

Section 2, Unit 1

1. Briefly describe what you believe are the two most important actions everyone *should observe* to remain safe in a machining environment.
Evaluate individually: answers will vary.
2. Briefly describe what you believe are the two most important actions that *should never be tolerated* in a machining environment.
Evaluate individually: answers will vary and can include horseplay, cleaning machinery while it is running, operating equipment while using alcohol or medication, operating equipment without training.
3. What should be done in the case of a personal injury emergency?
Contact 911 immediately and notify emergency personnel and supervisor or instructor.
4. What does OSHA stand for and what is OSHA's purpose?
Occupational Safety and Health Administration sets and enforces regulations for workplace safety
5. List three specific clothing items that should not be worn in a machining setting.
Evaluate individually: answers will vary and can include wearing shorts, skirts, dresses, baggy clothing, open toe shoes, high heel shoes, wearing gloves around moving machinery.
6. If someone working around machinery has long hair, how should it be worn?
Secured with a hat, cap, or hairnet to prevent being caught in moving equipment.
7. Never operate machinery without proper guards in place.
8. What is PPE?
Personal Protective Equipment is safety equipment that is to be worn to protect individuals from hazards.
9. What is the most common and important piece of PPE that should always be used in a machining environment?
ANSI Z87 approved safety glasses
10. What does NFPA stand for?
National Fire Protection Association
11. What does HMIS stand for?
Hazardous Material Identification System
12. What is the purpose of NFPA and HMIS labeling?
To provide safety warnings about hazardous materials.

13. What does MSDS stand for and what is the purpose of MSDS?
A Material Safety Data Sheet provides detailed information about storage, handling, and use of a hazardous material.
14. Class A fire extinguishers use water as a media to put out fires.
15. What class of fire extinguisher should be used on an electrical fire?
Class C
16. What class of fire extinguisher should be used on flammable liquids?
Class B
17. What is the purpose of lockout and tagout procedures?
To prevent operation of machinery during maintenance or repair.

Section 2, Unit 2

1. What is the inch equivalent of one millimeter?
.03937
2. What is the inch equivalent of 32.5 mm to the nearest .0001"?
1.2795
3. Use the decimal equivalent chart on page 68 to find the fraction nearest .267".
17/64
4. Use the decimal equivalent chart on page 68 to find the fraction nearest .69".
11/16
5. Use the decimal equivalent chart on page 68 to find the fraction nearest .345".
11/32
6. What does parallel mean?
Two lines or surface that are spaced at a continuous equal distance.
7. What does perpendicular mean?
Two lines or surfaces that are at 90 degrees to each other.
8. What is the radius of a 3.65 diameter circle?
1.825
9. What is the circumference of the circle in the previous question?
11.4668

10. What are the Cartesian coordinates of the four points shown at A, B, C, and D?
A: -2, 4
B: 4, 1
C: 1, -1
D: -1, -4
11. Label the hypotenuse, adjacent, and opposite sides of the given triangle as related to angle A.
a = opposite side
b = adjacent side
c = hypotenuse

Section 2, Unit 3

1. Define semi-precision measurement.
Measurement performed within $1/64$ or $1/100$ " , .5 mm, or 1 degree
2. What is comparison measurement?
Comparing a dimension to a gage or tool of a set size.
3. List three rules to follow when using or storing semi-precision measuring tools.
Answer will vary and can include:
Treat with care to prevent damage
Do not pile measuring tools on top of each other
Do not drop them
Keep them away from moving parts of machinery and metal chips
Use only for their intended purposes
Clean and store in safe locations away from moisture to prevent rust. Apply light coating of oil to help prevent rust during storage
4. List the parts of the combination set.
Blade or rule, square head, protractor head, center head
5. Describe four uses of the combination set.
Comparison measurement of perpendicularity and angles, measuring height, measuring depth, finding the center of round stock
6. What semi-precision tool is used to take angular measurements?
Plain protractor and/or combination set protractor
7. What type of square has a blade that can be tilted to angular settings?
Die Maker's Square

