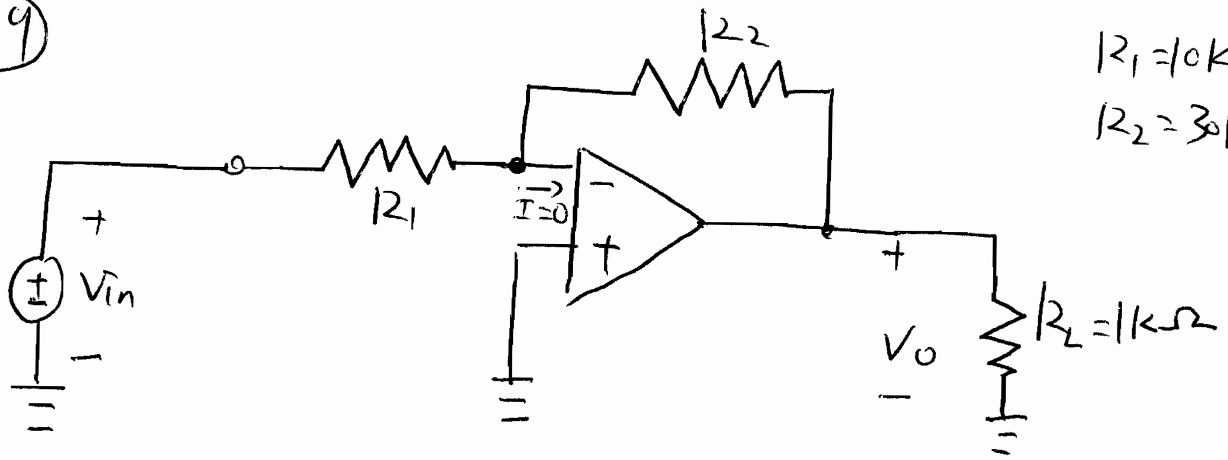
P14.9

$R_1 = 10k\Omega$
$R_2 = 30k\Omega$

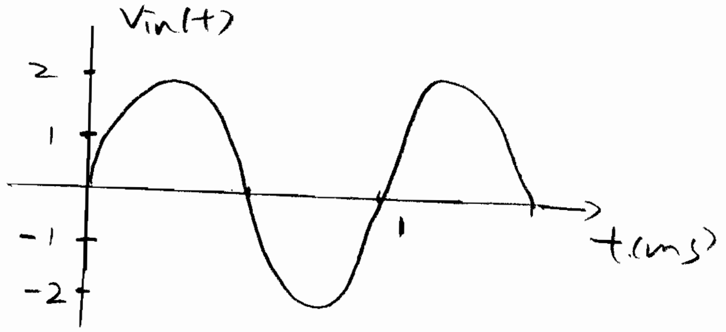


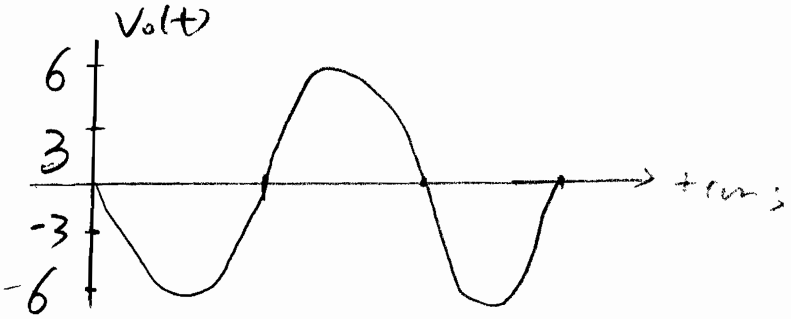
This is inverting amplifier. the voltage gain is given by:

$$A_v = \frac{-R_2}{R_1} = \frac{-30}{10} = \boxed{-3}$$

$V_{in}(t) = 2\sin(2000\pi t) \Rightarrow V_o(t) = -3\cdot[2\cdot\cos(2000\pi t)]$

