This drafting criterion-referenced test item bank is keyed to the machine shop competency profile developed by industry and education professionals in Missouri. The 16 references used for drafting the test items are listed. Test items are arranged under these categories: orientation to machine shop; performing mathematical calculations; performing precision measurement; blueprint reading; performing bench work; introduction to material science; operating power saws; operating drill presses; operating lathes; operating milling machines; operating grinders; tool and cutter grinding; concepts of numerical controlled machines; and leadership. The following information is provided for each test item: unique item number; duty area and task number (Missouri competency profile); letter of correct answer; source; date; learning domain (cognitive, affective, psychomotor); writer(s)/reviewer(s); and accompanying artwork. (YLB)
Criterion-Referenced Test Items for MACHINE SHOP
The activity which is the subject of this report was supported in whole or in part by funds from the Department of Elementary and Secondary Education, Division of Vocational and Adult Education. However, the opinions expressed herein do not necessarily reflect the position or policies of the Missouri Department of Elementary and Secondary Education or the Division of Vocational and Adult Education, and no official endorsement should be inferred.
FOREWORD

Rapid advances in technology are placing heavy demands on both teachers and students in vocational education. These Criterion-Referenced Test Items for Machine Shop are designed to help meet those demands.

All test writers face one basic challenge: to produce test items that accurately measure what they are intended to measure. This challenge was kept firmly in mind by all those who participated in the development of the bank. The items in the bank are based upon competencies found on the Missouri Machine Shop Competency Profile. Much care was taken to ensure that the test items will accurately measure a student’s knowledge in regard to these competencies. Every effort was made to ensure the items are presented in a fair and unbiased manner.

The items in this book are designed to work with both the Vocational Instructional Management System (ViMS) and VAMS. The test item bank will allow instructors and administrators to manage testing and evaluation activities in the most efficient way possible. Instructors pulling items from this bank for individual tests should still evaluate the new test to see that one question does not give away the answer to another question. For word processing and test-item generation purposes, an ASCII disk of the item bank has been included with this printed copy.

This test bank should be viewed as a beginning. It is hoped that future revisions and additions will build the bank into an even more powerful and reliable evaluation and management tool.

Judith Moore, supervisor
Industrial Education
Department of Elementary and Secondary Education

Charles "Chuck" Walbel, director
Industrial Education
Department of Elementary and Secondary Education
ACKNOWLEDGMENTS

These Criterion-Referenced Test (CRT) items for Machine Shop represent a continuing commitment to Missouri's Vocational Instructional Management System (VIMS). The bank is keyed to the Machine Shop Competency Profile developed by industry and education professionals in the state. The cycle of curriculum development includes the following steps:

1. Development of the competency profile
2. Instructional analysis
3. Search for existing materials and/or a crosswalk of existing curriculum materials to the competency profile
4. Development of the curriculum guide
5. Field-test of the curriculum guide
6. Development of mediated curriculum (videos)
7. Development of the test-item bank

To ensure that test items are firmly based on information available to students, development of the test-item bank is the final component in the development cycle.

These teachers contributed as writers and advisory committee members.

Junior Cagle, Poplar Bluff AVTS
Bill Daniel, Hannibal AVTS
Charles Dawson, Moberly AVTS
Don Marquardt, Hickman High School, Columbia
Coy Smith, Rolla AVTS
Charlie Walden, University of Missouri-Columbia

These CRTs were technically reviewed and/or field-tested by the following educators.

Charles Oviatt, educational consultant, Vienna, Mo.
Junior Cagle, Poplar Bluff AVTS
Bill Daniel, Hannibal AVTS
David Michael, Lax La-Ray Technical Center
James Shimel, Longview Community College
Coy Smith, Rolla AVTS

Support and contributions of IML staff members were instrumental to this project's development.

Harley Schlichting, director
Amon Herd, associate director
Phyllis Miller and Dan Stapleton, assistant directors
Lori Holliday, word processor III
REFERENCES USED FOR MACHINE SHOP CRTs

ANSI Y14.5M  

APS  

Basic BPR  

Feirer  

IML  

McGraw-Hill  

McKnight  

MTT  

Oberg  

Olivo  

Olivo, 1987  

Rutland  

Repp  

Repp SG#1  

TT  

VICA  
Goodrick, Bill. **Missouri VICA Curriculum Guide.** University of Missouri-Columbia: Instructional Materials Laboratory, 1986.
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Duty and task</th>
<th>Page #</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Orientation to Machine Shop</td>
<td>1</td>
</tr>
<tr>
<td>1. Operate safely in the workshop</td>
<td></td>
</tr>
<tr>
<td>2. List machine shop safety rules and regulations</td>
<td></td>
</tr>
<tr>
<td>3. Identify characteristics of a machinist</td>
<td></td>
</tr>
<tr>
<td>4. Inspect work area for safe work environment</td>
<td></td>
</tr>
<tr>
<td>B. Performing Mathematical Calculations</td>
<td>5</td>
</tr>
<tr>
<td>1. Convert common fraction to decimal fraction and vice versa</td>
<td></td>
</tr>
<tr>
<td>2. Calculate tap drill size with formula and charts</td>
<td></td>
</tr>
<tr>
<td>3. Convert customary measurements to metric and vice versa</td>
<td></td>
</tr>
<tr>
<td>4. Use calculator to perform mathematical operations</td>
<td></td>
</tr>
<tr>
<td>5. Calculate amount of stock required</td>
<td></td>
</tr>
<tr>
<td>6. Calculate part and feature dimensions and locations</td>
<td></td>
</tr>
<tr>
<td>7. Convert revolutions per minute (RPM) to surface feet per minute (SFPM)</td>
<td></td>
</tr>
<tr>
<td>8. Calculate feeds and speeds</td>
<td></td>
</tr>
<tr>
<td>9. Calculate tapers for machine set-up</td>
<td></td>
</tr>
<tr>
<td>10. Calculate sine-bar set-up</td>
<td></td>
</tr>
<tr>
<td>11. Perform angular and simple indexing calculations</td>
<td></td>
</tr>
<tr>
<td>12. Calculate measurements of right triangles</td>
<td></td>
</tr>
<tr>
<td>13. Calculate plane geometry/math applications</td>
<td></td>
</tr>
<tr>
<td>C. Performing Precision Measurement</td>
<td>19</td>
</tr>
<tr>
<td>1. Care for precision instruments</td>
<td></td>
</tr>
<tr>
<td>2. Measure workplace with tape measure</td>
<td></td>
</tr>
<tr>
<td>3. Measure workplace with pocket rule</td>
<td></td>
</tr>
<tr>
<td>4. Measure workplace with slide caliper rule</td>
<td></td>
</tr>
<tr>
<td>5. Lay out work with combination square</td>
<td></td>
</tr>
<tr>
<td>6. Transfer measurement with dividers</td>
<td></td>
</tr>
<tr>
<td>7. Lay out workplace with hermaphrodite calipers</td>
<td></td>
</tr>
<tr>
<td>8. Measure workplace with spring calipers</td>
<td></td>
</tr>
<tr>
<td>9. Measure workplace with vernier caliper</td>
<td></td>
</tr>
<tr>
<td>10. Measure workplace with depth gages</td>
<td></td>
</tr>
<tr>
<td>11. Measure workplace with micrometers</td>
<td></td>
</tr>
<tr>
<td>12. Measure workplace with dial calipers</td>
<td></td>
</tr>
<tr>
<td>13. Measure workplace with telescope and hole gages</td>
<td></td>
</tr>
<tr>
<td>14. Check work with gages, i.e., plug and ring gages</td>
<td></td>
</tr>
<tr>
<td>15. Measure workplace with height gages</td>
<td></td>
</tr>
<tr>
<td>16. Lay out workplace and measure on surface plate</td>
<td></td>
</tr>
<tr>
<td>17. Measure workplace on surface plate</td>
<td></td>
</tr>
<tr>
<td>18. Measure workplace with gage blocks</td>
<td></td>
</tr>
<tr>
<td>19. Measure workplace with dial indicators and attachments</td>
<td></td>
</tr>
<tr>
<td>20. Measure workplace with thread wires and micrometers</td>
<td></td>
</tr>
<tr>
<td>21. Check and/or lay out workplace with sine bar</td>
<td></td>
</tr>
<tr>
<td>D. Blueprint Reading</td>
<td>41</td>
</tr>
<tr>
<td>1. Interpret meaning of common drafting symbols</td>
<td></td>
</tr>
<tr>
<td>2. Interpret blueprint</td>
<td></td>
</tr>
<tr>
<td>3. Make a sketch from a finished workplace</td>
<td></td>
</tr>
<tr>
<td>4. Calculate tolerances and allowances</td>
<td></td>
</tr>
<tr>
<td>5. Calculate missing dimensions</td>
<td></td>
</tr>
<tr>
<td>6. Use geometric dimensioning and tolerancing</td>
<td></td>
</tr>
<tr>
<td>7. Use Machinist's Handbook to plan work</td>
<td></td>
</tr>
</tbody>
</table>
E. Performing Bench Work

1. Use and care for hand tools
2. Cut material with hand hack saw
3. Bench file/deburr workpiece
4. Mark locations with pricks and center punches
5. Locate holes with transfer screws and transfer punches
6. Cut threads with die
7. Cut threads with tap
8. Ream holes with hand reamer
9. Dress true grinding wheels on pedestal/bench grinder
10. Grind and shape tools on pedestal/bench grinder
11. Use abrasives/wet/whetstones/polishing/lapping
12. Grind using appropriate hand grinder
13. Remove damaged screws
14. Remove broken drills and taps
15. Remove and install dowel pins
16. Install a helical coil thread insert
17. Straighten workpiece on arbor press
18. Assemble and disassemble workpiece with arbor press
19. Broach workpiece with broaching tool
20. Assemble and disassemble precision parts

F. Introduction to Material Science

1. Identify types of metals and related materials
2. List properties that affect machinability
3. Correlate types of materials to their properties
4. List major cutting tool variables
5. Perform heat treatment process
6. Test workpiece for hardness without hardness tester

G. Operating Power Saws

1. Employ power saw safety guidelines consistently
2. Perform care and maintenance
3. Select proper blade type for sawing operations and materials
4. Cut and weld band saw blades
5. Select and set speeds and feeds on power saw
6. Cut material to length with power hack saw
7. Cut material to length with band saw
8. Select and apply cutting fluids
9. Contour saw to scribed line
10. Saw internal contours with band saw

H. Operating Drill Presses

1. Employ drill press safety guidelines consistently
2. Perform care and maintenance
3. Set up and clamp workpiece to drill press table
4. Select proper drill type based on job requirements
5. Determine cutting tool variables prior to use
6. Set up drill press to obtain calculated feeds and speeds
7. Select and apply cutting fluids
8. Drill holes to specification using manual feed
9. Drill holes to specification using automatic feed
10. Counter sink hole to specifications
11. Counter bore hole to specifications
12. Spotface to specific dimensions
13. Mount workpiece on V-blocks
14. Power ream hole to size
15. Use drill jigs and bushings
16. Hand tap hole using drill press
17. Tap hole with tapping attachments
18. Sharpen drills with grinding attachments and/or specialized grinders
19. Set up radial drill press

L. Operating Lathe

1. Employ lathe safety guidelines consistently
2. Perform care and maintenance
3. Align lathe centers using test bar and dial indicators
4. Determine cutting tool variables prior to use
5. Calculate feeds and speeds for lathe set-up
6. Free-hand grind turning and facing tools
7. Select and apply cutting fluids
8. Operate lathe controls
9. Face workpiece and center drill
10. Set up tooling
11. Turn workpiece between centers
12. Center workpiece in four-jaw chuck
13. Drill holes
14. Ream holes
15. Bore holes
16. Countersink holes
17. Counterbore holes
18. Knurl parts
19. Free-hand grind 60° threading tool
20. Cut/chase external threads
21. Chase/rechase internal threads
22. Chase metric threads
23. Use compound rest to cut short external tapered surface
24. Cut tapers by offset tailstock
25. Cut an external tapered surface with taper attachment
26. Cut internal tapered surfaces with taper attachment
27. Align workpiece on faceplate
28. Perform lathe filing
29. Polish workpiece
30. Turn or thread long workpieces using follower and steady rest
31. Cut multiple threads
32. Cut ACME threads
33. Use form tooling
34. Use mandrel

J. Operating Milling Machines

1. Employ milling machine safety guidelines consistently
2. Perform care and maintenance
3. Align mill head to table
4. Align milling machine attachments
5. Align workpiece mounted on machine table
6. Calculate proper feeds and speeds and set up mill accordingly
7. Select and apply proper cutting fluids
8. Determine cutting tool variables prior to use
9. Square workpiece using table vise
10. Mill workpiece with end mill
11. Locate work with edge finder
12. Drill holes with milling machine
13. Ream holes
14. Bore holes with milling machine
15. Form mill workpiece
16. Machine workpiece mounted on V-blocks
17. Machine external straight keyway
18. Machine woodruff keyway
19. Mill angular surfaces
20. Mill an external radius with rotary table
21. Mill internal radius with rotary table
22. Mill workpiece using simple indexing operation
23. Use digital readout
24. Machine workpiece by straddle milling
25. Perform gang milling
26. Perform gear cutting operations

K. Operating Grinders

1. Employ grinder safety guidelines consistently
2. Clean and lubricate grinders
3. Select and apply cutting fluids
4. Inspect grinding wheel
5. Balance grinding wheel
6. Select and mount grinding wheel
7. Dress and true machine tool grinding wheel
8. Grind workpiece on magnetic chuck using power feed
9. Grind workpiece square on surface grinder
10. Indicate workpiece to be ground
11. Grind angular surfaces
12. Grind workpiece between centers using cylindrical grinding

L. Tool and Cutter Grinding

1. Employ safety guidelines
2. Perform care and maintenance
3. Inspect grinding wheels
4. Select and mount grinding wheel
5. Dress and true grinding wheel
6. Set up machine
7. Sharpen cutters on tool and cutter grinders

M. Concepts of Numerical Controlled Machines

1. Employ CNC machine safety guidelines consistently
2. Perform care and maintenance
3. Calculate coordinates and dimensions of CNC drawing
4. Write program for CNC machine
5. Set up a CNC machine
6. Machine workpiece with CNC machine

Leadership

1. Demonstrate an understanding of VICA, its structure and activities
2. Demonstrate an understanding of one's personal values
3. Perform tasks related to effective personal management skills
4. Demonstrate interpersonal skills
5. Demonstrate etiquette and courtesy
6. Demonstrate effectiveness in oral and written communication
7. Develop and maintain a code of professional ethics
8. Maintain a good professional appearance
9. Perform basic tasks related to securing and terminating employment
10. Perform basic parliamentary procedures in a group meeting
When should safety glasses be worn in the machine shop?

a. When operating the drill press
b. When operating the lathe
c. When operating milling machine
d. When operating tool grinders
e. At all times

What is the best way to get a machine operator's attention?

a. Tap the person on the shoulder.
b. Turn off the machine.
c. Shout in the person's ear.
d. Wait until the operator shuts off the machine.

