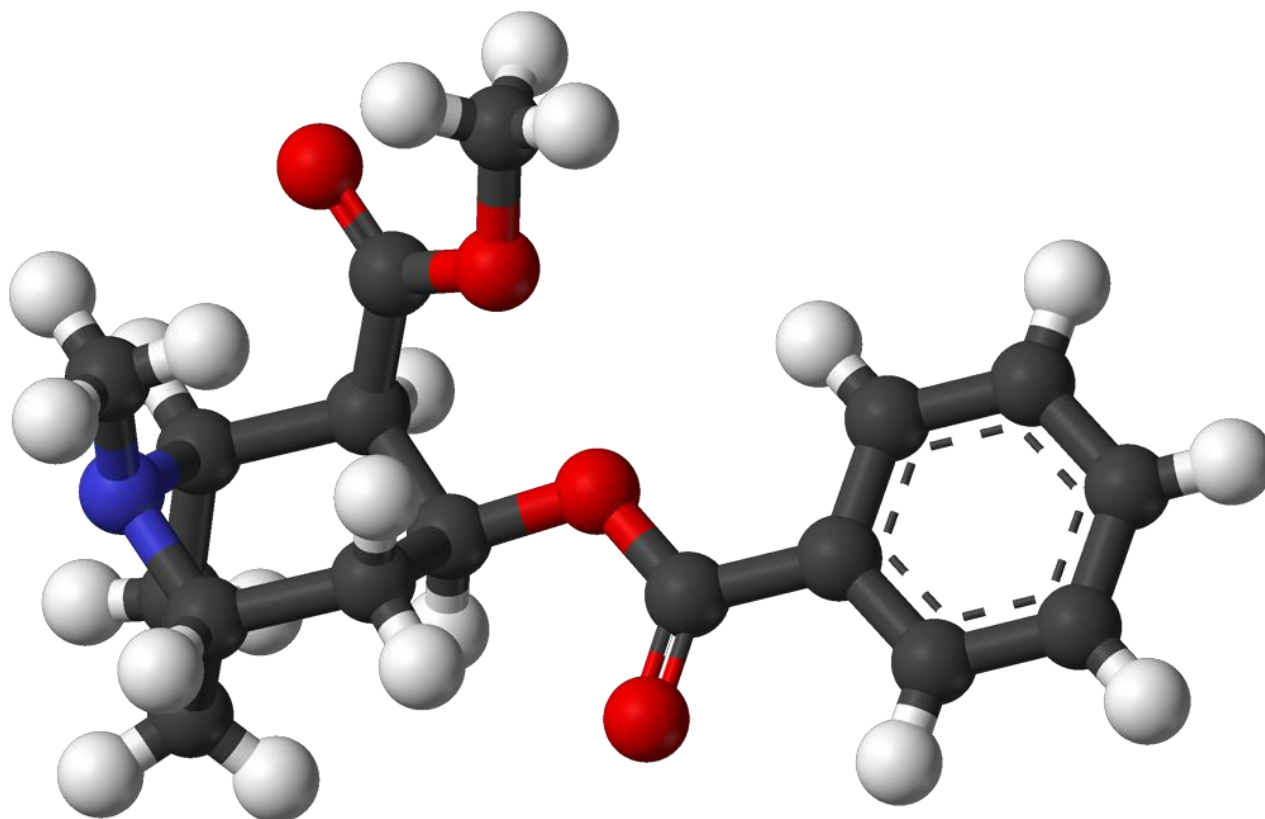
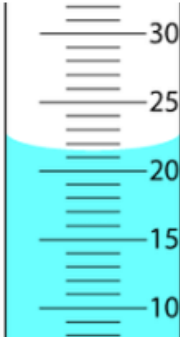
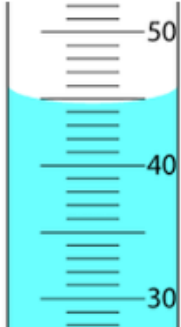


AP Chemistry
2018 Summer Packet
(Review of Pre-AP Chemistry)

A stapled handwritten packet with all work shown in the numerical order and final answers clearly circled or boxed in should be submitted for a double-minor grade on 08/31/18 (Fri). You will have the opportunity to ask questions during lunch on the first week of school in order to complete the packet; however, the instructor will proceed with the curriculum under the assumption that you have thoroughly reviewed the concepts reflected in this packet before the first day of class. You will have a major grade assessment over the material covered in this review packet during the first six week cycle.



