

Chemical Bonding Review

Objective

Review unit three's topics in order to gauge which topics you should review most for your assessment next class.

Homework

- Test next class
- School ID's

SAT Prep Question

Of the Christmas tree smelling chemicals presented, what pattern do you notice between them that might be responsible for the tree smell?

Aroma Chemistry
THE AROMA OF CHRISTMAS TREES

BORNYL ACETATE
FORMULA: $C_{15}H_{26}O_2$
CLASS OF COMPOUND: Ester
ABOUT
Found in various oils of conifers, particularly spruce, pine and balsam trees, and has a clean, pine-like odour. This one of those piney Christmas trees has declined, and balsam has become the most common Christmas tree.

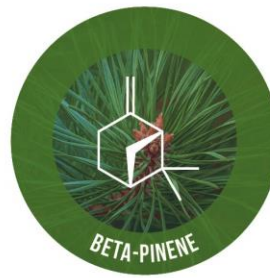
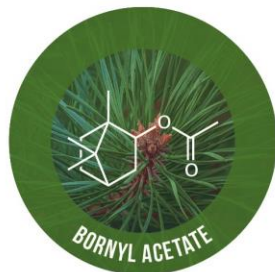
BETA-PHENE
FORMULA: $C_{10}H_{16}$
CLASS OF COMPOUND: Terpene
ABOUT
An isomer of alpha-pinene, beta-pinene is a major component emitted by forest trees. It has a fresh, woody, turpentine-like smell. Both pinene isomers are terpenoids, which are pine odour molecules.

ALPHA-PHENE
FORMULA: $C_{10}H_{16}$
CLASS OF COMPOUND: Terpene
ABOUT
Alpha-pinene has a characteristic odour, and is found in various oils of many different species of pine trees. It has the pine odour that is more common in European pines, but also more common in North American pines.

OTHER COMPOUNDS
LIMONENE
MYRCENE
CINEOLE
PINELLADIAHENE

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THE AROMA OF CHRISTMAS TREES



BORNYL ACETATE

FORMULA
 $C_{12}H_{20}O_2$

CLASS OF COMPOUND
Ester

ABOUT
Found in volatile oils of conifers, particularly silver pines and balsam firs, and has a clean, pine-like odour. The use of silver pines as Christmas trees has declined, but balsam firs are popular in the United States.

ALPHA-PINENE

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Alpha-pinene has a turpentine-like odour, and is found in volatile oils of many different species of pine tree. It has two enantiomers; one is more common in European pines, the other more common in North American pines.

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An isomer of alpha-pinene, beta-pinene is a major compound emitted by forest trees. It has a fresh, woody, turpentine-like smell. Both pinene isomers are flammable, hence why pine cones & Christmas trees burn well.

OTHER COMPOUNDS



LIMONENE



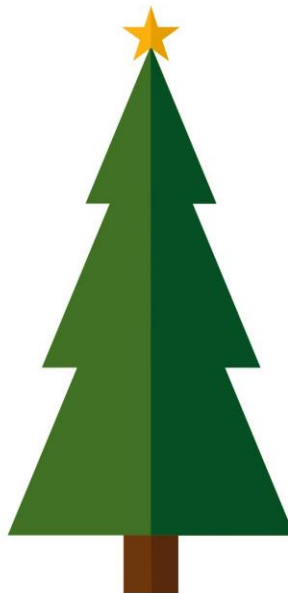
MYRCENE



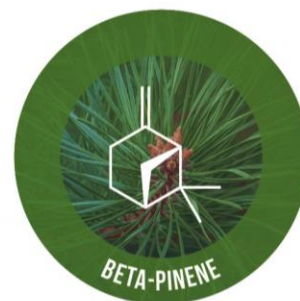
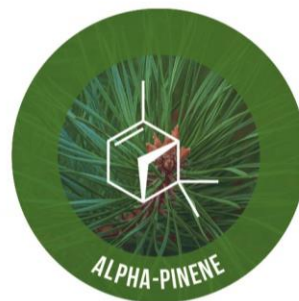
CAMPHENE



