pressure [Beneficial use of hydraulic pressure] Relationship of force to distortion in an elastic body [Polishing or surface condition] Effect of heating and cooling on expansion of materials (Change of dimensions) [Beneficial use of heat for straightening]	Given a coding system, recognize and identify each unit involved by assigning necessary symbols, numerical or literal [Identify part numbers from parts list] Measures of length

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Operations manuals	Comprehension, detail inference, description of mechanism, definition, instructions
Speaking	Instructions	Appropriate diction, trade terminology, clarity of expression, enunciation

(TASK STATEMENT) REPLACE PARTS IN MACHINE

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
All machinery and equipment listed under duties Assembly drawings Parts list	Be sure power is off Refer to assembly drawing Select tools for assembly Remove old parts Install new parts	Proper use of hand tools Machine damage Cuts and abrasions Power not turned off Electrical shock Cuts, bruises, and fractures

DECISIONS	CUES	ERRORS
Determine correct assembly procedures Select tools for assembly	Operations manual Assembly procedure	Incorrect assembly procedure Damage of new part during assembly

ASK STATEMENT) REPLACE PARTS IN MACHINE

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines [Simple hand tools] Effect of heating and cooling on expansion of materials [Shrink fits or welding] Fluids under pressure [Hydraulic pressure (Pascals Law)] Arrangement of molecules, atoms and ions and the effect on structure and strength of materials Resistance of materials to change in shape [Recognize strength of parts]	Given a coding system, recognize and identify each unit involved by assigning necessary symbols, numerical or literal [Identify parts number] Measure with the Metric and English system and convert between them Liquid and dry measures [Replace lubricant in gear box]

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Operations manual	Comprehension, trade terminology, detail inference, description of mechanism, definition, and instructions

(TASK STATEMENT) TEST MACHINE FOR PERFORMANCE AFTER REPAIR

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
All equipment and machinery listed under duties Operators manual Tachometer Wrenches Volt-ampmeter	Turn on power Visually inspect machine Start machine Operate machine Inspect machine for accuracy	All guards in place Getting caught in gears or pulleys
DECISIONS	**CUES**	**ERRORS**
Determine test equipment to be used Determine if machine is operating properly	Type of machinery repaired Readings from test equipment	Improper use of test equipment

(ASK STATEMENT) TEST MACHINE FOR PERFORMANCE AFTER REPAIR

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advartage Work input, work output, friction and efficiency in simple machines [Adjustments] Magnetic fields of force [Electronic gauges]	Measure of time and speed [R.P.M. speed] Given an instrument of measure, determine precision, and/or accuracy with respect to relative error, tolerance, and significant digits (Measuring other than linear, square, and cubic) [R.P.M. gauge] [Ampmeter]

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Operator's manual Physical Experimentation Report	Comprehension, inductive reasoning, detail and inference, logic
Viewing	Inspect machine Reading from test equipment	Visual analysis, describing, logic, detail inference, recognition of symbols, codes, emblems

Duty B Performing Bench Operations

1 Deburr a workpiece
2 Layout workpiece
3 File piece to a dimension
4 Drill hole with hand drill motor
5 Hand tap a hole
6 Cut a thread with a hand die

(TASK STATEMENT) DEBURR A WORKPIECE

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Workpiece File Soft jaws Vise File card Emery cloth Power deburring equipment Blueprint	Select deburring procedures and quipment Deburr part	Avoid sharp edges Cuts Place handle on file Cuts Avoid file breakage Cuts or eye injury

DECISIONS	CUES	ERRORS
Select correct deburring procedure and equipment	Part to be deburred	Damage part with deburring equipment

(TASK STATEMENT) DEBURR A WORKPIECE

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines [Simple hand tools] Arrangement of molecules, atoms and ions and the effect on structure and strength of materials Resistance of materials to change in shape [Hardness of material] Effects of friction on work processes and product quality [Filing]	Measure of length and angles

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Blueprint	Comprehension, trade terminology, detail inference, recognition of symbols, codes, emblems
Viewing	Part	Visual analysis, describing, logic, detail inference
Touching	Surface	Size, shape, and texture

(TASK STATEMENT) LAYOUT WORKPIECE

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Workpiece Center head Combination square Bevel head Scale Scribe Prick punch Hammer Blueprint Dividers Layout dye Safety glasses Vernier height gauge Center punch	Consult blueprint Apply layout dye Scribe and layout part Check layout Centerpunch as needed	Safe use of scribe and dividers Puncture wounds Safe use of hammer Bruises and eye injury Appropriate eye protection Eye injury

DECISIONS	CUES	ERRORS
Select proper layout procedure	Blueprint	Failure to maintain necessary accuracy

(TASK STATEMENT) LAYOUT WORKPIECE

SCIENCE

Simple machines used to gain mechanical advantage
Work input, work output, friction and efficiency in simple machines
[Use of layout tools]
Differences in absorption and radiation of energy between dark rough surfaces and light, smooth, polished surfaces.
[Absoption when applying layout dye]
Effects of friction on work processes and product quality
[Scratching workpiece with scribe]
Arrangement of molecules, atoms and ions and the effect on structure and strength of materials
Resistance of materials to change in shape
[Resistance and strength of material]

MATH – NUMBER SYSTEMS

Basic arithmetic skills

Measures of length
Measure with the Metric and English system and convert between them
[Read angular dimensions]
[Knowledge of metric dimensions]
Understanding and use of the Pythagorean theorem, based on the right triangle
Geometric constructions
Use of trigonometric functions in solution of problems involving right triangles

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Blueprint	Comprehension, trade terminology, detail inference, recognition of symbols, codes, emblems
Viewing	Layout	Visual analysis, describing, logic, detail inference

(TASK STATEMENT) FILE PIECE TO A DIMENSION

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
workpiece File File card Blueprint Measuring tools Soft jaws Vise Micrometer	Select file Clamp piece in place File workpiece Inspect part dimensions	Handle in place on file Puncture wound Avoid breaking file Cuts and eye injuries Avoid sharp edges on parts Cuts
DECISIONS	**CUES**	**ERRORS**
Determine correct workholding methods Determine correct file selection	Size and shape of workpiece, blueprint	Incorrect selection and use of file Damage to part in clamping Excessive metal removal

ASK STATEMENT) FILE PIECE TO A DIMENSION

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines [Using simple hand tools] Effects of friction on work processes and product quality [Filing] Arrangement of molecules, atoms and ions and the effect on structure and strength of materials Resistance of materials to change in shape [Hardness of workpiece]	Measures of length Given a coding system, recognize and identify each unit involved by assigning necessary symbols, numerical or literal [Blueprint dimensions correctly interpreted] Measure with the Metric and English system and convert between them Given an instrument of measure, determine precision, and/cr accuracy with respect to relative error, tolerance and significant digits (Measuring and other than linear, square, and cubic) [Micrometer] Basic arithmetic skills

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Blueprint	Comprehension, trade terminology, detail inference, recognition of symbols, codes, and emblems
Viewing	Part dimensions	Visual analysis, describing, and logic
Touching	Surface of part	Size, shape, and texture

(TASK STATEMENT) DRILL HOLE WITH HAND DRILL MOTOR

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Workpiece Drill motor Drill Drill chuck key Vise Soft jaws Safety glasses Clamps Wrenches Coolant Blueprint Countersink	Select proper drills Clamp workpiece Apply coolant Drill Deburr Inspect	Drill motor properly grounded Electrical shock Piece clamped properly to prevent movement Cuts and bruises Drill sharpened properly for material to be drilled Cuts and eye injury Broken drill Hot shavings and chips Cuts and bruises

DECISIONS	CUES	ERRORS
Select holding method	Size and shape of workpiece Blueprint	Incorrect drill size Improper clamping of workpiece Improperly sharpened drill Failure to use coolant

ASK STATEMENT) DRILL HOLE WITH HAND DRILL MOTOR

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines [Using simple hand tools] Effect of heating and cooling on expansion of materials Effect of heating and cooling on state of matter (Change of matter from one form to another) [Heat change shape or dimension of workpiece] Centrifugal forces developed by bodies in rotation Transfer of energy from one form to another Transfer of heat from one body to another [Transfer of mechanical energy to heat] Effects of friction on work processes and product quality [Effects of friction] Arrangement of molecules, atoms and ions and the effect on structure and strength of materials Resistance of materials to change in shape [Strength of materials]	Measures of length [Metric] Given a coding system, recognize and identify each unit involved by assigning necessary symbols, numerical or literal [Fractional, letter, and number drill sizes] Read and interpret charts, tables, and/or graphs [Use of tap drill chart] Locate by approximation rational numbers and integers on the number line (sequential ordering)

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Blueprint	Comprehension, trade terminology, detail inference, recognition of symbols, codes, and emblems
Viewing	Inspect workpiece	Visual analysis, describing, logic, detail inference
Touching	Surface of workpiece	Size, shape, texture, and temperature

(TASK STATEMENT) HAND TAP A HOLE

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Workpiece Tap Tap wrench Work holding device Lubricant for tap (cutting oil) Safety glasses Blueprint	Select tap and wrench Lubricate tap Tap hole Clean and inspect	Tap breakage Eye injury Sharp edges (burrs) on tapped hole Cuts
DECISIONS	**CUES**	**ERRORS**
Determine tap selection	Thread size, hole diameter	Failure to reverse tap to break chip Tapping with a dull tap Lack of lubricant Starting tap crooked

ASK STATEMENT) HAND TAP A HOLE

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines [Using hand tools] Effect of heating and cooling on expansion of materials [Effects of heat] Transfer of energy from one form to another [Transfer of mechanical energy to heat] Effects of friction on work processes and product quality Arrangement of molecules, atoms and ions and the effect on structure and strength of materials Resistance of materials to change in shape [Strength of materials (tap breakage)]	Basic arithmetic skills Read and interpret charts, tables, and/or graphs [Read and interpret tap drill chart] Manipulation of formula involving three factors [Formula for tap drill sizes]

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Blueprint	Comprehension, trade terminology, detail inference, recognize symbols, codes, and emblems
Viewing	Inspect workpiece	Visual analysis, describing, logic, detail inference
Touching	Surface of workpiece	Size, shape, and texture

(TASK STATEMENT) CUT A THREAD WITH A HAND DIE

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Workpiece Button die Die holder Cutting oil Vise Tap drill chart Clamps Wrenches Safety glasses	Clamp work in vise Select proper die and die stock Lubricate Cut thread Clean and inspect	Do not use power equipment to cut with hand dies Ruin piecework Break die Sharp edges on threads Cuts
DECISIONS	**CUES**	**ERRORS**
Determine type of die to use (Standard, pipe, or metric)	Thread size	Starting die crooked Failure to reverse die to break chip Thread with a dull die Lack of lubricant

ASK STATEMENT) CUT A THREAD WITH A HAND DIE

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines [Using hand tools] Effect of heating and cooling on expansion of materials [Effects of heat] Transfer of energy from one form to another [Transfer of mechanical energy to heat] Effects of friction on work processes and product quality Arrangement of molecules, atoms and ions and the effect on structure and strength of materials Resistance of materials to change in shape [Strength of materials (die breakage)]	Read and interpret charts, tables, and/or graphs [Read tap drill and thread chart] Measure with the Metric and English system and convert between them

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Tap drill and thread chart	Comprehension, trade terminology, detail inference, recognize symbols, codes, and emblems
Viewing	Inspect workpiece	Visual analysis, describing, logic, detail inference
Touching	Surface of workpiece	Size, shape, and texture

Duty C Performing Precision and Semi Precision Measurements

1 Measure with a steel rule
2 Measure with calipers
3 Measure angle with protractor
4 Check radius with radius gauge
5 Check work with a thickness gauge
6 Measure with a combination set
7 Measure with micrometers
8 Measure with vernier height gauge
9 Measure with vernier calipers
10 Check hole with a hole gauge
11 Check work with a dial indicator
12 Check work with plug and ring gages
13 Measure angles with sine bar
14 Calibrate micrometers

35

(TASK STATEMENT) MEASURE WITH STEEL RULE.

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Workpiece Steel rules Hook rules Depth rules Short length rules Tape rules Slide caliper rules Metric rules	Select proper rule as to calibration and graduation Read rule accurately	Shut off machinery Cuts and bruises

DECISIONS	CUES	ERRORS
Determine rule graduations and calibration to use Determine when to use English or Metric rule	Relative length of piecework	Failure to accurately read rule

36

(TASK STATEMENT) MEASURE WITH STEEL RULE

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage [Measuring tool]	Measures of length [English measuring system] Measure with the Metric and English system and convert between them [Metric measuring system] Basic arithmetic skills

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Rule	Comprehension, trade terminology, detail inference, recognize symbols, codes, and emblems

37

(TASK STATEMENT) MEASURE WITH CALIPERS

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Workpiece Inside caliper Outside caliper Hermaphrodite calipers Steel rule Micrometers Vernier calipers	Select calipers needed for degree of accuracy required Adjust calipers to correct fit Measure caliper setting with rule or micrometers	Sharp point on hermaphrodite caliper Puncture wounds
DECISIONS	**CUES**	**ERRORS**
Determine degree of accuracy required Determine when the feel or drag is correct	Relative precision of workpiece Tension on caliper opening	Incorrect "feel" of calipers when measuring

ASK STATEMENT) MEASURE WITH CALIPERS

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage [Measuring tool] Work input, work output, friction and efficiency in simple machines [Effects of friction with simple tools]	Measures of length Measure with the Metric and English system and convert between them Basic arithmetic skills

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Viewing	Calipers	Visual analysis, describing, logic, detail inference, recognition of symbols, codes, and emblems
Touching	Calipers	Size, movement, and tension

(TASK STATEMENT) MEASURE ANGLES WITH PROTRACTOR

40

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Workpiece Protractor head and steel blade Bevel protractor Vernier bevel protractor Surface plate	Select protractor needed for degree of accuracy required Set protractor to the corresponding angles Record reading	Shut off machinery Cuts or abrasions from moving parts
DECISIONS	**CUES**	**ERRORS**
Determine degree of accuracy required Determine correctness of fit of workpiece	Shape and surface condition of workpiece Precision of finished works	Moving of the protractor blade when reading

40

ASK STATEMENT) MEASURE ANGLES WITH PROTRACTOR

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage (measuring tool)	Given an instrument of measure, determine precision, and/or accuracy with respect to relative error, tolerance, and significant digits (Measuring in other than linear, square, and cubic) Given a coding system, recognize and identify each unit involved by assigning necessary symbols, numerical or literal [Degrees and minutes] Addition and subtraction of whole numbers

41

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Viewing	Protractor	Visual analysis, logic, and recognition of symbols, codes, and emblems
Writing	Record readings	Penmanship, classification, and trade terminology

47

(TASK STATEMENT) CHECK RADIUS WITH RADIUS GAGE

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Workpiece Radius gage and handle	Select proper radius gage Check radius by holding workpiece up to the light and checking with gage	Shut off machinery Cuts or abrasions

DECISIONS	CUES	ERRORS
Determine accuracy of reading needed	Workpiece is not clean or free from burrs	Improper measurement or reading

42

ASK STATEMENT) CHECK RADIUS WITH RADIUS GAGE

SCIENCE	MATH – NUMBER SYSTEMS
	Basic arithmetic skills Measure with the Metric and English system and convert between them [Changing fractions to decimals and decimals to fractions] Congruence (checking radius)

43

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Viewing	Compare workpiece to gage	Visual analysis, describing, logic, detail inference, recognition of symbols, codes, and emblems
Touching	Workpiece	Size, shape, and texture

(TASK STATEMENT) CHECK WORK WITH THICKNESS GAGE

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Workpiece Thickness gage Clamps Wrenches Surface plate	Select proper blade thickness Check with thickness blade	Shut off machinery Cuts or abrasions
DECISIONS	**CUES**	**ERRORS**
Determine when "feel or drag" is correct	Nature of piece to be measured	Incorrect measure

ASK STATEMENT) CHECK WORK WITH THICKNESS GAGE

SCIENCE	MATH – NUMBER SYSTEMS
Work input, work output, friction and efficiency in simple machines [Effects of friction with hand tools]	Basic arithmetic skills Given an instrument of measure, determine precision, and/or accuracy with respect to relative error, tolerance, and significant digits (Measuring in other than linear, square, and cubic) [Thickness gage]

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Viewing	Compare workpiece to gage	Visual analysis, describing, logic, detail inference, recognition of symbols, codes, and emblems
Touching	Gage	Size, tension

(TASK STATEMENT) MEASURE WITH A COMBINATION SET

46

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Workpiece Square head Level Scriber Center head Protractor head Steel blade	Select measuring device needed Mount proper device on the blade Position and fit set in place Read measure indicated	Sharp end on scriber Puncture wound
DECISIONS	**CUES**	**ERRORS**
Determine type of measuring to be done Select proper combination of set parts for shape of workpiece	Surface condition of workpiece Shape to be measured	Measuring device not tight on blade Improper fit on piecework

46

ASK STATEMENT) MEASURE WITH A COMBINATION SET

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines [Using simple hand tools]	Read degree measurement Measures of length Geometric constructions (Perpendiculars to line, bisecting angles, finding the center of an arc, etc.) [Determination of perpendicularity]

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Viewing	Read measures Shape of workpiece	Visual analysis, describing, logic, detail inference, recognize symbols, codes, and emblems
Touching	Fit of measuring	Size, shape, texture, tension, movement

(TASK STATEMENT) MEASURE WITH MICROMETER

48

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Workpiece Outside micrometer Vernier micrometer Thread micrometer Inside micrometer Depth micrometer Metric micrometer	Select micromter needed Check micrometer for accuracy Measure workpiece	Stop machinery before measurement Cuts Care when using micrometer Loss of accuracy
DECISIONS	**CUES**	**ERRORS**
Determine type of micrometer to use Determine the proper feel of the micrometer when measuring Determine if workpiece is too hot to measure accurately	Workpiece is not clean or free from burrs Temperature of workpiece when measuring	Improper measure Damage micrometer

48

ASK STATEMENT) MEASURE WITH MICROMETER

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines [Using simple hand tools] Arrangement of molecules, atoms and ions and the effect on structure and strength of materials [Strength of materials (overtightening)]	Measures of length [Decimals-English system] Measure with the Metric and English system and convert between them [Millimeter-Metric system] Given an instrument of measure, determine precision, and/or accuracy with respect to relative error, tolerance, and significant digits (Measuring other than linear, square, and cubic) [Micrometer] [Changing fractions to decimals] Basic arithmetic skills

49

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Viewing	Read measures Shape of workpiece	Visual analysis, describing, logic, detail inference, recognize symbols, codes, and emblems
Touching	Fit of measuring	Size, shape, texture, tension, movement, temperature

