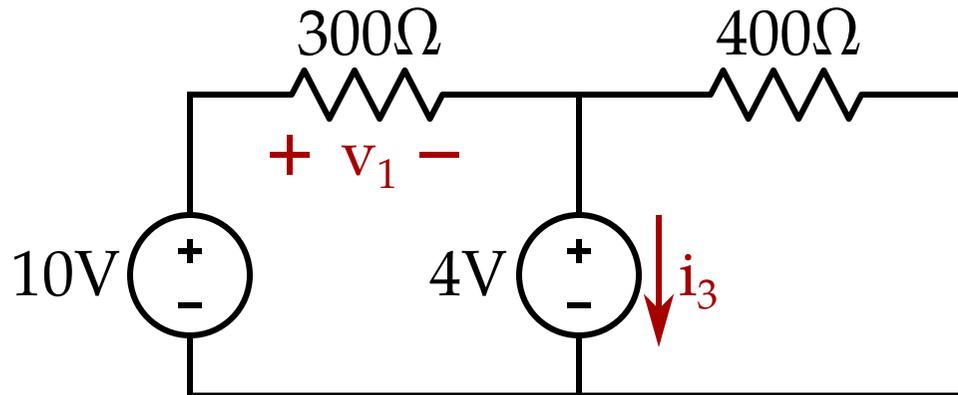


What is the voltage V_1 and the current i_3 ?



Submit your answer on **menti.com** with code **85 57 1**

ENGR 40M, Lecture 4:

Diodes and solar cells

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3 July 2016

Stanford University

By the end of today, you should be able to:

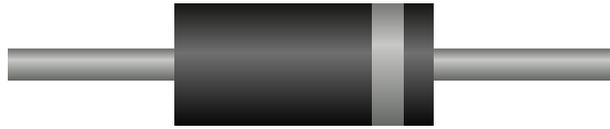
Find currents and voltages in a circuit containing **current sources** and **diodes**

Model a solar cell using a current source in parallel with a diode

Explain how **multiple solar cells** are used to build a solar panel

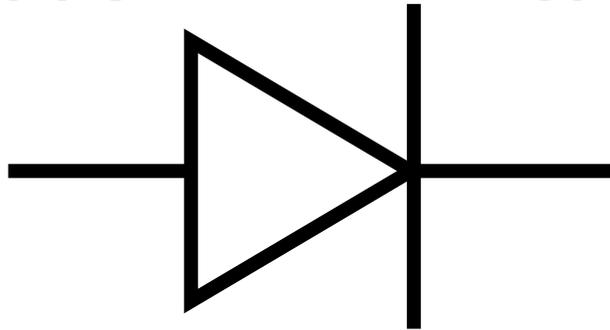
What do you need to know to design and build a solar-powered phone charger?

Diodes are like **one-way valves** for current.



