GIVEN:

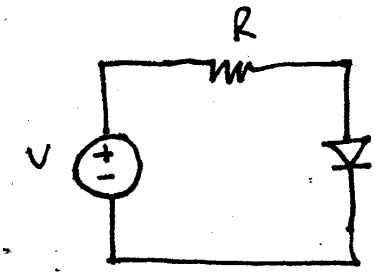

FIG. P3.42 i-v

FIND: Q POINT

A) $V = 10\,V$ $R = 5K\Omega$

B) $V = -10\,V$ $R = 5K\Omega$

C) $V = -2\,V$ $R = 2K\Omega$

SOLN: A) FOR LOAD LINE ... FIND i IF $v_d = 0$ ...

$i = \frac{10}{5K} = 2\,mA$ AND FIND v IF $i = 0$ ...

$v = 10\,V$

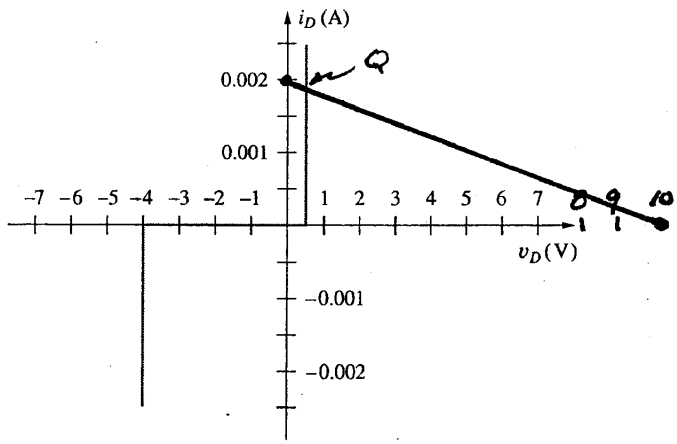

Figure P3.42

Q @ $v_d = 0.5\,V$ $i_d = 1.9\,mA$

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SOLN: B)

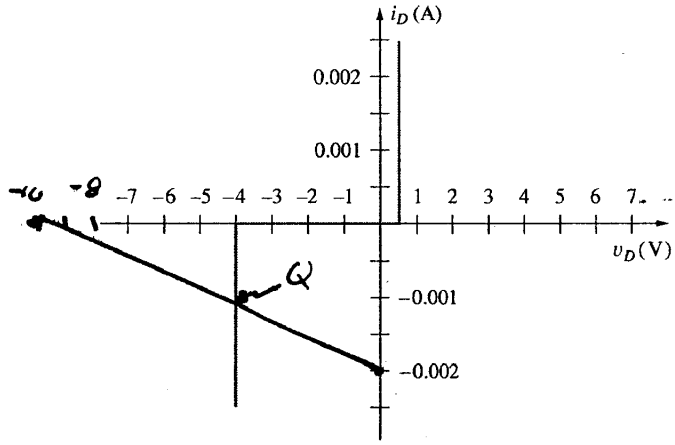


Figure P3.42

AGAIN @

$v_d = 0 \quad i_d = -2mA$

& $i_d = 0 \quad v_d = -10$

Q @ $v_d = -4V \quad i_d = -1.2\ mA$

C)

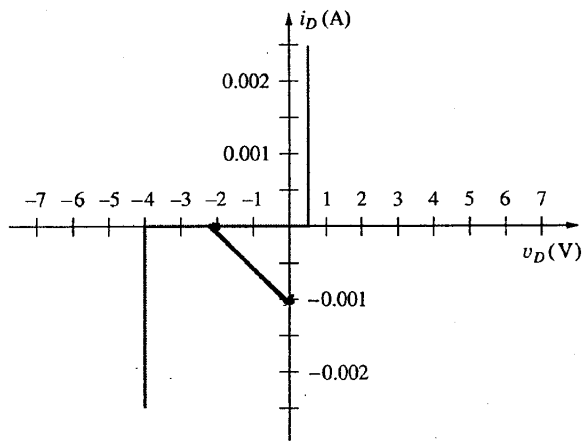


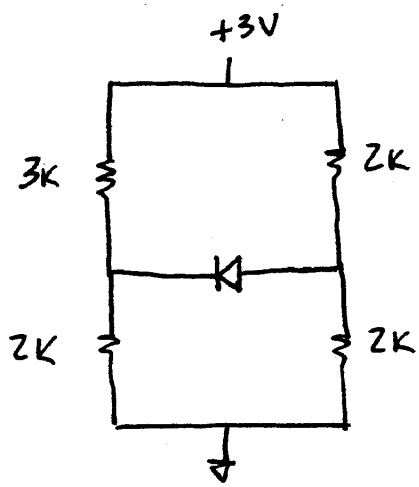
Figure P3.42

$v_d = 0 \quad i_d = -1mA$

$i_d = 0 \quad v_d = -2V$

So, Q @ $V_d = -2V \; i_d = 0\ mA$

GIVEN:



FIND: Q POINT

A) USING IDEAL MODEL

B) CONST. VOLT DROP MODEL W/ $V_{ON} = 0.6\,V$

C) DISCUSS RESULTS

D) USE ITERATIVE APPROACH WITH $I_S = 1\ fA$.

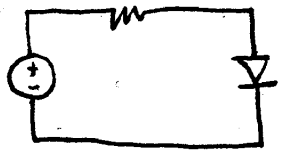
SOLN: A) FROM CIRCUIT INSPECTION - VOLT DIVIDER ON ANODE WILL RESULT IN A GREATER VOLT THAN VOLT DIVIDER ON CATHODE SO - DIODE WILL BE FWD.

TREAT DIODE AS LOAD & CALCULATE THEVENIN EQUIV. CIRCUIT

$R_{TH} = (2K+2K)//(3K+2K) = 2.2\,K\Omega$

$1.5 - \frac{2}{5}(3) = V_{TH}$

$0.3\,V$



$i_D = \frac{V_{TH}}{R_{TH}} = \frac{0.3}{2.2K}$

$i_D = 136\,mA$

B) WITH CONST VOLT DROP ... WE NEED A VOLTAGE "FORCING FUNCTION" > $V_D = 0.6V$

BUT IN THEV. CIRCUIT WE ONLY HAVE 0.3V!

SO DIODE IS REV BIASED!! $i_D = 0$.!

C) BIG DIFFERENCE .. IF 0.6 IS "ACCURATE" THEN B IS CORRECT AND A IS NOT

D) $i_D = 1 \times 10^{-15} e\left({}^{0.3}/_{25mV} - 1 \right)$

$i_D = 163\ pA \qquad V_d = 0.3V$

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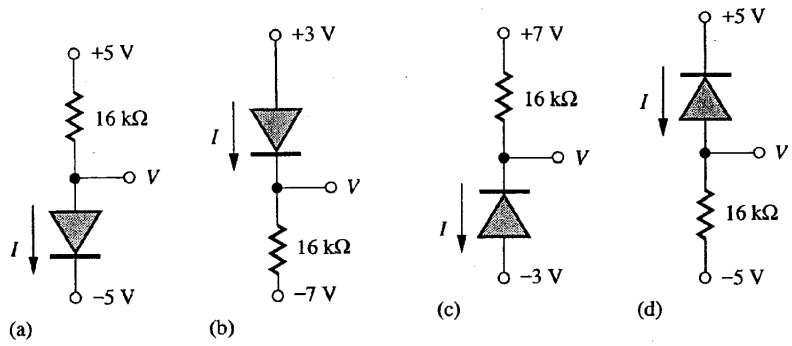

FIND: i & v FOR A) IDEAL MODEL B) CONST VOLT $V_D = 0.7V$

SOLN:

A) CIRCUIT BIASED "ON"

IDEAL: $V = -5V$ $\quad i = \frac{10}{16K} = 625\,mA$

CONST: $V = -4.3$ $\quad i = \frac{9.3}{16K} = 581\,mA$

B) CIRCUIT BIASED "ON"

IDEAL: $V = 3V$ $\quad i = \frac{10}{16K} = 625\,mA$

CONST: $V = 2.3V$ $\quad i = \frac{9.3}{16K} = 581\,mA$

C) CIRCUIT BIASED "OFF"

IDEAL: $V = 7V$ $\quad i = 0$

CONST: $V = 7V$ $\quad i = 0$

D) CIRCUIT BIASED "OFF"

