

**Agriculture  
Chemical Applications Worksheet**

Name Key

1. The third number on a fertilizer label is the percentage by weight of:

- A. nitrogen in the product  
B. nitrate in the product  
C. phosphorous in the product  
D. ammonium in the product  
E. potash in the product

2. A ten-pound bag of 12-4-8 contains:

- A. 12 pounds of elemental nitrogen  
B. .4 pounds of  $P_2O_5$  (phosphorous) equivalent  
C. 8 pounds of  $K_2O$  (potash) equivalent  
D. 1.2 pounds of elemental nitrogen  
E. both b and d

3. A 125-acre field that will be planted in corn needs <sup>18-15-10</sup> 180-150-100 units of fertilizer per acre. The required fertilizer was obtained in bulk, urea 46-0-0, DAP 18-46-0, and muriate of potash 0-0-60.

- a. How many pounds per acre of urea, DAP, and potash are needed?  
b. How many total pounds of fertilizer are needed per acre?  
c. How many tons of fertilizer are needed for the field?

$$.46x = 150$$

$$x \approx 326 \text{ lb/acre phosphorus}$$

$$326 \times .18 \approx 59 \text{ lbs N in DAP}$$

$$180 - 59 = 121 \text{ N needed}$$

$$.46x = 121$$

$$x = 263 \text{ lbs N (urea) per acre}$$

$$.6x = 100$$

$$x \approx 167 \text{ lb/acre potash}$$

$$326 + 263 + 167$$

DAP urea potash

$$= 756 \text{ lb/acre}$$

$$756 \frac{\text{lb}}{\text{acre}} \cdot 125 \text{ acre} = 94500 \text{ lbs}$$

$$94500 \text{ lbs} \cdot \frac{1 \text{ ton}}{2000 \text{ lbs}} = 47.25 \text{ tons}$$

4. A farmer wheat grower has 148 acres of wheat to top-dress with 60-0-0 units of nitrogen using liquid nitrogen 28-0-0. Liquid nitrogen weighs 10.67 pounds per gallon.

- a. How many pounds of liquid nitrogen were applied per acre?  
b. How many total <sup>gallons</sup> of liquid nitrogen were applied?  
c. How many tons were used?

A)  $.28x = 60$

$$x \approx 214 \text{ lb/acre}$$

B)  $214 \frac{\text{lb}}{\text{acre}} \cdot \frac{1 \text{ gal}}{10.67 \text{ lbs}} \cdot 148 \text{ acre} = 2968.3 \text{ gal}$

C)  $214 \frac{\text{lb}}{\text{acre}} \cdot 148 \text{ acre} = 31672 \text{ lbs} \cdot \frac{1 \text{ ton}}{2000 \text{ lbs}} = 15.84 \text{ tons}$

5. A farmer applied 60-60-90 units of fertilizer per acre to 180 acres of soybeans, using 46-0-0 urea at \$567 per ton, 18-46-0 DAP at \$675 per ton, and 0-0-60 muriate of potash at \$630 per ton.

- How many pounds per acre of bulk fertilizer were applied?
- How many tons were used?
- What was the total cost of the fertilizer?

$$46 \times 180 = 8280 \text{ lbs}$$

$$180 \times 18 = 3240 \text{ lbs N in DAP}$$

$$60 - 23 = 37 \text{ N needed}$$

$$46 \times 180 = 8280 \text{ lbs}$$

$$80 \times 180 = 14400 \text{ lbs urea (N)}$$

$$90 \times 180 = 16200 \text{ lbs}$$

$$150 \times 180 = 27000 \text{ lbs potash}$$

$$180 + 80 + 150 = 360 \text{ lbs/acre}$$

6. Urea ammonium nitrate (UAN) solution (32-0-0) has cost an average \$497 per ton. UAN has a density of 11.06 lb per gallon at 68°F. What is the cost per pound of N? How many gallons is a ton of UAN?

$$2000 \text{ lb} \times 0.32 = 640 \text{ lb N}$$

$$\$497 \div 640 \text{ lb} = \$0.78 \text{ per lb N}$$

$$2000 \text{ lb} \div 11.06 \text{ lb/gal} \approx 181 \text{ gallons}$$

7. Brad has 250 acres he sprayed with an herbicide. He used 1 quart of herbicide in 9.75 gallons of water per acre. Brad checked the sprayer manual to determine that 28 fluid ounces of liquid comes out of one nozzle per minute. The sprayer is a 60-foot boom sprayer with nozzles 20 inches apart that holds 300 gallons.

- How many gallons of liquid were used per acre?
- At what speed did Brad drive to apply the proper amount of spray?
- How many gallons of water were needed?

$$9.75 \text{ gal} + 0.25 \text{ gal} = 10 \text{ gal/acre}$$

$$10 \text{ gal/acre} \times 250 \text{ acres} = 2500 \text{ gal}$$

$$60 \text{ ft} \times \frac{12 \text{ in}}{18 \text{ in}} = 720 \text{ in} \quad 720 \div 20 \text{ in} = 36 \text{ nozzles}$$

$$\frac{28 \text{ oz}}{\text{min}} \times 36 = 1008 \frac{\text{oz}}{\text{min}}$$

$$1008 \frac{\text{oz}}{\text{min}} \times \frac{1 \text{ gal}}{128 \text{ oz}} \times \frac{60 \text{ min}}{1 \text{ hr}} = 472.5 \frac{\text{gal}}{\text{hr}}$$

$$2500 \text{ gal} \div 472.5 \frac{\text{gal}}{\text{hr}} = 5.3 \text{ hrs}$$

$$250 \text{ acre} \times \frac{43560 \text{ ft}^2}{1 \text{ acre}} = 10,890,000 \text{ ft}^2$$

$$10,890,000 \text{ ft}^2 \div 60 \text{ ft} = 181,500 \text{ ft}$$

$$181,500 \text{ ft} \times \frac{1 \text{ mi}}{5280 \text{ ft}} = 34.375 \text{ mi}$$

$$d = r \times t$$

$$34.375 = r (5.3)$$

$$r = 6.5 \text{ mph}$$

$$9.75 \times 2500 \text{ gal} = 24375 \text{ gal H}_2\text{O}$$

8. Answer the following questions using the following information:

- Your sprayer holds 50 gallons of spray material.
- The treatment area is 2 acres (43,560 sq ft = 1 acre) in size.
- The label rate for the pesticide is 4 ounces per 1,000 square feet.
- The application rate of the spray solution is 2 gallons per 1,000 square feet.

