Abstract: We study the heat kernels of the sub-Laplacian on both the CR sphere $\mathbb{S}^{2n+1}$ and the CR hyperbolic space $\mathbb{H}^{2n+1}$. We work in cylindrical coordinates that reflect the symmetries coming from the fibration $\mathbb{S}^{2n+1} \to \mathbb{C}P^n$ and $\mathbb{H}^{2n+1} \to \mathbb{C}H^n$, and derive explicit and geometrically meaningful formulas for the subelliptic heat kernels. As by-products we obtain the small-time asymptotics of the heat kernels, and also get explicit formulas for the sub-Riemannian distance.