

NAME _____

F2014/CHEM1301/Exam 5/Dooley

12/03/2014

Multiple Choice: (3 Pts Each) Write the letter corresponding to the correct answer in the blank to the left of the problem number.

- _____1. The speed of light (the speed light travels from its source) is:
- Slower if the wavelength of light is shorter. (Blue light is slower than red light)
 - Slower if the wavelength of light is longer. (Red light is slower than blue light)
 - The same for all light regardless of wavelength
 - Decreasing as the photon travels further from its source.
 - None of the above
- _____2. The wavelength of a light wave is defined as:
- The number of photons in a mole.
 - the distance between two peaks on the wave.
 - The number of peaks that pass a point in one second.
 - The speed that the light is travelling towards you.
 - The distance that light travels in one hour.
- _____3. What idea about the energy of an electron in an atom comes from the Bohr Model of the atom and is still used in the quantum mechanical model?
- An electron can have any amount of energy.
 - The energy of an electron cannot change when light is absorbed or emitted
 - An electron's energy is defined by which orbit the electron is in, and the energies of the orbits are quantized.
 - Sometimes, electrons turn into protons and are emitted from the atom as light
 - none of the above
- _____4. The principle quantum number (n):
- specifies the 3-D shape of the orbital.
 - specifies the size of the orbital.
 - determines the subshell of the orbital.
 - specifies how many electrons an orbital can contain.
 - none of the above
- _____5. An orbital is
- a path that the electron takes while orbiting the nucleus
 - always the same shape no matter the quantum numbers
 - a 3-D volume where you have a 90% chance of finding an electron
 - always the same size, no matter the quantum numbers.
 - none of the above

- _____6. The $n=$ _____ principal shell is the lowest that may contain a d-subshell.
- a) 1
 - b) 2
 - c) 3
 - d) 4
 - e) not enough information
- _____7. Which statement is NOT true about “p” orbitals?
- a) A “p”subshell contains three orbitals
 - b) These orbitals are shaped like dumbbells
 - c) An electron in a 3p orbital has a higher energy than a 2p orbital
 - d) These orbitals are spherical
 - e) All of the above statements are true
- _____8. Which of the following statements about Lewis structures is false?
- a) An octet is achieved when an atom has 8 valence electrons
 - b) A duet is a stable electron configuration for hydrogen
 - c) An ionic bond occurs when electrons are transferred.
 - d) A covalent bond occurs when electrons are shared.
 - e) All of the above statements are true.
- _____9. A noble gas does not form bonds because:
- a) It is lazy
 - b) It has a satisfied valence and doesn't need to share or transfer electrons.
 - c) It is in the gas phase and rarely encounters another element to bond with
 - d) They have too many protons to bond.
 - e) None of the above
- _____10. A double bond is formed when two atoms share a total of
- a) 2 electrons
 - b) 4 electrons
 - c) 6 electrons
 - d) 2 protons
 - e) None of the above

Calculations: For the following problems, show all your work!

1. (4 Pts) If light has a frequency of 2.73×10^9 Hz, what is the wavelength in meters?
2. (7 pts) What is the energy in Joules of 2.36×10^{20} photons of light with a wavelength of 3.45×10^{-7} m?
3. (10 Pts) A laser produces light of 1064 nm. What is the frequency in kHz of this light?
Be careful with unit conversions here!

4. (15 Pts) Fill in the table below with the short hand (abbreviated) electron configuration, and information about the number of valence electrons each atom contains:

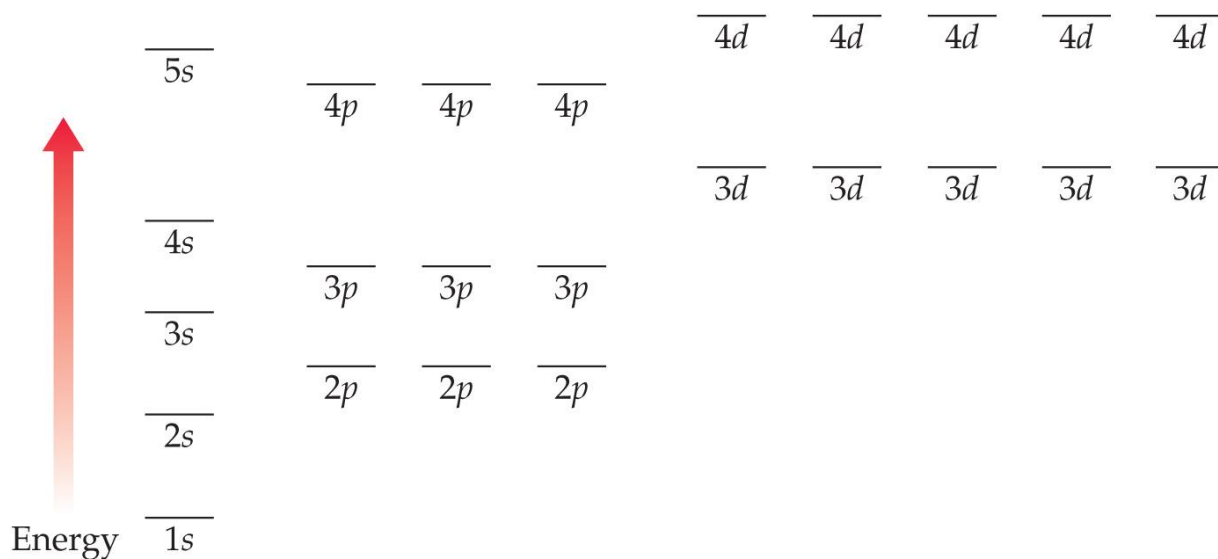
Element	Electron Configuration	Number of Valence e-
Ca		
Cl		
Zn		

5. (5 Pts) Write the full electron configuration for Aluminum.

Al	
----	--

6. (5 Pts) Fill in the orbital diagram below to represent the electrons in Silicon.

Circle the valence electrons!



(24 Pts) For the following molecules and polyatomic ions, draw Lewis Structures and answer the following questions.

Molecular Formula	Total Valence e- (2 Pts Each)	Lewis Structure (5 Pts each)	(1 Pt Each)
H₂O			How many lone pairs does the oxygen have in this molecule?
PCl₃			How many bonding pairs does the phosphorus have in this molecule?
CO₃²⁻			How many bonding pairs does the carbon have in this molecule?

NAME _____

F2014/CHEM1301/Exam 5/Dooley

12/03/2014

Multiple Choice: (3 Pts Each) Write the letter corresponding to the correct answer in the blank to the left of the problem number.

- _____1. The speed of light (the speed light travels from its source) is:
- The same for all light regardless of wavelength
 - Slower if the wavelength of light is shorter. (Blue light is slower than red light)
 - Slower if the wavelength of light is longer. (Red light is slower than blue light)
 - Decreasing as the photon travels further from its source.
 - None of the above
- _____2. The wavelength of a light wave is defined as:
- The number of photons in a mole.
 - The number of peaks that pass a point in one second.
 - The speed that the light is travelling towards you.
 - The distance between two peaks on the wave.
 - The distance that light travels in one hour.
- _____3. What idea about the energy of an electron in an atom comes from the Bohr Model of the atom and is still used in the quantum mechanical model?
- An electron can have any amount of energy.
 - The energy of an electron cannot change when light is absorbed or emitted
 - Sometimes, electrons turn into protons and are emitted from the atom as light
 - An electron's energy is defined by which orbit the electron is in, and the energies of the orbits are quantized.
 - none of the above
- _____4. The principle quantum number (n):
- specifies the 3-D shape of the orbital.
 - determines the subshell of the orbital.
 - specifies the size of the orbital.
 - specifies how many electrons an orbital can contain.
 - none of the above
- _____5. An orbital is
- a 3-D volume where you have a 90% chance of finding an electron
 - a path that the electron takes while orbiting the nucleus
 - always the same shape no matter the quantum numbers
 - always the same size, no matter the quantum numbers.
 - none of the above

_____6. The $n=$ _____ principal shell is the lowest that may contain a p-subshell.

- a) 1
- b) 2
- c) 3
- d) 4
- e) not enough information

_____7. Which statement is NOT true about “s” orbitals?

- a) A “s”subshell contains one orbital
- b) These orbitals are shaped like dumbbells
- c) An electron in a 3s orbital has a higher energy than a 2s orbital
- d) These orbitals are spherical
- e) All of the above statements are true

_____8. Which of the following statements is false?

- a) An octet is achieved when an atom has 6 valence electrons
- b) A duet is a stable electron configuration for hydrogen
- c) An ionic bond occurs when electrons are transferred.
- d) A covalent bond occurs when electrons are shared.
- e) All of the above statements are true.

