Atoms and matter

The term *matter* refers to anything that occupies space and has mass, in other words, everything around you. All matter is made up of substances called **elements**, which are the most basic materials in the universe. There are 118 of them, mostly found in nature, but some of them have been made in a laboratory. Every known substance (solid, liquid or gas) is composed of elements.

The smallest particle of an element is an **atom** and it retains all the properties of that element, that is to say that each element has its own kind of atom: for example, hydrogen atoms are all alike and different from the atoms of other elements. But all elements have some features in common. They all have an inner part, the **nucleus**, which is composed of very small particles called **neutrons** and **protons**.

Atoms also have an outer part, consisting of small particles, called **electrons**. They orbit around the nucleus in shells. **Shells** can be described as the result of the different rings traced by the electrons orbiting around the nucleus. The electrons sitting in the last shell are called **valence electrons** and the electrical properties of a material depend on the number of such electrons.

Neutrons have no electric charge, while protons are positively charged and electrons are negatively charged. Because of their charges, protons and electrons are particles of energy and form an electric field within the atom, pushing and pulling one another and thus producing energy in the form of movement. As long as this arrangement is not changed, that



is to say that the atom has the same number of electrons and protons, an atom is said to be electrically balanced and its charge is neutral.

Using enough force on the valence electron, either pushing it with another negative charge or attracting it with a positive charge, we can eject the electron from its orbit around the atom creating a free electron. As the free electron is floating in a space between atoms at random, it is pulled and pushed by surrounding charges in that space, until it eventually finds a new atom to join: in doing so, the negative charge of that electron ejects another valence electron from the atom. Now a new electron is drifting through free space doing the same thing. This chain effect can continue on and on thus creating a flow of electrons called an electric current.



The quark is a really small particle that makes up neutrons and protons. Quarks are nearly impossible to detect and it is only recently that scientists figured out that they exist. They were discovered in 1964 by Murray Gell-Man. alike: simile arrangement: disposizione at random: a caso because of: a causa di to drift: muoversi lentamente feature: caratteristica inner: interna outer: esterna that is to say: vale a dire thus: in questo modo



1 Choose the correct answer.

- 1. What is matter?
 - **a.** The measure of how heavy or light something is for its size.
 - **b.** The force of gravity of an object's mass.
- 2. What is at the centre of every atom?
 - a. An electron.
 - **b.** A compound.
- 3. What two particles make up the nucleus of an atom?
 - a. Protons and electrons.
 - **b.** Protons and neutrons.
- **4.** What is the role of an electron in an atom?
 - **a.** Electrons live inside the nucleus and carry a neutral charge.
 - **b.** Electrons circle the nucleus and have a positive charge.
- 5. In an electrically balanced atom, what is the number of protons equal to?
 - a. The number of electrons.
 - **b.** The number of protons.
- 6. What is a shell?
 - **a.** The number of protons in the atom.
 - **b.** The ring traced by an orbiting electron.

2 PAIR WORK Ask and answer the questions in turns.

- 1. What is an atom?
- 2. Are atoms all alike?
- 3. What does their nucleus consist of?
- 4. How does an electron fit into an atom?
- 5. What are valence electrons?
- **6.** What are free electrons?

- c. Anything that has both mass and volume.
- d. The amount of space an object takes up.
- c. A molecule.
- d. A nucleus.
- c. Molecules and compounds.
- d. Electrons and neutrons.
- **c.** Electrons circle the nucleus and have a negative charge.
- **d.** Electrons live inside the nucleus and have a negative charge.
- **c.** The number of molecules.
- **d.** The number of nuclei.
- **c.** The outer part of the nucleus.
- **d.** The charge surrounding the atom.



3 PAIR WORK Write a short summary of the text on the left page using suitable linkers. You may use the answers to the previous activity to help you.



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