anode

cathode

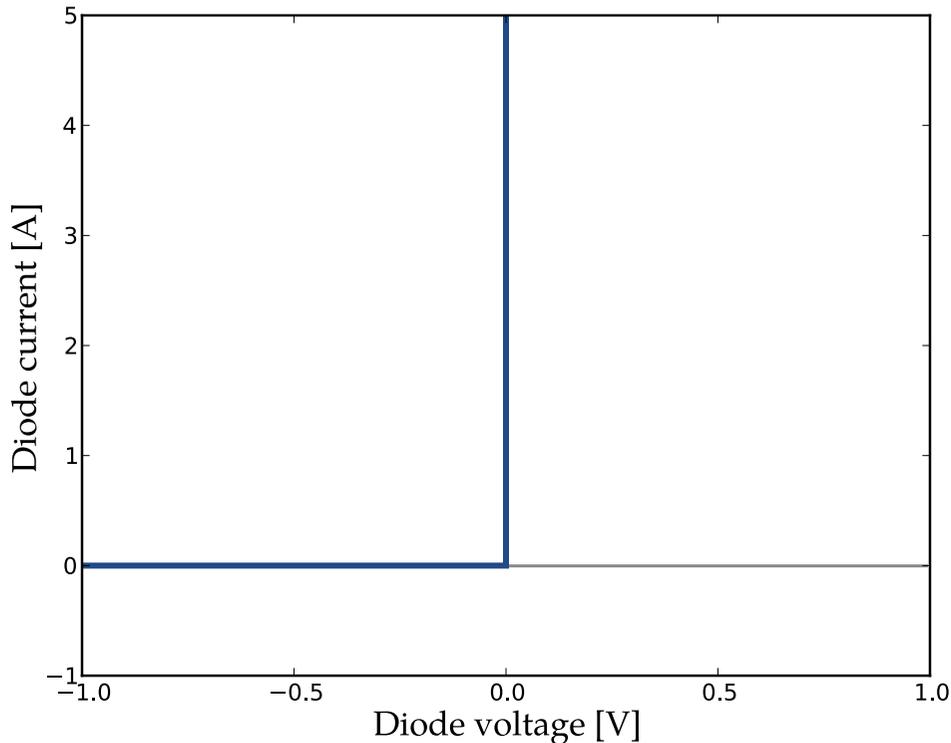


If it helps you remember: "cathode current departs"

For an **ideal diode**:

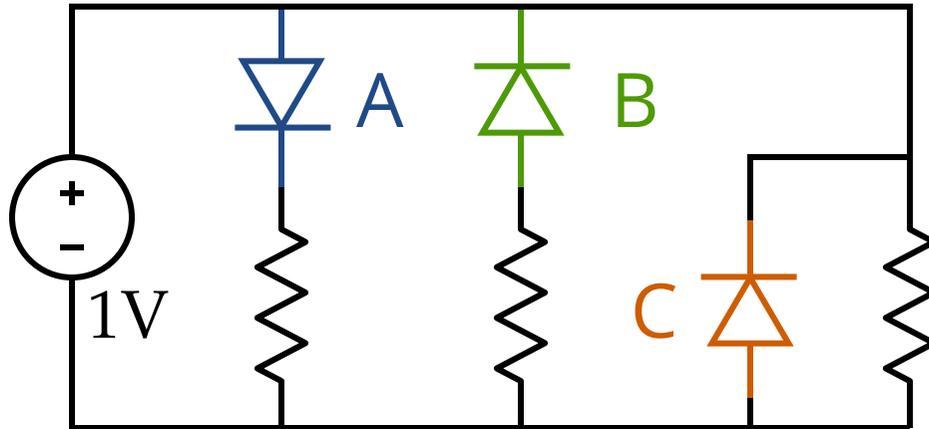
If the **voltage is negative**, **no current** flows (open circuit)

If the **current is positive**, **no voltage** drop (short circuit)

