

**DO NOT OPEN THIS EXAM UNTIL INSTRUCTED.
CALCULATORS ARE NOT TO BE SHARED.**

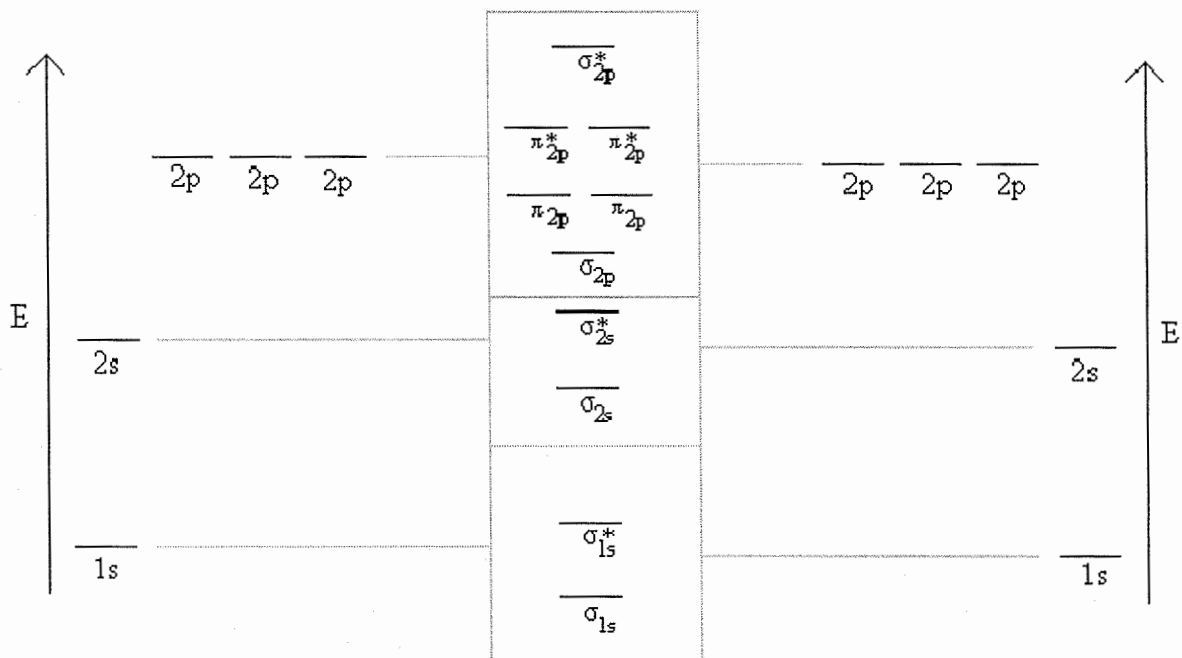
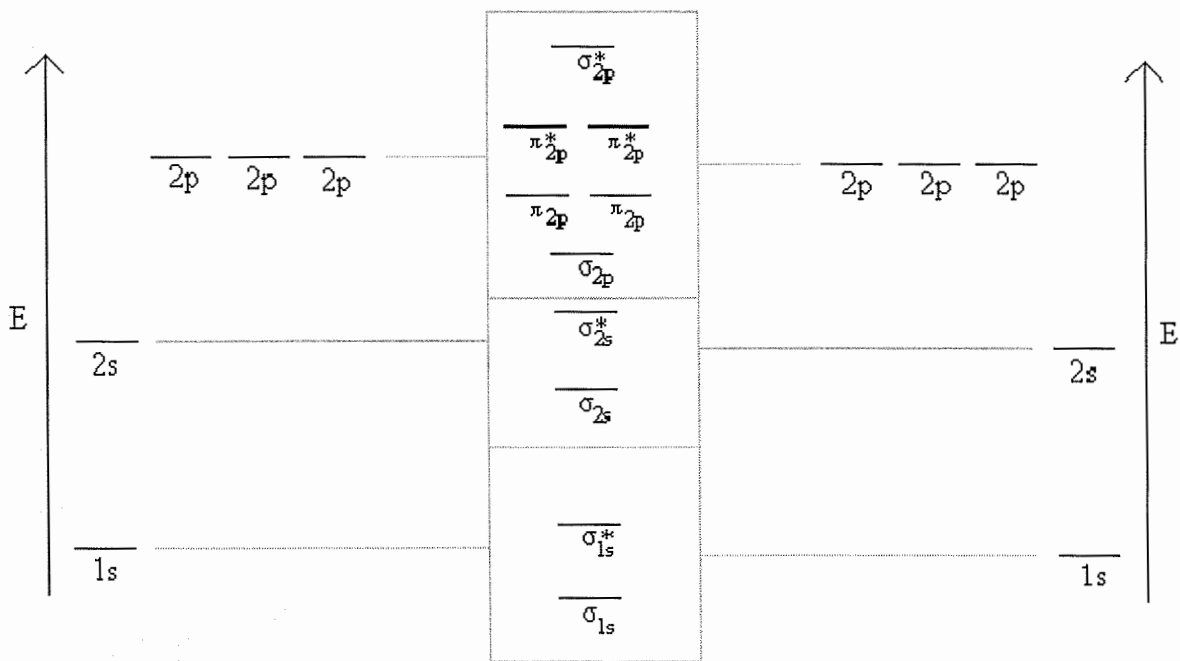
Test Form 3

