

Texas FFA Agricultural Mechanics CDE
Area X Qualifying Competition
Texas Agricultural Mechanics Committee
April 13, 2011
Superintendent – Mr. Jerome Tymrak
Theme for 2011 - "**Animal Production**"

Instructions: Thank you for competing in the Area X Agricultural Mechanics CDE. The written exam portion of the Agricultural Mechanics Career Development Event consists of 100 multiple-choice questions. Each question is worth one point. You have 60 minutes to complete this portion of the CDE. Make sure you are answering the questions in the proper place on the Scantron, and that you are marking completely. Please erase clearly and don't tear the scantron sheet. **DO NOT WRITE ON THE EXAM!** Thank you. Good luck.

1. Metal building frames are generally made from all of the following types of steel building components EXCEPT:
 - a. I-beam
 - b. Angle Iron
 - c. C or Z purling
 - d. Square or round tubing/pipe

2. What is the most popular/common type of metal post?
 - a. "U" Bar steel post
 - b. Studded "Y" steel post
 - c. "X" Bar steel post
 - d. Studded "T" steel post

3. Electricity is carried from a power generation facility to a step-up substation, where the voltage is increased to a range of _____ volts for transmission.
 - a. 120 to 240
 - b. 7,200 to 14,000
 - c. 69,000 to 750,000
 - d. none of the above

4. Electrical pressure or potential is measured in _____.
 - a. amperes
 - b. ohms
 - c. volts
 - d. watts

5. Horsepower (hp) is the unit of mechanical power equal to ____ watts of electrical power (assuming 74.6% electric motor efficiency).
 - a. 7.46 watts
 - b. 74.6 watts
 - c. 746 watts
 - d. 7,460 watts

6. The amount of resistance (ohm) in a conductor is determined by all of the following except:
- the material of which the conductor is made
 - the size of the conductor
 - the length of the conductor
 - the color of the conductor
7. In a _____ circuit all the current must flow through each device in the circuit.
- series
 - congruent
 - series-parallel
 - parallel
8. A _____ circuit has separate path for the current to flow through.
- series
 - congruent
 - series-parallel
 - parallel
9. When electrons always flow in one direction.
- alternating current (AC)
 - direct current (DC)
 - actuating current (AC)
 - detectable current (DC)
10. When electrons move back and forth, reversing their direction regularly.
- alternating current (AC)
 - direct current (DC)
 - actuating current (AC)
 - detectable current (DC)
11. Turning off the switch for a light is one example of what type of electrical circuit?
- short circuit
 - closed circuit
 - open circuit
 - “hot” circuit
12. What type of circuit results from an electrical current flowing in an unintended path?
- short circuit
 - closed circuit
 - open circuit
 - “hot” circuit
13. A _____ fuse can carry a temporary overload of electrical current, such as the starting of an electric motor, for a short period without disengaging the contacts or melting the fuse link.
- single-phase
 - double-phase
 - three-phase
 - time-delay

14. If one wire is carrying less current than the other, a condition known as _____ has occurred.
- circuit inequality
 - ground-fault
 - current-overload
 - terminal-fault
15. Which formula is used to calculate watts?
- ohms/amperes
 - volts/ohms
 - volts x amperes
 - volts/amperes
16. Which of the following is a type of electrical wire?
- solid
 - stranded
 - both a and b
 - none of the above
17. The guideline listing requirements for safe design and installation electrical wiring systems is _____.
- National Electric Code (NEC)
 - Underwriters Laboratory (UL)
 - Society of Agricultural Engineers (SAE)
 - National Engineers Committee (NEC)
18. The three main environmental factors destructive to electrical components in livestock facilities are:
- rain, hail, and snow
 - lightning, wind, and direct sunlight
 - dust, moisture, and corrosive vapors
 - oxygen, nitrogen, and potassium
19. If an outlet is at the end of a circuit, the bare wire connects to _____.
- the outlet
 - the grounding screw in the outlet box
 - the white wire
 - no connection necessary. Tape and push into box.
20. A unit for measuring the rate of flow of electrical current is the _____.
- ampere
 - volt
 - watt
 - ohm
21. According to industry standards, one duplex outlet per _____ to _____ square feet of floor space is required.
- 100 to 150
 - 120 to 180
 - 140 to 200
 - 160 to 220

22. Which one of the following types of electrical wire would be suitable for installation in locations where both moisture and heat are present?

