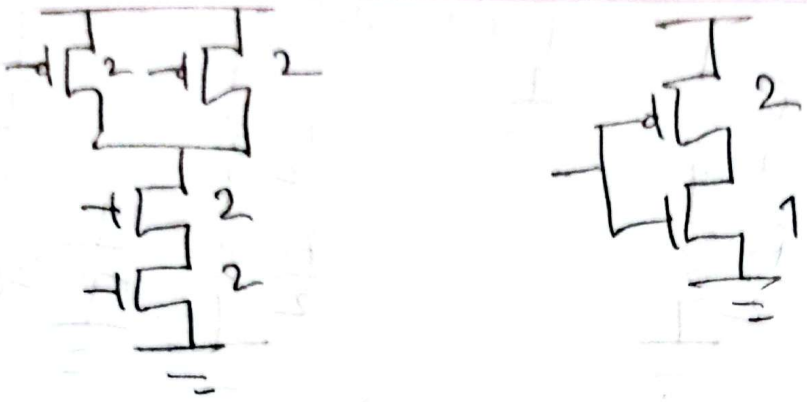
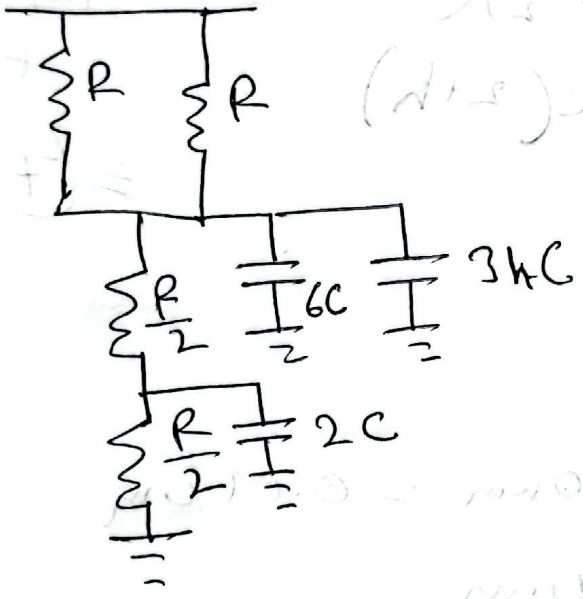
Set A

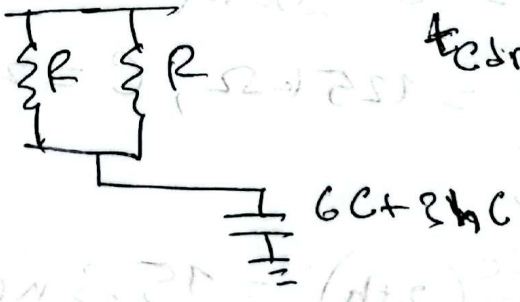
(a)



(b)

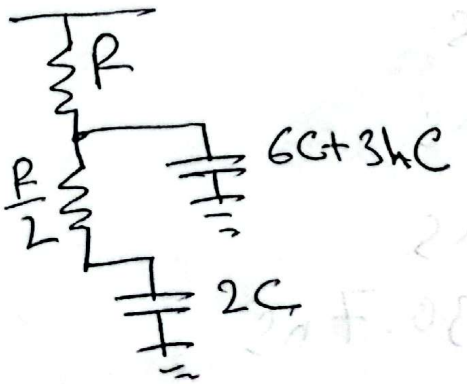


(c) Rise time :