Instructions: You should have with you several number two pencils, an eraser, your 3" x 5" note card, a calculator, and your University ID Card. If you have notes with you, place them in a sealed backpack and place the backpack OUT OF SIGHT or place the notes directly on the table at the front of the room.

Fill in the front page of the Scantron answer sheet with your test form number (listed above), last name, first name, middle initial, and student identification number. **Leave the class section number blank.**

This exam consists of 25 multiple-choice questions. Each question has four points associated with it. Select the best multiple-choice answer by filling in the corresponding circle on the rear page of the answer sheet. If you have any questions before the exam, please ask. If you have any questions during the exam, please ask the proctor. Open and start this exam when instructed. When finished, place your Scantron form and note card in the appropriate stacks. You may keep the exam packet, so please show your work and mark the answers you selected on it.

	IA												VIII A						
1	1 H Hydrogen 1.0079											2 He Helium 4.0026							
2	3 Li Lithium 6.941	4 Be Beryllium 9.01218											5 B Boron 10.81	6 C Carbon 12.011	7 N Nitrogen 14.0067	8 O Oxygen 15.9994	9 F Fluorine 18.9984	10 Ne Neon 20.179	
3	11 Na Sodium 22.98977	12 Mg Magnesium 24.305											13 Al Aluminum 26.9815	14 Si Silicon 28.0855	15 P Phosphorus 30.97376	16 S Sulfur 32.06	17 Cl Chlorine 35.453	18 Ar Argon 39.948	
4	19 K Potassium 39.0983	20 Ca Calcium 40.08	21 Sc Scandium 44.9559	22 Ti Titanium 47.88	23 V Vanadium 50.9415	24 Cr Chromium 51.996	25 Mn Manganese 54.9380	26 Fe Iron 55.847	27 Co Cobalt 58.9332	28 Ni Nickel 58.70	29 Cu Copper 63.546	30 Zn Zinc 65.38	31 Ga Gallium 69.72	32 Ge Germanium 72.59	33 As Arsenic 74.9216	34 Se Selenium 78.96	35 Br Bromine 79.904	36 Kr Krypton 83.80	
5	37 Rb Rubidium 85.4678	38 Sr Strontium 87.62	39 Y Yttrium 88.9059	40 Zr Zirconium 91.22	41 Nb Niobium 92.9064	42 Mo Molybdenum 95.94	43 Tc Technetium 98.906	44 Ru Ruthenium 101.07	45 Rh Rhodium 102.9055	46 Pd Palladium 106.4	47 Ag Silver 107.868	48 Cd Cadmium 112.41	49 In Indium 114.82	50 Sn Tin 118.69	51 Sb Antimony 121.75	52 Te Tellurium 127.60	53 I Iodine 126.9045	54 Xe Xenon 131.30	
6	55 Cs Cesium 132.9054	56 Ba Barium 137.33	57-71 *Rare earths	72 Hf Hafnium 178.49	73 Ta Tantalum 180.9479	74 W Tungsten 183.85	75 Re Rhenium 186.207	76 Os Osmium 190.2	77 Ir Iridium 192.22	78 Pt Platinum 195.09	79 Au Gold 196.9665	80 Hg Mercury 200.59	81 Tl Thallium 204.37	82 Pb Lead 207.2	83 Bi Bismuth 208.9804	84 Po Polonium (209)	85 At Astatine (210)	86 Rn Radon (222)	
7	87 Fr Francium (223)	88 Ra Radium 226.0254	89-103 *Actinides	104 Rf Rutherfordium (261)	105 Ha Hahnium (262)	106 Sg Seaborgium (263)	107 Ns Neilsbohrium (262)	108 Hs Hassium (265)	109 Mt Meitnerium (266)	110 †	111 †	→ Stable region?							

