**Chapter 2: Diode Applications**

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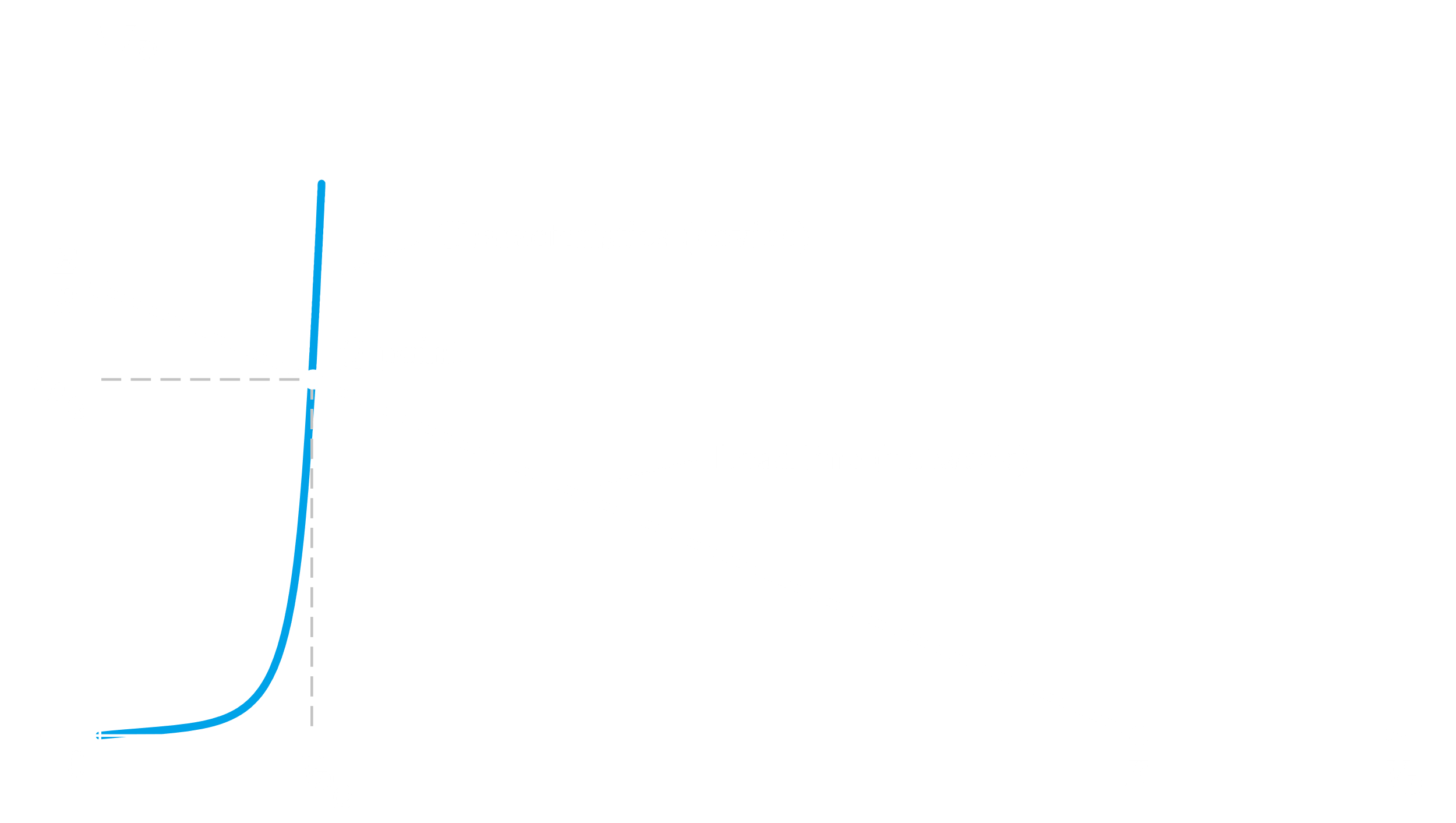
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## 2.2 Load-Line Analysis

Diodes can be analysed using either its actual characteristics or by applying an approximate model for the device. Load-line analysis is done to analyse a diode circuit using its actual characteristics.

