PHYSICS

BOOKS - MHTCET PREVIOUS YEAR PAPERS AND PRACTICE PAPERS

SEMICONDUCTORS

Example

1. The number of silicon atoms per $m^3 is 5 \times 10^{28}$. This is doped simultaneously with 5×10^{22} atoms per m^3 of Arsenic and $5 \times 10^{20} per m^3$ atoms of indium. Calculate the number of electrons and holes. Given that $n_i = 1.5 \times 10^{16} m^{-3}$. Is the material n-type or p-type?

A. $3.24 \times 10^{6} m^{-3}$

B. $6.24 \times 10^{8} m^{-3}$

C. $4.54 \times 10^{9} m^{-3}$

D. None of these

Answer: C

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2. Mobilities of electorns and holes in a sample of intrinsic germanium at room temperature are $0.54 m^{2} V^{-1} s^{-1}$ and $0.18 m^{2} V^{-1} s^{-1}$ respectively.

If the electron and hole densities are equal to $3.6 \times 10^{19} m^{-3}$ calculate the germanium conductivity.

A. $4.147 s m^{-1}$

B. $0.54 sm^{-1}$

C. $2.24 sm^{-1}$

D. $3.92\ sm^{-1}$

Answer: A

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3. The current gain of the amplifier in the common emitter configuration is 80. What is its current gain in common base configuration ?

A. 0.999

B. 0.909

C. 0.908

D. 0.988

Answer: D

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4. For a CE transistor amplifier, the audio signal voltage across the collector resistance of $2k\Omega$ is $2V$. Suppose the current amplification factor of the transistor is 100. The value of R_B in series with V_{BB} supply of $2V$, if the DC base current has to be 10 times the signal current is.

A. 16 $k\Omega$

B. 18 $k\Omega$

C. 14 $k\Omega$

D. 10 $k\Omega$

Answer: C

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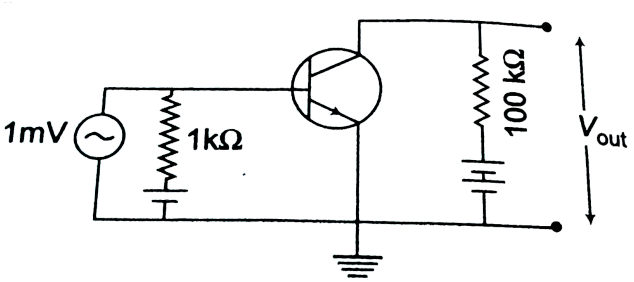
5. In given circuit, current gain of transistor is $\beta = 100$, the output of amplifier will be



A. 10 V

B. 0.1 V

C. 1.0 V

D. 100 V

Answer: A

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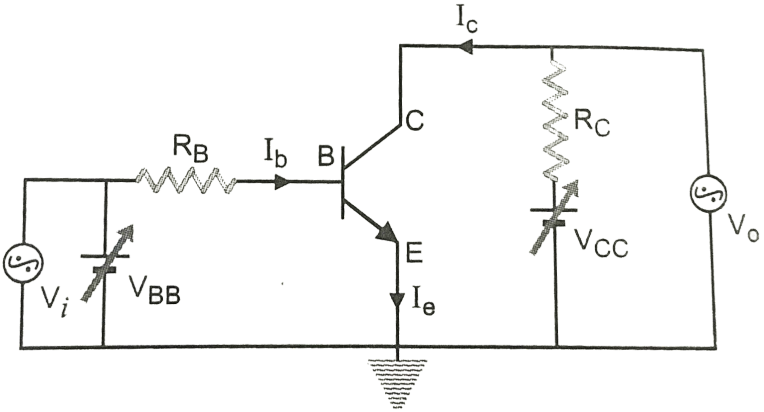
6. In common emitter transistor as shown in Fig., the V_{BB} supply can be varied from 0 V to 5.0V. The Si. Transistor has $\beta_{ac} = 250$ and $R_B = 100k\Omega$, $R_c = 1k\Omega$, $V_{CC} = 5.0V$. Assume that when the transistor is saturated, $V_{CE} = 0V$ and $V_{BE} = 0.8V$. Calculate the minimum base current, for which the transistor will reach saturation. Hence, determine V_i when the transistor is 'switched on' find ranges of V_i for which the

transistor is switched off and switched on.



A. $10\mu A$

B. $20\mu A$

C. $30\mu A$

D. $40\mu A$

Answer: B

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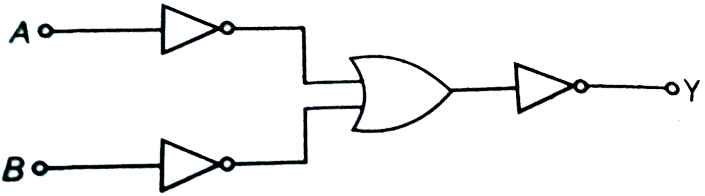
7. Which of the following logic gate is represented by the combination of logic gates ?



A. NAND gate

B. OR gate

C. AND gate

D. None of these

Answer: C

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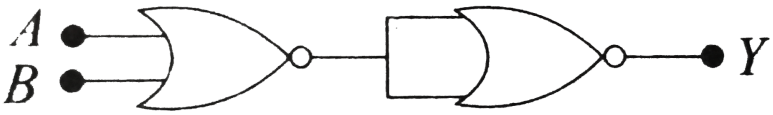
8. In the following circuit, the output Y for all possible inputs A and B is expressed by the truth table:



A.

A	B	Y
0	0	0
0	1	1
1	0	1
1	1	1

B.

A	B	Y
0	0	1
0	1	0
1	0	1
1	0	1

C.

A	B	Y
0	0	0
0	1	1
1	1	1
1	1	1

D. None of these

Answer: A

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Exercise 1 Topical Problems

1. When the conductivity of a semiconductor is only due to breaking of covalent bonds, the semi conductor is called.

A. intrinsic

B. extrinsic

C. p-type

D. n-type

Answer: A

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2. If a small amount of antimony is added to germanium crystal

A. the antimony becomes an acceptor atom

B. there will be more free electrons than holes in the semiconductor

C. its resistance is increased

D. it becomes a p-type semiconductor

Answer: B

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3. The maximum wavelength of electromagnetic radiation, which can create a hole-electron pair in germanium. (Given that forbidden energy gap in germanium is 0.72 eV)

A. 172220 Å

B. 172.2 Å

C. 17222 Å

D. 1722 Å

Answer: C

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4. Basic building blocks of all electronic circuits are

A. devices in which there is a flow of electrons

B. devices in which there is no flow of electrons

C. devices in which there is a controlled flow of electrons

D. devices in which there is an uncontrolled flow of electrons

Answer: C

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5. In a crystal, atomic separation is around 2A to 3A. At this separation due to interatomic interaction, energies of

A. outermost electrons is changed

B. innermost electrons is changed

C. Both (a) and (b)

D. None of these

Answer: A

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6. GaAs is-

A. an elemental semiconductor

B. alloy semiconductor

C. bad conductor

D. metallic semiconductor

Answer: B

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7. There is no hole current in conductors because they have

A. have large forbidden energy gap

B. have overlapping valence and conduction bands

C. are full of electron gas

D. have no valence band

Answer: B

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8. If N_P and N_e be the numbers of holes and conduction electrons in an extrinsic semiconductor, then

A. $N_p > N_e$

B. $N_p = N_e$

C. $N_p < N_e$

D. $N_p > N_e$ or $N_p < N_e$ depending on the nature of impurity

Answer: D

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9. An n-type and p-type silicon can be obtained by doping pure silicon with.

