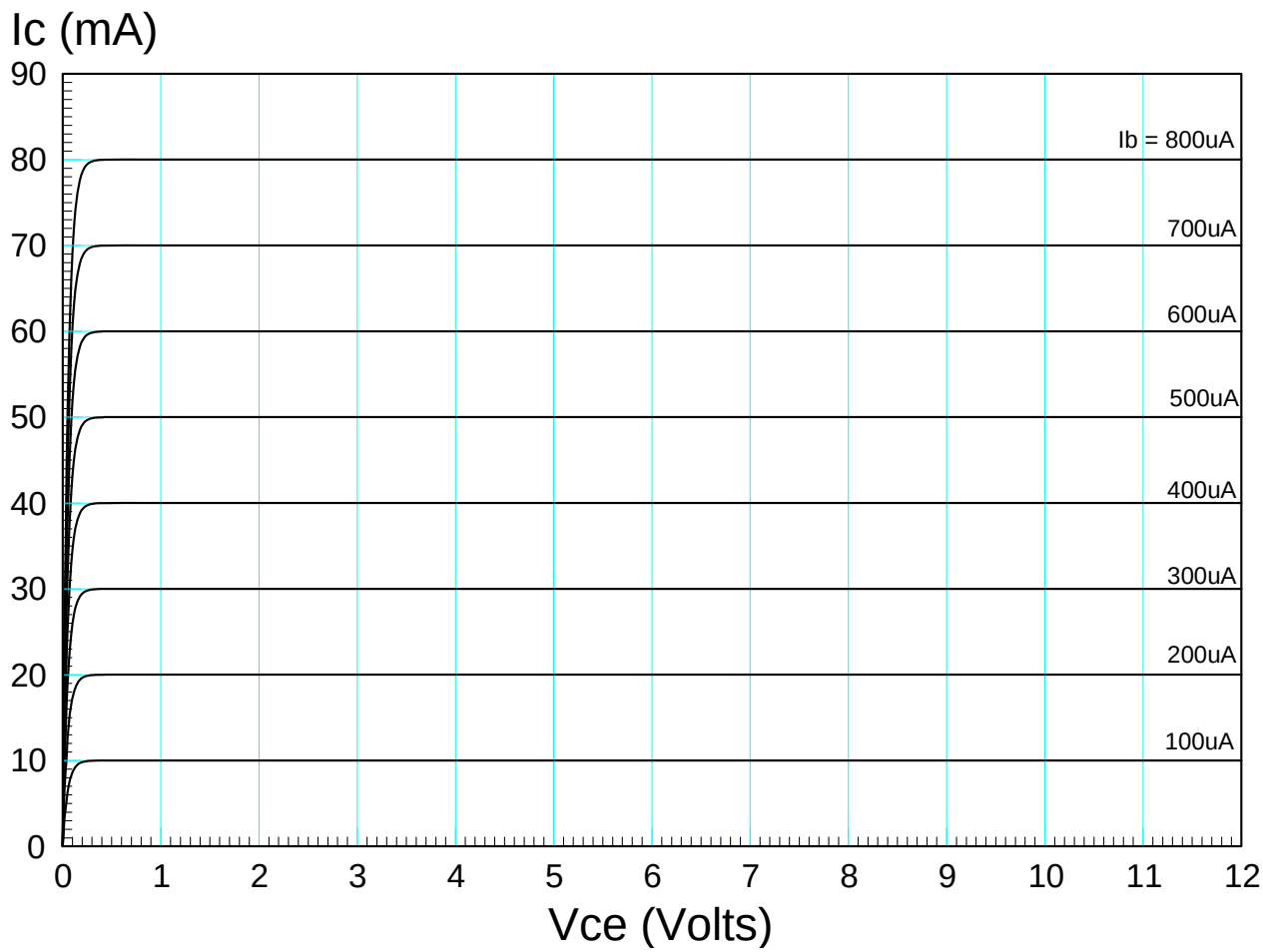
ECE 320 - Homework #5

Transistor Theory, Transistors used as a Switch. Due Monday, February 12th, 2018

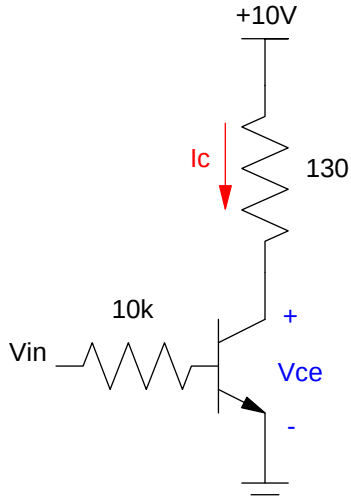
1) The VI characteristics for a transistor are shown below:

- What is the current gain, β?
- Label the Off / Saturated / Active regions.



2) Draw the load line for the following circuit. Mark on the load line the operating point (termed Q-point) when

- Vin = 0V
- Vin = 5V
- Vin = 10V



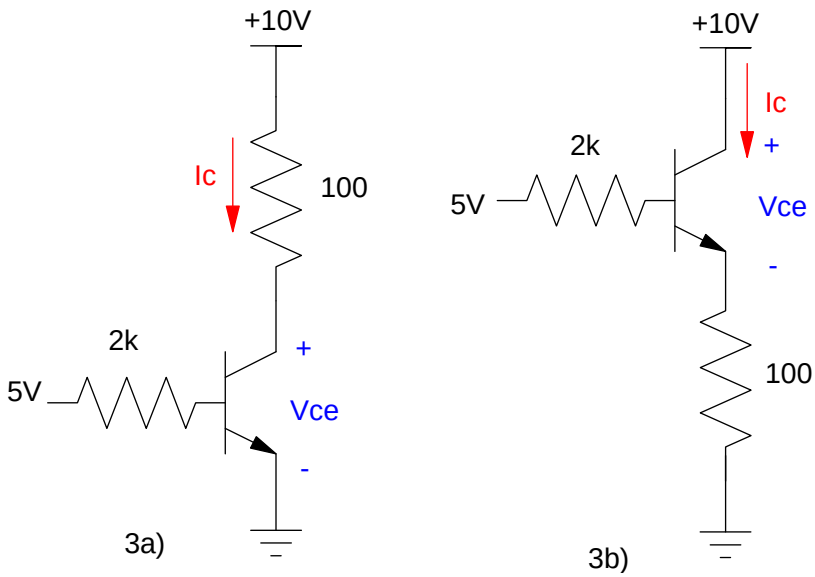
Problem 3-6: Assume a LM833 transistor ($0.04 each)

- $\beta = 100$
- $V_{ce:sat} = 0.2V$
- $\max(I_c) = 200mA$

3) Determine the operating point(Ic, Vce) for the following circuits

- a) An NPN transistor with the emitter tied to ground
- b) An NPN transistor with the collector tied to +10V

Which circuit uses a transistor as a switch (the transistor is saturated: Vce = 0.2V)?



4) Design a circuit to meet the following requirements (i.e. a transistor used as a switch)

- Input: 0V / 5V binary signal capable of 20mA
- Output: DC Motor which draws 200mA @ 10V
- Relationship:
  - When Vin = 0V, 0V is applied to the motor
  - When Vin = 5V, 10V is applied to the motor +/- 1V

5) Check your design in PartSim

6) Check your design in lab.

Problem 7: Assume a TIP112 transistor ($0.32 each)

- $\beta = 1000$
- $V_{ce:sat} = 0.9V$
- $\max(I_c) = 3A$

7) Design a circuit to meet the following requirements (i.e. a transistor used as a switch)

- Input: 0V / 5V binary signal capable of 20mA
- Output: 8 Ohm speaker
- Relationship:
  - When Vin = 0V, 0V is applied to the speaker
  - When Vin = 5V, 5V is applied to the speaker +/- 1V