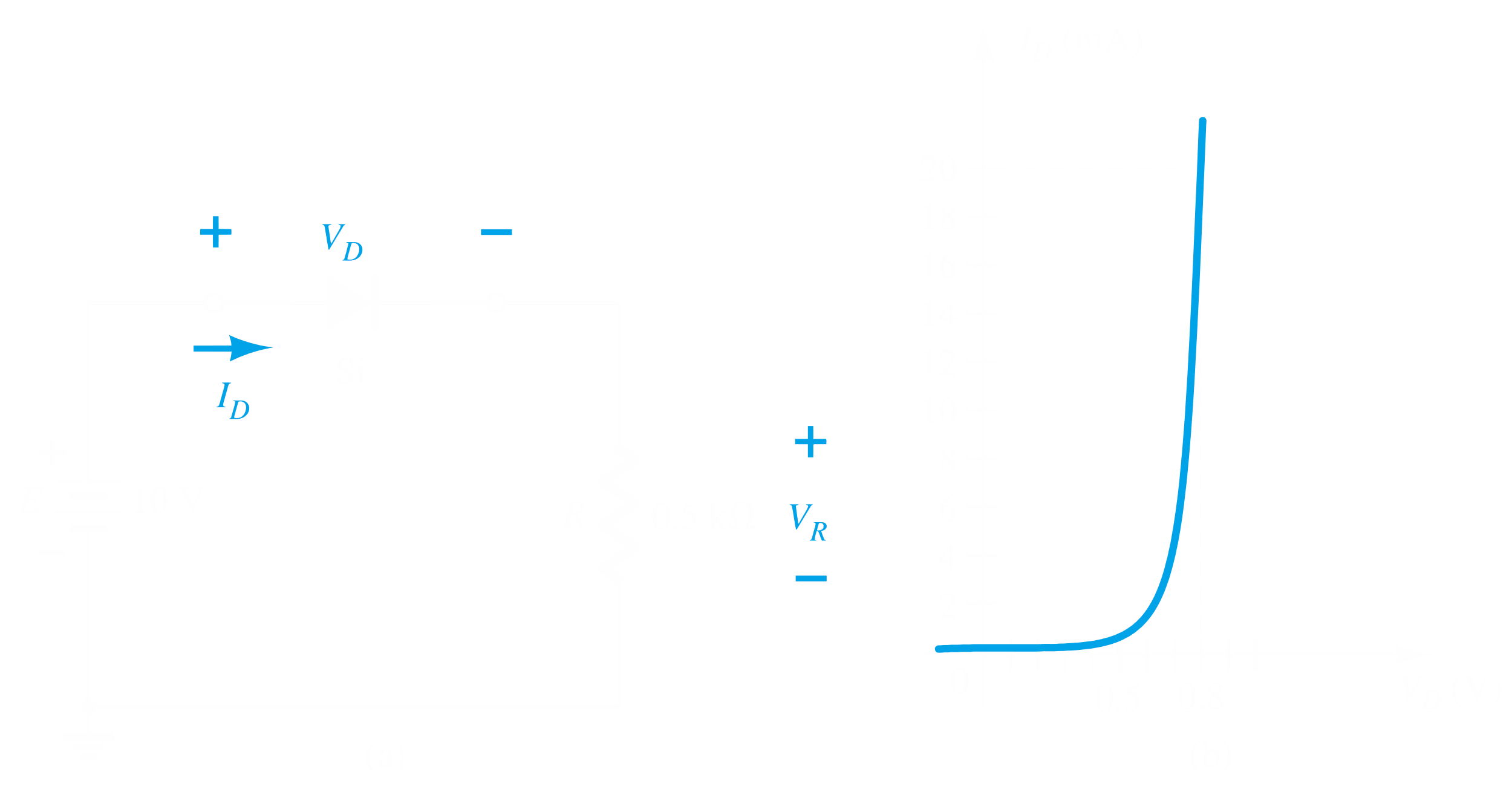


The parameters of the network being used will define a straight line that intercepts the vertical axis at . This line is called the load line, since it depends on . Putting this line on the same axis as the characteristic curve of the diode we get:



The point at which the load line intersects the curve is known as the Q-point, and this is the optimal operating point. We should attempt to create a circuit that places the Q-point at a linear place of the curve. From here, we can calculate the values of and for a particular diode in a given circuit.

Consider Example 2.1:



According to Kirchoff’s voltage law,

If , . If ,

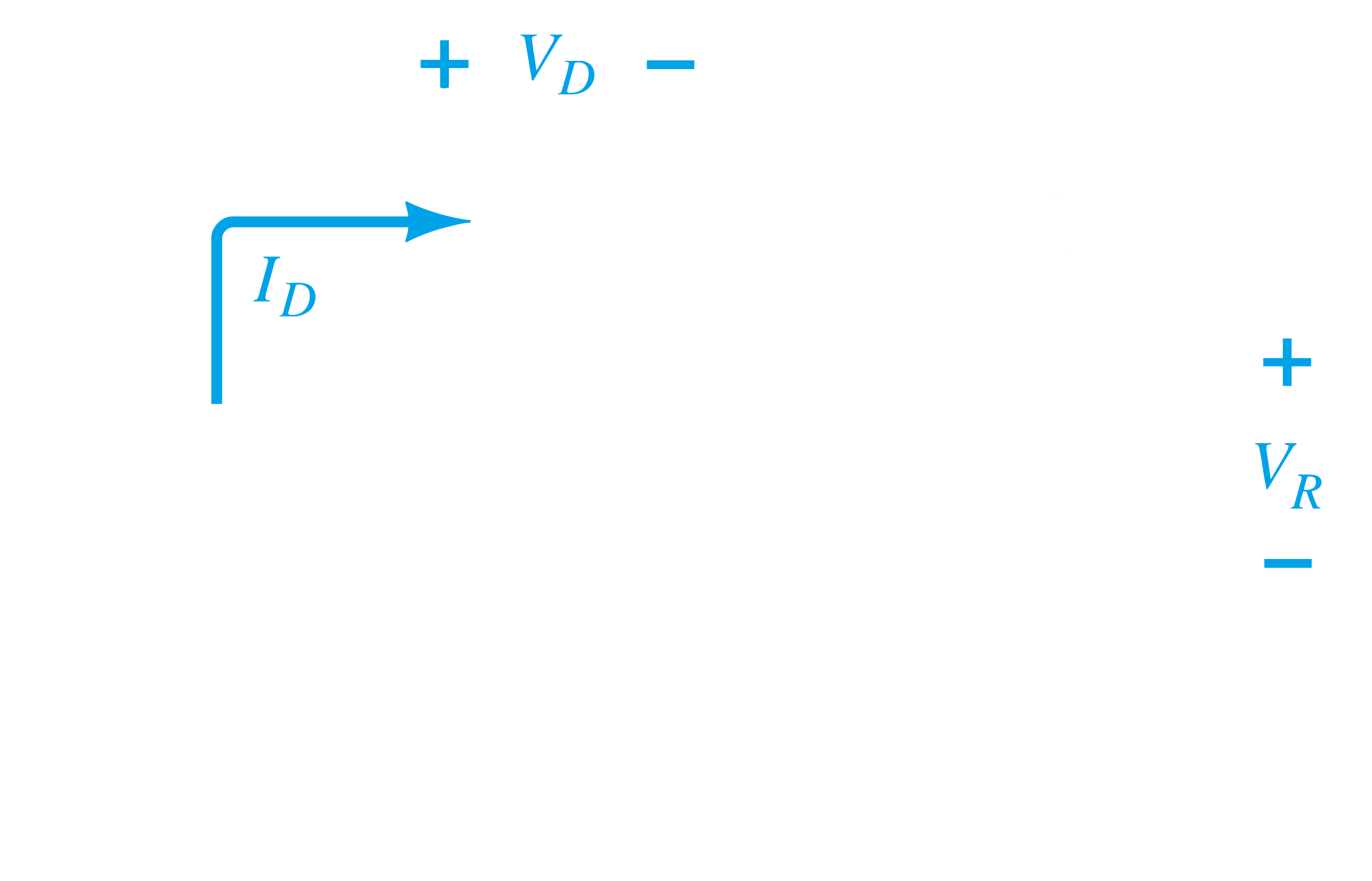
If we plot this line over the curve, we get a Q-point at , .

