

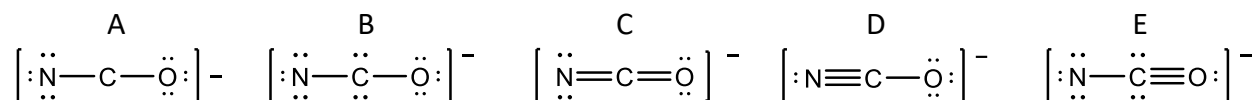
## Covalent Bonding and Molecular Geometry Sample Multiple Choice Questions Fall 2021

The number of sample questions does not reflect the number of questions that may appear on an In-term test.

1. Based on electronegativity trends, which of these is the MOST polar bond?

A. F—F      B. F—Cl      C. O—F      D. S—Cl      E. F—I

2. Which of these is the best Lewis structure for the isocyanate ion  $[\text{NCO}]^-$ ?



3. Consider the two resonance structures for nitrous acid ( $\text{HNO}_2$ ) shown below. What is the formal charge on the oxygen atom indicated by the arrow in each of the two resonance structures respectively?



A. +1, 0      B. -1, 0      C. 0, 0      D. 0, +1      E. 0, -1

4. For which one of the following molecule or ions do we invoke resonance in describing the bonding?

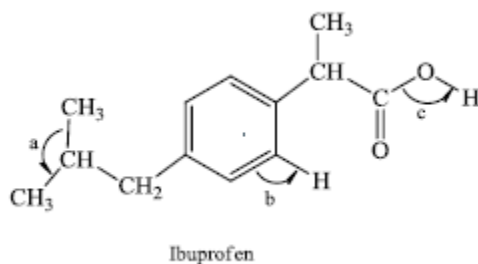
A.  $\text{N}_2$       B.  $\text{CCl}_4$       C.  $\text{CO}_3$       D.  $\text{PCl}_5$       E.  $\text{OF}_2$

5. The molecular geometry (shape) of a molecule with the general formula  $\text{AB}_2$  can be:

A. linear or bent  
B. linear or trigonal planar  
C. T-shaped only  
D. linear or T-shaped  
E. trigonal planar only

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6. Of the inter-halogen compounds  $\text{ICl}$ ,  $\text{ICl}_3$  and  $\text{ICl}_5$ , which statement concerning their molecular dipole moments is correct?
- A. None have a net molecular dipole.
  - B. All have a net molecular dipole.
  - C. Only  $\text{ICl}$  has a net molecular dipole.
  - D. Only  $\text{ICl}_3$  has a net molecular dipole.
  - E. Only  $\text{ICl}$  and  $\text{ICl}_3$  have net molecular dipoles.
7. Assuming that *the octet rule applies* to all these structures, which of the molecules:  $\text{HC}\equiv\text{CH}$ ,  $\text{HCN}$ ,  $\text{CO}$  has a non-zero formal charge on carbon?
- A.  $\text{HC}\equiv\text{CH}$
  - B.  $\text{HCN}$
  - C.  $\text{CO}$
  - D.  $\text{HCN}$  and  $\text{CO}$
  - E. none of them
8. A Lewis structure of Ibuprofen is shown below without its lone pairs of electrons. The *approximate* bond angle (in degrees,  $^\circ$ ) labeled "a", "b" and "c" in the drawing are, respectively:



- A. 120, 120, 120
- B. 120, 109, 180
- C. 180, 120, 120
- D. 109, 120, 109
- E. 109, 109, 120

## Covalent Bonding and Molecular Geometry Sample Multiple Choice Questions Fall 2021

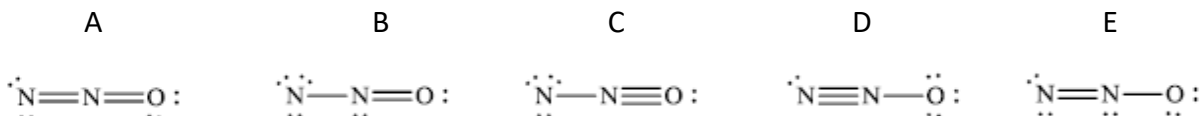
9. The number of electron pairs (bonding and non-bonding) around the Br atom in the best Lewis structure of  $\text{BrF}_5$  is
- A. 5 bonding, 0 non-bonding
  - B. 5 bonding, 1 non-bonding
  - C. 6 bonding, 0 non-bonding
  - D. 6 bonding, 1 non-bonding
  - E. 5 bonding, 2 non-bonding
10. How many F–Br–F bond angles are approximately  $90^\circ$  in  $\text{BrF}_5$ ?
- A.0      B.1      C.8      D.6      E.4
11. The molecular shape of the  $\text{PHCl}_2$  molecule is?
- A. Trigonal planar
  - B. Trigonal pyramidal
  - C. Bent
  - D. T-shaped
  - E. Tetrahedral
12. Which of the following statements about formal charges is INCORRECT?
- A. In calculating formal charge, shared electrons are assigned to the more electronegative atom.
  - B. In calculating formal charge, unshared electrons are assigned to the atom on which they are found.
  - C. In general, the Lewis structure in which the atoms bear the lowest formal charges is the preferred one.
  - D. In general, the Lewis structure in which any negative charge resides on the more electronegative element is the preferred one.
  - E. Formal charges do not represent the real charges on atoms.
13. What is the molecular geometry of  $\text{SF}_4$ ?
- A. seesaw
  - B. tetrahedral
  - C. square pyramidal
  - D. square planar
  - E. T-shaped

