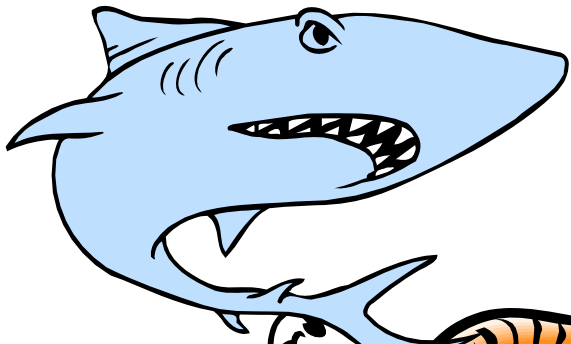
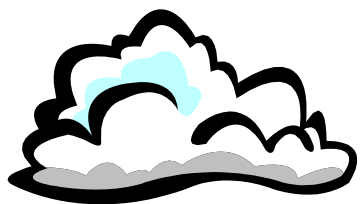


# All living things on Earth contain carbon. But, what is carbon? Why is it important?





**Carbon is found all over the Earth.**

**It is an element. It is in the air, in the ocean, in the Earth's crust.**

**If carbon is mixed with other elements you get; limestone, chalk, marble, coal, gas, alcohol, sugars, fats, and even medicines. The black stuff in your pencil, graphite, is carbon. Diamonds are 100% pure carbon. Your body even contains carbon, the same stuff from which diamonds are made!**

**Carbon is inside of us, outside of us, and right now you are breathing out carbon (in the form of a gas: carbon dioxide).**

