Question Exploration Guide

1 What is the Critical Question?

Ibuprofen, $C_{13}H_{18}0_2$, is the active ingredient in many nonprescription pain relievers. Its molar mass is 206.31 g/mol

a. If a bottle of tablets contains 33g of Ibuprofen, how many moles of Ibuprofen are in the bottle?
b. How many molecules of ibuprofen are in the bottle?
c. What is the total mass in grams of carbon in the bottle?

2 What are the Key Terms and explanations?

1. Molar mass	1. the mass in g of 1 mole of an element or compound (units are g/mol)
2. conversion factor	2. a fraction that allows you to convert from 1 unit to another
3. Avagadro's #	3. $6.022X10^{23}$ particles (atoms, molecules, or formula units) in 1 mole.
4. Mole	4. A unit of measurement that contains $6.022X10^{23}$ particles
5. Molecule	5. a group of atoms bonded together covalently (by sharing electrons). Each molecule is an individual unit.
6. dimensional analysis	6. a way of setting up a series of conversion factors so that units are carried and cancel out, to solve for an unknown
7. equalities	7. amounts of 2 different units that are equal to each other, i.e. 12 in = 1 ft
8. particles	8. term used to describe individual units of a substance. Can be atoms, molecules, or formula units (simplest units of ionic compounds), depending on what substance is being described.

3 What are the Supporting Questions and answers?

1. What equalities can be used to make conversion factors?	***1. 1 mole = $6.022X10^{23}$ atoms, molecules, or formula units, and molar mass = g/mol (so can make conversion factors, 1 mole C = 12.01 g C)***
2. What is the question really asking?	***2. How many moles and molecules of Ibuprofen are in the bottle? How many grams of Carbon are in the bottle?***
3. What information is given in the problem?	***3. Formula and molar mass for Ibuprofen, grams of Ibuprofen in a bottle***
4. How do you use the given information to set up a series of conversion factors to solve for the unknown?	***4. Start w/ grams of Ibuprofen, then use molar mass flipped (1 mol/206.31 g Ibuprofin) as the 1^{st} conversion factor***
5. How can I tell if I have set up the dimensional analysis for the problem correctly?	***5. All the units will cancel except the one unit of the answer***
6. Once the dimensional analysis is set up, what math do I use to calculate the answer?	***6. Multiply all the numerators (numbers on top of fraction), multiply all denominators (numbers on the bottom), divide final numerator by final denominator***
7. How does avogadro's #'s allow us to convert from moles to particles (molecules)?	7. ***1 mole of a compound will contain $6.022X10^{23}$ molecules of that compound***
8. What do the subscripts in the chemical formula tell us?	***8. The small number at the bottom of an element in a chemical formula, how many of each element are in that compound***

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4 What is the main Idea answer?

You can convert from grams to moles to molecules using molar mass (summed from element masses on periodic table) and Avagadro's #.
You use the chemical formula to find the total mass of carbon in Ibuprofen, divide by molar mass of Ibuporfen then multiply by 33 g

5 How can we use the main idea?

Set up steps to calculate all parts of problem

1) Identify the given, put it in the numerator of a fraction with a 1 in the denominator
2) Use molar mass to create a conversion factor with moles on the top and grams on the bottom
3) Calculate the # of moles
4) Use Avagadro's number to set up a conversion factor with molecules on the top and moles on the bottom
5) Calculate the # of molecules
6) Calculate the mass of 13 moles of Carbon and divide it by the molar mass of Ibuprofen

Set up dimensional analysis and solve.

6 Is there an Overall Idea? Is there a real-world use?

How would your set up change if the amount of ibuprofen in the bottle was given in moles instead of grams?