AP Chemistry – Unit2 – Key
Wkst: PreExam – MC

Compound	Melting Point (°C)
MgO	2852
NaF	993

1. The table above shows the melting points of MgO (s) and NaF (s). Which of the following best helps explain why the melting point of MgO(s) is much higher than that of NaF(s)?

   A. The mass of F^- ion is greater than that of O^{-2} ions

   B. The mass of Mg^{2-} ions is greater than that of Na^+ ions

   C. The difference between the electron negativity values of Mg and O is smaller than the difference between the values of Na and F

   D. The charges of Mg^{2+} and O^{2-} ions are greater than those of Na+ and F- ions.

The melting pt of an ionic lattice tends to be higher the stronger the force of attraction. The greater charge, the stronger the force of attraction & higher the melting pt

Element	Metallic Radius (pm)	Melting Point (°C)	Common Oxidation State
Au	144	1064	1+, 3+
Cu	128	1085	1+, 2+
Ag	144	961	1+

2. To make Au stronger and harder, it is often alloyed with other metals, such as Cu and Ag. Consider two alloys, one of Au and Cu and one of Au and Ag, each with the same mole fraction of Au. If the Au/Cu alloy is harder than the Au/Ag alloy, then which of the following is the best explanation based on the information in the table above?

   (A) Cu has two common oxidation states, but Ag has only one.

   (B) Cu has a higher melting point than Au has, but Ag has a lower melting point than Au has.

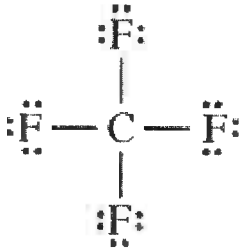
   (C) Cu atoms are smaller than Ag atoms, thus they interfere more with the displacement of atoms in the alloy.

   (D) Cu atoms are less polarizable than are Au or Ag atoms, thus Cu has weaker interparticle forces.

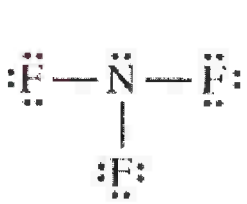
2

3. Which of the following Lewis electron-dot diagrams represents the molecule that contains the smallest bond angle?

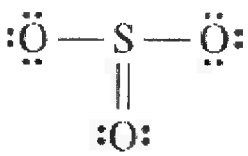
A.



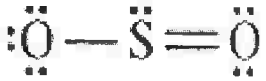
B.

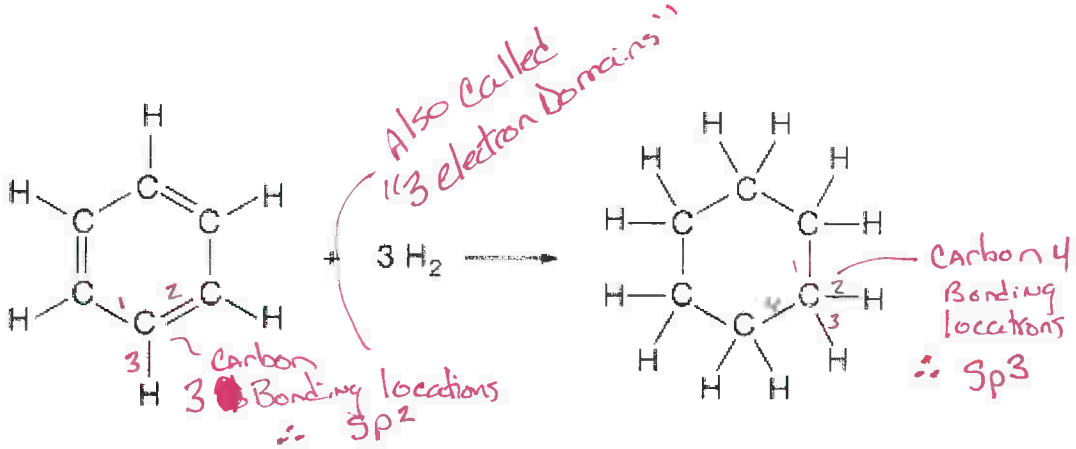


C.



D.





4. In the reaction represented above, which of the following sets correctly identifies the hybridization of the C atoms before and after the reaction occurs?

