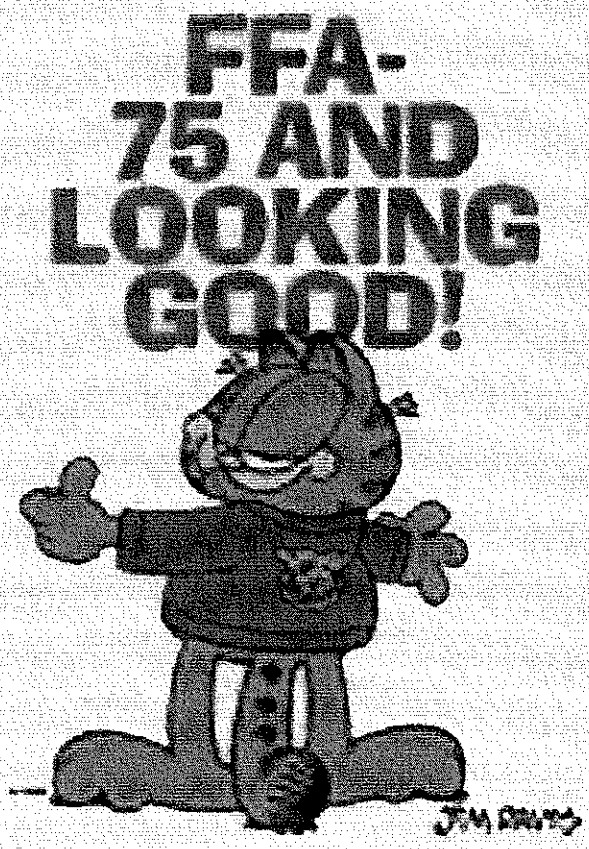
2004
IOWA FFA
CAREER DEVELOPMENT EVENT
AGRICULTURAL MECHANICS

WRITTEN EXAMINATION

IOWA STATE UNIVERSITY
AMES, IOWA
JUNE 3, 2004



Iowa FFA Agricultural Mechanics Career Development Event
2004

State of Iowa
DEPARTMENT OF EDUCATION
Career Education Division
Grimes State Office Building
Des Moines, IA 50319

CONTESTANT NAME _____

CONTESTANT SCHOOL _____

WRITEN EXAM

You will have 50 minutes 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.

MACHINERY AND EQUIPMENT SYSTEMS (GRAIN DRILL)

1. Row crop drills are often used to plant soybeans. The row width spacing sed is often _____ inches.
   a) 7
   b) 34
   c) 38
   d) 29

2. A PTO driven grain drill would operate at _____ PTO speed
   a) 1500
   b) 1000
   c) 2000
   d) 3 MPH

3. Seed metering is done by _____ on a late model John Deere box drill.
   a) counting PTO revolutions
   b) counting engine revolutions
   c) hand
   d) the right hand drive wheel on the drill

4. When planting soybeans with a row-crop drill, you would expect to _____ when the beans are up and growing.
   a) control weeds with a chemical application
   b) control weeds with a rear-mounted row-crop cultivator
   c) control weeds by planting the beans close together
   d) not have to control weeds

5. Soybeans are normally supplied in _____ _____ bags.
   a) 60 pound
   b) 1 bushel
   c) 50 pound
   d) 56 pound

6. SCN are:
   a) soybean control narks
   b) soybean cyst nematodes
   c) southern cyst nematodes
   d) standard counting norms

7. A drill used to renovate pastures, such as the "Tye Pasture Pleaser", could have any of the following features except:
   a) rotating tillers
   b) no-till coulters
   c) moldboards
   d) PTO-driven

8. When planting "Roundup Ready" soybeans, the following will be true.
   a) no modifications of the grain drill will be required
   b) an attachment to apply the Roundup to the bean seeds must be added
   c) Roundup ready beans are easy to distinguish from conventional beans
   d) a red flag must be attached to the drill to notify the neighbors that you are planting Roundup Ready beans

