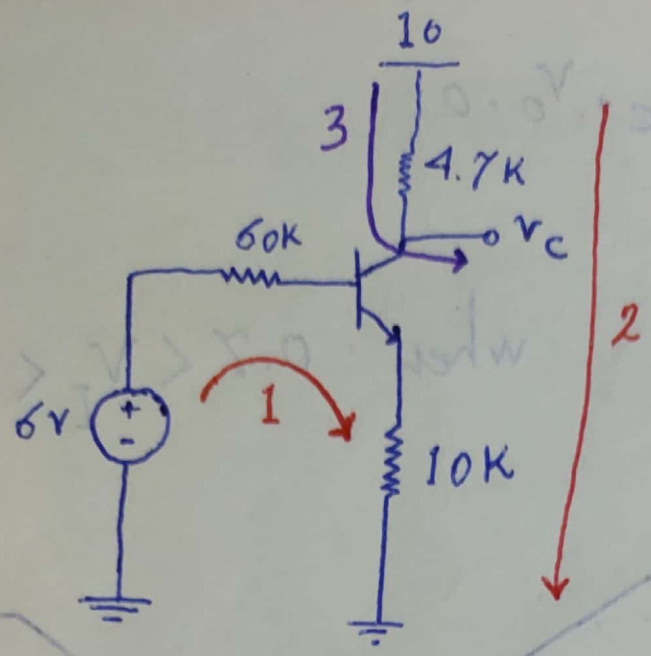
.1

(a



Kvl @ 1: $-6 + 0.7 + 10 I_C = 0 \longrightarrow I_C = 0.53\,mA$

Kvl @ 2: $-10 + 4.7(0.53) + V_{CE} + 10(0.53) = 0$

$V_{CE} = 2.2 > 0.2$ transistor is ON

Kvl @ 3: $-10 + 4.7(0.53) + V_C = 0 \longrightarrow V_C = 7.5V$

(b

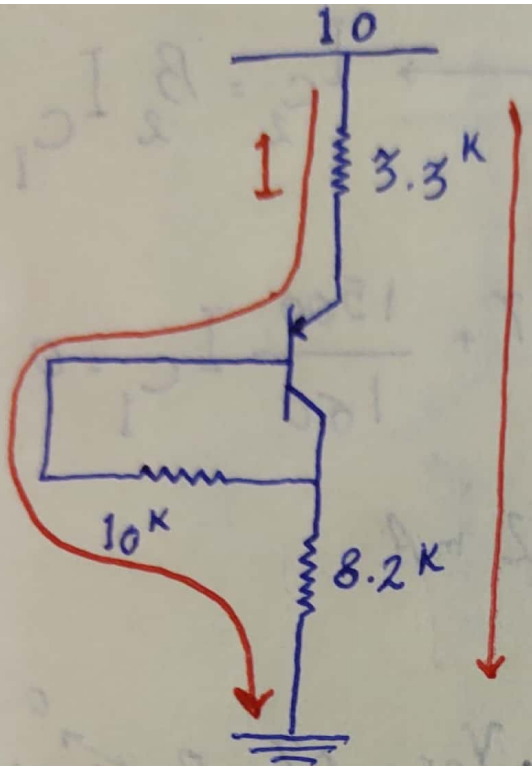
Kvl @ 1: $-6 + 60 I_B + 0.7 + 10 I_E = 0$

$-6 + \frac{60}{100} I_C + 0.7 + 10 I_C \longrightarrow I_C = 0.5\,mA$

Kvl @ 2: $V_{CE} = 2.65 > 0.2$ ✓

Kvl @ 3: $V_C = 7.65$

(a



KVL @ 1: $-10 + 3.3(I_C) + 0.7 + 8.2 I_C = 0 \longrightarrow I_C = 0.8\,mA$

KVL @ 2: $-10 + 3.3(0.8) + V_{CE} + 8.2(0.8) = 0 \longrightarrow V_{CE} = 0.8 > 0.2$