_____9. A noble gas does not form bonds because:

- a) It is lazy
- b) It has a satisfied valence and doesn't need to share or transfer electrons.
- c) It is in the gas phase and rarely encounters another element to bond with
- d) They have too many protons to bond.
- e) None of the above

_____10. A single bond is formed when two atoms share a total of

- a) 2 electrons
- b) 4 electrons
- c) 6 electrons
- d) 2 protons
- e) None of the above

Calculations: For the following problems, show all your work!

1. (4 Pts) If light has a frequency of 8.96×10^5 Hz, what is the wavelength in meters?

2. (7 pts) What is the energy in Joules of 1 mole of photons of light with a wavelength of 5.43×10^{-6} m?

3. (10 Pts) A laser produces light of 532 nm. What is the frequency in GHz of this light?
Be careful with unit conversions here!

4. (15 Pts) Fill in the table below with the short hand (abbreviated) electron configuration, and information about the number of valence electrons each atom contains:

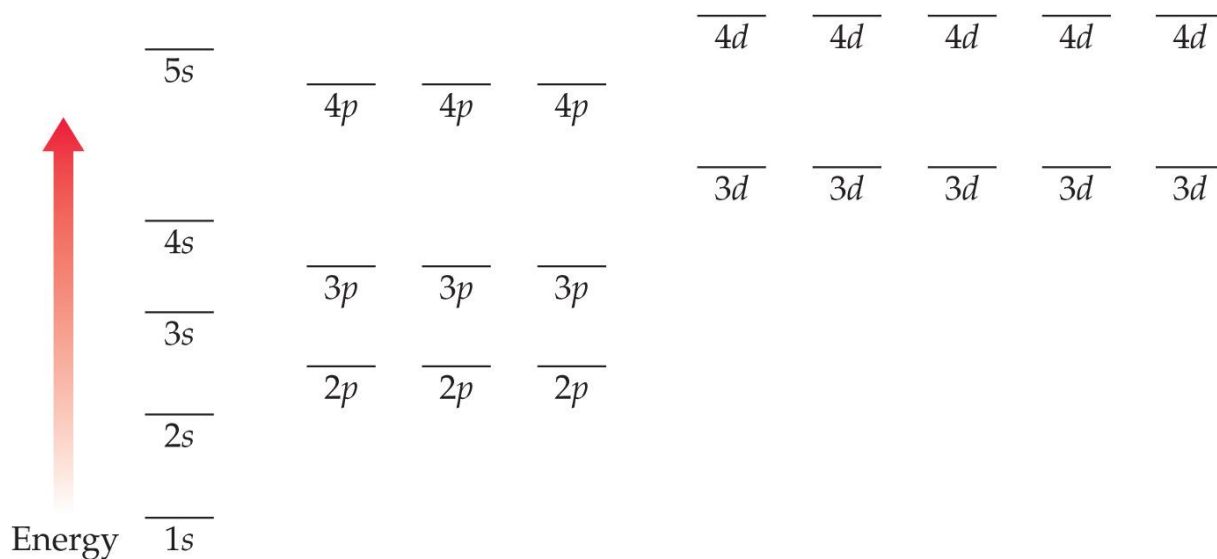
Element	Electron Configuration	Number of Valence e-
Na		
Mn		
Br		

5. (5 Pts) Write the full electron configuration for Aluminum.

Ne	
----	--

6. (5 Pts) Fill in the orbital diagram below to represent the electrons in Chromium (Cr).

Circle the valence electrons!



(24 Pts) For the following molecules and polyatomic ions, draw Lewis Structures and answer the following questions.

Molecular Formula	Total Valence e- (2 Pts Each)	Lewis Structure (5 Pts each)	(1 Pt Each)
H₂O			How many lone pairs does the oxygen have in this molecule?
SiO₂			How many bonding pairs does the silicon have in this molecule?
NO₃⁻			How many lone pairs does the Nnitrogen have in this molecule?