

14–16 years

Key terms accessible glossary: structure and bonding



Education
Inspiring your teaching and learning

Downloaded from rsc.li/444TbFh, teacher
notes also available

Contents

For how to use, metacognitive prompts, ideas for support and challenge, and linked resources, visit: rsc.li/444TbFh

General

Atom.....	4
Chemical bond.....	5
Compound.....	6
Conductor of electricity.....	7
Dot and cross diagram.....	8
Electron.....	9
Electron shells/energy levels.....	10
Element.....	11
Giant lattice.....	12
Inelastic.....	13
Regular lattice.....	14
Subatomic particle.....	15

Covalent structure and bonding

Covalent bond.....	16
Diatomic.....	17
Intermolecular forces.....	18
Intramolecular forces.....	19
Macromolecule.....	20
Molecule.....	21

Contents continued

Ionic structure and bonding

Anion.....	22
Brittle.....	23
Ion.....	24
Ionic bond.....	25
Polyatomic ion.....	26

Metallic structure and bonding

Alloy.....	27
Cation.....	28
Delocalised electron.....	29

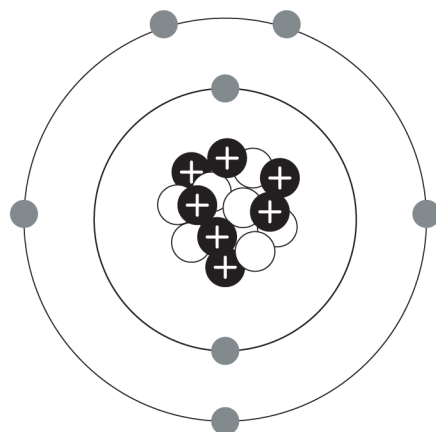
Ductile.....	30
Electrostatic force of attraction.....	31
Malleable.....	32
Metal.....	33
Metallic bond.....	34
Thermal conductivity.....	35

Structure and bonding of carbon

Allotropes.....	36
Tetrahedral.....	37

Atom

the smallest possible particle of an element; atoms are made up of protons, neutrons and electrons



Sign it

Watch a video:



bit.ly/3G7XpSi

Say it

A-tuhm

Example

One individual atom of nitrogen is the smallest form of nitrogen that can exist

Don't confuse with...

ions. Atoms have an equal number of protons and electrons. Atoms can form ions when they lose or gain electrons

Other contexts

In physics you will study similar topics about atomic structure and particles

Chemical bond

a strong electrostatic force of attraction holding atoms together

In other words...

a force that holds atoms together

Sign it

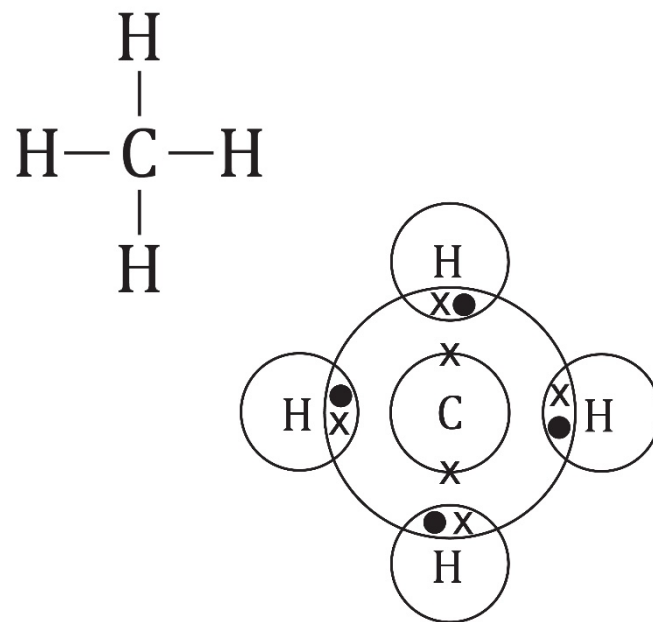
Watch a video:

bit.ly/4lydvVG



Say it

Kem-ih-kuhl bond



Example

Chemical bonds in methane connect each carbon atom to four hydrogen atoms

Don't confuse with...

changes of state. Melting and boiling a substance doesn't involve breaking any chemical bonds

Other contexts

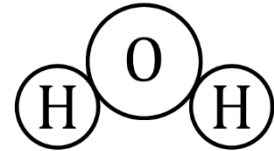
The type of bonding present in a substance can be named as either covalent, metallic or ionic bonding

Compound

a pure substance made of two or more different elements whose atoms are joined by chemical bonds; the atoms are in a fixed ratio

In other words...

two or more different elements chemically bonded

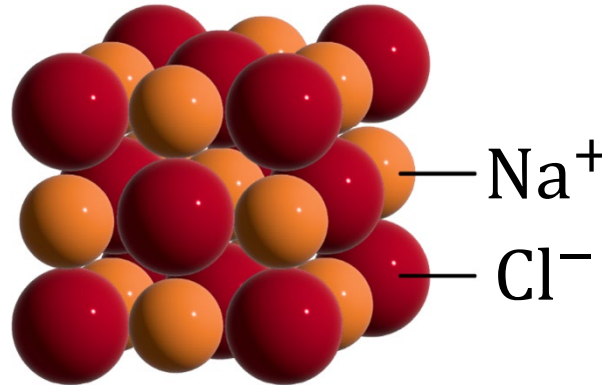


Example

Water and sodium chloride are common compounds

Sign it

Watch a video:  
bit.ly/4jDLKJD



Don't confuse with...

Mixture. Not all the atoms in a mixture will be chemically bonded together

Say it

Com-pound

Other contexts

In biology you will study the importance of glucose, carbon dioxide and many other compounds

Conductor of electricity

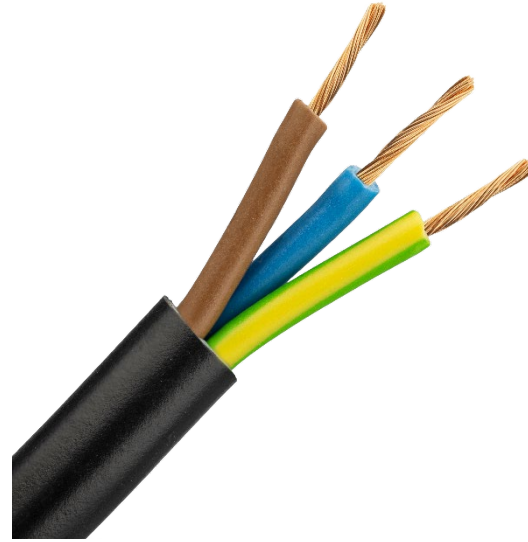
a substance that allows charged particles to move through it easily

In other words...

a material that conducts electricity

Say it

Con-duk-tor ov eh-lek-trih-sih-tee



Other contexts

You will discuss conductors of electricity in physics when learning about circuits and in chemistry when learning about electrolysis

Example

Metals like copper and gold are good conductors of electricity

Don't confuse with...

