
NIMS Machining Level I Preparation Guide

Turning

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Overview

Introduction

This preparation guide or test advisor is intended to help machinists study and prepare for the National Institute for Metalworking Skills (NIMS) written credentialing exam. The sample exam will prepare machinists to take the actual credentialing exam. None of the questions are duplicates from the credentialing exam. However, this preparation guide is a useful tool for reviewing technical knowledge and identifying areas of strength and deficiency for adequate credentialing exam preparation.

Achieving a NIMS credential is a means through which machinists can prove their abilities to themselves, to their instructors or employers and to the customer. By passing the NIMS credentialing exam, you will earn a valuable and portable credential. Because the credentialing exam is challenging, you will have the satisfaction of proving to yourself and others that you have reached a level of competency that is accepted nationally.

Who Wrote the Questions?

A panel of technical experts, from all areas of the metalworking industry, wrote the questions used on the actual credentialing exam. The panel of experts ranged from company presidents and owners, to engineers and quality personnel, to actual working machinists. Credentialing exam questions are designed to assess the knowledge skills needed for entry-level machinists. They are written to deal with practical problems, computations, and decisions machinists encounter in their day-to-day work.

The technical experts must first validate the credentialing exam questions. Then, before the questions become part of the credentialing exam, qualified machinists and industry personnel again validate them on a national level. Rejected questions are then rewritten or discarded altogether.

How to Prepare for the Credentialing Exam

Become familiar with the credentialing exam content and question format by utilizing the tools provided in this exam preparation guide. The **Exam Specifications** portion of this guide contains a summary description of the content covered by the actual credentialing exam. The **Task List** describes competencies for each particular area associated with the credentialing area.

Each question on the sample exam is linked to a particular task or set of tasks found in the **Task List**. Therefore, a review of the **Task List**, with an eye on judging whether you know how to perform each task listed, will provide you with valuable information as you prepare for the credentialing exam.

The questions are multiple-choice. Note instructions that may accompany some questions. Be sure to read each question carefully (twice, if necessary) so that you know exactly what is being asked. Check each answer and your work since an error in computation or understanding may make a wrong answer appear correct.

The following four steps are suggested for effective preparation:

- Step 1: Study the content list for each credentialing exam you will attempt.
- Step 2: Carefully read the **Task List** for each section.
- Step 3: Review the sample exam to become familiar with subject matter and question type. This is a very important step.
- Step 4: Repeat steps 1 through 3 and identify the area(s) where you need additional study. Use the preparation guide as a self-diagnostic assessment tool.

Areas of Knowledge Measured by the Credentialing Exam

The knowledge and skills you will need to pass the credentialing exam are as follows:

Credentialing Exam Sections

Although the NIMS credentialing exam is not labeled, it is divided into four major sections. They are:

- **Turning Speeds and Feeds**
- **Work Holding Devices and Basic Setup**
- **Lathe Components**
- **Turning Operations**

Following is a list of the basic knowledge areas assessed by the credentialing exam:

- **Process Improvement and Troubleshooting:** To improve a process, one must first understand the process. A competent machinist should be able to identify the root cause if a straight cut between centers measures as a taper. Measuring a taper (when a straight cut is intended) and moving the tailstock the proper amount based on the measurement is another skill needed to effectively and efficiently engage in turning operations. Other skill sets include the proper way to take the first cut on cast iron and hot roll steel, the root cause of lathe center runout, properly turning hard material and the effect of having the lathe tool above or below center.
- **Turning Safety:** Safety knowledge and practice is an important component for lathe operations. The operator must know the basic personal protective equipment needed to effectively operate a lathe safely. Proper lifting techniques, learning how to find MSDS and HMIS information and some basic personal first aid are essential knowledge for all machinists. Other safety components involve the safe installation of chucks and collets as well as chip control and chip removal.
- **Lathe Controls:** An understanding of basic lathe control mechanisms enables the machinist to utilize the lathe in an efficient and productive manner. Knowing how each control works and its function is imperative to any safe turning operation. Knowing how to use the feed reverse lever, half nut lever and the proper method to change speeds and feeds is imperative knowledge. Each manufacturer of lathes has unique methods of implementing lathe controls. It is the job of the machinist to become familiar with each particular set of lathe controls.
- **Single Point Threading:** Single point threading is one of the fundamental skill sets needed to operate a lathe. The machinist must be familiar with thread angles, helix angles, thread pitch diameter, lead and different families of thread forms. Proper alignment of the threading tool as well as the proper location of the compound rest are essential setup steps needed to turn threads with a single point tool. A machinist must be able to calculate the proper infeed to prevent the thread from either being cut too deep or too shallow.

