Math 096--Mixture Word Problems Using Two Equations--page 1

We're going to solve mixture word problems with two equations (so we need two variables). One way to organize your information is to use a chart. Observe carefully. By the way, all the "math" will be left up to you so you have the opportunity to "do the math". The answers for examples a-g appear before the homework.

Part A: Chemistry Mixture Problems

a. A chemist mixes some 70% solution with some 40% solution to obtain 120 gallons of 50% solution. Find the number of gallons of each solution.

Think: x = gallons of 70% solution
y = gallons of 40% solution

	strength (in %)	how many gallons	amount of pure (% times how many gallons)
1st solution	0.70	x	0.70(x)
2nd solution	0.40	y	0.40(y)
Final sol.	0.50	120	0.50(120)

The "how many gallons" column gives one equation; the "amount of pure" column gives the second equation.

x + y = 120 because gal + gal = total gal
.70x + .40y = .50(120) because %(gal) + %(gal) = %(total gal)

b. A pharmacist mixes two different strengths of peroxide. If she mixes a 1% with a 9% solution to obtain 60 ml of a 4% solution, how many ml of each type solution does she use?

Think: x = ml of 1%
y = ml of 9%

	strength (in %)	how many ml	amount of pure (% times how many ml)
1st solution	0.01	x	0.01(x)
2nd solution	0.09	y	0.09(y)
Final sol.	0.04	60	0.04(60)

x + y = 60 because ml + ml = total ml
.01x + .09y = .04(60) because %(ml) + %(ml) = %(total ml)

c. A chemist has to make 80 liters of 15.5% alcohol solution from mixing a 32% solution and a 10% solution. How many liters of each type are mixed?

Think: x = liters of 32% solution
y = liters of 10% solution

	strength (in %)	how many liters	amount of pure (% times how many liters)
1st solution	0.32	x	0.32(x)
2nd solution	0.10	y	0.10(y)
Final sol.	0.155	80	0.155(80)

x + y = 80 because liters + liters = total liters
.32x + .10y = .155(80) because %(liters) + %(liters) = %(total liters)

Part B: Investment Mixture Problems

d. A person had $10,000 to invest; some was invested at 6% and some at 8%. If the total annual interest was $730, find the amount invested at each interest rate.

Think: x = $ invested at 6%
y = $ invested at 8%

	%	how many dollars invested	interest (% times $ invested)
1st investment	0.06	x	0.06(x)
2nd investment	0.08	y	0.08(y)
overall		10,000	$730

x + y = 10,000 because $ invested + $ invested = total $ invested
.06x + .08y = 730 because %($ invested) + %($ invested) = total interest

e. Jenn invested some money at 5% and $6000 more than this at 7%. If the total annual interest is $1740, find the amount invested at each rate.

Think: x = # of $ invested at 5%
y = # of $ invested at 7%

	%	how many dollars invested	interest (% times $ invested)
1st investment	0.05	x	0.05(x)
2nd investment	0.07	y	0.07(y)
overall		y = x + 6000	$1740

y = x + 6000 because the 7% is $6000 more than the 5% and x represents the 5%
.05x + .07y = 1740 because %($ invested) + %($invested) = total interest

Part C: General Mixture Problems

f. A company manufactures some spigots at $25 each and others at $32 each. If the company sold 50 spigots and made $1334, find the number of each type spigot sold.

Think: x = spigots at $25 each
y = spigots at $32 each

	$ for one spigot	how many spigots	total value ($ for one times how many spigots)
1st	25	x	25(x)
2nd	32	y	32(y)
overall		50	$1334

x + y = 50 because spigots + spigots = total spigots
25x + 32y = 1334 because $(spigots) + $(spigots) = total $

g. A grocer mixed $1.80 a pound peanuts with $3.20 a pound chocolate to obtain 50 pounds of a mixture worth $2.92 a pound. Find the number of pounds of each item used.

Think: x = pounds of peanuts
y = pounds of chocolate

	$ for one pound	how many pounds	total value ($ for one times how many pounds)
1st	1.80	x	1.80(x)
2nd	3.20	y	3.20(y)
overall	2.92	50	2.92(50)

x + y = 50 because pounds + pounds = total pounds
1.80x + 3.20y = 2.92(50) because $(pounds) + $(pounds) = $\$_{ending}(pounds_{total})$

You should work a through g to make sure you can do the math :) and then check your results (see below). Then you should try the worksheet.

Answers:
a. x = 40 gallons of 70%; y = 80 gallons of 40%
b. x = 37.5 ml of 1%; y = 22.5 ml of 9%
c. x = 20 liters at 32%; y = 60 liters at 10%
d. x = $3500 at 6%; y = $6500 at 8%
e. x = $11,000 at 5%; y = $17,000 at 7%
f. x = 38 spigots at $25 each; y = 12 spigots at $32 each
g. x = 10 lbs peanuts at $1.80 a pound; y = 40 lbs chocolate at $3.20 a pound

Now try these.

1. A 25% acid solution must be added to a 40% solution to get 240 liters of 30% acid solution. How many of each solution must be used?