A. arsenic and phosphorous respectively

B. indium and aluminium respectively

C. phosphorus and indium respectively

D. aluminium and boron respectively

Answer: C

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10. In an insulator, the forbidden energy gap between the valence band and conduction band is of the order of

A. $3eV < E_g < 6eV$

B. $E_g > 6eV$

C. $E_g < 3eV$

D. $E_g = 0eV$

Answer: B

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11. Correct one is

A. $\sigma_{\text{semiconductor}} > \sigma_{\text{insulator}} > \sigma_{\text{metals}}$

B. $\sigma_{\text{metal}} > \sigma_{\text{semiconductor}} > \sigma_{\text{insulator}}$

C. $\sigma_{\text{semiconductor}} > \sigma_{\text{metals}} > \sigma_{\text{insulator}}$

D. $\sigma_{\text{insulator}} > \sigma_{\text{semiconductor}} > \sigma_{\text{metals}}$

Answer: B

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12. Forbidden energy gap in a semiconductor is

A. 1 eV

B. 6 eV

C. 0 eV

D. 3 eV

Answer: D

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13. In its crystalline structure, every Si or Ge atoms are attached to other atoms by

A. coordinate bond

B. electrovalent bond

C. covalent bond

D. hydrogen bond

Answer: C

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14. Let n_p and n_e be the number of holes and conduction electrons respectively in a semiconductor. Then,

A. $n_p > N_e$ in an intrinsic semiconductor, $I < I_p + I_e$

B. $n_p = n_e$ in an extrinsic semiconductor, $I > I_p + I_e$

C. $n_p = n_e$ in an intrinsic semiconductor, $I = I_p + I_e$

D. $n_p > n_e$ in an intrinsic semiconductor, $I = 0$

Answer: C

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15. At elevated temperature, few of covalent bonds of Si or Ge are broken a vacancy in the bond is created. Effective charge of vacancy or hole is

A. positive

B. negative

C. neutral

D. sometimes positive and sometimes negative

Answer: A

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16. Carbon, silicon and germanium atoms have four valence electrons each. Their valence and conduction bands are separated by energy band gaps represented by $(E_g)_C$, $(E_g)_{Si}$ and $(E_g)_{Ge}$, respectively. Which one of the following relationship is true in their case?

A. $E_g(Si) < E_g(Ge) < E_g(C)$

B. $E_g(Si) > E_g(Ge) < E_g(C)$

C. $E_g(Si) < E_g(Ge) < E_g(C)$

D. $E_g(Si) > E_g(Ge) > E_g(C)$

Answer: B

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17. A intrinsic semiconductor at a absolute zero of temperature behaves as

A. conductor

B. p-type semiconductor

C. n-type semiconductor

D. insulator

Answer: D

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18. Would there be any advantage to adding n-type or p-type impurities to copper

A. Yes

B. No

C. May be

D. Data insufficient

Answer: B

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19. The temperature of germanium is decreased from room temperature to 100 K, the resistance of germanium

A. decreases

B. increases

C. remains unaffected

D. depends on external conditions

Answer: B

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20. The contribution in the total current flowing through a semiconductor due to electrons and holes are $\frac{3}{4}$ and $\frac{1}{4}$ respectively. If the drift velocity of electrons is $\frac{5}{2}$ times that of

holes at this temperature, then the ratio of concentration of electrons and holes is

A. $6:5$

B. $5:6$

C. $3:2$

D. $2:3$

Answer: A

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21. Which one of the following statements is false ?

A. Pure Si doped with trivalent impurities gives a p-type semiconductor

B. Majority carriers in a n-type semiconductor are holes

C. Minority carriers in a p-type semiconductor are electrons

D. The resistance of intrinsic semiconductor decreases with increase of temperature

Answer: B

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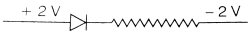
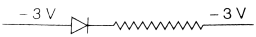
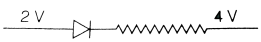
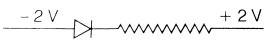
22. The forward biased diode connection is

A. 

B. 

C. 

D. 

Answer: A

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23. Reverse bias applied to a junction diode

A. lowers the potential barrier

B. decreases the majority charge carriers

C. raises the potential barrier

D. changes the mass of p-n junction diode

Answer: C

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24. In a reverse biased p-n junction, when the applied bias voltages is equal to the breakdown voltage, then

A. current remains constant while voltage increases sharply

B. voltage remains constant while current increases sharply

C. current and voltage increase

D. current and voltage decrease

Answer: B

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25. In a p- n junction diode not connected to any circuit,

A. the potential is the same everywhere

B. the p-type side has a higher potential than the n-type side

C. there is an electric field at the junction directed from the n-type side to p-type side

D. there is an electric field at the junction directed from the p-type side to n-type side

Answer: C

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26. When LED is forward biased, then

A. electrons from the n-type material cross the p-n junction and recombine with holes in the p-type material

B. electrons and holes neutralise each other

C. at junction electrons and holes remains at rest

D. None of the above

Answer: A

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27. A full wave rectifier uses two diodes with a load resistance of 100Ω. Each diode is having negligible forward resistance. Find the efficiency of this wave rectifier.

A. $812\ \%$

B. $40.6\ \%$

C. $80.4\ \%$

D. $40.2\ \%$

Answer: C

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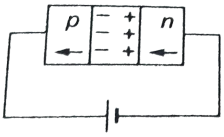
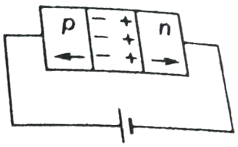
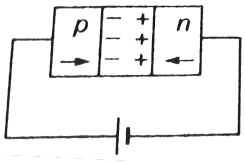
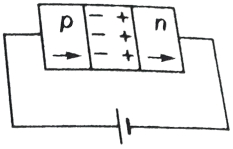
28. In forward biasing of the p-n junction:

A. 

B. 

C. 

D. 

Answer: D

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29. In a $P-N$ junction diode :

A. the current in the reverse biased condition is generally very small

B. the current in the reverse biased condition is small but the forward biased current is independent of the biase voltage

C. the reverse biased current is strongly dependent on the applied bias voltage

D. the forward biased current is very small in comparison to reverse biased current

Answer: C

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30. In the middle of the depletion layer of a reverse - biased $p-n$ junction , the

A. electric field is zero

B. potential is maximum

C. electric field is maximum

D. potential is zero

Answer: A

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31. In a semi conductor diode , the barrier potential offers opposition to only -

A. majority carrier in both regions

B. minority carrier in both regions

C. free electrons in the n-region

D. holes in the p-region

Answer: C

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32. For germenium crystal, the forbidden energy gap in joules is

A. zero

B. 1.6×10^{-19}

C. 1.1×10^{-19}

D. 1.76×10^{-19}

Answer: C

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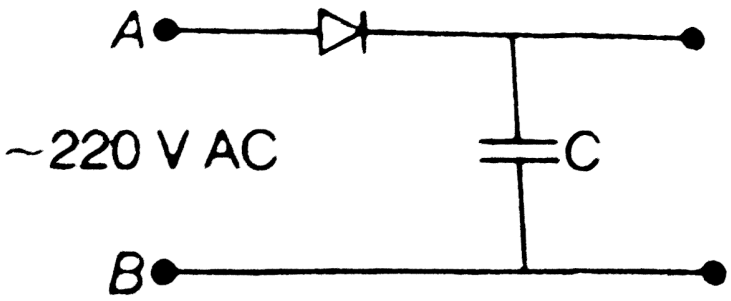
33. A 220 V AC supply is connected between points A and B.



