# Week 1 Review

# Reminders

1. Have you activated your ECF account for the labs? See our announcements on Portal.

2. Here are the current lab assignments:

   - **All 3 sections – Look at Quercus, under Announcements**

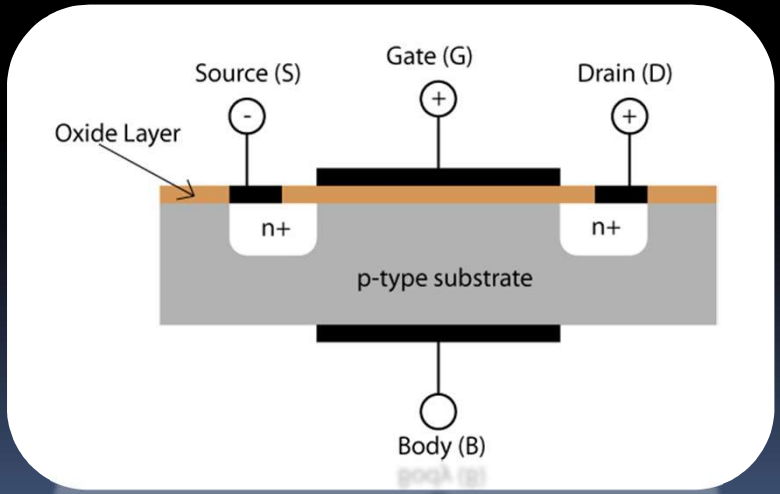
3. Have you done your Lab1 prelab? ☺
   - Check out the Breadboard Demo video; link posted under Course Materials -> Labs.

# Textbook

- In case you don't want to purchase a full-price textbook but want access to it for reference:
  - Check the book out first in the library (it's under course reserves).
  - Look for a used copy
- If you have a different edition:
  - You can find the table of contents of the 4th edition under Course Materials -> General Course Information.

# Week 1 Review

- Properties of electricity
- Semiconductor materials
  - Doping (n-type and p-type)
- p-n junctions
- Transistors
  - MOSFETs



# How CSC258 tutorials work

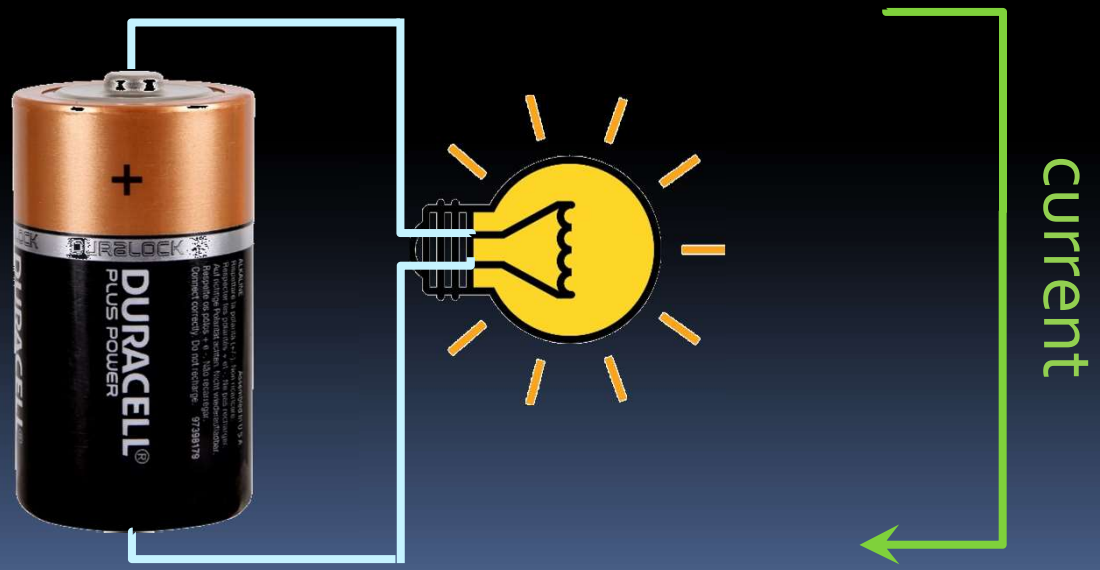
- Each week has three hours of classroom time.
  - Two hours of lectures,
  - One hour of tutorials.
- The tutorial is split into two halves:
  - The first half hour at the beginning, reviewing last week's material and potential exam questions.
  - The second half hour is later in the week, reviewing what you need to know for the upcoming lab.

