

READ ME! IMPORTANT! 😊

Thank you for showing an interest in taking AP Chemistry next year! Being successful in AP Chemistry requires that you enter the class with some foundational skills that you learned in your first year chemistry course. The PRACTICE PROBLEMS BELOW are problems that you should be able to solve BEFORE starting AP Chemistry. The answers can be found by clicking the link above, and they will show you how to solve the problems so you can find your potential mistakes. The single most important skill in AP Chem is perseverance. A large aspect of this summer assignment is about practicing the skill of perseverance and not giving up and shutting down. These are hard problems. Types of stoichiometry problems you probably haven't seen exact versions of. But you have all the foundational skills to put together to figure these out! You are most likely not going to get these all right on the first try. Which is fine...as long as you track down your mistakes, use the answer keys and your other resources as learning tools, puzzle through it, and improve. Those are the skills you need to practice this summer to set you up for success in AP Chem this coming year. *Note* The link for the answers will show some questions that we skipped. The skipped questions will be indicated below.

KEEP CALM AND PERSEVERE!
**“PERSEVERANCE IS THE HARD WORK YOU DO AFTER
 YOU GET TIRED OF DOING THE HARD WORK YOU ALREADY DID.”** – Newt Gingrich

#	Question	Got it Correct? ✓
1	A salt contains only barium and one of the halide ions. A 0.1480 g sample of the salt was dissolved in water and an excess of sulfuric acid was added to form barium sulfate, which was filtered, dried and weighed. Its mass was found to be 0.1660 g. What is the formula for the barium halide?	
2	SKIP	
3	A) A 5.000 gram sample of a dry mixture of potassium hydroxide, potassium carbonate and potassium chloride is reacted with 0.100 L of 2.00-molar HCl solution. A 249.0 mL sample of dry carbon dioxide gas, measured at 22.0 °C and 740.0 torr, is obtained from this reaction. What was the percentage of potassium carbonate in the mixture? B) SKIP	
4	A) For the reaction below, when 0.5000 g of XI_3 reacts completely, 0.2360 g of XCl_3 is obtained. Calculate the atomic weight of element X and identify it. $2XI_3 + 3Cl_2 \rightarrow 2XCl_3 + 3I_2$ B) $2XI_3 + 3Cl_2 \rightarrow 2XCl_3 + 3I_2$ If 0.520 grams of XCl_3 are treated with iodine, 0.979 g of XI_3 are produced. What is the chemical symbol for this element X?	
5	A 2.077 g sample of an element, which has an atomic mass between 40 and 55, reacts with oxygen to form 3.708 g of an oxide. Determine the formula mass of the oxide (and identify the element). TRY	
6	12.5843 g sample of $ZrBr_4$ was dissolved and, after several steps, all of the combined Br was precipitated as AgBr. The silver content of AgBr was found to be 13.2160 g. Assume the atomic masses of Ag and Br to be 107.868 and 79.904. What value was obtained for the atomic mass of Zr from this experiment?	
7 – 11	SKIP	
12	How many phosphate ions are in a sample of hydroxyapatite [$Ca_5(PO_4)_3OH$] that contains 5.50×10^{-3} g of O_2	
13	A mixture consisting of only sodium chloride (NaCl) and potassium chloride (KCl) weighs 1.0000 g. When the mixture is dissolved in water and an excess of silver nitrate is added, all the chloride ions associated with the original mixture are precipitated as insoluble silver chloride (AgCl). The mass of the silver chloride is found to be 2.1476 g. Calculate the mass percentages of sodium chloride and potassium chloride in the original mixture.	
14	Ammonia is produced industrially by reacting: $N_2 + 3H_2 \rightarrow 2NH_3$ Assuming 100% yield, what mass of ammonia will be produced from a 1:1 molar ratio mixture in a reactor that has a volume of 8.75×10^3 L under a total pressure of 2.75×10^7 Pa at 455 °C.	
15	Upon heating, a 4.250 g sample loses 0.314 grams. Assuming the sample is $BaCl_2 \cdot 2H_2O$ and NaCl, calculate the mass percent of $BaCl_2 \cdot 2H_2O$.	
16	SKIP	
17	Ammonium nitrate and potassium chlorate both produce oxygen gas when decomposed by heating. Without doing detailed calculations, determine which of the two yields the greater (a) number of moles of O_2 per mole of solid and (b) number of grams of O_2 per gram of solid. The unbalanced equations are: $NH_4NO_3(s) \rightarrow N_2(g) + O_2(g) + H_2O$ $KClO_3(s) \rightarrow KCl(s) + O_2(g)$	

