



2004 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!!!!**

Electrical Motors

1. In a high voltage motor (single phase), the amperage rating is _____ and the wire size is _____ than for a single-phase motor of the same size.
 - A. Less; larger
 - B. More; larger
 - C. More; smaller
 - D. Less; smaller

2. A single phase motor that had two pairs of poles would turn ____ RPM?
 - A. 400
 - B. 550
 - C. 1750
 - D. 3600

3. A permanent split capacitor motor is best starting
 - A. Low starting torque
 - B. High starting torque
 - C. Medium starting torque
 - D. A gasoline engine

4. When disassembling a motor which of the following should be done first?
 - A. Mark the end bells of the motor to insure they get placed back the same
 - B. Remove all end-bell bolts
 - C. Pull the rotor from the stator
 - D. Blow dirt out of the housing

5. The stationary electromagnet in the electric motor is called a:
 - A. Stator
 - B. Rotor
 - C. Armature
 - D. None the above

6. To change the speed of a three phase motor you should:
 - A. reverse the starting wiring on the switch plate
 - B. reverse the wiring at the motor disconnect
 - C. interchanging the connection between any two of the phases
 - D. none of the above are correct

7. Which of the following electric motors is best suited for three-speed operation?
 - A. series motor
 - B. split phase start, induction run motor
 - C. capacitor start, induction run motor
 - D. permanent-split capacitor motor

8. Which of the following electric motors would have a wound rotor?
 - A. repulsion start, induction run
 - B. split phase start, induction run motor
 - C. capacitor start, induction run motor
 - D. permanent-split capacitor motor

9. What is the synchronous (theoretical) speed of an electric motor if the motor has one pair of poles?
 - A. 3600 rpm
 - B. 1800 rpm
 - C. 1200 rpm
 - D. none of the above

10. Assume you are selecting the over-current device for a 120V electric motor. The motor draws 6 amps at full load. The correct size over-current device is:
 - A. 6 amps
 - B. 6.5 amps
 - C. 8 amps
 - D. none of the above are correct

11. You have just acquired an electric motor at an auction sale. The motor is equipped with sleeve type bushings. This motor can therefore be mounted:
 - A. with the shaft in the horizontal position
 - B. with the shaft in the vertical position
 - C. it makes no difference, you can mount it any way you like and the motor will not be affected in any way.

12. Which of the following motors should be selected if you wish to use it with a large capacity air compressor?
- A. capacitor start, capacitor run motor
 - B. capacitor start, induction run motor
 - C. series motor
 - D. permanent-split capacitor motor
13. You have just used the ammeter to determine the amps used by an electric motor. You also noted the voltage needed for the motor as well. Finally, connected to this motor is a wattmeter. Here is the following: Amps = 5.6; Volts = 120; Watts = 615. What is the power factor for this motor? (Assume it is operating at rated load, service factor=1)
- A. 1
 - B. 0.95
 - C. 0.92
 - D. 0.85
14. The type of motor enclosure that should be used to move feed for a confinement livestock facility.
- A. drip proof
 - B. splash proof
 - C. open
 - D. totally enclosed
15. The oil that should be used to lubricate an electric motor is:
- A. 10W-30
 - B. 10W
 - C. 90W gear oil
 - D. 30W non detergent
16. The type of motor that would be found operating a timeclock:
- A. direct current
 - B. synchronous
 - C. induction
 - D. three phase
17. The type of electric motor that you would expect to find powering a 19" box fan:
- A. wound rotor motor
 - B. repulsion start, induction run motor
 - C. permanent split capacitor motor
 - D. shaded pole motor