# Midterm Short Answer Q's

- True or False? Doping gives a semiconductor an overall positive or negative charge. **False**
- What kind of bias on a pn junction causes the depletion layer to expand? **Reverse bias**
- Phosphorus has 5 electrons in its outer valence shell. When added in small amounts to silicon, the result is a _____ semiconductor. **Doped or N-Type**

# Electricity review

- If electrons are traveling from the bottom of the battery to the top, which way is current said to be traveling?
  - Current is measured as the movement of positive charges.



# Transistor review

- Logic gates are built from transistors

This transistor is called nMOS

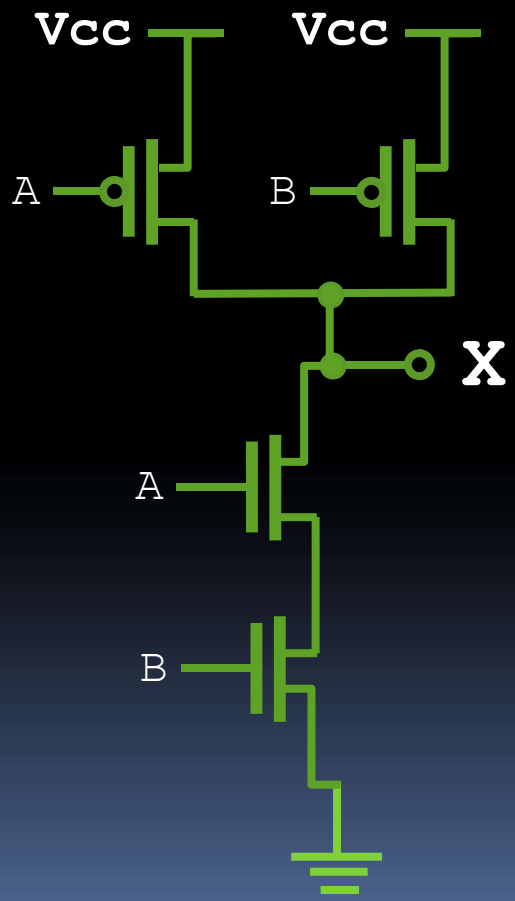
It conducts (i.e., acts as a closed switch) if we apply 5 Volts (logic-1) at its gate.

This transistor is called pMOS

It conducts (i.e., acts as a closed switch, if we apply 0 Volts (logic-0 , Gnd) at its gate.

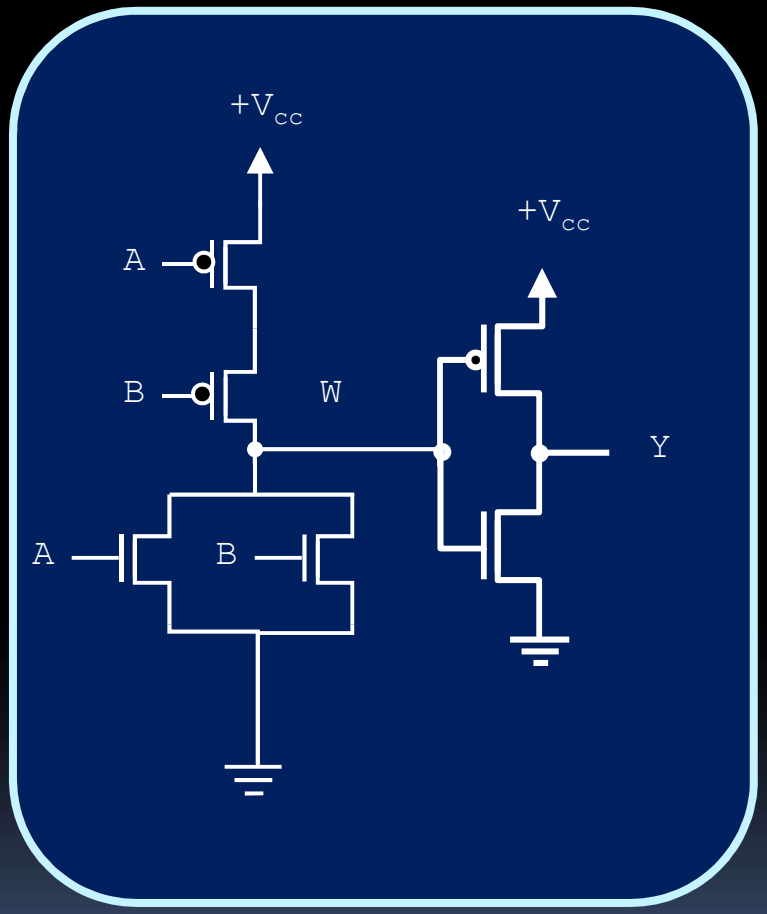
# More Transistor Questions

- What gate is created by the following?




Remember: transistors that look like  are activated when the gate input is high, whereas transistors that look like  are activated when the gate input is low.

