Why is Alien life commonly depicted as silicon base

(Luke and Saif)

Science fiction

Has long imagined alien worlds inhabited by silicon based life. Like Korg for example but life as we know it is carbon based but does it have to be that way?

Life as we know it is carbon based

All machinery of life all biochemistry is based around the carbon atom. If you look around you every living thing you can see is possible due to carbon. Why you may ask?

It's due to these key features:

- It provides scaffolding to form complex molecules
- It can form stable structures
- Can bond with multiple molecules

Would alien life be different to us?

For this to happen there would have to be an element which has similar chemical properties to carbon and could from complex molecules. To narrow down our options we need to look at the type of bonds carbon makes.

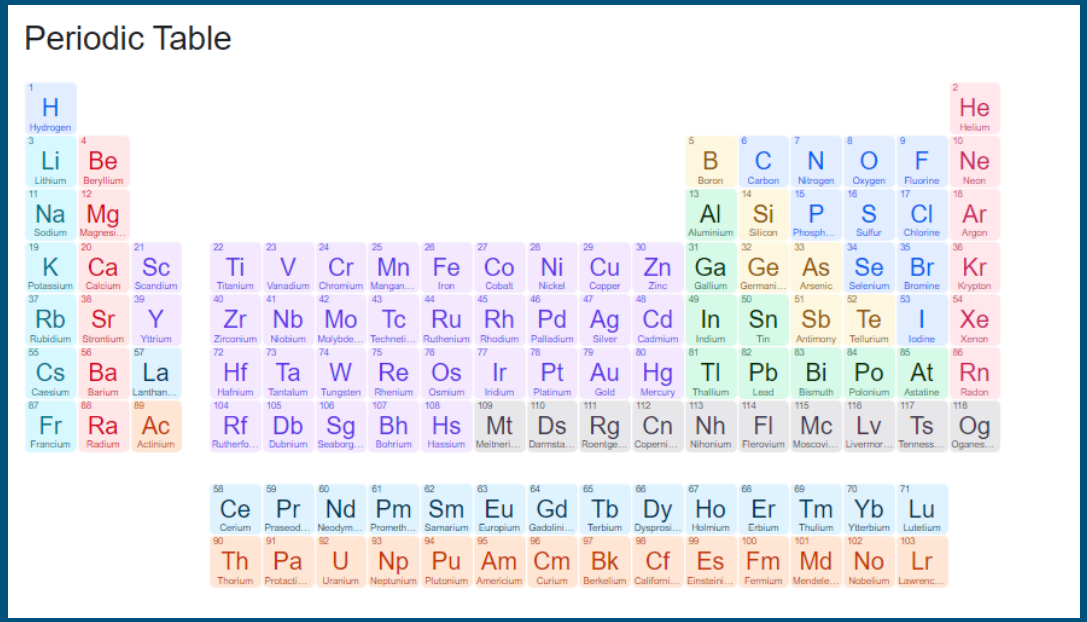
What types of bonds are there (Question):

- Ionic (are too unstable)
- Metallic (repeating structures don't have the chemical variety for life)
- Covalent ✔

Narrowing down the elements

We first have to look at the periodic table:

