

Name _____

CHEMISTRY 1A

Spring 2008

EXAM 3

CHAPTERS 7, 8, 9 & 10

You might find the following useful.

$$PV = nRT \quad R = \frac{0.082058 \text{ L} \cdot \text{atm}}{\text{K} \cdot \text{mol}} \quad \text{or} \quad \frac{8.3145 \text{ L} \cdot \text{kPa}}{\text{K} \cdot \text{mol}}$$

$$PV = \frac{g}{M}RT \quad g = \text{mass} \quad M = \text{molar mass}$$

$$P_{\text{total}} = \sum P_{\text{partial}} \quad \text{or} \quad P_{\text{total}} = (\sum n_{\text{each gas}}) \frac{RT}{V}$$

	1 1A	2 2A							1 2.20 H				13 3A	14 4A	15 5A	16 6A	17 7A	18 8A
2	0.98 Li	1.57 Be											2.04 B	2.55 C	3.04 N	3.44 O	3.98 F	
3	0.93 Na	1.31 Mg	3 3B	4 4B	5 5B	6 6B	7 7B	8 8B	9 8B	10 8B	11 1B	12 2B	1.61 Al	1.90 Si	2.19 P	2.58 S	3.16 Cl	
4	0.82 K	1.00 Ca	1.36 Sc	1.54 Ti	1.63 V	1.66 Cr	1.55 Mn	1.83 Fe	1.88 Co	1.91 Ni	1.90 Cu	1.65 Zn	1.81 Ga	2.01 Ge	2.18 As	2.55 Se	2.96 Br	3.00 Kr
5	0.82 Rb	0.95 Sr	1.22 Y	1.33 Zr	1.6 Nb	2.16 Mo	1.9 Tc	2.2 Ru	2.28 Rh	2.20 Pd	1.93 Ag	1.69 Cd	1.78 In	1.96 Sn	2.05 Sb	2.1 Te	2.66 I	2.6 Xe
6	0.79 Cs	0.89 Ba	1.27 Lu	1.3 Hf	1.5 Ta	2.36 W	1.9 Re	2.2 Os	2.20 Ir	2.28 Pt	2.54 Au	2.00 Hg	1.62 Tl	2.33 Pb	2.02 Bi	2.0 Po	2.2 At	
7	0.7 Fr	0.9 Ra																

For each of the following, write the word, words, or number in each blank that best completes each sentence. (2 points each)

1. The _____ is the energy necessary to remove one mole of electrons from one mole of isolated and gaseous +1 ions to form one mole of isolated and gaseous +2 ions.
2. A(n) _____ is a volume that contains a high percentage of the electron charge for an electron in a *molecule* or a volume within which an electron in a *molecule* has a high probability of being found.
3. A(n) _____ isomer is a structure that has like groups on different carbons (which are linked by a double bond) and on different sides of the double bond.
4. A polar molecule or ion (or a portion of a molecule or polyatomic ion) that is attracted to water is called _____.
5. Of the two elements lithium, Li, and fluorine, F, _____ has highest first ionization energy.
6. Of the two ionic bonds, Mg-P (in Mg_3P_2) or Mg-N (in Mg_3N_2), the _____ bond has the most covalent character.
7. Of the two ions, Sc^{3+} and K^+ , the _____ is larger.
8. Draw a reasonable Lewis structure for each of the following. Identify all formal charges. If the molecule has resonance, draw *all* the resonance structures *and* the resonance hybrid. (6 points each)
 - a. Nitric acid, HNO_3

 - b. Draw Lewis structures for two isomers of 2-butene, $\text{CH}_3\text{CHCHCH}_3$.