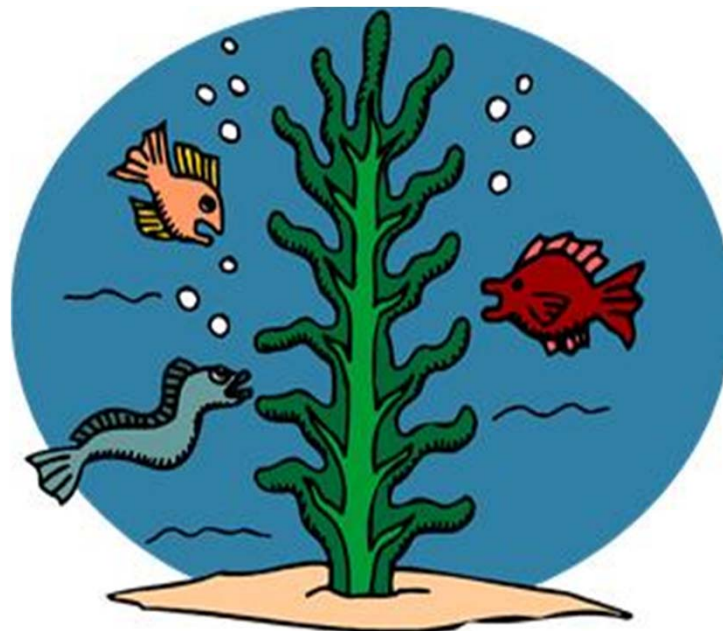
**Carbon is everywhere.**



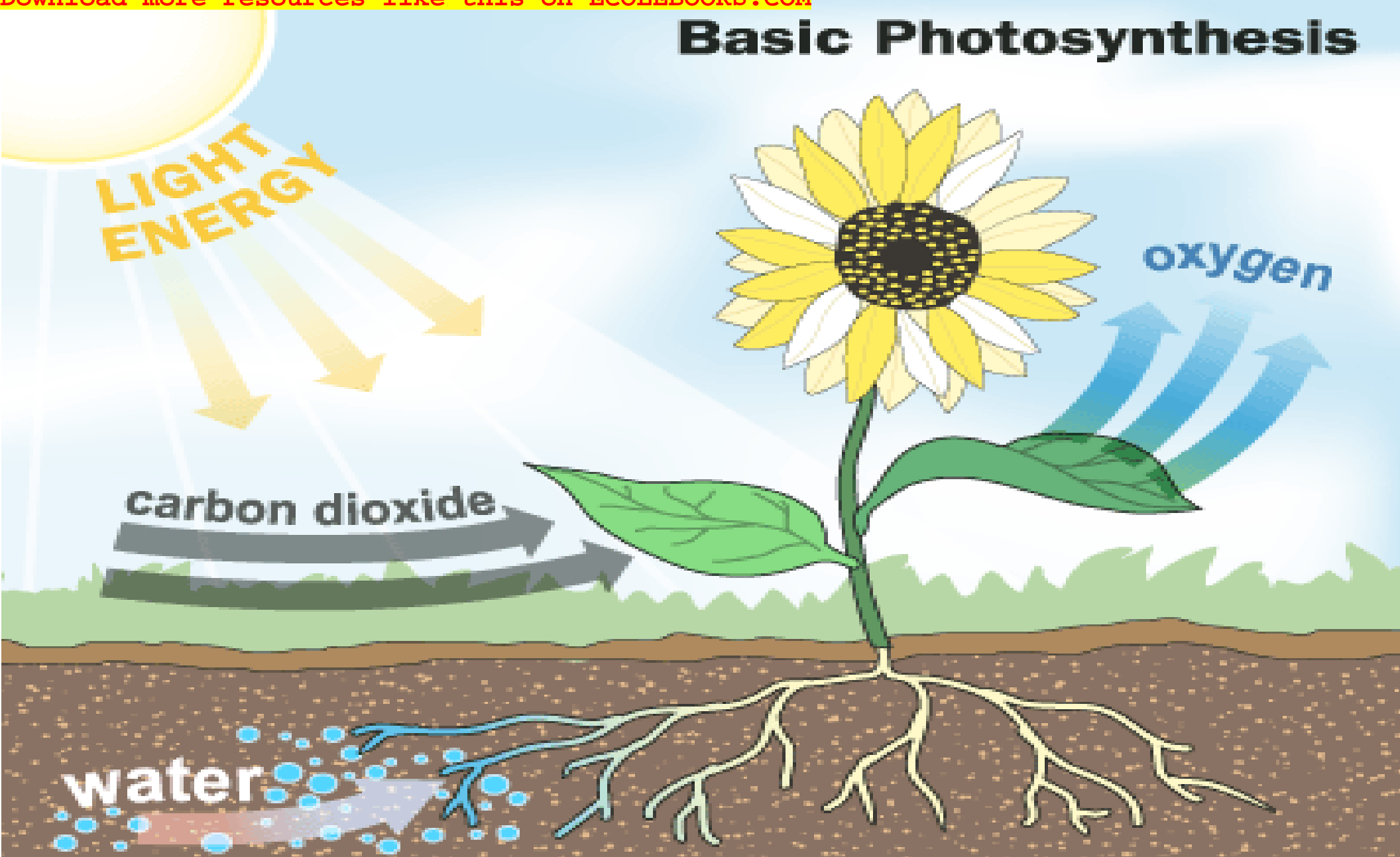
**People and animals all contain carbon. We get our carbon from eating plants or other animals. We breathe in oxygen which mixes with the carbon and then we breathe out carbon dioxide. (CO<sub>2</sub>)**



**photosynthesis to make their own food. They take in carbon from the water and release oxygen.**



# Basic Photosynthesis



- <http://science.howstuffworks.com/environmental/earth/geophysics/earth3.htm>

# Allotropes of carbon

- In the element carbon, atoms bond in different ways, creating different kinds of giant structures.

Two of these structures are **diamond** and **graphite**. They are called **allotropes** of carbon.

