

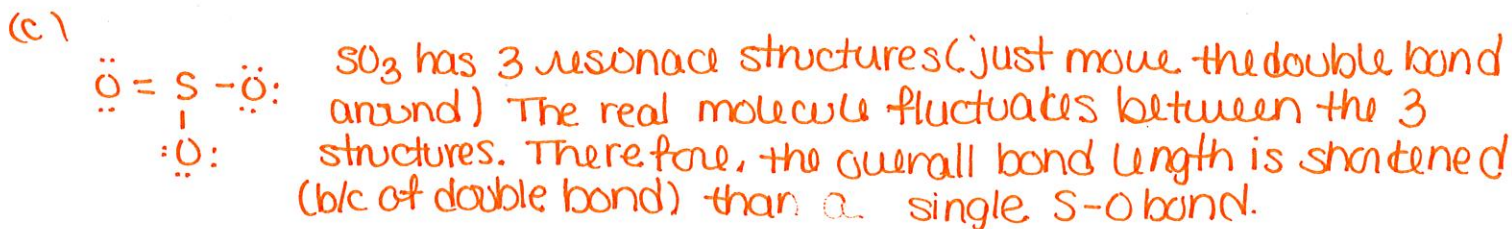
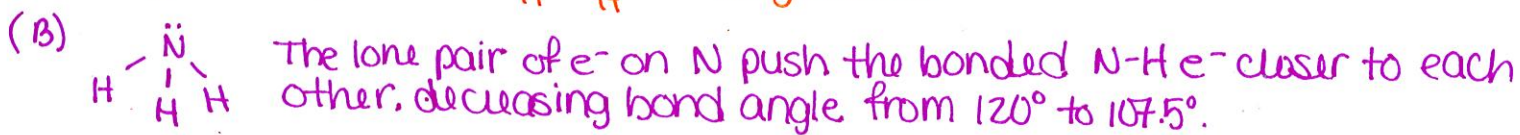
Key

1990 D (Required)

Use simple structure and bonding models to account for each of the following.

- (a) The bond length between the two carbon atoms is shorter in C_2H_4 than in C_2H_6 .
- (b) The H-N-H bond angle is 107.5° , in NH_3 .
- (c) The bond lengths in SO_3 are all identical and are shorter than a sulfur-oxygen single bond.
- (d) The I_3^- ion is linear.

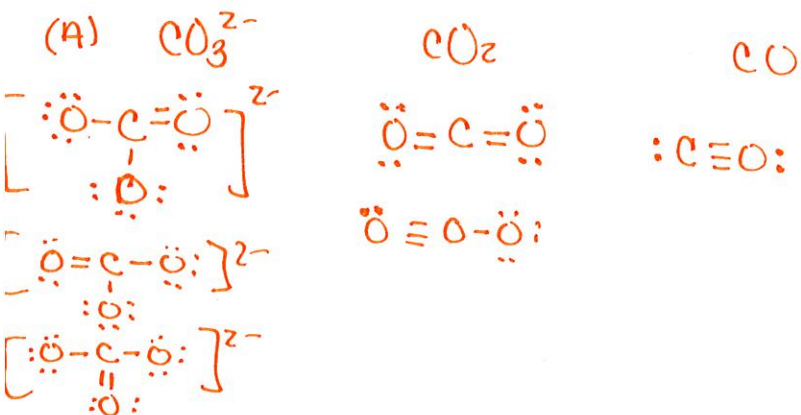
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1982 D

- (a) Draw the Lewis electron-dot structures for CO_3^{2-} , CO_2 , and CO , including resonance structures where appropriate.
- (b) Which of the three species has the shortest C-O bond length? Explain the reason for your answer.
- (c) Predict the molecular shapes for the three species. Explain how you arrived at your predictions.



(B): $C \equiv O$: → shortest bond length

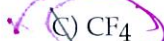
(C) CO_3^{2-} - trigonal planar CO_2 - linear CO - linear

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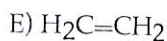
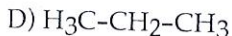
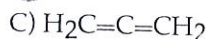
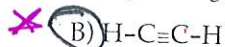
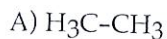
- 23) As the number of covalent bonds between two atoms increases, the distance between the atoms _____ and the strength of the bond between them _____.
- A) increases, increases
 - B) decreases, decreases
 - C) increases, decreases
 - D) decreases, increases
 - E) is unpredictable

- 6) Lattice energy is _____.
- A) the sum of electron affinities of the components in an ionic solid
 - B) the energy required to convert a mole of ionic solid into its constituent ions in the gas phase
 - C) the sum of ionization energies of the components in an ionic solid
 - D) the energy given off when gaseous ions combine to form one mole of an ionic solid
 - E) the energy required to produce one mole of an ionic compound from its constituent elements in their standard states

- 20) The central atom in _____ does not violate the octet rule.



