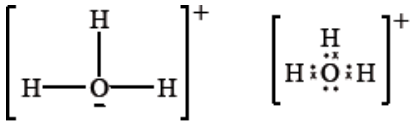
SL Paper 1

Lewis structures are represented in different ways in different parts of the world. Two ways of drawing the Lewis structure for H_3O^+ are shown below.



Which statement is correct about H_3O^+?

A. The ion has a tetrahedral shape.

B. The H–O–H bond angle is 120°.

C. The H–O–H bond angle is 90°.

D. The ion has a trigonal pyramidal shape.

Which compound has the **lowest** boiling point?

A. $CH_3CH_2CH_2OH$

B. $CH_3CH_2CH_2Br$

C. CH_3CH_2COOH

D. $CH_3CH_2CH_2CH_3$

Which is the best description of a metallic bond?

A. Electrostatic attraction between oppositely charged ions

B. Electrostatic attraction between a pair of electrons and positively charged nuclei

C. Electrostatic attraction between a lattice of positive ions and delocalized electrons

D. Electrostatic attraction for a bonding pair of electrons which have been supplied by one of the atoms

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Which statements are correct about hydrogen bonding?

I. It is an electrostatic attraction between molecules.

II. It is present in liquid ammonia.

III. It is a permanent dipole-permanent dipole attraction.

A. I and II only

B. I and III only

C. II and III only

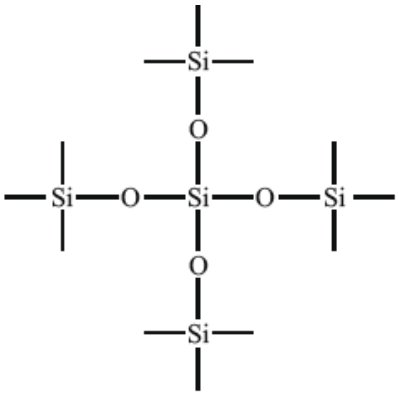
D. I, II and III

What describes the structure of silicon and silicon dioxide?

	Silicon		Silicon Dioxide	
	Shape	**Si–Si bonds per silicon atom**	**Shape**	**Si–O bonds per silicon atom**
A.	planar	4	planar	4
B.	linear	2	linear	2
C.	tetrahedral	4	linear	2
D.	tetrahedral	4	tetrahedral	4

Which diagram represents the bonding in SiO_2?

A.



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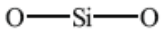

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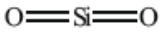

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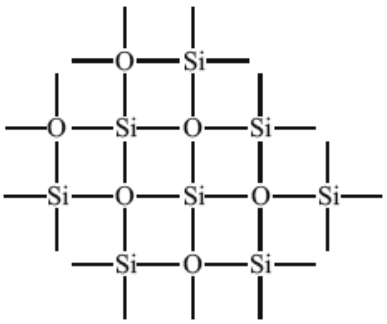


Which change explains why the boiling points of the halogens increase as their molecular masses increase?

A. The intermolecular attraction due to temporarily induced dipoles increases.

B. The gravitational attraction between molecules increases.

C. The polarity of the bond within the molecule increases.

D. The strength of the bond within the molecule increases.

The formula of gallium phosphate is $\mathrm{GaPO_4}$. What is the correct formula of gallium sulfate?

A. $\mathrm{GaSO_4}$

B. GaS

C. $\mathrm{Ga_2(SO_4)_3}$

D. $\mathrm{Ga_2S_3}$

Which compound has a covalent macromolecular (giant covalent) structure?

A. MgO(s)

B. $\mathrm{Al_2O_3(s)}$

C. $\mathrm{P_4O_{10}(s)}$

D. $\mathrm{SiO_2(s)}$

Which metal has the strongest metallic bond?

A. Li

B. Na

C. K

D. Rb

Which substance is made up of a lattice of positive ions and free moving electrons?

A. Graphite

B. Sodium chloride

C. Sulfur

D. Sodium

A substance has the following properties:

Melting point / °C	Electrical conductivity	
	Molten	Solid
1414	poor	poor

What is the most probable structure of this substance?

A. Network covalent

B. Polar covalent molecule

C. Ionic lattice

D. Metallic lattice

Which species contain a dative covalent (coordination or coordinate) bond?

I. Carbon monoxide, CO

II. Ammonia, NH_3

III. Oxonium ion, H_3O^+

A. I and II only

B. I and III only

C. II and III only

D. I, II and III

Which molecule is non-polar?

