

100 Bonding Questions

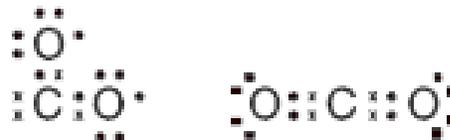
- Based on electronegativity values, which type of elements tends to have the greatest attraction for electrons in a bond? 1. metals 2. metalloids 3. nonmetals 4. noble gases
- Draw a Lewis electron-dot diagram for a chlorine atom in the ground state.
- Which element has atoms with the greatest attraction for electrons in a chemical bond?
1. beryllium 2. fluorine 3. lithium 4. oxygen
- Draw a Lewis electron-dot diagram of a aluminum atom in the ground state.
- Which of the following atoms has the greatest tendency to attract electrons?
1. barium 2. beryllium 3. boron 4. bromine
- Which of the following elements has the highest electronegativity? 1. H 2. K 3. Al 4. Ca
- The strength of an atom's attraction for the electrons in a chemical bond is the atom's
1. electronegativity 2. ionization energy 3. heat of reaction 4. heat of formation
- What is represented by the dots in a Lewis electron-dot diagram of an atom of an element in Period 2 of the Periodic Table?
1. the number of neutrons in the atom 2. the number of protons in the atom
3. the number of valence electrons in the atom 4. the total number of electrons in the atom
- As a neutral sulfur atom gains two electrons, what happens to the radius of the atom?
- As two chlorine atoms combine to form a molecule, energy is
1. absorbed 2. released 3. created 4. destroyed
- What occurs when an atom of chlorine forms a chloride ion?
1. The chlorine atom gains an electron, and its radius becomes smaller.
2. The chlorine atom gains an electron, and its radius becomes larger.
3. The chlorine atom loses an electron, and its radius becomes smaller.
4. The chlorine atom loses an electron, and its radius becomes larger.
- What occurs when an atom of chlorine and an atom of hydrogen become a molecule of hydrogen monochloride?
1. A chemical bond is broken and energy is released.
2. A chemical bond is formed and energy is released.
3. A chemical bond is broken and energy is absorbed.
4. A chemical bond is formed and energy is absorbed.

14. Which of these elements has the least attraction for electrons in a chemical bond?
 1. oxygen 2. fluorine 3. nitrogen 4. chlorine
15. Which change occurs when a barium atom loses two electrons?
 1. It becomes a negative ion and its radius decreases.
 2. It becomes a positive ion and its radius decreases.
 3. It becomes a negative ion and its radius increases.
 4. It becomes a positive ion and its radius increases.
16. Which Lewis electron-dot diagram represents a boron atom in the ground state?



17. Based on Reference Table S, the atoms of which of these elements have the strongest attraction for electrons in a chemical bond? 1. N 2. Na 3. P 4. Pt
18. Draw the electron-dot (Lewis) structure of calcium chloride.
19. Draw the Lewis dot diagram for carbon dioxide.
20. Draw the Lewis dot diagram for water.
21. Draw the Lewis dot diagram for aluminum phosphide.
22. Which compound contains ionic bonds? 1. NO 2. NO₂ 3. CaO 4. CO₂
23. Which formula represents an ionic compound? 1. NaCl 2. N₂O 3. HCl 4. H₂O
24. What is the total number of pairs of electrons shared in a molecule of N₂?
 1. one 2. two 3. three 4. four
25. What is the total number of electrons shared in a molecule of N₂?
 1. one 2. two 3. three 4. six
26. Which type of bond results when one or more valence electrons are transferred from one atom to another?
 1. a hydrogen bond 2. an ionic bond
 3. a nonpolar covalent bond 4. a polar covalent bond

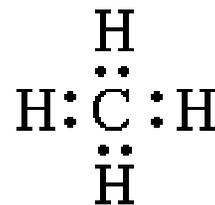
27. What is the total number of electrons shared in the bonds between the two carbon atoms in a molecule of C_2H_2 ? 1. 6 2. 2 3. 3 4. 8
28. A metal, M, forms an oxide compound with the general formula M_2O . In which group on the Periodic Table could metal M be found? 1. Group 1 2. Group 2 3. Group 16 4. Group 17
29. The two diagrams at right *should* make you remember...
1. CO_2 is bent and is a polar molecule
 2. CO_2 is straight and is a polar molecule
 3. CO_2 is bent and is a nonpolar molecule
 4. CO_2 is straight and is a nonpolar molecule.