- Rule out elements that don’t form covalent bonds




1
H
Hydrogen
2
He
Helium
6
C
Carbon
7
N
Nitrogen
8
O
Oxygen
9
F
Fluorine
10
Ne
Neon
14
Si
Silicon
15
P
Phosph...
16
S
Sulfur
17
Cl
Chlorine
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Ar
Argon
32
Ge
Germani...
33
As
Arsenic
34
Se
Selenium
35
Br
Bromine
36
Kr
Krypton
50
Sn
Tin
51
Sb
Antimony
52
Te
Tellurium
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I
Iodine
54
Xe
Xenon
82
Pb
Lead
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Bi
Bismuth
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Po
Polonium
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At
Astatine
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Rn
Radon
114
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Mc
Moscovi...
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Lv
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Tennesse...
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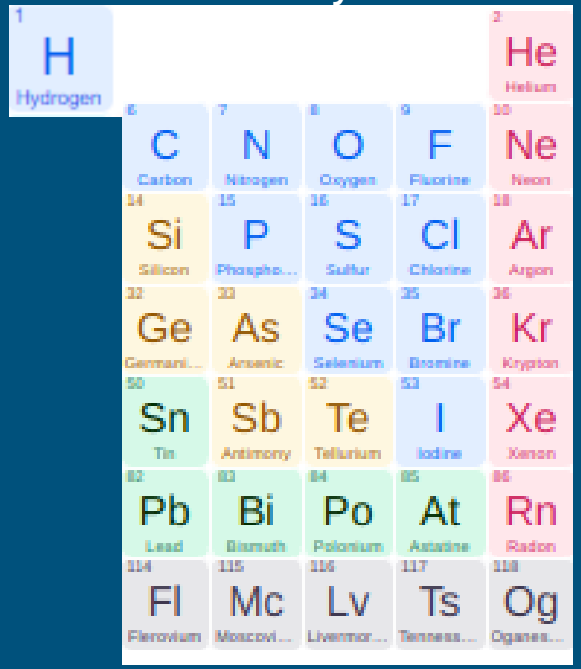
- Rule out noble gases because they are unreactive and don’t form covalent bonds

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Hydrogen


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Boron
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Carbon
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Nitrogen
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Oxygen
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F
Fluorine
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Al
Aluminium
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Si
Silicon
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Phosph...
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Gallium
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Germani...
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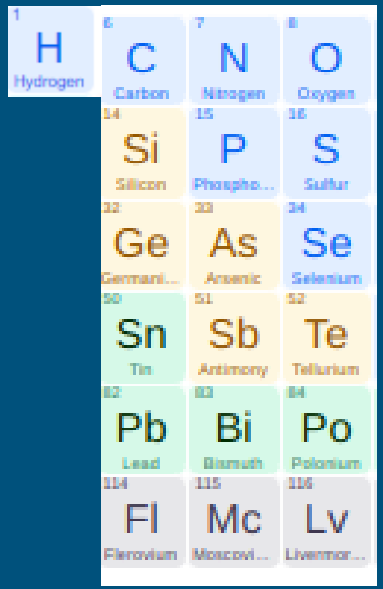
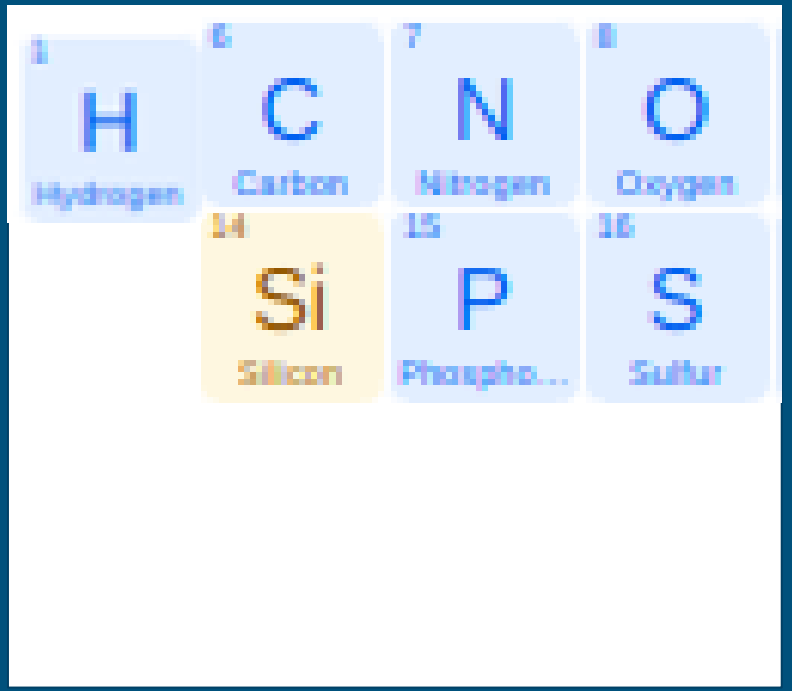
- Rule out halogens because they do form covalent bonds but it is hard to get them to form covalent bonds with more than one element