Set	Before	After
A	sp^2	sp^2
B	sp^2	sp^3
C	sp^3	sp^2
	sp^3	sp^3

A. Set A

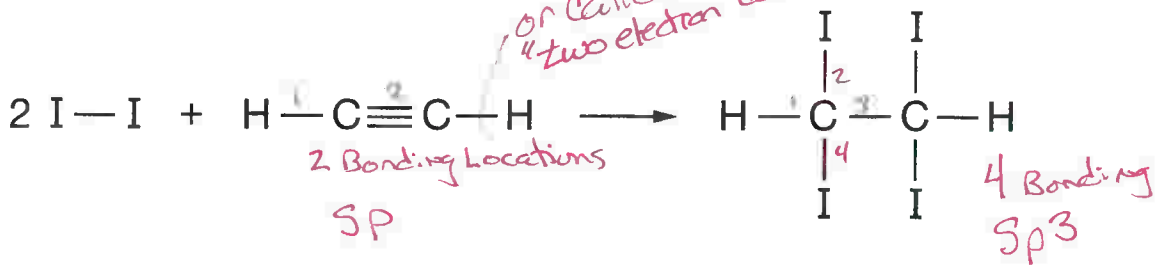
B. Set B

C. Set C

D. Set D

3/

5. The reaction of I_2 and C_2H_4 is represented by the following equation.



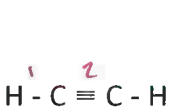
How does the hybridization of the carbon atoms change from reactants to products?

A. sp to sp^2

B. sp to sp^3

C. sp^2 to sp

D. sp^3 to sp



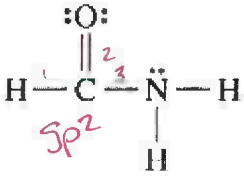
6. What is the hybridization of the carbon atoms in a molecule of ethyne, represented above?

(A) *sp*

(B) sp^2

(C) sp^3

(D) dsp^2



VSPER - 3 domains around an Atom achieves Max separation & is trigonal planer w/ 120°

7. The complete Lewis electron- dot diagram for $HCONH_2$ is shown above. Identify the hybridization of the valence orbitals for the carbon atom and the approximate hydrogen-carbon-nitrogen bond angle according to VSEPR theory.

is sp^2

A. *sp* hybridized and 180°

B. sp^2 hybridized and 120°

C. sp^2 hybridized and 180°

D. sp^3 hybridized and 120°

180 120°

8. Which of the following substances has bonds with the greatest ionic character? C $CaCl_2$

Answer C

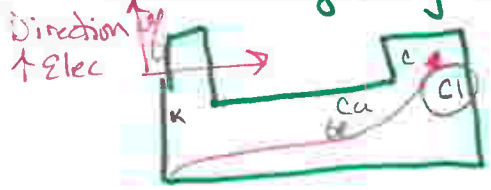
Correct. The degree of ionic character in a chemical bond is a function of the difference in electronegativities of the two atoms that form the bond. Among C, Cu, Ca, and N, the element with the lowest electronegativity is Ca as, it is to the left of the other elements on the periodic table. Thus, the difference between the electronegativity of Ca and the electronegativity of Cl is the largest difference, and the Ca – Cl bond has the greatest ionic character.

9. The atom of chlorine and an atom of which of the following elements will form a bond with the most ionic character?

   A. Germanium
   B. Carbon
   C. Copper
   D. Potassium

+ ↘

% ionic Char in a Bond ↑ w/ the difference in electronegativity Btwn Bonding atoms

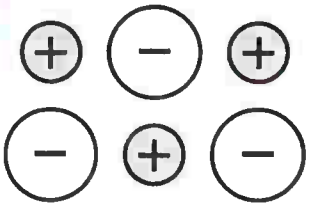


Cl is farest from K ∴ KCl most ionic Charctr

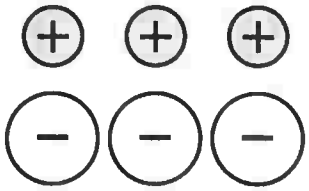
10. The particles in sold KI, a stable ionic compound, are arranged to maximize coulombic attractions while minimizing coulombic repulsions among the particles. Which of the following diagrams best represents the structure of solid KI?

(+)ions (−)ions surrounded By opposite Charge ∴ maximizing Attraction & Min Repulsi

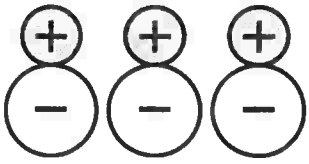
A.



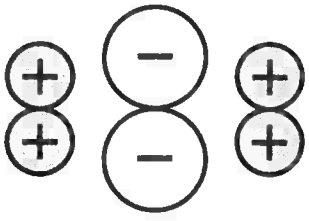
C.



C.



D.



11. The lattice energy of a salt is related to the energy required to separate the ions. For which of the following pairs of ions is the energy that is required to separate the ions largest? (Assume that the distance between the ions in each pair is equal to the sum of the ionic radii.)

