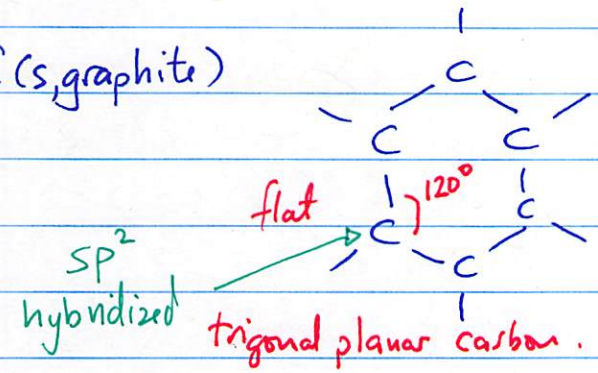
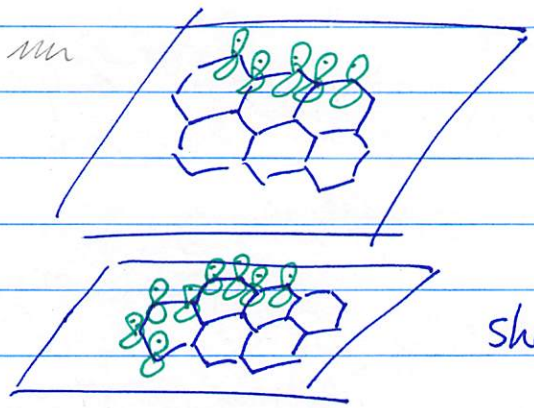
2/1/2019

Last kind of atomic solid is <u>Network Covalent</u>

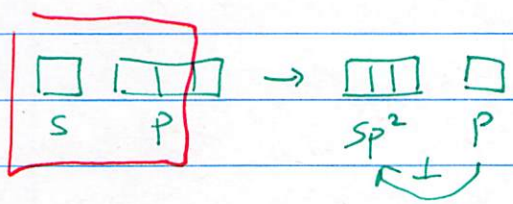
- atoms are held together by (STRONG!) covalent bonds.
- V. high mp

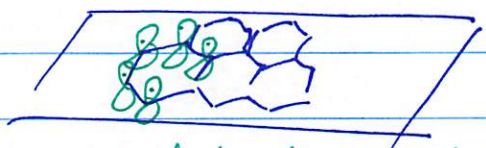
C(s, graphite)





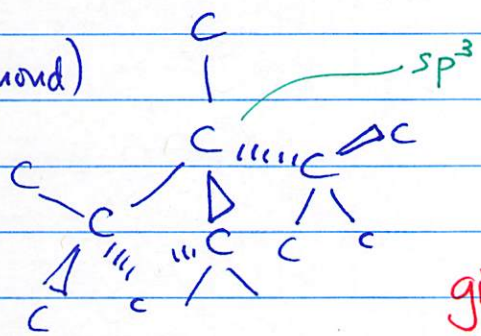
sheets.





conducts elec v. well due to unhybridized 2p orbital w/ e^-

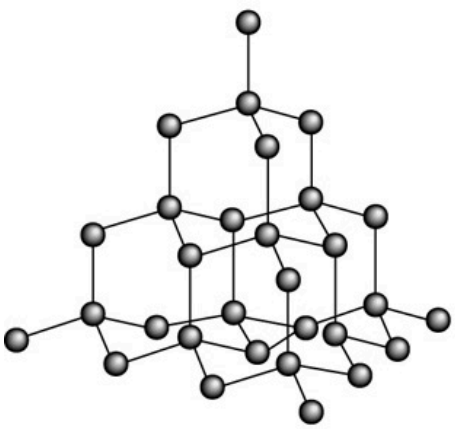
C(s, diamond)