A. CCl_4

B. CH_2Cl_2

C. CH_3Cl

D. CO

What are the correct formulas of the following ions?

	Ammonium	Hydrogencarbonate	Phosphate
A.	NH_4^+	HCO_3^{2-}	PO_4^-
B.	NH_3^+	HCO_3^-	PO_4^{3-}
C.	NH_4^+	HCO_3^{2-}	PO_4^{2-}
D.	NH_4^+	HCO_3^-	PO_4^{3-}

Which statement about the physical properties of substances is correct?

A. The only solids that conduct electricity are metals.

B. All substances with covalent bonds have low melting points.

C. Ionic solids are always brittle.

D. All metals have high densities.

Which molecule has a non-bonding (lone) pair of electrons on the central atom?

A. BF_3

B. SO_2

C. CO_2

D. SiF_4

What is the formula of magnesium fluoride?

A. Mg_2F_3

B. Mg_2F

C. Mg_3F_2

D. MgF_2

Which statements about the structure and bonding of silicon dioxide are correct?

	Structure	Bonding
A.	Silicon dioxide forms a giant covalent network.	Each oxygen atom is covalently bonded to two silicon atoms.
B.	Silicon dioxide molecules are V-shaped or bent.	Each silicon atom is covalently bonded to two oxygen atoms.
C.	Silicon dioxide molecules are linear.	A double covalent bond exists between silicon and oxygen atoms.
D.	Silicon dioxide forms a giant covalent network.	Each oxygen atom is covalently bonded to four silicon atoms.

Which particles are responsible for electrical conductivity in metals?

A. Anions

B. Cations

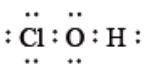
C. Electrons

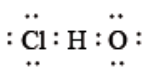
D. Protons

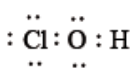
What are the correct formulas of the following ions?

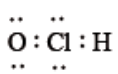
	Nitrate	Phosphate	Carbonate	Ammonium
A.	NO_3^-	PO_4^{3-}	CO_3^-	NH_3^+
B.	NO_3^{2-}	PO_3^{2-}	CO_3^{2-}	NH_3^+
C.	NO_3^-	PO_4^{3-}	CO_3^{2-}	NH_4^+
D.	NO_3^{2-}	PO_3^{2-}	CO_3^{2-}	NH_4^+

What is the correct Lewis structure for hypochlorous acid, a compound containing chlorine, hydrogen and oxygen?

A. 

B. 

C. 

D. 

What is the correct order of **increasing** boiling points?

A. $CH_3CH_3 < CH_3CH_2Cl < CH_3CH_2Br < CH_3CH_2I$

B. $CH_3CH_2Cl < CH_3CH_2Br < CH_3CH_3 < CH_3CH_2I$

C. $CH_3CH_2I < CH_3CH_2Br < CH_3CH_2Cl < CH_3CH_3$

D. $CH_3CH_2Br < CH_3CH_2Cl < CH_3CH_2I < CH_3CH_3$

What is the order of increasing boiling point?

A. $C_4H_{10} < CH_3COOH < CH_3CH_2CHO < CH_3CH_2CH_2OH$

B. $C_4H_{10} < CH_3CH_2CHO < CH_3CH_2CH_2OH < CH_3COOH$

C. $CH_3COOH < CH_3CH_2CH_2OH < CH_3CH_2CHO < C_4H_{10}$

D. $C_4H_{10} < CH_3CH_2CH_2OH < CH_3CH_2CHO < CH_3COOH$

Metal M has only one oxidation number and forms a compound with the formula $\mathrm{MCO_3}$. Which formula is correct?

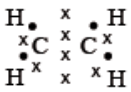
A. $\mathrm{MNO_3}$

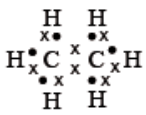
B. $\mathrm{MNH_4}$

C. $\mathrm{MSO_4}$

D. $\mathrm{MPO_4}$

Which is the correct Lewis structure for ethene?

A. 

B. 

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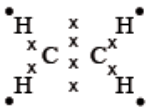
D. 

Which order is correct when the following compounds are arranged in order of **increasing** melting point?

A. $\mathrm{CH_4 < H_2S < H_2O}$

B. $\mathrm{H_2S < H_2O < CH_4}$

C. $\mathrm{CH_4 < H_2O < H_2S}$

D. $\mathrm{H_2S < CH_4 < H_2O}$

Which molecules react to form a dative covalent (coordinate) bond?