What will be potential difference across capacitor C ?

A. 220 V

B. 110 V

C. 0 V

D. $220\sqrt{2}V$

Answer: D

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34. If an alternating voltage is applied across a diode in series with a load, then

A. a DC voltage appears across load

B. an AC voltage appears across load

C. a pulsating voltage appears across load

D. no voltage appears across load

Answer: C

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35. In half - wave rectification, what is the output frequency, if the

input frequency is 50 Hz ? What is the output frequency of a

full - wave rectifier

for the same input frequency ?

A. $1:2$

B. $2:1$

C. $4:1$

D. $1:4$

Answer: B

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36. The p-n junction which generates an emf when solar radiation falls on it, with no external bias applied, is a

A. light emitting diode

B. photodiode

C. solar cell

D. zener diode

Answer: B

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37. Avalanche breakdown in a PN junction diode is to

A. shift of fermi level

B. widening of forbidden gap

C. high impurity concentration

D. commulative effect of conduction band electrons collision

Answer: D

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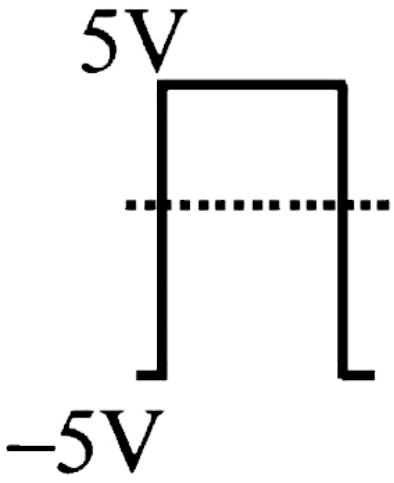
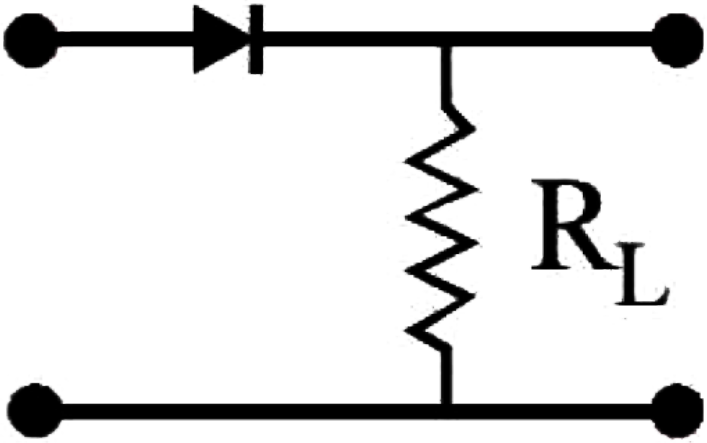
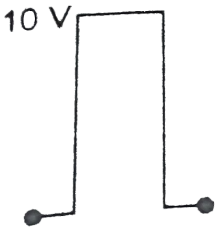
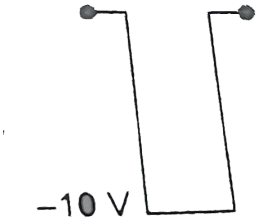
38. If in a $p-n$ junction diode , a square input single of $10V$ is applied as shown

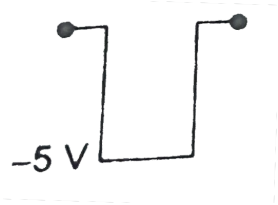


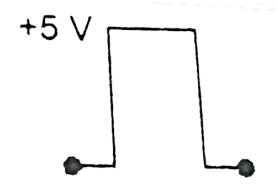


A.



B. 

C. 

D. 

Answer: D

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39. Pure Si at 300 K has equal electron (n_e) and hole (n_h) concentrations of $1.5 \times 10^{16} m^{-3}$ doping by indium increases n_h to $4.5 \times 10^{22} m^{-3}$. Caculate n_e in the doped Si-

A. 9×10^5

B. 5×10^9

C. 2.25×10^{11}

D. 3×10^{19}

Answer: B

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40. In an unbiased p-n junction,

A. potential at p is more than that at n

B. potential at p is less than that at n

C. potential at p is equal to that at n

D. potential at p is positive and that at n is negative

Answer: B

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41. The difference in the variation of resistance with temperature in a metal and a semiconductor arises essentially due to the difference in the

A. crystal structure

B. variation of the number of charge carriers with temperature

C. type of bonding

D. variation of scattering mechanism with temperature

Answer: B

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42. In semiconductor the concentrations of electron and holes are $8 \times 10^{18} / m^3$ and $5 \times 10^{18} / m$ respectively. If the mobilities of electrons and hole are $2.3 m^2 /$ volt-sec and $0.01 m^2 /$ volt-sec respectively, then semicondutor is

A. n-type and its resistivity is 0.34 Ω-m

B. p-type and its resistivity is 0.034 Ω-m

C. n-type and its resistivity is 0.034 Ω-m

D. p-type and its resistivity is 3.4 Ω-m

Answer: A

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43. A light emitting diode (LED) has a voltage drop of $2V$ across it and passes a current of $10mA$. When it operates with a $6V$ battery through a limiting resistor R. The value of R is

A. $40k\Omega$

B. $4k\Omega$

C. 200Ω

D. 400Ω

Answer: D

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44. Rectifier converts

A. mechanical energy to electrical energy

B. AC to DC

C. light energy to electrical energy

D. None of the above

Answer: B

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45. The probability of electrons to be found in the conduction band of an intrinsic semiconductor at a finite temperature

A. decreases exponentially with increasing band gap

B. increases exponentially with increasing band gap

C. decreases with increasing temperature

D. is independent of the temperature and the band gap

Answer: A

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46. A transistor is operated in common emitter configuration at $V_c = 2V$ such that a change in the base current from $100\mu A$ to $300\mu A$ produces a change in the collector current from $10mA$ to $20mA$. The current gain is

A. 75

B. 100

C. 25

D. 50

Answer: D

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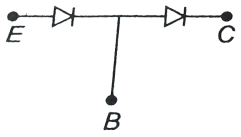
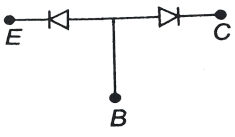
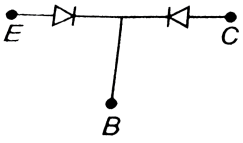
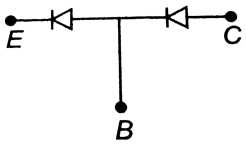
47. An n-p-n transistor can be considered to be equivalent to two diodes, connected. Which of the following figures is the correct one ?

A. 

B. 

C. 

D. 

