

AP Chemistry Review Packet

2019-2020

Mr. Coe C205

Conversions, Significant Figures & Observations

- How many significant figures are there in the following:
a) 1,092,000 b) 0.0024020 c) 500.
- Solve the following & report your answer in correct sig figs:
a) $1.490 + 9.23421$ b) $7.34 / 13.208$ c) $(3.4 \times 10^2) \times (1.87 \times 10^{14})$
- Convert the following:
a) 8.12 pL to L b) 92.63 hg to Gg c) 69.30 dm to km
- Give examples of quantitative & qualitative observations.

Structure of the Atom

- Draw the atom. Label the nucleus and the electron cloud.
- Describe what is at the center of the atom. Is it large or small, heavy or light? What particles are inside?
- Describe what is part outside of the nucleus of an atom. Is it large or small, heavy or light? What particles are inside?

Development of the Atom

- What was Democritus' contribution to developing the atom?
- What 2 parts of Dalton's modern atomic theory were incorrect? Why?
- What was Thomson's contribution to atomic theory? What was his experiment? What was his theory known as?
- What was Rutherford's contribution to atomic theory? What was his experiment? What two things did he conclude about the atom?

Protons, Neutrons and Electrons

- Which particle do you change to get a new atom? _____
- Which particle do you change to get a new isotope? _____
- Which particle do you change to get a new ion? _____
- Fill in the chart:

Atomic #	Mass #	p ⁺	n ⁰	e ⁻	Charge	Nuclear Symbol
20	42				0	
		17	19		-1	
12			12	10		
83	209				0	
	15	7			-3	

Average Atomic Mass

- 1) What is the most abundance isotope of:
a) Aluminum b) Xenon c) Mercury
- 2) Calculate the average atomic mass of unknown element Y when:
Isotope ^{24}Y has a mass of 24.012 amu and is 86% abundant
Isotope ^{23}Y has a mass of 22.991 amu and is 12% abundant
Isotope ^{22}Y has a mass of 21.008 amu and is 2% abundant

- 3) What is the unknown element (M) with the given isotopic info in the table?

Isotope	Abundance
^{16}M	99.762%
^{17}M	0.038%
^{18}M	0.200%

Radioactive particles

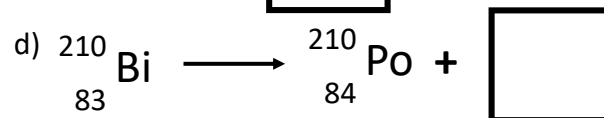
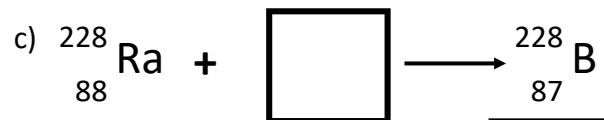
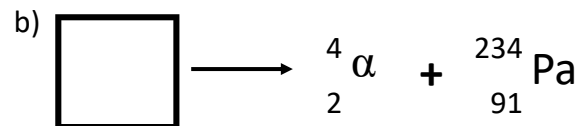
- 1) Describe each of the five radioactive decays. (Include symbol, what they're made of, charge, penetrating power, magnetic attraction)
 - a) alpha
 - b) beta
 - c) gamma
 - d) positron
 - e) electron

Nuclear Stability & Half Life

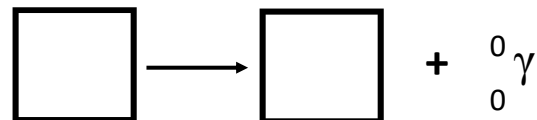
- 1) What is the force holding the nucleus together?
- 2) What ratio determines nuclei stability?
- 3) Determine if the following atoms are stable:
a) Calcium-45 b) Lead-208 c) Iron-56
- 4) Compare & Contrast between nuclear fission and fusion.
- 5) A sample of radioactive material has a half-life of 10 mins. How much of a 200 g sample will remain after 120 mins?
- 6) After 180 days, only 12.5% of a sample remains. What is the half life of the sample?

Nuclear Reactions

- 1) Find the missing piece in the following reaction:



daughter nuclide undergoes gamma radiation



Atomic Spectra

- 1) Describe Bohr's Theory of the atom.
- 2) How do electron movements in the atom create colored spectral lines?
- 3) How can scientists determine the composition of stars?
- 4) a) What are the seven colors of the rainbow?
b) Label the colors with the type of energy and frequency (high or low).
c) Label the colors with short or long wavelength.
- 5) Would a wave with high energy have short or long wavelength?

