In this work, heterojunctions of Cu2S/p-Si were prepared by high vacuum thermal evaporation technique and examined as a photodetector structure. The dark current\_voltage (I\_V ) characteristics of the heterojunctions measured at di\_erent temperatures ranging from 303 to 373 K were investigated. The predominant conduction mechanisms, series resistance, ideality factor and potential barrier height were determined. The downward curvature at su\_ciently large voltages in the I\_V characteristics is caused by the e\_ect of series resistance Rs. The ideality factor obtained from I\_V characteristics is larger than unity which can be attributed to the presence of a thin interfacial insulator layer between the metal and semiconductor. The photocurrent properties of the device under reverse bias using various illuminations were also explored for checking the validity of photodetector application of the studied device. The responsivity of light for the device under reverse bias con\_rms that the Cu2S/p-Si heterojunctions are valid for photodetector application. Moreover, these results suggest that the fabricated diode

can be used for optical sensor applications. The capacitance\_voltage characteristics of diode were also investigated at high frequency of 1 MHz.