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Chemistry Formula Triangles Student Lab Answers

Chemistry Magic Triangles

Background Theory:

In Chemistry, the measure the amount of a substance in a unit is called a 'mole'. It is a convenient way of counting atoms and allows chemists to make predictions about the masses of different substances that are involved in reactions. Regardless of the element in question, one mole of atoms contains 6 x 10^{23} atoms. This is known as the Avogadro number. The mole can be used to help you to work out other information about a substance, such as its concentration or its mass.

Learning Objectives

During this lesson you will:

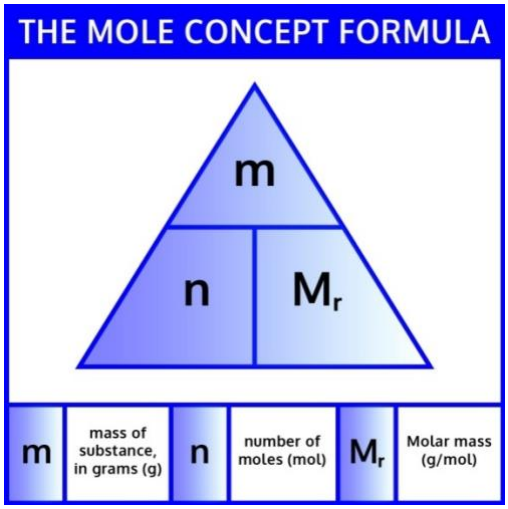
- Use the formula number of moles = mass/molar mass
- Use the formula concentration = number of moles/volume
- Manipulate the above formulas to solve Chemistry problems

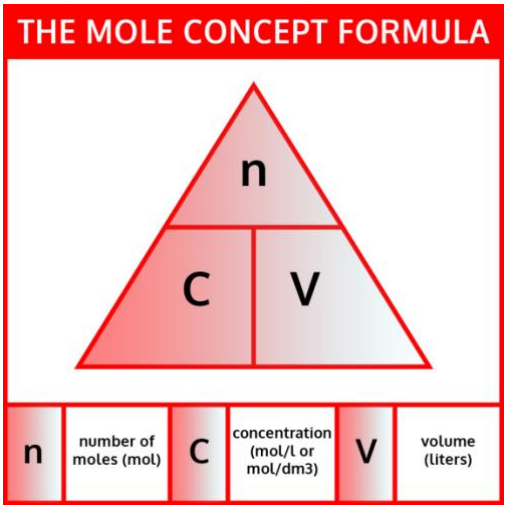
Formula Triangles:

Formula triangles are handy those of us who really struggle with algebra and manipulating terms. All you need to do is remember how to draw the triangle, what letters go where, what they mean, and how to use the triangle. NO ALGEBRA SKILLS NEEDED

- The horizontal line means that you must divide.
- The vertical line means that you must multiply.

The three equations derived from this triangle are:





$m = n \times M_r$
$n = m / M_r$
$M_r = m/n$

$C = n / V$
$n = C \times V$
$V = n/C$

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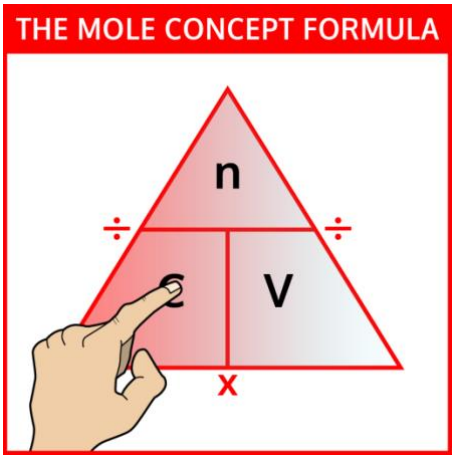
How to use a formula triangle:

1. Write down the term you wish to calculate (e.g. n =).
2. Cover the term you wish to calculate with your forefinger.
3. The remain two terms are those you must use in your equation on the other side of the = sign, working from the top down and/or left to right, and include all multiplication/division signs linking the two remaining terms.



Practice Problems:

1. Calculate the following:
   a. The molarity of a solution where 1.9 moles of iron (II) chloride are dissolved to make 1750 mL of solution.
      n = 1.9
      V = 1750ml (1.75L)
      C = n / V
      C = 1.9/1.75
      C = 1.09 mol/L

   b. The molarity of a solution where 1.1 moles of silver nitrate are dissolved to make 0.250L of solution.
      n = 1.1
      V = 0.250L
      C = n / V
      C = 1.1/0.250
      C = 4.4 mol/L

   c. The number of moles of Na_2CO3 in 0.750L of solution if the concentration is 0.640mol/L?
      V = 0.750l
      C= 0.640 mol/L
      n = C x V
      n = 0.640 x 0.750
      n = 0.48 mol

   d. The molarity if 3.2 moles of $CaCl_2$ are dissolved to make 1000 ml of solution?
      n = 3.2
      V = 1
      C = n / V
      C = 3.2/1
      C = 3.2 mol/L

   e. The volume of 1.7 moles of sucrose made into a 3.4mol/l solution.
      n = 1.7
      C = 3.4 mol/L
      V = n/C
      V = 1.7/3.4

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V = 0.5L

f. The number of moles of 54.9 grams in K_2SO_4.
K_2SO_4 M_r = (39.098 x 2) + 32.06 + (15.999 x 4) =174.252
m = 54.9
n = m/M_r
n = 54.9/174.252
n = 0.32 mol

g. The mass of 11 mol of hydrogen chloride.
HCl M_r = 1.008 + 35.45 = 36.458
n = 11 mol
m = n x M_r
m = 36.458 x 11
m = 401.04g

h. The number of moles of 99.4 grams of NaCl.
NaCl M_r = 22.90 + 35.45 = 58.35
m = 99.4
n = m/M_r
n = 99.4/58.35
n = 1.7 mol

2. Expert Level (hint you must use both equations)

a. The molarity when 54.8 grams of lithium sulfate are dissolved to make 250 mL of solution.
Li_2SO_4 M_r = (6.94 x 2) + 32.06 + (15.999 x 4) =109.936
m = 54.8g
n = m/M_r
n = 54.8 / 109.936
n = 0.5 mol

C = n/V
C = 0.5 / 0.250L
C = 2 mol/L

b. The molarity when 99.1 grams of $(NH_4)_2SO_4$ are dissolved to make 0.5 L of solution.

$(NH_4)_2SO_4$ M_r = (14.007 + (1.008 x4) x2) + 32.06 + (15.999 x 4) =132.134
m = 99.1g
n = m/M_r
n = 99.1 / 132.134
n = 0.75 mol

C = n/V
C = 0.75 / 0.50L
C = 1.5 mol/L