

STUDENTS DO NOT OPEN THIS TEST OR BEGIN UNTIL INSTRUCTED TO START

2015 Examination for the National Agricultural Technology and Mechanical Systems Career Development Event

Name _____
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Read the following instructions:

Mark all answers on the Scantron sheet using a pencil.

- *You have one hour to complete this exam.*
- *You may write on this exam, but information on this exam is not graded. Blank sheets are provided if additional calculation space is needed.*
- *When a reference page (diagrams, pictures, tables) is needed to answer a question, the question will refer to the appropriate reference page.*
- *Read each question carefully and determine the single correct answer.*
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Students are **NOT allowed** to use any type of electronic communication device, including but not limited to cellular telephones, pagers, two way radios, or PDAs, during the CDE on Wednesday or Thursday. If a student uses, handles, or accesses any type of electronic communication device, she or he may be disqualified. If a personal emergency should arise during the CDE, students should contact a CDE official immediately for assistance.

Order and Point Assignment for Exam Questions (2 points each)

1. Machinery	6. Environmental	11. Structural	16. Energy	21. Electrical
2. Electrical	7. Machinery	12. Environmental	17. Structural	22. Energy
3. Energy	8. Electrical	13. Machinery	18. Environmental	23. Structural
4. Structural	9. Energy	14. Electrical	19. Machinery	24. Environmental
5. Environmental	10. Structural	15. Energy	20. Electrical	25. Machinery

MACHINERY & EQUIPMENT SYSTEMS

ELECTRICAL SYSTEMS

ENERGY SYSTEMS

STRUCTURAL SYSTEMS

ENVIRONMENTAL & NATURAL RESOURCE SYSTEMS

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1. **Machinery:** A tractor's power takeoff produces 325 horsepower and turns at 1000 revolutions per minute. Approximately how much torque, in foot-pounds, can this PTO produce?

$$\text{Torque in foot-pounds} = \frac{\text{PTO Horsepower} \times 5252}{\text{Revolutions / Minute}}$$

- A. 1652.4 foot-pounds
B. 1706.9 foot-pounds
C. 1841.2 foot-pounds
D. 1927.5 foot-pounds

2. **Electrical:** A water supply station used to refill pesticide tanks has a 4 horsepower electrical pump that operates at 120 volts. If the motor is 85 percent efficient and has a 0.9 power factor, what is the approximate amperage of the motor?

$$1 \text{ horsepower} = 746 \text{ Watts} \quad \text{horsepower} = \frac{\text{voltage} \times \text{amperage} \times \text{power factor} \times \text{efficiency}}{746}$$

- A. 8.1 amps
B. 27.6 amps
C. 32.5 amps
D. 253.6 amps

3. **Energy:** A 200 horsepower eight-cylinder engine is operating at 6865 feet above sea level. What approximate horsepower can be produced by the engine when the engine's power is reduced 2.45 percent for each 1000 feet of elevation above sea level?

- A. 166.4 horsepower
B. 194.2 horsepower
C. 136.4 horsepower
D. 274.2 horsepower

4. **Structural:** A pesticide spray tank has a cylindrical shape that is 7 feet 9 inches long with a radius of 2 feet. What is the approximate total storage capacity of the tank in gallons?

$$1 \text{ gallon} = 231 \text{ cubic inches} \quad 1 \text{ foot} = 12 \text{ inches} \quad \pi = 3.14 \quad \text{Diameter} = 2 \times (\text{radius})$$

$$\text{Volume of a Cylinder} = (\pi) \times (\text{radius})^2 \times (\text{length}) \quad 1728 \text{ cubic inches} = 1 \text{ cubic foot}$$

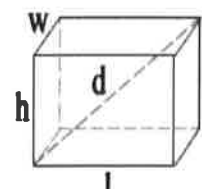
- A. 97 gallons
B. 728 gallons
C. 972 gallons
D. 1,438 gallons

5. **Environmental:** A rectangular shaped plastic hopper is used to transport granular pesticide in bulk. This hopper is transported on a trailer with a 5000-pound maximum load carrying capacity. The internal dimensions of the hopper are 6.5 feet wide, 8.75 feet long and 4.25 feet deep. What is the maximum weight in pounds per cubic foot (approximate value) that granular pesticide can weigh, completely fill the hopper, and still transport within safe load carrying limits?

$$1 \text{ gallon} = 231 \text{ cubic inches} \quad 1 \text{ cubic-foot} = 1728 \text{ cubic-inches}$$

$$\text{Volume of rectangular prism} = \text{Length} \times \text{Width} \times \text{Height}$$

- A. 20.7 lbs / ft³
B. 23.6 lbs / ft³
C. 27.1 lbs / ft³
D. 99.2 lbs / ft³



Picture of rectangular prism

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- 6. Environmental:** What is the approximate annual power consumption (kilowatt-hours, kWh) of a 240 volt electrical installation with 36 lights, each light using 0.95 amps and operating an average of 9 hours and 30 minutes each day, and 22.5 days per month? 1 year = 12 months Kilowatt = 1000 Watts
Watts = Volts \times Amps Volts = Amps \times Resistance in Ohms Kilowatt-hours = Kilowatts \times Hours
- A. 1,717.5 kWh
B. 2,169.3 kWh
C. 20,610.3 kWh
D. 21,053.5 kWh
- 7. Machinery:** Each cylinder in an eight cylinder tractor engine has a bore (diameter) of 4.85 inches and a piston stroke of 6.25 inches. What is the approximate total displacement of this engine in liters?
Area of a cylinder bore = $(\pi) \times (\text{radius})^2$ $\pi = 3.14$ radius = (diameter \div 2)
Volumetric displacement of a single cylinder = (length of piston stroke) \times (the area of the cylinder bore)
1 liter = 61 cubic inches 1 cubic inch = 0.0164 liter
- A. 1.9 liters
B. 15.1 liters
C. 60.5 liters
D. 900.5 liters
- 8. Electrical:** An inefficient electrical motor (identified as motor A) is to be replaced with a new high efficiency motor (identified as motor B). Motor A was operated 8 hours and 30 minutes per day, 322 days each year, and its annual electrical bill averaged \$18,983. The purchase price for motor B is \$1,318 and the installation charge is \$390. Motor B will be operated the same number of hours as motor A and will have an average cost of \$5.87 per hour to operate. Approximately how many months must motor B operate to payback the purchase and installation cost of the new motor?
1 year = 12 months 1 day = 24 hours 1 year = 365 days
- $$\text{Equipment Payback in months} = \frac{\text{total cost for new high efficient equipment}}{\text{average saving in energy cost per month}}$$
- A. 7 months
B. 84 months
C. 125 months
D. 294 months
- 9. Energy:** An available electronic thermometer is calibrated in degrees Celsius ($^{\circ}\text{C}$). A pesticide label specifies that the maximum allowable temperature for spray applications is 75 degrees Fahrenheit ($^{\circ}\text{F}$). What is the approximate temperature equivalent in degrees Celsius?
 $^{\circ}\text{F} = (9/5 \text{ } ^{\circ}\text{C}) + 32$ $^{\circ}\text{C} = 5/9 (\text{ } ^{\circ}\text{F} - 32)$ Water freezes at 32 $^{\circ}\text{F}$ Water boils at 212 $^{\circ}\text{F}$
- A. 9.7 $^{\circ}\text{C}$
B. 23.9 $^{\circ}\text{C}$
C. 41.7 $^{\circ}\text{C}$
D. 167.0 $^{\circ}\text{C}$
- 10. Structural:** Steel angle iron is sold for \$2.11 per linear foot, steel rod is sold for \$1.91 per linear foot, and steel pipe is sold for \$3.19 per linear foot. If 28.5 feet of angle iron, 23 feet of rod, and 15.5 feet of pipe are purchased, what is the approximate total price for the metal before taxes?
- A. \$ 60.15
B. \$ 93.36
C. \$ 109.58
D. \$ 153.51

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11. **Structural:** Which of the following quantities of lumber has the greatest number of board-feet?

1 board-foot = 144 cubic inches

1 square foot = 144 square inches

- A. 52 boards measuring 1 inches by 6 inches by 14 feet
- B. 27 boards measuring 2 inch by 8 inches by 10 feet
- C. 45 boards measuring 2 inches by 6 inches by 8 feet
- D. 46 boards measuring 1 inch by 8 inches by 12 feet

12. **Environmental:** A concrete slab will be installed to prevent contamination of the ground at a mixing and cleaning site for pesticide equipment. The inside dimensions of the slab's form boards are 24 feet wide by 14 feet long and the concrete forms provide an approximate depth of 5 inches. Order an additional 10 percent concrete to allow for any inconsistencies in the ground surface and note that pre-mixed concrete is sold/delivered in quarter-yard quantities (such as: 3 yd³, 6.25 yd³, 10.75 yd³, 15.5 yd³). Approximately how many cubic yards (yd³) of pre-mixed concrete should be ordered?

1 cubic yard = 27 cubic feet

1 cubic foot = 1728 cubic inches

1 foot = 12 inches

Volume of rectangular prism = Length × Width × Height

- A. 3.50 yd³
- B. 5.25 yd³
- C. 5.75 yd³
- D. 68.50 yd³

13. **Machinery:** Approximately how many acres are in a rectangular field measuring 1109 meters by 928 yards?

1 acre = 43, 560 square feet

1 hectare = 2.47 acres

1 acre = 0.4045 Hectares

Area of Rectangle = length × width

1 yard = 3 feet

1 foot = 0.3048 meter

- A. 2.4 acres
- B. 23.6 acres
- C. 232.5 acres
- D. 2325.4 acres

14. **Electrical:** A pesticide boom sprayer with eight spray nozzles is mounted on the back of an ATV (4-wheeler) and the pump motor is powered by the 12 volt battery of the vehicle. The spray pump's range of operation for spraying applications is 20 to 45 pounds per square inch (PSI), but there is a 20% loss in pressure due to the spray system's components. If each nozzle must deliver a range of 0.02 to 0.04 gallons per minute (GPM), which of the following motors is most economical to purchase and also has the appropriate capacity and specifications for this boom sprayer.

VDC = direct current voltage

VAC = alternating current voltage

- A. Motor A, rated at 12 VDC, cost \$219, and delivers up to 5 GPM at 100 PSI
- B. Motor B, rated at 12 VDC, cost \$149, and delivers up to 2 GPM at 65 PSI
- C. Motor C, rated at 12 VDC, cost \$119, and delivers up to 3.2 GPM at 45 PSI
- D. Motor D, rated at 12 VAC, cost \$93, and delivers up to 2.1 GPM at 65 PSI

15. **Energy:** A hot waterline is used 6 hours and 45 minutes each day, has three different water leaks, and the amount of water lost at each leak has been measured during a 30 minute time period. The three quantities of water from the leaks are (a) 75 ounces, (b) 68 ounces, and (c) 111 ounces. Approximately how many gallons of water will be lost from the waterline during 100 days of operation?

1 gallon = 128 ounces

24 hours = 1 day

60 minutes = 1 hour

- A. 2,679 gallons
- B. 13,395 gallons
- C. 44,648 gallons
- D. 342,900 gallons

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- 21. Electrical:** Three incandescent light bulbs (100 Watts, 200 Watts, 300 Watts) are operating in a 120 volt circuit. If each bulb operates at its rated wattage, which of the following statements is correct in regard to the operation of the bulbs? Wattage = Voltage \times Amperage
Voltage = Amperage \times Resistance
- All three bulbs operate at the same amperage.
 - All three bulbs have the same electrical resistance.
 - The 100-watt light bulb has more electrical resistance (ohms) than the 200 or 300-Watt light bulbs.
 - The 100-watt light bulb has less electrical resistance (ohms) than the 200 or 300-Watt light bulbs.
- 22. Energy:** An electric water heaters uses 880 kilowatt-hours (kWh) of power each day. If electric power cost 11.5 cents per kWh, approximately how much energy (in therms) does this water heater use during 22 days of operation? British Thermal Unit = BTU
1 kWh = 3412.3 BTUs of energy 1 therm of energy = 100,000 BTUs of energy
- 306.0 therms
 - 660.6 therms
 - 933.6 therms
 - 7507.0 therms
- 23. Structural:** A round concrete column is fabricated using 2.25 cubic yards of concrete. If the concrete column is 2 feet 4 inches in diameter, what is the approximate height of the column?
1 cubic yard = 27 cubic feet 1 cubic foot = 1728 cubic inches 1 foot = 12 inches
Volume of cylinder = $\pi \times (\text{cylinder radius})^2 \times \text{cylinder height}$ $\pi = 3.14$ diameter = (2 \times radius)
- 5.4 feet
 - 9.7 feet
 - 11.9 feet
 - 14.2 feet
- 24. Environmental:** A large volume of water contaminated with liquid pesticide (water and liquid pesticide) was collected from the runoff of a mixing and loading concrete pad. Initially the liquid is 6% pesticide and 94% water. Over the summer much of the water evaporates and only 42% of the water remains. All of the pesticide still remains. What is the approximate percentage of pesticide in the remaining liquid?
- 9.9 % pesticide
 - 11.4 % pesticide
 - 12.1 % pesticide
 - 13.2 % pesticide
- 25. Machinery:** A tractor powered herbicide boom sprayer with 24 spray nozzles, spaced 20 inches apart, is setup and calibrated to spray weeds in forage crops. The sprayer delivers a herbicide and water mixture at a uniform rate of 17.5 gallons per acre, travels at 4.75 miles per hour (MPH), and operates at a spray pressure of 30 pounds per square inch (PSI). An unusually high weed infestation requires an increase in the application of the herbicide mixture to 20 gallons per acre (GPA). Which of the following changes to one of the sprayer's operating parameters will most closely achieve 20 GPA?
$$\frac{\text{Gallons Per Minute}}{\text{Nozzle}} = \frac{\text{GPA} \times \text{MPH} \times \text{Nozzle Spacing in Inches}}{5940}$$
- Pressure Formula: $\text{New PSI} = (\text{Original PSI}) \times (\text{New GPM} \div \text{Original GPM})^2$
- Decrease speed from 4.75 MPH to 4.5 MPH
 - Decrease speed from 4.75 MPH to 4.25 MPH
 - Increase pressure from 30 PSI to 34 PSI
 - Increase pressure from 30 PSI to 39 PSI

