Competition Corner: Carbon Tracing

g10_u01_w03 | test the system boundary

Safe challenge: Work only from supplied data cards. No combustion, gas collection, or chemical handling is requested. Frozen values: H 1.008, C 12.011, N 14.007, O 15.999.

1. A 1.000 g sample stated to contain C, H, and O only yields 1.467 g CO_2 and 0.600 g H_2O. Find its empirical formula. Then explain why the same product cards would be insufficient if 0.1000 g N were later found in the sample.

2. Two product cards for the same claimed 0.500 g hydrocarbon report: A, 1.497 g CO_2 and 0.817 g H_2O; B, 1.550 g CO_2 and 0.817 g H_2O. Use C-plus-H mass checks and ratio reasoning to decide which record is more plausible. State a measurement check before rejecting either record.

3. A proposed compound is $C_4H_{10}O$. Predict the CO_2 and H_2O masses from a 0.05000 mol paper-data sample under complete combustion. A card reports 8.80 g CO_2 and 4.50 g H_2O. Is that agreement exact? Give a likely benign explanation.

4. A student says, "Because CO_2 plus H_2O weighs more than the fuel, mass is not conserved." Correct the claim with a system diagram in words: identify what is inside the initial and final systems, and the role of oxygen.