A. $Na^+(g)$ and $Cl^-(g)$

B. $Cs^+(g)$ and $Br^-(g)$

C. $Mg^{2+}(g)$ and $O^{2-}(g)$

D. $Ca^{2+}(g)$ and $O^{2-}(g)$

$\frac{1}{2}$ +2 more electron charge

Mg smaller Radius than Ca

smaller Radius more Energy to Break

Lattice enthalpy can be defined as the ΔH° associated with the separation of a solid crystal into gaseous ions. Lattice enthalpies for four compounds are given in the table.

Compoun	Lattice Enthalpy (kJ/mol)
LiF	1030
LiCl	834
$MgCl_2$	2510
$SrCl_2$	2127

F^- has fewer occupied electron Shells & is a smaller ion than Cl^-

Mg^{+2} is smaller ion than Sr^{+2}

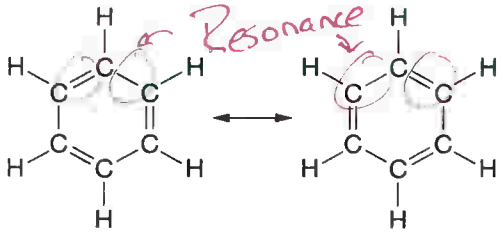
12. Which of the following statements about lattice enthalpy is consistent with the information in the table?

A. It increases with the increasing radii of the ions in the compound.

B. It increases with the decreasing radii of the ions in the compound.

C. It increases with the decreasing charge of the ions.

D. It increases with the decreasing electronegativity of the atoms.



or Resonance

Because of Resonance, all the Bonds Btwn Carbon Atoms in C_6H_6 are equal ∴ same strength & Length

13. The diagram above shows two resonance structures for a molecule of C_6H_6. The phenomenon shown in the diagram best supports which of the following claims about the bonding in C_6H_6 ?

(A) In the C_6H_6 molecule, all the bonds between the carbon atoms have the same length.

(B) Because of variable bonding between its carbon atoms, C_6H_6 is a good conductor of electricity.

(C) The bonds between carbon atoms in C_6H_6 are unstable, and the compound decomposes quickly.

(D) The C_6H_6 molecule contains three single bonds between carbon atoms and three double bonds between carbon atoms

Formal Charge

C = 4 − (3 + 0) = +1

O = 6 − (1 + 6) = −1

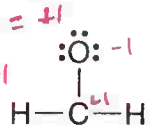


Diagram 1

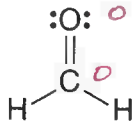


Diagram 2

C = 4 − (4 + 0) = 0

O = 6 − (2 + 4) = 0

14. Which of the diagrams above best represents the CH_2O molecule, and why?

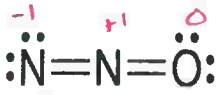
(A) Diagram 1, because all bond angles are 180°.

(B) Diagram 1, because all atoms have a formal charge of 0. NO

(C) Diagram 2, because the molecule has a trigonal pyramidal shape.

(D) Diagram 2, because all atoms have a formal charge of 0.

15. Which of the following Lewis diagrams best represents the bonding in the N_2O molecule, considering formal charges? overall = 0

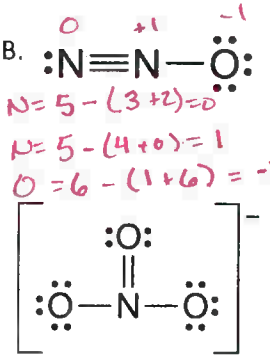
A. 

N = 5 − (2 + 4) = −1

N = 5 − (4 + 0) = 1

O = 6 − (2 + 4) = 0

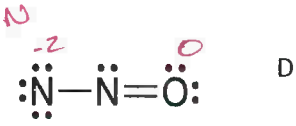
B. overall = 0



N = 5 − (3 + 2) = 0

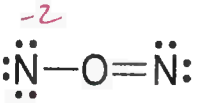
N = 5 − (4 + 0) = 1

O = 6 − (1 + 6) = −1

C 

N = 5 − (1 + 6) = −2

NO

D. 

NO

A & B both have overall FC = 0

Next → minimize Electronegativity of Atoms

O ↑ Electron than N

16. Which of the following statements, if true, would support the claim that the NO_3- ion, represented above, has three resonance structures?

(A) The NO_3 ion is not a polar species. True

B. The oxygen-to-nitrogen-to-oxygen bond angles are 90°.

C. One of the bonds in NO_3 is longer than the other two. so?

D. One of the bonds in NO_3 is shorter than the other two. so?

the Lewis Diagram that shows a − F.C. on Oxygen Atom is Best

Atomic radii and electronegativity values of some elements are given in the table.