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SECTION 1: MACHINERY & EQUIPMENT SYSTEMS Questions 1-5

1. A tractor's power takeoff produces 275 horsepower and turns at 1000 revolutions per minute. Approximately how much torque, in foot-pounds, can this PTO produce?

$$\text{Torque in foot-pounds} = \frac{\text{PTO Horsepower} \times 5252}{\text{Revolutions / Minute}}$$

- A. 1111 foot-pounds
B. 1222 foot-pounds
C. 1333 foot-pounds
D. 1444 foot-pounds
2. If a tractor travels at 28.5 kilometers per hour, what approximate length of time (in hours) is required to travel 29.5 miles? 1 mile = 1.6 kilometers 1 hour = 60 minutes
- A. 1 hour and 2.1 minutes
B. 1 hour and 16.8 minutes
C. 1 hour and 39.4 minutes
D. 2 hours and 11.7 minutes
3. There are 195 acres of corn with an average yield of 96.5 bushels per acre. Due to moisture content, a bushel has an average weight of 64.2 pounds. If the price is 14.2 cents per pound of harvested corn, what is the approximate income for the crop? 1 ton = 2000 pounds 1 bushel = 2.44 cubic feet
- A. \$ 120,808
B. \$ 171,548
C. \$ 1,208,084
D. \$ 1,715,479
4. The center section of a fuel storage tank has a cylindrical shape (capsule) that is 6.5 feet long with an inside diameter of 3.5 feet. Each end of the tank has a half-sphere shape (two halves of a sphere), each with an internal radius of 21 inches. What is the approximate total storage capacity of the tank in gallons? 1 gallon = 231 cubic inches 1 foot = 12 inches $\pi = 3.14$ Diameter = $2 \times (\text{radius})$
Volume of a Cylinder = $(\pi) \times (\text{radius})^2 \times (\text{length})$ Volume of Sphere = $4/3 \times (\pi) \times (\text{radius})^3$
- A. 515 gallons
B. 575 gallons
C. 635 gallons
D. 695 gallons
5. Each cylinder in a eight cylinder tractor engine has a bore (diameter) of 4.75 inches and a piston stroke of 5.9 inches. What is the approximate total displacement of this engine in liters?
Information: Area of a cylinder bore = $(\pi) \times (\text{radius})^2$ $\pi = 3.14$ radius = $(\text{diameter} \div 2)$
Volumetric displacement of a single cylinder = (length of piston stroke) x (the area of the cylinder bore)
1 liter = 61 cubic inches 1 cubic inch = 0.0164 liter
- A. 1.7 liters
B. 2.8 liters
C. 13.7 liters
D. 54.8 liters



Picture of capsule

SECTION 2: ELECTRICAL SYSTEMS Questions 6-10

6. What is the approximate annual power consumption (kilowatt-hours = kWh) of a 120 volt electrical installation with 24 incandescent lights, each light using 1.5 amps and operating 8 hours per day and 28 days per month? 1 year = 12 months Kilowatt = 1000 Watts Watts = Volts \times Amps
Volts = Amps \times Resistance in Ohms Kilowatt-hours = Kilowatts \times Hours
- A. 11,612 kWh
B. 116,122 kWh
C. 1,161,216 kWh
D. 11,612,160 kWh
7. Use reference Page A, Table 1 to answer this question. A 115-volt electrical circuit is 95 feet in length and uses 25 amps to operate an electrical space heater. According to Table 1 on reference sheet A what is the minimum size aluminum conductors are needed to limit the voltage drop to 3% and safety power this electrical load? Watts = Volts \times Amps Volts = Amps \times Resistance in Ohms
- A. # 6 AWG
B. # 4 AWG
C. # 2 AWG
D. # 0 AWG
8. Use reference Page A, Table 1 to answer this question. A 115-volt electrical circuit is 170 feet in length and uses 2070 Watts of power. According to Table 1 on reference sheet A what is the minimum size aluminum conductors needed to limit the voltage drop to 3% and safety power this electrical load? Watts = Volts \times Amps Volts = Amps \times Resistance in Ohms
- A. # 6 AWG
B. # 4 AWG
C. # 2 AWG
D. # 0 AWG
9. Use reference Page A, Table 2 to answer this question. A 230-volt electrical circuit is 221 feet in length and powers a resistance heating load of 18.5 ohms. According to Table 2 on reference sheet A what is the minimum size aluminum conductors needed to limit the voltage drop to 3% and safety power this electrical load? Watts = Volts \times Amps Volts = Amps \times Resistance in Ohms
- A. # 8 AWG
B. # 6 AWG
C. # 4 AWG
D. # 2 AWG
10. Use reference Page A, Tables 1, 2, & 3 to answer this question. The larger the cross sectional area of an electrical conductor, the more expensive the conductor will be to install. A dual voltage electrical motor can be connected to operate at either: 115 volts & 24 amps or 230 volts & 12 amps. If the motor will be installed at the end of a 145-foot electrical circuit, what voltage and minimum size conductors are needed for the most economical installation that will limit the voltage drop to 3% and safety power this electrical load?
- A. 115 Volts and # 3 AWG
B. 115 Volts and # 8 AWG
C. 230 Volts and # 3 AWG
D. 230 Volts and # 8 AWG

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SECTION 3: ENERGY SYSTEMS Questions 11-15

11. A kilowatt-hour meter records 5.9 kilowatts of power being used by an eight horsepower electric motor during one hour when it is operating at 230 volts and using 28 amps. What is the approximate power factor for this motor? Voltage = Amperage \times Resistance 1 kilowatt = 1000 hours
Wattage = Voltage \times Amperage \times Power Factor

- A. 0.92 power factor
B. 0.97 power factor
C. 1.09 power factor
D. 9.16 power factor

12. A 250 horsepower six cylinder engine is operating at 7150 feet above sea level. What approximate horsepower is produced by the engine if the engine's power is reduced 2.5 percent for each 1000 feet of elevation above sea level?

- A. 45 horsepower
B. 138 horsepower
C. 196 horsepower
D. 205 horsepower

13. A hot waterline that is used only 10 hours per day has three different leaks and the amount of water lost at each leak is measured during a 30 minute time period. The three quantities of water from the leaks are (a) 119 ounces, (b) 46 ounces, and (c) 91 ounces. Approximately how many gallons will be lost from the waterline during 30 days of operation?

Information: 1 gallon = 128 ounces 24 hours = 1 day 60 minutes = 1 hour

- A. 900 gallons
B. 1000 gallons
C. 1100 gallons
D. 1200 gallons

14. An available electronic thermometer is calibrated in degrees Celsius ($^{\circ}\text{C}$), but the requirements to sterilize agricultural testing equipment specify 100 degrees Fahrenheit ($^{\circ}\text{F}$) for 30 minutes. What is the approximate temperature equivalent in degrees Celsius?

$^{\circ}\text{F} = (9/5 ^{\circ}\text{C}) + 32$ $^{\circ}\text{C} = 5/9 (^{\circ}\text{F} - 32)$ Water freezes at 32°F Water boils at 212°F

- A. 37.8°C
B. 45.6°C
C. 51.0°C
D. 73.0°C

15. An inefficient electrical motor (identified as motor A) is to be replaced with a new high efficiency motor (identified as motor B). Motor A was operated 6 hours per day, 325 days each year, and its annual electrical bill averaged \$12,553. The purchase price for motor B is \$1,120 and the installation charge is \$345. Motor B will be operated the same number of hours as motor A and will have an average cost of \$6.07 per hour to operate. Approximately how many months will motor B operate to payback the purchase and installation cost of the new motor? 1 year = 12 months 1 day = 24 hours
1 year = 365 days Payback = $\frac{\text{total cost for new high efficient equipment}}{\text{average saving in energy cost per month}}$

- A. 24.5 months
B. 96.2 months
C. 125.3 months
D. 294.4 months

SECTION 4: STRUCTURAL SYSTEMS Questions 16-20

16. Steel angle iron is sold for \$1.83 per linear foot, steel rod is sold for \$1.61 per linear foot, and steel pipe is sold for \$2.94 per linear foot. If 19.5 feet of angle iron, 15.5 feet of rod, and 12 feet of pipe are purchased, what is the approximate total price for the metal before taxes?

A. \$ 9.59
 B. \$ 95.92
 C. \$ 959.92
 D. \$ 9599.20

17. Which of the following quantities of lumber has the smallest number of board-feet?

Information: 1 board-foot = 144 cubic inches

1 square foot = 144 square inches

A. 24 boards measuring 1 inches by 8 inches by 14 feet
 B. 27 boards measuring 2 inch by 4 inches by 12 feet
 C. 22 boards measuring 2 inches by 6 inches by 10 feet
 D. 20 boards measuring 1 inch by 8 inches by 16 feet

18. An rectangular shaped metal tank (rectangular prism) weighs 798 pounds empty. When filled with water the tank and water weighs 3604 pounds. If the internal height of the tank is 7.5 feet and the internal width of the tank is 3.75 feet, what is the internal length of the tank?

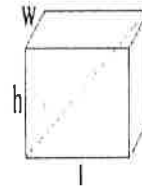
1 gallon = 231 cubic inches

1 gallon water = 8.34 pounds

1 cubic-foot = 1728 cubic-inches

Volume of rectangular prism = Length \times Width \times Height

A. 0.9 feet
 B. 1.6 feet
 C. 13.3 feet
 D. 19.1 feet



Picture of rectangular prism

19. A 21-foot length of unthreaded black pipe is to be cut into 13 pieces of equal length. Both ends of the 21-foot pipe are already cut square (90 degrees) and the 13 pieces will also have square cut ends. The metal saw being used cuts a kerf (material removed by saw blade) that is $\frac{5}{32}$ inch wide. Other than the material lost by the saw kerf, none of the pipe is wasted or unused in cutting the 13 pieces of equal length. What is the approximate length (in feet, inches and fraction of an inch) of each piece of the pipe. Information: 1 foot = 12 inches $\frac{5}{32}$ inch = 0.15625 inch

A. 1 foot, 6 and $\frac{7}{16}$ inches
 B. 1 foot, 6 and $\frac{15}{32}$ inches
 C. 1 foot, 7 and $\frac{1}{4}$ inches
 D. 1 foot, 7 and $\frac{3}{8}$ inches

20. A round concrete column is fabricated using 5.8 cubic yard of concrete. If the concrete column is 40 inches in diameter, what is the approximate height of the column?

Information: 1 cubic yard = 27 cubic feet

1 cubic foot = 1728 cubic inches

1 foot = 12 inches

Volume of cylinder = $\pi \times (\text{cylinder radius})^2 \times \text{cylinder height}$

$\pi = 3.14$

diameter = (2 \times radius)

A. 17.95 feet
 B. 18.45 feet
 C. 18.95 feet
 D. 19.45 feet

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SECTION 5: ENVIRONMENTAL & NATURAL RESOURCE SYSTEMS Questions 21-25

21. Approximately how many acres are in a rectangular field measuring 1109 meters by 928 yards?

Information: 1 acre = 43,560 square feet 1 hectare = 2.47 acres 1 acre = 0.41 Hectares
 Area of Rectangle = length \times width 1 yard = 3 feet 1 foot = 0.3048 meter

- A. 2.4 acres
- B. 23.6 acres
- C. 232.5 acres
- D. 2325.4 acres

22. Use reference Page B to answer this question. Refer to the dimensions of the proposed concrete slab for the new structure and the square footage lost by stacking the blocks on top of the slab to make the walls for the eight manure storage bays. After the blocks are set on top of the concrete slab, what is the remaining surface area for storing manure? Area of rectangle = Length \times Width

- A. 954 square-feet
- B. 994 square-feet
- C. 1024 square-feet
- D. 1054 square-feet

23. Use reference Page B to answer this question. Refer to the dimensions of the concrete blocks that will be used with the proposed storage facility. The push wall is stacked three blocks high and the side walls of each bay are stacked two blocks high. Approximately how many of the blocks will be needed for the proposed facility? Area of rectangle = Length \times Width

- A. 112 concrete blocks
- B. 120 concrete blocks
- C. 128 concrete blocks
- D. 136 concrete blocks

24. Use reference Page B to answer this question. Each of the storage bays shown on Page B Figure 4 will hold manure as shown in Figure 5. Refer to the length and width dimensions of each bay and the height of the blocks that make up the three walls. What is the maximum holding capacity (volume) of one bay when it is filled with compost? This answer must be estimated.