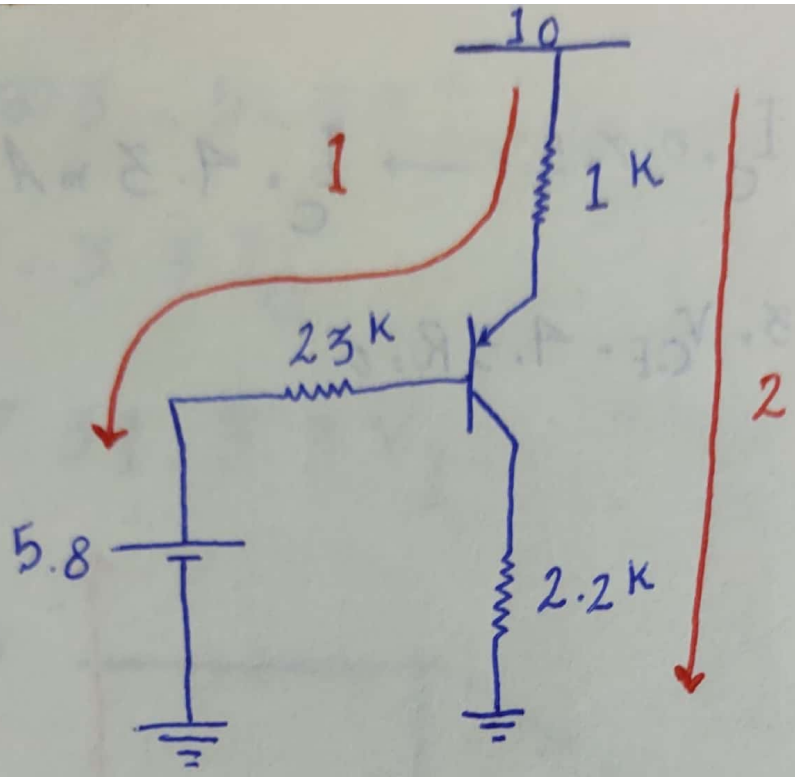
(b

KVL @ 1: $-10 + 3.3 I_C + 0.7 + 10 I_B + 8.2(I_B + I_C) = 0$

$11.682\, I_C = 9.3 \longrightarrow I_C = 0.79$

KVL @ 2: $V_{CE} = 0.91 > 0.2$ ✓

(a



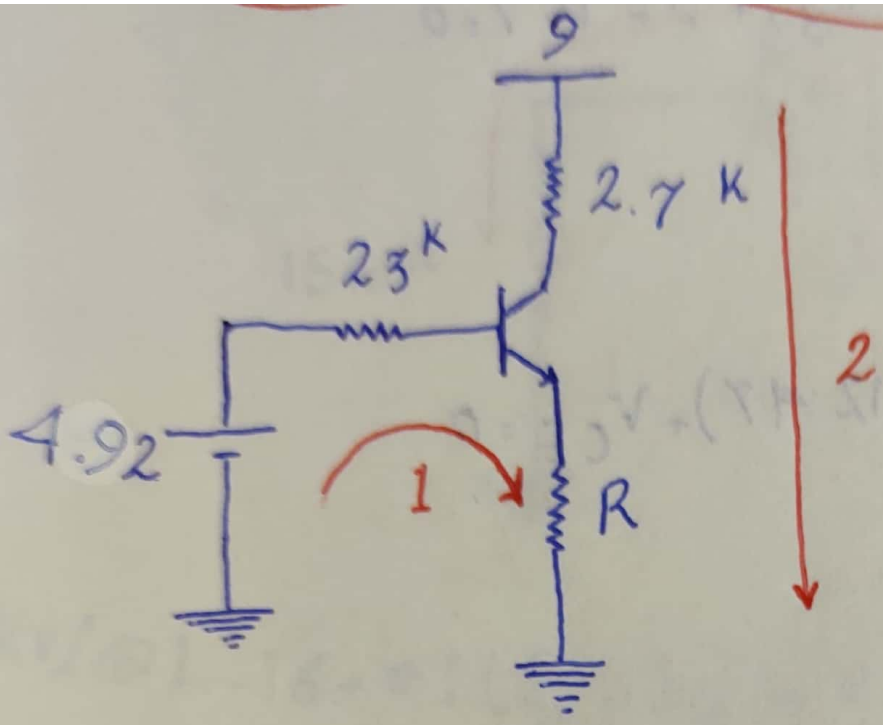
KVL @ 1: $-10 + I_C + 0.7 + 5.8 = 0 \longrightarrow I_C = 3.5\,mA$

