



2006 State Competition
FFA Agricultural Mechanics Contest
University of Missouri
100 points

Contestant # _____
Contestant Name _____
Chapter _____

Written Examination

Instructions: Select the most correct answer by darkening in the corresponding oval on the answer sheet provided. **DO NOT WRITE ON THIS EXAM!!!!**

Ag. Machinery

- The type of spray tip that you would expect to find mounted on a planter is a/an:
 - Flat fan
 - Even flat fan
 - Hollow cone
 - None of the above are correct
- Which of the following is **not** a positive displacement pump?
 - centrifugal
 - roller
 - piston
 - diaphragm
- What type of machinery would have a hydrostatic final drive?
 - Combine
 - Self-propelled windrower
 - Self propelled sprayer
 - All of the above
- According to popular press, when spraying for Asian Soybean Rust, what type of nozzle is recommended?
 - Twin Jet Flat Fan
 - Even Flat Fan
 - Turbo Jet
 - Flood Jet
- Which of the following agitators is commonly found on field sprayers such as the Patriot

SPX 3185?

- A. Jet
 - B. Hydraulic
 - C. Mechanical
 - D. Both A & B are correct
6. Power take off shafts that are designed to operate at 1000 R.P.M. are usually equipped with:
- A. 21 splines.
 - B. 22 splines.
 - C. 6 splines.
 - D. 5 splines.
7. What are the three most common types of hydraulic pumps?
- A. vane, roller, siphon
 - B. diaphragm, plunger, and gear
 - C. plunger, gear, and siphon
 - D. vane, piston, and gear
8. Name given to the device in the spray solution tank that keeps the chemical in suspension and promotes a more even application of the chemical is called:
- A. line strainer
 - B. boom valve
 - C. agitator
 - D. none of the above
9. Which of the following is **not** a type of spray drift?
- A. vapor
 - B. particle
 - C. wind
 - D. both A & C are spray drift
10. As a TeeJet XR8001 nozzle tips wear, the chemical application rate that these nozzles deliver:
- A. increases.
 - B. decreases.
 - C. stays the same.
 - D. the nozzles should not wear down because they are ceramic.
11. You have a twelve row planter with 30" spacings and you are working a rectangular shaped field that is a ½ mile long. How many acres will you cover when you reach the

- opposite end of the field (assume 1 pass).
- A. 1.82 acres
 - B. 1.67 acres
 - C. 1.45 acres
 - D. 1.27 acres
12. A power-take off shaft that has 6 splines rotates at how many RPM?
- A. 520
 - B. 540
 - C. 1000
 - D. None of the above are correct.
13. The term MFWD for tractors stands for what?
- A. Mechanical Front Wheel Drive
 - B. Mechanical Four Wheel Drive
 - C. Manufactured Front Wheel Drive
 - D. Manufactured Four Wheel Drive
14. Which of the following shaft speeds would you expect to find powering a small square hay baler?
- A. 540
 - B. 550
 - C. 900
 - D. None of the above are correct.
15. You have operated a large Rogator (90 feet) for 6 hours spreading lime at 81% efficiency. Your average travel speed is 11.5 mph. How many acres have you covered?
- A. 125.5 ac
 - B. 753 ac
 - C. 101.6 ac
 - D. 609 ac
16. Penetration of a tillage tool into the ground depends on:
- A. hitch angle (horizontal / level to ground).
 - B. soil type.
 - C. soil moisture.
 - D. all of the above.