1 cubic yard = 27 cubic-feet Volume of rectangular prism = Length \times Width \times Height

- A. 11 to 13 cubic yards
- B. 19 to 21 cubic yards
- C. 27 to 29 cubic yards
- D. 33 to 35 cubic yards

25. A large quantity of manure initially had 28 percent solids and 72 percent moisture by weight. The manure was stockpiled in a covered structure for several months and during that time 30 percent of the manure's original moisture content evaporated and/or drained away. What approximate percentages of solids remain? $1.00 = 100\%$

- A. 33.7 % solids
- B. 35.7 % solids
- C. 37.5 % solids
- D. 39.5 % solids

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**2013 Examination for the
National Agricultural Technology and
Mechanical Systems
FFA Career Development Event**

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If a reference sheet (diagram, picture, table) is needed to answer a question, the question will refer to the appropriate reference sheet.

*Read each question carefully and calculate the single correct answer.
If a marked Scantron answer needs to be changed, completely erase the incorrect answer and clearly mark the appropriate answer.*

Students need a calculator to complete this examination.

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SECTION 1: MACHINERY & EQUIPMENT SYSTEMS Questions 1-5

1. **What is the approximate speed, in miles per hour, for a planter that travels 200 feet in 28.7 seconds?**

Information: 5,280 ft = 1 mile 3600 seconds = 1 hour

- A. 3.98 miles per hour
B. 4.75 miles per hour
C. 5.50 miles per hour
D. 6.37 miles per hour

2. **A planter has a 18-foot effective swath width, it travels at 5.5 miles per hour, and it operates with a field efficiency of 87 percent. What is the approximate effective field capacity (EFC) of the planter in acres per hour?** Information: $EFC = \frac{\text{width of implement in feet} \times \text{speed in miles per hour} \times \text{efficiency}}{8.25}$

- A. 7.2 acres per hour
B. 8.6 acres per hour
C. 9.8 acres per hour
D. 10.4 acres per hour

4. **A pesticide label indicates that it is to be applied at the rate of 4.5 ounces per acre. Approximately how many acres will one gallon of this pesticide formulation treat? Note: 1 gallon = 128 ounces**

- A. 28.4 acres per gallon
B. 29.7 acres per gallon
C. 31.6 acres per gallon
D. 32.5 acres per gallon

4. **Each cylinder in an four cylinder engine has a circumference of 10.6 inches and a piston stroke of 5.8 inches. What is the approximate total displacement of the engine in liters?**

Hints: 1 liter = 61 cubic inches Circumference of a circle = $2 \times \pi \times \text{radius}$
Area of a cylinder bore = $\pi \times \text{radius}^2$ $\pi = 3.14$ radius = diameter \div 2
Displacement of a single cylinder = (length of piston stroke) x (the area of the cylinder bore)

- A. 0.85 liters
B. 3.40 liters
C. 33.55 liters
D. 134.18 liters

5. **A utility tractor is re-equipped with high profile tires (larger diameter than the factory equipped tires). If the original tires had a 39.8-inch outside diameter and the new larger tires have a 43.9-inch outside diameter, what is the actual speed of the tractor when the tractor's mechanical speedometer displays 20 miles per hour? Assume all tires are properly inflated, tires have no slippage, and the speedometer is still calibrated for the smaller diameter tires.**

Information: Circumference of a circle = $(2) \times (\pi) \times (\text{radius})$ $\pi = 3.14$ diameter of circle = $(2) \times (\text{radius})$

- A. 20.6 mph
B. 21.1 mph
C. 21.6 mph
D. 22.1 mph

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SECTION 2: ELECTRICAL SYSTEMS Questions 6-10

6. Three incandescent light bulbs (100 Watts, 200 Watts, 300 Watts) are operating in a 120 volt circuit. If each bulb operates at 120 volts, which of the following statements is correct in regard to the operation of the bulbs? Information: $\text{Wattage} = \text{Voltage} \times \text{Amperage}$ $\text{Voltage} = \text{Amperage} \times \text{Resistance}$

- A. All three bulbs operate at the same amperage.
 B. All three bulbs have the same electrical resistance.
 C. The 100-watt light bulb has more electrical resistance (ohms) than the 200- or 300-Watt light bulbs.
 D. The 100-watt light bulb has less electrical resistance (ohms) than the 200- or 300-Watt light bulbs.

7. A 120-volt electrical circuit operates TWO 2400-watt resistance heaters and TEN 300-watt lights. If the circuit is operated 8 hours each day for 330 days, how many kilowatt-hours (kWh) will the electrical system use during that time period?

$$\text{Information: Kilowatt hours} = \frac{\text{Total Watts} \times \text{Total hours}}{1000 \text{ Watts/Kilowatt}}$$

- A. 14,256 kWh
 B. 20,592 kWh
 C. 27,083 kWh
 D. 71,280 kWh

8. The monthly charge to operate an electric pump is 11.5 cents per kilowatt hour (kWh) for the first 1000 hours and 12.5 cents for each kWh greater than 1000 hours. If the pump uses 7.5 kilowatts per hour and it operates 20 days each month for 16 hours each day, what is the approximate monthly kWh charge to operate the pump? Information: 1 kilowatt = 1000 Watts 100 cents = \$1.00

- A. \$ 14.50
 B. \$ 229.00
 C. \$ 260.50
 D. \$ 290.00

9. A Wattmeter indicates that 4691 Watts of power is used by a eight horsepower electric motor (induction load), when it is connected to 215 volts and operates at 24 amps. What is the approximate power factor for this motor? Information: $\text{Voltage} = \text{Amperage} \times \text{Resistance}$

$$\text{Wattage of Induction Load} = \text{Voltage} \times \text{Amperage} \times \text{Power Factor}$$

- A. 0.74 power factor
 B. 0.91 power factor
 C. 1.09 power factor
 D. 8.95 power factor

10. An old electrical motor has 'burned' out and must be replaced. The old motor operates an average of 12 hours each day, 340 days each year, and its average annual electrical bill was \$12,665. The replacement cost for a motor (identified as A) that is identical to the old motor sells for \$899 dollars and the installation charge is \$245. An energy efficient motor (identified as B) sells for \$1,290 and the installation charge is \$295. Motor B will have an average cost of \$3.05 per hour to operate. Approximately how many months must motor B operate to make up for (payback) the higher cost to purchase and install an energy efficient motor B?

$$\text{Information: 1 year} = 12 \text{ months} \quad 1 \text{ day} = 24 \text{ hours}$$

$$\text{Burnout Payback} = \frac{(\text{total cost for high efficient equipment B}) - (\text{total cost for identical equipment A})}{(\text{average saving in energy cost per month})}$$

- A. 23.9 months
 B. 26.5 months
 C. 29.8 months
 D. 32.4 months

You may write on this exam, but only the Scantron sheet is graded.

SECTION 3: ENERGY SYSTEMS Questions 11-15

11. An auger has a 4.5-inch diameter pulley on the drive shaft and must turn at 1000 revolutions per minute (rpm). The auger is powered by an electric motor that rotates at 1725 rpm. What is the approximate diameter of the pulley needed on the motor shaft to rotate the auger at the correct speed?

Information: 1 foot = 12 inches

Pulley Size Formula: (Diameter of Pulley 1 × Speed of Pulley 1) = (Diameter of Pulley 2 × Speed of Pulley 2)

- A. 2.6 inches
B. 4.1 inches
C. 5.3 inches
D. 7.5 inches

12. A thermometer calibrated in degrees Celsius (°C) is used to measure the temperature during a feed processing operation that requires heating to 200 degrees Fahrenheit (°F). What temperature on the Celsius thermometer is approximately equal to 200 °F?

Information: °F = (9/5 °C) + 32

°C = 5/9 (°F - 32)

Water freezes at 32 °F

- A. 93.3 °C
B. 168.0 °C
C. 232.5 °C
D. 392.0 °C

13. An electric water heaters uses 1190 kilowatt-hours (kWh) of power each day. If electric power cost 8.9 cents per kWh, approximately how much energy (in therms) does this water heater use during 30 days of operation? Information: 1 kWh = 3412.3 Btus of energy 1 therm of energy = 100,000 Btus of energy

- A. 12.2 therms
B. 121.8 therms
C. 1218.2 therms
D. 121,819,110.0 therms

14. This question refers to the sample natural gas bill and accompanying information at the bottom of this page. Based on the values show on the sample bill, what is the approximate charge per therm for natural gas?

- A. \$ 1.42 per therm
B. \$ 6.67 per therm
C. \$ 7.89 per therm
D. \$ 9.57 per therm

15. This question refers to the sample gas bill and accompanying information at the bottom of this page. Including the connection fee, taxes, and the gas charge, what is the total amount paid by the consumer for each cubic-foot of natural gas?

- A. \$ 0.70 per ft³
B. \$ 0.91 per ft³
C. \$ 20.32 per ft³
D. \$ 26.38 per ft³

Sample Natural Gas Monthly Bill: September 29, 2013 to October 28, 2013 (29 days)			
NATURAL GAS CONSUMPTION		SERVICE FEES	
Current Meter Reading (cubic-feet)	1708	Gas Consumption Charge	\$ 52.62
Previous Meter Reading (cubic-feet)	1633	Monthly Connection Fee	\$ 11.00
Meter Difference (cubic-feet)	75	Subtotal	\$ 63.62
Average Consumption (cubic-feet / day)	2.59	City/State/Energy Taxes (7.4%)	\$ 4.71
Volume Multiplier	0.088914	Current Total Due	\$ 68.33

1 kWh = 3412.3 Btus 1 therm = 100,000 Btus (approximate, varies seasonally)

Therm: Unit of measurement used by gas companies to convert the volume of gas---to its heat equivalent (actual energy use).

Volume Multiplier: Converts gas volume (cubic-feet read on meter) to therms of gas consumed (value varies seasonally).

A British thermal unit (Btu) is the heat required to raise the temperature of one pound of water one degree Fahrenheit.

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SECTION 4: STRUCTURAL SYSTEMS Questions 16-20

16. Which of the following will have the greatest weight: 0.0039 acre-feet of water, 170 cubic-feet of water, 1275 gallons of water, or 4850 liters of water?

Information: 1 cubic foot of water = 62.43 pounds
1 liter of water = 2.20 pounds

1 gallon of water = 8.35 pounds
1 acre-foot water = 43,560 cubic feet of water

- A. 4.1 acre feet of water
B. 170 cubic-feet of water
C. 1275 gallons of water
D. 4850 liters of water

17. A concrete slab is needed to store equipment. The rectangular wooden forms to pour the concrete slab have inside dimensions of 24 feet by 36 feet and provide for a slab thickness of 6 inches. An additional five percent of the total volume of concrete must be ordered to allow for ground irregularities. What volume of concrete (in cubic yards) must be ordered to pour this slab? Special note: The local concrete company's minimum charge is for two cubic-yards of concrete and for amounts larger than two cubic-yards, concrete is sold/delivered only in quarter yard units (2.0, 2.25, 2.5, 2.75, 3.0, 3.25, 3.5, etc). Information: 1 cubic yard = 27 cubic feet 1 foot = 12 inches

- A. 15 cubic yards
B. 16 cubic yards
C. 17 cubic yards
D. 18 cubic yards

18. Use Reference Sheet A to answer this question. Examine the roof diagram 2_A. Which of the following statements correctly identifies the slope values for both angled portions of the roof.

Information: See Reference Sheet A for all information.

- A. The steepest slope is 12" to 12" (left side of 2_A) and the flatter slope is 4" to 12" (right side of 2_A).
B. The steepest slope is 8" to 12" (left side of 2_A) and the flatter slope is 6" to 12" (right side of 2_A).
C. The steepest slope is 6" to 12" (right side of 2_A) and the flatter slope is 8" to 12" (left side of 2_A).
D. The steepest slope is 4" to 12" (right side of 2_A) and the flatter slope is 12" to 12" (left side of 2_A).

19. Use Reference Sheet A to answer this question. Approximately how many square feet is there on this building's roof? Note: The roof does not extend beyond the walls of the building.

Information: See Reference Sheet A for all information.

- A. 864.0 square feet
B. 915.5 square feet
C. 988.5 square feet
D. 1026.0 square feet

20. Use Reference Sheet A to answer this question. What is the volume of this building's interior, including the space within the walls, and above the walls, under the roof?

Information: See Reference Sheet A for all information.

- A. 10,584 cubic feet
B. 11,232 cubic feet
C. 12,460 cubic feet
D. 14,324 cubic feet

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SECTION 5: ENVIRONMENTAL & NATURAL RESOURCE SYSTEMS Questions 21-25

21. Approximately how many hectares are in a rectangular field measuring 818 feet by 946 feet?

Information: 1 acre = 43,560 square feet 1 hectare = 2.47 acres 1 acre = 0.41 Hectares
 Area of Rectangle = length \times width

- A. 4.4 hectares
- B. 7.2 hectares
- C. 11.6 hectares
- D. 17.8 hectares

22. If a center pivot irrigation system is 0.25 mile long (has a 0.25 mile radius), approximately how many acres can be irrigated under the pivot's boom during 360 degrees of travel?