Concrete and Plumbing

18. The main purpose of rebar in concrete is to:
- A. increase compressive strength
 - B. increase tensile strength
 - C. resists a dead load
 - D. both B and C are correct
19. Sidewalks, unless a heavy truck must drive across them, are usually _____ thick.
- A. 3 inches
 - B. 4 inches
 - C. 5 inches
 - D. 6 inches
20. The keyway is formed into the:
- A. foundation wall
 - B. the footing
 - C. the floor
 - D. none of the above are correct
21. You are about to conduct an organic matter test for the water you are about to use when mixing concrete. The following guideline should be used: no more than _____ of an inch of silt should be found after 60 minutes.
- A. 1/16
 - B. 1/8
 - C. 1/4
 - D. none of the above, it just does not make any difference.
22. You are about to conduct a slump test for the footings of a building. The maximum slump that you can allow is:
- A. 3 inches
 - B. 4 inches
 - C. 5 inches
 - D. 2 inches
23. Assume you are about to pour concrete for a 25 foot diameter steel bin 9" deep. How much concrete will you need to order? (assume a waste factor of 10%)
- A. 14 cubic yards
 - B. 15 cubic yards
 - C. 16 cubic yards
 - D. None of the above are correct

24. One bag of Portland cement weighs:
- A. 92 pounds
 - B. 94 pounds
 - C. 96 pounds
 - D. 98 pounds
25. Fine aggregate is generally _____ of an inch or smaller in diameter.
- A. $\frac{1}{8}$
 - B. $\frac{1}{4}$
 - C. $\frac{1}{2}$
 - D. $\frac{3}{4}$
26. Which of the following would cure concrete with the most compressive strength?
- A. air-cure
 - B. frozen-cure
 - C. moist-cure
 - D. none of the above... it makes no difference.
27. The chemical, "calcium chloride" is added to _____ of concrete.
- A. speed the setting time in cold weather
 - B. slow the setting time in warm weather
 - C. speed the setting time in warm weather
 - D. slow the setting time in cold weather
28. One sack of Portland cement is equal to:
- A. $\frac{1}{2}$ cubic foot
 - B. 1 cubic foot
 - C. 1.5 cubic feet
 - D. 2 cubic feet
29. If the re-rod is placed within 2 inches of the forms, the largest size large aggregate stones should not exceed _____ inches in diameter.
- A. 1.50
 - B. 2.00
 - C. 2.25
 - D. 2.50
30. If in doubt, which water: cement ratio should you use?
- A. 5 gallons: sack of cement
 - B. 6 gallons: sack of cement
 - C. 7 gallons: sack of cement
 - D. 8 gallons: sack of cement

31. You have decided to use $\frac{3}{4}$ " re-rod to reinforce the concrete pad for your tractor. The pad measures 30' by 30'. This essentially forces you to overlap the re-rod in order to maintain the strength of the concrete. What is the minimum overlap that can be allowed and still maintain adequate strength?
- A. 24 inches
 - B. 18 inches
 - C. 12 inches
 - D. 6 inches
32. Which of the following floats leaves the coarsest finish on the concrete?
- A. Steel float
 - B. Wood float
 - C. Magnesium
 - D. Aluminum
33. Which of the following concrete tools should be selected to put a rough surface on concrete that will be used by cattle?
- A. broom
 - B. Wood float
 - C. Magnesium
 - D. Aluminum

Repair and Maintenance

34. Driving tool handles are held in place by
- A. bolts
 - B. nails
 - C. screws
 - D. wedges
35. Corners of doors and frames may be strengthened by using a
- A. hasp
 - B. butt hinge
 - C. flush plate
 - D. hook and eye bolt
36. When flat nailing lumber, the strongest nailing method is
- A. end nailing
 - B. clinching
 - C. toe nailing
 - D. splitting

37. If you cannot get to both sides of sheet metal, the best rivet to use is the
- A. split rivet
 - B. copper rivet and burr
 - C. pop rivet
 - D. solid steel rivet
38. A new grinding wheel for a bench grinder should be tested by
- A. hanging the stone with a string and striking it with the plastic handle of a screwdriver
 - B. bouncing on a concrete floor
 - C. pressing in a vise
 - D. the use of the eyes only
39. When putting threads on a bolt, the correct tool to use is the
- A. tap
 - B. die
 - C. nut you are going to be using
 - D. hacksaw
40. The most common “standard” length of galvanized pipe is:
- A. 16 feet
 - B. 21 feet
 - C. 24 feet
 - D. 48 feet
41. Most leaky faucets can be repaired by replacing:
- A. Washers
 - B. Disks
 - C. Turning the washer over
 - D. All of the above are correct
42. The correct angle to use when repairing the cutting lip of a steel twist drill bit is:
- A. 45 degrees
 - B. 59 degrees
 - C. 30 degrees
 - D. 60 degrees
43. You have just finished putting new cutting edges on your steel twist drill bit. The bit has one cutting lip that is 0.25 inch long and the second that is 0.28 inch long. This is:
- A. ok – move ahead and use the bit
 - B. not ok, they both need to be the same length