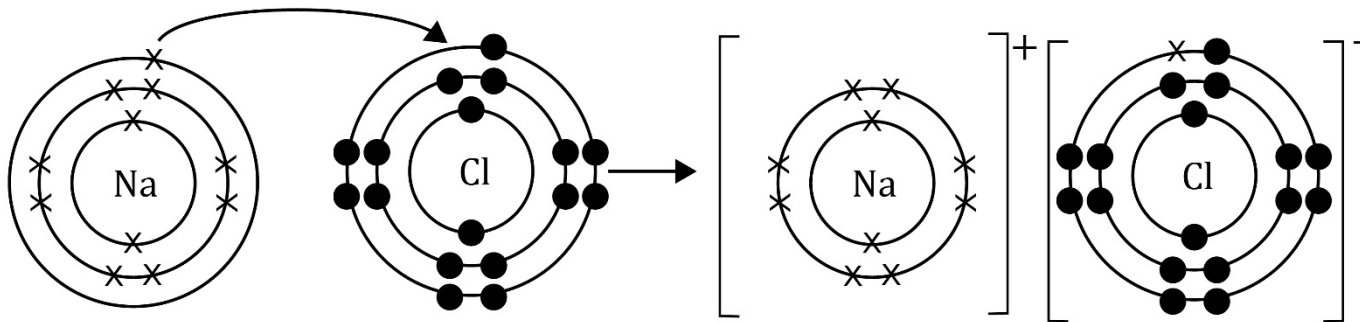
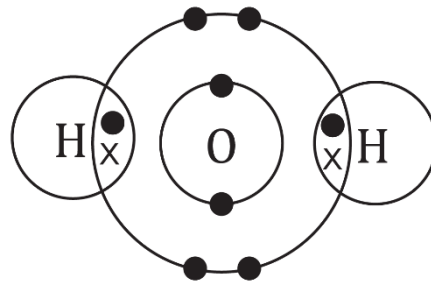
thermal conductor. The explanations for why a substance is a good electrical conductor vs. a conductor of thermal energy are different

Dot and cross diagram

used to show how electrons from the outer shells/energy levels of atoms are shared or transferred when atoms form molecules or ions

In other words...

a diagram to represent covalent and ionic bonding



Don't confuse with...

the full electron configuration of an individual atom. It is common in dot and cross diagrams to only represent the outer shell electrons of the atoms or ions involved

Electron

a negatively charged subatomic particle with very little mass found in the electron shells/energy levels of atoms

In other words...

negative subatomic particles found within atoms

Sign it

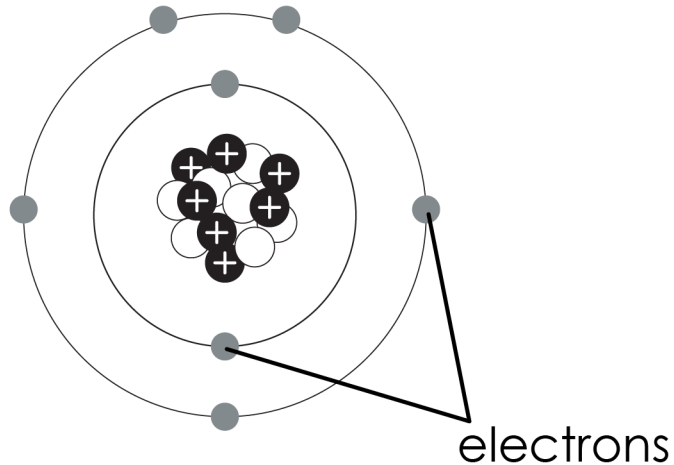
Watch a video:

bit.ly/4lxieqC



Say it

Eh-lek-tron



Example

Nitrogen atoms will contain seven electrons because the atomic number of nitrogen is 7

Don't confuse with...

Ion. Electrons are found within atoms and ions

Other contexts

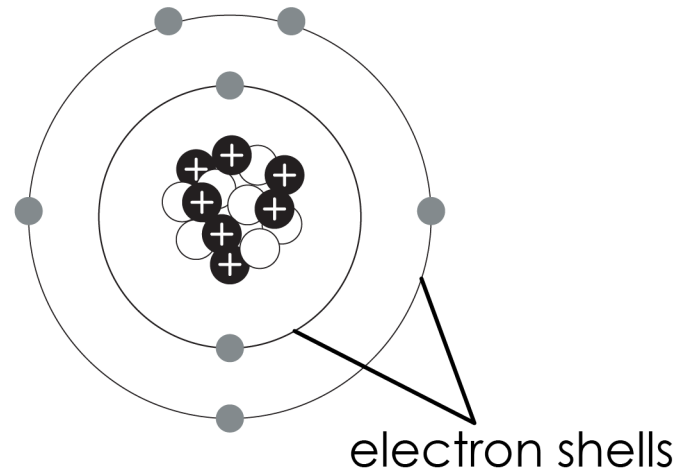
In physics you will study electrons in the context of electrical circuits

Electron shell (or energy level)

a region surrounding the nucleus of an atom where electrons are found; each level has a maximum number of electrons it can hold

In other words...

where electrons are found in an atom



Say it

Eh-lek-tron sh-ells

Example

An atom of nitrogen has two electron shells, so it is located in the second period of the periodic table

Don't confuse with...

delocalised electrons. They are not in the electron shells of any particular atom. Unless they are delocalised, electrons occupy space in an electron shell/energy level

Element

a pure substance made of only one type of atom

Sign it

Watch a video: 
bit.ly/4jAYL6M

O Oxygen 8	Na Sodium 11	P Phosphorus 15
-------------------------	---------------------------	------------------------------

Example

Oxygen, sodium and phosphorus are pure substances made of only one type of atom, so they are found on the periodic table

Say it

Eh-le-ment

Other contexts

In biology you will study how oxygen, carbon, nitrogen and several other elements are necessary for life

Don't confuse with...