Information: Area of a circle = $(\pi) \times (\text{radius})^2$ $\pi = 3.14$ diameter = $2 \times$ radius
 1 acre = 43,560 square feet 1 mile = 5,280 feet

- A. 62.8 acres
- B. 96.8 acres
- C. 125.6 acres
- D. 2009.6 acres

23. Use Reference Sheet B to answer this question. What is the approximate acreage of the irregularly shaped piece of farm land that is shown with dimension in Diagram 1 on Reference Sheet B?

Information: See Reference Sheet B for all information.

- A. 107.28 acres
- B. 127.63 acres
- C. 147.95 acres
- D. 167.56 acres

24. Use Reference Sheet B to answer this question. Compare Diagrams 2_B and 3_B on Reference Sheet B. Select the follow sentence that correctly describes the operational characteristics of the two different pivot locations? Information: See Reference Sheet B for all information.

- A. The center pivot in Diagram 2_B will irrigate the same acreage as the center pivot in Diagram 3_B.
- B. The center pivot in Diagram 3_B will irrigate less acreage than the center pivot in Diagram 2_B.
- C. The center pivot in Diagram 2_B will irrigate more acreage than the center pivot in Diagram 3_B.
- D. The center pivot in Diagram 3_B will irrigate more acreage than the center pivot in Diagram 2_B.

25. Use Reference Sheet B to answer this question. Approximate how many acres can be irrigated under the pivot's boom when the center of the pivot is located as show in Diagram 4_B on Reference Sheet B?

Information: See Reference Sheet B for all information.

- A. 90.4 acres
- B. 92.6 acres
- C. 94.2 acres
- D. 96.8 acres

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SECTION 1: MACHINERY & EQUIPMENT SYSTEMS Questions 1-5

- 1. A diesel tank has the capacity to hold 95.2 liters of fuel. What is the approximate capacity of the tank in gallons?** Information: 1 liter = 0.26 gallon 1 gallon = 3.79 liters

A. 15 gallons
B. 25 gallons
C. 85 gallons
D. 365 gallons

- 2. The torque requirement for a bolt is listed as 4 foot-pounds. If the only torque wrench available is calibrated in inch-pounds, how many inch-pounds are required to equal 4 foot-pounds?**

Information: 1 foot = 12 inches 1 pound = 16 ounces

A. 0.33 inch-pounds
B. 12 inch-pounds
C. 48 inch-pounds
D. 96 inch-pounds

- 3. If the average weight of wheat is 60 pounds per bushel, approximately how many bushels of wheat can be transported in a rail car with a maximum carrying capacity of 94.2 tons?**

Information: 1 ton = 2000 pounds 1 bushel 2.44 cubic feet

A. 1,287 bushels
B. 2,162 bushels
C. 3,140 bushels
D. 4,225 bushels

- 4. A hydraulic cylinder that operates the arm of a skid steer loader has a bore diameter of 3 inches and a stroke of 36 inches. The tractor's hydraulic system produces a maximum pressure of 2,900 pounds per square inch. Approximately, what is the maximum force the cylinder can exert on the lift arm?**

Information: Area of a cylinder bore = $(\pi) \times (\text{radius})^2$ $\pi = 3.14$
Force = Pressure \times Area radius = (diameter \div 2)

A. 20,490 pounds
B. 40,640 pounds
C. 60,810 pounds
D. 81,950 pounds

- 5. Each cylinder in a six cylinder tractor engine has a bore diameter of 4.1 inches and a piston stroke of 6.4 inches. What is the approximate total displacement of this engine in liters?**

Information: Area of a cylinder bore = $(\pi) \times (\text{radius})^2$ $\pi = 3.14$ radius = (diameter \div 2)
Volumetric displacement of a single cylinder = (length of piston stroke) \times (the area of the cylinder bore)
1 liter = 61 cubic inches 1 cubic inch = 0.0164 liter

A. 1.4 liters
B. 8.3 liters
C. 33.2 liters
D. 506.7 liters

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SECTION 2: ELECTRICAL SYSTEMS Questions 6-10

6. If each outlet on an electrical circuit theoretically uses 1.5 amperes, approximately how many outlets may safely be installed on a circuit sized to carry a maximum of 20 amperes?

A. 10 outlets
 B. 13 outlets
 C. 18 outlets
 D. 20 outlets

7. What is the approximate power consumption (Wattage) of a 120 volt electrical circuit (wired in parallel) with 6 incandescent (resistance) lighting loads, each load using 1.75 amps?

Information: Wattage = Voltage \times Amperage

Voltage = Amperage \times Resistance

A. 210 Watts
 B. 728 Watts
 C. 1260 Watts
 D. 6448 Watts

8. The monthly charge to operate an electric pump is 9.5 cents per kilowatt hour (kWh) for the first 1000 hours and 8.25 cents for each kWh greater than 1000 hours. If this pump uses 2669 kWhs of electricity during a single month, what is the approximate monthly cost to operate the pump?

Information: 1 kilowatt = 1000 Watts

100 cents = \$1.00

1 hour = 60 minutes

A. \$ 138
 B. \$ 159
 C. \$ 233
 D. \$ 253

9. The Occupational Safety and Health Administration (OSHA) lists the daily permissible noise level exposure during an eight-hour work day as 90 decibels (dB) followed by at least ten hours of recovery time where the noise level must be at 70 dB or lower. If the noise level is elevated to 95 dB, the daily permissible noise level exposure is limited to 4 hours. The OSHA guidelines indicate that for every 5 dB above the permissible level it reduces the permissible exposure time by 50 percent. Approximately how much time can a person be safely exposed to 92.5 dB?

Information: 50 % = 0.5

8 hours exposure - (8 hours \times 50% reduction) = 4 hours exposure

A. 6.0 hours
 B. 6.5 hours
 C. 7.0 hours
 D. 7.5 hours

10. A work environment exposes employees to *Sound 1* for approximately 5 hours and 24 minutes and *Sound 2* for approximately 3 hours and 9 minutes. The safe exposure time for *Sound 1* is 6 hours and *Sound 2* is 7 hours. When the daily noise exposure is composed of two or more periods of noise exposure, the combined effect determines safe exposure levels. What is the approximate Combined Exposure Value for these two sounds? Information: 1 hour = 60 minutes

Sound Exposure Is Safe When: (Exposure Time \div Allowed Exposure Time) = Value that is less than or equal to 1

Sound Exposure Is Unsafe When: (Exposure Time \div Allowed Exposure Time) = Value that is greater than 1

Combined Exposure Value = $(E_1 / T_1) + (E_2 / T_2)$

E_1 = 1st Exposure Time E_2 = 2nd Exposure Time T_1 = 1st Safe Exposure Time T_2 = 2nd Safe Exposure Time

A. 1.11 CEV
 B. 1.26 CEV
 C. 1.35 CEV
 D. 1.48 CEV

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SECTION 3: ENERGY SYSTEMS Questions 11-15

11. A wattmeter measures 6477 Watts of power being used by a eight horsepower electric motor (induction load), when it is operating at 220 volts and using 32 amps. What is the approximate power factor for this motor? Information: Voltage = Amperage \times Resistance
Wattage of Induction Load = Voltage \times Amperage \times Power Factor

- A. 0.92 power factor
B. 0.94 power factor
C. 0.96 power factor
D. 0.98 power factor

12. A portable auger has a 6 inch diameter pulley on the drive shaft and the auger needs to turn at 880 revolutions per minute. The auger will be powered by an electric motor that rotates at 1725 revolutions per minute. What is the approximate diameter of the pulley needed on the motor shaft to rotate the auger at the correct speed? Information: 1 foot = 12 inches

Pulley Size Formula: (Diameter of Pulley 1 \times Speed of Pulley 1) = (Diameter of Pulley 2 \times Speed of Pulley 2)

- A. 3 inches
B. 4 inches
C. 5 inches
D. 6 inches

13. A waterline that is used 24 hours each day has three different leaks and the amount of water lost at each leak is measured during a 30 minute time period. The three quantities of water from the leaks are (a) 78 ounces, (b) 29 ounces, and (c) 112 ounces. Approximately how many gallons will be lost from the waterline during each day of operation?

Information: 1 gallon = 128 ounces 24 hours = 1 day 60 minutes = 1 hour

- A. 41 gallons per day
B. 82 gallons per day
C. 164 gallons per day
D. 1970 gallons per day

14. The available electronic thermometer is calibrated in degrees Fahrenheit ($^{\circ}\text{F}$), but the requirements to anneal (soften) a machined part lists the temperature as a range from 32 to 38 degrees Celsius ($^{\circ}\text{C}$). What is the approximate temperature range for annealing in degrees Fahrenheit?

Information: $^{\circ}\text{F} = (9/5 ^{\circ}\text{C}) + 32$ $^{\circ}\text{C} = 5/9 (^{\circ}\text{F} - 32)$ Water freezes at 32°F

- A. 0 to 3°F
B. 0 to 10°F
C. 64 to 70°F
D. 90 to 100°F

15. An old electrical motor burned out and must be replaced. The old motor operated an average of 8 hours each day, 312 days each year, and its average annual electrical bill was \$14,985. The replacement cost for a motor (identified as A) that is identical to the old motor sells for \$990 dollars and the installation charge is \$285. An energy efficient motor (identified as B) sells for \$1,490 and the installation charge is \$325. Motor B will have an average cost of \$5.87 per hour to operate. Approximately how many months must motor B operate to make up for (payback) the higher cost to purchase and install the energy efficient motor B? Information: 1 year = 12 months 1 day = 24 hours

Burnout Payback = $\frac{(\text{total cost for high efficient equipment}) - (\text{total cost for identical equipment})}{(\text{average saving in energy cost per month})}$

- A. 1.6 months
B. 6.5 months
C. 18.0 months
D. 19.4 months

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SECTION 4: STRUCTURAL SYSTEMS Questions 16-20

16. Which of the following quantities of lumber has the greatest number of board-feet?

Information: 1 board-foot = 144 cubic inches

1 square foot = 144 square inches

- A. 12 boards measuring 2 inches by 4 inches by 10 feet
- B. 10 boards measuring 1 inch by 8 inches by 12 feet
- C. 6 boards measuring 2 inches by 6 inches by 10 feet
- D. 8 boards measuring 1 inch by 12 inches by 12 feet

17. Approximately how many sheets of standard sized plywood, three-quarters inch thick, are needed to completely cover a floor measuring 36 feet by 24 feet? Information: Plywood measures 4 feet by 8 feet

- A. 12 sheets of plywood
- B. 17 sheets of plywood
- C. 22 sheets of plywood
- D. 27 sheets of plywood

18. An irregularly shaped metal tank weighs 47 pounds empty. When it is filled with water, the tank and water weighs 440 pounds. Approximately how many gallons of water are required to fill this tank? Information: 1 gallon water = 8.34 pounds 1 gallon = 231 cubic inches

- A. 6 gallons
- B. 47 gallons
- C. 53 gallons
- D. 392 gallons

19. A 20-foot length of square tubing is to be cut into 14 pieces of equal length. Both ends of the 20-foot tubing are already cut square (90 degrees) and the 14 pieces will also have square cut (90 degrees) ends. The metal saw being used cuts a kerf (material removed by saw blade) that is $\frac{3}{16}$ inch wide. Other than the material lost by the saw kerf, none of the tubing is wasted or unused in cutting the 14 pieces of equal length. What is the approximate length (in feet, inches ~ fraction of an inch) of each piece of the square tubing. Information: 1 foot = 12 inches $\frac{3}{16}$ inch = 0.1875 inch

- A. 1 foot, 4~ $\frac{29}{32}$ inches
- B. 1 foot, 4~ $\frac{15}{16}$ inches
- C. 1 foot, 4~ $\frac{31}{32}$ inches
- D. 1 foot, 5~ $\frac{1}{32}$ inches

20. A round concrete column is fabricated using one cubic yard of concrete. If the concrete column is 15 feet in length, what is the approximate diameter of the column?

Information: 1 cubic yard = 27 cubic feet

1 cubic foot = 1728 cubic inches

1 foot = 12 inches

Volume of cylinder = $\pi \times (\text{cylinder radius})^2 \times \text{cylinder height}$

$\pi = 3.14$

diameter = (2 × radius)

- A. 0.8 inch diameter
- B. 1.5-inch diameter
- C. 15.7-inch diameter
- D. 18.2-inch diameter

You may write on this exam, but only the Scantron sheet is graded.

SECTION 5: ENVIRONMENTAL & NATURAL RESOURCE SYSTEMS Questions 21-25

21. Approximately how many hectares are in a rectangular field measuring 1210 feet by 336 feet?

Information: 1 acre = 43,560 square feet 1 hectare = 2.47 acres 1 acre = 0.41 Hectares
Area of Rectangle = length \times width

- A. 3.8 hectares
- B. 5.4 hectares
- C. 7.6 hectares
- D. 9.6 hectares

22. Use reference sheet A to answer this question. The diagram on reference sheet A shows the perimeter and dimensions of an irregularly shaped pasture. What is the area of the triangular shaped portion of land in the lower right-hand corner that is not part of the irregularly shaped pasture? Information: Area of Triangle = $\frac{1}{2}$ (Base Length \times Height)

1 acre = 43,560 square feet 1 mile = 5,280 feet

- A. 57.9 acres
- B. 65.7 acres
- C. 73.6 acres
- D. 115.8 acres

23. Use reference sheet A to answer this question. The diagram on reference sheet A shows the perimeter and dimensions of an irregularly shaped pasture. What is the area of the rectangular portion of land in the lower left-hand corner that is not part of the irregularly shaped pasture?