9 When taking the grain drill from one farm to another, _____ is (are) good safety practice(s).
   a) install an SMV emblem visible to the rear of the drill
   b) make sure that the flashing yellow lights on the drill are working
   c) make sure that you are clear of traffic before swinging out for a mailbox
   d) all of the above

10. If the recommended ground speed for a grain drill is exceeded, _____ would be the most likely result.
   a) the seeding rate would increase
   b) the seeding rate in acres per hour would be decreased
   c) seed placement accuracy would probably be affected
   d) the horsepower required to pull the drill would be decreased

11. The numbers 17 x 7 used to describe grain drill size, indicate:
   a) tire size
   b) seed and fertilizer hopper capacities
   c) width of the drill and seeding depth
   d) number of furrow openers and spacing

12. Fluted feed systems on grain drills used to plant soybeans:
   a) may damage the beans
   b) do not provide good seed placement accuracy
   c) are less accurate than air planting systems
   d) all of the above

INDUSTRY AND MARKETING SYSTEMS (GRAIN/ CROP QUALITY)

13. Asian Lady Beetles were originally imported to:
   a) eat European corn borers
   b) eat SCN
   c) eat giant foxtail
   d) eat soybean aphids

14 All of the following could be considered GMO's except:
   a) Starlink corn
   b) Low saturated fat soybeans
   c) Yield-Guard corn
   d) Roundup-Ready soybeans

15. Potential grain dust explosions are a constant hazard when working with stored grain. _____ is a good safety practice.
   a) Use conventional light fixtures
   b) Use explosion-proof lights
   c) Only smoke while waiting for the next load of grain
   d) Make sure that fire extinguishers are stored in the farthest corner

16. Fumigants are used in stored grain to:
   a) control moisture
   b) control grain weight
   c) control dust
   d) control insect pests

17. Standard metric weight for a sack of soybeans is _____ kilograms.
    a) 22.7
    b) 50
    c) 56
    d) 70

18. Chicago Board of Trade bids for corn are usually for:
    a) #1 yellow corn
    b) #2 yellow corn
    c) high lysine corn
    d) edible corn

19. If someone has been trapped by a grain spiral, do this first:
    a) try to empty the bin
    b) jump into the bin
    c) call 911
    d) administer first aid

20. High moisture corn is stored in _____ devices.
    a) breathable storage bags
    b) Butler bins
    c) ear corn cribs
    d) Harvestor silos

21. When corn has bridged over in a storage bin, you should _____ to dislodge the corn.
    a) stand apart from the grain on a scaffold or ladder and dislodge the crust with a long wooden pole
    b) abandon the bin
    c) tie a rope around your waist and jump on the crust
    d) hose down the corn with a water hose

22. Corn can be safely stored at a moisture content of _____ %.
    a) 50
    b) 40
    c) 32
    d) 13

23. Corn "fines" are:
    a) composed of cob parts only
    b) composed of kernel parts only
    c) composed of bits of cob, parts of broken kernels and chaff
    d) not cleaned out of the shelled corn by a grain cleaner

24. "TMDS" will affect Iowa's young corn crop. The causes of TMDS (Too Dang Much Stress) include all of the following except:
    a) sunshine
    b) cold weather
    c) hard rain
    d) flooding

ENERGY SYSTEMS (ELECTRICAL CONTROLS)

25. GFCI is the abbreviation for:
    a) ground found circuit interruption
    b) ground fault circuit interrupter
    c) general fault circuit interference
    d) grounded faulty circuit intercept

26. A _____ uses a small current to control a large current.
    a) resistor
    b) condenser
    c) rheostat
    d) relay

27. A _____ responds to changes in moisture in a grain drying system.
    a) rheostat
    b) Rectifier
    c) Condenser
    d) Humidistat

28. A _____ is a device which raises or lowers voltage.
    a) capacitor
    b) rectifier
    c) transformer
    d) condenser

29. If a man is being shocked and cannot get away, you should do this first:
    a) call 911
    b) grab hold and pull him loose
    c) squirt him with a Class A fire extinguisher
    d) find the switch or control box and de-energize the circuit

