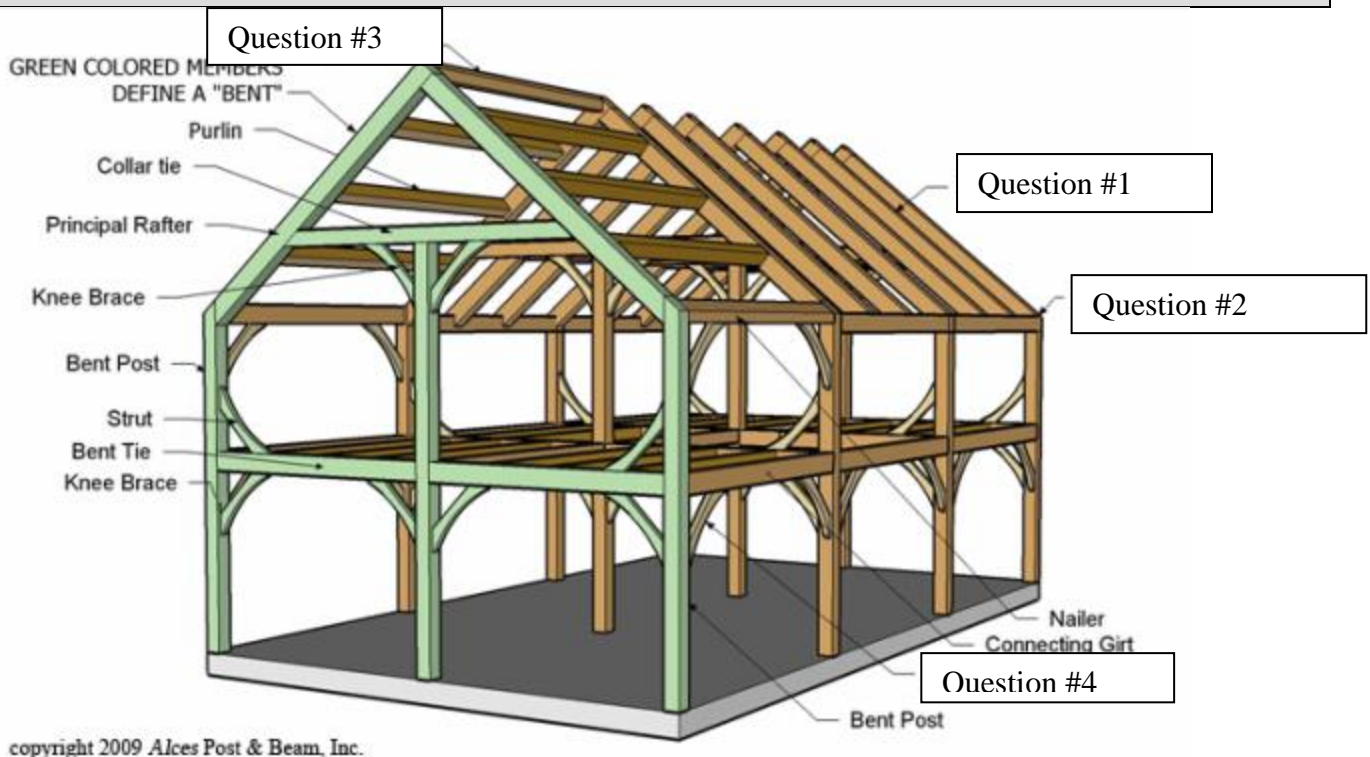


Iowa State FFA Agricultural Mechanics Career Development Event
2014

State of Iowa
Department of Education
Iowa State University
Department of Agricultural
Education and Studies

DO NOT WRITE ON THIS DOCUMENT

Structural Systems
Carpentry Problem Solving



1. What is the part identified as item # 1?
 - a. Principal Rafter
 - b. Common Rafter
 - c. Rafter Beam
 - d. Top Plate
2. What is the part identified as item # 2?
 - a. Principal Rafter
 - b. Common Rafter
 - c. Rafter Beam
 - d. Top Plate

3. What is the part identified as item # 3?
 - a. Principal Rafter
 - b. Common Rafter
 - c. Ridge Beam
 - d. Top Plate

4. What is the part identified as item # 1?
 - a. Bent Post
 - b. Knee Brace
 - c. Strut
 - d. Nailer

5. What type of hammer is being displayed on the front table?
 - a. Claw Hammer
 - b. Framing Hammer
 - c. Ball Peen
 - d. Engineer's Hammer