Why should an operator turn off a machine when he or she leaves?

a. Another person may be injured.
b. The tool might break.
c. The motor might overheat.
d. The machine might jam.
4. Why should liquid spilled on the shop floor be cleaned up immediately?
   a. Looks messy
   b. May damage the floor
   c. Someone may fall
   d. Creates more janitorial work

5. Other than safety shoes, what is the best foot protection that can be worn in the machine shop?
   a. Ordinary leather shoes
   b. Canvas sneakers
   c. Rubber boots
   d. Sandals

6. What should NEVER be used to remove metal chips from the machine?
   a. Shop cloth
   b. Fingers
   c. Brush
   d. Stick
How many hours must an apprentice work to become a machinist?

a. 2,000  
b. 4,000  
c. 8,000  
d. 10,000

What part of a machinist's record does an employer regard as most important?

a. Age  
b. Location  
c. Attendance  
d. Work speed

What ability describes an all-around machinist?

a. Operates one machine  
b. Operates several machines  
c. Sets up machine  
d. Is a machinist helper
10. When should guards be in place on a machine?
   a. When in use
   b. When the machine is plugged in
   c. When instructor/supervisor is watching
   d. During inspections

11. What type of container should be used for oily shop towels?
   a. Wood
   b. Cardboard
   c. Metal
   d. Plastic

12. When should the work area be inspected for safe working conditions?
   a. Daily
   b. Weekly
   c. Monthly
   d. Yearly
1. What is the decimal equivalent of $\frac{11}{16}$?
   a. .5625
   b. .6625
   c. .6875
   d. .7031

2. What proper fraction is equivalent to .1875?
   a. $\frac{1}{8}$
   b. $\frac{5}{32}$
   c. $\frac{3}{16}$
   d. $\frac{5}{16}$

3. How is a fraction changed to a decimal?
   a. Use the dividing head.
   b. Divide the bottom number by the top.
   c. Divide the addendum by the dedendum.
   d. Divide the top number by the bottom.
4. | B1 | b | Repp SG#1 | 0890 | C | C.S. |

What is the decimal equivalent of 1/4?

a. .125  
   b. .250  
   c. .375  
   d. .4375

5. | B1 | c | Repp SG#1 | 0890 | C | C.S. |

What is the decimal equivalent of 7/16?

a. .1875  
   b. .375  
   c. .4375  
   d. .500  

6. | B1 | b | Repp SG#1 | 0890 | C | C.S. |

What is the decimal equivalent of 3/16?

a. .0625  
   b. .1875  
   c. .250  
   d. .4375
What is the tap drill size for 1/4-20? \((TDS = D - 1/N)\)

a. \(0.1875\) (3/16)
b. \(0.2010\) (#7)
c. \(0.2570\) (F)
d. \(0.3125\) (5/16)

What is the tap drill size for 5/16-18? \((TDS = D - 1/N)\)

a. \(0.257\) (F drill)
b. \(0.3125\) (5/16")
c. \(0.368\) (U drill)
d. \(0.465\) (31/64")

What is the tap drill size for 9/16-12? \((TDS = D - 1/N)\)

a. \(0.201\) (#7)
b. \(0.312\) (5/16")
c. \(0.368\) (U drill)
d. \(0.484\) (31/64")
10. What is the metric equivalent of 29/64" (.453)? (1" = 25.4 mm)
   a. 8.334 mm
   b. 9.922 mm
   c. 11.509 mm
   d. 15.478 mm

11. What is the metric equivalent of .1575"? (1" = 25.4 mm)
   a. .70 mm
   b. .82 mm
   c. .99 mm
   d. 4 mm

12. What is the decimal equivalent of 27 mm? (1" = 25.4 mm)
   a. .750"
   b. .875"
   c. 1.063"
   d. 1.150"
<table>
<thead>
<tr>
<th>Field</th>
<th>Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Unique Item number</td>
</tr>
<tr>
<td>2</td>
<td>Duty area and task number (Mo. competency profile)</td>
</tr>
<tr>
<td>3</td>
<td>Letter of correct answer</td>
</tr>
<tr>
<td>4</td>
<td>Source (author, year of publication)</td>
</tr>
<tr>
<td>5</td>
<td>Date (MMYY)</td>
</tr>
<tr>
<td>6</td>
<td>Learning domain (Cognitive, Affective, Psychomotor)</td>
</tr>
<tr>
<td>7</td>
<td>Writer(s)/reviewer(s)</td>
</tr>
<tr>
<td>8</td>
<td>Accompanying artwork (ART)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Field</th>
<th>Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>13.</td>
<td>B4</td>
</tr>
</tbody>
</table>

With a sales tax rate of .06925, what is the total cost of a job in which materials and labor cost $345.77? (Use a calculator.)

a. $369.71
b. $369.97
c. $370.00
d. $371.20

<table>
<thead>
<tr>
<th>Field</th>
<th>Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>14.</td>
<td>B4</td>
</tr>
</tbody>
</table>

What is the area of a 1 x 9 x 10.5" steel block?

a. 92.5 square inches
b. 94.5 square inches
c. 104.5 square inches
d. 106 square inches

<table>
<thead>
<tr>
<th>Field</th>
<th>Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>15.</td>
<td>B4</td>
</tr>
</tbody>
</table>

What weight remains after 27.34 pounds is milled off of a 47.23 pound block of steel?

a. 18.90 pounds
b. 19.89 pounds
c. 20.10 pounds
d. 20.34 pounds
16. Cut seven pieces of 1" dia. stock 7 3/4" long. How much bar stock is used? (Allow 1/8" for cutoff.)
   a. 54.25"
   b. 54.5"
   c. 55.125"
   d. 56"

17. A job calls for 10000 pieces 4 3/8" long. A scrap allotment of 5% is allowed. How much material is used?
   a. 364.583 feet
   b. 365 feet
   c. 382.8125 feet
   d. 390 feet

18. What amount of stock is required for five 3 3/4" pieces? (Use 1/8" for cut-off.)
   a. 18.75"
   b. 18.875"
   c. 19"
   d. 19.375"
The surface of a 3.5" block of steel is cut to give five steps of the same size. How tall is each step?

a. .5"
b. .6"
c. .7"
d. .8"

With a 2.000" dia. round stock, cut four steps. Each step is .1875 smaller in dia. than the last step. What is the smallest diameter?

a. 1.125"
b. 1.187"
c. 1.250"
d. 1.312"

On a 12" part with .030" per inch taper, what is the taper in 6"?

a. .015"
b. .060"
c. .180"
d. .360"
22. | B7 | d | Oberg | 0890 | C | C.S. |

What is the surface speed on a 2" dia. workpiece turning at 375 rpm?

\[ \text{sfpm} = \pi \times \text{diameter (in.)} \times \text{rpm} \]

\[ \frac{12}{12} \]

a. 151
b. 176
c. 185
d. 196

23. | B7 | a | Oberg | 0890 | C | C.S. |

What is the surface speed on a 2.375" dia. workpiece turning at 475 rpm?

\[ \text{sfpm} = \pi \times \text{diameter (in.)} \times \text{rpm} \]

\[ \frac{12}{12} \]

a. 295
b. 300
c. 305
d. 310

24. | B7 | d | Oberg | 0890 | C | C.S. |

What is the surface speed on a 3.375" dia. workpiece turning at 118 rpm?

\[ \text{sfpm} = \pi \times \text{diameter (in.)} \times \text{rpm} \]

\[ \frac{12}{12} \]

a. 98.45
b. 100.35
c. 103.50
d. 104.26

23

12
25. B8 | c | Oberg | 0890 | C | C.S. |

At what rpm should a 1/4" drill run to drill steel at 80 sfpm?

a. 1200  
b. 1250  
c. 1280  
d. 1300

26. B8 | b | Oberg | 0890 | C | C.S. |

At what rpm should a 7/8" drill run to drill steel at 45 sfpm?

a. 200  
b. 206  
c. 226  
d. 256

27. B8 | b | Oberg | 0890 | C | C.S. |

At what rpm should a 1 1/4" drill run to drill steel at 80 sfpm?

a. 125  
b. 256  
c. 475  
d. 800
28. What is the taper per foot on a 1" dia. workpiece, 6" long, turned on a taper 1" in dia. down to .5" dia.?
   a. .50"
   b. .75"
   c. .875"
   d. 1.00"

29. What is the taper per foot on a 2" dia. workpiece, 6" long, turned on a taper from 2" dia. down to a 1.5" dia.?
   a. .50"
   b. .75"
   c. .875"
   d. 1.00"

30. What is the taper per foot on a 1.125" piece, 5.5" long, turned on a taper from 1.125" down to .5"?
   a. 1.00"
   b. 1.25"
   c. 1.36"
   d. 1.60"
What is the gage block set-up for a 2.5" sine bar set at 12.5 degrees?

a. 0.5410  
b. 0.7500  
c. 1.0621  
d. 1.0821

What is the gage block set-up for a 5" sine bar set at 27.5 degrees?

a. 1.0621  
b. 1.0821  
c. 1.4750  
d. 2.3087

What is the gage block set-up for a 10" sine bar set at 10.234 degrees?

a. 1.2509  
b. 1.5625  
c. 1.7676  
d. 1.8750
34. How many full turns of the crank on a dividing head are needed to cut an eight-sided part?
   a. 2
   b. 5
   c. 8
   d. 11

35. What angle is made by five full cranks on a dividing head?
   a. 25 degrees
   b. 35 degrees
   c. 45 degrees
   d. 60 degrees

36. What angle is made by 10 full cranks on a dividing head?
   a. 35 degrees
   b. 45 degrees
   c. 60 degrees
   d. 90 degrees
37. | B12 | a | Oberg | 0890 | C | C.S. | ART

Using the trigonometry chart shown, what is the length of the side opposite if the hypotenuse is 2.3745" long and the angle is 27 degrees?

a. 1.078"
b. 1.088"
c. 1.099"
d. 1.109"

<table>
<thead>
<tr>
<th>Angle</th>
<th>Sin</th>
<th>Cos</th>
<th>Tan</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>.03490</td>
<td>.99939</td>
<td>.03492</td>
</tr>
<tr>
<td>3</td>
<td>.05234</td>
<td>.99863</td>
<td>.05241</td>
</tr>
<tr>
<td>4</td>
<td>.06976</td>
<td>.99756</td>
<td>.06993</td>
</tr>
<tr>
<td>26</td>
<td>.43837</td>
<td>.98979</td>
<td>.48773</td>
</tr>
<tr>
<td>27</td>
<td>.45399</td>
<td>.99101</td>
<td>.50953</td>
</tr>
<tr>
<td>28</td>
<td>.46947</td>
<td>.98295</td>
<td>.53171</td>
</tr>
<tr>
<td>36</td>
<td>.58779</td>
<td>.80902</td>
<td>.72654</td>
</tr>
<tr>
<td>37</td>
<td>.60182</td>
<td>.79864</td>
<td>.75355</td>
</tr>
<tr>
<td>38</td>
<td>.61566</td>
<td>.78801</td>
<td>.78129</td>
</tr>
</tbody>
</table>

38. | B12 | b | Oberg | 0890 | C | C.S. | ART

Using the trigonometry chart shown, what is the length of the side adjacent if the hypotenuse is .8975 long and the angle is 37 degrees?

a. .700"
b. .717"
c. .725"
d. .825"

<table>
<thead>
<tr>
<th>Angle</th>
<th>Sin</th>
<th>Cos</th>
<th>Tan</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>.03490</td>
<td>.99939</td>
<td>.03492</td>
</tr>
<tr>
<td>3</td>
<td>.05234</td>
<td>.99863</td>
<td>.05241</td>
</tr>
<tr>
<td>4</td>
<td>.06976</td>
<td>.99756</td>
<td>.06993</td>
</tr>
<tr>
<td>26</td>
<td>.43837</td>
<td>.98979</td>
<td>.48773</td>
</tr>
<tr>
<td>27</td>
<td>.45399</td>
<td>.99101</td>
<td>.50953</td>
</tr>
<tr>
<td>28</td>
<td>.46947</td>
<td>.98295</td>
<td>.53171</td>
</tr>
<tr>
<td>36</td>
<td>.58779</td>
<td>.80902</td>
<td>.72654</td>
</tr>
<tr>
<td>37</td>
<td>.60182</td>
<td>.79864</td>
<td>.75355</td>
</tr>
<tr>
<td>38</td>
<td>.61566</td>
<td>.78801</td>
<td>.78129</td>
</tr>
</tbody>
</table>
39. | B12 | c | IML Mod. 1 | 0890 | C | C.S. |

What is the angle between holes in a layout of 12 equally spaced holes on a bolt circle?

a. 10 degrees
b. 20 degrees
c. 30 degrees
d. 45 degrees

40. | B12 | c | Oberg | 0890 | C | C.S. | ART

Using the trigonometry chart shown, what is the length of the hypotenuse if the side opposite is 1.2345" long and the angle is 3 degrees?

<table>
<thead>
<tr>
<th>Angle</th>
<th>Sin</th>
<th>Cos</th>
<th>Tan</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>.03490</td>
<td>.99939</td>
<td>.03482</td>
</tr>
<tr>
<td>3</td>
<td>.06234</td>
<td>.99863</td>
<td>.06241</td>
</tr>
<tr>
<td>4</td>
<td>.09976</td>
<td>.99756</td>
<td>.09993</td>
</tr>
<tr>
<td>5</td>
<td>.13778</td>
<td>.99686</td>
<td>.13801</td>
</tr>
<tr>
<td>6</td>
<td>.17692</td>
<td>.99592</td>
<td>.17701</td>
</tr>
<tr>
<td>7</td>
<td>.21632</td>
<td>.99492</td>
<td>.21642</td>
</tr>
<tr>
<td>8</td>
<td>.25601</td>
<td>.99389</td>
<td>.25612</td>
</tr>
<tr>
<td>9</td>
<td>.29599</td>
<td>.99284</td>
<td>.29609</td>
</tr>
<tr>
<td>10</td>
<td>.33616</td>
<td>.99175</td>
<td>.33625</td>
</tr>
<tr>
<td>11</td>
<td>.37650</td>
<td>.99064</td>
<td>.37656</td>
</tr>
<tr>
<td>12</td>
<td>.41703</td>
<td>.98951</td>
<td>.41710</td>
</tr>
<tr>
<td>13</td>
<td>.45774</td>
<td>.98835</td>
<td>.45780</td>
</tr>
<tr>
<td>14</td>
<td>.49862</td>
<td>.98716</td>
<td>.49872</td>
</tr>
<tr>
<td>15</td>
<td>.53967</td>
<td>.98595</td>
<td>.53977</td>
</tr>
<tr>
<td>16</td>
<td>.58090</td>
<td>.98472</td>
<td>.58100</td>
</tr>
<tr>
<td>17</td>
<td>.62230</td>
<td>.98347</td>
<td>.62240</td>
</tr>
<tr>
<td>18</td>
<td>.66389</td>
<td>.98221</td>
<td>.66400</td>
</tr>
<tr>
<td>19</td>
<td>.70566</td>
<td>.98093</td>
<td>.70580</td>
</tr>
<tr>
<td>20</td>
<td>.74760</td>
<td>.97963</td>
<td>.74780</td>
</tr>
<tr>
<td>21</td>
<td>.78972</td>
<td>.97832</td>
<td>.78990</td>
</tr>
<tr>
<td>22</td>
<td>.83203</td>
<td>.97699</td>
<td>.83220</td>
</tr>
<tr>
<td>23</td>
<td>.87451</td>
<td>.97565</td>
<td>.87470</td>
</tr>
<tr>
<td>24</td>
<td>.91717</td>
<td>.97429</td>
<td>.91737</td>
</tr>
<tr>
<td>25</td>
<td>.95992</td>
<td>.97292</td>
<td>.96012</td>
</tr>
<tr>
<td>26</td>
<td>.97292</td>
<td>.97154</td>
<td>.97312</td>
</tr>
<tr>
<td>27</td>
<td>.99592</td>
<td>.97015</td>
<td>.99612</td>
</tr>
<tr>
<td>28</td>
<td>1.00000</td>
<td>.96875</td>
<td>1.00000</td>
</tr>
</tbody>
</table>

a. 2.359"
b. 12.359"
c. 23.589"
d. 24.589"