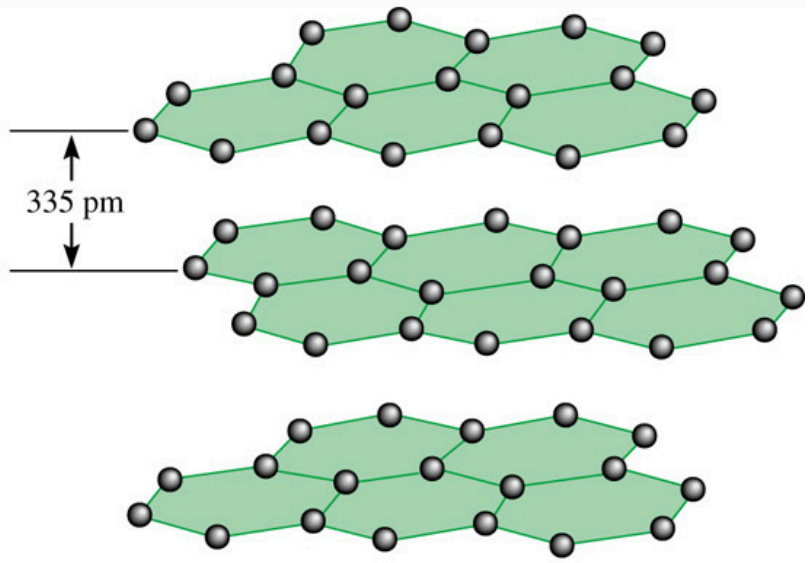
mp = ~3800°C

giant molecule!

- buckyballs, nanotubes.



(a)



(b)

C (s, diamond)

sp3 hybridized atoms

non-conductive of electricity

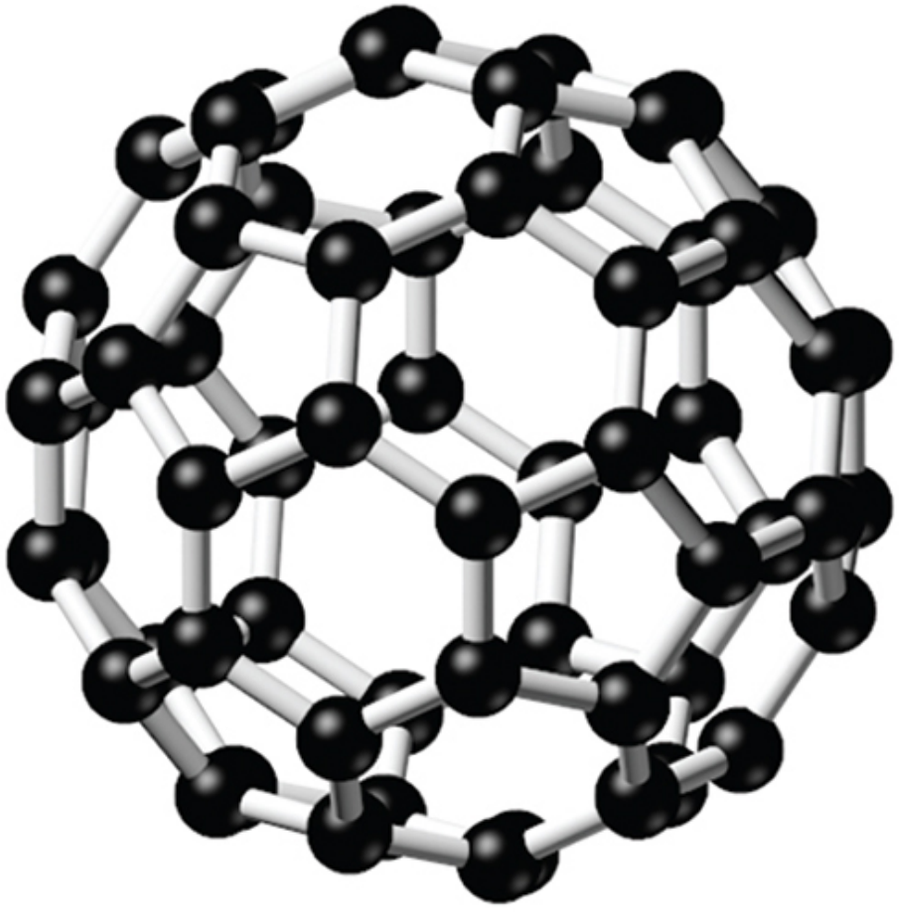
A giant, visible-to-the-eye, single molecule!

