

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 last name, first name, middle initial, and student identification number. **Leave the class section number and the test form number blank.**

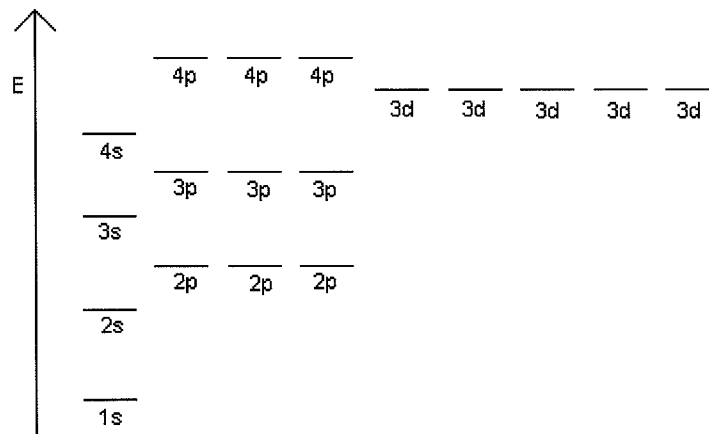
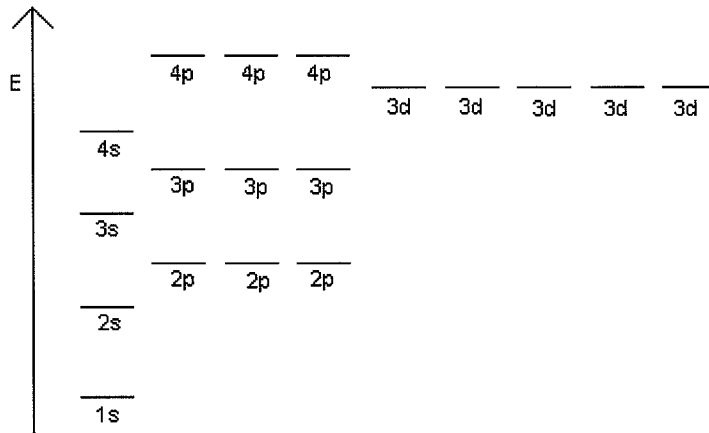
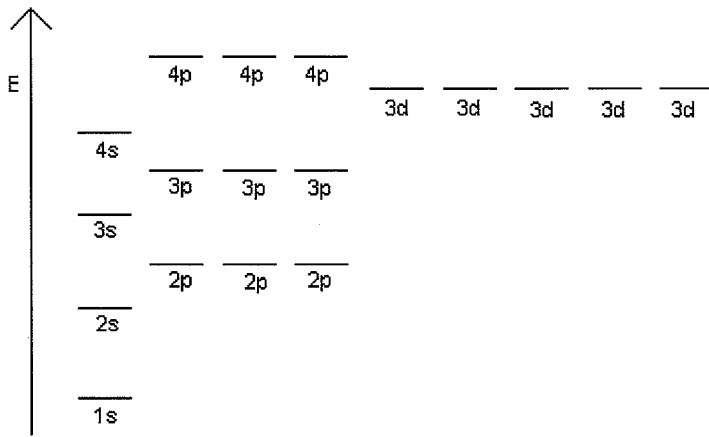
This exam consists of 25 multiple-choice questions. Each question has four points associated with it. Select the best multiple-choice answer by filling in the corresponding circle on the rear page of the answer sheet. If you have any questions before the exam, please ask. If you have any questions during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