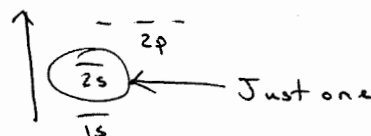


Please read each exam question carefully. Terms such as *correct, false, unpaired, pairs, H-C-F bond angle, H-C-H angle, greatest, and smallest* are used.

1. Which of the following statements is **false**?

- (A) A 2s orbital of a carbon atom is larger than a 1s orbital of a carbon atom.
- (B) A 1s orbital is spherical.
- (C) A 2s orbital of a carbon atom is higher in energy than a 1s orbital of a carbon atom.
- (D) A 2s orbital of a carbon atom is lower in energy than a 2p orbital of a carbon atom.
- (E) There are three 2s orbitals in a carbon atom.

Just one



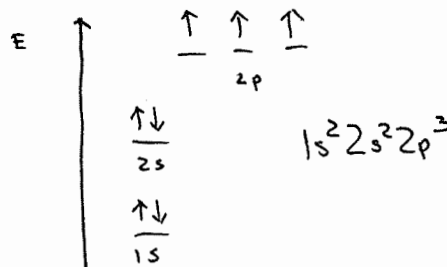
2. The nitride ion (N^{3-}) and _____ are isoelectronic (have the same number of electrons).

- (A) O.
- (B) N^{3+} .
- (C) P.
- (D) N.
- (E) O^{2-} .

N^{3-} and O^{2-} have 10 electrons.

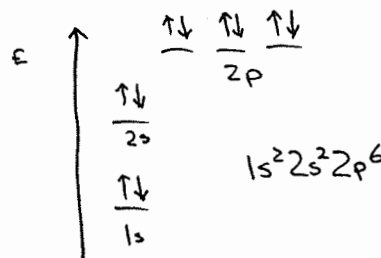
3. The ground-state electron configuration of a nitrogen atom is:

- (A) $1s^2 2s^2 3s^2 3p^1$.
- (B) $1s^2 2s^2 3s^1$.
- (C) $1s^2 2s^2 2p^5$.
- (D) $1s^2 2s^2 2p^3$.
- (E) $1s^2 2s^2 3s^3$.



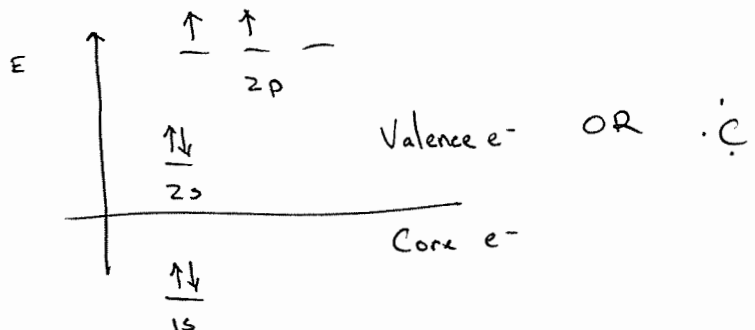
4. The ground-state electron configuration of a fluoride ion (F^-) is:

- (A) $1s^2 2s^2 3s^2 3p^2$.
- (B) $1s^2 2s^2 3s^1$.
- (C) $1s^2 2s^2 2p^4$.
- (D) $1s^2 2s^2 2p^6 3s^2 3p^2$.
- (E) $1s^2 2s^2 2p^6$.



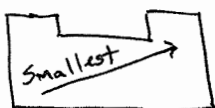
5. How many valence electrons are present in a carbon atom?

- (A) 0.
- (B) 2.
- (C) 4.
- (D) 6.
- (E) 8.



6. Consider B, C, N, O, and F. The atom with the **smallest** atomic size is:

- (A) B.
- (B) C.
- (C) N.
- (D) O.
- (E) F.



7. Consider Mg^{2+} , Mg, F^- , and F. Which of the following statements is **correct**?

- (A) Mg^{2+} is larger than Mg.
- (B) F^- is larger than F.

