

AP Chemistry Summer Work 2023

Questions during the summer email cheryl.pierce@polk-fl.net

Bring completed summer packet first day of school.

Unit 1.1 - Molar Mass Calculations

1. Use the AP periodic table to calculate the molar mass to 2 decimal places for the following compounds. Include units (g/mol).



2. Use the molar mass for the compound or Avogadro's number to solve the problems below. You must show the bracket set up for each. Include units.

$$\begin{array}{l} \text{Avogadro's \#}: \quad 1 \text{ mole} = 6.02 \times 10^{23} \text{ molecules} \\ \quad \quad \quad \quad 1 \text{ mole} = 6.02 \times 10^{23} \text{ atoms} \end{array}$$

(a) What is the mass in grams of 0.172 moles of NaHCO_3 ?

(b) How many moles of CdBr_2 are in a 39.25 gram sample of CdBr_2 ?

(c) How many molecules of aluminum oxide are in 0.58 moles of Al_2O_3 ?

(d) How many atoms of cobalt are in a 0.39 mole sample of $\text{Co}(\text{C}_2\text{H}_3\text{O}_2)_3$?

Unit 1.2 Mass Spectroscopy - calculate average atomic mass for an element from either data or graph

Watch the video from the 2 minute mark: <https://youtu.be/mBT73Pesiog>

Example: A sample of hydrogen contains three isotopes: hydrogen-1, hydrogen-2 and hydrogen-3. When the hydrogen sample is analyzed using a mass spectrometer the following data is obtained:

Isotope Mass	Percent
H-1	99%
H-2	0.80%
H-3	0.20%

$$\text{Atomic Mass} = (\text{mass 1})(\%/100) + (\text{mass 2})(\%/100) + (\text{mass 3})(\%/100) \dots$$

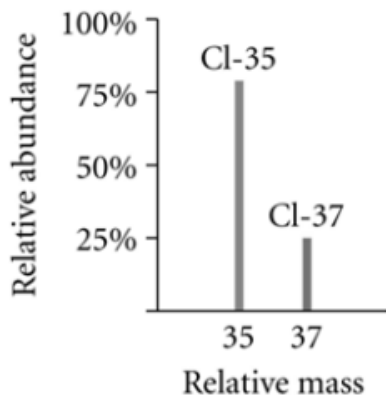
$$\text{Atomic Mass} = 1(0.99) + 2(0.0080) + 3(0.0020) = 1.012$$

1. Calculate the average atomic mass of magnesium using the following data for three magnesium isotopes.

Isotope Mass	Percent
23.985	78.70%
24.986	10.13%
25.983	11.17%

Atomic Mass =

2. Calculate the average atomic mass for Cl using the graph.



Unit 1.3-Percent composition, by mass, of an element in a compound

<https://youtu.be/Snnt0CpkWSM>

Example:

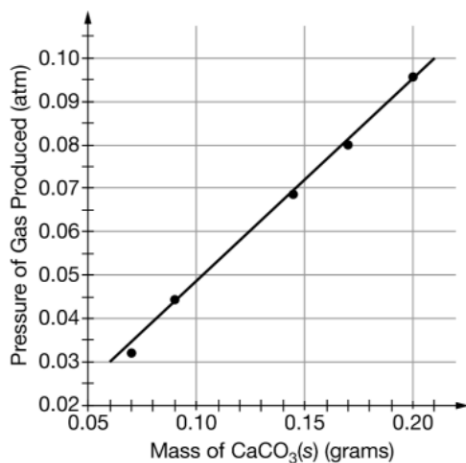
% Composition of O in $\text{CO}_2 = 2(16.00) / 44.01 \times 100 = 72.71\% \text{ O}$

1. What is the percent composition of oxygen in $\text{Al}(\text{OH})_3$?
2. What is the percent composition of carbon in soap, $\text{C}_{17}\text{H}_{35}\text{COONa}$?
3. A strip of pure copper, mass 7.546 g, is heated with oxygen to form a compound of copper and oxygen, mass 9.433 g. What is the percent composition of the compound? (Find percent by mass for copper and percent for oxygen).
4. Calcium dihydrogen phosphate is an important fertilizer. What is the percent phosphorus in $\text{Ca}(\text{H}_2\text{PO}_4)_2$?