Element	Radius	Electronegativity
Ag	165 pm	1.93
Au	174 pm	2.54
Cu	145 pm	1.90
N	56 pm	3.04
Ni	149 pm	1.91
W	193 pm	2.36

Similar Radius

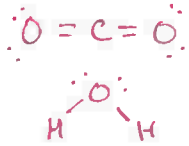
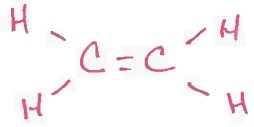
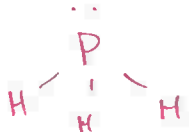
Form Bkn elements w/Atoms of Comparable radius

17. Which of the following names a pair of elements that would likely form a substitutional alloy and explain why?

A. Ni and Cu, because Ni atoms would fit in the spaces between Cu atoms in the solid lattice.
B. Ni and Cu, because Ni atoms would take the place of Cu atoms in the solid lattice.
C. W and N, because N atoms would fit in the spaces between W atoms in the solid lattice
D. W and N, because N atoms would take the place of W atoms in the solid lattice

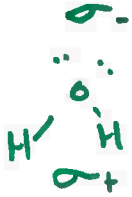
(A) *Directions*: Each set of lettered choices below refers to the numbered statements immediately following it. Select the one lettered choice that best fits each statement. A choice may be used once, more than once, or not at all in each set.

A. CO_2
B. H_2O
C. C_2H_4
D. PH_3

18. The molecule with the largest dipole moment.

A. CO_2
B. H_2O
C. C_2H_4
D. PH_3

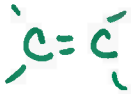


19. The molecule that has trigonal pyramidal geometry

A. CO_2
B. H_2O
C. C_2H_4
D. PH_3

20. The molecule with only one double bond

A. CO_2
B. H_2O
C. C_2H_4
D. PH_3

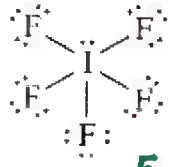


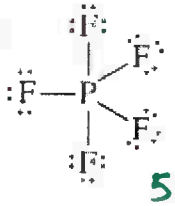
Dups

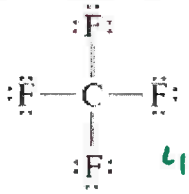
21. For which of the following molecules are resonance structures necessary to describe the bonding satisfactorily?

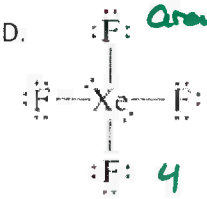
A. SO_2
B. CO_2
C. OF_2
D. PF_3

22. Which of the following represents a molecule with a trigonal bipyramidal geometry? must have 5 Bonding pairs & No NonBinding pairs of e's around Center Atom

A. 
5 But has lone electrons

B. 
5

C. 
4

D. 
4

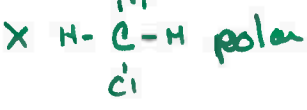
23. Which of the following has molecules with pyramidal shape?

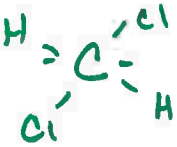
A. $NH_3(g)$
B. $BH_3(g)$
C. $H_2S(g)$ Bent
D. HBr(g) Linear

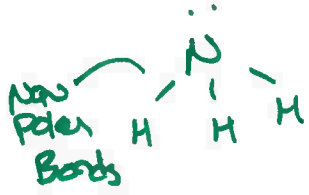
24. Of the following molecules, which has the largest dipole moment?

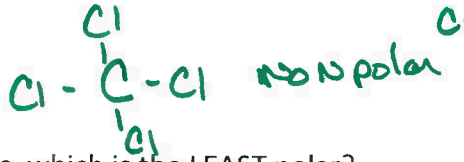
A. CO C≡O NO
B. CO_2 O=C=O NO
C. HF Biggest Electronegative difference H-F
D. F_2 NO

25. Which of the following molecules contain polar covalent bonds but is nonpolar molecules?

A. CH_3Cl X 
polar

B. CH_2Cl_2 
Nonpolar

C. NH_3 
Polar

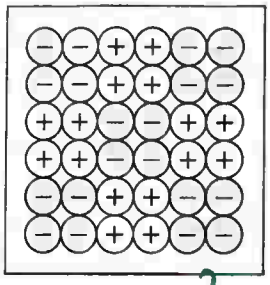
D. CCl_4 
Nonpolar

26. Of the following single bonds, which is the LEAST polar?

(A) N—H
(B) H—F Polar
(C) O—F O & F Closest on P.T.
(D) I—F Polar

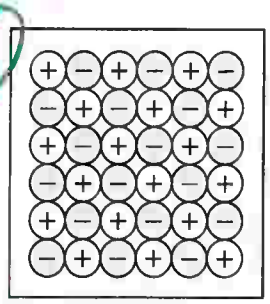
27. Of the following diagrams, which best represents the structure of solid KF?