**AP Chemistry
Summer Packet 2018**

- Evaluate each of the following, and write the answer to the appropriate number of significant figures.
 - $212.2 + 26.7 + 402.09$
 - $1.0028 + 0.221 + 0.10337$
 - $52.331 + 26.01 - 0.9981$
 - $2.01 \times 10^2 + 3.014 \times 10^3$
 - $7.255 - 6.8350$
- Perform the following mathematical operations, and express each result to the correct number of significant figures.
 - $\frac{0.102 \times 0.0821 \times 273}{1.01}$
 - $0.14 \times 6.022 \times 10^{23}$
 - $4.0 \times 10^4 \times 5.021 \times 10^{-3} \times 7.34993 \times 10^2$
 - $\frac{2.00 \times 10^6}{3.00 \times 10^{-7}}$
- A rectangular solid measures 1.0 cm by 5.6 cm by 2.1 cm. Express its volume in cubic meters.
- You pass a road sign saying "New York 112 km." If you drive at a constant speed of 65 mi/h, how long should it take you to reach New York? If your car gets 28 miles to the gallon, how many liters of gasoline are necessary to travel 112 km? (Note: 1 kilometer = 0.621 mile, 1 gallon = 3.785 liters)
- Carbon monoxide (CO) detectors sound an alarm when peak levels of carbon monoxide reach 100 parts per million (ppm). This level roughly corresponds to a composition of air that contains 400,000 μg carbon monoxide per cubic meter of air ($400,000 \mu\text{g}/\text{m}^3$). Assuming the dimensions of a room are 18ft x 12ft x 8ft, estimate the mass (in grams) of carbon monoxide in the room that would register 100 ppm on a carbon monoxide detector. (1m = 3.28 ft)
- The density of pure silver is $10.5 \text{ g}/\text{cm}^3$ at 20°C . If 5.25 g of pure silver pellets is added to a graduated cylinder containing 11.2 mL of water, to what volume level will the water in the cylinder rise?
- A copper wire (density = $8.96 \text{ g}/\text{cm}^3$) has a diameter of 0.25 mm. If a sample of this copper wire has a mass of 22g, how long is the wire in meters?
- The hottest temperature recorded in the history of United States is 134°F in Greenland Ranch, CA. The melting point of phosphorus is 44°C . At this temperature, would phosphorus be a liquid or a solid?
 $^\circ\text{C} = \frac{5}{9} (^\circ\text{F} - 32)$
- Read and record the volume of each of the following in mL:
 - 
 - 
 - 

10. Classify each of the following as a chemical or a physical property:
- The density of iron is 7.87 g/cm^3
 - A platinum wire glows red when heated.
 - An iron bar rusts.
 - Aluminum is a silver-colored metal.
 - The boiling point of water is 100°C .
11. Calculate the percent error for the following measurements:
- The density of an aluminum block determined in an experiment was 2.64 g/cm^3 . (True value 2.70 g/cm^3 .)
 - The experimental determination of iron in iron ore was 16.48%. (True value 16.12%.)
 - A balance measure the mass of a 1.000-g standard as 0.9981g.
12. Briefly describe the significance of the discoveries made by each of the following scientists:
- John Dalton
 - J.J. Thomson
 - Ernest Rutherford
 - Robert Millikan
13. How many protons, neutrons and electrons are in each of the following atoms or ions?
- $^{24}_{12}\text{Mg}$
 - $^{24}_{12}\text{Mg}^{2+}$
 - $^{59}_{27}\text{Co}^{2+}$
 - $^{59}_{27}\text{Co}^{3+}$
 - $^{59}_{27}\text{Co}$
 - $^{79}_{34}\text{Se}$
 - $^{79}_{34}\text{Se}^{2-}$
 - $^{63}_{28}\text{Ni}$
 - $^{59}_{28}\text{Ni}^{2+}$
14. Complete the following table.