44. The name given to a file that is specifically designed to be used on wood:
- A. milled tooth file
 - B. taper file
 - C. triangular file
 - D. rasp
45. The tool that would be used to easily find the center of a round stock is:
- A. combination square
 - B. centering head
 - C. try square
 - D. rafter square
46. The tool that should be used to determine the exact diameter of a hole that you think might be $\frac{1}{4}$ - $\frac{1}{2}$ in diameter is:
- A. Telescoping gauge
 - B. Small hole gauge
 - C. inside calipers
 - D. outside calipers
47. I just found a 5 point wood handsaw at a farm sale. This tool is most likely a:
- A. keyhole saw
 - B. cross cut saw
 - C. miter saw
 - D. rip saw
48. The correct hammer to use when re-shaping the tip of a cold chisel is:
- A. 16 oz curved claw hammer
 - B. 20 oz straight claw hammer
 - C. 8 oz ball peen hammer
 - D. 24 oz blacksmith hammer
49. Which of the following taps would be the correct choice if you were chasing the threads in the block of an engine?
- A. bottoming
 - B. plug
 - C. taper
 - D. Any of these can be used, it really does NOT matter.
50. What size wrench is needed to tighten the nut on a $\frac{1}{2}$ inch bolt?
- A. $\frac{9}{16}$ inch
 - B. $\frac{5}{8}$ inch
 - C. $\frac{11}{16}$ inch
 - D. $\frac{3}{4}$ inch

Oxy-Acetylene Welding

51. What type of oxyacetylene flame is recommended for use when welding cast iron?
- A. oxidizing
 - B. neutral
 - C. carburizing
52. When using a Smith equal pressure oxyacetylene welding torch, the oxygen pressure should be _____ and the acetylene pressure should be _____.
- A. 10 psi, 25 psi
 - B. 25 psi, 10 psi
 - C. 15 psi, 10 psi
 - D. 10 psi, 10 psi
53. Which of the following welding cylinders contain balsa wood?
- A. propane
 - B. acetylene
 - C. oxygen
 - D. none of the above contain balsa wood in the tank
54. A torch flashback can be caused by all EXCEPT which of the following factors?
- A. Loose connections
 - B. Improper pressures
 - C. Overheating of the torch
 - D. Touching the tip of the torch against the work
55. The oxyacetylene hose that you are using has become cracked and you have decided to replace it with a new one. The next step you should follow after connecting the hoses to the regulators is:
- A. attach the torch body
 - B. attach the blowpipe at the same time as the torch body
 - C. purge gas through the lines, then connect the torch body, etc.
 - D. it just does not matter... connect it up!
56. You are about to begin cutting thick metal (in excess of one inch). The recommended filter lens for this project is:
- A. 4
 - B. 5
 - C. 6
 - D. 8
57. The welding tank that has fusible plugs is:
- A. propane
 - B. acetylene
 - C. oxygen
 - D. none of the above have fusible plugs in the tank

