

These problems are intended to *supplement* the problems in the textbook, not *replace* them.

Questions – Stoichiometry Only

I. Phosphine gas is produced when calcium phosphide reacts with water:



1. Balance the equation.
2. How many kilograms of phosphine are formed if 16.43 kg of water reacts ?
3. What volume of phosphine does this correspond to at STP ?
4. How many grams of calcium hydroxide are produced if 262 mL of phosphine are also produced at 39.6 °C and 794 mm Hg ?

II. Sulfur dioxide is a product of the combustion of diarsenic trisulfide:



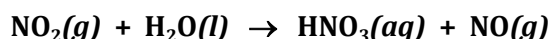
5. Balance the equation.
6. If the pressure and temperature remain constant at 102.6 kPa and 23.46 °C, then what volume of sulfur dioxide will be produced from 5.350 liters of oxygen ?
7. If the volume and temperature remain constant at 100.0 mL and 31.6 °C, then how many grams of diarsenic trisulfide are needed to produce a sulfur dioxide pressure of 1.56 bar ?

Questions – Stoichiometry And Limiting Reactant

III. Suppose 57.5 L of hydrogen gas at STP is bubbled through 6.40 L of 0.168 M gold(III) iodide solution.

8. Write a balanced chemical equation for the reaction that occurs.
9. Which is the limiting reactant ?
10. How many moles of the excess reactant will be left over ?
11. What is the theoretical yield (grams) of gold ?

IV. 142 liters of nitrogen dioxide gas combine with 100.0 mL of water at 60.0 °C and 444 mm Hg:



12. Balance the equation.
13. What volume of nitrogen monoxide will be produced at this temperature and pressure ?

V. The fizz produced when Alka-Seltzer tablets are dissolved in water is due to the reaction between sodium bicarbonate and citric acid:

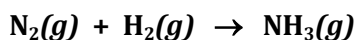


A typical tablet contains 1916 mg sodium bicarbonate and 1000 mg citric acid (assume 4 SF).

14. Balance the equation.

15. If this tablet is added to a glass of water which is then sealed, what is the maximum pressure of carbon dioxide that can be achieved, assuming the gas volume remains a constant 150.0 mL and the temperature is 62.3 °F?
16. What volume of water is produced during this reaction?
17. If there was originally 250.0 mL of water in the glass, then what is the final concentration of sodium citrate?
18. How many milligrams of each reactant will be left over?

VI. A 10.0 L vessel contains hydrogen gas at 1.25 atm and 12 °C. Nitrogen is introduced to a partial pressure of 0.500 atm. The following reaction occurs:



19. Balance the equation.
20. Which is the limiting reactant?
21. How many grams of ammonia will be produced in theory?
22. What is the theoretical final total pressure in the vessel?

Answers

If you cannot figure out how to get the correct answer, go to your instructor, the Science Tutoring Center, SI, etc.

NOTE: if your answer is different only in the last decimal place, then you probably rounded off at different points during the calculations. Don't be concerned about this.

NOTE: molar mass values were taken from the CHE 111 Lab Manual and used without rounding, the gas constant used was 0.08206 atm·L/mol·K, and standard temperature was 273.15 K

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| 1. $\text{Ca}_3\text{P}_2(s) + 6 \text{H}_2\text{O}(l) \rightarrow 2 \text{PH}_3(g) + 3 \text{Ca}(\text{OH})_2(aq)$ | 12. $3 \text{NO}_2(g) + \text{H}_2\text{O}(l) \rightarrow 2 \text{HNO}_3(aq) + \text{NO}(g)$ |
| 2. 10.33 kg PH_3 | 13. 47.3 L NO |
| 3. 6.810×10^3 L | 14. $3 \text{NaHCO}_3(aq) + \text{H}_3\text{C}_6\text{H}_5\text{O}_7(aq) \rightarrow 3 \text{CO}_2(g) + 3 \text{H}_2\text{O}(l) + \text{Na}_3\text{C}_6\text{H}_5\text{O}_7(aq)$ |
| 4. 1.18 g $\text{Ca}(\text{OH})_2$ | 15. 2.478 atm CO_2 |
| 5. $2 \text{As}_2\text{S}_3(s) + 9 \text{O}_2(g) \rightarrow \text{As}_4\text{O}_6(s) + 6 \text{SO}_2(g)$ | 16. 0.2815 mL H_2O |
| 6. 3.567 L SO_2 | 17. 0.02080 M $\text{Na}_3\text{C}_6\text{H}_5\text{O}_7$ |
| 7. 0.505 g As_2S_3 | 18. 604 mg NaHCO_3 and 0 mg $\text{H}_3\text{C}_6\text{H}_5\text{O}_7$ |
| 8. $3 \text{H}_2(g) + 2 \text{AuI}_3(aq) \rightarrow 6 \text{HI}(aq) + 2 \text{Au}(s)$ | 19. $\text{N}_2(g) + 3 \text{H}_2(g) \rightarrow 2 \text{NH}_3(g)$ |
| 9. gold(III) iodide | 20. hydrogen |
| 10. 0.96 mol H_2 | 21. 6.06 g NH_3 |
| 11. 212 g Au | 22. 0.917 atm |