1. Two parameters can be obtained in a Tafel equation: exchange current and Tafel slope. Exchange current is a measure of “intrinsic activity” whereas Tafel slope describes how the current varies with the application of overpotentials. A catalyst has been improved by increasing the number of its active sites. Explain how this improvement affects the exchange current and Tafel slopes.

Many new hydrogen evolution catalysts in acidic solutions based on MoS_2, Mo_2C and Ni_2P have been developed in recent years. Similar to metal sulfides, metal phosphides (MP_x) have been reported as active hydrogen evolution catalysts. (a) Based on the discussion in the course about the descriptor for HER, propose a reason why metal phosphides would be a good HER catalyst. (b) Propose two strategies to develop highly active samples of metal phosphides.