

In summary:

Types of Chemical Bonds				
	Made of	One unit is called	What holds them together?	Characteristic Properties
Ionic	metal + non-metal(s)	formula unit	<ul style="list-style-type: none"> electrostatic attraction: between cation (+) and anion (-) 	<ul style="list-style-type: none"> High melting and boiling points
Covalent	non-metal + non-metal	molecule	<ul style="list-style-type: none"> shared electrons 	<ul style="list-style-type: none"> Low melting and boiling points (unless a network covalent solid such as diamond)
Metallic	metals only	metal ☺	<ul style="list-style-type: none"> electrostatic attraction: between "sea" of mobile or delocalized electrons and positive metal ions 	<ul style="list-style-type: none"> Good conductors of heat and electricity (because of mobile electrons)

Let's Practice!

- When phosphorus and sulfur bond, the reaction involves a:
 - creation of electrons
 - sharing of electrons
 - transfer of electrons from P to S
 - transfer of electrons from S to P
- Which bond is the strongest?
 - C = C
 - C - H
 - C = N
 - N ≡ N
- Which of the following substances is an electrolyte when dissolved in water?
 - CH₃CH₂OH
 - SiF₄
 - HBr (strong acid!)
 - OF₂
- When calcium and fluorine bond:
 - two F atoms each give 7 electrons to Ca.
 - Ca loses 2 electrons, 1 to each fluorine.
 - two F atoms each give 1 electron to Ca.
 - Ca shares electrons with F, forming 2 Ca - F bonds.
- Which of the following has the lowest ionic character?
 - KCl
 - (NH₄)₂CO₃
 - SO₂
 - MgF₂
- Which of the following is NOT a property of an ionic compound?
 - hard
 - melts readily at room temperature
 - brittle
 - conducts electricity when dissolved in water

7. Which of the following substances would be predicted to have the highest melting point?

- a. H_2S **(b.)** AlF_3 c. P_2O_5 d. H_2

8. Which of the following is NOT a property of a metallic compound?

- a. malleable c. mobile electrons easily conduct heat and electricity
b. ductile **(d.)** held together by electrostatic attraction between cations and anions

9. When iron and oxygen bond, the reaction involves a:

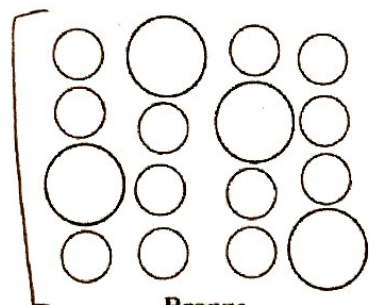
- a. creation of electrons **(c.)** transfer of electrons from Fe to O
b. sharing of electrons d. transfer of electrons from O to Fe

10. What substance will NOT conduct electricity when dissolved in water?

- (a.)** $\text{C}_6\text{H}_{12}\text{O}_6$ c. HCl
b. $(\text{NH}_4)_2\text{CO}_3$ d. AlF_3

11. Two alloys are shown in the diagrams below – bronze and steel. Which of the following correctly describes the malleability of both alloys compared to their primary metals?

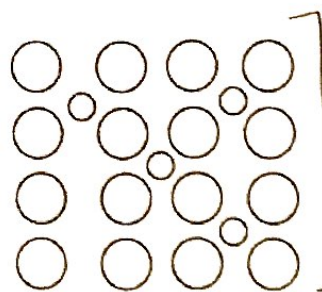
Substitutional alloy



Bronze

○ = Cu

○ = Sn



Steel

○ = Fe

○ = C

interstitial alloy

- (a.)** Bronze's malleability would be comparable to that of copper, but steel's malleability would be significantly lower than that of iron.
b. Bronze's malleability would be significantly higher than that of copper, but steel's malleability would be comparable to that of iron.
c. Both bronze and steel would have malleability values similar to those of their primary metals.
d. Both bronze and steel would have malleability values lower than those of their primary metals.

12. Which compound CaCl_2 or CaO , would you expect to have a higher melting point? Why?

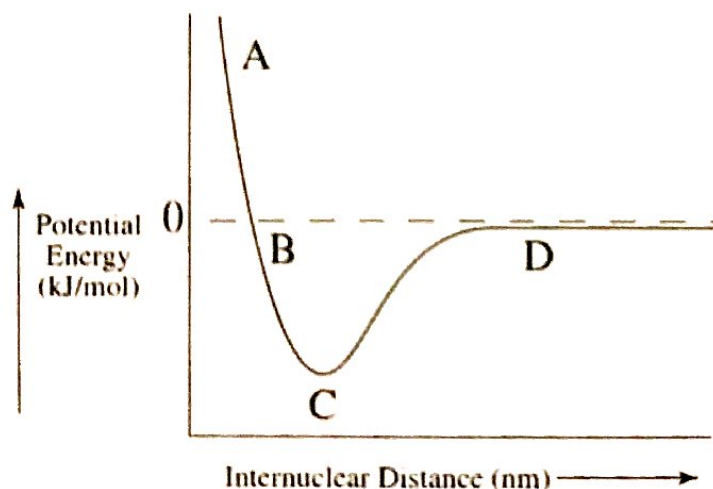
- a. CaCl_2 , because there are more ions per lattice unit.
b. CaCl_2 , because a chlorine ion is smaller than an oxygen ion.
(c.) CaO , because the charge of an oxygen ion exceeds that of a chlorine ion
d. CaO , because the common charges of calcium and oxygen atoms are identical in magnitude

Remember, nature is striving for a LOWER ENERGY STATE!

Types of Chemical Bonds			
	What holds them together?	Characteristic Properties	Conductivity
Ionic	Strong electrostatic attraction between ions (lattice energy)	<ul style="list-style-type: none"> Typically high melting and boiling points; Usually found in the solid state because the electrostatic attraction is SO strong 	<ul style="list-style-type: none"> Conductors of electricity only in (aq) or (l) states (when ions are mobile) Electrolytes when dissolved in water
Covalent	Electrons are shared by nuclei; however , sharing is hardly ever equal!	<ul style="list-style-type: none"> Can be solids, liquids or gases (depending on IMFs); Have low melting and boiling points 	<ul style="list-style-type: none"> Poor conductors of electricity (no mobile charges) Not electrolytes when dissolved in water
Metallic	Attraction between "sea" of mobile or delocalized electrons and positive metal ions	<ul style="list-style-type: none"> Solids with a crystalline structure at room temp; Range of melting points, usually depending on number of valence electrons 	<ul style="list-style-type: none"> Excellent conductors of electricity since electrons in the "sea" are free to move

More Practice!

- An unknown substance is found to have a high melting point. In addition, it is a poor conductor of electricity and does not dissolve in water. The substance most likely contains
 - ionic bonding
 - metallic bonding
 - non-polar covalent bonding
 - covalent network bonding
- The graph below shows the amount of potential energy between two hydrogen atoms as the distance between them changes. At which point in the graph would a molecule of H_2 be the most stable?



- Point A
- Point B
- Point C
- Point D