Mg^{2+} is smaller than Mg - same number of p
 Mg^{2+} has two fewer e^-

F^- is larger than F - same number of p
 F^- has one greater e^-

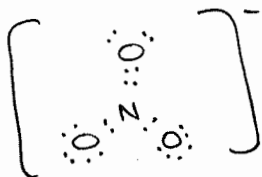
8. The Lewis Dot Structure of H_2O depicts:

- (A) There are no lone **pairs** of electrons.
- (B) There is one lone **pair** of electrons.
- (C) There are two lone **pairs** of electrons.
- (D) There are three lone **pairs** of electrons.
- (E) There are four lone **pairs** of electrons.




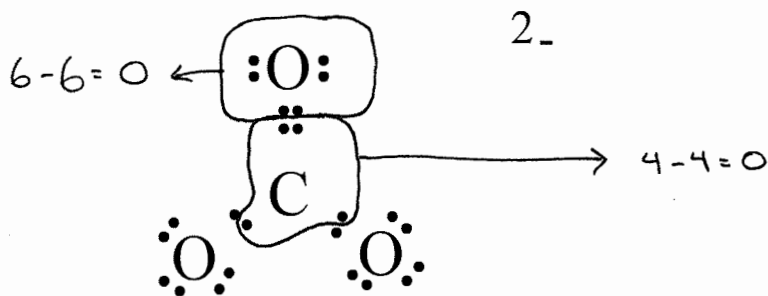
9. The nitrogen-oxygen bond order in the nitrate ion (NO_3^-) is:

- (A) 1.00.
- (B) 1.33.
- (C) 1.50.
- (D) 1.75.
- (E) 2.00.



$$\frac{4 \text{ bonds}}{3 \text{ locations}} = 1.33$$

10. A student () proposes



as a Lewis Structure for the carbonate ion.

- (A) Carbon has a formal charge of 0 and the top oxygen has a formal charge of 0.
- (B) Carbon has a formal charge of +1 and the top oxygen has a formal charge of 0.
- (C) Carbon has a formal charge of 0 and the top oxygen has a formal charge of +1.
- (D) Carbon has a formal charge of +1 and the top oxygen has a formal charge of -1.
- (E) Carbon has a formal charge of -1 and the top oxygen has a formal charge of +1.

11. The H-N-H bond angle in ammonia, NH_3 , is:

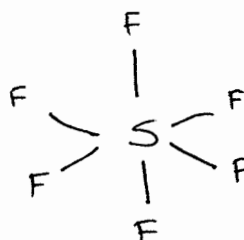
- (A) 180° .
- (B) 120° .
- (C) 109.5° .
- (D) A little greater than 109.5° .
- (E) A little less than 109.5° .



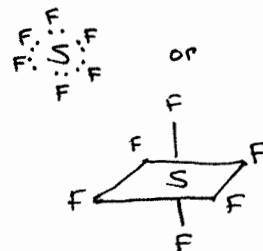
H-N-H bond angle is 109.5° minus a little (near 107° at room temp)

12. The F-S-F bond angle in SF_6 is:

- (A) 90° .
- (B) 120° .
- (C) 109.5° .
- (D) A little greater than 109.5° .
- (E) A little less than 109.5° .

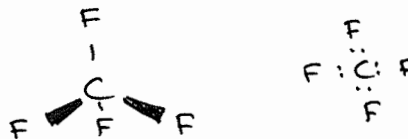


octahedral



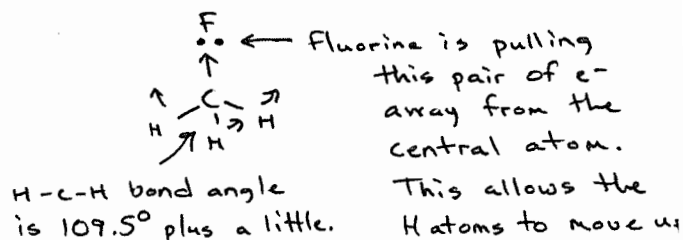
13. The molecular geometry of CF_4 is:

- (A) bent.
- (B) trigonal planar.
- (C) trigonal pyramidal.
- (D) tetrahedral.
- (E) octahedral.