A. $\mathrm{CH_4}$ and $\mathrm{NH_3}$

B. $\mathrm{C_2H_2}$ and $\mathrm{Cl_2}$

C. $\mathrm{NH_3}$ and HF

D. Cl2 and HF

Which combination of length and strength of the carbon-to-carbon bonds in C_2H_2 and C_2H_4 is correct?

	Bond length	Bond strength
A.	$C_2H_2 > C_2H_4$	$C_2H_2 < C_2H_4$
B.	$C_2H_2 > C_2H_4$	$C_2H_2 > C_2H_4$
C.	$C_2H_2 < C_2H_4$	$C_2H_2 < C_2H_4$
D.	$C_2H_2 < C_2H_4$	$C_2H_2 > C_2H_4$

Which compound does **not** form hydrogen bonds between its molecules?

A. CH_3NH_2

B. CH_3COCH_3

C. CH_3COOH

D. CH_3CH_2OH

What is the formula of magnesium nitride?

A. MgN

B. Mg_2N_3

C. Mg_3N

D. Mg_3N_2

Which series shows **increasing** boiling points?

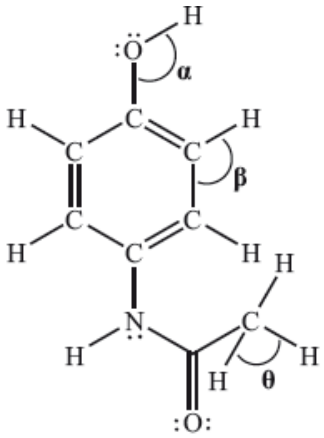
A. $CH_3CH_2CH_3 < CH_3CH_2OH < CH_3CHO$

B. $CH_3CHO < CH_3CH_2CH_3 < CH_3CH_2OH$

C. $CH_3CH_2OH < CH_3CHO < CH_3CH_2CH_3$

D. $CH_3CH_2CH_3 < CH_3CHO < CH_3CH_2OH$

The Lewis (electron dot) structure of paracetamol (acetaminophen) is:



What are the approximate values of the bond angles?

	α	β	θ
A.	104.5°	120°	109.5°
B.	109.5°	109.5°	109.5°
C.	120°	120°	90°
D.	104.5°	120°	90°

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 forces are present between molecules of carbon dioxide in the solid state?

A. Permanent dipole-permanent dipole interactions

B. Temporary dipole-induced dipole interactions (London/dispersion forces)

C. Covalent bonding

D. Ionic bonding

Diamond, C_{60} fullerene and graphite are allotropes of carbon. Which statements are correct about these allotropes?

I. In diamond each carbon is held in a tetrahedral arrangement.

II. In C_{60} fullerene each carbon is held in a trigonal arrangement.

III. In graphite each carbon is held in a tetrahedral arrangement.

A. I and II only

B. I and III only

C. II and III only

D. I, II and III

Which compound has the shortest C–N bond?

A. CH_3NH_2

B. $(CH_3)_3CNH_2$

C. CH_3CN

D. CH_3CHNH

Which combination of shape and bond angle best describes a molecule of sulfur dioxide, SO_2?

	Shape	Bond angle
A.	linear	180°
B.	tetrahedral	105°
C.	bent (v-shaped)	119°
D.	trigonal planar	120°

What are the correct formulas of the following ions?

	Nitrate	Sulfate	Phosphate	Hydrogencarbonate
A.	NO_3^-	SO_4^{2-}	PO_4^{3-}	HCO_3^-
B.	NO_3^-	SO_4^{2-}	PO_3^{3-}	HCO_3^{2-}
C.	NO_2^-	SO_4^-	PO_4^{3-}	HCO_3^-
D.	NO_2^-	SO_3^{2-}	PO_3^{3-}	HCO_3^{2-}

Which statement best describes ionic bonding?

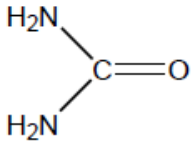
A. It is the electrostatic attraction between positive ions and delocalized electrons and occurs by the transfer of electrons.

B. It is the electrostatic attraction between positive ions and negative ions and occurs by the transfer of electrons.

C. It is the electrostatic attraction between positive ions and negative ions and occurs by the sharing of electrons.

D. It is the electrostatic attraction between positive nuclei and electrons and occurs by the sharing of electrons.

How many bonding electrons are there in the urea molecule?