6. What is the name of the tool on display on the front of the table?
 - a. Cordless Drill
 - b. Impact Driver
 - c. Hammer Drill
 - d. Impact Wrench

Using the Diagram on the next page, answer questions 7-11

7. Which of the following dimensions of is lumber required for the sides of the tool box.
 - a. $1\text{-}\frac{5}{8}\text{''} \times 5\frac{7}{8}\text{'} \times 30\text{''}$
 - b. $1\text{-}\frac{5}{8}\text{''} \times 5\frac{7}{8}\text{'} \times 31\frac{1}{2}\text{''}$
 - c. $2\text{-}\frac{5}{8}\text{''} \times 5\frac{7}{8}\text{''} \times 30\text{''}$
 - d. $5\frac{7}{8}\text{''} \times 5\frac{7}{8}\text{''} \times 31\frac{1}{2}\text{''}$

8. What is the thickness of the material being used to assemble the sides and bottom of the toolbox?
 - a. $\frac{1}{2}\text{''}$
 - b. $\frac{5}{8}\text{''}$
 - c. $\frac{3}{4}\text{''}$
 - d. 1''

9. What is the thickness of the material being used to assemble the ends of the toolbox?
 - a. $\frac{1}{2}\text{''}$
 - b. $\frac{5}{8}\text{''}$
 - c. $\frac{3}{4}\text{''}$
 - d. 1''

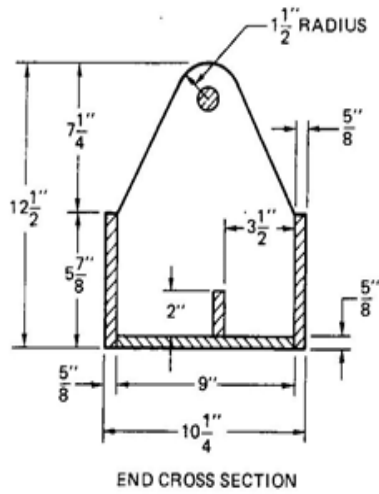
10. What is the minimum size board that I would need in order to cut the two end pieces?

- a. 1" x 10" x 2'
- b. 1" x 12" x 3'
- c. 1/2" x 12" x 2'
- d. 3/4" x 9" x 2'

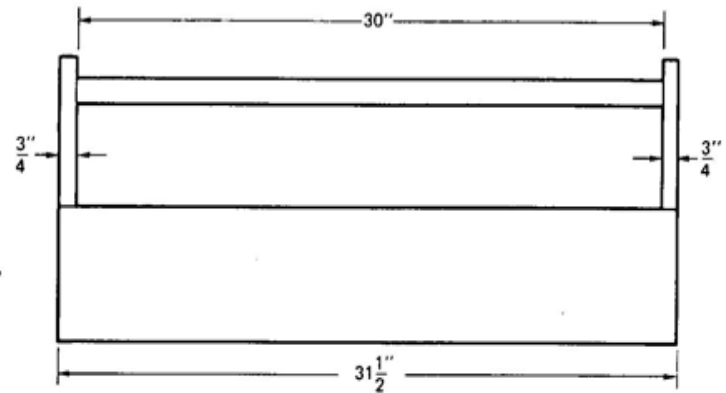
11. What is the actual length of the divider inside the toolbox?

- a. 9"
- b. 30"
- c. 31"
- d. 31 1/2"

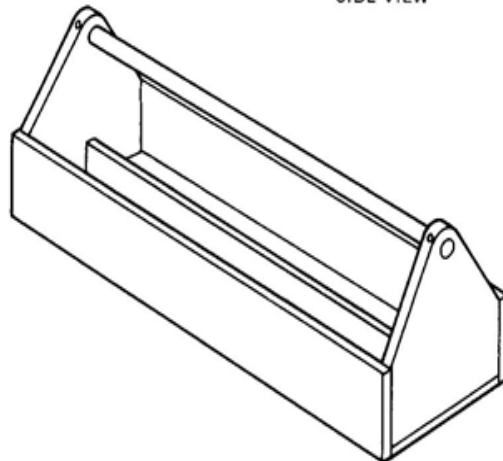
□ PLAN FOR TOOL BOX



END CROSS SECTION



SIDE VIEW



12. The 2x6's placed above a window opening in a wall are called:
- a. cripples
 - b. headers
 - c. studs
 - d. sill
13. Wall studs are generally placed _____ inches on center
- a. 12
 - b. 16
 - c. 21
 - d. 36
14. The _____ _____ is the part of the rafter that extends out past the stud wall.
- a. rooster tail
 - b. bird's mouth
 - c. bird's tail
 - d. rafter tail
15. The notch cut in the rafter which sits on the top plate is called the:
- a. bird's beak
 - b. bird's mouth
 - c. bird's tail
 - d. rafter tail