From there,

## 2.3 Series Diode Configurations

If the material for the diode is not given, assume that it is Silicon. Si has an operating voltage of . Germanium is an operating voltage of . If any other material is used, the voltage will be given.

Example 2.4

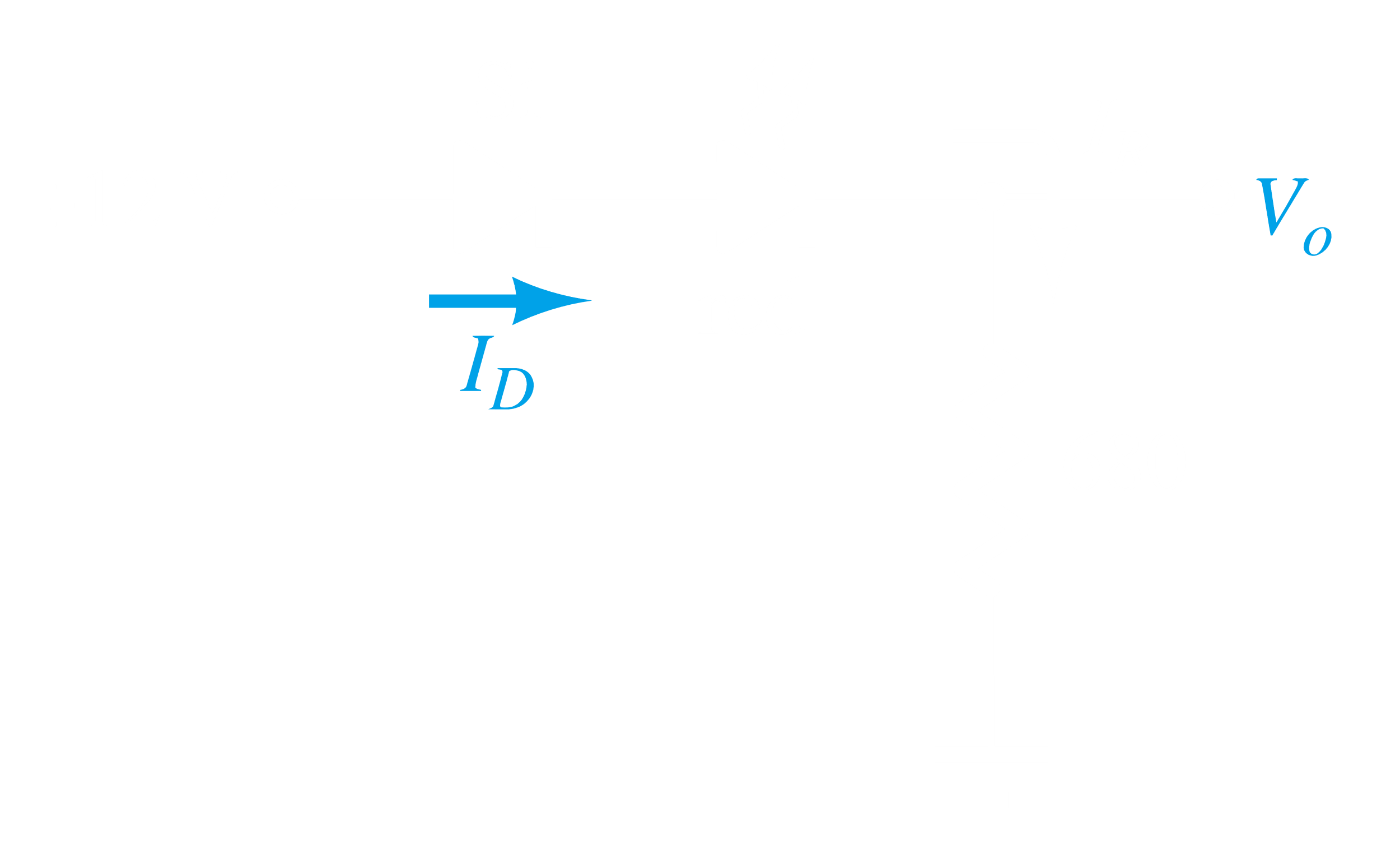


Here, since is higher than the forward bias voltage of a Silicon diode, the circuit will work.

Since ,

If the diode were flipped, it would act like an open circuit.

