
HL Paper 1

Which combination of properties is correct?

	Enthalpy of vaporization	Boiling point	Intermolecular forces	Volatility
A.	large	high	strong	low
B.	large	low	weak	high
C.	small	low	weak	low
D.	small	high	weak	low

Which group of ions and molecules has delocalized electrons in **all** the species?

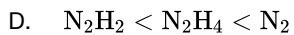
- A. CH_3COCH_3 , $\text{C}_2\text{H}_5\text{COO}^-$ and O_3
 - B. NO_3^- , NO_2^- and CO_2
 - C. C_6H_6 , CO_3^{2-} and graphite
 - D. C_6H_6 , CO_3^{2-} and C_2H_2
-

Which species contain dative covalent bonds?

- I. CO
 - II. NH_3
 - III. H_3O^+
- A. I and II only
 - B. I and III only
 - C. II and III only
 - D. I, II and III
-

Which sequence has the molecules in order of increasing nitrogen-nitrogen bond length?

- A. $\text{N}_2 < \text{N}_2\text{H}_4 < \text{N}_2\text{H}_2$
- B. $\text{N}_2 < \text{N}_2\text{H}_2 < \text{N}_2\text{H}_4$
- C. $\text{N}_2\text{H}_4 < \text{N}_2\text{H}_2 < \text{N}_2$



Which substance has the following properties?

- Low melting point
 - Very soluble in water
 - Does not conduct electricity when molten
- A. Glucose, $\text{C}_6\text{H}_{12}\text{O}_6$
B. Silicon dioxide, SiO_2
C. Sodium chloride, NaCl
D. Tetrachloromethane, CCl_4
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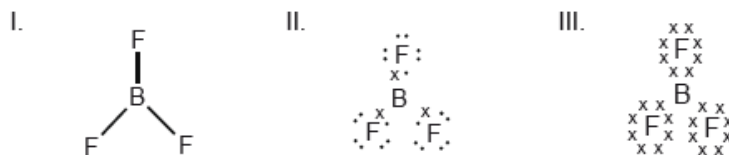
Which metal has the strongest metallic bonding?

- A. Na
B. Mg
C. Al
D. Ca
-

Which compounds have an ionic lattice structure in the solid state?

- I. Silicon dioxide
II. Sodium fluoride
III. Ammonium nitrate
- A. I and II only
B. I and III only
C. II and III only
D. I, II and III
-

Which diagrams can be used to represent the Lewis (electron dot) structure of boron trifluoride?



- A. I and II only
B. I and III only

- C. II and III only
 - D. I, II and III
-

What is the difference between the strength and the length of the carbon-oxygen bond in butanal and in butan-1-ol?

- A. The bond in butanal is stronger and longer than in butan-1-ol.
 - B. The bond in butanal is weaker and shorter than in butan-1-ol.
 - C. The bond in butanal is weaker and longer than in butan-1-ol.
 - D. The bond in butanal is stronger and shorter than in butan-1-ol.
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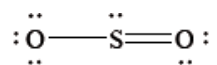
What is the formula of calcium nitride?

- A. Ca_3N_2
 - B. Ca_2N_3
 - C. $\text{Ca}(\text{NO}_2)_2$
 - D. $\text{Ca}(\text{NO}_3)_2$
-

Which molecule has an octahedral shape?

- A. SF_6
 - B. PCl_5
 - C. XeF_4
 - D. BF_3
-

The Lewis structure of SO_2 is given below.



What is the shape of the SO_2 molecule?

- A. Bent (V-shaped)
 - B. Linear
 - C. T-shaped
 - D. Triangular planar
-

Which correctly lists butane ($M_r = 58$), propanone ($M_r = 58$), propan-1-ol ($M_r = 60$) and propan-2-ol

($M_r = 60$) in order of **increasing** boiling point?

- A. $C_4H_{10} < CH_3COCH_3 < CH_3CH(OH)CH_3 < CH_3CH_2CH_2OH$
 - B. $CH_3CH_2CH_2OH < CH_3CH(OH)CH_3 < CH_3COCH_3 < C_4H_{10}$
 - C. $C_4H_{10} < CH_3CH(OH)CH_3 < CH_3CH_2CH_2OH < CH_3COCH_3$
 - D. $C_4H_{10} < CH_3COCH_3 < CH_3CH_2CH_2OH < CH_3CH(OH)CH_3$
-

What is the correct order if the compounds are arranged in order of increasing boiling point?

- A. $CH_4 < CH_3Cl < SiH_4 < CH_3OH$
 - B. $CH_3OH < CH_4 < CH_3Cl < SiH_4$
 - C. $CH_3OH < CH_3Cl < SiH_4 < CH_4$
 - D. $CH_4 < SiH_4 < CH_3Cl < CH_3OH$
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Zinc metal contains metallic bonding. Which is the best description of a metallic bond?

- A. The electrostatic attraction between a pair of electrons and positively charged nuclei.
 - B. The electrostatic attraction between oppositely charged ions.
 - C. The electrostatic attraction between a lattice of positive ions and delocalized electrons.
 - D. The bond formed when one atom provides both electrons in a shared pair.
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What is the bond angle in the H_3O^+ ion?

- A. 104°
 - B. 107°
 - C. 109°
 - D. 120°
-

Which molecule contains a dative covalent (coordinate) bond?

- A. HCN
 - B. H_2O_2
 - C. CO_2
 - D. CO
-

How many electrons form the carbon–oxygen bond in methanal, HCHO?

- A. 2
- B. 4
- C. 8
- D. 12

Four identical sealed containers are prepared each containing 10 cm^3 of an organic compound and at the temperature shown below. Which container will have the highest vapour pressure?

	Substance	Temperature / °C
A.	$\text{C}_2\text{H}_5\text{OH}$	15
B.	$\text{C}_2\text{H}_5\text{OH}$	30
C.	CH_3OCH_3	15
D.	CH_3OCH_3	30

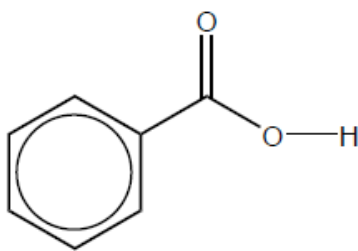
How many atoms is each carbon directly bonded to in its allotropes?

	Diamond	Graphite	C_{60} fullerene
A.	3	3	3
B.	4	3	3
C.	4	3	4
D.	4	4	3

A solid has a melting point of $1582 \text{ }^\circ\text{C}$ and does not dissolve in water. It does not conduct electricity in the molten state. What type of structure does the solid have?

- A. Ionic
- B. Metallic
- C. Giant molecular
- D. Simple molecular

Which combination describes the bonding and structure in benzoic acid, C_6H_5COOH ?



	Number of electron domains per carbon atom	Number of π -electrons	Number of σ -bonds
A.	3	6	6
B.	3	8	15
C.	4	6	6
D.	4	8	10