$$t_{cdr} = \frac{R}{2} \times (6C + 3kC)$$

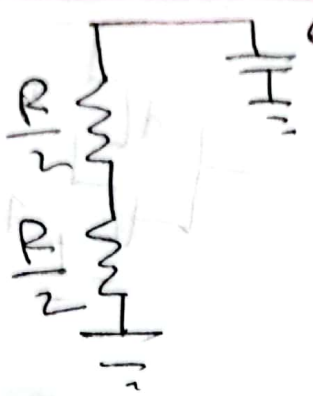
$$= \frac{3RC}{2}(2+k)$$



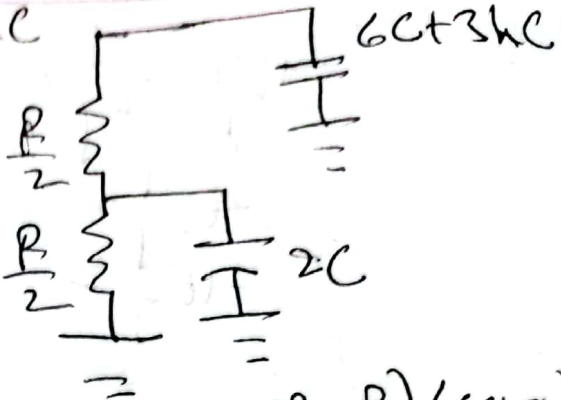
$$t_{pdr} = R(6C + 3kC) + R \times 2C$$

$$= (8+3k)RC$$

Fall time:



$$t_{cdf} = \left(\frac{R}{2}+\frac{R}{2}\right)(6C+3hC)$$
$$= 3RC(2+h)$$



$$t_{pdf} = \left(\frac{R}{2}+\frac{R}{2}\right)(6C+3hC) + \frac{R}{2}\times 2C$$
$$= (7+3h)RC$$