KVL @ 2: $-10 + 3.5 + V_{CE} + 2.2(3.5) \longrightarrow V_{CE} = -1.2\,V < 0.2$ X

(b

KVL @ 1: $-10 + I_C + 0.7 + \frac{23}{100} I_C + 5.8 = 0 \longrightarrow I_C = 2.84\,mA$

KVL @ 2: $-10 + 2.84 + V_{CE} + 2.2(2.84) = 0 \longrightarrow V_{CE} = 0.91 > 0.2$ ✓



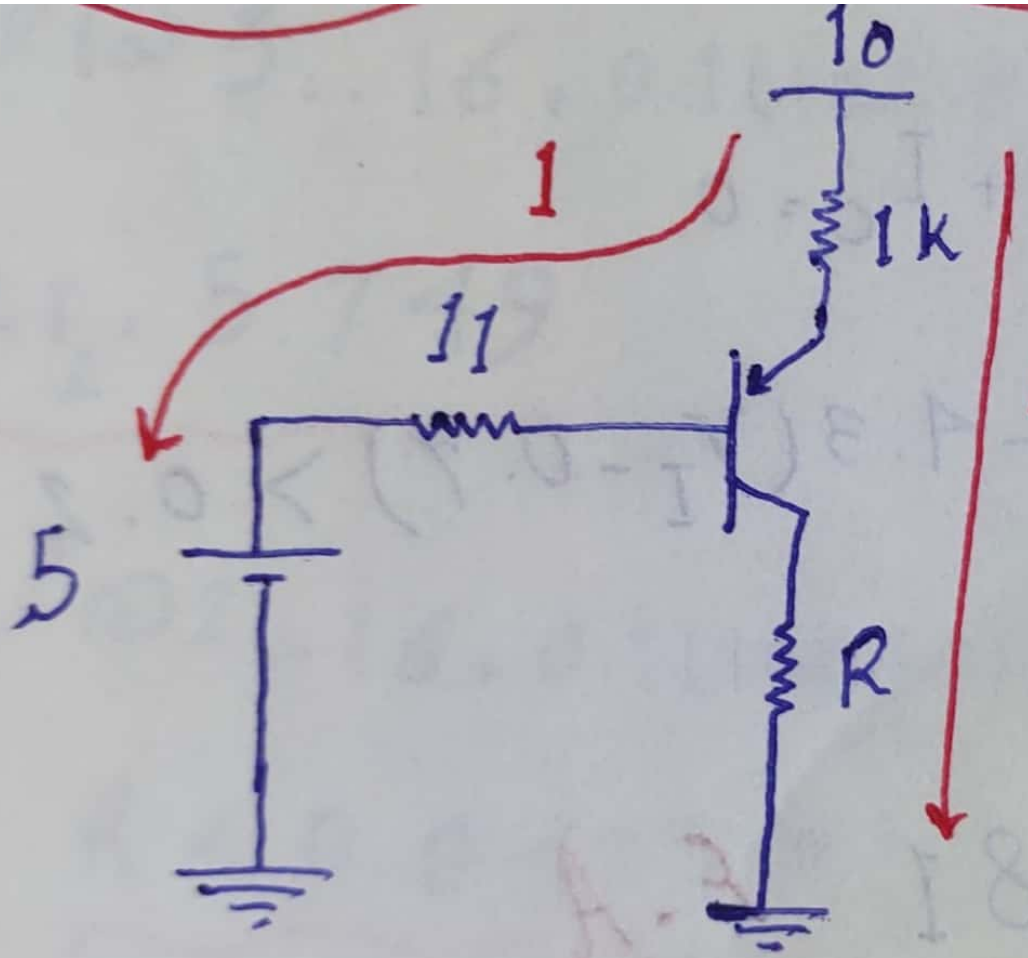
KVL @ 1: $-4.92 + \frac{23}{100} I_C + 0.7 + R I_C = 0$