41. | B13 | d | IML Mod. 1 | 0890 | C | C.S. |

What is the angle at the intersection of two lines that are perpendicular?

a. 25 degrees
b. 30 degrees
c. 45 degrees
d. 90 degrees
<table>
<thead>
<tr>
<th>Field</th>
<th>Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Unique item number</td>
</tr>
<tr>
<td>2</td>
<td>Duty area and task number (Mo. competency profile)</td>
</tr>
<tr>
<td>3</td>
<td>Letter of correct answer</td>
</tr>
<tr>
<td>4</td>
<td>Source (author, year of publication)</td>
</tr>
<tr>
<td>5</td>
<td>Date (MMYY)</td>
</tr>
<tr>
<td>6</td>
<td>Learning domain (Cognitive, Affective, Psychomotor)</td>
</tr>
<tr>
<td>7</td>
<td>Writer(s)/reviewer(s)</td>
</tr>
<tr>
<td>8</td>
<td>Accompanying artwork (ART)</td>
</tr>
</tbody>
</table>

---

1. | Cl | a | IML Mod. 2 | 0890 | C | B.D. |

Before returning precision measuring tools to their proper storage, they should be lightly oiled and wiped with a soft cloth.

a. True

b. False

---

2. | Cl | c | IML Mod. 2 | 0890 | C | B.D. |

Which oil should be used on joints or moving parts of precision tools?

a. Hypoid

b. 30 wt.

c. Light instrument

d. Water soluble

---

3. | Cl | d | Olivo, 1987 | 0890 | C | B.D. |

What should be done before taking measurements with a precision measuring tool?

a. Check the workpiece for burrs and foreign particles.

b. Clean all contact surfaces.

c. Check the instrument for accuracy.

d. All of the above
4. | C2 | e | IML Mod. 2 | 0890 | C | B.D. |

Which can be measured with a tape measure?

a. Long pieces of work
b. Hole depth
c. Diameters
d. Circumference of large work
e. All of the above

5. | C2 | b | IML Mod. 2 | 0890 | C | B.D. |

A tape measure is a precision measuring tool.

a. True
b. False

6. | C2 | a | IML Mod. 2 | 0890 | C | B.D. |

A tape measure can be marked in inches and metric.

a. True
b. False
7. What is the most commonly used steel rule in a machine shop?
   a. 6" steel rule
   b. Bench rule
   c. Hook rule
   d. Tape measure

8. When using a steel rule, the most accurate way to measure is from a point other than the very end of the rule.
   a. True
   b. False

9. A 6" steel rule can be used to do which of the following?
   a. Measure hole depth
   b. Set dividers
   c. Rough measure stock to length
   d. Measure diameters
   c. All of the above
10. | C4 | a | Repp | 0890 | C | B.D. |

A slide caliper rule can be used to take inside and outside measurements.

a. True
b. False

11. | C4 | b | IML Mod. 2 | 0890 | C | B.D. |

A slide caliper rule is considered a precision measuring tool.

a. True
b. False

c. Hole depth measurements

12. | C4 | c | IML Mod. 2 | 0890 | C | B.D. |

Which is an IMPROPER use of the slide caliper rule?

a. Outside fractional measurements
b. Inside fractional measurements

c. Hole depth measurements

d. Rapid measurements
What is a proper function of a combination square?

a. Lay out 45-degree lines
b. Lay out 90-degree lines
c. Lay out lines parallel to an edge
d. Measure height and depth
e. All of the above

The spirit level on a combination square is a precision level.

a. True
b. False

The blade and square make up the parts of a combination square.

a. True
b. False
Dividers are precision measuring tools.

- a. True
- b. False

What tool should be used to lay out linear or circular hole spacing quickly?

- a. Hermaphrodite calipers
- b. Combination set
- c. Dividers
- d. Hole gage

Which instrument is best for layout of arcs and circles?

- a. Combination set
- b. Hole gage
- c. Telescoping gage
- d. Dividers
19. Hermaphrodite calipers can be used to lay out parallel lines, locate centers and measure work from an edge.
   a. True
   b. False

20. Hermaphrodite calipers are precision layout tools.
   a. True
   b. False

21. What caliper is compass-like and has one straight leg and one hooked leg?
   a. Outside
   b. Inside
   c. Hermaphrodite
   d. Divider
Spring calipers can be used to transfer semi-precision measurements.

a. True
b. False

When measuring work with spring calipers, the work can be moving.

a. True
b. False

Measurements taken with spring calipers can be transferred to the steel rule.

a. True
b. False
Which calipers are used for the most accurate measurements?

a. Hermaphrodite  
b. Inside  
c. Outside  
d. Vernier

What is the accuracy of inside and outside measurements made with vernier calipers?

a. .0625"  
b. .010"  
c. .001"  
d. .0001"

Vernier scales are used on which of the following?

a. Depth gage  
b. Height gage  
c. Protractor  
d. Caliper  
e. All of the above
28. | C10 | d | Repp | 0890 | C | B.D. |

Which scale is found on a depth gage?

a. Micrometer
b. Vernier
c. Fractional
d. All of the above

29. | C10 | a | IML Mod. 2 | 0890 | C | B.D. |

Depth gages are used to measure the depths of holes, grooves, shoulders and projections.

a. True
b. False

c. Putting a piece of bar stock in the hole
d. All of the above
31. What dimensions are used to graduate a micrometer?
   a. Lines per inch
   b. Inches per revolution
   c. Degrees and minutes
   d. Inch and metric

32. Inside, outside and depth micrometers are read the same way.
   a. True
   b. False

33. A micrometer is a semi-precision measuring instrument.
   a. True
   b. False
34. What measurements can be made with a dial caliper?
   a. Inside
   b. Outside
   c. Depth
   d. All of the above
   e. None of the above

35. A dial caliper is a semi-precision measuring tool.
   a. True
   b. False

36. Dial calipers are faster and easier to read than vernier calipers.
   a. True
   b. False
<table>
<thead>
<tr>
<th>Field</th>
<th>Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Unique item number</td>
</tr>
<tr>
<td>2</td>
<td>Duty area and task number (Mo. competency profile)</td>
</tr>
<tr>
<td>3</td>
<td>Letter of correct answer</td>
</tr>
<tr>
<td>4</td>
<td>Source (author, year of publication)</td>
</tr>
<tr>
<td>5</td>
<td>Date (MMYY)</td>
</tr>
<tr>
<td>6</td>
<td>Learning domain (Cognitive, Affective, Psychomotor)</td>
</tr>
<tr>
<td>7</td>
<td>Writer(s)/reviewer(s)</td>
</tr>
<tr>
<td>8</td>
<td>Accompanying artwork (ART)</td>
</tr>
</tbody>
</table>

37. | C13 | b | Repp | 0890 | C | B.D. |

A telescoping gage is a direct measuring tool.

a. True

b. False

38. | C13 | a | Repp | 0890 | C | B.D. |

Telescoping gages are transferred to a micrometer for accurate measuring of holes from 5/16" to 6".

a. True

b. False

39. | C13 | a | Repp | 0890 | C | B.D. |

Small-hole gages can measure holes or recesses from 3/8" to 1/2".

a. True

b. False
40. C14 c Repp 0890 C B.D.

What measurement is quickly made with a plug gage?

a. Thickness
b. Slot width
c. Hole diameter
d. Hole depth

41. C14 c IMI Mod. 2 0890 C B.D.

Which tool gives quick and accurate measurements of shafts in a production setting?

a. Vernier height gage
b. Steel rule
c. Ring gage
d. Gage blocks

42. C14 a Repp 0890 C B.D.

What plug or ring gages are used to accurately check maximum and minimum sizes?

a. Go and no-go gages
b. "Jo" blocks
c. Reference standards
d. Micrometer gages
A height gage is a precision measuring tool.

a. True
b. False

A height gage is more accurate for layout than a surface gage.

a. True
b. False

For inspection work, a dial indicator can be clamped to the movable jaw of a height gage.

a. True
b. False
46. | C16 | d | Repp | 0890 | C | B.D. |

What material is used to make surface plates?

a. Granite  
b. Cast iron  
c. Heavy steel  
d. All of the above

47. | C16 | c | Repp | 0890 | C | B.D. |

Why should a surface plate never be hammered or struck?

a. Insufficient hardness  
b. Causes it to ring  
c. Affects its accuracy  
d. Not an ANSI standard

48. | C16 | a | IML Mod. 2 | 0890 | C | B.D. |

Surface plates are used for accurate layout and inspection work.

a. True  
b. False
What kind of surface is used to perform accurate layout and inspection?

a. Optical flat
b. Workbench top
c. Cast iron work table
d. Surface plate

A surface plate can be used with a height gage to lay out lines parallel to the plate.

a. True
b. False

Which tool holds work at 90 degrees to the surface plate for inspection and measurement?

a. Angle plate
b. Hold downs
c. Parallels
d. Precision vise
Which instrument is always calibrated without using gage blocks?

a. Sine bar  
b. Depth micrometer  
c. 1" micrometer  
d. Dial indicating height gage

In which process are gage blocks stuck together?

a. Buildup  
b. Wrenching  
c. Magnetism  
d. Wringing

The selection of gage blocks requires successive elimination of the right-hand figure of the desired dimension.

a. True  
b. False
Which is NOT true when using a dial test indicator?

a. Circular runout of a rotating part can be measured.
b. Gage blocks are used to set the dial test indicator accurately.
c. A surface plate is used for checking height and parallelism.
d. Dial test indicators are accurate to 10 microns or .000004".

Dial test indicators are used to check large quantities of nearly identical parts quickly.

a. True
b. False

What is the function of a dial test indicator?

a. Inspect parallelism or flatness
b. Inspect angularity using a sine bar
c. Inspect circularity using a V-block
d. All of the above
58. | C20 | a | IML Mod. 2 | 0890 | C | B.D. |

What does the three-wire method of checking threads determine?

a. Pitch diameter
b. Major diameter
c. Minor diameter
d. Undercut diameter

59. | C20 | a | IML Mod. 2 | 0890 | C | B.D. |

To cut a particular class of fit external thread, it is necessary to check the pitch diameter with thread wires.

a. True
b. False

60. | C20 | a | Oberg | 0890 | C | B.D. |

Cutting and wire-measuring accurate thread forms other than American standard or unified is possible using formulas found in the "Machinery's Handbook."

a. True
b. False
When using the sine bar for layout, inspection, or machining operations, what supports the bar vertically?

a. Gage blocks
b. Planer gage
c. Screw jack
d. Table of trigonometric functions

The sine bar is like what part of a triangle?

a. Hypotenuse
b. Base
c. Leg
d. Isosceles

The sine bar is a semi-precision measuring tool.

a. True
b. False
What form of communication is used worldwide in drafting?

a. Computer
b. Telephone
c. Symbols
d. FAX machine

What is the meaning of a circled M on a blueprint?

a. Mated material condition
b. Most material condition
c. Matched material condition
d. Maximum material condition

What is the drafting symbol for diameter?

a. φ
b. Ø
c. ⊗
d. ☺
Unless otherwise specified:
Machining limits on fractional dimensions are ±1/32".

No. required: 6
Material: cold drawn steel
Guide pin

Figure 1
In Figure 1, what are the lines with arrows called?

a. Center
b. Dimension
c. Extension
d. Leader

What is the block of information in the lower right hand of a blueprint called?

a. Title block
b. Information block
c. Materials block
d. Blueprint coding block

Which lines show the size of an object?

a. Section lines
b. Projection lines
c. Dimension lines
d. Object lines
7. What lines are drawn first in sketching a finished workpiece?
   a. Border
   b. Projection
   c. Object
   d. Dimension

8. How many views are normally shown in a sketch of a cylindrical object with different diameters?
   a. One
   b. Two
   c. Three
   d. Four

9. How many views are normally used when sketching a rectangular object?
   a. One
   b. Three
   c. Four
   d. Five
How much material should be left on the workpiece before heat treatment for final grinding?

a. 0.005
b. 0.010
c. 0.050
d. 0.100

What is the tolerance on a part dimensioned 1.250 +/- 0.002?

a. 0.002
b. 0.004
c. 1.248
d. 1.250

What controls the shape, feature, and deviation of a part?

a. Allowance
b. Hardness
c. Tolerance
d. Toughness
13. | D5 | d | Basic BPR, p. 3 | 0890 | C | J.C. | ART

Using Figure 1, calculate the missing dimension of step 1.

a. 3/8"

b. 1/2"

c. 5/8"

d. 1 1/32"

14. | D5 | b | Basic BPR | 0890 | C | J.C. | ART

Using Figure 1, calculate the missing dimension of step 2.

a. .625

b. .7187

c. .750

d. .875

15. | D5 | d | Basic BPR | 0890 | C | J.C. | ART

Calculate the missing dimension of step 3 in Figure 1.

a. .375

b. .4375

c. .875

d. .9375
16. What type of drawing leaves no doubt as to the intended definition of the specific part requirements?
   a. Johansson tolerancing
   b. Differential indexing
   c. Geometric tolerancing and dimensioning
   d. Conventional tolerancing

17. Which describes the origin from which the location of geometric characteristics of features of a part are established?
   a. American National Standards Institute
   b. Reference point
   c. Virtual condition
   d. Datum

18. What do the A, B, and C refer to in the feature control frame below?
   a. Diameter of the hole
   b. Coaxial alignment of parallel terms
   c. Primary, secondary, and tertiary datums
   d. Tolerance of the allowable diameter
19. Which is the most common standard reference anywhere mechanical products are designed or manufactured?
   a. Machinery's Handbook
   b. National Tool and Die Association
   c. American National Screw Thread Standard
   d. S.A.E. Standard

20. Which might NOT be found in the Machinery's Handbook?
   a. Statistical process control
   b. Thread fits
   c. Trigonometric functions
   d. Weights & properties of metals

21. What book would be used to find addendum and dedendum on an involute gear tooth form?
   a. Machinery's Handbook
   b. Student text
   c. IML Machine Shop Curriculum
   d. Vocational Administrative Management System
On what is part layout based?

a. Layout fluid  
b. Carbon or transfer paper  
c. Machine design  
d. Blueprint information

What purpose does layout serve for complex parts?

a. Verification of location during the machining process  
b. Elimination of need to measure  
c. Protection of the part surface from abrasion  
d. Prevention of rust on non-machine surfaces

Which is necessary for part layout?

a. Tolerances for dimensions  
b. Semi-precision scribed points, lines, or circles  
c. Thread pitch and classification  
d. Highly polished surface
25. What is needed to plan the steps in a machining procedure?
   a. Blueprint
   b. Stock cutting and layout plan
   c. Necessary tooling
   d. Precision measuring tools