49

(TASK STATEMENT) MEASURE WITH VERNIER HEIGHT GAGE

50

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Workpiece Vernier height gage Scriber point Dial indicator Gage blocks Layout dye Magnifying glass Thickness gage Surface plates	Clean surface plate Set height gage Check or scribe workpiece	Sharp scriber point Puncture wound or cuts
DECISIONS	**CUES**	**ERRORS**
Determine degree of accuracy required Determine proper feel when measuring	Dirt or grit on the surface plate Shape of workpiece to be measured	Improper measure Damaged gage

50

ASK STATEMENT) MEASURE WITH VERNIER HEIGHT GAGE

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines [Using simple hand tools] [Properties of light and focal length (magnifying glass]	Measures of length [Decimals] Given an instrument of measure, determine precision, and/or accuracy with respect to relative error, tolerance, and significant digits (Measuring other than linear, square, and cubic) Measure with the Metric and English system and convert between them Basic arithmetic skills [Changing fractions to decimals]

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Viewing	Read measures Shape of workpiece	Visual analysis, describing, logic, detail inference, recognize symbols, codes, and emblems
Touching	Fit of measuring	Size, shape, texture, tension, movement

(TASK STATEMENT) MEASURE WITH VERNIER CALIPERS

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Workpiece Vernier calipers Magnifying glass Vernier gear tooth calipers	Adjust calipers to proper "feel" Read vernier scale	Shut off machine Cuts and bruises Damage to calipers
DECISIONS	**CUES**	**ERRORS**
Determine proper adjustment when measuring	Workpiece clean or free from burrs Shape of workpiece to be measured	Improper measure

(TASK STATEMENT) MEASURE WITH VERNIER CALIPERS

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines [Using simple hand tools] Properties of light and focal length (magnifying glass)	Measures of length [Decimals] Given an instrument of measure, determine precision, and/or accuracy with respect to relative error, tolerance, and significant digits (Measuring other than linear, square, and cubic) [Calipers] Measure with the Metric and English system and convert between them Basic arithmetic skills [Changing fractions to decimals]

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Viewing	Read measures Shape of workpiece	Visual analysis, describing, logic, detail inference, recognize symbols, codes, and emblems
Touching	Fit of meauring	Size, shape, texture, tension, movement

(TASK STATEMENT) CHECK HOLE DIAMETER WITH HOLE GAGE

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Workpiece Small hole gage Telescoping gage Vernier calipers Inside micrometers Inside calipers Outside micrometers Dial bore gage	Select proper measuring device Set measuring device to fit hole Check measuring device with micrometer	Shut off machinery Cuts
DECISIONS	**CUES**	**ERRORS**
Determine degree of accuracy required Determine proper feel when measuring Determine proper temperature for accurate measure	Workpiece clean or free from burrs Temperature of workpiece	Incorrect measure

45

(TASK STATEMENT) CHECK HOLE DIAMETER WITH HOLE GAGE

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work inout, work output, friction and efficiency in simple machines [Using simple hand tools]	Measures of length Given an instrument of measure, determine precision, and/or accuracy with respect to relative error, tolerance, and significant digits (Measuring in other than linear, square, and cubic) [Micrometer] Measure with the Metric and English system, and convert between them Basic arithmetic skills [Changing fractions to decimals]

55

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Viewing	Read measures Shape of workpiece	Visual analysis, describing, logic, detail inference, recognize symbols, codes, and emblems
Touching	Fit of measuring device	Size, shape, texture, tension, movement, temperature

55

(TASK STATEMENT) CHECK WORK WITH A DIAL INDICATOR

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Workpiece Dial indicator Indicator holder Surface plate Clamps Wrenches Any piece of machinery where an indicator can be used	Clean work surface Select dial indicator needed Mount indicator on holding device Record reading of the dial	Care when using indicator Loss of accuracy Shut off machinery Cuts and abrasions

DECISIONS	CUES	ERRORS
Determine type of indicator to use Determine indicator holding device needed	Mount indicator securely Dirt or grit on work surface	Incorrect reading

95

(TASK STATEMENT) CHECK WORK WITH A DIAL INDICATOR

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines [Using simple tools]	Measures of length Given an instrument of measure, determine precision, and/or accuracy with respect to relative error, tolerance, and significant digits (Measuring other than linear, square, and cubic) Measure with the Metric and English system and convert between them Basic arithmetic skills

LS

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Viewing	Read indicator Size and shape of workpiece	Visual analysis, logic, detail inference, recognize symbols, codes, and emblems
Touching	Surfaces	Size, shape, texture, movement

52

(TASK STATEMENT) CHECK WORK WITH PLUG AN[illegible]NG GAGES

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Plug gage Ring gage Workpiece Micrometers Prussian blue	Select plug or ring gage needed Apply prussian blue if checking tapers is required	Shut off machine Cuts and abrasions
DECISIONS	**CUES**	**ERRORS**
Determine accuracy required Determine the proper feel Determine if workpiece is too hot to measure accurately	Workpiece clean or free from burrs Temperature of workpiece	Incorrect measure

85

TASK STATEMENT) CHECK WORK WITH PLUG AND RING GAGES

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines [Using simple tools] Composition of matter, including protons, neutrons, electrons, atoms, molecules, elements Effects of friction on work processes and product quality [Usage of Prussian blue]	Measures of length Given an instrument of measure, determine precision, and/or accuracy with respect to relative error, tolerance, and significant digits (Measuring in other than linear, square, and cubic) Measure with the Metric and English system and convert between them Basic arithmetic skills

59

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Viewing	Read measures Shape of workpiece	Visual analysis, describing, logic, detail inference, recognize symbols, codes, and emblems
Touching	Fit of measuring device	Size, shape, texture, tension, movement, temperature

(TASK STATEMENT) MEASURE ANGLES WITH A SINE BAR

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Two blocks Sine bar Vernier height gage Dial indicator Surface plate Magnifying glass Trigonometry table	Clean surface plate Select proper height of blocks Mount work on sine bar Mount indicator on holding device Measure angle	

DECISIONS	CUES	ERRORS
Determine degree of accuracy required	Dirt or grit on surface plate	Incorrect calculation of sine

TASK STATEMENT) MEASURE ANGLES WITH A SINE BAR

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines [Using simple tools] Properties of light and focal length (Magnifying glass)	Measures of length Given an instrument of measure, determine precision, and/or accuracy with respect to relative error, tolerance, and significant digits (Measuring in other than linear, square, and cubic) Measure with the Metric and English system and convert between them Basic arithmetic skills Use of trigonometric functions in solution of problems involving right triangles

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Trigonometry	Table, comprehension, detail inference, trade terminology
Viewing	Sine bar	Visual analysis, logic, detail inference, recognize symbols, codes, and emblems
Touching	Surface plate Mount	Texture, movement

(TASK STATEMENT)

CALIBRATE MICROMETER

62

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Micrometer Micrometer wrenches Standards	**Clean standards** Determine how to adjust micrometer Check micrometer for accuracy Set micrometer	Care when using micrometers Loss of accuracy
DECISIONS	**CUES**	**ERRORS**
Determine proper feel of micrometer	Tension of micrometer	Dirt on standard or micrometer Incorrect measure

62

(TASK STATEMENT) CALIBRATE MICROMETERS

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines [Using simple tools] Effect of heating and cooling on expansion of materials (Change of dimensions) [Effects of heating and cooling]	Measures of length Given an instrument of measure, determine precision, and/or accuracy with respect to relative error, tolerance, and significant digits (Measuring other than linear, square, and cubic) [Micrometer] Measure with the Metric and English system and convert between them Basic arithmetic skills Given a coding system, recognize and identify each unit involved by assigning necessary symbols, numerical or literal [Standards, blocks]

63

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Viewing	Micrometer readings	Comprehension, trade terminology, visual analysis, logic, detail inference, recognition of codes, symbols, and emblems
Touching	Fit of micrometer	Size, shape, and texture

63

Duty D Setting Up and Operating Metal Cutting Saws

1 Interpret blueprint language
2 Clean and lubricate saws
3 Install and adjust saw guides
4 Select and weld band saw blades
5 Install blade and adjust tension
6 Set and operate saw controls
7 Select and cut material with saw
8 Remove and inspect part of saw

64

(TASK STATEMENT) INTERPRET BLUFPRINT LANGUAGE

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Blueprint	Select appropriate print by code number Identify and interpret symbols and schematics Interpret locations and dimensions Interpret sizes, shapes, and finishes Transfer measures from blueprint to workpiece	

DECISIONS	CUES	ERRORS
Determine measurement transfer, layout procedure to maintain accuracy of tolerances	Degree of accuracy indicated on drawings	Misinterpretation of blueprint dimensions

59

TASK STATEMENT) INTERPRET BLUEPRINT LANGUAGE

SCIENCE	MATH – NUMBER SYSTEMS
	Determination of area and circumference of circles Given a coding system, recognize and identify each unit involved by assigning necessary symbols, numerical or literal [Blueprint code] Read and interpret charts, tables, and/or graphs Measure with the Metric and English system and convert between them Measures of length Given an instrument of measure, determine precision, and/or accuracy with respect to relative error, tolerance, and significant digits (Measuring in other than linear, square, and cubic) Basic arithmetic skills Determination of area, perimeter and diagonals of quadrilaterals (4 sided figures) Determination of area, perimeter and diagonals of polygons with more than 4 sides

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Comprehend blueprint	Comprehension, trade terminology, description of mechanism, clarity of expression, instruction (oral and informal), logic, recommendation report (oral and informal)

(TASK STATEMENT) CLEAN AND LUBRICATE SAW

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Oil Grease Oil can Grease gun Rags Solvent Brushes Measuring containers Lubrication charts Abrasive material Wrenches Drop cord	Clean fittings before lubrication Remove and install plug and covers Make necessary adjustments Start and stop machinery	Avoid chips Causes cuts Do not use pressurized air Eye and machine damage Shut machine off before cleaning Electrical shock Avoid spills Falls Proper disposal of lubricants and solvents Fire Water pollution
DECISIONS	**CUES**	**ERRORS**
Determine proper frequency of lubrication Select proper lubricant Locate all lubrication points Determine correct amount of lubricant	Operation manual guidelines Type of machinery	Equipment malfunction

ASK STATEMENT) CLEAN AND LUBRICATE SAW

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines Composition of matter, including protons, neutrons, electrons, atoms, molecules, elements [Properties of lubricants] Effects of friction on work processes and product quality [Friction causes deterioration]	Given a coding system, recognize and identify each unit involved by assigning necessary symbols, numerical or literal [Society of Automotive Engineers Specifications] [American Iron and Steel Institute Specifications] Read and interpret charts, tables, and/or graphs [Lubrication charts] Liquid and dry measures [Liquid measure]

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Operational manuals	Comprehension, trade terminology, description of mechanisms, definition instructions
Viewing	Equipment	Visual analysis, describing, logic, detailed inference, color discrimination
Touching	Equipment	Temperature, texture, movement, tension

(TASK STATEMENT) INSTALL AND ADJUST SAW GUIDES

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Cage Wrenches Thickness gage	Select saw guides Clean saw guides and slot Install guides Adjust guide and check	

DECISIONS	CUES	ERRORS
Determine proper guide to use Determine proper adjustment	Thickness of workpiece Type of workpiece	Improper selection Improper adjustment

ASK STATEMENT) INSTALL AND ADJUST SAW GUIDES

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines [Simple hand tools]	Measures of length

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Viewing	Saw guides	Visual analysis, describing, logic, detail inference, recognition of symbols, codes, and emblems
Touching	Adjustments	Movement

(TASK STATEMENT) SELECT AND WELD BAND SAW BLADE

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Band saw blade Band saw welder Pull out scale File Grinder Thickness gage	Select blade Cut to length Prepare ends Clamp in welder Set control for welder Weld blade Check weld Temper weld File or grind excess weld Fit blade to gage Retemper weld	Welding Flash or burns Handling saw blade Cuts Grinding weld Eye injury Abrasions Incorrect pitch blade for material Broken saw blade Cuts
DECISIONS	**CUES**	**ERRORS**
Select welder control setting Determine tempering heat	Saw blade Weld	Improper control setting Improper tempering Improper grinding of weld

ASK STATEMENT) SELECT AND WELD BAND SAW BLADE

SCIENCE	MATH – NUMBER SYSTEMS
Heat Treatment Metallurgy Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines [Simple hand tools (levers)] Effect of heating and cooling on state of matter (Change of matter from one form to another) Transfer of energy from one body to another [Electrical welder] Resistance of materials to flow of electrical current Arrangement of molecules, atoms and ions and the effect on structure and strength of materials Resistance of materials to change in shape [(Annealing) Strength of materials]	Measures of length [Linear measurement] Measures of temperature Given a coding sytem, recognize and identify each unit involved by assigning necessary symbols, numerical or literal [Color codes for temperature of tempering] [Pitch selection system]

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Viewing	Saw blade Weld scales	Visual analysis, describing, logic, detail inference, recognition of symbols, codes, and emblems
Touching	Blade surface Weld	Texture, temperature

(TASK STATEMENT) INSTALL BLADE AND ADJUST TENSION

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Saw Blade	Install blade on pulleys Adjust tension Check tension	Handling saw blade Cuts Blade reversed Dull or broken blade

DECISIONS	CUES	ERRORS
Select proper tension	Band tension gage	Blade reversed Improper tension

(TASK STATEMENT) INSTALL BLADE AND ADJUST TENSION

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines [Using levers and pulleys]	

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Viewing	Blade set-up Tension gage	Visual analysis, describing, logic, detail inference, recognition of symbols, codes, and emblems
Touching	Blade tension	Movement

(TASK STATEMENT) SET AND OPERATE SAW CONTROLS

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Saw Speed chart	Start saw Adjust speed control Adjust feed control	Excessive speed of saw Destroyed saw blade Excessive feed of material Broken blade Cuts
DECISIONS	**CUES**	**ERRORS**
Determine speed and feed to be utilized	Speed chart Formula Composition of workpiece Size of workpiece Shape of workpiece	Poor cutting action Dragging

(TASK STATEMENT) SET AND OPERATE SAW CONTROLS

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines [Using simple hand tools] Transfer of energy from one form to another Motion resulting from two or more forces acting on a point in a body [(Automatic feed) Transfer of energy]	Measure of time and speed (Example: time-seconds, minutes, etc.; speed-feet per minute, R.P.M., etc.) [RPM gage]

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Viewing	Saw controls	Visual analysis, logic, detail inference, recognize symbols, codes, and emblems
Touching	Controls	Tension, movement

(TASK STATEMENT) SELECT AND CUT MATERIAL WITH SAW

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Bar stock Saw Saw blade Pull out scale Steel color code chart Prick punch Dividers Hammer Blueprint	Select material Clamp material	Burrs on material Cuts Proper handling of heavy material Bruises, cuts, or fractures

DECISIONS	CUES	ERRORS
Select correct material Select proper clamping procedure Select feeds and speeds	Color code sheet Blueprint Formula Composition, size, shape of workpiece	Poor cutting action Dragging

(TASK STATEMENT) SELECT AND CUT MATERIAL WITH SAW

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines [Using simple hand tools] [Levers] Transfer of energy from one form to another [Transfer mechanical to heat energy] Effects of friction on work processes and product quality [Friction created by sawing] Arrangement of molecules, atoms and ions and the effect on structure and strength of materials Resistance of materials to change in shape [Strength of materials]	Measures of length [Linear measurement] Given a coding system, recognize and identify each unit involved by assigning necessary symbols, numerical or literal [Color codes for steel] Measure with the Metric and English system and convert between them [Knowledge of geometric shapes]

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Blueprint Steel color Code chart Scale	Comprehension, trade terminology, detail inference, recognize symbols, codes, and emblems
Viewing	Material Clamp set-up	Visual analysis, logic, detail inference
Touching	Clamp set-up	Tension and movement

(TASK STATEMENT) REMOVE AND INSPECT PART OF SAW

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Workpiece Pull out scale Blueprint Micrometers Vernier calipers	Remove part from saw Deburr part Inspect part Deburr excess material	Burrs on workpiece Cuts Avoid contact with saw blade Cuts Handle material properly Bruises Fractures
DECISIONS	**CUES**	**ERRORS**
Determine degree of accuracy required	Micrometer Scale Blueprint	Dirt or grit on part Burrs on part

ASK STATEMENT) REMOVE AND INSPECT PART OF SAW

SCIENCE	MATH – NUMBER SYSTEMS
	Measures of length

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Blueprint Scale	Comprehension, trade terminology, detail inference, recognize symbols, codes, and emblems
Viewing	Micrometer Calipers Workpiece	Visual analysis, logic, detail inference
Touching	Workpiece Micrometer	Size, shape, texture, tension, and movement

Duty E Setting Up and Operating Drill Presses

1 Clean and lubricate drill press
2 Select and mount work and work holding device
3 Center drill and drill a hole on the drill press
4 Ream a drilled hole with a drill press
5 Tap hole using tapping attachment
6 Spotface a hole
7 Countersink a hole
8 Counterbore a hole
9 Set and operate drill press controls
10 Remove and inspect part from drill press

(TASK STATEMENT) CLEAN AND LUBRICATE DRILL PRESS

82

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Oil Grease Oil can Grease gun Rags Solvent Brushes Measuring containers Lubrication charts Abrasive material Drop cord Wrenches	Clean fittings before lubrication Remove and install plug and covers Make necessary adjustments Start and stop machinery	Avoid chips Cuts Do not use pressurized air Eye and machine damage Shut machine off before cleaning Electrical shock Avoid spills Falls Proper disposal of lubricants and solvents Fire Water pollution
DECISIONS	**CUES**	**ERRORS**
Determine proper frequency of lubrication Select proper lubricant Locate all lubricant parts Determine correct amount of lubricant	Operation manual guidelines Type of machinery	Equipment malfunction

82

ASK STATEMENT) CLEAN AND LUBRICATE DRILL PRESS

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines Composition of matter, including protons, neutrons, electrons, atoms, molecules, elements [Properties of lubricants] Effects of friction on work processes and product quality [Friction causes deterioration]	Given a coding system, recognize and identify each unit involved by assigning necessary symbols, numerical or literal [Society of Automotive Engineers Specifications] [American Iron and Steel Institute Specifications] Read and interpret charts, tables, and/or graphs [Lubrication charts] Liquid and dry measures [Liquid measure]

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Operational manuals	Comprehension, trade terminology, description of mechanism, definition, instructions

