The thesis begins with proving some theorems about Gauss sums and Jacobi sums. Using theorems the first chapter ends with a proof that if $p$ is a prime such that $p$ is congruent to one modulo four, then $p$ can be represented as the sum of two integers squared. In the second chapter some useful results concerning the Dedekind zeta function are proven. Among these results are that the Dedekind zeta function is meromorphic with a simple pole at $s=1$. The third chapter has a new result concerning Carmichael numbers. We show that there are infinitely many Carmichael numbers composed solely of primes from the non-homogeneous Beatty sequence. In the fourth chapter we show that for any finite Galois extension $K$ of the rational numbers, there are infinitely many Carmichael numbers composed solely of primes for which the associated class of Frobenius automorphisms coincides with any given conjugacy class of the Galois group of $K$ over the rationals. The result has three corollaries: for any algebraic number field $K$, there are infinitely many Carmichael numbers which are composed solely of primes that split completely in $K$; for every natural number $n$, there are infinitely many Carmichael numbers of the form $a^2 + nb^2$ where $a$ and $b$ are integers; and there are infinitely many Carmichael numbers composed solely of primes $p$ congruent to a modulo $d$ with $a$, $d$ coprime. Finally, in chapter five we prove a new result regarding Piatetski-Shapiro primes in relation to almost primes. We show that for any fixed $c$ from 1 to $77/76$ there are infinitely many primes from the Piatetski-Shapiro sequence that come from a natural number with at most eight prime factors (counted with multiplicity).