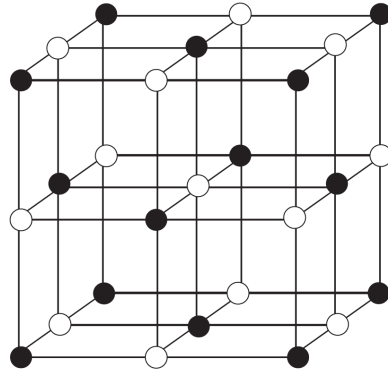
atoms, which are the individual particles that make up an element or compound

Giant lattice

the regular arrangement of atoms or ions that form extended structures

In other words...

a large repeating structure made of atoms or ions

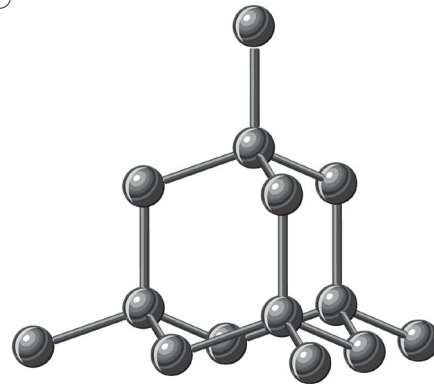


Say it

J-eye-ant lah-tiss

Other contexts

In physics, the particles of a solid are often represented as a giant lattice structure



Example

Diamond, silicon dioxide and sodium chloride are substances that all have their atoms arranged in a giant lattice structure

Don't confuse with...

simple molecules. These images only show a small section of the structures. These sections are repeated many times to make giant lattices

Inelastic

is not flexible

In other words...

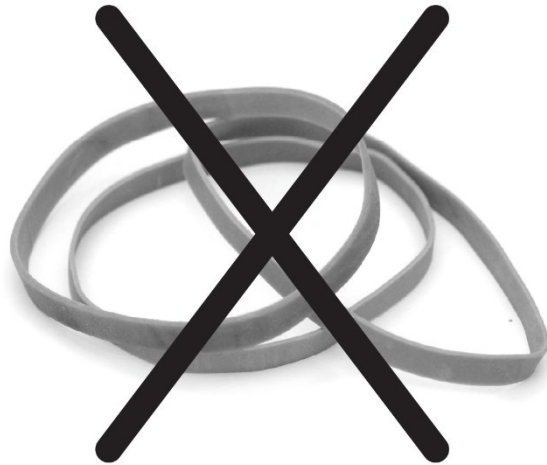
will not stretch or bend

Say it

In-el-as-tik

Break it down

'In' means not



Example

Metal drinks cans and glass bottles are common inelastic materials

Other contexts

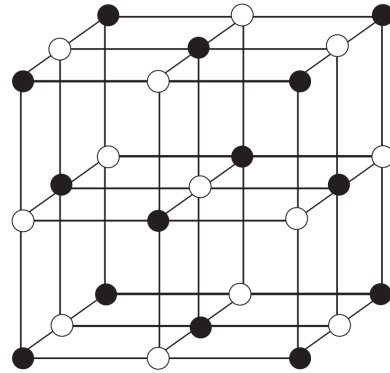
An inelastic object changes shape permanently when a force is applied to it. In physics you will investigate the properties of elastic and inelastic objects

Regular lattice

an arrangement of repeating atoms or ions that form a 3D structure

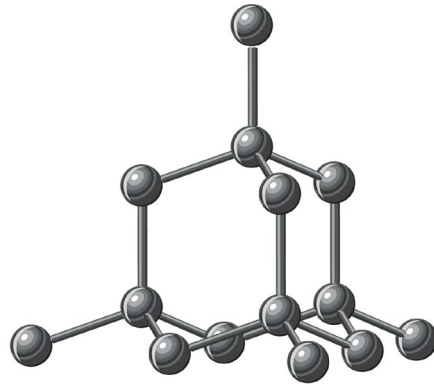
In other words...

particles arranged in a 3D repeating structure



Say it

Reh-gyu-lar lah-tiss



Other contexts

In physics you will learn about the arrangement of particles in solids

Example

Sodium chloride and diamond are substances that you will study that have a regular lattice structure

Don't confuse with...

simple molecules.

Subatomic particle

a particle smaller than an atom

In other words...

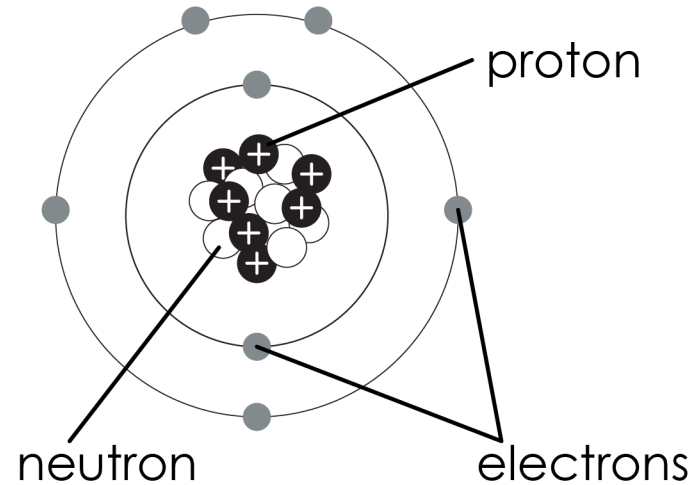
small particles that make up all elements

Say it

Sub-a-tom-ik par-tih-kuhl

Break it down

'Sub' means lower



Example

Protons, neutrons and electrons are subatomic particles

Don't confuse with...

atoms. Subatomic particles are what atoms are made from. They are found within the atom, not outside it

Other contexts

In physics you will encounter the same three subatomic particles that we learn about in chemistry: protons, neutrons and electrons

Covalent bond

a type of bond formed by atoms sharing one or more pairs of electrons

In other words...