Information: Area of Rectangle = length \times width 1 acre = 43,560 square feet 1 mile = 5,280 feet

- A. 98.6 acres
- B. 107.7 acres
- C. 117.1 acres
- D. 129.6 acres

24. Use reference sheet A to answer this question. The diagram on reference sheet A shows the perimeter and dimensions of an irregularly shaped pasture. What is the approximate area of the irregularly shaped pasture in sections, given the measurements and other information provided on the diagram? Information:

1 section of land = 640 acres 1 mile = 5,280 feet
Area of Rectangle = length \times width 1 yard = 3 feet 1 acre = 43,560 square feet

- A. 1.1 section
- B. 2.2 sections
- C. 3.3 sections
- D. 4.4 sections

25. Water flows through 86 feet of pipeline that includes three 90 degree elbows. The water flow rate is 6.5 gallons per minute where the water exits the 86-foot pipeline. The pressure loss through the pipeline is equivalent to 6.2 vertical feet of head (pressure) loss per 100 feet of horizontal run. The head loss through each elbow is equivalent to that of 4.75 feet of additional horizontal length. Approximately, what is the vertical head (pressure) loss for this horizontal pipeline?

- A. 5.3 feet of head loss
- B. 6.2 feet of head loss
- C. 100.3 feet of head loss
- D. 533.2 feet of head loss

You may write on this exam, but only the Scantron sheet is graded.

ANSWERS TO EXAMINATION Do Not Distribute 2011 Examination for the

National Agricultural Mechanics Career Development Event:

Mark all answers on the Scantron sheet using a pencil. Read each question carefully and identify the single correct answer. Use the blank sheet(s) of paper to do all scratch work. Students will need a calculator to complete this examination, but they are not allowed to share a calculator with another student.

SECTION 1: MACHINERY & EQUIPMENT SYSTEMS Question 1-20

1. What is most likely the problem with a tractor's hydraulic system if it has foaming hydraulic oil?

- A. The oil is dirty
- B. Water is in the hydraulic oil
- C. The oil level is too low
- D. The hydraulic pump is going bad

2. What technique will reduce the condensation (very slight build up of water) in the fuel tank of a tractor?

- A. Refuel at end of day
- B. Refuel at start of day
- C. To reduce time required for warm up
- D. Always (each morning) drain the water

3. If a tractor has 20% percent wheel slippage, what could be done to correct the tractor's wheel slippage?

- A. No correction is needed, 20 percent wheel slippage is appropriate
- B. Reduce tractor ballast
- C. Increase tractor ballast
- D. Double the tractor's operating speed to reduce the percentage wheel slippage

4. The seeding tool uses two, 1 ½-inch hydraulic rams to raise and lower its frame. If each ram receives a maximum pressure of 3,000 pounds per square inch, what is the maximum force that each lift cylinder can produce?

Note: Force = (Pressure) x (Area of Piston)

Area of circle = πR^2 $\pi = 3.14$

- A. 1,688 pounds
- B. 5,299 pounds
- C. 6,750 pounds
- D. 13,500 pounds

5. A tractor produces 100 PTO horsepower and has a power takeoff speed of 1000 revolutions per minute. Approximately how much torque, in foot-pounds, can this tractor produce?

$$\text{Note: Torque} = \frac{\text{PTO Horsepower} \times 5252}{\text{Rotational Speed}}$$

- A. 5 foot-pounds
 - B. 100 foot-pounds
 - C. 525 foot-pounds
 - D. 973 foot-pounds
6. When boosting a "down" battery one should take care to connect the jumper cables in:
- A. parallel
 - B. tandem
 - C. series
 - D. series-parallel
7. On a 4-stroke cycle engine, there is a power stroke during:
- A. every revolution of the crankshaft
 - B. every other revolution of the crankshaft
 - C. every four revolutions of the flywheel
 - D. none of the above
8. A tractor PTO shaft rated at 540 RPM would have:
- A. 6 splines
 - B. 12 splines
 - C. 20 splines
 - D. 21 splines
9. A slow moving vehicle (SMV) sign should be displayed on farm vehicles that will not be operated on public roads at speeds faster than:
- A. 25 miles per hour
 - B. 30 miles per hour
 - C. 35 miles per hour
 - D. 40 miles per hour
10. What color fuel tank would minimize the vaporization of gasoline during the summer months?
- A. John Deere green
 - B. Case IH red
 - C. New Holland blue
 - D. Case IH white
11. What is the greatest cause of wear in a tractor's hydraulic systems?
- A. moisture
 - B. dirt
 - C. rust
 - D. none of the above

12. The type of agricultural machinery that is most sensitive to variations in travel speed is:
- power take-off driven
 - ground wheel driven
 - hydraulic motor driven
 - electrical motor driven
13. What is the name of the device used to measure tractor power take off (PTO) horsepower?
- Calorimeter
 - Load cell
 - Precision scale
 - Dynamometer
14. The theoretical field capacity of a machine such as a mower conditioner is a function of what two factors?
- Type of grass/hay and working width
 - Travel speed and working width
 - Tractor power output and field terrain
 - Machine rating and velocity
15. Which of the following components physically engages the flywheel to the drive train?
- Clutch
 - Transmission
 - Differential
 - Final drives
16. Which of the following causes knock in a gasoline engine?
- Fuel igniting properly
 - Fuel igniting too rapidly
 - Fuel igniting too slowly
 - Incomplete combustion
17. Which of the following would be considered a fuel conservation technique?
- Operating tractor at partial load
 - Consistently operating the engine at rated rpm
 - Shifting to a lower gear and “throttling” up under light load
 - Shifting to a higher gear and “throttling” down under light load
18. A twenty-foot-long dump truck bed is 54 inches deep and 90 inches wide. What is the approximate capacity of the truck bed in cubic yards if a load is struck level across the top?
- Note: $1 \text{ yd}^3 = 27 \text{ ft}^3$
- 25 yd^3
 - 27 yd^3
 - 29 yd^3
 - 675 yd^3

19. Which type of corn harvesting loss is generally the highest?

- A. header ear loss
- B. header kernel loss
- C. combine cylinder loss
- D. Combine separator loss

20. From Portable Grinder-mixers, (Herrmann and Harnes) page 3 Tip speed of a hammer mill can be calculated by using a tachometer to determine shaft speed along with the simple formula for the circumference of a circle. The shaft speed of a hammer mill is discovered to be 3183.1 rpm and the radius to the hammer tip is 9 inches. Find the hammer tip speed (ft/min).

- A. 14,992.401 ft/min
- B. 89,951.580 ft/min
- C. 5,621.970 ft/min
- D. 179,908.812 ft/min

$$\pi \cdot \frac{D \times RPM}{12}$$

SECTION 2: INDUSTRY AND MARKETING SYSTEMS Question 21-40

21. Farmer A writes a check to Farmer B so that Farmer A's cattle can graze on Farmer B's pasture. This is an example of a _____ lease.

- A. Cash
- B. Credit
- C. Custom
- D. Livestock share

22. Commercial livestock feedlots must comply with the pollution regulations established by the _____ Act.

- A. Agricultural Animal Waste (AAW)
- B. Concentrated Animal Feeding Operations (CAFO)
- C. Livestock and Feedlot (LF)
- D. National Manure Management (MNM)

23. The cast iron housing on your mower must be welded as you cannot purchase a new cast iron replacement. You are forced to weld mild steel to cast iron. The filler rod you should select should be made from:

- A. Mild steel.
- B. Cast iron.
- C. Brazing rod.
- D. None of the above, the two cannot be joined using this type of welding equipment.

24. Livestock are considered to be _____ property.

- A. Inventory
- B. Personal
- C. Real
- D. Working

25. The National Electric Code (NEC) classifies a confinement livestock facility as a _____ building for wiring purposes.

- A. Dry
- B. Damp
- C. Dusty
- D. Hazardous

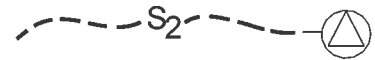
26. The electrical wiring symbol at right represents a _____.

- A. Duplex convenience outlet
- B. Single receptacle outlet
- C. Duplex special purpose outlet
- D. Single special purpose outlet



27. The electrical circuit schematic at right specifies a _____ switch.

- A. Double-pole single-throw (DPST)
- B. Double-pole double-throw (DPDT)
- C. Single-pole double throw (SPDT)
- D. Single-pole single-throw (SPST)



28. If conduit is used in wiring a confinement livestock building, the NEC indicates that _____ should be used.

- A. Electrical metallic tubing (EMT)
- B. Intermediate metallic conduit (IMC)
- C. Rigid metallic conduit (RMC)
- D. Rigid non-metallic conduit (RNMCM)

29. Sows in a farrowing house would be considered a _____ floor load from a building design standpoint.

- A. Capacity
- B. Carrying
- C. Dead
- D. Live

30. The decrease in value of an asset over time, such as a dairy milking parlor, is called _____.

- A. Appreciation
- B. Capital recovery
- C. Depreciation
- D. Time-value of money

31. Which of the following is a variable cost associated with owning small grain machinery?

- A. Storage
- B. Depreciation
- C. Interest
- D. Tires

32. A farmer has determined that his combine field loss is between 1-4 percent. The farmer should:
- A. harvest, this loss is acceptable.
 - B. adjust the reel speed to 1.12 times the forward speed.
 - C. slow the combine travel speed from 3.5 mph to 3 mph.
 - D. increase the combine travel speed from 3.5 mph to 4.5 mph.
33. During a hay harvesting operation, assume the field efficiency is 88 percent and the 13 ft wide mower conditioner being used will travel at 6.5 mph. If the hay field is 10.25 acres, how long will it take to cut the hay?
- A. 1 hour
 - B. 1 hour and 8 minutes
 - C. 1 hour and 16 minutes
 - D. 1 hour and 30 minutes
34. You are applying for a fuel tax rebate. The amount of fuel road tax is 32 cents per gallon. If the refunding is 50% of this amount, what will be the refund for 8,000 gallons of fuel?
- A. \$1,280
 - B. \$2,560
 - C. \$3,840
 - D. \$5,120
35. Which of the following items represents a fixed machinery cost?
- A. Fuel
 - B. Repairs
 - C. Depreciation
 - D. Labor
36. Which of the following is the safest way to drive a skid steer loader uphill with a heavily loaded bucket?
- A. Drive forward straight up the hill
 - B. Drive forward diagonally across the slope of the hill
 - C. Back straight up the hill
 - D. None of the above methods is safer than others
37. Which of the following is the cause for the majority of fatal tractor accidents?
- A. Falling from the tractor while in is being driven
 - B. Tractor runs over the operator
 - C. Power take off entanglements
 - D. Tractor roll over

38. When pulling (towing) a heavy load behind a tractor where is the best place to attach a chain to the tractor?
- A. The tractor's drawbar
 - B. Around the tractor's rear axel
 - C. The top three point hitch of the tractor's draft link
 - D. Low on the tractor's ROPS
39. A Kinze grain cart unloads 500 bushels/minute. Approximately how long would it take for a man (7.5 ft^3) to be completely pulled into the grain tank? (Assume $1 \text{ bushel} = 1.25 \text{ ft}^3$)
- A. 0.72 sec
 - B. 5.00 sec
 - C. 53.00 sec
 - D. 75.00 sec
40. A skid steer was purchased 5 years ago for \$44,600 and has an estimated 10 year life. If the accumulated depreciation is \$23,400 what is the current book value?
- A. \$21,200
 - B. \$23,400
 - C. \$28,600
 - D. \$44,600

SECTION 3: ENERGY SYSTEMS Question 41-60

41. In a service entrance panel, the 120-volt circuits should be planned and installed so that the total load on each of the two 120-volt ungrounded (hot) service conductors is approximately equal. What is the term that can best be used to refer to this condition?
- A. National Electric Code (NEC)
 - B. Parallel Distribution
 - C. Equal Series Service
 - D. Balanced Load
42. Overhead service conductors that run from the service pole to a building are usually made out of what type of material?
- A. Copper
 - B. Aluminum
 - C. Steel
 - D. A mixture of copper, aluminum and steel
43. Overhead service conductors often contain a bare neutral wire. What is the name often applied to this conductor?
- A. Messenger
 - B. Grounder
 - C. Relayer
 - D. Commoner

44. When there are three wires supplying power to the service entrance panel, if two wires are properly hooked up to the main breaker terminal lugs, to what is the third wire connected?
- A. Neutral buss
 - B. The grounding rod
 - C. The 120-volt breaker
 - D. The 220-volt breaker
45. Circuit breakers within the electrical panel may get weak or go bad. This condition is usually caused by what problem?
- A. Repeatedly tripping the breaker
 - B. Nuisance tripping of a GFCI
 - C. Oversizing the circuit breaker (against NEC)
 - D. Using a breaker with an ampere rating of 15 amps
46. When turning on an electric panel for the first time after working on it, you should wear safety glasses and do what other safety precaution?
- A. Stand to the side of the panel and look away
 - B. Always use a safety harness
 - C. Keep a class A fire extinguisher handy
 - D. Wear leather insulated gloves
47. On a receptacle, polarizing is accomplished by having one narrow slot longer than the other. What conductor goes to the terminal that is connected to the longer narrow slot?
- A. Neutral
 - B. Hot
 - C. Ground
 - D. Nothing – it is an extra terminal
48. In a standard 120/240-volt service entrance panel, what should the voltage measure between the two hot supply lugs?
- A. 0-volts
 - B. 120-volts
 - C. 240-volts
 - D. 480-volts
49. In a standard 120/240-volt service entrance panel, what should the voltage measure between the grounding bar and the neutral buss?
- A. 0-volts
 - B. 120-volts
 - C. 240-volts
 - D. 480-volts

50. In a standard 120/240-volt service entrance panel, what should the voltage measure from a terminal on a double-pole (240-volt) circuit breaker to the neutral buss?