Concrete & Plumbing

17. A check valve would be used to:
- A. prevent back flow.

- B. check the water pressure.
 - C. check flow rate.
 - D. shut off flow in all directions.
18. A relief valve is used to:
- A. adjust flow rate.
 - B. protect against excessive temperature and/or pressure.
 - C. shut off flow.
 - D. measure flow rate.
19. A street elbow has:
- A. two male ends.
 - B. two female ends.
 - C. a male and female end.
20. A trap in the water system, is used to:
- A. prevent emission of sewer gases.
 - B. prevent emission of radon gases.
 - C. prevent back flow of potable water.
 - D. prevent trash from entering waste water
21. Plastic pipe is measured by:
- A. Nominal outside diameter
 - B. Nominal inside diameter.
 - C. The thickness of the wall of the pipe.
 - D. Length of threads on the pipe.
22. Schedule 80 PVC pipe is:
- A. as thick as schedule 40 PVC pipe.
 - B. heavier than schedule 40 PVC pipe.
 - C. as heavy as schedule 120 PVC pipe.
 - D. none of the above are correct.
23. The fitting that should be used when joining two dissimilar types of pipe is a/an:
- A. Tee.
 - B. Street Elbow.
 - C. Union
 - D. Bushing.
24. Which method(s) is most commonly used to specify a water-cement ratio?
- A. Gallons/sack
 - B. Sacks/cubic yard
 - C. Pounds/pounds

- D. None of the above are correct
25. Adding extra water to the concrete mixture makes the mixture:
- A. stronger.
 - B. lighter.
 - C. stiffer.
 - D. weaker.
26. What type of finish should be applied to the surface of the floor that will be used for dairy cattle?
- A. Broom finish
 - B. Wood float finish
 - C. Steel trowel
 - D. No finish work is required
27. The substance that holds the concrete together is a mixture of water and
- A. sand
 - B. portland cement
 - C. gravel
 - D. Dirt
28. Reinforcement is placed in concrete to increase:
- A. compressive strength.
 - B. tensile strength.
 - C. overall strength.
 - D. dynamics strength.
29. In a 1:2:2.5 concrete mix the 2 stands for
- A. water
 - B. cement
 - C. sand
 - D. gravel
30. What would you use an edger for?
- A. round and smooth the edges of a sidewalk
 - B. smooth edges of cinder block
 - C. round the edge of a concrete block
 - D. spread concrete to edge of forms
31. A wall footing should have a depth equal to _____ the distance between the wall and edge of footing.
- A. 4 times
 - B. 5 times
 - C. 2 times

- D. $\frac{1}{2}$ times
32. Sidewalks are commonly poured _____ thick.
- A. 3"
 - B. 4"
 - C. 5"
 - D. 6"

Electrical Motors

33. Which motor does **not** have starting windings?
- A. Split Phase Start Induction Run
 - B. Capacitor Start induction Run
 - C. 3 Phase
 - D. Capacitor Start Capacitor Run
34. If the actual or measured watts are 3840, and the expected watts are 4800, what is the power factor?
- A. 0.80
 - B.. 1.25
 - C. 0.95
 - D. 1.00
35. What type of electrical power is your home operated on?
- A. Battery
 - B. Direct Current
 - C. Fast Current
 - D. Alternating Current
36. If the circuit has 5 amps and 10 ohms, how many volts does it have?
- A. 2 volts
 - B. 5 volts
 - C. 25 volts
 - D. 50 volts
37. Which of the following time ratings for an electrical motor will allow the end user to operate the motor at **full load** continuously?
- A. 5
 - B. 15
 - C. 30
 - D. 60
38. Which of the following is NOT a part of an electric motor?
- A. Babbit Bearing
 - B. Centrifugal Switch
 - C. Stator
 - D. End bell capacitor

