

**2012 Agricultural Mechanics Career Development Event
Written Examination and Problem Solving (50 points, 2 points each)**

1. A 55 gallon barrel of liquid is one-third empty. Approximately how many gallons of liquid are in the barrel?
Answer must be in gallons.

- A. 18.3 gallons
- B. 27.5 gallons
- C. 36.7 gallons
- D. 41.3 gallons

2. Approximately how many acres are in a rectangular field measuring 1029.5 feet by 375 yards?

Hints: Area of a rectangle is the length times the width 1 yard = 3 feet 1 acre = 43,560 square feet

- A. 8.86 acres
- B. 17.55 acres
- C. 26.59 acres
- D. 33.64 acres

3. Which has a greater volume: 17.5 pounds of water, 264 ounces of water, or 7.8 liters of water? Hints: 1 fluid gallon = 128 fluid ounces 1 fluid gallon = 8.34 pounds 1 fluid gallon = 3.79 liters

- A. 17.5 pounds of water
- B. 244 ounces of water
- C. 7.8 liters of water
- D. All three quantities have equal volumes

4. How much torque in ft-lbs is applied to a head bolt by applying 120 pounds of force on the end of a wrench 16 inches in length?

Note: Torque in ft-lbs = (Force in pounds) x (Length of lever arm in feet) 1 ft = 12 inches

- A. 160 ft-lbs
- B. 720 ft-lbs
- C. 1,540 ft-lbs
- D. 1,920 ft-lbs

5. A loader was purchased 5 years ago for \$52,000 and has a 10 year life. If the accumulated depreciation is \$23,400 what is the current book (remaining) value?

- A. \$23,400
- B. \$26,000
- C. \$28,600
- D. \$35,000

6. A tractor's power takeoff produces 125 horsepower and turns at 1000 revolutions per minute. Approximately how much torque, in foot-pounds, can this PTO produce?

Note: Torque = $\frac{\text{PTO Horsepower} \times 5252}{\text{Revolution / Minute}}$

- A. 324.5 foot-pounds
- B. 656.5 foot-pounds
- C. 988.5 foot-pounds
- D. 1245.5 foot-pounds

7. What is the total of the following fractional values? Final answer must be in feet, inches, and fractions of an inch. An answer in decimal format is wrong.

$$(12 \text{ feet}, 3\frac{1}{4} \text{ inches}) - (6 \text{ feet}, 6\frac{13}{16} \text{ inches}) - (3 \text{ feet } 5\frac{7}{8} \text{ inches})$$

- A. 2 feet $2\frac{9}{16}$ inches
 B. 3 feet $4\frac{3}{8}$ inches
 C. 4 feet $1\frac{1}{2}$ inches
 D. 5 feet $2\frac{5}{8}$ inches

8. A concrete slab is needed for the storage of equipment. The wooden forms to pour the concrete slab have inside dimensions of 24 feet by 36 feet and provide for a uniform slab thickness of 4.5 inches. What approximate volume of concrete (in cubic yards) is needed to fill the forms?

Hint: 1 cubic yard = 27 cubic feet 1 foot = 12 inches

- A. 12 cubic yards
 B. 324 cubic yards
 C. 1662 cubic yards
 D. 3886 cubic yards

9. There are 175 acres of corn with an average yield of 110 bushels per acre. Due to moisture content, a bushel has an average weight of 63.75 pounds. If the price is 17.15 cents for each pound harvested, calculate the approximate dollar amount that will be possible from harvesting the 175 acres?

- A. \$ 1,913.30
 B. \$ 63,301.58
 C. \$ 210,462.66
 D. \$ 331,561.58

10. If a tractor travels at 15.75 miles per hour, what approximate length of time (in hours) is required to travel 45 kilometers? Hint: 1 mile = 1.6 kilometers

- A. 0.9 hour
 B. 1.8 hours
 C. 2.7 hours
 D. 3.6 hours

11. Each cylinder in a six cylinder engine has a diameter of 3.6 inches and a piston stroke of 5.7 inches. What is the total displacement of the engine in liters? Answer must be in liters.

Hints: 1 liter = 61 cubic inches

Area of a cylinder bore in cubic inches = $(\pi) \times (\text{radius}^2)$ $\pi = 3.14$ radius = (diameter \div 2)

Volume displacement of a single cylinder in cubic inches = (length of piston stroke in inches) \times (the area of the cylinder bore in square inches)

- A. 3.7 liters
 B. 5.7 liters
 C. 11.7 liters
 D. 21.7 liters

12. A 10 horsepower single cylinder engine is operating at 5000 feet above sea level. What approximate horsepower is produced by the engine if the engine's power is decreased 2.5 percent for each 1000 feet of elevation above sea level?

- A. 6.65 horsepower
 B. 7.52 horsepower
 C. 8.75 horsepower
 D. 9.62 horsepower

13. A twenty-foot-long dump truck bed is 54 inches deep and seven feet wide. What is the approximate capacity of the truck bed in cubic yards if the load is struck level across the top surface?