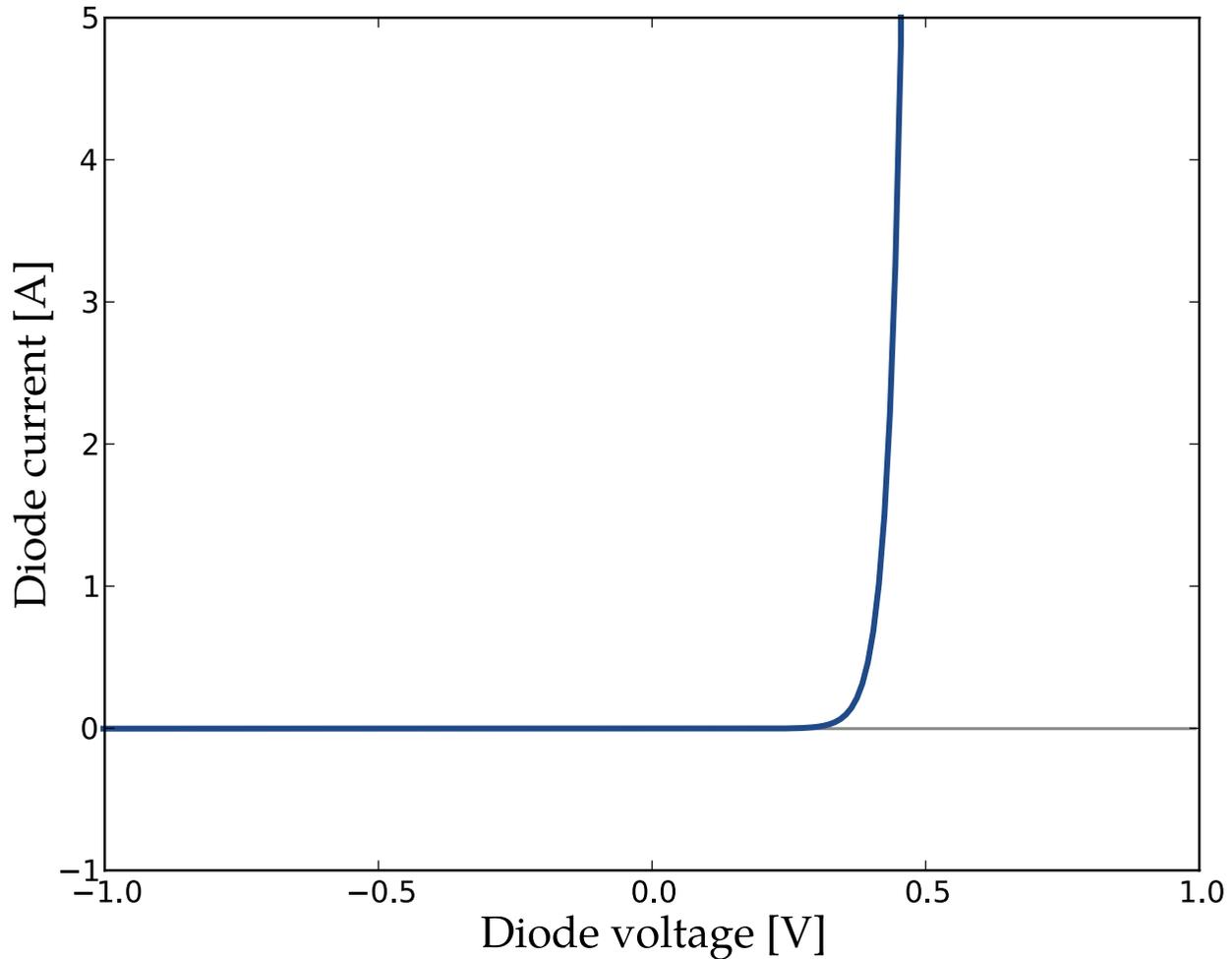


Which diodes turn on?

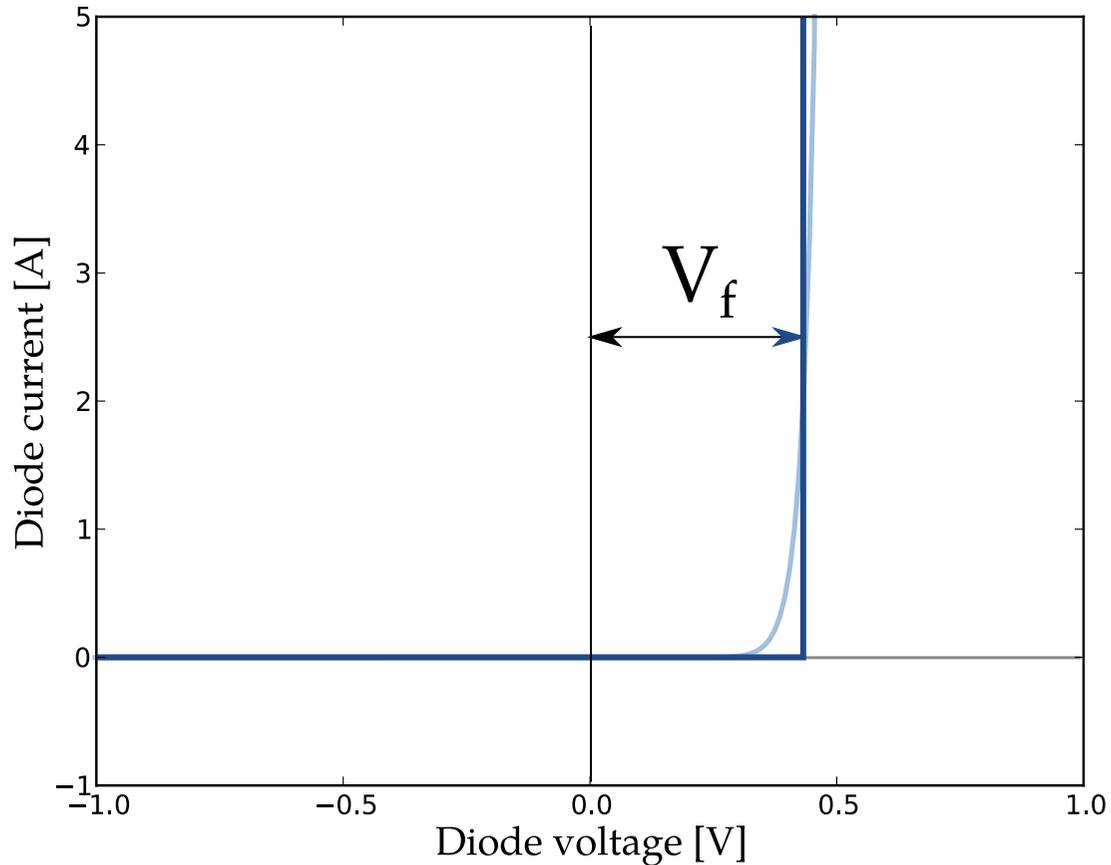
(i.e., which have current > 0 ?)



