Name: _____ **Date:** _____

Answer Key: Crush the Chemical Code: 8th Grade Stoichiometry Challenge

Students calculate theoretical yields and analyze atomic ratios to solve complex conservation of mass puzzles using advanced mole-to-mass conversions.

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1. A chemist ignites 10 grams of Magnesium (Mg) in a pressurized chamber filled with pure Oxygen (O_2). According to the Law of Conservation of Mass, which analytical result would most likely indicate an experimental error in the final white powder (MgO)?

Answer: A) The mass of the product is exactly 10 grams.

In a synthesis reaction, the product mass must equal the sum of both reactants (Mg + O). If the product is only 10g (the mass of the Mg alone), it implies no oxygen was added, violating the conservation of mass principle.

2. Consider the decomposition of Silver Oxide: 2Ag2O ’4Ag + O2. To produce exactly 2.0 moles of pure Silver (Ag), you must start with ____ mole(s) of Silver Oxide.

Answer: B) 1.0 moles

The stoichiometric ratio between Ag2O and Ag is 2:4 (which simplifies to 1:2). Applying this ratio, 1 mole of reactant produces 2 moles of product.

3. True or False: In a balanced chemical equation, the total number of moles of reactants must always equal the total number of moles of products.

Answer: B) False

While mass and atoms are conserved, the number of moles can change. For example, in 2H2 + O2 '2H2O, three moles of gas react to form only two moles of liquid.

4. An industrial engineer is producing Iron (Fe) from Hematite (Fe2O3) using Carbon Monoxide. If the engineer discovers the 'Yield' was only 75%, what does this imply about the stoichiometry?

Answer: C) The actual amount of Iron recovered was less than the calculated theoretical amount.

Percent yield measures the efficiency of a reaction; a 75% yield means only 75% of the theoretically predicted product was actually captured in the lab.

5. Identify the 'Limiting Reactant': If you have 5 moles of Nitrogen (N2) and 9 moles of Hydrogen (H2) for the reaction N2 + 3H2 ’2NH3, the reactant that will run out first is ____.

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Answer: B) Hydrogen (H2)

The ratio is 1 N2 : 3 H2. For 5 moles of N2, you would need 15 moles of H2. Since you only have 9 moles of H2, the Hydrogen will be consumed before the Nitrogen is finished.

6. Which of these samples contains the greatest number of individual atoms?

Answer: C) 1 mole of Methane (CH4)

One mole of any substance contains Avogadro's number of units. However, a CH4 molecule has 5 atoms, H2O has 3, and Au has 1. Therefore, 1 mole of CH4 contains 5 times Avogadro's number of atoms.

7. True or False: If you know the molar mass of a compound is 180 g/mol, a 90-gram sample of that compound represents exactly 0.5 moles.

Answer: A) True

Mole calculation is mass divided by molar mass. 90g / 180g/mol = 0.5 moles.

8. A balloon is filled with 12.044 x 10^23 molecules of Helium gas. Based on Avogadro's number, this quantity is equal to ____ mole(s).

Answer: C) 2.0 moles

Since one mole is 6.022 x 10^23, dividing 12.044 x 10^23 by that constant equals exactly 2.0 moles.

9. In the combustion of Glucose (C6H12O6 + 6O2 ’6CO2 + 6H2O), what is the specific molar ratio of Oxygen gas required to Water produced?

Answer: C) 1:1

The coefficients for both O2 and H2O are 6. A 6:6 ratio simplifies to a 1:1 ratio.

10. True or False: The molar mass of a molecule can be determined by solely looking at its atomic number on the Periodic Table.

Answer: B) False

Molar mass is derived from the Atomic Mass (average of isotopes), not the Atomic Number (number of protons).