Areas - 2002
Machinery - Combines
Industry - Grain + SB Handling
Energy - Electrical Motors
Structural - Storage Structures
Gen. - Grain + SB harvesting

2002

IOWA FFA AGRICULTURAL MECHANICS EVENT

Problem Solving, Skills, Exam & Keys

Prepared by
Dr. Tom Brumm
Agricultural and Biosystems Engineering
214D Davidson Hall
Iowa State University
Ames, IA 50011
tbrumm@iastate.edu

Mr. Dean Byerly
1505 - 271st Ave.
Ft. Atkinson, IA 52144

Iowa FFA Agricultural Mechanics Career Development Event - 2002

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

CONTESTANT NAME _____

CONTESTANT SCHOOL _____

WRITTEN EXAMINATION

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.

1. The AGCO Gleaner combine has _____ threshing and separation.
   a) single tine separation b) natural flow processor c) axial flow d) twin rotor

2. The New Holland TX series combine has _____ threshing and separation.
   a) single tine separation b) natural flow processor c) axial flow d) twin rotor

3. The Case-IH combine has _____ threshing and separation.
   a) single tine separation b) natural flow processor c) axial flow d) twin rotor

4. The John Deere combine, which is similar to rotary combines, has _____threshing and separation.
   a) single tine separation b) natural flow processor c) axial flow d) twin rotor

5. The rotor in the AGCO Gleaner is placed in a (an) _____ position.
   a) transverse b) longitudinal c) angled from front to rear d) both a and b

6. Harvest loss monitors will give accurate readings:
   a) with no calibration needed from new.
   b) only when used with Global Positioning Systems (GPS).
   c) only when hooked to a lap-top computer.
   d) after physically checking harvest losses and calibrating the monitor.

7. If you find cracked or crushed corn kernels in the combine grain tank, you should adjust the _____ first.
   a) chaffer and sieve to a wider setting c) decrease the rotor or cylinder clearance
   b) slow down the rotor or cylinder speed d) increase the fan speed

8. MOG is _____ _____ _____.
   a) material other than grain b) moldy old grain c) maximum output grain d) smoke mixed with fog

9. Do which of the following when leaving the combine operator's station:
   a) turn off the header and separator , leaving the header at operating height, stop the engine and remove the key
   b) leave the engine and separator running
   c) make sure that you have oil pressure
   d) turn off the header and separator, lower the header to the ground. stop the engine and remove the key

10. If you find excessive trash in the grain bin, you should _____ first.
    a) increase the rotor speed b) decrease the rotor speed c) open the chaffer d) decrease the ground speed

11. Your combine should be equipped with _____ for highway operation.
    a) flashing yellow lights b) SMV emblem c) turn signals d) all of the above

12. If you find complete bean pods when combining beans or complete corn ears on the ground when combining corn, you should:
    a) first make a pre-harvest check ahead of the combine, to find out if the pods or ears were already on the ground.
    b) assume that the loss is always caused by the grain platform or cornhead.
    c) assume that the loss is entirely pre-harvest loss.
    d) increase the ground speed by 25%.

13. Which of the following are good safety practices when working around grain stored in round metal bins?
    a) attach a knotted large rope to the center of the roof and let it hang down into the bin, so that, in case someone gets trapped by a grain spiral or collapse of a grain crust, they may be able to hang onto the rope until help arrives
    b) only allow adults to go into a bin when it is being unloaded
    c) if fumigants have been used in a grain bin, always allow sufficient air flow through the bin before attempting to enter
    d) both a and c

14. Stored grain should be checked on a regular basis for:
    a) GMO's. b) high moisture content. c) insect pests. d) both b and c.

15. Electric motors on grain augers _____.
    a) are always 120 V AC
    b) need to be checked on a regular basis for internal build-up of dirt and chaff
    c) must be 240 V , three phase motors
    d) should be reversible

16. If you wanted to purchase a new grain leg for your storage set-up, you would most likely select a _____ year depreciation schedule for tax purposes.
    a) 6 or 10 b) 1 c) 2 d) 50

17. Potential grain dust explosions are a constant hazard when working with stored grain. Good safety practices would include all of the following except:
    a) use explosion-proof lights.
    b) make sure that electric motors are vapor-proof to avoid sparks which might ignite grain dust.
    c) take a smoke break while the grain is being unloaded.
    d) do not use trouble lights unless they are approved for use in hazardous locations.

18. If you borrow $82.000 to purchase a new grain drying and storage set-up, the total interest would be $_____ if you pay 10% of the principle plus interest on the remaining principle and pay for the system in 10 years. (9.5% simple interest)
    a) 4,284.50 b) 428.45 c) 42,845.00 d) 428,450.00

19. Your new grain drying and storage set-up would cost $_____ , including interest, after all the payments are completed.
    a) 82,000 b) 124,845 c) 89,790 d) 42845

20. If a worker gets caught in a grain spiral, it can be potentially fatal. A grain spiral occurs:
    a) when a bin is unloaded from the bottom.
    b) only after grain has been stored over winter.
    c) only in bins more than 18 feet tall.
    d) none of the above.

21. If a grain bin has a crust on top of the grain and it will not dislodge, all of the following except _____ are correct actions.
    a) do not allow anyone to go into the bin and kick it down
    b) do not try to go into the bin and break up the crust with a scoop shovel
    c) use a long pole, while standing on a ladder outside the bin and try to dislodge the crust
    d) go into the bin yourself and kick it down

22. When moving elevators or augers around grain storage buildings, which of the following is(are) good safety practices?
a) "look up!"
b) move the auger carefully because of a tipping hazard
c) move the auger fast and don't worry about hazards
d) both a and b

23. A long rope with knots tied every foot and hangs in the center of a grain bin:
a) is for the kids to swing on when the grain bin is empty.
b) is silly, because no one is ever going to need it.
c) may save a life by giving someone a handhold if they get caught in a grain spiral.
d) is a hazard, because it might get in your way when you are unloading the bin.

24. _____ would be the safest way to pull a Killbros, Model 655 Heavy Duty grain wagon filled with 650 bushels of beans to town.
a) A 2WD Ranger pickup
b) A John Deere 8400 tractor
c) A Dodge Caravan with a trailer hitch
d) A 4WD Subaru Outback

25. A limit switch may be used to do all of the following except:
a) vary the temperature.
b) maintain water level in a tank.
c) shut off the auger when a bin becomes full.
d) stop a hoist at a pre-set height.

26. A pressure switch, using the pressure of grain against a sensing plate, may be used to:
a) control grain temperature in a grain dryer.
b) activate a signal light when a combine grain tank becomes full.
c) determine the moisture content of harvested grain in the combine grain tank.
d) limit the force needed to turn a grain auger.

