CHAPTER-14
Semiconductor Electronics, Materials, Devices and Simple Circuits
ASSIGNMENT-1
MCQ-1 MARK SECTION

1. The energy band gap is maximum in

(a) metals (b) superconductors (c) insulators (d) semiconductors

2. At absolute zero, silicon (Si) acts as

(a) non-metal (b) metal (c) insulator (d) none of these

3.The process of adding impurities to a pure semiconductor is called

(a) Mixing (b)Doping (c)Diffusing (d)None of the above

4. Silicon is doped with which of the following to obtain P type semiconductor

(a) Phosphorus (b) Gallium (c) Germanium (d) Bismuth

5.When an impurity is doped into an intrinsic semiconductor, the conductivity of the semiconductor

(a) Increases (b) decreases (c) remains the same (d) becomes zero

ASSERTION –REASONING TYPE QUESTIONS

Directions : In the following questions, A statement of Assertion (A) is followed by statement of Reason (R). Mark the correct choice as.

A ; If both Assertion and Reason are correct and the Reason is a correct explanation of the assertion.

B: If both Assertion and Reason are correct but Reason is not a correct explanation of the assertion.

C :If the Assertion is correct but Reason is incorrect.

D: If both the Assertion and Reason are incorrect.

6. **Assertion :**A pure semiconductor has negative temperature coefficient of resistance.

Reason : In a semiconductor on raising the temperature, more charge carriers are released,conductance increases and resistance decreases.

7. **Assertion :**A p-type semiconductors is a positive type crystal.

Reason :A p- type semiconductor is an uncharged crystal

8. **Assertion :**Silicon is preferred over germanium for making semiconductor devices.

Reason : The energy gap in germanium is more than the energy gap in silicon.

9. **Assertion :**The diffusion current in a p-n junction is from the p-side to the n-side.

Reason : The diffusion current in a p-n junction is greater than the drift current when the junction is in forward biased

10. **Assertion:** The energy gap between the valance band and conduction band is greater in silicon than in germanium.

Reason: Thermal energy produces fewer minority carriers in silicon than in germanium.

CASE BASED / SOURCE BASED QUESTIONS

11. On the basis of energy bands materials are also defined as metals, semiconductors and insulators. These semiconductors are classified as intrinsic semiconductors and extrinsic semiconductors also. Intrinsic semiconductors are those semiconductors which exist in pure form. And intrinsic semiconductors have number of free electrons is equal to number of holes. The semiconductors doped with some impurity in order to increase its conductivity are called as extrinsic semiconductors. Two types of dopants are used they are trivalent impurity and pentavalent impurity also. The extrinsic semiconductors doped with pentavalent impurity like Arsenic, Antimony, Phosphorus etc are called as n – type semiconductors. In n type semiconductors electrons are the majority charge carriers and holes are the minority charge carriers. When trivalent impurity is like Indium, Boron, Aluminium etc are added to extrinsic semiconductors then p type semiconductors will be formed. In p type semiconductors holes are majority charge carriers and electrons are the minority charge carriers.

(I) What is extrinsic semiconductor?

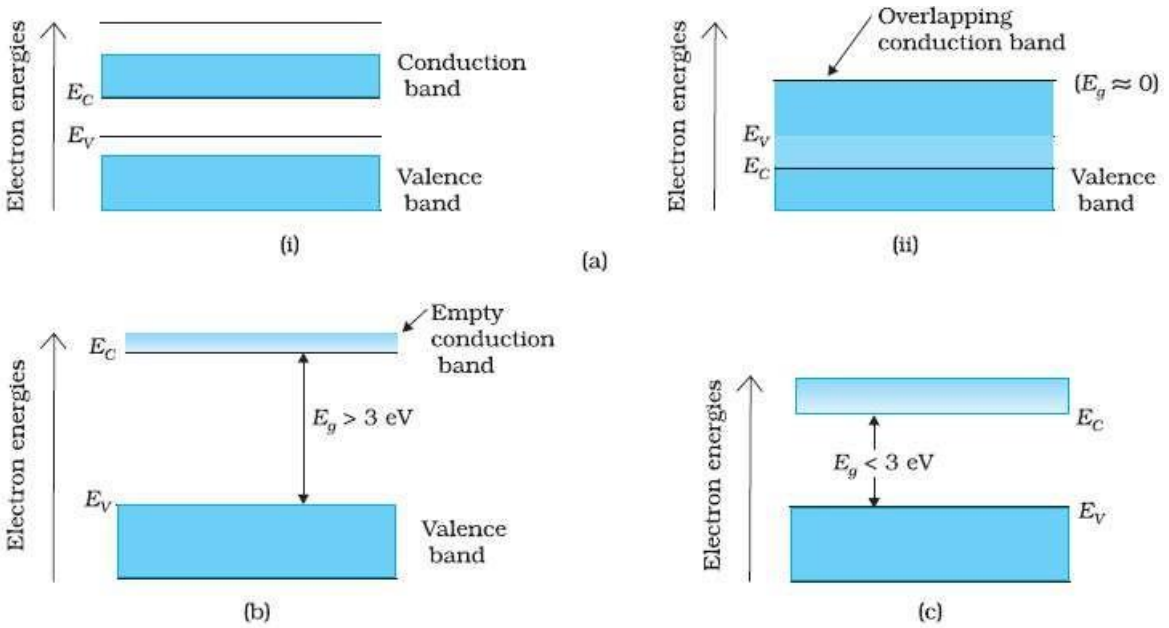
(II) What is ratio of number of holes and number of electrons in an intrinsic semiconductor?

