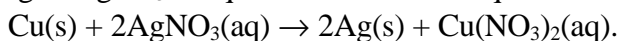


MORE STOICHIOMETRIC CALCULATIONS

1. Calculate the mass of silver that could be obtained by the reaction of a large excess of copper metal with 5.1 g of AgNO_3 in aqueous solution. The equation for the reaction is



2. (a) Which element is in excess when 3.00 g of Mg is ignited in 2.20 g of pure oxygen ? (b) What mass is in excess? (c) What mass of MgO is formed?

3. Given: $3\text{Fe}_2\text{O}_3 + \text{CO} \rightarrow 2\text{Fe}_3\text{O}_4 + \text{CO}_2$. How many grams of Fe_2O_3 can be converted to Fe_3O_4 by 14.0 g of CO ?

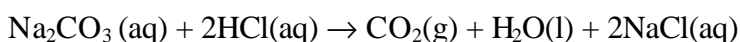
4. Calcium carbonate undergoes thermal decomposition according to the equation:



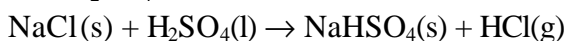
(a) How many grams of CaO and CO_2 are formed when 50.0 g of CaCO_3 is completely decomposed?

(b) When a 100 g sample of impure CaCO_3 (containing unreactive silica) was completely decomposed, the residue has a mass of 60.0 g. What was the percentage of CaCO_3 in the original sample?

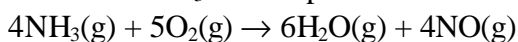
5. How many grams of CO_2 gas are released when a 50.0 g sample of Na_2CO_3 that is 60.0 percent pure reacts with excess HCl ?



6. How many grams of 97.0 percent pure NaCl are required to produce 100.0 g of pure HCl when reacted with H_2SO_4 ?

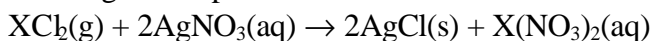


7. The oxidation of NH_3 is an important reaction in the preparation of nitric acid. The equation is



(a) How many liters of O_2 (STP) are needed to react with 5.00 kg of NH_3 ? (b) How many litres of air are required assuming air is 20.0 percent oxygen by volume ?

8. When 11.10 g of compound XCl_2 is reacted with excess AgNO_3 , 28.66 g of AgCl is produced.



What is the atomic mass of X ?

9. Impure nitrates may be analyzed by measuring the volume of NO generated during the reaction:



An impure sample of NaNO_3 weighing 2.50 g generated 400 mL of NO measured at STP. Calculate the percentage of NaNO_3 in the original sample.

10. Calculate the molarity of these solutions: (a) 1.00 L containing 119 g KCl, (b) 2.00 litres containing 223.5 g CuBr_2 , (c) 0.250 litres containing 13.35 g aluminum chloride, (d) 0.150 L containing 13.0 g cobalt(II) chloride, (e) 0.250 L containing 4.33 g chromium(III) iodide.

11. Concentrated H_2SO_4 has the density of 1.84 g/mL and is 98.0 percent H_2SO_4 . What volume of concentrated acid is needed to prepare 0.500 L of a 6.00M solution ?

12. Calculate the mass of solute needed to make these solutions: (a) 1.0 L of 1.0M sodium hydroxide, (b) 0.500 L of 2.00M calcium nitrate, (c) 2.0 L of 0.50M potassium bromide, (d) 0.200 L of 0.75M zinc chloride, (e) 0.125 L of 2.40M ammonium chloride.

13. Stock solutions of acids and bases for general use in the laboratory may be 6M solutions. How many milliliters of 6.0M stock solution are needed in order to prepare each of these solutions ? (a) 0.50 L of 1.0M HCl, (b) 124 mL of 0.25M H_2SO_4 , (c) 250 mL of 0.50M NH_3 , (d) 0.200 l of 2.00M NaOH, (e) 75 mL of 0.10 M H_3PO_4 .

14. One hundred mL of 0.50M HNO_3 is mixed with 400 mL of 0.25M $\text{Ca}(\text{NO}_3)_2$. Assume both compounds are 100 percent dissociated. Find the concentration of these ions in the mixture: (a) $\text{H}^+(\text{H}_3\text{O}^+)$, (b) Ca^{2+} , (c) NO_3^- .

15. (a) Two litres of 6.0M HNO_3 is added to 1.0 L of 2.0M HNO_3 . What is the concentration of HNO_3 in the mixture ? Assume volumes are additive. (b) Calculate the volume of 12M HCl that must be added to 2.5 L of 1.0M HCl in order to obtain 15 L of 1.0M HCl.

