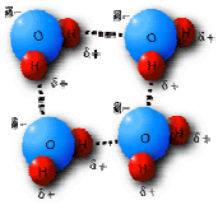
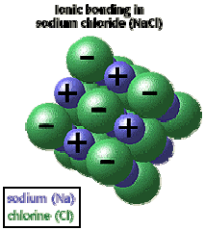
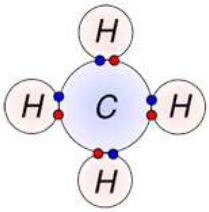


Bonding



Chapter 7 & 8



1

Endothermic vs. Exothermic

- Energy is required to _____ a bond:
  - Endothermic where Heat or E is a _____ and _____ into system
- Energy is released when a bond is _____:
  - Exothermic where Heat or E is a _____ and is _____ from the system
    - When a bond forms, the new compound has less _____ than the _____ (E released)
    - The more E released, the more _____ the compound

2

Ionic vs. Covalent

- Ionic Bonding: atoms will _____/_____ e- to other atoms
  - +/- ions form and _____ to one another
- Covalent Bonding: atoms _____ e- pairs equally
- A bond is never purely Ionic or Covalent, but is a combination depending on electronegativity differences (Table __)
- If _____ between atoms is roughly
  - 0.0 = Non polar covalent (0.0-0.3)
  - 0.1-1.7 = Polar covalent (0.3-1.7)
  - 1.7-3.3 = Ionic

3

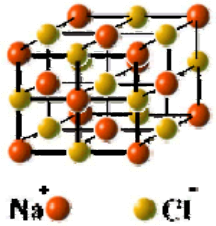
Ionic vs. Covalent continued

- Ionic Bonding: occurs between a _____ and _____
  - Electronegativity differences ___ or _____
  - Ex. NaCl, LiBr
- Covalent Bonding: occurs between two, or more, _____
  - Electronegativity differences ___ or _____
  - Ex. CO_2, CH_4

4

Ionic Compounds:

- Most exist as _____ solid (_____ structure)
- Chemical _____ shows the ratio of ions present that give electrical _____ (NaCl)
- Formation of 3D arrangement will _____ the potential energy of the structure (becomes more _____)
  - (+) ion = _____ (-) ion = _____



5

Characteristics of Ionic Bonds:

- Solid
  - _____ structure
  - Very _____ bonds
  - _____ melting and boiling points
  - Hard and _____
  - _____ conductors of electricity
- Liquid (typically molten)
  - Broken bonds allow for mobility of _____
  - Better conductor of _____ (than solid)
- Solution (dissolved in water)
  - _____ completely destroyed
  - Ions become _____ and are _____ conductors of electricity

6

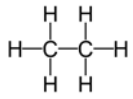
Characteristics of Covalent Bonds:

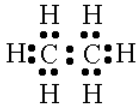
- _____ structure
- _____ bonds (smaller differences in electronegativity compared to ionic bonds)
- _____ melting points
- _____ conductors of electricity
- _____ as solids

7

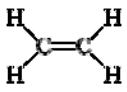
Electron Sharing

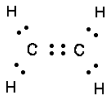
- Single Covalent Bond: sharing of __ pair or ___





- Double Covalent Bond: sharing of __ pair or ___





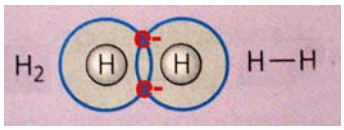
- Triple Covalent Bond: sharing of __ pair or ___

H : C ::: C : H

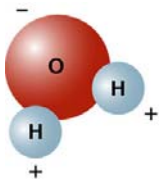
8

Non-Polar vs. Polar Molecules

- Non-polar covalent: _____ sharing of e- and _____ electrical charge



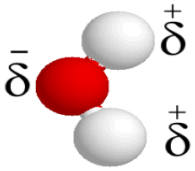
- Polar covalent: e- is attracted more towards the _____ electronegative atom, therefore creating an _____ distribution of charge. Ex. Water is a polar molecule



9

Polar molecules continued

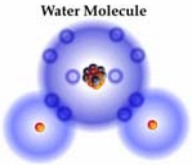
- Delta (δ) is used to represent partial charges
- δ- such as in _____ of a water molecule
  - __ pulls e- more so it is a partially (__) end
- δ+ such as in _____ of a water molecule
  - __ has e- pulled away so it is a partially (__) end



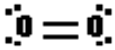
10

Molecular Geometry: Based on VSEPR

- Valence Shell Electron Pair Repulsion
- Shape of molecule depends on the _____ and _____-_____ electron pairs (_____ pairs)
- _____ will help determine polarity of molecule
  - Ex. Water is a _____ molecule because of its bent shape (_____)



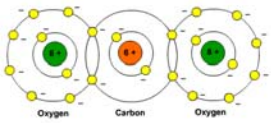
  - Oxygen is _____ because of its linear and _____ shape

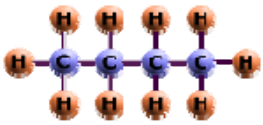


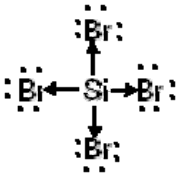
11

Molecular Geometry continued

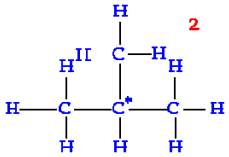
- Molecules with _____ are usually _____