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- **Tapping, Fits and Allowances:** The turning process is often used to size shafts and holes for certain fits. Knowledge of the definitions of a fit and an allowance is essential prior to machining. The machinist should have a basic knowledge of the types of fits and be able to reference the *Machinery's Handbook* to determine the size of the each component. Planning the sequence of operations is essential to prevent ruining a fit due to burrs and poor surface finish.
 - **Measurement:** Choosing the proper measuring instrument is an important facet of proper inspection. The best choice is dependent on the accuracy and reliability of the measuring instrument. The tolerance as well as the application will determine the choice. A machinist must also know how to read the measuring instrument properly. An example would be comparing a depth micrometer, outside micrometer and a dial indicator. Thread measurement and surface finish are also important factors when measuring features produced by the turning process.
 - **Process Control:** Monitoring the process with process control techniques results in quality parts and customer satisfaction. The first step in any process control endeavor is knowing when the part is accepted or rejected. Basic knowledge of process control techniques such as inspection sheets, Pareto charts, capability studies and X bar/R charts are effective means of process control. The most common method of process control, besides the inspection sheet, is SPC (statistical process control) utilizing the X bar/R chart. The machinist must understand the definition of range, mean, upper control limit, lower control limit and sample size.
 - **Tooling and Lathe Setup:** Many lathe applications use tooling with carbide inserts. However, some lathe applications use high-speed steel tools that must be ground to the desired shape. The machinist should know the proper sequence for grinding the surfaces of the lathe tool applying the proper rake angles. Knowledge of the various methods of aligning the lathe centers and the degree of accuracy of each method depends on the tolerance of the work piece dimensions. Proper setups for facing and compound rest fundamentals are other essential skill sets included in this area.
 - **Layout Procedures:** Layout is the initial step in any machining process. Understanding the concepts and proper utilization of semi-precision and precision layout techniques is important for every machinist. The machinist should know the function of a scribe and the types of layout instruments used with surface plates.

Before the Exam

Try to be well rested for the credentialing exam. Being well rested will make you more alert and efficient when taking the credentialing exam. Review any course material from your instructor. Review the test advisor information and sample exam found in the preparation guide. Bring at least two sharpened (#2) soft leaded pencils and an eraser. In addition, bring a calculator and the *Machinery's Handbook*. Become familiar with the procedure for taking a Scantron test. If you wish to pace yourself, bring a watch, or be aware of the location of clocks at the test site. Make sure to bring some form of identification, any necessary paperwork from NIMS and arrive at the test site at least 10 to 15 minutes prior to the specified exam time.

At the Testing Site

When you arrive at the test center, wait in the assigned area until the proctor begins the exam orientation and administration. The proctor will instruct you in the proper procedure for filling out any information on the answer sheet and will tell you the amount of time allotted for the credentialing exam, reference materials that can be used and if a calculator is permissible.

Once the credentialing exam has begun, keep track of time. Avoid spending too much time on any one question. Answer the questions to which you know the answers and then go back to those you had difficulty with if time allows. Repeat this process for each section. Again, do not spend an excessive amount of time on any one question.

It is to your advantage to answer every question. Do not leave any answers blank. Answers that are left blank will be counted as incorrect. Your score will be based on the number of correct answers.

Credentialing Exam Content, Sample Question Summary

Credentialing Exam Content and Sample Question Overview

The following material is designed to help machinists prepare for and obtain a NIMS credential in the area of Turning. This section begins with an **Exam Specifications** section. The **Exam Specifications** will list the main categories covered on the credentialing exam. This section also lists the name of the topic, the number of questions pertaining to that topic and the percentage of the credentialing exam devoted to that topic.

The **Task List** describes competencies a machinist must have in order to receive a credential for Turning. The **Task List** has a two-fold purpose. The first purpose is to prepare the machinist for credentialing. The second is to encourage instructors to apply the **Task List** as a measurement of the effectiveness of their curricula.

The number of questions in each content area may not be equal to the number of tasks listed. Some of the tasks are more complex, broader in scope and may be covered by several questions. Other tasks are simple and narrower in scope and one question may cover several tasks. The main objective in listing the tasks is to describe accurately what is done on the job, not to make each task correspond to a particular exam question.