58. Which of the following incidents can result in the second incident?
- A. flashback initiates a backfire
 - B. backfire initiates a flashback
59. You have been welding for few minutes and suddenly notice that the flame has a forked envelope. You should:
- A. finish your weld
 - B. shut down the welder and let it cool; the tip is just too hot
 - C. clean the tip using an approved tip cleaner
 - D. none of the above actions should be followed. This is a normal situation.
60. In order for one to perform fusion welding, the following rod(s) are needed:
- A. mild steel rod
 - B. coat hangers work ok, just use a coat hanger
 - C. a brazing rod should be selected for fusion welding
 - D. none of the above are correct.
- The metal plates that you are welding on can be positioned in such a way that you do not need to use filler rod.
61. The color that you see when the temperature of iron is MOST suited for brazing is:
- A. straw brown
 - B. dull red
 - C. cherry red
 - D. white
62. You have a piece of steel to cut with the oxy-acetylene welder that exceeds ½” thick. The tip size that will be best suited is:
- A. 0
 - B. 1
 - C. 2
 - D. 3
63. The name given to the welding technique that allows greater penetration when fusion welding mild steel is:
- A. backhand
 - B. forehand
 - C. left-hand
 - D. right-hand
64. The valve on the oxygen tank is made out of:
- A. steel
 - B. brass
 - C. copper
 - D. aluminum

65. What angle should you hold the rod in relation to the tip of the blowpipe when brazing?
- A. 25 degrees
 - B. 45 degrees
 - C. 65 degrees
 - D. 90 degrees
66. Which of the following angles (relationship of welding tip to work) is 15 degrees?
- A. lead angle
 - B. work angle
 - C. rod angle
 - D. blowpipe angle

Ag Machinery

67. In addition to cutting/feeding and threshing, our combines perform all of the following functions except:
- A. Distribution
 - B. Separating
 - C. Cleaning
 - D. Handling
68. If the operator increases the speed of his combine from three to four MPH;
- A. there will be a decrease in the number of kernels striking the sensors.
 - B. the rate of loss will either be reduced or remain about the same.
 - C. the rate of loss will increase.
 - D. the monitor must be reset.
69. The operator can view relative grain loss:
- A. only at the straw walkers.
 - B. only at the cleaning shoe.
 - C. at the cleaning shoe, straw walkers or both at the same time.
 - D. at the cutting head.
70. During the planting season, a farmer decides to recheck the plant population of his/her corn. The farmer has a 6 row – 30 inch row width planter. When examining how many seed he/her is planting he/her learns that there are 490 seeds for the 6 rows after planting 60 feet. How many seeds per acre is the farmer applying?
- A. 22,546
 - B. 23,716
 - C. 23,180
 - D. 24,689

71. How many tons per hour would a farmer bale if he/she is bailing a 21' windrow that yields 2.3 tons/acre. Assume he/she is driving 4.3 mph and operating at 87% efficiency.
- A. 25.17 acres/hour
 - B. 21.90 acres/hour
 - C. 20.65 acres/hour
 - D. none of the above
72. A 1000 RPM power take off shaft comes from the factory with how many splines?
- A. 21
 - B. 20
 - C. 7
 - D. 6
73. Which of the following factors is required to make a good bale?
- A. Properly operating baler density control system.
 - B. Proper windrow formation (width, size. Crop distribution)
 - C. Operator driving technique (weaving, monitoring strokes/bale)
 - D. Properly set tractor (wheel spacing, drawbar, PTO)
 - E. All of the above
74. What field installed parts will give better bale shape?
- A. Side hay resistors
 - B. Knotter cleaner air system
 - C. Last bale ejection system
 - D. Field working lights
 - E. All of the above
75. Where is the best place to find troubleshooting information on twine and knotter related problems?
- A. Operator's Manual
 - B. DTAC
 - C. Farmer Joe down the road a piece
 - D. Local TAM or TM
 - E. All of the above
76. Which of the following lubricants is an emulsion of mineral oil with soap?
- A. Engine oil
 - B. Grease
 - C. Hydraulic oil
 - D. Gear case oil