A.



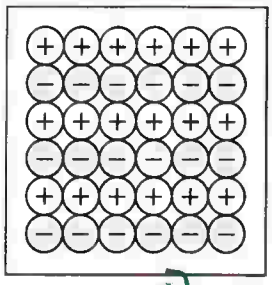
Repulsion!

B.



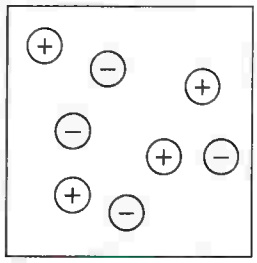
Best packing of + -

C.



Repulsion

D.

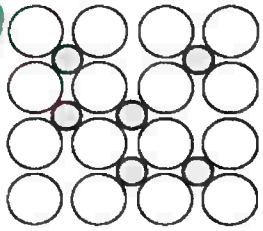


Gas phase

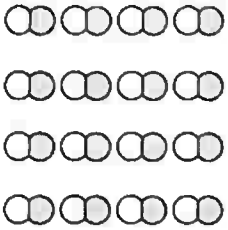
Solid KF

28. Which of the following diagrams best depicts an alloy of Ni and B?

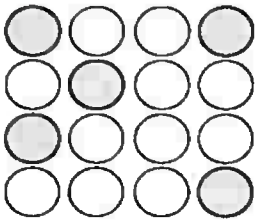
A.



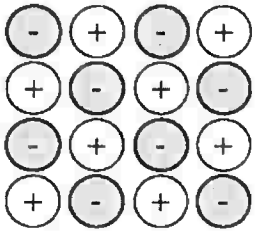
B.



C.



D.

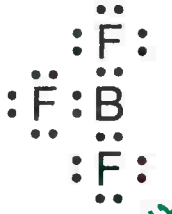


Alloy - one element dispersed in another

Metals not + & -

29. Which of the following Lewis diagrams represents a molecule that is polar? + & - Ends

X

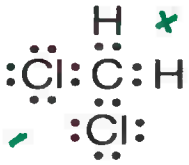


Nonpolar

B X

Nonpolar

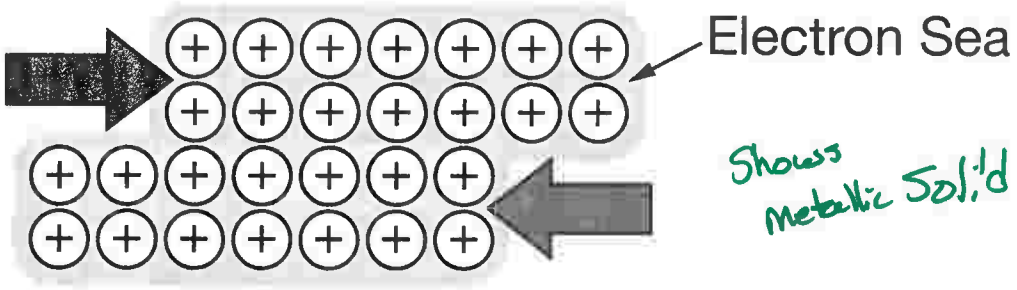
C.



D X

Nonpolar

10/



Shows Metallic Solid

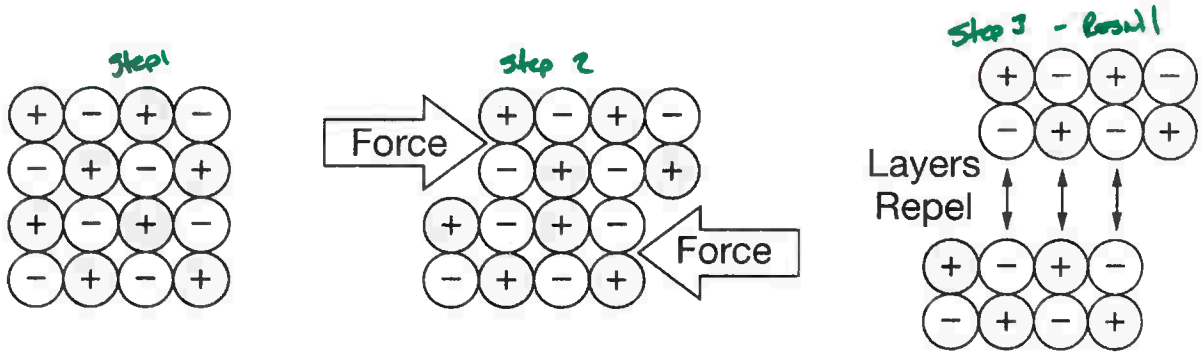
30. The diagram above best illustrates which of the following phenomena associated with solids that have metallic bonding?