39. What type of motor would you most likely find powering an electric drill?
- A. Universal
 - B. Start induction run
 - C. Shaded Pole
 - D. Capacitor start, induction run
40. Why should you NOT use emery cloth when polishing the PTO journal of an electric motor (just prior to disassembly)?
- A. Sorry, but this IS acceptable
 - B. Problem, the grit can cause the motor to become unbalanced.
 - C. Problem, the metallic grit can magnetically adhere to parts of the motor.
 - D. None of the above are accurate
41. Which one of these *requires* a capacitor to start the motor?
- A. Three Phase Motor
 - B. A 240 volt delta
 - C. Split Phase start
 - D. Permanent split capacitor
42. What would an electric motor with two visible capacitors be classified as?
- A. split phase start, induction start
 - B. capacitor start, induction run
 - C. three value capacitor motor
 - D. capacitor start, capacitor run
43. You have just removed the end bell from an electric motor. The larger heavier windings are most likely the :
- A. Main windings
 - B. Starting windings
 - C. Running windings
 - D. Starting circuit of the motor
44. How many pairs of pole does a motor have that operates at 1725 rpm?
- A. 1
 - B. 2
 - C. 3
45. Which winding of an electric motor (single phase) will have the greatest resistance?
- A. Starting windings
 - B. Running windings
 - C. Neither, both have the same resistance
46. You have just opened a box of electrical componets at home and found what you believe is a capacitor for an electric motor. The capacitor has a hard plastic-like material shell.

- This is most likely found in:
- A. the starting windings of an electric motor
 - B. the running windings of an electric motor
 - C. a three phase motor
 - D. none of the above are correct
47. Disconnects for electric motors, even when you can see the motor from the disconnect, should be no more than:
- A. 10 feet away
 - B. 25 feet away
 - C. 35 feet away
 - D. 50 feet away
48. Which type of bearing found in an electric motor will permit you to mount the power shaft of a motor in a vertical position?
- A. babbitt bearing
 - B. ball bearing
 - C. bronze bushing
 - D. copper sleeve
49. When lubricating an electric motor with oil, SAE 20W should be used if:
- A. The motor is one HP or smaller
 - B. The motor is two HP or larger
 - C. It just does not matter...
50. What is the theoretical RPM of a motor with 1 pair of windings? (Assume 60 Hertz)
- A. 1725
 - B. 3450
 - C. 3600
 - D. 1800

Repair & Maintenance

51. Using a digital multi-meter, what setting would you use to measure the voltage of an automotive battery?
- A. AC volts
 - B. ohms
 - C. amps
 - D. DC Volts
52. What voltage reading would you expect to find from a fully charged 12V battery when the engine and all other functions are turned off?
- A. 11 volts
 - B. 12 volts
 - C. 13 volts
 - D. 14 volts

53. If you were presented with a grade five bolt, how many hash marks would be stamped in the head to identify it as a grade five fastener?
- A. 2
 - B. 3
 - C. 6
 - D. 0
54. How is the dimension of steel pipe (black pipe) classified?
- A. By measuring the outside diameter of the material
 - B. By measuring the thickness of the material
 - C. By measuring the inside diameter of the material
 - D. By measuring the length of the material
55. You have just finished installing a shaft in a piece of equipment. You have set the end play, then preload the bearing. You need to now check the rolling drag on the shaft. What measuring tools would you use to finish this activity?
- A. speed square and a sharpie
 - B. click type torque wrench and appropriate socket
 - C. chalk line and tape measure
 - D. A spring scale and a long cotton string.
56. Installing a bearing locking collar, which direction should the locking collar be locked onto the shaft?
- A. In direction of shaft rotation.
 - B. Opposite direction of shaft rotation
 - C. The locking collar doesn't belong on the shaft.
 - D. none of the above
57. What is the function of the locking collar on a bearing and shaft?
- A. To secure the wheel to the tire
 - B. To lock the bearing to the shaft preventing the shaft from spinning in the bearing and ruining both items.
 - C. To maintain proper ballast of bias or radial tires of any type tread
 - D. To balance the shaft to ensure a smooth ride across roads of various surfaces
58. Which item will neutralize battery acid for cleanup after a spill?
- A. baking soda
 - B. flour
 - C. corn starch
 - D. oil dry
59. Before sharpening a drill bit you realize that your grinding wheel is glazed and untrue. Which tool should you select to recondition it?
- A. Another grinder