30. A capacitor was formerly known as a:
    a) condenser
    b) pulsar
    c) expander
    d) solenoid

31. A magnetic switch is used to control _____ electric motors.
    a) small fan
    b) computer cooling fan
    c) 5 horsepower
    d) fractional horsepower

32. A _____ switch is used to shut off the auger when the grain bin is full.
    a) limit
    b) humidistat
    c) solenoid
    d) pneumatic

33. If current was routed directly from the battery through the key switch to the starter on a diesel engine, the key switch would be melted down. Instead, the key switch controls a _____, which sends the large current to the starter.
    a) transformer
    b) rectifier
    c) solenoid
    d) capacitor

34. A condenser is used in a distributor to:
    a) limit coil voltage to 6 volts
    b) provide automatic spark advance
    c) eliminate plug fouling
    d) prevent burning of the contact points

35. A _____ controls air temperature in a grain dryer setup.
    a) humidistat
    b) thermostat
    c) pressure switch
    d) micro-switch

36. A thermostat is a _____ switch.
    a) normally closed, spring opened
    b) normally open, spring closed
    c) normally open
    d) gravity

STRUCTURAL SYSTEMS (Wood Construction)

37. A _____ is a structural member built of 2 x 4 angled braces inside of a 2 x 4 frame and is used for floor joists
    a) wood web floor truss
    b) I-joist
    c) 2 x 12
    d) stud

38. A _____ is a structural member built of a 2 ½" nailing flange grooved to accept a plywood vertical member which is glued in.
    a) wood web floor truss
    b) I-joist
    c) 2 x 12
    d) Stud

39. A roof which forms a peak with a constant angle on each side is a _____ roof.
    a) gambrel
    b) shed
    c) gable
    d) Quonset

40. A roof which forms a peak with a "hip" on each side is a _____ roof.
    a) gambrel
    b) shed
    c) gable
    d) Quonset

41. Wall studs are normally purchased at _____ length.
    a) 96"
    b) 108"
    c) 92 5/8"
    d) 8 feet

42 A furring strip is used to provide a nailer and is generally installed at _____ spacing when paneling a basement
    a) 1 foot
    b) 2 feet
    c) 3 feet
    d) 4 feet

43. A built-up roof framing member is called a:
    a) rafter
    b) joist
    c) sheeting
    d) truss

44. A nail gun provides great increases in building efficiency. _____ is a good safety practice to follow when using a nail gun.
    a) never point a nail gun at anyone
    b) keep nail guns away from children
    c) make sure that the nail gun is positioned correctly before pulling the trigger.
    d) all of the above

45. A double hung window:
    a) is two windows side-by-side hanging from a window frame.
    b) has a crank opening mechanism
    c) is always clad in vinyl or aluminum.
    d) is installed as a single unit.

46. A load-bearing wall could be set:
    a) centered between 2 parallel floor joists
    b) on the perimeter of the building only
    c) centered between 2 parallel floor joists if cross supports are installed between the joists
    d) directly on top of a single 2 x 6 standing on edge

47. A header is used over _____ in building construction.
    a) stud walls
    b) doors and windows
    c) windows only
    d) doors only

48. There are _____ total square feet in the following pieces of plywood roof sheeting. One piece, 3' x 7', a piece 4' x 8' and one piece 3'6" x 8'.
    a) 80
    b) 81
    c) 85
    d) 90

ENVIRONMENTAL/ NATURAL RESOURCES SYSTEMS (COMBINES/ CROP HARVESTING)

49. Parts of cobs with kernels attached, found behind the combine would probably indicate _____.
    a) cylinder speed too high
    b) concave clearance too close
    c) concave clearance too wide
    d) chaffer and sieve opening too wide

50. If you find 3 corn kernels per square foot behind the combine, it would be about _____ bushels per acre harvest loss.
    a) 30
    b) 1/3
    c) 3
    d) 15

51. If you find threshed soybeans on the ground behind the combine, a possible corrective action would be to adjust the:
    a) concave opening
    b) increase the fan speed
    c) increase the chaffer opening
    d) increase the cylinder speed

