

Minnesota FFA Agricultural Mechanics Career Development Event

University of Minnesota

Division of Agricultural, Food, and Environmental Education

320 VoTech Building

1954 Buford Avenue

St. Paul, MN 55108

WRITTEN EXAMINATION 2004

You will have 50minutes to complete this examination. Answer the multiple choice questions by selecting the one best answer for each question. Mark your answers on the **answer sheet** provided.

Do not write on this exam

Tractor Power (over 75hp)

- The oil ring specifications on your 4040 JD tractor engine states that new ring land clearance should be .002 to .004 inch and never to exceed .006 inch. The measurement on your piston rings is .005 inch. The rings:
 - must be replaced
 - must be aligned on the piston
 - should be filed to meet the specification
 - are within specifications**
- On a four stroke cycle diesel engine which stroke follows the intake stroke?
 - firing stroke
 - power stroke
 - compression stroke**
 - exhaust stroke
- The standard compression ratio for gasoline engines is:
 - 16 - 1
 - 10.5 - 1
 - 8 - 1**
 - 100 - 1
- These components are part of the tractor air intake system:
 - air cleaner, turbocharger, muffler, intake manifold
 - turbocharger, air cleaner, air inlet, intake manifold**
 - muffler, air inlet, air cleaner, intake manifold
 - intake manifold, radiator, air cleaner, air inlet
- When using an ohmmeter to check a circuit, current should be:
 - off**
 - in the AC mode
 - has no effect on testing
 - on
- When you are adjusting valve tappets you are actually adjusting:
 - the clearance between the convex surface of the tappet arm and the valve stem end when the valve is closed.**
 - the clearance between the valve face and the valve seat when the valve is open.
 - the clearance between the convex surface of the tappet arm and the valve stem when the valve is open.
 - the clearance between the valve stem and the valve guide.

7. The terminology used in determining the quality of diesel fuel ignition is:
 - a. high octane
 - b. octane rating
 - c. cetane number**
 - d. CD rating
8. The Carburetor component that allows the gasoline engine to operate at its maximum power output is called a:
 - a. main jet**
 - b. float
 - c. choke
 - d. throttle
9. Which of the following will result in excessive black engine exhaust:
 - a. lean fuel air ratio
 - b. excessive fuel air ratio**
 - c. low oil in the crankcase
 - d. low octane gasoline
10. At top dead center of the exhaust stroke of a diesel engine:
 - a. the intake valve is closed and the exhaust valve is open
 - b. the exhaust valve is closed and the intake valve is open
 - c. both intake and exhaust valves are open**
 - d. both intake and exhaust valves are closed
11. The Society of Automotive Engineers established a designation which is a measure of the fluidity of an oil at a given temperature. The term is:
 - a. service rating
 - b. viscosity**
 - c. API designation
 - d. CDI rating
12. A 7 psi Radiator cap will allow the cooling system to:
 - a. operate efficiently without the loss of coolant at lower boiling points.
 - b. provide control of the cooling system and allows higher boiling point temperatures (about 212 degrees F) in the cooling system to increase engine efficiency.**
 - c. operate in a vacuum for better efficiency
 - d. provide control of the cooling system and allows lower boiling point temperatures (below 212 degrees F) in the cooling system to prevent excessive stress on hoses and other components.
13. The spec's in your diesel pump manual calls for 15 ft-lbs torque for the pump drive shaft nut. What torque setting would you use to tighten the bolts with a torque wrench calibrated in in-lbs?
 - a. 150 in-lbs.
 - c. 180 in-lbs**
 - b. 15 in-lbs
 - d. 10.8 in-lbs.
14. Which of the following is **not** true when used to describe a tractor hydraulic system:
 - a. hydraulic oil will not compress
 - b. hydraulic oil follows the path of least resistance
 - c. hydraulic oil is used in power steering systems
 - d. hydraulic oil is not affected by temperature**
15. In the process of timing the ignition system by the timing light method, turning the distributor cap against the direction of rotor travel will:
 - a. advance the system or make it fire the plug sooner.**
 - b. retard the system or make it fire the plug later.
 - c. not affect the firing of the plug.
 - d. prevent the firing of the plug due to misalignment.