(III)Why doping is necessary?

(IV) Majority charge carriers in p-type semiconductor are_____.

12. From Bohr's atomic model, we know that the electrons have well defined energy levels in an isolated atom. But due to interatomic interactions in a crystal, the electrons of the outer shells are forced to have energies different from those in isolated atoms. Each energy level splits into a

number of energy levels forming a continuous band. The gap between top of valence band and bottom of the conduction band in which no allowed energy levels for electrons can exist is called energy gap. Following are the energy band diagrams for conductor fig (ii), for insulators fig (b) and for semiconductors fig (c).



(I) In an insulator energy band gap is

(a) E_g= 0eV (b) E_g> 3eV (c) E_g< 3eV (d) None of this

(II)In a semiconductor, separation between conduction and valence band is of the order of

(a) E_g= 0eV (b) E_g> 3eV (c) E_g< 3eV (d) None of this

(III) Based on the band theory of conductors, insulators and semiconductors, the forbidden gap is smallest in

(a)conductor (b) insulators (c) semiconductors (d) All of these

(IV) Solids having highest energy level partially filled with electrons are

(a)semiconductor (b) conductor (c) insulator (d) none of these

2 MARKS QUESTIONS

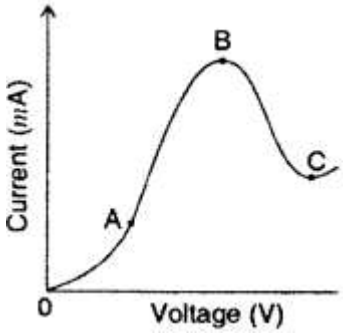
13. What happens to the width of depletion layer of a p-n junction when it is (i)forward biased? (ii)reverse biased?

14. **E**xplain, with the help of a circuit diagram, the working of a p-n junction diode as a half- wave rectifier.

15. Distinguish between a metal and an insulator on the basis of energy band diagram.16.Explain, how a depletion region is formed in a junction diode?

17. Carbon and silicon both have four valence electrons each, then how are they distinguished?

18. The graph shown in the figure represents a plot of current versus voltage for a given semi-conductor. Identify the region, if any, over which the semi-conductor has a negative resistance.



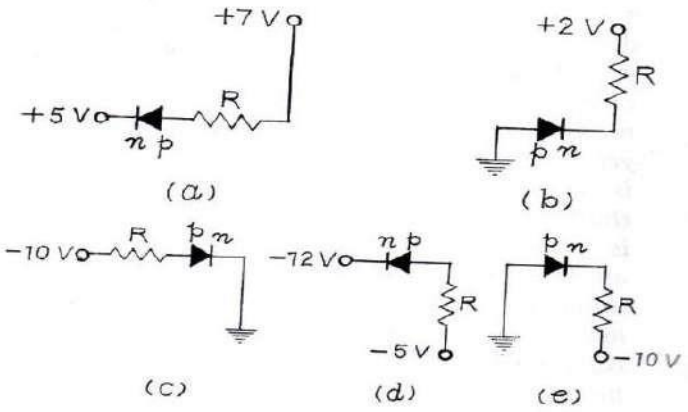
19. Plot a graph showing variation of current versus voltage for the material GaAs.

3 MARKS QUESTIONS

20.Draw the circuit diagram of a full wave rectifier using p-n junction diode. Explain its workingand show the output and input waveforms. (CBSE-2011)

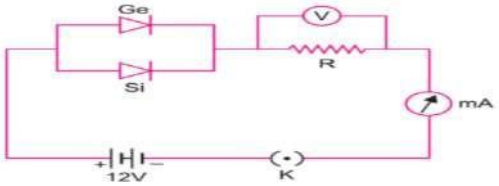
5 MARKS QUESTION

21. Indicate which of the following p- n diodes are forward biased and which are reverse biased:



22. (i) Sn, C and Si, Ge are all group 14 elements. Yet Sn is a conductor, C is an insulator while Si and Ge are semiconductor. Why?

(ii)Germanium and silicon junction diodes are connected in parallel. A resistance R, a 12 V battery,a milli ammeter (mA) and key (K) are connected as shown in figure. When Key (K) is closed, current begins to flow in milli ammeter. What will be the maximum reading of voltmeter connectedacross resistance R?



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