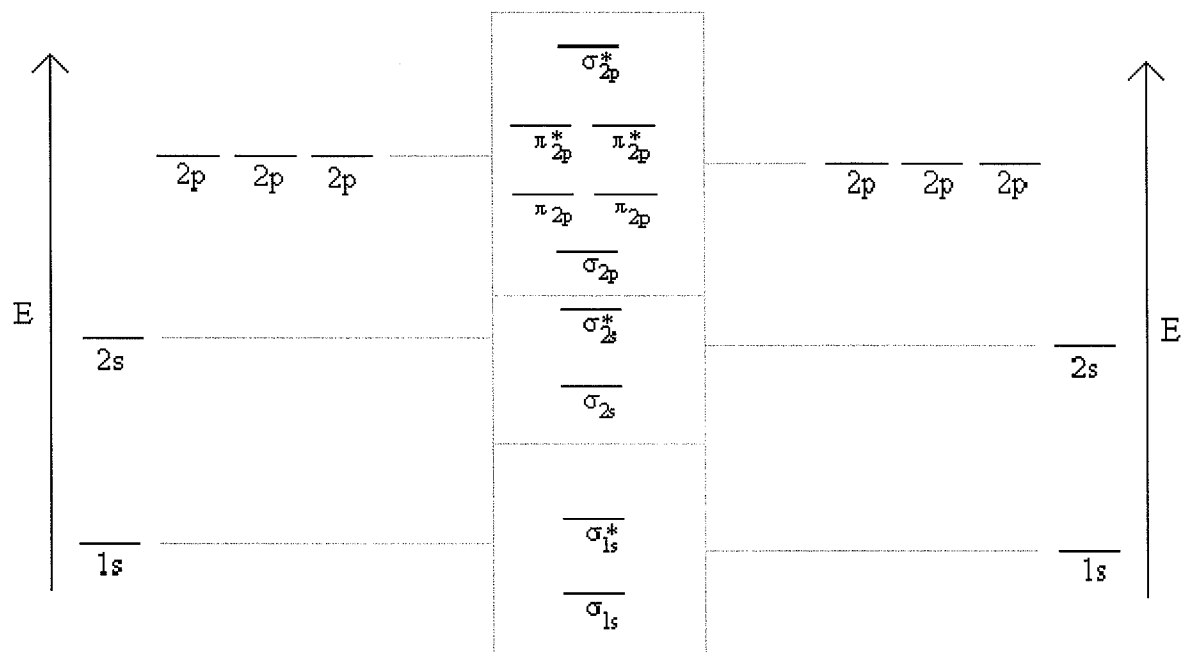
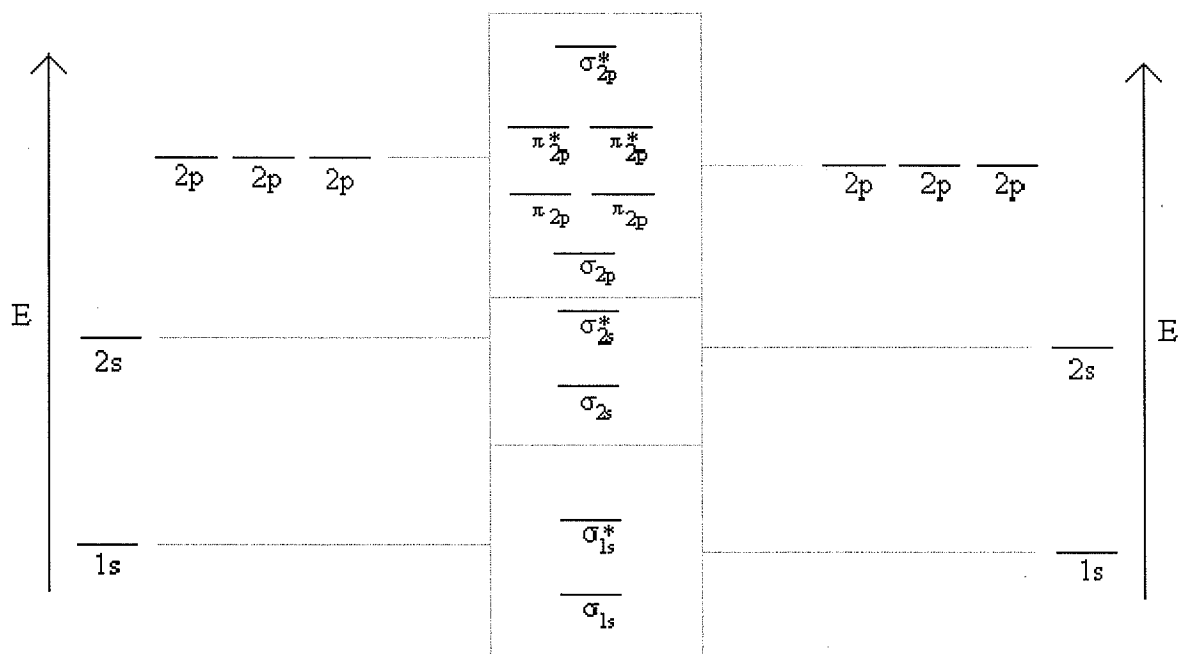
IA

VIIIA

1 H Hydrogen 1.0079																	2 He Helium 4.0026				
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				
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				
		IIB		IVB		VB		VIB		VIIB		VII				IB		IIB			
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				
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				
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)				
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 †			114	→ Stable region?							