a way for atoms to bond together by sharing pairs of electrons

Sign it

Watch a video:

bit.ly/44pZVxh

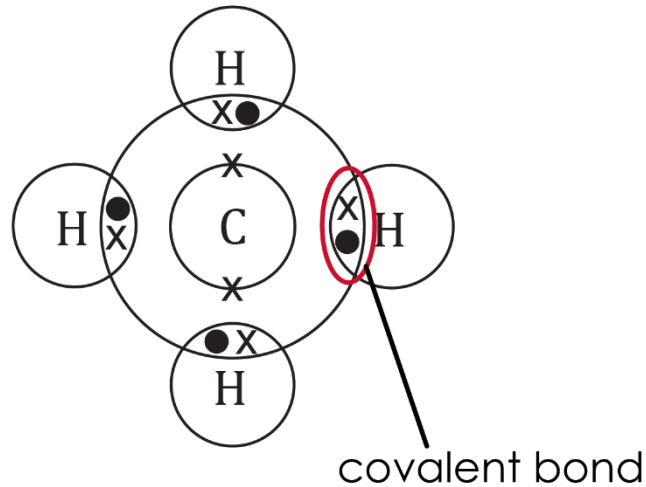


Say it

Co-vay-lent

Break it down

'Co-' means together with



Example

The atoms in methane molecules are held together by covalent bonds

Don't confuse with...

intermolecular forces. There are covalent bonds within small molecules but not between them

Other contexts

In biology the digestive enzymes amylase, protease and lipase work by breaking the covalent bonds in certain food molecules

Diatomic

when a molecule is composed of two atoms

In other words...

a bonded pair of atoms

Sign it

Watch a video: 

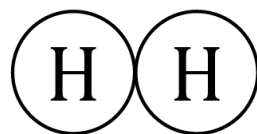
bit.ly/4ihXFeX

Say it

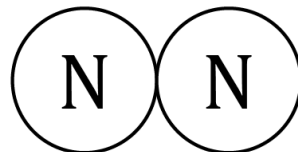
D-eye-a-tom-ik

Break it down

'Di-' means two



hydrogen molecule



nitrogen molecule



Example

Hydrogen (H_2) and nitrogen (N_2) are diatomic molecules

Don't confuse with...

compound; a diatomic molecule has two atoms, but they don't need to be different atoms. So, a diatomic molecule can be an element or a compound

Other contexts

In biology you will use the formula for diatomic oxygen, O_2 , in symbol equations

Intermolecular forces

the relatively weak attractive and repulsive forces between molecules

Say it

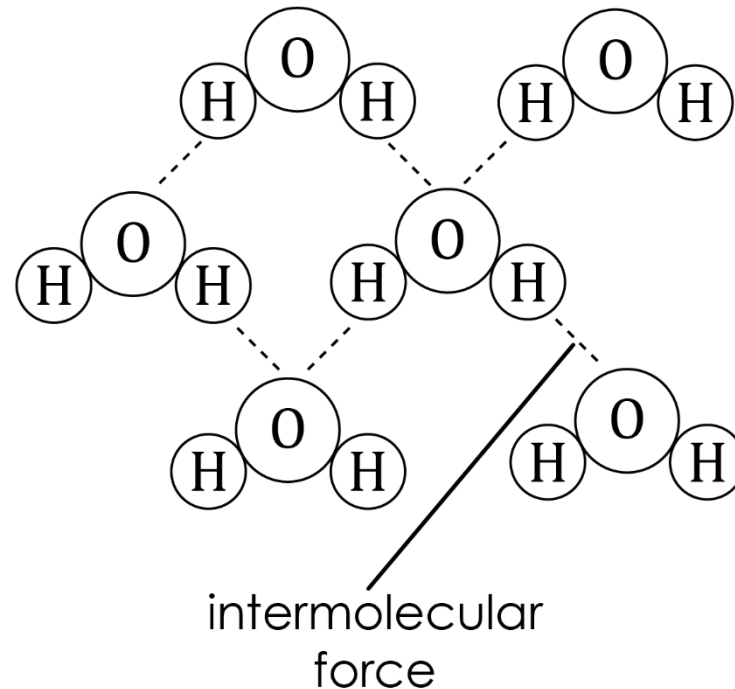
In-tur-mol-leh-kyu-lar
for-sez

Break it down

'Inter' means
between or among

Other contexts

In physics you may discuss intermolecular forces when learning about the particle model



Example

The water molecules in ice are held together by attractive forces between the molecules

Don't confuse with...

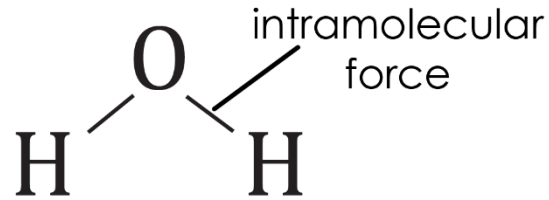
chemical bonds. No covalent bonds are broken when substances made of small covalent molecules undergo melting or boiling – it is the intermolecular forces that are overcome

Intramolecular forces

the attractive and repulsive forces within a molecule

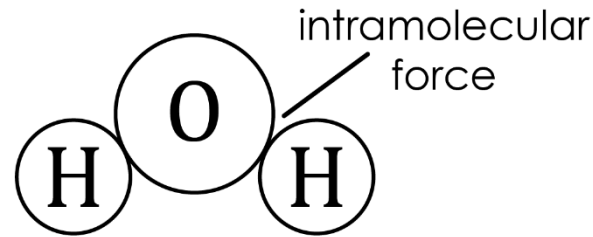
In other words...

the forces that keep atoms held together within a molecule



Say it

In-tra-mol-leh-kyu-lar
for-sez



Break it down

'Intra-' means inside
or within

Example

Covalent, ionic and metallic bonds are examples of intramolecular forces of attraction

Don't confuse with...

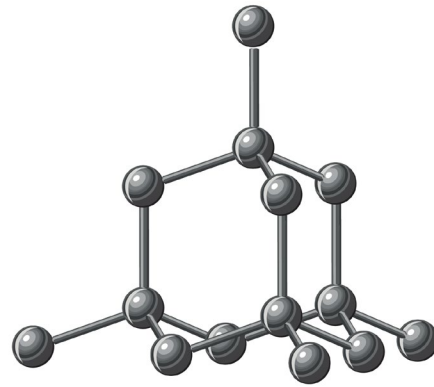
intermolecular forces. Molecules can have intramolecular and intermolecular forces, not just one or the other

Macromolecule

a very large molecule

Say it

Mac-ro-mol-eh-kyul



Break it down

'Macro-' means large

Example

A diamond is a macromolecule - one giant molecule made up of covalently bonded carbon atoms

Don't confuse with...

a lattice.

