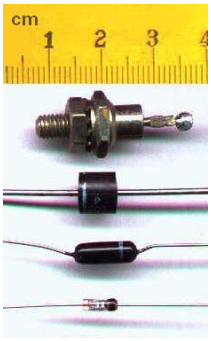
Name : _____ Section : _____

Exam1. Idea by Steven Gosselin



A *diode* is an electrical component, as shown on the picture. It allows the current to flow in one direction but not the other. Therefore it is used to protect electrical circuits, preventing current flowing in the 'wrong' direction.
However, the range of voltage (in Volts) at which the diode operates properly is very small. Through graphical analysis, **solve for the voltage at which a diode will operate properly (V_{D_P})**.

Two equations link the current (I_D) vs. the voltage (V_D) in the diode. They are:

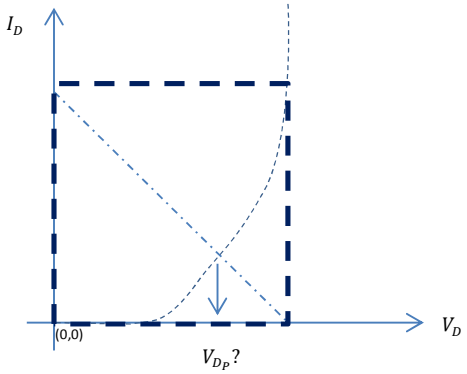
$$I_D(V_D) = \frac{-V_D + V_{SS}}{R}$$ (Linear equation ·-·-·-·)

$$I_D(V_D) = I_S * (e^{\left(\frac{V_D}{n * V_T}\right)} - 1)$$ (Exponential equation - - - - -)

where the variables are (don't worry about fully understanding these!)

V_{SS}	the voltage source (a battery for example) (in Volts)
R	a resistance in the circuit (in Ohms)
I_S	the saturation current (Amps)
n	the ideality factor (value between 1 and 2) (no units)
V_T	the thermal voltage (in Volts)

Solving for the proper V_D using algebra is NOT Freshmen level! Fortunately, it can be solved graphically by reading the coordinates at the intersection of the two curves!



The exponential curve will grow very quickly. You will have to limit the axis today to the dashed square shown, in order to be able to read properly off the graph! Therefore, the x-intercept (where the linear line crosses the x-axis) and the y-intercept (where the linear line crosses the y-axis) of the linear equation need to be known. They are:

$$x_{intercept} = V_{SS}$$

$$y_{intercept} = \frac{V_{SS}}{R}$$

Using the above information, plot the curves and read the voltage at the intersection point. Remember this is the voltage at which the diode works properly. Continue using the code to calculate automatically the current value (I_D) associated with it. The requirements (to help you, they are in order) are as follows:

- Prompt the user for the source voltage (use between 2 and 5 Volts).
- Hardcode the other givens as $n = 1$, $V_T = 0.026$ Volts, $I_S = 10 \times 10^{-14}$ Amps, $R = 10$ Ohms.
- Plot the two curves, title, and label properly. Use `axis()` to limit the range of the figure.
- Once you read off the voltage at which the diode operates properly, go back to the code. The code should now be prompting for that value. Once entered, calculate the current (in Amps) associated with it, using the linear equation. Display the resulting current in Amps, in a formatted sentence with 4 decimal places.

Step1:

Step2 is done, 3 and 4 are not required.
Step5 (6) is impossible as a freshmen.
Step7 a, b, and c are to be done in the code as shown in class AND ON THE SOLUTION TO THE PRACTICE EXAM!

I WILL NOT POST THE SOLUTION TO THIS EXAM UNTIL TOMORROW. I WILL GIVE UNTIL 11:59PM THURSDAY TO FIX IT ON YOUR OWN for points. Submit the final file in the 2nd link online. NO GROUP WORK ALLOWED. DO NOT DISCUSS AMONGST EACH OTHER.TUTORS HAVE BEEN WARNED NOT TO HELP. Any sort of obvious collaboration will null the exam grade completely.

Rubric: Please check all these before turning work in.

Step1		5pts
Step7		
	Introduction	5
	Clean up commands	3
	Variable names	5
	Spacing of the code	5
	7a. ALGORITHM	10
	Correct prompt Vss	7
	Define given values	5
	~~Define vectors to plot~~	~~10~~
	Plot, markers	5
	Title, Labels	5
	Axis restriction	5
	Prompt Id	7
	Correct numerical solution	5
	Correct formatted sentence	5
	7c. Testing	5

Even if you cannot figure out the vectors to plot, you can STILL get 90% !!

DO THE REST PERFECTLY !

ASSUME VARIABLES AND MOVE ON !!

Other 8pts (used for leeway, or unforeseen random errors I don't even want to dream of..)