(TASK STATEMENT) SELECT AND MOUNT WORK AND WORK HOLDING DEVICE

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Workpiece Vee blocks Clamps Wrenches Drill jig Vise Step blocks	Select proper work holding device Clean table and work holding device Mount work holding device on table Mount work in work holding device	Holding device not tight Cuts and abrasions Work not clamped tightly Cuts and abrasions
DECISIONS	**CUES**	**ERRORS**
Determine type of holding device Determine how to mount holding device	Size and shape of workpiece	Dirty table Work holding device not tight Work improperly clamped

(TASK STATEMENT) SELECT AND MOUNT WORK AND WORK HOLDING DEVICE

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines [Clamps, T-bolds, jigs, and fixtures] [Setting time] Motion resulting from two or more forces acting on a point in a body [Resistance to motion (torque)] Relationship of force to distortion in an elastic body Resistance of materials to change in shape [Proper tightening torque]	Given a coding system, recognize and identify each unit involved by assigning necessary symbols, numerical or literal [Wrench sizes]

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Viewing	Workpiece Mounting	Visual analysis, detail inference, logic, describing
Touching	Workpiece Mounting	Size, shape, tension, and movement

(TASK STATEMENT) CENTER DRILL AND DRILL A HOLE ON THE DRILL PRESS

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Drill press Drill chuck Chuck key Sleeve Drill Center drill Workpiece Drift key Ballpeen hammer Safety glasses Coolant Blueprint	Select proper drills Clamp workpiece Apply coolant Center drill Drill Deburr Inspect	Hot shavings and chips Cuts, burns, and eye injury Drill breakage-Improper grind Cuts and eye injury Improper clamping of material Cuts and abrasions
DECISIONS	**CUES**	**ERRORS**
Determine speeds and feeds	Size, shape, and composition of workpiece	Incorrect drill size Improper clamping of workpiece Improperly sharpened drill Failure to use coolant

(TASK STATEMENT) CENTER DRILL AND DRILL A HOLE ON THE DRILL PRESS

SCIENCE	MATH – NUMBER SYSTEMS
Relationship of force to distortion in an elastic body Simple machines used to gain mechanical advantage [Drill chuck gears] Work input, work output, friction and efficiency in simple machines [Drill efficiency] Effect of heating and cooling on expansion of materials [Changing of dimension of the drilled hole] Transfer of heat from one body to another [Coolant] Motion resulting from two or more forces acting on a point in a body [Workpiece must resist motion] Effects of friction on work processes and product quality [Deterioration of workpiece and tool] Arrangement of molecules, atoms and ions and the effect on structure and strength of materials (tools, fixture) Resistance of materials to change in shape	Given a coding system, recognize and identify each unit involved by assigning necessary symbols, numerical or literal [Drill coding system] Measures of length [Measurement of length] Multiplication and division with whole numbers Multiplication and division of proper and improper fractions Multiplication and division of decimal fractions Measure of time and speed (Example: time-seconds, minutes, etc.; speed-feet per minute, R.P.M., etc.)

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Blueprint	Comprehension, trade terminology, detail inference, recognition of symbols, codes and emblems
Viewing	Inspect workpiece	Visual analysis, describing, logic, detail inference
Touching	Surface of workpiece	Size, shape, texture, and temperature

(TASK STATEMENT) REAM A DRILLED HOLE ON A DRILL PRESS

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Workpiece Reamers Drill chuck Chuck key Sleeve Drift Hammer Holding devise Plug gage Micrometers Vernier calipers Coolant Safety glasses	Select reamer Mount work in holding device Mount reamer in chuck Apply coolant Select feeds and speeds Ream hole Check hole diameter	Hot shavings and chips Cuts, burns, and eye injury Improper clamping of material Cuts and abrasions Avoid contact with rotating tools Cuts and bruises
DECISIONS	**CUES**	**ERRORS**
Determine type of reamer to use Determine proper speeds and feeds	Size and shape of hole Size, shape, and composition of workpiece	Use wrong type of reamer Lack of coolant Running the reamer in reverse RPM of reamer too high

(TASK STATEMENT) REAM A DRILLED HOLE ON A DRILL PRESS

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage [Clamps, T-bolds, jigs, and fixtures] Work input, work output, friction and efficiency in simple machines [Setting time] Motion resulting from two or more forces acting on a point in a body [Resistance to motion (torque)] Relationship of force to distortion in an elastic body Resistance of materials to change in shape [Proper tightening torque] Effects of friction on work processes and product quality [Speed critical to dimensional accuracy]	Given a coding system, recognize and identify each unit involved by assigning necessary symbols, numerical or literal [Reamer sizing system] Given an instrument of measure, determine precision, and/or accuracy with respect to relative error, tolerance, and significant digits (Measuring and other than linear, square, and cubic) Measure of time and speed (Example: time-seconds, minutes, etc.; speed-feet per minute, R.P.M., etc.)

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Viewing	Workpiece Micrometers Calipers Gage	Visual analysis, logic, detail inference, recognition of codes, symbols, and emblems
Touching	Workpiece	Size, shape, texture, movement, and temperature

(TASK STATEMENT) TAP HOLE USING TAPPING ATTACHMENT

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Workpiece Tap Tapping attachment Coolant Wrenches Holding device Safety glasses	Selection of tapping speed Select tap Clamp workpiece securely Lubricate tap Tap workpiece Check threads	Tap breakage Cuts and eye injury Failure of holding device Tap breakage Cuts and bruises Eye injuries
DECISIONS	**CUES**	**ERRORS**
Select tap Select speeds	Thread, size, and hole diameter Size, shape, and composition of workpiece	Improper tap selection Workpiece not clamped correctly

ASK STATEMENT) TAP HOLE USING TAPPING ATTACHMENT

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage [Clamps, T-bolds, jigs, and fixtures] [Ratio of speeds between tapping attachment and spindle] Work input, work output, friction and efficiency in simple machines [Setting time] [Excess speed deteriorates tools] Composition of matter, including protons, neutrons, electrons, atoms, molecules, elements [Properties of tapping lubricant] Transfer of heat from one body to another [Lubricant justification] Effects of friction on work processes and product quality [Excess friction detrimental to threads] Relationship of force to distortion in an elastic body Resistance of materials to change in shape [Strength of tool]	Given a coding system, recognize and identify each unit involved by assigning necessary symbols, numerical or literal [Tap sizing system] Read and interpret charts, tables, and/or graphs [Tap drill chart] Measures of length Measure with the Metric and English system and convert between them

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Viewing	Workpiece Holding device	Visual analysis, logic, and detail inference
Touching	Workpiece	Size, shape, movement, and temperature

(TASK STATEMENT) SPOTFACE A HOLE

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Workpiece Spotfacing tool Pilot Counterbore Work holding device Coolant Scale Safety glasses Mics Wrenches	Select proper spotface Clamp work Mount spotface in chuck Apply coolant Select speeds and feeds Spotface hole to proper depth Check hole	Keep hands clear of cutter Cuts Avoid hot shavings Cuts and burns Eye injury
DECISIONS	**CUES**	**ERRORS**
Determine feeds and speeds	Size, shape, and composition of workpiece	Lack of coolant Running spotface in reverse Vibrations

ASK STATEMENT) SPOTFACE A HOLE

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage [Clamps, T-bolds, jigs, and fixtures] Work input, work output, friction and efficiency in simple machines [Setting time] Motion resulting from two or more forces acting on a point in a body [Resistance to motion (torque)] Effects on friction on work processes and product quality [Damage to tools by excess friction] Transfer of heat from one body to another [Lubricant justification]	Measures of length

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Viewing	Workpiece Scale	Visual analysis, logic, detail inference, recognize symbols, codes, and emblems
Touching	Workpiece	Size, shape, movement, texture, and temperature

(TASK STATEMENT) COUNTERSINK A HOLE

94

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Workpiece Scale Countersink Drill chuck Chuck key Sleeve Drift Hammer	Select countersink Clamp work Mount countersink in chuck Apply coolant Select speeds and feeds Countersink hole Check hole	Keep hands clear of cut Cuts Avoid hot chips Cuts and burns Eye injury
DECISIONS	**CUES**	**ERRORS**
Determine speeds and feeds	Size, shape, and composition of workpiece	Lack of coolant Running countersink in reverse Vibrations

94

ASK STATEMENT) COUNTERSINK A HOLE

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage [Clamps, T-bolds, jigs, and fixtures] Work input, work output, friction and efficiency in simple machines [Setting time] Motion resulting from two or more forces acting on a point in a body [Resistance to motion (torque)] Effects of friction on work processes and product quality [Damage to tool by excess friction] Transfer of heat from one body to another [Lubricant justification]	Given a coding system, recognize and identify each unit involved by assigning necessary symbols, numerical or literal [Angular sizing]

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Viewing	Workpiece Scale	Visual analysis, logic, detail inference, recognize symbols, codes, and emblems
Touching	Workpiece	Size, shape, movement, texture, and temperature

(TASK STATEMENT) COUNTERBORE A HOLE

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Workpiece Counterbore Pilot Spotfacer Drill chuck Chuck key Sleeve Drift Hammer Wrenches Coolant	Select counterbore Clamp work Mount counterbore in chuck Apply coolant Select speeds and feeds Counterbore hole to proper depth Check hole	Keep hands clear of cutter Cuts Avoid hot shavings Cuts, burns, and eye injury
DECISIONS	**CUES**	**ERRORS**
Determine feeds and speeds	Size, shape, and composition of workpiece	Lack of coolant Running counterbore in reverse Vibrations

ASK STATEMENT) COUNTERBORE A HOLE

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechaincal advantage [Clamps, T-bolds, jigs, and fixtures] Work input, work output, friction and efficiency in simple amchines [Setting time] Motion resulting from two or more forces acting on a point in a body [Resistance to motion (torque)] Effects of friction on work processes and product quality [Damage to tools by excess friction] Transfer of heat to one body to another [Lubricant justification]	Measures of length Given a coding system, recognize and identify each unit involved by assigning necessary symbols, numerical or literal [Counterbore sizing]

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Viewing	Workpiece Holding device	Visual analysis, logic, and detail inference
Touching	Workpiece	Size, shape, movement, and temperature

(TASK STATEMENT) SET AND OPERATE DRILL PRESS CONTROLS

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Wrenches Chart for speeds and feeds	Adjust speed control Adjust feed control Start machine Engage automatic feeds	Excessive speeds and feeds Destroyed or broken cutting tools Cuts Eye injury
DECISIONS	**CUES**	**ERRORS**
Determine feeds and speeds Determine when to use automatic feeds	Speed chart Size, shape, and composition of workpiece	Improper feed and speed selection

(TASK STATEMENT) SET AND OPERATE DRILL PRESS CONTROLS

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines [Speed and feed controls] Inertia and momentum (Body at rest and body in motion) [When and how to adjust spindle speed and feeds]	Measure of time and speed (Example: time-seconds, minutes, etc., speed-feet per minute, R.P.M., etc.) [R.P.M. gage] Multiplication and division with whole numbers Multiplication and division of proper and improper fractions Multiplication and division of decimal fractions [Feeds and speeds]

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Viewing	Drill press controls	Visual analysis, logic, detail inference, recognize symbols, codes, and emblems
Touching	Controls	Tension, movement

(TASK STATEMENT) REMOVE AND INSPECT PART FROM DRILL PRESS

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Workpiece Scale Blueprint Mics Hole gages Wrenches Vernier calipers	Remove part Deburr part Inspect part	Burrs on workpiece Cuts Handle tools and material properly Cuts and burns Material damage
DECISIONS	**CUES**	**ERRORS**
Determine degree of accuracy required	Scale Blueprint Micrometer Gage	Dirt or grit on part Burrs on part Incorrect tolerances

(TASK STATEMENT) REMOVE AND INSPECT PART FROM DRILL PRESS

SCIENCE	MATH – NUMBER SYSTEMS
Effects of friction on work processes and product quality [Poor quality due to friction on workpiece or tool]	Measures of length

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Blueprint Scale	Comprehension, trade terminology, detail inference, recognize symbols, codes, and emblems
Viewing	Micrometer Calipers Workpiece	Visual analysis, logic, detail inference
Touching	Workpiece Micrometer	Size, shape, texture, tension, and movement

Duty F Operating a Pedestal Grinder

1 Clean and lubricate pedestal and grinder
2 Select mount and dress grinding wheel for pedestal grinder
3 Grind and sharpen tool bits on a pedestal grinder
4 Sharpen twist drill with grinder
5 Interpret blueprint language

102

(TASK STATEMENT) CLEAN AND LUBRICATE PEDESTAL AND GRINDER

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Oil Grease Oil can Grease gun Rags Solvent Brushes Measuring containers Lubrication charts Abrasive material Wrenches Drop cord	Clean fittings before lubrication Remove and install plug and covers Make necessary adjustments Start and stop machinery	Avoid chips Cuts Do not use pressurized air Eye and machine damage Shut machine off before cleaning Electrical shock Avoid spills Falls Proper disposal of lubricants and solvents Fire Water pollution
DECISIONS	**CUES**	**ERRORS**
Determine proper frequency of lubrication Select proper lubricant Locate all lubrication parts Determine correct amount of lubricant	Operation manual guidelines Type of machinery	Equipment malfunction

(91)

ASK STATEMENT) CLEAN AND LUBRICATE PEDESTAL GRINDER

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines Composition of matter, including protons, neutrons, electrons, atoms, molecules, and elements [Properties of lubricants] Effects of friction on work processes and product quality [Friction causes deterioration]	Given a coding system, recognize and identify each unit involved by assigning necessary symbols, numerical or literal [Society of Automotive Engineers Specifications] [American Iron and Steel Institute Specifications] Read and interpret charts, tables, and/or graphs [Lubrication charts] Liquid and dry measures [Liquid measure]

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Operational manuals	Trade terminology, description of mechanism, definition, instructions
Viewing	Equipment	Visual analysis, describing, logic, detail inference, color discrimination
Touching	Equipment	Temperature, texture, movement, and tension

(TASK STATEMENT) SELECT MOUNT AND DRESS GRINDING WHEEL FOR PEDESTAL GRINDER

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Wheel dresser Diamond Mechanical Stick Grinding wheel Wrenches Safety glasses	Select wheel Inspect wheel Clean arbor Install blotters Install washers Tighten nut Install guards Dress wheel	Use of damaged wheel Cuts and abrasions Eye injury Improper dressing procedure Damaged wheel Cuts and abrasions Eye injury Failure to wear eye protection Eye injury Inadequate wheel guards Cuts Bruises Eye injury
DECISIONS	**CUES**	**ERRORS**
Select proper wheel Select mounting procedures	Wheel selection chart	Incorrect wheel selection Improper mounting Guards not installed

501

(TASK STATEMENT) SELECT MOUNT AND DRESS GRINDING WHEEL FOR PEDESTAL GRINDER

SCIENCE	MATH – NUMBER SYSTEMS
Effects of friction on work processes and product quality [Types and strengths of grinding wheel] Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines [Dressing device and wrenches] Centrifugal forces developed by bodies in rotation Centripetal forces developed by bodies in rotation [Discharge of grinding wheel particles] Arrangement of molecules, atoms and ions and the effect on structure and strength of materials [Strength of grinding wheels]	Measures of length Measure of time and speed (Example: time-seconds, minutes, etc.; speed-feet per minute, R.P.M., etc.) [R.P.M.] Given a coding system, recognize and identify each unit involved by assigning necessary symbols, numerical or literal [Wrench sizing]

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Viewing	Wheel Mount set-up	Visual analysis, detail inference, logic
Touching	Install washers Nuts	Size, shape and tension

(TASK STATEMENT) GRIND OR SHARPEN TOOL BITS ON A PEDESTAL GRINDER

107

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Tool bit Safety galsses Template Protractor Coolant Radius gage Center gage Wrenches	Inspect wheel Select tool bit Select angles Adjust tool rest Grind angles Cool tool bit Check angles Hone edges	Failure to cool tool properly Cracked tools Burns Improperly held tool Broken wheel Eye injury Cuts and abrasions Improperly adjusted tool rest Cuts Bruises Tool and/or wheel damage
DECISIONS	**CUES**	**ERRORS**
Select clearance and rake angles	Protractor Radius and center gage	Overheating Holding tool loosely Tool rest too far from wheel

La1

(TASK STATEMENT) GRIND OR SHARPEN TOOL BITS ON A PEDESTAL GRINDER

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines [Drive mechanisms] Effect of heating and cooling on expansion of materials (Change of dimensions) [Heat effects workpiece] Centrifugal forces developed by bodies in rotation [Materials fly out] [Workpiece tends to be pulled out of your hand] Inertia and momentum (Body at rest and body in motion) Effects of friction on work processes and product quality [Overheating will tend to anneal or soften tool bits] Transfer of energy from one form to another [Mechanical energy changes to heat]	Read and interpret charts, tables, and/or graphs [Clearance and rake angles] Measures of length

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Viewing	Protractor Template Gages	Visual analysis, logic, detail inference, recognize symbols, codes, and emblems
Touching	Workpiece	Size, shape, texture, temperature

(TASK STATEMENT) SHARPEN TWIST DRILL WITH GRINDER

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Drill Drill point gage Safety glasses Coolant	Select drill Inspect wheel and dress Adjust tool rest Grind drill Cool drill Check grind with drill point gage	Failure to wear eye protector Eye injury Avoid contact with grinding wheel Cuts and abrasions
DECISIONS	**CUES**	**ERRORS**
Select correct angles	Drill point gage	Improper flute angles Inadequate clearance angle (relief) Unequal flute length

69

(TASK STATEMENT) SHARPEN TWIST DRILL WITH GRINDER

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines [Drive mechanisms] Effect of heating and cooling on expansion of materials (Change dimensions) [Materials fly out] [Workpiece tends to be pulled out of your hand] Inertia and momentum (Body at rest and body in motion) Effects of friction on work processes and product quality [Overheating will tend to anneal or soften tool bits] Transfer of energy from one form to another [Mechanical energy changes to heat]	Given an instrument of measure, determine precision, and/or accuracy with respect to relative error, tolerance, and significant digits (Measuring other than linear, square, and cubic) [Drill point gage] Measures of length

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Viewing	**Wheel dresser** Drill point gage	Visual analysis, logic, detail inference, recognize symbols, codes, and emblems
Touching	Drill	Size, shape, texture, and temperature

TASK STATEMENT) INTERPRET BLUEPRINT LANGUAGE

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Blueprint	Select appropriate print by code number Identify and interpret symbols and schematics Interpret locations and dimensions Interpret sizes, shapes, and finishes	

DECISIONS	CUES	ERRORS
Determine measurement transfer, layout procedure to maintain accuracy of tolerance	Degree of accuracy indicated on drawings	Misinterpretation of blueprint dimensions