Similar words

The macromolecules silicon dioxide and diamond can be described as giant covalent structures

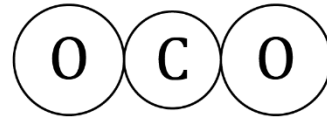
Molecule

two or more atoms connected by chemical bonds

Sign it

Watch a video:

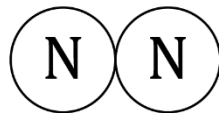
bit.ly/4lBjGbG



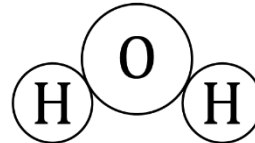
carbon dioxide
molecule



hydrogen
molecule



nitrogen
molecule



water
molecule

Say it

Mol-eh-kyul

Similar words

Molecules of gases and liquids could also be described as gas and liquid particles

Example

Carbon dioxide (CO_2), water (H_2O) and all other compounds are molecules

Don't confuse with...

elements and compounds. A molecule can be either an element or a compound

Other contexts

In biology you will study many different molecules found within living organisms, such as glucose and carbon dioxide

Anion

a negative ion

In other words...

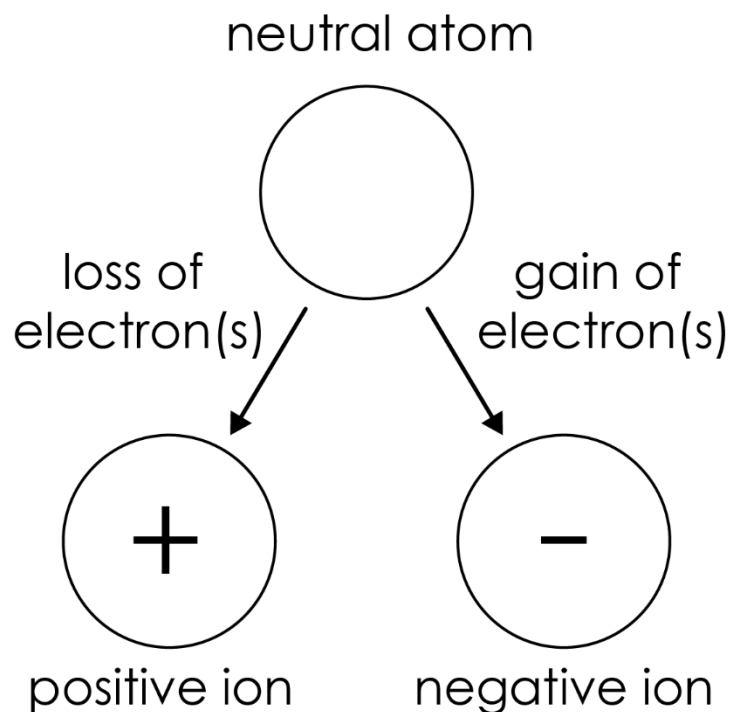
a particle with a negative charge

Say it

An-eye-on

Similar words

Negative ion



Example

Non-metals like chlorine and bromine can form chloride and bromide anions

Don't confuse with...

electrons. Both anions and electrons are negatively charged. But anions are negatively charged because an atom has gained more electrons in its outer shell

Brittle

something that cracks or breaks when force is applied to it

In other words...

objects that will break,
not bend or stretch

Sign it

Watch a video:



bit.ly/3RfV1eN



Example

A rock will crack
when a strong
enough force is
applied to it
because rock is
brittle

Say it

Brit-uhl

Similar words

Inelastic

Don't confuse with...

fragile (easy to
break). Not all brittle
objects are fragile

Ion

a charged particle formed when one or more electrons are lost or gained from an atom or molecule

In other words...

a particle with a positive or negative charge

Sign it

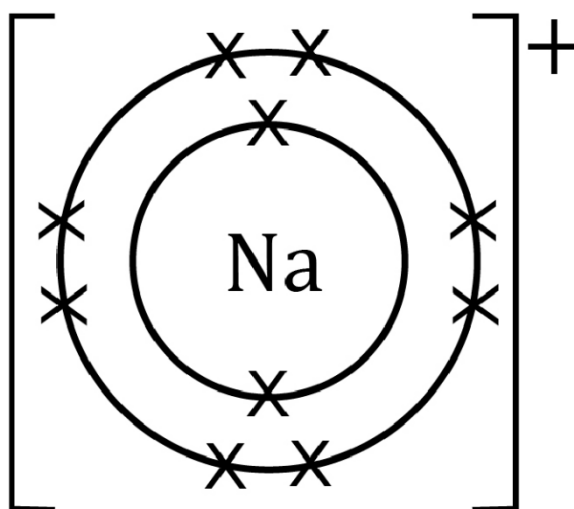
Watch a video:



bit.ly/3Yv76R2

Say it

Eye-on



Similar words

Cations are ions with a positive charge and anions are ions with a negative charge

Example

When a sodium atom loses an electron, it becomes a positively charged ion

Don't confuse with...

protons (positive) or electrons (negative)

Other contexts

In physics you may discuss ions when learning about electricity

Ionic bond

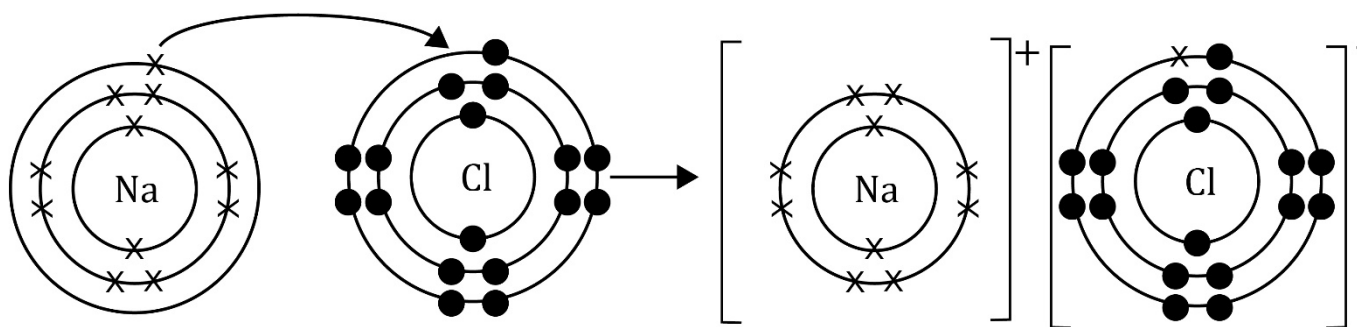
an electrostatic force of attraction between oppositely charged ions in a regular lattice that forms between a metal and a non-metal

In other words...

the bond between a metal and a non-metal

Say it

Eye-on-ik bond



Don't confuse with...

diatomic molecule. Ionic bonds will not always form in a 1:1 ratio of metal to non-metal ions. For example, MgCl_2 has two Cl^- chloride ions for every Mg^{2+} magnesium ion

Example

Sodium chloride NaCl (table salt) is a compound held together by ionic bonds. If you crush a large grain of salt, you are breaking the ionic bonds between the sodium and chloride ions

Polyatomic ion

a charged particle made of two or more atoms joined together

In other words...

