

Chem Bonding

Notes

- At STP, the element oxygen can exist as either O_2 or O_3 gas molecules. These two forms of the element have
 - the same chemical and physical properties
 - the same chemical properties and different physical properties
 - different chemical properties and the same physical properties
 - different chemical and physical properties
- Which of the following solids has the highest melting point?
 - $H_2O(s)$
 - $Na_2O(s)$
 - $SO_2(s)$
 - $CO_2(s)$
- The bond between Br atoms in a Br_2 molecule is
 - ionic and is formed by the sharing of two valence electrons
 - ionic and is formed by the transfer of two valence electrons
 - covalent and is formed by the sharing of two valence electrons
 - covalent and is formed by the transfer of two valence electrons
- What occurs when an atom of chlorine and an atom of hydrogen become a molecule of hydrogen chloride?
 - A chemical bond is broken and energy is released.
 - A chemical bond is broken and energy is absorbed.
 - A chemical bond is formed and energy is released.
 - A chemical bond is formed and energy is absorbed.
- Which molecule is nonpolar?
 - H_2O
 - NH_3
 - CO
 - CO_2
- What is the correct formula for iron (III) phosphate?
 - FeP
 - Fe_3P_2
 - $FePO_4$
 - $Fe_3(PO_4)_2$
- Which of the following compounds has the highest boiling point?
 - H_2O
 - H_2S
 - H_2Se
 - H_2Te
- Which compound contains ionic bonds?
 - NO
 - NO_2
 - CaO
 - CO_2
- Metallic bonding occurs between atoms of
 - sulfur
 - copper
 - fluorine
 - carbon
- Covalent bonds are formed when electrons are
 - transferred from one atom to another
 - captured by the nucleus
 - mobile within a metal
 - shared between two atoms

21. The bonds between hydrogen and oxygen in a water molecule are classified as

- (1) polar covalent
- (2) nonpolar covalent
- (3) ionic
- (4) metallic

22. Which compound contains both ionic and covalent bonds?

- (1) CaCO_3
- (2) PCl_3
- (3) MgF_2
- (4) CH_2O

23. Which formula represents a nonpolar molecule?

- (1) HCl
- (2) H_2O
- (3) NH_3
- (4) CF_4

24. Which type of bond is formed when electrons are transferred from one atom to another?

- (1) covalent
- (2) ionic
- (3) hydrogen
- (4) metallic

25. Which Lewis electron-dot structure is drawn correctly for the atom it represents?

- (1) $\text{:}\ddot{\text{N}}$
- (2) $\text{:}\ddot{\text{F}}$
- (3) $\text{:}\ddot{\text{O}}$
- (4) $\text{:}\ddot{\text{Ne}}$

26. What is the correct IUPAC name for the compound NH_4Cl ?

- (1) nitrogen chloride
- (2) nitrogen chlorate
- (3) ammonium chloride
- (4) ammonium chlorate

27. Which characteristic is a property of molecular substances?

- (1) good heat conductivity
- (2) good electrical conductivity
- (3) low melting point
- (4) high melting point

28. Molecules in a sample of NH_3 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 — Polar Molecule

29. Which substance is correctly paired with its type of bonding?

- (1) NaBr —nonpolar covalent
- (2) HCl —nonpolar covalent
- (3) NH_3 —polar covalent
- (4) Br_2 —polar covalent

30. The table below shows the normal boiling point of four compounds. Which compound has the strongest intermolecular forces?

Compound	Normal Boiling Point (°C)
HF(ℓ)	19.4
CH ₃ Cl(ℓ)	-24.2
CH ₃ F(ℓ)	-78.6
HCl(ℓ)	-83.7

- (1) HF (3) CH₃F
 (2) CH₃Cl (4) HCl

31. The data table below represents the properties determined by the analysis of substances A, B, C, and D.

Substance	Melting Point (°C)	Boiling Point (°C)	Conductivity
A	-80	-20	none
B	20	190	none
C	320	770	as solid
D	800	1250	in solution

Which substance is an ionic compound?

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

32. A chemist performs the same tests on two homogeneous white crystalline solids, A and B. The results are shown in the table below.

	Solid A	Solid B
Melting Point	High, 801°C	Low, decomposes at 186°C
Solubility in H ₂ O (grams per 100.0 g H ₂ O at 0°C)	35.7	3.2
Electrical Conductivity (in aqueous solution)	Good conductor	Nonconductor

The results of these tests suggest that

- (1) both solids contain only ionic bonds
 (2) both solids contain only covalent bonds
 (3) solid A contains only covalent bonds and solid B contains only ionic bonds
 (4) solid A contains only ionic bonds and solid B contains only covalent bonds

33. In the space provided *in your answer booklet*, draw an electron-dot diagram for *each* of the following substances:

a. calcium oxide (an ionic compound) [1]



b. hydrogen bromide [1]

c. carbon dioxide [1]

Each molecule listed below is formed by sharing electrons between atoms when the atoms within the molecule are bonded together.

Molecule A: Cl_2

Molecule B: CCl_4

Molecule C: NH_3

34. In the box provided *in your answer booklet*, draw the electron-dot (Lewis) structure for the NH_3 molecule. [1]

35. Explain why CCl_4 is classified as a nonpolar molecule. [1]

36. Explain why NH_3 has stronger intermolecular forces of attraction than Cl_2 . [1]

37. Explain how the bonding in KCl is different from the bonding in molecules A, B, and C. [1]

Base your answers to questions 38 through 40 on the information below.

Naphthalene, a nonpolar substance that sublimates at room temperature, can be used to protect wool clothing from being eaten by moths.

38. Explain, in terms of *intermolecular forces*, why naphthalene sublimates. [1]

39. Explain why naphthalene is *not* expected to dissolve in water. [1]

40. The empirical formula for naphthalene is C_5H_4 and the molecular mass of naphthalene is 128 grams/mole. What is the molecular formula for naphthalene? [1]

41. In the box provided *in your answer booklet*, draw the electron-dot (Lewis) structure of an atom of calcium. [1]

42. In the box provided *in your answer booklet*, draw the electron-dot (Lewis) structure of an atom of chlorine. [1]

43. In the box provided *in your answer booklet*, draw the electron-dot (Lewis) structure of calcium chloride. [2]

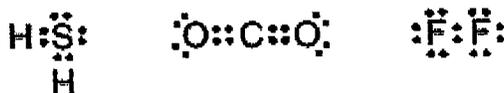
Base your answers to questions 44 through 46 on the information below.

Testing of an unknown solid shows that it has the properties listed below.

- (1) low melting point
- (2) nearly insoluble in water
- (3) nonconductor of electricity
- (4) relatively soft solid

44. State the type of bonding that would be expected in the particles of this substance. [1]
45. Explain in terms of attractions between particles why the unknown solid has a low melting point. [1]
46. Explain why the particles of this substance are nonconductors of electricity. [1]

Lewis electron-dot diagrams of H_2S , CO_2 , and F_2 below.



47. Which atom, when bonded as shown, has the same electron configuration as an atom of argon? [1]
48. Explain, in terms of *structure* and/or *distribution of charge*, why CO_2 is a nonpolar molecule. [1]
49. Explain, in terms of *electronegativity*, why a C–O bond in CO_2 is more polar than the F–F bond in F_2 . [1]