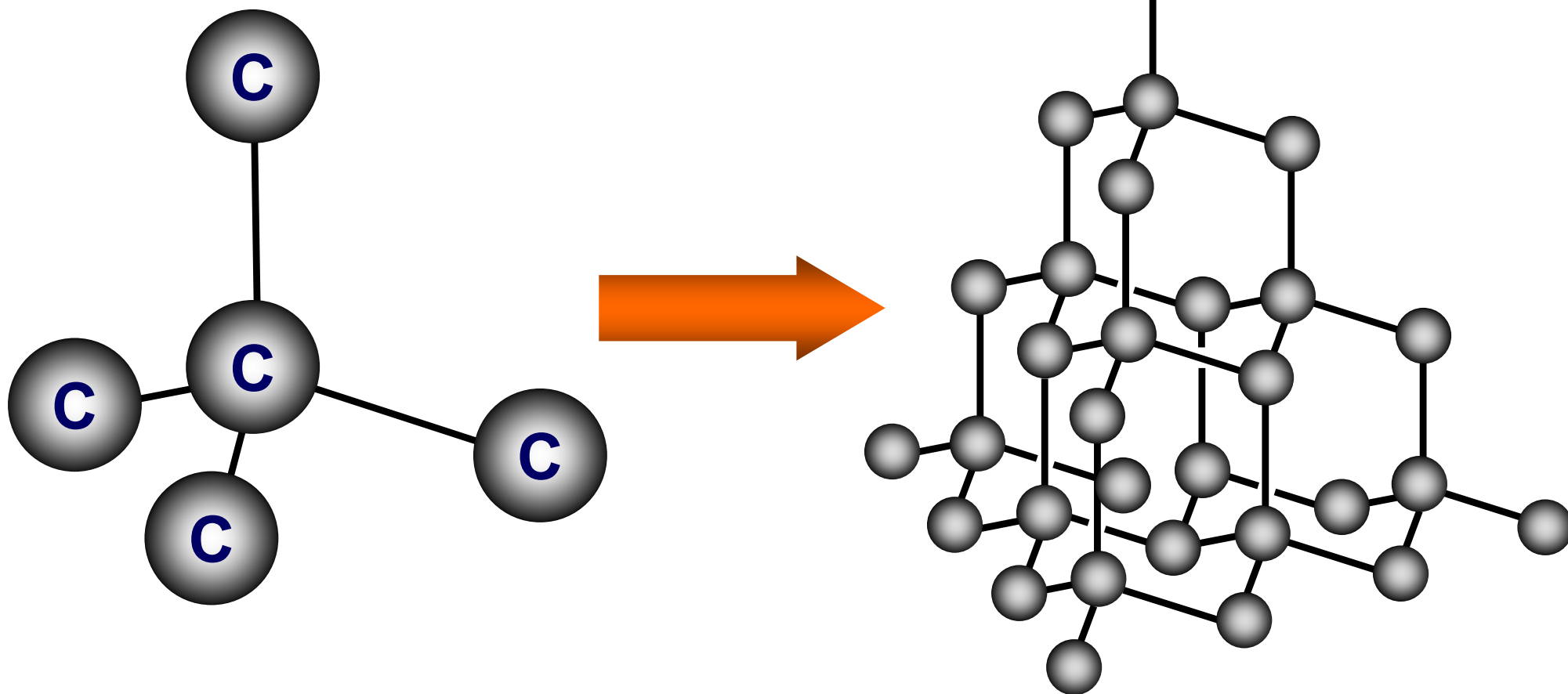
Allotropes have the same chemical properties because they have the same number of electrons.

However, they have different physical properties because the electrons are shared in different ways with other atoms.

# The structure of diamond

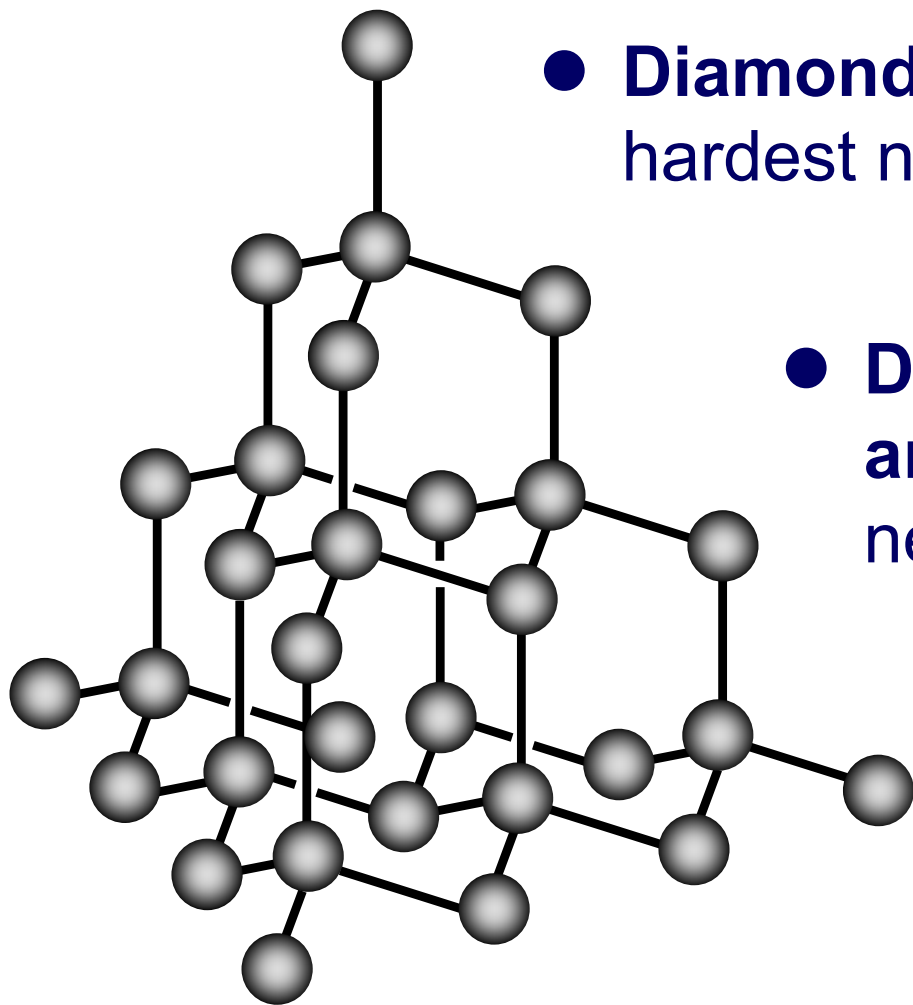
- Diamond is a rare form of carbon in which each atom is covalently bonded to four others.