α -PHELLANDRENE



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OTHER COMPOUNDS

limonene

camphene α -phellandrene



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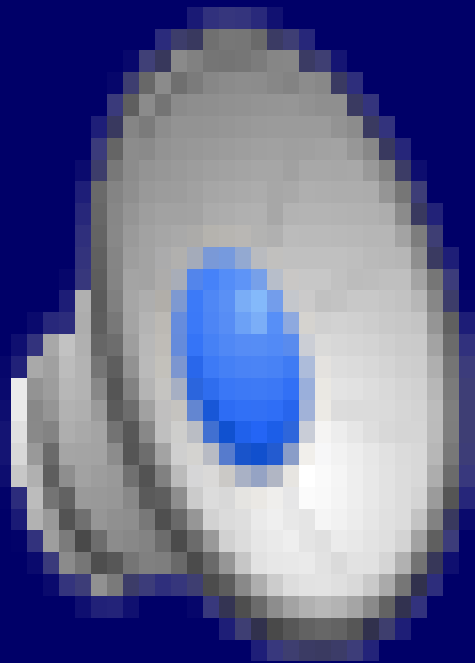
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BETA-PHENE
FORMULA: $C_{10}H_{16}$
CLASS OF COMPOUND: Terpene
ABOUT
An isomer of alpha-phenene, beta-phenene is a cyclic compound similar to bicyclic terpenes, but with a highly specific, sweet pine-like smell. Both phenene isomers are terpenes, which are organic compounds derived from isoprene.

ALPHA-PHENE
FORMULA: $C_{10}H_{16}$
CLASS OF COMPOUND: Terpene
ABOUT
Alpha-phenene has a characteristic odour, and is found in various oils of many different species of pine trees. It has the same general structure as beta-phenene, but with a different arrangement of atoms, and is more common in European pines. The other main terpene in North American pines.

OTHER COMPOUNDS
LIMONENE
MYRCENE
CAMPHENE
PINELLADIAHENE

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Bonding Properties	Bonding Type Identification	Lewis Dot Structures	Molecular Shapes	Polarity, Electronegativity, Intermolecular Forces	Hodgepodge
\$200	\$200	\$200	\$200	\$200	\$200
\$400	\$400	\$400	\$400	\$400	\$400
\$600	\$600	\$600	\$600	\$600	\$600
\$800	\$800	\$800	\$800	\$800	\$800
\$1000	\$1000	\$1000	\$1000	\$1000	\$1000

What determines the chemical properties of an element?

A. atomic number

B. number of electron shells


C. number of valence electrons

D. physical state at room temperature ←

Four different solids were tested for conductivity. Each solid was then placed in a crucible and heated until it melted. The melting point and conductivity for each melted sample were measured?

Solid	Conductivity (solid state)	Conductivity (liquid state)	Melting Point
A	No	Yes	High
B	Yes	Yes	High
C	No	No	High
D	No	No	Low

Which solid displays the properties of an ionic compound?

- A. Solid A** 
- B. Solid B**
- C. Solid C**
- D. Solid D**


Which of the follow is a property of a metallic bond?

- A. Malleable** ←
- B. Gas at room temperature**
- C. Doesn't conduct**
- D. Dissolves in water**


Which of the following is a property of an ionic bond?

- A. Conducts as a solid**
- B. Consists of metal and nonmetal atoms** ←
- C. Doesn't dissolve in water**
- D. Liquid at room temperature**

Which of the following is a property of a network covalent bond?

- A. Consists of metal and nonmetal atoms**
- B. Dissolves in water**
- C. Conducts when dissolved**
- D. Very hard solid** 

What type of bond forms between potassium and bromine?

- A. hydrogen
- B. ionic 
- C. nonpolar covalent
- D. polar covalent


What type of bond forms between oxygen and fluorine?

- A. covalent** ←
- B. hydrogen**
- C. ionic**
- D. metallic**

What type of bond forms as the result of electron sharing?

- A. covalent** ←
- B. intermolecular**
- C. ionic**
- D. metallic**

What type of bond forms as the result of electron taking?