But **real diodes** aren't ideal



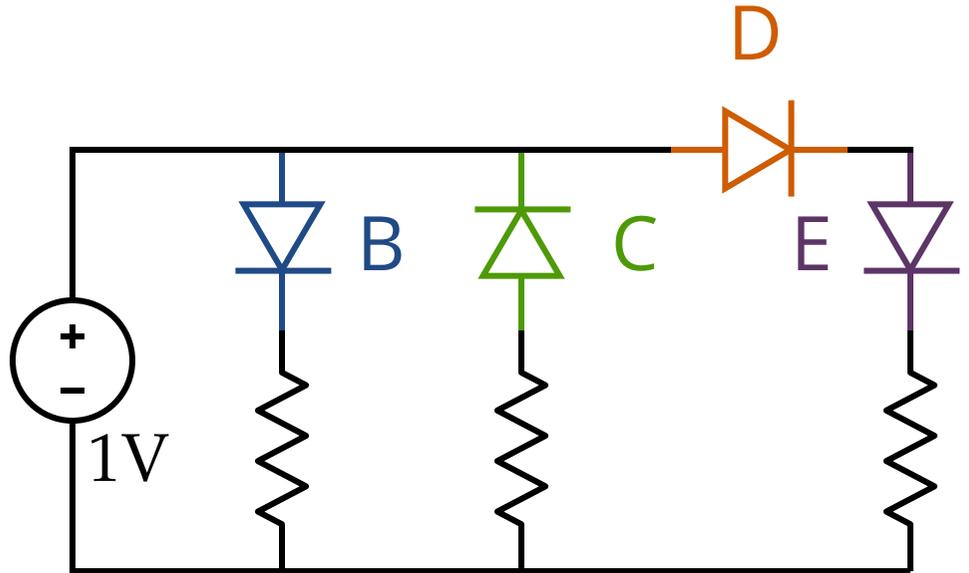
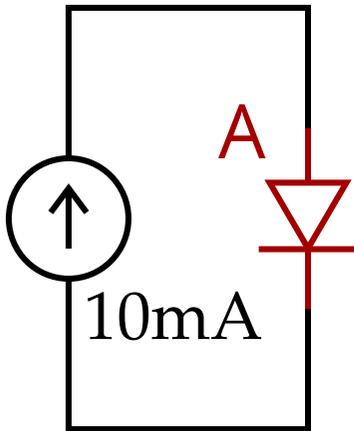
The "**idealized**" model is a compromise



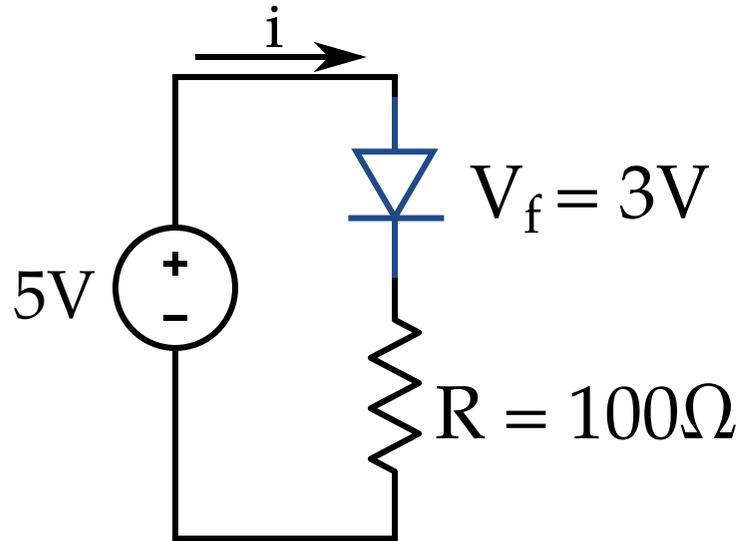
The diode turns on at V_f , the "forward voltage"

Which diodes turn on?