- B. Wheel dresser
 - C. Rat tailed file
 - D. This is impossible to recondition. Throw the stone away and purchase a new one.
60. A grinding wheel needs to be replaced when:
- A. Worn to the OEM paper on the stone
 - B. Worn to $\frac{3}{4}$ the original diameter
 - C. Worn to $\frac{1}{8}$ the original diameter
 - D. Worn down to the metal washer
61. The cold chisel should be sharpened to a:
- A. 45 degree angle
 - B. 60 degree angle
 - C. 135 degree angle
 - D. non of the above are correct
62. What is the first thing that should be done to metal before it is bent, cut, drilled, or filed?
- A. Cooled
 - B. Heated
 - C. Identified
 - D. Painted
63. When compared to machinery repairs, preventative maintenance is:
- A. About the same cost.
 - B. Less costly.
 - C. More costly.
 - D. Twice as costly.
64. What tool is best to make a starting dent before drilling a hole in metal?
- A. Center punch
 - B. Nail set
 - C. Pin punch
 - D. Prick punch
65. What tool would you use to install a roll pin?
- A. center punch
 - B. drift punch
 - C. pin punch
 - D. cold chisel
66. Which tool is best suited to sharpen a pocket knife?
- A. emery wheel dresser
 - B. coarse grinding wheel
 - C. fine grinding wheel

D. wet stone

Oxy Welding

67. A reverse flow check valve can be found on a/an:
- A. regulator.
 - B. torch body.
 - C. both a and b.
 - D. none of the above.
68. Free acetylene should not be stored above what PSI?
- A. 5
 - B. 15
 - C. 75
 - D. 50
69. What is the color of the oxygen hose?
- A. yellow
 - B. blue
 - C. green
 - D. red
70. If acetylene valve on the acetylene cylinder can be fully opened with fifteen turns, how many should it be opened prior to use?
- A. 1.5
 - B. 7
 - C. 11
 - D. 15
71. In general, the thicker the metal to be cut...
- A. the larger the center hole of the cutting tip.
 - B. the smaller the center hole of the cutting tip.
 - C. use of a cutting tip with no center hole.
 - D. non of the above are correct.
72. Which of the following have a coupling with a left-handed thread?
- A. acetylene
 - B. oxygen
 - C. CO₂
 - D. none of the above are correct
73. The torch valve has been shut off yet the pressure side of acetylene regulator valve increases to an unusually high level, this is called:
- A. creep
 - B. jump

- C. frost & freezing
 - D. purging
74. What is the chemical liquid that absorbs large quantities of acetylene under pressure in the acetylene cylinder?
- A. acetone
 - B. nitric acid
 - C. sulfuric acid
 - D. anhydrous ammonia
75. What should the temperature of steel be raised to prior to beginning oxy-acetylene cutting?
- A. 1000 degrees F
 - B. 1500 degrees F
 - C. 2000 degrees F
 - D. 2500 degrees F
76. Acetylene gas can be safely distributed through which type of pipe?
- A. rigid copper
 - B. plastic (PVC)
 - C. high temperature plastic pipe (CPVC)
 - D. None of the above can be safely used.
77. Before opening the cylinder valve on the oxygen cylinder the regulator valve should be...
- A. fully released.
 - B. half released.
 - C. fully closed.
 - D. none of the above are correct.
78. Because of its ability to dissipate heat rapidly, what are most welding tips made out of ?
- A. brass
 - B. copper
 - C. aluminum
 - D. steel
79. To increase the pressure on the acetylene regulator, which way do you turn the valve on the regulator?
- A. clockwise
 - B. counter clockwise
 - C. none of the above are correct.
80. If the flame consists of a slight excess of acetylene it is known as:
- A. neutral flame
 - B. oxidizing flame
 - C. carburizing flame
 - D. none of the above are correct

