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UDUPI

CET25P14 ELECTRONIC DEVICES

Class 12 - Physics

Time Allowed: 1 hour and 30 minutes **Maximum Marks: 75**

1. In n-type semiconductor when all donor states are filled, then the net charge density in the donor states becomes: **[1]**

   a) < 1, but not zero
   b) > 1
   c) 1
   d) zero

2. Distance between body centred atom and a corner atom in sodium (a = 4.225 $\mathring{A}$) is **[1]**

   a) 2.54 $\mathring{A}$
   b) 3.17 $\mathring{A}$
   c) 3.66 $\mathring{A}$
   d) 2.99 $\mathring{A}$

3. The example of p-type semiconductor is **[1]**

   a) germanium doped with arsenic
   b) pure germanium
   c) germanium doped with boron
   d) pure silicon

4. A half wave rectifier is being used to rectify an alternating voltage of frequency 50 Hz. The number of pulses of rectified current obtained in one second is **[1]**

   a) 50 Hz
   b) 200 Hz
   c) 100 Hz
   d) 25 Hz

5. The valence electron in an alkali metal is a **[1]**

   a) s-electron
   b) p-electron
   c) d-electron
   d) f-electron

6. In an extrinsic semiconductor, the number density of holes is 4×10^{20} m^{-3}. If the number density of intrinsic carriers is 1.2×10^{15} m^{-3}, the number density of electrons in it is **[1]**

   a) 2.4×10^{10} m^{-3}
   b) 3.2×10^{10} m^{-3}
   c) 1.8×10^{9} m^{-3}
   d) 3.6×10^{9} m^{-3}

7. Photo diodes are used to detect **[1]**

   a) IR rays
   b) radio waves
   c) optical signals
   d) gamma rays

8. At a certain temperature in an intrinsic semiconductor, the electrons and holes concentration is 1.5×10^{16} m^{-3}. When it is doped with a trivalent dopant, hole concentration increases to 4.5×10^{22} m^{-3}. In the doped semiconductor, the concentration of electrons (n_e) will be: **[1]**

   a)
   b)

$5 \times 10^9\ m^{-3}$ $3 \times 10^6\ m^{-3}$

c) $5 \times 10^7\ m^{-3}$ d) $6.75 \times 10^{38}\ m^{-3}$

9. Carbon (C), silicon (Si) and germanium (Ge) have four valence electrons each. At room temperature, which one of the following statements is most appropriate? **[1]**

a) The number of free conduction electrons is significant only in Si, but small in C.

b) The number of free conduction electrons is significant in C, but small in Si and Ge.

c) The number of free conduction electrons is significant in all the three.

d) The number of free conduction electrons is negligible in all the three.

10. The relation between the forward current I_f and saturation current I_s for p-n junction diode is: **[1]**

a) $I_f I_s = 1$ b) $I_f = I_s$

c) $I_f = I_s \left[\frac{qV}{KT} - 1\right]$ d) $I_f = I_s e^{(qV/KT)-1}$

11. Diode is used as a/an **[1]**

a) rectifier b) amplifier

c) modulator d) oscillator

12. In an n-type semiconductor, the donor energy level lies **[1]**

a) in the conduction band b) just below the conduction band

c) just above the valance band d) at the center of the energy gap

13. The resistivity of a semiconductor at room temperature is in between: **[1]**

a) 10^{-3} to $10^6\ \Omega$ cm b) 10^{10} to $10^{12}\ \Omega$ cm

c) 10^{-2} to $10^{-5}\ \Omega$ cm d) 10^6 to $10^8\ \Omega$ cm

14. An intrinsic semiconductor, at the absolute zero temperature, behaves like a/an **[1]**

a) insulator b) superconductor

c) n-type semiconductor d) p-type semiconductor

15. In the energy-band diagram of n-type Si, the gap between the bottom of the conduction band E_C and the donor energy level E_D is of the order of: **[1]**