- a. TW
- b. THHN
- c. THWN
- d. NPTH

23. When using hydraulic systems never adjust or service the system ____.

- a. when the system is cold
- b. when the system is under pressure
- c. when the system is leaking
- d. when the system is empty

24. Wire special service outlets for large loads in an animal production facility for ____ service.

- a. 110-120 volts
- b. 150-160 volts
- c. 220-240 volts
- d. 400-440 volts

25. ____ refers to a loss of voltage as it travels along a wire.

- a. voltage lag
- b. voltage drop
- c. voltage reverb
- d. voltage slag

26. An efficient electric motor generates one Hp of force while using about ____ watts of electricity.

- a. 500
- b. 600
- c. 700
- d. 800

27. Which of the following electric motors would NOT be recommended for hard-to-start loads?

- a. split phase
- b. three-phase
- c. capacitor
- d. repulsion start-capacitor run

28. The number one enemy of a hydraulic system is:

- a. dirt, water, and foreign material
- b. excessive loading
- c. improper positioning
- d. overheating

29. When the roof of a loafing shed is 40 square, what does this mean?

- a. the roof is 40' x 40'
- b. it will take 40 sheets of plywood to cover the roof
- c. the roof is 4,000 square feet
- d. the roof is 400 square feet

30. The self-tapping screws used to attach wall and roof sheets to purlins are called ____.
- a. carriage bolts
 - b. drywall screws
 - c. lag screws
 - d. Tek screws
31. ____ screws have un-slotted heads.
- a. lag
 - b. oval
 - c. pan
 - d. round
32. The greatest challenge in making out-of-position welds is:
- a. angle grinding
 - b. controlling distortion
 - c. controlling the molten puddle
 - d. root penetration
33. There are generally two types of steel produced: carbon and ____.
- a. alloy
 - b. mild
 - c. wrought iron
 - d. stainless
34. One of the fundamental physical laws of hydraulics is that liquids:
- a. cannot be compressed
 - b. reduce their volume proportional to the pressure applied
 - c. do not transmit force as efficiently as gasses
 - d. can be neither created nor destroyed
35. Hydraulic accumulators store ____.
- a. Water
 - b. Air
 - c. Fuel
 - d. Energy
36. Many manufacturers recommend that hydraulic oil be drained and new oil added after ____ hours of operation.
- a. 25
 - b. 50-100
 - c. 100-150
 - d. over 200
37. Hydraulic power is generated from ____.
- a. electric power
 - b. mechanical power
 - c. solar power
 - d. potential energy

38. A hydraulic pump does NOT pump pressure; it creates _____.
a. flow
b. power
c. heat
d. problems
39. Flow through an orifice or restriction causes pressure to _____.
a. stop
b. increase
c. reverse
d. decrease
40. Each of the following is a type of hydraulic valve EXCEPT _____.
a. pressure control
b. exhaust control
c. volume control
d. directional control
41. Each of the following are types of hydraulic pumps EXCEPT _____.
a. gear
b. vane
c. by-pass
d. piston
42. The two types of hydraulic gear pumps are _____ and _____.
a. flow and slide
b. fuel and oil
c. internal and external
d. piston and vane
43. A _____ allows fluid to pass freely into the cylinder as fluid pushes a ball off its seat. When the flow stops the spring pushes the ball onto the seat trapping the fluid in the cylinder.
a. flow valve
b. manual valve
c. check valve
d. gauge valve
44. The _____ hydraulic system uses high pressure and slow movement of fluid to do work.
a. hydrodynamic
b. hydrostatic
c. torque
d. harmonic
45. The engineering science of the energy of liquids pressurized flow is called _____.
a. physics
b. biology
c. chemistry
d. hydrostatics

46. The volume of oil displaced by one complete stroke or revolution of a pump, motor, or cylinder.
- capacity
 - area
 - stroke
 - displacement
47. _____ law states that when a pressure is developed on fluids it acts equally in all directions, regardless of the shape of the container.
- Pascal's
 - Newton's
 - Murphy's
 - Smith's
48. A(n) _____ system is a hydraulic system in which the control valves are open to continuous oil flow when in neutral.
- open-center
 - upper push
 - closed-center
 - variable
49. Pressure multiplied by the area of the piston equals the _____.
- length of the stroke
 - pounds per square inch (psi)
 - revolutions per minute (rpm)
 - load carrying capacity
50. Ferrous metals contain _____.
- ferruginous materials
 - iron
 - no impurities
 - rust-resistant qualities
51. Tool steel contains _____, which allows it to be hardened.
- aluminum
 - carbon
 - helium
 - lithium
52. The cutting speed of a twist drill in feet per minute is $[(\text{size of drill}) \times 3.1416 \times (\text{speed in rpm})] / 12$. A $\frac{1}{4}$ " twist drill that is travelling at 250 rpm cuts at a rate of _____ fpm.
- 20.83
 - 16.36
 - 12
 - 3.89