Iowa State FFA Agricultural Mechanics Career Development Event 2014

State of Iowa
Department of Education
Iowa State University
Department of Agricultural
Education and Studies

**DO NOT WRITE ON THIS
DOCUMENT**

Electrical Systems Electrical Problem Solving



1. What is the tool located in the picture above?
 - a. Linesman Pliers
 - b. Wire Strippers
 - c. Cable Cutting Pliers
 - d. Conduit Bender



2. What is the tool located in the picture above?
 - a. Circuit Tester
 - b. Wire Strippers
 - c. Cable Cutting Pliers
 - d. Conduit Bender



3. What is the name of the tool in the image above?
 - a. Fish tape
 - b. Wire wheel
 - c. Measuring tape
 - d. Toilet auger

4. What is the purpose of the tool in the image above?
 - a. Measure the distance in between two points
 - b. Clean a clog out of a toilet and/or drain
 - c. Store Mig welding wire to protect from the environment
 - d. To pull electrical lines through conduit

5. Using the wiring schematic, troubleshoot the circuit and determine why the breaker is tripping. What is the problem?
 - a. Using the wrong switch
 - b. Hot and neutral wires are reversed on the lamp
 - c. The switch is wired incorrectly
 - d. There is a short in the wire

6. The outlet has power to the top terminal but no power to the bottom terminal, what could explain this issue?
 - a. The tab has been removed connecting the top and bottom terminals
 - b. The outlet has been incorrectly wired
 - c. The outlet is broken
 - d. All of the above

7. What type of wire is on display?
 - a. 14-2
 - b. 14-2 with ground
 - c. 14-3
 - d. 14-3 with ground

8. What does the 14 on a 14-2 wire inform you of?
- The length of the wire
 - The wire gauge
 - The number of wires
 - Type of metal used to make the wire
9. If you were going to connect two three way switches, which of the following wires would you use?
- 12-2 without ground
 - 12-2 with ground
 - 14-2 with ground
 - 14-3 with ground
10. The electromotive force that causes electrons to flow in a circuit is measured in:
- Amps
 - Ohms
 - Volts
 - Watts
11. The quantity of electrons flowing in a circuit is measured in:
- Amps
 - Ohms
 - Volts
 - Watts
12. Which of the following formulas describes ohm's law?
- $\text{Volts} = \text{Amps} \times \text{Ohms}$
 - $\text{Amps} = \text{Volts} \times \text{Ohms}$
 - $\text{Ohms} = \text{Volts} \times \text{Amps}$
 - $\text{Volts} = \text{Amps} - \text{Ohms}$
13. Find the current through a 12-ohm resistive circuit when 24 volts is applied.
- 2 Amps
 - 2 Volts
 - 288 Amps
 - 288 Ohms
14. Find the resistance of a circuit that draws 0.06 amperes with 12 volts applied.
- 2 Amps
 - 2 Volts
 - 200 Amps
 - 200 Ohms

15. A DC electric motor transforms 1.50 kW of electrical power into mechanical form. If the motor's operating voltage is 300 volts, how much current does it "draw" when operating at full load (full power output)?
- a. 5 Amps
 - b. 5 Ohms
 - c. 450 Amps
 - d. 450 Ohms