C (s, graphite)

sp2 hybridized atoms

unhybrizied p-orbital overlaps throughout each graphene layer, making it extremely conductive!

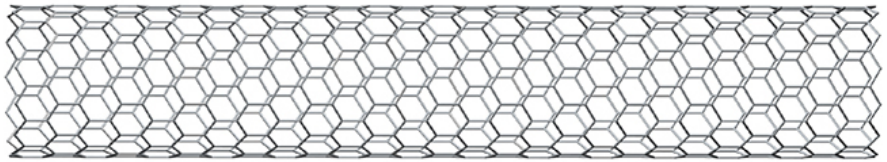
Layers can slide over one another, making it an important lubricant (and is found in pencil “lead”)



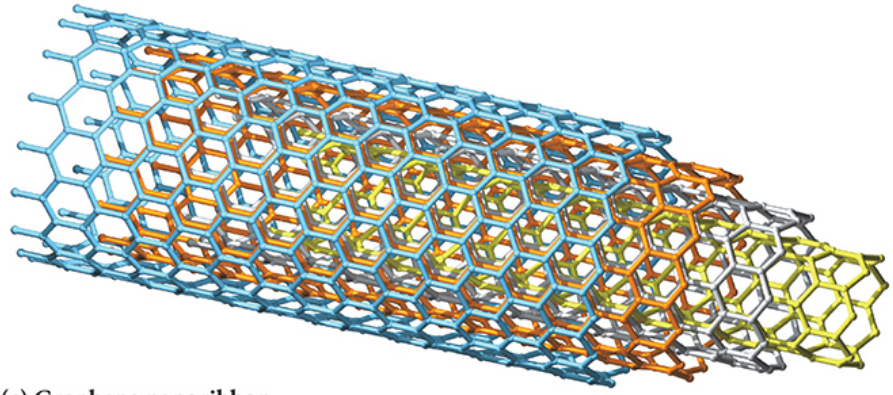
C_{60}

Buckminsterfullerene - a beautiful molecule with interesting technological applications, such as: chemical sensors, single-molecule transistors, etc.

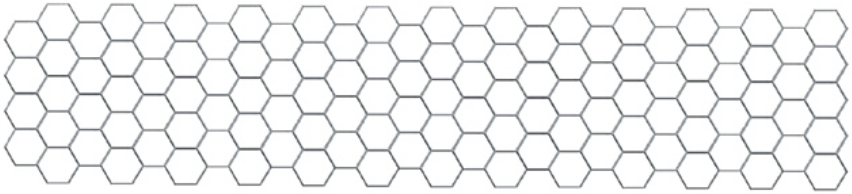
(a) Single-walled nanotube (SWNT)



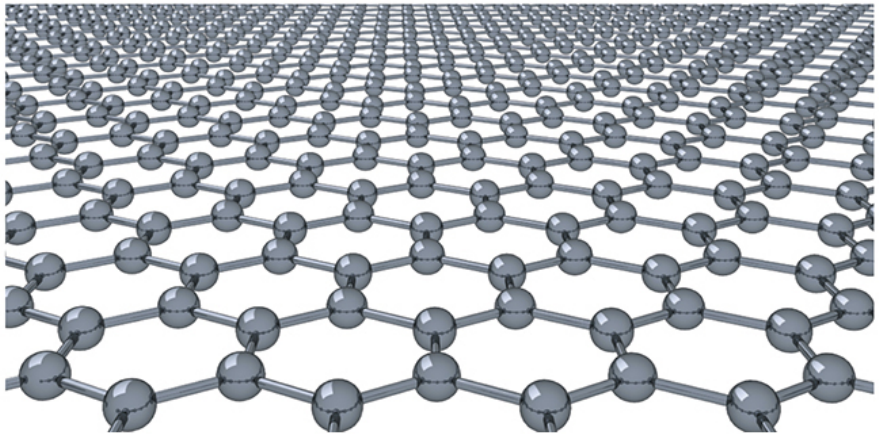
(b) Multiwalled nanotube (MWNT)



(c) Graphene nanoribbon



(d) Graphene sheet



A possible (futuristic) application of carbon nanotubes: a space elevator!

