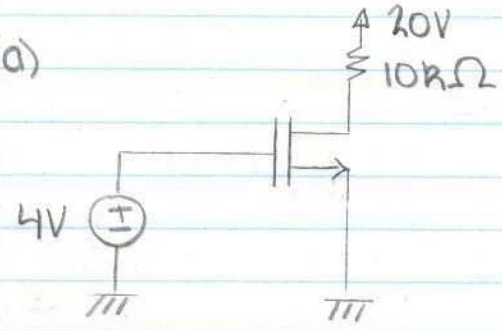
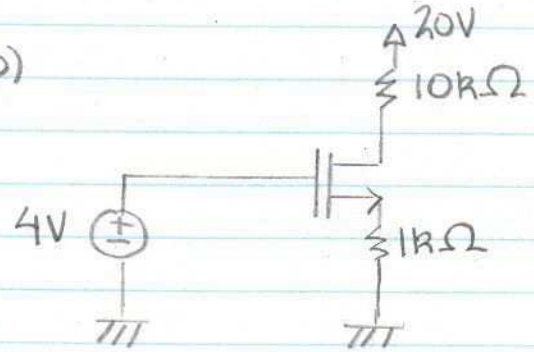
Problem: The parameters of the MOSFETs in the circuits below are $K = 0.2\,mA/V^2$ and $V_t = 1.5V$. Calculate the Q-points of the MOSFETs.

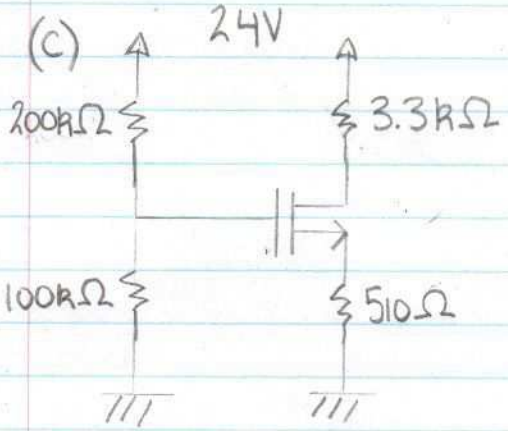
(a)



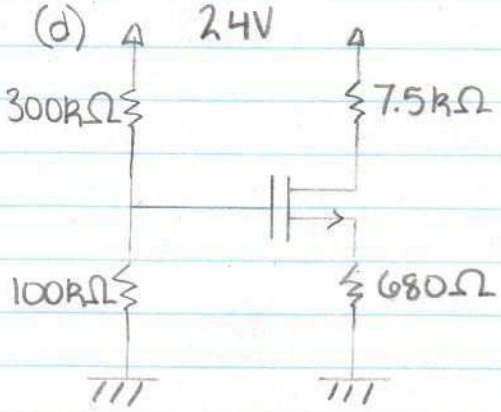
(b)



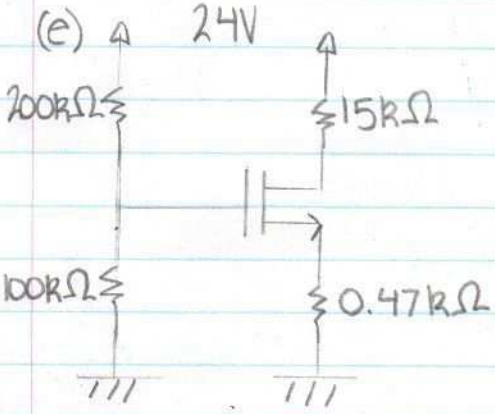
(c)



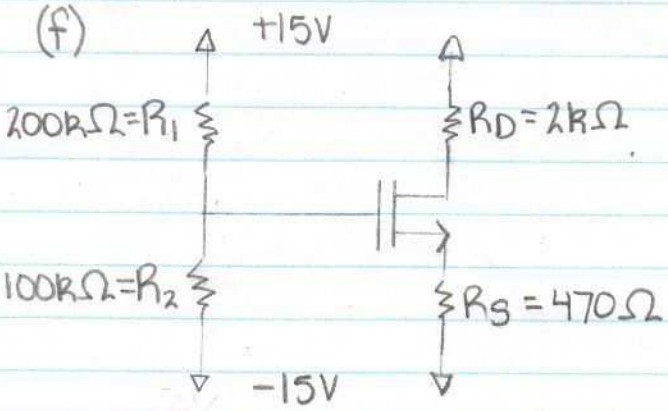
(d)



(e)



(f)



Answers:

(a) $V_{GS} = 4V$
$I_D = 1.25mA$
$V_{DS} = 7.5V$
active

(b) $V_{GS} = 3.33V$
$I_D = 0.669873mA$
$V_{DS} = 12.6314V$
active

(c) $V_{GS} = 5.9658V$
$I_D = 3.9887mA$
$V_{DS} = 8.803V$
active

(d) $V_{GS} = 4.65V$
$I_D = 1.985mA$
$V_{DS} = 7.7638V$
active

(e) $V_{GS} = 7.292V$
$I_D = 1.507mA$
$V_{DS} = 0.692V$
ohmic

(f) $V_{GS} = 7.0767V$
$I_D = 6.220mA$
$V_{DS} = 14.637V$
active