

CHAPTER 3 - STOICHIOMETRY

The Mole Concept

1. Calculate the mass of 8.12×10^{22} atoms of Mg.

- A. 3.28 g
- B. 2.01×10^{45} g
- C. 180. g
- D. 0.305 g
- E. 0.334

2. A sample of 0.467 moles of aluminum contains how many atoms of aluminum?

- A. 2.81×10^{23} atoms
- B. 7.59×10^{24} atoms
- C. 1.04×10^{22} atoms
- D. 1.29×10^{24} atoms
- E. none of the above

3. The molar mass, in g/mol, nitrobenzene, $C_6H_5NO_2$, is

- A. 107.11
- B. 43.03
- C. 109.10
- D. 123.11
- E. 3.06

4. What is the mass of 2.63 moles of nickel?

- A. 154 mg
- B. 0.154 g
- C. 0.448 mg
- D. 44.8 g
- E. none of the above

NOTE: The correct answer to this problems is “none of the above.” Why is that?

5. Calculate the number of moles in 56.5 g of CH_2Cl_2 .

- A. 0.858 mol
- B. 1.17 mol
- C. 1.50 mol
- D. 4800 mol
- E. 0.665 mol

6. What is the mass in g of 0.837 moles of C_6H_6 ?

- A. 93.3 g
- B. 10.9 g
- C. 0.0107 g
- D. 65.4 g
- E. none of the above

7. How many molecules of CH_4 are present in 0.15 moles of CH_4 ?

- A. 0.15 molecules
- B. 2.5×10^{-25} molecules
- C. 5.6×10^{21} molecules
- D. 1.4×10^{24} molecules
- E. 9.0×10^{22} molecules

8. How many atoms of carbon are in 3.50 moles of ethanol, C_2H_6O ?

- A. 1.1×10^{24} atoms C
- B. 2.1×10^{24} atoms C
- C. 4.2×10^{24} atoms C
- D. 6.7×10^{25} atoms C
- E. none of the above

Mass Percent and Empirical Formulas

9. What is the mass of chlorine in 5.56 g of Freon-12, CCl_2F_2 ?

- A. 0.394 g
- B. 0.157 g
- C. 1.63 g
- D. 3.26 g
- E. none of the above

10. Calculate the mass percent of each of the elements in the compound N_2O .

- | | |
|-------------|----------|
| A. 63.65% N | 36.35% O |
| B. 46.68% N | 53.32% O |
| C. 30.45% N | 69.55% O |
| D. 56.77% N | 43.23% O |
| E. 50.00% N | 50.00% O |

11. What is the empirical formula of the compound that is 89.93% C and 10.07% H?

- A. C_9H_1
- B. $C_1H_{1.25}$
- C. C_3H_5
- D. C_3H_4
- E. C_4H_5

12. Determine the empirical formula for a compound that is 36.86% N and 63.14 % O by mass.

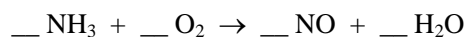
- A. NO_2
- B. NO_3
- C. N_2O
- D. N_2O_3
- E. NO

13. The empirical formula for a compound is CCl . The molar mass of this compound is 284.77 g/mol . What is the molecular formula of this compound?

- A. C_2Cl_2
- B. C_3Cl_3
- C. C_4Cl_4
- D. C_5Cl_5
- E. C_6Cl_6

Writing and Balancing Chemical Reactions

14. Pick the correct set of coefficients that correspond to the unbalanced chemical equation below.



- A. 2, 3, 2, 3
- B. 2, 2, 2, 3
- C. 4, 6, 4, 6
- D. 4, 5, 4, 6
- E. 3, 5, 3, 5

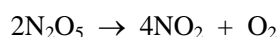
15. Write a balanced equation to show the reaction of gaseous ethane, C_2H_6 , with gaseous oxygen to form carbon dioxide gas and water vapor.