Answer: B

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48. The transfer characteristics of a base biased transistor has the operation regions, namely, cutoff, active region and saturation region. For using the transistor as an amplifier it has to operate in the

A. active region

B. cut off region

C. saturation region

D. cut off and saturation

Answer: A

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49. For a transistor the parameter $\beta = 99$. The value of the parameter α is

A. 0.1

B. 1

C. 0.9

D. 9

Answer: D

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50. The current gain in the common emitter mode of a transistor is 10. The input impedance is $20k\Omega$ and load of resistance is $100k\Omega$. The power gain is

A. 300

B. 500

C. 200

D. 100

Answer: B

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51. If β, R_L and r are the AC current gain, load resistance and the input resistance of a transistor respectively in CE configuration, the voltage and the power gains respectively are

A. $\beta\frac{R_L}{r}$ and $\beta^2\frac{R_L}{r}$

B. $\beta\frac{r}{R_L}$ and $\beta^2\frac{r}{R_L}$

C. $\beta\frac{R_L}{r}$ and $\beta\left(\frac{R_L}{r}\right)^2$

D. $\beta\frac{r}{R_L}$ and $\beta\left(\frac{r}{R_L}\right)^2$

Answer: A

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52. In a common base configuration (transistor circuit) $I_E = 1mA, I_C = 0.95mA$. The value of base current is

A. 195 mA

B. 0.05 mA

C. 105 mA

D. 0.95 mA

Answer: B

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53. In case of NPN-transistor the collector current is always less than the emitter current because

A. collector side is reverse biased and the emitter side is forward biased

B. a few electrons are lost in the base and only remaining ones reach the collector

C. collector being reverse biased, attracts less electrons

D. collector side is forward biased and emitter side is reverse biased

Answer: B

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54. The input resistance of a common emitter transistor amplifier, if the output resistance is $500k\Omega$, the current gain $\alpha = 0.98$ and the power gain is 6.0625×10^6 is

A. 198Ω

B. 300Ω

C. 100Ω

D. 400Ω

Answer: A

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55. An amplifier has a voltage gain $A_v = 1000$. The voltage gain in dB is:

A. 30

B. 60

C. 3

D. 20

Answer: A

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56. A $p - n - p$ transistor is said to be in active region of operation, When

A. both emitter junction and collector junction are forward biased

B. both emitter junction and collector junction are reverse biased

C. emitter junction is forward biased and collector junction is reverse biased

D. emitter junction is reverse biased and collector junction is forward biased

Answer: C

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57. The current of transistor in common emitter mode is 49. The change in collector current and emitter current corresponding to the change in the base current by $5.0\mu A$m will be :-

A. $245\mu A, 250\mu A$

B. $240\mu A, 235\mu A$

C. $260\mu A, 255\mu A$

D. None of these

Answer: A

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58. A transistor can be used practically in

A. only one configuration

B. only two configurations

C. three possible configurations

D. four possible configurations

Answer: C

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59. In an n-p-n transistor in CE configuration when V_{BE} is increased by small amount, then

A. I_B increases and I_C increases proportionately

B. I_B increases and I_C remains constant

C. I_B remains constant and I_C increases

D. Both I_B and I_C remain nearly constant

Answer: A

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60. For a transistor circuit, $I_B = 10mA$ and $I_C = 5.2mA$,

A. transistor can be used as amplifier with $A_V = 10$

B. transistor can be used as amplifier with $A_V = 100$

C. transistor can be used as amplifier with $A_V = 1000.$

D. transistor cannot be used as amplifier

Answer: D

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61. The current gain of a common base transistor circuit is 0.96. On changing the emitter current by 10.0 mA, the change in the base current will be

A. 9.6 mA

B. 0.4 mA

C. 19.6 mA

D. 24 mA

Answer: A

Watch Video Solution

62. In case of NPN-transistor the collector current is always less than the emitter current because

A. collector side is reverse biased and the emitter side is forward biased

B. a few electrons are lost in the base and only remaining ones reach the collector

C. collector being reverse biased, attracts less electrons

D. collector side is forward biased and emitter side is reverse biased

Answer: D

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63. In transistor, forward bias is always smaller than the reverse bias. The correct reason is

A. to avoid excessive heating of transistor

B. to maintain a constant base current

C. to produce large coltage gain

D. None of the above

Answer: A

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64. The device that can act as a complete electronic circuit is

A. junction diode

B. integrated circuit

C. junction transistor

D. zener diode

Answer: B

Watch Video Solution

65. The voltage gain of an amplifier with 9% negative feedback is 10. The voltage gain without feedback will be

A. 90

B. 10

C. 125

D. 100

Answer: D

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66. The minimum potential difference between the base and emitter required to switch a silicon transistor ON is approximately?

A. 1 V

B. 3 V

C. 5 V

D. 4.2 V

Answer: A

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67. In the CB mode of a transistor, when the collector voltage is changed by 0.5 volt. The collector current changes by $0.05mA$. The output resistance will be

A. $10k\Omega$

B. $20k\Omega$

C. $5k\Omega$

D. $2.5k\Omega$

Answer: A

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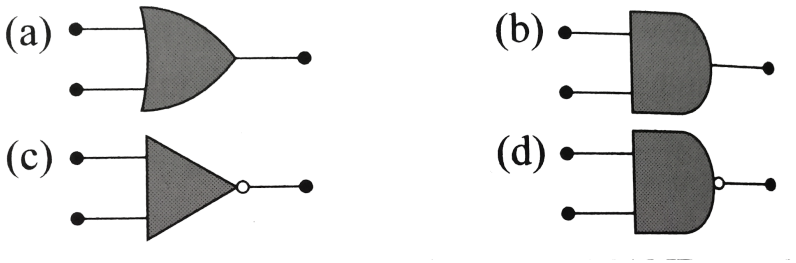
68. Symbolic representation of four logic gates are shown as



A. (iii), (ii) and (i)

B. (iii), (ii) and (v)

C. (ii), (iv) and (iii)

D. (ii), (iii) and (iv)

Answer: C

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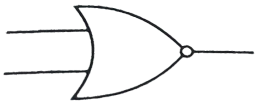
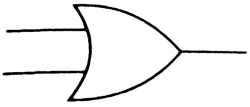
69. Symbolic representation of NOR gate is

A. 

B. 

C. 

D. 

Answer: A

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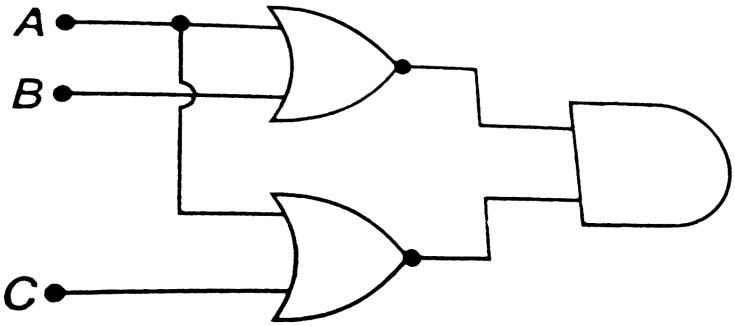
70. The output of given logic circuit is



A. $A \cdot (B + C)$

B. $A \cdot (B \cdot C)$

C. $(A + B) \cdot (A + C)$

D. $A + B + C$

Answer: C

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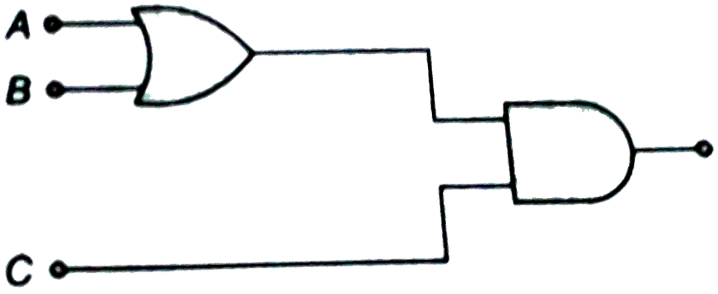
71. To get an output 1 from the circuit shown in the figure, the input must be



A. $A = 0, B = 1, C = 0$

B. $A = 1, B = 0, C = 0$

C. $A = 1, B = 0, C = 1$

D. $A = 1, B = 1, C = 0$

Answer: C

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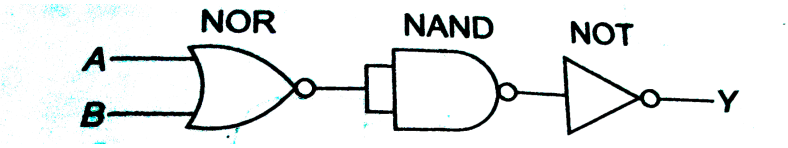
72. The circuit is equivalent to



A. AND gate

B. NAND gate

C. NOR gate

D. OR gate

Answer: C

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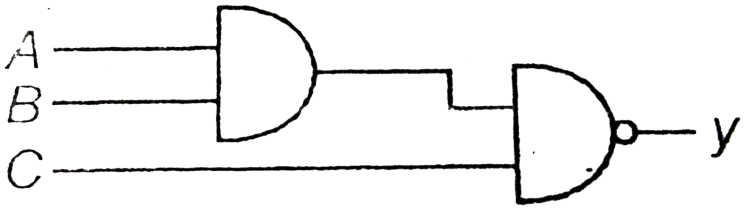

73.