a) 0.01 eV b) 10 eV

c) 1 eV d) 0.1 eV

16. Forward biasing of p-n junction offers **[1]**

a) zero resistance b) high resistance

c) infinite resistance d) low resistance

17. 12 V battery is applied in forward bias across a circuit having p-n junction and resistance R in series. 0.6 V potential is dropped across the p-n junction, and current is 2×10^{-3} A. The resistance R is **[1]**

a) $5.7 \times 10^4\ \Omega$ b) 5.7×10^3

c) $5.7 \times 10^2\ \Omega$ d) 5.7×10^5

18. For forward biasing a p-n junction, the positive terminal of the battery is connected to **[1]**

a) n-type crystal
b) either p-type or n-type crystal
c) p-type crystal
d) neither p-type nor n-type crystal

19. The energy gap between the valence and conduction bands of a substance is 6 eV. The substance is a: **[1]**

a) semiconductor
b) superconductor
c) insulator
d) conductor

20. Suitable impurities are added to a semiconductor depending upon its use. This is done to **[1]**

a) increase its electrical resistivity
b) enable it to withstand high voltage
c) increase its electrical conductivity
d) increase its life

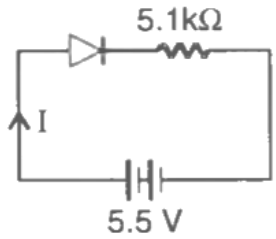
21. Which of the following is the weakest kind of bonding in solids? **[1]**

a) Van der Waals
b) Covalent
c) Metallic
d) Ionic

22. When an intrinsic semiconductor is doped with a small amount of trivalent impurity, then: **[1]**

a) its resistance increases.
b) it becomes a p-type semiconductor.
c) there will be more free electrons than holes in the semiconductor.
d) dopant atoms become donor atoms.

23. A p-n junction diode is connected to a battery of emf 5.5 V and external resistance 5.1 kΩ. The barrier potential in the diode is 0.4 V. The current in the circuit is: **[1]**



a) 1 mA
b) 1.08 mA
c) 0.08 mA
d) 1 A

24. In p-type semiconductor, **[1]**

A. major current carrier are electrons
B. major carrier are mobile negative ions
C. major carrier are mobile holes
D. the number of mobile holes exceeds the number of acceptor atoms

a) Option C
b) Option A
c) Option D
d) Option B

25. When trivalent impurity is mixed in a pure semiconductor, the conduction is mainly due to **[1]**

a) holes
b) protons
c) positive ions
d) electrons

26. In a good conductor, the energy gap between the valence and conduction bands is **[1]**

a) infinite
b) 6 eV
c) zero
d) 1 eV

27. Which one of the following elements will require the highest energy to take out an electron from them? Pb, Ge, C and Si **[1]**

a) C
b) Ge
c) Pb
d) Si

28. Holes are charge carriers in **[1]**

a) intrinsic and p-type semiconductors
b) n-type semiconductor
c) intrinsic semiconductor only
d) p-type semiconductor only

29. The dominant mechanisms, due to the concentration gradient, for motion of charge carriers in silicon p-n junction are: **[1]**

a) Diffusion of holes from p to n and electrons from n to p
b) Diffusion of electrons only from n to p
c) Diffusion of holes only from p to n
d) Diffusion of holes from n to p and electrons from p to n

30. The unidirectional flow of current through p-n junction makes it ideal to be used as **[1]**

a) photoelectricity
b) modulator
c) oscillator
d) rectifier

31. In a middle of the depletion layer of a reverse biased p-n junction, the **[1]**

a) electric field is maximum
b) potential is zero
c) potential is maximum
d) electric field is zero

32. The potential barrier in the depletion layer is due to **[1]**

a) Holes
b) Forbidden gap
c) Electrons
d) Ions

33. The intrinsic semiconductor becomes an insulator at: **[1]**

a) -100 C
b) 300 K
c) 0 C
d) 0 K

34. A solid having uppermost energy band partially filled with electrons is called **[1]**

a) non-metal
b) semi-conductor
c) insulator
d) conductor

35. A p-type semiconductor can be obtained by adding **[1]**

a) phosphorus to pure germanium
b) gallium to pure silicon
c) arsenic to pure silicon
d) antimony to pure germanium

