

The International Standard for Education and Care

The agglomeration of humans into settlements at the dawn of society precipitated a need to keep records of individuals, resources, and possessions. Writing was thus born, first as impressions in clay tablets, then as expressions on paper with ink. Some say that the externalization of knowledge has shrunk the human brain, but this is silly, since evolutionary pressures, without human intervention, work over longer timespans than human history. There are a great many substances, natural and artificial, that can create lasting marks on a surface. Soot was the first, and indeed blacks are among the most simple pigments to create, but various mineral and chemical formulations have been used to cover the majority of colors perceptible to the human eye.

The first synthetic blue pigment was Egyptian Blue, which gets its hue from copper. This was used through nearly the entire history of Ancient Egypt, up until Roman times, after which it was largely forgotten. Other blue dyes were synthesized from indigo (in the case of the Mayans) and aluminosilicates (in the case of Ultramarine, which is ground-up Lapis Lazuli and thus extremely expensive). In modern times, blue is often synthesized using cobalt-derived pigments (especially in glass) and iron pigments such as Prussian Blue. Lead tin or verdigris was first synthesized from copper pigments, as oxidized copper is already green. The Romans created verdigris by soaking copper plates in wine, creating a cheap pigment that is not particularly stable and easily darkens. It is also mildly poisonous, though not as much as arsenic green. While it was far more vibrant than any pigment that came before, it also famously poisoned Napoleon, whose room while imprisoned had green wallpaper. A safer and more stable ink is phthalo green, a greenish-blue hue that

contains copper and chlorine. Even more diverse in composition are red pigments. Many are composed of iron oxides, because rust is red, and indeed evidence of iron ochre pigments dates back to the very earliest cave art. Vermilion is a more vibrant pigment made by grinding cinnabar, or mercury sulfide. It is somewhat toxic and not particularly stable but was historically extremely popular due to its wide availability. Cadmium red is a similar hue and is more stable but is also highly toxic. Their resistance to breaking down at high temperatures has given them use in the coloring of plastics. Yet another historically toxic pigment is orpiment, which yields a golden-yellow. Like cinnabar, it is found near volcanic vents and is thus relatively common. It was particularly popular in the east but saw little use in Europe. Ochre can also come in yellow forms, and was thus used by the ancient Egyptians. One of the earliest synthetic yellow pigments to be invented was lead-tin yellow, famous for being the yellow of choice of many great European painters. Gradually, it was supplanted by chrome yellow, cadmium sulfide, and

cobalt yellow. Comparatively few white pigments have been used throughout history. Lead white was the dominant pigment in Europe until the 19th century, and it was prepared by soaking lead in vinegar, similar to verdigris. Despite these positive qualities, it is extremely toxic and has been recently supplanted by titanium white, which is primarily composed of titanium dioxide. It is non-toxic and is more opaque, stable, and durable than lead white, particularly when mixed with zinc white.

The history of the fountain pen is more brief. In the 9th century, an Egyptian caliph demanded a pen that would not stain his clothes, and commissioned a pen with its ink reservoir attached. Much later on, Leonardo da Vinci likely created a working fountain pen, which he used to write his journals. Fountain pens are delicate things, so they were difficult to manufacture and did not catch on at the time, with feather-and-ink being the dominant mode of writing at the time. The biggest difficulty was in getting the pen to emit ink, but in limited quantities that meant that it would not do so unless it was actually in use. Early fountain pens, which were hollow quills with a corked reservoir attached, did not solve this problem. Ink, too, was an issue because those that were available were not smooth and were also highly corrosive. In the early 19th century, the nib feed was invented, which solved the first problem. Feeds are conduits between the ink reservoir and the nib that contain numerous small channels. Ink travels through the feed by capillary action rather than through gravity. Fins were added as a way to further moderate ink flow. The nib, too, has greatly developed. Nibs are now made of metal, almost always either steel (cheap) or gold (expensive). Nibs were first mass-produced in the early 19th century, an innovation which finally brought writing to the masses. Initially, most of these nibs were for dip pens, but fountain pens made up a significant portion of the pen trade in the 20th century up until the invention of the ballpoint pen. Since then, little has changed, although pen nibs are now firmer in order to stay durable (as people are now used to ballpoint pens, which require you to press on the page with a level of force that would damage a flexible nib). Flexible nibs, however, are more comfortable to write with and the most flexible ones can be used to create calligraphy. The last important aspect of the fountain pen is its filling system. Historically, there has been huge diversity in how fountain pens have been filled. The simplest are eyedroppers, which are just empty barrels that can be filled entirely with ink via eyedropper. However, this is inconvenient because it requires one to carry around a part that is external to the pen itself, in addition to the ink. It also has the potential to get extremely messy. More advanced are squeeze-filters, in which the reservoir inside the barrel is made of some flexible material that can squeeze out air and suck in ink. These are highly convenient and intuitive, but are less durable and also tend to waste a lot of space. It is not possible to squeeze all the air out of a rubber sac, so the capacity of a pen using such a mechanism is reduced. Nowadays, the most common filling mechanism used with bottled ink is the piston filler, invented in the 1920s. Pens using this mechanism have a knob at the end that, when twisted, pulls a piston in the barrel. The piston will create a vacuum that causes the pen to suck ink through the nib. This is relatively durable and holds a large amount of ink. Cartridges, invented in the 1950s, are the most common filling system because they are the most convenient. Initially made of glass, they are now single-use plastic containers pre-filled with ink. Cartridge pens can also take bottled ink via the converter, which is a mini piston-filling reservoir with the same shape. This makes cartridge fillers the best of both worlds—the only disadvantage is that they have only a small capacity.

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The image consists of a vertical column of repeating abstract symbols. Each symbol is a combination of a red 'r' shape and a blue 'z' shape, oriented vertically. These symbols are arranged in a staggered grid pattern. At the bottom of the image, the word "reservoirs" is printed in a bold, white, sans-serif font.