- A. 0-volts
- B. 120-volts
- C. 240-volts
- D. 480-volts

51. To turn an overhead light on and off with wall switches from three different locations, the following number and types of light switches are necessary.

- A. Two 3-way switches and one 4-way switch
- B. One 3-way switch and two 4-way switches
- C. Two 3-way switches and one 2-way switch
- D. Three 4-way switches

52. If three different sized (watts) lights are connected to electrical power and the voltage available is equal throughout the circuit, these lights are wired:

- A. In series
- B. In parallel
- C. In a split connection with one light in series and two in parallel
- D. In a split connection with two lights in series and one in parallel

53. Which of the following motor types is most often used for a 120 volt portable single phase, electric drill?

- A. Capacitor start, induction run motor
- B. Shaded pole motor
- C. Split phase motor
- D. Universal

54. What current (amperage) is required for a 9000VA electric water heater when it operates at 240 volts? Assume a power factor of 1.

Formula: $\text{Wattage} = \text{Voltage} \times \text{Amperage} \times \text{Power Factor}$

1 kilowatt = 1000 Watts

- A. 15.0 amps
- B. 37.5 amps
- C. 40.0 amps
- D. 50 amps

55. If a wattmeter measures 6500 watts of power being used by a five horsepower electric motor, operating at 240 volt, and 29 amps, what is the approximate power factor for the motor?

Formula: $\text{Wattage} = \text{Voltage} \times \text{Amperage} \times \text{Power Factor}$

- A. Power factor of 1
- B. 0.838 or 84% power factor
- C. 0.933 or 93% power factor
- D. 1.87 or 187% power factor

56. What type of wiring cable should be installed for a branch circuit in a facility for livestock confinement?

- A. underground feeder (UF)
- B. flexible armored (AC)
- C. non-metallic sheathed (NM)
- D. underground service entrance (USE)

57. According the NEC, the maximum allowable voltage drop for branch and feeder circuits for electrical motors is:

- A. 2%
- B. 4%
- C. 6%
- D. 8%

58. Assume convenience outlets will be placed a maximum of 20 feet apart along the outside walls in the farm machinery shed. If the shed is rectangular shaped, measuring 60 feet by 225 feet, what is the minimum number of convenience outlets required for this installation?

- A. 29
- B. 27
- C. 15
- D. 14

59. What year did the National Electric Code include the requirement that a GFCI protection should be installed in a livestock barn?

- A. 2002
- B. 2005
- C. 2008
- D. 2011

60. The thermal protection device found on many 120-volt electric motors would be classified as:

- A. single poled, normally open
- B. single poled, normally closed
- C. doubled poled, normally open
- D. doubled poled, normally closed

SECTION 4: STRUCTURAL SYSTEMS Questions 61-80

61. What is a metal called when it has two or more significant metallic elements?

- A. Alloy
- B. Ferrous
- C. Non-ferrous
- D. Carbon steel

62. What is another name for “stick” welding?
- A. Gas metal arc welding
 - B. Tungsten inert gas welding
 - C. Shielded metal arc welding
 - D. Flux core arc welding
63. What does the third digit in the electrode identification designation E6011 indicate?
- A. The tensile strength of the core wire material in pounds per square inch
 - B. The electrode can be used to weld in all positions
 - C. The electrode can be used only to make flat or horizontal fillet welds
 - D. The electrode flux contains iron oxide
64. What is the approximate temperature of the arc in shielded metal arc welding?
- A. 1250-1850 degrees Fahrenheit
 - B. 2000-3500 degrees Fahrenheit
 - C. 4000-5500 degrees Fahrenheit
 - D. 6500-7000 degrees Fahrenheit
65. What is the average no-load (or open circuit) amperage and voltage in a direct current (DC) arc welding circuit?
- A. 100 amperes and 240 volts
 - B. 100 amperes and 120 volts
 - C. 0 amperes and 60-80 volts
 - D. 0 amperes and 240 volts
66. What is the name of the mix of base metal and filler rod that remains after a weld is complete?
- A. Slag
 - B. Bead
 - C. Crater
 - D. Electrode
67. What angle should be maintained between the base metal and the electrode while welding in the flat (down-hand) position ?
- A. 75-80 degrees with the direction of travel
 - B. 45 degrees with the direction of travel
 - C. 75-80 degrees opposite the direction of travel
 - D. 45 degrees opposite the direction of travel
68. To reduce the risk of hydrogen cracking, which electrode would you select?
- A. E7014
 - B. E7018
 - C. E7024
 - D. E7010

69. Assume you have just purchased the hoses and regulators for an oxyacetylene welder. The hose that would be used to contain the oxygen would most likely be _____ in color and the fittings would have _____ threads.

- A. Green, left-hand
- B. Green, right-hand
- C. Red; left-hand
- D. Red; right-hand

70. What is the device inside the power supply of an AC/DC SMAW welding machine that changes AC to DC?

- A. Rectifier
- B. Transformer
- C. Inverter
- D. Choke

71. How many board feet are 15 pieces 1" x 4" lumbers that are 8 ft long (use nominal not actual measurements)?

- A. 15
- B. 40
- C. 60
- D. 66

72. The horizontal lumber that is attached to rafters so that metal sheeting can be attached in pole building construction is called:

- A. purlins
- B. headers
- C. girt
- D. poles

73. The highest quality grade listed below for plywood is:

- A. N
- B. A
- C. B
- D. C
- E. E

74. SMAW cutting of galvanized metal should be avoided because it:

- A. increases the danger of a flashback
- B. can result in zinc poisoning
- C. increases the danger of a fire
- D. None of the above are correct

75. Assume you have a 30' x 60' farm shop with an equal sided gable roof. The roof has a four inches rise per foot of run. Assume a 2 ft overhang beyond the exterior wall. What will the approximate length of the common rafter when you are ready to install the rafter?

$$a^2 + b^2 = c^2$$

- A. 15' 9 3/4"
 - B. 17' 11"
 - C. 15' 2 1/8"
 - D. 17' 1 1/4"
76. The portion of the common rafter which sets on the top plate is called the:
- A. birds mouth
 - B. sill
 - C. rafter notch
 - D. valley notch
77. Roof pitch is a ratio of:
- A. rise per foot of run
 - B. run per foot of rise
 - C. rise over span
 - D. run over span
78. On a typical shielded metal arc welding E7018 electrode, the 70 indicates what value for tensile strength?
- A. 70 psi tensile strength
 - B. 700 psi tensile strength
 - C. 7,000 psi tensile strength
 - D. 70,000 psi tensile strength
79. A total of 478.5 feet of steel rod is used to construct a hay feeding rack and the rod weighs 0.658 pounds per foot of length. If the filler metal from welding adds an additional 2.8 pounds to the overall weight, what is the approximate total weight of the hay feeding rack?
- A. 224 pounds
 - B. 273 pounds
 - C. 318 pounds
 - D. 329 pounds
80. Steel angle iron is sold for \$1.95 per linear foot, steel rod is sold for \$1.43 per linear foot, and steel pipe is sold for \$2.86 per linear foot. If 5.9 feet of angle iron, 75.12 feet of rod, and 25.22 feet of pipe are purchased, what is the total price for the metal before taxes?
- A. \$ 91.82
 - B. \$111.64
 - C. \$131.48
 - D. \$191.06

SECTION 5: ENVIRONMENTAL AND NATURAL RESOURCE SYSTEMS**Question 81-100**

81. How many gallons of water are found in two acre-inches of water?

- A. 1,000 gallons
 - B. 27,152 gallons
 - C. 43,560 gallons
 - D. 54,305 gallons
- Note: $7.48 \text{ gal} = 1 \text{ ft}^3$

82. What does a humidistat measure?

- A. Moisture in the air
- B. Amount of rainfall
- C. Oxygen levels in the soil
- D. pH levels in the soil

83. What type of irrigation pump is designed to pump water from deep wells?

- A. Centrifugal pump
- B. Gear pump
- C. Vertical turbine pump
- D. Siphon pump

84. What device is used to measure soil moisture levels?

- A. Humidistat
- B. Thermostat
- C. Manometer
- D. Tensiometer

85. In a Contained Animal Feeding Operation (CAFO), at what level does Carbon dioxide gas (CO_2) affect animals causing them to become dizzy and even unconscious?

- A. 4% CO_2
- B. 10% CO_2
- C. 14% CO_2
- D. 25% CO_2

86. In a swine Contained Animal Feeding Operation (CAFO), what is the optimum pipe discharge size for a manure pump that you would use to pump solid manure?

- A. 0 to 1 inch
- B. 1.5 to 2 inch
- C. 3.0 to 4 inch
- D. 5.0 to 6 inch

87. When used for manure storage, what rainfall frequency and amount should the holding pond be designed to withstand?

- A. 10 year, 48 hour rainfall
- B. 25 year, 24 hour rainfall
- C. 50 year, 24 hour rainfall
- D. 100 year, 72 hour rainfall

88. For a Contained Animal Feeding Operation (CAFO), what alternative method is an approved method to limit runoff other than a holding pond?
- A. Infiltration area
 - B. Levee
 - C. Sand bags
 - D. Anaerobic lagoon
89. What type of biological treatment system is designed for the biodegradation of animal waste and does **not** use oxygen?
- A. Aerobic
 - B. Composting
 - C. Methane generation
 - D. Anaerobic
90. What percentage of solids can most irrigation systems handle when applying manure for fertilization purposes?
- A. 0% solids
 - B. 1% solids
 - C. 4% solids
 - D. 10% solids
91. What are the two most common locations where wet or spoiled grain is likely to be found in a grain bin that is filled level to the eaves of the bin? Note: The bin does **not** have a spreader/leveler but it does have a natural air drying system.
- A. Top and bottom of the grain bin
 - B. Top-center of the grain bin and next to the wall of the bin
 - C. Bottom-center of the grain bin and next to the wall of the bin
 - D. Center of the grain bin and near the perforated floor of grain
92. What is the optimal percent moisture content for alfalfa hay when it is baled into large round (dry, not silage) bales?
- A. 10-15%
 - B. 20-30%
 - C. 40-60%
 - D. 80-90%
93. A rod is commonly used to determine the acres of a field. A rod equals 16.5 feet. Assume you are measuring a 40 acre field. If this field is $\frac{1}{2}$ mile long, how many rods wide is the field?
- A. 160 rods
 - B. 320 rods
 - C. 80 rods
 - D. 40 rods

94. When grain will be used for seed, what is the safe temperature for drying the grain?
- A. 110⁰F
 - B. 120⁰F
 - C. 150⁰F
 - D. 175⁰F
95. Which of the following grain drying fan types is quietest?
- A. Centrifugal
 - B. Axial
 - C. Van axial
 - D. Shaded pole
96. A home development company has been pushing you for several years to sell some of your farm ground. The price they have given you is based on a per square foot basis. How many square feet are in the N $\frac{1}{2}$, NW $\frac{1}{4}$, SW $\frac{1}{4}$ of Section 30? Note: 1 acre = 43,560 square feet.
- A. 435,600 ft²
 - B. 871,200 ft²
 - C. 1,742,400 ft²
 - D. 3,484,800 ft²
97. What is the approximate combined total weight of a trailer weighing 10,000 pounds when it is loaded with 500 bushels of shelled corn that weighs 58 pounds per bushel?
- A. 29,000 lbs
 - B. 34,000 lbs
 - C. 39,000 lbs
 - D. 42,000 lbs
98. Approximately how much time is required to remove 600 round hay bales from a field if bale transport can be completed at an average hauling rate of 9.5 bales per hour?
- A. 63 hours and 10 minutes
 - B. 64 hours and 48 minutes
 - C. 65 hours and 2 minutes
 - D. 65 hour and 13 minutes
99. A tractor fueled by No. 2 diesel burns 8.00 gallons per hour. When the same tractor is fueled with B20 biodiesel it burns 66 gallons of fuel in eight hours. Approximately how many more gallons of fuel will the tractor use during eight hours of operation if it is fueled by B20 biodiesel rather than No. 2 diesel?
- A. 2.0 gallons
 - B. 3.0 gallons
 - C. 3.5 gallons
 - D. 4.0 gallons

100. Determine the volume of a 6-foot diameter round bale that is 5-feet long? What is the weight of the bale if the density of the bale is 14 lbs/ft³?