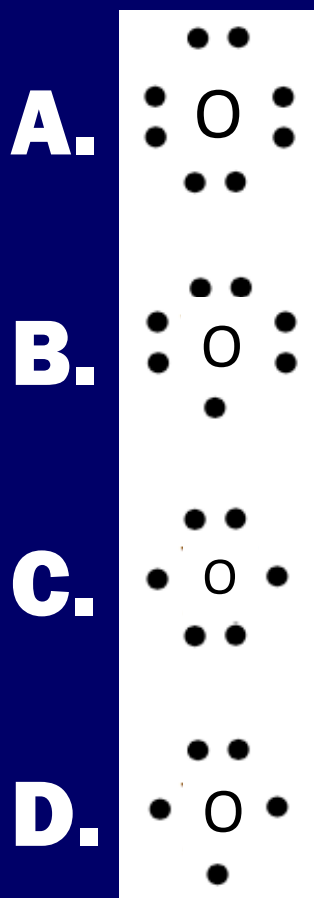
- A. covalent**
- B. intermolecular**
- C. ionic** 
- D. metallic**

Elements form chemical bonds because their atoms have _____.

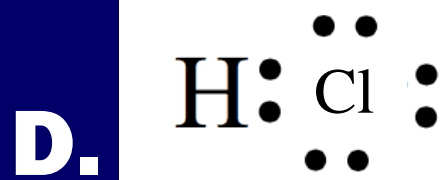
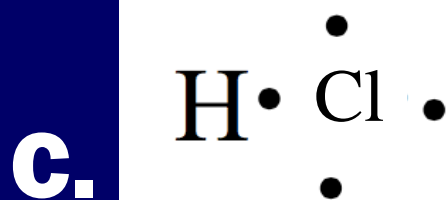
- A. too many electrons**
- B. more protons than electrons**
- C. complete inner electron shells**
- D. incomplete outer electron shells**



Which is the correct Lewis dot structure for the oxygen atom?



Which is the correct Lewis dot structure for hydrogen chloride (HCl)?



How many single covalent bonds are in a molecule of methane, CH₄?

A. 1

B. 2

C. 3

D. 4 

How many single covalent bonds are in a molecule of phosphorus trichloride, PCl_3 ?

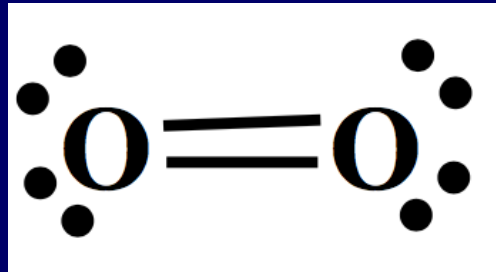
A. 1

B. 2

C. 3 

D. 4

How many electrons are shared in the double bond between the two oxygen atoms?



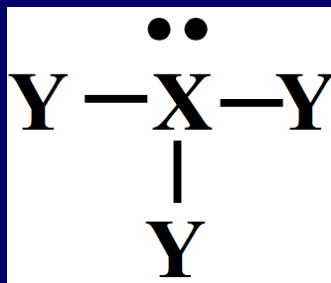
A. 8

B. 4 ←

C. 2


D. 1

How many nonbonding domains are there in the hypothetical molecule (XY_3)?

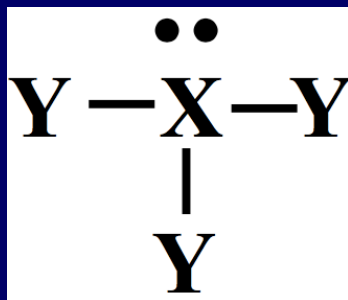


- A. **1** ←
- B. **2**
- C. **3**
- D. **4**

According to VSEPR Theory, which of these determines the shape of a molecule?