# Which gate is this one?

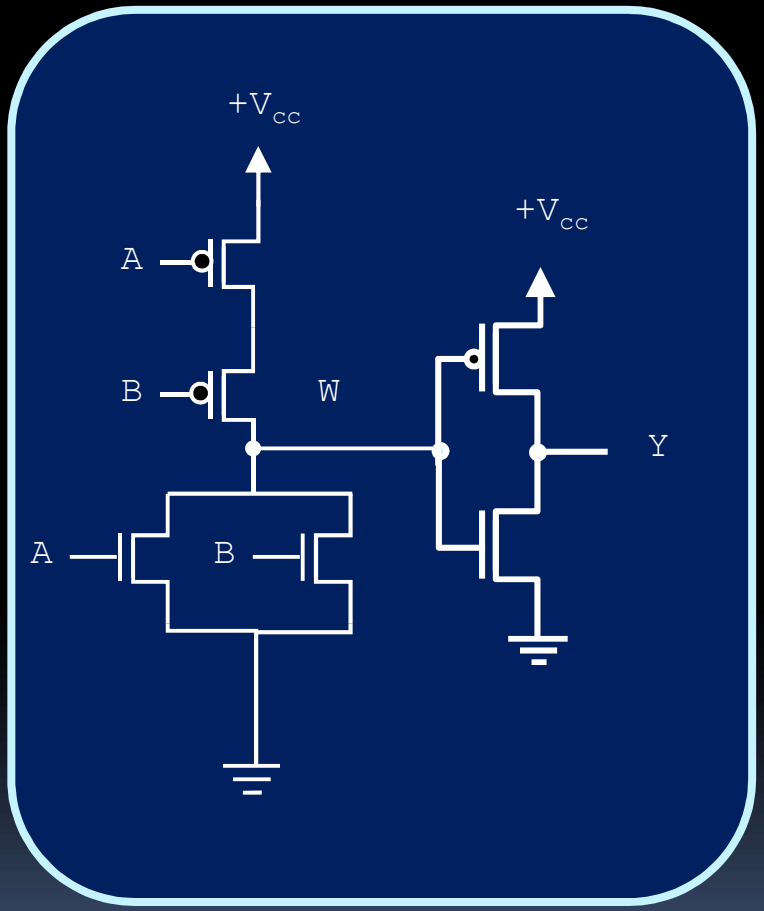



| A | B | W | Y |
|---|---|---|---|
| 0 | 0 | | |
| 0 | 1 | | |
| 1 | 0 | | |
| 1 | 1 | | |

W =

Y =

# Which gate is this one?




| A | B | W | Y |
|---|---|---|---|
| 0 | 0 | 1 | 0 |
| 0 | 1 | 0 | 1 |
| 1 | 0 | 0 | 1 |
| 1 | 1 | 0 | 1 |

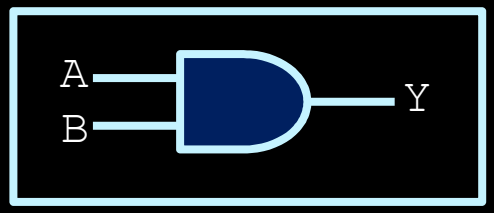
$$W = \overline{(A + B)}$$

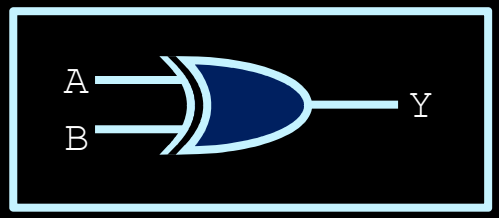
$$Y = (A + B)$$

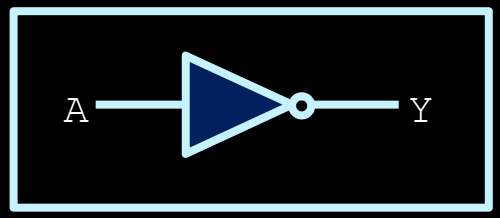
# Basic Logic Gates: Symbols and Truth Tables

- What are the names and truth table values for the following gates?

How many transistors do you need to build a NOT gate?