16. After a four stroke cycle engine has completed one full operating cycle the crankshaft has traveled how many degrees?
- a. 360 degrees
 - b. 920 degrees
 - c. **720 degrees**
 - d. 180 degrees
17. The wear in an engine bore that is defined as the difference in cylinder diameter at the top, middle and bottom is called?
- a. out of round
 - b. distortion
 - c. **taper**
 - d. scoring
18. The diesel injection nozzle must:
- a. time the fuel delivery to the cylinder.
 - b. **atomize the fuel for better combustion.**
 - c. regulate the delivery of fuel to the cylinder.
 - d. provide pressure for fuel injection
19. Endplay is defined as:
- a. clearance between the teeth of two mated gears
 - b. **end to end movement of a shaft due to bearing clearances.**
 - c. cannot be measured with a dial indicator
 - d. less the zero end movement of a shaft.
20. A loose electrical connection will cause:
- a. low voltage
 - b. high voltage
 - c. **high resistance**
 - d. high current flow

Row Crop Forage Harvester - Corn

21. The drive gear in the feeder housing is operating at 580 rpm and has 40 teeth. The driven gear has 25 teeth. What is the speed of the driven gear shaft:
- a. **928**
 - b. 92.8
 - c. 9280
 - d. 362.5
22. The standard splines for 540 and 1000 rpm PTO shafts are:
- a. 6 and 540
 - b. **6 and 21**
 - c. 8 and 21
 - d. 8 and 24
23. The best source for machine operation and adjustment is found in the:
- a. machine assembly manual
 - b. machine service manual
 - c. **machine operators manual**
 - d. machine sales literature
24. Knife register on a forage harvester sickle refers to:
- a. **the centering of the sickle knife in the guards at the end of both back and forward motions of the bar**
 - b. the length of the forward stroke of the sickle
 - c. proper spacing of guards on the header
 - d. adjustment is by use of single or dual point knives

25. The hand signal with the arm and finger pointing down while rotating in a circular motion illustrates what command to the operator.
- stop the engine
 - start the engine
 - lower the equipment**
 - this far to go
26. When increasing the forage harvester ground speed the machine operating speed (PTO) must:
- increase
 - decrease
 - remain the same**
 - vary with crop load
27. Gear box lubricant is generally classified as:
- 80/90**
 - 5W30
 - 30
 - 15W40
28. This component is located behind the cutterhead and is used for custom cutting crops to the best length and fineness. Will require a minimum of 15% more power:
- sieve
 - chaffer
 - finger bar
 - recutter screen**
29. Which of the following is **not** a distinct type of forage harvester:
- cut and throw
 - cut and blow
 - flail
 - spike tooth**
30. Which of the following best describes the flow of material through a forage chopper
- gathering chains, sickle, feed rolls, cutterhead, stationary knife**
 - gathering chains, sickle cutterhead, feed rolls, stationary knife
 - sickle, cutterhead, feed rolls, forage head, stationary knife
 - forage head, feeder rolls, stationary knife, sickle, cutterhead

Electrical Controls and Sensing Devices

31. Which of the listed devices will sense the amount of moisture in the air off a grain dryer:
- thermostat
 - humidistat**
 - barometer
 - microstat
32. Cooling thermostats that are used to control fans in confined housing units have:
- contacts that open with increase in temperature
 - contacts that close with increase in temperature
 - contacts that open with a decrease in temperature
 - both b and c**
33. Under normal operating conditions, the on/off electric motor magnetic switch contacts :
- are closed by a:
- | | |
|---------------------|--------------------------|
| a. capacitors | b. electro-magnet |
| c. inductance purge | d. repulsion pulse |

34. You encountered an old fuse box with a time delay fuse for a motor circuit.
Why was this special fuse used:
- allows for continuous motor overloading
 - allows for lighter wire sizes in the circuit
 - allows for cooler motor operation
 - d. allows for the greater motor starting current and reduced running current.**
35. With a given flow of current in a electromagnetic switch coil, the strength of the electromagnet is proportional to:
- insulating factor of the wire
 - b. number of turns of wire in the coil**
 - size of the coil iron core
 - housing diameter
36. Which statement is **not true** concerning High Intensity Discharge Lights (HID)
- HID lights include mercury, metal halide, high pressure sodium and low pressure sodium lights.
 - HID lights have long service lives and are very energy efficient
 - c. HID lights start quickly and have application where light are turned on and off often**
 - HID lights operate well at low temperatures
37. To control a circuit carrying large current demands with a low current circuit you would use a:
- a. relay**
 - breaker
 - overload switch
 - time delay switch
38. Dusty and damp buildings present unique problems to electric controls and devices. Which article of the National Electrical Code (NEC) addresses these requirements:
- a. NEC article 547**
 - NEC article 550
 - NEC article 370
 - NEC article 445
39. This organization is a nationally recognized nonprofit organization that provides a voluntary product testing and listing program of electrical materials:
- National Electrical Code (NEC)
 - b. The Underwriters' Laboratories (UL)**
 - National Fire Protection Association (NFPA)
 - Society of Automotive Engineers (SAE)
40. Electric motors are best protected from burnout by:
- circuit breakers
 - fuses
 - overload protectors
 - d. all of the above**
41. Unless discharged after power is turned off, a serious electrical shock can occur from a:
- transistor
 - rheostat
 - potentiometer
 - d. capacitor**