The output y, when all three inputs are first high and then low, will respectively be

A. 1, 0

B. 1, 1

C. 0, 0

D. 0, 1

Answer: D

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74. An AND gate is following by a NOT gate in series. With two inputs A & B, the Boolean expression for the out put Y will be :

A. $\overline{A+B}$

B. $\overline{A \cdot B}$

C. $A \cdot B$

D. $A+B$

Answer: B

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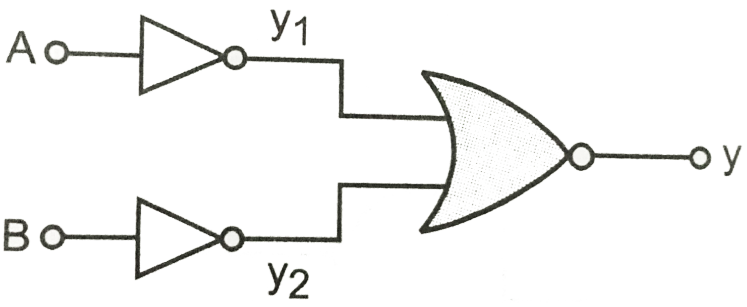
75. Which logic gate is represented by the following combination of logic gates



A. OR

B. NAND

C. AND

D. NOR

Answer: C

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76. To which logic gate does the truth table given below correspond ?

A	B	X
0	0	0
0	1	1
1	0	1
1	1	0

A. AND

B. OR

C. NAND

D. XOR

Answer: D

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77. In Boolean algebra $A + B = Y$ implies that :

A. sum A and B is Y

B. Y exists when A exists of B exists or both A and B exists.

C. Y exists only when A and B both exist

D. Y exists when A or B exists but not when both A and B exist

Answer: B

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78. Digital circuit can be made by repetitive use of

A. OR gate

B. AND gates

C. NOT gates

D. NAND gates

Answer: D

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79. If $A = B = 1$, then in terms of Boolean algebra the value of $A.\ B + A$ is not equal to.

A. $B \cdot A + B$

B. $B + A$

C. B

D. None of these

Answer: D

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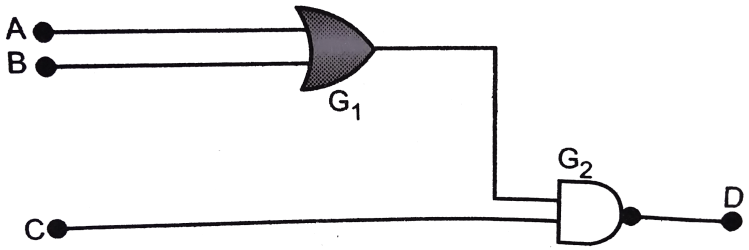
80. For the given combination of gates, if the logic states of inputs $A, B, C,$ are as follows $A = B = C = 0$ and $A = B = 1, C = 0$ then the logic states of output D are



A. 0, 0

B. 0, 1

C. 1, 0

D. 1, 1

Answer: D

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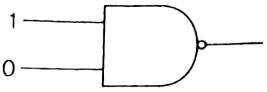
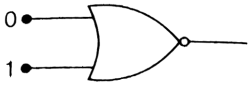
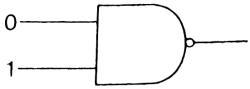
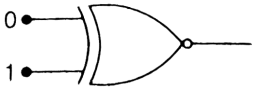
81. Which of the following gates will have an output of 1

A. 

B. 

C. 

D. 

Answer: C

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82. What will be the input of A and B for the Boolean expression $\overline{(A+B)}.\overline{(A.B)} = 1$?

A. 0, 0

B. 0, 1

C. 1, 0

D. 1, 1

Answer: A

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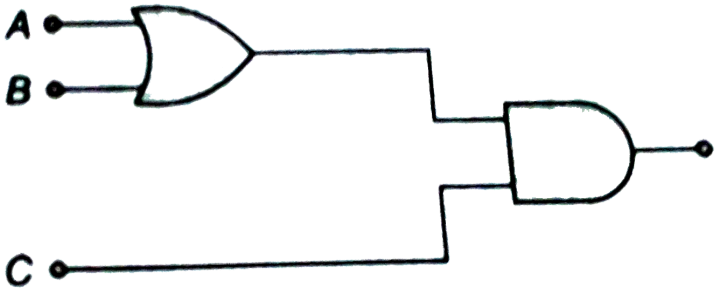
83. To get an output 1 from the circuit shown in the figure, the input must be



A. $A = 0, B = 1, C = 0$

B. $A = 1, B = 0, C = 0$

C. $A = 1, B = 0, C = 1$

D. $A = 1, B = 1, C = 0$

Answer: C

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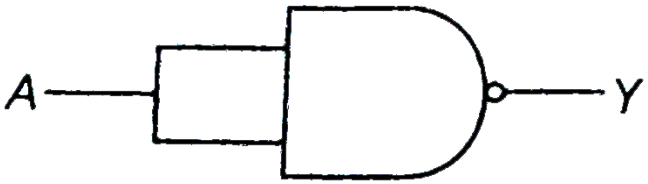
84. Which of the following is the truth table for the circuit below ?



A.

A	Y
1	0
0	1

B.

A	Y
0	0
1	1

C.

A	Y
1	1
0	1

D.

A	Y
0	1
0	0

Answer: A

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Exercise 1 Miscellaneous Problems

1. in an n-type semiconductor, the donor energy level lies (a) at the center of the energy gap (b) just below the conduction band (c)just above the valence band (d) in the conduction band

A. an insulator

B. a conductor

C. p-type semiconductor

D. n-type semiconductor

Answer: D

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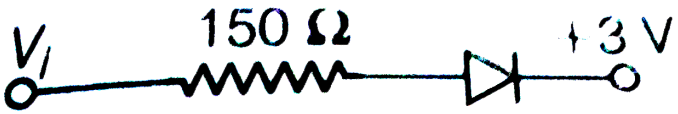
2. In the circuit shown below, assume the diode to be ideal. When V_i increases from 2 V to 6 V, the change in the current in (in mA)



A. zero

B. 20

C. $80/3$

D. 40

Answer: B

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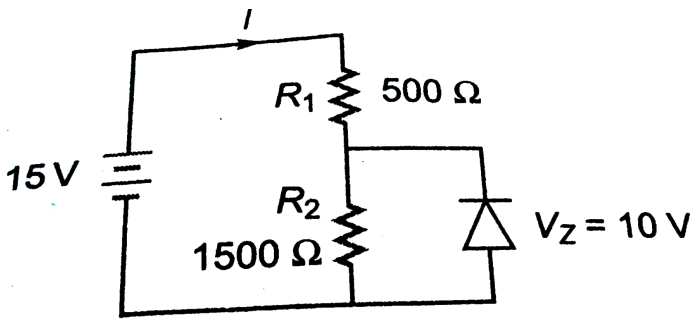
3. In the circuit given the current through the Zener diode is