(TASK STATEMENT) INTERPRET BLUEPRINT LANGUAGE

SCIENCE	MATH – NUMBER SYSTEMS
	Determination of area and circumference of circles Given a coding system, recognize and identify each unit involved by assigning necessary symbols, numerical or literal [Blueprint code] Read and interpret charts, tables, and/or graphs Measure with the Metric and English system and convert between them Measure of length Given an instrument of measure, determine precision, and/or accuracy with respect to relative error, tolerance, and significant digits (Measuring other than linear, square, and cubic) Basic arithmetic skills Determination of area, perimeter, and diagonals of quadrilaterals (4 sided figures); and polygons with more than 4 sides

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Blueprint	Comprehension, trade terminology, description of mechanism, appropriate diction, enunciation, clarity of expression, instruction (oral and informal), logic, recommendation report (oral and informal)

112

Duty G Setting Up and Operating Lathes

1 Clean and lubricate lathes
2 Grind and sharpen tool bits on a lathe
3 Sequence cutting tools and holder
4 Select and mount work and work holding device
5 Set and operate lathe controls
6 Face a workpiece
7 File a workpiece for burr removal
8 Hand finish a workpiece
9 Turn a shaft to a shoulder
10 Turn a taper on engine lathe
11 Knurl a workpiece
12 Cut off a workpiece with a parting tool
13 Cut with a form tool
14 Center drill and drill with a lathe
15 Bore a hole on a lathe
16 Thread a lathe
17 Grind with a tool post grinder on an engine lathe
18 Remove and inspect part from lathe

(TASK STATEMENT) CLEAN AND LUBRICATE LATHES

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Oil Solvent Grease Oil can Grease gun Rags Brushes Measuring containers Lubrication charts Abrasive material Wrenches Drop cord	Clean fittings before lubrication Remove and install plug and covers Make necessary adjustments Start and stop machinery	Avoid chips Cuts Do not use pressurized air Eye and machine damage Shut machinery off before cleaning Electrical shock Avoid spills Falls Proper disposal of lubricants and solvents Fire Water pollution
DECISIONS	**CUES**	**ERRORS**
Determine proper frequency of lubrication Select proper lubricant Locate all lubrication points Determine correct amount of lubricant	Operation manual guidelines Type of machinery	Equipment malfunction

ASK STATEMENT) CLEAN AND LUBRICATE LATHES

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines Composition of matter, including protons, neutrons, electrons, atoms, molecules, elements [Properties of lubricants] Effects of friction on work processes and product quality [Friction causes deterioration]	Given a coding system, recognize and identify each unit involved by assigning necessary symbols, numerical or literal [Society of Automotive Engineers Specifications] [American Iron and Steel Institute Specifications] Read and interpret charts, tables, and/or graphs [Lubrication charts] Liquid and dry measures [Liquid measure]

S11

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Operational manuals	Comprehension, trade terminology, description of mechanism, definition, instructions

115

(TASK STATEMENT) GRIND OR SHARPEN TOOL BITS ON A LATHE

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Tool bit Safety glasses Template Protractor Coolant Radius gage Center gage	Inspect wheel Select tool bit Select angles Adjust tool rest Grind angles Cool tool bit Check angles Hone edges	Avoid overheating tool bit Burns Destroy tool Avoid contacting wheel with fingers Cuts and abrasions Set tool rest close to wheel (16'') Broken wheel Cuts and abrasions Eye injury Wear safety glasses Eye injury
DECISIONS	**CUES**	**ERRORS**
Select clearance and rake angles	Protractor Radius and center gage	Overheating tool Holding tool loosely Tool rest too far from wheel

911

ASK STATEMENT) GRIND OR SHARPEN TOOL BITS ON A LATHE

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechaincal advantage Work input, work output, friction and efficiency in simple machines [Drive mechanisms] Effect of heating and cooling on expansion of materials (Change of dimensions) [Heat effects workpiece] Centrifugal forces develcped by bodies in rotation [Materials fly out] [Workpiece tends to be pulled out of your hand] Inertia and momentum (Body at rest and body in motion) Effects of friction on work processes and product quality [Overheating will tend to anneal or soften tool bits] Transfer of energy from one form to another [Mechanical energy changes to heat]	Read and interpret charts, tables, and/or graphs [Clearance and rake angles] Measures of length

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Viewing	Protractor Template Gages	Visual analysis, logic, detail inference, recognize symbols, codes, and emblems
Touching	Workpiece	Size, shape, texture, temperature

(TASK STATEMENT) SEQUENCE CUTTING TOOLS AND HOLDERS

118

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Tool bits (carbide and steel) Tool holders Drill Reamers Boring bars Mandrel Driving dog Grinder Drill chuck Drill sleeves Drill drift Hammer Wrenches Sleeve	Select tools and holders Clean tools and holders Install tools and holders	Proper handling of tools and holders Cuts, abrasions Damaged tools Damaged holders
DECISIONS	**CUES**	**ERRORS**
Determine types of tools and holders Determine sequence and procedures of mounting tools and holders	Size and shape of tools	Dirty tools and holders Incorrect selection of tools and equipment

811

ASK STATEMENT) SEQUENCE CUTTING TOOLS AND HOLDERS

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines [Strength of holding device] Effects of friction on work processes and product quality [Selection of tool material] Arrangement of molecules, atoms and ions and the effect on structure and strength of materials Resistance of materials to change in shape [Strength of material]	Given a coding system, recognize and identify each unit involved by assigning necessary symbols, numerical or literal [Wrench and cutting tool sizing]

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Viewing	Mounting set-up Tools	Visual analysis, logic, and detail inference

119

(TASK STATEMENT) SELECT AND MOUNT WORK AND WORK HOLDING DEVICE

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Four jaw chuck Three jaw chuck Steady rest Follower rest Centers Drive plate and dog Collet and drawbar Face plate Workpiece Mandrel Chuck wrench Clamps	Select workholding device Clean workholding device Mount workholding device Mount workpiece	Drop work or workholding device Cuts or bruises Part fly out of machine Eye injury Cuts and bruises
DECISIONS	**CUES**	**ERRORS**
Select proper workholding method Select proper workholding device	Size and shape of workpiece	Dirty fixtures Loose fixture Springing the work by improper mounting Loose work

ASK STATEMENT) SELECT AND MOUNT WORK AND WORKHOLDING DEVICE

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage [Clamps, T-bolds, jigs, and fixtures] Work input, work output, friction and efficiency in simple machines [Setting time] Motion resulting from two or more forces acting on a point in a body [Resistance to motion (torque)] Relationship of force to distortion in an elastic body Resistance of materials to change in shape [Proper tightening torque] Centrifugal forces developed by bodies in rotation Centripetal forces developed by bodies in rotation [Tendency of workpiece to fly out] Inertia and momentum (Body at rest and body in motion) Effects of friction on work processes and product quality	Given a coding system, recognize and identify each unit involved by assigning necessary symbols, numerical or literal

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Viewing	Workpiece Mount set-up	Visual analysis, detail inference, and logic

(TASK STATEMENT) SET AND OPERATE LATHE CONTROLS

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Speed and feed calculator or charts	Adjust speed control Adjust feed control Start machine Engage automatic feeds	Excessive speeds and feeds Destroyed or broken cutting tools Cuts Eye injury

DECISIONS	CUES	ERRORS
Determine feeds and speeds Determine when to use automatic feeds	Speed chart Formula of workpiece Size, shape, and composition of workpiece	Improper speed and feed selection

(TASK STATEMENT) SET AND OPERATE LATHE CONTROLS

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines [Speed and feed controls] Inertia and momentum (Body at rest and body in motion) [When and how to adjust spindle speed and feeds]	Measure of time and speed (Example: time-seconds, minutes, etc.; speed-feet per minute, R.P.M., etc.) [R.P.M.] Read and interpret charts, tables, and/or graphs [Lathe control chart] Measure with the Metric and English system and convert between them

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Viewing	Lathe controls	Visual analysis, logic, detail inference, recognize symbols, codes, and emblems
Touching	Controls	Tension and movement

(TASK STATEMENT) FACE A WORKPIECE

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Workpiece Tool and holder Coolant Wrenches Micrometers Safety glasses Scale File Vernier calipers	Start machine Set to cut Engage feed Face workpiece Deburr workpiece Check piece	Avoid sharp edges Cuts Tool failure Cuts and eye injury Loose workpiece Cuts and bruises Failure to wear eye protection Eye injury Avoid contact with revolving work Cuts and bruises Broken bones

DECISIONS	CUES	ERRORS
Determine amount of stock to be removed	Use of workpiece	Tool failure

ASK STATEMENT) FACE A WORKPIECE

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines [Cutting tool] Effect of heating and cooling on expansion of materials (Change of dimensions) [Overheating distorts workpiece] Transfer of energy from one form to another Transfer of heat from one body to another [Coolant usage-mechanical to heat energy] Effects of friction on work processes and product quality [Tool wear effects accuracy] [Tendency to workharden workpiece] Centrifugal forces developed by bodies in rotation [Workpiece flying off] Arrangement of molecules, atoms and ions and the effect on structure and strength of materials [Wear resistance of tool]	Measures of length

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Viewing	Workpiece Measuring devices	Visual analysis, logic, detail inference, recognize symbols, codes, and emblems
Touching	Workpiece Micrometer Caliper	Size, shape, texture, tension, and movement

(TASK STATEMENT) FILE A WORKPIECE

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Workpiece File and handle Chuck Collet Wrenches Safety glasses	Select file Install handle Start machine File part Check part	Avoid contact with revolving work Cuts and bruises Broken bones Improper filing Cuts and bruises Eye injury
DECISIONS	**CUES**	**ERRORS**
Select file of proper cut	Shape of workpiece Amount of stock to be removed	Improper file selection Incorrect filing procedure

TASK STATEMENT) FILE A WORKPIECE

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Composition of matter, including protons, neutrons, electrons, atoms, molecules, elements [Selection of type of tool] Effect of heating and cooling on expansion of materials [Overheating distorts workpiece] Centrifugal forces developed by bodies in rotation Centripetal forces developed by bodies in rotation [Workpiece flying out] Effects of friction on work processes and product quality [Tool wear effects accuracy]	Measures of length Measure with the Metric and English system and convert between them

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Viewing	Collet Workpiece	Visual analysis, logic, and detail inference
Touching	Workpiece	Size, shape, and texture

(TASK STATEMENT) HAND FINISH A WORKPIECE

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Workpiece Emery cloth Safety goggles Chuck Collets	Select emery cloth Start machine Finish surface of part Check part	Avoid contact with revolving work Cuts, bruises, and fractures Improper use of emery cloth Cuts and bruises

DECISIONS	CUES	ERRORS
Selection of emery cloth	Amount of stock to be removed	Excessive stock removal

ASK STATEMENT) HAND FINISH A WORKPIECE

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Composition of matter, including protons, neutrons, electrons, atoms, molecules, elements [Selection of type of tool] Effect of heating and cooling on expansion of materials [Overheating distorts workpiece] Centrifugal forces developed by bodies in rotation Centripetal forces developed by bodies in rotation [Workpiece flying out] Effects of friction on work processes and product quality [Tool wear effects accuracy]	Given a coding system, recognize and identify each unit involved by assigning necessary symbols, numerical or Literal [Grit texture]

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Viewing	Collet Workpiece	Visual analysis, logic, and detail inference
Touching	Workpiece	Size shape, and texture

(TASK STATEMENT) TURN A SHAFT TO A SHOULDER

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Workpiece Tool and holder Micrometers Micrometer stop Wrenches Scale Safety glasses Coolant	Start machine Set to cut Set stops Turn on coolant Turn part Deburr Check	Avoid contact with revolving work Cuts, bruises, and fractures Avoid sharp edges (tool and work) Cuts Failure to use eye protection Eye injury

DECISIONS	CUES	ERRORS
Determine amount of cut to be taken Determine setting of micrometer stops	Measuring devices	Incorrect stop setting Tool failure

(TASK STATEMENT) TURN A SHAFT TO A SHOULDER

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines [Cutting tool] Effect of heating and cooling on expansion of materials (Change of dimensions) [Overheating distorts workpiece] Transfer of energy from one form to another Transfer of heat from one body to another [Coolant usage-mechanical to heat energy] Effects of friction on work processes and product quality [Tool wear effects accuracy] [Tendency to workharden workpiece] Centrifugal forces developed by bodies in rotation [Workpiece flying off] Arrangement of molecules, atoms and ions and the effect on structure and strength of materials [Wear resistance of tool]	Measures of length

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Viewing	Workpiece Measuring devices	Visual analysis, logic, detail inference, recognize symbols, codes, and emblems
Touching	Workpiece Micrometer	Size, shape, temperature, tension, and movement

(TASK STATEMENT) TURN A TAPER ON ENGINE LATHE

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Chuck or collet Workpiece Tool and holder Wrenches Safety glasses Blueprint Plug gage Indicator and holder Micrometers Scale Coolant Prussian Blue	Set taper Compound rest Taper attachment Offset tailstock Start machine Turn on coolant Turn taper Check Finish taper Check	Avoid contact with revolving work Cuts, bruises, and fractures Avoid sharp edges (tool and work) Cuts Failure to use eye protection Eye injury
DECISIONS	**CUES**	**ERRORS**
Select method of turning taper Correct selection of taper angle	Blueprint Measuring devices	Incorrect selection of taper angle

ASK STATEMENT) TURN A TAPER ON ENGINE LATHE

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advatage Work input, work output, friction and efficiency in simple machines [Cutting tool] Effect of heating and cooling on expansion of materials (Change of dimensions) [Overheating distorts workpiece] Transfer of energy from one form to another Transfer of heat from one body to another [Coolant usage-mechanical to heat energy] Effects of friction on work processes and product quality [Tool wear effects accuracy] [Tendency to workharden workpiece] Centrifugal forces developed by bodies in rotation [Workpiece flying off] Arrangement of molecules, atoms and ions and the effect on structure and strength of materials [Wear resistance of tool]	Measures of length Use of trigonometric functions in solution of problems involving right triangles Given a coding system, recognize and identify each unit involved by assigning necessary symbols, numerical or literal [Degree coding system] Given an instrument of measure, determine precision, and/or accuracy with respect to relative error, tolerance, and significant digits (Measuring in other than linear, square, and cubic) [Plug and ring gage]

(33)

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Blueprint	Comprehension, trade terminology, detail inference, and recognize symbols, codes, and emblems
Viewing	Workpiece Collet Measuring devices	Visual analysis, detail inference, logic, and recognize symbols, codes, and emblems
Touching	Workpiece Measuring devices	Size, shape, texture, tension, movement, and temperature

133

(TASK STATEMENT) KNURL A WORKPIECE

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Wrenches Workpiece Knurling tool Chuck Collet Scale Coolant Center Sleeve	Set knurl Set feed Start machine Set cut Install center in workpiece Start coolant Knurl Check	Avoid contact with revolving work Cuts, bruises, and fractures Failure to wear eye protection Eye injury
DECISIONS	**CUES**	**ERRORS**
Determine speed and feed selection	Depth of knurl desired Size, shape, and composition of workpiece	Incorrect selection of knurl Lack of coolant Improperly supported work Double cut

ASK STATEMENT) KNURL A WORKPIECE

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines [Cross feed screw exerts pressure] Centrifugal forces developed by bodies in rotation Centripetal forces developed by bodies in rotation [Workpiece flying off] Inertia and momentum (Body at rest and body in motion) Transfer of energy from one form to another Transfer of heat from one body to another [Coolant usage] Effects of friction on work processes and product quality [Tool wear effect part quality]	Measures of length

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Viewing	Workpiece Collet Measuring devices	Visual analysis, detail inference, logic, and recognize symbols, codes, and emblems
Touching	Workpiece Measuring devices	Size, shape, texture, tension, movement, and temperature

135

(TASK STATEMENT) CUT OFF A WORKPIECE WITH A PARTING TOOL

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Workpiece Blueprint Tool and tool holder Wrenches Scale Mics File Coolant	Start machine Set to cut Turn on coolant Start cut off Deburr Cut off Check part	Avoid contact with revolving work Cuts, bruises, and fractures Avoid sharp edges (tool and work) Cuts Failure to use eye protection Eye injury
DECISIONS	**CUES**	**ERRORS**
Select speed and feed	Composition of metal Size and shape of workpiece	Improper feed Improper speed Dull tool

TASK STATEMENT) CUT OFF A WORKPIECE WITH A PARTING TOOL

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines [Cutting tool] Effect of heating and cooling on expansion of materials (Change of dimension) [Overheating distorts workpiece] Transfer of energy from one form to another Transfer of heat from one body to another [Coolant usage-mechanical to heat energy] Effects of friction on work processes and product quality [Tool wear effects accuracy] [Tendency to workharden workpiece] Centrifugal forces developed by bodies in rotation [Workpiece flying off] Arrangement of molecules, atoms and ions and the effect on structure and strength of materials [Wear resistance of tool]	Measures of length Measure with the Metric and English system and convert between them

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Blueprint	Comprehension, trade terminology, detail inference, recognize symbols, codes, and emblems
Viewing	Workpiece Measuring devices	Visual analysis, detail inference, logic, and recognize symbols, codes, and emblems
Touching	Workpiece Measuring devices	Size, shape, texture, tension, movement, and temperature

(TASK STATEMENT) CUT WITH A FORM TOOL

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Workpiece Blueprint Form tool Coolant Wrenches Center Sleeves Scale Mics File	Set stops Start machine Set to cut Install center in workpiece Turn on coolant Form part Deburr Check	Avoid contact with revolving work Cuts, bruises, and fractures Avoid sharp edges (tool and work) Cuts Failure to use eye protection Eye injury
DECISIONS	**CUES**	**ERRORS**
Support of workpiece Selection of feed and speed	Size, shape, and composition of workpiece	Incorrect speed and feed selection Improper support of workpiece Tool failure

ASK STATEMENT) CUT WITH A FORM TOOL

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines [Cutting tool] Effect of heating and cooling on expansion of materials (Change of dimension) [Overheating distorts workpiece] Transfer of energy from one form to another Transfer of heat from one body to another [Coolant usage-mechanical to heat energy] Effects of friction on work processes and product quality [Tool wear effects accuracy] [Tendency to workharden workpiece] Centrifugal forces developed by bodies in rotation [Workpiece flying off] Arrangement of molecules, atoms and ions and the effect on structure and strength of materials [Wear resistance of tool]	Measures of length

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Blueprint	Comprehension, trade terminology, detail inference, recognize symbols, codes, and emblems
Viewing	Workpiece Measuring devices	Visual analysis, detail inference, logic, and recognize symbols, codes, and emblems
Touching	Workpiece Measuring devices	Size, shape, texture, tension, movement, and temperature

