

Chem 121 Rybolt Exam 3 Fall 2008 Name \_\_\_\_\_

Numerical constants may be listed below. Other needed information is given in the problem or written on the board or found in the periodic tables you will use during exam. For numerical problems, be sure to **show your work**, include units and circle your final answer. If several choices are given, **circle the correct answer**. Your written answers should be brief and to the point. You can use your own calculator on the exam, but no notes, books, external information, or other electronic devices are to be used. No cell phone is to be used in Exam room.

$$1 \text{ cal} = 4.184 \text{ J} \quad c = 3.00 \times 10^8 \text{ m/s} \quad 1 \text{ atm} = 760 \text{ torr} = 1.01 \times 10^5 \text{ N/m}^2 \quad ^\circ\text{C} = (^\circ\text{F} - 32) / 1.8$$

$$R = 0.08206 \text{ (L atm/ mol K)} \quad 1 \text{ g} = 6.02 \times 10^{23} \text{ amu} \quad h = 6.63 \times 10^{-34} \text{ Js} \quad \text{K} = ^\circ\text{C} + 273$$

-----  
1) Which of the following pairs of elements would most likely form an ionic compound?

N,F      Ca,Br      H,Cl      Si,Cl

2) Which of the following elements will have the highest electronegativity?

K      Ca      As      Br

3) The predicted formula for a compound composed of Ca and Br atoms

CaBr      Ca<sub>2</sub>Br      Ca<sub>2</sub>Br<sub>2</sub>      CaBr<sub>2</sub>      CaBr<sub>3</sub>

4) Charles Hall was a 22 year old Ohio college student in 1886 when he developed a method using electricity to extract aluminum from ore containing aluminum oxide. This development led to a dramatic drop in the price of aluminum (at one time it was more expensive than gold) and its world-wide production and use. Balance the reaction below



5) Aluminum has only one isotope aluminum-27. In the ion <sup>27</sup>Al<sup>3+</sup> what are the number of

protons                      electrons

6) Write the electron configuration (full) for the aluminum ion Al<sup>3+</sup>

7) Draw the Lewis structure for N<sub>2</sub>



17) Which of the following has the largest size?

Si          P          S          Cl

18) Draw the Lewis structure for ethanol  $C_2H_6O$

19) Indicate which of the following is a network, metallic, ionic, and molecular compound by writing the appropriate word below each formula.

Na                   $SiO_2$                    $H_2O$                    $MgF_2$

20 (a) What element has the abbreviated electron configuration  $[Ar] 4s^2 3d^6$

(b) The 3d orbitals are shown by the lines below. Draw arrows up or down to indicate how the 6 3d electrons are grouped in these d orbitals

\_\_\_\_\_      \_\_\_\_\_      \_\_\_\_\_      \_\_\_\_\_      \_\_\_\_\_

21) Draw a picture of a 2p orbital

22) How many radial nodes in a 3s orbital

23) A method that can be used to identify positions atomic nuclei and the size of atoms is  
x-ray diffraction      gas chromatography      mass spectroscopy      acid-base titration

24) If  $n=4$  and  $l=1$  a) then what orbital is this

b) and what are the possible values of  $m_l$

25) To understand the results of the Schrodinger equation one must think of an electron as a

26) Draw a Lewis Structure for urea (a compound found in urine)  $CH_4N_2O$  (hints: molecule is symmetrical, carbon is in the center, and hydrogens are bonded to nitrogens)

27) How many sigma bonds and how many pi bonds in the ethyne molecule  $C_2H_2$ ? - Draw Lewis structure first and then count.

28) Draw a Lewis structure for  $NH_3$  and then identify the type of hybridization on the nitrogen atom

sp    $sp^2$     $sp^3$     $sp^3d$     $sp^3d^2$

29) What is the name for the electron pair geometry around nitrogen?

bent   linear   tetrahedral   octahedral   trigonal pyramidal

30) And what is the name for the molecular geometry when only the atoms are considered?

bent   linear   tetrahedral   octahedral   trigonal pyramidal

31) And what is the more electronegative side of the polar ammonia molecule  
nitrogen side   hydrogens side

32) Draw the overlap of a p orbital and a s orbital to give a sigma bond