

## 2: The Greek Alphabet

Ancient Greek is the language spoken in the region around modern Greece, from time of the poet Homer (8th century BC) through the time of classical Greece ( 4 th and 5th centuries BC). Its alphabet consists of 24 letters, as shown in Table 2-1.

This is not a course in ancient Greek, so we will not have the opportunity to study the language in detail. However, the letters of the Greek alphabet are very common in physics, mathematics, and engineering, because we need symbols to stand for different quantities, and the 26 letters of the Roman/English alphabet are often not enough.<sup>1</sup>

Table 2-1 shows the 24 letters of the Greek alphabet. In order to be mathematically and scientifically literate, and so that you can communicate with others who study mathematics and physical science, you should know the proper names of these Greek letters. Therefore you should memorize the entire Greek alphabet, so that you can provide the correct name of each letter when you see it.

<sup>2</sup> The table shows both uppercase and lowercase forms are shown in the table.

Note that several letters have alternate forms. Especially common are the two forms for epsilon (  $\epsilon$  and  $\varepsilon$  ) and for *phi* ( $\phi$  and  $\varphi$ ).

Note also that there are two different forms of the Greek lowercase letter sigma. The second form (  $\varsigma$  ) is used when sigma is the last letter of a word; otherwise the form  $\sigma$  is used.<sup>3</sup> This variation affects only lowercase sigma, not its uppercase counterpart, which is always written as  $\Sigma$ . Although common in ancient Greek writing, the  $\varsigma$  form of the letter sigma is almost never used in mathematics, physics, or engineering.

Originally the Greeks wrote using only capital letters. There was no punctuation, nor were there even spaces between words. Lowercase letters, spacing, and punctuation were later additions to the language, and are used today when printing and reading ancient Greek texts.<sup>4</sup> Unlike in English, the first letter of a Greek sentence is generally not capitalized; only proper names begin with a capital letter.

Before the time of Homer, during the Greek Dark Ages (1200-800 BC), the Greek language was written using a completely different writing system-a syllabary called Linear B, which was not deciphered until the 1950s. [3, 7]

Table 2.1. The Greek alphabet.

Letter	Name	
Aα	alpha	a as in father
Bβ	beta	b as in boy
Γγ	gamma	always hard g, as in girl
Δδ	delta	d as in dent
Eε	epsilon	e as in g e t
Zζ	zeta	d z as in adze
Hη	eta	a y as in hay
Θθ	theta	unvoiced t h as in thorn
Iι	iota	i as in pin ( unstressed) or machine (stressed)
Kκ	kappa	k as in kill
Λλ	lambda	l as in lamb
Mμ	mu	m as in money
Nν	nu	n as in nest
Ξξ	xi	x or k s, as in box
Oο	omicron	o as in got
Ππ	pi	p as in pie
Pρ	rho	r trilled or flipped as in Spanish pero

Letter	Name	
$\Sigma\sigma\varsigma$	sigma	s as in song
$T\tau$	tau	t as in tank
$\Upsilon\upsilon$	upsilon	u as in tube
$\Phi\phi$	phi	f or ph as in phase
$X\chi$	chi	as in Scottish loch; or like English k
$\Psi\psi$	psi	p s as in o o p s
$\Omega\omega$	omega	o as in poke

(Alternate forms:  $b = \beta$ ,  $\epsilon = \varepsilon$ ,  $\vartheta = \theta$ ,  $\kappa = \kappa$ ,  $\varpi = \pi$ ,  $\varrho = \rho$ ,  $\varsigma = \sigma$ ,  $\phi = \varphi$  .)

<sup>1</sup> Rarely, authors will sometimes even dip into the Hebrew alphabet when even the Roman and Greek alphabets together don't provide enough symbols.

<sup>2</sup> By tradition, in science and mathematics we call Greek letters by their ancient Greek names. Their names in modern Greek are similar, but often different.

<sup>3</sup> English had a similar feature until fairly recently. Until the 19th century, the letter *s* was written as a "long s" symbol ( *f* ) when it was the last letter of a word. You'll see this usage in some older documents like the Declaration of Independence.

<sup>4</sup> These statements are also true of ancient Latin: originally there were no spaces, punctuation, or lowercase letters.

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