27. If a person is being shocked and cannot move, do all of the following, except:
a) find the switch or control box and shut off the electrical circuit.
b) administer CPR.
c) grab the person and try to pull him/her away from the electrical contact.
d) phone 911.

28. A _____ is a device which stores electrical energy.
a) capacitor b) transformer c) rectifier d) alternator

29. A humidistat responds to _____ to activate and control the operation of a grain dryer.
a) grain temperature
b) air flow in cubic feet per minute
c) grain moisture content
d) ambient temperature

30. A(n) _____ is a device which uses a small current to control a large current.
a) inverter b) relay c) condensor d) capacitor

31. You would use a _____ if you wanted a fan, used to control temperature in stored grain, to turn off when the ambient temperature falls to 40 degrees.
a) NC thermostat that opens on temperature decrease
b) NC thermostat that closes on temperature decrease
c) humidistat
d) NO thermostat that closes on temperature decrease

32. The _____ is an electrical test instrument that measures electrical resistance.
a) ammeter b) tachometer c) voltmeter d) ohmmeter

33. To _____, a Ground Fault Circuit Interruptor (GFCI) is used.
a) prevent serious injury to a person in case of a fault in the electrical circuit
b) satisfy the electrical code, but the device consumes large amounts of electrical energy
c) detect excessive power consumed by power tools
d) allow unsafe equipment to be used anyway

34. _____ is the correct method of hooking up the wires to an electrical outlet.
a) bare wire to green screw, white wire to brass screw, black wire to chrome screw
b) bare wire to brass screw, black wire to green screw, white wire to chrome screw
c) bare wire to green screw, black wire to brass screw, white wire to chrome screw
d) none of the above

35. _____ should be used to ground grain drying equipment circuits.
a) A close-by steel fence post
b) A nearby PVC water pipe
c) The grain bin
d) A ½ inch copper rod, 8 feet long, driven almost all of the way into moistened earth and connected to the ground circuit

36. A(n) _____ is the term used to describe the lack of continuity in an electrical circuit.
a) open b) short c) ground d) cross-over

37. A _____ nail is commonly called a spike
a) 6d b) 7d c) 8d d) 16d

38. Roof trusses used in pole type grain storage buildings are generally placed _____ apart.
a) 2 b) 4 c) 8 d) 16

39. _____ is the term used to describe the wood or metal piece used to cover the vertical end cut of rafters or trusses.
a) soffit b) plate c) sill d) facia

40. _____ is the term used for thickness of painted metal roofing sheets used in the construction of metal covered, pole type grain storage buildings.
a) gauge b) pitch c) run d) slope

41. Enough building material to cover 100 square feet is called a:
a) bunch. b) hectare. c) rectangle. d) square.

42. If you were building a grain storage building in Iowa with wooden roof trusses, you would specify trusses designed to withstand the _____ snow load.
a) maximum b) minimum c) average d) none of the above

43 The nails for sheet metal roofing should be made of:
a) the same material as the roofing material.
b) different material than the roofing material.
c) steel only.
d) aluminum only.

44. The term "dead load" of a building roofing system refers to:
a) the weight of snow and ice which may accumulate on the roof.
b) the weight of livestock and equipment that are contained in the building.
c) the weight of all materials used to construct the roof.
d) the wind force which creates a lifting effect on the roof.

45. The top plate of a stud wall is constructed with _____ 2" x 4" pieces.
a) 1 b) 2 c) 3 d) 4

46. A 2" x 12" piece of lumber actually measures _____" by _____".
a) 1 5/8 x 11 5/8 b) 2 x 12 c) 1 ½ x 11 ½ d) 1 ½ x 11 ¼

. You would need _____ studs to build a 40-foot wall for a grain storage building, when the studs are 16" on center and double studs are used at each end of the wall.
a) 40 b) 20 c) 23 d) 33

48. A header to be used over a 20 foot door opening in a wooden grain storage building would generally be built up using:
a) 2 - 2"x12" planks with plywood sandwiched in between.
b) 2 - 2" X 12" planks.
c) 2 - 2" x 6" planks with plywood sandwiched in between.
d) 4 - 3/4" pieces of plywood.

49. A rectangular building 120 feet long and 60 feet wide, and filled to a level depth of 8 feet would hold _____ bushels of corn.

FORMULA
LFC= L xW x D x 0.8
LFC= level filled storage capacity in bushels
L = storage length in feet
W= storage width in feet
D= grain depth in feet at the sidewall
0.8= conversion factor, cubic feet to bushels bu/ ft

a) 46,080 b) 4608 c) 460,800 d) 57,600

50. A round metal grain storage bin, 40 feet in diameter, filled to a depth of 30 feet would hold _____ bushels of corn.

FORMULA
RBC=0.785 x D x D x H x 0.8
RBC= estimated capacity of level filled round bin in bushels
0.785= constant
D= bin diameter in feet
H=bin height in feet
0.8=conversion factor, cubic feet to bushels bu/ft

a) 38,400 b) 48,000 c) 30,144 d) 40,000

51. When grain is stored during the Fall and Winter months, all of the following are true, except:
a) aeration is essential for successful dry grain storage.
b) the most moisture problems will occur with Roundup-Ready beans.
c) wet corn can be stored for a few weeks if the air temperature remains below 25 degrees.
d) moisture problems will most likely occur at the center top of the bin or along the cold north wall of the bin.

52. PTO shafts for portable augers:
a) are not a critical hazard.
b) can cause serious injury to humans and animals if they become entangled.
c) are very dangerous and should be properly shielded.
d) both b and c.

53. Soy diesel fuel and ethanol blend gasoline are good for Iowa because:
a) these are both markets for Iowa crops.
b) both fuels are environmentally friendly.
c) using soy diesel and ethanol blend gasoline will positively affect the balance of trade with other nations.
d) all of the above.

54. Roundup-Ready beans:
a) are a GMO crop.
b) are easily sold in European markets.
c) look exactly the same as conventional beans.
d) both a and c.

55. If you used a fungicide on stored grain, you are treating the grain for:
a) insects. b) molds. c) moisture content. d) GMO's.

56. _____ % is the recommended moisture content for safe storage of shelled corn for 6 months.
a) 14 b) 10 c) 20 d) 28

57. Spontaneous combustion can occur in a round metal storage structure filled with soybeans. The most likely cause would be:
a) GMO soybeans.
b) soybeans that are too dry.
c) soybeans that are stored at the correct moisture content.
d) soybeans which are wet and full of trash.