26. What does a blueprint specify?
   a. Tolerances
   b. Surface finish
   c. Material
   d. All of the above

27. The size and shape of a part dictates machining sequence.
   a. True
   b. False
<table>
<thead>
<tr>
<th>Field</th>
<th>Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Unique item number</td>
</tr>
<tr>
<td>2</td>
<td>Dutty area and task number (Mo. competency profile)</td>
</tr>
<tr>
<td>3</td>
<td>Letter of correct answer</td>
</tr>
<tr>
<td></td>
<td>Source (author, year of publication)</td>
</tr>
<tr>
<td>411</td>
<td>Source (author, year of publication)</td>
</tr>
<tr>
<td>5</td>
<td>Date (MMYY)</td>
</tr>
<tr>
<td>6</td>
<td>Learning domain (Cognitive, Affective, Psychomotor)</td>
</tr>
<tr>
<td>7</td>
<td>Writer(s)/reviewer(s)</td>
</tr>
<tr>
<td>8</td>
<td>Accompanying artwork (ART)</td>
</tr>
</tbody>
</table>

1. | E1 | c | McKnight | 0890 | C | D.M. |

To what angle is a dull cold chisel best sharpened?

a. 20 degrees
b. 45 degrees
c. 60 degrees
d. 90 degrees

2. | E1 | c | McGraw-Hill | 0890 | C | D.M. |

Which hammer best moves a tight-fitting steel part without marring its surface?

a. Toolmaker's
b. Machinist's
c. Lead
d. Sledge
3. When hacksawing metal by hand, how many strokes per minute should be averaged?
   a. 10-30
   b. 40-50
   c. 70-90
   d. 100-120

4. If a 1/2" soft iron rod is cut by hand, how many teeth per inch should the hacksaw selected have for most efficient cutting?
   a. 14
   b. 18
   c. 24
   d. 32

5. When sawing by hand, on which stroke should pressure be applied?
   a. Forward only
   b. Backward only
   c. Forward and backward equally
6. Which file tooth removes waste material rapidly?
   a. Smooth
   b. Second cut
   c. Bastard
   d. Dead smooth

7. Which file would best shape an internal square corner without removing metal from the intersecting edge?
   a. Half round
   b. Pillar
   c. Square
   d. Three-square

8. What is the best method of cleaning a clogged machine file?
   a. Brushing with a file card
   b. Hitting it on a vise or piece of metal
   c. Rubbing it with chalk
   d. Soaking it in mineral spirits
9. A center punch ground to what angle would be appropriate for guiding a drill bit center?
   a. 20 degrees
   b. 45 degrees
   c. 60 degrees
   d. 90 degrees

10. When making precise layouts, which punch is most accurate?
    a. Center
    b. Drift
    c. Pin
    d. Prick

11. If the head of a chisel or punch develops a mushroom shape, it should be forged back to the original shape.
    a. True
    b. False
Which tool most accurately positions the location of threaded holes from one part to another?

a. Transfer punch
b. Transfer screw
c. Center punch
d. Prick punch

Which punch is best when transferring the location of holes from one part to another?

a. Center
b. Pin
c. Drift
d. Transfer

Transfer screws are used to transfer threaded hole locations to another part.

a. True
b. False
15. Which type of threading die has the most possible adjustments?
   a. Adjustable and removable screw plate die
   b. Adjustable and removable solid hex die
   c. Solid die
   d. Adjustable split die

16. When rechasing threads, how often should the diestock be reversed (about 1/2 turn) to prevent chips from roughing threads?
   a. Every turn
   b. Every 10-12 threads
   c. Every 2-3 threads
   d. Backing up is not needed.

17. When threading to a shoulder, the entire threading operation should be performed with the tapered threads on the die mounted away from the workpiece.
   a. True
   b. False
18. | E7 | a | McGraw-Hill | 0890 | C | D.M. |

If threads are specified to the end of a blind hole, what style of tap should be used?

a. Bottoming
b. Plug
c. Taper
d. Universal

19. | E7 | c | McGraw-Hill | 0890 | C | D.M. |

What lubricant should NOT be used to tap a hole in brass?

a. Soluble oil
b. Kerosene
c. Soda water
d. Mineral oil

20. | E7 | b | McGraw-Hill | 0890 | C | D.M. |

The tap drill for a 1/4-20 NC taper tap should be 1/4" diameter.

a. True
b. False
21. In hand reaming, what is the maximum amount of material that should be removed by one reamer?

a. 0.00005"
b. 0.0005"
c. 0.005"
d. 0.05"

22. When hand reaming, which direction should the reamer be turned to enter and leave the hole?

a. Clockwise, both in and out
b. Counterclockwise in and out
c. Clockwise in and counterclockwise out
d. Either direction either time

23. When reaming a hole containing a keyway, the reamer should have helical flutes.

a. True
b. False
What is the best dressing tool to true bench grinder wheels?

a. Abrasive stick
b. Huntington
c. Abrasive wheel
d. Diamond

When dressing a bench grinder wheel, the tool should be held above the tool rest so it does not become caught.

a. True
b. False

A Huntington dresser works well to recondition a loaded grinding wheel.

a. True
b. False
27. When sharpening chisels and drill bits on a standard bench grinder, it is usually best to use the side of the grinding wheel.
   a. True
   b. False

28. If a cutting tool turns blue during sharpening with a pedestal grinder, simply grinding off the blue color will correct the problem.
   a. True
   b. False

29. How should the cutting edge of a cold chisel be ground on a bench grinder to get the best shearing action?
   a. Slightly concave
   b. Flat
   c. Slightly convex
What is the most common artificial abrasive used in the majority of grinding wheels?

a. Aluminum oxide
b. Silicon carbide
c. Boron carbide
d. Crocus cloth

In the lapping process, the lap tool used must be of the same hardness as the material being lapped.

a. True
b. False

When polishing a rectangular steel surface, in which direction should the strokes be made to have the surface appear the brightest?

a. Parallel to the longest side
b. Parallel to the shortest side
c. Diagonal to the length of the rectangle
d. In a circular motion
33. Which hand grinder is designed for heavy grinding?
   a. Electric
   b. Pneumatic
   c. Hydraulic

34. A major concern when using a hand grinder is to avoid slipping and touching the grinder to an adjacent finished surface.
   a. True
   b. False

35. Which is the BEST application for a hand grinder?
   a. Deburring castings
   b. Producing truly flat surfaces
   c. Producing an accurate convex curve
   d. Removing large amounts of waste stock quickly
When removing a broken bolt with a screw extractor made with spiral flutes, in which direction should the extractor be turned?

a. Counterclockwise
b. Clockwise
c. Does not matter

What size hole should be drilled in a broken bolt to utilize a screw extractor?

a. Equal to the shank diameter of the extractor
b. Smaller than the minor thread diameter
c. Equal to the minor thread diameter
d. Larger than the minor thread diameter

Which chisel is best for removing a broken bolt?

a. Diamond-point
b. Flat
c. Cape
d. Round-nose
To remove a broken high-speed steel threading tap, drill its center out and use a screw extractor.

a. True
b. False

Which is best for removing a broken threading tap?

a. Flat chisel
b. Center punch
c. Prick punch
d. Carbide end mill

Which machine is most often used to remove a broken threading tap if a tap extractor does not work?

a. Arbor press
b. Electrical discharge machine
c. Milling machine
d. MIG welder
A dowel pin is usually chamfered on one end to help guide it into the hole.

a. True
b. False

When selecting a dowel pin to align parts, its diameter should be 0.05" larger than the holes to ensure accuracy.

a. True
b. False

Dowel pins are often used to temporarily assemble parts when checking for acceptable fit.

a. True
b. False
45. | E16 | d | McKnight | 0890 | C | D.M. |

Of what material are thread inserts to repair holes having damaged threads usually made?

a. Aluminum
b. Brass
c. Magnesium
d. Steel

46. | E16 | b | IML Mod. 3 | 0890 | C | D.M. |

Which is commonly used to install a helical coil thread insert?

a. Diestock
b. Tap handle
c. Locking pliers
d. Screw extractor

47. | E16 | a | IML Mod. 3 | 0890 | C | D.M. |

When installing a helical coil thread insert in a damaged hole, special care should be taken to center the drill bit in the original hole, or the new threads may not be in the desired location.

a. True
b. False
When straightening stock with the arbor press, the high point should be placed on the plates facing down.

a. True
b. False

Since all materials have the same amount of springback, the arbor press should deflect them equally past their desired ending position.

a. True
b. False

don what part of the arbor press should a bent piece be placed?

a. Ram
b. Quill
c. Arbor
d. Platen
51. An arbor press is often used to mount a gear or pulley on a shaft using a force fit.
   a. True
   b. False

52. A common feature found on the hydraulic jack press, but not on the arbor press, is a pressure gage.
   a. True
   b. False

53. When pressing a new bearing on a shaft, the shaft should NOT be lubricated so the fit will be tighter.
   a. True
   b. False
54. | E19 | d | McKnight | 0890 | C | D.M. |

Which job would best be done by the broaching process?

a. Removing broken taps

b. Removing broken stud bolts

c. Fastening precision pieces together

d. Cutting keyways

55. | E19 | a | Feirer | 0890 | C | D.M. |

When broaching at the bench, the broach and bushing are often operated by the arbor press.

a. True

b. False

56. | E19 | a | Feirer | 0890 | C | D.M. |

When broaching in bronze, no lubricant is needed.

a. True

b. False
57. | E20 | a | McKnight | 0890 | C | D.M. |

What is the small, semicircular piece used to assemble a pulley on a shaft?

a. Woodruff key
b. Oval undercut key
c. Gib-head key
d. Fillister key

58. | E20 | c | McKnight | 0890 | C | D.M. |

What is the best punch to select when moving holes in an assembly into alignment?

a. Center
b. Pin
c. Drift
d. Prick

59. | E20 | b | McKnight | 0890 | C | D.M. |

What type of wrench is best used to assemble nuts to a specific tightness?

a. Allen
b. Torque
c. Spanner
d. Socket
Spark testing of steel on the grinding wheel can provide an estimate of its carbon content.

a. True
b. False

What do the first two digits on an AISI (American Iron and Steel Institute) designation of steel indicate?

a. Amount of carbon content
b. Whether metal is ferrous or non-ferrous
c. Hardness designation
d. Basic alloy group

Spark testing on a grinding wheel quickly distinguishes aluminum from brass.

a. True
b. False
Which would machine most easily?

a. SAE/AISI 1112 rated at 100 percent
b. SAE/AISI 1113 rated at 135 percent
c. SAE/AISI 1115 rated at 81 percent
d. SAE/AISI 1120 rated at 78 percent

Lead is sometimes added to carbon steel to improve its machinability.

a. True
b. False
What is added to iron and nickel to make stainless steel?

a. Molybdenum
b. Tungsten
c. Vanadium
d. Chromium

Which type of iron contains the least carbon?

a. Wrought
b. Low-carbon
c. Cast
d. Grey

Which metal has the lowest melting point?

a. Aluminium
b. Brass
c. Copper
d. Steel
9. What type of metal is best machined with a two-degree back and side rake?
   a. Copper
   b. Medium-carbon steel
   c. Brass
   d. Aluminum

10. A general rule of thumb is that the harder the material to be machined, the sharper the cutting edge should be.
    a. True
    b. False

11. Carbide-tipped cutting tools can usually cut much faster than high-speed steel tools.
    a. True
    b. False
What is the best quenching material for heat treatment of W-1 steel?

a. Brine  
b. Kerosene  
c. Air  
d. Sand

Hardness and toughness of a metal are directly related to each other, and both increase with tempering.

a. True  
b. False

Which heat treatment process will produce the maximum softness in steel?

a. Full annealing  
b. Normalizing  
c. Carburizing  
d. Tempering
15. The spark test on a grinder is a good way of determining relative hardness between samples of the same grade of steel.
   a. True
   b. False

16. If a file test for hardness barely makes a mark, the metal's Rockwell C hardness number would be 50 or higher.
   a. True
   b. False

17. Which would best be used to conduct a non-marring hardness test on steel?
   a. Shore scleroscope
   b. File
   c. Ultrasonic inspection
   d. Eddy current inspection
To increase visibility of material extending into a walkway, what should be placed on its end?

a. Chair
b. Bucket
c. Red cloth
d. Adjustable wrench

Where should the operator stand when starting an abrasive saw?

a. Front of saw
b. Back of saw
c. Out of line of saw
d. Behind a door

What should be used to remove metal chips from the saw blade?

a. Hand
b. Brush
c. Shop towel
d. Metal rod
What type of oil should be used on moving parts of a cut-off saw?

a. Lubricating
b. Cutting
c. Soluble
d. Threading

How often should a cut-off saw be cleaned and oiled?

a. Daily
b. Weekly
c. Monthly
d. According to manufacturer's specifications

How often should the blade tension of a vertical band saw be checked?

a. After each use
b. Before each use
c. Weekly
d. Yearly
Which type of material requires the finest saw teeth?

a. Copper  
b. Steel  
c. Aluminum  
d. Plastic

What material is used to make most power hacksaw blades?

a. Carbon steel  
b. Diamond impregnated  
c. High-speed steel  
d. Carbide insert

What type of saw wastes the least material when making a cut?

a. Cold saw  
b. Power hacksaw  
c. Abrasive  
d. Band saw
How should the ends of a band saw blade be cut before they are welded?

a. 90 degrees
b. 45 degrees
c. 30 degrees
d. 15 degrees

It is necessary to anneal a saw blade after it has been welded.

a. True
b. False

do. Timer
b. Automatically
c. Remotely
d. By hand
<table>
<thead>
<tr>
<th>Field</th>
<th>Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Unique item number</td>
</tr>
<tr>
<td>2</td>
<td>Duty area and task number (Mc. competency profile)</td>
</tr>
<tr>
<td>3</td>
<td>Letter of correct answer</td>
</tr>
<tr>
<td>4</td>
<td>Source (author, year of publication)</td>
</tr>
<tr>
<td>5</td>
<td>Date (NMMYY)</td>
</tr>
<tr>
<td>6</td>
<td>Learning domain (Cognitive, Affective, Psychomotor)</td>
</tr>
<tr>
<td>7</td>
<td>Writer(s)/reviewer(s)</td>
</tr>
<tr>
<td>8</td>
<td>Accompanying artwork (ART)</td>
</tr>
</tbody>
</table>

13. | **G5** | **b** | MTT | 0890 | **C** | **C.D.** |

When charts are not available, how are speeds for sawing selected?

a. Experiment  
b. See instructor  
c. Use high speed  
d. Use low speed

14. | **G5** | **c** | MTT | 0890 | **C** | **C.D.** |

What blade speed is used in friction sawing?

a. 30-150 fpm  
b. 300-1,500 fpm  
c. 3,000-15,000 fpm  
d. 30,000-150,000 fpm
15. | G6 | c | MTT | 0890 | C | C.D. |

In what direction does a power hacksaw move?

a. Rotary  
b. Continuous  
c. Reciprocating

16. | G6 | c | MTT | 0890 | C | C.D. |

What measuring device is used to measure a 10' length of bar stock cut by a power hacksaw?

