Mole Ratios and Limiting Reactants

Student Worksheet | g09_u08_w31

I can: use a balanced equation as a particle recipe, then as a mole ratio, to identify a limiting reactant.
Frozen values: Classroom calculation values from `audits/atomic_masses_v2024.1.json`, derived from CIAAW/IUPAC Standard Atomic Weights 2024 (accessed 2026-07-26). H 1.008, C 12.011, O 15.999, Mg 24.305. Use provided paper data only; sources in `sources.md`.

1. For $2H_2 + O_2 \rightarrow 2H_2O$, state the particle recipe in words.

2. With 6 H_2 particles and 3 O_2 particles, how many H_2O particles form? leftovers?

3. With 8 H_2 and 3 O_2, identify the limiting particle and product particles.

4. Write the three mole ratios available from $2H_2 + O_2 \rightarrow 2H_2O$.

5. Convert 4.00 mol H_2 to mol H_2O using a factor-label ratio.

6. Convert 3.00 mol O_2 to mol H_2O.

7. If 5.00 mol H_2 reacts with 3.00 mol O_2, identify the limiting reactant and mol H_2O.

8. For $N_2 + 3H_2 \rightarrow 2NH_3$, state the recipe and mole ratio H_2:NH_3.

9. Convert 9.00 mol H_2 to mol NH_3.

10. With 4.00 mol N_2 and 9.00 mol H_2, identify the limiter and mol NH_3.

11. For $2Mg + O_2 \rightarrow 2MgO$, convert 6.00 mol Mg to mol MgO.

12. With 5.00 mol Mg and 3.00 mol O_2, identify the limiter and mol MgO.

13. Convert 4.00 mol MgO to g MgO using frozen masses.

14. Convert 12.0 g Mg to mol Mg, then predict mol MgO if O_2 is excess.

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15. **Data card A:** 12.0 g Mg and 10.0 g O_2 are listed. Convert both to mol and identify the limiting reactant for $2Mg + O_2 \rightarrow 2MgO$.

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16. Using item 15, predict theoretical g MgO.

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17. **Data card B:** 4.00 mol H_2 and 1.50 mol O_2 are supplied. Calculate leftover mol of the excess reactant.

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18. Explain why the limiting reactant is not "used up atoms" but the reactant that runs out first under the recipe ratio.

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19. A student compares 2.00 mol Mg with 1.50 mol O_2 and says O_2 limits because 1.50 is smaller. Critique using the recipe ratio.

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20. **Data card C:** An open-cup product mass is lower than the theoretical prediction. Explain why this does not change the balanced mole ratio or mean atoms vanished.