Example 2.7



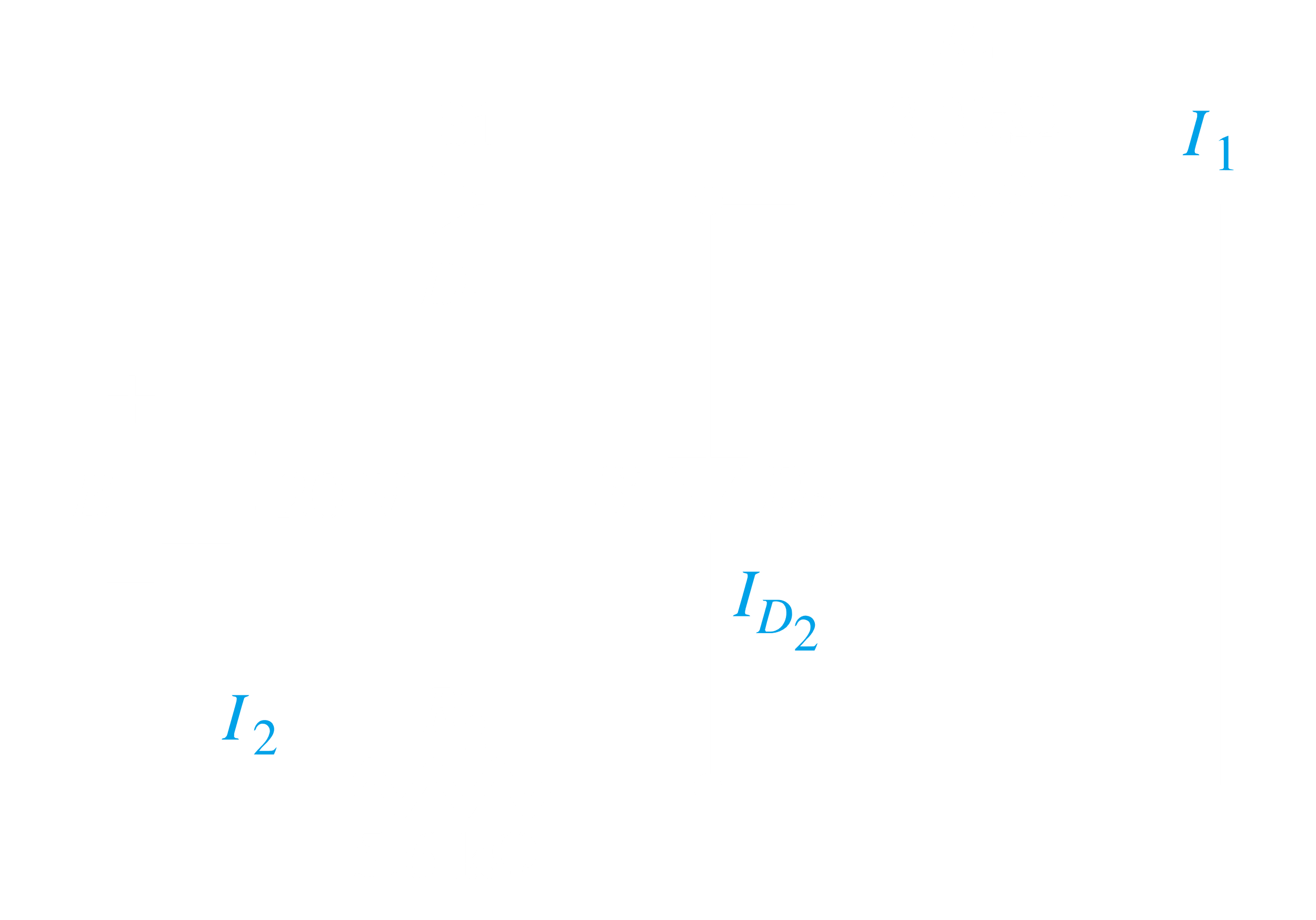
The forward bias voltage of the red LED is given as 1.8V.

Thus,

## 2.4 Parallel and Series-Parallel Diode Configurations

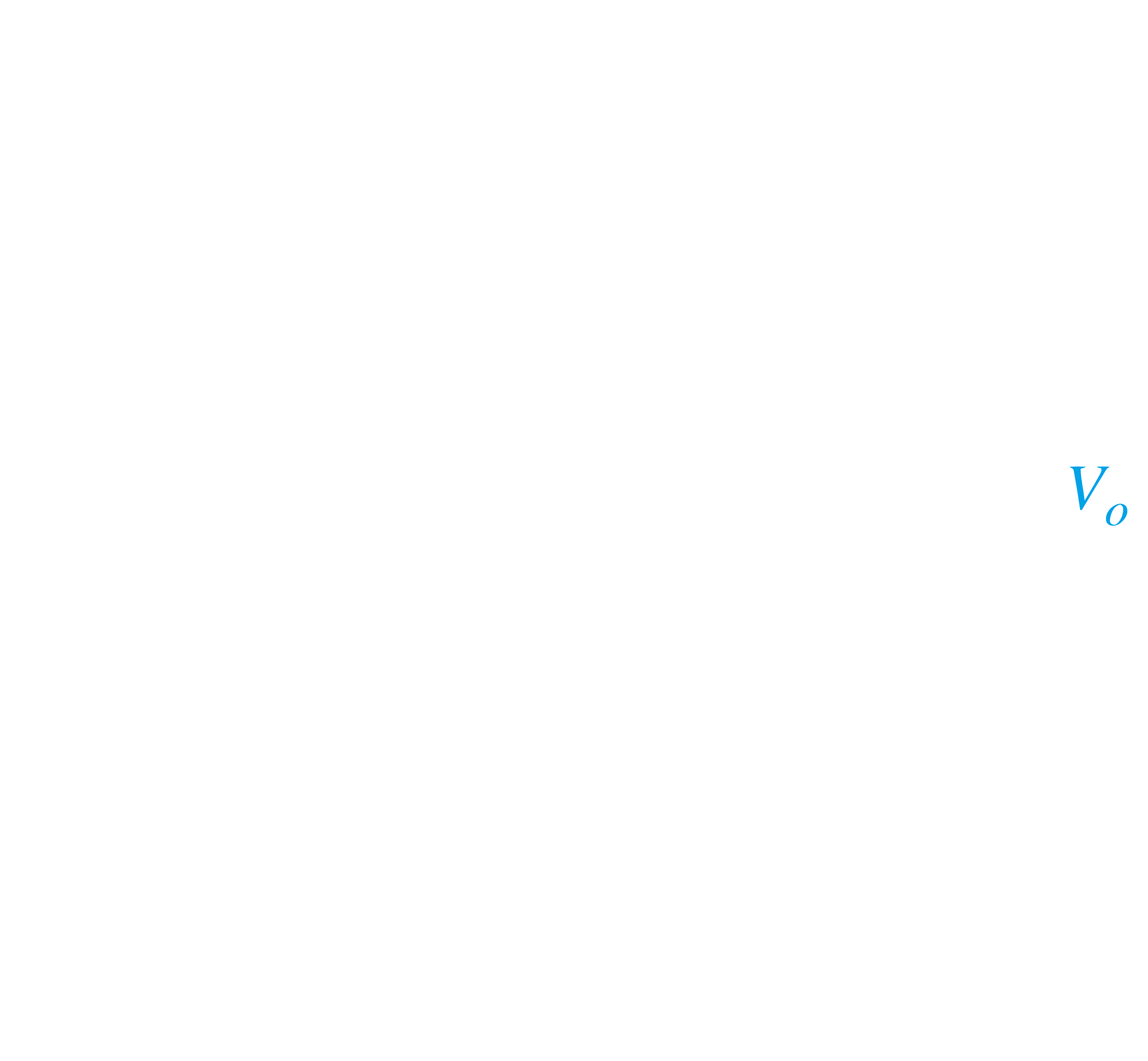
Always remember that the voltage drop across a diode is , given that the diode is made of silicon.