36. If n_e and n_h are the number of electrons and holes in pure germanium, then **[1]**

a) n_e = finite and $n_h = 0$
b) $n_e = n_h$

c) $n_e < n_h$ d) $n_e > n_h$

37. Semiconductors behave like insulators at _____ **[1]**

a) 273 K b) 0^oC

c) 0 K d) 300 K

38. In semiconducting materials, the mobilities of electrons and holes are μ_e and μ_h respect. Which of the following is true? **[1]**

a) $\mu_e = \mu_h$ b) $\mu_e > \mu_h$

c) $\mu_e < 0; \mu_h > 0$ d) $\mu_e < \mu_h$

39. The impurity atoms to be mixed in pure silicon to form p-type semiconductor are, of **[1]**

a) aluminum b) phosphorus

c) germanium d) antimony

40. In a reverse-biased p-n junction, when the applied bias voltage is equal to the breakdown voltage, then **[1]**

a) current remains constant while voltage increases sharply b) voltage remains constant while current increases sharply

c) current and voltage decrease d) current and voltage increase

41. If a p-n diode is reverse biased, then the resistance measured by an ohmmeter will be **[1]**

a) low b) infinite

c) zero d) high

42. In the depletion region of an unbiased p-n junction diode, there are **[1]**

a) immobile ions b) electrons

c) mobile ions d) holes

43. In an unbiased p-n junction, **[1]**

a) undetermined b) high potential at n side and low potential at p side

c) p and n both are at same potential d) high potential at p side and low potential at n side

44. The output from a full wave rectifier is **[1]**

a) a pulsating unidirectional voltage b) a dc voltage

c) zero d) unidirectional voltage having ripples

45. Number of atoms per unit cell in bcc lattice is **[1]**

a) 9 b) 2

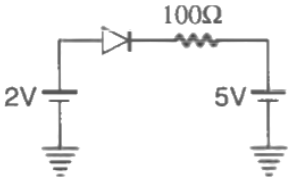
c) 4 d) 1

46. In forward bias, the width of a potential barrier in a p-n junction diode **[1]**

a) remains constant b) increases

c) decreases d) first remains constant then decreases

47. Current through the ideal diode is: **[1]**



a) 20 A
b) $(\frac{1}{20})$ A
c) zero
d) $(\frac{1}{50})$ A

48. The number of valence electrons in a good conductor is generally **[1]**

a) three or less than three
b) four
c) six or more than six
d) five

49. A donor impurity results in **[1]**

a) increase of resistance of the semiconductor
b) production of n-semiconductor
c) energy bands just above the filled valency
d) production of p-semiconductor

50. Rectification is the process of conversion of **[1]**

a) low d.c. into high d.c.
b) low a.c. into high a.c.
c) a.c. into d.c.
d) d.c. into a.c.

51. The difference in variation of resistance with temperature in a metal and semiconductor is due to **[1]**

a) type of bonding
b) variation of scattering with temperature
c) variation in number of charge carries with temperature
d) crystal structure

52. In a p-type semiconductor, the majority carriers of current are **[1]**

a) electrons
b) neutrons
c) holes
d) protons

53. When a forward bias is applied to a p-n junction, it **[1]**

a) reduces the majority carrier current to zero
b) lowers the potential barrier
c) free electrons and holes move away from the juction
d) raises the potential barrier

54. Atomic packing factor of simple cubic cell is **[1]**

a) $\frac{\pi}{6}$
b) $\frac{\pi}{8}$
c) $\frac{\pi}{3\sqrt{2}}$
d) $\pi\frac{\sqrt{3}}{8}$

55. Energy required to break one bond in DNA is approximately **[1]**

a) $\approx$ 2.1eV
b) $\approx$ 1eV
c) $\approx$ 0.1eV
d) $\approx$ 0.01eV

56. Forbidden energy gap for a diamond is about: **[1]**

a) 1.5 eV
b) 6 eV
c) 1 eV
d) 0.6 eV

57. Energy gap between valence band and conduction band of a semiconductor is **[1]**

a) infinite
b) zero
c) 10 eV
d) 1 eV

58. The formation of depletion region in a p-n junction diode is due to **[1]**

a) movement of dopant atoms
b) drift of electrons only
c) diffusion of both electrons and holes
d) drift of holes only

