EE 330
Section 5
Homework 4

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This is just algebra busy work.
There is little learning being done here.

1) Area of wafer $= \pi(300/2)^2 = 70685.8mm^2$
Chips/Wafer: $70685.8/50 = 1413\ chips$
Hours/Year: $365\ days/yr * 24\ hrs/day = 8760hrs$

248 nm Machine:
Wafers/Year: $80\ wafers/hr * 8760\ hr/yr = 700,800\ wafers/yr$

Cost/Wafer: $\$10M/700,800 = \$14.27$

Cost/Chip: $\$14.27/1413 = \$0.01$

193 nm Machine:
Wafers/Year: $20\ wafers/hr * 8760\ hr/yr = 175,200\ wafers/yr$

Cost/Wafer: $\$40M/175,200 = \$228.31$

Cost/Chip: $\$228.31/1413 = \$0.162$

Difference $= \$0.162 - \$0.01 = \$0.152$

2) Dielectrics: $SiO_2 = 3.9, HfO_2 = 25$. Thickness must be proportional to dielectric, therefore $t_{HfO_2} = 25/3.9 * 2 = 12.82nm$

3) Vol $SiO_2 = .044nm^3$ $25A \rightarrow 2.5nm$
$7nm * 14nm * 2.5nm = 245nm^3 = 5568\ molecules$

4) Resistivity of Aluminum $= 2.8 * 10^{-8}\Omega m$

5) Silver. Expensive with high electron migration potential.

6) 300mm wafer thickness = 775 +/- 25um, + 150um for saw = 925um
$2m/(925 + / - 25um) = 2105 \rightarrow 2222\ wafers$

7)