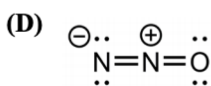
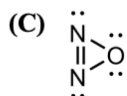
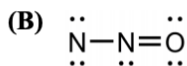
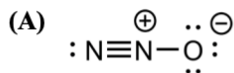


Bonding

Here are some practice problems!
-Venky & Anugrah

2019 USNCO Local

9. Which solid is least soluble in water at 298 K?
- (A) CaF_2 (B) AgF
(C) Ba(OH)_2 (D) CoSO_4
14. Ammonia (NH_3) has a higher normal boiling point (-33°C) than its heavier congeners PH_3 (bp -88°C) or AsH_3 (bp -63°C). Which is the best explanation for this difference?
- (A) NH_3 is trigonal pyramidal and polar while PH_3 and AsH_3 are trigonal planar and nonpolar.
(B) NH_3 is much more acidic than PH_3 or AsH_3 .
(C) $\text{NH}_3(l)$ experiences stronger London dispersion forces than $\text{PH}_3(l)$ or $\text{AsH}_3(l)$.
(D) $\text{NH}_3(l)$ has extensive hydrogen bonding while $\text{PH}_3(l)$ and $\text{AsH}_3(l)$ do not.
15. In which are the ionic solids ranked in order of increasing melting point?
- (A) $\text{KBr} < \text{NaCl} < \text{NaF} < \text{MgO}$
(B) $\text{NaF} < \text{NaCl} < \text{MgO} < \text{KBr}$
(C) $\text{KBr} < \text{NaCl} < \text{MgO} < \text{NaF}$
(D) $\text{MgO} < \text{NaF} < \text{KBr} < \text{NaCl}$
49. Which statements correctly describe the geometry of the carbonate ion, CO_3^{2-} ?
- I. All three carbon-oxygen bond distances are the same.
II. All three bond angles are 120° .
- (A) I only (B) II only
(C) Both I and II (D) Neither I nor II
50. Which molecule has a trigonal pyramidal geometry?
- (A) PCl_3 (B) BCl_3 (C) IF_3 (D) SO_3
52. Which resonance structure contributes the most to the overall bonding in nitrous oxide, N_2O ?



53. How many σ bonds and how many π bonds are present in allene, H_2CCCH_2 ?
- (A) One σ , one π (B) Five σ , one π
(C) Six σ , two π (D) Seven σ , two π

2018 USNCO Local

49. Which compound contains both ionic and covalent bonds?
- (A) PF_3 (B) KF
(C) CH_3COOH (D) MgSO_4
50. Which gas-phase molecule is NOT linear?
- (A) CS_2 (B) SO_2 (C) HCCH (D) BrCN
51. In the Lewis structure of the chlorate ion, ClO_3^- , how many lone pairs of electrons does the chlorine atom have?
- (A) 0 (B) 1 (C) 2 (D) 3

2015 USNCO Local

49. Which species are linear?
- I. NO_2^+ II. I_3^-
- (A) I only (B) II only
(C) Both I and II (D) Neither I nor II
51. Which statement about bonding is correct?
- (A) A σ bond has cylindrical symmetry about the bonding axis.
(B) A π bond is twice as strong as a σ bond.
(C) A double bond consists of two π bonds.
(D) A π bond results from the sideways overlap of hybridized orbitals.

2014 USNCO Local

49. Which atom is least likely to violate the octet rule in its compounds?
- (A) B (B) Cl (C) F (D) H
50. In the Lewis structure for formic acid, HCOOH , how many bonding pairs and lone pairs of electrons are present?
- (A) 4 bonding, 2 lone (B) 4 bonding, 5 lone
(C) 5 bonding, 0 lone (D) 5 bonding, 4 lone
51. Which ionic compound has the largest lattice energy?
- (A) LiF (B) BeO (C) KBr (D) CaS

52. When 1.0 mole of H_2O_2 decomposes to form H_2O and O_2 , 103 kJ of energy is released. Given the bond energies below, what is the bond energy of the O—O single bond in H_2O_2 ?

Bond	H—O	O=O
Bond Energy, $\text{kJ}\cdot\text{mol}^{-1}$	463	498

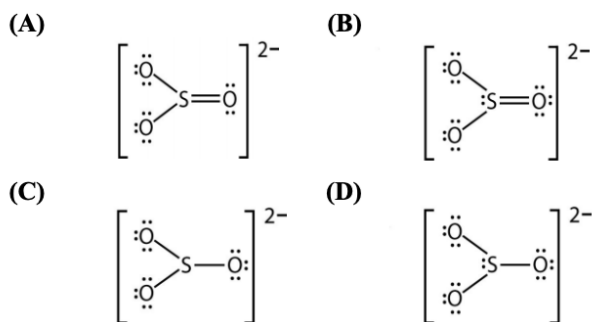
- (A) $+395 \text{ kJ}\cdot\text{mol}^{-1}$ (B) $+249 \text{ kJ}\cdot\text{mol}^{-1}$
 (C) $+146 \text{ kJ}\cdot\text{mol}^{-1}$ (D) $+103 \text{ kJ}\cdot\text{mol}^{-1}$
53. Which species has a different number of pi bonds than the others?
 (A) C_2H_2 (B) CO_2 (C) N_2 (D) O_3
54. Which molecule is correctly matched with its shape as predicted by VSEPR theory?
 (A) PCl_3 trigonal pyramidal
 (B) OF_2 linear
 (C) ClF_3 trigonal planar
 (D) SF_6 hexagonal

53. A triple bond is found in which of the following species?
 I CO II C_2H_2 III CN^-
 (A) I only (B) II only
 (C) I and II only (D) I, II and III

54. Which of the following compounds has a non-zero dipole moment?
 (A) CO_2 (B) AsH_3 (C) CCl_4 (D) PF_5

2012 USNCO Local

49. Which species contains only covalent bonds?
 (A) AlF_3 (B) NH_4NO_3
 (C) H_2SO_4 (D) $\text{K}_2\text{Cr}_2\text{O}_7$
50. In which species can we describe the central atom as having sp^2 hybridization?
 (A) BeF_2 (B) CO_2 (C) KrF_2 (D) SO_2
51. Which Lewis dot structure is a valid representation for the sulfite ion, $[\text{SO}_3]^{2-}$?



ANSWER KEYS:

2019 Local:

9: A
 14: D
 15: A
 49: C
 50: A
 52: A
 53: C
 2018 Local:
 49: D
 50: B
 51: B
 2015 Local:
 49: C
 51: A

2014 Local:

49: C
 50: D
 51: B
 52: C
 53: D
 54: A
 2012 Local:
 49: C
 50: D
 51: D
 53: D
 54: B