57 La Lanthanum 138.9055	58 Ce Cerium 140.12	59 Pr Praseodymium 140.9077	60 Nd Neodymium 144.24	61 Pm Promethium 145	62 Sm Samarium 150.4	63 Eu Europium 151.96	64 Gd Gadolinium 157.25	65 Tb Terbium 158.9254	66 Dy Dysprosium 162.50	67 Ho Holmium 164.9304	68 Er Erbium 167.26	69 Tm Thulium 168.9342	70 Yb Ytterbium 173.04	71 Lu Lutetium 174.967
89 Ac Actinium 227.0278	90 Th Thorium 232.0381	91 Pa Protactinium 231.0359	92 U Uranium 238.029	93 Np Neptunium 237.0482	94 Pu Plutonium (244)	95 Am Americium (243)	96 Cm Curium (247)	97 Bk Berkelium (247)	98 Cf Californium (251)	99 Es Einsteinium (254)	100 Fm Fermium (257)	101 Md Mendelevium (258)	102 No Nobelium 259	103 Lr Lawrencium 262

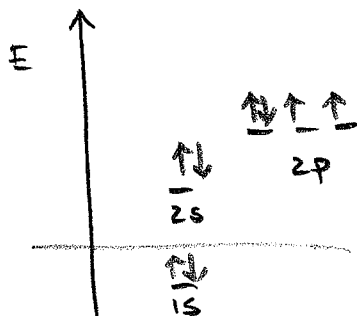




Please read each exam question carefully. Terms such as *correct, false, unpaired, pairs, H-C-F bond angle, H-C-H angle, greatest, and smallest* are used.

1. There are ___ **unpaired** electrons in a ground-state oxygen atom.

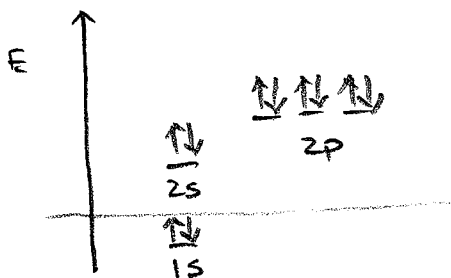
- (A) 0
- (B) 1
- (C) 2
- (D) 3
- (E) 4



8 total e⁻
6 valence e⁻

2. There are ___ **unpaired** electrons in a ground-state magnesium ion (Mg²⁺).

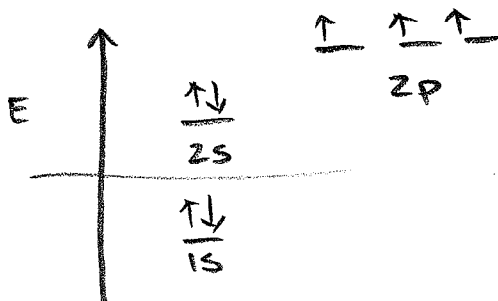
- (A) 0
- (B) 1
- (C) 2
- (D) 3
- (E) 4



10 total e⁻
8 valence e⁻

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

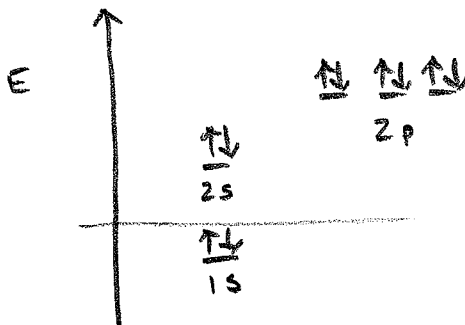
- (A) 1s²2s²3s²3p¹
- (B) 1s²2s²3s¹
- (C) 1s²2s²2p⁵
- (D) 1s²2s²2p³
- (E) 1s²2s²3s³



