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Why Carbon Forms Millions of Compounds

1. Four reasons

1. **4 bonds:** carbon is tetravalent, so one atom can grow in 4 directions.
2. **Strong C–C bonds:** about 350 kJ/mol, so long chains and rings are stable (catenation). Si–Si bonds are only about 225 kJ/mol, so long silicon chains are not stable.
3. **Bond variety:** single, double and triple bonds, and easy bonds to O, N and halogens.
4. **Isomerism:** the same atoms can be arranged in different ways.



C–C chain: stable

Si–Si chain: weak

2. How fast isomers grow

Formula	Structural isomers
C_4H_{10}	2
C_5H_{12}	3
$C_{10}H_{22}$	75
$C_{20}H_{42}$	366,319

Solved example

Q. Draw the isomers of C_4H_{10}.
A. Two: butane, $CH_3CH_2CH_2CH_3$, and 2-methylpropane, $(CH_3)_3CH$.

Practice questions

1. (MCQ) Self-linking of carbon atoms is called (a) isomerism (b) catenation (c) resonance (d) hydration
2. (Very short) How many covalent bonds does carbon form?
3. (Short) Why are long silicon chains unstable?
4. (Numerical) How many structural isomers does C_5H_{12} have?
5. (Short) Give the four reasons for the large number of carbon compounds.
6. (Very short) Name two elements carbon bonds to easily, other than hydrogen.

Answer key

1. (b).
2. Four.
3. Si–Si bonds are weaker than C–C bonds.

4. 3.
5. Four bonds, strong C–C bonds, bond variety, isomerism.
6. For example oxygen and nitrogen.

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