A. 8

B. 16

C. 20

D. 24

Which molecule contains a bond angle of approximately 120°?

A. CH_4

B. C_2H_2

C. C_2H_4

D. C_2H_6

Which two atoms form the most polar bond?

A. C and F

B. C and Cl

C. Si and F

D. Si and Cl

Between which pair of molecules can hydrogen bonding occur?

A. CH_4 and H_2O
B. CH_3OCH_3 and CF_4
C. CH_4 and HF
D. CH_3OH and H_2O

Which molecule has the shortest bond between carbon atoms?

A. C_2H_6

B. C_2H_4

C. C_2H_2

D. $C_2H_4Cl_2$

What is the formula of calcium nitride?

A. Ca_3N_2

B. Ca_2N_3

C. $Ca(NO_2)_2$

D. $Ca(NO_3)_2$

Which pair of molecules has the same bond angles?

A. PCl_3 and BCl_3

B. SO_2 and CO_2

C. H_2O and NH_3

D. CCl_4 and SiH_4

What are the approximate bond angles and structure of crystalline SiO_2?

	O–Si–O	Structure
A.	90°	giant molecule
B.	109°	giant molecule
C.	180°	small molecule
D.	180°	giant molecule

Which form of carbon is the poorest electrical conductor?

A. Graphite

B. Graphene

C. Diamond

D. Carbon nanotube

Which substance does **not** conduct electricity?

A. Solid zinc

B. Molten zinc

C. Solid zinc chloride

D. Molten zinc chloride

Which combination best describes the type of bonding present and the melting point of silicon and silicon dioxide?

	Silicon		Silicon dioxide	
A.	covalent bonding	high melting point	covalent bonding	high melting point
B.	metallic bonding	high melting point	covalent bonding	low melting point
C.	ionic bonding	high melting point	ionic bonding	low melting point
D.	covalent bonding	low melting point	ionic bonding	high melting point

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What is the formula of the ionic compound formed when calcium and nitrogen react together?

A. Ca_2N_3

B. Ca_3N_2

C. Ca_5N_2

D. Ca_2N_5

Which statements concerning the sodium chloride ionic lattice are correct?

I. Sodium ions are larger than chloride ions.

II. Each sodium ion is surrounded by six chloride ions.

III. Each chloride ion is surrounded by six sodium ions.

A. I and II only

B. I and III only

C. II and III only

D. I, II and III

What is the molecular geometry and bond angle in the molecular ion NO_3^-?

	Molecular geometry	Bond angle
A.	tetrahedral	109.5°
B.	trigonal planar	120°
C.	trigonal pyramidal	107°
D.	trigonal planar	109.5°

Which statements about graphite are correct?

I. Carbon atoms are held in layers with weak attractions between layers.

II. Graphite is a non-metal which conducts electricity.

III. Each carbon atom is covalently bonded to three other carbon atoms.

A. I and II only

B. I and III only

C. II and III only

D. I, II and III

What describes the relationship between diamond, graphite and C_{60} fullerene?

A. Allotropes

B. Isomers

C. Isotopes

D. Polymers

What is the correct order of **increasing** boiling point?

A. $C_2H_6 < HCHO < CH_3OH$

B. $HCHO < C_2H_6 < CH_3OH$

C. $CH_3OH < HCHO < C_2H_6$

D. $C_2H_6 < CH_3OH < HCHO$

How do the bond angles in CH_4, NH_3 and H_2O compare?

A. $CH_4 = NH_3 = H_2O$
B. $CH_4 < NH_3 < H_2O$
C. $NH_3 < CH_4 < H_2O$
D. $H_2O < NH_3 < CH_4$

What compound is formed when lithium reacts with selenium?

A. LiSe
B. Li_2Se
C. $LiSe_2$
D. Li_2Se_2

Which properties do typical ionic compounds have?

	Melting point	Conductivity of solid
A.	high	good
B.	low	good
C.	high	poor
D.	low	poor

What is the formula of magnesium nitride?

A. Mg_2N_3
B. Mg_3N_2
C. $Mg(NO_3)_2$
D. $Mg(NO_2)_2$

Which substance can form intermolecular hydrogen bonds in the liquid state?

A. CH_3OCH_3
B. CH_3CH_2OH
C. CH_3CHO
D. $CH_3CH_2CH_3$

Which particles are responsible for the conduction of electricity in molten aluminium?

