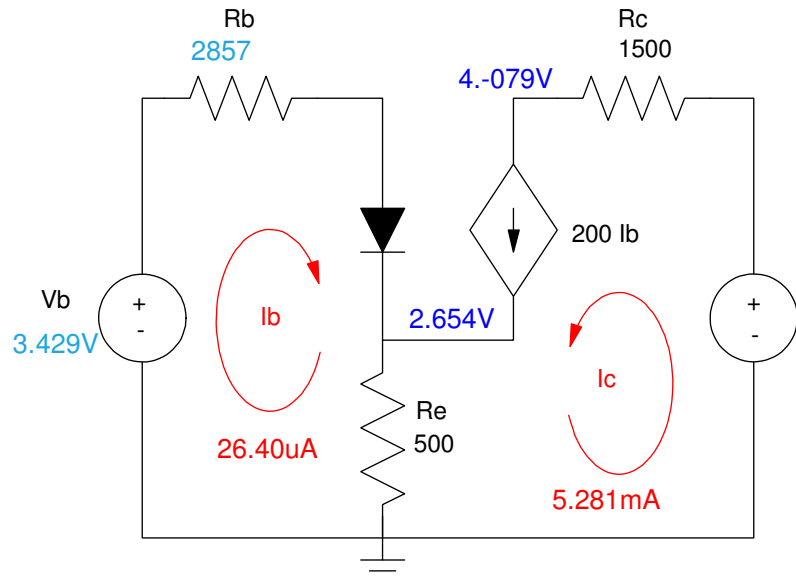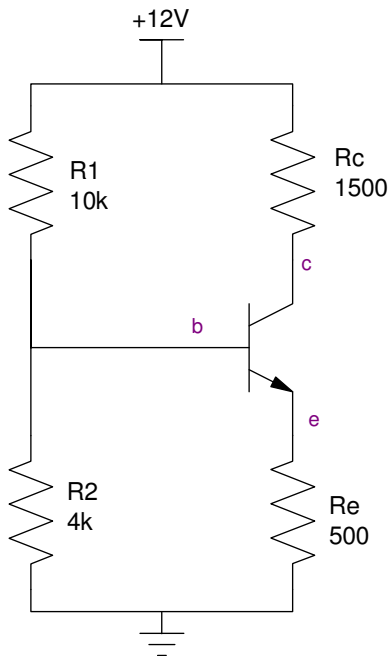# ECE 321 - Quiz #3 - Name _____

CE Amplifiers & 2-Port Models. Open-Book, Open Notes. Calculators and Matlab permitted.

1) Determine the Thevenin equivalent for R1 and R2 and Q-point for the following transitor circuit. Assume ideal 3904 transistors
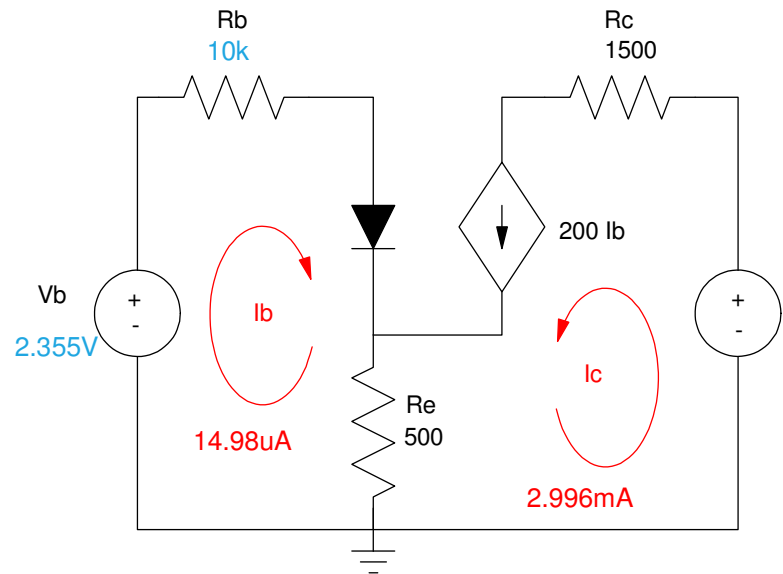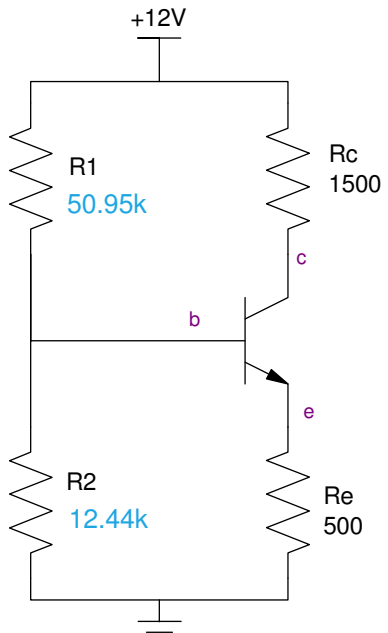
- $\beta = 200$
- $|Vbe| = 0.7V$