7 total e⁻
5 valence e⁻

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

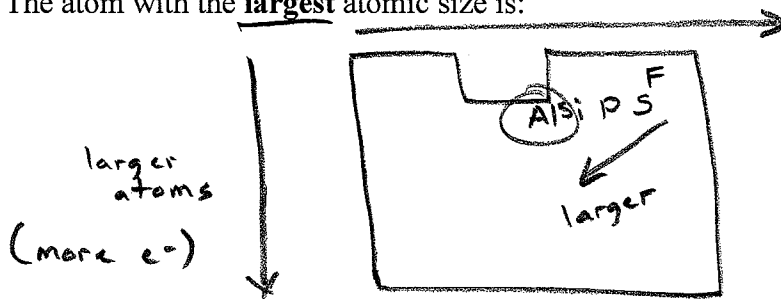
- (A) 1s²2s²3s²3p²
- (B) 1s²2s²3s¹
- (C) 1s²2s²2p⁶
- (D) 1s²2s²2p⁶3s²3p²
- (E) 1s²2s²2p⁴



10 total e⁻
8 valence e⁻

5. Consider F, S, P, Si, and Al. The atom with the **largest** atomic size is: Smaller atoms (more p)

- (A) F
- (B) S
- (C) P
- (D) Si
- (E) Al

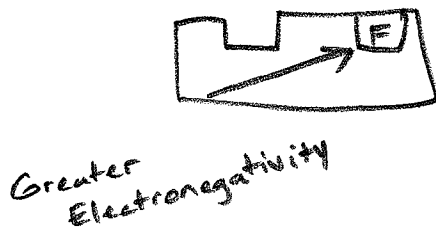


6. Consider Mg and Mg^{2+} . Consider O, and O^{2-} . Which of the following statements is correct?

- (A) Mg is smaller than Mg^{2+} ~~X~~ Mg^{2+} has fewer e^- and is smaller
- (B) O is smaller than O^{2-} O has fewer e^-
- (C) This question is ambiguous and cannot be answered without a data table.

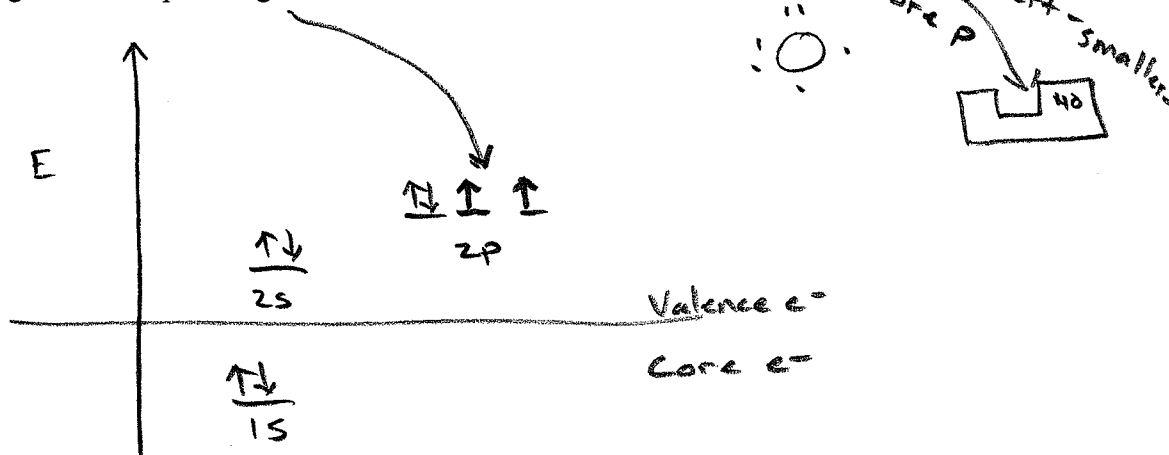
7. Consider F, S, P, Si, and Al. The atom with the **greatest** electronegativity is:

- (A) F
- (B) S
- (C) P
- (D) Si
- (E) Al



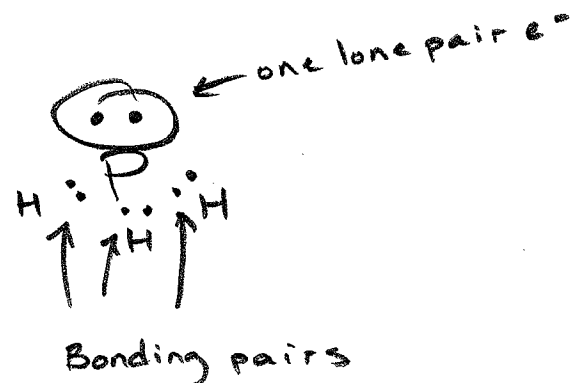
8. Consider an oxygen atom in the ground-state. Which of the following statements is **false**?