Assume that $V_f = 0.6V$



What is the current through the diode?



Breaking break:
smashing apart a diode

To learn more:

Veritasium: How does a transistor work?

<https://youtu.be/IcrBqCFLHIY>

Doc Physics: How does a diode work?

https://youtu.be/b3xys6rYM_Q

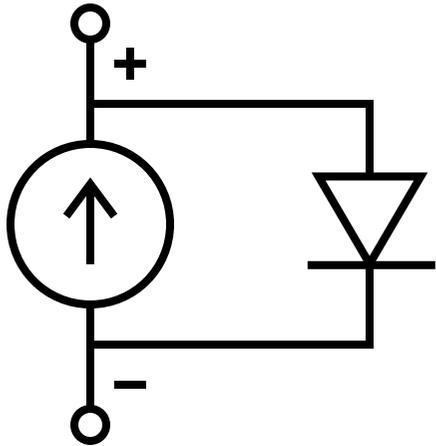
Doc Physics: How solar panels work

<https://youtu.be/JxOTuIMExWU>

There are entire classes on these topics, like **EE116**

Our model for a solar cell

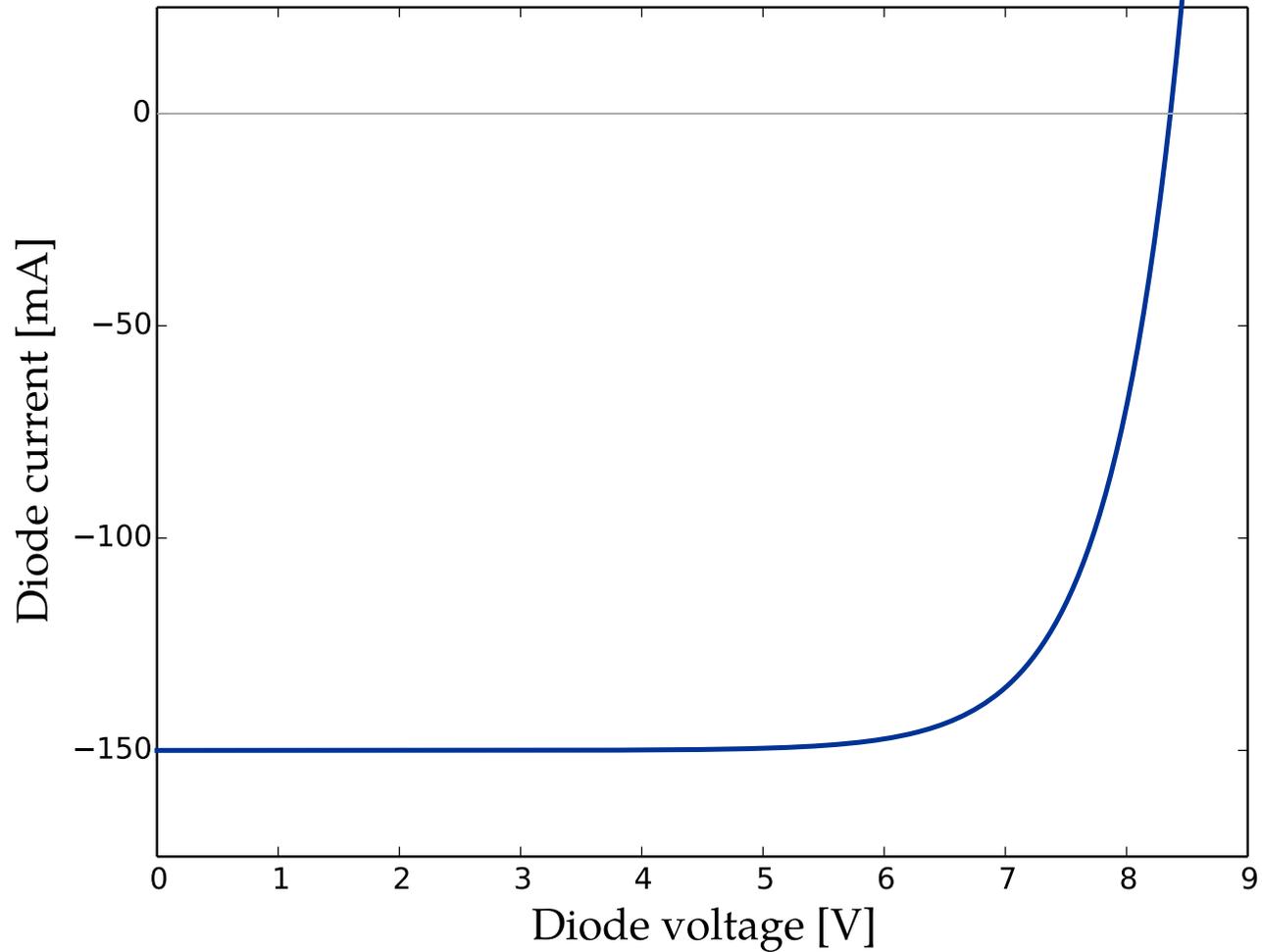
They're a current source,
but they're also still diodes