Example 2.13



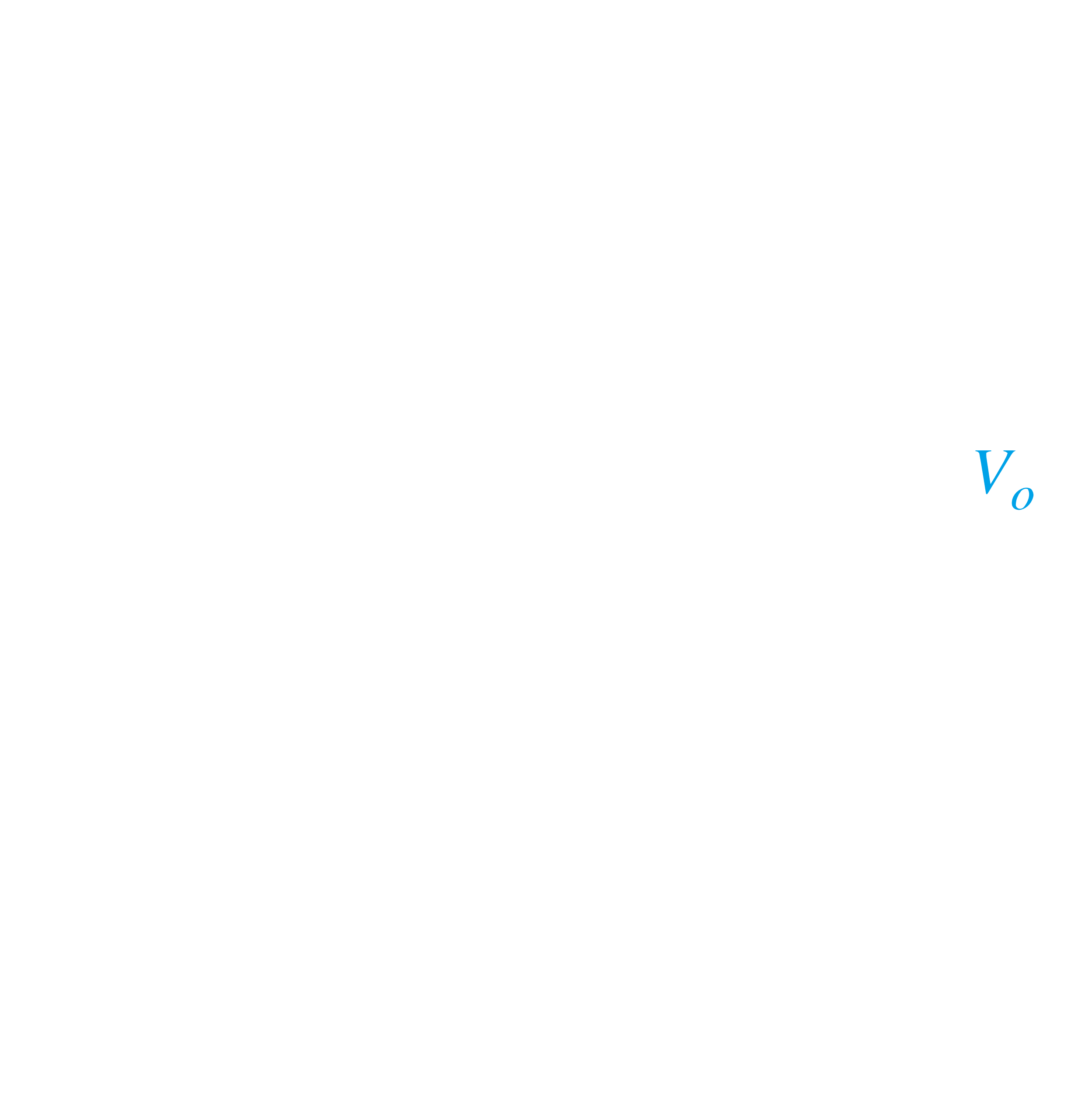
## 2.5 AND/OR Gates

Example 2.14



This is an example of an OR gate configuration. We assume that each diode only takes away . Thus, after crossing D1, 9.3V are left that are equally sent to and . Nothing goes to D2, since it has the incorrect orientation.

