

NAME: _____ BLOCK: _____ DATE: _____

Welcome to AP Chemistry!!



Summer work: Complete the packet and *show ALL work for full credit!* This will count as **50%** of your first **TEST** grade in your upcoming AP Chemistry course! You will take a test on this material during the first week of school. Good Luck!

****Due Date: first day your class meets**

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ALL WORK MUST BE SHOWN FOR CREDIT & INCLUDE SIG FIGS AND UNITS/LABELS

Dimensional Analysis & Math in Chemistry

- 1) How many milliliters is 0.005 L?
- 2) Express 7,500 nm as picometers.
- 3) Convert 5.6 g to kg
- 4) How many significant figures are in 2.30×10^4 ?
- 5) Round 800,000 to two significant figures.
- 6) How many significant figures are in 0.000450?
- 7) The density of lead is 11.4 g/cm^3 at 25°C . Calculate the volume occupied by 25.0 g of lead.
- 8) Iron has a density of 7.86 g/cm^3 . What is the volume occupied by 55.85 g of iron?
- 9) Bromine is a red liquid at 25°C . Its density is 3.12 g/cm^3 . What is the volume of 28.1 g of liquid bromine?
- 10) Express the number 26.7 in scientific notation.
- 11) Express the number 0.000053 in scientific notation.
- 12) Convert 5.00×10^2 milliliters to quarts. (1L = 1.06 qt)
- 13) The average distance from Earth to the sun is 9.3×10^7 miles. How many kilometers is this? (1 mi = 1.6 km)
- 14) What is the area, in square centimeters, of an 8.5 inch by 11 inch sheet of paper? (2.54 cm = 1 in)
- 15) What is the volume, in cubic centimeters, of a brick that is 4.0 in \times 2.7 in \times 8.0 in?
- 16) How many square kilometers are equivalent to 28.5 cm^2 ?
- 17) If a car has an EPA mileage rating of 30 miles per gallon, what is this rating in kilometers per liter? (1 L = 1.06 qt; 4 qt = 1 gal)
- 18) If the price of gasoline is \$3.85 per U.S. gallon, what is the cost per liter?
- 19) An aluminum beverage can contain 12.0 fluid ounces of liquid. Express this volume in liters. (1 fl oz = 29.6 mL)
- 20) How many cubic centimeters of an ore containing only 0.22% gold (by mass) must be processed to obtain \$100.00 worth of gold? The density of the ore is 8.0 g/cm^3 and the price of gold is \$818 per troy ounce. (14.6 troy oz = 1.0 ordinary pound, called an avoirdupois pound; 1 lb = 454 g)

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Chemical Nomenclature and Formula Writing

Name the following compounds (give acid names for all acids!)

- | | | | |
|--|--|--|--|
| 1. <u>Ca</u> (OH) ₂ | 14. H ₂ SO ₄ | 27. K ₂ CrO ₄ | 40. <u>Zn</u> O |
| 2. ZnS | 15. HCl | 28. MgCl ₂ | 41. MnO ₂ |
| 3. ZnSO ₄ | 16. CuC ₂ O ₄ | 29. KBrO ₃ | 42. FeO |
| 4. AgCl | 17. KMnO ₄ | 30. <u>Na</u> CN | 43. P ₂ O ₅ |
| 5. <u>Cu</u> I | 18. NH ₄ Cl | 31. <u>Sr</u> (OH) ₂ | 44. SrCl ₂ |
| 6. CuI ₂ | 19. Al(H ₂ PO ₄) ₃ | 32. Na ₂ Cr ₂ O ₇ | 45. Mg ₃ N ₂ |
| 7. Al ₂ (S ₂ O ₃) ₃ | 20. HNO ₃ | 33. Al ₂ O ₃ | 46. <u>Cr</u> (NO ₃) ₂ |
| 8. NO | 21. HC ₂ H ₃ O ₂ | 34. Na ₃ PO ₃ | 47. NaHCO ₃ |
| 9. H ₃ PO ₃ | 22. H ₂ CO ₃ | 35. N ₂ O ₅ | 48. CS ₂ |
| 10. NO ₂ | 23. Cu ₂ SO ₄ | 36. H ₃ BO ₃ | 49. HClO ₄ |
| 11. CO | 24. Al ₄ C ₃ | 37. <u>Ca</u> (OH) ₂ | 50. <u>Ba</u> (ClO ₃) ₂ |
| 12. CO ₂ | 25. H ₂ O ₂ | 38. Na ₂ SO ₃ | |
| 13. <u>Ca</u> S | 26. NaCl | 39. <u>Cu</u> (HCO ₃) ₂ | |