58. A Killbros Heavy Duty Grain Wagon is filled with 625 bushels of corn. The approximate weight of the wagon and the corn would be _____ pounds. The wagon, with integral gear weighs 6500 pounds. 13% corn weighs about 59 pounds per bushel.
a) 6500 b) 43,375 c) 36,875 d) 62,500

59. Number 2 yellow corn has a standard weight of _____ pounds per bushel.
a) 30 b) 40 c) 56 d) 80

60. All of the following are true statements about grain dust, except:
a) grain dust is harmful to your lungs.
b) grain dust is explosive.
c) dust will irritate your eyes.
d) grain dust is harmless.

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CONTESTANT NAME Key

CONTESTANT SCHOOL

WRITTEN EXAM

Darken the circle 0 under A, B, C, or D indicating the one best answer

	A	B	C	D
1.	0	●	0	0
2.	0	0	0	●
3.	0	0	●	0
4.	●	0	0	0
5.	●	0	0	0
6.	0	0	0	●
7.	0	●	0	0
8.	●	0	0	0
9.	0	0	0	●
10.	0	●	0	0
11.	0	0	0	●
12.	●	0	0	0
13.	0	0	0	●
14.	0	0	0	●
15.	0	●	0	0
16.	●	0	0	0
17.	0	0	●	0
18.	0	0	●	0
19.	0	●	0	0
20.	●	0	0	0

MES

	A	B	C	D
21.	0	0	0	●
22.	0	0	0	●
23.	0	0	●	0
24.	0	●	0	0
25.	●	0	0	0
26.	0	●	0	0
27.	0	0	●	0
28.	●	0	0	0
29.	0	0	●	0
30.	0	●	0	0
31.	●	0	0	0
32.	0	0	0	●
33.	●	0	0	0
34.	0	0	●	0
35.	0	0	0	●
36.	●	0	0	0
37.	0	0	0	●
38.	0	●	0	0
39.	0	0	0	●
40.	●	0	0	0

IMS

ES

	A	B	C	D
41.	0	0	0	●
42.	●	0	0	0
43.	●	0	0	0
44.	0	0	●	0
45.	0	●	0	0
46.	0	0	0	●
47.	0	0	0	●
48.	●	0	0	0
49.	●	0	0	0
50.	0	0	●	0
51.	0	●	0	0
52.	0	0	0	●
53.	0	0	0	●
54.	0	0	0	●
55.	0	●	0	0
56.	●	0	0	0
57.	0	0	0	●
58.	0	●	0	0
59.	0	0	●	0
60.	0	0	0	●

SS

E/NRS

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CONTESTANT NAME _____

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ENERGY SYSTEMS
Problem Solving/Skill

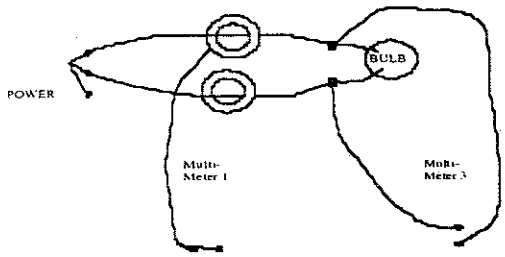
Instructions:
You will have 15 minutes to do this exercise. Ask for assistance if you're not sure what you are doing.

Part A. Use the Fluke multimeter to measure the resistance of the light bulb. To do this, turn the function selector to Ω and touch the leads to the terminals of the lamp holder containing the bulb:

_____ ohms

Shut off the multimeter when finished.

Part B. **CAUTION!** You are working with 120-V line power. Do not touch any connections. All connections have been made for you.



- Turn function selectors to Ã on Fluke multimeters 1
- Turn function selector to Ṽ on Fluke multimeter 3
-
- Turn on power
- Read values: Multimeter 1 _____ amps
  Multimeter 3 _____ volts

- Turn off power
- Turn off all three Fluke multimeters

- Compute bulb watts: _____ (amps) x _____ (volts) = _____ (watts)

- If electricity costs $0.09/kWh, what will it cost to operate this bulb continuously for one week? $_____

Evaluation Score Sheet

Items	Points Possible	Earned
Resistance measurement	4	_____
Voltage measurement	4	_____
Current measurement	4	_____
Power computation	5	_____
Cost computation	5	_____
Safe work habits	3	_____
Total	25	

Iowa FFA Agricultural Mechanics Career Development Event
2002

KEY

CONTESTANT NAME _____

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CONTESTANT SCHOOL _____

ENERGY SYSTEMS
Problem Solving/Skill

Instructions:
You will have 15 minutes to do this exercise. Ask for assistance if you're not sure what you are doing.

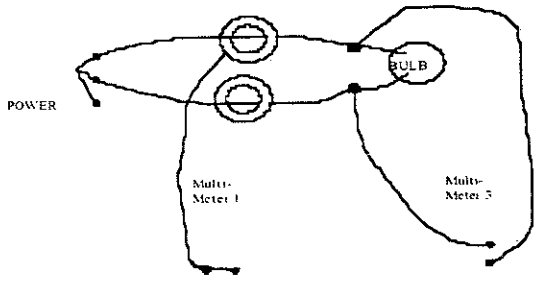
Part A. Use the Fluke multimeter to measure the resistance of the light bulb. To do this, turn the function selector to Ω and touch the leads to the terminals of the lamp holder containing the bulb:

30 ohms

Shut off the multimeter when finished.

Part B. **CAUTION!** You are working with 120-V line power. Do not touch any connections. All connections have been made for you.

- Turn function selectors to Ã on Fluke multimeters 1
- Turn function selector to $\tilde{V}$ on Fluke multimeter 3
-
- Turn on power
- Read values: Multimeter 1 0.30 amps
  Multimeter 3 120 volts



- Turn off power
- Turn off all three Fluke multimeters

- Compute bulb watts: 0.30 amps x 120 volts = 36 watts

- If electricity costs $0.09/kWh, what will it cost to operate this bulb continuously for one week? $ 0.54

$$\frac{36\text{W} \quad 7\text{DAY} \quad 24\text{h} \quad \text{k} \quad 0.09\$}{\text{DAY} \quad 1000 \quad \text{kWh}} = \$0.54$$

Evaluation Score Sheet

Items	Points Possible	Earned
Resistance measurement	4	
Voltage measurement	4	
Current measurement	4	
Power computation	5	
Cost computation	5	
Safe work habits	3	
Total	25	

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CONTESTANT NAME _____

CONTESTANT SCHOOL _____
(print clearly)

ENVIRONMENTAL/NATURAL RESOURCES SYSTEMS
Problem Solving/Skills

You task is to evaluate the supplied corn samples for a number of quality charactertics. Follow the instructions that might be at each station.

Station #1

1. The moisture content of the sample is _____%.

Station #2

2. Which of the two screen sizes listed here should be used to assist in determining broken corn and foreign material (BCFM) in corn.