Electrical Calculation Formulas

$$I=E/R$$

$$R=E.I$$

$$E = IR$$

$$P=IV$$

$$I = P/V$$

$$V= P/I$$

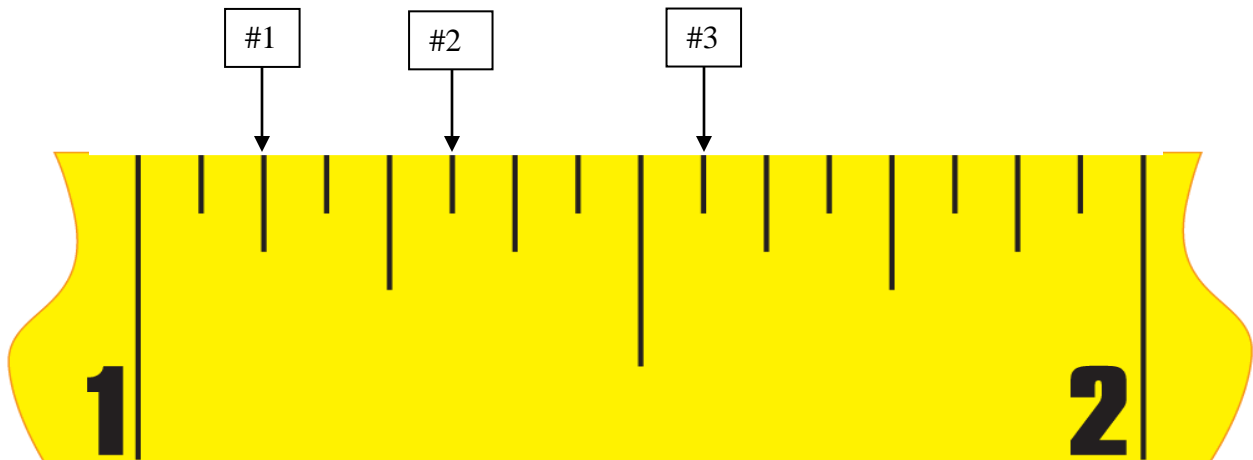
Iowa State FFA Agricultural Mechanics Career Development Event
2014

State of Iowa
Department of Education
Iowa State University
Department of Agricultural
Education and Studies

**DO NOT WRITE ON THIS
DOCUMENT**

Environmental/Natural Resource Systems
Land Measurement Problem Solving

Please use this image to answer 1-4

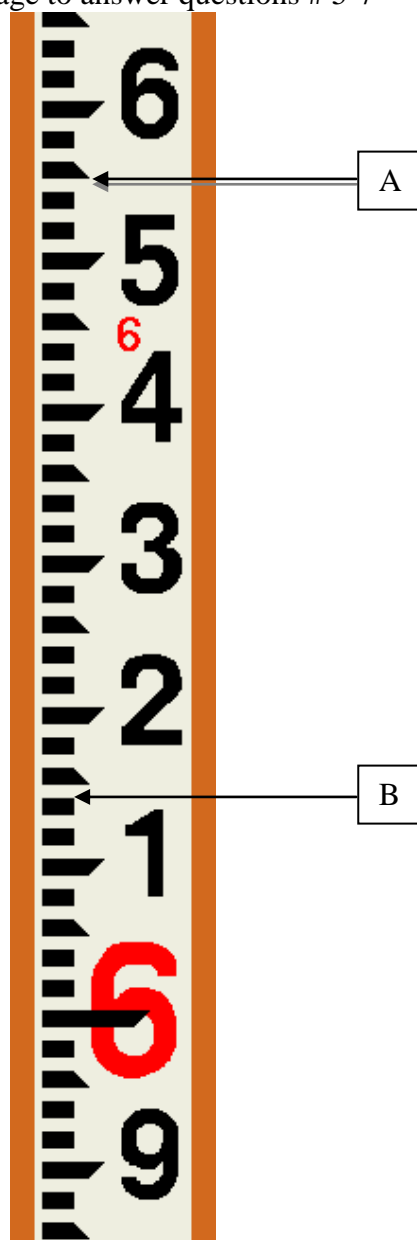


Standard Tape Measure Showing Inch Breakdown

1. What is the measurement of #1 in the image above?
 - a. $1/4$ "
 - b. $1/2$ "
 - c. $1 \frac{1}{16}$ "
 - d. $1 \frac{1}{8}$ "
2. What is the measurement of #2 in the image above?
 - a. $1 \frac{1}{4}$ "
 - b. $1 \frac{3}{16}$ "
 - c. $1 \frac{5}{16}$ "
 - d. $1 \frac{3}{8}$ "

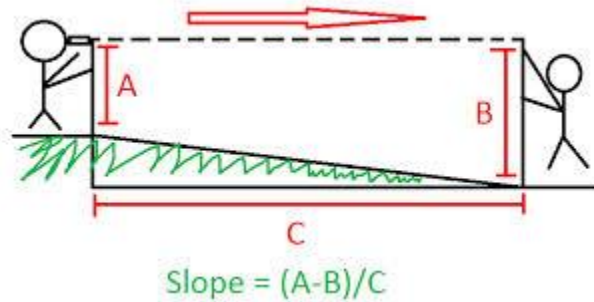
3. What is the measurement of #3 in the image above?
- a. $1/2$ "
 - b. $9/16$ "
 - c. $1 \frac{5}{8}$ "
 - d. $1 \frac{9}{16}$ "
4. What is the distance between A & C on the tape measure?
- a. $1/2$ "
 - b. $15/32$ "
 - c. $7/16$ "
 - d. $3/8$ "

