

Name: _____ Date: _____

Stellar Synthesis Quest: stoichiometry for 7th Grade Chemists

Calculate cosmic chemical yields and balance planetary fuel ratios as you synthesize the relationship between Avogadro's number and mass conservation.

1. An environmental engineer is analyzing a water sample where 2.0 moles of Silver Nitrate (AgNO_3) reacts with excess Sodium Hydroxide (NaOH). If the reaction theoretical yield is 1.0 mole of Silver Oxide (Ag_2O), which stoichiometric ratio represents the connection between the reactant and this specific product?

- A. 1:1 ratio
- B. 2:1 ratio
- C. 1:2 ratio
- D. 3:2 ratio

2. A space station's life support system uses Lithium Hydroxide to scrub CO_2 . If the molar mass of Lithium is 7 g/mol, Oxygen is 16 g/mol, and Hydrogen is 1 g/mol, the molar mass of the compound LiOH is exactly ____ g/mol.

- A. 23
- B. 24
- C. 30
- D. 14

3. True or False: In a closed system, if you react 1 mole of Iron (Fe) with 1 mole of Sulfur (S) to form Iron(II) sulfide (FeS), the total mass of the system remains identical before and after the reaction.

- A. True
- B. False

4. A chemist has 3.011×10^{23} molecules of a mystery gas. Which of the following best describes this quantity relative to a standard mole?

- A. Exactly 2 moles
- B. Exactly 0.5 moles
- C. Exactly 1 mole
- D. Exactly 0.25 moles

5. In the reaction $2\text{Al} + 3\text{Cl}_2 \rightarrow 2\text{AlCl}_3$, if you want to produce 10 moles of Aluminum Chloride (AlCl_3), you would need to start with ____ moles of Chlorine gas (Cl_2).

- A. 10
- B. 15
- C. 20
- D. 5

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6. If you have 1 mole of Glucose ($C_6H_{12}O_6$), how many total moles of 'atoms' are contained within that single mole of the compound?

- A. 3 moles of atoms
- B. 12 moles of atoms
- C. 24 moles of atoms
- D. 6 moles of atoms

7. True or False: The molar mass of a substance is numerically equal to its atomic or molecular mass, but the units change from atomic mass units (amu) to grams per mole (g/mol).

- A. True
- B. False

8. Imagine you are synthesizing ammonia: $N_2 + 3H_2 \rightarrow 2NH_3$. If you have 4 moles of Nitrogen and 9 moles of Hydrogen, which reactant will run out first (the limiting reactant)?

- A. Nitrogen (N_2)
- B. Hydrogen (H_2)
- C. The reaction is perfectly balanced
- D. Ammonia (NH_3)

9. A balloon is filled with 4.0 grams of Helium (He). Given that the molar mass of Helium is roughly 4 g/mol, the balloon contains approximately _____ atoms.

- A. 1.0
- B. 6.022×10^{23}
- C. 1.204×10^{24}
- D. 4.0

10. True or False: Stoichiometry allows scientists to predict the exact amount of product that will form, even if the reaction temperature and pressure change constantly in an open environment.

- A. True
- B. False