- 7) In which of the molecules below is the carbon-carbon distance the shortest?



- 10) The Lewis structure of AsH_3 shows _____ nonbonding electron pair(s) on As.

A) 0

B) 1

C) 2

D) 3

E) This cannot be determined from the data given.

- 15) How many equivalent resonance forms can be drawn for SO_2 without expanding octet on the sulfur atom (sulfur is the central atom)?

A) 3

B) 0

C) 4

D) 2

E) 1

50. In the periodic table, as the atomic number increases from 11 to 17, what happens to the atomic radius?

(A) It remains constant.

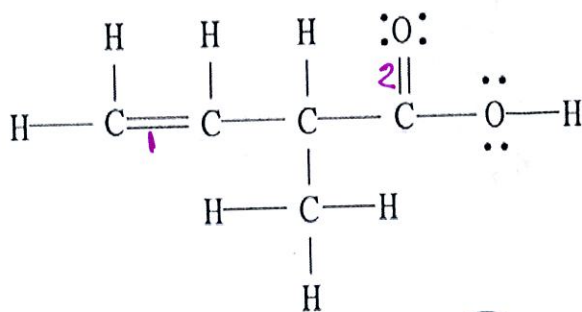
(B) It increases only.

(C) It increases, then decreases.

(D) It decreases only.

(E) It decreases, then increases.

48) There is/are _____ π bond(s) in the molecule below.



- A) 0 B) 1 ~~C) 2~~ D) 4 E) 16

35) The central iodine atom in IF_5 has _____ unbonded electron pairs and _____ bonded electron pairs in its valence shell.

- A) 1, 4 B) 4, 1 ~~C) 1, 5~~ D) 0, 5 E) 5, 1

22. $1s^2 2s^2 2p^6 3s^2 3p^3$

Atoms of an element, X, have the electronic configuration shown above. The compound most likely formed with magnesium, Mg, is

- (A) MgX
 (B) Mg_2X
 (C) MgX_2
 (D) MgX_3
~~(E) Mg_3X_2~~

12) The Lewis structure of N_2H_2 shows _____.

- ~~(A) each nitrogen has one nonbinding electron pair~~
 (B) each hydrogen has one nonbonding electron pair
 (C) each nitrogen has two nonbinding electron pairs
 (D) a nitrogen-nitrogen single bond
 (E) a nitrogen-nitrogen triple bond

29) The molecular geometry of the CS_2 molecule is _____.

- A) tetrahedral
 B) T-shaped
 C) bent
 D) trigonal planar
~~(E) linear~~

17. In which of the following groups are the three species isoelectronic; i.e., have the same number of electrons?

- ~~(A) S^{2-} , K^+ , Ca^{2+}~~
 (B) Sc , Ti , V^{2+}
 (C) O^{2-} , S^{2-} , Cl^-
 (D) Mg^{2+} , Ca^{2+} , Sr^{2+}
 (E) Cs , Ba^{2+} , La^{3+}

1989

Questions 1-3

- (A) O
- (B) La
- (C) Rb
- (D) Mg
- (E) N

- * 1. What is the most electronegative element? **A**
- ~~B~~ 2. Which element exhibits the greatest number of different oxidation states? **D**
- * 3. Which of the elements above has the smallest ionic radius for its most commonly found ion? **A**

38) The molecular geometry of the CHF_3 molecule is _____, and the molecule is _____.

- A) seesaw, nonpolar
- B) trigonal pyramidal, polar
- C) tetrahedral, nonpolar
- D) seesaw, polar
- * **E) tetrahedral, polar**

39) The electron-domain geometry of a carbon-centered compound is tetrahedral. The hybridization of the central carbon atom is _____.

- * **A) sp^3**
- B) sp
- C) sp^3d^2
- D) sp^2
- E) sp^3d

40) The hybridization of the carbon atom in carbon dioxide is _____.

- A) sp^3d
- B) sp^2
- * **C) sp**
- D) sp^3
- E) sp^3d^2

11. How many sigma (σ) and pi (π) electrons pairs are in a carbon dioxide molecule?

- a) four σ and zero π
- d) two σ and four π
- b) three σ and two π
- e) one σ and three π

- * **c) two σ and two π**

