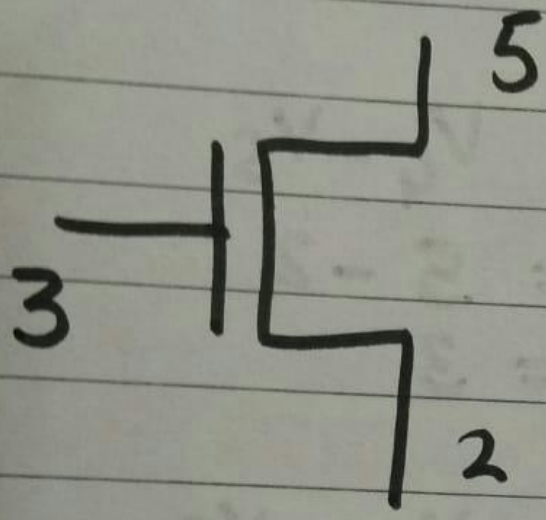
$V_{th} = 1V$

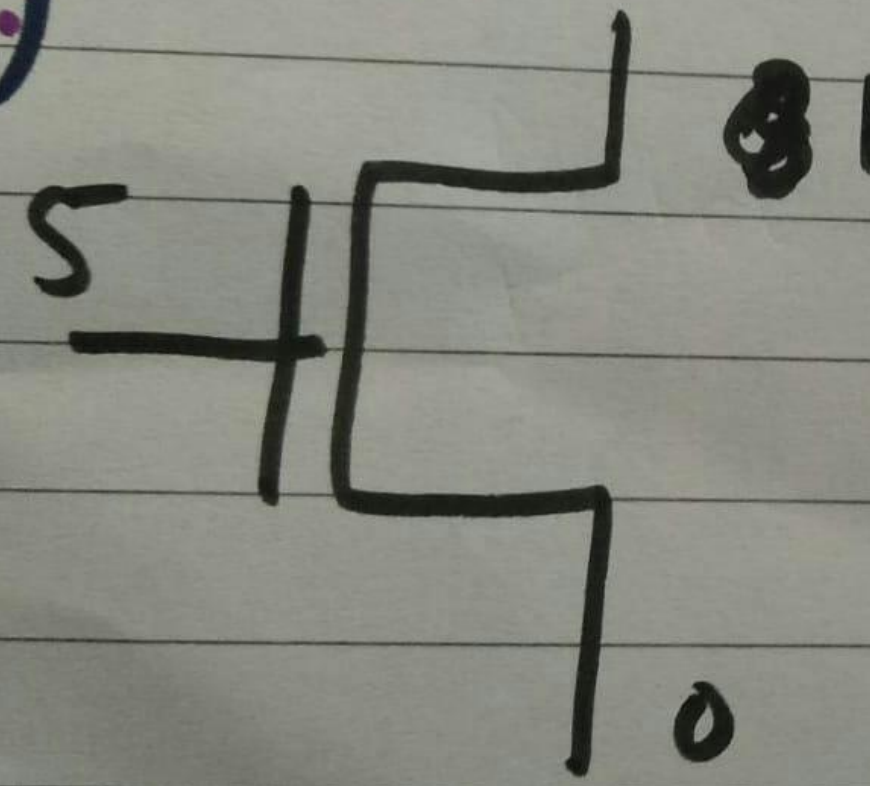
(1)

(2)

(3)



4.



$V_{th} = 0.4V$

$I_{D_{sat}} = 2.25\mu A$

$V_{GS} = 0.5V$

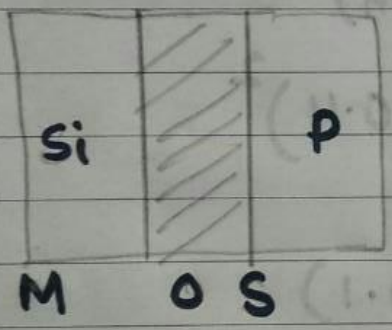
Find I_D if $V_{GS} = 0.7V$ and MOSFET still operates in saturation region.