   ☐ 8/64" round-hole ☐ 12/64" round hole

3. The total weight of the sample, in grams _____g.

4. The weight of BCFM in the sample, in grams _____g.

5. The weight percentage of BCFM in the sample _____%

RETURN ALL MATERIAL (whole corn & BCFM) TO THE SAMPLE BAG

Station #3

6. The test weight of the sample, in pounds per bushel _____lb/bu.

Evaluation Score Sheet

	Items	Points Possible	Points Earned
1.	Grain moisture content	5	_____
2.	Screen size	3	_____
3.	Total sample weight	3	_____
4.	BCFM weight	3	_____
5.	BCFM %	3	_____
6.	Test weight	5	_____
5.	Attitude, use of materials, safety	3	_____
	Total	25	☐

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CONTESTANT NAME KEY

CONTESTANT SCHOOL _____
(print clearly)

ENVIRONMENTAL/NATURAL RESOURCES SYSTEMS
Problem Solving/Skills

You task is to evaluate the supplied corn samples for a number of quality charactertics. Follow the instructions that might be at each station.

Station #1

1. The moisture content of the sample is 13 to 14 %.

Station #2

2. Which of the two screen sizes listed here should be used to assist in determining broken corn and foreign material (BCFM) in corn.

   ☐ 8/64" round-hole ☒ 12/64" round hole

3. The total weight of the sample, in grams ~ 1000 g.
4. The weight of BCFM in the sample, in grams 35-40 g.
5. The weight percentage of BCFM in the sample 3.5 - 4.0 %

RETURN ALL MATERIAL (whole corn & BCFM) TO THE SAMPLE BAG

Station #3

6. The test weight of the sample, in pounds per bushel 58.5-60 lb/bu.

Evaluation Score Sheet

	Items	Points Possible	Points Earned
1.	Grain moisture content	5	
2.	Screen size	3	
3.	Total sample weight	3	
4.	BCFM weight	3	
5.	BCFM %	3	
6.	Test weight	5	
5.	Attitude, use of materials, safety	3	
	Total	25	

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CONTESTANT NAME _____

CONTESTANT SCHOOL _____
(print clearly)

INDUSTRY AND MARKETING SYSTEMS
Problem Solving/Skills

Answer the following questions:

1. How long does it take for someone to become helplessly trapped in flowing grain?
   a) less than 6 seconds b) less than 60 seconds c) more than 60 seconds

2. How much physical force is required to pull out a person buried below the surface of grain?
   a) less than 400 lb. b) 400 to 1,000 lb. c) more than 1,000 lb.

3. Identify possible way(s) a person can suffocate in grain.
   a) chest is constricted, breathing is difficult
   b) grain fills lungs and air passages
   c) lack of breathable air surrounding a person
   d) all of the above

4. Children never can ride safely in grain wagons.
   a) True b) False

5. Which is <u>not</u> a sign after unloading grain that the surface of grain in a bin may be crusted and unsafe to walk or stand upon:
   a) inverted cone-shaped surface
   b) shiny surface on the inside of the bin
   c) cone shaped surface
   d) all are signs that the surface is crusted

6. Short answer: Name one practice you can implement to avoid dangerous situations around grain handling and storage systems.

_____

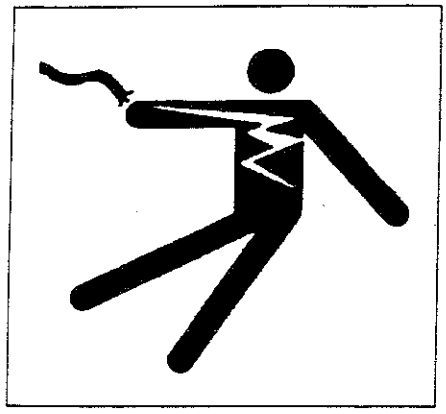
7. A handout shows a number of warning symbols used around grain handling and storage facilities. Match the symbols to the correct hazard it describes.

Symbol Number	Hazard
1 _____	a) Wrap point
2 _____	b) Electric shock
3 _____	c) Entanglement
4 _____	d) Overhead wires
5 _____	e) Pinch point
6 _____	f) Suffocation

Evaluation Score Sheet

	Items	Points Possible	Points Earned
1.	.....	2	_____
2.	.....	2	_____
3.	.....	2	_____
4.	.....	2	_____
5.	.....	2	_____
6.	.....	2	_____
7.	.....	12	_____
8.	Attitude, use of materials, safety	1	_____
	Total	25	

#1



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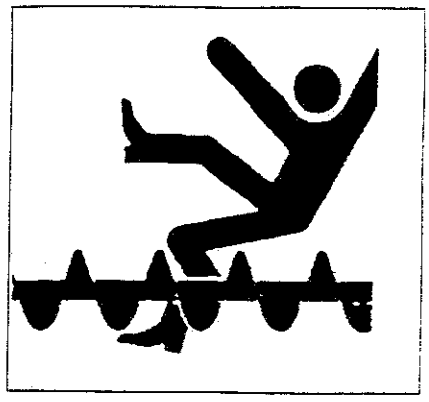

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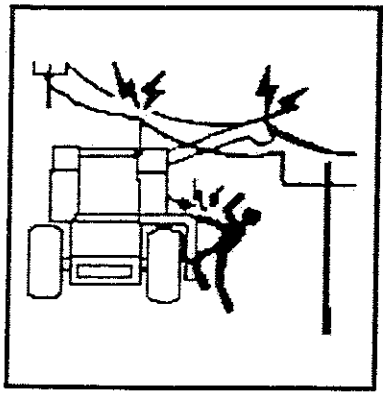

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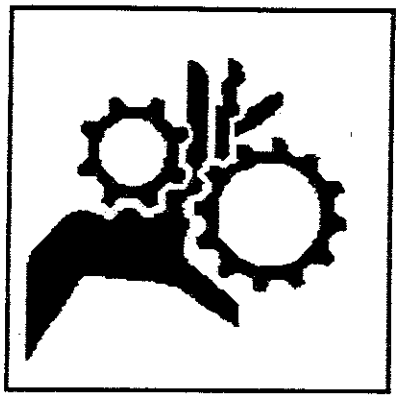
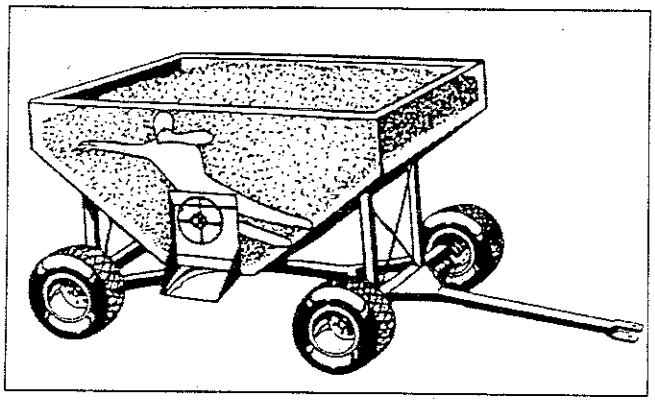


#5



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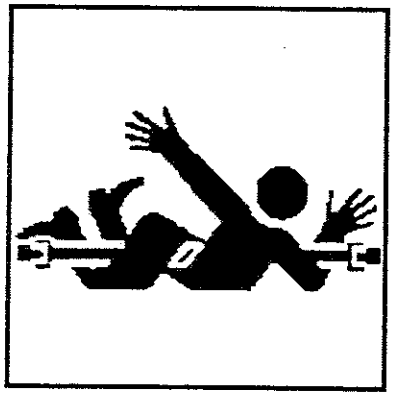

* Handout for Question #7, Industry and Marketing Systems - Problem Solving/Skills.

