Q1

least four digits

Student ID → xx --- $\underline{4}$ $\underline{3}$ $\underline{2}$ $\underline{1}$

fixed

$$V_I = (3 + 1) - 20 = -16$$

$V_I = \boxed{?}$ Write only the answer, no calculations!!!

Q2

V_I from Q1
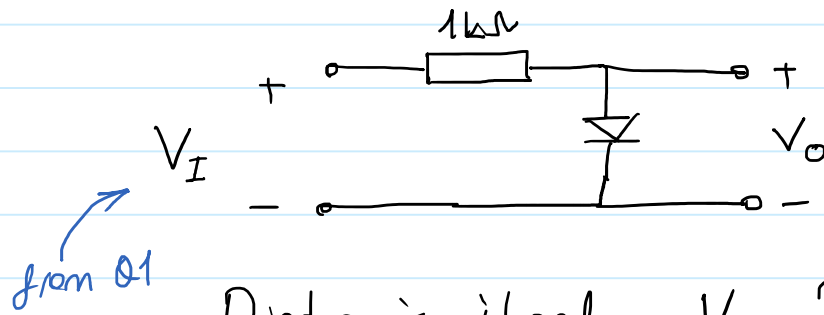
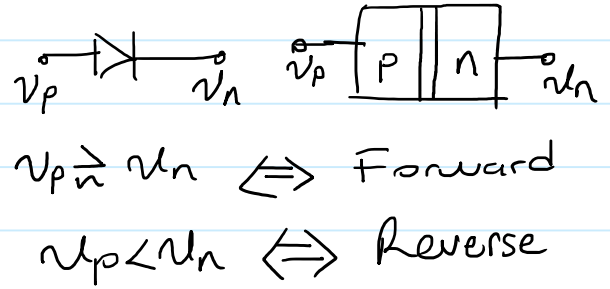Diodes is ideal. $V_o = ?$

$V_I < 0$ thus the diode will be off.

$$V_o = V_I$$

Q3
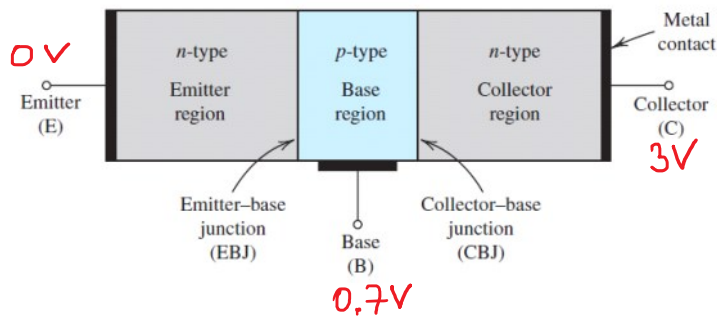
0 V (Emitter) 3V (Collector) 0.7V (Base)

In which region the BJT is operating?

cutoff / active / saturation

Table 6.1 BJT Modes of Operation

Mode	EBJ	CBJ
Cutoff	Reverse	Reverse
Active	Forward	Reverse
Saturation	Forward	Forward

