

CHEMISTRY 150 C
Winter 1997

HOUR EXAM #2 (A)
2/12/97

Name: _____

TA Name/Section _____

SHOW YOUR WORK IN
THE SPACE PROVIDED.

Score: p. 1 _____

p. 2 _____

p. 3 _____

p. 4 _____

p. 5 _____

p. 6 _____

POINTS AS INDICATED ()

GOOD LUCK !!

Total _____

1. Name two allotropes of the element O and three of the element C

(5)

oxygen _____

carbon _____

2. What is the essential difference between a σ -type molecular orbital (4) and a π -type molecular orbital in a diatomic molecule? (Be brief!)

3. Give the sequence (AAAAA.. , ABABABAB.. , ABCABCABC.. , ABCDABCD.. (4) which best represents successive layers in a crystal which is:

(a) hexagonal close-packed

(b) simple cubic

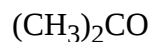
(c) body-centered cubic

(d) face-centered cubic

4. Give the four (4) types of hydrogen bonding which are possible in living (4) systems (e.g. H-O -----O).

5. For each of the following, give the dominant intermolecular force:

(4)



6. Label each of the following semiconductors as either "n" or "p" type:

(3)

(a) Si doped with Ga

(b) Ge doped with As

(c) GaAs doped with Zn

7. Which of the following neutral molecules or ions has a dipole moment?

(5)



8. Put the following molecular species in order of **INCREASING** bond angle.

(5) _____



9. Give the possible Lewis resonance structures for the chlorate ion ClO_3^-

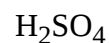
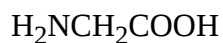
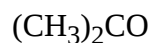
(4)

10. Arrange the following bonds in order of **INCREASING** bond length:

(4)



11. Which of the following molecules can form hydrogen bonds with itself? For (6) those molecules which can form hydrogen bonds, give the Lewis structure and indicate with arrows all possible sites for this hydrogen bonding.



12. Draw the unit cell for a body-centered cubic, give the number of atoms (4) in the unit cell.
13. Which of the following molecules are stabilized by conjugation? For those (6) which are stabilized, circle the part of the molecule over which the delocalized π -type bonding extends.
14. Capillary action occurs because the forces of adhesion are (greater than, (4) less than) the forces of cohesion in the liquid (circle correct answer).
15. Rank the following attractive forces in order of **DECREASING** strength:
(3)
Covalent bond Dispersion Hydrogen bond
16. The figure shows the departure of a real gas from the behavior expected (6) for an ideal gas, $PV/(nRT) = 1.00$, as the pressure P is increased at a constant temperature T . What is the cause of both the negative (-) and the positive (+) deviations from ideal behavior?

On the same figure, sketch the shape of this curve for the same real gas at a much higher temperature (flatter or more

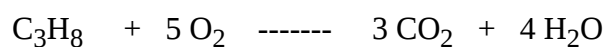
17. Draw the energy level diagram for the molecular orbitals of the diatomic (6) species CN^- . Fill the orbitals with the valence electrons ($n=2$). Calculate the bond order.

QUANTITATIVE: DO ANY TWO (2) OF THE FOLLOWING PROBLEMS.

18. Cadmium sulfide (CdS) is a yellow solid semiconductor which absorbs blue (15) light of wavelength = 472 nanometers (10^{-9} m). What is the bandgap E_g (kJ/mole) of this semiconductor ?

19. For $n = 1.05$ moles of carbon dioxide CO_2 gas with volume $V = 1.20$ liters, (15)
temperature $T = 41^\circ\text{C}$, and pressure $P = 19.8$ atmospheres, what is the percent (%)
departure from ideal gas behavior ($PV = nRT$) ?

20. Use bond energies of the reactants and products (see table) to calculate the (15) energy change
of the following reaction for the complete oxidation of one mole of propane:



Is this reaction exothermic or endothermic