Let $n$ be a positive integer. Compute the number of words $w$ (finite sequences of letters) that satisfy all the following three properties:

(1) $w$ consists of $n$ letters, all of them are from the alphabet $\{a, b, c, d\}$;

(2) $w$ contains an even number of letters a;

(3) $w$ contains an even number of letters b.

(For example, for $n = 2$ there are 6 such words: aa, bb, cc, dd, cd and dc.)