GEMS 160 Feb 6, 2006

- Exams handed out at end of class
- Note Ch. 9 intro experiment as related to lab !!
- Chem news:
  - Wed: David Hunyadi
  - Fri: Heather Janofski, Elizabeth Knappe
- Ch. 9 homework, due Friday, 5:00 pm
- Chem news notebooks due Friday, in class

Toll House Cookies (2 dozen)

- 1/2 cup unsalted butter at room temperature
- 1/4 cup vegetable shortening at room temperature
- 1/2 cup packed light brown sugar
- 1/2 cup granulated sugar
- 5 eggs
- 2 teaspoons vanilla
- 1 1/2 cup all purpose flour
- 1/2 teaspoon baking soda
- 1/2 teaspoon baking powder
- 1/2 teaspoon salt
- 2 cups (1 12oz package) semisweet chocolate chips

How many cookies could you make if you only had 7 eggs? How many oz of chocolate chips would then be required? How much flour would be needed to prepare 100 cookies? How many oz of chocolate chips?

How many cookies could you make if you only had 7 eggs?

|  5%  | 1. 42 |
|  22% | 2. 48 |
|  19% | 3. 96 |
|  0%  | 4. 186 |
|  86% | 5. Answer not listed |

NOTE: Correct answer is 84 !! Green bar is not correct.

How many oz of chocolate chips would be required if you use 7 eggs?

| 12% | 1. 21 |
|  3% | 2. 36 |
| 84% | 3. 42 |
|  3% | 4. 48 |
|  0% | 5. 54 |
| 21% | 6. 84 |
|  9% | 7. Answer not listed |

How much flour would be needed to prepare 100 cookies?

|  5%  | 1. 4.5 cups |
|  0%  | 2. 5.25 cups |
|  0%  | 3. 5.75 cups |
|  3%  | 4. 6.0 cups |
| 88%  | 5. 6.25 cups |
|  6%  | 6. Answer not listed |

100 cookies x ( ) = ? oz chips

| 12% | 1. (4 cookies/12 oz chips) |
| 15% | 2. (2 cups chips/24 cookies) |
| 44% | 3. (16 oz chips/12 cookies) |
|  0% | 4. (16 oz chips/1 lb cookies) |
| 29% | 5. None of the above |
Some chemical questions?

- \(2 \text{H}_2 + \text{O}_2 \rightarrow 2 \text{H}_2\text{O}\) (This is a fuel cell reaction)
- How much energy (or water) can be obtained from 100 grams of \(\text{H}_2\)?
- \(\text{CH}_4 + 2 \text{O}_2 \rightarrow \text{CO}_2 + 2 \text{H}_2\text{O}\) (Combustion of natural gas)
- How much \(\text{CO}_2\) is produced by burning 1 kg of methane?
- \(2 \text{Fe}_2\text{O}_3 \rightarrow 4 \text{Fe} + 3 \text{O}_2\) (Production of steel)
- How much iron ore (\(\text{Fe}_2\text{O}_3\)) is needed to produce 2 tons of Fe?
- The balanced equations are written in terms of atoms and molecules, but the way the products and reactants are dealt with in the real world is in terms of weights and volumes.

Counting in the chemical world

- In the commercial world a common counting unit is the dozen, a pair, a gross
- In the chemical world the counting unit is the mole. How many moles of something is given by the coefficient in the balanced equation.
- A mole is 6.02 \(\times 10^{23}\) particles => Avogadro’s number
- When counting in moles, the atomic weight from the periodic table represents the mass in grams of one mole of the element.

What did Avogadro put on his pancakes?

- 9% 1. Syrup
- 8% 2. Honey
- 79% 3. Molasses
- 9% 4. Strawberries

Arrange the items on the center slide in order of total number of atoms or ions:

- 76% 1. \(\text{CH}_3\text{O} > \text{CO}_2 > \text{NaCl}\)
- 0% 2. \(\text{CH}_3\text{O} > \text{NaCl} > \text{CO}_2\)
- 5% 3. \(\text{CO}_2 > \text{CH}_3\text{O} > \text{NaCl}\)
- 0% 4. \(\text{CO}_2 > \text{NaCl} > \text{CH}_3\text{O}\)
- 18% 5. \(\text{NaCl} > \text{CO}_2 > \text{CH}_3\text{O}\)
- 0% 6. \(\text{NaCl} > \text{CH}_3\text{O} > \text{CO}_2\)
- 0% 7. They each have the same total

Arrange the items on the center slide in order of mass, greatest mass first:

- 94% 1. \(\text{NaCl} > \text{CO}_2 > \text{CH}_3\text{O}\)
- 9% 2. \(\text{CH}_3\text{O} > \text{CO}_2 > \text{NaCl}\)
- 0% 3. \(\text{CO}_2 > \text{CH}_3\text{O} > \text{NaCl}\)
- 0% 4. \(\text{CO}_2 > \text{NaCl} > \text{CH}_3\text{O}\)
- 0% 5. \(\text{NaCl} > \text{CO}_2 > \text{CH}_3\text{O}\)
- 0% 6. \(\text{NaCl} > \text{CH}_3\text{O} > \text{CO}_2\)

- Given a chemical formula and a periodic table you can calculate how much 1 mole of any substance weighs and use this info as a ratio, i.e.
- 1 mole \(\text{CO}_2/44\) grams OR 44 grams/1 mole \(\text{CO}_2\)
- This is the molecular or formula weight, include units

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In any system the amount of material present will be given as mass or moles - and you need to be able to switch between them.

- 100 grams of water is how many moles?
  - Molecular weight of water?
  - Set up the correct ratio

\[100 \text{ g H}_2\text{O} \times \frac{1 \text{ mole H}_2\text{O}}{18 \text{ g H}_2\text{O}} = 5.5 \text{ mole H}_2\text{O}\]

A few more examples

- 600 grams of hydrogen (H\text{2}) is how many moles?
- 2 grams of hydrogen peroxide (H\text{2}O\text{2}) is how many moles?

If the amount of matter is given as moles, determine the number of grams.

- 175 moles of oxygen (O\text{2}) is how many grams
- 0.25 moles of sugar (C\text{6}H\text{12}O\text{6}) is how many grams

1/2 way to dealing with any amount of product or reactant for any balanced equation!!

- CH\text{4} + 2 O\text{2} \rightarrow CO\text{2} + 2 H\text{2}O Balanced?
- Relate any two items in terms of moles
  - (1 mole CH\text{4}/2 mole O\text{2}) OR (2 mole H\text{2}O/1 mole CH\text{4})
  - 6.5 mole O\text{2} can produce how many mole CO\text{2}?
  - (6.5 mole O\text{2}/1 mole CO\text{2}/2 mole O\text{2}) = 3.25 mole CO\text{2}
- How much methane is needed to produce 15 moles of water?

Concentrations: volumes instead of weights

- % (amount item/total amount) *100
  - Amount could be grams, ml, lbs, etc, as long as the type of amount is the same (w/w %)
- ppm (amount item/total amount) *1,000,000
- Molarity (moles solute/L of solution)