Graphene, a single layer of $sp^2$-bonded carbon atoms arranged in a honeycomb lattice, is quickly becoming an ideal next generation material for electrical components. With industry pushing silicon to its physical limits, the properties of graphene are becoming more attractive to engineers and scientists alike. With photon-like, massless electronic band dispersions, graphene boasts of a high electron mobility (100 times that of silicon at room temperature), the ability to switch between insulating and conducting states, and a strong likelihood of bridging the terahertz technology gap. Furthermore, the small spin-orbit coupling of carbon atoms makes graphene an ideal candidate material for constructing spintronic devices. However, relatively little is known spin properties of graphene, compared to graphite. Here, we explore the spin properties of graphene via electron spin resonance (ESR) experiments. In an ESR experiment, the sample of interest is subjected to a DC magnetic field of strength $B_0$ and an AC (or microwave) magnetic field of frequency $\nu$. The sample absorbs the microwave field resonantly when $h\nu = g\mu_B B_0$ is satisfied, where $h$ is the reduced Planck constant, $\mu_B$ is the Bohr magneton, and $g$ is the Lande $g$-factor of the material. This equation physically means that the spin splitting (i.e., the Zeeman energy) of electrons is equal to the microwave photon energy. In practical experimentation, the strength of the DC magnetic field $B_0$ is scanned while microwave absorption is recorded. ESR thus appears as an absorption peak as a function of magnetic field. The resonance magnetic field as well as the microwave frequency $\nu$ ($\sim 9.14$ GHz in our case) allow us to determine the $g$-factor using the above equation. We have already observed ESR in graphite using our current setup and are currently attempting to observe ESR in a graphene sample exfoliated from graphite. Once ESR in graphene is observed, we will systematically compare its $g$-factor with that of graphite as a function of temperature and magnetic field orientation to further elucidate its fundamental spin properties. If the sensitivity of this standard ESR method turns out to be not high enough to detect ESR in a single flake of graphene, we will attempt to use a novel resistive technique for ESR detection.