52. When making combine adjustments for varying crop conditions, a good rule to follow is to:
    a) always increase the cylinder speed first
    b) always adjust the cylinder speed and cleaning fan speed together
    c) make several adjustments to see what happens
    d) make only one change at a time and check the results

53. Rotary combines work best when:
    a) operated at capacity
    b) operated at about half of capacity
    c) operated at the fastest ground speed that you can stand
    d) operated at 2 miles per hour

54. When leaving the operator's station of the combine, do all of the following except:
    a) leave the combine running with the separator engaged
    b) lower the header to the ground and shut off the engine
    c) back down the ladder
    d) remove the key from the switch

55. If you are operating the combine and suddenly hear a new sound, you should:
    a) stop the combine immediately, shut it down, and find out what is causing the noise
    b) ignore the sound until you have the grain hopper full
    c) keep operating the combine while calling the technician at your combine repair business
    d) turn up the radio

56. Unthreshed grain found ahead of the combine is _____ loss.
    a) cylinder
    b) cleaning shoe
    c) pre-harvest
    d) walker

57. If you find pieces of cob in the grain tank, one of the first adjustments to make would be to:
    a) increase the cylinder speed
    b) decrease the cylinder speed
    c) increase the cleaning fan speed
    d) open the chaffer and sieve

58. Stripper plates in the corn head should have the front opening _____(than) the opening at the rear of the stripper plates.
    a) closer
    b) wider
    c) the same as
    d) none of the above

59. A common unloading rate for class 8 combines would be _____ bushels per second
    a) 1
    b) 2.2
    c) 3 3
    d) 5

60. Unthreshed grain found on the ground behind the combine, but not in front of the combine is likely _____ loss.
    a) header
    b) cylinder
    c) pre-harvest
    d) shoe

Iowa FFA Agricultural Mechanics Career Development Event
2004

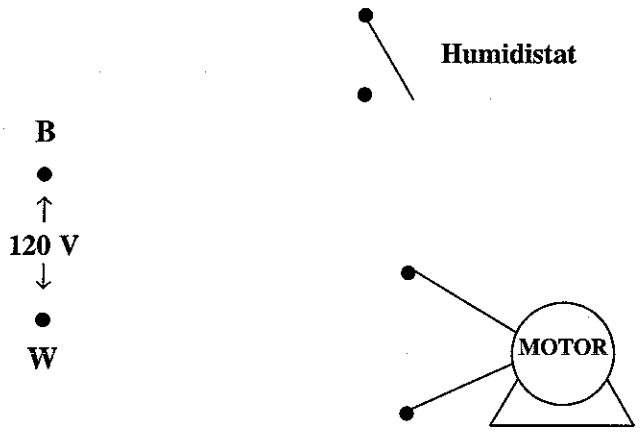
State of Iowa
DEPARTMENT OF EDUCATION
Career Education Division
Grimes State Office Building
Des Moines, IA 50319

CONTESTANT NAME _____

CONTESTANT SCHOOL _____

ENERGY SYSTEMS
Problem Solving/Skills
Motor Controls, Remote Sensors
Humidstat Operating A Dryer Fan Motor
(15 minutes)

Connect a 120-V dryer motor to a humidistat so the dryer fan motor will turn on when the humidity in the bin goes above a specific setting. All materials needed are at the work stations. First, draw the wiring circuit below for the humidistat switch and motor using _____ solid lines for the black wire and ----- dashed for the neutral (white) wire. Second, connect the circuit. Third, complete the specifications.



Specifications Section

1. The switch will _____ when the humidity rises.
2. What is the humidity as measured by the humidistat at your work station? _____
3. Full load amps of control on 120 volts _____
4. Locked rotor amps of control on 240 volts _____

After completing the exercise on paper, complete the actual connection of the humidstat switch and dryer fan motor using the materials provided at the work station. When completed, place your work station in order and request the judge to come to your station to evaluate your completed exercise.