This pattern arrangement is repeated millions of times to create a giant lattice.



## The properties of diamond

- All the electrons in the outer shell of the carbon atom (2.4) are used in covalent bonds. This affects diamond's properties.



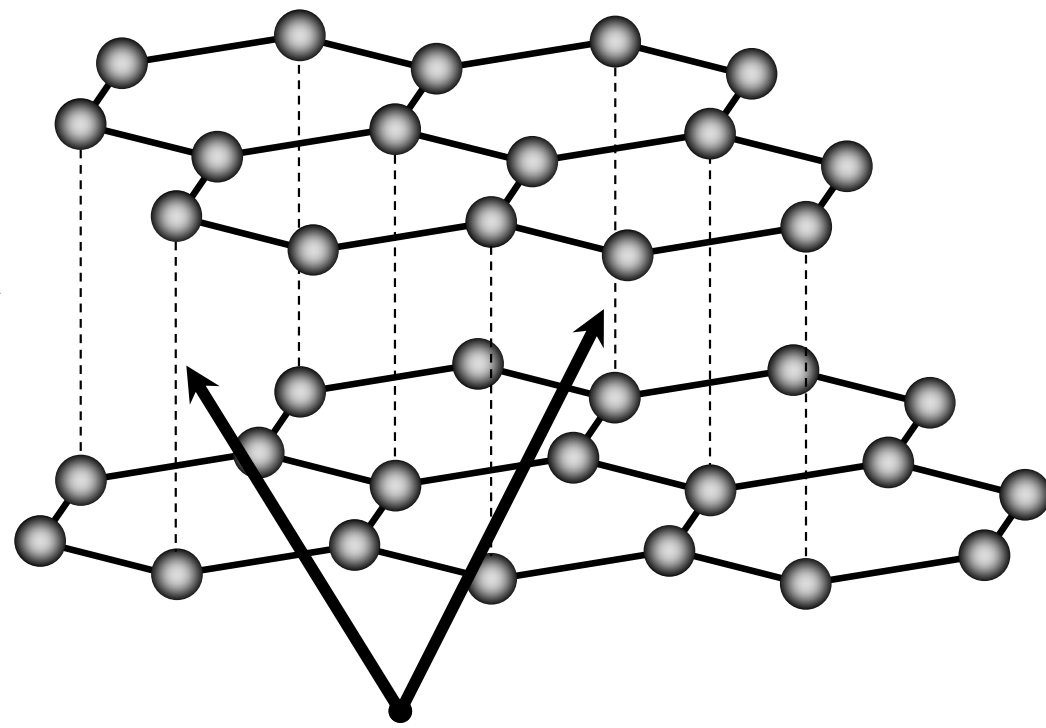
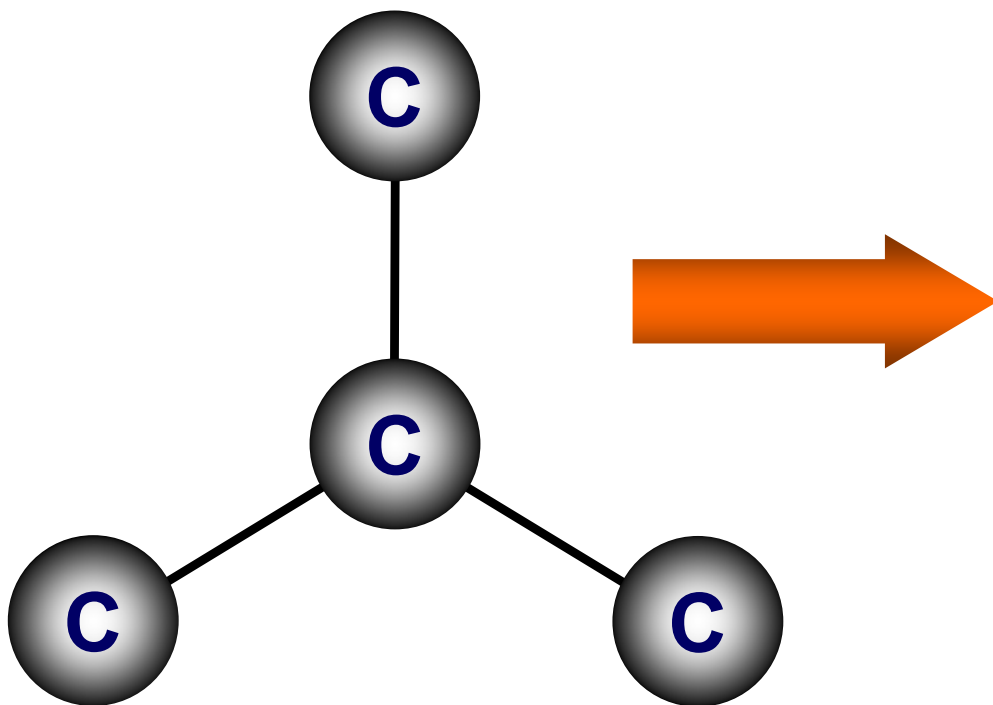
- **Diamond is very hard** – the hardest natural substance on Earth.
- **Diamond has a very high melting and boiling point** – a lot of energy is needed to break the covalent bonds.
- **Diamond cannot conduct electricity** – there are no free electrons or ions to carry a charge.