Sample questions follow the **Task List**. Although these same questions will not appear on the actual credentialing exam, they are in the same format as the actual exam questions. All questions on the credentialing exam are in the multiple-choice format. Some concepts evaluated on the credentialing exam are assessed in greater depth in the sample exam questions. The sample exam questions are developed to evaluate conceptual knowledge of machining rather than specific competencies. The sample exam may be longer than the actual credential exam.

Answers to the sample questions are located at the end of the sample exam. Work with your instructor to identify weak areas and evaluate answers. Use the sample exam as a study guide and diagnostic tool.

Exam Specifications – Turning

Content Area	No. Of Questions	% of Test
Turning Speeds and Feeds	9	12.3
Work Holding Devices and Basic Setup	9	12.3
Lathe Components	7	9.6
Turning Operations	7	9.6
Process Improvement and Troubleshooting	7	9.6
Turning Safety	5	6.8
Lathe Controls	5	6.8
Single Point Threading	5	6.8
Tapping, Fits and Allowances	5	6.8
Measurement	4	5.5
Process Control	4	5.5
Tooling and Lathe Setup	4	5.5
Layout Procedures	2	2.9
	Total of 73	100 %

Task List

Turning

Reading this **Task List** will allow the machinist to focus preparation on those subject areas that need attention. The instructor can use the **Task List** to fine-tune the curricula to meet the standards. If you feel comfortable with your knowledge about a particular task, you are probably ready to answer the questions on that subject matter. If, on the other hand, you have any doubts, you and your instructor can work on these areas to build up proficiencies. Many texts and other resources are available to provide information.

Turning Speeds and Feeds

- Definition of cutting speed
- Definition of feed
- Calculating the RPM
- Identification of the RPM formula
- Calculating the number of revolutions needed to move a lathe tool a given distance when given the feed per revolution
- Time required to make one cut over a given length when given the RPM and feed per revolution
- Calculating the RPM of a given drill diameter when drilling on a lathe

Sample questions:

- 1) Which of the following statements best defines cutting speed:
 - a) Cutting speed is based on RPM and is the amount a times a tool revolves in 1 second
 - b) Cutting speed is based on the diameter of the tool and is given in surface revolutions per minute
 - c) Cutting speed is based on the distance the work moves past the tool based on the number of feet that passes the tool in one minute and is given in surface feet per minute
 - d) Cutting speed is based on revolutions per diameter of the tool and is given in feet per inch

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- 2) Which of the following statements best defines feed?
- a) The machine movement that causes a tool to cut into or along the surface of a work piece
 - b) The distance the work piece moves past the tool in one minute
 - c) The revolution of the tool per minute
 - d) The diameter of the tool correlated to the distance the tool moves in one second
- 3) When calculating the RPM for a turning operation, the machinist uses _____ instead of the diameter of the tool.
- a) Tool nose radius
 - b) The diameter of the work piece
 - c) Cutter speed compensation
 - d) Surface feet per minute
- 4) What is the RPM needed to drill a $\varnothing.750$ " hole in mild steel with a cutting speed of 100 SFM on 3.50" diameter stock (use 3.82 for the constant)?
- a) 262.5 RPM
 - b) 286.5 RPM
 - c) 123 RPM
 - d) 509 RPM
- 5) A part is being turned at 250 RPM with a feed rate of .008 inches per revolution. How long will it take to make one pass if the part is 10.625 inches long?
- a) 4.25 minutes
 - b) 5.30 minutes
 - c) 1.75 minutes
 - d) 2.10 minutes

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- 6) Identify the proper formula for determining the RPM for a turning operation:
- a) $(CS \bullet 3.82) / D$
 - b) $D / (CS/3.82)$
 - c) $(D \bullet 3.82) / CS$
 - d) $(D \bullet CS) / 3.82$
- 7) How is a feed rate designated on a lathe?
- a) Feet per second
 - b) Inches per minute
 - c) Feet per revolution
 - d) Inches per revolution
- 8) The feed rate is at .008 IPR. How many RPM will it take to move the tool a distance of 3.600 inches in a minute?
- a) 288 RPM
 - b) 225 RPM
 - c) 576 RPM
 - d) 450 RPM
- 9) Which of the following formulas is the correct formula for determining the time to make one cut across a given distance? {T = time f = feed (IPR)
L = length of cut (inches) N = spindle speed (RPM)}
- a) $T = (fN) / L$
 - b) $T = f / NL$
 - c) $T = L / (fN)$
 - d) $T = (Lf) / N$