(TASK STATEMENT) CENTER DRILL AND DRILL WITH A LATHE

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Workpiece Center drill Drill Drill chuck Chuck key Sleeve Coolant	Select proper drills Clamp workpiece Apply coolant Center drill Drill Deburr Inspect	Avoid contact with revolving work Cuts, bruises, and fractures Avoid sharp edges (tools and work) Cuts Failure to use eye protection Eye injury
DECISIONS	**CUES**	**ERRORS**
Select holding method	Blueprint Size and shape of workpiece	Incorrect drill size Improper clamping of workpiece Improperly sharpened drill Failure to use coolant Improper depth of center drill

(TASK STATEMENT) CENTER DRILL AND DRILL WITH A LATHE

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage [Drill chuck gears] Work input, work output, friction and efficiency in simple machines [Drill efficiency] Effect of heating and cooling on expansion of materials (Change of dimensions) [Changing dimension of the drilled hole] Transfer of heat from one body to another [Coolant] Motion resulting from two or more forces acting on a point in a body [Workpiece must resist motion] Effects of friction on work processes and product quality [Deterioration of workpiece and tool] Relationship of force to distortion in an elastic body [Distortion of workpiece] Arrangement of molecules, atoms and ions and the effect on structure and strength of materials Resistance of materials to change in shape [Tools and fixtures]	Given a coding system, recognize and identify each unit involved by assigning necessary symbols, numerical or literal [Drill coding system] Measures of length

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Blueprint	Comprehension, trade terminology, detail inference, recognition of symbols, codes, and emblems
Viewing	Inspect workpiece	Visual analysis, describing, logic, and detail inference
Touching	Surface of workpiece	Size, shape, texture, temperature

(TASK STATEMENT) BORE A HOLE ON A LATHE

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Boring bar and holder Tool bit Telescope gage Micrometers Wrenches Scale Chuck Collet	Start machine Set to cut Set stops Turn on coolant Take first cut Check Take second cut Deburr Check	Avoid contact with revolving work Cuts, bruises, and fractures Avoid sharp edges (tool and work) Cuts Failure to use eye protection Eye injury
DECISIONS	**CUES**	**ERRORS**
Setting depth of cut Setting of stops	Size, shape, composition of workpiece	Cut too heavy Stops set improperly

142

(TASK STATEMENT) BORE A HOLE ON A LATHE

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines [Cutting tool] Effect of heating and cooling on expansion of materials (Change of dimensions) [Overheating distorts workpiece] Transfer of energy from one form to another Transfer of heat from one body to another [Coolant usage-mechanical to heat energy] Effects of friction on work processes and product quality [Tool wear effects accuracy] [Tendency to workharden workpiece] Centrifugal forces developed by bodies in rotation [Workpiece flying off] Arrangement of molecules, atoms and ions and the effect on structure and strength of materials [Wear resistance of tool]	Measures of length Given an instrument of measure, determine precision, and/or accuracy with respect to relative error, tolerance, and significant digits (Measuring other than linear, square, and cubic) [Telescoping or small hole gage] Addition and subtraction of proper and improper fractions Addition and subtraction of decimal fractions

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Viewing	Workpiece Collet Measuring devices	Visual analysis, detail inference, logic, recognize symbols, codes, and emblems
Touching	Workpiece Measuring devices	Size, shape, texture, tension, movement, and temperature

(TASK STATEMENT) THREAD ON A LATHE

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Workpiece Center Sleeve Threading tool Center gage Thread mics Wrenches Micrometer stop Chuck Collets Boring bar and holder Thread gage Safety glasses O.D. mics	Set to cut Start machine Use coolant Start cut Check Take successive cuts Deburr Check	Avoid contact with revolving work Cuts, bruises, and fractures Avoid sharp edges (tool and work) Cuts Failure to use eye protection Eye injury
DECISIONS	**CUES**	**ERRORS**
Determine setting of tool to work Determine setting of threads per inch	Tap drill size	Incorrect threads per inch Too heavy a cut Tool failure

(TASK STATEMENT) THREAD ON A LATHE

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines [Cutting tool] Effect of heating and cooling on expansion of materials (Change of dimensions) [Overheating distorts workpiece] Transfer of energy from one form to another Transfer of heat from one body to another [Coolant usage-mechanical to heat energy] Effects of friction on work processes and product quality [Tool wear effects accuracy] [Tendency to workharden a workpiece] Centrifugal forces developed by bodies in rotation [Workpiece flying off] Arrangement of molecules, atoms and ions and the effect on structure and strength of materials [Wear resistance of tool]	Measures of length Given an instrument of measure, determine precision, and/or accuracy with respect to relative error, tolerance, and significant digits (Measuring other than linear, square, and cubic) [Screw pitch micrometer] Addition and subtraction of proper and improper fractions Addition and subtraction of decimal fractions Given a coding system, recognize and identify each unit involved by assigning necessary symbols, numerical or literal [Ability to read and set degree measurements]

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Viewing	Workpiece Collet Measuring devices	Visual analysis, detail inference, logic, and recognize symbols, codes, and emblems
Touching	Workpiece Measuring devices	Size, shape, texture, tension, movement, and temperature

(TASK STATEMENT) GRIND WITH A TOOL POST GRINDER ON AN ENGINE LATHE

126

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Workpiece Tool post grinder Grinding wheel Chuck Collet Indicator and holder Mics Small hole gage Telescope gage Safety glasses Plug gage Wrenches	Set to grind O.D. I.D. Set stops Start grinder and machine Take trial cut Check Grind to finish Check	Prevent wheel breakage Eye injuries Avoid contact with revolving work Cuts, bruises, and fractures Avoid sharp edges (tool and work) Cuts Failure to use eye protection Eye injury
DECISIONS	**CUES**	**ERRORS**
Wheel selection Speed and feed selection	Length of shank or mandrel Diameter of hole Size, shape, and composition of workpiece	Incorrect wheel Incorrect speed and feed Incorrect rotation of part

149

(TASK STATEMENT) GRIND WITH A TOOL POST GRINDER ON AN ENGINE LATHE

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines [Cutting tool] Effect of heating and cooling on expansion of materials (Change of dimensions) [Overheating distorts workpiece] Transfer of energy from one form to another Transfer of heat from one body to another [Coolant usage-mechanical to heat energy] Effects of friction on work processes and product quality [Tool wear effects accuracy] [Tendency to workharden a workpiece] Centrifugal forces developed by bodies in rotation [Workpiece flying off] Arrangement of molecules, atoms and ions and the effect on structure and strength of materials [Wear resistance of tool]	Given a coding system, recognize and identify each unit involved by assigning necessary symbols, numerical or literal [Degrees] Measure of time and speed (Example: time-seconds, minutes, etc.; speed-feet per minute. R.P.M., etc.) Measures of length

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Viewing	Workpiece Collet Measuring devices	Visual analysis, detail inference, logic, and recognize symbols, codes, and emblems
Touching	Workpiece Measuring devices	Size, shape, texture, tension, movement, and temperature

(TASK STATEMENT) REMOVE AND INSPECT PART FROM LATHE

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Wrenches Mics Blueprint Scale Vernier calipers	Remove part Deburr part Inspect part	Burrs on workpiece Cuts Handle tools and material properly Cuts and burns Material damage
DECISIONS	**CUES**	**ERRORS**
Determine degree of accuracy required	Scale, blueprint, and micrometer gage	Dirt or grit on part Burrs on part Incorrect tolerances

(TASK STATEMENT) REMOVE AND INSPECT PART FROM LATHE

SCIENCE	MATH – NUMBER SYSTEMS
Effect of friction on work processes and product quality [Poor quality due to friction on workpiece or tool]	Measures of length Given an instrument of measure, determine precision, and/or accuracy with respect to relative error, tolerance, and isgnificant digits (Measuring) other than linear, square, and cubic

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Viewing	Workpiece Scale Calipers Micrometer	Visual analysis, logic, detail inference, and recognize symbols, codes, and emblems
Touching	Workpiece Micrometer	Size, shape, movement, texture, and temperature
Reading	Blueprint	Comprehension, detail inference, logic, and trade terminology

Duty H Setting Up and Operating Shaper and Slotter

1 Clean and lubricate shaper and slotter
2 Grind or sharpen tool bit
3 Select and mount cutting tool and holders
4 Select and mount work and work holding devices
5 Set and operate shaper and slotter controls
6 Shape or slot part to drawing specifications
7 Remove and inspect part from shaper and slotter

150

(TASK STATEMENT) CLEAN AND LUBRICATE SHARPER AND SLOTTER

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Oil Grease Oil can Grease gun Rags Solvent Brushes Measuring containers Lubrication charts Abrasive materials Wrenches Drop cord	Clean fittings before lubrication Remove and install plug and covers Make necessary adjustments Start and stop machinery	Avoid chips Cuts Do not use pressurized air Eye and machine damage Shut machine off before cleaning Electrical shock Avoid spills Falls Proper disposal of lubricants and solvents Fire Water pollution

DECISIONS	CUES	ERRORS
Determine proper frequency of lubrication Select proper lubricant Locate all lubrication points Determine correct amount of lubricant	Operation manual guidelines Type of machinery	Equipment malfunction

TASK STATEMENT) CLEAN AND LUBRICATE SHARPER AND SLOTTER

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines Composition of matter, including protons, neutrons, electrons, atoms, molecules, and elements [Properties of lubricants] Effects of friction on work processes and product quality [Friction causes deterioration]	Given a coding system, recognize and identify each unit involved by assigning necessary symbols, numerical or literal [Society of Automotive Engineers Specifications] [American Iron and Steel Institute Specifications] Read and interpret charts, tables, and/or graphs [Lubrication charts] Liquid and dry measures [Liquid measures]

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Operational manuals	Comprehension, trade terminology, description of mechanisms, definition, and instructions
Viewing	Equipment	Visual analysis, describing, logic, detail inference, color discrimination
Touching	Equipment	Temperature, texture, movement, and cension

(TASK STATEMENT) GRIND OR SHARPEN TOOL BIT

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Tool bit Safety glasses Template Protractor Coolant Radius gage Center gage	Inspect wheel Select tool bit Select angles Adjust tool rest Grind angles Cool tool bit Check angles Hone edges	Failure to cool tool properly Cracked tool Burns Improperly held tool Broken wheel Eye injury Cuts and abrasions Improper adjustment of tool rest Cuts Bruises Tool and/or wheel damage
DECISIONS	**CUES**	**ERRORS**
Select clearance and rake angles	Protractor Radius and center gage	Overheating tool Holding tool loosely Tool rest too far from wheel

(TASK STATEMENT) GRIND OR SHARPEN TOOL BIT

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines [Drive mechanisms] Effect of heating and cooling on expansion of materials (Change of dimensions) [Heat effects workpiece] Centrifugal forces developed by bodies in rotation [Workpiece tends to be pulled out of your hand] [Materials fly out] Inertia and momentum (Body at rest and body in motion) Effects of friction on work processes and product quality [Overheating will tend to anneal or soften tool bits] Transfer of energy from one form to another [Mechanical energy changes to heat]	Read and interpret charts, tables, and/or graphs [Clearance and rake angles] Measures of length

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Viewing	Protractor Template Gages	Visual analysis, logic, detail inference, recognize symbols, codes, and emblems
Touching	Workpiece	Size, shape, texture, temperature

(TASK STATEMENT) SELECT AND MOUNT CUTTING TOOLS AND HOLDERS

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Tool bit Tool holder Wrenches	Select tool and holder Clean tool and holder Install tool and holder	Proper handling of tools and holders Cuts, abrasions Damaged tools Damaged holders

DECISIONS	CUES	ERRORS
Determine types of tools and holders Determine sequence and procedure of mounting tools and holders	Size and shape of tools	Dirty tools and holders Incorrect selection of tools and equipment

5-51

TASK STATEMENT) SELECT AND MOUNT CUTTING TOOLS AND HOLDERS

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines [Strength of holding device] Effects of friction on work processes and product quality [Selection of tool material] Arrangement of molecules, atoms and ions and the effect on structure and strength of materials Resistance of materials to change in shape [Strength of material]	Read and interpret charts, tables, and/or graphs [Clearance and rake angles] Measures of length

156

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Viewing	Mounting set-up Tools	Visual analysis, logic, and detail inference

(TASK STATEMENT) SELECT AND MOUNT WORK AND WORK HOLDING DEVICE

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Workpiece Vise Clamps Wrenches Scale Surface gage Index head Vee blocks Parallels	Select proper work holding device Clean table and work holding device Mount work holding device on table Mount work in work holding device	Holding device not tight Cuts and abrasions Work not clamped tightly Cuts and abrasions
DECISIONS	**CUES**	**ERRORS**
Determine type of holding device Determine how to mount holding device	Size and shape of workpiece	Dirty table Work holding device not tight Work improperly clamped

(TASK STATEMENT) SELECT AND MOUNT WORK AND WORK HOLDING DEVICE

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage [Clamps, T-bolds, jigs, and fixtures] Work input, work output, friction and efficiency in simple machines [Setting time] Motion resulting from two or more forces acting on a point in a body [Resistance to motion (torque)] Relationship of forces to distortion in an elastic body Resistance of materials to change in shape [Proper tightening torque]	Given a coding system, recognize and identify each unit involved by assigning necessary symbols, numerical or literal [Wrench sizes]

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Viewing	Scale Gage Workpiece Mounting	Visual analysis, detail inference, logic, and describing
Touching	Workpiece Mounting	Size, shape, tension, and movement

TASK STATEMENT) SET AND OPERATE SHAPER AND SLOTTER CONTROLS

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY — HAZARD
Speeds and feed calculator or chart	Adjust speed control Adjust feed control Start machine Engage automatic feeds	Excessive speeds and feeds Destroyed or broken cutting tools Cuts Eye injury Avoid moving tool and ram Cuts Bruises Fractures

DECISIONS	CUES	ERRORS
Determine feeds and speeds Determine when to use automatic feeds	Speed chart Formula of workpiece Size, shape, and composition of workpiece	Improper feed and speed selection

TASK STATEMENT) SET AND OPERATE SHAPER AND SLOTTER CONTROLS

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines [Speed and feed controls] Inertia and momentum (Body at rest and body in motion) [When and how to adjust spindle speed and feeds]	Measure of time and speed (Example: time-seconds, minutes, etc.; speed-feet per minute, R.P.M., etc.) [Speed] Read and interpret charts, tables, and/or graphs [Shaper and slotter controls] Measure with the Metric and English system and convert between them

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Viewing	Shaper and slotter controls	Visual analysis, logic, detail inference, recognize symbols, codes, and emblems
Touching	Contols	Tension and movement

(TASK STATEMENT) SHAPE OR SLOT PART TO DRAWING SPECIFICATIONS

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Safety glasses Workpiece Coolant Tool and holder Micrometers Scale	Set cut depth Adjust length and position of stroke Shape or slot part Check part	**Avoid moving** **Shaper cutting tool** **Cuts and abrasions** **Flying chips** **Cuts, burns, and eye injury**
DECISIONS	**CUES**	**ERRORS**
Determine length and position of stroke for proper over run	Amount of clearance on each end	Incorrect feeds and speeds Incorrect length or position of stroke

(TASK STATEMENT) SHAPE OR SLOT PART TO DRAWING SPECIFICATIONS

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines [Cutting tool] Inertia and momentum (Body at rest and body in motion) Effects of friction on work processes and product quality [Tool wear effects accuracy] [Tendency to workharden workpiece] Centrifugal forces developed by bodies in rotation [Workpiece flying off] Arrangement of molecules, atoms and ions and the effect on structure and strength of materials [Wear resistance of tool]	Read and interpret charts, tables, and/or graphs [Machine control charts]

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Viewing	Workpiece Measuring devices	Visual analysis, logic, detail inference, recognize symbols, codes, and emblems
Touching	Workpiece Micrometer	Size, shape, tension, and movement

(TASK STATEMENT) REMOVE AND INSPECT PART FROM SHAPER AND SLOTTER

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Workpiece Scale Blueprint Mics Verniers	Remove part Deburr part Inspect part	Burrs on workpiece Cuts Handle tools and material properly Cuts and burns Material damage

DECISIONS	CUES	ERRORS
Determine degree of accuracy required	Scale Blueprint Micrometer Gage	Dirt or grit on part Burrs on part Incorrect tolerances

ASK STATEMENT) REMOVE AND INSPECT PART FROM SHAPER AND SLOTTER

SCIENCE	MATH – NUMBER SYSTEMS
Effects of friction on work processes and product quality [Poor quality due to friction on workpiece or tool]	Measures of length Given an instrument of measure, determine precision, and/or accuracy with respect to relative error, tolerance, and significant digits (Measuring other than linear, square, and cubic)

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Blueprint Scale	Comprehension, trade terminology, detail inference, recognize symbols, codes, and emblems
Viewing	Micrometer Calipers Workpiece	Visual analysis, logic, and detail inference
Touching	Workpiece Micrometer	Size, shape, texture, tension, and movement

Duty I Set Up and Operating Horizontal and Vertical Milling Machine

1 Clean and lubricate milling machine
2 Select and mount work and work holding devices
3 Select and mount cutter holding devices and cutter
4 Set and operate milling machine controls
5 Index work with the dividing head
6 Mill a flat surface
7 Mill a keyway
8 Center drill and drill a hole on the vertical mill
9 Bore a hole with a mill
10 Mill an angular surface
11 Mill a dovetail on a vertical mill
12 Gang mill on a horizontal mill
13 Remove and inspect work from milling machine

165

(TASK STATEMENT) CLEAN AND LUBRICATE VERTICAL MILLING MACHINE

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Oil Grease Oil can Grease gun Rags Solvent Brushes Measuring containers Lubrication charts Abrasive materials Wrenches Drop cord	Clean fittings before lubrication Remove and install plug and covers Make necessary adjustments Start and stop machinery	Avoid chips Cuts Do not use pressurized air Eye and machine damage Shut machine off before cleaning Electrical shock Avoid spills Falls Proper disposal of lubricants and solvents Fire Water pollution
DECISIONS	**CUES**	**ERRORS**
Determine proper frequency of lubrication Select proper lubricant Locate all lubrication points Determine correct amount of lubricant	Operation manual guidelines Type of machinery	Equipment malfunction

TASK STATEMENT) CLEAN AND LUBRICATE VERTICAL MILLING MACHINE

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines Composition of matter, including protons, neutrons, electrons, atoms, molecules, elements [Properties of lubricants] Effects of friction on work processes and product quality [Friction causes deterioration]	Given a coding system, recognize and identify each unit involved by assigning necessary symbols, numerical or literal [Society of Automotive Engineers Specifications] [American Iron and Steel Institute Specifications] Read and interpret charts, tables, and/or graphs [Lubrication charts] Liquid and dry measures [Liquid measure]