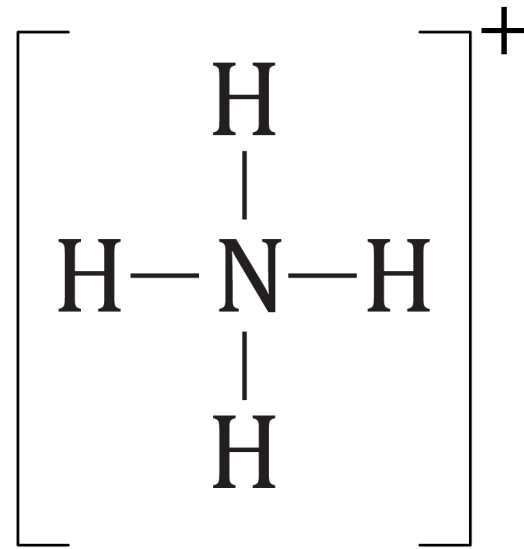
two or more atoms bonded together to form a molecule that has an overall positive or negative charge

Say it

Polly-a-tom-ik eye-on

Break it down

'Poly-' means many



Other contexts

In biology nitrate and phosphate ions are polyatomic ions important for plant nutrition

Example

OH^- (hydroxide) and NH_4^+ (ammonium) are polyatomic ions that you will frequently encounter in chemistry

Don't confuse with...

ionic compound. Ionic compounds are overall neutral so there is no charge shown in the formula. A polyatomic ion within the compound has a charge which always needs to be shown

Alloy

a mixture of two or more elements at least one of which is a metal, where the resulting mixture has metallic properties

In other words...

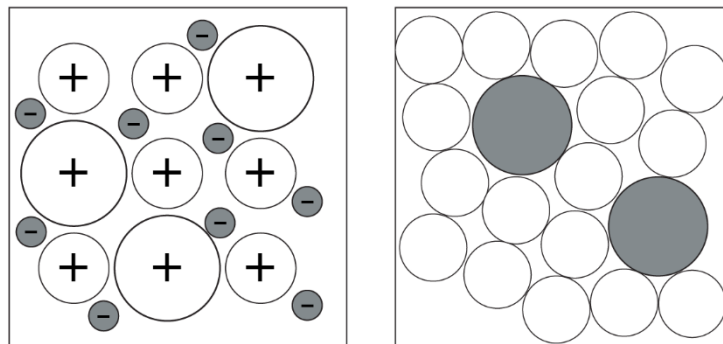
a metal element mixed with another element to improve the properties of the metal, such as making it harder

Sign it

Watch a video: 
bit.ly/3RNR0rl

Say it

Ah-loy



Example

Bronze is an alloy of the two metals copper and tin

Don't confuse with...

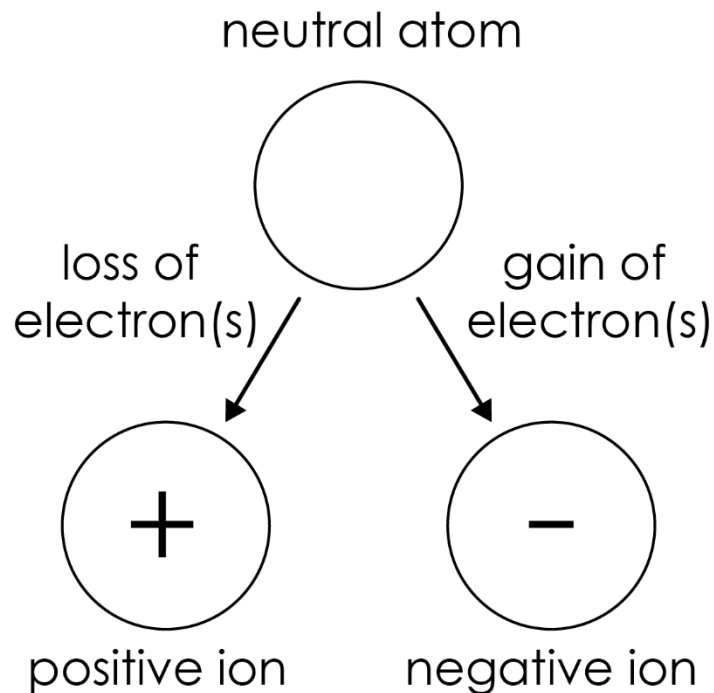
ionic compounds, even though alloys may contain a non-metallic element mixed with the metal

Cation

a positive ion

Say it

Cat-eye-on



Example

Metallic elements can form cations like Na^+ and Mg^{2+}

Don't confuse with...

protons. Both are positive particles, but protons are found within atoms and ions

Delocalised electron

an electron in a molecule or structure that is not associated with any particular atom, ion, or covalent bond and which is free to move

In other words...

electrons that are free to move throughout a structure because they are not bound to one particular atom or ion

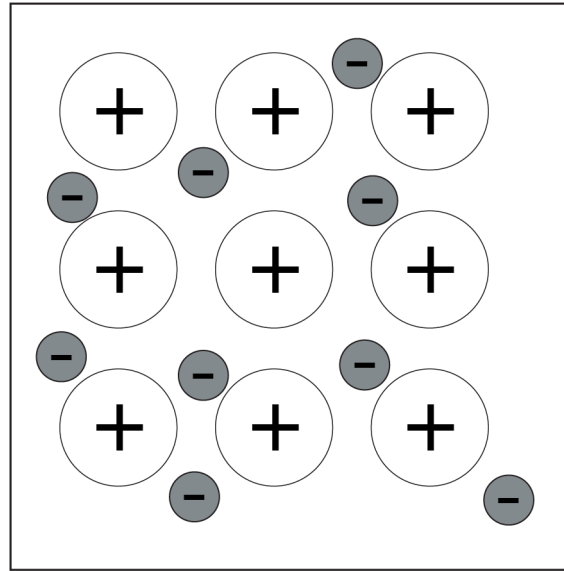
Sign it

Watch a video: 

bit.ly/4jCGh5R

Say it

Dee-lo-cul-eyes-d eh-lek-tron



Similar words

Free electron

Example

Metals are good electrical conductors because they have delocalised electrons

Don't confuse with...