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INDUSTRY AND MARKETING SYSTEMS
Problem Solving/Skills

Answer the following questions:

1. How long does it take for someone to become helplessly trapped in flowing grain?
   (a) less than 6 seconds b) less than 60 seconds c) more than 60 seconds

2. How much physical force is required to pull out a person buried below the surface of grain?
   a) less than 400 lb. b) 400 to 1,000 lb. (c) more than 1,000 lb.

3. Identify possible way(s) a person can suffocate in grain.
   a) chest is constricted, breathing is difficult
   b) grain fills lungs and air passages
   c) lack of breathable air surrounding a person
   (d) all of the above

4. Children never can ride safely in grain wagons.
   (a) True b) False

5. Which is not a sign after unloading grain that the surface of grain in a bin may be crusted and unsafe to walk or stand upon:
   a) inverted cone-shaped surface
   b) shiny surface on the inside of the bin
   (c) cone shaped surface
   d) all are signs that the surface is crusted

6. Short answer: Name one practice you can implement to avoid dangerous situations around grain handling and storage systems. Apply suffocation hazard decals; Lock access door to bins; Instruct others about suffocation hazards; Use an extra person; Lockout

7. A handout shows a number of warning symbols used around grain handling and storage facilities. Match the symbols to the correct hazard it describes.

Symbol Number	Hazard
1 b	a) Wrap point
2 c	b) Electric shock
3 d	c) Entanglement
4 e	d) Overhead wires
5 f	e) Pinch point
6 a	f) Suffocation

Evaluation Score Sheet

Items	Points Possible	Points Earned
1.	2	
2.	2	
3.	2	
4.	2	
5.	2	
6.	2	
7.	12	
Attitude, use of materials, safety	1	
Total	25	

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MACHINERY AND EQUIPMENT SYSTEMS
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 combines, answer the following questions.

I. Determine the following for this machine: 2 pts.

a) Machine Model Number _____

b) Engine Serial Number _____

II. Identify by proper name the machine components and their function. 10 pts.

	Name	Function
a)	_____	_____
b)	_____	_____
c)	_____	_____
d)	_____	_____
e)	_____	_____

III. Determine the initial crop settings (standard rotor) for corn and soybeans: 8 pts.

	Corn	Soybeans
Rotor		
Speed (RPM)	_____	_____
Concave		
Indicator settings	_____	_____
Type	_____	_____
Fan speed	_____	_____

IV. Determine (measure) the chaffer and sieve adjustment on this combine. **Note: DO NOT ADJUST** 3 pts.

Chaffer _____
Sieve _____

Is this machine properly adjusted for soybeans? (circle answer) Yes No

V. Determine the current setting of the feeder house conveyor chain speed. Record setting _____ 1 pts.

Evaluation Score Sheet

Items	Points Possible	Earned
Make, Model, PIN, ESN	2	_____
Part Identification/Function	10	_____
Initial Crop Settings	8	_____
Chaffer Sieve Adjustment	3	_____
Feeder house conveyor chain speed setting	1	_____
Safety	1	_____
Total	25	

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CONTESTANT NAME KEY

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MACHINERY AND EQUIPMENT SYSTEMS
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 combines, answer the following questions.

I. Determine the following for this machine: 2 pts.

a) Machine Model Number 9750 STS

b) Engine Serial Number XX6081H046268X

II. Identify by proper name the machine components and their function. 10 pts.

	Name	Function
a)	Clean grain elevator	
b)	Tailings return elevator	
c)	Grain moisture sensor	
d)	Grain Loss sensor	
e)	Rock Trap Lever for Door	

III. Determine the initial crop settings (standard rotor) for corn and soybeans: 8 pts.

	Corn	Soybeans
Rotor Speed (RPM)	250-400	450-650
Concave Indicator settings	25-35	15-25
Concave Type	round bar	large wire OR round bar
Fan speed	1250-1400	1150-1250

IV. Determine (measure) the chaffer and sieve adjustment on this combine. **Note: DO NOT ADJUST** 3 pts.

Chaffer 11
Sieve 12

Is this machine properly adjusted for soybeans? (circle answer) Yes (No) small sprockets

V. Determine the current setting of the feeder house conveyor chain speed. Record setting Slow 1 pts.

Evaluation Score Sheet

Items	Points Possible	Earned
Make, Model, PIN, ESN	2	
Part Identification/Function	10	
Initial Crop Settings	8	
Chaffer Sieve Adjustment	3	
Feeder house conveyor chain speed setting	1	
Safety	1	
Total	25	

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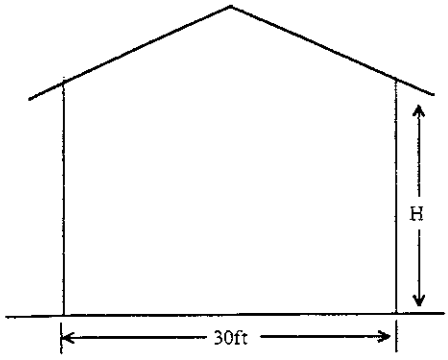
STRUCTURAL SYSTEMS
Problem Solving/Skills
Grain/Soybean Storage Structures



Given
Area of a circle = πR^2 or $0.785D^2$
Volume of a cylinder = $\pi R^2 H$ or $0.785D^2H$
1 bushel = 1.245 ft^3 volume basis
1 ton = 2000 lbs
1 bushel of shelled corn = 56 lbs.

Consider the circular grain bin pictured above. It is used to dry shelled corn in batches and then to store shelled corn through winter and spring.

