

## BONDING

A: The atoms in any molecule  
are held together  
by chemical bonds.

B: A line stands for a bond

A: Yes. So in H<sub>2</sub>O, which is really H-O-H,  
there are two O-H bonds.  
A bond has a characteristic length,  
for O-H it's  $0.98 \times 10^{-8}$  centimeters,  
and a certain strength.

B: Bonds are like springs  
if you stretch them  
or squeeze them  
the atoms bounce back

A: What you have to do is to solve  
this equation,  
Schrödinger's equation,  
at a certain O-H distance.  
repeat at a different geometry,  
finding this way the O-H distance  
and the H-O-H angle  
at which the energy is lowest.

B: But what holds it together?

A: Well, the chemical bond. You see  
there's a stable electron configuration  
at a magic number, eight. Some atoms  
get there by taking up electrons  
to become negatively charged anions.  
Some readily yield up an electron  
to become positive cations. Anions  
and cations then attract each other.  
That's ionic bonding.

B: Opposites attract each other

A: Yes. Before we knew any of this  
Geoffroy in France  
and Bergman in Sweden

made tables of affinities

B: And Goethe wrote a novel,  
"Elective Affinities". Eduard and Charlotte  
were married happily until  
until the Captain and Otilie came

A: Yes. But getting back to oxygen,  
it attracts electrons when it binds  
with almost any element. We say  
it's very electronegative. It takes electrons  
from the two hydrogens.

B: So the bonding in water is ionic

A: Not quite. Sometimes two atoms  
coming near each other  
can reach a stable configuration,  
not by transferring electrons,  
but by sharing a pair  
(or two, or more).  
That's covalent bonding  
common between like atoms.

B: Like attracts like

A: That's right. When we analyze  
the wave function. . .

B: What's a wave function?

A: You'll have to take a course  
in quantum mechanics. Anyway, we find  
that the bonding in  $H_2O$  is  
part ionic, part covalent.

B: Do you mean like attracts like and  
like attracts unlike  
at the same time?

A: Yes, I know it sounds strange.  
If only I knew quantum mechanics  
I'd show you the wave function. . .

B: I'm not worried. It's life-like.