IDEAL: $V = -5V$ $\quad i = 0$

CONST: $V = -5V$ $\quad i = 0$

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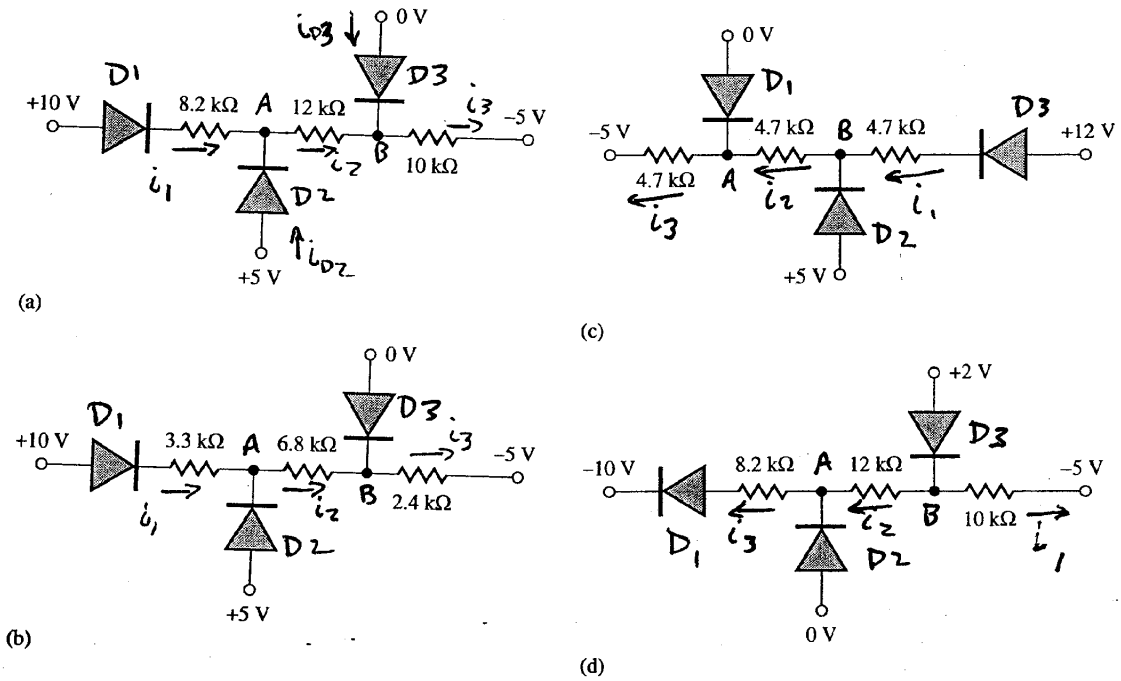
GIVEN:



FIND: Q USING IDEAL MODEL

SOLN: A) ASSUME ALL DIODES ARE ON...

$\therefore V_A = +5V \qquad V_B = 0V$

$i_1 = \frac{10-5}{8.2K} = 610mA \qquad i_2 = \frac{5-0}{12K} = 417mA$

$i_3 = \frac{0-(-5)}{10K} = 500mA$ KCL @ A WOULD YIELD $i_{D2} = -193mA$!

SO, D2 → OFF! D_1 ON D_3 ON

AND $i_1 = i_2 = \frac{10}{20.2K} = 495mA \qquad i_3 = 500mA$

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B) ASSUME D_1, D_2, D_3 ON

$\therefore \quad i_1 = \frac{10-5}{3.3} = 1.52\,mA \qquad i_2 = \frac{5}{6.8} = 735\,\mu A$

$i_3 = \frac{5}{2.4} = 2.08\,mA$ KCL @ A WOULD YIELD $i_{D2} = -780\,\mu A$!!

SO, D2 OFF

AND $i_1 = i_2 = \frac{10}{10.1K} = 991\,\mu A$

$i_3 = 2.08\,mA \qquad i_{D2} = 1.09\,mA$

C) ASSUME ALL DIODES ON...

$i_1 = \frac{12-5}{4.7} = 1.49\,mA$ KCL @ B WOULD YIELD $i_{D2} = -425\,\mu A$!!

$i_2 = \frac{5-0}{4.7} = 1.064\,mA$

$i_3 = \frac{5}{4.7} = 1.064\,mA$

SO, D2 OFF ... ASSUME D1 ON STILL

$i_1 = i_2 = \frac{12}{9.4} = 1.27\,mA$ KCL @ A WOULD YIELD $i_{D1} = -213\,\mu A$!

$i_3 = 1.064\,mA$

SO D_1 OFF ALSO ... ONLY D3 ON!

D) ASSUME ALL DIODES ON...

$$i_1 = \frac{2-(-5)}{10K} = 700\mu A$$

$$i_2 = \frac{2}{12K} = 167\mu A$$

$$i_3 = \frac{0-(-10)}{8.2} = 1.22mA$$

ALL DIODE CURRENTS ARE IN CORRECT DIRECTION

SO, ALL DIODES ON

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