v_p ⟶ v_n v_p | P | n | v_n

$v_p \gtrless v_n \iff$ Forward

$v_p < v_n \iff$ Reverse

(EBJ) $\quad v_B - v_E = v_p - v_n = 0.7 \qquad$ Forward

(CBJ) $\quad v_B - v_C = v_p - v_n = -2.3 \qquad$ Reverse

$$\text{Active Mode}$$
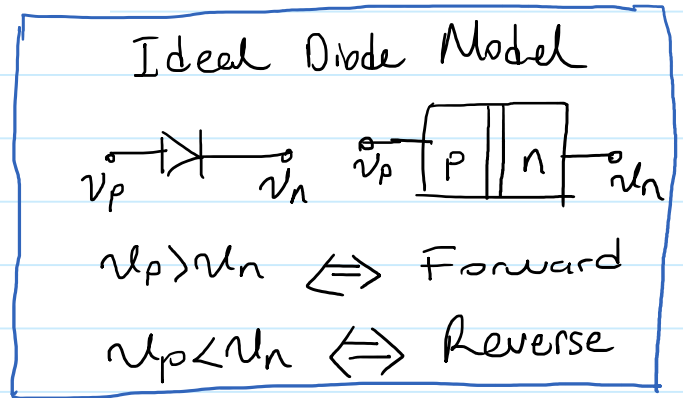
Q3
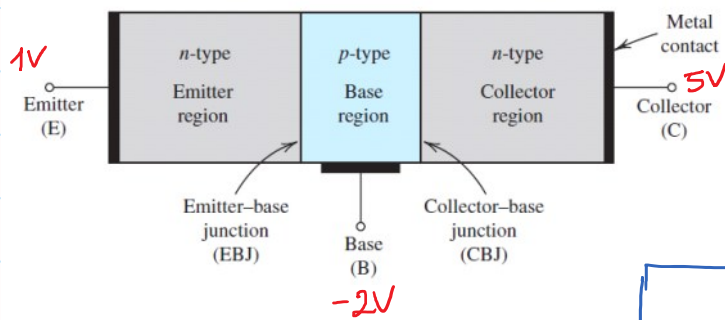
1V

Emitter (E)

| n-type Emitter region | p-type Base region | n-type Collector region |

Emitter–base junction (EBJ)

Base (B)

−2V

Collector–base junction (CBJ)

Metal contact

5V

Collector (C)

In which region the BJT is operating?

cutoff / active / saturation

Table 6.1 BJT Modes of Operation

Mode	EBJ	CBJ
Cutoff	Reverse	Reverse
Active	Forward	Reverse
Saturation	Forward	Forward

Ideal Diode Model

$$v_p \quad \rightarrow\!\!\!\mid \quad v_n \qquad v_p \quad \boxed{P \;\|\; n} \quad v_n$$

$$v_p > v_n \iff \text{Forward}$$

$$v_p < v_n \iff \text{Reverse}$$

EBJ $\qquad v_B - v_E = -2 - 1 = -3 \qquad$ Reverse

CBJ $\qquad v_B - v_C = -2 - 5 = 7 \qquad$ Reverse

Cutoff

Q3
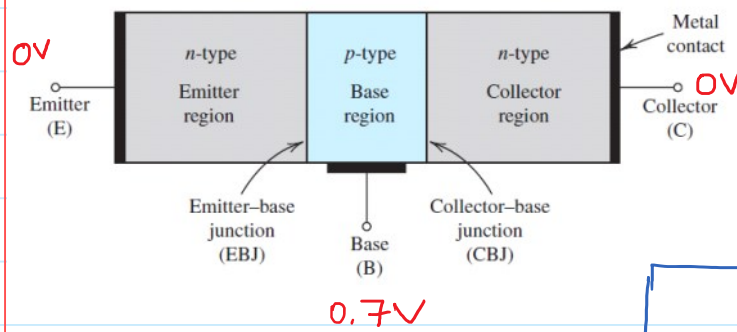
0V

0.7V

In which region the BJT is operating?

cutoff / active / saturation

Table 6.1 BJT Modes of Operation

Mode	EBJ	CBJ
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Ideal Diode Model

$v_p > v_n \iff$ Forward

$v_p < v_n \iff$ Reverse
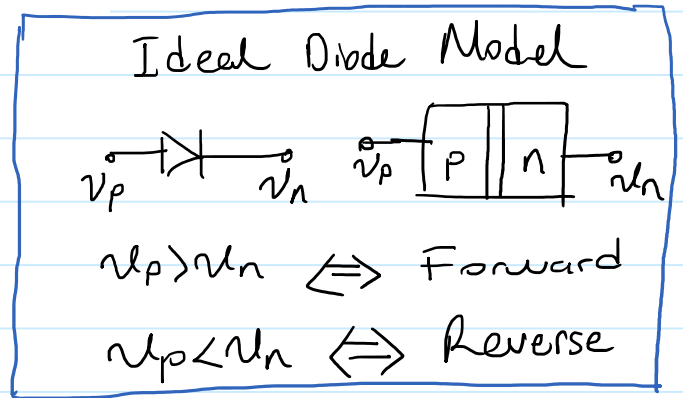
EBJ $V_B - V_E = v_p - v_n = 0.7 \implies$ Forward

CBJ $V_B - V_C = v_p - v_n = 0.7 \implies$ Forward

Saturation