Symbol	Number of Protons in Nucleus	Number of Neutrons in Nucleus	Number of Electrons	Net Charge
$^{53}_{26}\text{Fe}^{2+}$				
	26	33		3+
	85	125	86	
	13	14	10	
		76	54	2-

15. Name the following compounds:

- NaBr
- Rb₂O
- CaS
- AlI₃
- Hg₂O
- FeBr₃
- CoS
- TiCl₄
- CsF
- Ag₂S
- Li₃N
- MnO₂
- TiO₂
- Sr₃P₂
- BaSO₃
- NaNO₂
- KMnO₄
- K₂Cr₂O₇

16. Write the formulas for the following compounds:

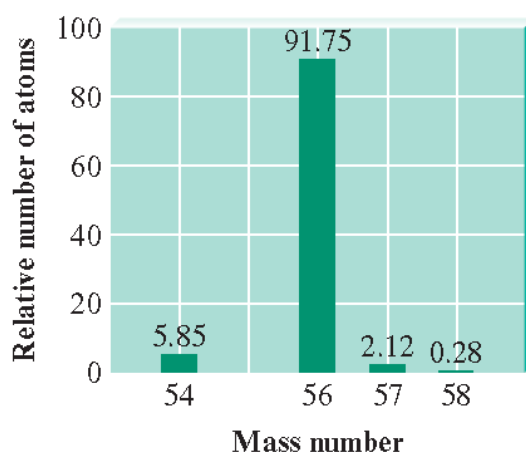
- | | |
|-------------------------|--------------------------------|
| a. Strontium fluoride | n. Silver iodide |
| b. Aluminum selenide | o. Sulfur hexafluoride |
| c. Potassium nitride | p. Sodium dihydrogen phosphate |
| d. Magnesium phosphide | q. Ammonium acetate |
| e. Tin(II) nitride | r. Potassium chlorate |
| f. Cobalt(III) iodide | s. Nickel(II) fluoride |
| g. Mercury(II) oxide | t. Ammonia |
| h. Chromium(VI) sulfide | u. Ammonium sulfite |
| i. Zinc chloride | v. Zinc sulfide |
| j. Tin(IV) fluoride | w. Nitrous acid |
| k. Calcium nitride | x. Copper(II) nitrate |
| l. Aluminum sulfide | y. Potassium cyanide |
| m. Mercury(I) selenide | z. Lead(IV) sulfide |

17. Assume silicon has three major isotopes in nature as shown in the table below. Fill in the missing information.

Isotope	Mass (u)	Abundance
^{28}Si	27.98	_____
^{29}Si	_____	4.70%
^{30}Si	29.97	3.09%

18. The element silver (Ag) has two naturally occurring isotopes: ^{109}Ag and ^{107}Ag with a mass of 106.905 amu. Silver consists of 51.82% ^{107}Ag and has an average atomic mass of 107.868 amu. Calculate the mass of ^{109}Ag .

19. The stable isotopes of iron are Fe-54, Fe-56, Fe-57 and Fe-58. The mass spectrum of iron is below:



Use the data on the mass spectrum to estimate the average atomic mass of iron, then compare it to the value given on the Periodic Table.

20. What is the number of phosphorus atoms present in 1.00g of calcium phosphate?
21. What is the number of nitrogen atoms present in 5.00g of magnesium nitride?