Evaluation Score Sheet

Items		Points Possible	Points Earned
1.	Wiring Diagram	5	_____
2.	Specifications and questions (2 points each)	8	_____
3.	Connecting the control		
	a) Control properly connected	7	_____
	b) Wiring color code followed	3	_____
4.	Safety and work habits	2	_____
	Total	25	

Iowa FFA Agricultural Mechanics Career Development Event
2004

State of Iowa
DEPARTMENT OF EDUCATION
Career Education Division
Grimes State Office Building
Des Moines, IA 50319

CONTESTANT NAME _____

CONTESTANT SCHOOL _____
(print clearly)

ENVIRONMENTAL/NATURAL RESOURCES SYSTEMS
Combine and Crop Harvesting

You have 15 minutes to complete this problem. You are estimating the amount of field loss from a combine corn harvesting operation. The combine uses a rotary threshing system. The corn sample provided to you was collected off the ground from a 10 ft x 10 ft area in a field that has just been harvested.

Conversion factors needed: **1 acre = 43,560 ft^2** **1 bushel of corn = 56 lbs** **1 kg = 1000 g = 2.204 lbs**
Express your answers to the nearest 10th (0.1).

The sample identifier for your sample: _____

1. What is the harvest loss, in bushels per acres? _____ answer #1

2. If the crop yield was 180 bushels per acre, what is the harvest loss in percent? _____ answer #2

3. Which components of the combine should you check and/or adjust to reduce the amount of harvest loss?

Component	Check/Adjust?
a). Corn snapping rolls	☐ Yes ☐ No
b). Stripper/deck plates	☐ Yes ☐ No
c). Gathering chains	☐ Yes ☐ No
d). Platform auger	☐ Yes ☐ No
e). Concave clearance	☐ Yes ☐ No
f). Cylinder/rotor speed	☐ Yes ☐ No
g). Straw walkers	☐ Yes ☐ No
h). Grain Cleaning fan	☐ Yes ☐ No
i). Cleaning shoe Sieves	☐ Yes ☐ No
j). Clean Grain auger	☐ Yes ☐ No

4. What is an acceptable or good target level of harvest loss, in bushels per acre? _____ answer #4

EVALUATION SCORE SHEET

ITEM	POINTS POSSIBLE	EARNED
#1 – Harvest Loss, bu/acre	7	_____
#2 – Harvest Loss, %	4	_____
#3 – Checks/Adjustments	10	_____
#4 – Acceptable harvest loss	3	_____
General quality and procedures	1	_____
TOTAL	25	

Iowa FFA Agricultural Mechanics Career Development Event
2004

State of Iowa
DEPARTMENT OF EDUCATION
Career Education Division
Grimes State Office Building
Des Moines, IA 50319

CONTESTANT NAME _____

CONTESTANT SCHOOL _____

INDUSTRY AND MARKETING SYSTEMS

Problem Solving/Skills

Answer the following questions:

1. Name four possible sources of co-mingling identity preserved grain.

   1.) _____

   2.) _____

   3.) _____

   4.) _____

2. Name three different identity-preserved markets:

   1.) _____

   2.) _____

   3.) _____

3. You are cleaning a planter to prevent contamination of seed between plantings. After a planter's seed metering system has been cleaned of seed, name three other areas to check for seed on the planter.

   1.) _____

   2.) _____

   3.) _____

4. Name three different pieces of person protective equipment that might be used during equipment cleanout:

   1.) _____

   2.) _____

   3.) _____

5. How many undesirable corn seeds would be allowed in 1000 ft of row if co-mingling during planting is to be limited to 0.1% or less? Assume 30-inch rows and a planting rate of 35,000 seeds per acre.

6. How many undesirable soybean seeds would be allowed with the same criteria in #5 (0.1% co-mingling or less) with a seeding rate of 175,000 seeds/acre? Assume 30-inch rows and a planting rate of 175,000 seeds/acre.

7. 100 kernels of corn, on average, weigh approximately 30 grams (1000 g = 2.204 lbs). A bushel of corn weighs 56 lbs. How many kernels of GMO corn can be in a "non-GMO" bushel if the maximum allowable contamination is 0.5% by weight?