Work Holding Devices and Basic Setup

- Best method of holding a long shaft requiring a drilling and boring operation on one end
- Steps to clamp a rectangular block using a 4-jaw chuck
- Shapes of work that can be held with a 3-jaw universal chuck
- Shapes of work that can be held with an independent chuck

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- The feature that identifies a chuck as a universal chuck
 - The function of a lathe steady rest
 - The function of a lathe follower rest and how it is attached to the lathe
 - The advantage of turning between centers
 - The included angle of a lathe center

Sample questions:

- 10) Which of the following shapes **cannot** be held adequately by a 3-jaw universal chuck:
- a) Hexagon
 - b) Rounds
 - c) Octagon
 - d) All of the above
 - e) Only a and c
- 11) The included angle of a lathe center measures:
- a) 30°
 - b) 45°
 - c) 60°
 - d) 75°
- 12) The primary advantage of turning between centers is that:
- a) The work piece can be turned end for end without losing concentricity
 - b) Each end can be total faced off in one setup
 - c) The part is totally clamped (360° of contact)
 - d) Chatter is reduced on long work pieces
- 13) Identify the statement that is **not** characteristic of a lathe steady rest:
- a) The jaws on a steady rest are made of hardened tool steel
 - b) The steady rest is clamped to the bed of the lathe and the jaws are initially clamped finger tight
 - c) The jaws on a steady rest are soft and support long shafts
 - d) The steady rest should not be used on rough castings

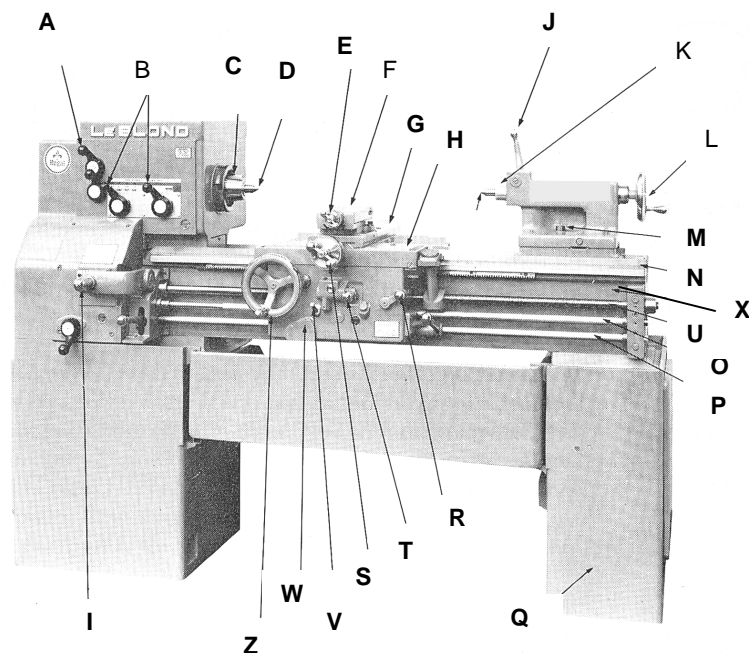
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- 14) Which of the following statements **does not** describe a universal chuck:
- a) A universal chuck can have two, three or six jaws
 - b) All the jaws move in or out equally by means of a scroll plate located behind the jaws
 - c) Accuracy is lost when the scroll and jaws wear
 - d) Each jaw can move independently of the others with the jaws always being soft
- 15) The work holding device best used to clamp round, square or irregular shaped pieces is a/an:
- a) Collet
 - b) Faceplate, lathe dog, lathe center
 - c) Independent chuck (4-jaw chuck)
 - d) Universal chuck
 - e) Follower rest
- 16) A drilling and boring operation has to be performed on one end of a shaft measuring 3" in diameter and 25" long. Which of the following methods provides the most stable set up?
- a) A faceplate, lathe dog and live center (in the tailstock)
 - b) A three jaw universal chuck, follower rest and live center (in the tailstock)
 - c) A three jaw universal chuck and a steady rest
 - d) Collet, follower rest, lathe dog and faceplate, dead center
- 17) Which of the following statements is a step for clamping a square block using a 4-jaw chuck?
- a) Facing the end of the block to prepare the block for center drilling
 - b) Using a draw bar to compress the jaws around the work piece
 - c) Mounting the block on the faceplate and using a lathe dog as a driver
 - d) Use the concentric rings on the chuck to visually align the jaws and work piece on center, then use a dial indicator for final alignment

- 18) Which of the following accessories is attached to the carriage and used to support long thin shafts?
- a) Follower rest
 - b) Collet
 - c) Faceplate, lathe centers and a lathe dog
 - d) Steady rest

Lathe Components

- Function of the gibs in a cross-slide
- Characteristics that determine the size of a lathe
- Carriage
- Lead screw
- Apron
- Headstock
- Spindle
- Tailstock
- Bed

Use the following diagram to identify lathe components.



