To show that $a^k \equiv b^k \pmod{n}$ for any positive integer k when $a \equiv b \pmod{n}$, we will use mathematical induction.

Base Case:

When k = 1, $a^1 = a \equiv b = b^1 \pmod{n}$. So the statement is true for k = 1.

Induction Hypothesis:

Assume that $a^k \equiv b^k \pmod{n}$ for some positive integer k.

Induction Step:

We need to show that $a^{(k+1)} \equiv b^{(k+1)} \pmod{n}$. We can use the fact that $a \equiv b \pmod{n}$ to write $a = b + kn$, where k is some integer. Then,

$a^{(k+1)} = a^k * a$
$= (b + kn)^k * (b + kn)$ [Substituting $a = b + kn$]

$= b^k * (b + kn) + kn * (b + kn)^k$

Similarly,
$b^{(k+1)} = b^k * b$

$= b^k * (b + kn) - kn * (b + kn)^k$

Subtracting these two equations, we get:

$a^{(k+1)} - b^{(k+1)} = kn(b + kn)^k - kn(b + kn)^k$

$= kn[(b + kn)^k - (b + kn)^k]$

Since $(b + kn)^k - (b + kn)^k = 0$, we can conclude that $a^{(k+1)} - b^{(k+1)}$ is divisible by n, which means that $a^{(k+1)} \equiv b^{(k+1)} \pmod{n}$.

Therefore, by the principle of mathematical induction, we have shown that for any positive integer k, if $a \equiv b \pmod{n}$, then $a^k \equiv b^k \pmod{n}$.