Name: _____
Hour: ____ Date: _____

Chemistry: *Real Life Chemistry (for the Business World)*

You work for Gateway as a purchasing agent. You are responsible for ordering certain parts for the newest model system. The following information is necessary for your order:

one system requires 12 widgets and 48 watzits	a watzit weighs 0.50 lbs.
one system takes up 2 ft^3 of space	a widget weighs 0.25 lbs.

Solve the following problems. Show your work and use units for full credit.

1. You are making 150 000 systems for next year.
   a. How many widgets must you order?

   b. How many watzits must you order?

2. a. How much will the widgets weigh?

   b. How much will the watzits weigh?

3. Your warehouse has a volume of 1 000 000 ft^3. How many systems can you place there?

4. You place your original order, but the factory producing watzits can only provide 2500 watzits. How many systems can you produce?

5. If the factory producing watzits can only provide 2500 watzits…
   a. How many widgets will do you need to order now?

   b. What will the total weight of these widgets be?

6. It costs $0.30 per widget and $0.50 per watzit, what is the cost of…
   a. 1 system?

   b. 150 000 systems?

7. If each system sells for $250, how many systems must you sell to earn $1 000 000 dollars ***profit***?

Name: _____
Hour: ____ Date: _____

Chemistry: *Real Life Chemistry*

Imagine you are working as a chemist at Dow Chemicals. You are responsible for ordering chemicals for a new fertilizer that Dow will be producing next year. The following information is necessary for your order…

1 mole contains 6.02×10^{23} molecules
1 mole of gas takes up 22.4 L (or 22.4 dm^3) of space
1 mole of fertilizer requires 2 moles of NH_3 and 3 moles of CH_4

Use the above information to solve the following problems. Show your work.

1. You are making 150 000 moles of fertilizer.
   a. How many moles of NH_3 do you need?

   b. How many moles of CH_4 do you need?

2. a. How much will the NH_3 weigh?

   b. How much will the CH_4 weigh?

3. Your storage tank holds 1 000 000 dm^3. How many moles of gas would it hold?

4. You place your order, but the company that provides CH_4 can only obtain 15 000 moles of CH_4. How many moles of NH_3 will you be able to use with this quantity of CH_4?

5. Using your information from question #4…
   a. How many molecules of NH_3 will you order?

   b. How much space will it take up?

   c. How much will it weigh?

6. If it costs $1.75 per mole of fertilizer produced, how much will it cost to make 150 000 moles?

KEY

Chemistry: *Real Life Chemistry (for the Business World)*

You work for Gateway as a purchasing agent. You are responsible for ordering certain parts for the newest model system. The following information is necessary for your order:

one system requires 12 widgets and 48 watzits	a watzit weighs 0.50 lbs.
one system takes up 2 ft^3 of space	a widget weighs 0.25 lbs.

Solve the following problems. Show your work and use units for full credit.

2. You are making 150 000 systems for next year.
   a. How many widgets must you order?

$$x \text{ widgets} = 150{,}000 \text{ systems}\left(\frac{12 \text{ widgets}}{1 \text{ system}}\right) = 1{,}800{,}000 \text{ widgets}$$

   b. How many watzits must you order?

$$x \text{ watzits} = 150{,}000 \text{ systems}\left(\frac{48 \text{ watzits}}{1 \text{ system}}\right) = 7{,}200{,}000 \text{ watzits}$$

2. a. How much will the widgets weigh?

$$x \text{ lbs} = 1{,}800{,}000 \text{ widgets}\left(\frac{0.25 \text{ lbs}}{1 \text{ widget}}\right) = 450{,}000 \text{ lbs}$$

   b. How much will the watzits weigh?

$$x \text{ lbs} = 7{,}200{,}000 \text{ watzits}\left(\frac{0.5 \text{ lbs}}{1 \text{ watzit}}\right) = 3{,}600{,}000 \text{ lbs}$$

3. Your warehouse has a volume of 1 000 000 ft^3. How many systems can you place there?

$$x \text{ systems} = 1{,}000{,}000 \text{ ft}^3\left(\frac{1 \text{ system}}{2 \text{ ft}^3}\right) = 500{,}000 \text{ systems}$$