53. High speed twist drills often have ____ stamped on the shank.
- a. FPM
 - b. date of manufacture
 - c. length
 - d. HS
54. An alloy is a mixture of two or more _____.
- a. distinct groups
 - b. metals
 - c. substances
 - d. electric currents
55. Mechanical steel is used in _____ applications.
- a. chemical refining
 - b. manufacturing and building
 - c. low pressure, low heat
 - d. underground water transport
56. Structural steel is used in _____ applications.
- a. chemical refining
 - b. manufacturing and building
 - c. high pressure, high heat
 - d. underground drilling
57. Joining metal pieces at an angle is ____ welding.
- a. braze
 - b. fillet
 - c. MIG
 - d. forge
58. Ferrous metals are easy to identify because they are _____ and give off sparks when ground on an emery wheel.
- a. copper
 - b. aluminum
 - c. lead
 - d. magnetic
59. Foamy hydraulic oil and jerk-noisy operation is an indication that _____.
- a. pump is worn out
 - b. oil has dirt in it
 - c. reservoir is too low
 - d. air in the hydraulic system
60. _____ means the use of fluid to transfer power or to change a power source into useful force.
- a. Hydraulics
 - b. Pneumatics
 - c. Electronics
 - d. Biologics

61. A cable consisting of #12 conductors, with one red, one white, one black, and a ground wire will be stamped _____ on the jacket.

- a. 12/2
- b. 12/3
- c. 12/3 WG
- d. 12/3 RWBG

62. To ensure correct polarity in electrical circuits, the neutral (white) wire is always connected to the _____.

- a. brass colored terminal
- b. silver colored terminal
- c. AC circuits are not polarized
- d. either color terminal is acceptable

63. Which type of cable should be used in a dry, corrosive free environment?

- a. Type NM
- b. Type NMC
- c. Type UF
- d. Type USE

64. Which type of conduit is best suited for agricultural applications?

- a. EMT
- b. IMC
- c. rigid metal conduit
- d. PVC

65. The rate of electrical flow through a conductor is measured in _____.

- a. horsepower
- b. volts
- c. ohms
- d. amperes

66. The minimum size conductor for a 15 amp circuit is _____.

- a. 10 gauge
- b. 12 gauge
- c. 14 gauge
- d. 18 gauge

67. To protect all receptacles included in a circuit with a receptacle type Ground Fault Circuit Interrupter (GFCI), one must _____.

- a. replace any receptacle in the circuit with a GFCI
- b. replace each receptacle with an individual GFCI
- c. replace the first receptacle in the circuit with a c GFCI
- d. replace the last receptacle in the circuit with a GFCI

68. How often should a Ground Fault Circuit Interrupter (GFCI) be tested?
- daily
 - weekly
 - monthly
 - semi-annually
69. Duty cycle refers to the percentage of time a welder may run at a maximum output amperage before it must be allowed to cool, and is expressed as percentage of a _____ minute test period.
- 5
 - 10
 - 20
 - 30
70. The direction which electricity flows across the arc gap is referred to as _____.
- amperage
 - ohms
 - polarity
 - voltage
71. The electrical system component that activates a motor is the:
- power supply
 - circuit breaker
 - control switch
 - voltage regulator
72. A building component that provides stability against high winds is called a:
- girt
 - knee brace
 - purlin
 - sill
73. The mild steel shape best suited for structural support and distance is the _____.
- angle
 - channel
 - I-beam
 - flat
74. One safety component of hydraulic systems is the incorporation of _____.
- controlled flow
 - low-pressure applications
 - pressure relief valves
 - high-tensile fasteners
75. Dirty or milky hydraulic fluid can be caused by _____.
- incorrect fluid viscosity
 - contaminated fluid
 - excessive component wear
 - fluid restriction