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Operational manuals	Comprehension, trade terminology, description of mechanism, definition, and instructions
Viewing	Equipment	Visual analysis, describing, logic, detail inference, color discrimination
Touching	Equipment	Temperature, texture, movement, and tension

(TASK STATEMENT) SELECT AND MOUNT WORK AND WORKHOLDING DEVICES

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY -- HAZARD
Workpiece Vise Wrenches Clamps Bolts and nuts Vee blocks Parallels Dividing head Footstock Rotary table Dial indicator Scale Thickness gauge Screw jack Surface gage	Select proper work holding device Clean table and work holding device Mount work holding device on table Mount work in work holding device	Holding device not tight Cuts and abrasions Work not clamped tightly Cuts and abrasions
DECISIONS	**CUES**	**ERRORS**
Determine type of holding device Determine how to mount holding device	Size and shape of workpiece	Dirty table Work holding device not tight Work improperly clamped

(TASK STATEMENT) SELECT AND MOUNT WORK AND WORKHOLDING DEVICES

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage [Clamps, T-bolds, jigs, and fixtures] Work input, work output, friction and efficiency in simple machines [Setting time] Motion resulting from two or more forces acting on a point in a body [Resistance to motion (torque)] Relationship of force to distortion in an elastic body Resistance of materials to change in shape [Proper tightening torque]	Given a coding system, recognize and identify each unit involved by assigning necessary sumbols, numerical or literal [Wrench sizes]

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Viewing	Workpiece Mounting Scale Gage	Visual analysis, detail inference, logic, and describing
Touching	Workpiece Mounting	Size, shape, tension, and movement

(TASK STATEMENT) SELECT AND MOUNT CUTTER HOLDING DEVICES AND CUTTER

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Cutter Arbor Collet Wrenches	Select tool and holder Clean tool and holder Install tool and holder	Proper handling of tools and holders Cuts and abrasions Damaged tools Damaged holders
DECISIONS	**CUES**	**ERRORS**
Determine types of tools and holders Determine sequence and procedures of mounting tools and holders	Size and shape of tools	Dirty tools and holders Incorrect selection of tools and equipment

ASK STATEMENT) SELECT AND MOUNT CUTTER HOLDING DEVICES AND CUTTER

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines [Strength of holding device] Effects of friction on work processes and product quality [Selection of tool material] Arrangement of molecules, atoms and ions and the effect on structure and strength of materials Resistance of materials to change in shape [Strength of material]	Given a coding system, recognize and identify each unit involved by assigning necessary symbols, numerical or literal [Size coding system] Measures of length

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Viewing	Mounting set-up Tools	Visual analysis, logic, and detail inference

(TASK STATEMENT) SET AND OPERATE MILLING MACHINE CONTROLS

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Speed charts Feed charts Gearing charts	Adjust speed control Adjust feed control Start machine Engage automatic feeds	Excessive speeds and feeds Destroyed or broken cutting tools Cuts Eye injury

DECISIONS	CUES	ERRORS
Determine feeds and speeds Determine when to use autoratic feeds	Speed chart Size, shape, and composition of workpiece	Improper feed and speed selection

ASK STATEMENT) SET AND OPERATE MILLING MACHINE CONTROLS

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines [Speed and feed controls] Inertia and momentum (Body at rest and body in motion) [When and how to adjust spindle speed and feeds]	Measure of time and speed (Example: time-seconds, minutes, etc.; speed-feet per minute, R.P.M., etc.) [R.P.M.] Read and interpret charts, tables, and/or graphs [Speed and feed charts] Measure with the Metric and English system and convert between them

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Viewing	Milling machine controls	Visual analysis, logic, detail inference, recognize symbols, codes, and emblems
Touching	Controls	Tension and movement

173

(TASK STATEMENT) INDEX WORK WITH THE DIVIDING HEAD

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Workpiece Wrenches Clamps Bolts and nuts Dial indicator Surface gage Dividing head Footstock Scale Mics Milling cutters Safety glasses Coolant	Select indexing plate Apply coolant Cut workpiece Index as required Cut workpiece after each indexing operation Check workpiece	Keep hands clear of revolving cutters Cuts and abrasions

DECISIONS	CUES	ERRORS
Determine proper indexing plate to use Determine speeds and feeds	Size, shape, and composition of workpiece	Incorrect indexing procedures Lack of coolant Not allowing for backlash

TASK STATEMENT) INDEX WORK WITH THE DIVIDING HEAD

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines [Ratio of gearing]	Determination of facts involving sectors of a circle Ratio and proportion Basic arithmetic skills Manipulation of formula involving three factors Determination of area and circumference of circles Read and interpret charts, tables, and/or graphs [Machinist's Handbook (Gears and Gearing)]

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Viewing	Workpiece Measuring devices	Visual analysis, detail inference, logic, and recognize symbols, codes, and emblems
Touching	Workpiece Measuring devices	Size, shape, temperature, texture, tension, and movement

(TASK STATEMENT) MILL A FLAT SURFACE

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Workpiece Collet Arbor Wrenches Vise Dividing head Footstock End mill Slab mill Fly cutter Mics Coolant Safety glasses	Select speeds and feeds Set for depth of cut Apply coolant Mill workpiece Check workpiece	Avoid revolving cutters Cuts Avoid contact of cutter or spindle to work holding device Damage to spindle or work holding device
DECISIONS	**CUES**	**ERRORS**
Determine speeds and feeds Determine depth of cut Determine when to sharpen cutter	Size, shape, and composition of workpiece	Improper speeds and feeds Lack of coolant Rough cut or finished surface Climb milling

TASK STATEMENT) MILL A FLAT SURFACE

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines [Cutting tool] Transfer of energy from one form to another Transfer of heat from one body to another [Coolant usage-mechanical to heat energy] Effect of heating and cooling on expansion of materials (Change of dimensions) [Overheating distorts workpiece] Effects of friction on work processes and product quality [Tool wear effects accuracy] [Tendency to workharden workpiece] Arrangement of molecules, atoms and ions and the effect on structure and strength of materials [Wear resistance of tool]	Measures of length Addition and subtraction of whole numbers Measure with the Metric and English system and convert between them

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Viewing	Workpiece Measuring devices	Visual analysis, detail inference, logic, recognize symbols, codes, and emblems
Touching	Workpiece Measuring devices	Size, shape, temperature, texture, tension, and movement

(TASK STATEMENT) MILL A KEYWAY

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Workpiece Woodruff key cutter Blueprint End mill Side milling cutter Inspection equipment Mics Vise Parallels Dividing head Footstock Coolant Safety glasses	Select speeds and feeds Set for depth of cut Apply coolant Mill workpiece Check workpiece	Avoid revolving cutters Cuts Avoid contact of cutter or spindle to work holding device Damage to spindle or work holding device

DECISIONS	CUES	ERRORS
Determine speeds and feeds Determine depth of cut Determine when to sharpen cutter	Size, shape, and composition of workpiece Use of Machinist's Handbook	Improper speeds and feeds Lack of coolant Rough cut on finished surface Climb milling

(TASK STATEMENT) MILL A KEYWAY

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines [Cutting tool] Transfer of energy from one form to another Transfer of heat from one body to another [Coolant usage-mechanical to heat energy] Effect of heating and cooling on expansion of materials (Change of dimensions) [Overheating distorts workpiece] Effects of friction on work processes and product quality [Tool wear effects accuracy] [Tendency to workharden workpiece] Arrangement of molecules, atoms and ions and the effect on structure and strength of materials [Wear resistance of tool]	Measures of length Addition and subtraction of whole numbers Measure with the Metric and English system and convert between them

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Viewing	Workpiece Measuring devices	Visual analysis, detail inference, logic, recognize symbols, codes, and emblems
Touching	Workpiece Measuring devices	Size, shape, temperature, texture, tension, and movement

(TASK STATEMENT) CENTER DRILL AND DRILL A HOLE ON THE VERTICAL MILL

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Drill chuck Chuck key Center drill Drill Vise Clamps Scale Vernier calipers Plug gage Safety glasses Coolant	Select proper drills Clamp workpiece Apply coolant Center drill Drill Deburr Inspect	Piece clamped properly to prevent movement Cuts and bruises Drill sharpened properly for material to be drilled Cuts and eye injury Broken drill Hot shavings and chips Cuts and burns
DECISIONS	**CUES**	**ERRORS**
Select holding method	Blueprint Size and shape of workpiece	Incorrect drill size Improper clamping of workpiece Improperly sharpened drill Failure to use coolant

(TASK STATEMENT) CENTER DRILL AND DRILL A HOLE O.. THE VERTICAL MILL

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage [Drill chuck gears] Work input, work output, friction and efficiency in simple machines [Drill efficiency] Effect of heating and cooling on expansion of materials (Change of dimensions) [Changing of dimension of the drilled hole] Transfer of heat from one body to another [Coolant] Motion resulting from two or more forces acting on a point in a body [Workpiece must resist motion] Effects of friction on work processes and product quality [Deterioration of workpiece and tool] Relationship of force to distortion in an elastic body [Distortion of workpiece] Arrangement of molecules, atoms and ions and the effect on structure and strength of material Resistance of materials to change in shape [Fixtures]	Given a coding system, recognize and identify each unit involved by assigning necessary symbols, numerical or literal [Drill coding systems] Measures of length Multiplication and division with whole numbers Multiplication and division of proper and improper fractions Multiplication and division of decimal fractions Measure of time and speed (Example: time-seconds, minutes, etc.; speed-feet per minute, R.P.M., etc.)

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Viewing	Workpiece Measuring devices	Visual analysis, detail inference, logic, recognize symbols, codes, and emblems
Touching	Workpiece Measuring devices	Size, shape, temperature, texture, tension, and movement

(TASK STATEMENT) BORE A HOLE WITH A MILL

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Workpiece Adjustable boring head Wrenches Dial indicator Collets Mics Verniers Telescope gages Vise Clamps Tee nuts and bolts Circular table	Select speeds and feeds Adjust boring head for depth of cut Apply coolant Bore workpiece Check workpiece	Avoid revolving cutters Cuts Avoid contact of cutter or spindle to work holding device Damage to spindle or work holding device Cutter damage Cuts Abrasions Eye injury
DECISIONS	**CUES**	**ERRORS**
Determine speeds and feeds Determine depth of cut Determine when to sharpen cutter	Size, shape, composition of workpiece	Improper speeds and feeds Lack of coolant Rough cut on finished surface

182

ASK STATEMENT) BORE A HOLE WITH A MILL

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines [Cutting tool] Effect of heating and cooling on expansion of materials (Change of dimensions) [Overheating distorts workpiece] Transfer of energy from one form to another Transfer of heat from one body to another [Coolant usage-mechanical to heat energy] Effects of friction on work processes and product quality [Tool wear effects accuracy] [Tendency to workharden workpiece] Arrangement of molecules, atoms and ions and the effect on structure and strength of materials [Wear resistance of tool]	Measures of length Given an instrument of measure, determine precision, and/or accuracy with respect to relative error, tolerance, and significant digits (Measuring other than linear, square, and cubic) [Telescoping or small hole gage] Addition and subtraction of proper and improper fractions Addition and subtraction of decimal fractions

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Viewing	Workpiece Measuring devices	Visual analysis, detail inference, logic, recognize symbols, codes, and emblems
Touching	Workpiece Measuring devices	Size, shape, temperature, texture, tension, and movement

(TASK STATEMENT) MILL AN ANGULAR SURFACE

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Workpiece Blueprint Fly cutter Slab mill End mill Arbor Collets Vise Clamps Parallels Tee nuts and bolts Wrenches Double angle cutter Shell end mill Surface gage Mics Dial indicator Scale Combination square	Select speed and feeds Set depth of cut Apply coolant Cut angle Swivel table Swivel vice Tilt head Tilt workpiece Use angular cutter Check workpiece	Avoid revolving cutters Cuts Avoid contact of cutter or spindle to work holding device Damage to spindle or work holding device Cuts Bruises Eye injury
DECISIONS	**CUES**	**ERRORS**
Determine speeds and feeds Determine depth of cut Determine when to sharpen cutter	Size, shape, and composition of workpiece	Improper speed and feeds Lack of coolant Rough cut on finished surface Climb milling

TASK STATEMENT) MILL AN ANGULAR SURFACE

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines [Cutting tool] Effect of heating and cooling on expansion of materials (Change of dimensions) [Overheating distorts workpiece] Transfer of energy from one form to another Transfer of heat from one body to another [Coolant usage-mechanical to heat energy] Effects of friction on work processes and product quality [Tool wear effects accuracy] [Tendency to workharden workpiece] Arrangement of molecules, atoms and ions and the effect on structure and strength of materials [Wear resistance of tool]	Measures of length Addition and subtraction of whole numbers Addition and subtraction of proper and improper fractions Addition and subtraction of decimal fractions

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Viewing	Workpiece Measuring devices	Visual analysis, detail inference, logic, and recognize symbols, codes, and emblems
Touching	Workpiece Measuring devices	Size, shape, temperature, texture, tension, and movement

(TASK STATEMENT) MILL A DOVETAIL

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Vise Collets Arbor Workpiece Clamps Tee nuts and studs Dove tail cutter Mics Safety glasses Wrenches Coolant	Select speed and feeds Set for depth of cut Apply coolant Mill workpiece Check workpiece	Avoid revolving cutters Cuts Avoid contact of cutter or spindle to work holding device Damage to spindle or work holding device

DECISIONS	CUES	ERRORS
Determine speeds and feeds Determine depth of cut Determine when to sharpen cutter	Size, shape, and composition of workpiece	Improper speeds and feeds Lack of coolant Rough cut on finished surface Climb milling

(TASK STATEMENT) MILL A DOVETAIL

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines [Cutting tool] Effect of heating and cooling on expansion of materials (Change of dimension) [Overheating distorts workpiece] Transfer of energy from one form to another Transfer of heat from one body to another [Coolant usage-mechanical to heat energy] Effects of friction on work processes and product quality [Tool wear effects accuracy] [Tendency to workharden workpiece] Arrangement of molecules, atoms and ions and the effect on structure and strength of materials [Wear resistance of tool]	Measures of length Addition and subtraction of whole numbers Addition and subtraction of proper and improper fractions Given a coding system, recognize and identify each unit involved by assigning necessary symbols, numerical or literal [Degrees]

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Viewing	Workpiece Measuring devices	Visual analysis, detail inference, logic, and recognize symbols, codes, and emblems
Touching	Workpiece Measuring devices	Size, shape, temperature, texture, tension, and movement

(TASK STATEMENT) GANG MILL ON A HORIZONTAL MILL

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Arbor Milling cutters Mica Vise Fixture (workholding) Clamps Tee nuts and studs Indicator Safety glasses Coolant Thickness gage Wrenches Parallels	Select spacers and shims for correct spacing of cutters Select speeds and feeds Set depth of cut Apply coolant Mill workpiece Check workpiece	Avoid revolving cutters Cuts Avoid contact of cutter or spindle to work holding device Damage to spindle or work holding device
DECISIONS	**CUES**	**ERRORS**
Determine speeds and feeds Determine depth of cut Determine when to sharpen cutters Determine number of cutters to use	Size, shape, and composition of workpiece	Improper feeds and speeds Lack of coolant Improper spacing of cutters Rough cut on finished surface Climb milling

(TASK STATEMENT) GANG MILL ON A HORIZONTAL MILL

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines [Cutting tool] Effect of heating and cooling on expansion of materials (Change of dimensions) [Overheating distorts workpiece] Transfer of energy from one form to another Transfer of heat from one body to another [Coolant usage-mechanical to heat energy] Effects of friction on work processes and product quality [Tool wear effects accuracy] [Tendency to workharden workpiece] Arrangement of molecules, atoms and ions and the effect on structure and strength of materials [Wear resistance of tool]	Addition and subtraction of decimal fractions Measures of length Given an instrument of measure, determine precision, and/or accuracy with respect to relative error, tolerance, and significant digits (Measuring other than linear, square, and cubic)

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Viewing	Workpiece Measuring devices	Visual analysis, detail inference, logic, recognize symbols, codes, and emblems
Touching	Workpiece Measuring devices	Size, shape, temperature, texture, tension, and movement

(TASK STATEMENT) REMOVE AND INSPECT WORK FROM MILLING MACHINE

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Blueprint Mics Wrenches Scale File Surface indicator	Remove part Deburr part Inspect part	Burrs on workpiece Cuts Handle tools and material properly Cuts and abrasions Material damage Burns

DECISIONS	CUES	ERRORS
Determine degree of accuracy required	Scale Blueprint Micrometer Gage	Dirt or grit on part Burrs on part Incorrect tolerances

TASK STATEMENT) REMOVE AND INSPECT WORK FROM MILLING MACHINE

SCIENCE	MATH – NUMBER SYSTEMS
Effects of friction on work processes and product quality [Poor quality due to friction on workpiece or tool]	Measures of length Given an instrument of measure, determine precision, and/or accuracy with respect to relative error, tolerance, and significant digits (Measuring other than linear, square, and cubic)

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Viewing	Workpiece Measuring devices	Visual analysis, detail inference, logic, recognize symbols, codes, and emblems
Touching	Workpiece Measuring devices	Size, shape, temperature, texture, tension, and movement
Reading	Blueprint	Comprehension, detail inference, trade terminology, recognize symbols, codes, and emblems

Duty J Performing Heat Treating Operations

1 Set furnace controls
2 Heat workpiece
3 Quench or cool workpiece
4 Remove and inspect part after heat treatment

172

(TASK STATEMENT) SET FURNACE CONTROLS

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Temperature indicator Torch controls Flame source	Turn on gas or electrical power Set temperature indicator to desired point Light furnace (if applicable) Light torch (if applicable)	Care when lighting a furnace Burns Watch for gas leaks Improper ignition Gas fumes
DECISIONS	**CUES**	**ERRORS**
Determine proper temperature	Failure of furnace to light	Set controls at wrong temperature

TASK STATEMENT) SET FURNACE CONTROLS

SCIENCE	MATH – NUMBER SYSTEMS
Effect of heating and cooling on expansion of materials [Recognize thermal expansion] Arrangement of molecules, atoms and ions and the effect on structure and strength of materials [Isothermal structure (3-T curves)]	Read and interpret charts, tables, and/or graphs [Temperature chart] Measure of time and speed (Example: time-seconds, minutes, etc.; speed-feet per minute, R.P.M., etc.) [Time] Measures of temperature Measure with the Metric and English system and convert between them [Centigrade] Given an instrument of measure, determine precision, and/or accuracy with respect to relative error, tolerance, and significant digits (Measuring other than linear, square, and cubic) [Pyrometer]

