

- Which element has atoms that can form single, double, and triple covalent bonds with other atoms of the same element?
 - hydrogen
 - oxygen
 - fluorine
 - carbon
- What is the number of electrons shared between the atoms in an I₂ molecule?
 - 7
 - 2
 - 8
 - 4
- What is the number of electrons shared between the atoms in a molecule of nitrogen, N₂?
 - 8
 - 2
 - 3
 - 6
- The nitrogen atoms in a molecule of N₂ share a total of
 - one pair of electrons
 - one pair of protons
 - three pairs of electrons
 - three pairs of protons
- Which type of bonding is found in all molecular substances?
 - covalent bonding
 - hydrogen bonding
 - ionic bonding
 - metallic bonding
- Which formula represents a molecular compound?
 - Kr
 - LiOH
 - N₂O₄
 - NaI
- Which terms describe a substance that has a low melting point and poor electrical conductivity?
 - covalent and metallic
 - covalent and molecular
 - ionic and molecular
 - ionic and metallic
- Which characteristic is a property of molecular substances?
 - good heat conductivity
 - good electrical conductivity
 - low melting point
 - high melting point
- What is the maximum number of covalent bonds that a carbon atom can form?
 - 1
 - 2
 - 3
 - 4
- The bond between which two atoms is most polar?
 - C-O
 - F-F
 - H-O
 - N-H
- An atom of which element reacts with an atom of hydrogen to form a bond with the greatest degree of polarity?
 - carbon
 - fluorine
 - nitrogen
 - oxygen
- Which combination of atoms can form a polar covalent bond?
 - H and H
 - H and Br
 - N and N
 - Na and Br
- Which molecule contains a polar covalent bond?
 - $$\begin{array}{c} \times \times \\ \times \text{I} \times \text{I} \times \\ \times \times \end{array}$$
 - $$\text{H} \times \text{H}$$
 - $$\begin{array}{c} \times \\ \text{H} \times \text{N} \times \text{H} \\ \times \\ \text{H} \end{array}$$
 - $$:\text{N} \times \times \text{N} \times$$
- Which type of molecule is CF₄?
 - polar, with a symmetrical distribution of charge
 - polar, with an asymmetrical distribution of charge
 - nonpolar, with a symmetrical distribution of charge
 - nonpolar, with an asymmetrical distribution of charge
- At STP, fluorine is a gas and bromine is a liquid because, compared to fluorine, bromine has
 - stronger covalent bonds
 - stronger intermolecular forces
 - weaker covalent bonds
 - weaker intermolecular forces
- Which electron dot formula represents a nonpolar molecule?
 - $$\begin{array}{c} \text{H} \\ \text{H} : \text{C} : \text{Cl} \\ \text{H} \end{array}$$
 - $$\begin{array}{c} \text{H} \\ \text{H} : \text{N} : \\ \text{H} \end{array}$$
 - $$\begin{array}{c} \text{H} \\ \text{H} : \text{C} : \text{H} \\ \text{H} \end{array}$$
 - $$\begin{array}{c} \text{H} \\ \text{H} : \text{O} : \\ \text{H} \end{array}$$

Practice Test

17A 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

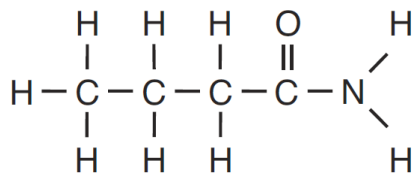
- 1) both solids contain only ionic bonds
- 2) both solids contain only covalent bonds
- 3) solid *A* contains only covalent bonds and solid *B* contains only ionic bonds
- 4) solid *A* contains only ionic bonds and solid *B* contains only covalent bonds

18. Which statement explains why a molecule of CH₄ is nonpolar?
- 1) The bonds between the atoms in a CH₄ molecule are polar.
 - 2) The bonds between the atoms in a CH₄ molecule are ionic.
 - 3) The geometric shape of a CH₄ molecule distributes the charges symmetrically.
 - 4) The geometric shape of a CH₄ molecule distributes the charges asymmetrically.
19. Which is the formula of a nonpolar molecule containing nonpolar bonds?
- 1) CO₂
 - 2) H₂
 - 3) NH₃
 - 4) H₂O
20. Which formula represents a polar molecule?
- 1) Br₂
 - 2) CO₂
 - 3) CH₄
 - 4) NH₃
21. Which attractions are most prevalent between molecules of HF in the liquid phase?
- 1) van der Waals forces
 - 2) hydrogen bonds
 - 3) molecule-ion attractions
 - 4) ion-ion attractions
22. Hydrogen bonds would be strongest between the molecules of a compound of hydrogen and
- 1) I
 - 2) Br
 - 3) Cl
 - 4) F
23. Oxygen, nitrogen, and fluorine bond with hydrogen to form molecules. These molecules are attracted to each other by
- 1) ionic bonds
 - 2) hydrogen bonds
 - 3) electrovalent bonds
 - 4) coordinate covalent bonds
24. The phase of a sample of a molecular substance at STP is *not* determined by its
- 1) arrangement of molecules
 - 2) intermolecular forces
 - 3) number of molecules
 - 4) molecular structure
25. Which statement explains why Br₂ is a liquid at STP and I₂ is a solid at STP?
- 1) Molecules of Br₂ are polar, and molecules of I₂ are nonpolar.
 - 2) Molecules of I₂ are polar, and molecules of Br₂ are nonpolar.
 - 3) Molecules of Br₂ have stronger intermolecular forces than molecules of I₂.
 - 4) Molecules of I₂ have stronger intermolecular forces than molecules of Br₂.
26. Which substance has the highest normal melting point?
- 1) CH₄
 - 2) C₂H₆
 - 3) C₃H₈
 - 4) C₄H₁₀