Use this image to answer questions # 5-7

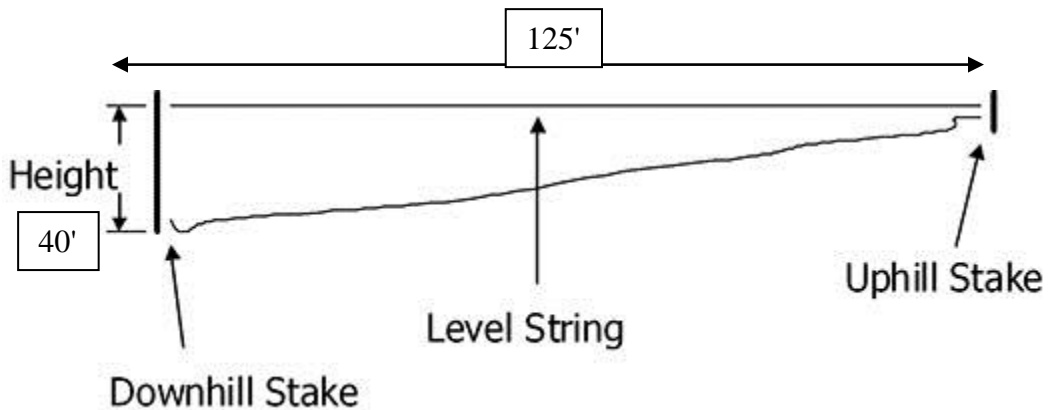


5. Using the surveying rod in the image on the previous page, what is the reading at A?
- a. 0.5
 - b. 5.5
 - c. 5.05
 - d. 6.55

6. Using the surveying rod in the image on the previous page, what is the reading at B?
- a. 1.4
 - b. 6.14
 - c. 6.15
 - d. 6.50



7. Assuming that you are assisting on a job site and are wanting to prep the job site to lay a level pad of cement in a feedlot to keep feed troughs out of the mud. In order to minimize costs you will need to determine if there is any slope over the 50' site. If there is more than a 3% slope you will need to backfill the area that slopes off to ensure that costs remain low. Using the measurements taken at A & B in the image on the previous page what is the percent slope?
- a. 0.82%
 - b. 0.41%
 - c. 3.2%
 - d. 12.69%



8. Using the information in the figure on the bottom of the previous page calculate the percent slope for the worksite of your next concrete pad.

- a. 32%
- b. 40%
- c. 85%
- d. 125%

9. A concrete slab is needed for the storage of equipment. The wooden forms to pour the concrete slab have inside dimensions of 24 feet by 36 feet and provide for a uniform slab thickness of 4.5 inches. What approximate volume of concrete (in cubic yards) is needed to fill the forms?

Hint: 1 cubic yard = 27 cubic feet 1 foot = 12 inches

- a. 12 cubic yards
- b. 324 cubic yards
- c. 1662 cubic yards
- d. 3886 cubic yards

10. Approximately how many acres are in a rectangular field measuring 1029.5 feet by 375 yards?

Hints: Area of a rectangle is the length times the width

1 yard = 3 feet 1 acre = 43,560 square feet

- a. 8.86 acres
- b. 17.55 acres
- c. 26.59 acres
- d. 33.64 acres

11. You have been asked to fertilize a lawn for one of your relatives. The bags of fertilizer that are available at the local Co-Op if applied properly can cover 250 square feet per bag. The yard that you will be applying the fertilizer to is rectangular in shape and is 33 feet wide and 41 feet long. How many bags of fertilizer will you need?

