

**CHEM 1101 MOCK**  
**MID-TERM TEST #1 FALL 2013 – 75 MINUTES**

- PRINT YOUR NAME AND STUDENT NUMBER ON YOUR BOOKLET. Underline your last name.
- SPACE OUT YOUR ANSWERS – we will mark answers on the lined side of the page only – you can use the other side for rough work if you wish
- **KEEP YOUR TEST PAPER - HAND IN ONLY THE BOOKLET**
- **TURN OFF YOUR CELL PHONES AND ANY ALARMS YOU MAY HAVE**

20% 1. Electromagnetic radiation of wavelength 287 nm has just enough energy to cause potassium to undergo the photoelectric effect. Determine the ionization energy of K in:

- a) Joules
- b) kJ/mol

2. a) Determine the wavelength of the electromagnetic radiation that can promote an electron from the ground state of a hydrogen atom into the fourth level. Give your answer in nanometers.

20% b) Briefly describe what would happen if you used electromagnetic radiation with just slightly more energy than the EMR in part a. No need to do another calculation; a few words will do it.

20% 3. For silver  $_{79}\text{Au}$ :

- a) Give the electron configuration
- b) Identify the valence subshell(s). Give the orbital diagram and the quantum numbers for all electrons in the valence subshell(s)
- c) Identify the highest energy subshell. Give the orbital diagram and the quantum numbers for all electrons in the highest energy subshell, if different from above.
- d) Give the electron configuration for the silver (I) ion,  $\text{Ag}^+$

10% 4. For the following elements: Al, F, K, Ne, O, P, Mg, Si

- a) Rank in order of **increasing** size
- b) Rank in order of **increasing** ionization energy

15% 5. Name the following:

- a)  $\text{As}_2\text{O}_3$                       b)  $\text{In}_2\text{O}_3$                       c)  $\text{MnPO}_4$                       d)  $\text{N}_2\text{O}_4$

Give the chemical formula for the following:

- e) Lead carbonate                      f) gallium(I) carbonate                      g) ammonium nitride

15% 6. For the ion  $\text{NO}_3^-$                       a) Show the Lewis diagram  
b) Give the bond order for each bond  
c) Draw and name the VSEPR geometry

### Data and Equations

$$E = hc/\lambda$$

$$h = 6.626 \times 10^{-34} \text{ J}\cdot\text{s}$$

$$E = h\nu$$

$$c = 3.00 \times 10^8 \text{ m/s}$$

$$1 \text{ mol: } 6.02 \times 10^{23}$$

$$E = R_H ( - )$$

$$R_H = 2.18 \times 10^{-18} \text{ J}$$

Periodic table will be given

### ANSWERS

1a.  $6.93 \times 10^{-19} \text{ J}$

1b.  $417 \text{ kJ/mol}$

2a.  $97.3 \text{ nm}$

2b. Nothing. You have to have exactly the correct energy (and therefore wavelength) for the EMR to be absorbed.

3a.  $[\text{Xe}] 6s^1 4f^{14} 5d^{10}$

3b.  $6s^1$  the rest is unshown. See the notes

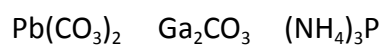
3c.  $5d^{10}$  The rest is unshown. See the notes

3d.  $[\text{Xe}] 6s^0 4f^{14} 5d^{10}$

4a.  $\text{Ne} < \text{F} < \text{O} < \text{P} < \text{Si} < \text{Al} < \text{Mg} < \text{K}$

4b.  $\text{K} < \text{Al} < \text{Mg} < \text{Si} < \text{P} < \text{O} < \text{F} < \text{Ne}$

5. Arsenic (III) oxide; indium oxide; manganese(II) sulfate, dinitrogen tetroxide



6a. there is resonance (but you do NOT correct for formal charge; N is in the second row.)

6b. Bond orders are  $1\frac{1}{3}$  each.

6c. geometry is triangular