WRITE THE FORMULAS FOR THE FOLLOWING COMPOUNDS

- | | | |
|---------------------------------|------------------------------------|-------------------------------|
| 1. ammonium bromide | 18. <u>disulfur</u> pentoxide | 34. hydroiodic acid |
| 2. carbonic acid | 19. aluminum nitride | 35. potassium permanganate |
| 3. acetic acid | 20. lithium oxalate | 36. <u>tin</u> (II)sulfide |
| 4. <u>diphosphorus</u> trioxide | 21. <u>copper</u> (II)permanganate | 37. <u>copper</u> (II)cyanide |
| 5. <u>lead</u> (II)chloride | 22. lithium borate | 38. ammonium bromide |
| 6. potassium sulfide | 23. sodium hydrogen phosphate | 39. beryllium acetate |
| 7. nitric acid | 24. hydrogen peroxide | 40. rubidium nitrate |
| 8. aluminum sulfate | 25. <u>nickel</u> (II)bicarbonate | 41. calcium telluride |
| 9. strontium bisulfite | 26. magnesium perchlorate | 42. <u>mercury</u> (II)iodide |
| 10. sulfur trioxide | 27. <u>cobalt</u> (II)bromide | 43. potassium dichromate |
| 11. stannic arsenate | 28. nitrogen pentoxide | 44. potassium chlorate |
| 12. sulfuric acid | 29. carbon tetraiodide | 45. strontium <u>bromate</u> |
| 13. zinc phosphate | 30. <u>cadmium</u> (III)cyanide | 46. beryllium sulfide |
| 14. <u>cobalt</u> (II)nitrate | 31. <u>lead</u> (II)chromate | 47. barium oxide |
| 15. calcium <u>bromate</u> | 32. dinitrogen pentoxide | 48. strontium acetate |
| 16. carbon monoxide | 33. ferrous chloride | 49. cuprous bicarbonate |
| 17. <u>iron</u> (III)chromate | | 50. silver chloride |

The Mole & Stoichiometry

- 1) Calculate the average atomic mass of lithium using the following data:

Isotope	Abundance	Mass
${}^6\text{Li}$	7.5 %	6.0151 amu
${}^7\text{Li}$	92.5%	7.0160 aum

- 2) Calculate the average atomic mass of silver using the following data:

Isotope	Abundance	Mass
${}^{107}\text{Ag}$	51.84%	106.9051 amu
${}^{109}\text{Ag}$	48.16%	108.9048 amu

- 3) How many Br atoms are in 2.50 g of Br?
 4) Determine the number of moles of aluminum in 96.7 g of Al.
 5) Calculate the number of moles of xenon in 12.0 g of xenon.
 6) Calculate the molar mass of $(\text{NH}_4)_2\text{SO}_4$

Balance and state the type for each of the following reactions:

1. $\text{Li}_{(s)} + \text{H}_2\text{SO}_{4(aq)} \rightarrow \text{Li}_2\text{SO}_{4(aq)} + \text{H}_{2(g)}$
 2. $\text{CaO}_{(s)} + \text{C}_{(s)} \rightarrow \text{CaC}_{2(s)} + \text{CO}_{(g)}$
 3. $\text{NH}_{3(g)} + \text{O}_{2(g)} \rightarrow \text{NO}_{(g)} + \text{H}_2\text{O}_{(g)}$
 4. $\text{CaF}_{2(aq)} + \text{H}_2\text{SO}_{4(aq)} \rightarrow \text{CaSO}_{4(s)} + \text{HF}_{(aq)}$
 5. $\text{Ca}_{(s)} + \text{HOH}_{(l)} \rightarrow \text{Ca(OH)}_{2(aq)} + \text{H}_{2(g)}$
 6. $(\text{NH}_4)_2\text{SO}_{4(aq)} + \text{NaOH}_{(aq)} \rightarrow \text{Na}_2\text{SO}_{4(aq)} + \text{HOH}_{(l)} + \text{NH}_{3(g)}$

Use the balanced equations from above to answer the following questions:

- 1) Using equation # 2, at STP, how many liters of carbon monoxide gas will form if 15 g of carbon are reacted with excess calcium oxide?
 2) Using equation #3, what mass of ammonia is needed to react with oxygen to form 25.0 g of water?
 3) Using equation #1, If you add 2.6 g of lithium to 25 mL of a 0.24 M sulfuric acid solution, how many molecules of hydrogen gas will form?

