AP Chemistry Study Guide: Unit 0 and 1

Please answer the following on a separate sheet of paper.

1. Classify the following as either *chemical* or *physical* changes.

    a. Ice melting

    b. Gasoline burning

    c. Evaporation of perfume from an open bottle

2. Mercury is a liquid metal that has a density of 13.58 g/mL. Calculate the volume of mercury that must be poured out in order to obtain 0.5000 g of mercury.

3. Convert these numbers to scientific notation.

    a. 350000000000000

    b. 0.00000000821

4. Round the following numbers to four figures.

    a. 4.000474×10^6

    b. 3.682417

    c. 7.2518

5. Use dimensional analysis to perform the following conversions.

    a. 0.75 kg to mg

    b. 0.52 nm to km

6. Suppose an experiment is performed in which the molar mass of a gas is found to be 48.45 g mol^{-1}. The actual value is 52.9 g mol^{-1}. Calculate the percent error.

7. Consider the following pairs. Does either pair represent a pair of isotopes? ***Explain***.

    a. $^{23}_{11}Na$ and $^{23}_{11}Na$

    b. $^{24}_{11}Na$ and $^{24}_{12}Mg$

8. Determine the number of protons, electrons and neutrons in each of the following isotopes.

    a. $^{171}_{79}Au$

    b. $^{79}_{35}Br^-$

9. Give the missing formula or name.

Formula	Name
Pb_3N_2	
SF_6	
$(NH_4)_2CO_3$	

	Phosphorus pentachloride
	Potassium hydrogen carbonate
	Iron(III) oxide

10. A 52.00-g sample of a hydrocarbon (a compound that contains the elements hydrogen and carbon) was analyzed and found to contain 43.74 g of carbon.
    a. How many grams of hydrogen are present in this sample?
    b. Determine the percentage composition for each element in this compound.
    c. How many grams of each element are present in a 31.00-g sample?
    d. Determine the empirical formula for this compound.
    e. The molar mass of this compound is 114 g mol^{-1}. Determine the molecular formula for this compound.

11. How many atoms of hydrogen are in 32.59 g of water?

12. An electron moves from energy level 5 to level 3 in an atom of hydrogen.
    a. Is energy absorbed or released?
    b. Calculate the energy per photon associated with this transition.
    c. Calculate the energy of one mole of these photons.
    d. Determine the frequency and wavelength (in nm) of one photon of this light.

13. Give full **and** noble gas core method (condensed) electron configurations for the following.
    a. Br
    b. Cr
    c. S^{2-}

14. For each of the following sets, indicate which is **higher** in energy.
    a. 1s, 2s
    b. 2p, 3p
    c. 4s, 3d$_{yz}$
    d. 3p$_x$, 3p$_y$, 3p$_z$

15. An **atom** has two electrons in (n) = 1, eight electrons in (n) = 2 and seven electrons in (n) = 3. From this data, supply the following values (if insufficient information is given, say so).
    a. Mass number
    b. Atomic number
    c. Electron configuration

16. Identify the element from the electron configurations of **atoms** shown below.
    a. [Ne] 3s^{2}3p^2
    b. [Ar] 4s^{2}3d^7
    c. [Xe] 6s^2

17. Give the symbol of the atom or ion represented by the following sets of atomic numbers and electron configurations.
    a. 8, 1s^{2}2s^{2}2p^4
    b. 11, 1s^{2}2s^{2}2p^6
    c. 17, 1s^{2}2s^{2}2p^{6}3s^{2}3p^6
    d. 22, 1s^{2}2s^{2}2p^{6}3s^{2}3p^{6}3d^2

18. Give the electron configurations of the following transition metal ions.
    a. Sc^{3+}
    b. Cr^{2+}
    c. Ni^{3+}

19. Complete the following table.

Element	Charge on most common ion
Rb	
Cs	
Ga	
At	
Se	

20. Define ionization energy.

21. Using the metal magnesium as an example, write *two* separate equations to show the first and second ionization processes of magnesium.

22. Which of the following elements (one from each pair) would you expect to have the highest first ionization energy? Explain your answer.
    a. Ca or Be?
    b. Na or Ar?

23. Consider the table of the first four ionization energies for element A shown below.

Ionization Energy in kJ mol^{-1}	1st	2nd	3rd	4th
	578	1817	2745	11580

    a. In which group does element A appear on the periodic table?
    b. Predict the formula of the compound that A forms with fluorine.
    c. What is the minimum number of electrons that A must have?

24. Arrange the following species in order of *increasing* size: Rb^+, Y^{3+}, Br^-, Kr, Sr^{2+} and Se^{2-}.

25. Are there any atoms for which the second ionization energy is greater than the first? Explain.

26. Is it possible for two different *atoms* to be isoelectronic?

27. Is it possible for two different *anions* to be isoelectronic?

28. Define electron affinity.

29. Write an equation to summarize the process of *second* electron affinity of oxygen.

30. Consider the table of ionization energies for element X shown below.

Ionization Energy in kJ/mol	1st	2nd	3rd	4th	5th	6th
	737	1450	7732	10540	13360	17995

     a. In which group will X be found?
     b. Explain your answer to 'a' above.
     c. Predict the formula of X's bromide salt.

31. *Explain* carefully why rubidium tends to form only a +1 ion.

32. *Explain* carefully why elements in the same group react in similar ways.

33. How would you expect the sizes of the hydrogen ion, H^+, and the hydride ion, H^-, to compare with that of the hydrogen atom?

34. How would you expect the sizes of the hydrogen ion, H^+, and the hydride ion, H^-, to compare to that of the helium atom?

35. Identify any isoelectronic species in the this list: Fe^{2+}, Sc^{3+}, Ca^{2+}, F^-, Co^{2+}, Co^{3+}, Sr^{2+}, Cu^+, Zn^{2+} and Al^{3+}.

36. Arrange the following atoms into order of ***increasing*** first ionization energy: Sr, Cs, S, F and As.

37. What do you understand by the term, "shielding?"

38. A hydrate of lithium perchlorate is dehydrated. Use the following data to determine the percent of water in the hydrate and the empirical formula:

Item	Mass (g)
Crucible and lid	32.97 g
Crucible and hydrated compound	40.18 g
Crucible and dehydrated compound after 1st heating	37.76 g
Crucible and dehydrated compound after 1st heating	37.75 g