Practice Test

27. Base your answer to the following question on the information below and on your knowledge of chemistry.

The formula below represents a molecule of butanamide.



State the type of chemical bond between a hydrogen atom and the nitrogen atom in the molecule.

28. The table below shows the normal boiling point of four compounds.

Compound	Normal Boiling Point (°C)
$\text{HF}(\ell)$	19.4
$\text{CH}_3\text{Cl}(\ell)$	-24.2
$\text{CH}_3\text{F}(\ell)$	-78.6
$\text{HCl}(\ell)$	-83.7

Which compound has the strongest intermolecular forces?

- 1) $\text{HF}(\ell)$ 2) $\text{CH}_3\text{Cl}(\ell)$
3) $\text{CH}_3\text{F}(\ell)$ 4) $\text{HCl}(\ell)$
29. Nitrogen gas will become a liquid at low temperatures primarily because of
- 1) van der Waals forces
 - 2) hydrogen bonding
 - 3) covalent bonding
 - 4) ionic attraction
30. Which characteristic of the compound C_5H_{12} causes it to have a higher normal boiling point than C_2H_6 ?
- 1) The distance between molecules of C_5H_{12} is greater.
 - 2) The force of attraction between molecules of C_5H_{12} is greater.
 - 3) C_5H_{12} has a larger number of ionic bonds.
 - 4) C_5H_{12} has a larger number of double bonds.
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Practice Test


31. Base your answer to the following question on the information below and on your knowledge of chemistry.

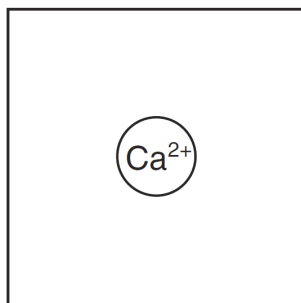
A sample of seawater is analyzed. The table below gives the concentration of some ions in the sample.

**Concentration of Some Ions
in a Seawater Sample**

Ion	Concentration (M)
Cl ⁻	0.545
Na ⁺	0.468
Mg ²⁺	0.054
SO ₄ ²⁻	0.028
Ca ²⁺	0.010
K ⁺	0.010

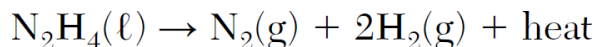
Using the key, draw *two* water molecules in the box, showing the orientation of *each* water molecule toward the calcium ion.

Key
● = hydrogen atom
○ = oxygen atom
 = water molecule



32. Base your answer to the following question on the information below and on your knowledge of chemistry.

Hydrazine, N₂H₄, is a compound that is very soluble in water and has a boiling point of 113°C at standard pressure. Unlike water, hydrazine is very reactive and is sometimes used as a fuel for small rockets. One hydrazine reaction producing gaseous products is represented by the balanced equation below.



Explain, in terms of intermolecular forces, why the boiling point of hydrazine at standard pressure is higher than the boiling point of water as standard pressure.

Practice Test

33. Base your answer to the following question on the information below and on your knowledge of chemistry.

The formulas and the boiling points at standard pressure for ethane, methane, methanol, and water are shown in the table below.

Information for Four Compounds

Name	Formula	Boiling Point (°C)
ethane	$\begin{array}{c} \text{H} \quad \text{H} \\ \quad \\ \text{H}-\text{C}-\text{C}-\text{H} \\ \quad \\ \text{H} \quad \text{H} \end{array}$	-88.6
methane	$\begin{array}{c} \text{H} \\ \\ \text{H}-\text{C}-\text{H} \\ \\ \text{H} \end{array}$	-161.5
methanol	$\begin{array}{c} \text{H} \\ \\ \text{H}-\text{C}-\text{OH} \\ \\ \text{H} \end{array}$	64.6
water	$\begin{array}{c} \text{H}-\text{O} \\ \\ \text{H} \end{array}$	100.0

Explain, in terms of molecular polarity, why the solubility of methanol in water is greater than the solubility of methane in water.