Section 2, Unit 4

1. List three key points in caring for precision measuring tools.
Answer will vary and can include:
Do not drop or bump them
Keep away from dust, grit, and moving machinery
Store away from dust, dirt, and moisture
Store so they do not touch other tools and use cases when available
Keep clean and lubricated to prevent rust
2. What type of fixed gage can be used to check hole diameters?
Pin or plug gage
3. What fixed gage can be used to check a threaded hole?
Thread plug gage
4. How is the “go” member of a go/no-go ring gage set identified?
By a groove around its circumference.
5. What type of fixed gage can be used to check external threads?
Thread ring gage
6. A surface plate can provide a reference plane for taking precision measurements.
7. What two other tools could be used with the previous question to check for perpendicularity?
Solid square and feeler gages
8. Wringing is the process of attaching gage blocks to each other.
9. What is the smallest graduation on an English vernier caliper?
.001”
10. What is the smallest graduation on a metric vernier caliper?
.02 mm
11. A micrometer uses an accurate screw thread to perform measurement.
12. What is the smallest graduation on an inch micrometer with a vernier scale?
.0001”
13. What is the smallest graduation on a metric micrometer with a vernier scale?
.002 mm
14. What is calibration and why is it important?
Calibration is checking the accuracy of a measuring tool against a tool of higher accuracy. It is important to ensure that measuring tools are accurate enough to measure dimensions within the required degree of precision.

15. What is a transfer type measuring tool?
A measuring tool that does not directly show a measurement. It must be used with another measuring tool to determine a measurement.
16. What are the two basic types of indicator movements?
Test and plunge (or plunger or travel) type.
17. Briefly describe the main difference between the two indicator types from the previous question.
The test indicator uses a lever type movement and usually only allows travel equal to slightly over one turn on the dial face. A plunge, or plunger, type indicator uses a straight movement and usually allows a much larger range of travel.
18. A sine tool uses the trigonometric function of sine.
The length of a sine tool represents which side of a right triangle? The hypotenuse
19. List the two most common methods for measuring surface finish.
A surface finish comparator gage and a profilometer
20. What is one advantage and one disadvantage of each surface finish measurement method from the previous question?
The surface finish comparator gage is inexpensive, but can only be used to compare a surface to the gage. It does not give an actual measurement. The profilometer is more expensive, but gives an actual measurement in microinches or micrometers.
21. A(n) optical comparator displays a magnified image of a part on a screen for conducting measuring.
22. What other tool can be useful for measuring very small parts?
Toolmaker's microscope
23. What does CMM stand for?
Coordinate Measuring Machine

Section 2, Unit 5

1. What are the four basic parts of a process plan?
Material selection, machine selection, tooling selection, and speed & feed calculation

2. Briefly define quality control and explain its purpose.
The inspection of part dimensions to ensure that required specifications are met.
3. Briefly explain the purpose of a sampling plan.
A sampling plan shows how often and how many parts should be inspected. It gives a reasonable assurance that all parts are within specifications without the need for 100% inspection.
4. What is the purpose of an inspection plan?
An inspection plan details dimensions to be inspected and the methods to inspect those dimensions.
5. What is the most important factor to consider when choosing the proper measuring tool to inspect a dimension?
The tolerance of the dimension.
6. What does SPC stand for?
Statistical Process Control
7. What does an X-bar chart track?
The average (or mean) size of each sampling (or subgroup).
8. What does an R-chart track?
The range (amount of variation) of the samplings (or subgroups).
9. If an x-bar chart graph is between the LCL and the UCL a machining process is said to be in control
10. If an x-bar chart graph falls below the LCL or rises above the UCL a machining process is said to be out of control.