18	An element X forms both a dichloride (XCl_2) and a tetrachloride (XCl_4). Treatment of 10.00 g XCl_2 with excess chlorine forms 12.55 g XCl_4 . Calculate the atomic mass of X, and identify X.	
19	Water is added to 4.267 g of UF_6 . The only products of the reaction are 3.730g of a solid containing only uranium, oxygen, and fluorine and 0.970 g of a gas. The gas is 95.0% fluorine, the remainder is hydrogen. A) What fraction of the fluorine of the original is in the solid & what fraction in the gas after the rxn? B) What is the formula of the solid product?	
20	A compound containing titanium and chlorine is analyzed by converting all the titanium into 1.20 g of titanium dioxide and all the chlorine into 6.45 g of AgCl . What is the simplest (empirical) formula for the original compound?	
21	An unknown element X is found in two compounds, XCl_2 and XBr_2 . In the following reaction: $\text{XBr}_2 + \text{Cl}_2 \rightarrow \text{XCl}_2 + \text{Br}_2$ when 1.5000 g XBr_2 is used, 0.8897 g XCl_2 is formed. Identify the element X.	
22	SKIP	
23	A sheet of iron with a surface area of 525 cm^2 is covered with a coating of rust that has an average thickness of 0.0021 cm. What minimum volume of an HCl solution, in mL, having a density of 1.07 g/mL and consisting of 14% HCl by mass is required to clean the surface of the metal by reacting with the rust? Assume that the rust is $\text{Fe}_2\text{O}_3(\text{s})$, that it has a density of 5.2 g/cm^3 , and that the reaction is: $\text{Fe}_2\text{O}_3(\text{s}) + 6\text{HCl}(\text{aq}) \rightarrow 2\text{FeCl}_3(\text{aq}) + 3\text{H}_2\text{O}(\ell)$	
24	A 1.42 g sample of a pure compound, with formula M_2SO_4 , was dissolved in water and treated with an excess of aqueous calcium chloride, resulting in the precipitation of all the sulfate ions as calcium sulfate. The precipitate was collected, dried, and found to weigh 1.36 g. Determine the atomic mass of M. What element is it?	
25	Calculate volume change when 1 cm^3 Fe is oxidized to Fe_2O_3 ($d = 5.24 \text{ g}/\text{cm}^3$). Density of Fe = 7.787 g/cm^3 .	
26	A 0.204 gram sample of a metal, M, reacts completely with sulfuric acid according to: $\text{M} + \text{H}_2\text{SO}_4 \rightarrow \text{MSO}_4 + \text{H}_2$ A volume of 213 mL of hydrogen is collected over water; the water level in the collecting vessel is the same as the outside level. Atmospheric pressure is 756.0 torr and the temperature is 25.0 $^\circ\text{C}$ (H_2O vapor pressure = 23.756 torr). Calculate the molar mass of the metal.	
27	A common way to obtain a pure metal from its impure metal oxide is to react the oxide with carbon, expressed generically as: $2\text{MO}(\text{s}) + \text{C}(\text{s}) \rightarrow 2\text{M}(\text{s}) + \text{CO}_2(\text{g})$ If 5.00 g of an unknown metal oxide (MO) reacted with excess carbon and formed 738 mL of CO_2 at 200.0 $^\circ\text{C}$ and 0.978 atm, what is the identity of the metal?	
28	A compound of P and F was analyzed as follows: heating 0.2324 g of the compound in a 378 cm^3 flask turned all of it to gas, which had a pressure of 97.3 mmHg at 77 $^\circ\text{C}$. Then, the gas was mixed with calcium chloride solution which turned all of the F to 0.2631 g of CaF_2 . Determine the molecular formula of the compound.	
29	A metal chloride reacts with silver nitrate solution to give a precipitate of silver chloride: $\text{MCl}_2 + 2\text{AgNO}_3 \rightarrow \text{M}(\text{NO}_3)_2 + 2\text{AgCl}$ When a solution containing 0.4750 g of metal chloride is made to react with silver nitrate, 1.435 grams of silver chloride are formed. Identify the metal.	
30	An unidentified metal M reacts with an unidentified halogen X to form a compound MX_2 . When heated the compound decomposes by the reaction: $2\text{MX}_2(\text{s}) \rightarrow 2\text{MX}(\text{s}) + \text{X}_2(\text{g})$ When 1.12 g of MX_2 is heated, 0.720 g of MX is obtained along with 56.0 mL of X_2 gas (at STP). A) What is the atomic mass and the identity of the halogen X? B) What is the atomic mass and identity of the metal M?	
31	A metal sulfate has the formula M_2SO_4 . 10.99 g of the compound was dissolved in water to make 500.0 cm^3 of solution. A 25.0 cm^3 sample was removed and reacted with an excess of $\text{BaCl}_2(\text{aq})$ to produce a precipitate of BaSO_4 , which when dried had a mass of 1.167 g. A) Determine the number of moles of BaSO_4 precipitated. B) Determine the concentration of M_2SO_4 C) Identify M	
32	An element, X, forms two compounds with bromine: XBr_2 and XBr_4 . When 10.00 grams of the XBr_2 is reacted with excess bromine, 14.35 g of XBr_4 is formed. Identify X.	
33	Exactly 4.32 g of oxygen gas was required to completely combust a 2.16 g sample of a mixture of methanol and ethanol: A) How many moles of ethanol are contained within the sample? B) What is the percentage by weight of methanol in the sample?	
34	A 3.41 g sample of a metallic element, M, reacts completely with 0.0158 mol of a gas, X_2 , to form 4.53 g MX. What are the identities of M and X?	