Draw an electron-dot diagram for each of the following substances:

30. calcium oxide, CaO
 31. hydrogen monobromide, HBr
 32. ethane, C_2H_2
33. Which molecule contains a triple covalent bond? 1. H_2 2. N_2 3. O_2 4. Cl_2
34. Which of these formulas contains the most polar bond? 1. $H-Br$ 2. $H-Cl$ 3. $H-F$ 4. $H-I$
35. Which element has atoms that can form single, double, and triple covalent bonds with other atoms of the same element? 1. hydrogen 2. oxygen 3. fluorine 4. carbon
36. Which type of chemical bond is formed between two atoms of bromine?
1. metallic
 2. hydrogen
 3. ionic
 4. covalent
37. Which type of bond is formed when electrons are transferred from one atom to another?
1. metallic
 2. hydrogen
 3. ionic
 4. covalent
38. The bond between Br atoms in a Br_2
1. ionic and is formed by the sharing of two valence electrons
 2. covalent and is formed by the sharing of two valence electrons
 3. ionic and is formed by the transfer of two valence electrons
 4. covalent and is formed by the transfer of two valence electrons
39. Covalent bonds are formed when electrons are
1. transferred from one atom to another
 2. captured by the nucleus
 3. mobile within a metal
 4. shared between two atoms
40. The bonds between hydrogen and oxygen in a water molecule are classified as
1. polar covalent
 2. nonpolar covalent
 3. ionic
 4. metallic

41. Which compound contains only covalent bonds?
 1. NaOH 2. Ba(OH)₂ 3. Ca(OH)₂ 4. CH₃OH



42. In the diagram at right, which electrons are represented by all of the dots?
 1. only carbon valence electrons 2. only hydrogen valence electrons
 3. the carbon + hydrogen valence electrons 4. all of the carbon + hydrogen electrons

43. Which substance is correctly paired with its type of bonding?
 1. NaBr - nonpolar covalent 2. HCl - nonpolar covalent
 3. NH₃ - polar covalent 4. Br₂ - polar covalent

44. Which compound contains both ionic and covalent bonds?
 1. CaCO₃ 2. PCl 3. MgF₂ 4. CH₂O

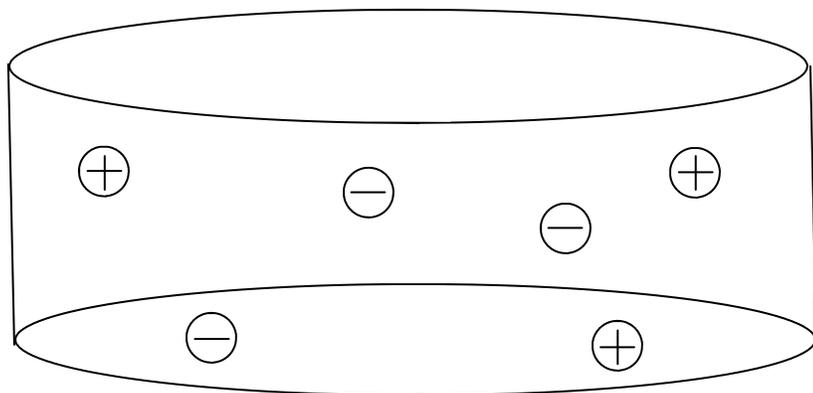
45. Which formula represents a nonpolar molecule containing polar covalent bonds?
 1. H₂O 2. CCl₄ 3. NH₃ 4. H₂

46. The degree of polarity of a chemical bond in a molecule of a compound can be predicted by determining the difference in the
 1. melting points of the elements in the compound
 2. densities of the elements in the compound
 3. electronegativities of the bonded atoms in a molecule of the compound
 4. atomic masses of the bonded atoms in a molecule of the compound

47. Which formula represents a nonpolar molecule? 1. CH₄ 2. HCl 3. H₂O 4. NH₃

48. The strongest forces of attraction occur between molecules of
 1. HCl 2. HF 3. HBr 4. HI

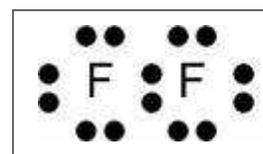
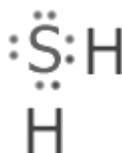
49. Using the symbols in the key at right, draw at least 12 water molecules with proper orientation to the potassium nitrate ions.



| KEY | |
|------------------|--|
| water | |
| potassium cation | |
| nitrate anion | |

50. Explain why CCl_4 is classified as a nonpolar molecule.
51. Explain why NH_3 has stronger intermolecular forces of attraction than Cl_2 .
52. Draw the electron-dot (Lewis) structure for the ammonia molecule.
53. Explain why the bonding in KCl is different than the compounds in questions 50, 51, and 52.
54. Which molecule is nonpolar? 1. H_2O 2. NH_3 3. CO 4. CO_2
55. Which of the following compounds has the highest boiling point? 1. H_2O 2. H_2S 3. H_2Se 4. H_2Te
56. Which type of molecule is CF_4 ?
1. polar, with a symmetrical distribution of charge
 2. nonpolar, with a symmetrical distribution of charge
 3. polar, with an asymmetrical distribution of charge
 4. nonpolar, with an asymmetrical distribution of charge
57. Molecules in a sample of $\text{NH}_3(\text{l})$ are held closely together by intermolecular forces
1. existing between ions
 2. existing between electrons
 3. caused by different numbers of neutrons
 4. caused by unequal charge distribution
58. Based on intermolecular forces, which of these substances would have the highest boiling point?
1. He
 2. O_2
 3. CH_4
 4. NH_3

Base your answers to questions 59-61 on your knowledge of chemical bonding and on the Lewis electron-dot diagrams of CO_2 , H_2S , and F_2 below.