$$I_C = \frac{4.22}{0.37 + R} \quad \text{I}$$

KVL @ 2: $-9 - 2.7 I_C + V_{CE} + R I_C = 0$

$$V_{CE} = 9 - I_C (2.7 + R) > 0.2 \quad \text{II}$$

I in II $\quad R > 1\ K\Omega$

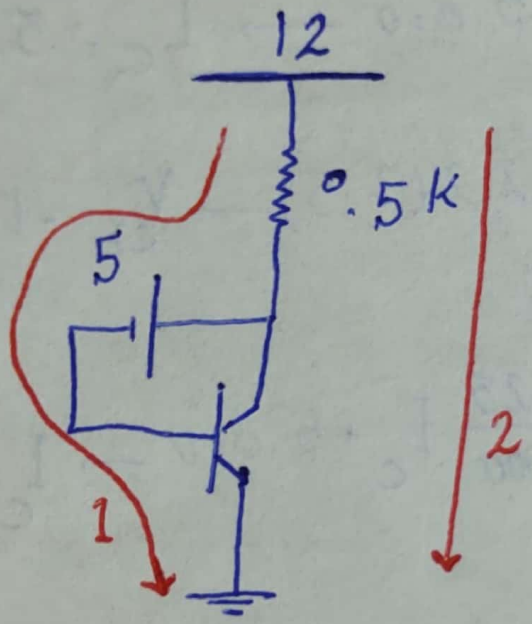


.3

KVL @ 1: $-10 + I_C + 0.7 + 5 = 0 \longrightarrow I_C = 4.3\ mA$

KVL @ 2: $-10 + 4.3 + V_{CE} + 4.3R = 0$

$R < 1.2$



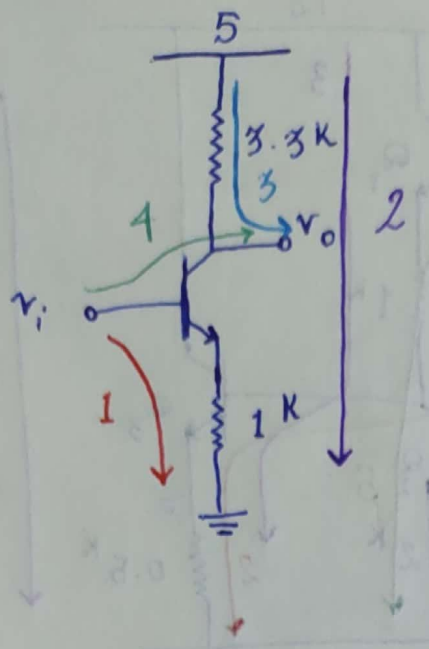
KVL @ 1: $-12 + 0.5(I_C + I_B) + 5 + 0.7 = 0$

$I_C = 12.47\ mA$

KVL @ 2: $-12 + 0.5(12.47) + V_{CE} = 0$

$V_{CE} = 5.76\ V$

.5



$I_C = I_E = 0 \qquad V_{BE} < 0.7$: قطع شود

$Kvl\ @1: \ -V_i + V_{BE} + 1(0) = 0 \Longrightarrow V_i = V_{BE} \Rightarrow V_i < 0.7$

