

AP Chemistry Chapter 3 Assignment – Stoichiometry Review

1. Naturally occurring sulfur consists of four isotopes, ^{32}S (95.0 %), ^{33}S (0.76 %), ^{34}S (4.22 %), and ^{36}S (0.014 %). Using these data, calculate the atomic weight of naturally occurring sulfur. The masses of the isotopes are given in the table below.

Isotope	Atomic Mass (amu)
^{32}S	31.91
^{33}S	32.97
^{34}S	33.97
^{35}S	35.97

2. A noble gas consists of three isotopes of masses 19.99 amu, 20.99 amu, and 21.99 amu. The relative abundance of these isotopes is 90.92 %, 0.257 %, and 8.82 % respectively. What is the average atomic mass of this noble gas? What element might this be?
3. An element "X" has 5 major isotopes, listed below along with their relative abundances. What is this element? Does the atomic mass you calculate based on these data agree with that listed in your periodic table?

Isotope	% Natural Abundance	Atomic Mass
^{46}X	8.0 %	45.95269
^{47}X	7.3 %	46.951764
^{48}X	73.8 %	47.947947
^{49}X	5.5 %	48.947841
^{50}X	5.4 %	49.944792

4. How many moles are in a sample of 300 atoms of nitrogen? How many grams?
5. If you buy 38.9 moles of M & M's, how many M & M's do you have?
6. A sample of sulfur has a mass of 5.37 g. How many moles are in the sample? How many atoms?
7. Give the number of moles of each elements present in 1.0 mole of each of the following substances:
- Hg_2I_2
 - LiH
 - PbCO_3
 - $\text{Ba}_3(\text{AsO}_4)_2$
 - $\text{RbOH} \cdot 2\text{H}_2\text{O}$
 - H_2SiF_6
8. How many grams of zinc are in 1.16×10^{22} atoms of zinc?
9. Calculate the molar masses of each of the following:
- Cu_2SO_4
 - NH_4OH
 - $\text{C}_{10}\text{H}_{16}\text{O}$
 - $\text{Zr}(\text{SeO}_3)_2$
 - $\text{Ca}_2\text{Fe}(\text{CN})_6 \cdot 12\text{H}_2\text{O}$
 - $\text{Cr}_4(\text{P}_2\text{O}_7)_3$
10. What is the mass of 4.28×10^{22} molecules of water?
11. How many milligrams of Br_2 are in 4.8×10^{20} molecules of Br_2 ?
12. How many sodium ions are present in each of the following:
- 2 moles of sodium phosphate
 - 5.8 g of sodium chloride
 - A mixture containing 14.2 grams of sodium sulfate and 2.9 grams of sodium chloride?
13. Determine the molar mass of $\text{KAl}(\text{SO}_4)_2 \cdot 12\text{H}_2\text{O}$.
14. How many moles of cadmium bromide, CdBr_2 , are in a 39.25 gram sample?
15. Bauxite, the principle ore used in the production of aluminum cans, has a molecular formula of $\text{Al}_2\text{O}_3 \cdot 2\text{H}_2\text{O}$.
- Determine the molar mass of bauxite.
 - How many grams of Al are in 0.58 moles of bauxite?
 - How many atoms of Al are in 0.58 moles of bauxite?
 - What is the mass in grams of 2.1×10^{24} formula units of bauxite?
16. Calculate the mass percent of Cl in each of the following compounds:
- ClF
 - HClO_2
 - CuCl_2
 - PuOCl
17. Calculate the mass percent of each element in potassium ferricyanide, $\text{K}_3\text{Fe}(\text{CN})_6$.
18. Calculate the mass percent of silver in each of the following compounds:
- AgCl
 - AgCN
 - AgNO_3