Ch 13 – Solutions

Solution = homogeneous mixture

- largest component = SOLVENT
- smaller component(s) = SOLUTE(S)

if SOLVENT = water, AQUEOUS SOLN, (aq)

ex: AIR :	$N_2(g)$,	$O_2(g)$,	$Ar(g)$	Gaseous Soln
	78%	21%	1%	
ex: SALINE:	$H_2O(l)$,	$NaCl(s)$		Liquid Soln (aq)
	99.1%	0.9%		
ex: BRASS:	$Cu(s)$	$Zn(s)$		Solid soln (alloy)
	67%	33%		
	Solvent	Solute(s)		

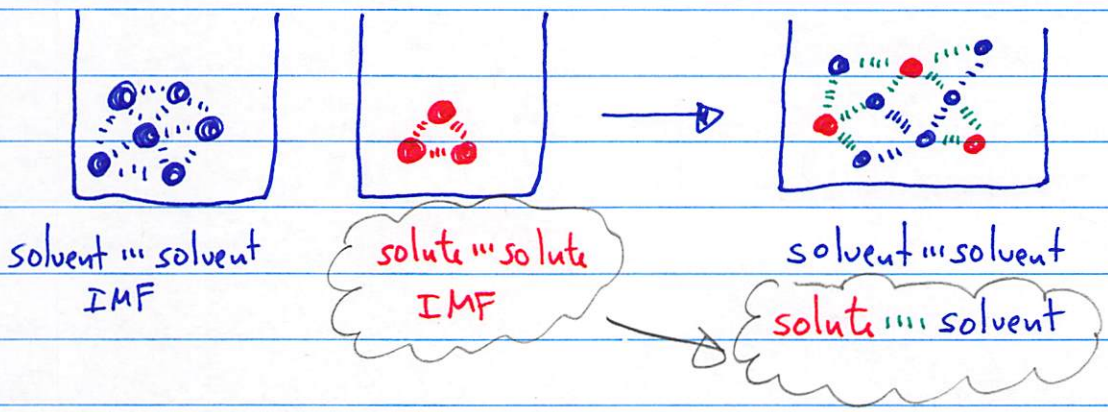
Solubility = a measure of the amt of solute that can dissolve in a specified amt of solvent.

Dissolving process:

● = solvent

● = solute

Before:



if solute ··· solvent IMF $\gtrsim$ solute ··· solute

... get dissolving!

(else ... insoluble)

if: solute ··· solute > solute ··· solvent, won't dissolve (insol)

Rough rule: like-dissolves-like (polar/polar ✓ ; polar/non-polar ✗

~~non-polar~~/non-polar/non-polar ✓

polar / polar

methanol (CH_3OH) / water (H_2O) ✓

hexane (C_6H_{14}) / octane (C_8H_{18}) ✓

non-polar / non-polar

water (H_2O) / octane (C_8H_{18}) ✗

polar / non-polar

TABLE 13.3 Common Laboratory Solvents

Common Polar Solvents	Common Nonpolar Solvents
Water (H_2O)	Hexane (C_6H_{14})
Acetone (CH_3COCH_3)	Diethyl ether ($CH_3CH_2OCH_2CH_3$)*
Methanol (CH_3OH)	Toluene (C_7H_8)
Ethanol (CH_3CH_2OH)	Carbon tetrachloride (CCl_4)