electrons in a metal. Graphite, an allotrope of carbon, also has delocalised electrons

Other contexts

In physics delocalised electrons flow through a circuit to produce a current

Ductile

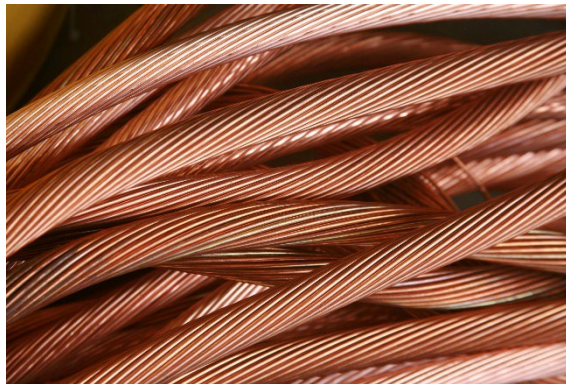
In other words...

a material that can be stretched or drawn out into thin wires without breaking

Say it

Duk-tah-yul

can be drawn out into wires



Example

Copper is used to make wires in electrical circuits because it is ductile

Electrostatic force of attraction

a force of attraction between particles with opposite charges

In other words...

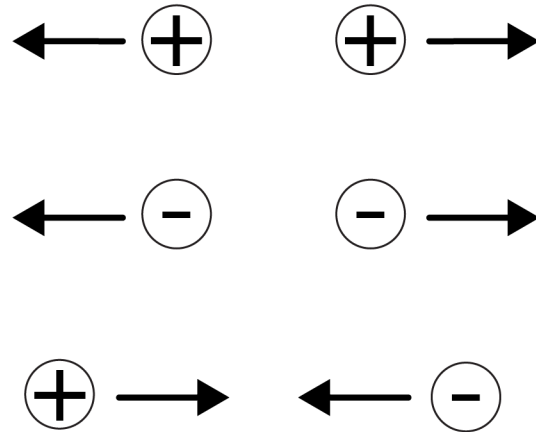
positive and negative particles will attract each other

Say it

Eh-lek-tro-stah-tik for-ss
ov at-rak-shuhn

Other contexts

In physics you will study electrostatics during the electricity topic



Example

There is an electrostatic force of attraction between positively charged protons and negatively charged electrons

Don't confuse with...

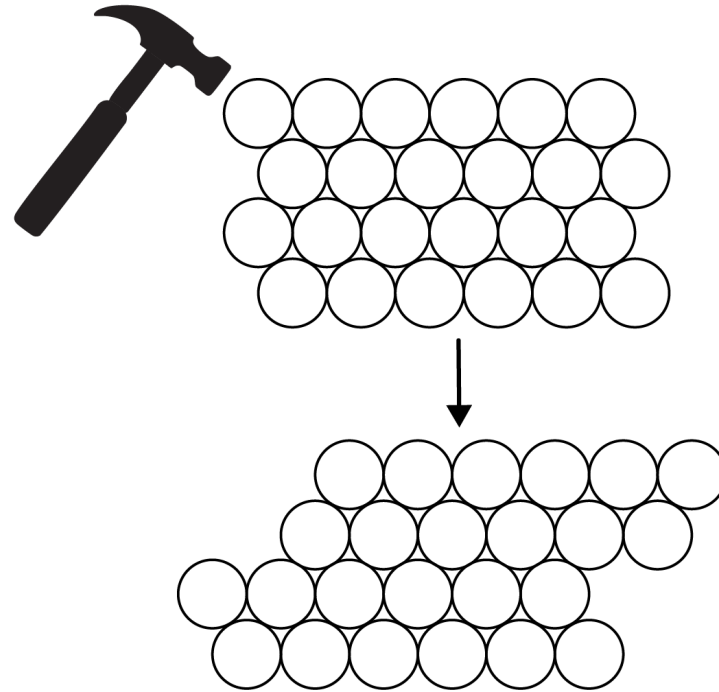
chemical bonding. All types of bonding involve an electrostatic force of attraction, but this force is also what causes protons and electrons to attract within individual atoms

Malleable

can be hammered or bent into shape

Say it

Mah-lee-ah-buhl



Example

Metals can be used for the bodywork of vehicles such as cars and planes because metals can be easily shaped – they are malleable

Metal

an element that is shiny when cut, malleable and conducts electricity well; metals are found on the left and middle of the periodic table and tend to lose electrons to form positive ions

In other words...

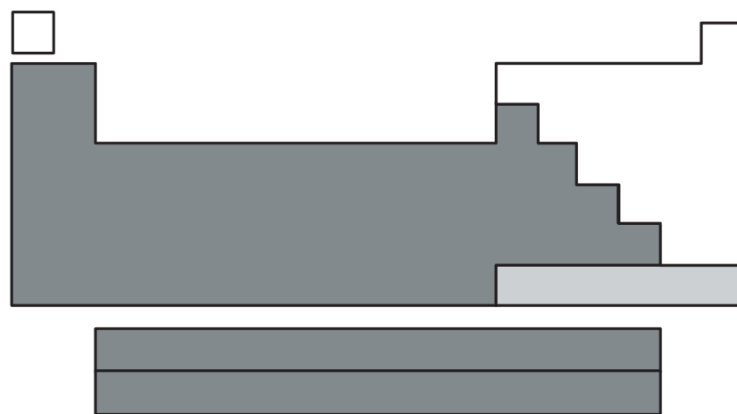
elements which can be bent into shape and conduct electricity. Most are shiny solids at room temperature

Sign it

Watch a video: 
bit.ly/42fFYYP

Say it

Met-uhl



Example

Iron, aluminium and copper are metals commonly used to manufacture useful products

Don't confuse with...

metallic bonding. Pure metals will have metallic bonding, but metals can form ionic bonds with non-metals