- (A) An oxygen atom has 8 total electrons; 2 are core electrons and 6 are valence electrons. True
- (B) The Lewis Dot Structure for an oxygen atom has 6 electrons (dots). True
- (C) An oxygen atom is larger than a nitrogen atom. ~~X~~
- (D) There are two unpaired electrons in the oxygen atom. True
- (E) The oxygen atom is paramagnetic. True



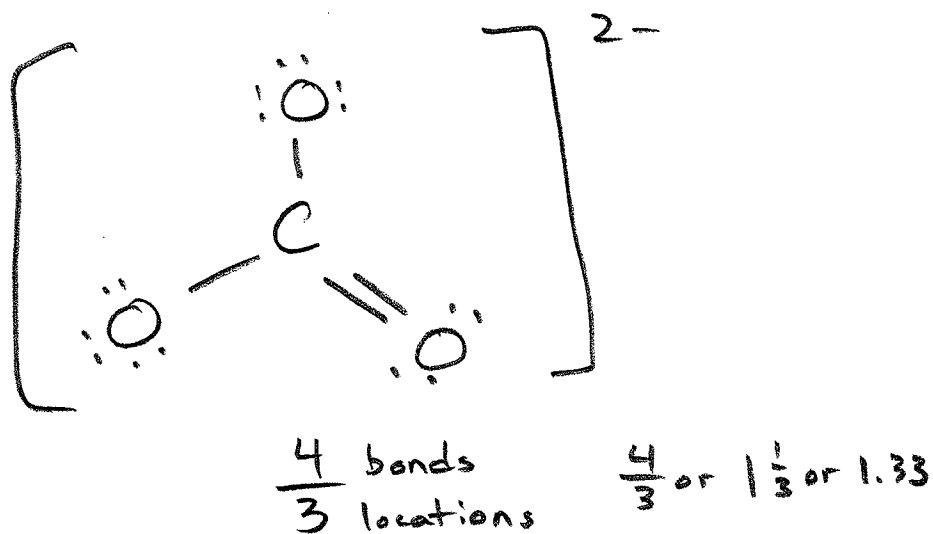
9. The Lewis Dot Structure of phosphine, PH_3 , depicts:

- (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.

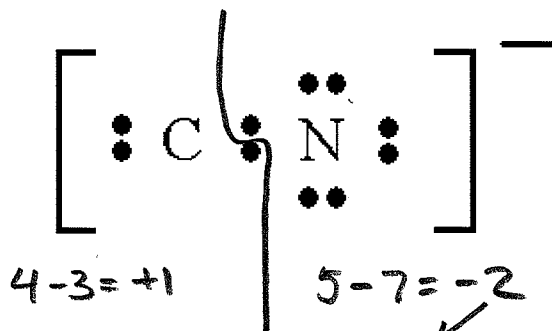


10. Consider one carbon-oxygen bond in the carbonate ion (CO_3^{2-}). The carbon-oxygen bond order in the carbonate ion is:

- (A) 1.00
- (B) 1.33
- (C) 1.50
- (D) 2.00
- (E) 2.66



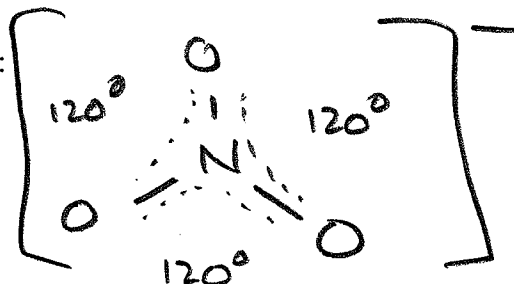
11. A student () proposes the Lewis Dot Structure below for the cyanide ion, CN^- . Determine the formal charge on the nitrogen atom in this structure.