Sample questions:

- 19) The carriage of the lathe is identified by the letter:
- a) Z
 - b) H
 - c) A
 - d) E
- 20) The tailstock of the lathe is identified by the letter:
- a) M
 - b) C
 - c) R
 - d) F
- 21) The leadscrew of the lathe is identified by the letter:
- a) C
 - b) U
 - c) W
 - d) L
- 22) The bed of the lathe is identified by the letter:
- a) X
 - b) Q
 - c) F
 - d) Z
- 23) The spindle of the lathe is identified by the letter:
- a) K
 - b) P
 - c) C
 - d) H

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- 24) The apron of the lathe is identified by the letter:
- a) M
 - b) F
 - c) T
 - d) W
- 25) Which of the following is **not** characteristic of the gibs found in the cross slide and compound slide?
- a) Only adjust the gibs when the slide is completely over the mating dovetail
 - b) Tapered gibs only have one thrust screw
 - c) Gib adjustments are used to control the amount of side play on the slide
 - d) The gibs are adjusted to maintain a .003" clearance gap that is checked with a feeler gage
- 26) The size of the lathe is determined by:
- a) The size of the lathe centers
 - b) Length of the bed
 - c) The largest diameter of material capable of turning
 - d) The highest RPM of the motor
 - e) Only b and c
 - f) Only a and d

Turning Operations

- Procedure and spindle speed relationship for a parting operation
- Methods of expressing tapers
- Definition of knurling
- Cutting speed relationship, stock allowance and basic procedure for reaming on a lathe
- Proper location for the tool point when performing a facing operation
- Methods to enlarge an existing hole on a lathe
- RPM relationship between drilling and reaming

Sample questions:

- 27) A taper can be defined by:
- a) Taper per foot (tpf)
 - b) Taper per inch (tpi)
 - c) Included angle in degrees
 - d) Angle with the centerline in degrees
 - e) All of the above
 - f) Only a and b
- 28) Name the tool and process used to precisely enlarge an existing hole:
- a) Boring bar, boring
 - b) Twist drill, drilling
 - c) Counterbore, counterboring
 - d) Parting tool, parting
 - e) Spotfacing tool, spotfacing
- 29) Reaming operations on a lathe require less RPM than drilling for the same diameter. The RPM for reaming is approximately _____ the RPM for drilling.
- a) One-third
 - b) One-half
 - c) Twice
 - d) The same as
 - e) Three times
- 30) To prevent the creation of a small protrusion when performing a facing operation, the machinist must set the tool point:
- a) Slightly above center
 - b) Slightly below center
 - c) On center
 - d) Below center with a negative side relief angle

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- 31) Which of the following is **not** characteristic of a parting operation?
- a) The parting tool must be set on center and the carriage of the lathe should be locked to the ways
 - b) The RPM is the same as for drilling the same diameter
 - c) The parting tool must be set square to the work piece
 - d) The tool should always be making a chip applying a lubricant
 - e) Diagonally ground parting tools reduce the burr
- 32) Knurling is:
- a) A raised impression on the surface of a turned work piece
 - b) Displacement of material and not impressions caused by a cutting action
 - c) Usually produced with hardened rolls that create a pattern
 - d) All of the above
 - e) Only a and c
- 33) Which of the following is **not** part of a procedure for knurling?
- a) Mount the work piece between centers to prevent creeping
 - b) Do not lubricate the knurling tool and work piece
 - c) Use low RPM similar to RPM used for threading
 - d) Use a feed of .005" to .015 inches
 - e) Center the knurling rollers vertically
- 34) To machine ream a hole on the lathe, the machinist should:
- a) Drill a hole to the diameter specified on the print prior to reaming
 - b) Use twice the feed rate for a drilling operation with the same diameter
 - c) Use twice the cutting speed of a drilling operation for that same diameter
 - d) Install the reamer in the headstock within a live center
 - e) Let the cutting edges of the reamer rub to glaze to a finished size