A. Cations

B. Anions

C. Electrons

D. Protons

What are the predicted electron domain geometries around the carbon and both nitrogen atoms in urea, $(NH_2)_2CO$, applying VSEPR theory?

	Carbon atom	Nitrogen atoms
A.	trigonal planar	trigonal pyramidal
B.	trigonal planar	tetrahedral
C.	tetrahedral	tetrahedral
D.	trigonal pyramidal	trigonal planar

Which compound has the highest boiling point?

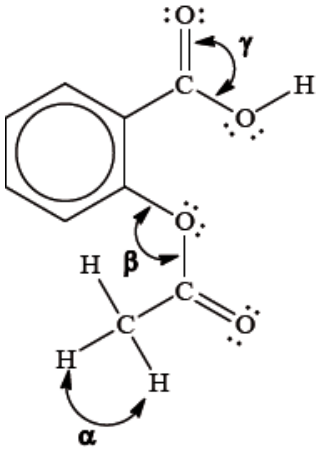
A. CH_3CH_3

B. CH_3OH

C. CH_3CH_2OH

D. $CH_3CH_2CH_3$

The Lewis (electron dot) structure of aspirin is represented below.



What are the approximate values of the bond angles α, β and γ, in the molecule?

	α	β	γ
A.	90°	104.5°	104.5°
B.	90°	120°	120°
C.	109.5°	120°	120°
D.	109.5°	104.5°	120°

Which particles are present in the lattice of a metal?

A. Negative ions

B. Positive and negative ions

C. Positive ions

D. Molecules

Which statement best describes metallic bonding?

A. Electrostatic attractions between oppositely charged ions

B. Electrostatic attractions between a lattice of positive ions and delocalized electrons

C. Electrostatic attractions between a lattice of negative ions and delocalized protons

D. Electrostatic attractions between protons and electrons

The number of electrons in the valence shell of elements A and B, are 6 and 7 respectively. What is the formula and type of bonding in a compound formed by these elements?

A. $\mathrm{A_2B}$, covalent

B. $\mathrm{AB_2}$, covalent

C. $\mathrm{A_2B}$, ionic

D. $\mathrm{AB_2}$, ionic

Which statement best describes the **intramolecular** bonding in HCN(l)?

A. Electrostatic attractions between $\mathrm{H^+}$ and $\mathrm{CN^-}$ ions

B. Only van der Waals' forces

C. Van der Waals' forces and hydrogen bonding

D. Electrostatic attractions between pairs of electrons and positively charged nuclei

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Which statements are correct for the bonds between two carbon atoms?

I. Single bonds are longer than triple bonds.

II. Single bonds are stronger than double bonds.

III. Triple bonds are stronger than double bonds.

A. I and II only

B. I and III only

C. II and III only

D. I, II and III

What is the shape of the ammonia molecule, $\mathrm{NH_3}$?

A. Trigonal planar

B. Trigonal pyramidal

C. Linear

D. V-shaped (bent)

Which molecule is non-polar?

A. OF_2

B. NH_3

C. BF_3

D. SO_2

$\mathrm{C_{60}}$ fullerene consists of a simple molecular structure. Silicon dioxide, $\mathrm{SiO_2}$, can be described as a giant covalent (macromolecular) structure. Which statements are correct?

I. Each carbon atom in $\mathrm{C_{60}}$ fullerene is bonded in a sphere of 60 carbon atoms, consisting of pentagons and hexagons.

II. Each O–Si–O bond angle in $\mathrm{SiO_2}$ is 180°.

III. $\mathrm{SiO_2}$ is insoluble in water.

A. I and II only

B. I and III only

C. II and III only

D. I, II and III

Which pair has the same bond angles?

A. CH_4 and NH_4^+

B. NH_3 and H_2O

C. C_2H_4 and C_2H_2

D. CO_2 and SO_2

Which process involves the breaking of hydrogen bonds?

A. $2HI(g) \rightarrow H_2(g) + I_2(g)$

B. $CH_4(g) \rightarrow C(g) + 4H(g)$

C. $H_2(l) \rightarrow H_2(g)$

D. $NH_3(l) \rightarrow NH_3(g)$

When C_2H_2, C_2H_4 and C_2H_6 are arranged in order of **increasing** carbon-carbon bond strength (weakest bond first), what is the correct order?

