ANSWER KEY.

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Empirical Formulas

Chemistry | ANSWER KEY

Percent to mass (assume 100 g), mass to mole, divide by small, multiply 'til whole. Round only if within 0.1 of a whole number. Use atomic masses rounded to two decimal places.

1. A compound is 27.3% carbon and 72.7% oxygen by mass. Find its empirical formula.

C: 27.3 g ÷ 12.01 = 2.273 mol
O: 72.7 g ÷ 16.00 = 4.544 mol
Divide by small (2.273): C 1.00, O 2.00
Answer: CO_2

2. A compound is 85.6% carbon and 14.4% hydrogen by mass. Find its empirical formula.

C: 85.6 g ÷ 12.01 = 7.127 mol
H: 14.4 g ÷ 1.01 = 14.26 mol
Divide by small (7.127): C 1.00, H 2.00
Answer: CH_2

3. A sample of an aluminum oxide contains 2.70 g of aluminum and 2.40 g of oxygen. Find its empirical formula.

Al: 2.70 g ÷ 26.98 = 0.1001 mol
O: 2.40 g ÷ 16.00 = 0.1500 mol
Divide by small (0.1001): Al 1.00, O 1.50
Multiply by 2: Al 2.00, O 3.00
(Masses were given, so the 100 g step is skipped. 1.50 ends in .5, so multiply by 2.)
Answer: Al_2O_3

4. A compound is 43.6% phosphorus and 56.4% oxygen by mass. Find its empirical formula.

P: 43.6 g ÷ 30.97 = 1.408 mol
O: 56.4 g ÷ 16.00 = 3.525 mol
Divide by small (1.408): P 1.00, O 2.50
Multiply by 2: P 2.00, O 5.00
Answer: P_2O_5

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5. A compound is 32.4% sodium, 22.6% sulfur, and 45.0% oxygen by mass. Find its empirical formula.

Na: 32.4 g ÷ 22.99 = 1.409 mol
S: 22.6 g ÷ 32.07 = 0.7047 mol
O: 45.0 g ÷ 16.00 = 2.813 mol
Divide by small (0.7047): Na 2.00, S 1.00, O 3.99
Answer: Na_2SO_4

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6. A compound is 72.4% iron and 27.6% oxygen by mass. Find its empirical formula.

Fe: 72.4 g ÷ 55.85 = 1.296 mol
O: 27.6 g ÷ 16.00 = 1.725 mol
Divide by small (1.296): Fe 1.00, O 1.33
Multiply by 3: Fe 3.00, O 3.99
(1.33 is not within 0.1 of a whole number, so multiply by 3.)
Answer: Fe_3O_4

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7. A compound has the empirical formula CH_2 and a molar mass of 56.12 g/mol. Find its molecular formula.

Empirical formula mass = 14.03 g/mol
n = 56.12 ÷ 14.03 = 4.00
Answer: C_4H_8 (check: 56.12 g/mol)

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8. A compound has the empirical formula NO_2 and a molar mass of 92.02 g/mol. Find its molecular formula.

Empirical formula mass = 46.01 g/mol
n = 92.02 ÷ 46.01 = 2.00
Answer: N_2O_4 (check: 92.02 g/mol)

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