Orbital Diagrams & Quantum Numbers

- 1) Briefly describe the rules for filling in orbital diagrams.
- 2) a) What is the shape of an s orbital?
b) What is the shape of the three p orbitals?
- 3) What do the quantum numbers (n, l, m, & s) represent?
- 4) What is the orbital diagram for:
a) Rb b) P c) Mo d) Np
- 5) What are the quantum numbers for the 15th electron in Chlorine?
- 6) What element's last electron has the quantum numbers:
a) $n = 4, l = 1, m = 0, s = -1/2$
b) $n = 2, l = 2, m = +1, s = -1/2$

Wavelength, Frequency & Energy Calculations

- 1) Convert 102.7 MHz to Hz.
- 2) Convert 3.15×10^{19} J to kJ.
- 3) Convert 750 nm to m.
- 4) a) What is the wavelength (λ) of a wave when $\nu = 3.19 \times 10^8$ MHz?

b) What is the energy of the wave?
- 5) a) What is the frequency (ν) of a wave with a wavelength of 482 nm?

b) What is the energy of the wave in kJ?
- 6) What is the wavelength (λ) of a wave with an energy of 4.25×10^{-19} J?
- 7) What is the frequency (ν) of a wave with an energy of 5.65×10^{-19} J?

Electron Configurations

- 1) What is the electron configuration for the following:
a) Rb
b) P
c) Mo
d) Np
- 2) Why do some atoms steal electrons from s orbitals?
- 3) Which elements are known as stealers?
- 4) What do the following represent in $3p^5$?
a) "3" represents: _____
b) "p" represents: _____
c) "5" represents: _____

Noble Gas Notation, Lewis Dot Diagrams & Oxidation Numbers

- 1) What is the noble gas notation for the following:
 - a) Rb
 - b) P
 - c) Mo
 - d) Np
- 2) What is the Lewis Dot Diagrams & oxidation numbers for the atoms in the question above?
- 3) Why do elements gain or lose valence electrons?
- 4) All elements want _____ valence electrons, except _____ and _____ which only want _____.
- 5) A cation is:
- 6) An anion is:

Valence Electrons, Oxidation Numbers & Ending Configurations

- 1) Lactinides have _____ valence electrons and therefore have an oxidation number of _____.
- 2) How many valence electrons do most noble gases have? _____
- 3) What is the oxidation number of all alkaline earth metals? _____
- 4) What is the energy level and sublevel of all actinides? _____
- 5) What is the ending electron configuration of:
 - a) K _____
 - b) Se _____
 - c) Os _____
 - d) Ta _____
 - e) Cu _____
 - f) Ba _____
- 6) What element has the following ending electron configuration:
 - a) $5s^2$ _____
 - b) $3p^3$ _____
 - c) $5d^2$ _____
 - d) $4d^7$ _____
 - e) $4s^1 3d^5$ _____
 - f) $1s^2$ _____
- 7) What elements are liquids at room temperature?
- 8) What elements are gases at room temperature?
- 9) Categorize all elements in Group 13 as nonmetal, metalloid or metal

Periodic Table—History & Organization

- 1) a) How did Mendeleev create his periodic table?

b) What was Mendeleev's fault? How was it fixed and by who?

c) Why did Mendeleev leave gaps in his design?
- 2) Which element is in Group 13, Period 5? _____
- 3) Which element is in Group 5B, Period 6? _____
- 4) Which element is the 3rd period halogen? _____
- 5) Where are the Lactinides?
- 6) What are the elements on the staircase?
- 7) What are some properties of nonmetals?

Atomic Radius Trend & Ionic Radius

- 1) Atomic radius _____ going down a group because:
- 2) Atomic radius _____ going from right to left across a period because:
- 3) Put the following elements in order from smallest radius to largest radius: Si, O, Cs, Sr, He. Justify your answer.
- 4) _____ is the largest atom on the periodic table.
- 5) Cations are _____ than neutral atoms while anions are _____ than neutral atoms.
- 6) Put the following in order from largest radius to smallest: Br^{-1} , Rb^{+1} , Sr^{+2} , Kr, Se^{-2} . Justify your answer.

Ionization Energy & Multiple Ionization Energies

- 1) Ionization energy _____ going up a group because:
- 2) Ionization energy _____ going from left to right across a period because:
- 3) _____ is the atom that requires the most energy to remove a valence electron.
- 4) Put the following elements in order from smallest IE to largest: Si, O, Cs, Sr, He. Justify your answer.
- 5) Which would require more energy: removing the 4th valence electron in Carbon or the 2nd valence electron in Lithium? Justify your answer.

Electronegativity Trend

- 1) Electronegativity _____ going up a group because:
- 2) Electronegativity _____ going left to right across a period because:
- 3) _____ is the atom who's nucleus has the highest attraction to shared electrons in a bond.
- 4) Put the following elements in order from highest electronegativity to lowest: Si, O, Cs, Sr, Ne. Justify your answer.
- 5) Why aren't noble gases included in the electronegativity trend?