- A. 23.3 yd³
- B. 66.6 yd³
- C. 98.9 yd³
- D. 105.3 yd³

14. Three identical tractor powered land scrapers are being operated. Each scraper's pan measures four feet deep, 10 feet wide, and six feet long. If each scraper's pan can be filled (level full) in eight minutes and it requires 12 additional minutes to dump and restart the filling of each scraper, what is the approximate total capacity of the three scrapers in cubic yards per hour?

Hint: 1 cubic yard = 27 cubic feet

- A. 60 yd³/hr
- B. 70 yd³/hr
- C. 80 yd³/hr
- D. 90 yd³/hr

15. A utility tractor is re-equipped with low profile tires (smaller diameter than the factory equipped tires) for orchard use. If the original tires had a 36-inch diameter and the new smaller tires have a 30-inch diameter, what is the actual speed of the tractor when the tractor's mechanical speedometer displays 15 miles per hour? Assume all tires are properly inflated, tires have no slippage, and the speedometer is not recalibrated.

Note: Circumference of a circle = $\pi \times$ diameter $\pi = 3.14$

- A. 12.5 mph
- B. 15.0 mph
- C. 17.5 mph
- D. 20.0 mph

16. If property tax rate is 2.2%, what is the tax cost per year on a storage facility with a value of \$150,000?

- A. \$ 1,800
- B. \$ 3,300
- C. \$ 4,800
- D. \$ 5,300

17. A manure spreader typically spreads animal waste that has a high moisture content by weight. If the moisture content of stored manure is between 63.2 and 82.5 percent and the average of those two values is used, what is the approximate weight of manure solids that will be applied in a 10-ton application?

- A. 1.6 tons
- B. 2.1 tons
- C. 2.7 tons
- D. 3.6 tons

18. A tractor fueled by No. 2 diesel consumes 7.75 gallons per hour. When the same tractor is fueled with B20 biodiesel it consumes 8.25 gallons per hour. Approximately how many more gallons of fuel will the tractor consume during eight hours of operation if it is fueled by B20 biodiesel rather than No. 2 diesel?

- A. 3.0 gallons
- B. 3.5 gallons
- C. 4.0 gallons
- D. 4.5 gallons

19. If a tractor towed fertilizer spreader travels at an average speed of 6.2 miles per hour and has an effective application swath of 24 feet, what is the approximate number of acres that can be fertilized in four hours of continuous operation? Hints: 1 acre = 43,560 square feet 1 mile = 5280 feet

- A. 72.15 acres
- B. 84.09 acres
- C. 96.17 acres
- D. 118.07 acres

20. A truck tire is warranted for 50,000 miles and costs \$360. The warranty credits a prorated amount of the purchase price toward a replacement tire based on miles of service. What warranty amount is credited toward the price of a new replacement tire if the older tire fails after 40,000 miles of service?

- A. \$ 72
- B. \$ 131
- C. \$ 188
- D. \$ 211

21. A total of 410.5 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 1.8 pounds to the overall weight, what is the total weight of the hay feeding rack?

- A. 191 pounds
- B. 224 pounds
- C. 272 pounds
- D. 291 pounds

22. Steel angle iron is sold for \$1.59 per linear foot, steel rod is sold for \$1.34 per linear foot, and steel pipe is sold for \$2.68 per linear foot. If 9.5 feet of angle iron, 12.75 feet of rod, and 22.25 feet of pipe are purchased, what is the total price for the metal before taxes?

- A. \$ 91.82
- B. \$ 96.20
- C. \$111.64
- D. \$129.40

23. Steel angle iron weighs 1.32 pounds per foot of length and cost \$78.88 for a 20-foot length. Steel pipe weighs 1.19 pounds per foot of length and cost \$83.57 for a 20-foot length. If 118 pounds of each type of steel is purchased, which of the following statements is correct?

- A. 118 pounds of angle iron will provide more feet of length than 118 pounds of steel pipe
- B. 118 pounds of pipe will provide more feet of length than 118 pounds of steel angle iron
- C. 118 pounds of angle iron or 118 pounds of steel pipe will each be more than 100 linear feet of steel
- D. 118 pounds of angle iron or 118 pounds of steel pipe will each be more than 200 linear feet of steel

24. A fertilizer label requires that 4.5 tablespoons of the concentrated liquid fertilizer must be diluted with one gallon of water prior to application. If the mixing spray tank has a 150 gallon capacity (maximum) and three full tanks (water and fertilizer) will be needed, what is the approximate quantity of concentrated fertilizer (total number of gallons) that is needed for the 450 gallons of mixture?

Hints: 1 fluid gallon = 128 fluid ounces

1 fluid ounce = 2 fluid tablespoons

- A. 7.53 gallons
- B. 7.77 gallons
- C. 7.91 gallons
- D. 8.31 gallons

25. In a farming situation, freshly collected manure was found to be 30 percent solids and 70 percent moisture by weight. The collected 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. If 6 tons of the drier manure is applied to crop fields, what approximate weight (in pounds) of the applied manure is actually solid?

Note: 1 ton = 2000 pounds

- A. 1,445 pounds
- B. 4,557 pounds
- C. 7,889 pounds
- D. 10,089 pounds