For the questions below, assume the following parameters $V_{dd} = 2.5V$, $U_T = 25mV$, $V_A = 25V$, $\kappa = 1$, $V_T = 0.5V$, for both nFET and pFET devices, unless otherwise stated.

Assume we have two nFET MOSFET devices. Both devices have their source terminal tied to GND, and we can assume both devices are in saturation. The first device has a W/L of 1 (resulting in $I_{th} = 500nA$, $K = 200\mu A/V^2$), and the second device has a W/L of 16 (resulting in $I_{th} = 8\mu A$, $K = 3.2mA/V^2$). Both devices have a bias current of $4\mu A$ for the questions below.

1. Device 1 Transconductance
   a. $1/50k\Omega$
   b. $1/25k\Omega$
   c. $1/12.5k\Omega$
   d. $1/6.25k\Omega$
   e. None of the Above

2. Device 1 Minimum Drain Voltage for Sat
   a. 400mV
   b. 300mV
   c. 200mV
   d. 100mV
   e. None of the Above

3. Device 1 ~gate voltage for 4μA bias current
   a. 0.81V
   b. 0.74V
   c. 0.68V
   d. 0.64V
   e. None of the Above

4. Device 1 Output Resistance
   a. 25MΩ
   b. 12.5MΩ
   c. 6.25MΩ
   d. 1.6 MΩ
   e. None of the Above

5. Device 2 Transconductance
   a. $1/50k\Omega$
   b. $1/25k\Omega$
   c. $1/12.5k\Omega$
   d. $1/6.25k\Omega$
   e. None of the Above

6. Device 2 Minimum Drain Voltage for Sat
   a. 200mV
   b. 150mV
   c. 100mV
   d. 50mV
   e. None of the Above

7. Device 2 ~gate voltage for 4μA bias current
   a. 0.60V
   b. 0.54V
   c. 0.48V
   d. 0.42V
   e. None of the Above

8. Device 2 Max Gain (magnitude)
   a. 1000
   b. 500
   c. 250
   d. 125
   e. None of the Above

9. A MOSFET is operating with gate voltage of 1V and a source voltage at 0V and drain voltage at 2.4V is operating
a.) subthreshold, ohmic region
b.) subthreshold, saturation region
c.) above threshold, ohmic region
d.) above threshold, saturation region
e.) None of the above

10. A MOSFET is operating with gate voltage of 1.1V and a source voltage at 0.5V and drain voltage at 2.4V is operating
a.) subthreshold, ohmic region
b.) subthreshold, saturation region
c.) above threshold, ohmic region
d.) above threshold, saturation region
e.) None of the above

11. A MOSFET is operating with gate voltage of 1.6V and a source voltage at 0.8V and drain voltage at 0.9V is operating
a.) subthreshold, ohmic region
b.) subthreshold, saturation region
c.) above threshold, ohmic region
d.) above threshold, saturation region
e.) None of the above
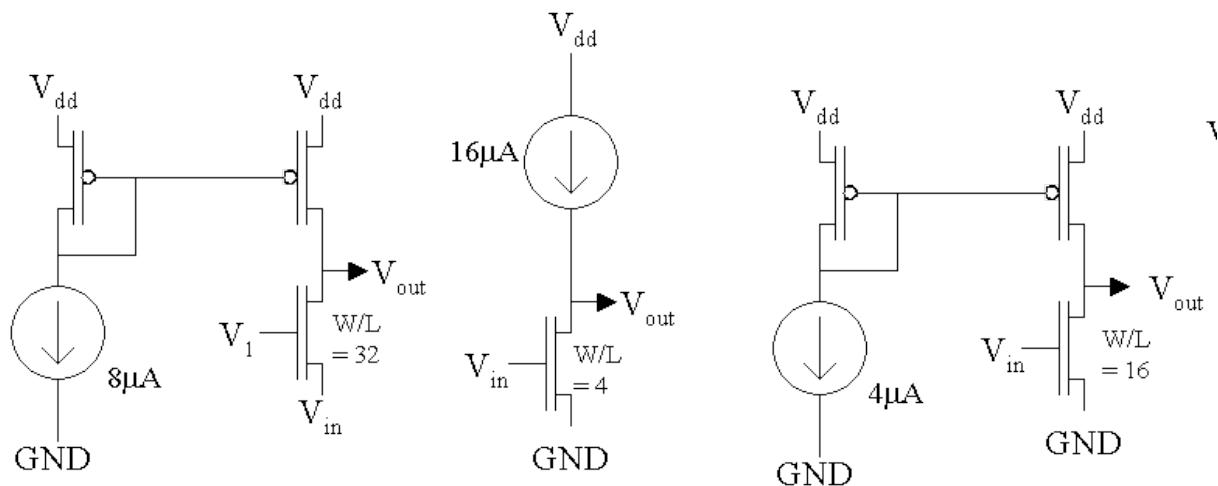
Output voltage is biased at 1.5V.

W/L = 1	$I_{th} = 500nA$, $K = 200\mu A/V^2$
W/L = 4	$I_{th} = 2\mu A$, $K = 0.8mA/V^2$
W/L = 16	$I_{th} = 8\mu A$, $K = 3.2mA/V^2$
W/L = 32	$I_{th} = 16\mu A$, $K = 6.4mA/V^2$

16. Circuit 1 Input Resistance (V_1 terminal)
   a. 6.25MΩ
   b. 3.13MΩ
   c. 6.25kΩ
   d. 3.13kΩ
   e. None of the Above

17. Circuit 1 Output Resistance
   a. 6.25MΩ
   b. 3.13MΩ
   c. 12.5kΩ
   d. 6.25kΩ
   e. None of the Above

18. Circuit 2 Gain (magnitude)
   a. 1000
   b. 500
   c. 250
   d. 125
   e. None of the Above

19. Circuit 2 Output Resistance
   a. 6.25MΩ
   b. 3.13MΩ
   c. 1.56MΩ
   d. 0.78MΩ
   e. None of the Above

20. Circuit 3 Gain (magnitude)
   a. 1000
   b. 500
   c. 250
   d. 125
   e. None of the Above

21. Circuit 3 Output Resistance
   a. 6.25MΩ
   b. 3.13MΩ
   c. 12.5kΩ
   d. 6.25kΩ
   e. None of the Above

22. Circuit 1 Gain
   a. -1000
   b. 1000
   c. −500
   d. 500
   e. None of the Above

V_dd

200nA

V_out

V_in

C_L

GND   GND
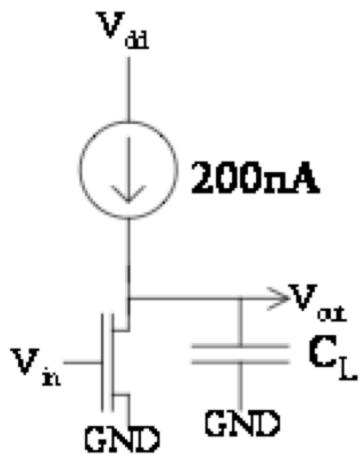
23. This amplifier operates with above threshold currents.
a.) True
b.) False

24. This amplifier has a high-pass frequency response
a.) True
b.) False

25. The time-constant for the corner frequency is
a.) 12.5us
b.) 25us
c.) 50us
d.) 100us
e.) None of the Above

CL = 200fF

Plot taken from a FET, with source voltage at 0V, gate voltage fixed, drain voltage changing, and measured the resulting output (drain) current.