Electron Affinity Trend

- 1) Electron Affinity is _____ going up a group.
- 2) Electron Affinity is _____ going left to right across a period.
- 3) _____ is the atom that has the most negative energy change to add a valence electron to it.
- 4) Put the following elements in order from most negative to least negative Si, O, Cs, Sr, Ne.
- 5) Why aren't noble gases included in the electron affinity trend?

Fireworks Article, Flame Test Lab & Periodic Trends Lab

- 1) Describe how you determined the metallic solutions in the mixtures in the flame test lab.
- 2) Metallic activity _____ going down a group because:
- 3) Metallic activity _____ going from right to left across a period because:
- 4) _____ is the most active metal on the whole periodic table.
- 5) Describe how Fireworks' colors are made.

Metallic Bonding

- 1) Explain delocalized electrons.
- 2) Why are metals malleable and ductile?
- 3) Why are metals good conductors of electricity in the solid state?
- 4) What are alloys? Why are they important? Name common ones.
- 5) Draw a picture of a metallic substance on a molecular level.

Polyatomic Ions & Acids

- 1) What is a polyatomic ion?
- 2) Name 8 polyatomic ions and their formulas:
- 3) Name 7 acids that are ionically bonded.
(Drop and swap H^+ and the polyatomic or ion)
- 4) Draw the electron movement to determine the formula when
 - a) Aluminum
 - b) Sodium & Sulfur bond& Oxygen bond

Ionic Bonding

- 1) Differentiate between an ionic compound & a formula unit.
- 2) How are ionic bonds held together?
- 3) Ionic compounds can be found in the _____ state, typically in a _____ structure.
- 4) What do ionic compounds have high melting/boiling points but are considered brittle?
- 5) Describe ionic compounds conductivity capabilities in solid, liquid and aqueous form.

Naming & Formula Writing

- 1) True or False Nonmetals/Anions go first when naming.
- 2) True or False Polyatomic ion names are never changed.
- 3) True or False Nonmetal elements names are changed to -ide.
- 4) True or False Ionic compounds can never be neutral.
- 5) True or False Always simplify ionic compound subscripts.
- 6) True or False Roman numerals ONLY for transition metals, Sn & Pb.
- 7) Name the following:

a) K_2O	d) FeO	g) H_2SO_4
b) NH_4OH	e) $ZnSO_4$	h) HCl
c) Cu_2O	f) Ca_3PO_4	i) $NaBr$
- 8) Determine the formula for the following:

a) phosphoric acid	f) lithium hydroxide
b) magnesium hydroxide	g) barium sulfate
c) copper (I) nitrate	h) silver (I) nitrate
d) ammonium cyanide	i) lead (IV) sulfide
e) hydrofluoric acid	j) nitric acid

Covalent Properties, Naming & Formula Writing

- 1) Describe covalent molecular compounds conductive capabilities.
- 2) True or False The first nonmetal always needs a prefix.
- 3) True or False The prefix for 7 is septa-.
- 4) True or False Phosphorus is a diatomic.
- 5) True or False The second nonmetal's ending changes to -ide.
- 6) True or False If an element starts with a vowel the "a" in the prefix is dropped, but never the "i".
- 7) Name the following:
 - a) P_2O_5
 - c) Cl_3O
 - e) H_2
 - b) N_2
 - d) O_7Cl_{10}
 - f) SF_6
- 8) Determine the formula for the following:
 - a) silicon tetraiodide
 - d) fluorine gas
 - b) pentanitrogen heptabromide
 - e) nitrogen trichloride
 - c) oxygen gas
 - f) dihydrogen monosulfide

Polarity & Intermolecular Forces

- 1) Determine the polarity & IMF, then draw the IMF of the following:
 - a) H_2O
 - c) SeS_3
 - e) $NHCl_2$
 - b) PH_3
 - d) CCl_4
 - f) CO
- 2) Why is Dipole-Dipole stronger than London Dispersion Forces?
- 3) Substances that experience London Dispersion Forces are typically found in the _____ state, where dipole-dipole substances are typically found in the _____ state.
- 4) Why is Hydrogen Bonding the strongest IMF?

Lewis Dot Structures, VSEPR & Molecular Shapes

- 1) Determine the number of dots then draw the Lewis Dot Structure & line structure for the following.
 - a) H_2S
 - c) SeO_3
 - e) HCN
 - b) PH_3
 - d) CF_4
 - f) H_2O
- 2) What does VSEPR stand for and why is it important?
- 3) Determine the molecular shape and draw the 3D molecule of the molecules in #1.

Three Types of Bonding

- 1) What's the octet rule?
- 2) Why don't noble gases typically bond?
- 3) Which of the following is an ionic compound with covalent bonds?
 - a) $CuCl_2$
 - b) Brass
 - c) $CaSO_4$
- 4) Fill in the table:

	How the e^- act	Types of Elements	
Metallic			
Ionic			
Covalent			