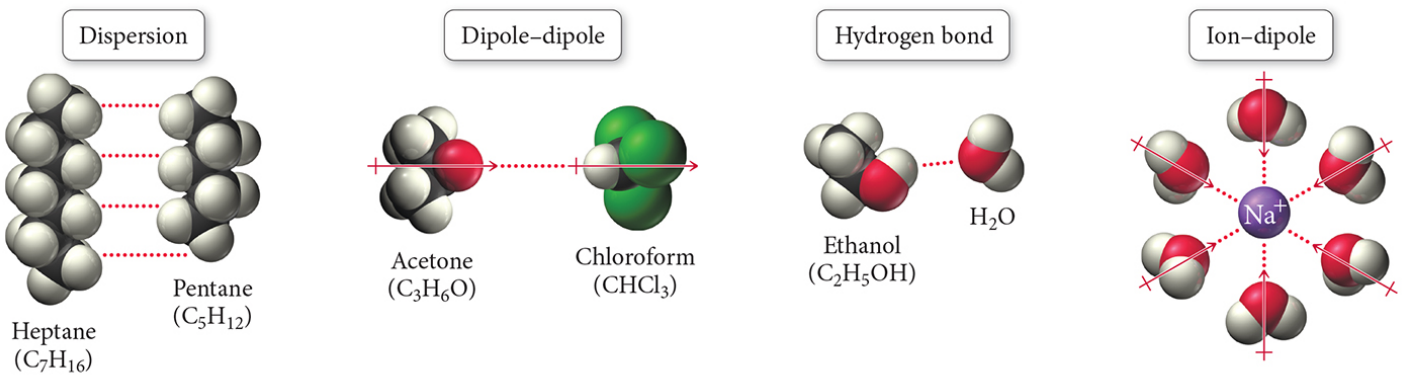
*Diethyl ether has a small dipole moment and can be considered intermediate between polar and nonpolar.

TABLE 13.2 Relative Interactions and Solution Formation

Solvent–solute interactions	$>$	Solvent–solvent and solute–solute interactions	Solution forms
Solvent–solute interactions	$=$	Solvent–solvent and solute–solute interactions	Solution forms
Solvent–solute interactions	$<$	Solvent–solvent and solute–solute interactions	Solution may or may not form, depending on relative disparity

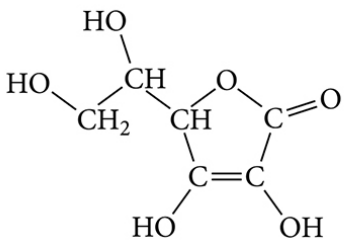
Intermolecular Forces

These forces may contribute to or oppose the formation of a solution.

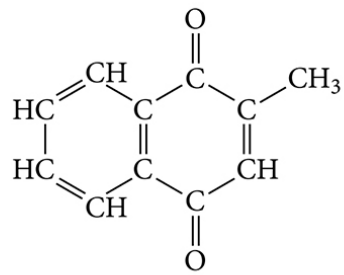


Vitamins C and B5 are covered with polar OH (and NH) groups, making them quite water soluble.

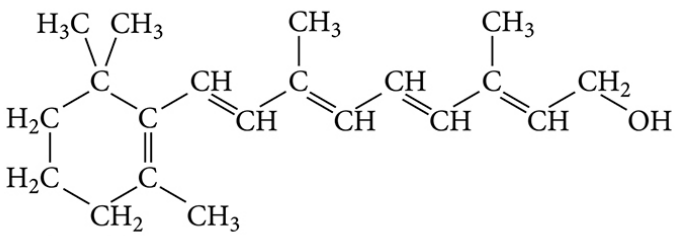
(a) Vitamin C



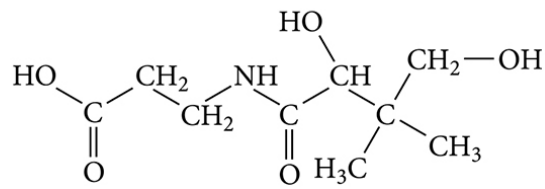
(b) Vitamin K_3



(c) Vitamin A



(d) Vitamin B_5



In contrast, vitamins A and K3 are either non-polar, or only contain a single polar group over the course of a largely non-polar molecule. These vitamins are fat soluble.