

2021/03/09

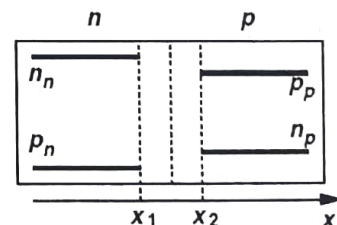
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Class: King Huang **Part 1 : Single Choice Questions(50%)**

For the following five questions, please choose "one" the most appropriate answer.

- (C) 1. What is the possible **acceptor** for Silicon?
- (a) Ge,
 - (b) As,
 - (c) B,
 - (d) P,
- (A) 2. At room temperature, a piece of **intrinsic** semiconductor contains what type of carrier?
- (a) Electrons and Holes
 - (b) Electrons
 - (c) Holes
 - (d) Ions
- (C) 3. Which statement is **NOT** correct in description of Digital and Analog circuits?
- (a) Analog circuit such as amplifier must process each point on a waveform
 - (b) Digital signal assumes only a finite number of values at only certain point of time
 - (c) The only difference between the analog and digital signals is the signal format.
 - (d) Digital circuit are more robust against noise
- (d) 4. At $T=300\text{K}$, a piece of Si is doped $N_A=2\times 10^{17}\text{cm}^{-3}$, with $n_i = 1\times 10^{10}\text{cm}^{-3}$. What is its minority carrier & its concentration?
- (a) holes, $5\times 10^{17}\text{cm}^{-3}$
 - (b) holes, $5\times 10^3\text{cm}^{-3}$
 - (c) electrons, $5\times 10^{17}\text{cm}^{-3}$
 - (d) electrons, $5\times 10^3\text{cm}^{-3}$
- (b) 5. Below is a pn junction at equilibrium where the doping level in p and n-regions are N_A and N_D , respectively, which is **Correct**?
- (a) $N_A > N_D$
 - (b) $N_D > N_A$
 - (c) $N_A = N_D$
 - (d) Can not tell from this figure

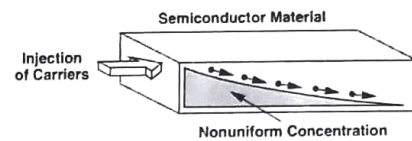
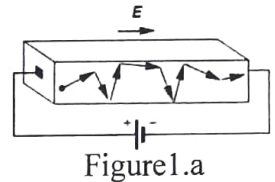


Part 2: Multiple Choice Questions (50%)

For the following five questions, please choose the most appropriate answers. 10 points for exact correct answers and -5 points for each wrong choice, the lowest is zero point for each question.

(cde) 6. Figure 1.a & Figure 1.b show the carrier transport mechanisms, which statements are **True**?

- (a) Figure 1.a is diffusion current, Figure 1.b is drift current
- (b) Figure 1.b, current direction is the same as gradient direction
- (c) In Figure 1.a, current is proportional to E .
- (d) Both mechanisms can occur at the same time
- (e) Increase in carrier mobility will lead to increase in both currents



(bd) 7. Which statements for a piece of p-type Si with $N_A = 10^{15} \text{cm}^{-3}$ are **Correct**?

- (a) Contains donor type dopants
- (b) $p \gg n$
- (c) majority carriers are electrons
- (d) $n < n_i$
- (e) As temperature increases, conductivity increases drastically

(abe) 8. Which statements are **True** for an intrinsic Si at equilibrium state?

- (a) $np = n_i^2$
- (b) $n = p$
- (c) When electric field is applied, drift current = 0
- (d) As temperature increase, conductivity decrease
- (e) Has larger bandgap than Ge

(ae) 9. For a p-n junction in thermal equilibrium with zero bias. $N_A = 10^{19} \text{cm}^{-3}$ in the p region and $N_D = 5 \times 10^{17} \text{cm}^{-3}$ in the n region. x_n and x_p are depletion width in the n and p type regions, respectively. Which is **True** in describing the interface?

- (a) the level of drift current equals that of diffusion current;
- (b) $n = p = n_i$;
- (c) electric field = 0;
- (d) potential difference = 0;
- (e) net current = 0;

(bc) 10. For a p-n junction with doping levels of N_A , N_D and junction depths x_p , x_n on the p and n sides, respectively. At zero bias, which statements are **True**?

- (a) Built-in potential decreases with increasing N_A
- (b) Built-in potential increases with increasing N_D
- (c) Net current is zero
- (d) Built-in potential prevents diffusion of electrons from p-region to n-region
- (e) Electric field falls to zero at the junction