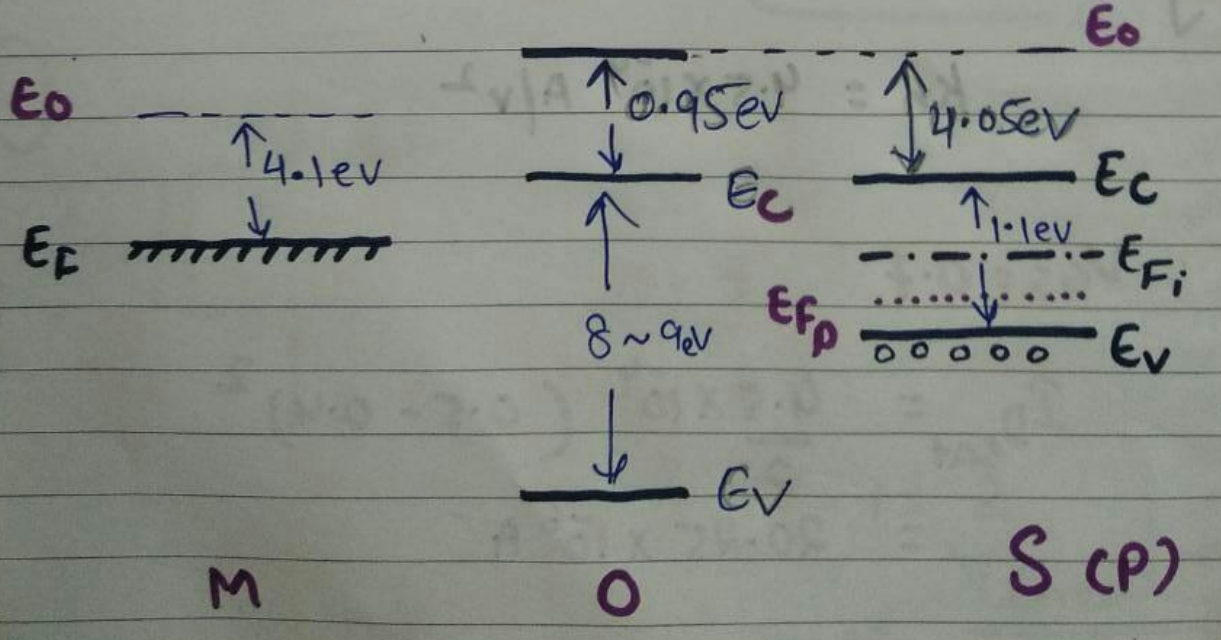
Threshold Voltage (V_{th}) or (V_t)

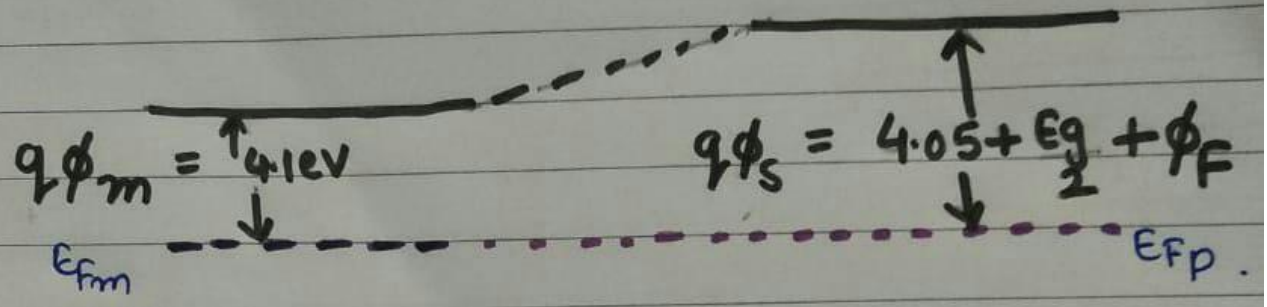
- inversion layer
- Channel formed

} V_{GS}

$$V_t = \phi_{ms} - 2\phi_F - \frac{Q_{b0}}{C_{ox}} - \frac{Q_{ox}}{C_{ox}}$$







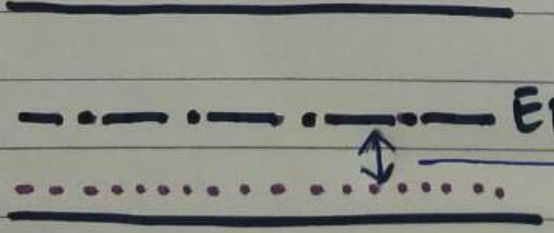
(i) $\phi_{ms} = 4.1 - q\phi_s = V_{FB}$ —(i)

$4.05 + \frac{1.1}{2} + \phi_F$

(ii) $\phi_{F_p} = \frac{kT}{q} \ln\left(\frac{n_i}{N_A}\right)$ —(ii)

$\phi_F = \frac{kT}{q} \ln\left(\frac{n_i}{N_A}\right)$

4.75



(iii) $\frac{Q_{BO}}{C_{ox}}$

(iv) $\frac{Q_{ox}}{C_{ox}}$

$$V_{th} = -|\phi_{ms}| |2\phi_F| + \left|\frac{Q_{BO}}{C_{ox}}\right| - \left|\frac{Q_{ox}}{C_{ox}}\right|$$

— (A).