4. You place your original order, but the factory producing watzits can only provide 2500 watzits. How many systems can you produce?

$$x \text{ systems} = 2500 \text{ watzits}\left(\frac{1 \text{ system}}{48 \text{ watzits}}\right) = 52 \text{ systems } \& \text{ (4 watzits left over)}$$

5. If the factory producing watzits can only provide 2500 watzits…
   a. How many widgets will do you need to order now?

$$x \text{ widgets} = 2500 \text{ watzits}\left(\frac{12 \text{ widgets}}{48 \text{ watzits}}\right) = 625 \text{ widgets}$$

or

$$x \text{ widgets} = 52 \text{ systems}\left(\frac{12 \text{ widgets}}{1 \text{ system}}\right) = 624 \text{ widgets}$$

Chemistry: *Real Life Chemistry (for the Business World)*

b. What will the total weight of these widgets be?

$$x\ \text{lbs} = 635\ \text{widgets}\left(\frac{0.25\ \text{lbs}}{1\ \text{widget}}\right) = 156.25\ \text{lbs}$$

or

$$x\ \text{lbs} = 624\ \text{widgets}\left(\frac{0.25\ \text{lbs}}{1\ \text{widget}}\right) = 156\ \text{lbs}$$

6. It costs \$0.30 per widget and \$0.50 per watzit, what is the cost of…
   a. 1 system?

$$x\ \$\ /\text{system} = 12\ \text{widgets}\left(\frac{\$0.30}{1\ \text{widget}}\right) + 48\ \text{watzits}\left(\frac{\$0.50}{1\ \text{watzit}}\right) = \$27.60\ /\text{system}$$

   b. 150 000 systems?

$$x\ \$\ = 150{,}000\ \text{systems}\left(\frac{\$27.60}{1\ \text{system}}\right) = \$4{,}140{,}000$$

7. If each system sells for \$250, how many systems must you sell to earn \$1 000 000 dollars ***profit***?

Sell	\$250.00
Cost	-\$ 27.60
Profit	\$222.40 / system

$$\$222.40\overline{)\$1{,}000{,}000} \quad 4497$$

KEY

Chemistry: *Real Life Chemistry*

Imagine you are working as a chemist at Dow Chemicals. You are responsible for ordering chemicals for a new fertilizer that Dow will be producing next year. The following information is necessary for your order…

1 mole contains 6.02×10^{23} molecules 1 mole of gas takes up 22.4 L (or 22.4 dm^3) of space 1 mole of fertilizer requires 2 moles of NH_3 and 3 moles of CH_4

Use the above information to solve the following problems. Show your work.

1. You are making 150 000 moles of fertilizer.
   a. How many moles of NH_3 do you need?

$$x \text{ mol } NH_3 = 150{,}000 \text{ fertilizer}\left(\frac{2 \text{ mol } NH_3}{1 \text{ mol fertilizer}}\right) = 300{,}000 \text{ mol } NH_3$$

   b. How many moles of CH_4 do you need?

$$x \text{ mol } CH_4 = 150{,}000 \text{ mol } CH_4\left(\frac{3 \text{ mol } CH_4}{1 \text{ mol fertilizer}}\right) = 450{,}000 \text{ mol } CH_4$$

2. a. How much will the NH_3 weigh?

$$x \text{ g } NH_3 = 300{,}000 \text{ mol } NH_3\left(\frac{17 \text{ g } NH_3}{1 \text{ mol } NH_3}\right) = 5{,}100{,}000 \text{ g } NH_3 \text{ or } 5100 \text{ kg } NH_3$$

   b. How much will the CH_4 weigh?

$$x \text{ g } CH_4 = 450{,}000 \text{ mol } CH_4\left(\frac{16 \text{ g } CH_4}{1 \text{ mol } CH_4}\right) = 7{,}200{,}000 \text{ g } CH_4 \text{ or } 7{,}200 \text{ kg } CH_4$$

3. Your storage tank holds 1 000 000 dm^3. How many moles of gas would it hold?

$$x \text{ mol} = 1{,}000{,}000 \text{ dm}^3\left(\frac{1 \text{ mol gas}}{22.4 \text{ dm}^3}\right) = 44{,}643 \text{ mol gas (@STP)}$$

