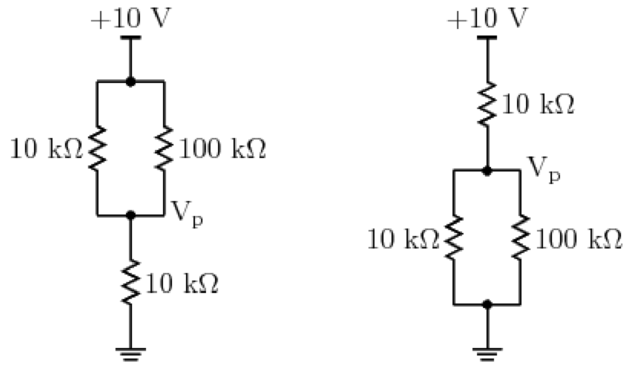
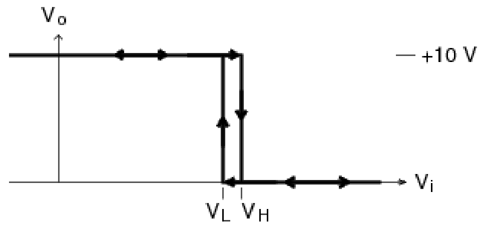
1)

11 For $V_o = 10$ V, the voltage at the positive terminal can be found easily if we realize that the situation is effectively a voltage divider as shown below (left).



This gives a voltage $V_p = 5.24$ V. For $V_o = 0$, the situation is effectively as in the right part of the figure, resulting in $V_p = 4.76$ V. These are the V_H and V_L switching voltages, respectively, for the input voltage V_i. We see from Figure 39 that the input signal is at the negative terminal of the opamp, and we can expect the output to be the positive supply voltage (10 V) for the smallest input voltages and the negative supply voltage (0) for the largest input voltages. We thus wind up with the behavior as shown below.



2)

12 Define the two voltage dividers, $\beta_1 \equiv R_1/(R_1 + R_2)$ and $\beta_2 \equiv R_4/(R_3 + R_4)$. Then $V_p = \beta_1 V_o + (1 - \beta_1)V_{ref}$ and $V_n = \beta_2 V_i$. Then, for the commutation point a, we have $V_o = -10$ V, $V_i = a$, $V_n = V_p$, the latter rewritten as

$$\beta_1(-10 \text{ V}) + (1 - \beta_1)V_{ref} = a\beta_2 \tag{147}$$

For the second commutation point (b), we have $V_o = +10$ V, $V_i = b$, and $V_n = V_p$, the latter resulting in

$$\beta_1(10 \text{ V}) + (1 - \beta_1)V_{ref} = b\beta_2 \tag{148}$$

Combining the two equations (Subtract 147 from 148) gives $\beta_1(20 \text{ V}) = (b - a)\beta_2$. For a = 1 V and b = 2 V this becomes $\beta_2 = 20\beta_1$. Substituting this into Eq. 148 gives $\beta_1 = V_{ref}/(30 \text{ V} + V_{ref})$. For example: $\beta_2 = 1$ ($R_3 = 0$), $\beta_1 = 1/20$, and $V_{ref} = 30/19$ V.