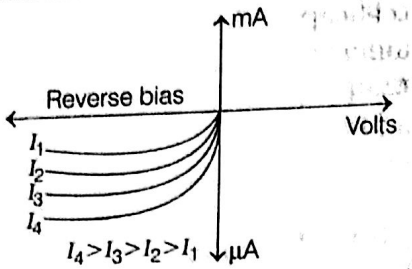
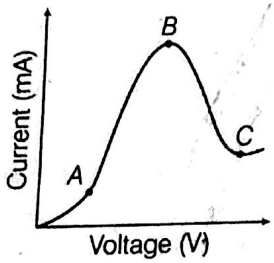
Semiconductor devices-CBSE

1 Mark Questions

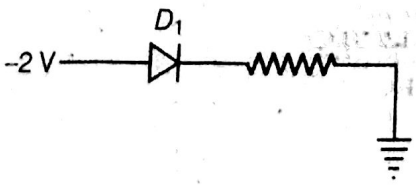
1. Draw the I-V characteristics of a Zener diode.
2. Identify the semiconductor diode whose V-I characteristics are as shown.



3. The graph shown in the figure represents a plot of current *versus* voltage for a given semiconductor. Identify the region, if any over which the semiconductor has a negative resistance.

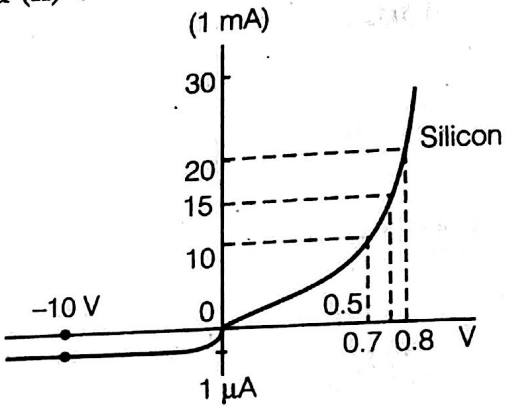


4. What is the difference between an n-type and a p-type extrinsic semiconductor?
5. What happens to the width of depletion layer of a p-n junction when it is
   (i) forward biased?
   (ii) reverse biased?
6. Why cannot we take one slab of p-type semiconductor and physically join it to another slab of n-type semiconductor to get p-n junction?



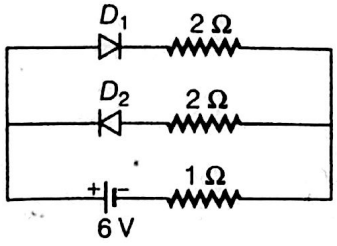
2 Marks Questions

7. Explain briefly how a photodiode operates.
8. A student wants to use two p-n junction diodes to convert alternating current into direct current. Draw the labelled circuit diagram she would use and explain how it works.
9. The V-I characteristic of a silicon diode is as shown in the figure. Calculate the resistance of the diode at (i) $I = 15$ mA and (ii) $V = -10$V



10. Distinguish between 'intrinsic' and 'extrinsic' semiconductors?
11. Explain, with the help of a circuit diagram, the working of a p-n junction diode as a half-wave rectifier.
12. Draw energy band diagram of n-type and p-type semiconductor at temperature $T > 0$K. Mark the donar and acceptor energy level with their energies
13. Distinguish between a metal and an insulator on the basis of energy band diagram.
14. Explain, with the help of a circuit diagram, the working of a photodiode. Write briefly how it is used to detect the optical signals.
15. Assuming that the two diodes D_1 and D_2 used in the electric circuit shown in the figure are ideal, find out the value of the

current flowing through 1 Ω resistor.



16. Mention the important considerations required while fabricating a *p-n* junction diode to be used as a Light Emitting Diode (LED). What should be the order of band gap of an LED, if it is required to emit light in the visible range?

17. Write two characteristics features to distinguish between *n*-type and *p*-type semiconductors.

18. Give two advantages of LED's over the conventional incandescent lamps.

19. The current in the forward bias is known to be more (~ mA) than the current in the reverse bias (~ μA). What is the reason, to operate the photodiode in reverse bias?

20. How does a light emitting diode (LED) work? Give two advantages of LED's over the conventional incandescent lamps.

21. (i) Why are Si and GaAs preferred materials for fabrication in solar cells?

(ii) Draw *V-I* characteristic of solar cell and mention its significance.

22. Name the semiconductor device that can be used to regulate an unregulated DC power supply. With the help of *I-V* characteristics of this device, explain its working principle.