$V_o = 5v$

$V_{CE} = 0.2$ مرز اشباع

$Kvl\ @2: \ -5 + 3.3\,I_C + V_{CE} + I_C = 0 \longrightarrow I_C = 1.1mA$

$Kvl\ @1: \ -V_i + 0.7 + 1.1 = 0 \longrightarrow V_i = 1.8$

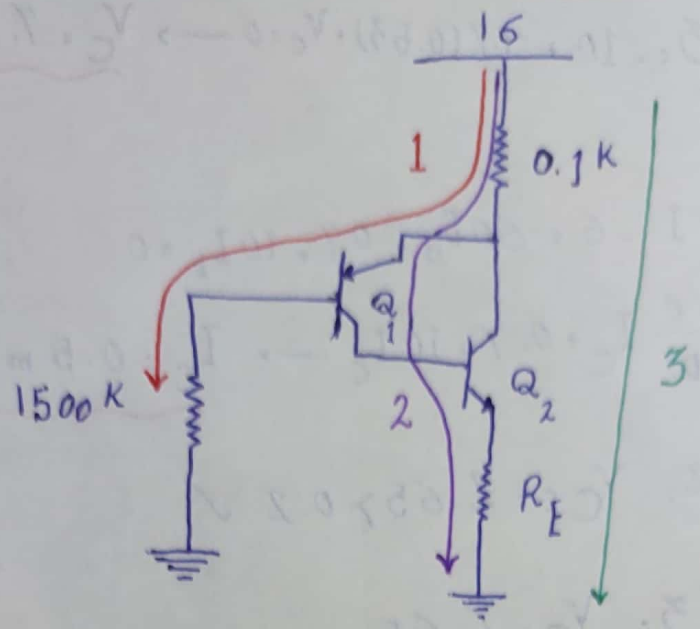
$Kvl\ @1: \ I_C = V_i - 0.7$

$Kvl\ @3: \ -5 + 3.3(I_C) + V_o = 0 \longrightarrow V_o = 7.31 - 3.3V_i$

$0.7 < V_i < 1.8$

$V_i > 1.8$ اشباع

$Kvl\ @4: \ -V_i + V_{BC} + V_o = 0 \Rightarrow V_o = V_i - V_{BC}$ (0.6)



KVL @ 1: $-16 + 0.1(I_{C_1} + I_{C_2}) + 0.7 + 1500 I_{B_1} = 0$

$I_{C_1} = I_{B_2} \longrightarrow I_{C_1} = \frac{I_{C_2}}{\beta_2} \longrightarrow I_{C_2} = \beta_2 I_{C_1}$

$-16 + 0.1 I_{C_1} + 0.1 I_{C_2} + 0.7 + \frac{1500}{160} I_{C_1} = 0$

$I_{C_1} = 0.51 \text{ mA} \qquad I_{C_2} = 102 \text{ mA}$

KVL @ 2: $-16 + 0.1(102.51) + V_{CE} + 0.7 + R_E(102) = 0$

$V_{CE_1} = 5.049$

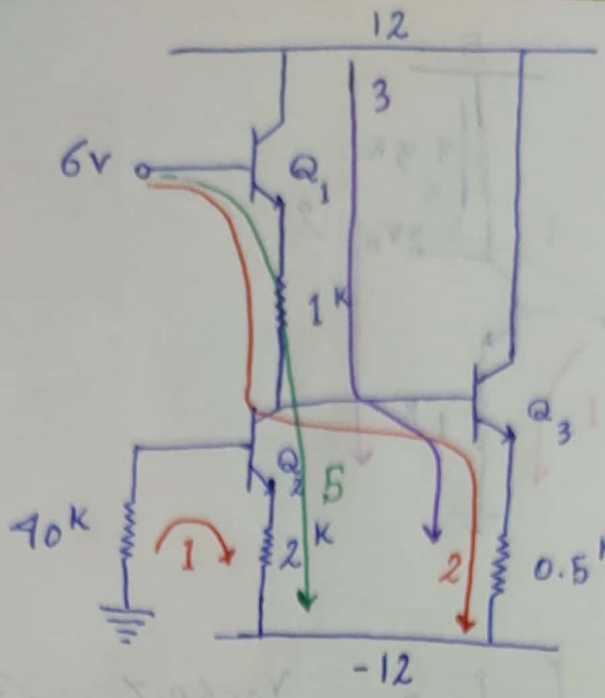
KVL @ 3: $-16 + 0.1(102.51) + V_{CE_2} = 0$