59. Which atom, when bonded as shown, has the same electron configuration as an atom of argon?
60. Explain, in terms of structure and/or distribution of charge, why CO_2 is a nonpolar molecule.
61. Explain, in terms of electronegativity, why a $\text{C}-\text{O}$ bond in CO_2 is more polar than the $\text{F}-\text{F}$ bond in F_2

62. Draw a Lewis electron-dot diagram for a molecule of chlorine, Cl_2 .
63. Explain, in terms of electrons, why the bonding in NaCl is ionic.
64. Which element is malleable and can conduct electricity in the solid phase?
1. iodine 2. phosphorus 3. sulfur 4. tin
65. Which type of bond is found in sodium bromide? 1. covalent 2. hydrogen 3. ionic 4. metallic
66. Explain, in terms of molecular polarity, why hydrogen monochloride is more soluble than hydrogen in water under the same conditions of temperature and pressure.

Base your answers for questions 67, 68, and 69 on the information below.

Testing of an unknown solid shows that it has the properties listed here: It has a low melting point, it's nearly insoluble in water, it's a nonconductor of electricity, and it is a relatively soft solid.

67. State the type of bonding that would be expected in the particles of this substance.
68. Explain in terms of attractions between particles why the unknown solid has a low melting point.
69. Explain why the particles of this substance are nonconductors of electricity.
70. Metallic bonding occurs between atoms of 1. sulfur 2. copper 3. fluorine 4. carbon
71. The high electrical conductivity of metals is primarily due to
1. high ionization energies 2. filled energy levels 3. mobile electrons 4. high electronegativities
72. Which substance contains metallic bonds? 1. $\text{Hg}_{(L)}$ 2. $\text{H}_2\text{O}_{(L)}$ 3. $\text{NaCl}_{(S)}$ 4. $\text{C}_6\text{H}_{12}\text{O}_6_{(S)}$
73. Which is a property of most nonmetallic solids?
1. high thermal conductivity 2. high electrical conductivity 3. brittleness 4. malleability
74. Which statement describes a chemical property of iron?
1. Iron can be flattened into sheets. 2. Iron conducts electricity and heat.
3. Iron combines with oxygen to form rust. 4. Iron can be drawn into a wire.
75. Which characteristic is a property of molecular substances?
1. good heat conductivity 2. good electrical conductivity 3. low melting point 4. high melting point
76. A substance that does not conduct electricity as a solid but does conduct electricity when melted is most likely classified as 1. an ionic compound 2. a molecular compound 3. a metal 4. a nonmetal
77. What sort of symmetry does a nonpolar molecule exhibit?

78. What sort of bonding exists in a carbon monoxide molecule?
79. What sort of bonding exists in an ozone molecule?
80. What sort of bonding exists in the compound copper (II) sulfate pentahydrate?
81. Draw six water molecules and clearly show the hydrogen bonding that exists between them.
82. Draw the Lewis dot diagram for sodium chloride
83. Draw the Lewis dot diagram for water.
84. Explain why fluorine and chlorine are gases at STP, but bromine is liquid, and iodine is a solid.
85. Name two compounds with molecular bonds only.
86. Name two compounds with ionic bonds only.
87. Why does Cl_2 have a nonpolar bond while HCl has a polar bond?
88. Rank these bonds from strongest to weakest polarity: HCl HF HI HBr
89. Which element has atoms that can form single, double, or triple covalent bonds with atoms of the same element? 1. H 2. O 3. C 4. F
90. Which substance represents a compound? 1. $\text{C}_{(s)}$ 2. $\text{Co}_{(s)}$ 3. $\text{CO}_{(g)}$ 4. $\text{O}_{2(g)}$
91. As two chlorine atoms combine to form one molecule of chlorine, energy is
1. absorbed 2. released 3. created 4. destroyed
92. Which bond type is formed when electrons are transferred from one atom to another atom?
1. covalent 2. ionic 3. hydrogen 4. metallic
93. Covalent bonds are formed when electrons are
1. transferred from one atom to another 2. captured by the nucleus
3. mobile within a metal 4. shared between two atoms
94. Which of these substances contains a coordinate covalent bond? 1. CO 2. CO_2 3. NaCl 4. Au
95. Which molecule here does not have radial symmetry and is polar? 1. CBr_4 2. CHCl_3 3. CH_4 4. N_2
96. Explain why CCl_4 is a nonpolar molecule but contains polar bonds.
97. Explain what the valence electrons are doing in the molecule boron tri-iodide
98. Draw the electron dot diagram for sodium chloride
99. Draw the Lewis dot diagram for phosphorous trichloride
100. Contrast electron dispersion forces with dipole attraction forces.