[What is claimed is]

1. A surface-treated steel sheet comprising:

a steel sheet;

a zinc-based plated layer formed on a surface of the steel sheet; and

a chemical conversion treatment layer formed on a surface of the zinc-based plated layer,

wherein the chemical conversion treatment layer contains Si, C, O and P,

the chemical conversion treatment layer has a C concentration of 20.0 mass% or more, an O concentration of 15.0 mass% or more, a Si concentration of 10.0 mass% or more, and a P concentration of 0.10 mass% or more,

when t is a thickness of the chemical conversion treatment layer, an area starting from a surface of the chemical conversion treatment layer and ending at a position of t/10 from the surface of the chemical conversion treatment layer in a thickness direction is a surface layer region, an area starting from the position of 9t/10 from the surface of the chemical conversion treatment layer in the thickness direction and ending at an interface between the chemical conversion treatment layer and the zinc-based plated layer is an interface side region, and a region sandwiched between the surface layer region and the interface side region is an intermediate region,

a maximum value of a P concentration of the surface layer region is 1.5 times to 5.0 times an average P concentration of an intermediate region, and

Sb is present in the interface side region.

2. The surface-treated steel sheet according to claim 1, wherein Al is present in the interface side region, and

an F content of the interface side region is 20% or more of an F content of the entire chemical conversion treatment layer.

3. The surface-treated steel sheet according to claim 1 or 2, wherein

a surface of the zinc-based plated layer is regular spangle-finished.