1. When filled with shelled corn to a depth of 18 feet (H = 18 ft):
   a) Volume in cubic ft 12,717.0 / 12,723.5 ft^3 (4)
   b) Volume in bushels 10,200.0 / 10,219.6 bushels (2)
   c) Volume in bushels, per foot of grain depth 565.0 / 567.8 bushels/ft (1)
   d) Weight of corn, in tons 286.1 tons (1)

2. When this bin is used to dry corn in batches, it is filled to a depth of 6 ft. At this depth of grain:
   Volume in bushels 3406.5 (3)

3. Use the attached table to assist in answering this question. (8)
   How many 10-hp axial fans are needed on the bin to achieve an airflow for drying of at least 8 cfm/bushel?
   (check your answer) ☐ one ☐ two ☒ three ☐ four

4. Grain can be dried at a rate of 225 bushels per hour in this bin. How long does it take to dry one batch? (5)
   (round to the nearest half hour). 15.0 hours

Evaluation Score Sheet

	Items	Points Possible	Points Earned
1.	Grain storage capacity	8	
2.	Grain drying capacity	3	
3.	Number of fans	8	
4.	Drying time	5	
5.	Attitude and use of materials	1	
	Total	25	

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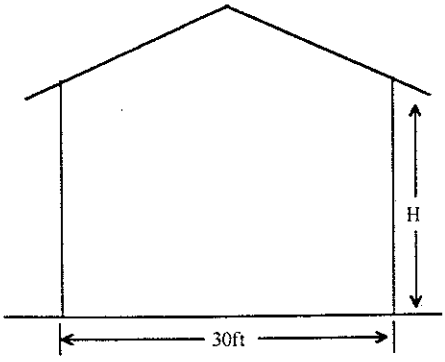
STRUCTURAL SYSTEMS
Problem Solving/Skills
Grain/Soybean Storage Structures



Given
Area of a circle = πR^2 or $0.785D^2$
Volume of a cylinder = $\pi R^2 H$ or $0.785D^2H$
1 bushel = 1.245 ft^3 volume basis
1 ton = 2000 lbs
1 bushel of shelled corn = 56 lbs.

Consider the circular grain bin pictured above. It is used to dry shelled corn in batches and then to store shelled corn through winter and spring.

1. When filled with shelled corn to a depth of 18 feet (H = 18 ft):

   a) Volume in cubic ft _____ ft^3

   b) Volume in bushels _____ bushels

   c) Volume in bushels, per foot of grain depth _____ bushels/ft

   d) Weight of corn, in tons _____ tons

2. When this bin is used to dry corn in batches, it is filled to a depth of 6 ft. At this depth of grain:

   Volume in bushels _____

3. Use the attached table to assist in answering this question.

   How many 10-hp axial fans are needed on the bin to achieve an airflow for drying of at least 8 cfm/bushel?
   (check your answer) ☐ one ☐ two ☐ three ☐ four

4. Grain can be dried at a rate of 225 bushels per hour in this bin. How long does it take to dry one batch?
   (round to the nearest half hour). _____ hours

Evaluation Score Sheet

	Items	Points Possible	Points Earned
1.	Grain storage capacity	8	
2.	Grain drying capacity	3	
3.	Number of fans	8	
4.	Drying time	5	
5.	Attitude and use of materials	1	
	Total	25	

Table 3-4. Example fan performance at different grain depths.

No. of fans	Corn depth ft	Axial flow			Centrifugal		
		Static pressure in. water	Total airflow cfm	Airflow rate cfm/bu	Static pressure in. water	Total airflow cfm	Airflow rate cfm/bu
One	2	0.7	16,890	14.9	0.6	14,190	12.6
	6	1.8	15,275	4.5	1.6	13,355	3.9
	10	2.7	13,935	2.5	2.4	12,645	2.2
	14	3.4	12,755	1.6	3.1	11,980	1.5
	18	3.9	11,745	1.2	3.7	11,450	1.1
Two	2	1.8	30,555	27.0	1.5	26,845	23.7
	6	3.7	24,380	7.2	3.5	23,370	6.9
	10	4.5	19,350	3.4	4.9	20,755	3.7
	14	4.8	16,355	2.1	5.9	18,440	2.3
	18	5.0	14,180	1.4	6.5	16,770	1.7
Three	2	2.9	41,000	36.3	2.5	37,705	33.3
	6	4.6	27,515	8.1	5.3	29,975	8.8
	10	5.0	21,020	3.7	6.5	25,260	4.5
	14	5.2*	16,935*	2.1*	7.3	21,605	2.7
	18	5.3*	15,010*	1.5*	7.7	18,655	1.8

*These static pressures exceed the maximum value in the fan tables and curves. Therefore, the total airflow and airflow rate values shown are estimates.

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COMPUTER APPLICATION

Use the given Excel computer spreadsheet to assist in determining the grain receiving capacity and grain unloading requirements for a grain storage facility. Some data is given below; the rest must be obtained from the appropriate tables from the attached sheets.

Instructions:

1. Enter your name and school into the computer spreadsheet.
2. Enter the given data provided to determine the grain receiving capacity and grain loadout.
3. Enter remaining data from tables noted on the spreadsheet.
4. Print out the completed spreadsheet.
5. Change the data for a new scenario and print out the new spreadsheet.
6. Answer the specified question.

GRAIN RECEIVING CAPACITY

Given (enter into spreadsheet):

- Travel speed for largest vehicle = 10 mph.
- Capacity of largest vehicle = 500 bu.
- Capacity of smallest vehicle = 300 bu.
- Actual pit capacity = 250 bu.
- Distance to farthest field = 1 mile.
- Miscellaneous activities = 5 min.
- Maximum harvest rate = 400 bu/hr.

Spreadsheet Output (calculated by spreadsheet):

- Travel time for largest vehicle.
- Time to fill smallest vehicle.
- Time available for largest vehicle to unload.
- Unloading conveyor capacity.
- Minimum receiving pit capacity.

GRAIN LOADOUT

Given (enter into spreadsheet):

- Conveyor length = 51'
- Auger diameter = 6"
- Auger operating speed = 450 rpm
- Auger incline = 35 degrees

Spreadsheet Output (calculated by spreadsheet):

- Relative operating speed
- Capacity
- Horsepower per 10'
- Total Horsepower

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COMPUTER APPLICATION - Page 2

QUESTION:
Write a brief statement indicating what effect the change in distance has on the capacity and loadout. For example, if the distance to the farthest field increases to 2 miles (due to a land purchase) what changes in the requirements are observed? Note: Change appropriate values in your current spreadsheet and print out the new spreadsheet.

Statement:

Evaluation Score Sheet

Item	Points Possible	Points Earned
1. Data entered correctly	18	_____
2 Computer printouts	2	_____
3 Statement answer	5	_____
TOTAL	**25**	

Iowa FFA Agricultural Mechanics Career Development Event
2002

KEY

COMPUTER APPLICATION - Page 2

QUESTION:
Write a brief statement indicating what effect the change in distance has on the capacity and loadout. For example, if the distance to the farthest field increases to 2 miles (due to a land purchase) what changes in the requirements are observed? Note: Change appropriate values in your current spreadsheet and print out the new spreadsheet.