A. C_2H_2, C_2H_4, C_2H_6

B. C_2H_2, C_2H_6, C_2H_4

C. C_2H_6, C_2H_4, C_2H_2

D. C_2H_6, C_2H_2, C_2H_4

What is the shape and the bond angle of the molecule BF_3?

	Shape	Bond angle
A.	Trigonal pyramidal	109.5°
B.	Trigonal planar	109.5°
C.	Trigonal pyramidal	120°
D.	Trigonal planar	120°

Which species contains a bond angle of approximately 107°?

A. H_2O

B. CF_4

C. NCl_3

D. BF_3

Which bond is the **least** polar?

A. C–H

B. F–H

C. O–H

D. N–H

What is the formula of calcium phosphide?

A. $Ca_2(PO_3)_3$

B. Ca_2P_3

C. $Ca_3(PO_4)_2$

D. Ca_3P_2

Which of the following are van der Waals' forces?

I. Dipole-dipole forces
II. Hydrogen bonds
III. London (dispersion) forces

A. I and II only
B. I and III only
C. II and III only
D. I, II and III

Which is the best description of ionic bonding?

A. The electrostatic attraction between positively charged nuclei and an electron pair

B. The electrostatic attraction between positive ions and delocalized negative ions

C. The electrostatic attraction between positive ions and delocalized electrons

D. The electrostatic attraction between oppositely charged ions

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Which single covalent bond is the most polar, given the following electronegativity values?

Element	H	C	S	O
Electronegativity	2.2	2.6	2.6	3.4

A. C–O

B. S–H

C. C–H

D. O–H

Which bonds are arranged in order of **increasing** polarity?

A. H–F $<$ H–Cl $<$ H–Br $<$ H–I

B. H–I $<$ H–Br $<$ H–F $<$ H–Cl

C. H–I $<$ H–Br $<$ H–Cl $<$ H–F

D. H–Br $<$ H–I $<$ H–Cl $<$ H–F

How many non-bonding pairs of electrons are there in a nitrogen molecule?

A. 0

B. 1

C. 2

D. 3

Which compound forms hydrogen bonds in the liquid state?

A. C_2H_5OH

B. $CHCl_3$

C. CH_3CHO

D. $(CH_3CH_2)_3N$

The compounds shown below have similar relative molecular masses. What is the correct order of increasing boiling point?

A. $CH_3COOH < (CH_3)_2CO < (CH_3)_2CHOH$

B. $CH_3COOH < (CH_3)_2CHOH < (CH_3)_2CO$

C. $(CH_3)_2CO < CH_3COOH < (CH_3)_2CHOH$

D. $(CH_3)_2CO < (CH_3)_2CHOH < CH_3COOH$

Which compound contains both ionic and covalent bonds?

A. SIH_4

B. $NaNO_3$

C. H_2CO

D. Na_2S

Which of the following series shows increasing hydrogen bonding with water?

A. Propane < propanal < propanol < propanoic acid

B. Propane < propanol < propanal < propanoic acid

C. Propanal < propane < propanoic acid < propanol

D. Propanoic acid < propanol < propanal < propane

Which combination of the characteristics of element X, a metal, and element Y, a non metal, is most likely to lead to ionic bonding?

	X	Y
A.	low ionization energy	high electronegativity value
B.	low ionization energy	low electronegativity value
C.	high ionization energy	high electronegativity value
D.	high ionization energy	low electronegativity value

Which species contains a dative covalent (coordinate) bond?

A. HCN

B. C_2H_2

C. CO_2

D. CO

The following compounds have similar molar masses:

CH_3CH_2COOH, $CH_3CH_2CH_2CH_2OH$ and $CH_3CH_2CH_2CH_2CH_3$

What is the order of **increasing** boiling points?

A. $CH_3CH_2CH_2CH_2OH < CH_3CH_2COOH < CH_3CH_2CH_2CH_2CH_3$

B. $CH_3CH_2COOH < CH_3CH_2CH_2CH_2CH_3 < CH_3CH_2CH_2CH_2OH$

C. $CH_3CH_2COOH < CH_3CH_2CH_2CH_2OH < CH_3CH_2CH_2CH_2CH_3$

D. $CH_3CH_2CH_2CH_2CH_3 < CH_3CH_2CH_2CH_2OH < CH_3CH_2COOH$

The electronegativity values of four elements are given.

