Chem 1A Midterm 3

Practice Test

Credit will only be given for answers on this sheet. Units must be included in your answers and points will be taken off for incorrect or missing units. No partial credit will be awarded. Calculators are allowed. Cell phones may not be used as calculators.

Name	Perm Number

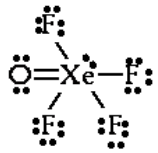
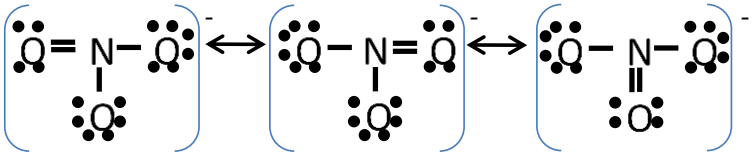
Make sure your writing is dark and large enough to be picked up by a scanner. Failure to do this results in the loss of 5 points on the exam.

If you are sitting next to someone with the same version of the test you both will lose 5 points.

If you are still writing after time is called, you will lose 5 points on the exam.

Fundamental	
Question (Points)	**Answer**
1 (5 pts)	5.50×10^{-4} m
2 (10 pts) 2,2,2,2,2	a. ○ Na ○ Si ● S ○ Al
	b. ○ Na^+ ● O^{2-} ○ Mg^{2+} ○ F^-
	c. ● C-N ○ C-O ○ O-H
	d. ○ Al ○ C ○ Na ● N
	e. ● K ○ Na ○ Mg
3 (6 pts)	Emitted, 1.10×10^{-8} m
4 (9 pts) 3,3,3	a. 120°
	b. 120°
	c. less than 109.5°
5 (6 pts)	-1,228 kJ
6 (8 pts) 2,2,2,2	a. 0
	b. 4
	c. 2
	d. 10

Multiple Choice	
Question (Points)	**Answer**
7 (7 pts)	● A ○ B ○ C ○ D ○ E
8 (5 pts)	● A ○ B ○ C ○ D ○ E
9 (4 pts)	○ A ● B ○ C ○ D ○ E
10 (6 pts)	○ A ○ B ● C ○ D ○ E
11 (4 pts)	○ A ● B ○ C ○ D ○ E
12 (4 pts)	○ A ○ B ● C ○ D ○ E

Challenge	
Question (Points)	**Answer**
13 (8 pts)	$9.78 \times 10^5 \frac{m}{s}$
14 (18 pts) 6,6,6	a. 
	b. 
	c. S

Fundamental

1) *5 pts* What is wavelength of energy released when an electron in a box (length 50. nm) transitions from the n=4 state to the ground state?

2a) *2 pts* Which has the smallest atomic radius? ○ Na ○ Si ○ S ○ Al

2b) *2 pts* Which had the largest ionic radius? ○ Na^+ ○ O^{2-} ○ Mg^{2+} ○ F^-

2c) *2 pts* Which has the least polar bond? ○ C-N ○ C-O ○ O-H

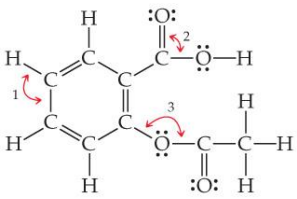
2d) *2 pts* Which has the greatest electronegativity? ○ Al ○ C ○ Na ○ N

2e) *2 pts* Which has the smallest first ionization energy? ○ K ○ Na ○ Mg

3) *6 pts* Determine if energy is absorbed or emitted when an electron transitions from the n=7 to the n=2 level of C^{5+} and the wavelength of the photon associated with the transition?

4a) *3 pts* What is the bond angle for 1?

4b) *3 pts* What is the bond angle for 2?



4c) *3 pts* What is the bond angle for 3?

5) *6 pts* Using the following bond energies:

Bond	Bond Energy (kJ/mol)
C≡C	839
C-H	413
O=O	495
C=O	799
O-H	467

estimate the heat of combustion for 1 mol of acetylene:
$C_2H_2(g) + 5/2O_2(g) \rightarrow 2CO_2(g) + H_2O(g)$

6a) *2 pts* What number of orbitals can have the designation 3f?

6b) *2 pts* What number of orbitals can have the designation n=2?

6c) *2 pts* What number of electrons can have the designation $3dz_2$?

6d) *2 pts* What number of electrons can have the designation n=6 and l=2?

Multiple Choice

7) *7 pts* Which of the following is polar?

A) XeO_2
B) I_3^-
C) XeF_2
D) NON
E) ICl_4^-

8) *5 pts* Which of the following statements is(are) true?

I. An excited atom can return to its ground state by absorbing electromagnetic radiation.
II. The energy of an atom is increased when electromagnetic radiation is emitted from it.
III. The energy of electromagnetic radiation increases as its frequency increases.
IV. An electron in the *n* = 4 state in the hydrogen atom can go to the *n* = 2 state by emitting electromagnetic radiation at the appropriate frequency.
V. The frequency and wavelength of electromagnetic radiation are inversely proportional to each other.

A) III, IV, V
B) I, II, IV
C) II, III, IV
D) III, V
E) I, II, III

9) *4 pts* As the bond order of a bond increases, its bond energy _____ and its bond length _____.

A) decreases, decreases
B) increases, decreases
C) decreases, increases
D) increases, increases

10) *6 pts* Consider an atom traveling at 1% of the speed of light. The de Broglie wavelength is found to be 3.31×10^{-3} pm. Which element is this?

A) P
B) He
C) Ca
D) F
E) Be

11) *4 pts* Which of the following statements is true?

A) Only three quantum numbers are needed to uniquely describe an electron.
B) Ni has 2 unpaired electrons in its 3d orbitals.
C) We can determine the exact location of an electron if we know its energy.
D) An electron in a 2s orbital can have the same n, l, and m_l quantum numbers as an electron in a 3s orbital.
E) In the building up of atoms, electrons occupy the 4f orbitals before the 6s orbitals.

12) *4 pts* From the following list of observations, choose the one that most clearly supports the conclusion that electrons have wave properties.

A) the photoelectric effect
B) cathode "rays"
C) diffraction
D) the emission spectrum of hydrogen
E) the scattering of alpha particles by metal foil

Challenge

13) *8 pts* It takes 208.4 kJ of energy to remove one mol of electrons from the atoms on the surface of rubidium metal. If rubidium metal is irradiated with 254-nm light, what is the maximum velocity the released electrons can have?

14a) *6 pts* Draw the Lewis structure that minimizes the formal charges for $XeOF_4$.

14a) *6 pts* Draw the Lewis structure that minimizes the formal charges for NO_3^-.

14c) *6 pts* The following Lewis structure was drawn for a Period 3 element. Identify the element