# The structure of graphite

- Graphite is a much more common form of carbon. in which each atom is covalently bonded to three others.

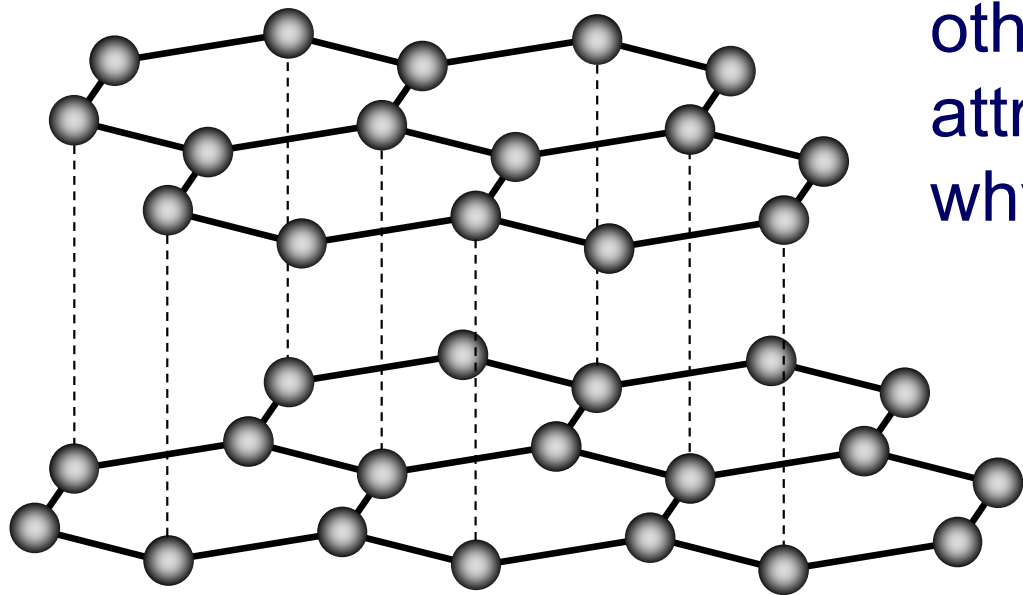
This forms rings of six atoms, creating a giant structure containing many layers. These layers are held together by weak forces of attraction.