42. A _____ is a variable resistor used to control current:
- a. potentiometer
 - b. transistor
 - c. rheostat**
 - d. capacitor
43. This device attached to a limit switch would operate a motor for a drainage lift pump:
- a. float**
 - b. check valve
 - c. flapper valve
 - d. electro-magnet
44. When selecting pressure switches for a water system the term differential refers to:
- a. motor running amperage vs the starting amperage
 - b. ability of the system to draw water from given depths
 - c. difference in cut-in and cut-out pressures of the water system**
 - d. current load ranges of the system before circuit breaker will be tripped
45. This device is used for overcurrent protection and can be reset after being tripped:
- a. fuse
 - b. circuit breaker**
 - c. GFFC
 - d. time delay fuse

Metal and Wood Building Construction

46. Grain in lumber is the result of:
- a. annular rings in tree growth**
 - b. drying techniques
 - c. cutting process in the saw mill
 - d. lumber aging process
47. A groove cut across the end of a board to receive another board is a:
- a. miter
 - b. rabbet**
 - c. dado
 - d. drip edge
48. Wood frame buildings have walls constructed of:
- a. beams
 - b. rafters
 - c. studs**
 - d. purlins
49. A structural exterior plywood that has a sanded front with some knots to 1 ½ in. and splits to ½ in and rear knot holes or knots to 2 ½ in would carry a grade of:
- a. C-D**
 - b. A-C
 - c. A-B
 - d. A-A

50. A This panel used primarily for sheeting and subflooring is made from reconstituted wood strands bonded with adhesive under heat and pressure. The wood strands in the panels are directional oriented in layers that are perpendicular to each other:
- Oriented Strand Board**
 - Waferboard
 - Hardboard
 - Masonite
51. A building foundation rests upon a:
- footing**
 - foot pad
 - wall support
 - girder
52. If a wall is vertically straight it is referred to a being:
- plumb**
 - level
 - in alignment
 - sighted
53. The actual thickness of 1 X 8 dressed lumber is:
- 1/8 inch less than nominal
 - 1/4 inch less than nominal
 - 1/2 inch less than nominal**
 - 1 inch less than nominal
54. The items that permits a structure to span over 100 feet without support posts is called a:
- super stud
 - girder
 - truss**
 - support purlin
55. End wall trusses are generally constructed without:
- webs
 - joints
 - outside gussets**
 - joining plates
56. The blade of the framing square is 24 inches long. How long is the tongue (other leg).
- 10"
 - 12"
 - 16"**
 - 20"
57. An auger bit with the number 10 stamped on the tang (shank) would bore a hole with a diameter of:
- 3/4 inch
 - 5/8 inch**
 - 1/2 inch
 - 1/10 inch

58. The size of a claw hammer is determined by the:
- weight of the entire hammer
 - length of the hammer handle
 - weight of the hammer head**
 - length of the head
59. The width of the cut a saw makes in a piece of lumber is called the:
- kerf**
 - notch
 - relief
 - cut clearance
60. This tool is used to make long straight lines. It is pulled tight between two determined points and snapped.
- masons line
 - folding ruler
 - chalk line**
 - laser line

Tool Equipment Maintenance, Plumbing, fiberglass and Plastic

61. Galvanized pipe is coated with?
- galvanoleum
 - lead
 - zinc**
 - aluminum
62. Galvanized pipe may be hazardous when:
- exposed to soil
 - used in conjunction with copper tubing
 - cut with a torch or welded**
 - used in systems for drinking water
63. Pipe (tubing) that is available in both flexible and rigid form is:
- black pipe
 - PVC
 - CPVC
 - copper**
64. A type of flexible pipe (tubing) that is preferred for long runs of outdoor cold water lines is:
- copper
 - oxidizing
 - PVC
 - PE**
65. Pipe wrench sizes are determined by:
- jaw opening size
 - weight of the wrench
 - length of the wrench**
 - width of the jaws
66. Pipe joint compound and Teflon tape are both used to seal threads and prevent leakage. If the pipe is also used for electrical grounding what is the application?
- only the pipe dope or joint compound can be used**
 - only Teflon tape can be used
 - either the Teflon tape or the pipe joint compound can be used
 - neither of the sealing devices can be used and the pipe must be tightened enough to prevent leaks