(d) $\lambda = 10\,nm = 0.01\,\mu m$

$W = 4\lambda = 0.04\,\mu m$

$R = \frac{5}{0.04} = 125\,k\Omega$, $C = 20\times 0.04 = 0.8\,fF$

$h = 100$

$t_{cdr} = \frac{3RC}{2}(2+h) = 15.3\,ns$

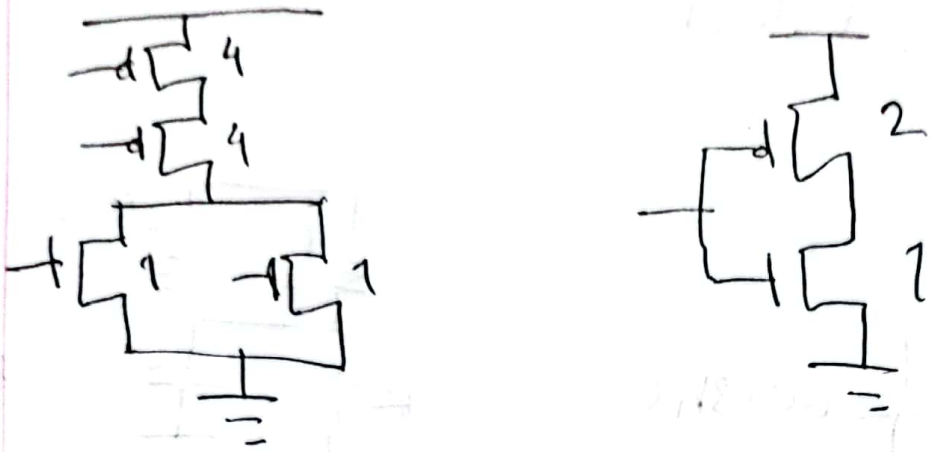
$t_{pdr} = (8+3h)RC = 30.8\,ns$

$t_{cdf} = 3RC(2+h) = 30.6\,ns$

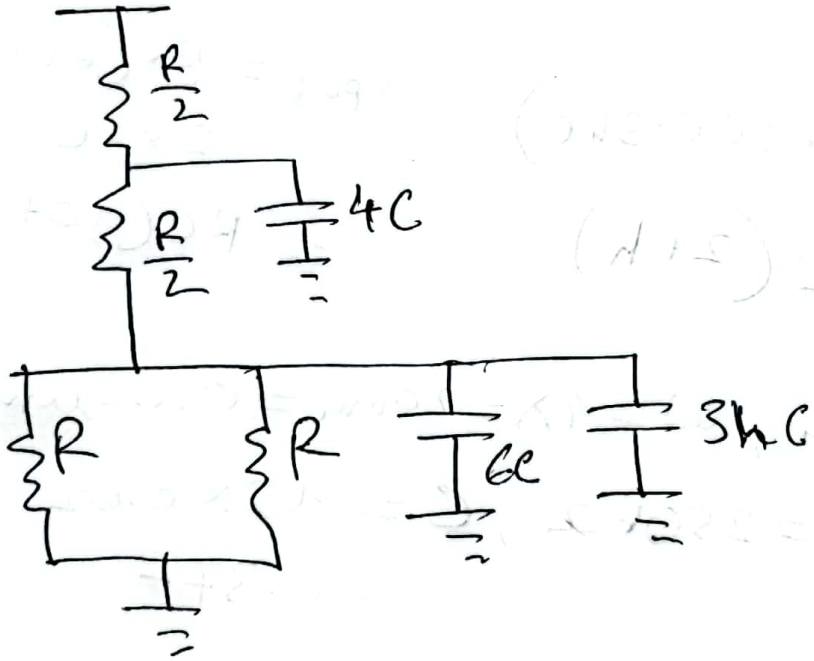
$t_{pdf} = (7+3h)RC = 30.7\,ns$

Set B

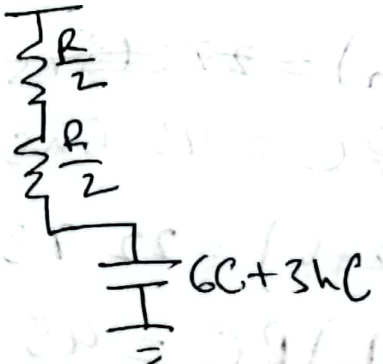
(a)

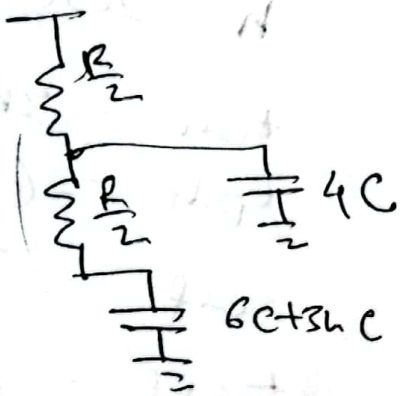


(b)



(c) Rise time :





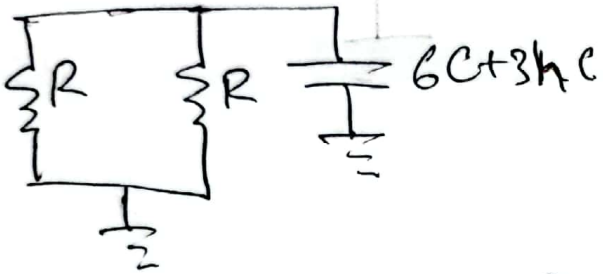
$t_{cdr} = \left(\frac{R}{2} + \frac{R}{2}\right)(6C + 3hC)$

$= 3RC(2+h)$

$t_{pdr} = \left(\frac{R}{2} + \frac{R}{2}\right)(6C+3hC) + \frac{R}{2} \times 4C$

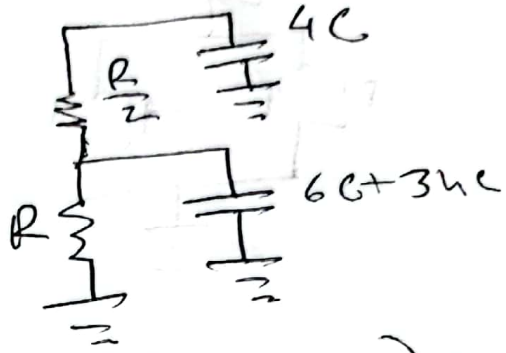
$t_{pdr} = (8+3h)RC$

Fall time :



$t_{cdf} = \frac{R}{2} \times (6C+3hC)$

$= \frac{3RC}{2}(2+h)$



$t_{pdf} = R \times (6C+3hC) + R \times 4C$

$= RC(10+3h)$

(d) $\lambda = 5nm$, $W = 4\lambda = 20nm = 0.02\mu m$

$R = \frac{10}{0.02} = 250k\Omega$, $C = 15 \times 0.02$

$= 0.3fF$

$h = 200$

$t_{cdr} = 3RC(2+h) =$ ~~22.95ns~~ 45.5 ns

$t_{pdr} = (8+3h)RC = 45.6ns$

$t_{cdf} = \frac{3RC}{2}(2+h) = 22.73$ ns

$t_{pdf} = (10+3h)RC = 45.75$ ns