81. Which of the following is not recommended to prevent backfire?
- A. Using the forehand method when oxy-acetylene welding
 - B. Cooling your tip by dipping it in water
 - C. Cleaning your tip with a tip cleaner
 - D. Holding the tip of your flame at least 3/4 inches away from the metal
82. Which of the following is not a characteristic of a dirty tip?
- A. Sprigs in the flame
 - B. Frequent backfire
 - C. Hissing flame
 - D. All are characteristics of a dirty tip
83. An advantage that a flashback arrester has over a check valve is that:
- A. Stops reverse flow of gas
 - B. Extinguishes the flame
 - C. Shuts off the fuel supply
 - D. Cost- a flashback arrester is cheaper

Tractor Power

84. Which grade number of diesel fuel would be used in weather like today?
- A. 1-D
 - B. 2-D
 - C. 3-D
 - D. Each (1-D, 2-D, or 3-D) performs equally well during this type of weather.
85. For most diesel engines, a common compression ratio is:
- A. 8 to 1
 - B. 11 to 1
 - C. 16 to 1
 - D. 18 to 1
86. The function of the in-line diesel fuel injection pump is to:
- A. Atomize and spray fuel into the cylinder
 - B. Put the fuel under extremely high pressure
 - C. Serve as a radiator to cool the diesel fuel
 - D. increase the lubricity of the fuel.
87. When boosting a "down" battery one should take care to connect the cables from the battery charger in:
- A. Parallel
 - B. Tandem
 - C. Series
 - D. Series-parallel

88. In a 4-stroke diesel engine the camshaft rotates ____?
- A. At half the speed of the crankshaft
 - B. Twice the speed of the crankshaft
 - C. Same speed as the crankshaft
 - D. None of the above
89. Better sealing and longer valve life can be obtained by grinding the valve with a slight interference angle. What is this recommended angle?
- A. $0 - \frac{1}{2}$ degree
 - B. $\frac{1}{2} - 1 \frac{1}{2}$ degree
 - C. $1 - 1 \frac{1}{2}$ degree
 - D. $1 \frac{1}{2} - 2$ degree
90. What are some traction conditions that affect performance?
- A. soil parameters (physical properties)
 - B. presence of crop cover
 - C. tire pressure
 - D. all the above
91. When looking at ballasting of an articulated 4-wheel drive tractor there should be _____% ballast over the front axle and _____% ballast over the back axle.
- A. 60/40
 - B. 50/50
 - C. 40/60
 - D. 35/65
92. The basic parts of a planetary system include all of the following except?
- A. sun gear
 - B. planet pinions and carrier
 - C. ring gear
 - D. countershaft

93. What are the two basic types of overrunning clutches?
- A. roller; sprag or cam
 - B. roller; cone
 - C. cone; sprag or cam
 - D. cone; band
94. What should be used to extinguish a fire that occurs when refueling the tractor?
- A. extinguisher filled with water
 - B. dry chemical extinguisher
 - C. wet chemical extinguisher
 - D. none of these are adequate
95. Hydraulic lines are divided into what three classes?
- A. rigid, semi-rigid, flexible
 - B. rigid, solid, flexible
 - C. rigid, tubing, semi-rigid
 - D. rigid, semi-rigid, solid
96. Which fuel vaporizes most readily?
- A. gasoline
 - B. ethanol
 - C. diesel
 - D. LP gas (propane)
97. The indicator that is used to reflect the anti-knock qualities of gasoline is:
- A. Cetane
 - B. Octane
 - C. Pentane
 - D. Butane
98. A hydrometer is used to test:
- A. The temperature at which antifreeze will protect your engine
 - B. The specific gravity of battery acid.
 - C. The level of refrigerant in the air conditioning system.
 - D. Both A & B are correct
99. A cylinder liner that does not come into direct contact with the coolant is a:
- A. "dry" type sleeve
 - B. "wet" type sleeve
 - C. none of the above are correct, sleeves are no longer used.
100. What feature allows the 3 point hitch of a tractor to compensate for uneven terrain conditions?
- A. hydramatic
 - B. draft control
 - C. torque rod compensation
 - D. cable link manipulation