Unit 1.4-Composition of Mixtures

1. A mixture of gases contains 23.5 g CO₂, 16.28 g H₂O vapor and 3.5 g H₂. Calculate the percent H₂ in the mixture.

2. An experiment is performed to measure the percent by mass of CaCO_{3(s)} in eggshells. The CaCO_{3(s)} is reacted with aqueous HCl in a sealed container.



Mass of eggshell sample	0.200 g
Pressure prior to reaction	0.800 atm
Pressure at completion of reaction	0.870 atm

The percent by mass of CaCO_{3(s)} in the eggshell sample is closest to:

- (a) 30% (b) 45% (c) 60% (d) 75%

3.

1	2	3	4
Total mass of sample (g)	Mass of C in sample (g)	Mass of Mg in sample (g)	Mass of Ca in sample (g)
98.5	12.0	2.4	36.1

A sample of carbonate rock is a mixture of CaCO₃ and MgCO₃. The rock is analyzed in a laboratory, and the results are recorded in the table above. What is the mole ratio of Ca to Mg in the rock?

Unit 1.5-Atomic Particles & Electron Configuration

Questions 1-3

- (A) $1s^2 2s^2 2p^6 3s^2 3p^6 4s^2$ (B) $1s^2 2s^2 2p^6 3s^2 3p^4$ (C) $1s^2 2s^2 2p^6 3s^2 3p^6 3d^{10}$
(D) $1s^2 2s^2 2p^6 3s^2 3p^5$ (E) $1s^2 2s^2 2p^6$

- _____ 1. The electron configuration of a nitride (N^{-3}) ion.
_____ 2. The electron configuration of an atom with two unpaired electrons.
_____ 3. The electron configuration of a Zn^{+2} ion.
_____ 4. Which of the following lists includes only species that are isoelectric (same electron configuration) with one another?
I. Ca^{+1} , Na^{+1} , Al^{+1} II. Ca^{+2} , Ar, K^{+1} III. S^{-2} , Cl^{-1} , P^{-3}
(A) I only (B) II only (C) III only (D) II and III only (E) I, II and III

5. Give the electron configuration for the following atoms:

- a. Mg b. Rb
c. I d. Ba
e. As f. Kr

6. Give the electron configuration for the following ions:

- a. Mg^{+2} b. Rb^{+1}
c. I^{-1} d. Sr^{+2}

7. Draw the orbital notation (arrows) for the following elements:

- a. I b. Ca
c. Ag d. As

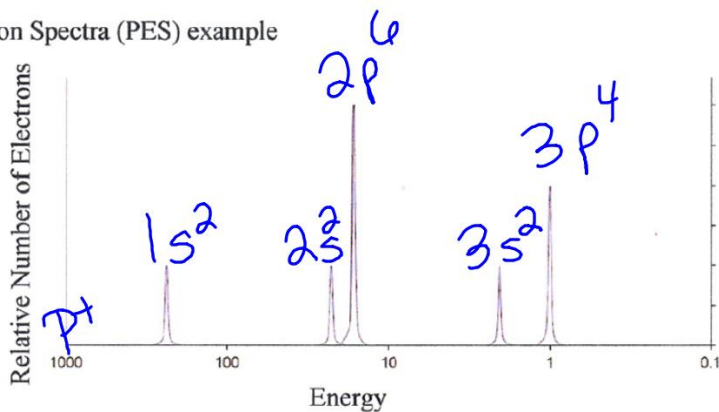
8. Draw the electron dot diagram for:

- a. Mg b. Se d. Sr e. C

Unit 1.6-PhotoElectron Spectra (PES) Graphs & electron configuration

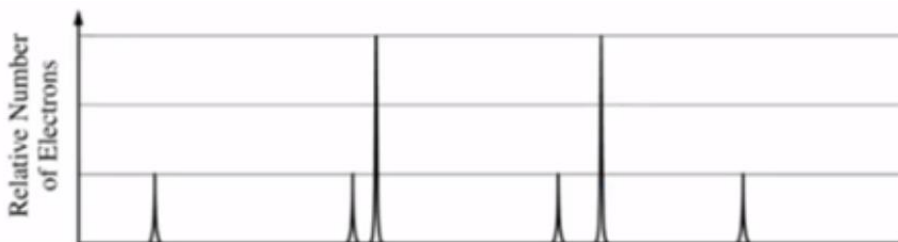
<https://www.youtube.com/watch?v=gyKD6QULa0A>