- a. 2
- b. 4
- c. 6
- d. 8

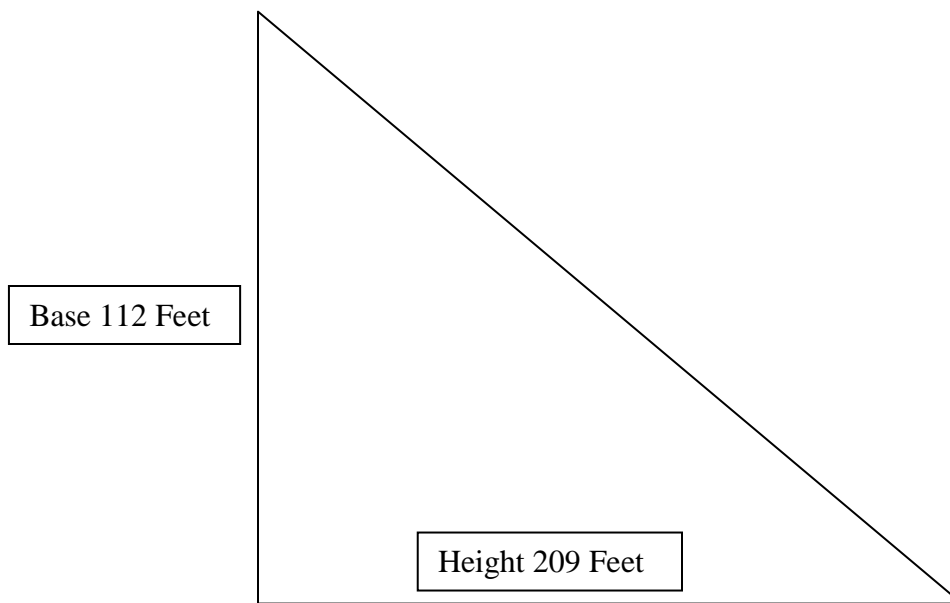
12. Your relative wants to pay you for the fertilizer and your time. You charge \$0.10 per square foot for your labor and overhead expenses. The fertilizer is on sale at \$23 per bag. How much does your relative owe you?

- a. \$153.00
- b. \$273.30
- c. \$288.00
- d. \$1,491.00

13. Your relatives neighbor is really impressed with your work habit and the how your relatives lawn looks after you applied the fertilizer. The neighbor wants to hire you to apply the same fertilizer in their yard at the same application rate. Fuel prices have gone up so you had to increase your labor and overhead expenses to \$0.12 per square foot. How many square feet is their yard? Please see the image below to determine square footage.

Fields with Right Triangles: $\text{Base} \times \text{Height} \div 2 = \text{Area}$

- a. 23,408
- b. 11,704
- c. 1,704
- d. 1, 352



14. Using the information provided in question # 13, how much will you charge to fertilize this lawn?

- a. \$1,170
- b. \$1,081
- c. \$2,251
- d. \$4502

15. How many acres is the lawn? Remember 1 acre= 43,560 square feet

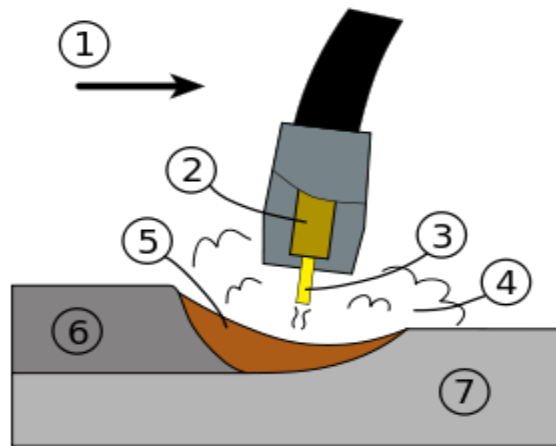
- a. 0.27 acres
- b. 0.54 acres
- c. 2.70 acres
- d. 5.40 acres

Iowa State FFA Agricultural Mechanics Career Development Event
2014

State of Iowa
Department of Education
Iowa State University
Department of Agricultural
Education and Studies

DO NOT WRITE ON THIS

Metals & Welding Systems
Gas Metal Arc Welding Problem Solving



Answer questions 1-5 using the diagram above

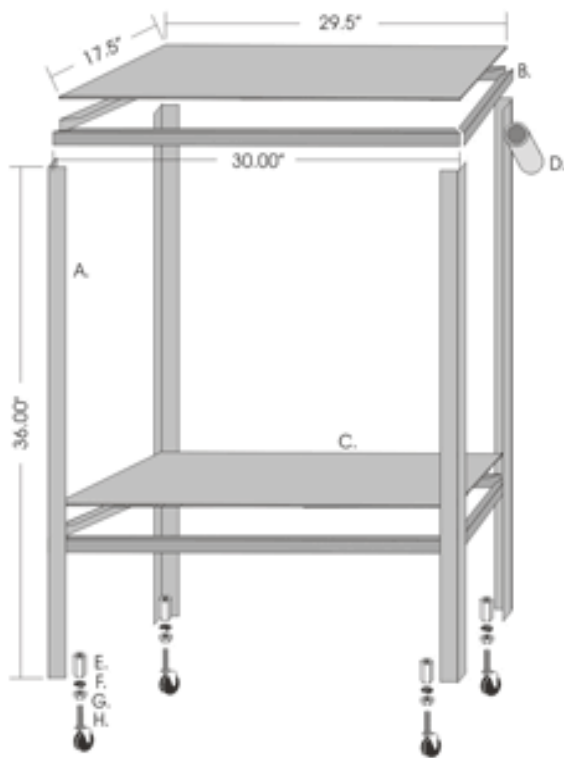
1. Item number 2 above illustrates which of the following items:
 - a. Direction of Travel
 - b. Contact Tip
 - c. Electrode
 - d. Shielding Gas
2. Item number 3 above illustrates which of the following items:
 - a. Shielding Gas
 - b. Electrode
 - c. Contact Tip
 - d. Molten weld metal
3. Item number 4 above illustrates which of the following items:
 - a. Solidified Weld Metal
 - b. Molten Weld Metal
 - c. Direction of Travel
 - d. Shielding Gas

