

WHAT EVERYTHING CENTRES AROUND

arrangement: *placement, layout*
 bonded: *attached*
 to break (broke-broken) down: *to separate*
 to equal: *to be the same as*
 to hold (held-held): *to keep*
 inner: *internal*
 joined: *united*
 main: *chief, principal*
 ratio: *proportion*
 to share: *to have in common*
 since: *because*
 to spin (spun-spun): *to rotate*
 to transfer: *to move*

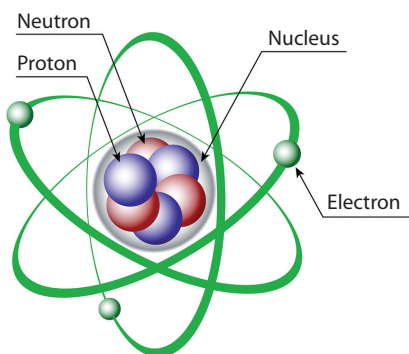


The optimist sees the glass half full.
 The pessimist sees the glass half empty.
 The chemist sees the glass completely full, half in the liquid state and half in the vapour state.

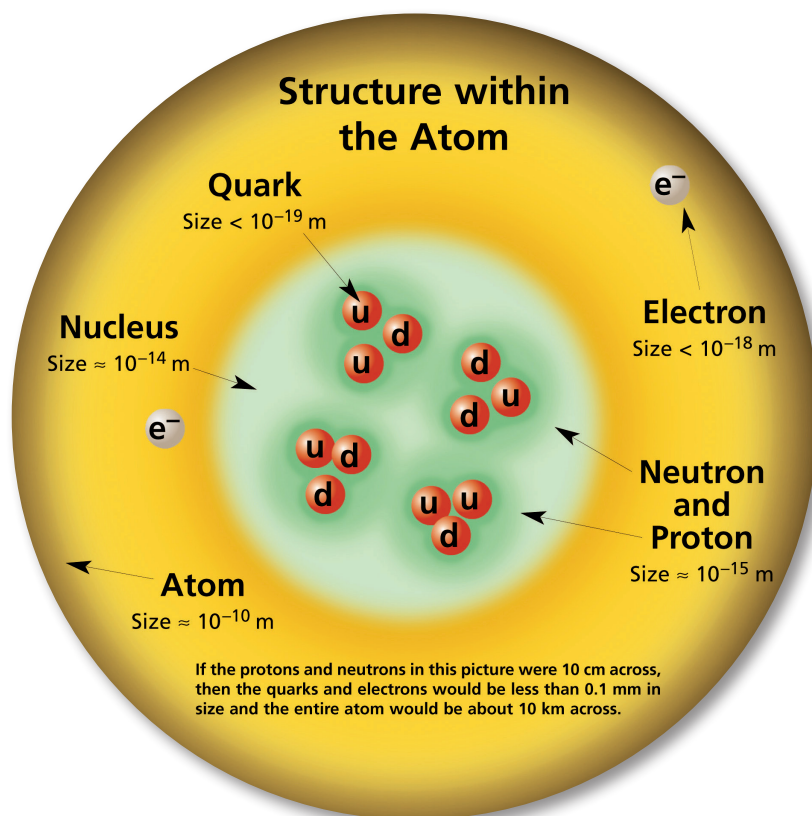
Q: Why isn't energy made of matter?

A: It doesn't matter.

Atom structure



A schematic view of an atom structure



All matter in the natural world is composed of one or more fundamental substances called **elements**. An element is a pure substance that cannot be created or **broken down** by ordinary chemical means. Each element's name can be replaced by a one- or two-letter symbol.

An atom is the smallest quantity of an element that retains the unique properties of that element. Atoms are made up of even smaller subatomic particles, three types of which are important: the **proton**, **neutron** and **electron**.

Protons and neutrons are made of varieties of a still smaller particle called the quark. Quarks are made up of, and interact with, smaller subatomic particles.

An atom does not need to have all three particles, but will always contain at least protons.

An atom has an **inner** core called a **nucleus**, which is where the protons and neutrons are located. An atom's protons and electrons carry electrical charges. The number of positively charged protons and non-charged (neutral) neutrons gives mass to the atom, and the number of each in the nucleus of the atom determine the element. The number of negatively charged electrons that **'spin'** around the nucleus **equals** the number of protons.

Atoms can lose or gain electrons. When they do, they form charged particles called ions. Cations have fewer electrons and have a positive charge. Anions have extra electrons that create a negative charge.

The **atomic number**, which is the number of protons in the nucleus of the atom, identifies the element and, **since** an atom usually has the same number of electrons as protons, it identifies the usual number of electrons as well.

An element's **mass number** is the sum of the number of protons and neutrons in its nucleus. Certain elements can exist in two or more different forms. These forms are called **allotropes** in which the element's atoms are **bonded** together in a different manner.

An **isotope** is one of the different forms of an element, distinguished from one another by different numbers of neutrons.

Isomers are molecules that have the same chemical formula, but a different **arrangement** of atoms.

Two **main** forces **hold** atoms together: the **electric force**, which holds the electrons in orbit around the nucleus, and the **nuclear force**, which holds the protons and neutrons together within the nucleus.

Matter can exist in the form of a pure element, but combinations of elements are more common.

A **molecule** is the smallest particle in a chemical element or compound that has the chemical properties of that **element** or **compound**. Molecules are made up of atoms that are held together by chemical bonds.

A compound is a substance composed of two or more elements **joined** by chemical bonds. Generally, compounds are considered a subclass of molecules.

A chemical formula is a concise way of showing the elements contained in a molecule/compound and their **ratio**.

The atoms in a compound are chemically joined together by strong forces called chemical bonds. An ionic bond is formed when an electron **transfers** from one atom to another. A covalent bond is formed when two atoms **share** one or more electrons.

Mass number
Number of protons
and neutrons in atom

A
Z
X

Atomic symbol
Abbreviation used
to represent atom
in chemical
formulas

Atomic number
Number of protons
in atom

12
6
C

6 protons

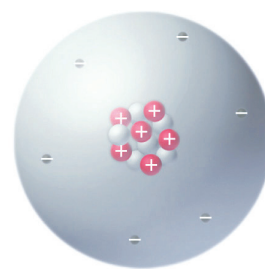
6 neutrons

6 electrons

+

0

-

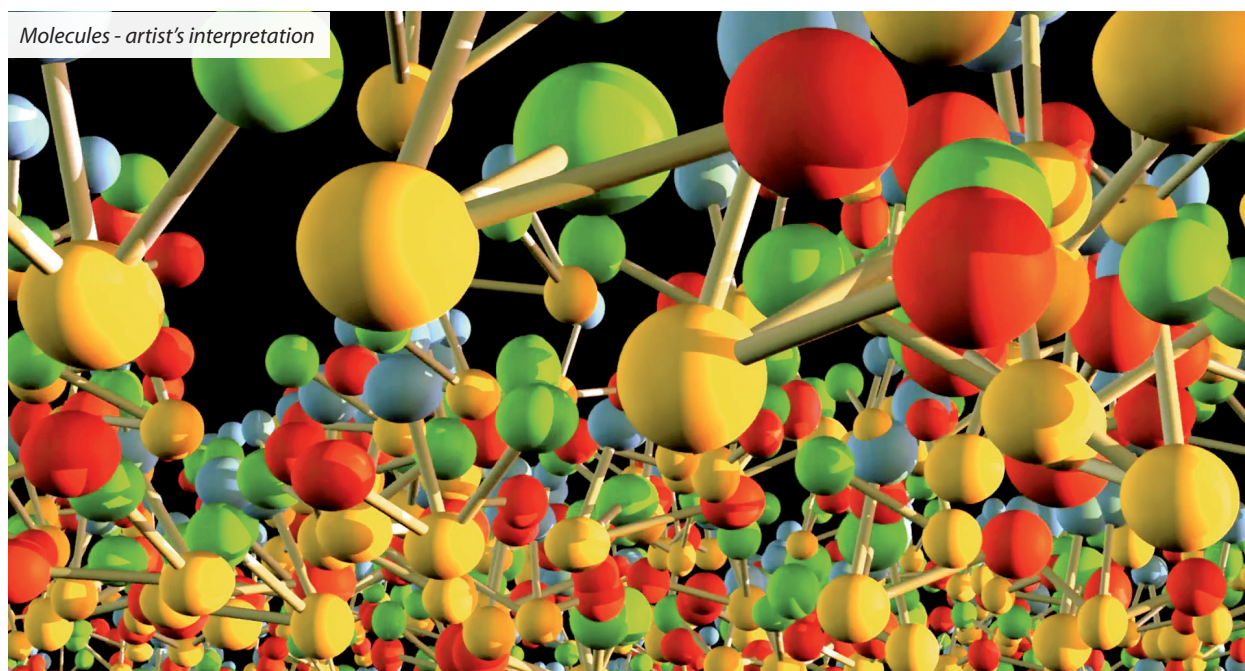


Atomic and mass number



A diamond is a well-known carbon allotrope

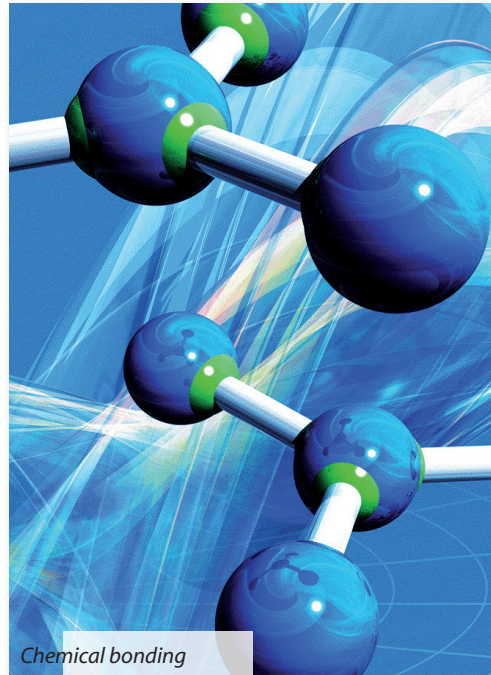
Molecules - artist's interpretation



1 Join the *Heads* and *Tails* to make an outline of the reading passage.

Heads

1. Matter is made up of
2. Each element is a pure substance, made up of
3. Atoms contain
4. Electrons are
5. Protons have
6. Neutrons do not have
7. The protons and neutrons are located
8. The electrons orbit
9. The number of electrons in an atom is
10. Allotropes are
11. The atomic number of an element is
12. The mass number of an element is
13. A molecule is
14. A compound is
15. A chemical bond is

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Tails

- a. a combination of two or more atoms from the same or from different elements.
- b. a combination of two or more chemically bonded elements.
- c. a positive charge.
- d. an attraction between atoms that enables the formation of compounds.
- e. an electrical charge.
- f. around the outside of the nucleus.
- g. different forms of the same chemical element.
- h. in the nucleus at the centre of the atom.
- i. negatively charged particles.
- j. one or more of about 100 naturally-occurring elements.
- k. only one type of atom.
- l. the number of protons its atom contains.
- m. the same as the number of protons, so atoms are electrically neutral overall.
- n. the total number of protons and neutrons its atom contains.
- o. three sub-atomic particles: protons, neutrons, and electrons.