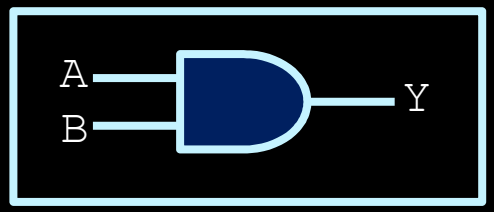

| A | B | Y |
|---|---|---|
| 0 | 0 | |
| 0 | 1 | |
| 1 | 0 | |
| 1 | 1 | |

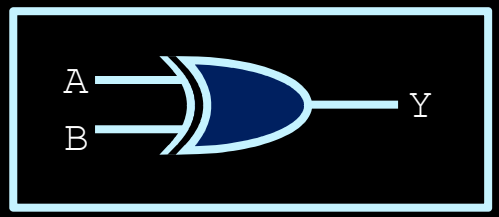
| A | B | Y |
|---|---|---|
| 0 | 0 | |
| 0 | 1 | |
| 1 | 0 | |
| 1 | 1 | |

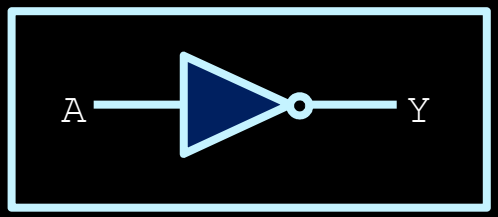
| A | Y |
|---|---|
| 0 | |
| 1 | |

# Basic Logic Gates: Symbols and Truth Tables

- What are the names and truth table values for the following gates?



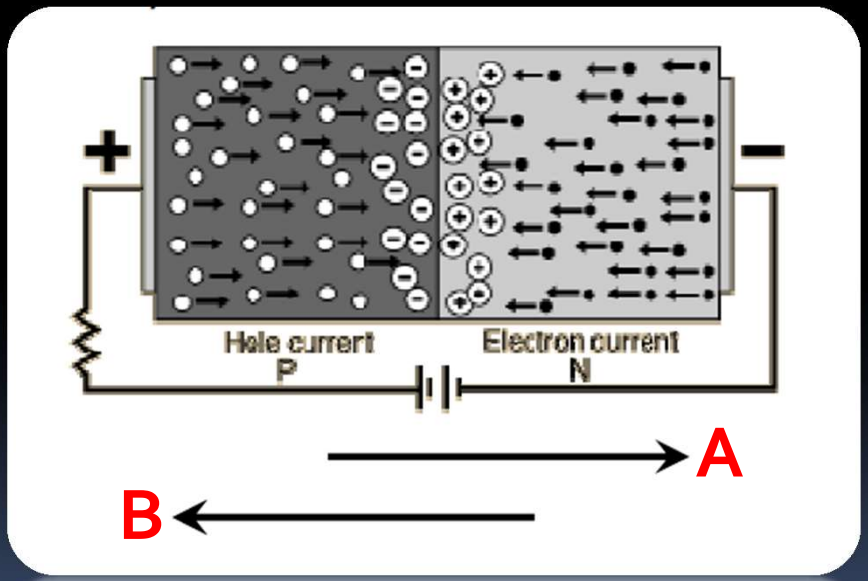

| A | B | Y |
|---|---|---|
| 0 | 0 | 0 |
| 0 | 1 | 0 |
| 1 | 0 | 0 |
| 1 | 1 | 1 |

| A | B | Y |
|---|---|---|
| 0 | 0 | 0 |
| 0 | 1 | 1 |
| 1 | 0 | 1 |
| 1 | 1 | 0 |

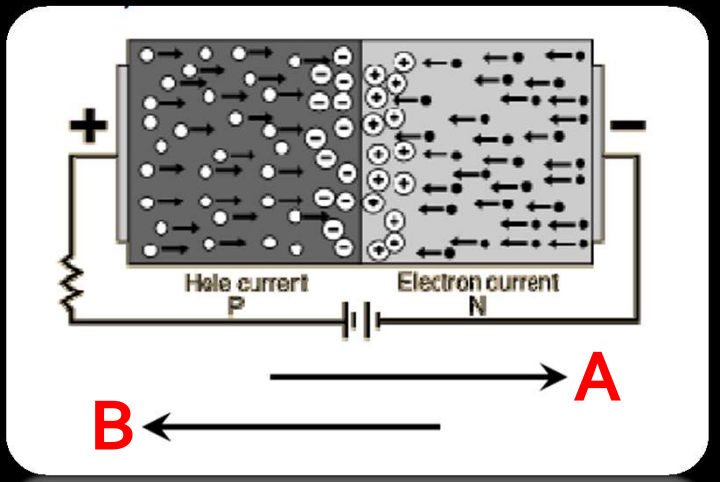
| A | Y |
|---|---|
| 0 | 1 |
| 1 | 0 |

# Kinds of current

- What is the name of currents A and B, and how are they produced?



# Kinds of current




- Two things to note here:
  - Need to determine which electrons are moving from high concentration to low concentration (diffusion), and which are moving because of the electric field (drift).
  - Remember: Current is measured in the opposite direction of electron flow (i.e. as *the flow of positive charge* through the material)
  - A → diffusion  B → drift