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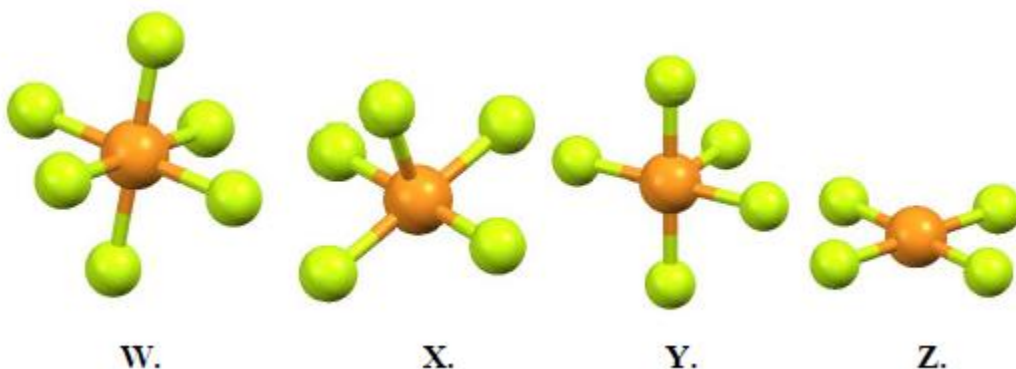
14. How many equivalent resonance structures (having the minimum number of formal charges) are possible for the ion  $[\text{SFO}_3]^-$ ? (The central atom is S.)

- A. 1      B. 2      C. 3      D. 4      E. 5

15. Which one of the following resonance structures of nitrous oxide ( $\text{N}_2\text{O}$ ) represents the most significant contributor to the resonance hybrid in this neutral molecule?



Use the structures below to answer the following three questions.



16. Which of the above structures is/are based on an octahedral **electron region geometry**?

- A. W only      B. X only      C. W, X & Y only      D. Z only      E. all of them

17. For the structure labeled **W** above, what atom would be the central atom **A** if the formula of the molecule is **AF<sub>6</sub>**?

- A. Sn      B. Sb      C. Te      D. I      E. Xe

18. How many lone pairs does the central atom of structure **Z** (above) possess?

- A. 2      B. 1      C. 0      D. 4      E. indeterminable

## Covalent Bonding and Molecular Geometry Sample Multiple Choice Questions Fall 2021

19. The triiodide ion ( $\text{I}_3^-$ ) is known but the trifluoride ion ( $\text{F}_3^-$ ) is not. Which of the following statements best explains the reason there's no such ion as  $\text{F}_3^-$ ?

- A. Iodine is more likely to be electron-deficient.
- B. Fluorine is too electronegative to form negative ions.
- C. Iodine has a larger electron affinity than fluorine.
- D. Fluorine can't accommodate three lone pairs and two bonds.
- E.  $\text{I}_2$  is known but  $\text{F}_2$  is not.

20. In which of the following compounds does every atom have an octet of electrons (8 electrons) in the Lewis structure?

- A.  $\text{SiF}_4$       B.  $\text{C}_2\text{H}_4$       C.  $\text{IF}_5$       D.  $\text{NO}_2$       E.  $\text{KH}$

21. What is the molecular geometry of  $[\text{SnCl}_5]^-$ ?

- A. Tetrahedral
- B. See-saw
- C. Octahedral
- D. Trigonal pyramidal
- E. Trigonal bipyramidal

22. How many of the molecules  $\text{SiCl}_4$ ,  $\text{SeCl}_2$ ,  $\text{SeCl}_4$  and  $\text{ICl}$  have a molecular dipole moment of zero?

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

23. Which molecule has a T-shaped molecular structure?

- A.  $\text{GaBr}_3$       B.  $\text{NH}_3$       C.  $\text{BrF}_3$       D.  $\text{AsH}_3$       E.  $\text{PCl}_3$

24. Which of these ionic compounds has the highest crystal lattice energy?

- A.  $\text{KCl}$       B.  $\text{CaCl}_2$       C.  $\text{Sc}_2\text{O}_3$       D.  $\text{CaO}$       E.  $\text{ScCl}_3$

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25. In what situation is the molecular shape the same as the shape of the electron-domain arrangement?
- A. When the central atom does not obey the octet rule
  - B. When the central atom does obey the octet rule
  - C. When all of the electron pairs on the central atom are involved in bonding
  - D. When all but one of the electron pairs on the central atom are involved in bonding
  - E. More than one of the above are correct.
26. How many non-bonding lone pairs are there in the best Lewis structure of  $\text{TeCl}_2$ ?
- A. 0                      B. 6                      C. 8                      D. 9                      E. 10
27. Which of these molecules contains the longest bond?
- A. F–F                      B. F–Cl                      C. O–F                      D. N–Cl                      E. F–I

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Question	Answer
1	E
2	D
3	D
4	C
5	A
6	B
7	C
8	D
9	B
10	C
11	B
12	A
13	A
14	C
15	D
16	E
17	C
18	A
19	D
20	A
21	E
22	B
23	C
24	C
25	C
26	C
27	E