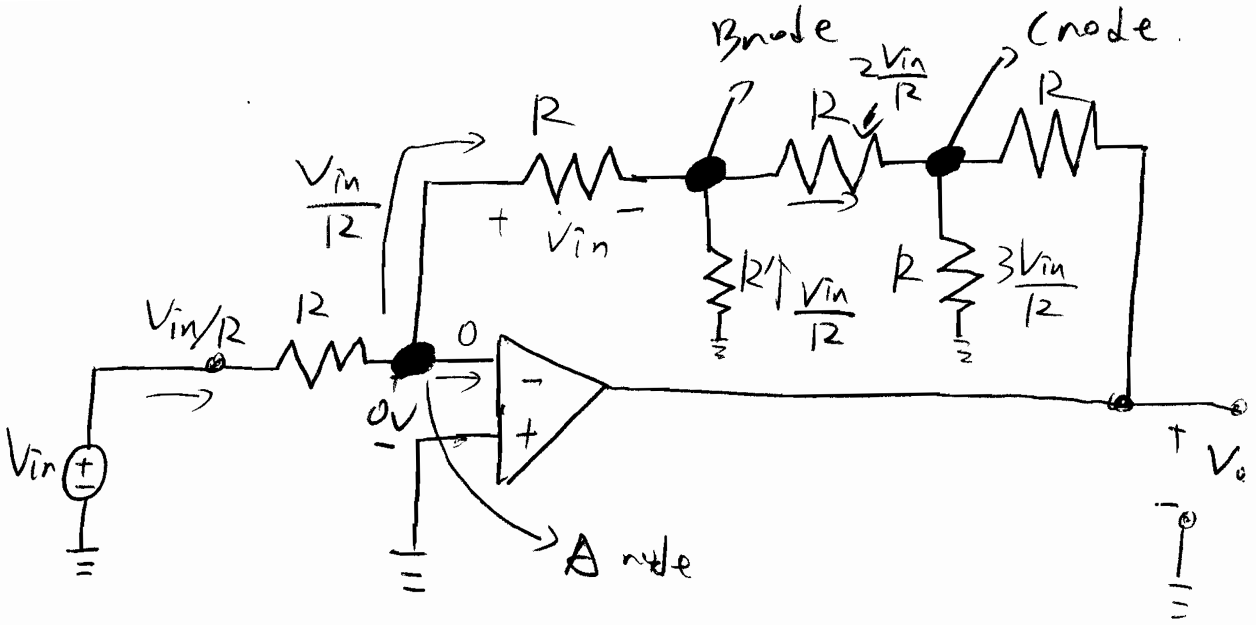
$= \boxed{-6\cdot\cos 2000\pi t}$





They are not drawn on scale!

P 14.10

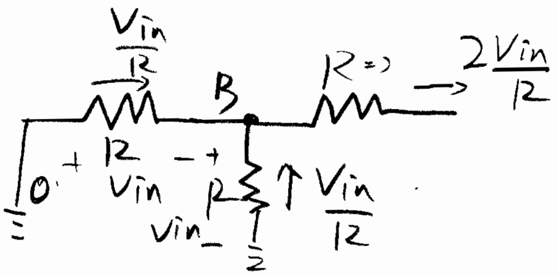


We can use KCL at each node to find the current.

At: **node A**: $I_A = \frac{V_{in} - 0}{R} = \frac{V_{in}}{R}$ voltage drop across $\mp$ terminals of Amplifier is 0V.

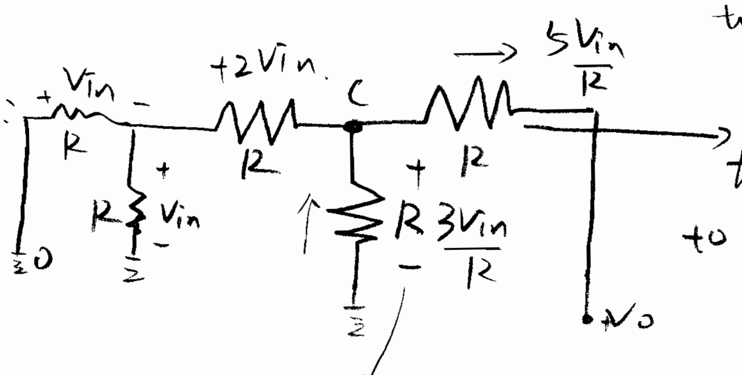
Since no current flow into amplifier, we have $\frac{V_{in}}{R}$ flows to the next R resistor:

node B:



summing constraint: same voltage drop seems across the two R resistors from node B.