A. Electrical conductivity, because it shows a lattice of positive ions immersed in a sea of electrons.

B. Malleability, because it shows how adjacent layers of positive ions can move relative to one another while remaining in full contact with the electron sea.

C. Heat conductivity, because it shows how layers of atoms can slide past one another, creating friction between layers and causing the temperature of the solid to increase.

D. The ability to form substitutional alloys, because it shows how atoms of two different metals can combine in a one-to- one ratio.



31. The particulate-level diagram shown above best helps to explain which of the following properties of ionic solids?

A. Density

B. Brittleness

C. Malleability

D. Conductivity

32. Resonance is most commonly used to describe the bonding in molecules of which of the following?

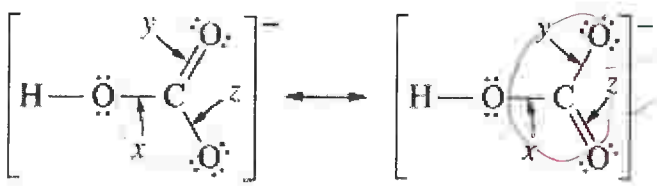
A. CO_2

B. O_3

C. H_2O

D. SF_6

The primary resonance structures of HCO_3 are shown



33. What are the relative lengths of the carbon-to-oxygen bonds in this ion?

X is single & longer than Double Bond of y & z

A. Bonds y and z are equal in length and longer than bond x.
B. Bonds y and z are equal in length and shorter than bond x.
C. Bonds x and z are equal in length and longer than bond y.
D. All three bonds are equal in length

34. Which of the following molecules has the shortest bond length?

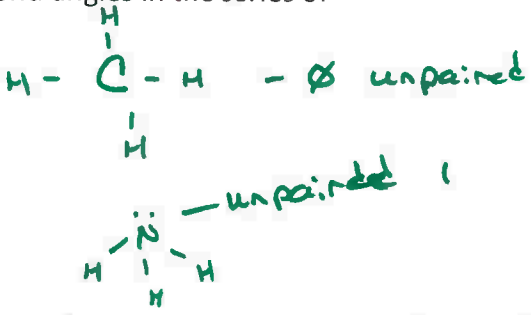
A. N_2
B. O_2
C. Cl_2
D. I_2

N ≡ N
O = O
Cl-Cl
I - I

— S
= D
≡ T

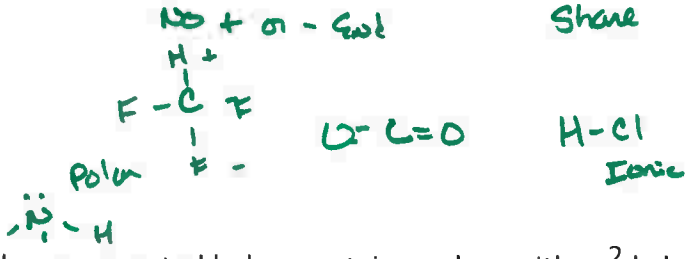
35. According to the VSEPR model, the progressive decrease in the bond angles in the series of molecules CH_4, NH_3, and H_2O is best accounted for by the

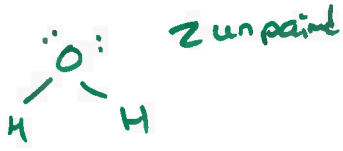
A. increasing strength of the bonds
B. increasing electronegativity of the central atom
C. increasing number of unshared pairs of electrons
D. decreasing repulsion between hydrogen atoms



36. Which of the following is a nonpolar molecule that contains polar bonds?

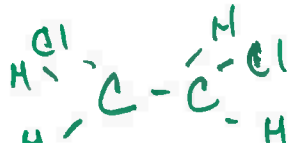
A. CHF_3
B. CO_2
C. HCl ionic
D. NH_3 Polar