Vb (Vth)	Rb (Rth)	Vce	Ic
3.429V	**2857 Ohms**	**1.425V**	**5.281mA**

2) Determine R1 and R2 as well as Vb and Rb so that
   - The Q-point is stabilized for variations in β (meaning $(1+\beta)R_e \gg R_b$), and
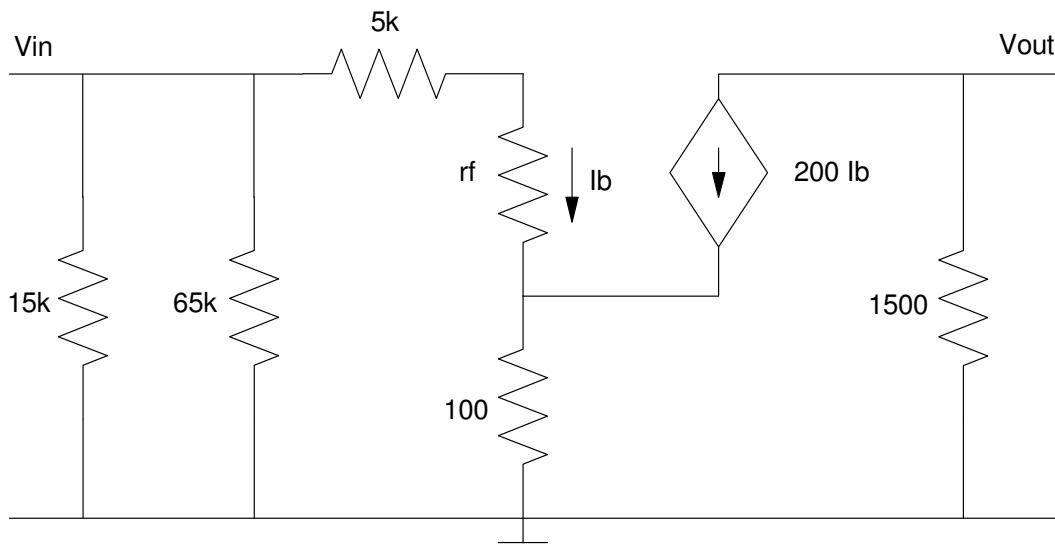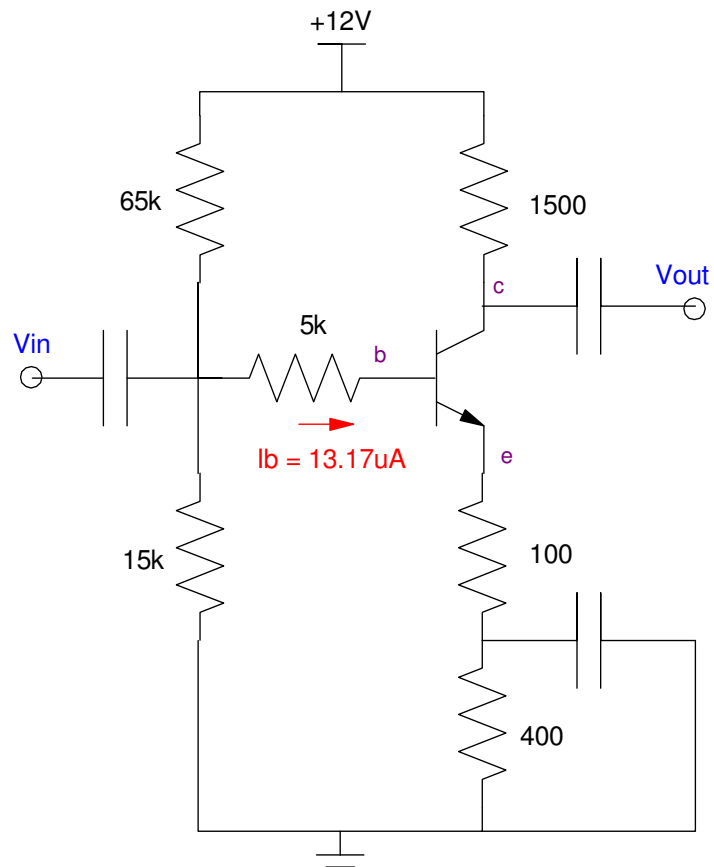   - Vce = 6.00V