node C:

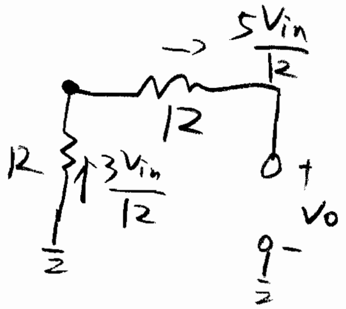


this resistor has current equal to $\frac{5V_{in}}{R}$.

this resistor has $3V_{in}$ voltage drop.

?14.10 continue:

use KVL at the Vo node:

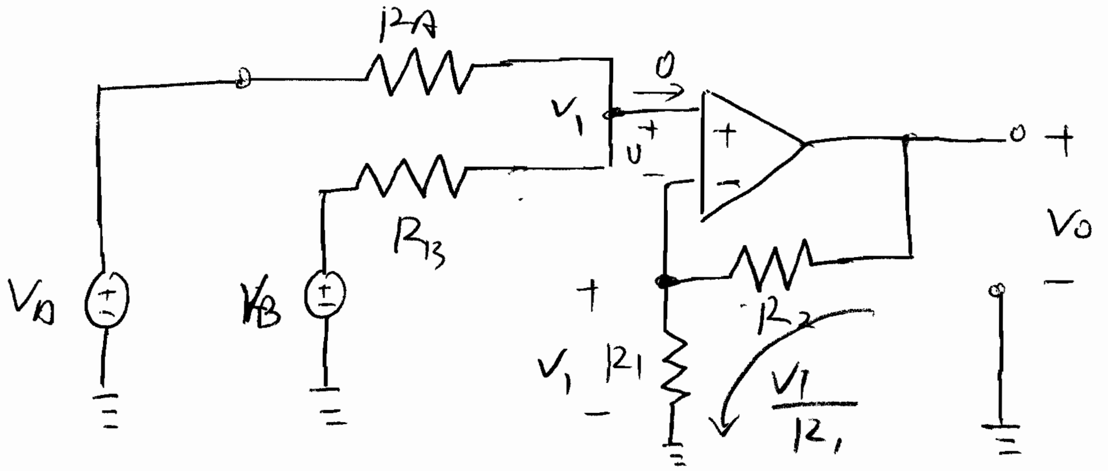


$\Rightarrow -V_o = 3V_{in} + 5V_{in}$

$V_o = -8V_{in}$

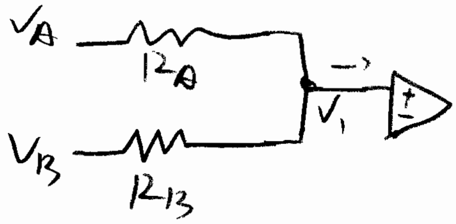
$$A_v = \frac{V_o}{V_{in}} = \boxed{-8}$$

P.14.21



Let us assume the voltage drop across $R_1 \Rightarrow V_1$, then the current flows through R_1 is $= \frac{V_1}{R_1}$

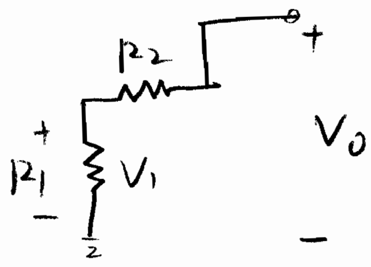
$\Rightarrow$ for KCL at the + input of amplifier.



$$\Rightarrow \frac{V_A - V_1}{R_A} + \frac{V_B - V_1}{R_B} = 0 \qquad (1)$$

$\Downarrow$

P.14.21 continue.



