3.1

The diode can be reverse-biased and thus no current would flow, or forward-biased where current would flow.

(a) Reverse biased \( I = 0 \text{A} \) \( V_D = 1.5 \text{V} \)
(b) Forward biased \( I = 1.5 \text{A} \) \( V_D = 0 \text{V} \)

3.2

(a) Diode is conducting and thus has a 0V drop across it. Consequently

\[
V = -3 \text{V}
\]

\[
I = \frac{3 - (-3)}{10k\Omega} = 0.6 \text{mA}
\]

(b) Diode is cut off.

\[ V = 3 \text{V} \quad I = 0 \text{A} \]

(c) Diode is conducting

\[ V = 3 \text{V} \]

\[
I = \frac{3 - (-3)}{10k\Omega} = 0.6 \text{mA}
\]

(d) Diode is cut off.

\[ V = -3 \text{V} \quad I = 0 \text{A} \]

3.3

(a) \[ V = 3 \text{V} \]

\[ I = \frac{3 - (-3)}{2k\Omega} = 3 \text{mA} \]

(b) \[ V = 1 \text{V} \]

\[ I = \frac{3 - (-1)}{2} = 1 \text{mA} \]

3.6

<table>
<thead>
<tr>
<th>A</th>
<th>B</th>
<th>x</th>
<th>y</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
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<tr>
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<tr>
<td>1</td>
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</tbody>
</table>

\[ x = A \oplus B \]

- \( x \) and \( y \) are the same for \( A = B \)
- \( x \) and \( y \) are opposite if \( A \neq B \]
### 3.7

\[
\frac{5 - 0}{R} \leq 0.1 \text{mA}
\]

\[R \geq \frac{5}{0.1} = 50 \text{ k}\Omega\]

### 3.9

(a) \[I = \frac{1}{2} \text{mA}\]

(b) \[I = 0 \text{mA} \quad \text{D1 cut off, D2 conducting}\]

\[V = -5 + \frac{2}{3} (5) = -\frac{5}{3} \text{V}\]

\[V = 4.5 \text{V}\]

\[\frac{2}{10} = 0.225 \text{mA}\]

\[V = \frac{20}{(10+10)} + 2 \times 6 = 4.5 \text{V}\]

### 3.16

V | RED | GREEN
---|-----|-------
3V | ON  | OFF
0  | OFF | OFF
-3V| OFF | ON

- D1 conducts
- No current flows
- D2 conducts