19. Fill in the blanks to balance the following chemical equations:
- $\text{___ AgI} + \text{___ Na}_2\text{S} \rightarrow \text{___ Ag}_2\text{S} + \text{___ NaI}$
 - $\text{___ (NH}_4\text{)}_2\text{Cr}_2\text{O}_7 \rightarrow \text{___ Cr}_2\text{O}_3 + \text{___ N}_2 + \text{___ H}_2\text{O}$
 - $\text{___ Na}_3\text{PO}_4 + \text{___ HCl} \rightarrow \text{___ NaCl} + \text{___ H}_3\text{PO}_4$
 - $\text{___ TiCl}_4 + \text{___ H}_2\text{O} \rightarrow \text{___ TiO}_2 + \text{___ HCl}$
 - $\text{___ Ba}_3\text{N}_2 + \text{___ H}_2\text{O} \rightarrow \text{___ Ba(OH)}_2 + \text{___ NH}_3$
 - $\text{___ HNO}_2 \rightarrow \text{___ HNO}_3 + \text{___ NO} + \text{H}_2\text{O}$
20. Balance the following equation:
 $\text{___ NH}_4\text{OH}(l) + \text{___ KAl(SO}_4\text{)}_2 \cdot 12\text{H}_2\text{O} \rightarrow \text{___ Al(OH)}_3(s) + \text{___ (NH}_4\text{)}_2\text{(SO}_4\text{)}(aq) + \text{___ KOH}(aq) + \text{___ H}_2\text{O}(l)$
21. Balance the following equation:
 $\text{___ Fe}(s) + \text{___ HC}_2\text{H}_3\text{O}_2(aq) \rightarrow \text{___ Fe(C}_2\text{H}_3\text{O}_2\text{)}_3(aq) + \text{___ H}_2(g)$
22. How many grams of sodium hydroxide are required to form 51.63 g of lead hydroxide?
 $\text{Pb(NO}_3\text{)}_3(aq) + \text{NaOH}(aq) \rightarrow \text{Pb(OH)}_2(aq) + \text{NaNO}_3(aq)$ (**unbalanced**)
23. How many grams of water vapor can be generated from the combustion of 18.74 g of ethanol?
 $\text{C}_2\text{H}_6\text{O}(g) + \text{O}_2(g) \rightarrow \text{CO}_2 + \text{H}_2\text{O}$ (**unbalanced**)
24. How many grams of potassium iodide are necessary to completely react with 20.61 g of mercury (II) chloride?
 $\text{HgCl}_2(aq) + \text{KI}(aq) \rightarrow \text{HgI}_2(s) + \text{KCl}(aq)$ (**unbalanced**)
25. How many grams of oxygen are necessary to completely react with 22.8 g of methane, CH_4 ? (Please write the entire reaction.)
26. If, in the previous problem, only 25.9 g of water vapor were formed, how much methane actually reacted with oxygen?
27. What mass of calcium carbonate, CaCO_3 , would be formed if 248.6 g of carbon dioxide, CO_2 , were exhaled into limewater, Ca(OH)_2 ? How many grams of calcium would be needed to form that amount of calcium carbonate? Assume 100% yield in each reaction.
28. The following reaction is used to form lead iodide crystals. What mass of crystal (PbI_2) could be formed from 1.0×10^3 g of lead (II) acetate [$\text{Pb(C}_2\text{H}_3\text{O}_2\text{)}_2$]?
 $\text{Pb(C}_2\text{H}_3\text{O}_2\text{)}_2(aq) + 2 \text{KI}(aq) \rightarrow \text{PbI}_2(s) + 2 \text{K C}_2\text{H}_3\text{O}_2(aq)$
29. How many grams of precipitate (Hg_2Cl_2) would be formed from a solution containing 102.9 g of mercury ions that are reacted with chloride ions as follows?
 $2 \text{Hg}^+(aq) + 2 \text{Cl}^-(aq) \rightarrow \text{Hg}_2\text{Cl}_2(s)$
30. You were hired by a laboratory to recycle 6 moles of silver ions. You were given 150. g of copper. How many grams of silver can you recover using the following reaction? Is this enough copper to recycle 6 moles of silver ions?
 $2 \text{Ag}^+ + \text{Cu} \rightarrow 2 \text{Ag} + \text{Cu}^{2+}$
31. Fermentation converts sugar into ethanol and carbon dioxide. If you were to ferment a bushel of apples containing 235 g of sugar, what is the maximum amount of ethanol in grams that would be produced?
 $\text{C}_6\text{H}_{12}\text{O}_6 \rightarrow 2 \text{C}_2\text{H}_6\text{O} + 2 \text{CO}_2$
32. The reaction between potassium chlorate and red phosphorus is highly exothermic and takes place when you strike a match on a matchbox. If you were to react 52.9 g of potassium chlorate (KClO_3) with red phosphorus, how many grams of tetraphosphorus decaoxide (P_4O_{10}) would be produced?
 $\text{KClO}_3(s) + \text{P}_4(s) \rightarrow \text{P}_4\text{O}_{10}(s) + \text{KCl}(s)$ (**unbalanced**)