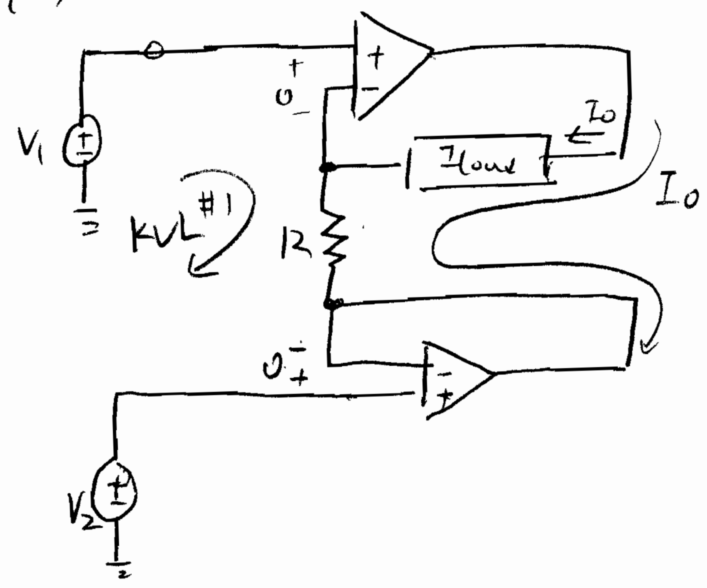
$$V_1 = \frac{V_o \cdot R_1}{R_1 + R_2} \qquad (2)$$

we then can substitute equation (1) into (2)

$$\boxed{V_o = \left(\frac{R_1 + R_2}{R_1}\right) \frac{V_A R_B + V_B R_A}{R_A + R_B}}$$

P14.23

(a)

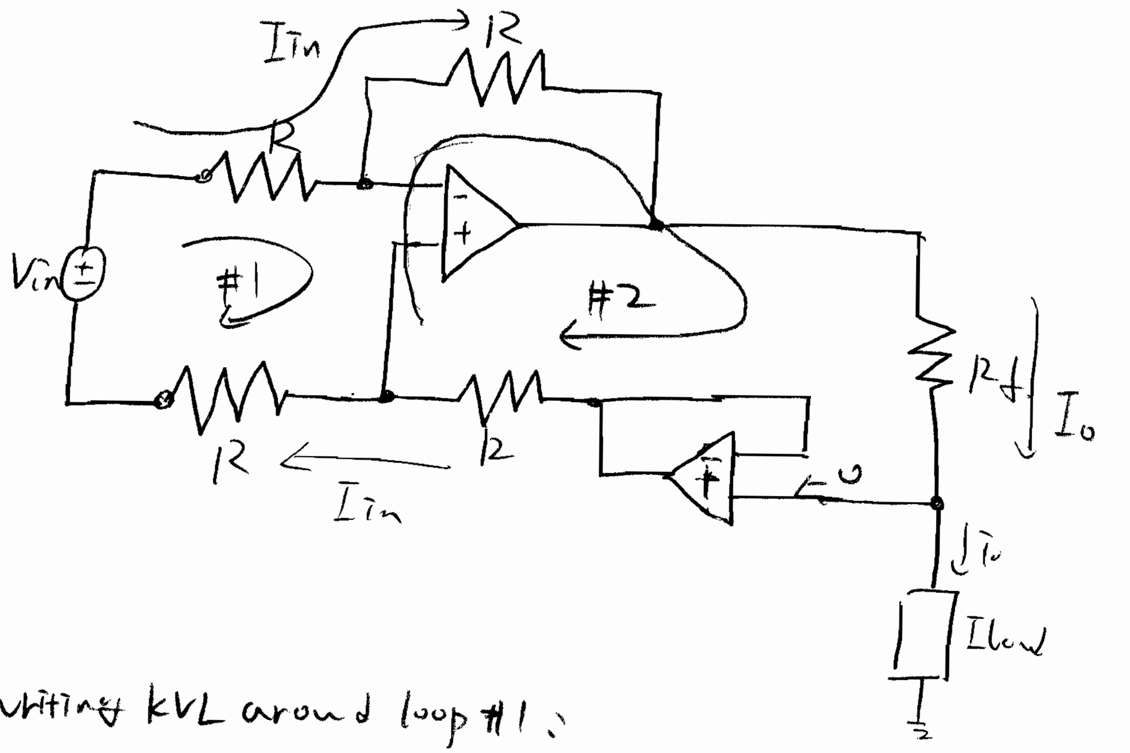


$V_1 = 0 + R I_o + 0 + V_2$ ⇒ write a KVL at mesh #1

$$\boxed{I_o = \frac{V_1 - V_2}{R}}$$

The Io is independent of Iload, so the output impedance is infinite

P14.23 (b)