- (A) The nitrogen atom has a formal charge of -2
- (B) The nitrogen atom has a formal charge of -1
- (C) The nitrogen atom has a formal charge of 0
- (D) The nitrogen atom has a formal charge of +1
- (E) The nitrogen atom has a formal charge of +2

12. The O-N-O bond angle in the nitrate ion, NO_3^- , is:

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



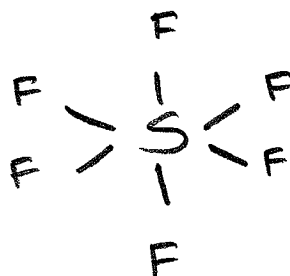
13. Tetrafluoromethane, also known as carbon tetrafluoride, Freon-14, and R 14, is CF_4 . The molecular geometry of CF_4 , is:

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



14. The molecular geometry of SF_6 is:

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



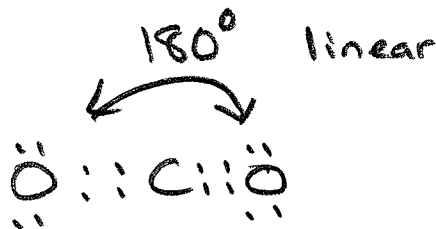
15. The H-N-H bond angle in ammonia (NH_3) is:

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



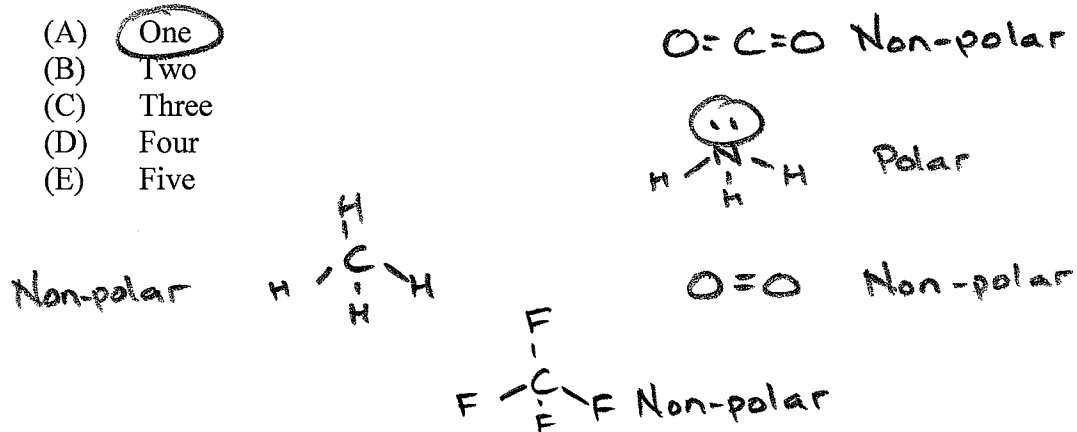
16. The O-C-O bond angle in carbon dioxide, CO₂, is:

- (A) A little less than 109.5°
- (B) 180°
- (C) 120°
- (D) 109.5°
- (E) 90°

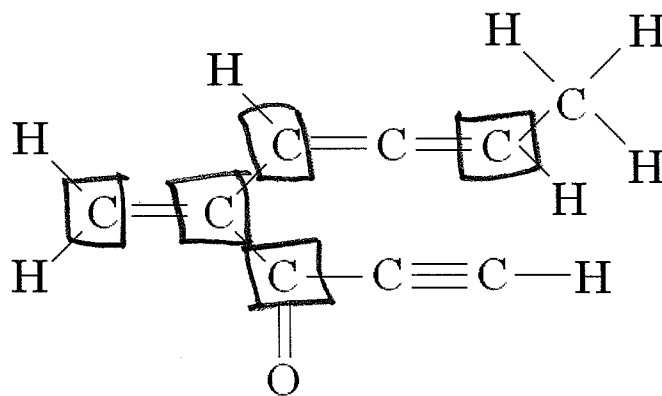


17. Consider the following five molecules: CO₂, NH₃, O₂, CH₄, and CF₄. How many of these are **polar** molecules?

- (A) One
- (B) Two
- (C) Three
- (D) Four
- (E) Five



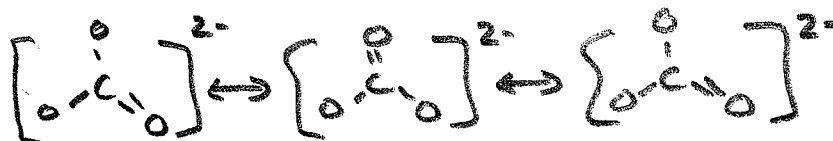
18. Consider the molecule below and identify the **correct** statement.