23. How is forward biasing different from reverse biasing in a *p-n* junction diode?

24. Explain, how a depletion region is formed in a junction diode?

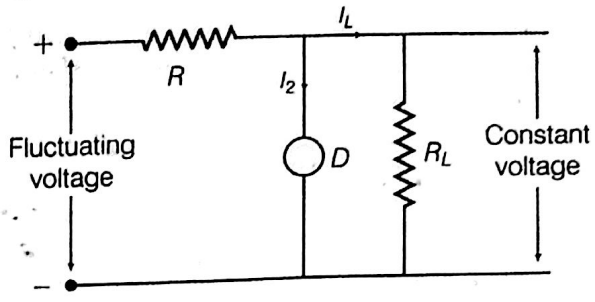
25. Draw the circuit diagram showing how a *p-n* junction diode is

(i) forward biased (ii) reverse biased

How is the width of depletion layer affected in the two cases?

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

27. Name the device, *D* which is used as a voltage regulator in the given circuit and give its symbol.



28. Draw the circuit diagram of an illuminated photodiode in reverse bias. How is photodiode used to measure light intensity?

29. Write the main use of the

(i) photodiode

(ii) Zener diode.

3 Marks Questions

30. (i) Three photodiodes D_1, D_2 and D_3 are made of semiconductors having band gaps of 2.5 eV, 2 eV and 3 eV respectively. Which of them will not be able to detect light of wavelength 600 nm?

(ii) Why photodiodes are required to operate in reverse bias ? Explain.

31. Draw the circuit diagram of a full wave rectifier and explain its working. Also, give the input and output waveforms.

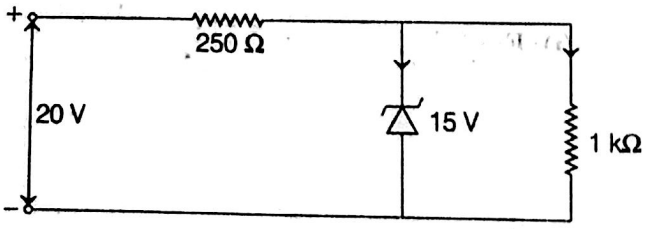
32. Draw the circuit diagram of a full wave rectifier. Explain its working principle. Show the input waveforms given to the diodes D_1 and D_2 and the corresponding

output waveforms obtained at the load connected to the circuit.

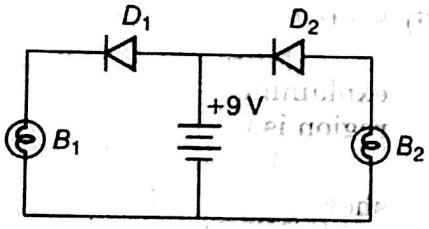
33. (i) What is the reason to operate photodiodes in reverse bias?

(ii) A *p-n* photodiode is fabricated from a semiconductor with a band gap of range of 2.5 to 2.8 eV. Calculate the range of wavelengths of the radiation which can be detected by the photodiode.

34. Give reason to explain why *n* and *p* regions of a Zener diode are heavily doped. Find the current through the Zener diode in the circuit given below. (Zener breakdown voltage is 15 V)



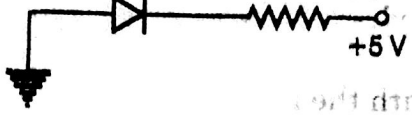
35. (i) In the following diagram, which bulb out of B_1 and B_2 will glow and why?



(ii) Draw a diagram of an illuminated *p-n* junction solar cell.

(iii) Explain briefly the three processes due to which generation of emf takes place in a solar cell.

36. (i) In the following diagram, is the junction diode forward biased or reverse biased?



(ii) Draw the circuit diagram of a full wave rectifier and state how it works?

37. Write the two processes that take place in the formation of a *p-n* junction. Explain with the help of a diagram, the formation of depletion region and barrier potential in a *p-n* junction.

38. A Zener diode is fabricated by heavily doping both *p*- and *n*- sides of the junction. Explain, why.
Briefly explain the use of Zener diode as a DC voltage regulator with the help of a circuit diagram.

39. (i) Explain with the help of a diagram the formation of depletion region and barrier potential in a *p-n* junction.

(ii) Draw the circuit diagram of a half-wave rectifier and explain its working.

40. (i) Describe the working principle of a solar cell. Mention three basic processes involved in the generation of emf.

(ii) Why are Si and GaAs preferred materials for solar cells?

41. With what considerations in view, a photodiode is fabricated? State its working with the help of a suitable diagram. Even though the current in the forward bias is known to be more than in the reverse bias, yet the photodiode works in reverse bias. What is the reason?

42. (i) Distinguish between *n*-type and *p*-type semiconductors on the basis of energy band diagrams.

(ii) Compare their conductivities at absolute zero temperature and at room temperature

43. Draw the energy band diagrams of

(i) *n*-type and

(ii) *p*-type semiconductor at temperature, $T > 0K$.