$V_{CE_2} = 5.749$

KVL @ 2: $-16 + 0.1(102.51) + V_{CE_1} + 0.7 + R(102) = 0$

$R < 0.049 \text{ K}\Omega$

.8



KVL @ 1: $40 I_{B_2} + 0.6 + 2 I_{E_2} - 12 = 0 \longrightarrow I_{E_2} = 4.75\ mA$

KVL @ 2: $-6 + 0.6 + (I_{E_2} + I_{B_3}) + 0.6 + 0.5 I_{E_3} - 12 = 0$

$I_{E_3} = 23.6$ $\quad I_{B_3} = 0.236$ $\quad I_{C_1} = 4.98$

KVL @ 3: $-12 + V_{CE_1} + 4.98 + 0.6 + 0.5(23.6) - 12 = 0$

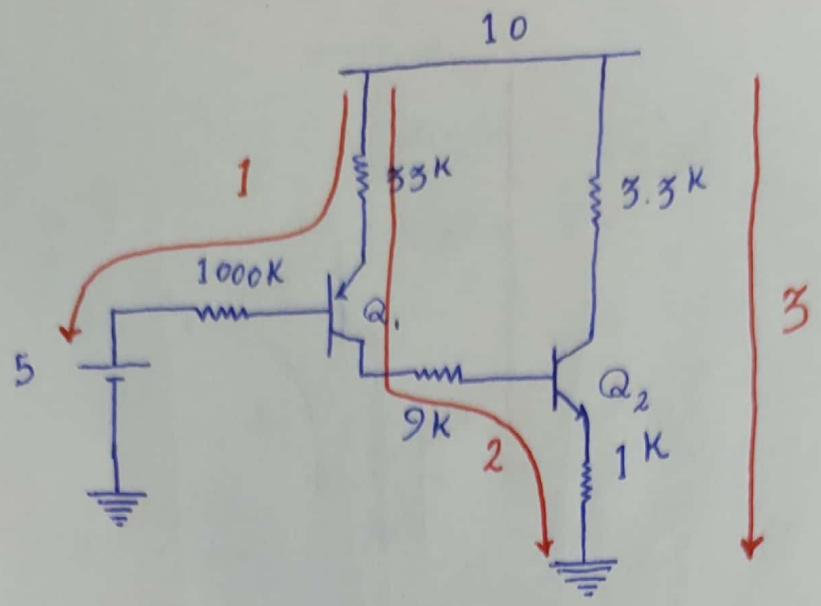
$V_{CE_1} = 6.62$

KVL @ 4: $-12 + V_{CE_3} + 0.5(23.6) - 12 = 0$

$V_{CE_3} = 12.2$

KVL @ 5: $-6 + 0.6 + 4.98 + V_{CE_2} + 2(4.75) - 12 = 0$

$V_{CE_2} = 2.92$



KVL @ 1: $-10 + 33 I_{E_1} + 0.7 + 1000 I_{B_1} + 5 = 0$

$I_{E_1} = I_{C_1} = 0.1\,mA$

$I_{C_1} = I_{B_2} \longrightarrow I_{C_2} = \beta_2 I_{B_2} \longrightarrow I_{C_2} = 1\,mA \longrightarrow I_{E_2} = 1.1\,mA$

$I_C = \frac{\beta}{\beta + 1} I_E$

KVL @ 2: $-10 + 3.3 + V_{CE_1} + 0.9 + 0.7 + 1.1 = 0$

$V_{CE_1} = 4 > 0.2$ ✓

KVL @ 3: $-10 + 3.3 + V_{CE_2} + 1.1 = 0$

$V_{CE_2} = 5.6 > 0.2$ ✓