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Section #_____
TA_____

Chemistry 103
Lecture 4
EXAM II
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Fall 2002

This exam consists of 15 multiple choice questions. After the questions you will find an answer sheet, scratch paper, a periodic table and a list of constants and conversion factors. For each question, cross the letter corresponding to the correct answer, ON THE ANSWER SHEET. You may remove the scratch paper and periodic table from your exam, but do not remove the answer sheet.

Just a reminder, programmable calculators, class notes and note cards are not allowed.

Some problems are easier than others. Some advice: save the more difficult calculational problems for the end.

Good luck!

1. What important concept was learned from the Photoelectric Experiment?

a. That the Rydberg formula for the H atom emission spectrum is incorrect.
b. That "c" is the speed of light.
c. That electrons behave both as particles and as waves.
d. That light is quantized and it comes in "packets" known as photons.
e. That the Schröedinger equation only applies to the Hydrogen atom.

2. What is the energy of one quantum of visible radiation of wavelength λ = 700 nm? The speed of light, c, is c = 3.00 x 10^{8} m/sec, and the Planck's constant is h = 6.626x10^{-34} J sec.

a. 19.9 x 10^{-10} J
b. 6.63 x 10^{-34} J
c. 2.84 x 10^{-19} J
d. 55.2 x 10^{3} J
e. 700. x 10^{-25} J

3. A given orbital has a magnetic quantum number m = + 1. This could NOT be:

a. an *s* orbital
b. a *p* orbital
c. a *d* orbital
d. an *f* orbital
e. a *g* orbital

4. Calculate the wavelength of the light emitted as an electron changes from an excited state with principal quantum number n=3 to the ground state (TIP #1: remember what the value of "n" is for the ground state; TIP #2: start from Bohr's formula for the H atom wavelength of emitted radiation), in the H atom. The Rydberg constant is R = 1.0974 x 10^{7} m^{-1}.

a. 0.88889 nm
b. 700.03 nm
c. 1.03 x 10^{-12} m
d. 559.13 nm
e. 102.52 nm

4. Which of the following atoms has the largest atomic radius (i.e., it is the largest in size)?

a. Be
b. Rb
c. F
d. Ne
e. Fr

5. Which of the following atoms has the largest ionization energy?

a. Ne
b. Li
c. K
d. N
e. Kr

6. Indicate which series correctly ranks the following H atom orbitals in order of <u>increasing</u> energy.

a. 3s, 2s, 2p, 4s, 3p, 1s, 3d.
b. 1s, 2s, 2p, 4s, 3p, 3s, 3d.
c. 1s, 2s, 2p, 3s, 3p, 4s, 3d.
d. 3d, 2s, 2p, 1s, 3p, 4s, 3s.
e. 1s, 2s, 2p, 3s, 4s, 3p, 3d.
f. 3d, 2s, 2p, 4s, 3p, 1s, 3s.

7. Which of the following is the correct electron configuration for Copper (Cu)?

a. [Ar] $3d^9$
b. [Ar] $4s^2$, $3d^9$
c. [Ar] $4s^1$, $3d^7$
d. [Ar] $4s^2$, $4d^9$
e. [Ar] $3s^2$, $3d^9$

8. Indicate which of the following statements regarding the Schröedinger equation is correct (NOTE: only one statement is correct!).

a. The Schröedinger equation is: $E = m c^2$.
b. The Schröedinger equation allows determining energy levels and electron probability distributions for the H atom only.
c. The Schröedinger equation is: $H ? = E ?^2$.
d. The Schröedinger equation contains the H term. This term is best known as the Hermisolian operator.
e. The Schröedinger equation allows determining energy levels and electron probability distributions for any atom in the periodic table.

9. When arranged in order of increasing atomic number and organized in the periodic table, the elements exhibit periodicity for all of the following properties except

a. electronegativity
b. atomic radius
c. atomic mass
d. ionization energy
e. electron affinity

10. Which molecule has the most polar <u>bonds</u>?

a. CO_2
b. H_2
c. BaF_2
d. CO
e. CCl_4

11. Which <u>molecule</u> is most polar?

a. CO_2
b. H_2
c. BaF_2
d. CO
e. CCl_4

12. What are the formal charges on phosphorus (P) and oxygen (O) in the PO_4^{3-} ion?

a. Phosphorus is 1+ and Oxygen is 2-.
b. Phosphorus is 1+ and Oxygen is 1-.
c. Phosphorus is 2+ and Oxygen is 2-.
d. Phosphorus is 2+ and Oxygen is 1-.
e. Phosphorus is 4+ and Oxygen is 2-.

13. What is the molecular geometry of SCl_4 according to the VSEPR theory?

a. trigonal planar
b. octahedral
c. square pyramid
d. trigonal pyramid
e. seesaw

14. Based on bond orders, list the species N_2, N_2^- and N_2^{2+} in order of increasing bond energy.

a. N_2^{2+}, N_2^-, N_2
b. N_2, N_2^- and N_2^{2+}
c. N_2^-, N_2 and N_2^{2+}
d. N_2^{2+}, N_2 and N_2^-
e. all molecules have the same bond energy

15. Consider the following molecules derived from atoms in the second period of the periodic table: Li_2, Be_2, B_2, C_2, N_2, O_2, F_2. Which of them are paramagnetic?

a. Be_2, B_2, and O_2
b. C_2 and O_2
c. Li_2, Be_2 and B_2
d. N_2, O_2 and F_2
e. B_2 and O_2

1.	(a)	(b)	(c)	(d)	(e)
2.	(a)	(b)	(c)	(d)	(e)
3.	(a)	(b)	(c)	(d)	(e)
4.	(a)	(b)	(c)	(d)	(e)
5.	(a)	(b)	(c)	(d)	(e)
6.	(a)	(b)	(c)	(d)	(e)
7.	(a)	(b)	(c)	(d)	(e)
8.	(a)	(b)	(c)	(d)	(e)
9.	(a)	(b)	(c)	(d)	(e)
10.	(a)	(b)	(c)	(d)	(e)
11.	(a)	(b)	(c)	(d)	(e)
12.	(a)	(b)	(c)	(d)	(e)
13.	(a)	(b)	(c)	(d)	(e)
14.	(a)	(b)	(c)	(d)	(e)
15.	(a)	(b)	(c)	(d)	(e)

NAME_____ NUMBER CORRECT_____

SCRATCH PAPER

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