Section 2, Unit 6

1. What is the difference between ferrous and non-ferrous metals?
Ferrous metals contain iron while non-ferrous metals do not contain iron.
2. Briefly describe an alloy.
A combination of metals or a metal and other elements.
3. Name three alloying elements added to steel.
Answers will vary and can include manganese, chromium, molybdenum, nickel, tungsten, vanadium, silicon, lead, boron

4. What is cast iron?
A very hard ferrous metal that contains high amounts of carbon (usually between 1.7 and 4.5%). It is cast into shapes by pouring molten metal into molds.
5. What element is in stainless steel that makes it corrosion resistant?
Chromium
6. Small particles of magnesium alloys are flammable.
7. What are the two major benefits of titanium?
It is lightweight and very strong.
8. What does AISI stand for?
American Iron and Steel Institute
9. What does SAE stand for?
Society of Automotive Engineers
10. What is (are) the major alloying elements in 8730 steel?
Nickel, chromium, molybdenum
11. What is the carbon content of 8730 steel?
.30%
12. What does IADS stand for?
International Alloy Designation System
13. What is the overall purity of 1030 aluminum?
99.30%
14. What is (are) the major alloying elements of 6061 aluminum?
Magnesium and silicon
15. What does UNS stand for?
Unified Numbering System

Section 2, Unit 7

1. Briefly define the term heat treatment.
Controlled heating and cooling of metals to change their characteristics
2. Direct hardening can be performed on steel containing at least .3% carbon.
3. Quenching is the rapid cooling of metal during heat treatment.

4. What type of hardening operation is sometimes performed on medium carbon steels that leaves the inner core in a softer condition?
Surface hardening
5. In what two ways can the process described in the previous question be accomplished.
Flame or induction hardening
6. What method is used to harden low carbon steels?
Case hardening
7. List two methods of performing the operation described in the previous question.
Carburizing, cyaniding, and nitriding
8. After hardening, steel is very hard and brittle. What operation is usually performed to reduce hardness and increase toughness so the steel is in a more usable condition?
Tempering (or drawing)
9. Briefly define annealing.
Heating a steel slightly below the hardening temperature and cooling slowly to return it to its soft condition.
10. What is the result of aluminum alloys after solution heat treatment?
The aluminum is softer and more uniform in structure
11. A dual chamber furnace allows the user to harden in one chamber and temper (or draw) in the second chamber.
12. In addition to standard PPE, what specific PPE and safety precautions should be used during heat treating?
Wear a heat resistant face shield, long sleeve fire resistant jacket and gloves.
Handle metals with long handled tongs. When lighting a gas-fired furnace, keep the door open. Use metal signs with the word 'hot' to identify hot metals, but still treat all metals in the heat treating area as if they were hot.
13. What hardness testing scale uses many different penetrators and loads?
Rockwell
14. What is a Brale penetrator and what hardness scale uses it?
It is a diamond tipped point used to test and measure hardness on the Rockwell C scale.

Section 2, Unit 8

1. Why is a routine maintenance plan important?
To keep machinery in good, safe working order.
2. What is a lubricant?
Greases and oils used to cool and minimize wear between moving parts of machinery.
3. List three methods of applying lubricants to machine tools.
Answers will vary and can include reservoirs, oil cups, ball oilers, grease zerks
4. List two components of machine tools that should be periodically inspected for wear.
Answers will vary and can include belts, gears, slides, threaded nuts used to move slides
5. Briefly describe a gib.
A tapered wedge adjusted between the mating parts of a dovetail slide to tighten the fit of the slide.
6. What are the purposes of cutting fluids?
Cool the cutting tool, cool the workpiece being machined, reduce friction between the cutting tool and material, wash away chips
7. What are the two major types of cutting fluids?
Oil based and chemical based
8. What is a wetting agent?
A cutting fluid additive that helps the fluid stick to the tool and work
9. What two ingredients are often used as additives to improve lubrication qualities of cutting oils?
Sulfur and chlorine
10. Oils that can be combined with water are called soluble, emulsifiable, or water miscible oils.
11. What is the major benefit of cutting fluids that contain water?
High cooling ability
12. What is the difference between synthetic and semi-synthetic cutting fluids?
Semi-synthetics contain oil, synthetics contain no oil
13. A refractometer can be used to measure cutting fluid concentrations.
14. List three methods of applying cutting fluids.
Manually (by brush, spray bottle, squirt bottle), flood system, mist system

15. Always review the MSDS before using any lubricant or cutting fluid.
16. What type of cutting fluids should never be used when machining magnesium alloys?
Water based