4. Item number 5 above illustrates which of the following items:
 - a. Workpiece
 - b. Solidified Weld Metal
 - c. Molten Weld Metal
 - d. Electrode

Items 5-7 will require you to identify items or issues with actual welds provided to you

5. What item needs to be replaced?
 - a. Gas Nozzle
 - b. Gas Diffuser
 - c. Gas liner
 - d. Contact Tip
6. Identify the weld joint shown
 - a. T-joint
 - b. Lap joint
 - c. Butt joint
 - d. Corner
7. You produced the following weld, identify the major issue associated with this weld
 - a. Travel Speed Too Slow
 - b. Wire Speed Too Fast
 - c. Arc length Too Far Away
 - d. No Shielding Gas

Plans for making a Welding Table



Using the diagram provided answer questions 11-20

8. What length of 1/8"x 1.25"x 1.25" Angle iron will you need to build the legs?
 - a. 36"
 - b. 72"
 - c. 10'
 - d. 12'
9. What length of 1/8"x 1"x 1" Angle iron will be needed to complete the two frames
 - a. 48"
 - b. 96"
 - c. 16'
 - d. 32'
10. The current cost for the caster and caster assembly for the tables run \$13.99 (including tax) a piece, how much should you budget for casters?
 - a. \$13.99
 - b. \$28.00
 - c. \$55.96
 - d. \$56.00

11. Determine the cost for 1/8"x 1.25"x 1.25" Angle iron that you will need to complete this project. The angle iron is sold in two foot increments and costs \$5.99 per two foot increment.
- \$23.96
 - \$29.95
 - \$35.94
 - \$59.99
12. Determine the cost for 1/8"x 1"x 1" Angle iron that you will need to complete this project. The angle iron is sold in two foot increments and costs \$4.99 per two foot increment.
- \$19.96
 - \$39.92
 - \$79.84
 - \$159.68
13. You have been able to work with a company that will sale you the plate steel by the square foot instead of requiring you to purchase the entire 4'x 8' sheet. They require you to purchase the plate in whole dimensions (example 1x2 or 3x4, etc) Determine how much you should expect to pay for the plate steel. The plate steele is \$10.21 per square foot.
- \$10.21
 - \$122.52
 - \$326.72
 - \$40.84
14. How much will it cost you to build one table?
- \$122.52
 - \$254.34
 - \$326.72
 - \$408.40
15. You have decided that you want to start selling the welding tables and have determined that you want to charge a 50% mark-up to account for labor and overhead costs. Based on your answer on #19 how much will you attempt to sale your tables for?
- \$127.17
 - \$183.78
 - \$381.51
 - \$490.08

Iowa State FFA Agricultural Mechanics Career Development Event 2014

State of Iowa
Department of Education
Iowa State University
Department of Agricultural
Education and Studies

DO NOT WRITE ON THIS DOCUMENT

Machinery & Equipment Systems Small Gas Engines Problem Solving

Read each question carefully and circle your answer.

1. A four-stroke engine gets its name from:
 - a. The number of cylinders it has
 - b. The number of valves used in the engine design
 - c. The number of piston movements during a combustion cycle
 - d. The number of engineers who designed the original engine

2. A screwdriver keeps slipping out of a slotted screw, burring the head and slot. The service technician should have:
 - a. Pressed harder to remove the screw
 - b. Selected a proper fitting screwdriver
 - c. Ground the screwdriver blade before using it
 - d. Heated the screw with a torch to loosen it

3. Which stroke follows the exhaust stroke?
 - a. Combustion
 - b. Compression
 - c. Intake
 - d. Power

4. To complete one operating cycle the crankshaft of a four-stroke engine must rotate:
 - a. One-half rotation
 - b. One revolution
 - c. Two revolutions
 - d. Four revolutions