Statement: Travel time is increased by 6 minutes, time available for largest vehicle to unload decreases by 12 minutes, minimum receiving pit capacity increases by 80 bushels, and the unloading conveyor capacity is increased by 402 Bu./Hr.

Evaluation Score Sheet

Item	Points Possible	Points Earned
1. Data entered correctly	18	_____
2 Computer printouts	2	_____
3 Statement answer	5	_____
TOTAL	**25**	

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Computer Application Activity

IA-2002

Key
5

Name: KEY
School:

GRAIN RECEIVING CAPACITY

Travel speed for largest vehicle	[illegible] MPH
Capacity of largest vehicle	[illegible] Bushels
Capacity of smallest vehicle	[illegible] Bushels
Actual pit capacity	[illegible] Bushels
Distance to farthest field	[illegible] Miles
Travel time for largest vehicle	12 Minutes
Miscellaneous activities	[illegible] Minutes
Time to fill the smallest vehicle	45 Minutes
Maximum harvest rate	[illegible] Bu/hour
Time available for largest vehicle to unload	16.0 Minutes
Minimum receiving pit capacity	393 Bushels
Unloading conveyor capacity	938 Bu/hour

GRAIN LOADOUT

Input:		
	Conveyor length	51 feet
	Auger diameter	6 inches
	Auger operating speed	450 RPM
	Auger Incline	35 degrees
From Table 2-3		
	Auger operating speed	600 RPM
	Conveyor capacity	1290 bu/hr
	Horsepower per 10' of auger	1.6 Hp
	Relative operating speed	75 percent
From Table 2-4		
	Capacity multiplier	
	Power multiplier	
	Capacity	1019 bu/hr
	Horsepower per 10'	1.22 Hp
	Total Horsepower	6.20 Hp
From Table 6-11		
	Select electric motor size	[illegible] Hp
	Select gasoline engine	Hp

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CONTESTANT NAME _____

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TEAM PROBLEM SOLVING
Skills

Your team's task is to specify the augers to be used to transport wet corn (approximately 25% moisture content) for the grain system pictured on the attached sheet.

Based on harvest rate and travel time to and from the fields, it was previously determined that a minimum unloading capacity of 950 bushels per hour is needed.

You wish to choose the smallest augers possible that still convey wet corn at the desired rate. Determine the auger specifications listed below. Use the attached tables as the basis of your calculations. For questions #1 and 2, assume that the rated auger speed in Table 2-3 will be used.

1. Auger #1

   a) Auger #1 diameter (inches) _____ in
   b) Auger #1 speed (rpm) _____ rpm
   c) Auger #1 minimum length (feet) _____ ft
   d) Auger #1 required power (hp) _____ hp
   e) Auger #1 actual conveying capacity (bu/hr) _____ bu/hr

2. Auger #2

   a) Auger #2 diameter (inches) _____ in
   b) Auger #2 speed (rpm) _____ rpm
   c) Auger #2 length (feet) _____ ft
   d) Auger #2 required power (hp) _____ hp
   e) Auger #2 actual conveying capacity (bu/hr) _____ bu/hr

3. Analysis of system changes during operation:

   a) If the angle of auger #1 is decreased, the conveying capacity will ☐ increase ☐ decrease

   b) If dry corn is conveyed with this system instead of wet corn, the conveying capacity will increase by what percentage? _____%

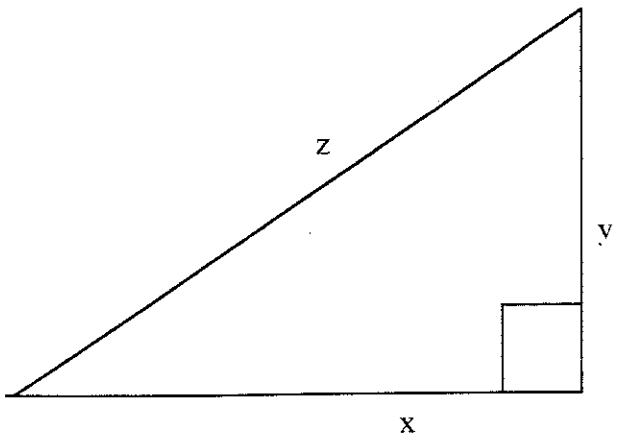
   c) If the speed of auger #1 increases by 25%, the required power will increase by _____%

   d) Short answer: if the speed of a correctly-sized auger #1 is increased by more than 25%, what problem(s) might occur when conveying grain to bin #2?

Iowa FFA Agricultural Mechanics Career Development Event - 2002
TEAM PROBLEM SOLVING - Page 2

Evaluation Score Sheet

Items	Points Possible	Points Earned
Auger #1		
1. a) diameter	4	_____
b) speed	3	_____
c) length	3	_____
d) power	3	_____
e) capacity	3	_____
Auger #2		
2. a) diameter	4	_____
b) speed	3	_____
c) length	3	_____
d) power	3	_____
e) capacity	3	_____
3. a) Angle change	3	_____
b) Dry vs wet corn	4	_____
c) Problem	3	_____
d) Short answer	5	_____
4. Attitude, use of materials	3	_____
Total	50	