4. You place your order, but the company that provides CH_4 can only obtain 15 000 moles of CH_4. How many moles of NH_3 will you be able to use with this quantity of CH_4?

$$x \text{ mol } NH_3 = 15{,}000 \text{ mol } CH_4\left(\frac{2 \text{ mol } NH_3}{3 \text{ mol } CH_4}\right) = 10{,}000 \text{ mol } NH_3$$

5. Using your information from question #4…
   a. How many molecules of NH_3 will you order?

$$x \text{ molecules } NH_3 = 10{,}000 \text{ mol } NH_3\left(\frac{6.02 \times 10^{23} \text{ molecules } NH_3}{1 \text{ mol } NH_3}\right) = 6.02 \times 10^{27} \text{ molecules } NH_3$$

Chemistry: *Real Life Chemistry*

5. Using your information from question #4…
   a. How many molecules of NH_3 will you order?

$$x \text{ molecules } NH_3 = 10{,}000 \text{ mol } NH_3 \left(\frac{6.02 \times 10^{23} \text{ molecules } NH_3}{1 \text{ mol } NH_3} \right) = 6.02 \times 10^{27} \text{ molecules } NH_3$$

   b. How much space will it take up?

$$x \text{ dm}^3 = 10{,}000 \text{ mol } NH_3 + 15{,}000 \text{ mol } CH_4$$

$$x \text{ dm}^3 = 25{,}000 \text{ mol "gas"} \left(\frac{22.4 \text{ dm}^3}{1 \text{ mol gas}} \right) = 56{,}000 \text{ dm}^3$$

   c. How much will it weigh?

$$x \text{ g} = 10{,}000 \text{ mol } NH_3 \left(\frac{17 \text{ g } NH_3}{1 \text{ mol } NH_3} \right) + 15{,}000 \text{ mol } CH_4 \left(\frac{16 \text{ g } CH_4}{1 \text{ mol } CH_4} \right) = 257{,}000 \text{ g or } 257 \text{ kg}$$

$$x \text{ g} = 17{,}000 \text{ g } NH_3 + 240{,}000 \text{ g } CH_4$$

$$x \text{ g} = 257{,}000 \text{ g "gas"} \left(\frac{1 \text{ kg "gas"}}{1000 \text{ g "gas"}} \right) = 257 \text{ kg}$$

6. If it costs $1.75 per mole of fertilizer produced, how much will it cost to make 150 000 moles?

$$x \text{ \$} = 150{,}000 \text{ mol fertilizer} \left(\frac{\$1.75}{1 \text{ mol fertilizer}} \right) = \$2{,}625{,}000$$

Real Life Chemistry (for the Business World)

1a.

$$x \text{ widgets} = 150{,}000 \text{ systems}\left(\frac{12 \text{ widgets}}{1 \text{ system}}\right) = 1{,}800{,}000 \text{ widgets}$$

b

$$x \text{ watzits} = 150{,}000 \text{ systems}\left(\frac{48 \text{ watzits}}{1 \text{ system}}\right) = 7{,}200{,}000 \text{ watzits}$$

2a.

$$x \text{ lbs} = 1{,}800{,}000 \text{ widgets}\left(\frac{0.25 \text{ lbs}}{1 \text{ widget}}\right) = 450{,}000 \text{ lbs}$$

b.

$$x \text{ lbs} = 7{,}200{,}000 \text{ watzits}\left(\frac{0.5 \text{ lbs}}{1 \text{ watzit}}\right) = 3{,}600{,}000 \text{ lbs}$$

3.

$$x \text{ systems} = 1{,}000{,}000 \text{ ft}^3\left(\frac{1 \text{ system}}{2 \text{ ft}^3}\right) = 500{,}000 \text{ systems}$$

4.

$$x \text{ systems} = 2500 \text{ watzits}\left(\frac{1 \text{ system}}{48 \text{ watzits}}\right) = 52 \text{ systems } \& \text{ (4 watzits left over)}$$

5a.

