

Student Learning Map

Unit Topic:

Key Learning(s):

Mole Concept

Unit Essential Question:

What is a mole?

Instructional Tools

11.1, 11.4, 11.5
WS 11.2, 11.3

Concept:

What is a mole?

Concept:

Calculating Moles

Concept:

Measuring Moles

Concept:

Lesson EQ:

How is the mass of extremely small objects determined?

How many objects are in one mole of a compound?
What volume at STP is one mole of a gas?

Lesson EQ:

1. What is the molar mass of an atom or molecule?

2. What is the relationship between g and moles?

Lesson EQ:

1. How can the number of moles be determined experimentally?

2. How are the number of atoms in a reaction calculated?

Lesson EQ:

Vocabulary:

Avogadro's #
mole

Vocabulary:

molar mass

Vocabulary:

Vocabulary:

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11.1 Counting Small

Objective: To determine a method for masses objects too small for a balance

Procedure:

1. Obtain three containers of small objects
2. Measure the total mass of all the objects
3. Count the total number of objects present

Data

Object	Total Mass (g)	# of Objects	Mass of each object (g)

Data Analysis

Show your work for the calculation used for mass of each object

Conclusions – Concepts

Atoms and molecules are also too small to measure on a balance, but their masses are determined in a similar way

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11.2 Avogadro's Number

Avogadro's Law is equal volumes of gas at the same temperature and pressure has the same number of molecules. At STP (1 atm and 0°C) this equals 22.4 L. The amount of gas particles was found to be 6.02×10^{23} - a quantity called a mole

$$1 \text{ mole} = 22.4 \text{ L} = 6.02 \times 10^{23} \text{ molecules or atoms}$$

Moles	Volume	Number of Molecules
1 mole O ₂		
2 moles CO ₂		
4 moles NO ₂		
0.5 moles SO ₂		
0.1 moles H ₂		
0.01 moles N ₂		
10 moles O ₂		
	22.4 L	
	44.8 L	
	11.2 L	

Since the mass of atoms and compounds is small, their masses are recorded as the mass of one mole (6.02×10^{23} particles) of the materials – molar mass. This mass is found on the periodic table. For compounds the molar mass is the sum of the individual masses.

Atom	Mass (g)	Compound	Mass (g)
O		NaOH	
Ca		P ₂ O ₅	
Zn		CaCO ₃	
Mg		Ba(NO ₃) ₂	
Au		HCl	
Fe		HCN	
Na		Al(NO ₃) ₃	
Cu		H ₂ SO ₄	
F		H ₂ O	

Show work for mass of compounds

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11.3 Calculating Moles

To convert Grams to moles

1 mole = molar mass in grams

Ex. Convert 3.5 g on NaOH to moles

$$\frac{3.5 \text{ g}}{1} \times \frac{1 \text{ mole}}{40.0 \text{ g}} = .0875 \text{ mole}$$

Ex. Convert .055 moles of HCl to grams

$$\frac{0.055 \text{ moles}}{1} \times \frac{36.5 \text{ g}}{1 \text{ mol}} = 2.01 \text{ g}$$

Problems

Convert the following to grams

1. 3 moles of Na
2. 3.5 moles CaCO_3
3. 1.5 moles Ba(OH)_2
4. 0.2 moles H_2SO_4
5. 0.15 moles

Convert the following to moles

1. 200g F_2
2. 180 g of Ca

3. 10 g of Na_2S

4. 80 g of H_2O_2

5. 228.8 g CO_2