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Viewing	Temperature of indicator	Visual analysis, logic, detail inference, recognize symbols, codes, and emblems

194

(TASK STATEMENT) HEAT WORKPIECE

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Workpiece Oven Torch	Put workpiece in furnace or light torch Close furnace door (if applicable)	Keep clear of furnace and workpiece Burns Apply heat slowly and evenly Distortion of workpiece
DECISIONS	**CUES**	**ERRORS**
Determine whether to use torch or furnace Determine temperature or color desired	Uneven heating of workpiece	Overheating or underheating workpiece

ASK STATEMENT) HEAT WORKPIECE

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines [Usage of tongs to put work in furnace] Effect of heating and cooling on expansion of materials (Change of dimensions) Resistance of materials to change in shape [Recognize thermal changes] Transfer of heat from one body to another Arrangement of molecules, atoms and ions and the effect on structure and strength of materials [Rate of heat flow in heat treating] (heating and cooling) Temperature measurement is critical Be aware of warpage in heat treatment	Measures of temperature

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Viewing	Workpiece	Visual analysis, logic, and detail inference

(TASK STATEMENT) QUENCH OR COOL WORKPIECE

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Quenching media Oil Water Brine Air Tongs	Remove workpiece from furnace Pack in sand or let air cool Quench in solution Oil Brine Water Air	Avoid contact with hot workpiece or furnace Burns Avoid spills of liquids Falls, bruises, and cuts

DECISIONS	CUES	ERRORS
Determine type of quench Determine type of quenching solution	Composition and shape of workpiece Degree of hardness desired	Quenching too fast Quenching in wro[illegible]

L61

TASK STATEMENT) QUENCH OR COOL WORKPIECE

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines [Usage of tongs to hold work] Effect of heating and cooling on expansion of materials (Change of dimensions) Resistance of materials to change in shape [Recognition of dimensional change] Transfer of heat from one body to another [Rate of cooling in quenching] Arrangement of molecules, atoms and ions and the effect on structure and strength of materials [Isothermal transformation]	Read and interpret charts, tables, and/or graphs [Quenching solution chart]

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Conversion chart	Comprehension, detail inference, trade terminology, recognize symbols, codes, and emblems
Viewing	Test equipment Workpiece	Visual analysis, logic, detail inference, recognize symbols, codes, and emblems
Touching	Surface Texture	

198

(TASK STATEMENT) REMOVE AND INSPECT PART AFTER HEAT TREATMENT

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Workpiece File Hardness testing equipment Hardness conversion chart Safety glasses Tongs Wire brush	Remove from quenchen tongs Clean part Remove scale from area to be tested Take reading on test equipment	Be sure workpiece is cool Burns
DECISIONS	**CUES**	**ERRORS**
Determine degree of hardness	Test equipment readings Hardness conversion chart	Incorrect hardness Heated incorrectly Quenched improperly Improper selection of material Distorted part Uneven heating Uneven quench

(TASK STATEMENT) REMOVE AND INSPECT PART AFTER HEAT TREATMENT

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines [Use of a hardness tester] Hardness test Relationship of force to distortion in an elastic body [Rockavell and Brinell hardness tester] Resistance of materials to change in shape [Scleroscope hardness tester] [File test for hardness (resistance to abrasions)]	Measures of length Given an instrument of measure, determine precision, and/or accuracy with respect to relative error, tolerance, and significant digits (Measuring other than linear, square, and cubic) [Hardness testing] Read and interpet charts, tables, and/or graphs [Conversion charts (hardness)]

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Conversion chart	Comprehension, detail inference, trade terminology, recognize symbols, codes, and emblems
Viewing	Test equipment Workpiece	Visual analysis, logic, detail inference, recognize symbols, codes, and emblems
Touching	Surface Texture	

Duty K Setting Up and Operating Surface Grinder

1 Clean and lubricate surface grinder
2 Select, mount and dress grinding wheel
3 Select and mount work and work holding device
4 Set stops, feed and grind workpiece
5 Remove and inspect part from surface grinder

201

(TASK STATEMENT) CLEAN AND LUBRICATE SURFACE GRINDER

202

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Oil Grease Oil can Grease gun Rags Solvent Brushes Measuring containers Lubrication charts Abrasive material Wrenches Drop cord	Clean fittings before lubrication Remove and install plug and covers Make necessary adjustments Start and stop machinery	Do not use pressurized air Eye and machine damage Shut machine off before cleaning Electrical shock Avoid spills Falls Proper disposal of lubricants and solvents Fire Water pollution
DECISIONS	**CUES**	**ERRORS**
Determine proper frequency of lubrication Select proper lubricant Locate all lubricantion points Determine correct amount of lubricant	Operation manual guidelines Type of machinery	Equipment malfunction

202

ASK STATEMENT) CLEAN AND LUBRICATE SURFACE GRINDER

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines Composition of matter, including protons, neutrons, electrons, atoms, molecules, and elements [Properties of lubricants] Effects of friction on work processes and product quality [Friction causes deterioration]	Given a coding system, recognize and identify each unit involved by assigning necessary symbols, numerical or literal [Society of Automotive Engineers Specifications] [American Iron and Steel Institute Specifications] Read and interpret charts, tables, and/or graphs [Lubrication charts] Liquid and dry measures [Liquid measure]

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Operational manuals	Comprehension, trade terminology, description of mechanism, definition and instructions
Viewing		Visual analysis, describing, logic, detail inference, color discrimination
Touching	Equipment	Temperature, texture, movement, and tension

203

(TASK STATEMENT) SELECT, MOUNT, AND DRESS GRINDING WHEEL FOR SURFACE GRINDER

204

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Wheel dresser Diamond Mechanical Stick Grinding wheel Wrenches Safety glasses	Select wheel Inspect wheel Clean arbor Install blotters Install washers Tighten nut Install guards Dress wheel	Improper dressing procedure Damaged wheel Cuts and bruises Eye injury Failure to wear eye protection Eye injury Use of damaged wheel Cuts and abrasions Eye injury Inadequate wheel guards Cuts and abrasions Eye injury
DECISIONS	**CUES**	**ERRORS**
Select wheel Determine correct mounting procedures	Type of grinding performance desired Tension of adaptor flanges	Incorrect wheel selection Improper mounting Guards not installed

202

ASK STATEMENT) SELECT, MOUNT, DRESS GRINDING WHEEL FOR SURFACE GRINDER

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage [Use of hand tools] Effect of heating and cooling on state of matter. (Change of matter from one form to another) [Resistance to erosion to wheel] Magnetic fields of force [Magnetic tool holding device for dressing] Centrifugal forces developed by bodies in rotation [Broken grinder wheel] Transfer of energy from one form to another Transfer of heat from one body to another [Mechanical to heat energy] [Justification of coolant] Arrangement of molecules, atoms and ions and the effect on structure and strength of materials [Wheel selection]	Measures of length Measure of time and speed (Example: time-seconds, minutes, etc.; speed-feet per minute, R.P.M., etc.) Given a coding system, recognize and identify each unit involved by assigning necessary symbols, numerical or literal [Grit, grade, structure, and bond]

59-265

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Viewing	Mounting	Visual analysis, logic, detail inference
Touching	Wheel	Tension and movement

(TASK STATEMENT) SELECT AND MOUNT WORK AND WORK HOLDING DEVICE

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Vise Magnetic chuck Angle plate "C" clamps Clamps Blocks Shims Studs and nuts Magnetic vee blocks Magnetic parallels Safety glasses	Select work holding device Clean magnetic chuck Install workpiece Turn on magnetic chuck Set to cut Grind Check Finish grind Check	Dirt on chuck Work scrapped Failure to turn on magnetic chuck Scrap work Broken wheel Cuts and bruises Abrasions
DECISIONS	**CUES**	**ERRORS**
Select workholding method	Size and shape of workpiece	Magnetic chuck not turned on Dirt on chuck Imprcperly held workpiece

206

TASK STATEMENT) SELECT AND MOUNT WORK AND WORK HOLDING DEVICE

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage [Clamps, T-bolds, jigs, and fixtures] Work input, work output, friction and efficiency in simple machines [Setting time] Motion resulting from two or more forces acting on a point in a body [Resistance to motion (torque)] Relationship of force to distortion in an elastic body Resistance of materials to change in shape [Proper tightening torque]	Given a coding system, recognize and identify each unit involved by assigning necessary symbols, numerical or literal [Wrench sizes]

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Viewing	Workpiece Mounting	Visual analysis, detail inference, logic, and describing
Touching	Workpiece Mounting	Size, shape, tension, and movement

(TASK STATEMENT) SET STOPS, FEED AND GRIND WORKPIECE

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Workpiece Safety glasses Mics	Set stops to length of stroke required Adjust feed Bring wheel down to work Turn on coolant Engage feed and grind	Flying grit from wheel Eye injury Avoid contact with wheel Cuts and abrasions Workpiece comes loose from holding device Scrap parts Wheel breakage Personal injury
DECISIONS	**CUES**	**ERRORS**
Determine correct feeds	Size, shape, and composition of workpiece	Initial cut excessive Lack of coolant Too heavy feed

(TASK STATEMENT) SET STOPS, FEED AND GRIND WORKPIECE

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines [Drive mechanisms] Effect of heating and cooling on expansion of materials (Change of dimensions) [Heat effects workpiece] Centrifugal forces developed by bodies in rotation [Materials fly out] [Workpiece tends to be pulled out of your hand] Effects of friction on work processes and product quality [Overheating will tend to anneal or soften tool bits] Transfer of energy from one form to another [Mechanical energy changes to heat]	Measures of length Addition and subtraction of decimal fractions Measure with the Metric and English system and convert between them

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Viewing	Scale Gage Workpiece Mounting	Visual analysis, detail inference, logic, and describing
Touching	Workpiece Mounting	Size, shape, tension, and movement

209

(TASK STATEMENT) REMOVE AND INSPECT PART FROM SURFACE GUIDER

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Workpiece File Inspection instruments Blueprint	Remove part Clean part Deburr part Inspect part	Careless handling of inspection tools Damaged or destroyed tools Burrs on workpiece Cuts

DECISIONS	CUES	ERRORS
Determine degree of accuracy	Blueprint Precision gages Micrometers	Inaccuracte inspection equipment Dirty part Burrs on part

ASK STATEMENT) REMOVE AND INSPECT PART FROM SURFACE GUIDER

SCIENCE	MATH – NUMBER SYSTEMS
Effects of friction on work processes and product quality [Poor quality due to friction on workpiece or tool]	Measures of length Given an instrument of measure, determine precision, and/or accuracy with respect to relative error, tolerance, and significant digits (Measuring other than linear, square, and cubic)

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Blueprint	Comprehension, trade terminology, detail inference, recognize symbols, codes, and emblems
Viewing	Workpiece Inspection devices	Visual analysis, detail inference, logic, and recognize symbols, codes, and emblems
Touching	Workpiece Inspection devices	Size, shape, texture, tension, movement, and temperature

Duty L Setting Up and Operating Universal Grinder

1 Clean and lubricate universal grinder
2 Select, mount and dress grinding wheel
3 Select and mount work and work holding device
4 Grind workpiece
5 Remove and inspect part from universal grinder

212

(TASK STATEMENT) CLEAN AND LUBRICATE UNIVERSAL GRINDER

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Oil Grease Oil can Grease gun Rags Solvent Brushes Measuring containers Lubrication charts Abrasive material Wrenches Drop cord	Clean fittings before lubrication Remove and install plug and covers Make necessary adjustments Start and stop machinery	Avoid chips Cuts Do not use pressurized air Eye and machine damage Shut machine off before cleaning Electrical shock Avoid spills Falls Proper disposal of lubricants and solvents Fire Water pollution
DECISIONS	**CUES**	**ERRORS**
Determine proper frequency of lubrication Select proper lubricant Locate all lubrication points Determine correct amount of lubricant	Operation manual guidelines Type of machinery	Equipment malfunction

(TASK STATEMENT) CLEAN AND LUBRICATE UNIVERSAL GRINDER

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines Composition of matter, including protons, neutrons, electrons, atoms, molecules, elements [Properties of lubricants] Effects of friction on work processes and product quality [Friction causes deterioration]	Given a coding system, recognize and identify each unit involved by assigning necessary symbols, numerical or literal [Society of Automotive Engineers Specifications] [American Iron and Steel Institute Specifications] Read and interpret charts, tables, and/or graphs [Lubrication charts] Liquid and dry measures [Liquid measure]

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Operational manuals	Comprehension, trade terminology, description of mechanisms, definition, and instructions
Viewing	Equipment	Visual analysis, describing, logic, detail inference, color discrimination
Touching	Equipment	Temperature, texture, movement, and tension

(TASK STATEMENT) SELECT, MOUNT, AND DRESS GRINDING WHEEL

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Grinding wheel Quill Wheel dresser Wrenches Blotters	Select wheel Inspect wheel Clean arbor Install blotters Install washers Tighten nut Install guards Dress wheel	Use of damaged wheel Cuts and abrasions Eye injury Improper dressing procedure Damaged wheel Cuts and abrasions Eye injury Failure to wear eye protection Eye injury Inadequate wheel guards
DECISIONS	**CUES**	**ERRORS**
Select proper wheel Select mounting procedures	Type of grinding performance desired Tension of adaptor flanges	Incorrect wheel selection Improper mounting Guards not installed

TASK STATEMENT) SELECT, MOUNT, AND DRESS GRINDING WHEEL

SCIENCE	MATH – NUMBER SYSTEMS
Using simple machines to gain mechanical advantage [Use of hand tools] Effect of heating and cooling on state of matter (Change of matter from one form to another) [Resistance to erosion to wheel] Magnetic fields of force [Magnetic tool holding device for dressing] Centrifugal forces developed by bodies in rotation [Broken grinder wheel] Transfer of energy from one form to another Transfer of heat from one body to another [Mechanical to heat energy] [Justification of coolant] Arrangement of molecules, atoms and ions and the effect on structure and strength of materials [Wheel selection]	Measures of length Measure of time and speed (Example: time-seconds, minutes, etc.; speed-feet per minute, R.P.M., etc.) [R.P.M.] Given a coding system, recognize and identify each unit involved by assigning necessary symbols, numerical or literal [Grit, grade, structure, and bond]

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Viewing	Mounting	Visual analysis, logic, and detail inference
Touching	Wheel	Tension and movement

(TASK STATEMENT) SELECT AND MOUNT WORK AND WORKHOLDING DEVICE

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Workpiece Centers Chuck Drive plate Driving dog Internal grinding holding fixture White lead and oil Wrenches Center rest	Select workholding device Clean part Mount work	Work improperly mounted Scrap parts Cuts and bruises Damaged wheel
DECISIONS	**CUES**	**ERRORS**
Selection of workholding method	Size and slope of workpiece	Improperly mounted work Stops set incorrectly

L12

TASK STATEMENT) SELECT AND MOUNT WORK AND WORKHOLDING DEVICE

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advanatage [Clamps, T-bolds, jigs, and fixtures] Work input, work output, friction and efficiency in simple machines [Setting time] Motion resulting from two or more forces acting on a point in a body [Resistance to motion (torque)] Relationship of force to distortion in an elastic body Resistance of materials to change in change in shape [Proper tightening torque]	Given a coding system, recognize and identify each unit involved by assigning necessary symbols, numerical or literal [Wrench sizes]

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Viewing	Mounting	Visual analysis, logic, and detail inference
Touching	Workpiece	Tension and movement

218

(TASK STATEMENT) GRIND WORKPIECE

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Workpiece Micrometers O.D. and I.D. Coolant Wrenches Safety glasses	Set stops to length of stroke required Adjust feed Bring wheel into workpiece Turn on coolant Engage feed and grind	Flying grit from wheel Eye injury Avoid contact with wheel Cuts and abrasions Workpiece comes loose from holding device Scrap parts Wheel breakage Personal injury
DECISIONS	**CUES**	**ERRORS**
Determine correct feeds	Size, shape, and composition of workpiece	Initial cut excessive Lack of coolant Too heavy feed

TASK STATEMENT) GRIND WORKPIECE

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines [Drive mechanisms] Effect of heating and cooling on expansion of materials (Change of dimensions) [Heat effects accuracy] Effects of friction on work processes and product quality [Effect of friction on workpiece] Transfer of energy from one form to another [Mechanical to heat energy]	Measures of length Addition and subtraction of decimal fractions Measure with the Metric and English system and convert between them Use of trigonometric functions in solution of problems involving right triangles

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Viewing	Workpiece Measuring devices	Visual analysis, detail inference, logic, recognize symbols, codes, and emblems
Touching	Workpiece Measuring devices	Size, shape, temperature, texture, tension, and movement

(TASK STATEMENT) REMOVE AND INSPECT PART FROM UNIVERSAL GRINDER

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Wrenches I.D. mics O.D. mics Safety glasses Blueprint	Remove part Deburr part Inspect part	Burrs on workpiece Cuts Handle tools and materials properly Cuts and burns Material damage
DECISIONS	**CUES**	**ERRORS**
Determine degree of accuracy required	Scale Blueprint Micrometer Gage	Dirt or grit on part Burrs on part Incorrect tolerances

DECISIONS	CUES	ERRORS
Determine degree of accuracy required	Scale Blueprint Micrometer Gage	Dirt or grit on part Burrs on part Incorrect tolerances

(TASK STATEMENT) REMOVE AND INSPECT PART FROM UNIVERSAL GRINDER

SCIENCE	MATH – NUMBER SYSTEMS
Effects of friction on work processes and product quality [Poor quality due to friction on workpiece or tool]	Measures of length Given an instrument of measure, determine precision, and/or accuracy with respect to relative error, tolerance, and significant digits (Measuring other than linear, square, and cubic) [Plug and ring gage-Sine bar]

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Blueprint	Comprehension, detail inference, trade terminology, recognize symbols, codes, and emblems
Viewing	Workpiece Measuring devices	Visual analysis, detail inference, logic, and recognize symbols, codes, and emblems
Touching	Workpiece Measuring devices	Size, shape, temperature, texture, tension, and movement

222

222

Duty M Setting Up and Operating Tool and Cutter Grinder

1 Clean and lubricate tool and cutter grinder
2 Select, mount and dress grinding wheel
3 Select and mount tool or cutter holding device
4 Grind tool or cutter
5 Remove and inspect tool or cutter