If the current has nowhere to go, it just goes back
through the diode

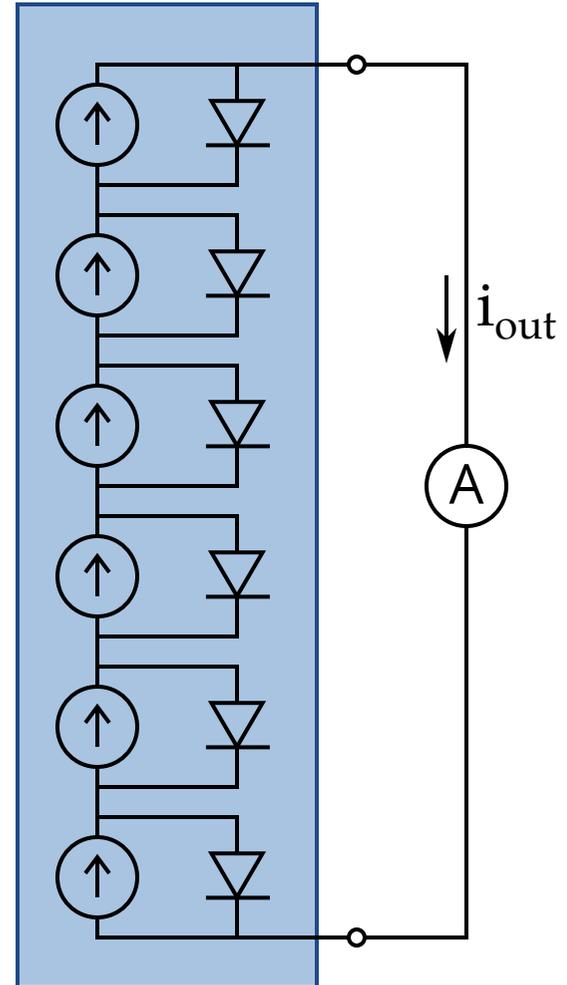
A single solar cell gives us **about 0.6V**

Our solar panels **provide ~8V** - how?



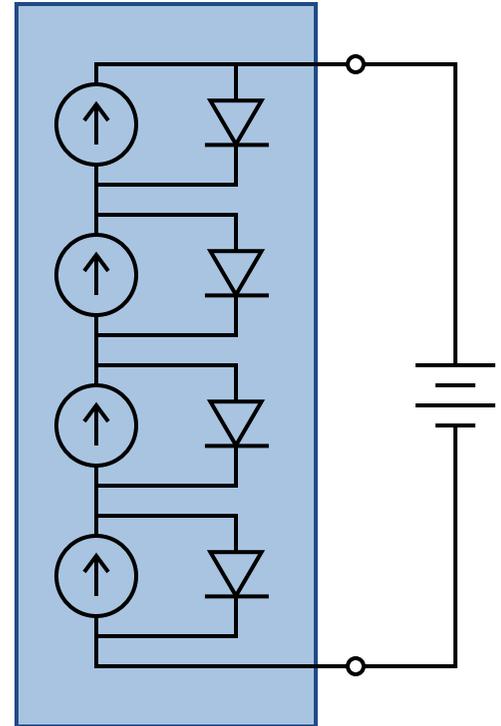
Suppose **one cell out of six** gets blocked (i.e., no light). What happens to the output current?

- A) 5/6 current (83%)
- B) 1/2 current (50%)
- C) No current (0%)
- D) Something breaks or burns



What happens if you connect your panel to a battery, and leave it in the dark?

- A)** Nothing
- B)** The solar panel charges the battery a tiny but measureable amount
- C)** Current flows through the solar panel, discharging the battery
- D)** C, and this breaks the solar panel



Note: P8 on your prelab has the battery backwards!