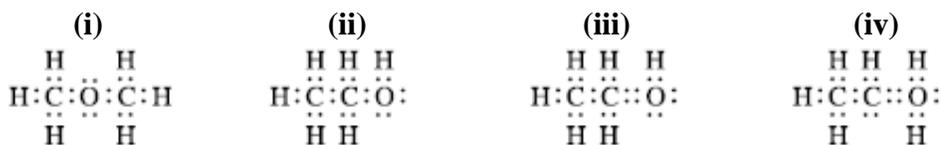


Multiple-Choice Questions

Circle the letter for the choice that best completes the statement or answers the question.

- The bonds in a network solid responsible for the hardness and rigidity are
 - hydrogen bonds
 - dipole-dipole forces
 - ionic bonds
 - covalent bonds
- In an ionic lattice, the structure is made up of a repeating pattern of
 - atoms all linked by covalent bonds
 - formula units in a geometric arrangement of unit cells
 - positive ions in a sea of electrons
 - positive ends of one molecule attracted to the negative end of another

Use the structures below to answer questions 3 and 4.



- Each of the Lewis structures above has the molecular formula $\text{C}_2\text{H}_6\text{O}$. Which Lewis structures are correct?
 - (i) and (iii) only
 - (i), (ii), and (iii) only
 - (i) and (ii) only
 - All are possible correct structural formulas.
- Which **one** of the following statements is correct about Lewis structure (i)?
 - The molecule is bent and is a dipole.
 - The molecule is linear and is a dipole.
 - Hydrogen bonding can occur between molecules.
 - There is a double bond to the oxygen atom.
- In ice, what type of bonds are the strongest?
 - hydrogen bonding between molecules of H_2O
 - London (dispersion) forces between molecules of H_2O
 - covalent bonds between hydrogen and oxygen atoms in molecules of H_2O
 - dipole-dipole attractions between molecules of H_2O

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13. Which one of the compounds listed below has only London (dispersion) forces between molecules?

- a) $C_4H_9OH(l)$
- b) $K_2Cr_2O_7(s)$
- c) $C_6H_6(l)$
- d) $CH_2F_2(g)$

14. Which of the following molecules would be polar?

- a) $CO_2(g)$
- b) $CH_3OCH_3(g)$
- c) $CF_4(g)$
- d) $NI_3(s)$

15. Which one of the following compounds is least likely to dissolve in a polar liquid?

- a) $CCl_4(l)$
- b) $CH_3OH(l)$
- c) $H_2S(g)$
- d) $NH_3(g)$

16. Argon is a noble gas that freezes to a solid at $-189\text{ }^\circ\text{C}$. What type of bonds will form between atoms of argon in the solid state?

- a) metallic
- b) covalent
- c) London dispersion forces
- d) dipole-dipole

17. Water (H_2O) boils at $100\text{ }^\circ\text{C}$ and hydrogen sulfide (H_2S) boils at $-61\text{ }^\circ\text{C}$. Which statement explains this difference in boiling point?

- a) The total number of electrons is greater in H_2S than in H_2O .
- b) There are stronger dipole-dipole attractions between H_2O molecules.
- c) There are greater London dispersion forces between H_2O molecules.
- d) The molar mass of H_2S is greater than the molar mass of H_2O .

18. The molecular shape of a molecule may be described as one of the following:

bent

trigonal planar

tetrahedral

pyramidal

What will be the correct ordering of the numbered examples when arranged to match the order of the listed molecular shapes?

1 $CH_2O(l)$	2 $PH_3(g)$	3 $SiCl_4(l)$	4 $OF_2(g)$
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- a) 1, 4, 2, 3
- b) 4, 2, 1, 3
- c) 2, 4, 3, 1
- d) 4, 1, 3, 2

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19. Four of the chemicals in the table below can be classified as polar covalent solids at certain temperature and pressure conditions. Which numbers correspond to these polar covalent solids?

1. NaCl(s)	4. CCl ₄ (l)	7. K ₂ SO ₄ (s)
2. CH ₃ Br(g)	5. HF(g)	8. C ₁₃ H ₂₈ (l)
3. PI ₃ (s)	6. CO ₂ (g)	9. OF ₂ (g)

- a) 3, 6, 8, 9
- b) 2, 3, 5, 9
- c) 2, 4, 5, 9
- d) 2, 3, 4, 9

20. The following are formulas for covalent compounds. Each is attracted to molecules like itself by different strengths of intermolecular forces. **Reorder** the formulas below so they correspond to the expected order of their boiling temperatures, from lowest to highest.

1	2	3	4
H ₂ O(l)	CH ₄ (g)	C ₄ H ₁₀ (g)	CH ₂ Cl ₂ (l)

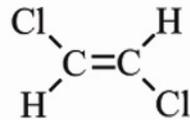
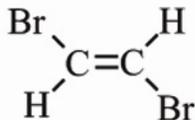
- a) 2, 3, 4, 1
- b) 2, 4, 3, 1
- c) 1, 3, 4, 2
- d) 4, 3, 2, 1

Written Response Questions

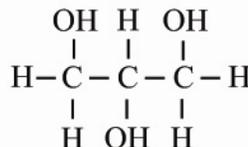
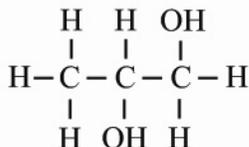
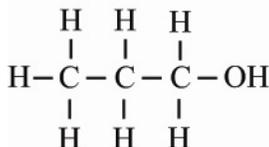
Answer each question in the space provided. Use complete sentences and diagrams when necessary.

21. The angle between C—H bonds in CH₄ is 109.5°. Will this angle between C—H bonds increase, remain the same, or decrease in the molecule CH₃Cl? Give a reason for your answer.

22. The structural formulas for two compounds that can be derived from ethene are shown below. One has a boiling point of 108 °C and the other boils at 47 °C. Which compound has the lower boiling point? Give a reason for your answer.

**1,2,-dibromoethene****1,2,-dichloroethene**

23. The structural formulas for three alcohols are shown below.

**propan-1-ol****propane-1,2-diol****propane-1,2,3-triol**

Compare the intermolecular bonding that is present in these three molecules.

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24. Why is a chemical formula for a compound such as ethylene dichloride, $C_2H_4Cl_2$, not reduced to a simplest whole-number ratio as would be the case for an ionic compound?

25. One end of a piece of copper wire, which is 30 cm in length, is heated until it is red hot. In a short period of time, the opposite end of the wire becomes warm but not red hot. Explain what has happened in terms of the structure of copper.

26. Tests are carried out on a solid to determine the nature of the bonding in the sample. It does not dissolve to any appreciable degree in water, it does not conduct electric current, and it has a melting point above $650\text{ }^\circ\text{C}$.

a) Based on these results, what type of bonding can be ruled out for this sample? Explain your reasoning for this answer.

b) What additional experimental test can be carried out to determine the type of bonding in the sample. Explain what the result of this experimental test would tell you about the nature of the bonding in the sample.