Process Improvement and Troubleshooting

- Effect of lathe center misalignment
- Effect of headstock misalignment
- Proper procedure for taking the initial cut on cast iron
- Direction to align centers when given dimensions and their locations
- Root causes for a headstock center to runout
- Spindle speed relationship when machining a block of hard metal
- Root cause of a small tip left at the center of the work piece after a facing operation

Sample questions:

- 35) If the tailstock is offset in a direction away from the operator, the shaft will:
- a) Have a taper with the end by the tailstock being larger
 - b) Be stepped with the larger step nearest the headstock
 - c) Cut oversize evenly across the shaft the amount of the offset
 - d) Have a taper with the end by the headstock being larger
- 36) A trail cut was taken on the lathe. The readings on the work piece are 2.240" at the headstock end and 2.220" at the tailstock end. To align the centers, the machinist should adjust the tailstock:
- a) .005 inches toward the operator
 - b) .010 inches toward the operator
 - c) .020 inches away from the operator
 - d) .010 inches away from the operator
- 37) A small tip was left on the end of the part when performing a facing operation. The root cause of this problem is:
- a) Setting the tool at a right angle to the facing surface with the tool on center
 - b) Setting the tool on center
 - c) Setting the tool slightly below center
 - d) The end relief angle of the cutting edge is too large

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- 38) Lathe center runout in the headstock may be caused by:
- a) Burrs and nicks on the center sleeve or spindle
 - b) Chips inside the spindle area that accommodates the lathe center
 - c) The angle and centerline of the angle was ground off center from the center axis
 - d) All of the above
 - e) Only a and b
- 39) Which of the following is **not** a true statement for taking the first cut on a cast iron shaft?
- a) Take a depth of cut that cuts below the hard casting scale on the outside surface
 - b) Apply heavy cutting oil
 - c) Machine the part dry
 - d) Reduce the cutting speed by 5% - 10%
- 40) Which of the following statements best describes a root cause for excessive tool wear when machining a hard material?
- a) The RPM is set too high
 - b) The feed is set slightly below the recommended feed rate
 - c) The cutting tool is defective and must be replaced
 - d) The depth of cut is too shallow and must be increased

Turning Safety

- Proper Personal Protective Equipment for operating a lathe
- Potential safety hazards when operating a lathe
- Basic hazardous communication
- Proper method to lift heavy objects
- Self-imposed first aid procedure for materials (solids) that become lodged in the eye

Sample questions:

- 41) Which of the following type of personal protective equipment (PPE) is best for turning operations:
- a) Safety glasses with side shields
 - b) Steel toe work shoes with metatarsal protection
 - c) Ear plugs
 - d) Heat resistant gloves
 - e) Back support vest
- 42) Which one of the following types of information is **not** found on MSDS?
- a) Chemical composition
 - b) Container size
 - c) Flash point
 - d) Recommended PPE
- 43) Which one of the following colors is not found on HMIS stickers?
- a) Red
 - b) Blue
 - c) White
 - d) Green
- 44) Which one of the following steps should **not** be performed when lifting heavy objects?
- a) Lift with the knee bent
 - b) Lift with the arms only, keeping the back hunched
 - c) Keep the back straight
 - d) Keep the arms straight
- 45) If a small particle becomes lodged in the eye, the first step for self-imposed first aid is to:
- a) Rub the eye to dislodge the particle
 - b) Use compressed air to blow out the particle
 - c) Pull the top lid over the bottom lid to help dislodge the particle
 - d) Pull at the outside corner of the eyelid and then at the inside corner of the eyelid to dislodge the particle

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- 46) Which of the following are potential safety hazards when operating a lathe?
- a) Removing long stringy chips with bare hands
 - b) Removing shields when turning to view the operation
 - c) Failing to use a lube on a dead center
 - d) Cutting a length less than two diameters in a chucking operation
 - e) All of the above
 - f) Only a and b

Lathe Controls

- Function of the feed reverse lever
 - Function of the quick-change gear box
 - Proper method for changing the spindle speed on a geared head lathe
 - Purpose of the half-nut lever
- 47) The feed reverse lever will reverse the direction of the _____ and controls the direction of movement for both the _____ and the _____:
- a) Motor, crossfeed, tailstock
 - b) Leadscrew, crossfeed, longitudinal feed
 - c) Back gear, headstock, tailstock
 - d) Leadscrew, tailstock, crossfeed
- 48) To change the RPM on a **geared** head lathe, the machinist must:
- a) Move the belt from one set of pulleys to the next set
 - b) Engage the half nut lever to get twice the RPM of the motor
 - c) Use the feed reverse lever and the tailstock lock lever
 - d) Shift speed change levers and feed selection levers
- 49) The main function of the lathe half-nut lever is to facilitate:
- a) Threading
 - b) Counterboring
 - c) Taper turning
 - d) Straight turning