In the case *n*-type Si semiconductor, the donor energy level is slightly below the bottom of conduction band whereas in *p*-type semiconductor, the acceptor energy level is slightly above the top of the

valence band. Explain, what role do these energy levels play in conduction and valence bands.

44. Write any two distinguishing features between conductors, semiconductors and insulators on the basis of energy band diagrams.

45. (i) How is a photodiode fabricated?

(ii) Briefly explain its working. Draw its *V-I* characteristics for two different intensities of illumination.

46. Draw the circuit diagram of a full-wave rectifier using *p-n* junction diode. Explain its working and show the output input waveforms.

47. Draw *V-I* characteristics of a *p-n* junction diode. Answer the following questions, giving reasons.

(i) Why is the current under reverse bias almost independent of the applied potential upto a critical voltage?

(ii) Why does the reverse current show a sudden increase at the critical voltage?

Name any semiconductor device which operates under the reverse bias in the breakdown region.

48. Draw a labelled diagram of a full-wave rectifier circuit. State its working principle. Show the input-output waveforms.

49. Name the important processes that occurs during the formation of a *p-n* junction. Explain briefly, with the help of a suitable diagram, how a *p-n* junction is formed. Define the term 'barrier potential'?

50. (i) Why is a photodiode operated in reverse bias mode?

(ii) For what purpose is a photodiode used?

(iii) Draw its *I-V* characteristics for different intensities of illumination.

51. (i) Why are Si and GaAs preferred materials for solar cells?

(ii) Describe briefly with the help of a necessary circuit diagram, the working principle of a solar cell.

52. (i) Describe the working of Light Emitting Diodes (LEDs).

(ii) Which semiconductors are preferred to make LEDs and why?

(iii) Give two advantages of using LEDs over conventional incandescent low power lamps.

5 Marks Questions

53. (i) Explain with the help of suitable diagram, the two processes which occur during the formations of a *p-n* junction diode. Hence, define the terms (i) depletion region and (ii) potential barrier.

(ii) Draw a circuit diagram of a *p-n* junction diode under forward bias and explain its working.

54. (i) State briefly the processes involved in the formation of *p-n* junction, explaining clearly how the depletion region is formed.

(ii) Using the necessary circuit diagrams, show how the *V-I* characteristics of a *p-n* junction are obtained in (a) forward biasing (b) reverse biasing

How are these characteristics made use of in rectification?

55. (i) Draw the circuit arrangement for studying the *V-I* characteristics of a *p-n* junction diode in (a) forward and (b) reverse bias. Briefly explain how the typical *V-I* characteristics of a diode are obtained and draw these characteristics.

(ii) With the help of necessary circuit diagram, explain the working of a photodiode used for detecting optical signals.

56. (i) Explain with the help of diagram, how a depletion layer and barrier potential are formed in a junction diode.

(ii) Draw a circuit diagram of a full-wave rectifier. Explain its working and draw input and output waveforms.

57. (i) How is a depletion region formed in *p-n* junction?

(ii) With the help of a labelled circuit diagram. Explain how a junction diode is used as a full-wave rectifier. Draw its input, output waveforms.

(iii) How do you obtain steady DC output from the pulsating voltage?

58. Why is a Zener diode considered as a special purpose semiconductor diode? Draw the *I-V* characteristics of Zener diode and explain briefly, how reverse current suddenly increase at the breakdown voltage?

Describe briefly with the help of a circuit diagram, how a Zener diode works to obtain a constant DC voltage from the unregulated DC output of a rectifier.

59. (i) Describe briefly, with the help of a diagram, the role of the two important processes involved in the formation of a *p-n* junction.

(ii) Name the device which is used as a voltage regulator. Draw the necessary circuit diagram and explain its working.

60. (i) Draw the circuit diagram of a *p-n* junction diode in

(a) forward bias. (b) reverse bias.

How are these circuits used to study the *V-I* characteristics of a silicon diode? Draw the typical *V-I* characteristics.

(ii) What is a Light Emitting Diode (LED)? Mention two important advantages of LEDs over conventional lamps.

61. (i) Draw *I-V* characteristics of a Zener diode.

(ii) Explain with the help of a circuit diagram, the use of a Zener diode as a voltage regulator.

(iii) A photodiode is operated under reverse bias although in the forward bias, the current is known to be more than the current in the reverse bias. Explain, giving reason

62. (i) Draw a circuit arrangement for studying *V-I* characteristics of a *p-n* junction diode in

(a) forward bias and

(b) reverse bias.

Show typical *V-I* characteristics of a silicon diode.

(ii) State the main practical application of LED. Explain, giving reason, why the semiconductor used for fabrication of visible light LEDs must have a band gap of at least (nearly) 1.8 eV.