

1. For the circuit in Fig. 1, given the diode is ideal.

- Determine the state of the diode.
 - If you conclude the diode is on, provide the diode current (I_D).
 - If you conclude the diode is off, provide the diode voltage (V_D);

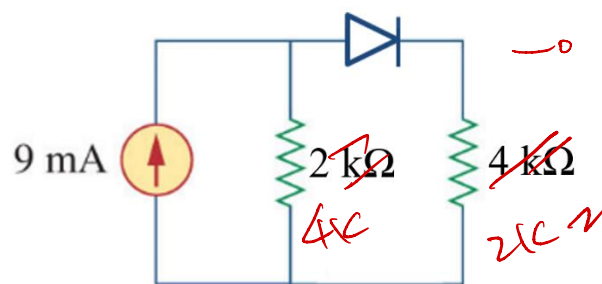


Fig. 1

- Hence, the voltage across the 2 kΩ resistor.
- Rework part (a) and (b) again if the 2 kΩ and 4 kΩ resistors are interchanged, and the diode has an offset voltage of 0.6V.

Justify all your answers.

Answer: (a) Diode is ON, $I_D = 3\text{ mA}$ (b) $V_{2k} = 12\text{ V}$ (c) Diode is ON, $I_D = 5.9\text{ mA}$, $V_{2k} = 11.8\text{ V}$

2. For the circuit on the in Fig 2, given that the diode has an offset voltage of 0.6V:

- Determine the state of the diode
- Find the power consumed by the diode

Justify you answers.

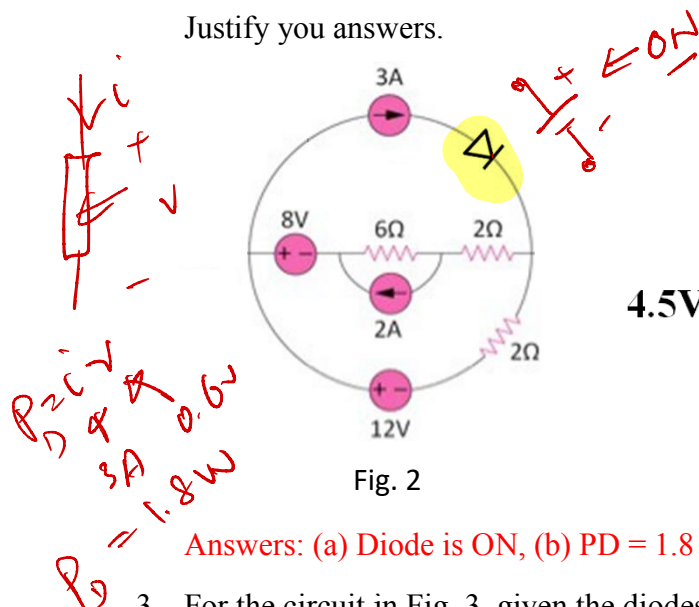


Fig. 2

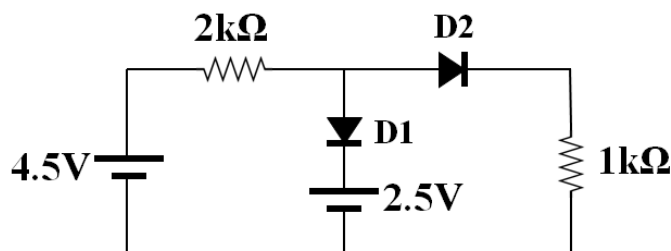


Fig. 3

Answers: (a) Diode is ON, (b) $P_D = 1.8\text{ W}$

3. For the circuit in Fig. 3, given the diodes is ideal.

- Determine the state of diode D1 and D2.
- If the diode (D1 or D2) is ON, determine its corresponding forward bias current. Otherwise, determine its corresponding reverse voltage bias.

Answers: (a) D1 is OFF and D2 is ON (b) $V_{D1} = -1\text{ V}$ and $I_{D2} = 1.5\text{ mA}$

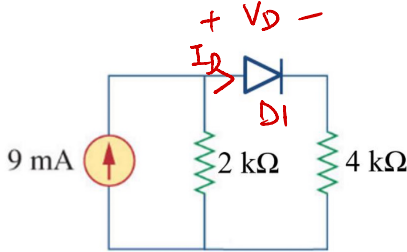


Fig. 1

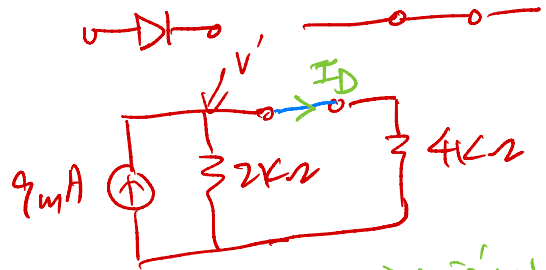
current divider

$$I_D = (9) \frac{2}{2+4}$$

$$= \frac{9 \times 2}{6} = 3 \text{ mA} > 0$$

Conclusion: D_1 is 'ON'

