

The Mole and Avogadro's Number

- The Mole
- Avogadro's Number
- Molar Mass
- Finding n
- Finding the # of atoms
- Working with formulas - Practice



$$6.02 \times 10^{23}$$

Preview File

Please enjoy this preview of your Student Version of the presentation. Please note within this sample file:

- Some slides appear blank because they have been removed
- Student versions have portions of the text removed which is given in the teacher version and appear as _____ which the students are to fill in
- Other slides may have on them, this represents writing that has been removed on this sample

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We sometimes give a name to a specific amount



Dozen = 12

Pair = 2



Can you think of any others?

The Mole.....

- We need a relationship between the mass of a sample of an element/compound and the number of atoms/molecules in that sample
- For this, we use the MOLE



The Mole.....

- A mole is 6.02×10^{23} of anything
- A mole of _____
- A mole of _____

In fact, a mole of basketballs would roughly fit into a bag the size of Earth!

That's a lot of basketballs!!



The Mole is a BIG Number

- If one mole of pennies were distributed equally among 6 billion people, each person would get 1×10^{14} pennies or 1×10^{12} dollars (1,000,000,000,000 = 1 trillion dollars)
- If Avogadro's number of sheets of paper were divided into a million equal piles, each pile would be so tall that it would stretch from Earth to the Sun and beyond
- In order to obtain Avogadro's number of grains of sand, you would have to dig the entire surface of the Sahara Desert to a depth of 2 m

Activity

On a sheet of paper, make a box (approximately 10 cm x 10 cm). When instructed to, you will make as many dots in the box as possible in 1 minute.

Now, count the dots (a highlighter may be useful). What is your dot making rate in dots/minute?

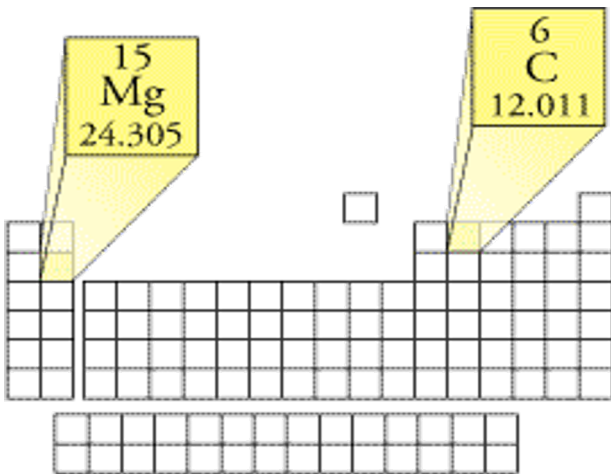
How many dots could you make in an hour?

Hint:
$$\frac{\text{_____ dots}}{1 \text{ minute}} \times \frac{60 \text{ minutes}}{1 \text{ hour}} = \text{_____ dots/hr}$$

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Molar Mass

- ---
- Coins, chickens, computers, students, etc.
- 1 mole ^{12}C atoms = 6.02×10^{23} atoms = 12.01 g
- 1 mole ^{15}Mg atoms = 6.02×10^{23} atoms = 24.305 g



For any element

The atomic mass (amu) =
molar mass (grams/mol)

Find the molar mass of one mole of:

C

S

Hg

Cu

Fe

Mole Formula

$$n = \frac{m}{M}$$

n = number of moles

m = mass of the sample

M = molar mass

Check Your Understanding

Determine the amount of substance in a mass of 10.0 g of iron?

Given: $m_{\text{Fe}} = 10.0 \text{ g}$, $M_{\text{Fe}} = 55.85 \text{ g/mol}$

Required: amount of substance, $n = ? \text{ mol}$

$$n = m/M$$

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The Number of Atoms

- How do you find the number of atoms? $n = \frac{m}{M}$
- What does n represent?

- What is a mole?

The Number of Atoms

Remember, the mole represents a number, a really big number but it's just a number. The same as a dozen = 12 or a pair = 2. Therefore, for now, let n = a dozen

- 1) How many dozen eggs do you have if you have 4 eggs?
- 2) How many dozen eggs do you have if you have 18 eggs?
- 3) How many dozen eggs do you have if you have 12 eggs?

The Number of Atoms

Remember, the mole represents a number, a really big number but it's just a number. The same as a dozen = 12 or a pair = 2. Therefore, for now, let n = a dozen

1) How many dozen eggs do you have if you have 4 eggs?

- _____
- _____

2) How many dozen eggs do you have if you have 18 eggs?

- _____

3) How many dozen eggs do you have if you have 12 eggs?

- _____

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Check Your Understanding:

Find the # of particles/atoms

1. How many atoms are in 7.2 mol of chlorine?
2. How many atoms are in 36 g of bromine?
3. How many moles are in 1.0×10^9 atoms?

$$n = \frac{\text{\# of particles}}{6.02 \times 10^{23}}$$

$$n = \frac{m}{M}$$

Two Step Calculations

- Given the number of particles, the mass of the substance can be determined

Particles $\rightarrow$ moles $\rightarrow$ Mass

$$n = \frac{\text{\# of particles}}{6.02 \times 10^{23}}$$

$$n = \frac{m}{M}$$

- Given the mass, the number of particles can be determined

Mass $\rightarrow$ moles $\rightarrow$ Particles

Check Your Understanding

How many atoms are in 0.551 g of potassium (K)?

Write down what your given and what you need and include the units.

Molar Mass

- The molar mass of a compound is found by adding together the molar masses of all of its elements, taking into account the number of moles of each element present
- Recall: atomic mass = molar mass if there is 1 mole of substance
- _____
- e.g., $\text{H}_2 = 1.008 + 1.008$ (we don't round) $= 2(1.008) = 2.016$ g/mol
- If there is 1 mole of H_2 (6.02×10^{23} H_2) then the molar mass of the compound = 2.016 g/mol

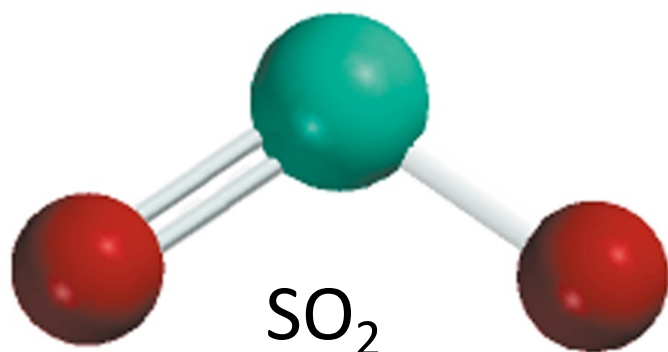
Check Your Understanding:

What is the molar mass?

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Molecular Mass

Molecular mass (or molecular weight) is the sum of the atomic masses (in amu) in a molecule.



1 S	32.07 amu
2 O	+ 2 x 16.00 amu
SO ₂	64.07 amu

1 molecule SO₂ = 64.07 amu

1 mole SO₂ = 64.07 g SO₂

Check Your Understanding

How many H atoms are in 72.5 g of $\text{C}_3\text{H}_8\text{O}$?