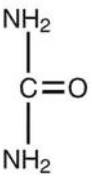


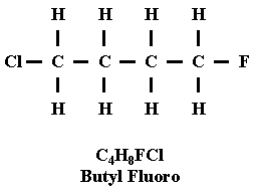




- Molecules _____ symmetry are usually polar



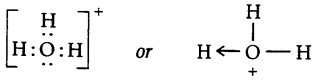




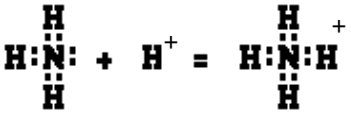
12

Coordinate Covalent Bonds

- ____ atom provides _____ that are shared in a bond
  - Ex. Hydronium ion H_3O+ (found in water and acids)
    - H = __ valence electron
    - H^+ = __ valence electrons (same as Proton)
      - H^+ will attract to ___ end of H_2O
      - (__) ion results



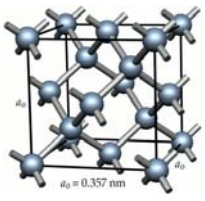
      - This is also the case with the ammonium ion $(NH_4)^+$

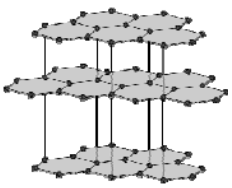


13

Network solids:

- _____ bonding with millions of atoms in a _____ network
- _____molecules (large)
- Very _____ bonds
- _____ melting points
- _____conductors of electricity
  - Ex. diamond/graphite/asbestos/silicon dioxide

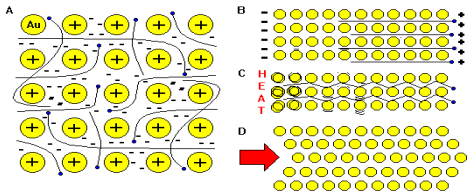




14

Metallic Bonding:

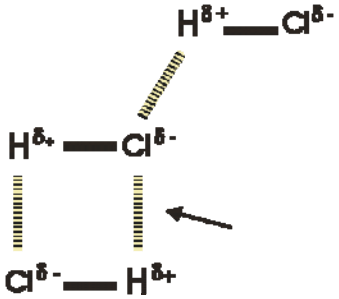
- Bonding between _____ atoms in a _____substance
- Consists of an arrangement of _____ in a 'sea' of _____ (A in diagram below)
- Mobile electrons give the metals:
  - _____
  - _____ (D)
  - Ability to _____ electricity/heat (B/C)



15

Intermolecular Forces Between Molecules:

- Are ___ true bonds and can be separated relatively easy
- Dipole Attraction
  - Exists between _____ molecules
  - Opposite partial charges _____
  - Are _____ forces



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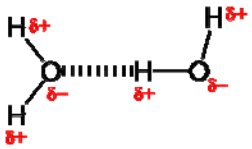
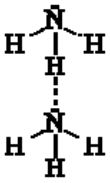
Intermolecular Forces continued

- Hydrogen Bonding
  - Between _____ molecules containing Hydrogen with __, __ and __
  - Hydrogen bonds are strongest with H δ^+ and an atom with a _____ atomic radius and _____ electrogenativity





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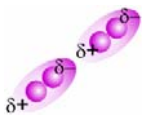
Intermolecular Forces continued

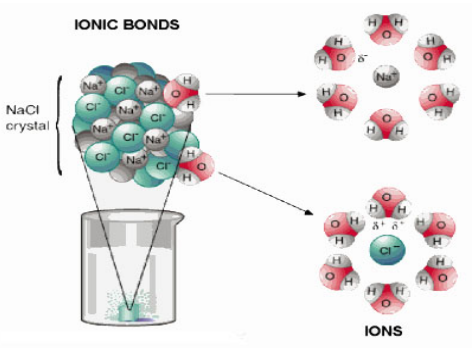
- Vander waals Forces
  - Between _____ molecules due to a momentary _____ in electron _____
  - _____ force-but helps geckos defy gravity
  - Seen in noble gases and diatomics
    - ___, ___, ___, ___, ___, ___, ___
  - Force increases as:
    - Distance between molecules _____
    - Size of molecule _____
- Ex. Iodine (I_2) →
- Which will be strongest? $Br_2(l)$, $I_2(s)$, $Cl_2(g)$
  - → ___, as it has the _____ radius and thus closer molecules due to being a _____

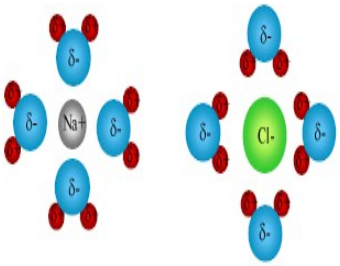


18

Ion-Molecule Attractions:

- Ex. When _____ substances in water
  - δ^+ side of the molecule will attack (__) ion
  - δ^- side of the molecule will attack (__) ion

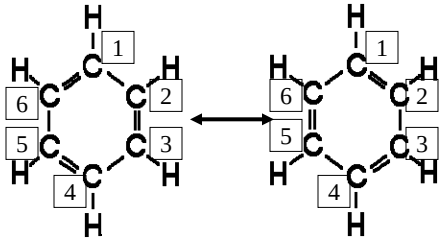


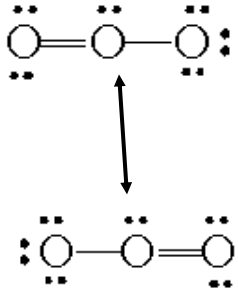


19

Resonance:

- _____ one Lewis structure may represent a molecule (average between the two is considered as _____ could exist)
- Designated by a _____
- Ex. Benzene (C_6H_6) and Ozone (O_3)





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