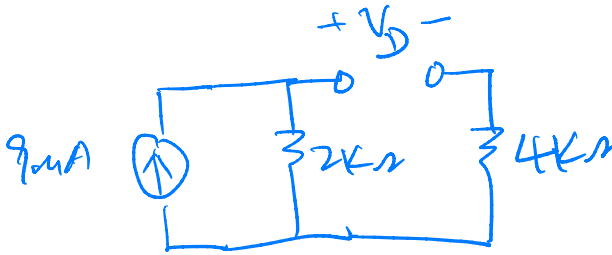
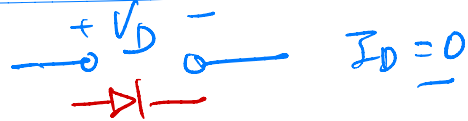
assume D_1 is 'ON'



if $I_D \geq 0$, D_1 is 'ON'
 $I_D < 0$, D_1 should be OFF

$$V' = (9)(2/4) = \frac{9 \times 2}{2} = 9 \text{ V}$$

assume D_1 is 'OFF'



$$V_D = V_+ - V_- = 18 \text{ V}$$

$$\uparrow \quad \uparrow \quad \geq 0$$

$$(9)(2) = 18 \text{ V}$$

conclusion = the assumption of D_1 is 'ON' is contradictory to the result.

$$\because V_D = 18 \text{ V} > 0 \Rightarrow \text{'ON'}$$

$\Rightarrow D_1$ must be 'ON'

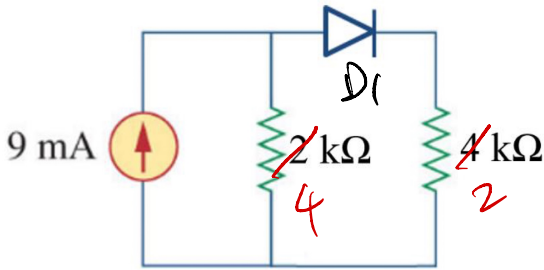
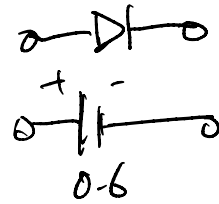
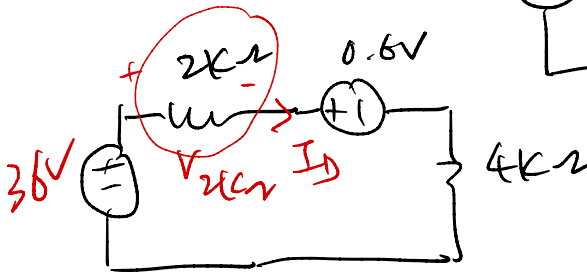
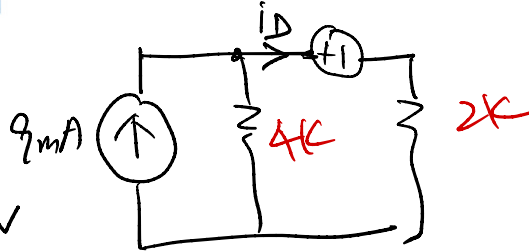


Fig. 1



assume the D_1 is 'ON'



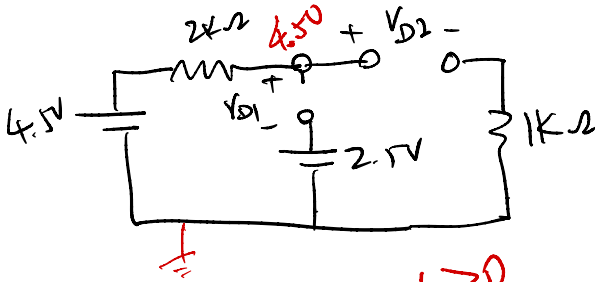
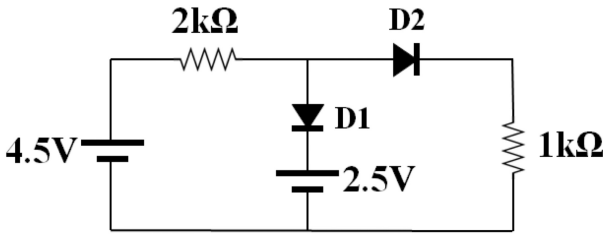
$$I_D = \frac{36 - 0.6}{2 + 4}$$

$$= 5.9 \text{ mA} > 0$$

conclusion: D_1 should be 'ON'
because $I_D > 0$

$$V_{2k} = (I_D)(2k)$$

$$= (5.9)(2k) = 11.8 \text{ V}$$



$$V_{D1} = 4.5 - 2.5 = 2V > 0$$

$$\Rightarrow \text{'ON'} \times$$

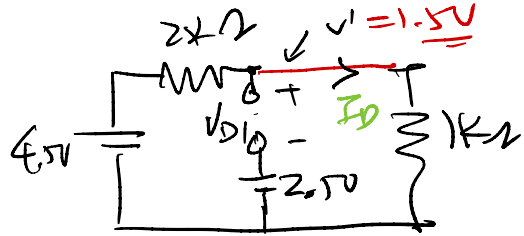
$$V_{D2} = 4.5 - 0 = 4.5 > 0$$

$$\Rightarrow \text{'ON'} \times$$

X

→

assume		actual	
D1	D2	D1	D2
OFF	OFF	ON' X	ON' X
OFF	ON	OFF' ✓	ON' ✓
ON	OFF		
ON	ON		



$$V' = 4.5 \frac{1}{2k + 1k}$$

$$= 1.5V$$

$$V_{D1} = 1.5 - 2.5$$

$$= -1V < 0$$

$$\Rightarrow \text{'OFF'}$$

$$I_D = \frac{4.5}{2k + 1k} = 1.5mA$$

$$> 0$$