2. A 50% antifreeze must be mixed with a 20% antifreeze to get 250 gallons of 32% antifreeze solution. How many of each must be used?

3. A certain metal is 40% tin. A 40% tin metal must be mixed with a 70% tin metal to get 150 kilograms of metal that is 52% tin. How much of each must be used?

4. A 1% solution should be mixed with a 4% solution to get 75 ml of 2% solution. How much of each must be used?

5. A 60% acid solution must be mixed with a 75% acid solution to get 20 liters of a 72% solution. How much of each must be used?

6. Gloria invested some money at 18%, and $3000 less than this at 20%. The total annual interest is $3200. How much is invested at each rate?

7. Marty inherited a sum of money from a relative. He deposits some of the money at 16%, and $4000 more than this at 12%. He earns $3840 in interest per year. How much is invested at each rate?

8. Evelyn invested some money at 10%, and $5000 more than this at 14%. Her total annual interest was $3100. How much was invested at each rate?

9. Joe invested some money at 8%, and $3000 more than twice as much at 10%. The total annual interest was $2540. How much was invested at each rate?

10. Larry has $20,000 to invest, some at 5% and some at 7%. If the annual interest is $1240, how much is invested at each rate?

11. Mary has $35,000 to invest, some at 6% and some at 9%. If the annual interest is $2760, how much is invested at each rate?

12. $50,000 is invested, some at 8% and some at 15%. If the average yield is 11%, find the amount invested at each rate. (Round to the nearest hundredth.)

13. Ink worth $100 per barrel will be mixed with ink worth $60 per barrel to get 48 barrels of ink worth $75 per barrel. How many barrels of each type of ink should be used?

14. Helen has 2 more dimes than nickels. Altogether she has $1.70. How many coins of each type does she have?

15. A bank teller has some five-dollar bills and some twenty-dollar bills. The teller has 5 more twenties than fives. The total value of the money is $725. How many of each type of bill does she have?

16. A merchant wishes to mix candy worth $5 per pound with candy worth $2 per pound to get 60 pounds of a mixture that can be sold for $3 per pound. How many pounds of each type of candy should be used?

17. A merchant wishes to mix some candy worth $1.50 a pound with some candy worth $5.50 a pound to get 240 pounds of candy worth $3.50 per pound. How many pounds of the $5.50 candy should she use?

Answer Key.

1. $x + y = 240$
$.25(x) + .40(y) = .30(240)$
$x =$ 160 liters of 25% solution
$y =$ 80 liters of 40% solution

2. $x + y = 250$
$.50(x) + .20(y) = .32(250)$
$x =$ 100 gallons of 50% antifreeze
$y =$ 150 gallons of 20% antifreeze

3. $x + y = 150$
$.40(x) + .70(y) = .52(150)$
$x =$ 90 kilograms of 40% tin metal
$y =$ 60 kilograms of 70% tin metal

4. $x + y = 75$
$.01(x) + .04(y) = .02(75)$
$x =$ 50 ml of 1% solution
$y =$ 25 ml of 4% solution

5. $x + y = 20$
$.60(x) + .75(y) = .72(20)$
$x =$ 4 liters of 60% solution
$y =$ 16 liters of 75% solution

6. $y = x - 3000$
$.18(x) + .20(y) = 3200$
$x =$ $10,000 at 18%
$y =$ $7000 at 20%

7. $y = x + 4000$
$.16(x) + .12(y) = 3840$
$x =$ \$12,000 at 16%
$y =$ \$16,000 at 12%

8. $y = x + 5000$
$.10(x) + .14(y) =$ \$3100
$x =$ \$10,000 at 10%
$y =$ \$15,000 at 14%

9. $y = 2x + 3000$
$.08(x) + .10(y) = 2540$
$x =$ \$8,000 at 8%
$y =$ \$19,000 at 10%

10. $x + y = 20{,}000$
$.05(x) + .07(y) = 1240$
$x =$ \$8,000 at 5%;
$y =$ \$12,000 at 7%

11. $x + y = 35{,}000$
$.06(x) + .09(y) = 2760$
$x =$ \$13,000 at 6%
$y =$ \$22,000 at 9%

12. $x + y = 50{,}000$
$.08(x) + .15(y) = .11(50{,}000)$
$x =$ \$28,571.43 at 8%
$y =$ \$21,428.57 at 15%

13. $x + y = 48$
$100(x) + 60(y) = 75(48)$
$x =$ 18 barrels of \$100 ink
$y =$ 30 barrels of \$60 ink

14. $y = x + 2$
$.05(x) + .10(y) = 1.70$
$x =$ 10 nickels
$y =$ 12 dimes

15. $y = x + 5$
$5(x) + 20(y) = 725$
$x =$ 25 five-dollar bills
$y =$ 30 twenty-dollar bills

16. $x + y = 60$
$5(x) + 2(y) = 3(60)$
$x =$ 20 pounds of \$5 candy
$y =$ 40 pounds of \$2 candy

17. $x + y = 240$
$1.50(x) + 5.50(y) = 3.50(240)$
$x =$ 120 pounds of \$1.50 candy
$y =$ 120 pounds of \$5.50 candy