a. 6" scale  
b. 12" rule  
c. Tape measure  
d. Combination square

17. | G5 | b | MTT | 0890 | C | C.D. |

What is used to check the squareness of the end of a part cut with a power hacksaw?

a. Carpenter square  
b. Combination square  
c. Angle binder  
d. Eyeball
What is the motion of a horizontal band saw blade?

a. Continuous
b. Reciprocating
c. Vertical
d. Up and down

In what direction should the teeth on a band saw blade point?

a. Does not matter
b. Away from the workpiece
c. Toward the workpiece
d. Upward

When cutting one part on the band saw, how is the feed accomplished?

a. Hydraulic cylinder
b. Springs
c. By hand
d. Power
21. Why is a coolant used with a cut-off saw?
   a. Blade lasts longer
   b. Produces good finish
   c. Keeps part cool
   d. All of the above

22. What type of coolant is used on a cut-off saw?
   a. Spindle
   b. Soluble
   c. Gear oil
   d. Motor oil

23. When sawing aluminum with a power saw, what coolant is used?
   a. None
   b. Lard
   c. Kerosene
   d. Soluble
When sawing external sharp corners, what width of saw blade is best suited?

a. Wide
b. Narrow
c. Thick
d. Coarse

When contour sawing a very sharp curve, it may be advisable to bypass it temporarily.

a. True
b. False

What should be done at the end of a saw cut?

a. Stop the machine.
b. Remove the workpiece.
c. Clean the machine.
d. All of the above
27. When internal contour sawing, what size hole is drilled through the part when a 1/4" saw blade is used?
   a. 1/16"
   b. 1/8"
   c. 3/16"
   d. 5/16"

28. When the enclosure is rectangular, how many pilot holes are drilled for sawing?
   a. 1
   b. 2
   c. 3
   d. 4
<table>
<thead>
<tr>
<th>Field</th>
<th>Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Unique item number</td>
</tr>
<tr>
<td>2</td>
<td>Duty area and task number (Mo. competency profile)</td>
</tr>
<tr>
<td>3</td>
<td>Letter of correct answer</td>
</tr>
<tr>
<td>4</td>
<td>Source (author, year of publication)</td>
</tr>
<tr>
<td>5</td>
<td>Date (MMYY)</td>
</tr>
<tr>
<td>6</td>
<td>Learning domain (Cognitive, Affective, Psychomotor)</td>
</tr>
<tr>
<td>7</td>
<td>Writer(s)/reviewer(s)</td>
</tr>
<tr>
<td>8</td>
<td>Accompanying artwork (ART)</td>
</tr>
</tbody>
</table>

What should always be worn when operating a drill press?

a. Rings  
b. Loose clothing  
c. Safety glasses  
d. Gloves

What should be used to remove chips from the drill press table?

a. Brush  
b. Air hose  
c. Hands  
d. Broom

What should be done before servicing a drill press?

a. Run at high speed  
b. Run at low speed  
c. Turn off machine  
d. Remove spindle
4. What part of a drill press should be lubricated daily?
   a. Belt
   b. Handle
   c. Table
   d. Quill

5. When the belt slips on a sensitive drill press, what can be applied to stop slippage?
   a. Oil
   b. Belt dressing
   c. Silicon lubricant
   d. Cutting oil

6. When a drill press is NOT in use, what should be rubbed on the table?
   a. Wet rag
   b. Spindle oil
   c. Paper towel
   d. Soluble oil
7. What work-holding device is most commonly used on the sensitive drill press?
   a. Angle plate
   b. Straps
   c. Vise
   d. Jack screws

8. What should be used when drilling round stock on the drill press?
   a. V-blocks
   b. Step blocks
   c. Shims
   d. T-bolts

9. What is the most common tool used to clamp a flat piece of material to the drill press table?
   a. Vise
   b. Parallels
   c. C-clamp
   d. Drill jig
10. High helix drill
b. Subland drill
c. Spade bit
d. Carbide tip

What type of drill is used to drill cast iron or cast steel?

11. a. Enlarging cored holes
b. Drilling small holes
c. Drilling large holes
d. Reaming

What are three-fluted core drills used for?

12. a. True
b. False

Oil-hole drills are used on high-production screw machines.
What determines the angle of the cutting edge on a drill bit?

a. Type of material  
b. Type of drill press  
c. Depth of hole

What is the correct included lip angle for general-purpose drilling of steels?

a. 12 degrees  
b. 90 degrees  
c. 118 degrees  
d. 130 degrees

What material is drilled with a standard 118-degree point drill?

a. Cast iron and steel  
b. Steel  
c. Aluminum  
d. Brass and bronze
16. What is the optimal cutting speed of a high-speed drill when drilling brass?
   a. 50 sfpm  
   b. 100 sfpm  
   c. 200 sfpm  
   d. 300 sfpm

17. What is the optimal feed rate for high-speed steel drills when drilling a 1/2" diameter hole?
   a. .001  
   b. .007  
   c. .030  
   d. .040

18. To change speeds on a variable speed drill press, the drill press is always turned off.
   a. True  
   b. False
19. When drilling cast iron, what type of coolant is used?
   a. 30 weight
   b. Spindle
   c. White lead
   d. None

20. What is used to apply cutting oil to a drill bit?
   a. Grease gun
   b. Hand broom
   c. Shop towel
   d. 1" brush

21. Why is cutting fluid applied to a drill bit?
   a. Hardening a part
   b. Avoiding a mess
   c. Cooling and lubricating
   d. Keeping drills clean
22. | H8 | e | MTT | 0890 | C | C.D. |

What is NOT done when drilling a hole with a drill press?

a. Lubricate drill press.
b. Select proper drill bit size.
c. Turn on drill press.
d. Select speed.
e. Turn tailstock handwheel.

23. | H8 | c | MTT | 0890 | C | C.D. |

What type of hole is drilled first when a large diameter hole is needed?

a. Square
b. Reamed
c. Pilot
d. Cored

d. Cored

24. | H8 | b | MTT | 0890 | C | C.D. |

What should be done just before the drill bit breaks through the part?

a. Apply more pressure
b. Apply less pressure
c. Slow rpm
d. Increase rpm
What is one advantage of power feed on a drill press?

a. Less effort needed
b. Faster drilling
c. Slower drilling
d. Uses smaller drill bits

What type of drill press is NOT equipped with power feed?

a. Multiple drill head
b. Radial
c. Sensitive
d. Gang

How is the feed rate changed on the automatic feed drill press?

a. Belt
b. Variable pulleys
c. Worn gears
d. Gear levers
28. What tool is used to form an angular recess for a flat-head screw? 
   a. Countersink 
   b. Tapered reamer 
   c. Undercutting tool 
   d. Counterbore

29. What are the two most commonly used angles on countersinks? 
   a. 20 and 32 degrees 
   b. 60 and 82 degrees 
   c. 100 and 112 degrees 
   d. 110 and 122 degrees

30. When countersinking, use approximately one-fourth the rpm used for drilling the same material. 
   a. True 
   b. False
What tool is used to recess a surface for a cap-head screw?

a. Countersink
b. Reamer
c. Undercutting tool
d. Counterbore

Which is NOT part of a counterbore?

a. Shank
b. Slot
c. Head
d. Pilot

Ordinarily, how much smaller should the pilot hole be drilled for counterboring?

a. .050
b. .030
c. .020
d. .002
34. | H12 | d | MTT | 0890 | C | C.D. |

What type of tool can be used for spotfacing?

a. Countersink  
b. Spotter  
c. Drill  
d. Counterbore

35. | H12 | d | MTT | 0890 | C | C.D. |

What operation is performed on a part when the head of a cap screw is to rest on a rough surface?

a. Countersink  
b. Undercut  
c. Counterbore  
d. Spotface

36. | H12 | a | MTT | 0890 | C | C.D. |

What is the rpm used for spotfacing compared to the rpm used in drilling the same material?

a. 1/4  
b. 1/2  
c. 3/4  
d. 7/8
What is the most common use of a V-block?

a. Clamp in vise
b. Hold square workpiece
c. Hold round workpiece
d. School project

What is the first thing to do when drilling a hole using the V-block on a drill press?

a. Center punch
b. Clamp in V-block
c. Set feed
d. Set speed

A stop may be set when using V-blocks.

a. True
b. False
40. | H14 | c | MTT | 0890 | C | C.D. |

What is the purpose of reaming a hole?

a. Start a hole
b. Thread a hole
c. Produce a smooth, accurate hole
d. Take the place of a drill

41. | H14 | d | MTT | 0890 | C | C.D. |

What type of reamer is used as a roughing reamer?

a. #2 M.T. reamer
b. Hand reamer
c. Relief reamer
d. Rose reamer

42. | H14 | a | MTT | 0890 | C | C.D. |

What speed and feed rates are used for reaming?

a. One-third that of drilling
b. Three-fourths that of drilling
c. Same as drilling
d. Faster than drilling

11
What size drill should be used for a 1/2" reamer?

a. 31/32"
b. 33/64"
c. 31/64"
d. 17/32"
What is the purpose of a drill jig?

a. Permit quick, accurate drilling
b. Improve training programs
c. Eliminate need for V-blocks
d. Reduce material costs

How are drill jigs used in production?

a. Substitute for slides
b. Substitute for a vise
c. Drilling holes in large numbers of parts
d. Drilling holes in one part
46. | H16 | a | MTT | 0890 | C | C.D. |

What should always be done when tapping a hole using the drill press?

a. Align hole to be tapped.
b. Set drill press at high speed.
c. Hold part by hand.
d. Tap part without cutting oil.

47. | H16 | b | MTT | 0890 | C | C.D. |

When should the hand tap be removed from the drill chuck?

a. After about one turn
b. After it has turned three or four times
c. About 1" through part
d. When tapping aluminum

48. | H16 | b | MTT | 0890 | C | C.D. |

What threads are cut when using a starting tap?

a. External
b. Internal
c. Rolled
d. Acme
With a drill press, what speed is best for tapping most materials with a tapping attachment?

a. 20-30 rpm  
b. 40-50 rpm  
c. 60-100 rpm  
d. 120-160 rpm

How does the tapping attachment reverse itself?

a. When the machine is turned off  
b. With up or down pressure  
c. When changing a belt  
d. When variable speed is changed

When using a tapping attachment, what will happen if a 1/4"-20 tap hits the bottom of a hole too quickly?

a. Machine reverses  
b. Breaks the tap  
c. Motor will pull down  
d. Stops the tapping attachment
What is the recommended clearance angle for twist drills?

a. 5-8 degrees  
b. 8-12 degrees  
c. 15-30 degrees  
d. 120-130 degrees

What should be done to a grinding wheel before sharpening a drill bit?

a. Dress  
b. True  
c. Ring-check  
d. Balance

How is the cutting edge of a drill bit angle checked?

a. Drill angle gage  
b. Hole gage  
c. Combination square  
d. Machinist's square
55. | H19 | c | MTT | 0890 | C | C.D. |

How is the arm of a smaller radial drill press raised or lowered?

a. Crane
b. Hoist
c. Hand crank
d. Floor jack

56. | H19 | a | MTT | 0890 | C | C.D. |

Which machine is most versatile?

a. Radial drill
b. Multiple drill
c. Turret drill
d. Sensitive drill

57. | H19 | b | MTT | 0890 | C | C.D. |

A radial arm drill press will position the part automatically.

a. True
b. False
1. | Il | c | Feirer | 0890 | A | D.M. |

What is best used to remove chips from the lathe?

a. Hand
b. Compressed air
c. Brush
d. Cloth

2. | Il | d | McKnight | 0890 | A | D.M. |

What is the safest and most efficient tool to use when filing on the lathe?

a. Second cut file with tang removed
b. Double-ended riffler file
c. Long angle file without handle
d. Long angle file with handle

3. | Il | a | McKnight | 0890 | C | D.M. |

What is the greatest danger of switching the lathe to reverse while it is turning forward?

a. A threaded chuck may unscrew from the spindle.
b. The switch may burn out.
c. The lathe belt may slip.
d. The cutting tool will develop metal buildup on top of it.
A continuous chip is desirable when machining a ductile metal on the lathe.

a. True

b. False
5. | I2 | a | McKnight | 0890 | C | D.M. |

What should be placed below a lathe chuck when removing it from the spindle?

a. Cradle board
b. Oil-soaked cloth
c. Piece of plastic sheeting
d. Piece of galvanized sheet metal

6. | I2 | b | Feirer | 0890 | A | D.M. |

When no coolant is used with a tool-post grinder on a lathe, no cover is needed on the bed ways.

a. True
b. False

7. | I2 | b | McKnight | 0890 | A | D.M. |

When cleaning a lathe, all oil should be wiped off the bed ways and other unpainted parts so they will not attract dirt and dust.

a. True
b. False
8. When checking accuracy of lathe centers with a test bar and dial indicator, where should the dial indicator be mounted?
   a. In the tool post
   b. On the bed
   c. On the headstock
   d. On the tailstock

9. When checking lathe center accuracy with a test bar and dial indicator, the indicator should first be set to check the rotating live center for accuracy.
   a. True
   b. False

10. The technique of moving the tailstock center to meet the headstock center is as accurate as the test bar and dial indicator method of aligning centers on a lathe.
    a. True
    b. False
11. | I4 | d | McKnight | 0890 | C | D.M. |

Which cutting tool material will withstand the most heat?

a. Hard-cast (nonferrous) alloys
b. High-speed steel
c. Water-hardening steel
d. Tungsten carbide

12. | I4 | a | McKnight | 0890 | C | D.M. |

Which material would best machine with a tool having a negative back rake?

a. Brass
b. Free-machining steel
c. Medium-carbon steel
d. Aluminum

13. | I4 | c | McKnight | 0890 | C | D.M. |

What is the purpose of the back rake angle on a cutting tool?

a. Cools cutting tool tip
b. Promotes tool digging into the workpiece
c. Guides direction of chip flow
d. Prevents cutting tool from rubbing on the stock
14. Which is NOT a factor to consider when setting the appropriate rpm for a lathe?
   a. Workpiece diameter
   b. \( \text{C.S.} \times \frac{4}{D} \)
   c. Condition of the machine
   d. Workpiece length

15. At what rpm should a lathe be operated to turn a mild steel workpiece (100 fpm) on 1.875" diameter?
   a. 113
   b. 213
   c. 250
   d. 400

16. How can cutting speed be expressed?
   a. Square feet
   b. Surface meters per minute
   c. Revolutions per minute
   d. Cubic centimeters
Which is true concerning the side rake angle of a lathe tool?

a. It controls the flow and formation of the chip.
b. It should be zero for most materials.
c. It must be extremely precise.
d. It prevents the cutting edge from heating the workpiece.