22. Arrange the following substances in order of increasing mass percent of carbon.
- Caffeine, $\text{C}_8\text{H}_{10}\text{N}_4\text{O}_2$
 - Sucrose, $\text{C}_{12}\text{H}_{22}\text{O}_{11}$
 - Ethanol, $\text{C}_2\text{H}_5\text{OH}$
23. Hemoglobin is the protein that transports oxygen in mammals. Hemoglobin is 0.347% Fe by mass, and each hemoglobin molecule contains four iron atoms. Calculate the molar mass of hemoglobin.
24. Determine the molecular formula of a compound that contains 26.7% P, 12.1% N and 61.2% Cl, and has a molar mass of 580 g/mol.
25. Maleic acid is an organic compound composed of 41.39% C, 3.47% H and the rest oxygen. If 0.129 mole of maleic acid has a mass of 15.0g, what are the empirical and molecular formulas of maleic acid?
26. Write the balanced equation for each of the following:
- The combustion of ethanol ($\text{C}_2\text{H}_5\text{OH}$) forms carbon dioxide and water vapor.
 - Aqueous solution of lead(II) nitrate and sodium phosphate are mixed, resulting in the precipitate formation of lead(II) phosphate with aqueous sodium nitrate.
 - Solid zinc reacts with aqueous hydrochloric acid to form aqueous zinc chloride and hydrogen gas.
 - Aqueous strontium hydroxide reacts with aqueous hydrobromic acid to produce water and aqueous strontium bromide.
27. The space shuttle environmental control system handles excess carbon dioxide (which the astronauts breathe out; it is 4.0% by mass of exhaled air) by reacting it with lithium hydroxide pellets to form lithium carbonate and water. If there are seven astronauts on board the shuttle, and each exhales 20.L of air per minute, how long, in hours, could clean air be generated if there were 25,000 g of lithium hydroxide pellets available for each shuttle mission? Assume the density of air is 1.0×10^{-3} g/mL.
28. Consider the following unbalanced reaction: $\text{P}_4(\text{s}) + \text{F}_2(\text{g}) \rightarrow \text{PF}_3(\text{g})$
What mass of F_2 is needed to produce 120.g of PF_3 if the reaction has a 78.1% yield?
29. Commercial brass, an alloy of zinc and copper, reacts with hydrochloric acid to produce zinc chloride and hydrogen gas (note: copper does not react with hydrochloric acid). When 0.5065g of a certain brass alloy is reacted with excess hydrochloric acid, 0.0985g of zinc chloride is produced. What is the percent composition of the brass by mass?
30. Calculate the concentration of all ions present in each of the following solutions of strong electrolytes.
- 5.00g of ammonium chloride in 500.0 mL of solution
 - 1.00g of potassium phosphate in 250.0 mL of solution
 - 1.50g of potassium chloride in 0.500 L of solution
 - 132g of ammonium sulfate in 1.50 L of solution
31. If 10.0 g of silver nitrate is available, what volume of 0.25M solution can be prepared?
32. A solution was prepared by mixing 50.00 mL of 0.100M nitric acid and 100.00 mL of 0.200M nitric acid. Calculate the molarity of the final solution.
33. What volume (in mL) of 0.100M sodium phosphate is required to precipitate all the lead(II) ions from 150.0 mL of 0.250M lead(II) nitrate?
34. What mass, in grams, of silver chloride can be prepared by the reaction of 100.0 mL of 0.20M silver nitrate with 100.0 mL of 0.15M calcium chloride?
35. What are the postulates of the Kinetic Molecular Theory?
36. Consider the following chemical equation: $2\text{NO}_2(\text{g}) \rightarrow \text{N}_2\text{O}_4(\text{g})$
If 25.0 mL NO_2 gas is completely converted to N_2O_4 gas under the same conditions, what volume will the N_2O_4 occupy?