8. Consider the supplied diagram of a rotary combine with a bean platform attached. Of the following pairs of components, check the component that is more likely to harbor left-over grain after the combine has been unloaded of grain.

☐ Grain tank	☐ Rotor	☐ Straw Distributors	☐ Platform augers
☐ Clean Grain Auger	☐ Straw walker	☐ Concaves	☐ Grain tank
☐ Reel	☐ Unloading auger	☐ Clean Grain Auger	☐ Platform conveyor

---

Evaluation Score Sheet

	Items	Points Possible	Points Earned
1.		4	
2.		3	
3.		3	
4.		2	
5.		2	
6.		2	
7.		3	
8.		6	
	Total	25	

Iowa FFA Agricultural Mechanics Career Development Event
2004

State of Iowa
DEPARTMENT OF EDUCATION
Career Education Division
Grimes State Office Building
Des Moines, IA 50319

CONTESTANT NAME _____

CONTESTANT SCHOOL _____

MACHINERY AND EQUIPMENT SYSTEMS
Grain Drills
Problem Solving/Skill

Instructions:

You will have 15 minutes to do this exercise. Using the sections from the owner's manual at your station, and your knowledge of grain drills, answer the following questions.

I. Determine the following for this machine: 4 pts.

a) Machine Model Number _____ Machine weight, full _____ lb

b) Machine Serial Number _____ Recommended tractor size _____ _hp

II. Identify by proper name the machine components. 7 pts.

Name

a) _____
b) _____
c) _____
d) _____
e) _____
f) _____
g) _____

III. What are the lubrication intervals (number of hours) for the following: 4 pts.

a) drive clutch _____ c) disk opener hubs _____
b) rockshaft bearings _____ d) caster wheel hubs _____

IV. To plant 40 lb/ac of oats the seed index should be set on notch number _____ 2 pts.

If seed density is 3000 seeds/lb and it's desired to plant 150,000 seeds/ac, the drill should be set to plant _____ lb/ac 5 pts.

V. What's the recommended tire inflation pressure? _____psi 2 pts.

Evaluation Score Sheet

Items	Points Possible	Earned
Model, Serial No., Wt., Tractor	4	_____
Part Identification	7	_____
Lubrication Intervals	4	_____
Seeding setting, rate	7	_____
Inflation	2	_____
Safety	1	_____
Total	25	

Iowa FFA Agricultural Mechanics Career Development Event
2004

State of Iowa
DEPARTMENT OF EDUCATION
Career Education Division
Grimes State Office Building
Des Moines, IA 50319