R1	R2	Vb (Vth)	Rb (Rth)
12.44k	**50.95k**	**2.355V**	**10k** Rb << 100.5k

3) Draw the small-signal model for the following amplfifier. Assume
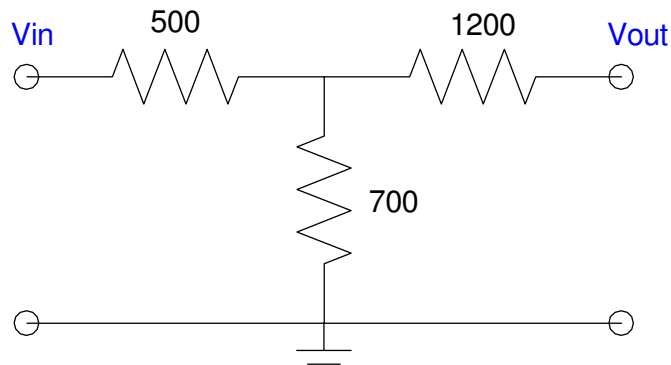   - $\beta = 200$
   - $I_b(DC) = 13.17\mu A$

note: you don't need to find the 2-port model. That's a later quiz problem.

+12V

65k

1500

Vout

5k

c

Vin

b

Ib = 13.17uA

e

15k

100

400

5k

Vin

Vout

rf

Ib

200 Ib

15k

65k

1500

100

4) Determine the 2-port model for the following circuit

Rin	Ai	Rout	Ao
942	**0.3684**	**1492**	**0.5833**

Rin:

- Short Vout
- Rin = 500 + 1200 || 700

Ai:

- apply 1V at Vout. Measure Vin
- Vin = 700 / (700 + 1200)

Rout:
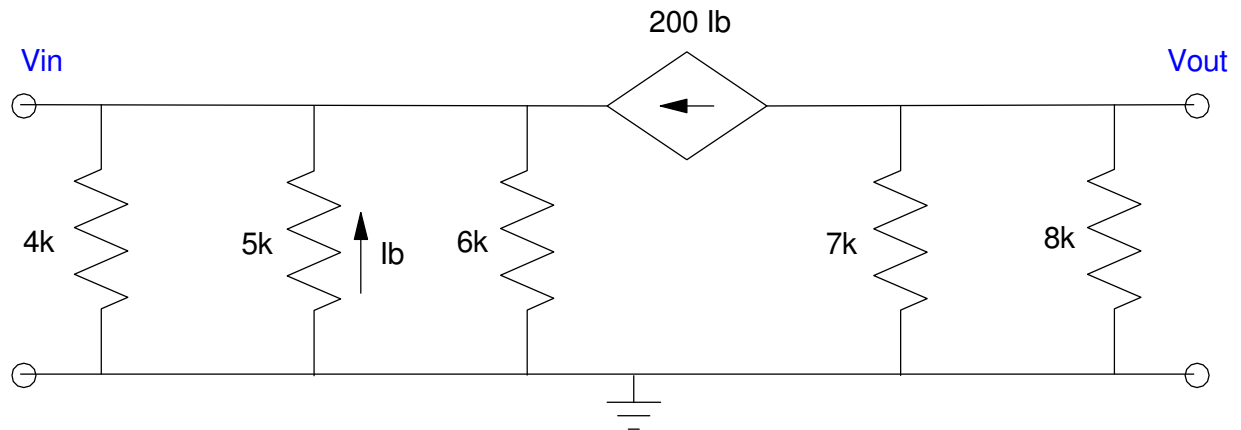
- Short Vin
- Rout = 1200 + 500 || 700

Ao:

- Apply 1V to Vin
- Vout = 700 / (700 + 500)

5) Determine the 2-port model for the following circuit

Rin	Ai	Rout	Ao
24.62 Ohms	**0**	**3733 Ohms**	**149.3**

Rin:
- Short Vout
- Apply 1V to Vin. Compute the current

$$I = \frac{1}{4k} + \frac{1}{5k} + \frac{1}{6k} + 200\left(\frac{1}{5k}\right) = 40.62mA$$

$$R_{in} = \frac{1V}{40.62mA} = 24.62\Omega$$

Ai: = 0

Rout
- Short Vin
- Rout = 7k || 8k = 3733

Ao:
- Apply 1V to Vin

$$I_b = -\frac{1V}{5k} = -200uA$$

$$200I_b = -40mA$$

$$V_{out} = 40mA \cdot 7k||8k = 149.3$$

6) Determine the 2-port model for the following amplifier

Rin	Ai	Rout	Ao
2k	**0**	**1000** `3k || 1500`	**+1333**