$z^2 = x^2 + y^2$

or

$z = \sqrt{x^2 + y^2}$

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Team Problem

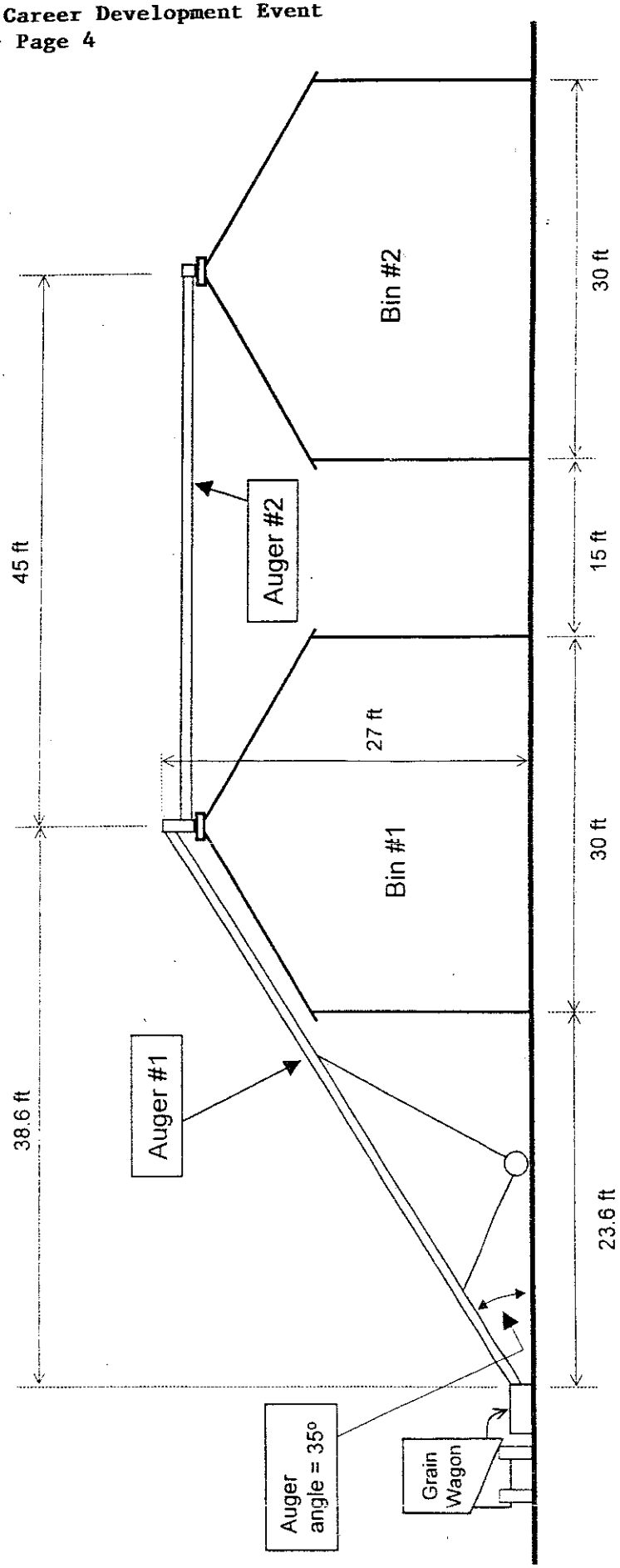

Table 2-3. Estimated auger capacity and power.
For dry (14% maximum moisture content) corn. Values for 4" and 6" augers are based on a lot of data. Values for 8" and 10" augers are based on very limited data. Values for 12"-16" augers were extrapolated. Actual auger performance may vary so use manufacturer's data for designing auger systems. Multiply dry corn values by 0.6 for wet corn capacity. Use the table values for wheat, grain sorghum, oats, barley, and rye because actual values are only slightly less. For soybeans, multiply capacity by 0.75 and power by 1.10. Multiply bu/hr by 50 for approximate lb/hr capacity for meal or concentrate feed.

Auger dia., in.	Auger speed[1] rpm	Incline angle 0° bu/hr	0° hp/10'	25° bu/hr	25° hp/10'	35° bu/hr	35° hp/10'	45° bu/hr	45° hp/10'	90° bu/hr	90° hp/10'
4	900 [2]	560	0.6	500	0.9	480	0.9	450	1.0	270	0.8
6	600	1,500	1.0	1,350	1.5	1,290	1.6	1,190	1.6	710	1.3
8	450	2,210	1.4	1,990	2.2	1,890	2.2	1,760	2.3	1,050	1.8
10	360	3,300	2.0	2,970	3.1	2,830	3.2	2,620	3.2	1,570	2.5
12	300	4,520	2.5	4,070	3.9	3,870	4.0	3,590	4.0	2,150	3.2
14	260	6,230	3.4	5,610	5.3	5,340	5.4	4,950	5.5	2,960	4.3
16	225	8,040	4.4	7,240	6.8	6,870	7.0	6,390	7.1	3,820	5.6

[1]Auger speeds for 3,600 in/min flighting velocity along auger length (theoretical grain velocity) for all diameters.
[2]4" auger at 900 rpm vibrates excessively. 900 rpm values are for converting with Tables 2-4 and 2-5.

Table 2-4. Conversions for auger speed.
nverting Table 2-3 for different auger speeds. You can interpolate n speeds with reasonable accuracy. These values are for dry corn—convert first for speed, then for moisture content, Table 2-5.

Speed relative to Table 2-3 %	Multiplier Capacity	Power
125	1.17	1.23
100	1.00	1.00
75	0.79	0.76
50	0.56	0.51
25	0.29	0.26

Table 6-11. Motor selection for continuous conveyor operation.

Calculated conveyor hp	Electric motor hp	Gasoline engine hp
Up to 0.27	¼	½
0.28 to 0.35	⅓	⅔
0.36 to 0.55	½	1
0.56 to 0.81	¾	1½
0.82 to 1.10	1	2
1.11 to 1.60	1½	3
1.61 to 2.10	2	4
2.11 to 3.20	3	5
3.21 to 5.25	5	8
5.26 to 7.90	7½	12
7.91 to 10.50	10	15

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CONTESTANT NAME KEY

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TEAM PROBLEM SOLVING
Skills

Your team's task is to specify the augers to be used to transport wet corn (approximately 25% moisture content) for the grain system pictured on the attached sheet.

Based on harvest rate and travel time to and from the fields, it was previously determined that a minimum unloading capacity of 950 bushels per hour is needed.

You wish to choose the smallest augers possible that still convey wet corn at the desired rate. Determine the auger specifications listed below. Use the attached tables as the basis of your calculations. For questions #1 and 2, assume that the rated auger speed in Table 2-3 will be used.

1. Auger #1

   a) Auger #1 diameter (inches) ___8___ in

   b) Auger #1 speed (rpm) ___450___ rpm

   c) Auger #1 minimum length (feet) ___47.1___ ft

   d) Auger #1 required power (hp) ___19.7___ hp

   e) Auger #1 actual conveying capacity (bu/hr) ___1134___ bu/hr

2. Auger #2

   a) Auger #2 diameter (inches) ___8___ in

   b) Auger #2 speed (rpm) ___450___ rpm

   c) Auger #2 length (feet) ___4.5___ ft

   d) Auger #2 required power (hp) ___17.6___ hp

   e) Auger #2 actual conveying capacity (bu/hr) ___1326___ bu/hr

3. Analysis of system changes during operation:

   a) If the angle of auger #1 is decreased, the conveying capacity will ☒ increase ☐ decrease

   b) If dry corn is conveyed with this system instead of wet corn, the conveying capacity will increase by what percentage? ___67___ %

   c) If the speed of auger #1 increases by 25%, the required power will increase by ___23___ %

   d) Short answer: if the speed of a correctly-sized auger #1 is increased by more than 25%, what problem(s) might occur when conveying grain to bin #2?

   Auger #1 moves grain faster than Auger #2. Grain spillage/plugging at the top of bin #1.