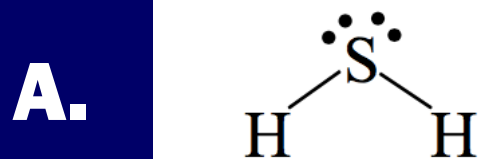
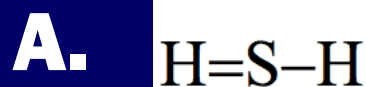
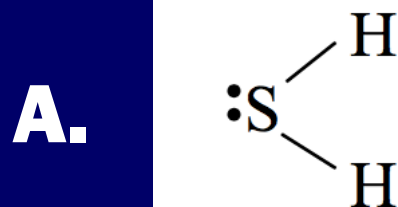
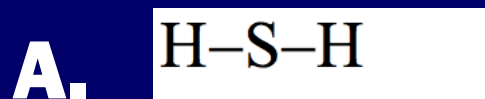
- A. number of atoms in the molecule**
 - B. number of polar covalent bonds**
 - C. number of valence electrons around the central atom**
 - D. number of bonding and non-bonding electron pairs**
- 

What is the predicted shape of a molecules of XY_3 ?

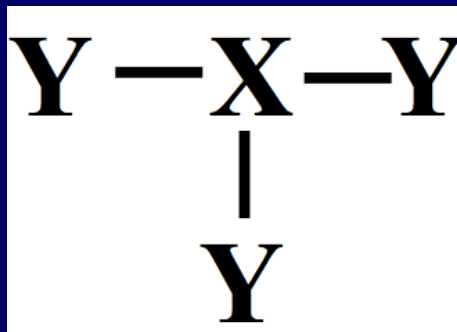


- A. trigonal planar**
- B. tetrahedral**
- C. pyramidal** ←
- D. bent**

Which of these diagrams is consistent with the predicted shape of a molecules of H_2S ?



What is the bond angle between the terminal atoms?



- A. 90°
- B. 107°
- C. 120°
- D. 180°



Which of the following pairs of atoms forms the most polar bond?

ELECTRONEGATIVITY VALUES FOR ATOMS OF SELECTED ELEMENTS

H 2.1						
Li 1.0	Be 1.5	B 2.0	C 2.5	N 3.0	O 3.5	F 4.0
Na 0.9	Mg 1.2	Al 1.5	Si 1.8	P 2.1	S 2.5	Cl 3.0

A. H, Si

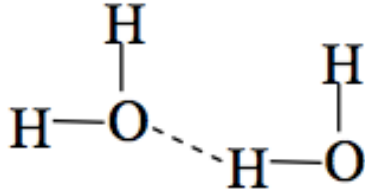
B. H, Cl ←

C. H, H

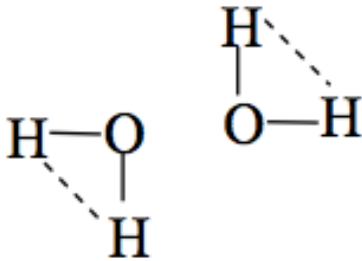
D. H, S

Which diagram accurately shows the hydrogen bonding that occurs between two water molecules?

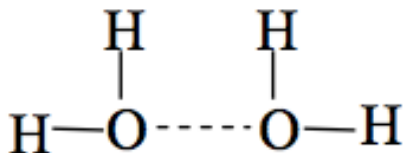
A.



B.



C.



Which of these attractions is the weakest?

A. covalent bond

B. hydrogen bond

C. ionic bond

D. Van der Waals forces 

The Lewis dot structures of methane (CH_4) and methyl chloride (CH_3Cl) are given below.

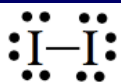


Which of these statements describing the polarity of the molecules is true?

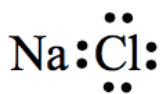
- A. CH_4 is a polar molecule, CH_3Cl is a nonpolar molecule
- B. CH_4 is a nonpolar molecule, CH_3Cl is a polar molecule
- C. CH_4 and CH_3Cl are both nonpolar molecules
- D. CH_4 and CH_3Cl are both polar molecules

Which of these is a nonpolar molecule containing polar bonds?

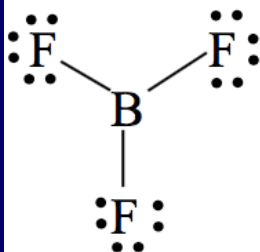
A.



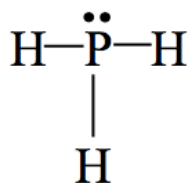
A.