A. 10 mA

B. 6.67 mA

C. 5 mA

D. 3.33 mA

Answer: D

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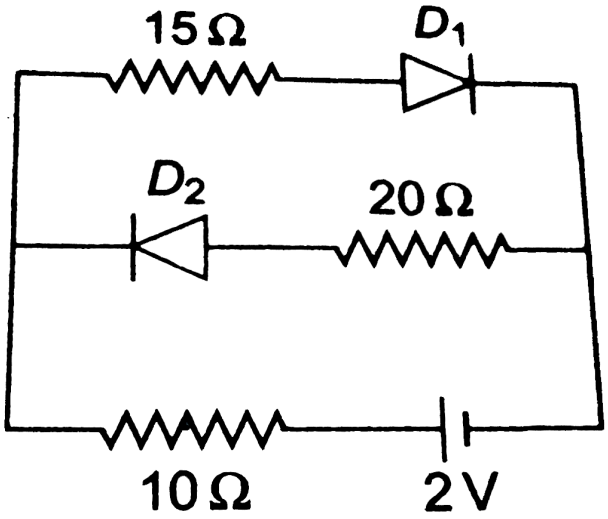
4. The current I through 10Ω resistor in the circuit given below is



A. 50 mA

B. 20 mA

C. 40 mA

D. 80 mA

Answer: D

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5. A full wave rectifier uses two diode, the internal resistance if each diode is $20ohm$. The transformer rms secondary voltage from center tap to each end of secondary is 50 V and load resistance is $980Ohm$. Find (i) the mean load current (ii) the rms value of load current.

A. 0.05 A

B. 45 mA

C. 0.25 A

D. 25 mA

Answer: B

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6. If the ratio of the concentration of electron to that of holes in a semiconductor is $\frac{7}{5}$ and the ratio of current is $\frac{7}{4}$ then what is the ratio of their drift velocities ?

A. $\frac{5}{8}$

B. $\frac{4}{5}$

C. $\frac{5}{4}$

D. $\frac{4}{7}$

Answer: C

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7. As shown in figure, the current in the circuit is

A. 0.03 A

B. 0.02 A

C. 0.04 A

D. 0.05 A

Answer: B

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8. Identify the property which is not characteristic for a semiconductor ?

A. At a very low temperatures, it behaves like an insulator

B. At higher temperatures two types of charge carriers will cause conductivity

C. The charge carriers are electrons and holes in the valence band at higher temperatures

D. The semiconductor is electrically neutral

Answer: C

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9. A piece of copper and another of germanium are cooled from room temperature to 77 K, the resistance of -

A. each of them increases

B. each of them decreases

C. copper decreases and germanium increases

D. copper increases and germanium decreases

Answer: C

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10. In a transistor output characteristics commonly used in common emitter configuration, the base current I_B, the collector current I_C and the collector-emitter voltage V_{CE} have values of the following orders of magnitude in the active region

A. I_B and I_C both are in μA and V_{CE} in V

B. I_B is in μA, I_C is in mA and V_{CE} in V

C. I_B is in mA, I_C is in μA and V_{CE} in mV

D. I_B is in mA, I_C is in mA and V_{CE} in mV

Answer: B

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11. In a common emitter transistor amplifier, the output resistance is 500Ω and the current gain $\beta = 49$. If the power gain of the amplifier is 5×10^6, the input resistance is

A. 325Ω

B. 165Ω

C. 198Ω

D. 240Ω

Answer: D

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12. The current gain of a transistor in a common base arrangement in 0.98 . Find the change in collector current corresponding to a change of 5.0 mA in emitter current . What would be the change in base current?

A. 4 mA

B. 4.5 mA

C. 5.6 mA

D. zero

Answer: B

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13. A tuned amplifier circuit is used to generate a carrier frequency of 2 MHz for the amplitude modulation. The value of $\sqrt{LC}$ is

A. $\frac{1}{2\pi \times 10^6}$

B. $\frac{1}{2 \times 10^6}$

C. $\frac{1}{3\pi \times 10^6}$

D. $\frac{1}{4\pi \times 10^6}$

Answer: D

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14. In a common-base amplifier, the phase difference between the input signal voltage and output voltage is :

A. $\frac{\pi}{4}$

B. π

C. zero

D. $\frac{\pi}{2}$

Answer: C

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15. In an n-p-n transistor circuit, the collector current is 9 mA. If 90% of the electrons emitter reach the collector, find the base current and emitter current.

A. $\alpha = 0.9, \beta = 9.0$

B. the base current is 10 mA

C. the emitter current is 1 mA

D. $\alpha = 9.0, \beta = 0.9$

Answer: A

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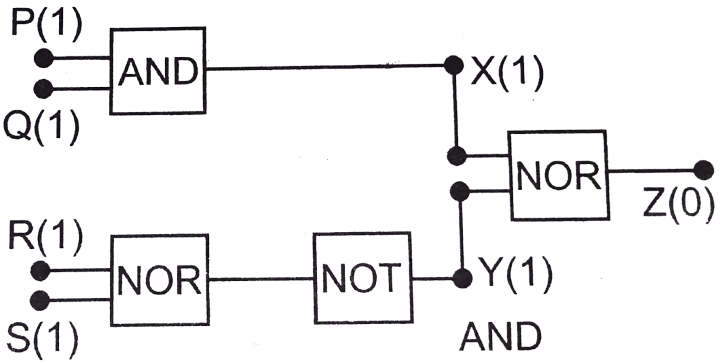
16. The circuit diagram (see fig.) shows a 'logic combination' with the states outputs X, Y and Z given for input P, Q, R and S all at state 1 (i.e., high). When inputs P and R change to state 0 i.e., low) with inputs Q and S still at 1, the condition of

output X, Y and Z chages to



A. 1, 0, 0

B. 1, 1, 1

C. 0, 1, 0

D. 0, 0, 1

Answer: C

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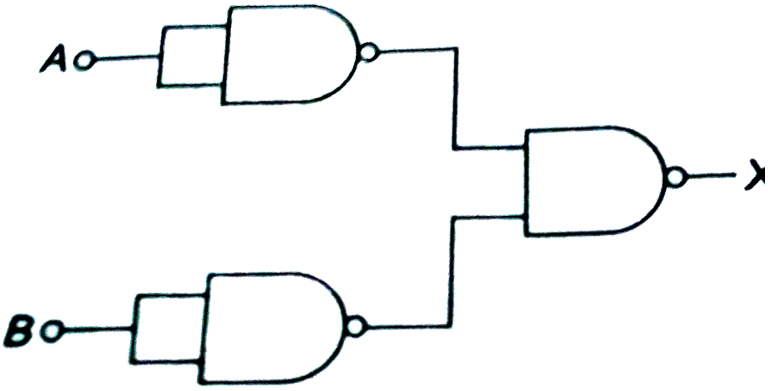
17. The combination of gates shown below yields



A. OR gate

B. NOT gate

C. XOR gate

D. NAND gate

Answer: A

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18. The input resistance of a silicon transistor is 100Ω base current is changed by $40\mu A$ which results in a change in collector current by $2mA$. This transistor is used as a common emitter amplifier with a load resistance of $4k\Omega$. The voltage gain of the amplifier is