- A. $2\text{C}_2\text{H}_6(\text{g}) + 7\text{O}_2(\text{g}) \rightarrow 4\text{CO}_2(\text{g}) + 6\text{H}_2\text{O}(\text{g})$
- B. $\text{C}_2\text{H}_6(\text{g}) + 5\text{O}(\text{g}) \rightarrow 2\text{CO}(\text{g}) + 3\text{H}_2\text{O}(\text{g})$
- C. $2\text{C}_2\text{H}_6(\text{g}) + 5\text{O}_2(\text{g}) \rightarrow 4\text{CO}(\text{g}) + 6\text{H}_2\text{O}(\text{g})$
- D. $\text{C}_2\text{H}_6(\text{g}) + 7\text{O}(\text{g}) \rightarrow 2\text{CO}_2(\text{g}) + 3\text{H}_2\text{O}(\text{g})$
- E. $\text{C}_2\text{H}_6(\text{g}) + 3\text{O}_2(\text{g}) \rightarrow 2\text{CO}_2(\text{g}) + 3\text{H}_2\text{O}(\text{g})$

Reaction Stoichiometry

Answer the next two questions about the reaction below.

Consider the following balanced reaction:



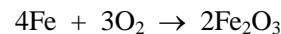
16. How many moles of NO_2 form when 3.0 moles of N_2O_5 react?

- A. 6.0 moles
- B. 4.0 moles
- C. 3.0 moles
- D. 2.0 moles
- E. 1.0 moles

17. How many moles of O_2 form when 3.0 moles of N_2O_5 react?

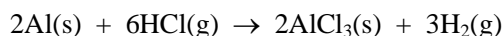
- A. 4.0 moles
- B. 3.0 moles
- C. 2.0 moles
- D. 1.5 moles
- E. 1.0 moles

18. Calculate the number of moles of Fe and O_2 that will be required to produce 4.00 mol of Fe_2O_3 according to the following reaction:



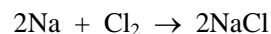
- A. 1.00 mol Fe, 3.00 mol O_2
- B. 2.00 mol Fe, 2.67 mol O_2
- C. 6.00 mol Fe, 2.00 mol O_2
- D. 4.00 mol Fe, 3.00 mol O_2
- E. 8.00 mol Fe, 6.00 mol O_2

19. Calculate the mass of hydrochloric acid, HCl , that will be needed to react with 125 g of Al in the following reaction. (MM: Al = 26.98 g/mol; HCl = 36.46 g/mol, AlCl_3 = 133.34 g/mol; H_2 = 2.02 g/mol)



- A. 169 g
- B. 13.9 g
- C. 507 g
- D. 56.3 g
- E. $1.37 \times 10^4 \text{ g}$

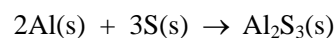
20. Sodium reacts with molecular chlorine to produce sodium chloride as shown below. How many grams of NaCl are produced from 12.8 g of Cl_2 ?



- A. 5.27 g
- B. 21.1 g
- C. 374 g
- D. 116 g
- E. 98.6 g

Limiting Reactants and Theoretical Yields

21. Aluminum reacts with sulfur according to the following equation:

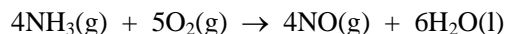


If 3.0 mol Al and 3.0 mol S are mixed, what is the theoretical yield of Al_2S_3 (in units of moles)?

- A. 0.50 mol Al_2S_3
- B. 1.5 mol Al_2S_3
- C. 2.5 mol Al_2S_3
- D. 2.0 mol Al_2S_3
- E. 1.0 mol Al_2S_3

Answer the next four questions about the reaction below.

Ammonia, NH_3 , reacts with molecular oxygen, O_2 , to form nitric oxide, NO , and water:



(MM NH_3 = 17.03 g/mol, MM O_2 = 32.00 g/mol, MM NO = 30.01 g/mol, MM H_2O = 18.02 g/mol) During an experiment, 105 g of NH_3 and 315 g of O_2 are mixed.

22. What is the limiting reactant (LR), and what is the theoretical yield of NO ?

- A. O_2 is the LR; 295 g of NO
- B. NH_3 is the LR; 59.6 g of NO
- C. NH_3 is the LR; 185 g of NO
- D. O_2 is the LR; 236 g of NO
- E. none of the above

23. What is the theoretical yield of H_2O ?

- A. 167 g
- B. 354 g
- C. 111 g
- D. 177 g
- E. none of the above

24. How many grams of excess reagent will be left over?

- A. 247 g
- B. 68 g
- C. 315 g
- D. 210 g
- E. none of the above

25. If the actual yield of NO had been 91 g, what would be the percent yield of the reaction?

- A. 56.8%
 - B. 38.6%
 - C. 82.0%
 - D. 49.2%
 - E. none of the above
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