NAME_____
CHEM1450/Exam 2 /Dr. Dooley
Practice Exam

Multiple Choice: (3 Points each) Write the letter associated with the correct response in the space provided to the left of each numbered problem.

_____1. What is the mass of 4.957×10^{20} molecules of N_2?

a) 0.02307 g
b) 0.03951 g
c) 2.939×10^{-5}g
d) 0.1153 g
e) none of the above

_____2. An covalent bond is best described as

a) the sharing of electrons.
b) the transfer of electrons from one atom to another.
c) the attraction between positive and negatively charged particles.
d) the attraction between nonmetal and metal atoms.
e) the attraction between 2 metal atoms.

_____3. Calculate the molar mass of $Ni_2(CO_3)_3$.

a) 86.70 g/mol
b) 297.41 g/mol
c) 145.39 g/mol
d) 177.39 g/mol
e) none of the above

_____4. Calculate the percent mass N in the molecule N_2O_5.

a) 28.57%
b) 13.00%
c) 25.94%
d) 63.58%
e) none of the above

_____5. The distance between peaks of a wave is called the:

a) wavelength
b) amplitude
c) frequency
d) area
e) median

_____6. How many f orbitals are there in the n=4 shell?

a) 5
b) 7
c) 3
d) 6
e) 0

_____7. Identify a set of quantum numbers that would describe an electron in a 3d orbital.

a) n=3, l=2, m_l=-2, m_s= +1/2
b) n=3, l=3, m_l=2, m_s= -1/2
c) n=3, l=2, m_l=3, m_s= -1/2
d) n=3, l=1, m_l=2, m_s= -1/2
e) n=3, l=2, m_l=2, m_s= -1

_____8. Which of the following is NOT an allowed set of quantum numbers?

a) $n = 4$ $l = 3$ $m_l = 3$
b) $n = 1$ $l = 0$ $m_l = 0$
c) $n = 5$ $l = 4$ $m_l = -2$
d) $n = 2$ $l = 1$ $m_l = 0$
e) $n = 3$ $l = 3$ $m_l = -2$

_____9. Hund's rule states that:

a) Only two electrons of opposing spin are allowed in the same orbital
b) You should fill orbitals from the lowest energy up.
c) All matter can be described as a wave.
d) When filling orbitals, you should half-fill degenerate orbitals before pairing electrons.
e) Electrons in the same orbital need opposite spins.

_____10. How many valence electrons do the halogens possess?

a) 1
b) 2
c) 7
d) 6
e) 8

Problems: Make sure to show your work! Answers without proper work/reasoning will not receive credit! Report all answers to 3 sig figs.

1. The first ionization energy for magnesium is 738 kJ/mol.

    a. (3 Points) Write a reaction that corresponds to the first ionization energy of Mg.

    b. (3 Points) When we examine the successive ionization energies of magnesium, we notice two things. First, the successive ionization energies increase. Second, there is a large jump in energy between IE_2 and IE_3. What causes this large increase?

    c. (5 Points) What is the longest wavelength of light that is able to ionize magnesium?

2. (8 Points) An excited electron in a hydrogen atom emits a photon with a wavelength of 4652.84 nm as it makes a transition from the n=7 energy level. Which level did the electron relax to?

Short Answer: For problems hat require you to explain, I am looking for short phrases or sentences. The space left on the page should be a guide as to how much you need to write. Please no essays!

1. (3 Pts Ea) Write the predicted electronic configurations for the following atoms or ions:
   Write the abbreviated version using the noble gases.

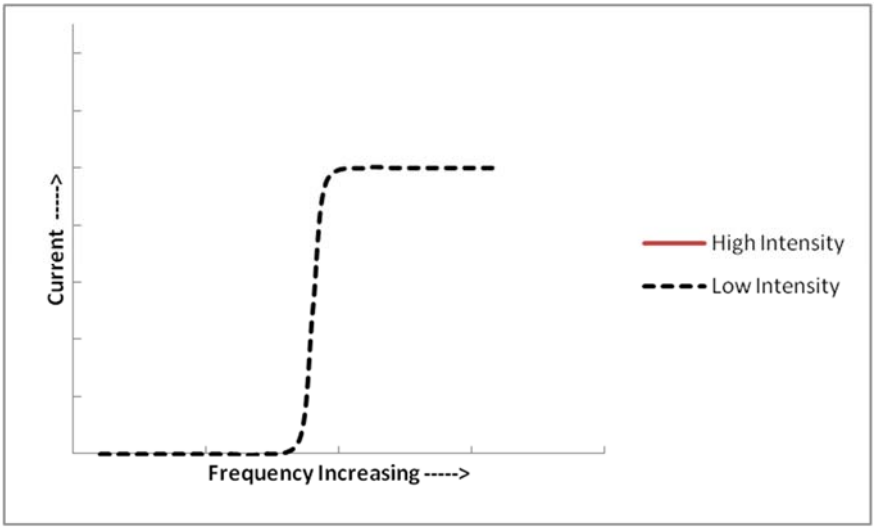
   a. Pb^{4+}

   b. Ir:

2. In class, we talked about the photoelectric effect that is explained by Einstein through modeling a beam of light as a stream of small particles. In this experiment, light hits a metal surface at various frequencies and the number of electrons ejected from the metal (the current) is measured.

   a. (3 Points) In the chart below, add a solid line showing the current measured when higher intensity light is used.

   b. (2 Points) Place an "**X**" on the curve that indicates the threshold frequency.



   c. (3 Points) When a photon has more than enough energy to eject an electron from the metal surface, what happens to the extra energy?

SHORT ANSWER: The following questions are about periodic trends. Be concise in your explanations. Where appropriate, circle the correct response from the list given.

3. (4 Points) Circle the atom or ion with the SMALLEST radius in each group?

   a. Kr Rb Se^{2-} Sr^{2+}

   b. Cl Ru I Cs

4. (5 Points) The first ionization energy of Be is larger than that of B, which is an exception to the trend. Explain why we see this exception.

5. (4 Points) Based on the trend, circle the atom in each group with the LARGEST IE_1.

   a. F S Br Zn

   b. Si P N C

6. (5 Points) Write the reaction associated with the electron affinity of neon:

   Why is the electron affinity of neon unfavorable?

Naming (2 Points Each) Provide the name of the following compounds or molecules if a formula is given, or provide the formula if the name is given. Place your answers in the right-hand column of the table. There is no partial credit for this section!

Name/Formula	**Answer:**
a. P_2S_5	
b. hydrofluoric acid	
c. Li_2S	
d. $CrPO_4$	
e. manganese (II) acetate	

Problems. ***Conversion factors, needed equations and a periodic table are provided, and a calculator is allowed. Show all work where work is required. Answers with work that cannot be logically followed will not receive credit.***

1. (5 Points) How many grams of pure potassium (K) are there in 23.7 grams K_3PO_4?

2. (10 Points) A sample compound contains only carbon, hydrogen and chlorine. Combustion Analysis of a 14.300g sample produces 12.465 g CO_2 and 7.656g H_2O. What is the empirical formula for this compound?