Note: Volume of cylinder = $(\pi) \times (r)^2 \times (\text{length})$ ($\pi = 3.14$, $r = \text{radius}$)

- A. 1,850#s
- B. 1,979#s
- C. 2,220#s
- D. 2,375#s

End of Examination

**2010 Examination for the National Agricultural Mechanics
Career Development Event: INTEGRATED PEST MANAGEMENT**

Mark all answers on the Scantron sheet using a pencil. Read each question carefully and identify the single correct answer. Use the blank sheet(s) of paper to do all scratch work. Students will need a calculator to complete this examination, but they are not allowed to share a calculator with another student.

SECTION 1: MACHINERY & EQUIPMENT SYSTEMS Question 1-20

1. **Which one of the following must be present in the soil for seed germination?**
 - A. Water
 - B. Nitrogen
 - C. Potassium
 - D. Phosphorous

2. **When moving a tractor up a steep incline, which of the following techniques is recommended?**
 - A. Back up the incline
 - B. Steer straight while driving up the incline
 - C. Angle about 45 degree along the slope while driving up the incline
 - D. Have someone stand on the front of the tractor while driving up the slope

3. **What is the purpose of a press wheel on a planter?**
 - A. Opens the soil for seed planting
 - B. Firms the soil after the seed is covered
 - C. Presses the seed to the bottom of the groove
 - D. Distributes the seed evenly throughout the groove

4. **Which of the following variables directly influence power output of a tractor's power takeoff (PTO)?**
 - A. PTO torque and rotational speed
 - B. Tractor travel speed and direction
 - C. Tractor wheel diameter and travel speed
 - D. PTO diameter and tractor engine oil pressure

5. **How many splines are on the shaft of a 540 rpm PTO stub?**
 - A. 6 splines
 - B. 10 splines
 - C. 20 splines
 - D. 21 splines

6. **Which of the following factors directly influence the field capacity of agricultural equipment?**
 - A. Power takeoff (PTO) speed and temperature
 - B. Machine weight and ground clearance
 - C. Travel speed and operating efficiency
 - D. Machine height and length

7. **How does an underinflated ground driven planter drive tire affect the number of seeds planted per acre?**
 - A. No affect
 - B. Over planting occurs
 - C. Under planting occurs
 - D. Correct amount of seed is planted per acre

8. **When an engine is operated in an enclosed shed, what exhaust gas presents a hazard to people and animals?**
 - A. Hydrogen Peroxide
 - B. Carbon Monoxide
 - C. Hydrogen Sulfide
 - D. Carbon Dioxide

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9. When a tractor is equipped with a rollover protective structure (ROPS) and a seat belt, what is the purpose of the ROPS?

- A. Lower the tractor's center of gravity
- B. Prevent head injuries caused by falling objects
- C. Limit most rollovers to 90 degrees and when the seatbelt is worn, to protect the operator
- D. Limit most rollovers to 180 degrees and when the seatbelt is not worn, to protect the operator

10. Which of the following is an acceptable way to dispose of empty herbicide containers after use?

- A. Rinse once and burn on site
- B. Reuse the container to store nontoxic liquids
- C. Triple rinse and puncture
- D. Cut the top out and reuse for food storage

11. What is the term for a herbicide that is applied to kill a plant before it emerges from the surface of the soil?

- A. Post emergence
- B. Pre-emergence
- C. Incorporated
- D. Aerated

12. What type of pest management systems relies on the physical removal of pests such as hoeing weeds?

- A. Biological
- B. Chemical
- C. Incorporated
- D. Mechanical

13. Applying insecticide often eliminates natural enemies of the pest insects; what term describes the process where a pest population recovers from a pesticide treatment?

- A. Resurgence
- B. Residual
- C. Reactant
- D. Mechanical

14. What is the term/practice for planting a different crop to prevent the buildup of pest organisms that feed on a particular type of plant?

- A. Multiple cropping
- B. Strip cropping
- C. Crop rotation
- D. Intercropping

15. Which of the following terms describes the inspection of a field to determine if there is a pest problem?

- A. Scouting
- B. Eradication
- C. Cultural control
- D. Resistance

16. Using living organisms to control pest populations is known as what type of control system?

- A. Biological
- B. Chemical
- C. Mechanical
- D. Physical

17. The use of botanical and synthetic pesticides is known as what type of control system?

- A. Biological
- B. Chemical
- C. Mechanical
- D. Physical

18. A planter has a 20-foot effective swath width, travels at 5 miles per hour, and operates with a field efficiency of 80 percent. What is the approximate effective field capacity (EFC) of the planter in acres per hour?

Note: $EFC \text{ in acres per hour} = \frac{\text{width of implement in feet} \times \text{speed in miles per hour} \times \text{efficiency}}{8.25}$

- A. 7.3 acres per hour
- B. 8.0 acres per hour
- C. 9.7 acres per hour
- D. 11.0 acres per hour

19. What is the approximate speed, in miles per hour, of a planter that travels 200 feet in 25.6 seconds?

Note: 5,280 ft = 1 mile 3600 seconds = 1 hour

- A. 3.9 miles per hour
- B. 5.3 miles per hour
- C. 6.5 miles per hour
- D. 8.7 miles per hour

20. If a farm cooperative charges \$17.00 per acre to apply pesticide, what is the total cost to treat six fields with the following acreages: 139 acres, 245 acres, 180 acres, 375 acres, 607 acres, and 495 acres?

- A. \$34,697.00
- B. \$45,831.00
- C. \$52,488.00
- D. \$61,625.00

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SECTION 2: INDUSTRY AND MARKETING SYSTEMS Question 21-40

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21. Which of the following would be considered a liability in farm accounting?

- A. The herbicide bill that you owe to the farm supply store
- B. Money in your checking account
- C. A debt owed to you by another farmer
- D. The cash value of your life insurance policy

22. What is the name for the decrease in the value of a capital asset that occurs over time?

- A. Repair and maintenance
- B. Obsolescence
- C. Depreciation
- D. Capital accrual

23. In economics, applying any production input, such as herbicides, in excess of the required amount, leads to which of the following?

- A. Diminishing returns
- B. Profit maximization
- C. Differentiated input function
- D. Liquidity

24. Which of the following correctly describes the owner(s) of the cooperative?

- A. Stockholders
- B. Private investors
- C. Member-patrons of the cooperative
- D. A sole proprietor

25. Which type of pesticide can only be purchased by a certified pesticide applicator?

- A. General use pesticide
- B. Special use pesticide
- C. Reserve use pesticide
- D. Restricted use pesticide

26. What type of insurance gives a farmer protection against financial loss if a chemical application drifts onto an adjacent farm and damages a neighbor's crop?

- A. Accident insurance
- B. Property insurance
- C. Liability insurance
- D. Crop insurance

27. In economics, a product or service has this characteristic if it satisfies a consumer's need.
- A. Elasticity
 - B. Leverage
 - C. Parity
 - D. Utility
28. What type of business arrangement gives a farmer the right to use a self-propelled spray rig owned by a machinery dealership for a certain period of time in exchange for one or more payments?
- A. Barter
 - B. Exchange
 - C. Lease
 - D. Sale
29. Which of the following is a variable cost associated with owning fertilizer application equipment?
- A. Depreciation
 - B. Chemical expense
 - C. Interest expense
 - D. Annual taxes
30. Which type of fuel is most efficiently converted into work by a tractor's engine?
- A. Gasoline
 - B. Diesel fuel
 - C. LP-gas
 - D. Ethanol
31. Which of the following is an example of a variable cost for a grain elevator employing seasonal workers?
- A. Monthly telephone charge for local calls
 - B. Property tax on elevator
 - C. Depreciation on a grain auger
 - D. Overtime wages paid to hired labor
32. Which of the following is a variable cost associated with owning grain handling equipment?
- A. The operating costs not declared on income tax expenses
 - B. Depreciation costs
 - C. Fuel/energy costs
 - D. Principal payment on a fixed loan
33. Which of the following is an example of a variable cost for a pesticide company that is hiring certified applicators?
- A. Fuel cost
 - B. School tax on the company's property
 - C. Casualty insurance on transport trailers
 - D. Depreciation on a new semi-truck with tanker
34. In this accounting system, an expense is recognized as an expense before cash is paid.
- A. Cash accounting system
 - B. Accrual accounting system
 - C. Liability accounting system
 - D. Expense accounting system
35. Which of the following are all fixed costs associated with operating a farm?
- A. Soil conservation losses, lost crop repayments, death benefits, and federal incentive payments
 - B. The opportunity and entertainment costs not declared on Schedule F of the IRS 1040 Form
 - C. Shelter, interest, taxes, depreciation, and insurance
 - D. Livestock depreciation and all operating costs
36. Which one of the following costs is generally considered to vary with individual operator use?
- A. Annual cost for repairs
 - B. Annual cost for equipment shelter
 - C. Annual cost for equipment taxes
 - D. Annual cost for the interest on the loan for the equipment's purchase

37. Which of the following 2WD tractor weighting schemes is most agreed upon for a heavy duty chisel plow?
- A. 50 percent on the front and 50 percent on the rear
 - B. 40 percent on the front and 60 percent on the rear
 - C. 35 percent on the front and 65 percent on the rear
 - D. 25 percent on the front and 75 percent on the rear
38. If sales tax is 7.25 percent, what is the approximate total cost including the sales tax, for an item marked \$636.94?
- A. \$225.58
 - B. \$319.63
 - C. \$497.36
 - D. \$683.12
39. It costs \$5.45 per acre per year to have a crop service scout for insect pests. What will be the approximate yearly charge to scout a field measuring 2588 feet wide and 2409 feet long? Note: 1 acre = 43,560 square feet
- A. \$679 per year
 - B. \$780 per year
 - C. \$867 per year
 - D. \$987 per year
40. A label specifies that pesticide formulation be applied at the rate of 6.5 ounces per acre. Approximately how many acres will one gallon of this pesticide formulation treat? Note: 1 gallon = 128 ounces
- A. 16.5 acres per gallon
 - B. 19.7 acres per gallon
 - C. 22.9 acres per gallon
 - D. 25.3 acres per gallon

SECTION 3: ENERGY SYSTEMS Question 41-60

41. What material provides great resistance to the flow of electricity?
- A. Insulator
 - B. Conductor
 - C. Filament
 - D. Commutator
42. What type of wire can be used for direct burial in soil?
- A. Type T
 - B. Type TW
 - C. Type UF
 - D. Type THWN
43. What type of variable resistor is used to control voltage?
- A. Voltmeter
 - B. Ammeter
 - C. Oscilloscope
 - D. Potentiometer
44. What device converts light energy into electrical energy?
- A. Photodiode
 - B. Phototransistor
 - C. Photovoltaic cell
 - D. Photoconductive cell
45. A white wire that is connected to the screw of a 3-way switch is:
- A. Hot.
 - B. Neutral.
 - C. A grounding conductor.
 - D. Is not accepted according to the National Electric Code.

46. When an electrical wiring system provides power to a 230-volt motor, why is the frame of the motor grounded?
- To complete the branch circuit
 - To prevent the motor from turning in reverse
 - To physically connect the motor to equipment frames
 - To ground the motor and reduce the likelihood of electrical shock
47. The grounded conductor in an electrical wiring system serves what purpose?
- It is the neutral conductor for the electrical system
 - It is a noncurrent carrying conductor for most appliances
 - It is the unnecessary connection of an electrical conductor to earth
 - It is the only possible electrical connection between the electrical system and the earth
48. What type of switch is used to control water levels in livestock water tanks and other areas where liquid levels must be controlled?
- Timer switch
 - Actuator switch
 - Thermocouple
 - Float switch
49. If a wiring circuit has a path through which electricity can flow, it is said to have what property?
- Switched
 - Parallel
 - Power
 - Continuity
50. When measuring an unknown voltage with a multimeter that requires you to select a voltage, what is the recommended procedure?
- Select the highest voltage range and work your way down
 - Select the lowest voltage range and work your way up
 - Select the voltage range closest to the voltage you expect
 - Select 120 volts
51. When measuring resistance with a multimeter what is the name of the units of the value measured?
- Voltage
 - Amperage
 - Ohms
 - Continuity
52. In an irrigation electrical wiring system, what is the result of broken and/or damaged electrical wires?
- A closed circuit.
 - A complete circuit.
 - An open circuit.
 - A long circuit.
53. How do ohm meters work?
- By combining the amperage and the wattage measurement of the circuit
 - By measuring the current of a component being tested
 - By passing current through the component being tested
 - By combining the voltage and the amperage measurement of the circuit
54. What is the purpose of the ground fault circuit interrupter (GFCI)?
- Provide protection from electrical shock
 - Signal the probability of an earthquake
 - Step up the output voltage of equipment
 - Measure stray voltage
55. What function do sprinkler control valves perform in a sprinkler system?
- Control the amount of water in the system
 - Direct the flow of water
 - Turn the flow of water on or off
 - Allow the water in the system to drain during cold weather

56. What type of zone control valve should be used underground?

- A. Anti-siphon valve
- B. In-line valve
- C. A UL listed gate valve
- D. A UL listed solenoid actuated anti-siphon valve

57. Which of the following types of valves, when properly installed, is most effective at preventing back flow?

- A. Anti-siphon valve
- B. In-line valve
- C. A gate valve
- D. A pressure limiting safety valve

58. The monthly charge to operate a pivot irrigation system is 8 cents per kilowatt hour (KWH) for the first 1000 hours and 7.75 cents for each hour greater than 1000 hours. If the irrigation system uses 1785 KWHs of electricity during a single month, what is the monthly cost, in dollars, to operate the irrigation system? (1 Kilowatt = 1000 Watts)

- A. \$113.84
- B. \$140.84
- C. \$162.84
- D. \$191.84

59. If a wattmeter measures 5800 watts of power being used by a five horsepower electric motor, operating at 230 volt, and 28 amps, what is the power factor for the motor?

