Show all work in the allotted space for each problem and circle each answer. No other material will be accepted for test answers.

1. Consider the schematic given at the right in which $V_1 = 2\text{V}$, rail voltages are $\pm 15\text{V}$, $R_1 = R_2 = R_3 = R_4 = 1\text{k}$. Assume that a forward-biased diode has a drop of .7 volt.
   a. (20) Find $V_1$, $V_2$, $V_3$, and the current in $R_4$ if $V_3 = 4.7\text{V}$.
   b. (10) Find the current in $R_4$.
   c. (10) What is the operating mode of the transistor if $V_3 = 20\text{V}$?
2. In the given circuit, \( V_1 = 20 \text{V} \), \( R_2 = 100 \text{K} \), \( R_3 = 0.5 \text{K} \), \( V_1 = 5 \text{V} \), \( V_2 = 20 \text{V} \) and the Zener diode has a breakdown voltage of 5 volts. The transistor has a \( \beta \) of 100.

a. (10) Find \( I_B \).
b. (10) Find \( I_C \).
c. (10) Find \( V_{CE} \).
d. (10) What is the operating mode of the transistor?
e. (10) Suppose that \( R_C = 10 \text{K} \). What is \( V_{CE} \) now?
f. (10) What is the current in \( R_2 \) now?