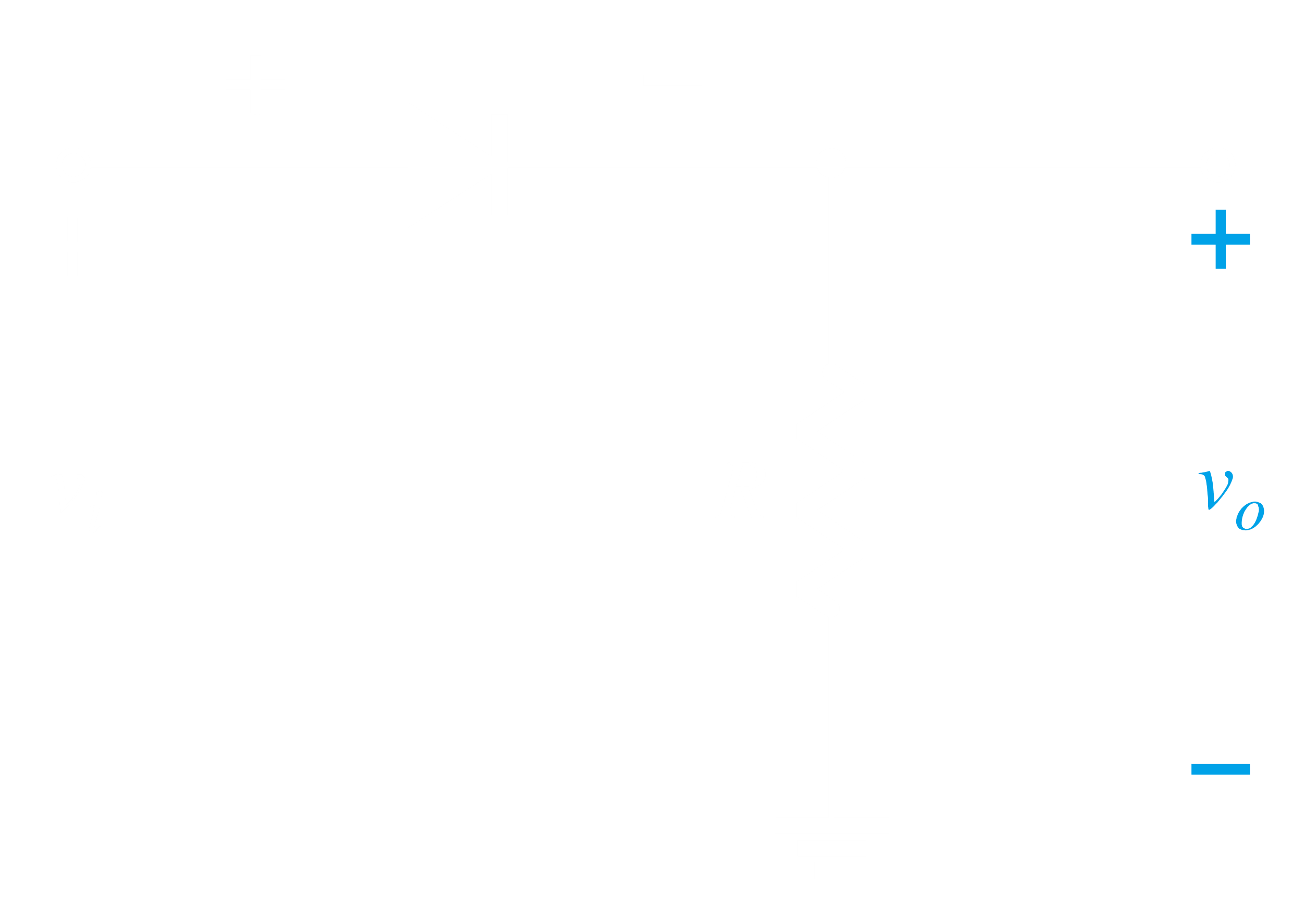
Example 2.15

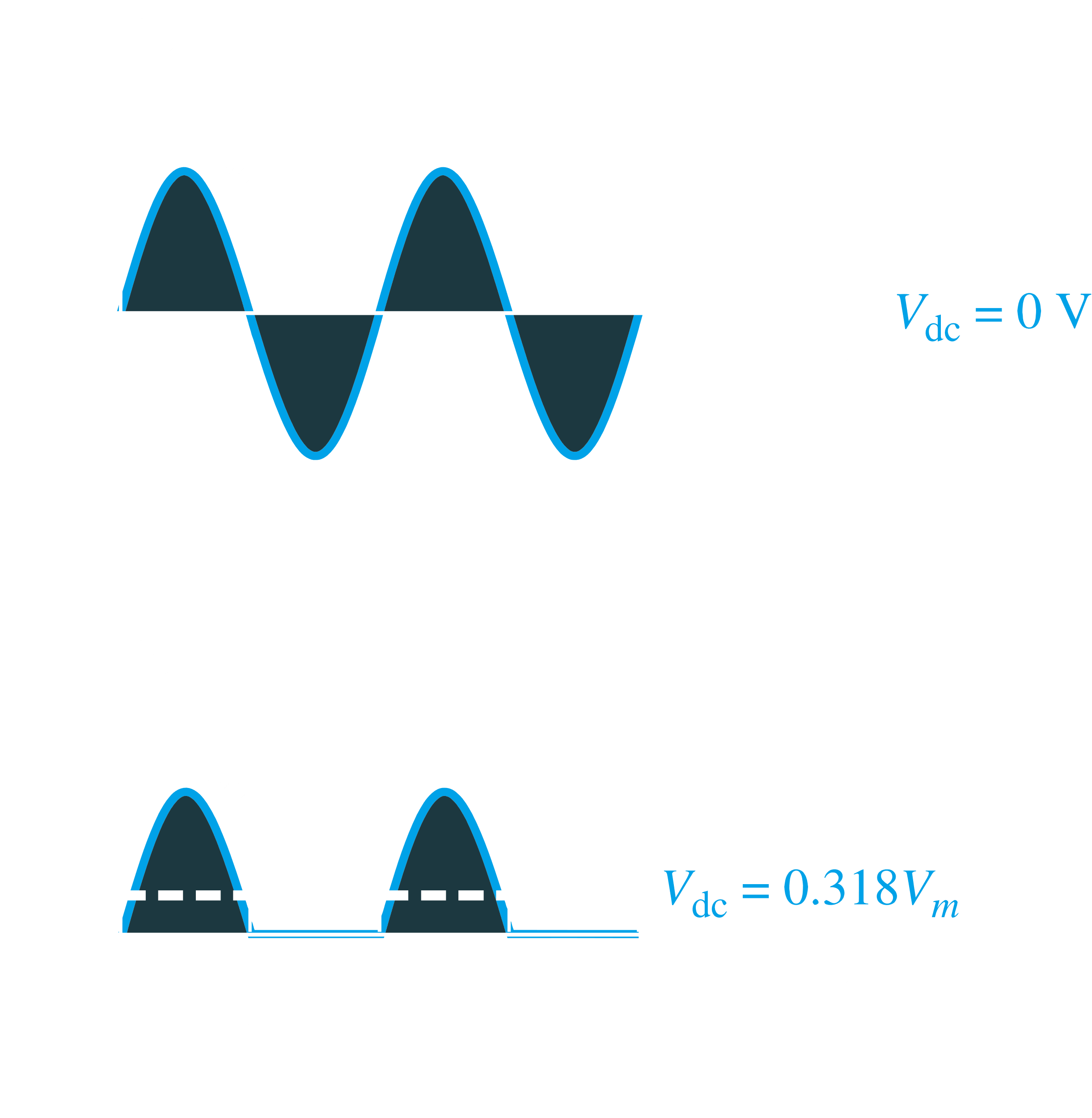


This is the configuration for an AND gate. is at the same voltage (or probably higher) than , so no current goes in that direction. is at , so the entirety of the 10 volts is dropped between and . We are assuming only takes up , so the rest is dropped at . Since is a point beyond , it also gets , the same as . Thus, we consider that is at the off state. If both and had been at , no voltage would be dropped at and , and whatever voltage was left after crossing would go to .