67. In hot water systems that exceed 180 degrees F. or 82 degrees C. the only pipe that meets requirements is:
- CPVC
 - PVC
 - ABC
 - copper**
68. The reason for applying soldering paste to a copper tubing joint prior to soldering is:
- to prevent oxidation
 - remove rust
 - etch the metal**
 - to allow the solder to flow
69. Which of the following statements is **not** true:
- PE (Polyethylene) pipe is highly resistant to rodents and puncture**
 - PVC (Polyvinyl chloride) pipe has a higher safe working pressure than PE pipe
 - PVC pipe has a high resistance to deterioration from sunlight
 - PE pipe is more tolerant to cold temperature than PVC
70. This type of pipe joint allows for opening the water line without cutting the pipe.
- coupling
 - reducer
 - elbow
 - union
71. Fiberglass is a combination of:
- fibrous glass and PVC cement
 - ABS plastic and solvent
 - fiberglass and plastic resin**
 - ABS plastic and plastic resin
72. A fiber glass mat is:
- used where the most strength and least thickness is required
 - used for a rapid buildup of material to increase job speed**
 - very rigid and is most applicable for flat surfaces
 - identified by the strands per square yard
73. This chemical when added to resin and epoxy causes them to harden:
- surfactant
 - activator
 - catalyst**
 - inhibitor
74. A plastic that hardens when heated but will not soften or melt with repeated heating is called:
- heat sensitive
 - thermosetting**
 - thermoactive
 - polystyrene
75. When repairing a crack in fiber glass it is best to:
- use solvent for final cleaning
 - clean the area with a dry cloth or compressed air**
 - use coarse sandpaper (80 grit) for a rough surface to allow for better filler bonding
 - grind all the way through the laminate panel to guarantee resin penetration

76. What is Xylol used for:
 a. it is an epoxy adhesive
 b. it is a body filler
 c. it is a hardner
d. it is a cleaner to remove wax or foreign materials
77. When tapering the edges of a crack in fiber glass the angle must be no more than:
a. 45 degrees
 b. 15 degrees
 c. 30 degrees
 d. 60 degrees
78. The finished product consisting of a molded hardened mixture including fiber glass and plastic is called a:
 a. plate
 b. form
c. laminate
 d. substrate
79. _____ damage in fiber glass means surface scratches or cracks while _____ damage refers to penetration through the total laminate:
 a. heavy, light
 b. structural, cosmetic
c. cosmetic, structural
 d. structural, surface
80. Three characteristics that make fiber glass a useful material include:
a. strength, light weight, toughness
 b. good electrical carrying capacity, strength, toughness
 c. toughness, light weight, water permeable
 d. water permeable, impact resistant, toughness
81. For general purpose use a cold chisel should be sharpened to an angle of__ degrees:
 a. 30
b. 70
 c. 45
 d. 90
82. The tool rest on a power grinder should be _____ center of the wheel and within _____ inch of the wheel:
 a. below, 1/2
 b. below, 1/8
c. above, 1/8
 d. above, 3/8
83. A properly sharpened twist drill should have approximately _____ degrees relief from the cutting lip to the heel:
 a. 27
 b. 3
c. 12
 d. 45

Land Measurement and Leveling

84. A permanent reference point for which the elevation is known is called a:
 a. foresight
 b. backsight
c. benchmark
 d. corner marker

85. If a farmer owns the NW quarter of the NW quarter of section 8, he owns how many acres?
- a. 160
 - b. 40**
 - c. 320
 - d. 640
86. Each township is divided into 36 equally sized sections numbered 1 – 36 beginning in the _____ corner:
- a. northeast**
 - b. northwest
 - c. southwest
 - d. southeast
87. The surveying instrument that allows the telescope to be used for sighting vertically and horizontally is a:
- a. hand level
 - b. transit**
 - c. base mount
 - d. contractor's level
88. There are _____ sq. ft in an acre and _____ linear feet in a mile:
- a. 43,560 and 5,280**
 - b. 5,280 and 43,580
 - c. 43,580 and 5,820
 - d. 5,260 and 43,560
89. The Act of 1785 provided for divisions of land that were 6 miles square and were called:
- a. sections
 - b. counties
 - c. ranges
 - d. townships**
90. Lines that run through points of equal elevation are called:
- a. contrast elevation lines
 - b. sighting points
 - c. contour lines**
 - d. terrace lines