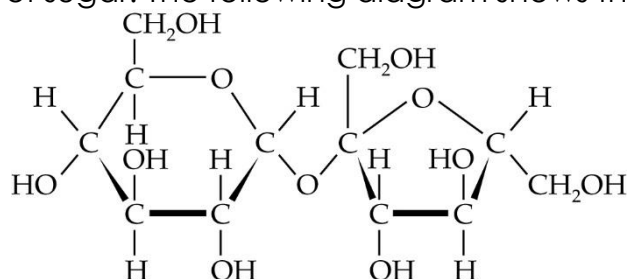


Quiz (Intermolecular Forces)

Section A: Multiple-choice

- Which of the following statements correctly explains the fact that heptane has a higher boiling point than 2,2-dimethylpentane?
 - 2,2-dimethylpentane has a smaller area of contact than heptane.
 - 2,2-dimethylpentane has a lower molecular mass than heptane.
 - There are hydrogen bonds among heptane molecules.
 - There are hydrogen bonds among 2,2-dimethylpentane molecules.
- Which of the following molecules are NOT held by hydrogen bonds?

A. CH_2F_2	B. CH_3NH_2
C. HF	D. CH_3OH
- Sucrose is a type of sugar. The following diagram shows the structure of sucrose:



Which of the following explain(s) the high solubility of sucrose in water?

- Sucrose has a large molecular size.
 - Sucrose can form hydrogen bonds with water molecules.
 - Sucrose is an ionic compound.
- (1) only
 - (2) only
 - (1) and (3) only
 - (2) and (3) only
- Which of the following substances has the highest boiling point?

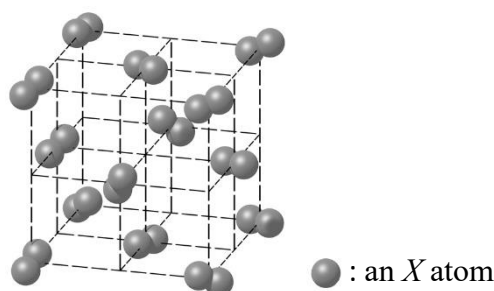
A. Antiseptic alcohol	B. Dry ice
C. Quartz	D. Water
 - The strengths of intermolecular forces between molecules can be compared by measuring the temperature changes during the evaporation of liquids. Which of the following liquids would give the smallest temperature change?

A. Chloroethane	B. 1,1-dichloroethane
C. 1,2-dichloroethane	D. 1,1,1-trichloroethane
 - Which of the following types of electrostatic attractions can be found in methane?

(1) Covalent bonding	(2) Hydrogen bonding
(3) Van der Waals' forces	

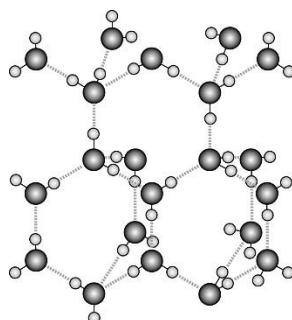
 - (1) and (2) only
 - (1) and (3) only
 - (2) and (3) only
 - (1), (2) and (3)

7. Which of the following statements about hydrogen fluoride and hydrogen chloride is INCORRECT?
- They both dissolve in water to give an acidic solution.
 - They both have a simple molecular structure.
 - They are both polar molecules.
 - Hydrogen bonding exists between both molecules.
8. Which of the following hydrogen halides has the lowest boiling point?
- HF
 - HCl
 - HBr
 - HI
9. X has the following structure at a certain temperature:



The melting point of X is 113.7°C. X is probably

- argon.
 - carbon.
 - hydrogen.
 - iodine.
10. A part of the structure of ice is shown below:



How many hydrogen bonds can be formed by each water molecule?

- 2
 - 4
 - 6
 - 8
11. Consider the following four substances.

Substance	Melting point (°C)	Electrical conductivity
P	808	Conducts in aqueous state
Q	84	Does not conduct in all states
R	98	Conducts at room temperature
S	2300	Does not conduct in all states

Which of the above substances is probably a molecular crystal?

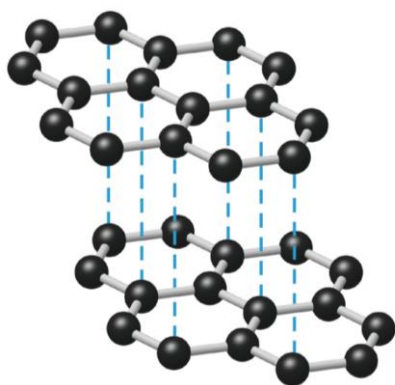
- P
- Q
- R
- S

Section B: Structured questions

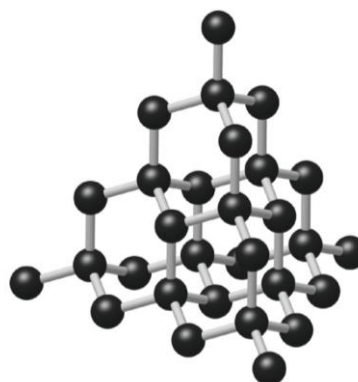
1. The table below shows some information of cyclohexanol and cyclohexene:

	Cyclohexanol	Cyclohexene
Density (g cm^{-3})	0.96	0.81
Boiling point ($^{\circ}\text{C}$)	160.8	83.0

- (a) Name the functional groups in cyclohexanol and cyclohexene respectively.
- (b) Explain why cyclohexanol has a higher boiling point than cyclohexene.
- (c) Suggest a method to separate a mixture of cyclohexanol and cyclohexene. Explain the working principle of this method.
2. Graphite and diamond are allotropes of carbon. The structures of graphite and diamond are given below:



Graphite



Diamond

- (a) State the meaning of 'allotropes'.
- (b) Describe briefly the bonding and structures in graphite and diamond respectively.
- (c) Compare and explain the hardness of graphite and diamond.
- (d) Explain the electrical conductivities of graphite.

Suggested Answer

Section A

1.	A	7.	D
2.	A	8.	B
3.	B	9.	D
4.	C	10.	B
5.	D	11.	B
6.	B		

Section B

1. (a) Cyclohexanol: hydroxyl group
Cyclohexene: carbon-carbon double bond

- (b) Cyclohexanol molecules are held together mainly by hydrogen bonds while cyclohexene molecules are held together by van der Waals' forces.

The intermolecular forces between cyclohexanol molecules are stronger than those between cyclohexene molecules.

- (c) Any ONE:

- Distillation
They have significantly different boiling points.
- Using a separating funnel
They are immiscible and have different densities.

2. (a) Allotropes are different forms of an element in the same physical state.

- (b) In graphite, each carbon atom is bonded to three other carbon atoms by strong covalent bonds within a layer. The layers of carbon atoms are held together by weak van der Waals' forces only.

In diamond, each carbon atom is bonded to four other carbon atoms tetrahedrally by strong covalent bonds. This results in a giant network of carbon atoms.

- (c) Diamond is harder because all the carbon atoms in its structure are held together by strong covalent bonds. Graphite is softer because the layers of carbon atoms in its structure are held together by weak van der Waals' forces. These layers can slide over each other easily when a force is applied.
- (d) Graphite conducts electricity because of the presence of delocalized electrons along the layers of atoms.