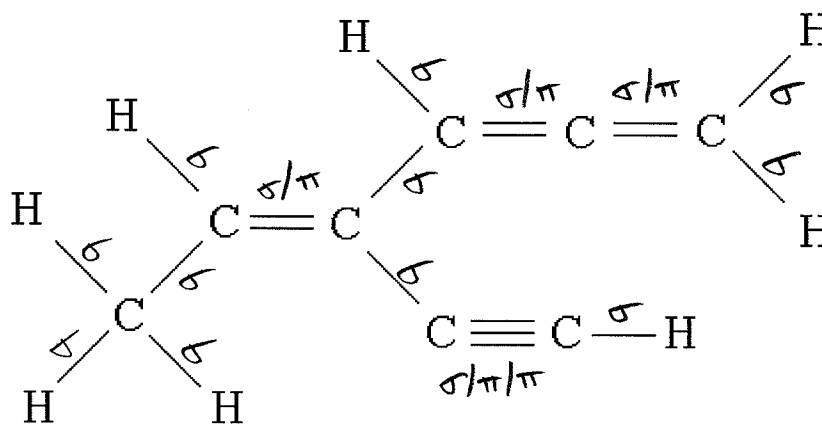
- =C'
- (A) There is one carbon that has an sp² hybridization scheme.
 - (B) There are two carbons that have sp² hybridization schemes.
 - (C) There are three carbons that have sp² hybridization schemes.
 - (D) There are four carbons that have sp² hybridization schemes.
 - (E) There are five carbons that have sp² hybridization schemes.

19. There are _____ resonance forms for the carbonate ion (CO_3^{2-}).

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



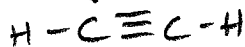
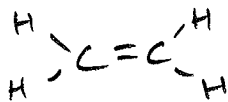
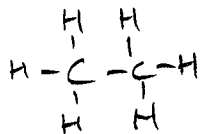
20. Consider the molecule below and identify the **correct** statement.



- (A) There are 15 pi-bonds
- (B) There are 5 pi-bonds
- (C) There are 4 pi-bonds
- (D) There are 11 pi-bonds
- (E) There are 3 pi-bonds