writing KVL around loop #1:

$$V_{in} = RI_{in} + 0 + RI_{in} \rightarrow V_{in} = 2RI_{in}$$

writing KVL around loop #2:

$$RI_{in} + R_f I_o + RI_{in} = 0$$

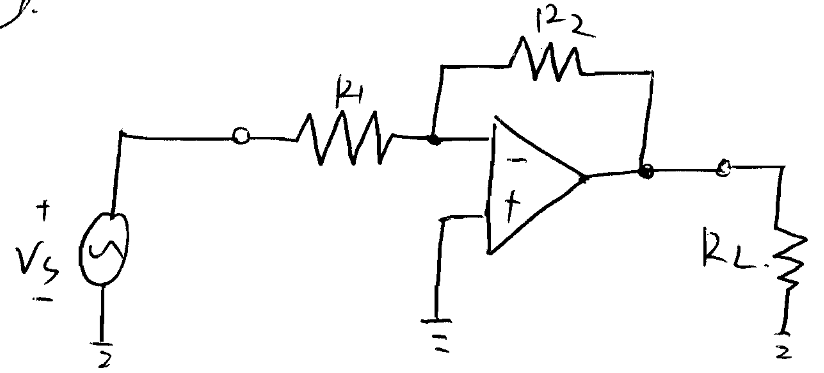
$$\Rightarrow \quad V_{in} + R_f I_o = 0$$

$$\boxed{I_o = -\frac{V_{in}}{R_f}}$$

I_o is independent of the load, so the output impedance is infinite.

P14.27

(a).



(a) inverting amplifier.

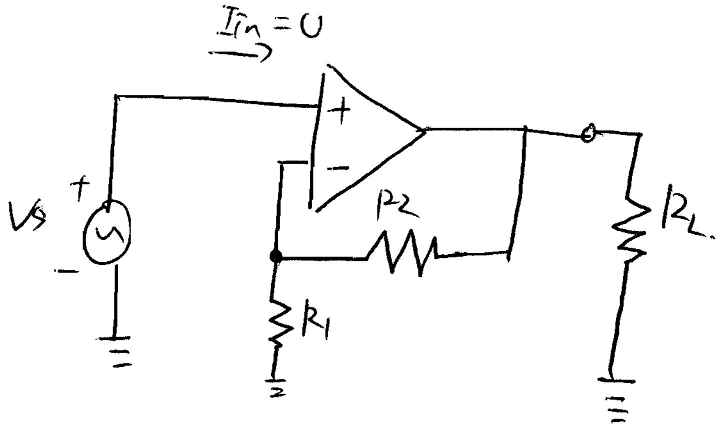
$$A_V = \frac{-R_2}{R_1} \Rightarrow R_{in} = R_1.$$

input power: $P_{input} = \frac{V_s^2}{R_{in}} = \boxed{\frac{V_s^2}{R_1}}$

output power: $P_o = \boxed{\frac{V_o^2}{R_L}}$

the power gain G: $\frac{P_o}{P_{in}} = \frac{V_o^2/R_L}{V_s^2/R_1} = A_V^2 \frac{R_1}{R_L} = \boxed{\frac{R_2^2}{R_1 R_L}}$

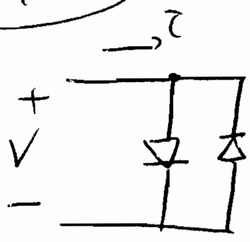
(b)



This is a noninverting amplifier.