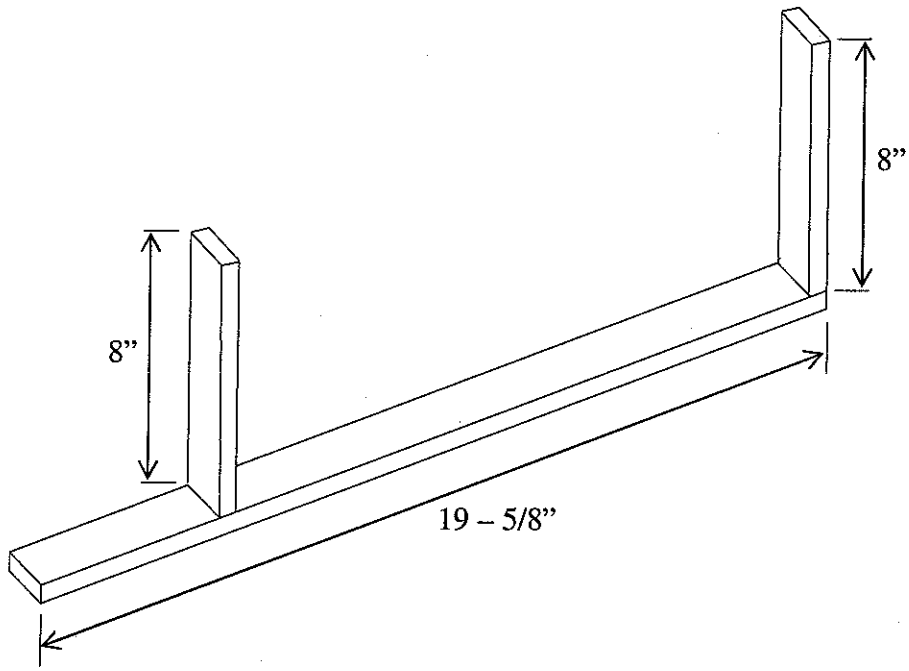
CONTESTANT NAME _____

CONTESTANT SCHOOL _____

Structural Systems

Wood Construction—Stud Frame Wall

You will have **15 minutes** to complete this activity. Your job is to layout and nail two short studs on to a bottom plate of a stud-frame wall. Study the plan of the completed job. Measure and cut the two studs from the 2x4 furnished. Layout and mark the end stud and first stud 16" on-center on the plate. Toe-nail the two studs to the plate assuming the plate is in place, nailed solid to a sub-floor.



Use the tools, materials, and sawhorse at your work station to complete this job. When completed turn in your skill sheet for evaluation and leave your work station in order.

Evaluation Score Sheet

Items		Points Possible	Earned
1.	Length of studs	4	_____
2.	Length of plate	4	_____
3.	Layout of studs on plate, 16" O.C.	5	_____
4.	Location of studs on plate	5	_____
5.	Correct number of nails and proper nailing of studs to plate	5	_____
6.	Use of tools, safety and work habits	2	_____
	Total	25	

Iowa FFA Agricultural Mechanics Career Development Event
2004

State of Iowa
DEPARTMENT OF EDUCATION
Career Education Division
Grimes State Office Building
Des Moines, IA 50319

CONTESTANT NAME _____
(print clearly)

CONTESTANT SCHOOL _____

TEAM ACTIVITY
Electrical Equipment

Instructions:

Motor Number:_____

You will have 50 minutes to complete this exercise. Using one of the electric motors and related materials, answer the following questions. **Write** motor number on this sheet. Write all answers in the spaces provided. When completed, hand this sheet to the person in charge of evaluation.

Answer questions 1 through 9 with the motor OFF.

_____ 1. What type of electric motor is this?

a) 3-phase b) split phase c) universal d) capacitor start-induction run

_____ 2. This motor is connected for operation at what voltage?

a) 115V b) 230V

_____ 3. The type of enclosure on this motor is:

a) open drip proof
b) totally enclosed-fan cooled
c) explosion proof
d) totally enclosed-non vented

_____ 4. If loaded to its service factor hp, this motor will be delivering:

a) 1/4 hp b) 1/3 hp c) 1/2 hp

_____ 5. What is the synchronous speed of this motor (in rpm)?

_____ 6. Compute the torque in lb-ft. produced by this motor under full-load conditions:

$$HP = \frac{2\pi(T)(N)}{33{,}000}$$

where HP = power output, horsepower
π = 3.14
T = torque, lb-ft
N = speed, rev/minute

_____ 7. The full-load amps of this motor, as connected, is:

_____ 8. This motor is connected for this rotation (facing lead end):

a) counter-clockwise b) clockwise

9. Using the supplied watt-hour meter, measure the power use of the connected motor while it is running. You will need to count disk revolutions and use the formula below. Write your answer in the space provided.

$$P = \frac{R}{t} \times K_h \times 3600$$

Power = _____ watts

where P = power (watts)
R = number of revolutions
t = time for R revolutions (seconds)
K_h = meter constant (watt-hr per rev)

10. Determine the voltage and current with the motor running.

Voltage = _____ volts

Current = _____ amps

11. Compute the power factor of the motor.

$$P = (I)(E)(PF)$$

Power Factor = _____

where: P = power (watts)
I = current (amps)
E = voltage (volts)
PF = power factor

Evaluation Score Sheet

Items		Points Possible	Points Earned
1.	Questions 1 through 5, 8 pts each	40	_____
2	Question 6	20	_____
3.	Question 7 and 8, 5 pts each	10	_____
4.	Question 9	50	_____
4.	Question 10	10	_____
4.	Question 11	20	_____
	Total	150	