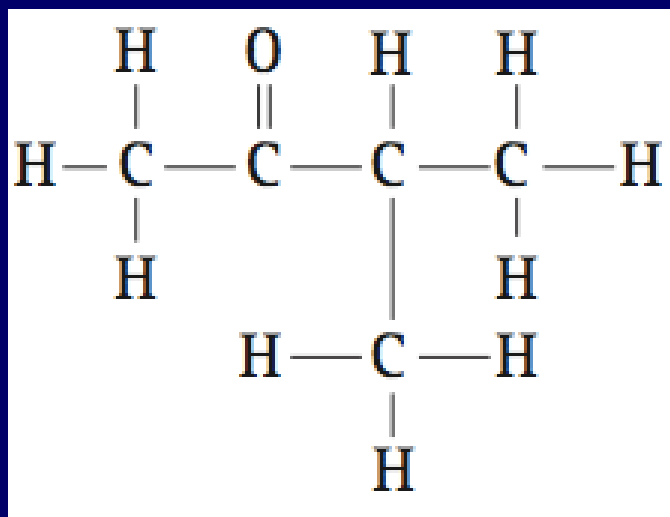
A.



A.



What is the molecular formula of the compound shown below?



If the electronegativity difference between two atoms is extremely large, what type of bond will they form?

- A. ionic** ←
- B. polar covalent**
- C. nonpolar covalent**
- D. nonpolar ionic**

Based on the position of the elements on the periodic table, which of these compounds should have chemical bonds that are the most polar?

A. LiCl

B. KCl

C. MgCl₂

D. BaCl₂ 

Arsenic has 5 valence electrons. Predict the shape of a molecule of AsH_3 ?

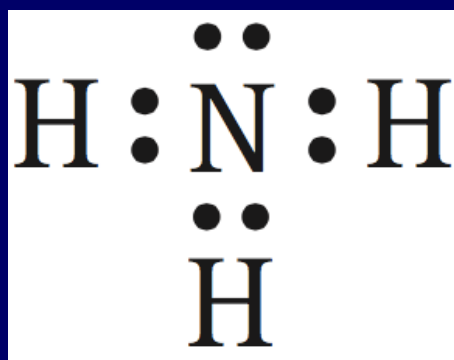
A. trigonal planar

B. pyramidal 

C. tetrahedral

D. bent

What type of molecular representation is shown below?



- A. Lewis dot diagram** ←
- B. Structural formula**
- C. Molecular formula**
- D. Ball-and-stick model**

Lewis Dot Structures & Polarity

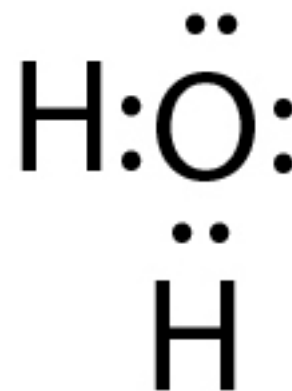
A student from Chef B's class spills cooking oil on her new shirt. She knows from chemistry class that an oil molecule is nonpolar. She knows a nonpolar liquid solvent is needed to remove the stain. The liquids available in the classroom are carbon tetrachloride, CCl_4 , and water, H_2O .

Which liquid solvent should she use to remove the oil stain? Justify your answer. Be sure to include:

- a) the Lewis dot structures for both molecules
- b) an explanation of how the shape and symmetry of each molecule influences its polarity
- c) the name of the liquid solvent that will remove the stain
- d) justification (explanation) for your choice of the liquid solvent that will remove the stain



a) The Lewis dot structures for both molecules



b) An explanation of how the shape and symmetry of each molecule influences its polarity

The electrons being shared by the elements in CCl_4 are being done so equally, resulting in a nonpolar molecule with polar bonds.

The electrons in water are attracted to the electronegative oxygen, which results in a partial negative on the oxygen and a partial positive on the hydrogens.

C. The name of the liquid solvent that will remove the stain

Carbon tetrachloride

d) Justification (explanation) for your choice of the liquid solvent that will remove the stain

The oil stain is nonpolar, so a nonpolar solvent that will mix with it will be required to remove the stain.