- Remove elements row 4 and below due to them being too heavy and the bonds they form too unstable

We are left with:

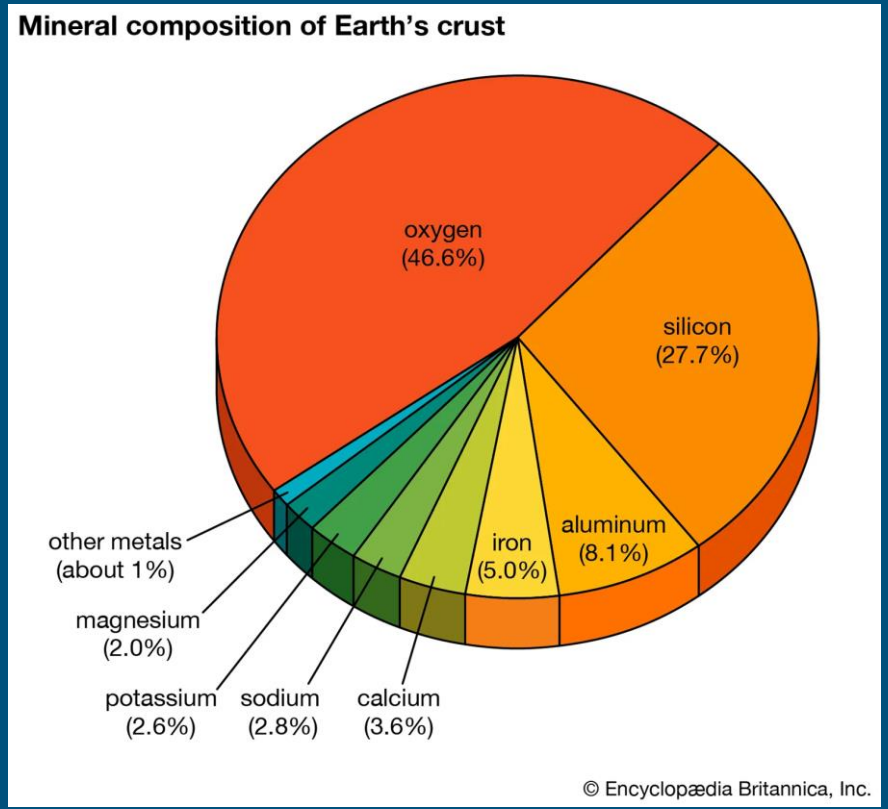
Hydrogen, carbon, nitrogen, oxygen, phosphorus and sulfur. These elements make up the biochemistry of all life. However Silicon is separated being less involved in biological molecules than trace elements such as carbon.



This begs the question:

So if silicon is far more abundant than elements such as carbon. Why is it not more prevalent in biochemistry?

This means that carbon must have major advantages in forming the scaffolding of biological molecules compared to silicon.



Problems with silicon

Problems with silicon	Solutions to this problem
• Silicon is far more reactive with water than carbon - meaning when placed into water solvents they break down destroying their structure	• Silicon is stable in solvents such as hydrocarbons (methane) which are present in large quantities on the moons of gas giants in our solar system. • Silicon is also stable in most acids such as sulfuric acids.

Benefits to Silicon

$CO_2 \longrightarrow O_2 + C$

$SiO_2 \longrightarrow O_2 + C$

When breaking the bonds of between silicon dioxide compared to carbon dioxide, silicon releases more energy due to silicon forming stronger bonds.

However the benefit of CO2 is that it can be easily respired whereas SiO2 is silica which is sand which is difficult to respire due to it being sand.