$$x \text{ widgets} = 2500 \text{ watzits}\left(\frac{12 \text{ widgets}}{48 \text{ watzits}}\right) = 625 \text{ widgets}$$

b.

$$x \text{ lbs} = 635 \text{ widgets}\left(\frac{0.25 \text{ lbs}}{1 \text{ widget}}\right) = 156.25 \text{ lbs}$$

6a.

$$x \text{ \$ /system} = 12 \text{ widgets}\left(\frac{\$0.30}{1 \text{ widget}}\right) + 48 \text{ watzits}\left(\frac{\$0.50}{1 \text{ watzit}}\right) = \$27.60 \text{ /system}$$

b.

$$x \text{ \$ } = 150{,}000 \text{ systems}\left(\frac{\$27.60}{1 \text{ system}}\right) = \$4{,}140{,}000$$

7.

Sell $250.00
Cost - $ 27.60
Profit $222.40 / system

$$\$222.40\overline{)\$1{,}000{,}000}\quad 4497$$

Real Life Chemistry

1a.

$$x \text{ mol } NH_3 = 150{,}000 \text{ fertilizer}\left(\frac{2 \text{ mol } NH_3}{1 \text{ mol fertilizer}}\right) = 300{,}000 \text{ mol } NH_3$$

b

$$x \text{ mol } CH_4 = 150{,}000 \text{ mol } CH_4\left(\frac{3 \text{ mol } CH_4}{1 \text{ mol fertilizer}}\right) = 450{,}000 \text{ mol } CH_4$$

2a.

$$x \text{ g } NH_3 = 300{,}000 \text{ mol } NH_3\left(\frac{17 \text{ g } NH_3}{1 \text{ mol } NH_3}\right) = 5{,}100{,}000 \text{ g } NH_3 \text{ or } 5100 \text{ kg } NH_3$$

b.

$$x \text{ g } CH_4 = 450{,}000 \text{ mol } CH_4\left(\frac{16 \text{ g } CH_4}{1 \text{ mol } CH_4}\right) = 7{,}200{,}000 \text{ g } CH_4 \text{ or } 7{,}200 \text{ kg } CH_4$$

3.

$$x \text{ mol} = 1{,}000{,}000 \text{ dm}^3\left(\frac{1 \text{ mol gas}}{22.4 \text{ dm}^3}\right) = 44{,}643 \text{ mol gas (@STP)}$$

4.

$$x \text{ mol } NH_3 = 15{,}000 \text{ mol } CH_4\left(\frac{2 \text{ mol } NH_3}{3 \text{ mol } CH_4}\right) = 10{,}000 \text{ mol } NH_3$$

5a.

$$x \text{ molecules } NH_3 = 10{,}000 \text{ mol } NH_3\left(\frac{6.02 \times 10^{23} \text{ molecules } NH_3}{1 \text{ mol } NH_3}\right) = 6.02 \times 10^{27} \text{ molecules } NH_3$$

b.

$$x \text{ dm}^3 = 10{,}000 \text{ mol } NH_3 + 15{,}000 \text{ mol } CH_4$$

$$x \text{ dm}^3 = 25{,}000 \text{ mol "gas"}\left(\frac{22.4 \text{ dm}^3}{1 \text{ mol gas}}\right) = 56{,}000 \text{ dm}^3$$

c.

$$x \text{ g} = 10{,}000 \text{ mol } NH_3\left(\frac{17 \text{ g } NH_3}{1 \text{ mol } NH_3}\right) + 15{,}000 \text{ mol } CH_4\left(\frac{16 \text{ g } CH_4}{1 \text{ mol } CH_4}\right) = 257{,}000 \text{ g or } 257 \text{ kg}$$

$$x \text{ g} = \quad 17{,}000 \text{ g } NH_3 \quad + \quad 240{,}000 \text{ g } CH_4$$

$$x \text{ g} = \quad 257{,}000 \text{ g "gas"}\left(\frac{1 \text{ kg "gas"}}{1000 \text{ g "gas"}}\right) = 257 \text{ kg}$$

6.

$$x \text{ \$} = 150{,}000 \text{ mol fertilizer}\left(\frac{\$1.75}{1 \text{ mol fertilizer}}\right) = \$2{,}625{,}000$$