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- 50) The distance the carriage moves per revolution of the spindle is determined by:
- a) Feed reverse lever
 - b) Quick change gear box
 - c) Thread dial
 - d) Clutch rod
- 51) On most lathes, the crossfeed speed is about _____ that of the longitudinal feed.
- a) Two to three times
 - b) One eighth to one quarter
 - c) One third to one half
 - d) The same speed to two times

Single Point Threading

- Thread angle for an American National thread form
 - Proper direction and angle to rotate the compound rest for chasing an external right handed thread
 - Infeed calculations (single depth) for a given American Standard thread
 - Method of aligning a V-threading toolbit with the work piece
 - Proper direction and angle to rotate the compound rest for chasing an internal right handed thread
- 52) What is the angle formed by the sides of the thread for an American National thread form?
- a) 30°
 - b) 60°
 - c) 90°
 - d) 120°

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- 53) A _____ is used to align a single point threading tool with the work piece.
- a) Screw pitch gage
 - b) Feeler gage
 - c) Center gage
 - e) Taper gage
- 54) The compound rest is set perpendicular to the axis of the work piece (centerline of the lathe). To cut (chase) an external right-handed thread, the compound rest must be swiveled:
- a) 60° to the left
 - b) 45° to the left
 - c) 29.5° to the right
 - d) 90.5° to the right
- 55) The compound rest is set perpendicular to the axis of the work piece (centerline of the lathe). To cut (chase) an internal right-handed thread, the compound rest must be swiveled:
- a) 29.5° to the left
 - b) 29.5° to the right
 - c) 59.5° to the right
 - d) 59.5° to the left
- 56) Using the *Machinery's Handbook* as a reference, calculate the amount of infeed for an American Standard Unified Inch Screw thread form with 18 threads per inch. Use the following equation:
- Infeed = $P \bullet .708$**
- P = pitch**
- a) .03608
 - b) .04687
 - c) .05293
 - d) .03934

Tapping, Fits and Allowances

- Reference the standard clearance fit for a given diameter
- Appropriate process plan for a slip fit hole exceeding 1 inch in diameter
- Determine the tap drill for a given National Pipe Thread
- The allowance for a press fit for a shaft of a given diameter
- Tap drill for a given thread

Sample questions:

- 57) Using the *Machinery's Handbook* as a reference, calculate the diameter of a hole for an RC1 clearance fit with a 2.000 inch diameter shaft:
- a) 2.0005
 - b) 1.9997
 - c) 2.0058
 - d) 1.9963
- 58) Using the *Machinery's Handbook* as a reference, determine the tap drill diameter that will produce a 75% thread for a $\frac{3}{4}$ -10 American National form thread:
- a) 17/32 drill
 - b) 23/32 drill
 - c) 21/32 drill
 - e) 19/32 drill
- 59) Using the *Machinery's Handbook* as a reference, calculate the diameter of a shaft for an LN2 interference fit with 1.500 inch diameter hole:
- a) 1.5051
 - b) 1.5013
 - c) 1.4998
 - d) 1.4963

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- 60) The process plan calls for a 2.5" diameter clearance fit hole. The **best** process plan is to:
- a) Center drill, drill, bore and ream
 - b) Drill, double drill, hand ream and countersink
 - c) Ream, bore, drill and center drill
 - d) Center drill, double drill, bore
- 61) What is the tap drill for a 1/2-14 American National Pipe thread?
- a) 7/16 drill
 - b) 37/64 drill
 - c) 27/32 drill
 - d) 23/32 drill

Measurement

- The feature of a thread that is measured with a thread micrometer
- Methods to inspect a surface finish
- Main parameter to consider when choosing the correct measuring instrument
- Graduations on a thimble and a sleeve of an inch micrometer

Sample questions:

- 62) What feature of a screw thread is measured with a screw thread micrometer?
- a) Pitch diameter
 - b) Minor diameter
 - c) Helix angle
 - d) Major diameter
- 63) Surface finish can be checked with a profilometer or a:
- a) Surface plate
 - b) Toolmakers eye loupe
 - c) Dial indicator with .0001 resolution
 - d) Surface finish comparison chart