77. Which of the following is not considered a basic hydraulic pump?
- A. Gear
 - B. Vane
 - C. Swash plate
 - D. Piston
78. The term ROPS is the safety devise that protects the driver of the tractor in case of an accident. What does the term ROPS stand for?
- A. Rollover protective structure
 - B. Rollover protective system
 - C. Rollover protection structure
 - D. Rollover protection system
79. What is the main power transfer device between a tractor and an implement that is attached to it?
- A. The drawbar
 - B. The PTO shaft
 - C. Hydraulic hose
 - D. A belt
80. On every piece of equipment, what is the first thing that one should do if it breaks down?
- A. Turn off the power supply
 - B. Run after the tools
 - C. See what is broken
 - D. Call someone to fix it
81. What should be the first thing that is done everyday before using a tractor or combine?
- A. Start it up and let it warm-up
 - B. Check the fluid levels
 - C. Read through the operator's manual
 - D. Nothing should be done before one uses it
82. There is a hundred and twenty acre field that is being disked with forty-foot disk and the tractor is pulling it at five miles per hour. The field is 1600 ft wide and 3267 ft long. The efficiency is 80%. How long will it take to finish the field?
- A. 3.96 hours
 - B. 4.95 hours
 - C. 5.5 hours
 - D. 6.19 hours
83. The tailing augers on a combine perform what function?
- A. carries clean grain into the bin of the combine
 - B. carries farm material into the chopper to be disposed of
 - C. Carry dirty grain into the concave/threshing area of the combine
 - D. carries grain out of the bin onto a truck or grain cart

Tractor Power

84. When there is _____, there may be black smoke coming from the exhaust pipe.
- A. Oil in the fuel
 - B. Restriction in the air filter
 - C. Diesel fuel in the crankcase oil
 - D. A short in the spark plug wire
85. Injector parts of a diesel engine:
- A. can be handled with dry hands
 - B. cannot be handled unless oil has been applied to your hands.
86. A blue nozzle tip indicates:
- A. The difference in brands
 - B. Burning oil in the cylinder
 - C. Improper cracking of the cylinder
 - D. Injector not properly torqued
87. White smoke coming out of the exhaust pipe is generally an indication of:
- A. Oil in the fuel
 - B. Use of stale fuel
 - C. Unburned fuel passing through the system
 - D. The engine is running correctly
88. A restricted exhaust muffler can be caused by:
- A. Incorrect timing
 - B. Poor acceleration
 - C. Excessive smoke
 - D. fuel injectors that are not properly torqued
89. The fuel characteristic "cetane number" is used as the ignition indicator for:
- A. Gasoline.
 - B. Methane.
 - C. Diesel fuel.
 - D. Acetylene.
90. What part is considered the backbone of an engine?
- A. Cylinder head
 - B. Cylinder block
 - C. Crankshaft
 - D. Camshaft

91. Which of the following would NOT be used as a cylinder lining for pistons?
- A. Dry liner
 - B. Wet liner
 - C. Cast-in-block
 - D. Heated liner
92. Exhaust valves in engines are typically _____ than intake valves.
- A. Larger
 - B. Smaller
 - C. Same size
 - D. Not applicable
93. A six- cylinder tractor will have uniform firing orders of _____ degrees.
- A. 120
 - B. 180
 - C. 240
 - D. 360
94. Peak temperatures that an engine can reach are as high as _____ degrees Fahrenheit if it was not for the cooling system.
- A. 1200
 - B. 2500
 - C. 4000
 - D. 4800
95. The earlier tractors, such as a John Deere A, were equipped with this type of an air cleaner.
- A. Dry- type
 - B. Oil- type
 - C. Dry canister
 - D. Wet canister
96. A diesel engine's spark plugs fire every _____ turn to the camshaft.
- A. one
 - B. two
 - C. four
 - D. not applicable to this situation
97. A rear tire that is designated for industrial use and has intermediate tread will have a designation of this.
- A. R-1
 - B. R-2
 - C. R-3
 - D. R-4

98. An articulating four-wheel drive tractor will have a weight distribution of ____% on the front axle and ____% on the back axle.
- A. 40-60
 - B. 45-55
 - C. 50-50
 - D. 60-40
99. Which of the following is a type of intercooler?
- A. Oil-to-air
 - B. Water-to-water
 - C. Air-to-air
 - D. Water-to-air
100. What valve in the hydraulic system of a tractor will release the pressure on the pump when it reaches a desired level?
- A. Unloading
 - B. Throttling
 - C. Directional control valve
 - D. Relief