## 2.6 Half Wave Rectification

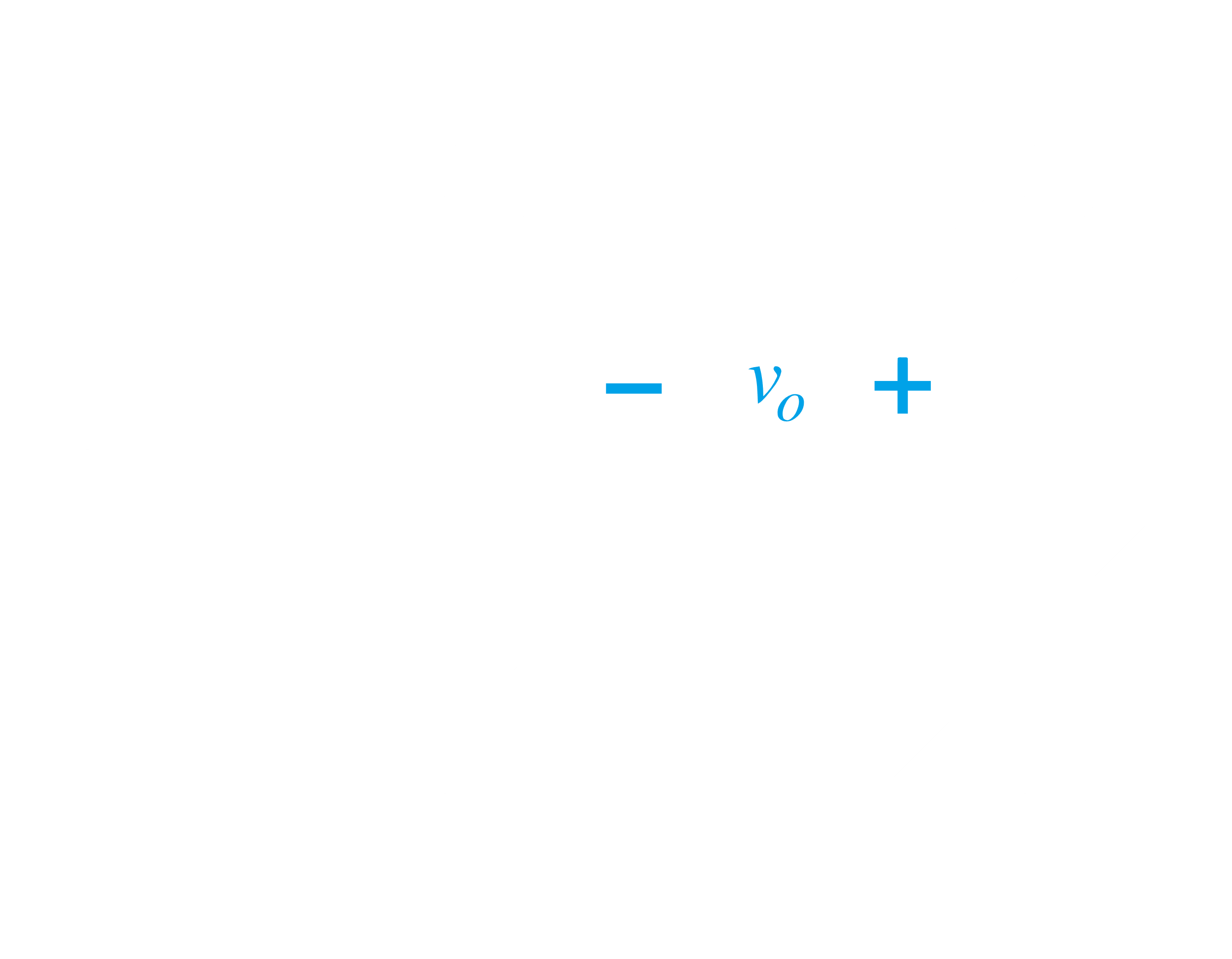
Since a diode only allows movement of current in one direction, a simple circuit with a diode can create a half-wave rectifier. In this process, one half of the original signal is removed.