223

(TASK STATEMENT) CLEAN AND LUBRICATE TOOL AND CUTTER GRINDER

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Oil Grease Oil can Grease gun Rags Solvent Brushes Measuring containers Lubrication charts Abrasive materials Wrenches Drop cord	Clean fittings before lubrication Remove and install plug and covers Make necessary adjustments Start and stop machinery	Avoid chips Cuts Do not use pressurized air Eye and machine damage Shut machine off before cleaning Electrical shock Avoid spills Falls Proper disposal of lubricants and solvents Fire Water pollution
DECISIONS	**CUES**	**ERRORS**
Determine proper frequency of lubrication Select proper lubricant Locate all lubrication points Determine correct amount of lubricant	Operation manual guidelines Type of machinery	Equipment malfunction

ASK STATEMENT) CLEAN AND LUBRICATE TOOL AND CUTTER GRINDER

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines Composition of matter, including protons, neutrons, electrons, atoms, molecules, elements [Properties of lubricants] Effects of friction on work processes and product quality [Friction causes deterioration]	Given a coding system, recognize and identify each unit involved by assigning necessary symbols, numerical or literal [Society of Automotive Engineers Specifications] [American Iron and Steel Institute Specifications] Read and interpret charts, tables, and/or graphs [Lubrication charts] Liquid and dry measures [Liquid measure]

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Operational manuals	Comprehension, trade terminology, description of mechanisms, definition, and instructions
Viewing	Equipment	Visual analysis, describing, logic, detail inference, color discrimination
Touching	Equipment	Temperature, texture, movement, and tension

(TASK STATEMENT) SELECT, MOUNT, AND DRESS GRINDING WHEEL

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Grinding wheel Wheel arbor and nut Wheel dresser Blotters Wrenches	Select wheel Inspect wheel Clean arbor Install blotters Install washers Tighten nut Install guards Dress wheel	Use of damaged wheel Cuts and abrasions Eye injury Improper dressing procedures Damage wheel Cuts and abrasions Eye injury Failure to wear eye protection Eye injury Inadequate wheel guards
DECISIONS	**CUES**	**ERRORS**
Select proper wheel Select mounting procedures	Type of grinding performance desired Tension of adaptor flanges	Incorrect wheel selection Improper mounting Guards not installed

ASK STATEMENT) SELECT, MOUNT, AND DRESS GRINDING WHEEL

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage [Use of hand tools] Effect of heating and cooling on state of matter (Change of matter from one form to another) [Resistance to erosion to wheel] Magnetic fields of force [Magnetic tool holding device for dressing] Centrifugal forces developed by bodies in rotation [Broken grinder wheel] Transfer of energy from one form to another Transfer of heat from one body to another [Mechanical to heat energy] [Justification of coolant] Arrangement of molecules, atoms and ions and the effect on structure and strength of materials [Wheel selection]	Measures of length Measure of time and speed (Example: time-seconds, minutes, etc., speed-feet per minute, R.P.M., etc.) Given a coding system, recognize and identify each unit involved by assigning necessary symbols, numerical or literal [Grit, grade, structure, and bond]

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Viewing	Wheel Mount set-up	Visual analysis, detail inference, and logic
Touching	Install washers Nuts	Size, shape, and tension

227

(TASK STATEMENT) SELECT AND MOUNT TOOL OR CUTTER HOLDING DEVICE

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Workhead Centers Toolmakers vise End mill sharpening device Wrenches Stub arbor Mandrel Tooth rest Form cutter holding fixture Indicator and holder	Select cutter holding device Clean holder Mount cutter	Avoid contact with sharp edges of cutter or tools Cuts Handle cutters properly Damaged cutter Cuts and bruises
DECISIONS	**CUES**	**ERRORS**
Select proper mounting devices	Type of tool or cutter	Incorrect selection of holding device Dirty workholding device Tool or cutter mounted loosely

ASK STATEMENT) SELECT AND MOUNT TOOL OR CUTTER HOLDING DEVICE

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage [Clamps, T-bolds, jigs and fixtures] Work input, work output, friction and efficiency in simple machines [Setting time] Motion resulting from two or more forces acting on a point in a body [Resistance to motion (torque)] Relationship of force to distortion in an elastic body Resistance of materials to change in shape [Proper tightening torque]	Measures of length

229

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Viewing	Mounting	Visual analysis, logic, and detail inference
Touching	Mounting	Tension and movement

229

(TASK STATEMENT) GRIND TOOL OR CUTTER

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Cutter clearance chart Scale Micrometers Cutter Coolant Wrenches Safety glasses	Set wheel to work Take trial cut Check Grind primary relief Check Grind secondary relief Check	Avoid contact with rotating grinding wheel Cuts and abrasions Avoid flying grit from grinding wheel Eye injury Workpiece comes loose from holding device Broken wheel Cuts and abrasions Eye injury
DECISIONS	**CUES**	**ERRORS**
Select relief angles	Cutter clearance chart	Relief angles incorrect Wheel damage Overheating of cutter

ASK STATEMENT) GRIND TOOL OR CUTTER

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines [Drive mechanisms] Effect of heating and cooling on expansion of materials (Change of dimensions) [Heat effects accuracy] Effects of friction on work processes and product quality [Effect of friction on workpiece] Transfer of energy from one body to another [Mechanical to heat energy]	Measures of length Use of trigonometric functions in solution of problems involving right triangles [Clearance angles]

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Viewing	Workpiece Measuring devices	Visual analysis, detail inference, logic, recognize symbols, codes, and emblems
Touching	Workpiece Measuring devices	Size, shape, temperature, texture, tension, and movement

(TASK STATEMENT) REMOVE AND INSPECT TOOL OR CUTTER FROM GRINDERS

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY -- HAZARD
Mics Scale Charts Wrenches Surface gage Indicator	Remove cutter Inspect	Handle sharp cutters carefully Damage cutter Cuts

DECISIONS	CUES	ERRORS
Determine properly sharpened tool or cutter	Size, shape, and composition of workpiece	Careless handling of cutter Careless inspection Improper angles on tool or cutter

TASK STATEMENT) REMOVE AND INSPECT TOOL OR CUTTER FROM GRINDERS

SCIENCE	MATH – NUMBER SYSTEMS
Effects of friction on work processes and product quality [Poor quality due to friction on workpiece and tool]	Measures of length [Linear measurement] Given a coding system, recognize and identify each unit involved by assigning necessary symbols, numerical or literal [Angular measurement] Read and interpret charts, tables, and/or graphs [Clearance angles]

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Viewing	Workpiece Measuring devices	Visual analysis, detail inference, logic, and recognize symbols, codes, and emblems
Touching	Workpiece Measuring devices	Size, shape, temperature, texture, tension, and movement

233

233

Duty N Setting Up and Operating Arbor Press

1 Clean and lubricate arbor press
2 Remove and install bearings or bushings
3 Perform broaching operations
4 Remove and inspect part from arbor press

236.

(TASK STATEMENT) CLEAN AND LUBRICATE ARBOR PRESS

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY -- HAZARD
Oil Grease Oil can Grease gun Rags Solvent Brushes Measuring containers Lubrication charts Abrasive materials Wrenches Drop cord	Clean fittings before lubrication Remove and install plug and covers Make necessary adjustments Start and stop machinery	Avoid chips Cuts Do not use pressurized air Eye and machine damage Shut machine off before cleaning Electrical shock Avoid spills Falls Proper disposal of lubricants and solvents Fire Water pollution
DECISIONS	**CUES**	**ERRORS**
Determine proper frequency of lubrication Select proper lubricant Locate all lubrication points Determine correct amount of lubricant	Operation manual guidelines Type of machinery	Equipment malfunction

TASK STATEMENT) CLEAN AND LUBRICATE ARBOR PRESS

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines Composition of matter, including protons, neutrons, electrons, atoms, molecules, elements [Properties of lubricants] Effects of friction on work processes and product quality [Friction causes deterioration]	Given a coding system, recognize and identify each unit involved by assigning necessary symbols, numerical or literal [Society of Automotive Engineers Specifications] [American Iron and Steel Institute Specifications] Read and interpret charts, tables, and/or graphs [Lubrication charts] Liquid and dry measures [Liquid measure]

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Operational manuals	Comprehension, trade terminology, description of mechanisms, definition, and instructions
Viewing	Equipment	Visual analysis, describing, logic, detail inference, and color discrimination
Touching	Equipment	Temperature, texture, movement, and tension

(TASK STATEMENT) REMOVE AND INSTALL BEARINGS OR BUSHINGS

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY -- HAZARD
Drift Punch Vee blocks Parallels Plugs Bushings Micrometers Scale	Remove old bearings or bushing Select new bearings or bushings Press fit bearings or bushings Check bearing or bushing for tightness or looseness	Misalignment of bearing or bushing Shearing of seat wall Proper usage of press Eye injury Mashed fingers Workpiece falling on feet It is usually advisable to have another person help when using a press

DECISIONS	CUES	ERRORS
Determine tool used to remove and install bearing or busning Determine proper bearing or bushing Determine correct fit	Location of replacement Boundary dimensions Reference numbers Sound of equipment	Marr wall surface when removing Bearing or bushing too tight or loose

TASK STATEMENT) REMOVE AND INSTALL BEARINGS OR BUSHINGS

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines [Rack and pinion gear on arbor press] [Friction of the press fit] Relationship of force to distortion in an elastic body [Excessive force will damage seat wall] Resistance of materials to change in shape [Compression of bearing or bushings]	Measures of length Given a coding system, recognize and identify each unit involved by assigning necessary symbols, numerical or literal [Part numbers]

238

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Viewing	Bearings and bushings Measuring devices	Visual analysis, detail inference, logic, and recognize symbols, codes, and emblems
Touching	Bearings and bushings Measuring devices	Size, shape, temperature, texture, tension, and movement
Listening	Operating equipment	Noise discrimination and logic

(TASK STATEMENT) PERFORM BROACHING OPERATIONS

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY -- HAZARD
Broaches Shims Parallels Vee blocks	Select broaching tools (Broach, bushing, and shims) Set-up workpiece Broach workpiece	Care when using broach Cuts from broach Avoid breaking broach Cuts Eye injury
DECISIONS	**CUES**	**ERRORS**
Determine proper broach, bushing, and shims to be used	Size and shape of hole/exterior	Applying pressure incorrectly (Hammering arbor press spindle) Poor set-up of workpiece

(TASK STATEMENT) PERFORM BROACHING OPERATIONS

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines [Broach constitutes simple machines] Relationship of force to distortion in an elastic body Resistance of materials to change in shape [Cutting motion is a distorting factor]	Addition and subtraction of decimal fractions Measures of length Read and interpret charts, tables, and/or graphs [Machinist's Handbook (Keys and Keyways)] Given a coding system, recognize and identify each unit involved by assigning necessary symbols, numerical or literal [Broach sizing system]

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Viewing	Set-up Workpiece	Visual analysis, logic, and detail inference
Touching	Workpiece	Size and shape

(TASK STATEMENT) REMOVE AND INSPECT PART FROM ARBOR PRESS

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY -- HAZARD
Plug gages Mics Verniers Blueprint Plug gace	Remove part Deburr part Inspect part	Burrs on workpiece Cuts Handle tools and material properly Cuts and burns Materi.' damage

DECISIONS	CUES	ERRORS
Determine degree of accuracy required	Scale Blueprint Micrometer Gage	Dirt or grit on part Burrs on part Incorrect tolerances

(TASK STATEMENT) REMOVE AND INSPECT PART FROM ARBOR PRESS

SCIENCE	MATH – NUMBER SYSTEMS
Effects of friction on work processes and product quality [Poor quality due to friction on workpiece or tool]	Measures of length Given an instrument of measure, determine precision, and/or accuracy with respect to relative error, tolerance, and significant digits (Measuring other than linear, square, and cubic)

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Blueprint	Comprehension, detail inference, trade terminology, recognize symbols, codes, and emblems
Viewing	Workpiece Measuring devices	Visual analysis, detail inference, logic, recognize symbols, codes, and emblems
Touching	Workpiece Measuring devices	Size, shape, temperature, texture, tension, and movement

Duty 0 Setting Up and Operating Electrical Discharge Machine (EDM)

1 Clean and lubricate electrical discharge machine
2 Make electrode
3 Setup (EDM) machine
4 Machine part to drawing specifications
5 Remove and inspect part from EDM

(TASK STATEMENT) CLEAN AND LUBRICATE ELECTRICAL DISCHARGE MACHINE

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY -- HAZARD
Oil Grease Oil can Grease gun Rags Solvent Brushes Measuring containers Lubrication charts Abrasive materials Wrenches Drop cord	Clean fittings before lubrication Remove and install plug and covers Make necessary adjustments Start and stop machinery	Avoid chips Cuts Do not use pressurized air Eye and machine damage Shut machine off before cleaning Electrical shock Avoid spills Falls Proper disposal of lubricants and solvents Fire Water pollution
DECISIONS	**CUES**	**ERRORS**
Determine proper frequency of lubrication Select proper lubricant Locate all lubrication points Determine correct amount of lubricant	Operation manual guidelines Type of machinery	Equipment malfunction

TASK STATEMENT) CLEAN AND LUBRICATE ELECTRICAL DISCHARGE MACHINE

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines Composition of matter, including protons, neutrons, electrons, atoms, molecules, and elements [Properties of lubricants] Effects of friction on work processes and product quality [Friction causes deterioration]	Given a coding system, recognize and identify each unit involved by assigning necessary symbols, numerical or literal [Society of Automotive Engineers Specifications] [American Iron and Steel Institute Specifications] Read and interpret charts, tables, and/or graphs [Lubrication charts] Liquid and dry measures [Liquid measure]

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Operational manuals	Comprehension, trade terminology, description of mechanisms, definition, and instructions
Viewing	Equipment	Visual analysis, describing, logic, detail inference, color discrimination
Touching	Equipment	Temperature, texture, movement, and tension

245

(TASK STATEMENT) MAKE ELECTRODE

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY -- HAZARD
Electrode materials Machining equipment Wrenches Safety glasses Micrometers	Select electrode materials Machine electrode to exact print specifications Inspect the electrode	Improper use of equipment Cuts and abrasions Eye injury Burns
DECISIONS	**CUES**	**ERRORS**
Determine electrode materials Determine number of electrodes to make (roughing and finishing)	Electrical conductivity Machinability Resistance to deformation during erosion process Low tool wear rates	Rough finish on electrode

(TASK STATEMENT) MAKE ELECTRODE

SCIENCE	MATH – NUMBER SYSTEMS
Resistance of materials to change in shape [Electrodes made from soft materials] Composition of matter, including protons, neutrons, electrons, atoms, molecules, and elements [Composition of electrode materials] Resistance of materials to flow of electrical current	Measures of length Given an instrument of measure, determine precision, and/or accuracy with respect to relative error, tolerance, and significant digits (Measuring other than linear, square, and cubic)

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Blueprint	Comprehension, detail inference, trade terminology, recognize symbols, codes, and emblems
Viewing	Workpiece Measuring devices	Visual analysis, detail inference, logic, recognize symbols, codes, and emblems
Touching	Workpiece Measuring devices	Size, shape, temperature, texture, tension, and movement

(TASK STATEMENT) SETUP ELECTRICAL DISCHARGE MACHINE

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY – HAZARD
Feed controls Feed charts Electrode holder (collets)	Mount electrode Select and mount work and holding device Select and set feed rate Check dielectric fluid	Proper feed rate Excessive electrode wear
DECISIONS	**CUES**	**ERRORS**
Determine type of holding device Determine feed rate Determine type of dielectric fluid	Electrical conductivity Gap between electrode and workpiece Vaporizing qualities	Poor mounting of work Improper dielectric fluid Damaged electrode

(TASK STATEMENT) SETUP ELECTRICAL DISCHARGE MACHINE

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines [Specific gravity of dielectric] [Tools to mount workpiece]	Measure of time and speed (Example: time-seconds, minutes, etc., speed-feet per minute, R.P.M., etc.) [Speed]

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Feed charts	Comprehension, detail inference, trade terminology, recognize symbols, codes, and emblems
Viewing	Set-up	Visual analysis, logic, and detail inference

(TASK STATEMENT) MACHINE PART TO DRAWING SPECIFICATIONS

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY -- HAZARD
Workpiece Micromters Blueprint Wrenches Holding fixtures Dielectric fluid	Start machine and feed machine mechanisms Check circulation of dielectric fluids Change electrodes when needed	Oil splashing Slips or falls Oil splashing in eye
DECISIONS	**CUES**	**ERRORS**
Determine when to change electrode Determine pressure of dielectric fluid Determine efficiency of electrode	Average wear ratio of workpiece to electrode Point of machining process (beginning or optimum cutting) Metal removal rates	Rough finish Short circuit

TASK STATEMENT) MACHINE PART TO DRAWING SPECIFICATIONS

SCIENCE	MATH – NUMBER SYSTEMS
Transfer of energy from one form to another [Transfer electrical to heat energy] Transfer of heat from one body to another [Heat absorbed by dielectric] Resistance of materials to flow of electrical current	Measures of length Addition and subtraction of decimal fractions Measure with the Metric and English system and convert between them Use of trigonometric functions in solution of problems involving right triangles

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Feed charts	Comprehension, detail inference, trade terminology, recognize symbols, codes, and emblems
Viewing	Set-up	Visual analysis, logic, and detail inference

(TASK STATEMENT) REMOVE AND INSPECT PART FROM EDM

TOOLS, EQUIPMENT, MATERIALS, OBJECTS ACTED UPON	PERFORMANCE KNOWLEDGE	SAFETY -- HAZARD
Blueprint Workpiece Scale Mics	Remove part Deburr part Inspect part	Burrs on workpiece Cuts Handle tools and materials properly Cuts and burns Material damage

DECISIONS	CUES	ERRORS
Determine degree of accuracy required	Scale Blueprint Micrometer Gage	Dirt or grit on part Burrs on part Incorrect tolerances

(TASK STATEMENT) REMOVE AND INSPECT PART FROM EDM

SCIENCE	MATH – NUMBER SYSTEMS
Simple machines used to gain mechanical advantage Work input, work output, friction and efficiency in simple machines [Tools to remove workpiece]	Measures of length Given an instrument of measure, determine precision, and/or accuracy with respect to relative error, tolerance, and significant digits (Measuring other than linear, square, and cubic)

COMMUNICATIONS

PERFORMANCE MODES	EXAMPLES	SKILLS/CONCEPTS
Reading	Blueprint	Comprehension, detail inference, trade terminology, recognize symbols, codes, and emblems
Viewing	Workpiece Measuring devices	Visual analysis, detail inference, logic, recognize symbols, codes, and emblems
Touching	Workpiece Measuring devices	Size, shape, temperature, texture, tension, and movement