21. Consider C_2H_6 , C_2H_4 , and C_2H_2 . Which of these has the **strongest** carbon-carbon bond?

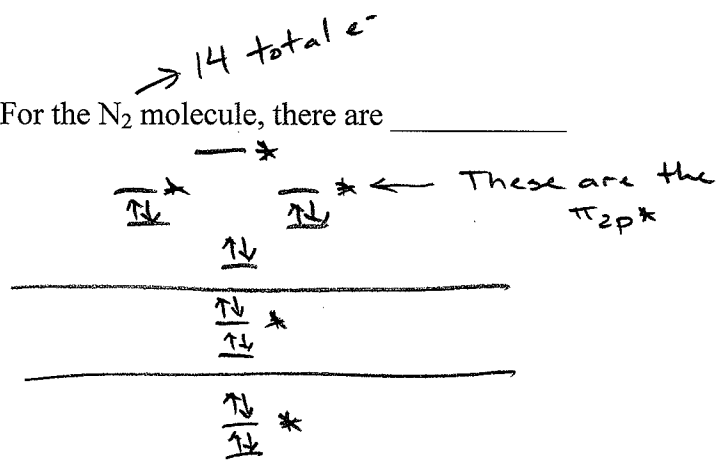
- (A) C_2H_6
- (B) C_2H_4
- (C) C_2H_2



↓
shortest, greatest bond order

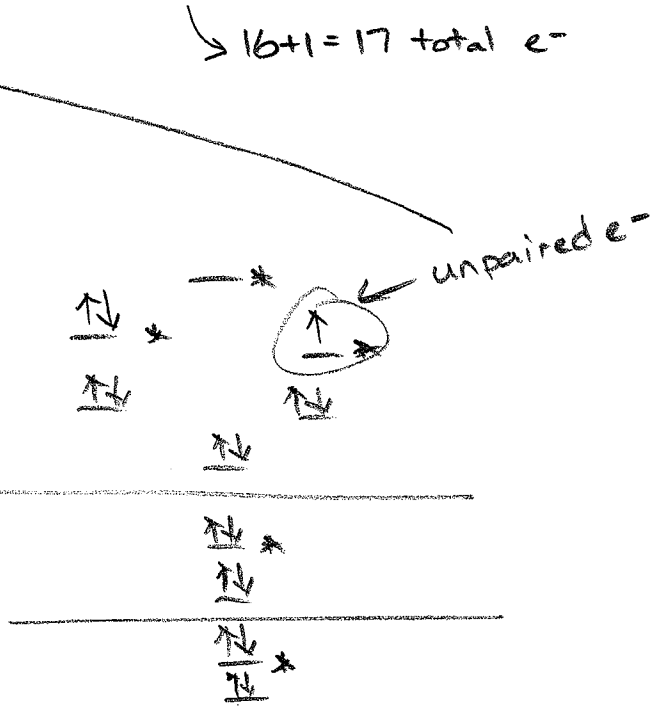
22. Consider MO (Molecular Orbital Theory). For the N_2 molecule, there are _____ electrons in the π_{2p}^* anti-bonding orbitals?

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



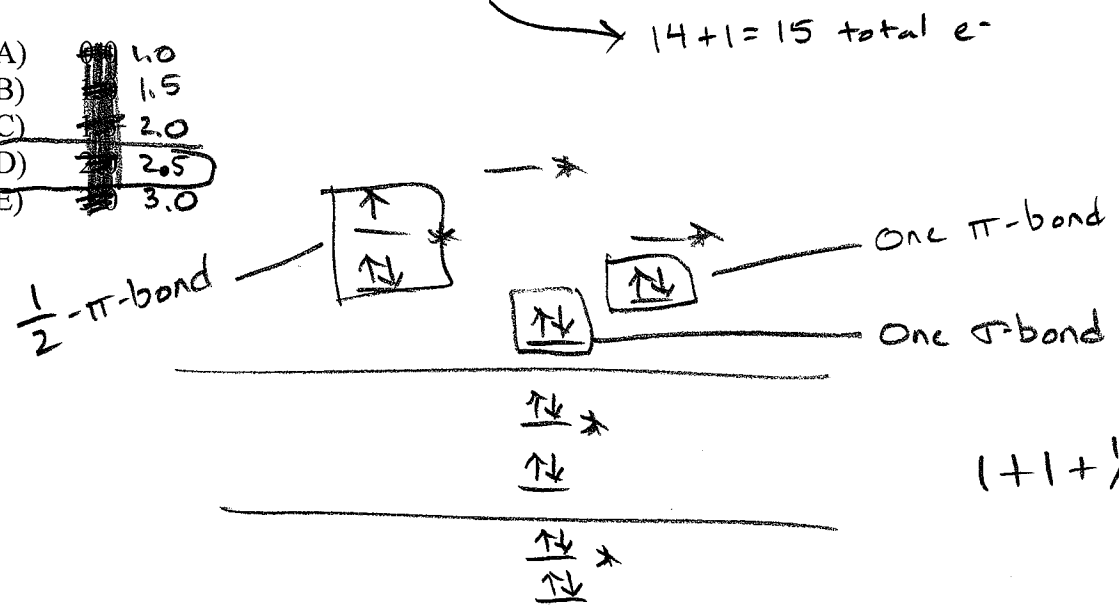
23. Consider MO (Molecular Orbital Theory). The O_2^- (a negative one charge) ion is:

- (A) paramagnetic
- (B) diamagnetic
- (C) tetramagnetic
- (D) Jay-Z-magnetic
- (E) Inauguration-magnetic



24. Molecular orbital theory predicts the N_2^- ion (a negative one charge) has a bond order of:

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



25. Because of Chemistry 122...

- (A) I've been getting a whole lot of dates by using pick-up lines that include the words polar, dipole, lobes, 180 degrees, see-saw, tetrahedral, and orbitals.
- (B) I have switched to a dandruff shampoo.
- (C) I have laughed more times in the past four weeks than I have in the previous four weeks... um, whatever.
- (D) I have completely forgotten about Hannah Montana—at least until 3 seconds ago; thanks for the reminder!
- (E) I like pie.

[Any response will receive full credit; even no response.]