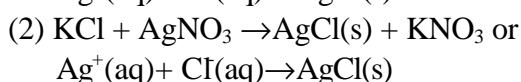
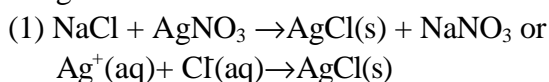
16. Barium nitrate and potassium sulphate solutions react and form a precipitate. What is the precipitate? How many mL of 0.40M $\text{Ba}(\text{NO}_3)_2$ solution are required to precipitate completely the sulphate ions in 25 mL of 0.80M K_2SO_4 solution ?

17. What mass of silver chloride can be precipitated from silver nitrate solution by 200 mL of a solution of 0.50M CaCl_2 ?

18. An impure, 0.500 g sample of NaCl was dissolved in 20.0 mL of water. The chloride ions were precipitated completely by addition of a AgNO_3 solution. The dried AgCl precipitate has a mass of 1.15 g. (a) How many moles AgCl formed ? (b) How many moles of NaCl were in the sample ? (c) How many grams of NaCl were in the sample ? (d) What was the percentage of NaCl in the impure sample ?

19. An impure sample of Na_2SO_4 has a mass of 1.65 g and is dissolved in water. Addition of BaCl_2 solution produced a precipitate of barium sulphate with mass 2.32 g. What is the percentage of Na_2SO_4 in the impure sample ?

20. A sample known to contain only NaCl and KCl has a mass of 1.00 g. The sample is dissolved and treated with AgNO_3 until precipitation is complete. The precipitate of AgCl has a mass of 2.32 g. What is the percentage of NaCl in the mixture ?



21. A mixture of Na_2SO_4 and K_2SO_4 having a total mass 0.500 g was dissolved in water. Barium chloride was added as a precipitating agent. The dried BaSO_4 resulting from the reaction had a mass of 0.715 g. What is the percentage of each component in the original mixture ?
22. A compound of carbon and hydrogen is found to contain 75.0% carbon and 25.0% hydrogen. (a) How many moles of C are contained in a 100 g sample ? (b) How many moles of H are contained in a 200 g sample ? (c) How many moles of hydrogen atoms (gram-atoms of H) are combined with 1 mole of carbon atoms (1 gram-atom of C) ? (d) What is the simplest formula for this compound ?
23. Calculate the simplest formula for each compound: (a) 92.3% C, 7.7% H, (b) 75.7% As, 24.3% O, (c) 31.9% K, 28.9% Cl, 39.2% O, (d) 29.1% Na, 40.5% S, 30.4% O.
24. A titanium (Ti) chloride is analyzed by converting all the titanium into 1.20 g of TiO_2 and all the chloride into 6.45 g AgCl . What is the simplest formula of the original compound ?
25. When a 3.00 g sample of a compound containing only C,H and O was completely burned, 1.17 g of H_2O and 2.87 g of CO_2 were formed. What is the simplest formula for the compound ?
26. A compound contains 82.7% carbon and 17.3% hydrogen. The density of its vapor at STP is 2.59 g/l. What is the molecular formula of the compound ?
27. The composition of nicotine is 74.0% C, 8.7% H, and 17.3% N. The molecular mass of nicotine is 162. What is the molecular formula ?
28. A certain volume of arsenic (g) has a mass of 4.56 g. The same volume of O_2 at the same conditions has a mass of 0.477 g. (a) What is the molecular mass of arsenic (g) ? Assume $\text{O}_2 = 32.0$. (b) What is the molecular formula for arsenic vapor ? (c) How many atoms are there per molecule of arsenic ?
29. A compound whose formula is XCl_2 contains 34.05% chlorine by mass. Chlorine has an atomic mass of 35.45. What is the atomic mass of X ?
30. A compound whose formula is Y_2O_5 contains 44.0 percent O by mass. What is the atomic mass of Y?
31. Indium reacts with sulfur and forms a compound having the formula In_2S_3 . Analysis reveals that 3.26 g of compound contains 2.30 g of indium. Assume the atomic mass of sulfur is 32.1 and calculate the atomic mass of indium.

ANSWERS:

1. 3.24 g Ag. 2. (c) 5.00 g. 3. 240 g.
 4. (b) 91.0 percent. 5. 12.5 g. 6. 165.3 g.
 7. (b) 41,200 L. 8. 40.1 9. 60.7 percent
 10. (c) 0.400M, (d) 0.667M. 11. 163 mL.
 12.(b) 164 g, (d) 20g. 13. (a) 83 mL, (b) 5.2 mL, (e) 1.3 mL.
 14. (c) 0.50M. 15. (a) 4.67M. 16. 50 mL.

17. 28.7 g. **18.** (d) 93.8 percent.
19. 85.6 percent. **20.** 76.1 percent NaCl.
21. 30.0 percent Na_2SO_4 . **23.** (d) $\text{Na}_2\text{S}_2\text{O}_3$.
26. C_4H_{10} . **31.** 115.