Other contexts

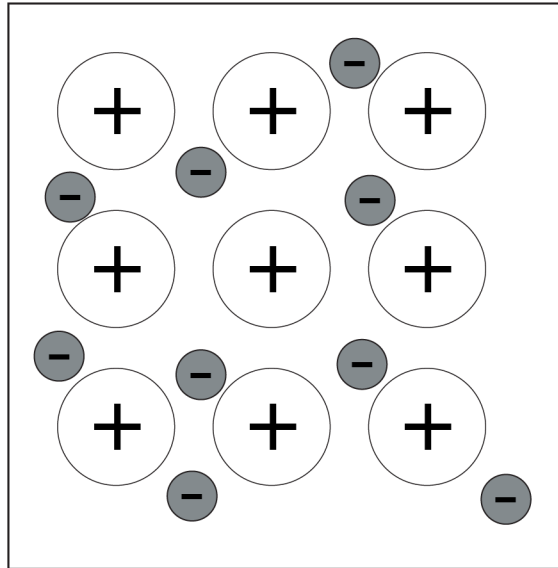
In physics you will study the magnetic metals iron, nickel and cobalt

Metallic bond

an electrostatic force of attraction between delocalised electrons and the positive ions in a regular lattice

In other words...

a type of bonding between metal atoms when the outer shell electrons become delocalised but remain attracted to the positive metal ions that have formed



Example

'Tin foil' (a very thin sheet of aluminium) has metallic bonds, so when you tear the foil you are actually breaking the metallic bonds

Say it

Met-ah-lik bond

Don't confuse with...

ionic bonds. Only the positive metal ions are in a fixed position in a metallic bond, the delocalised electrons can move freely through the structure

Thermal conductivity

In other words...

substances with a high thermal conductivity are good at transferring heat

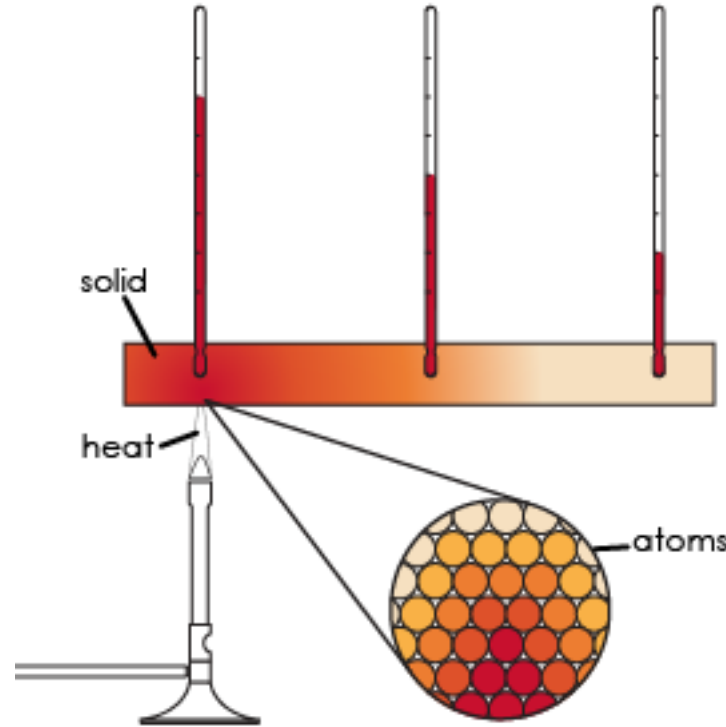
Say it

Th-ur-mul con-duk-tiv-ih-tee

Similar words

Thermal conductors can also be described as conductors of heat

a measure of how easily a substance allows heat to move through it



Example

Most metals are good thermal conductors, so they are used in applications such as saucepans and radiators

Don't confuse with...

electrical conductivity. The explanations for why a substance is a conductor of electricity or conductor of thermal energy will be different

Allotropes

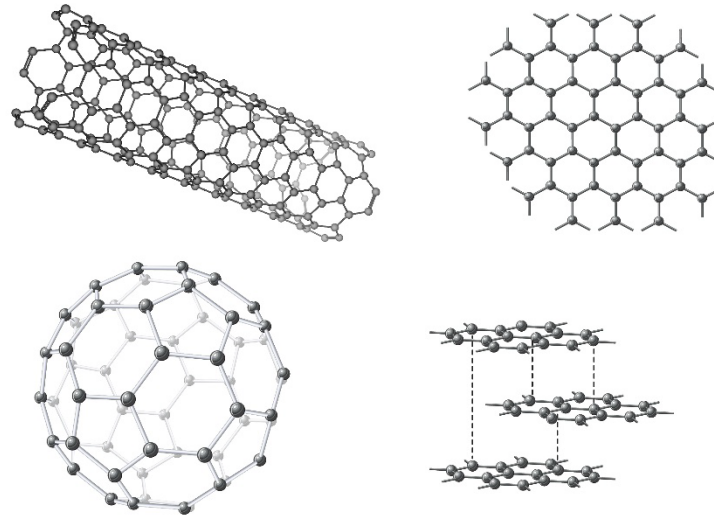
different forms of the same element in the same physical state; for example, allotropes of carbon are diamond, graphite, graphene and fullerenes

In other words...

different forms of the same element where the atoms are arranged in different ways, giving each allotrope different properties

Say it

Ah-lo-troh-ps



Example

Diamond and graphite are two allotropes of carbon

Don't confuse with...

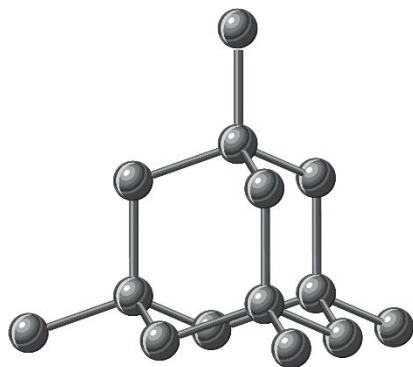
isotope. Allotropes are described in terms of their structure and bonding, not the number of subatomic particles within the atomic nucleus

Tetrahedral

molecules and structures that have one atom in the centre and four atoms at the corners of a triangular pyramid

Say it

Teh-trah-heed-rahl



Example

Carbon atoms are arranged in a tetrahedral structure within a diamond molecule

Break it down

'Tetra-' means four

Don't confuse with...

diamond. It does have a tetrahedral structure, but so do many other molecules. Silicon is another macromolecule with a tetrahedral structure and some small molecules like methane (CH_4) also have a tetrahedral shape

Acknowledgements

Images on slide 7, 13, 23 and 30 are © Shutterstock

SSC BSL Glossaries of Curriculum Terms
(<https://www.ssc.education.ed.ac.uk/BSL/>)