**weak forces of attraction**

## The properties of graphite

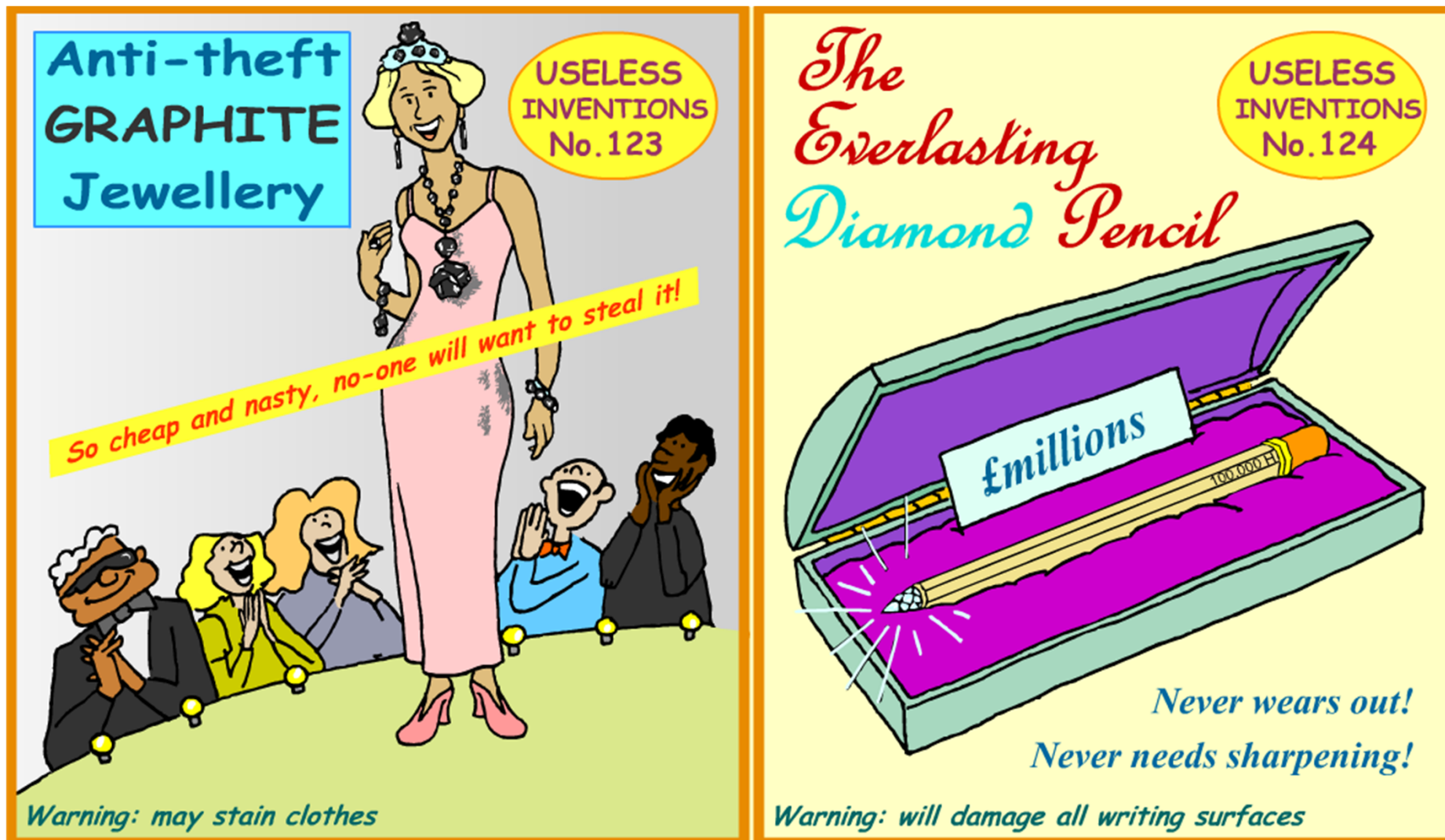
- Only three of the four electrons in the outer shell of the carbon atom (2.4) are used in covalent bonds. This affects graphite's properties.



- **Graphite is soft and slippery** – layers can easily slide over each other because the weak forces of attraction are easily broken. This is why graphite is used as a lubricant.
- **Graphite can conduct electricity** – the only non-metal to do. There is a free electron from each atom to carry a charge.

# Allotropes and their properties

- How do the different properties of diamond and graphite depend on their structures?



## Other allotropes of carbon

- Other allotropes of carbon have been discovered in the last 30 years. They are large but not really giant structures.

One allotrope is **buckminsterfullerene**. It contains 60 carbon atoms, each of which bonds with three others by forming two single bonds and one double bond.

These atoms are arranged in 12 pentagons and 20 hexagons to form spheres, which are sometimes called 'bucky balls'.

