

## 9.2: Property of Gases

Why does the average person often overlook the presence of gases? Probably because the properties of gases are so unobtrusive. All gases are transparent, and most are colorless. The major exceptions to the second half of this rule are fluorine,  $F_2$ , and chlorine,  $Cl_2$ , which are pale yellow-green; bromine,  $Br_2$ , and nitrogen dioxide,  $NO_2$ , which are reddish brown; and iodine,  $I_2$ , which is violet.

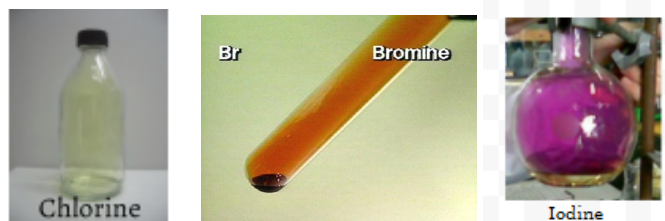


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Another important property of all gases is their mobility. Every gas will disperse to fill all space, unless prevented from doing so by a solid or liquid barrier or a force. (The force of earth's gravity, for example, prevents air from escaping our planet.)

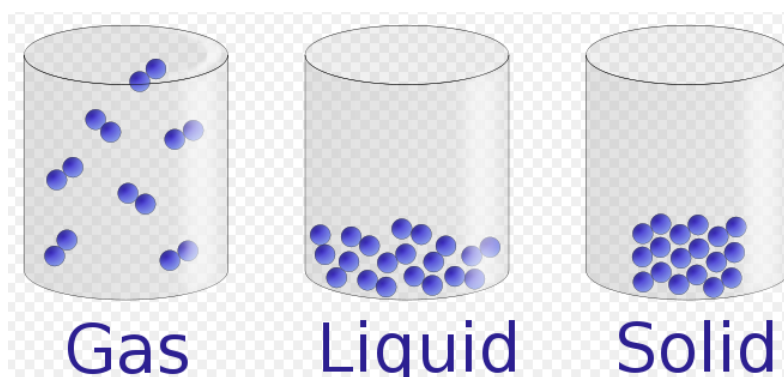


Figure 9.2.1 Unlike solids and liquids, which have a definite shape, gases expand to fill the shape of their container, as can be seen from the image above.

Illustration of the three different states of matter with circles in a beaker. The beaker labeled Gas has circles spread far apart occupying the entire beaker. The next beaker labeled liquid has circles that are still in a random order but are significantly closer to each other at the bottom of the beaker. The last beaker labeled Solid has an ordered arrangement of the circles tightly packed together.

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Moreover, gases are capable of escaping through small holes (**pores**) in barriers such as plaster of paris or a balloon, even though the human eye sees such materials as continuous and impenetrable. The mobility of gases is also demonstrated by the minimal resistance they present to objects moving through them. You can wave your hand through air much more easily than you can through any liquid.

A third general characteristic of gases is their wide variation in density under various conditions. Densities of solids and liquids change by only a few percent when temperature or pressure is doubled or halved. Similar changes in the conditions of a gas can alter its density by a factor of 2. This occurs because the volume of any gas increases greatly with an increase in temperature or with a reduction in pressure.

This third characteristic is related to gases abilities to compress and expand. The variable density of gases is made possible by their ability to change volume. This property of gases makes them very versatile, allowing gases to be compressed for storage or heated and expanded to drive a piston (as in an engine).

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