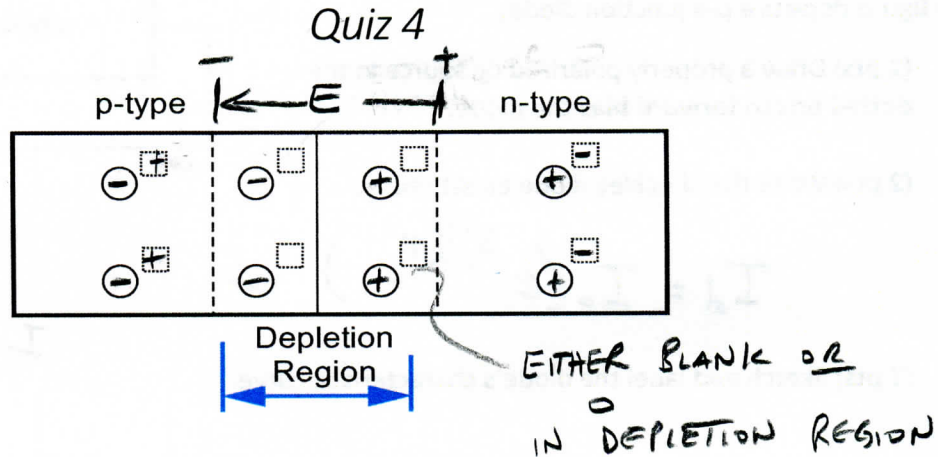


LAST NAME SOLUTION Alphabetic # _____

FIRST NAME _____



1. The diagram depicts a p-n junction diode.

- (2 pts) Mark the fixed charge polarities in the p- and n-type materials in the circles.
- (2 pts) Mark the free charge polarities in squares.
- (2 pts) Draw and label the electric field on the diode figure.
- (4 pts) Briefly explain the physical phenomena depicted in the figure using these bullet points as a guide

- p-type material: PROVIDES MOBILE h^+ (FREE POSITIVE CHARGES)
DONOR ATOMS FIXED IN CRYSTAL LATTICE HAVE '-' CHARGE
- n-type material: PROVIDES MOBILE e^- (FREE NEGATIVE CHARGES)
DONOR ATOMS FIXED IN CRYSTAL LATTICE HAVE '+' CHARGE

- Electric field's source in the depletion region:

DONOR ATOMS w/ FIXED CHARGE GIVE RISE TO \vec{E}
FROM '+' TO '-' CHARGE

- Electric field's affect upon charge in the depletion region:

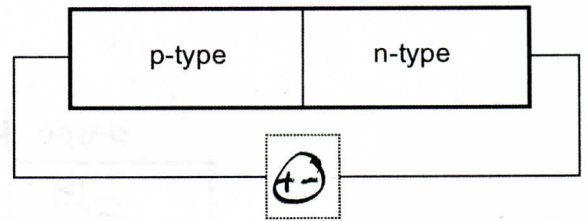
ELECTRIC FIELD SWEEPS FREE CHARGE OUT OF THE
DEPLETION REGION

e^- TOWARD N-TYPE MAT'L

h^+ TOWARD P-TYPE MAT'L

NAME SOLUTION

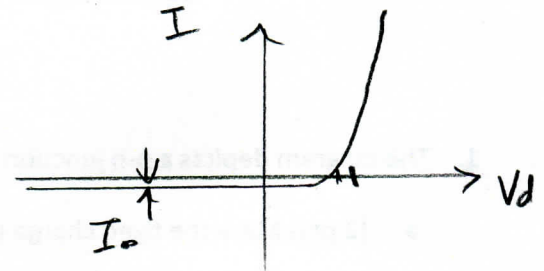
2. The figure depicts a p-n junction diode.



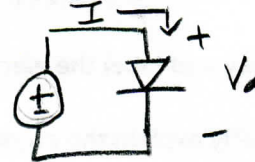
- a. (2 pts) Draw a properly polarized dc source in the dotted box to **forward bias** the diode.
- b. (2 pts) Write the Shockley diode equation.

$$I_d = I_0 (e^{qV_d/kT} - 1)$$

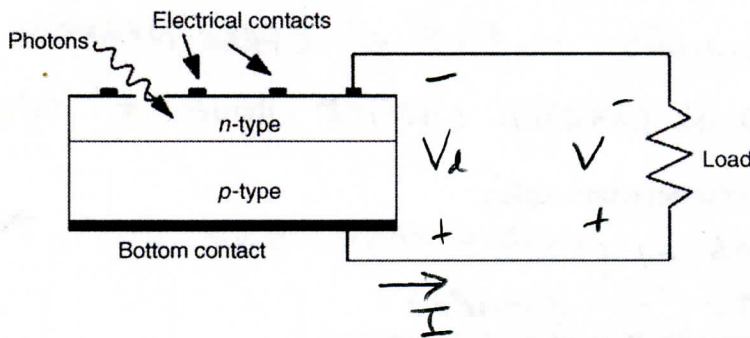
- c. (2 pts) Sketch and label the diode's characteristic curve.



- d. (2 pts) Draw the equivalent circuit using a dc source and a diode symbol.



3. (2 pts) Mark and label current direction and voltage polarities across the photodiode and resistor for a functioning PV cell on the diagram below.



Bonus (2 pts): Define Leadership:

INFLUENCING PEOPLE TO ACT TO
COMMON PURPOSE.