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The Gaussian free field on a bounded domain $K \subset \mathbb{R}^d$ is, roughly speaking, a standard Gaussian random variable on the Sobolev space $H^1(K)$, or a d -time-dimensional Brownian motion. Such objects, which form the building blocks of scalar quantum field theory, are well studied on Euclidean domains. In this paper we undertake the first systematic investigation of Gaussian free fields on fractals. We explicitly construct the massless and massive free fields on several representative fractals, such as the Sierpinski gasket and the Sierpinski carpet, and discuss their properties in detail. (Received December 12, 2011)