Photo Electron Spectra (PES) example

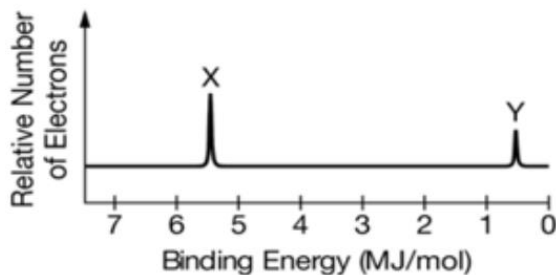


Answer the following questions about the PES graph above.

1. Electrons in which orbital require the most energy to remove?
2. Why are the peaks for 1s, 2s and 3s the same height?
3. Why is the 2p peak higher than the 2s peak in the graph?
4. Identify the element identified by the PES graph?
5. Identify the element represented in the PES graph below.



6. The PES graph of an element is given below.

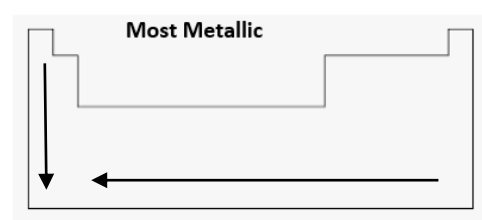
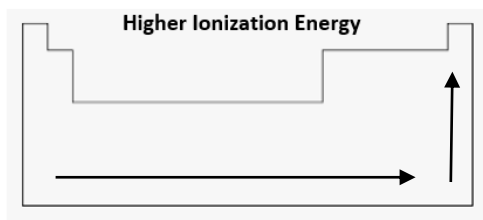
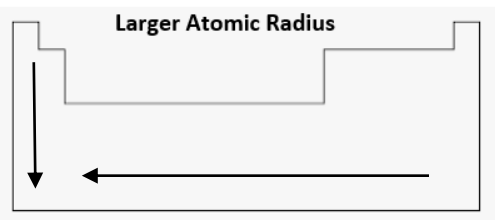


_____ Which labelled peak corresponds to the 1s electron and why?

- (a) Peak X, because 1s electrons are easier to remove from the atom.
- (b) Peak X, because 1s electrons have the strongest attractions to the nucleus.
- (c) Peak Y, because electrons in the 1s sublevel are the farthest from the nucleus.
- (d) Peak Y, because there are fewer electrons in an s sublevel than in a p sublevel.

Unit 1.7-Periodic Trends-Atomic Radius, Ionization Energy, Nuclear Charge & Electron Affinity

<https://www.youtube.com/watch?v=hePb00CqvP0>



1. Consider these elements:

Al Si P S

- which is the most metallic?
- least metallic?
- highest ionization energy?
- largest atomic radius?
- which are nonmetals?
- which lose e^- to reach an octet?
- which would form anions?
- which would form cations?

2. Consider these elements:

Mg Ca Sr Ba

- name given to this group of elements?
- would ions be cations or anions?
- which are nonmetals?
- list from small to large atom
- gain or lose electrons to form ion?
- ion larger or smaller than atom?

3. Name the element found in:

- Group 1, period 4
- Group 13, period 3
- Group 16, period 3
- Group 2, period 6

4. Name the element group found:

- in Groups 3-12
- in the “d” block
- in Group 18
- along the zig zag line

Unit 1.8-Ions & Ionic Compounds

1. Give the ion formula and charge for the following ions:

- (a) Ba (b) I (c) Al (d) N
- (g) chromium III (h) tin IV (i) Zn (j) Ag

2. Give the formula for the compounds formed between:

- a. Ba and O b. K and SO_3
- c. Cr^{+3} and O d. Zn and Cl

3. Name the following:

- a. AlCl_3 b. Na_2CO_3
- c. CuO d. KMnO_4

4. Give the correct formula for the following compounds:

- a. potassium iodide b. iron II sulfide
- c. ammonium phosphate d. chromium III hydroxide

5. Give the short electron configuration for:

- a. Cl^{-1} b. Ba^{+2}
- c. Se^{-2} d. N^{-3}
- e. Fe^{+2} f. Cu^{+1}
- g. Sr^{+2} h. S^{-2}