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1. You want to know how many waters of hydration there are per mole of BaCl_2 in hydrated barium chloride. You weigh out 1.270 g of the hydrated barium chloride and heat it in a crucible to drive off the waters of hydration. After all the water has been driven off, the mass of the anhydrous barium chloride is 1.083 g. What is the formula for the hydrated barium chloride?
2. Fill in the following table:

Name	Symbol	# protons	# neutrons	# electrons	Mass number	Electric charge	Cation, Anion, Isotope, Atom
	Br			36			
Lead-210							
				27		+2	

Physical Thermochemistry

1. A 15.3 g piece of metal with an initial temperature of 100.9°C is added to 90.3 g of water with an initial temperature of 20.9°C . The final temperature is 27.0°C . Calculate the specific heat of the metal.
2. A 10.4 g piece of metal with an initial temperature of $100.^\circ\text{C}$ is added to 33.3 g of water with an initial temperature of 22.0°C . The specific heat of the metal is $0.593\text{J/g}^\circ\text{C}$. Calculate the final temperature. (c_p for water is $4.18\text{ J/g}^\circ\text{C}$)
3. What is the enthalpy of solution in kJ/mole if 5.05 g of NaOH is dissolved into 124 g of water? The temperature of the water changes from 23.1°C to 26.4°C . Is this exothermic or endothermic? Explain.
4. When ice at 0°C melts to liquid at 0°C , it absorbs 0.334 kJ of heat per gram. Suppose the heat needed to melt 38.0 g of ice is absorbed from the water contained in a glass. If this water has a mass of 0.210 kg and a temperature of 21.0°C , what is the final temperature of the water? (Note that you will also have 38.0 g of water at 0°C from the ice).

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Go to this link and learn about the Gas Laws:

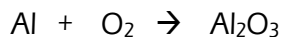
[https://chem.libretexts.org/Bookshelves/Physical_and_Theoretical_Chemistry_Textbook_Maps/Supplemental_Modules_\(Physical_and_Theoretical_Chemistry\)/Physical_Properties_of_Matter/States_of_Matter/Properties_of_Gases/Gas_Laws/The_Ideal_Gas_Law](https://chem.libretexts.org/Bookshelves/Physical_and_Theoretical_Chemistry_Textbook_Maps/Supplemental_Modules_(Physical_and_Theoretical_Chemistry)/Physical_Properties_of_Matter/States_of_Matter/Properties_of_Gases/Gas_Laws/The_Ideal_Gas_Law)

Answer the following questions:

- 1) The volume of a gas-filled balloon is 30.0 L at 40.0°C and 153 kPa pressure. What volume will the balloon have if pressure remains constant and the temperature is raised to 389 K?
- 2) A 39.7 L sample of N₂ (g) has a pressure of 2.98 atm when the temperature is 345 K. What will the volume of this sample be if the pressure is reduced to 1.60 atm and the temperature is raised to 459 K?
- 3) A quantity of gas has a volume of 200.0 L at 17.0°C and 106.6 kPa. To what temperature must the gas be cooled for its volume to be reduced to 155.0 L at a pressure of 98.6 kPa?
7. A sample of oxygen gas (O₂) with a mass of 35.8 g occupies a volume of 48.5 L at 85.0°C and what pressure?
- 4) A quantity of gas has a volume of 140.0 L when confined under a pressure of 113.3 kPa at a temperature of 20.0°C. At what pressure will the volume of the gas be 50.0 L at 20.0°C?
- 5) Calculate the volume 4.25 moles of a gas will occupy at 85.0 °C and 121.9 kPa.

Gas Stoichiometry

- 6) When aluminum is burned in 3.2 L of oxygen at 1.43 atm and 24 °C, how many grams of aluminum are needed for the reaction to occur?



- 7) If 3.70g of CaCO₃ decomposes at 17°C and 730 torr, how many liters of CO₂ are formed?