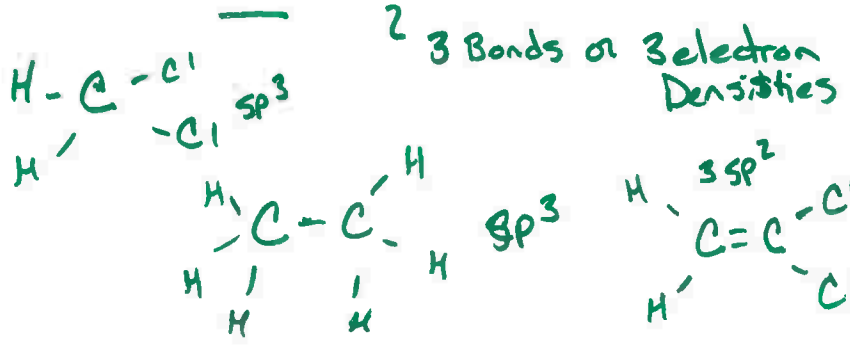




37. Which of the molecules represented below contains carbon with sp^2 hybridization?

A. CH_2Cl_2 NO
B. C_2H_6 NO
C. $C_2H_2Cl_2$
D. $C_2H_4Cl_2$ NO





12/

38. Which of the following has a zero dipole moment?

A. HCN
B. SO_2
C. NO_2
D. PF_5

No charged end

$-C\equiv N$

$O=S=O$

39. The BF_3 molecule is nonpolar, whereas the NF_3 molecule is polar. Which of the following statements accounts for the difference in polarity of the two molecules?

A. In NF_3, each F is joined to N with multiple bonds, whereas in BF_3 , each F is joined to B with single bonds.
B. N — F bonds are polar, whereas B — F bonds are nonpolar.
C. NF_3 is an ionic compound, whereas BF_3 is a molecular compound.
D. Unlike BF_3, NF_3 has a nonplanar geometry due to an unshared pair of electrons on the N atom.

40. Which of the following scientific claims about the bond in the molecular compound HF is most likely to be true?

$\delta+\ H-F\ \delta-$

A. There is a partial negative charge on the H atom. NO
B. Electrons are shared equally between the H and F atoms. NO Diopile
C. The bond is extremely weak. NO
D. The bond is highly polar. YES Huge Difference in Electronegitive values

41. Two pure elements react to form a compound. One element is an alkali metal, X, and the other element is a halogen, Z. Which of the following is the most valid scientific claim that can be made about the compound?

A. It has the formula XZ_2. NO Z^{-1} X^{+1} Z^{-1}
B. It does not dissolve in water. Halogens ("salts") Alkali Halogen
C. It contains ionic bonds. + Alkali Always Dissolve
D. It contains covalent bonds. NO

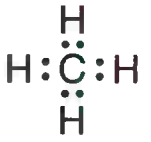
42. The elements C and Se have the same electronegativity value, 2.55. Which of the following claims about the compound that forms from C and Se is most likely to be true?

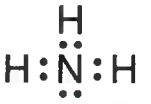
A. The carbon-to-selenium bond is unstable.
B. The carbon-to-selenium bond is nonpolar covalent.
C. The compound has the empirical formula CSe. NO
D. A molecule of the compound will have a partial negative charge on the carbon atom. No

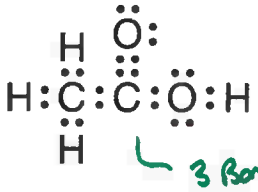
Δ diff = $\emptyset$ * * Nonpolar Covalent

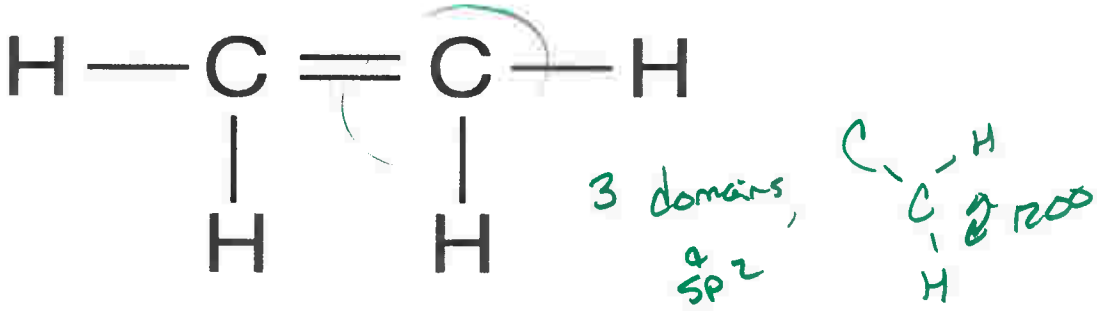
43. Which of the following complete Lewis diagrams represents a molecule containing a bond angle that is closest to 120°?