What is the body portion of a turning tool called?

a. Shank
b. Base
c. Radius
d. Point

What is the purpose of relief angles?

a. Prevent tool flanks from rubbing
b. Allow for smooth flow of chips
c. Permit the tool to be withdrawn
d. Provide for heat dissipation
20. a. True
   b. False

21. a. Aluminum
    b. All steels
    c. Brass
    d. Cast iron

22. a. They are mixed with water.
    b. They provide good lubrication.
    c. They often contain rust inhibitors.
    d. They are excellent for removing heat.
23. | I8 | d | Repp | 0890 | C | C.W. |

The half-nut lever is associated with which operation?

a. Drilling
b. Taper turning
c. Facing
d. Threading

24. | I8 | b | Repp | 0890 | C | C.W. |

What is the quick-change gearbox used to set?

a. Spindle rpm
b. Feed rate
c. Depth of cut
d. Tailstock feed

25. | I8 | d | Repp | 0890 | C | C.W. |

What is adjusted to set the depth of cut?

a. Quick-change gearbox
b. Tailstock spindle
c. Carriage hand wheel
d. Cross-slide micrometer dial
26. Center drilling permits the workpiece to be held between centers.
   a. True
   b. False

27. What is the cone angle of a center drill designed to match?
   a. The tailstock guide taper
   b. 60-degree lathe center
   c. The angle of the compound rest
   d. The included angle of the lathe tool

28. To what portion of its length should the tapered portion of a center drill penetrate the workpiece?
   a. 1/4
   b. 1/2
   c. 3/4
   d. Full length
What device is used to center a workpiece in a four-jaw chuck on a lathe?

a. Combination set
b. Wiggler
c. Pin punch
d. Dial indicator

What is the proper relationship between the tool tip and the workpiece center on a lathe?

a. Left of center
b. On center
c. Slightly below center
d. Slightly above center

What lathe operation requires a center gauge for setup?

a. Facing
b. Threading
c. Knurling
d. Boring
32. | Ill | a | TT | 0890 | ạ | C.W. |

What lathe accessory is used to make positive drive on the workpiece when turning between centers?

a. Lathe dog  
b. Four-jaw chuck  
c. Arbor plate  
d. Facing tool

33. | Ill | a | TT | 0890 | ạ | C.W. |

What device is used to measure side-to-side movement of the tailstock on a lathe?

a. Dial indicator  
b. Master square  
c. Micrometer dial  
d. Bench rule

34. | Ill | d | TT | 0890 | ạ | C.W. |

Which item is adjusted to eliminate wobble from a workpiece on a lathe?

a. Headstock  
b. Compound rest  
c. Tool post  
d. Tailstock
Which work-holding device permits the greatest accuracy?

a. Collet chuck  
b. Four-jaw chuck  
c. Three-jaw universal chuck  
d. Rubber-flex chuck  

Which would NOT be used to center work in a four-jaw chuck?

a. Precision square  
b. Digigler  
c. Tailstock center  
d. Dial indicator  

After checking opposite sides of a workpiece in a four-jaw chuck with a dial indicator, how much should the workpiece be moved to center it?

a. One-fourth of the difference  
b. One-half of the difference  
c. Less than .001"  
d. All the difference
38. | I13 | d | TT | 0890 | C | C.W. |

When drilling with a lathe, how is the drill held?

a. In the four-jaw chuck
b. In the headstock
c. In the toolpost
d. In the tailstock

39. | I13 | b | TT | 0890 | C | C.W. |

What tool is used to center and guide a drill on a lathe?

a. Center punch
b. Center drill
c. Knurling tool
d. Reamer

40. | I13 | c | TT | 0890 | C | C.W. |

Why is it necessary to back the drill out of the workpiece several times during the drilling process?

a. Lubricate headstock
b. Adjust the compound rest
c. Clean chips and apply coolant
d. Check spindle speed
Feed rate for reaming is generally about the same as for drilling.

a. True
b. False

What size should the preparatory hole be for using a 1/2" machine reamer?

a. 9/16"
b. 7/16"
c. 31/64"
d. 33/64"

It is generally unnecessary to use cutting fluid when reaming on the lathe.

a. True
b. False
44. When boring, depth of cut is established by turning the cross-slide micrometer dial counterclockwise.
   a. True
   b. False

45. What tool is used to check the diameter of a bored hole?
   a. Pin gauge
   b. Outside micrometer
   c. Center gage
   d. Telescoping gage

46. How much material should be left in a drilled hole to bore for finishing?
   a. .001"
   b. .002"
   c. .010"
   d. .075"
What tool is used to remove the burr from a drilled hole?

a. Counterbore  
b. Counter drill  
c. Center drill  
d. Countersink

How is the countersink held?

a. In the tailstock  
b. On the compound rest  
c. In the headstock  
d. In the tool post

What is the included angle of a countersink for deburring?

a. 10 degrees  
b. 25 degrees  
c. 90 degrees  
d. 180 degrees
What is the purpose of a counterbore?

a. Enlarge a hole
b. Deburr
c. Align incorrectly drilled holes
d. Ream short sections

Counterboring can be performed with a single-point boring tool.

a. True
b. False

c. Counterbores should be run at higher speeds than drills of the same diameter.

a. True
b. False
What operation deforms rather than cuts the surface of the workpiece?

a. Threading
b. Turning
c. Facing
d. Knurling

A diamond-pattern knurling tool is used to provide a suitable grip on a workpiece.

a. True
b. False

A knurling tool on a lathe need not be set exactly on center.

a. True
b. False
56. | I19 | d | TT | 0890 | C | C.W. |

Which tool is used to check the angle of a 60-degree threading tool?

a. Cutter gauge
b. Rose-radius comparator
c. Micrometer calipers
d. Center gauge

57. | I19 | a | Repp | 0890 | C | C.W. |

The point of a threading tool may be a radius or a flat.

a. True
b. False

58. | I19 | b | Repp | 0890 | C | C.W. |

What is the proper end relief for a 60-degree lathe threading tool?

a. 1-2 degrees
b. 8-10 degrees
c. 20-35 degrees
d. 60 degrees
59. | 120 | d | Repp | 0890 | C | C.W. |

To what angle should the compound rest be turned to cut threads on a lathe with a single-point tool?

a. 60 degrees
b. 45 degrees
c. 30 1/2 degrees
d. 29 1/2 degrees

60. | 120 | c | Repp | 0890 | C | C.W. |

To achieve the desired number of threads per inch, which lathe component must be adjusted?

a. Headstock
b. Carriage levers
c. Quick-change gear box
d. Tailstock

61. | 120 | a | Repp | 0890 | C | C.W. |

When an odd number of threads must be cut, where should the thread dial be set?

a. On any number
b. On odd numbers only
c. On even numbers only
d. On any lined graduation
62. | I21 | b | TT | 0890 | C | C.W. |

Which is the correct tap drill size for cutting a 1 1/2" 7 UNC internal thread?

a. 1.250
b. 1.357
c. 1.458
d. 1.5

63. | I21 | b | TT | 0890 | C | C.W. |

How must the compound rest be set for internal threading?

a. 0 degrees
b. 29.5 degrees to the left
c. 29.5 degrees to the right
d. 90 degrees

64. | I21 | a | Repp | 0890 | C | C.W. |

A thread pitch gage can be used to check for the correct number of internal threads.

a. True
b. False
What is the included angle of ISO metric threads?

a. 30 degrees  
b. 60 degrees  
c. 80 degrees  
d. 90 degrees

How is metric thread pitch expressed?

a. Number of threads per inch  
b. Number of threads per meter  
c. Number of threads per centimeter  
d. Lead per revolution in millimeters

To set the pitch for cutting metric threads, adjust the quick-change gearbox.

a. True  
b. False
68. | I23 | b | TT | 0890 | C | C.W. |

When machining a taper with the compound rest, the lead screw must be engaged.

a. True
b. False

69. | I23 | c | TT | 0890 | C | C.W. |

To what angle should the compound rest be adjusted to cut a 90-degree included angle taper?

a. 15 degrees
b. 30 degrees
c. 45 degrees
d. 90 degrees

70. | I23 | b | TT | 0890 | C | C.W. |

The compound rest is well suited to cut long tapers on work held between centers.

a. True
b. False
What is the tailstock offset for turning a .2 tpi on a 12" long workpiece?

a. .2"
b. 1.2"
c. 1.5"
d. 2.0"

What is the taper per foot on a 10" taper with a large end of 1 1/2" diameter and a small end of 3/4" diameter?

a. .5 tpf
b. .9 tpf
c. 1.5 tpf
d. 10 tpf

The tailstock offset method of taper turning is best suited to making long tapers.

a. True
b. False
A taper attachment can be used to produce tapers on work held either between centers or in a chuck.

a. True
b. False

When using a taper attachment, the compound rest can be used to feed the tool into the work.

a. True
b. False

The angle of a taper attachment can be set using a taper bar and a dial indicator.

a. True
b. False
When cutting an internal taper with the taper attachment, how is the depth of cut set?

a. Turn compound rest clockwise  
b. Turn compound rest counterclockwise  
c. Turn carriage handwheel  
d. Turn cross-slide clockwise

A long, narrow, internal taper may require the use of a boring bar.

a. True  
b. False

Large, short, internal tapers can be turned using a standard toolpost and toolholder.

a. True  
b. False
When mounting a heavy, awkward piece of work to a faceplate, the faceplate should be mounted in the lathe.

a. True
b. False

It is NOT possible to hold round work on a faceplate.

a. True
b. False

Which is most valuable in aligning work held in a faceplate?

a. Dial indicator
b. Center punch
c. Wiggler
d. Vernier caliper
Which is NOT a good reason for filing in the lathe?

a. Deburring
b. Improve finish
c. Improve accuracy
d. Removing tool marks

It is unnecessary to use a file handle when filing on the lathe because the tang is held away from the operator.

a. True
b. False

When filing in the lathe, it is best to use many short, quick strokes.

a. True
b. False
86.  | I29 | b | TT | 0890 | C | C.W. |

Use of a dead center in the tailstock is recommended while polishing.

a. True
b. False

87.  | I29 | b | TT | 0890 | C | C.W. |

What is the best abrasive for polishing aluminum in the lathe?

a. Flint powder
b. Silicon carbide
c. Garnet
d. Diamond

88.  | I29 | a | TT | 0890 | C | C.W. |

When polishing in the lathe, the bed should be covered by paper to prevent contact with abrasive particles.

a. True
b. False
How is work usually mounted when working with a steady rest?

a. On a faceplate

b. In a collet

c. Between centers

d. In a Jacob's chuck

To what part of the lathe is a follower rest mounted?

a. Bed

b. Headstock

c. Tailstock

d. Saddle

What is the purpose of a steady rest?

a. Provide support for taking extremely heavy cuts on a workpiece

b. Permit the operator to leave the machine unattended

c. Assist in holding and aligning extra long workpieces

d. Provide a means of machining a short, steep taper
92. | I31 | b | TT | 0890 | C | C.W. |

How is the quick-change gearbox set to produce a 3/4-16 UNC-1/8 lead 2 start thread?

a. 3 tpi
b. 8 tpi
c. 12 tpi
d. 16 tpi

93. | I31 | b | TT | 0890 | C | C.W. |

To what angle should the compound rest be set to cut multiple start threads by the compound rest method?

a. 20 degrees
b. 29.5 degrees
c. 90 degrees
d. 120 degrees

94. | I31 | a | TT | 0890 | C | C.W. |

What distance (lead) will a 3/4-10 UNC double-lead thread travel in one revolution?

a. 1/5" 
b. 1/8"
c. 1/10"
d. 1/20"
What is the included angle of an Acme thread?

a. 10 degrees  
b. 14.5 degrees  
c. 29 degrees  
d. 58 degrees

An Acme threading tool has a 1/32 radius at its tip.

a. True  
b. False

When cutting Acme threads, to what angle should the compound rest be set?

a. 14.5 degrees  
b. 29.5 degrees  
c. 59 degrees  
d. 60 degrees
Which method is used to turn a long form on a workpiece?

a. Radius turning attachment
b. Radius tool
c. Tracer attachment
d. 60-degree threading tool

Which method is used to machine large convex and concave forms?

a. Radius turning attachment
b. Radius tool
c. Template with follower
d. 60-degree threading tool

A small radius on the end of a workpiece can be machined with a 60-degree V-tool.

a. True
b. False
A lathe mandrel has a relatively large taper of .020" per inch of length.

a. True
b. False

What is used for positive drive of a lathe mandrel?

a. Lathe dog
b. Tailstock center
c. Center lubrication
d. Collet chuck

A mandrel is usually made from soft material so the workpiece will not be damaged.

a. True
b. False
When milling with a two-flute cutter, the safest way is to climb-mill.

a. True
b. False

The safest way to do any milling is to lock the table opposite the travel of the cutter.

a. True
b. False

The safest way to remove and replace a vise from the milling machine is to have help from a fellow worker.

a. True
b. False
4. As long as the milling machine is running smoothly, there is no need to oil the spindle.
   a. True
   b. False

5. The care and maintenance of a milling machine should be done by the janitor.
   a. True
   b. False

6. A milling machine with a one-shot oiling system oils the table and knee assembly.
   a. True
   b. False
When aligning the milling head to the table, the right and left adjustments are aligned first.

a. True
b. False

The correct way to tram the mill is to use precision-ground parallels or gage blocks.

a. True
b. False

When aligning the milling head to the table, align the head with the workpiece.

a. True
b. False
10. What is used when aligning the vise to the milling head?
   a. Dial indicator
   b. Edge finder
   c. Solid square
   d. Combination square

11. With what precision-ground piece are V-blocks aligned on a milling machine?
   a. Round stock and edge finder
   b. Square stock and edge finder
   c. Round stock and dial indicator
   d. Square stock and dial indicator

12. With what are the boring bar and workpiece aligned on the milling machine?
   a. Combination square
   b. Dial indicator
   c. Edge finder
   d. Solid square
What is done to align a workpiece on a milling table?

a. Indicate top only
b. Indicate sides only
c. Indicate ends
d. Indicate top and sides

How is a cylindrical workpiece mounted to align it on a milling table?

a. Directly to table
b. Parallels
c. Step blocks
d. V-blocks

When drilling through-holes, how is a large, square workpiece mounted to align it on a milling table?

a. Gage blocks
b. V-blocks
c. Parallels
d. Plywood spacers
16. When calculating feeds and speeds, the type of material has no effect.
   a. True
   b. False

17. When calculating feeds and speeds, the type of cutting fluid has no effect.
   a. True
   b. False

18. When calculating milling feeds and speeds, the rpm may be different for a step pulley and a variable drive.
   a. True
   b. False
What is the best method for applying a cutting fluid for heavy or rough cuts?

a. Air
b. Flood
c. Mist
d. Pressurized

What is the best method for applying a cutting fluid for a finish or fine cut?

a. Air
b. Flood
c. Mist
d. Pressurized

What is the best cutting fluid for milling most metals?

a. Compressed air
b. Mineral oil
c. Soluble oil
d. Sulfur-based
22.  | J8   | a   | IML Mod. 6 | 0890  | C  | J.C.  |

The type of material to be milled determines the type of cutter to be used.

a. True
b. False

23.  | J8   | b   | IML Mod. 6 | 0890  | C  | J.C.  |

The rate of feed is the same for both two-flute and four-flute cutters.

a. True
b. False

24.  | J8   | b   | IML Mod. 6 | 0890  | C  | J.C.  |

Right-hand and left-hand fluted end mills rotate in the same direction.

a. True
b. False
To square a workpiece, the largest side should be milled first.
   a. True
   b. False

The proper way to square a workpiece in a vise is to use a precision-ground dowel pin.
   a. True
   b. False

When squaring a workpiece, a reduced feed rate will produce a better finish.
   a. True
   b. False
28. Which type of mill should be used to mill a captive slot with an end mill?
   a. Center cut
   b. Two-flute
   c. Single end
   d. Double end