C	N	O	F
2.6	3.0	3.4	4.0

What is the order of **increasing** polarity of the **bonds** in the following compounds?

A. $CO < OF_2 < NO < CF_4$

B. $CF_4 < CO < OF_2 < NO$

C. $NO < OF_2 < CO < CF_4$

D. $CF_4 < NO < OF_2 < CO$

Which bonds cause the boiling point of water to be significantly greater than that of hydrogen sulfide?

A. London (dispersion)

B. Covalent

C. Ionic

D. Hydrogen

Which diatomic molecule has the strongest bonding between its atoms?

A. H_2

B. N_2

C. O_2

D. F_2

Which compounds contain both ionic **and** covalent bonding?

I. $CaCO_3$

II. NaCl

III. NaOH

A. I and II only

B. I and III only

C. II and III only

D. I, II and III

What is the formula of ammonium phosphate?

A. $(NH_3)_3PO_4$

B. $(NH_4)_3PO_4$

C. $(NH_4)_2PO_4$

D. $(NH_3)_2PO_3$

Which is the best description of the bonding present in silicon dioxide, SiO_2?

A. Each silicon atom forms four single covalent bonds to oxygen atoms.

B. Each silicon atom forms two double covalent bonds to oxygen atoms.

C. Each silicon atom forms two single covalent bonds to oxygen atoms.

D. Each silicon atom forms four double covalent bonds to oxygen atoms.

Which species contain a dative covalent bond?

I. HCHO

II. CO

III. H_3O^+

A. I and II only

B. I and III only

C. II and III only

D. I, II and III

Which molecule is polar?

A. CH_2Cl_2

B. BCl_3

C. Cl_2

D. CCl_4

Which row correctly describes the bonding type and melting point of carbon and carbon dioxide?

	Carbon		Carbon dioxide	
A.	covalent bonding	high melting point	covalent bonding	low melting point
B.	ionic bonding	low melting point	ionic bonding	high melting point
C.	ionic bonding	high melting point	ionic bonding	low melting point
D.	covalent bonding	low melting point	covalent bonding	high melting point

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Which species has the longest carbon to oxygen bond length?

A. CO

B. CH_3OH

C. $CH_3CO_2^-$

D. H_2CO

Which compound has resonance structures?

A. C_6H_{12}

B. CH_3CHO

C. NaBr

D. Na_2CO_3

Which statement is correct about carbon-oxygen bond lengths?

A. The C–O bond lengths are equal in propanoic acid, C_2H_5COOH.

B. The C–O bond length in carbon dioxide, CO_2, is longer than the C–O bond length in methanol, CH_3OH.

C. The C–O bond length in carbon dioxide, CO_2, is longer than the C–O bond length in carbon monoxide, CO.

D. The C–O bond lengths are equal in ethyl ethanoate, $CH_3COOC_2H_5$.

What are the strongest intermolecular forces between molecules of propanone, CH_3COCH_3, in the liquid phase?

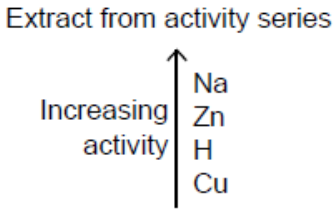
A. London (dispersion) forces

B. Covalent bonding

C. Hydrogen bonding

D. Dipole–dipole forces

Which of the following does **not** react with dilute HCl(aq)?



A. Na_2CO_3

B. Cu

C. Zn

D. CuO

Which correctly states the strongest intermolecular forces in the compounds below?

	CH_4	CH_3Cl	CH_3NH_2
A.	dipole-dipole	London forces	hydrogen bonding
B.	London forces	dipole-dipole	hydrogen bonding
C.	hydrogen bonding	London forces	dipole-dipole
D.	London forces	hydrogen bonding	dipole-dipole

Which substance has a giant covalent structure?

	Melting point / °C	Solubility in water	Electrical conductivity in the molten state
A.	186	high	none
B.	801	high	good
C.	1083	low	good
D.	1710	low	none

Which combination describes the sulfate(IV) ion, SO_3^{2-} (also known as sulfite ion)?

	Number of electron domains around S	Electron domain geometry	Molecular geometry	O-S-O angle
A.	3	trigonal planar	trigonal planar	120°
B.	3	tetrahedral	trigonal pyramidal	109.5°
C.	4	trigonal pyramidal	trigonal pyramidal	107°
D.	4	tetrahedral	trigonal pyramidal	107°