59. An n-type Ge is obtained on doping the Ge-crystal with **[1]**

a) phosphorus
b) gold
c) aluminum
d) boron

60. The cause of the potential barrier in a p-n diode is **[1]**

a) depletion of positive charges near the junction
b) the concentration of positive and negative charges near the junction
c) concentration of positive charges near the junction
d) depletion of negative charges near the junction

61. The probability of finding an electron in Fermi energy level is: **[1]**

a) 50%
b) 20%
c) 0%
d) 100%

62. The state of energy gained by valence electrons when the temperature is raised or when an electric field is applied is called **[1]**

a) valence band
b) non valence band
c) conduction band
d) forbidden band

63. In a p-type semiconductor, germanium is doped with **[1]**

a) aluminium
b) all of these
c) gallium
d) boron

64. The energy gap between the conduction band and valence band is of the order of 0.07 eV. It is a/an **[1]**

a) insulator
b) semiconductor
c) conductor
d) alloy

65. During the formation of a p-n junction: **[1]**

a) both the diffusion current and drift current remain constant.
b) diffusion current keeps increasing.
c) diffusion current remains almost constant but drift current increases till both currents become equal.
d) drift current remains constant.

66. For the forward biasing of a p-n junction diode, which of the following statements is **not** correct? **[1]**

a) Forward current is due to the diffusion of both holes and electrons.
b) Minority carrier injection occurs.

c) The potential barrier decreases. d) Width of depletion layer increases.

67. At equilibrium, in a p-n junction diode the net current is **[1]**

a) due to drift of minority charge carriers b) due to diffusion of majority charge carriers

c) zero as diffusion and drift currents are equal and opposite d) zero as no charge carriers across the junction

68. The behavior of Ge as a semiconductor is due to the width of **[1]**

a) forbidden band being small and narrow b) forbidden band being large and wide

c) conduction band being small and narrow d) conduction band being large

69. The electrical conductivity of a semiconductor increases when electromagnetic radiation of wavelength shorter than 2480 nm is incident on it. The band gap (in eV) for the semi conductor is: **[1]**

a) 1.1 b) 0.9

c) 0.7 d) 0.5

70. The typical ionization energy of a donor in silicon is **[1]**

a) 1.0 eV b) 10.0 eV

c) 0.001 eV d) 0.1 eV

71. A Ge specimen is doped with Al. The concentration of acceptor atoms is $\approx 10^{21}$ atoms m^{-3}. Given that the intrinsic concentration of electron-hole pair is $\approx 10^{19}$ m^{-3}, the concentration of electrons in the specimen is **[1]**

a) 10^{17} m^{-3} b) 10^{2} m^{-3}

c) 10^{15} m^{-3} d) 10^{4} m^{-3}

72. In n-type semiconductors, majority charge carriers are **[1]**

a) holes b) protons

c) electrons d) neutrons

73. C and Si both have the same lattice structure, having 4 bonding electrons in each. However, C is an insulator whereas Si is an intrinsic semiconductor. This is because **[1]**

A. In case of C the valence band is not completely filled at absolute zero temperature.

B. In case of C the conduction band is partly filled even at absolute zero temperature.

C. The four bonding electrons in the case of C lie in the second orbit, whereas in the case of Si they lie in the third.

D. The four bonding electrons in the case of C lie in the third orbit, whereas for Si they lie in the fourth orbit.

a) Option B b) Option A

c) Option D d) Option C

74. A p-n junction has a thickness of the order of **[1]**

a) 1 cm b) 1 mm

c) 10^{-6}m d) 10^{-12}cm

75. Sodium has body-centered packing. If the distance between two nearest atoms is 3.7 $\mathring{A}$, then lattice parameter is **[1]**

a) 3.3 Å

b) 3.9 Å

c) 4.8 Å

d) 4.3 Å