29. What should be used when milling graphite with an end mill?
   a. Plunge feed
   b. Low feed rate
   c. Cutting oil
   d. Low rpm

30. What is the best procedure for milling a deep slot in a workpiece?
   a. Make several cuts
   b. Make two plunge cuts
   c. Make one cut
   d. Any of the above
<table>
<thead>
<tr>
<th>Field</th>
<th>Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Unique item number</td>
</tr>
<tr>
<td>2</td>
<td>Duty area and task number (Mo. competency profile)</td>
</tr>
<tr>
<td>3</td>
<td>Letter of correct answer</td>
</tr>
<tr>
<td>4</td>
<td>Source (author, year of publication)</td>
</tr>
<tr>
<td>5</td>
<td>Date (MMYY)</td>
</tr>
<tr>
<td>6</td>
<td>Learning domain (Cognitive, Affective, Psychomotor)</td>
</tr>
<tr>
<td>7</td>
<td>Writer(s)/reviewer(s)</td>
</tr>
<tr>
<td>8</td>
<td>Accompanying artwork (ART)</td>
</tr>
</tbody>
</table>

---

31. | J11 | a | IML Mod. 6 | 0890 | C | J.C. |
---

Which quadrant is best to use in locating an edge with an edge finder?

a. \(+x +y\)

b. \(+x -y\)

c. \(-x -y\)

d. \(-x +y\)

---

32. | J11 | a | IML Mod. 6 | 0890 | C | J.C. |
---

What should be used to hold an edge finder?

a. Collet

b. Drill chuck

c. C clamp

d. Magnetic holder

---

33. | J11 | c | IML Mod. 6 | 0890 | C | J.C. |
---

At what rpm should an edge finder run?

a. 200

b. 400

c. 1,000

d. 1,500
What is the best tool holder for drill bits on a mill?

a. Drill chuck
b. Boring head
c. Boring bar
d. Solid collet

What method is best when tool steel is drilled on a mill?

a. Pecking motion
b. Plunge drilling
c. Power feed
d. Slow feed rate

What should be used when drilling most metals?

a. Cutting oil
b. Coolant fluid
c. No fluids
d. Air
| # | What should be used for reaming holes with a milling machine after drilling? | a. | Same rpm as drilling | b. | Increased rpm | c. | Reduced rpm | d. | None of the above |
|---|---|---|---|---|---|---|---|---|
| 37 | | | | | | | | |

| # | What should be done when reaming holes in mild/soft metal? | a. | Leave more material to be reamed. | b. | Leave less material to be reamed. | c. | Drill the hole to the exact size. | d. | None of the above |
|---|---|---|---|---|---|---|---|---|
| 38 | | | | | | | | |

| # | What should be used when reaming holes in tool steel? | a. | Cutting oil | b. | Coolant fluid | c. | No fluids | d. | None of the above |
|---|---|---|---|---|---|---|---|---|
| 39 | | | | | | | | |
40. IIML Mod. 6 | 0890 | C | J.C. |  

How should a cutter be set when boring aluminum?

a. Positive back rake  
b. Negative back rake  
c. No back rake  
d. None of the above  

41. IIML Mod. 6 | 0890 | C | J.C. |  

Hand-feeding the boring bar will produce the best finish.

a. True  
b. False  

42. IIML Mod. 6 | 0890 | C | J.C. |  

When boring on a milling machine, it is best to bore only on the down stroke.

a. True  
b. False
When milling a beveled edge, what type of cutter is recommended?

- a. Radius
- b. Chamfer
- c. Ball-nose
- d. T-slot

When milling a concave corner, what type of cutter is recommended?

- a. Chamfer
- b. Radius
- c. Straight-end mill
- d. Ball-nose

When milling a T-slot, what operation is performed?

- a. Mill to minor diameter and depth first.
- b. Mill to proper depth with correct T-slot cutter.
- c. Mill by several passes to depth of T-slot cutter.
- d. None of the above
46. | J16 | a | IML Mod. 6 | 0890 | C | J.C. |

When machining a workpiece mounted on V-blocks, opposing flats can be milled without remounting the workpiece.

a. True
b. False

47. | J16 | b | IML Mod. 6 | 0890 | C | J.C. |

Dovetail slots cannot be milled on a workpiece mounted on V-blocks.

a. True
b. False

48. | J16 | a | IML Mod. 6 | 0890 | C | J.C. |

V-blocks can be mounted in a vise to hold the workpiece.

a. True
b. False
External keyways are milled on round/tapered stock.

a. True
b. False

A captive keyway cannot be milled externally.

a. True
b. False

External straight keyways are milled best with a standard end mill.

a. True
b. False
What is the first step in machining a Woodruff keyway?

a. Determine size of keyway  
b. Determine depth of keyway  
c. Determine the cutter number  
d. None of the above

A Woodruff keyway can be cut on top and side of a surface at the same time.

a. True  
b. False

Woodruff keyways are usually cut in what shape of material?

a. Round shafts  
b. Square shafts  
c. Flat surfaces  
d. Hexagonal shafts
What is the best way to mill an angle with a plain vise?

a. Yaw the head
b. Shim the vise
c. Angled parallel
d. None of the above

An angle can be milled on a workpiece using a rotary table.

a. True
b. False

What is the best set-up for milling a compound angle?

a. Universal vise
b. Swivel vise
c. Plain vise
d. Angled parallels
<p>| | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>58.</td>
<td>J20</td>
<td>b</td>
<td>IML Mod. 6</td>
<td>0890</td>
<td>C</td>
</tr>
</tbody>
</table>

How is the rotary table centered with the spindle on the vertical milling machine?

- a. 6" scale
- b. Dial indicator
- c. Dial caliper
- d. Center gage

<p>| | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>59.</td>
<td>J20</td>
<td>a</td>
<td>IML Mod. 6</td>
<td>0890</td>
<td>C</td>
</tr>
</tbody>
</table>

What is the purpose of the hole in the center of a rotary table?

- a. Alignment
- b. Less weight on table
- c. Looks better
- d. Holding part to table

<p>| | | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>60.</td>
<td>J20</td>
<td>b</td>
<td>IML Mod. 6</td>
<td>0890</td>
<td>C</td>
</tr>
</tbody>
</table>

When machining an external radius with a rotary table, which type of milling is most common?

- a. Climb
- b. Conventional
- c. Radius
- d. Square
What are the two types of milling rotary tables?

a. Left and right
b. Up and down
c. Stationary and reciprocating
d. Vertical and horizontal

What is the most common use of a rotary table?

a. Gear cutting
b. Milling circles and arcs
c. Reaming
d. Boring

What is the purpose of T-slots on the rotary table?

a. Clamping of the workpiece
b. Catch chips
c. Appearance
d. Catch excess cutting oil
64. In simple indexing, how many teeth are on the worm wheel?
   a. 40
   b. 30
   c. 20
   d. 10

65. How many turns of the crank of a dividing head are needed to turn
    the part one complete turn in simple indexing?
   a. 10
   b. 20
   c. 30
   d. 40

66. How are the number of divisions needed for indexing calculated?
   a. Divide
   b. Multiply
   c. Subtract
   d. Add
<table>
<thead>
<tr>
<th>Field</th>
<th>Contents</th>
<th>Field</th>
<th>Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Unique item number</td>
<td>6</td>
<td>Date (MMYY)</td>
</tr>
<tr>
<td>2</td>
<td>Duty area and task number (Mo. competency profile)</td>
<td>7</td>
<td>Writer(s)/reviewer(s)</td>
</tr>
<tr>
<td>3</td>
<td>Letter of correct answer</td>
<td>8</td>
<td>Accompanying artwork (ART)</td>
</tr>
<tr>
<td></td>
<td>Source (author, year of publication)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

How accurate is a vertical mill's digital readout unit?

a. 0.0001  
b. 0.0005  
c. 0.0010  
d. 0.0050

A digital readout reads in absolute and incremental measurements.

a. True  
b. False

A digital readout can control X and Y table movement automatically.

a. True  
b. False
70. Which process involves milling two sides of a block simultaneously?
   a. Fluting mill
   b. Straddle milling
   c. Double milling
   d. Slotting

71. Which type of milling machine can perform straddle milling?
   a. Planetary
   b. Vertical
   c. Fixed bed
   d. Horizontal

72. What is used to separate the cutters to the required length for straddle milling?
   a. Backlash eliminator
   b. Arbor nuts
   c. Spacers
   d. Arbor support
What method of machining uses several cutters in a single operation?

a. Boring
b. Gang milling
c. End milling
d. Gear cutting

Which machine setup is used frequently in gang milling?

a. Horizontal milling machine
b. Horizontal milling machine with type A or B arbor
c. Horizontal milling machine with type C arbor
d. Vertical milling machine

In gang milling, the form produced on the workpiece is determined by the diameter and width of the cutters used.

a. True
b. False
76. | J26 | b | Repp | 0890 | C | C.W. |

Gear-cutting operations are usually performed on a vertical milling machine and require very little special equipment.

a. True  
b. False

77. | J26 | a | Repp | 0890 | C | C.W. |

When machining a spur gear, the gear blank can be mounted between centers on an indexing head.

a. True  
b. False

78. | J26 | c | Repp | 0890 | C | C.W. |

What features of a gear will the gear tooth vernier measure?

a. Gear diameter and metric module pitch  
b. Hub size  
c. Chordal thickness and addendum distance  
d. Pitch and number of teeth
1. | K1, L1 | b | IML Mod. 7 | 0890 | C | C.S. |

How long should a grinding wheel run at full speed before work is started?

a. 15 sec.
b. 30 sec.
c. 45 sec.
d. 1 min.

2. | K1, L1 | c | IML Mod. 7 | 0890 | C | C.S. |

What type of eye protection should be worn at all times in the shop?

a. Contacts
b. Face shield
c. Safety glasses
d. Sunglasses

3. | K1, L1 | a | IML Mod. 7 | 0890 | A | C.S. |

What is the BEST advice regarding stopping a grinding wheel after it has been turned off?

a. Never stop the wheel with hands.
b. Stop a slow-moving wheel with hands.
c. Use a block of wood to stop the wheel.
d. Use a piece of steel to stop the wheel.
4. What should be done if a person is cut by a grinding wheel?
   a. Wash the cut with coolant.
   b. Keep working.
   c. Report to instructor.
   d. Go home without reporting it.
### Field | Contents
---|---
1 | Unique item number
2 | Duty area and task number (Mo. competency profile)
3 | Letter of correct answer
4 | Source (author, year of publication)
5 | Date (MMDY)
6 | Learning domain (Cognitive, Affective, Psychomotor)
7 | Writer(s)/reviewer(s)
8 | Accompanying artwork (ART)

5. | K2 | b | Olivo | 0890 | C | C.S. |

What is the oil sight glass used for?

a. To see inside the machine
b. To see the oil level in the machine
c. To make the machine look better
d. To remove and add oil

6. | K2 | c | Olivo | 0890 | A | C.S. |

What should NOT be used to clean a surface grinder?

a. Shop towel
b. Scraper
c. Air hose
d. Brush

7. | K2 | d | Olivo | 0890 | C | C.S. |

What should be used to lubricate a surface grinder?

a. Water
b. Light oil
c. Heavy grease
d. Manufacturer's recommendation
8. What grinding fluid is most recommended for medium to heavy stock removal?
   a. Cutting oil
   b. Water-soluble oil
   c. Water-soluble chemical
   d. Water

9. What grinding fluid is most recommended for accurate removal of very hard stock?
   a. Cutting oil
   b. Water-soluble oil
   c. Water-soluble chemical
   d. Water

10. What grinding fluid is most recommended for light to moderate stock removal?
    a. Cutting oil
    b. Water-soluble oil
    c. Water-soluble chemical
    d. Water
What should a grinding wheel be inspected for before it is used?

a. Dirt
b. Cracks
c. Oil
d. Size

What method is used to test a grinding wheel for cracks?

a. Visual
b. Ring test
c. Black light
d. Touch

What should always be visible on each side of the wheel?

a. Wheel size
b. Wheel grit
c. Brand name
d. Blotters
14. K5 b IML Mod. 7 0890 C C.S.

To balance a grinding wheel, it should be rotated 90 degrees.

a. True

b. False

15. K5 a Olivo 0890 C C.S.

A grinding wheel should be mounted on the mandrel before it is balanced.

a. True

b. False

16. K5 a Olivo 0890 C C.S.

A balanced grinding wheel will help the grinder run more smoothly.

a. True

b. False
<table>
<thead>
<tr>
<th>Field</th>
<th>Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Unique item number</td>
</tr>
<tr>
<td>2</td>
<td>Duty area and task number (Mo. competency profile)</td>
</tr>
<tr>
<td>3</td>
<td>Letter of correct answer Source (author, year of publication)</td>
</tr>
<tr>
<td>4</td>
<td>Learning domain (Cognitive, Affective, Psychomotor)</td>
</tr>
<tr>
<td>5</td>
<td>Date (MMYY)</td>
</tr>
<tr>
<td>6</td>
<td>Writer(s)/reviewer(s)</td>
</tr>
<tr>
<td>7</td>
<td>Accompanying artwork (ART)</td>
</tr>
</tbody>
</table>

17. | K6 | c | Olivo | 0890 | C | C.S. |

What does the 46 mean on a grinding wheel labeled 32A46-F8VBE?

a. Date of manufacture
b. Weight
c. Grit
d. Hardness

18. | K6 | d | Olivo | 0890 | C | C.S. |

What does the F mean on a grinding wheel labeled 32A46-F8VBE?

a. Year of manufacture
b. Weight
c. Grit
d. Hardness

19. | K6 | a | Olivo | 0890 | A | C.S. |

Before a grinding wheel is mounted, what should the operator do?

a. Ring test the wheel
b. Wipe the wheel
c. Write the grit size on the wheel
d. Replace the blotters
20. | K7 | c | Olivo | 0890 | C | C.S. |
What is a sign of a loaded grinding wheel?
a. Smooth cutting
b. Dull grit
c. Workpiece burn marks
d. Vibrating grinder

21. | K7 | b | Olivo | 0890 | C | C.S. |
What is the common drag angle for mounting the diamond dresser?
a. 1-3 degrees
b. 3-15 degrees
c. 15-25 degrees
d. None of the above

22. | K7 | b | Olivo | 0890 | A | C.S. |
The wheel should always be tested by grinding before dressing.
a. True
b. False
23. | KB | d | Olivo | 0890 | C | C.S. |

What should be set when using power travel on the grinder table?

a. Oil level  
b. Wheel speed  
c. Diamond dresser  
d. Table stroke dogs

24. | KB | a | Olivo | 0890 | C | C.S. |

When using automatic down feed, what is the common fine-feed increment?

a. .0001-.0009  
b. .001-.009  
c. .010-.020  
d. .040-.065

25. | KB | d | Olivo | 0890 | C | C.S. |

What must always be done when using a magnetic chuck?

a. Oil chuck  
b. Block up large parts  
c. Set back rail  
d. Turn on magnet
26. What tool should be used when grinding stock square?
   a. Angle plate
   b. V-block
   c. Diamond stick
   d. Combination square

27. To grind a part square, what should be used to hold the part in the grinder?
   a. Back-up blocks
   b. Magnet
   c. Machine vise
   d. Precision angle plate

28. To grind a block square, the operator must use a precision level.
   a. True
   b. False
29. | K10 | b | Olivo | 0890 | C | C.S. |

The magnet should be turned off all the way before indicating a part.

a. True
b. False

c. Indicate the table with the head.
d. Using a rule, line up the part and run.
31. To grind an angular surface, a sine bar is a very accurate way to set the angle.
   a. True
   b. False

32. Which tools are used to grind an angle?
   a. Sine bar
   b. Sine chuck
   c. Angle plate and sine bar
   d. Magnetic V-block
   e. All of the above

33. To grind some angles, the operator may need to use a sine bar and angle plate together.
   a. True
   b. False
To what tolerance are toolroom cylindrical grinders capable of grinding round cylinders?

a. .001
b. .0002
c. .0006
d. .000025

What are the tapers that can be cut on a cylindrical grinder with a swivel table?

a. 45-60 degrees
b. 30-45 degrees
c. 10-25 degrees
d. 0-20 degrees

A cylindrical grinder is NOT suited for internal grinding.

a. True
b. False
1. How long should a grinding wheel run at full speed before work is started?
   a. 15 sec.
   b. 30 sec.
   c. 45 sec.
   d. 1 min.