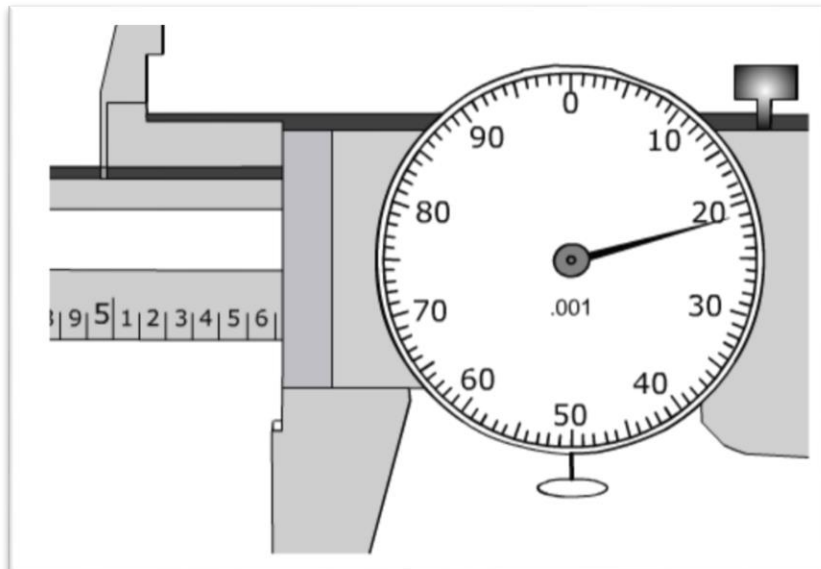
5. Recommended torque for a cylinder head bolt is 384 inch pounds. What is the foot pound equivalent?
 - a. 26 foot-pounds
 - b. 32 foot-pounds
 - c. 36 foot-pounds
 - d. 42 foot-pounds

6. What is the optimum fuel/air ration by weight for NORMAL combustion?
 - a. 10.0 parts of air to one part of fuel
 - b. 14.7 parts of fuel to one part of air
 - c. 14.7 parts of air to one part of fuel
 - d. 17.4 parts of air to one part of fuel

7. The correct method for tightening a flywheel is:
 - a. As tight as possible
 - b. Using a torque wrench
 - c. With proper tools and to manufacturer's specifications
 - d. With an impact wrench

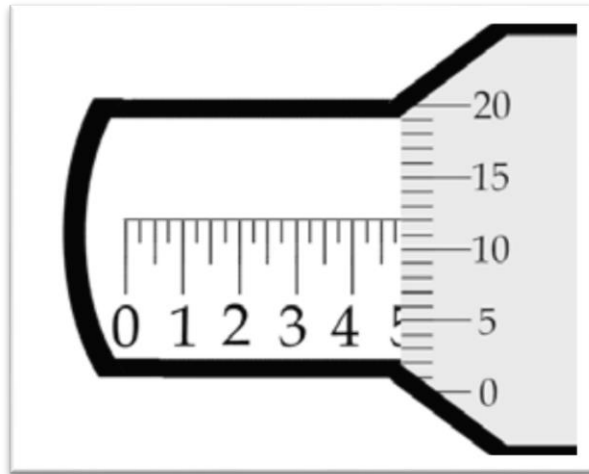
8. For each revolution of the crankshaft the camshaft revolves:
 - a. One revolution
 - b. One-half revolution
 - c. Two revolutions
 - d. Four revolutions

9. What is the measurement indicated on the dial caliper pictured below?
 - a. 5.623
 - b. 6.521
 - c. 5.621
 - d. 5.620



10. Using the picture of the micrometer below. What is the correct measurement?

- a. .512
- b. .482
- c. .486
- d. .487



For questions 11 – 15 you will need to identify the various parts and engines located on the table in the front.

11. What type of engine is this:

- a. L-Head
- b. V-Twin
- c. Overhead Valve
- d. 2 cycle

12. What type of engine is this:

- a. L-Head
- b. V-Twin
- c. Overhead Valve
- d. 2 cycle

13. What small engine part is this:

- a. Exhaust valve
- b. Tappet
- c. Push rod
- d. Intake valve

14. Identify the part of the carburetor:

- a. Choke plate
- b. Main jet
- c. Venturi
- d. Throttle plate

15. Identify the piston ring:

- a. Compression**
- b. Wiper**
- c. Oil**
- d. None of these**