

Name: \_\_\_\_\_ Date: \_\_\_\_\_

## Answer Key: Could You Feed the Whole Colony? 6th Grade Mole Calculations

Analyze chemical recipes to predict mass outcomes and verify Avogadro's constant in real-world scenarios designed to bridge foundational chemistry with analytical reasoning.

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**1. A team of space explorers needs to synthesize 180 grams of water (H<sub>2</sub>O) for their journey. If the molar mass of water is 18 g/mol, how many moles of water does the team need to produce to survive?**

**Answer:** B) 10 moles

To find the number of moles, divide the total mass (180g) by the molar mass (18g/mol).  $180 / 18 = 10$  moles.

**2. If a balanced chemical equation shows a 1:2 ratio between Methane (CH<sub>4</sub>) and Oxygen (O<sub>2</sub>), calculating how much Oxygen is needed for 5 moles of Methane would require \_\_\_\_\_ moles of Oxygen.**

**Answer:** D) 10

A 1:2 ratio means you need twice as much Oxygen as Methane. Therefore, 5 moles of Methane multiplied by 2 equals 10 moles of Oxygen.

**3. True or False: Avogadro's number ( $6.022 \times 10^{23}$ ) represents a different quantity of atoms if you are measuring Lead compared to when you are measuring Helium.**

**Answer:** B) False

A mole is a constant unit of measurement for the number of particles. Just as a dozen always means 12, a mole always represents the same number of particles regardless of the element.

**4. In a lab experiment, you have 2 moles of Silver (Ag) and 2 moles of Gold (Au). Which of the following statements is true regarding their physical properties?**

**Answer:** A) They have the same number of atoms, but different masses.

While both samples contain exactly 2 moles (the same number of atoms), different elements have different atomic weights, meaning their total mass will be different.

**5. A chef is using a chemical reaction to carbonate water. The formula requires 2 moles of Bicarbonate for every 1 mole of Citric Acid. To react with 0.5 moles of Citric Acid, the chef needs \_\_\_\_\_ moles of Bicarbonate.**

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**Answer:** C) 1.0

Using the 2:1 ratio (Bicarbonate: Citric Acid), we multiply the 0.5 moles of Citric Acid by 2 to get 1.0 mole of Bicarbonate.

**6. You discover a mystery substance with a molar mass of 32 g/mol. If you have a 64-gram sample, how many individual particles (atoms or molecules) are in that sample?**

**Answer:** B)  $1.204 \times 10^{24}$

64g divided by 32g/mol equals 2 moles. Since 1 mole is  $6.022 \times 10^{23}$ , 2 moles is  $1.204 \times 10^{24}$ .

**7. True or False: Stoichiometry is primarily used in chemistry to determine the speed (velocity) at which a reaction occurs.**

**Answer:** B) False

Stoichiometry deals with the quantitative relationships (the 'how much') of reactants and products, not the speed or kinetics of the reaction.

**8. Analyze the reaction:  $2\text{Al} + 3\text{Cl}_2 \rightarrow 2\text{AlCl}_3$ . If an industrial plant wants to create 50 moles of  $\text{AlCl}_3$ , how many moles of Chlorine gas ( $\text{Cl}_2$ ) must they start with?**

**Answer:** C) 75 moles

The molar ratio of  $\text{Cl}_2$  to  $\text{AlCl}_3$  is 3:2. For every 2 moles produced, 3 are needed. Calculation:  $50 * (3 / 2) = 75$  moles.

**9. A scientist has  $3.011 \times 10^{23}$  atoms of Iron. This represents \_\_\_\_\_ of a mole.**

**Answer:** B) 1/2 (0.5)

Avogadro's number is  $6.022 \times 10^{23}$ .  $3.011 \times 10^{23}$  is exactly half of that value, or 0.5 moles.

**10. Why is the mole used as a standard unit in chemistry instead of just measuring everything by its weight in grams?**

**Answer:** A) Because atoms react in specific number ratios, not mass ratios.

Chemical reactions occur between particles (atoms/molecules). Since different atoms have different masses, using the mole allows scientists to count 'groups' of atoms to match ratios in balanced equations.