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- 64) Each division found on the thimble of a micrometer is equal to _____ and each division found on the sleeve is equal to _____.
- a) .100, .001
 - b) .001, .025
 - c) .025, .001
 - d) .010, .025
- 65) One factor to consider when choosing the appropriate measuring device to measure a specific feature of a part is the:
- a) Labor involved when measuring the part
 - b) The expense of each measuring device capable of measuring the feature
 - c) The tolerance of the dimension to inspect
 - d) The skill level of the operator

Process Control

- Definition of the range used in SPC
 - The chart that measures the variation in SPC
 - Characteristics determining if a part is rejected
 - Most appropriate method or lathe component used to obtain repeatability when turning specific lengths
- 66) An X-bar R chart is used with control charts to monitor:
- a) Number and type of rejects
 - b) Variation between sample sets of parts
 - c) Number of parts that are good and number that are bad
 - d) The difference between the largest and smallest readings of sample set
- 67) Control charts measure the range. The range can be defined as:
- a) The mean of a sample set of parts
 - b) The number of rejects for a production
 - c) The capability index of a specific dimension
 - d) The difference between the largest reading and smallest reading of a sample set

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- 68) A part can be rejected when:
- a) A dimension is made out of tolerance
 - b) The wrong material is used
 - c) The part does not follow the process flow
 - d) The wrong revision of the print is used to make the part
 - e) All of the above
 - f) Only a and b
- 69) Which of the following provides the highest level of repeatability when turning a shoulder on a work piece held in a lathe?
- a) Screw feed stop on the cross slide
 - b) Compound rest set perpendicular to the centerline axis of the lathe
 - c) Compound rest set parallel to the centerline axis of the lathe
 - d) Tailstock
 - e) Indicol stop set on the tailstock

Tooling and Lathe Setup

- The total amount of rotation for a compound rest
- Procedure for grinding a high speed steel tool bit
- The most accurate way to check the alignment between lathe centers
- Procedure for aligning centers using a dial indicator

- 70) The compound rest can be rotated:
- a) 45°
 - b) 180°
 - c) 235°
 - d) 360°

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- 71) Identify the best method for aligning centers when turning between centers:
- a) Take a trial cut and measure each end with a micrometer
 - b) Visually align the points of the lathe centers
 - c) Use a true bar and two dial indicators (one on each end)
 - d) Align the largest witness marks on the tailstock
- 72) To align lathe centers using a dial indicator and a test bar, the plunger of the dial indicator should be set:
- a) Perpendicular to the lathe center axis
 - b) On center
 - c) In a horizontal position
 - d) In a vertical position
 - e) a, b, and d
 - f) a, b and c
- 73) A high-speed steel lathe tool bit has to be ground. Which characteristics of the lathe tool bit must be ground first?
- a) Side relief angle and the side cutting angle
 - b) Back rake and the end relief angle
 - c) Side rake and the side cutting angle
 - d) Side relief angle and the side rake
 - e) Back rake and side rake

Layout Procedures

- The basic precision layout instrument commonly used with a surface plate
- The layout tool used to make fine lines on metal surfaces

- 74) Which of the basic precision layout tools is used with a height gage?
- a) Machinist scale with a 1/100 inch resolution
 - b) Surface plate
 - c) Dial caliper
 - d) One inch micrometer

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- 75) Which of the following instruments is **not** capable of making fine lines on a metal surface?
- a) Dial caliper
 - b) Scriber
 - c) Machinist square or a combination set scale
 - d) Specially ground lathe tool bit with a sharp edge

Turning

Sample Test Answers

- 1) C
- 2) A
- 3) B
- 4) D
- 5) B
- 6) A
- 7) D
- 8) D
- 9) C
- 10) C
- 11) C
- 12) A
- 13) A
- 14) D
- 15) C
- 16) C
- 17) D

18) A

19) B

20) A

21) B

22) A

23) C

24) D

25) D

26) E

27) E

28) A

29) B

30) C

31) B

32) D

33) B

34) B

35) A

36) D

37) C

38) D

39) B

40) A

41) A

42) B

43) D

44) B

45) C

46) F

47) B

48) D

49) A

50) B

51) C

52) B

53) C

54) C

55) A

56) D

57) A

58) C

59) B

60) D

61) D

62) A

63) D

64) B

65) C

66) B

67) D

68) E

69) C

70) D

71) A

72) F

73) A

74) B

75) C