A. 2000

B. 3000

C. 4000

D. 1000

Answer: A

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19. Pure sodium (Na) is a good conductor of electricity because the $3s$ and $3p$ atomic bands overlap to from a partially filled conduction band. By contrast the ionic sodium chloride $(NaCl)$ crystal is

A. insulator

B. conductor

C. semiconductor

D. None of these

Answer: A

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20. In a common base amplifier circuit, calculate the change in base current if that in the emitter current is $2mA$ and $\alpha = 0.98$

A. 0.04 mA

B. 196 mA

C. 0.98 mA

D. 2 mA

Answer: A

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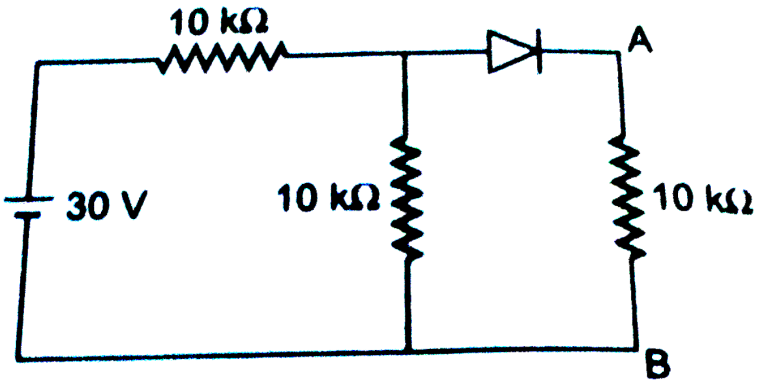
21. In the figure, potential difference between A and B is



A. zero

B. 5 V

C. 10 V

D. 15 V

Answer: C

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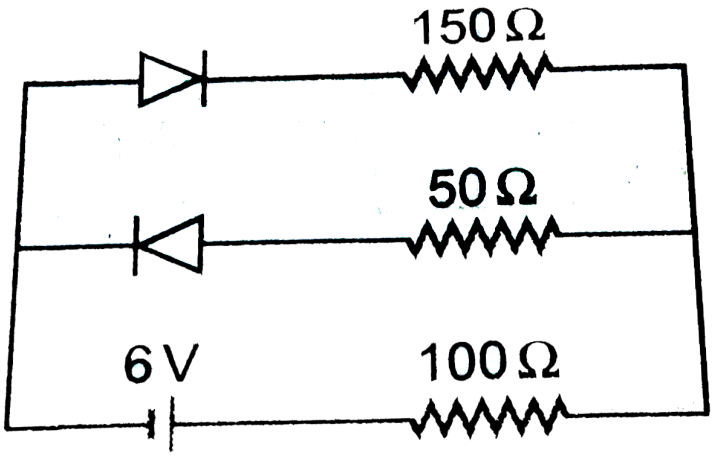
22. The circuit shown in the figure contains two diodes each with a forward resistance of 50 Ω and with infinite backward resistance. If the battery is 6 V, the current through the 100 Ω resistance (in ampere) is



A. zero

B. 0.02

C. 0.03

D. 0.036

Answer: B

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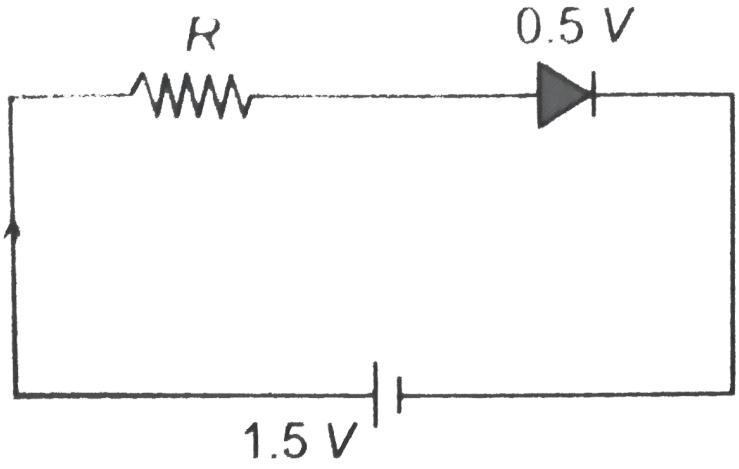
23. The diode used in the circuit shown in the figure has a constant voltage drop of $0.5V$ at all currents and a maximum power rating fo 100 milliwatts. What should be the value of the resistor R, connected in series with the diode for obtaining maximum current?



A. 15Ω

B. 5Ω

C. 6.67Ω

D. 200Ω

Answer: B

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24. In a common emitter amplifier, using output reisistance of 5000 ohm and input resistance fo 2000ohm, if the peak value of input signal voltage is $10mV$ and $\beta = 50$, then the peak value of output voltage is

A. $5 \times 10^{-6}V$

B. $12.50 \times 10^{-6}V$

C. 1.25 V

D. 125.0 V

Answer: C

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25. The length of a germanium rod is $0.58cm$ and its area of cross-section is $10cm^2$. If for germanium $n_i = 2.5 \times 10^{19} m^{-3}$, $\mu_h = 0.19 m^2/V - s$, $\mu_e = 0.39 m^2/V - s$, then the resistance of the rod will be-

A. $2.5k\Omega$

B. $4.0k\Omega$

C. $5.0k\Omega$

D. $10.0k\Omega$

Answer: B

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26. If a Zener diode $(V_Z = 5 \text{ and } I_Z = 10mA)$ is connected in series with a resistance and 20 V is applied across the combination, then the maximum resistance one can use without spoiling zener action is

A. $20k\Omega$

B. $15k\Omega$

C. $10k\Omega$

D. $1.5k\Omega$

Answer: D

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27. A red LED emits light of 0.1 watt uniformaly around it. The amplitude of the electric field of the light at a distance of 1m from the diode is

A. $1.73Vm^{-1}$

B. $2.45Vm^{-1}$

C. $5.48Vm^{-1}$

D. $7.75Vm^{-1}$

Answer: B

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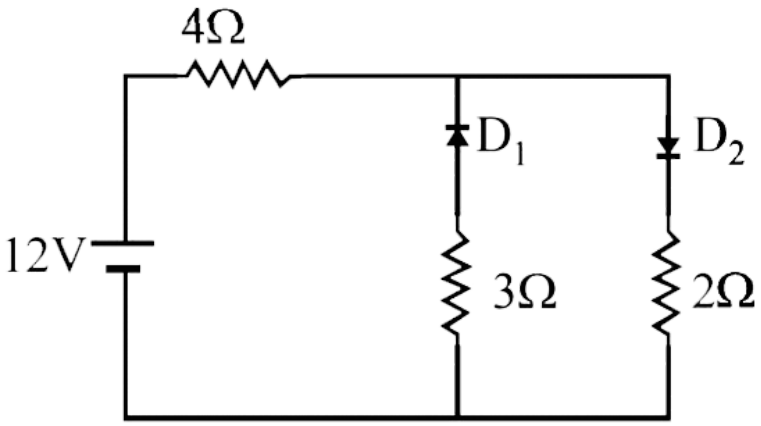
28. The circuit has two oppositively connected ideal diodes in parallel what is the current flowing in the circuit ?