(A)

(B) 

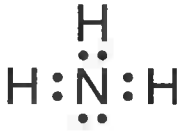
(C) 

(D) 



44. A Lewis diagram for the molecule C_2H_4 is shown above. In the actual C_2H_4 molecule, the H-C-H bond angles are closest to

A. 90°
B. 109.5°
C. 120°
D. 180°



45. Based on the Lewis diagram for NH_3, shown above, the H-N-H bond angle is closest to which of the following?

A. 60°
B. 90°
C. 109.5°
D. 120°

46. Which of the following bonds is most polar?

A. F-F

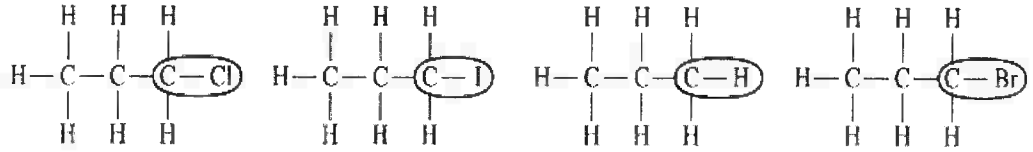
B. O-F

C. O-I

D. O-Cl

Electronegativity decreases ↓ down a column

→



47. Which of the following bonds represented in the diagram above is the most polar?

A. C–Cl

B. C–I

C. C–H

D. C–Br

Cl is most electronegative of Cl, I, H, Br

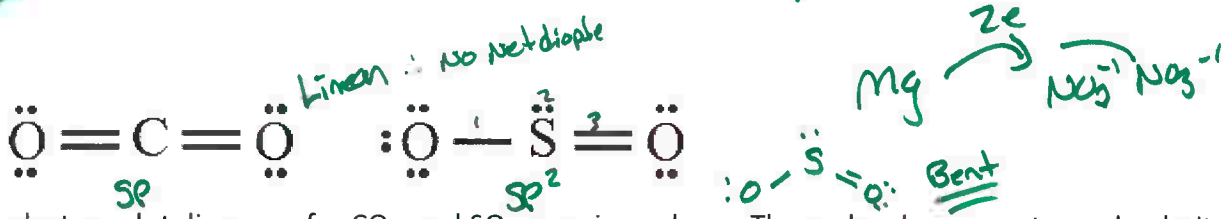
48. On the basis of electronegativity differences between atoms, which of the following scientific claims is the most accurate regarding the bonding in $Mg(NO_3)_2(s)$?

A. There is polar covalent bonding between Mg atoms and N atoms. NO

B. There is polar covalent bonding between Mg atoms and O atoms. NO

C. There is ionic bonding between N^{5-} ions and O^{2-} ions. NO

D. There is ionic bonding between Mg^{2+} ions and NO_3^- ions. yes!



49. Lewis electron-dot diagrams for CO_2 and SO_2 are given above. The molecular geometry and polarity of the two substances are

A. the same because the molecular formulas are similar

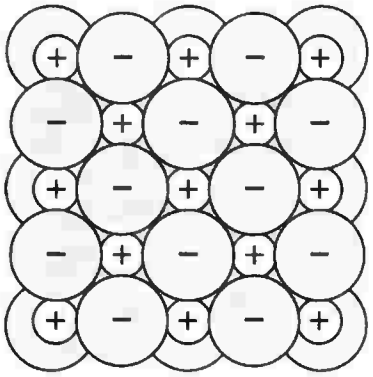
B. the same because C and S have similar electronegativity values

C. different because the lone pair of electrons on the S atom make it the negative end of a dipole

D. different because S has a greater number of electron domains (regions of electron density) surrounding it than C has

yes

sp vs sp²



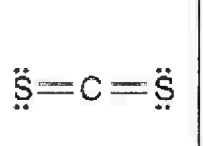
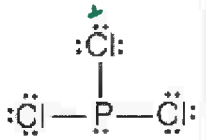
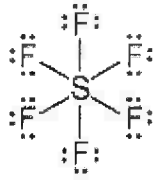
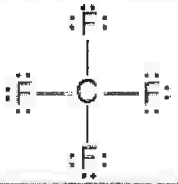
50. Which of the following correctly indicates whether the solid represented by the particulate model shown above conducts electricity and explains why or why not?

A. It conducts electricity because it is made of positive and negative ions.

B. It conducts electricity because it is made of particles of different sizes.

C. It does not conduct electricity because its ions cannot move freely within the solid.

D. It does not conduct electricity because there are small spaces between the particles.

CS_2	PCl_3	SF_6	CF_4
			

51. Based on the diagrams shown above, which of the following would have the greatest dipole moment, and why?

A. CS_2, because the double bonds create an area of higher electron density around the C atom.

B. PCl_3, because the Cl atoms draw electron density away from the P atom and the bond dipoles do not cancel one another.

C. SF_6, because it has the greatest number of polar bonds.

D. CF_4, because the large electronegativity difference between C and F results in very polar bonds.