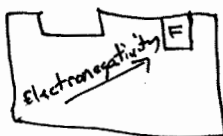
14. The H-C-H bond angle in monofluoromethane (CH_3F) is:

- (A) 90° .
- (B) 120° .
- (C) 109.5° .
- (D) A little greater than 109.5° .
- (E) A little less than 109.5° .



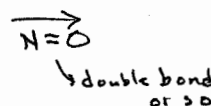
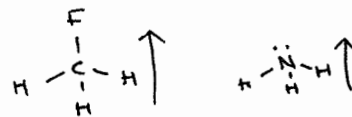
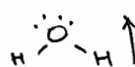
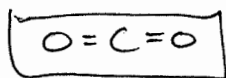
15. Consider Fr, C, N, F, and O. The atom with the **greatest** electronegativity is:

- (A) Fr.
- (B) C.
- (C) N.
- (D) F.
- (E) O.



16. Consider H_2O , CH_3F , NH_3 , CO_2 , and NO . Which is a non-polar molecule?

- (A) H_2O .
- (B) CH_3F .
- (C) NH_3 .
- (D) CO_2 .
- (E) NO .



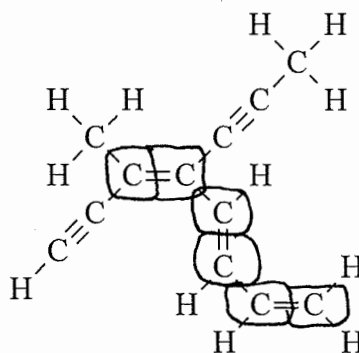
17. Consider CH_4 , CF_4 , CCl_4 , and NH_3 . Which of the following statements is **correct**?

- (A) CH_4 contains only **nonpolar covalent bonds**.
- (B) CF_4 contains only **nonpolar covalent bonds**.
- (C) CCl_4 contains only **nonpolar covalent bonds**.
- (D) NH_3 contains only **nonpolar covalent bonds**.
- (E) CH_4 , CF_4 , CCl_4 , and NH_3 contain only **polar covalent bonds**.

Every bond in these four molecules is polar.

18. Consider the molecule below and identify the **correct** statement.

sp² carbon



- (A) There are two carbons that have sp² hybridization schemes.
- (B) There are three carbons that have sp² hybridization schemes.
- (C) There are four carbons that have sp² hybridization schemes.
- (D) There are five carbons that have sp² hybridization schemes.
- (E) There are six carbons that have sp² hybridization schemes.

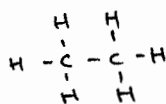
19. Consider ethene, C₂H₄. Ethene contains:

- (A) no π-bonds.
- (B) one π-bond.
- (C) two π-bonds.
- (D) three π-bonds.



20. Consider C₂H₆, C₂H₄, and C₂H₂. Which of these has the longest carbon-carbon bond?

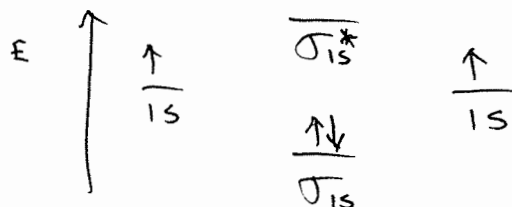
- (A) C₂H₆.
- (B) C₂H₄.
- (C) C₂H₂.



↳ C-C longer C=C longer C≡C

21. Consider MO (Molecular Orbital Theory). For the H₂ molecule, there are _____ electrons in the σ_{1s} bonding orbital?

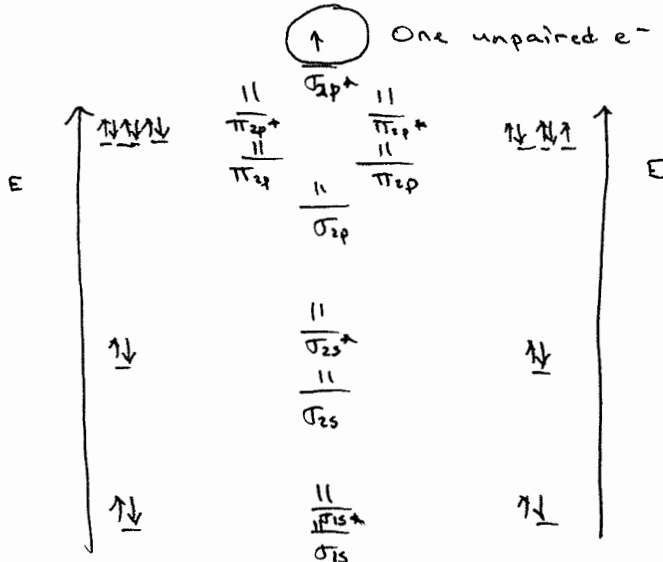
- (A) 0.
- (B) 1.
- (C) 2.
- (D) 3.
- (E) 4.



