6. Since $gcd(a_i, n) = 1$ for any i, and $gcd(a, n) = 1$, it is obvious that $gcd(aa_i, n) = 1$ for any i.

We next prove that aa_i is not $\equiv aa_j \mod (n)$ if $i \neq j$. If not, $aa_i \equiv aa_j \mod (n)$, and $n|a(a_i - a_j)$. However, since $gcd(a, n) = 1$, this implies that $n|(a_i - a_j)$ or in other words $a_i \equiv a_j \mod (n)$, which is a contradiction.

This implies that if $a_1, a_2, \cdots a_{\phi(n)}$ is a reduced residue modulo n, so is $aa_1, aa_2, \cdots aa_{\phi(n)}$. This concludes the proof.