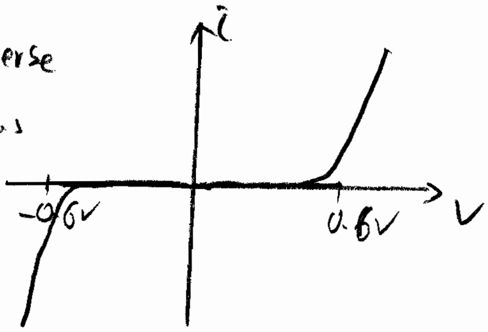
$\boxed{I_{in} = 0}$. Therefore $\boxed{P_{in} = 0}$ and $\boxed{G = \infty}$

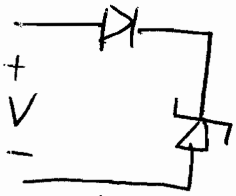
P. 10. 6.



(a).

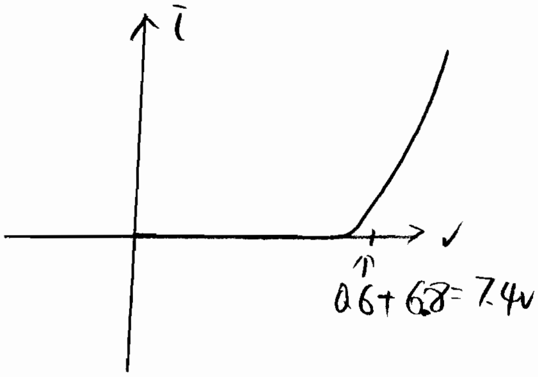
one diode in forward bias region.
Another one is in reverse bias region as Vbias is sweeping

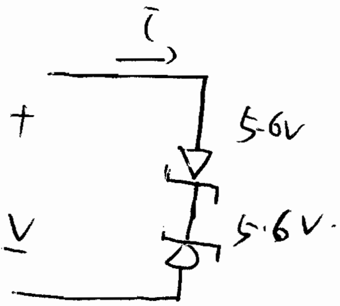


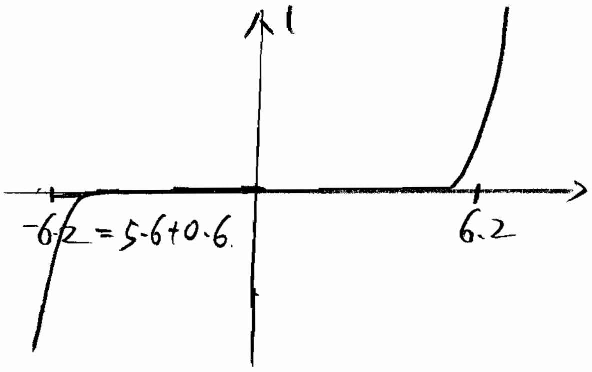


(b)

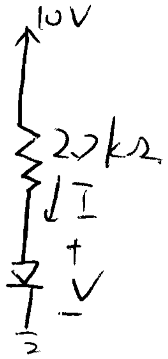
The zener diode is operated as constant-voltage in reverse-breakdown region.



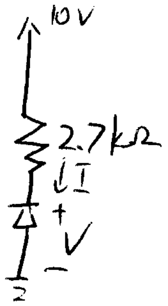




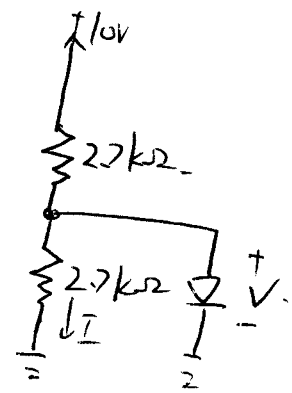
P10.36



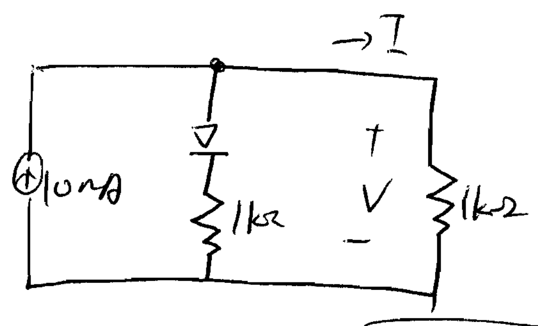
(a) The diode is on, $\boxed{V=0}$ and $I = \frac{10}{2700} = \boxed{3.70\text{ mA}}$.