22. Molecular orbital theory predicts the F₂⁻ ion (a minus one charge) has:

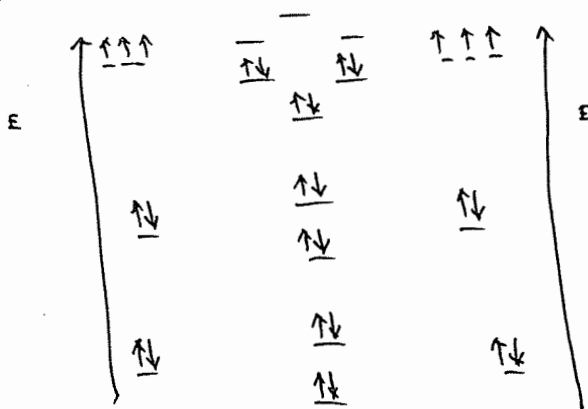
F_2^- 19 electron system

- (A) no unpaired electrons.
- (B) one unpaired electrons.
- (C) two unpaired electrons.
- (D) three unpaired electrons.
- (E) six unpaired electrons.



23. Consider MO (Molecular Orbital Theory). The N_2 molecule is:

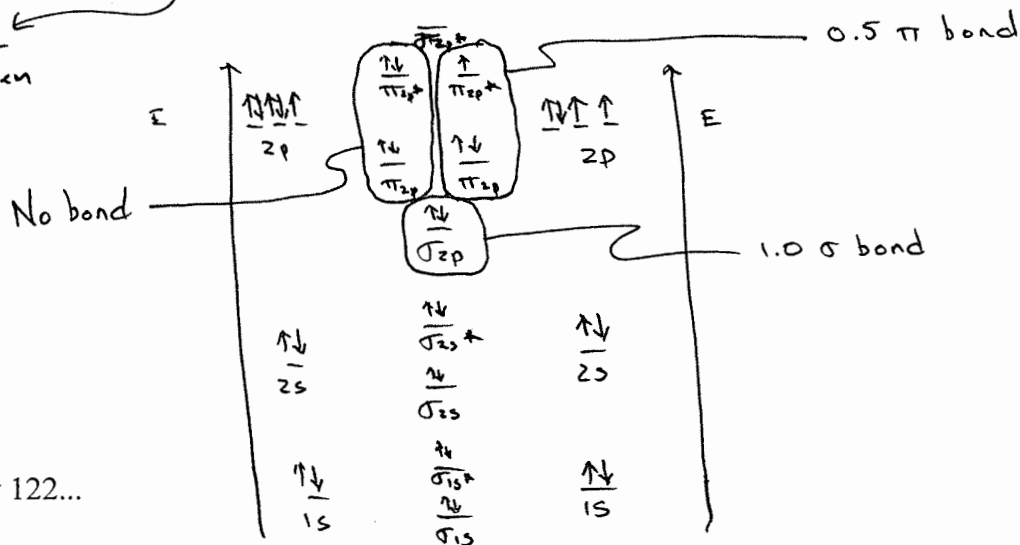
- (A) diamagnetic. all e^- paired
- (B) paramagnetic.
- (C) wrestling-magnetic.
- (D) inaugural-magnetic.
- (E) gymnastics-magnetic.



24. Molecular orbital theory predicts the O_2^- ion (a minus one charge) has a bond order of:

- (A) 1.0
- (B) 1.5
- (C) 2.0
- (D) 2.5
- (E) 3.0

17 e^- system



25. Because of Chemistry 122...

- (A) I put all my CDs in my friend's microwave oven and I have no more music to listen to. I guess I'll have to purchase an iPod.
- (B) I blackout when I hear the name "Lewis."
- (C) I blackout when I hear the words "ChemSkill Builder."
- (D) My octahedrals hurt.
- (E) I understand the nature of the universe. (Any response will receive full credit; even no response.)