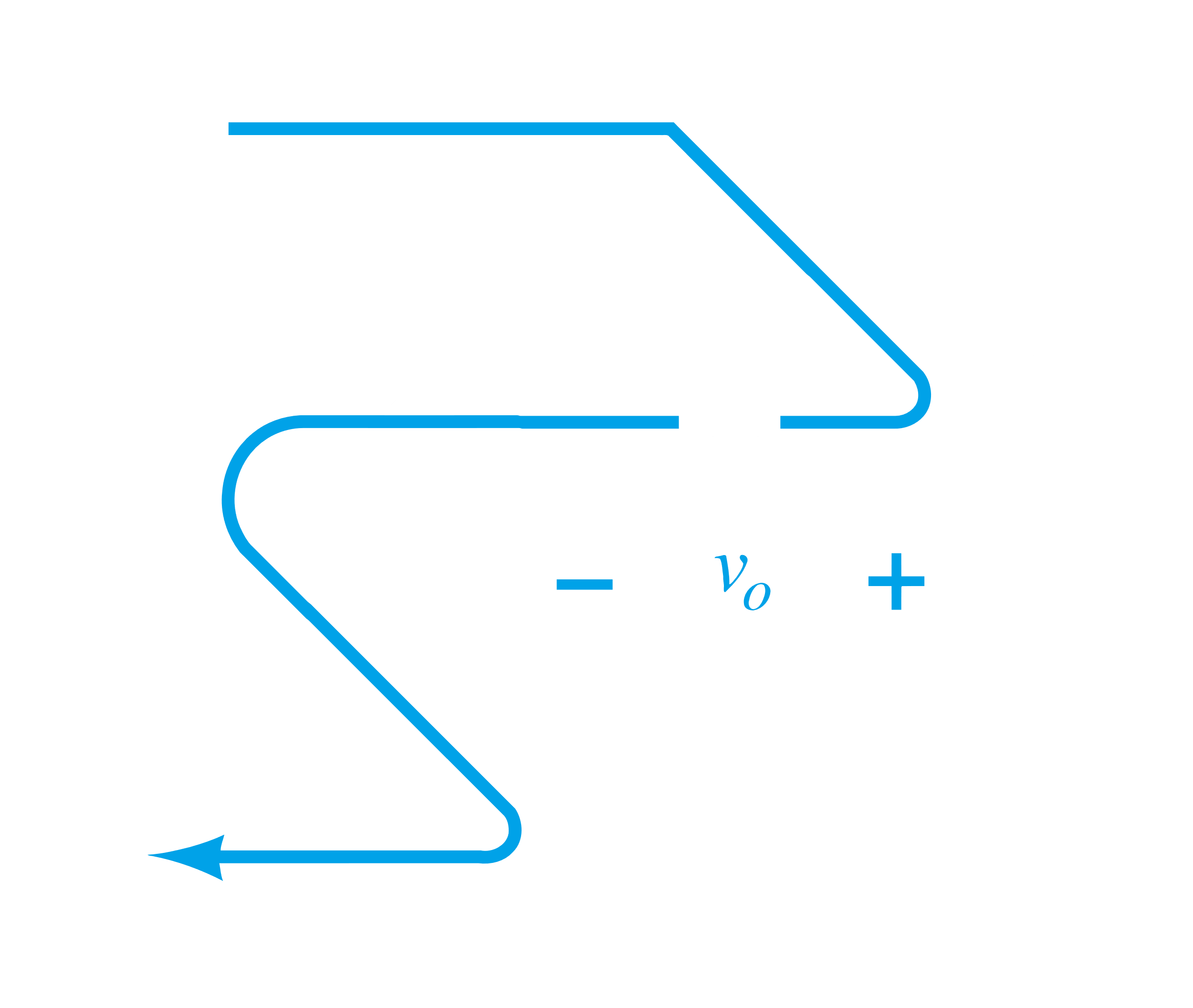


## 2.7 Full Wave Rectifier

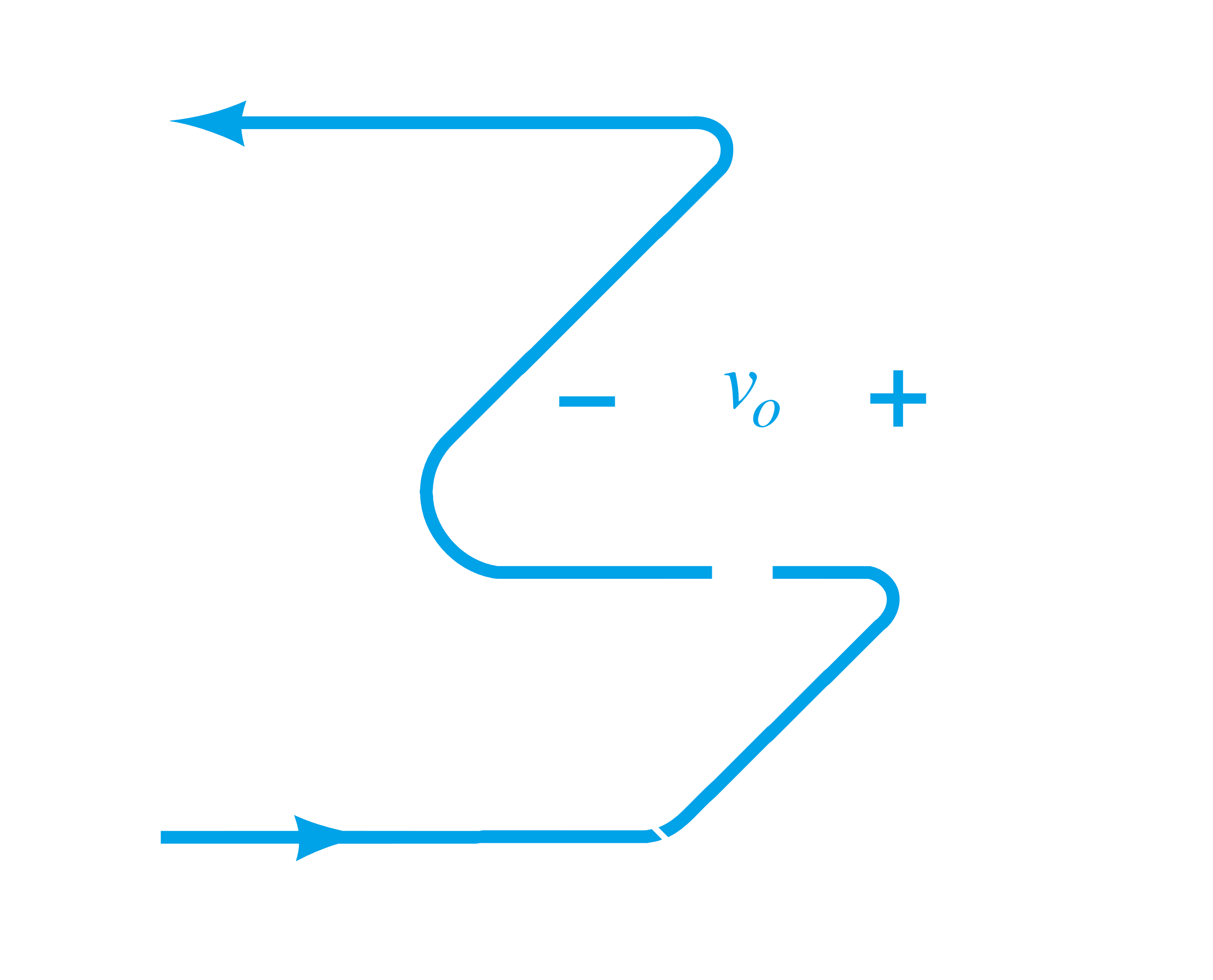
To create a full wave rectifier, we must use a bridge network with four diodes.



Thus, during the time period in which the voltage is positive, the current flows like this:



And during the time period for which voltage is negative, the current flows like this:



The overall voltage across the resistor is thus:

