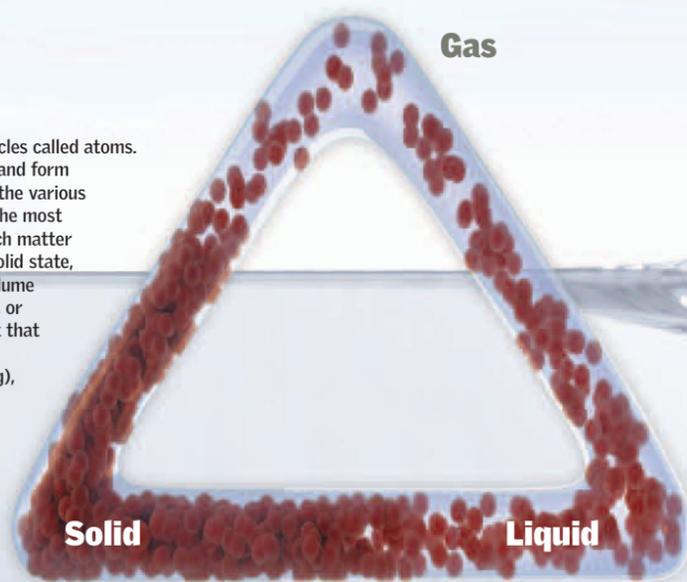


Matter

The dictionary says that matter is everything that takes up space. In other words, whatever makes up a substance in the physical universe—the Earth, the seas, the Sun, the stars—is matter. Everything that humans see, touch, or feel is matter. Matter can be hard as steel, adaptable as water, and shapeless as the oxygen in the air. The study of matter has permitted the fabrication of tools, construction of cities, and even flights into space. Regardless of what is currently known about it, the more scientists look into matter, the more complexity they find. For example, it is now known that not even the hardest diamond is really solid, because the atom—the heart of matter—is almost all empty space. ●

What Is Matter Made of?

Matter is made of small particles called atoms. The atoms group themselves and form molecules, which are arranged into the various forms of matter. In our daily lives, the most commonly recognized states in which matter exists are solid, liquid, and gas. In solid state, bodies have an almost invariable volume because their particles (atoms, ions, or molecules) are in such close contact that they can get no closer. When the temperature is high enough (melting), particles lose their fixed positions and, although they are still very close, the crystalline structures exclusive to solids disappear in changing to the liquid state. Above the boiling point, the particles lose contact with each other and move freely (gaseous state).



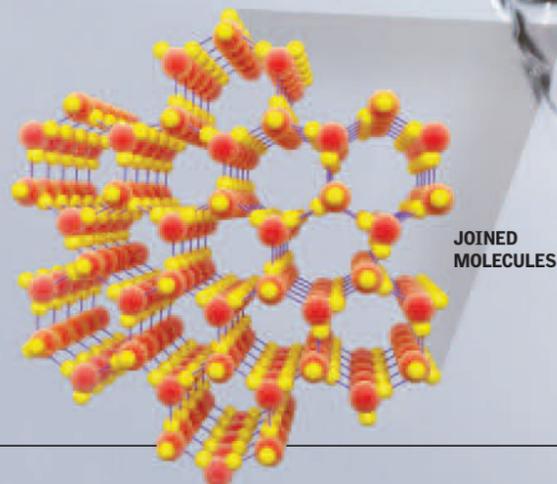
From the Solid State to the Gaseous

Ice and steam are the same substance as liquid water. The difference lies in the strength with which their molecules attract each other and the way in which they group themselves. Water molecules

have the same shape and the same atoms in the three states. Water can change directly from ice to a gaseous state, but the process, called sublimation, occurs slowly at normal air pressure.

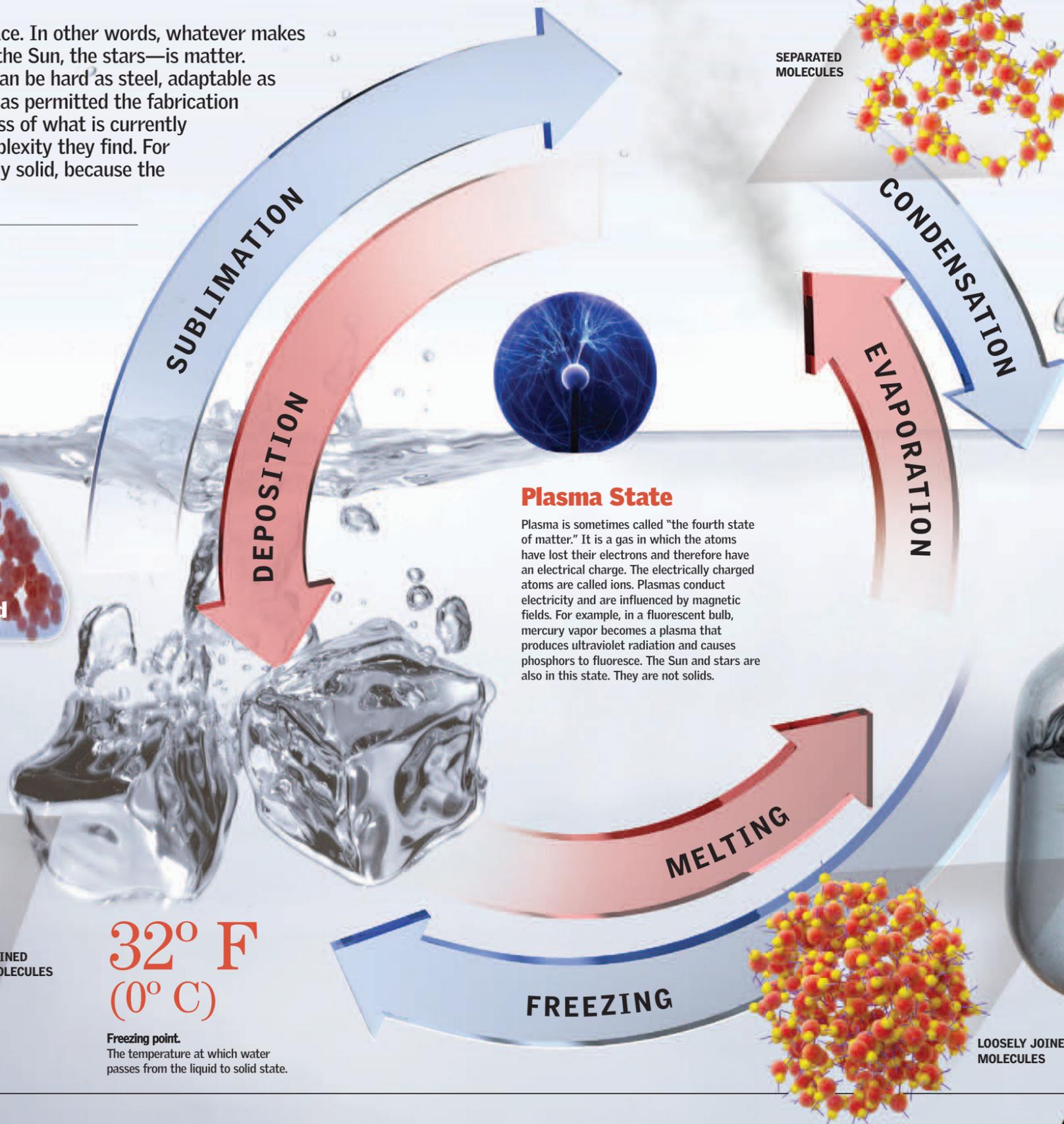
A Solid State

As a general rule, in solids the particles (atoms or molecules) are closer together than liquids. That is why the density of a solid substance is greater than in the liquid state. However, water is an exception. In other words, when water freezes, it expands and becomes lighter. Ice floats on water because of this process. When the temperature of a piece of ice increases, the molecules increase their vibration and their separation.



32° F
(0° C)

Freezing point. The temperature at which water passes from the liquid to solid state.



Plasma State

Plasma is sometimes called "the fourth state of matter." It is a gas in which the atoms have lost their electrons and therefore have an electrical charge. The electrically charged atoms are called ions. Plasmas conduct electricity and are influenced by magnetic fields. For example, in a fluorescent bulb, mercury vapor becomes a plasma that produces ultraviolet radiation and causes phosphors to fluoresce. The Sun and stars are also in this state. They are not solids.

C Gaseous State

At various temperatures, molecules escape the surface of liquid water to form gas or steam. The change from gas to liquid state is called condensation, and the change from liquid to solid state is called solidification, or freezing. In other instances, there can be a direct change from solid to gas (sublimation) and from gas to solid (condensation).

B Liquid State

As in all liquids, water molecules tend to form groups. They can move over one another, allowing water to flow with ease. The variable form of liquids (which adjust to the containers that house them) results from the fact that, above the melting point, liquid particles do not stay in the fixed positions of a solid and instead move in a disordered fashion.

212° F
(100° C)

Boiling point. The temperature at which water turns into vapor.