- How many total gallons of spray material will be needed to cover this area?
- How many total gallons of the pesticide will be used?
- How many tanks will it take to complete this job using the outputs given above?

$$2 \text{ acres} \cdot \frac{43560 \text{ ft}^2}{1 \text{ acre}} = 87120 \text{ ft}^2$$

$$87120 \text{ ft}^2 \cdot \frac{2 \text{ gal}}{1000 \text{ ft}^2} = 174.24 \text{ gal}$$

$$87120 \text{ ft}^2 \cdot \frac{4 \text{ oz}}{1000 \text{ ft}^2} \cdot \frac{1 \text{ gal}}{128 \text{ oz}} = 2.7 \text{ gal}$$

$$\begin{array}{r} 175 \text{ gal} \div 50 \text{ gal} \\ 3.5 \\ \hline 4 \text{ tanks} \end{array}$$

9. Potatoes prefer a pH of 4.8 - 5.4 and require lime or alum to be applied to adjust the pH. A potato farmer had a pH test reading of 4.0 and wants to add lime to a 125-acre field and the rate of application is 82.5 pounds per 1000 square feet. How many tons of lime will the farmer need to order?

$$125 \text{ acres} \cdot \frac{43560 \text{ ft}^2}{1 \text{ acre}} = 5,445,000 \text{ ft}^2$$

$$5,445,000 \text{ ft}^2 \cdot \frac{82.5 \text{ lbs}}{1000 \text{ ft}^2} = 449,212.5 \text{ lbs}$$

$$449,212.5 \text{ lbs} \cdot \frac{1 \text{ ton}}{2000 \text{ lbs}} = 225 \text{ tons}$$

10. Tomatoes prefer a pH of 6.0 - 7.0 and require lime or alum to be applied to adjust the pH. A gardener had a pH test reading of 5.0 and wants to add lime to a 1/4-acre garden and the rate of application is 110 pounds per 1000 square feet. How many tons of lime will the farmer need to order?

$$\frac{1}{4} \text{ acre} \cdot \frac{43560 \text{ ft}^2}{1 \text{ acre}} = 10890 \text{ ft}^2$$

$$10890 \text{ ft}^2 \cdot \frac{110 \text{ lbs}}{1000 \text{ ft}^2} = 1197.9 \text{ lbs}$$

$$1197.9 \text{ lbs} \cdot \frac{1 \text{ ton}}{2000 \text{ lbs}} = .6 \text{ tons}$$

$$-3(x+2y = -6)$$

11.  $3x + 8y = -20$

$$\begin{array}{r} -3x - 6y = 18 \\ 3x + 8y = -20 \\ \hline 2y = -2 \\ y = -1 \end{array}$$

$$\begin{array}{r} x + 2(-1) = -6 \\ x - 2 = -6 \\ +2 \quad +2 \\ \hline x = -4 \end{array}$$

$(-4, -1)$

$$3x - 4y = -24$$

12.  $4(x + y = -1)$

$$\begin{array}{r} 3x - 4y = -24 \\ 4x + 4y = -4 \\ \hline 7x = -28 \\ x = -4 \end{array}$$

$$\begin{array}{r} -4 + y = -1 \\ +4 \quad +4 \\ \hline y = 3 \end{array}$$

$(-4, 3)$

$$3x - 4y = 9$$

13.  $-3x + 2y = 9$

$$\begin{array}{r} -2y = 18 \\ -2y = -2 \\ \hline y = -9 \end{array}$$

$$\begin{array}{r} 3x - 4(-9) = 9 \\ 3x + 36 = 9 \\ -36 \quad -36 \\ \hline 3x = -27 \\ x = -9 \end{array}$$

$(-9, -9)$

14.  $2(5x + 3y = -6)$   
 $3(3x - 2y = 4)$

$$\begin{array}{r} 10x + 6y = -12 \\ 9x - 6y = 12 \\ \hline 19x = 0 \\ x = 0 \end{array}$$

$$\begin{array}{r} 3(0) - 2y = 4 \\ -2y = 4 \\ -2 \quad -2 \\ \hline y = -2 \end{array}$$

$(0, -2)$

15. A chemist has a solution which is 75% acid and another which is 30% acid solution. How many pounds of each solution should be used to produce 36 pounds of a 55% acid solution?

	Solution 1 +	Solution 2 =	New Solution
Amount of mixture	$x$	$y$	36
* % of acid	.75	.30	.55
= total acid in mix	.75x	.3y	19.8

$$\begin{array}{l} .3(x + y = 36) \\ .75x + .3y = 19.8 \end{array}$$

$$\begin{array}{r} -.3x - .3y = -10.8 \\ .75x + .3y = 19.8 \\ \hline .45x = 9 \\ .45 \quad .45 \\ \hline x = 20 \end{array}$$

$$\begin{array}{r} x + y = 36 \\ 20 + y = 36 \\ -20 \quad -20 \\ \hline y = 16 \end{array}$$

20 lbs at 75%  
 16 lbs at 30%