微电子器件物理　第六周作业

范云潜 18373486

微电子学院 184111 班

日期：2020 年 10 月 18 日

Problem 单项选择

(1) a (2) e (3) b (4) c (5) d

Problem 2

SubProblem 1a

$n_i \exp((E_i - E_F)/kT) = N_A$

$\therefore E_i - E_F = \dfrac{kT}{1} \ln(N_A/n_i) = 0.025851 \cdot \ln 10^7 = 6.6750e-20J$

$\Phi_F = \dfrac{E_i - E_F}{q} = 0.41667V$

SubProblem b,c,d,e

这是 pMOS，分别对应耗尽、积累、平带与耗尽反型转换，如 **图 1**

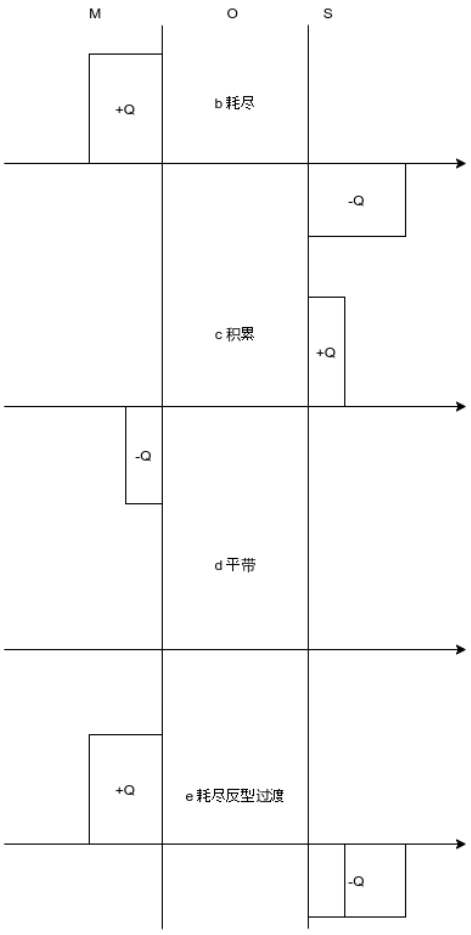

图 1: 1 题图解

Problem 2

SubProblem 2a

$\Phi_F = \dfrac{kT}{q} \ln(N_A/n_i) = 0.47619V$

SubProblem 2b

$W = \sqrt{2\kappa_s \epsilon_0 \Phi_S / qN_A} = \sqrt{2 \cdot 11.8 \cdot 8.85e-14 \cdot 2\Phi_F / qN_A} = 0.0000035237cm = 0.035237\mu m$

SubProblem 2c

$E_S = \frac{qN_A W}{\kappa_s \epsilon_0} = 5.41e5V/cm$

SubProblem 2d

$V_T = V_G = \Phi_F + \frac{\kappa_S}{\kappa_O} x_0 E_S = 0.47619 + 11.8/3.9 \cdot (5.41e5 \cdot 2e-7) = 0.80356V$

Problem 3

SubProblem 3a

$\Phi_S = E(0) * x/2 = 0.240185V$

$N_D = E_S^2 K_S \epsilon_0 / (2q\Phi_S) = 1.987e17/cm^3$