76. Solderless connectors are used when _____.
a. all other methods fail
b. joining wires with a rat tail splice
c. the electrician runs out of solder
d. the humidity is low
77. The live conductor in an electric circuit is generally:
a. red or black
b. aluminum
c. multi-stranded
d. larger than other conductors
78. During oxy-fuel cutting, metal is heated to the _____ temperature.
a. candling
b. extreme
c. kindling
d. sparking
79. Electric motors generally use about _____ watts of electricity per hp of work produced.
a. 645
b. 746
c. 1 KW
d. 288/420
80. The appropriate motor control device for a motor operating on a 240v circuit is:
a. double pole
b. single pole
c. single pole, double throw
d. triple pole
81. The vertical distance from the top of the plate to the upper end of the measuring line on a rafter is called the _____.
a. pitch
b. rise
c. run
d. span
82. When current stops flowing in an electric motor, the _____ ceases to exist.
a. electricity
b. magnetic field
c. motor
d. polarity
83. One type of direct drive for an electric motor is the _____.
a. belt and pulley
b. differential
c. flexible shaft
d. transmission

84. A GFCI (ground fault circuit interrupter) device can detect load current differences as low as _____.

- a. .005 amp
- b. .05 amp
- c. .1 amp
- c. 1.0 amp

85. When constructing a poultry laying facility one must design a reliable lighting system due to the fact that proper lighting will stimulate _____.

- a. meat production
- b. egg production
- c. feather production
- d. broiler production

86. If a pasture is 326,570 square feet, it is _____ acres.

- a 7.50
- b 14.50
- c 27.30
- d 61.85

87. You purchase a hydraulic squeeze chute for \$5300.00. You expect to keep the chute for 10 years, and anticipate a salvage value of \$300 at that time. The approximate monthly cost of owning the chute for those 10 years is _____.

- a \$41.67
- b \$416.70
- c \$4.167
- d \$50.34

88. A cattle producer borrows \$400,000 annually at 4.2%. to finance the operation. An interest rate reduction of 0.5% would save the producer _____ per year.

- a 500.00
- b 1000.00
- c 2000.00
- d 2500.00

89. An electrical device that operates on 115 volts at 20 amps consumes _____ watts in one hour..

- a 5.75
- b 235
- c 575
- d 2300

90. The melting temperature of mild steel is _____.

- a 300 – 400 F
- b 763 – 886 F
- c 1350 – 1570 F
- d 2400 – 2800 F

91. A 225 amp AC welder with a 20% duty cycle can operate safely at the maximum setting for ____ out of every 10 minutes,

- a 1
- b 2
- c 4
- d 10

92. Acetylene burns at 4000 degrees F. Combining acetylene with oxygen raises the flame temperature to 6000 degrees F, which is an increase of _____.

- a 33%
- b 50%
- c 67%
- d 150%

93. A 5-strand barbed-wire fence needs to be lengthened by 350 yards. The minimum amount of wire needed is _____ feet.

- a 350
- b 1050
- c 1750
- d 5250

94. A standard roll of fence wire is _____ rods.

- a 40
- b 80
- c 120
- d 160

95. Woven wire fences are stretched properly when _____ of the crimp is pulled out of the wire.

- a $\frac{1}{4}$
- b $\frac{1}{3}$
- c $\frac{1}{2}$
- d $\frac{2}{3}$

96. Woven wire fence designated 832 is composed of wire that is _____.

- a coated with 8 mils of galvanizing and will last 30 years, plus or minus 2 years
- b dipped in galvanizing 8 times, and will last 32 years
- c is composed of #8 wire, and is designed to stretch as much as 32%
- d is composed of 8 horizontal wires, and is 32" tall

97. In fabricating six different weldments for a working chute, a technician used 95, 48, 33, 31, 19, and 14 electrodes. The average number of electrodes used per weldment is _____.

- a 20
- b 40
- c 50
- d 60

98. Eight pieces of steel weighing 230 lb. are used for fabricating gussets. The average weight for each piece is _____ lbs.

- a 25
- b 29
- c 33
- d 37

99. A triangular gusset with a base of 12" and a height of 33" has an area of _____ in².

- a 90.75
- b 181.5
- c 198
- d 396

100. A hanger gusset for a corral panel has a trapezoid shape, with bases of 10" and 5" and a height of 2.5". The area of this gusset is _____ in².

- a 15
- b 18.75
- c 37.5
- d 42

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