(b) The diode is off, $\boxed{V = 10\text{ V}}$ and $\boxed{I = 0}$

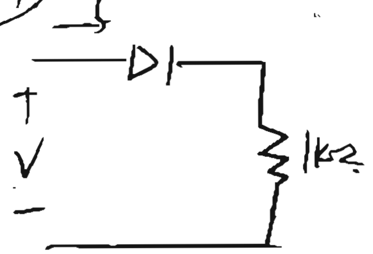


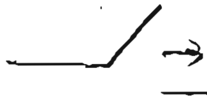
(c) The diode is on, $\boxed{V=0}$ and $\boxed{I=0}$.

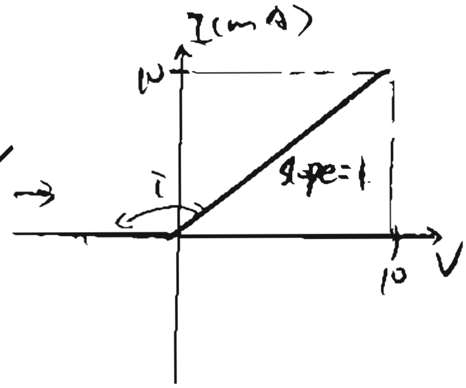


(d) The diode is on. $\boxed{I=5\text{ mA}}$ and $\boxed{V=5\text{ V}}$

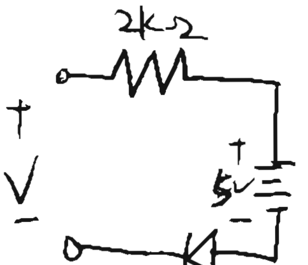
P10.39

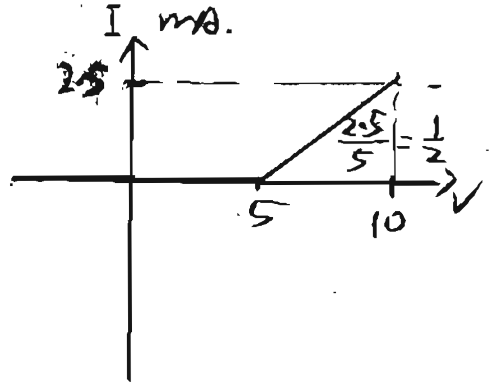






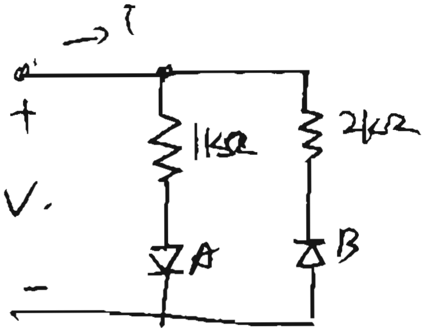
(a)

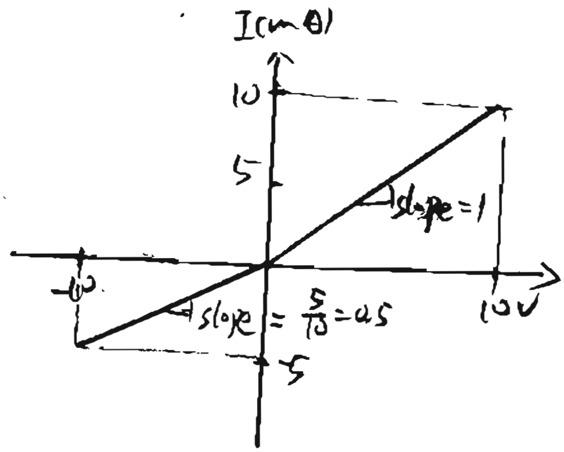




(b)

replace the diode with a voltage source and resistor.





(c).