Formula: $\text{Wattage} = \text{Voltage} \times \text{Amperage} \times \text{Power Factor}$

- A. 0.123 or 12% power factor
- B. 0.252 or 25% power factor
- C. 0.901 or 90% power factor
- D. 0.972 or 97% power factor

60. An 120-volt electrical circuit will operate a 2400-watt resistance heater and ten 300-watt incandescent light bulbs. If the circuit is operated 10 hours each day for 300 days, how many kilowatt hours will the electrical system use during the time period? Note: $\text{Kilowatt hours} = \frac{\text{Total Watts} \times \text{Total hours}}{1000 \text{ Watts/Kilowatt}}$

- A. 10,900 kilowatts hours
- B. 13,700 kilowatts hours
- C. 16,200 kilowatts hours
- D. 19,400 kilowatts hours

SECTION 4: STRUCTURAL SYSTEMS Questions 61-80

61. What is another name for metallic inert gas welding (MIG)?

- A. Stick welding
- B. Gas tungsten arc welding (GTAW)
- C. Shielded metal arc welding (SMAW)
- D. Gas metal arc welding (GMAW)

62. What is the name of the tool used to cut internal threads?

- A. Tap
- B. Die
- C. Drill
- D. Reamer

63. What is the most common shielding gas used for TIG welding aluminum?

- A. Carbon dioxide
- B. Argon
- C. Nitrogen
- D. Carbon dioxide/argon mix

64. What is indicated by the two (sometimes three) digits immediately to the right of the E of shielded metal arc welding electrodes?
- A. Weld position
 - B. Tensile strength
 - C. Compression strength
 - D. Special electrode characteristic
65. What is the maximum safe working pressure for acetylene?
- A. 15 psi
 - B. 20 psi
 - C. 25 psi
 - D. 30 psi
66. What is the process by which base metals are fastened with a filler metal that melts at temperatures below 840° F?
- A. Brazing
 - B. Braze welding
 - C. Soldering
 - D. Welding
67. What type welding uses an arc surrounded by a layer of flux and is established and maintained between a continuously fed wire and the work piece?
- A. Flux cored arc welding (FCAW)
 - B. Submerged arc welding (SAW)
 - C. Plasma arc welding (PAW)
 - D. Laser beam welding (LBW)
68. What is the typical arc length for a 1/8" diameter E6011 electrode used in SMAW for the flat position?
- A. The electrode should touch and drag along the base metal
 - B. 1/32"
 - C. 1/8"
 - D. 3/8"
69. What device can be installed on oxy-fuel equipment to prevent a flame from traveling back up the torch/hose, past the point of installation?
- A. Regulator
 - B. Cylinder valve
 - C. Flashback arrester
 - D. Reverse flow check valve
70. What type of flame is formed when oxygen is added to a neutral flame?
- A. Neutral flame
 - B. Oxidizing flame
 - C. Carburizing flame
 - D. Pure acetylene flame
71. Which of the following is the fuel gas that can be used for welding purposes?
- A. MAPP
 - B. Propane
 - C. Acetylene
 - D. Propylene
72. What is the safe gas withdrawal rate for an acetylene cylinder?
- A. 1/7 of the cylinders capacity per hour
 - B. 1/4 of the cylinders capacity per hour
 - C. 1/2 of the cylinders capacity per hour
 - D. 2/3 of the cylinders capacity per hour
73. What fuel gas has the highest flame temperature when burned with oxygen?
- A. Acetylene
 - B. Natural Gas
 - C. MAPP Gas
 - D. Propylene

74. According to the American Welding Society (AWS), what is the color code for pure tungsten electrodes (EWP) that are used with the Gas Tungsten Arc Welding process?

- A. Green
- B. Orange
- C. Black
- D. Yellow

75. According to the American Plywood Association, which of the following grades of veneer is the highest (best) quality?

- A. Grade A
- B. Grade B
- C. Grade 1
- D. Grade 2

76. What is the name of a single board that supports a section of a roof on truss type building construction?

- A. Girder
- B. Column
- C. Subfloor
- D. Rafter

77. What is the concrete base that provides a solid, level foundation for brick, stone, or block walls?

- A. Form
- B. Footer
- C. Control joint
- D. Moisture barrier

78. If 180 feet of steel rod is used to construct a hay feeding rack and the rod weighs 0.385 pounds per foot of length, what is the approximate weight of the hay feeding rack?

- A. 69 pounds
- B. 91 pounds
- C. 155 pounds
- D. 260 pounds

79. Steel angle iron is sold for \$2.45 per linear foot, steel rod is sold for \$1.93 per linear foot, and steel pipe is sold for \$2.79 per linear foot. If 18 feet of angle iron, 25 feet of rod, and 28 feet of pipe are purchased, what is the total price for the metal before taxes?

- A. \$ 83.75
- B. \$110.23
- C. \$138.61
- D. \$170.47

80. What is the volume, in cubic inches, of a cylinder with a diameter of 10 inches and a length of 3 feet?

Note: Volume of Cylinder = $\pi \times (\text{radius})^2 \times (\text{length})$ $\pi = 3.14$ $(\text{dia.}/2) = \text{radius}$ 1 foot = 12 inches

- A. 1,384 cubic inches
- B. 1,826 cubic inches
- C. 2,044 cubic inches
- D. 2,826 cubic inches

SECTION 5: ENVIRONMENTAL AND NATURAL RESOURCE SYSTEMS Question 81-100

81. What is the primary purpose of the spinner located below the feed chute on a granular fertilizer spreader?

- A. Force air through the hopper and aid the gravity feed process
- B. To improve the uniform distribution of the granular fertilizer
- C. Vary the distance that fertilizer is thrown during turns and stops
- D. Mix fertilizer and water together prior to injection in the soil

82. Which of the following statements describes effective swath width for a broadcast granular fertilizer spreader?

- A. The maximum distance that fertilizer is thrown directly below the hopper of a spreader
- B. The maximum distance that fertilizer is thrown behind a granular fertilizer spreader
- C. The width of the application that achieves uniform deposition rates with appropriate overlap between adjacent passes
- D. The width of the application that achieves maximum deposition rates without having to overlap between adjacent passes

- 83. Which of the following describes the benefit of conducting a spread pattern test for a granular fertilizer spreader?**
- A. It evaluates the uniformity of the fertilizer distributed over the effective swath width by the spreader
 - B. It determines the volume of the fertilizer that is distributed directly in front of the power unit towing the fertilizer spreader
 - C. It measures the width of a fertilizer application that also achieves the maximum soil deposition rates
 - D. It accounts for the number of pounds of fertilizer that are distributed beyond the spreader's effective swath width

84. Which of the following statements is correct with regard to how the spinner's rotating speed effects granular fertilizer distribution?

- A. Increasing spinner speed (revolutions per minute) decreases the distance that granular fertilizer is thrown
- B. Increasing spinner speed (revolutions per minute) increases the distance that granular fertilizer is thrown
- C. Decreasing spinner speed (revolutions per minute) increases the flow rate of the fertilizer from the hopper
- D. Decreasing spinner speed (revolutions per minute) decreases the flow rate of the fertilizer from the hopper

85. How will a 6 mile per hour wind, blowing perpendicular to the direction of travel, effect the distribution of a liquid hebicide being applied by a spray boom positioned 30 inches above the ground?

- A. Increases off target fertilizer movement
- B. Decreases off target fertilizer movement
- C. Increases the uniform effectiveness of fertilizer application
- D. Decreases the amount of fertilizer required for a application

86. Which of the following is the best option to reduce the off target movement of a liquid fertilizer being applied by a boom sprayer?

- A. Reduce the height of the spray boom above the ground
- B. Use fertilizer spray nozzles that produce smaller spray droplets
- C. Increase the spray pressure (pounds per square inch) being used to deliver the fertilizer
- D. Increase the travel speed (miles per hour) of the fertilizer application

87. What values are used to calculate the application rate of granular applications in pounds per acre?

- A. Use travel speed in miles per hour, effective swath width in feet, and delivery rate in pounds to calculate application rate
- B. Use effective swath width in feet, delivery rate in pounds, and granular size in inches to calculate application rate
- C. Use delivery rate in pounds, granular size in inches, and travel speed in miles per hour to calculate application rate
- D. Use granular size in inches, travel speed in miles per hour, and hopper volume to calculate application rate

88. Which of the follow correctly describes the relationship between application rate (pounds per acre) and the overlap between multiple passes of a granular fertilizer spreader?

- A. Less overlap between passes will increase the travel speed requirements for the application
- B. Less overlap between passes will decrease the travel speed requirements for the application
- C. Greater overlap between passes will increase the overall application rate
- D. Greater overlap between passes will decrease the overall application rate

89. When liquid pesticide is applied with a traditional boom sprayer, if all other variables remain constant, which of the following will result in a decreased chemical application rate?

- A. Reduce the travel speed of the sprayer
- B. Increase the travel speed of the sprayer
- C. Replace the existing nozzles with nozzles having a larger tip size
- D. Increase the spray pressure at the nozzle

90. Which of the following pesticide spray equipment components can directly control and vary the pressure developed at the sprayer nozzle and the quantity of spray delivered to the nozzles?

- A. Strainer
- B. Screen
- C. Nozzle body
- D. Pressure regulator

91. Which of the following is a true statement with respect to groundwater and liquid chemical contamination?

- A. Groundwater is easily cleaned after it becomes contaminated
- B. Chemicals are not transported into groundwater by leaching
- C. Shallow groundwater is more susceptible to contamination than deeper groundwater
- D. Contamination is more likely with clay soils than with sandy soils

92. If other variables remain constant, which of the following adjustments to spray equipment will result in the greatest increase in application rate?

- A. Increase the travel speed 20 percent
- B. Decrease the travel speed 20 percent
- C. Increase the spray pressure 10 percent
- D. Decrease the spray pressure 10 percent

93. If other variables remain constant, which of the following adjustments to spray application equipment will have the described effect?

- A. Doubling the travel speed will double the spray application rate
- B. Doubling the spray pressure will double the spray application rate
- C. Doubling the travel speed will reduce the application rate by one-half
- D. Doubling the spray pressure will reduce the application rate by one-half

94. Which of the following conditions are most likely to reduce the likelihood of off target movement by liquid chemical?

- A. High spray pressure, high temperature, no wind, and high humidity
- B. Low spray pressure, low temperature, low wind speed, and high humidity
- C. High spray pressure, low temperature, high wind speed, and low humidity
- D. Low spray pressure, high temperature, high wind speed, and low humidity

95. Which of the following is typically the reason why inexperienced operators apply granular fertilizer incorrectly with a pull-behind/towed spreader?

- A. Improper fertilizer is applied for the crop being treated
- B. Improper loading of the spreader resulting in poor operation of the hopper delivery system
- C. Improper overlap distance between passes resulting in under or over application
- D. Improper and/or inconsistent travel speed when operating wheel driven spreaders

96. Which of the following statements is true with regard to granular fertilizer spreaders?

- A. Two fertilizers with different densities will have the same rate of flow and distance of throw
- B. Operating spreaders with low quantities of fertilizer does not influence application rate
- C. Two fertilizers with different particle sizes have the same rate of flow and distance of throw
- D. When a spreader with spinners is operated over sloped terrain, the fertilizer is not uniformly applied

97. Which of the following results in feed problems from the hopper to the spinner of a fertilizer spreader?

- A. Normal motion and agitation of the spreader during operation
- B. Uniform granule size and density
- C. Wet or damp fertilizer granules
- D. Fine rather than coarse granular fertilizer is used

98. Approximately how many acres are in a rectangular field measuring 1200 yards by 2360 feet?

Note: 1 acre = 43, 560 square feet 1 yard = 3 feet

- A. 141 acre
- B. 195 acres
- C. 256 acres
- D. 320 acres

99. What is the approximate speed, in miles per hour, of a granular pesticide spreader that travels 275 feet in 0.75 minutes? Note: 5,280 ft = 1 mile 60 minutes = 1 hour

- A. 4.2 miles per hour
- B. 5.0 miles per hour
- C. 6.4 miles per hour
- D. 8.6 miles per hour

100. A pesticide label specifies that 1.5 pints of pesticide concentration, mixed with 20 gallons of water, are to be applied per acre. Approximately how many gallons of pesticide concentration are required to treat a 320-acre field?

Note: 128 ounces = 1 gal 16 ounces = 1 pint

- A. 20 gallons
- B. 45 gallons
- C. 60 gallons
- D. 85 gallons

End of Examination