2. What type of eye protection should be worn at all times in the shop?
   a. Contacts
   b. Face shield
   c. Safety glasses with side shields
   d. Sunglasses

3. What is the best advice regarding stopping a grinding wheel after it has been turned off?
   a. Never stop the wheel with hands.
   b. Stop a slow-moving wheel with hands.
   c. Use a block of wood to stop the wheel.
   d. Use a piece of steel to stop the wheel.
4.  | L1, Kl | c | IML Mod. 7 | 0890 | A | C.S. |

What should be done if a person is cut by a grinding wheel?
a. Wash the cut with coolant.
b. Keep working.
c. Report to instructor.
d. Go home without reporting it.

5.  | L1 | a | Olivo | 0890 | C | C.S. |

While running a cutter grinder, the operator should be very careful not to hit tooling.
a. True
b. False

6.  | L1 | b | Olivo | 0890 | A | C.S. |

Sharpened cutters can be handled without a rag or gloves.
a. True
b. False

7.  | L1 | a | Olivo | 0890 | A | C.S. |

If a grinding wheel has been dropped, it should be ring-tested before mounting it on the machine.
a. True
b. False
The grinder should be clean and oiled for best operation.

a. True

b. False

The grinder should be cleaned with an air hose.

a. True

b. False

The operator should take time to check the grinding machine for any loose or broken parts.

a. True

b. False
What should a grinding wheel be inspected for before it is used?

a. Dirt
b. Cracks
c. Oil
d. Age

Before putting the grinding wheel on the spindle, inspect it for blotters.

a. True
b. False

If the grinding wheel does not fit, it should be forced on.

a. True
b. False
What type of wheel is used for hard material?

a. Coarse grit  
b. Fine  
c. Hard  
d. Soft

What type of wheel is used to grind a sharp corner against a shoulder?

a. Coarse grit  
b. Wide  
c. Hard  
d. Soft

What does the operator wipe off before mounting a grinding wheel?

a. Table  
b. Dresser  
c. Flange  
d. Hand wheel
17. On a surface grinder, which tool is best for dressing the grinding wheel?
   a. High-speed tool
   b. Diamond
   c. Carbide
   d. Dressing stick

18. What is one cause of grinding wheel chatter?
   a. Poorly dressed wheel
   b. Wheel that is too soft
   c. Too much coolant
   d. Too strong a magnet

19. A wheel that is out-of-balance will not cause chatter.
   a. True
   b. False
On a tool and cutter grinder, where should the wheel center line be (relative to the center line of the cutter) while the wheel is rotating toward the cutting edge?

a. Above
b. Below
c. On
d. None of the above

What will happen if the cutter relief angle is too large?

a. No sharpening
b. Poor finish on cutter
c. Heat build-up
d. Damage to wheel

When measuring clearance angles on a rotary cutting tool, which method is faster and measures directly in degrees?

a. Indicator drop
b. Clearance gage
c. Drill gage
d. None of the above
23. A long cutter grinding arbor is used for light grinding.
   a. True
   b. False

24. Internal grinding can be done by adding an internal grinding
    spindle to a tool post grinder.
   a. True
   b. False

25. Most cutters do not need a secondary clearance angle.
   a. True
   b. False
1. | L1, K1 | b | IML Mod. 7 | 0890 | C | C.S. |

How long should a grinding wheel run at full speed before work is started?

- 0.5 sec.
- 0 sec.
- 5 sec.
- min.

2. | L1, K1 | c | IML Mod. 7 | 0890 | C | C.S. |

What type of eye protection should be worn at all times in the shop?

a. Contacts
b. Face shield
c. Safety glasses with side shields
d. Sun glasses

3. | L1, K1 | a | IML Mod. 7 | 0890 | A | C.S. |

What is the best advice regarding stopping a grinding wheel after it has been turned off?

a. Never stop the wheel with hands.
b. Stop a slow-moving wheel with hands.
c. Use a block of wood to stop the wheel.
d. Use a piece of steel to stop the wheel.
4. What should be done if a person is cut by a grinding wheel?
   a. Wash the cut with coolant.
   b. Keep working.
   c. Report to instructor.
   d. Go home without reporting it.

5. While running a cutter grinder, the operator should be very careful not to hit tooling.
   a. True
   b. False

6. Sharpened cutters can be handled without a rag or gloves.
   a. True
   b. False

7. If a grinding wheel has been dropped, it should be ring-tested before mounting it on the machine.
   a. True
   b. False
<table>
<thead>
<tr>
<th>Field</th>
<th>Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Unique item number</td>
</tr>
<tr>
<td>2</td>
<td>Duty area and task number (Mo. competency profile)</td>
</tr>
<tr>
<td>3</td>
<td>Letter of correct answer</td>
</tr>
<tr>
<td></td>
<td>Source (author, year of publication)</td>
</tr>
<tr>
<td>5</td>
<td>Date (MMYY)</td>
</tr>
<tr>
<td>6</td>
<td>Learning domain (Cognitive, Affective, Psychomotor)</td>
</tr>
<tr>
<td>7</td>
<td>Writer(s)/reviewer(s)</td>
</tr>
<tr>
<td>8</td>
<td>Accompanying artwork (ART)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>L2</th>
<th>a</th>
<th>IML Mod. 7</th>
<th>0890</th>
<th>C</th>
<th>C.S.</th>
</tr>
</thead>
<tbody>
<tr>
<td>8.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The grinder should be clean and oiled for best operation.

a. True
b. False

<table>
<thead>
<tr>
<th></th>
<th>L2</th>
<th>b</th>
<th>IML Mod. 7</th>
<th>0890</th>
<th>A</th>
<th>C.S.</th>
</tr>
</thead>
<tbody>
<tr>
<td>9.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The grinder should be cleaned with an air hose.

a. True
b. False

<table>
<thead>
<tr>
<th></th>
<th>L2</th>
<th>a</th>
<th>IML Mod. 7</th>
<th>0890</th>
<th>A</th>
<th>C.S.</th>
</tr>
</thead>
<tbody>
<tr>
<td>10.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The operator should take time to check the grinding machine for any loose or broken parts.

a. True
b. False
What should a grinding wheel be inspected for before it is used?

a. Dirt
b. Cracks
c. Oil
d. Age

Before putting the grinding wheel on the spindle, inspect it for blotters.

a. True
b. False

If the grinding wheel does not fit, it should be forced on.

a. True
b. False
14. What type of wheel is used for hard material?
   a. Coarse grit
   b. Fine
   c. Hard
   d. Soft

15. What type of wheel is used to grind a sharp corner against a shoulder?
   a. Coarse grit
   b. Wide
   c. Hard
   d. Soft

16. What does the operator wipe off before mounting a grinding wheel?
   a. Table
   b. Dresser
   c. Flange
   d. Hand wheel
1. How should chips be removed from a CNC machine?
   a. Brush or hook
   b. Compressed air
   c. Gloves
   d. Oil rag

2. What should be done if the tool breaks or a crash is imminent on a CNC machine?
   a. Push the emergency stop button.
   b. Notify the instructor.
   c. Rewind the program.
   d. Go to manual data input.

3. On manual tool change CNC machines, when should the tool be changed?
   a. When all rotary and table motion has stopped
   b. At the end of the program
   c. Before the finish cut
   d. By pushing the program hold button
When should lubrication and maintenance procedures be performed on a CNC machine?

- At the end of the day
- When the computer indicates an error code
- Before a major malfunction
- According to the manufacturer's specifications

When should chips be removed from a CNC machine?

- As necessary
- When they reach the top of the tray
- After they have cooled off
- At the end of the week

How should tools such as hammers, micrometers, wrenches, etc., be used on a CNC machine?

- Remove them from the machine immediately after use.
- Remove them from the cutter path.
- Leave them on the machine table.
- They are not needed on a CNC machine.
Before any program can be put into a CNC machine, what must be done with the print?

a. Make backup copies.
b. File it in the print drawer.
c. Define all geometry.
d. Define all terms.

What is the basis of the coordinate measuring system for CNC-operated milling and punch machines?

a. Orthogonal
b. Cartesian
c. Point to point
d. Incremental

On a CNC machine, to what do c, w, x, y, and z refer?

a. Axis movements
b. Quadrants
c. Isometric projections
d. Trigonometric construction
10. What are the codes that allow the controller to interpret block data called?
   a. Preparatory
   b. Fixed block format
   c. Word address
   d. Block buffer

11. On a milled part, how much does cutter compensation offset the tool path from the machined surface?
   a. .002"
   b. The cutter radius
   c. The diameter of the tool
   d. The length of the tool

12. What is the process of checking correctness of a new program on the machine?
   a. Coordinate dimensioning
   b. Dry run
   c. Linear interpolation
   d. Sequence determination
From what point are all absolute control systems measured and programmed?

a. Machine table reference point (home)
b. Set-up point
c. Part reference point
d. Point of incidence

What does the tool inventory sheet for a CNC program designate?

a. Available tooling for the system
b. Cost and number of tools in stock
c. Where the tools are located in the shop
d. Tool diameter, length, flutes, helix, rotation, grind

Why is a fixture or jig used to hold multiple pieces for machining?

a. To establish common datums
b. Because they are inexpensive to make
c. Because parts are kept cooler during machining
d. To eliminate extreme axis limits
What must be done to a typical fixture on a CNC machine before the next part is put in it?

a. Remove chips and foreign materials.
b. Re-indicate for accuracy.
c. Re-home the machine axis.
d. Take full increments of .005".

Which step is NOT critical when setting up multiple tools for CNC usage?

a. Check proper tool for number and position.
b. Set tool length offset for each tool.
c. Clean and check all tools before they are used.
d. Omit the steps that involve a missing tool.

When manual override is used to modify the program, what should be done?

a. Observe the cutter chip response to the altered speed/feed.
b. Note or highlight changes on operator instruction sheet.
c. Determine the speed/feed increase or decrease.
d. All of the above
Why should students NOT enroll in occupational training programs?

a. To work toward a career
b. To develop business and industry contacts
c. To avoid taking math, science, or English classes
d. To work toward financial independence

Only one VICA club per school is allowed.

a. True
b. False

g. How many VICA districts does Missouri have?

a. 3
b. 5
c. 7
d. 9
In which national VICA region is Missouri located?

a. 3
b. 4
c. 5
d. 6
<table>
<thead>
<tr>
<th>Field</th>
<th>Contents</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Unique item number</td>
</tr>
<tr>
<td>2</td>
<td>Duty area and task number (Mo. competency profile)</td>
</tr>
<tr>
<td>3</td>
<td>Letter of correct answer</td>
</tr>
<tr>
<td>4</td>
<td>Source (author, year of publication)</td>
</tr>
<tr>
<td>5</td>
<td>Date (MYY)</td>
</tr>
<tr>
<td>6</td>
<td>Learning domain (Cognitive, Affective, Psychomotor)</td>
</tr>
<tr>
<td>7</td>
<td>Writer(s)/reviewer(s)</td>
</tr>
<tr>
<td>8</td>
<td>Accompanying artwork (ART)</td>
</tr>
</tbody>
</table>

5. Leadership 2 | b | VICA | 0889 | C | Fred Smith |

Personal values rarely affect career choices.

a. True

b. False

6. Leadership 2 | a | VICA | 0889 | C | Fred Smith |

A career should align with one's personal values, interests, and abilities.

a. True

b. False
7. Effective decision making can be broken down into six steps.
   a. True
   b. False

8. A new supervisor should be liked by all workers in order to be effective.
   a. True
   b. False

9. Which goal should a supervisor work toward in order to succeed and improve worker morale?
   a. Keep attention on getting work done
   b. Be as fair as possible
   c. Avoid taking a worker's negative feelings personally
   d. All the above

10. To be more productive, workers need ways to measure and use time more effectively.
    a. True
    b. False
Which trait or traits do employers expect from their employees?

a. Cooperation and acceptance of evaluation
b. Honesty
c. Initiative
d. All the above

Which characteristic should employees expect from their employers?

a. Understanding of job requirements
b. Fair payment for labor
c. Equal treatment for all employees
d. All of the above

Effective communication, care for people, flexibility, dependability, optimism, and perseverance are traits of good leaders.

a. True
b. False
14. Good table manners include entering into table conversation.
   a. True
   b. False

15. A coat room clerk at a restaurant is usually NOT tipped.
   a. True
   b. False

16. Employees should stand when an authority figure (employer) joins them for a meal.
   a. True
   b. False
17. | Leadership 6 | b | VICA | 0889 | C | Fred Smith |

It is a good idea to use big words when writing in order to impress people.

a. True
b. False

18. | Leadership 6 | a | VICA | 0889 | C | Fred Smith |

Self-concept affects verbal communication.

a. True
b. False

19. | Leadership 6 | a | VICA | 0889 | C | Fred Smith |

When speaking, always use a vocabulary that others can understand.

a. True
b. False
20. Professionals respect themselves and others.
   a. True
   b. False

21. A person's code of ethics defines his or her principles or standards of right and wrong.
   a. True
   b. False

22. A professional code of ethics includes both legal and moral standards.
   a. True
   b. False
23. | Leadership 8 | a | VICA | 0889 | C | Fred Smith |

Appropriate business dress for women would include a skirt.

a. True
b. False

24. | Leadership 8 | a | VICA | 0889 | C | Fred Smith |

Appropriate business attire for men would include a traditional dark suit.

a. True
b. False

25. | Leadership 8 | a | VICA | 0889 | C | Fred Smith |

Fashion accessories reflect the self-image of an individual.

a. True
b. False

26. | Leadership 8 | a | VICA | 0889 | C | Fred Smith |

Getting plenty of sleep and avoiding junk food can improve personal appearance.

a. True
b. False
27. A resume is a well-organized overview of what one has to offer an employer.
   a. True
   b. False

28. A letter of application should ask an employer for an interview.
   a. True
   b. False

29. The local chamber of commerce can help people research employers.
   a. True
   b. False
When parliamentary procedures are used at a meeting, only one subject at a time should be discussed.

a. True
b. False

Parliamentary procedure calls for the finishing of old business before new business is started.

a. True
b. False

Parliamentary procedure calls for standing committee reports to be given before special committee reports.

a. True
b. False
Proper use of the gavel signals members to stand or sit.

a. True

b. False