37. The average lung capacity of a human is 6.0 L. How many moles of air are in your lungs when you are at the top of Mount Everest where the temperature is -73°C and the atmospheric pressure is 0.296 atm?
38. A student adds 4.00g of dry ice (solid carbon dioxide) to an empty balloon. What will be the volume (in liters) of the balloon at STP after all the dry ice sublimates (converts to gaseous carbon dioxide)?
39. Helium is collected over water at 25°C and 1.00 atm total pressure. What total volume (in L) of gas must be collected to obtain 0.586g of Helium? (At 25°C the vapor pressure of water is 23.8 torr.)
40. A compound has the empirical formula CHCl . A 256-mL flask, at 373K and 750.torr, contains 0.800g of the gaseous compound. Determine the molecular formula.
41. A 5.0-L flask contains 0.60g of oxygen gas at a temperature of 22°C . What is the pressure (in atm) inside the flask?
42. An ideal gas at 7°C is in a spherical flexible container with a radius of 1.00 cm. The gas is heated at a constant pressure to 88°C . Determine the radius (in cm) of the spherical container after the gas is heated. (Volume of a sphere = $\frac{4}{3}\pi r^3$)
43. The specific heat capacity of silver is $0.24 \text{ J}/^{\circ}\text{C}\cdot\text{g}$.
 - a. Calculate the energy (in Joules) required to raise the temperature of 150.0g of Ag from 273K to 298K.
 - b. It takes 1.25 kJ of energy to heat a sample of pure silver from 12.0°C to 15.2°C . Calculate the mass of the sample of silver.
44. A biology experiment requires the preparation of a water bath at 37.0°C . The temperature of the cold tap water is 22.0°C , and the temperature of the hot tap water is 55.0°C . If a student starts with 90.0g cold water, what mass of hot water must be added to reach 37.0°C ?
45. A 110.-g sample of copper (specific heat capacity = $0.20 \text{ J}/^{\circ}\text{C}\cdot\text{g}$) is heated to 82.4°C and then placed in a container of water at 22.3°C . The final temperature of the water and copper is 24.9°C . What is the mass of the water in the container, assuming that all the heat lost by the copper is gained by the water?
46. Define each of the following:
 - a. Arrhenius acid
 - b. Bronsted-Lowry acid
 - c. Lewis acid
47. Calculate $[\text{H}^+]$ and $[\text{OH}^-]$ for each solution at 25°C . Identify each solution as neutral, acidic, or basic.
 - a. $\text{pH} = 7.40$
 - b. $\text{pH} = 10.3$
 - c. $\text{pH} = 3.20$
 - d. $\text{pOH} = 5.0$
 - e. $\text{pOH} = 9.60$
48. The pOH of a sample of baking soda dissolved in water is 5.74 at 25°C . Calculate the pH , $[\text{H}^+]$ and $[\text{OH}^-]$ for this sample. Is the solution acidic or basic?
49. Write the full electron configuration for:
 - a. Sr^{2+}
 - b. N
 - c. Ag^+
 - d. Ti
 - e. Cr^{3+}
50. For each of the following groups, place the atoms and/or ions in order of decreasing size.
 - a. Ni^{2+} , Pd^{2+} , Pt^{2+}
 - b. Te^{2-} , I, Cs^+ , Ba^{2+}
 - c. O^{2-} , S^{2-} , Se^{2-} , Te^{2-}

51. Draw Lewis structures for each of the following molecules and predict the molecular geometry/shape using the VSEPR theory:

- CO_2
- HCN
- ClO_4^-
- NH_3
- PO_3^{3-}

52. A photon of ultraviolet (UV) light possesses enough energy to mutate a strand of human DNA. What is the energy of a single UV photon having a wavelength of 25 nm?

53. Electromagnetic radiation type A has a frequency of 107.1 MHz, type B has a wavelength of 2.12×10^{-10} m, and type C of electromagnetic radiation has photons with energy equal to 3.97×10^{-19} J/photon. Identify each type of electromagnetic radiation and place them in order of increasing photon energy and increasing frequency. You may refer to the diagram below.