9. Write abbreviated electron configurations for each of the following, Identify each as paramagnetic or diamagnetic, and write the number of unpaired electrons for each. (4 points each)

a. Nickel(II) ion, Ni^{2+}

Abbreviated electron configuration _____

Paramagnetic or diamagnetic? _____

Number of unpaired electrons _____

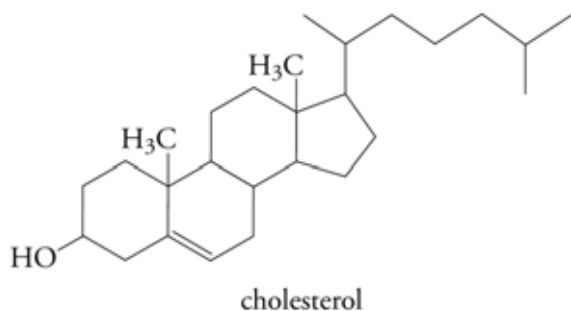
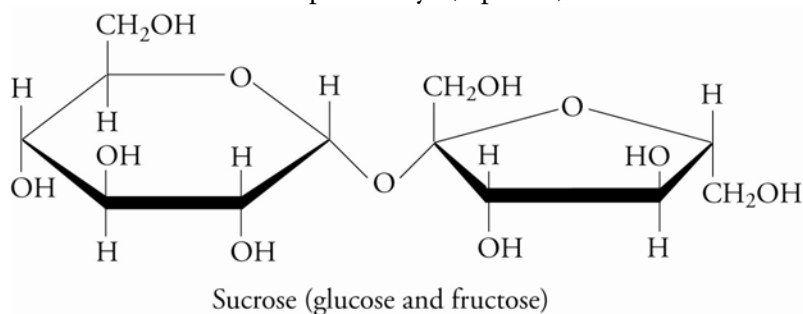
b. Gold atom, Au

Abbreviated electron configuration _____

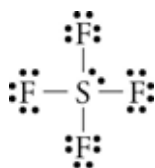
Paramagnetic or diamagnetic? _____

Number of unpaired electrons _____

10. Sucrose, which is a disaccharide composed of glucose and fructose, is white table sugar. Cholesterol is a natural substance that is both essential for the normal operation of the body and a potential cause of health problems. Which compound would you expect to be more soluble in water? Explain why. (4 points)



13. Consider the SF₄ molecule. (8 points)



a. With reference to the assumptions of the valence bond model, explain how sulfur atoms are able to form four *equivalent* covalent bonds, have one lone pair, and have zero formal charge.

b. What's the name of the electron group geometry around the sulfur atom?

c. Sketch the molecule, including bond angles.

d. What's the name of the molecular geometry around the sulfur atom?

14. For each of the following, write the name of the type of attraction holding these particles in the solid and liquid form. Indicate the formula in each pair that represents the substance that you would expect to have the stronger attractions among particles.

(3 points each)

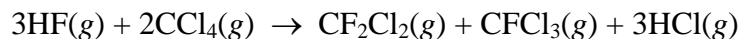
a. Formaldehyde, H_2CO
type of attraction _____
or carbon (diamond), $\text{C}(\text{dia})$
type of attraction _____

stronger attractions? _____
b. 2-Propanol, $\text{CH}_3\text{CH}(\text{OH})\text{CH}_3$
type of attraction _____
or butane, C_4H_{10}
type of attraction _____

stronger attractions? _____
c. 2-Propanol, $\text{CH}_3\text{CH}(\text{OH})\text{CH}_3$
type of attraction _____
or 1-hexanol, $\text{CH}_3(\text{CH}_2)_5\text{OH}$
type of attraction _____

stronger attractions? _____

15. Some chlorofluorocarbons, CFCs, such as CFC-12, CF_2Cl_2 , and CFC-11, CFCl_3 , are formed from carbon tetrachloride, CCl_4 and hydrogen fluoride, HF . What is the minimum volume of $\text{HF}(g)$ in cubic meters at 1.2 atm and 19°C that would be necessary to react with 235 kg of CCl_4 in the reaction below? (6 points)



16. Explain why lowering the temperature of a gas and/or increasing its concentration leads to a greater difference between the measured pressure of a gas and the pressure calculated from the ideal gas equation. (8 points)

17. Answer the following questions that relate to the ozone layer in the stratosphere and the threat to it from CFCs. (12 points)

a. Explain why we are fortunate that UV-C radiation is almost completely filtered out by gases in the atmosphere.

b. Explain how oxygen molecules, O_2 , and ozone molecules, O_3 , work together to protect us from high-energy ultraviolet radiation.

c. Explain why CFCs eventually make their way into the stratosphere when most chemicals released into the atmosphere do not.

d. Briefly explain why the chlorine atoms liberated from CFCs are thought to be a serious threat to the ozone layer.