A. 1.71 A

B. 2.00 A

C. 2.31 A

D. 133 A

Answer: B

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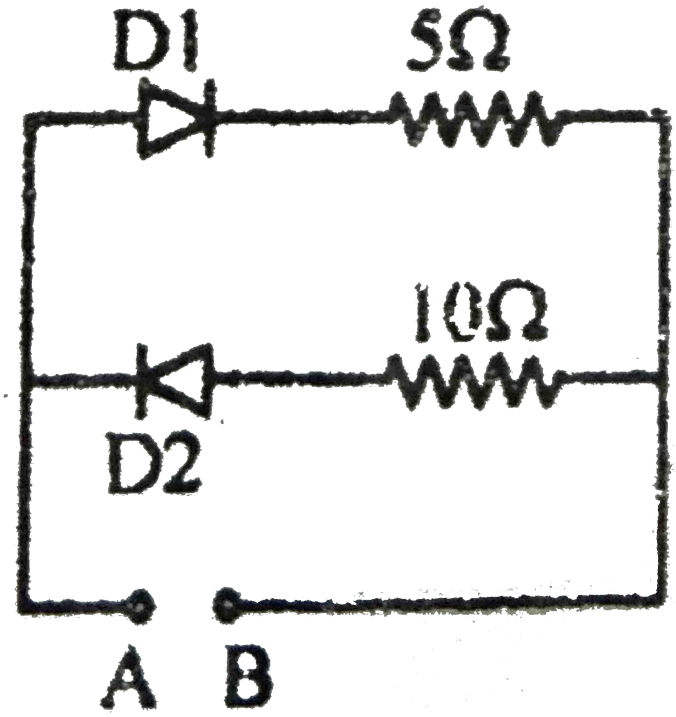
29. A 2V battery is connected across AB as shown in the figure. The value of the current supplied by the battery when in one case battery's positive terminal is connected to A and in other case when positive terminal of battery is connected to B will respectively be :-



A. 0.4 A and 0.2 A

B. 0.2 A and 0.4 A

C. 0.1 A and 0.2 A

D. 0.2 A and 0.1 A

Answer: A

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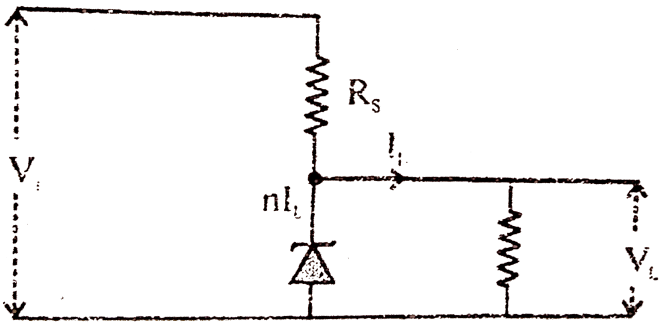
30. The value of the resistor, R_S, needed in the dc voltage regulator circuit shown here, equals :-



A. $\frac{(V_i - V_L)}{(n+1)I_L}$

B. $\frac{(V_i + V_L)}{(n+1)I_L}$

C. $\frac{(V_i - V_L)}{nI_L}$

D. $\frac{(V_i - V_L)}{nI_L}$

Answer: A

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31. An LED is constructed from a p-n junction based on a certain semi-conducting material whose energy gap is 1.9 eV. Then, the wavelength of the emitted light is

A. $6.5 \times 10^{-7} m$

B. $2.9 \times 10^{-9} m$

C. $9.1 \times 10^{-5} m$

D. $1.6 \times 10^{-8} m$

Answer: A

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32. In a triode, $gm = 2 \times 10^{-3} ohm^{-1}$, $\mu = 42$, resistance load, R = 50 kilo ohm. The voltage amplification obtained from this triode will be

A. 30.42

B. 29.57

C. 28.18

D. 27.15

Answer: B

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33. The input characteristics of a transistor in CE mode is the graph obtained by plotting

A. I_B against I_C at constant V_{CE}

B. I_B against V_{BE} at constant V_{CE}

C. I_B against I_C at constant V_{BE}

D. I_B against V_{CE} at constant V_{BE}

Answer: B

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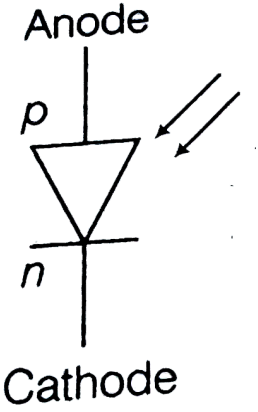
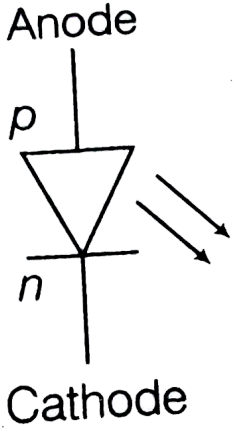
1. The schematic symbol of light emitting diode (LED) is

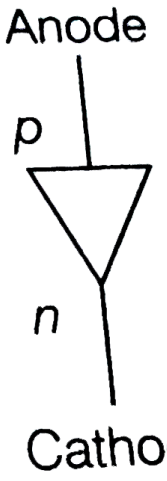
A.



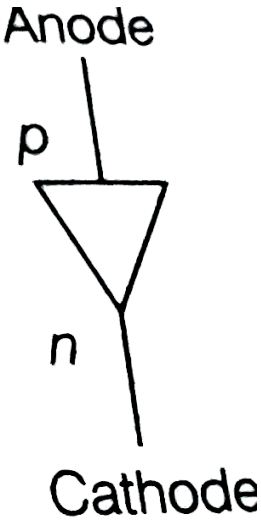
B.



C.



D.



Answer: B

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2. In an oscillator, for sustained oscillations, Barkhausen criterion is $A\beta$ equal to (A = voltage gain without feedback and β = feedback factor)

A. zero

B. $\frac{1}{2}$

C. 1

D. 2

Answer: C

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3. Which logic gate produces LOW output when any of the inputs in HIGH

A. AND

B. OR

C. NAND

D. NOR

Answer: D

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4. For a transitor the current ratio α_{DC} is 69/70 the current gain β_{DC} is

A. 66

B. 67

C. 69

D. 71

Answer: C

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5. In insulators (CB is conduction band and VB is valence band)

A. VB is partially filled with electrons

B. CB is partially filled with electrons

C. CB is empty and VB is filled with electrons

D. CB is filled with electrons and VB is empty

Answer: C

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6. In common base circuit of a transistor , current amplification factor is 0.95. Calculate the emitter current , if base current is 0.2 mA

A. 2 mA

B. 4 mA

C. 6 mA

D. 8 mA

Answer: B

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7. In a n-type semiconductor, which of the following statement is true?

A. Electrons are majority carriers and trivalent atoms are dopants

B. Electrons are minority carriers and pentavalent atoms are dopants

C. Holes are minority carriers and pentavalent atoms are dopants

D. Holes are majority carriers and trivalent atoms are dopants

Answer: C

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8. In a common emitter (CE) amplifier having a voltage gain G, the transistor used has transconductor 0.03 mho and current gain 25. If the above transistor is replaced with another one with transconductance 0.02 mho and current gain 20, the voltage gain will

A. $\frac{2}{3}G$

B. 15 G

C. $\frac{1}{3}G$

D. $\frac{5}{4}G$

Answer: A

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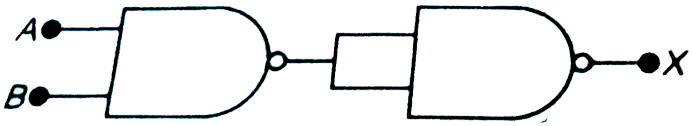
9. The output (X) of the logic circuit shown in figure will be



A. $X = \overline{\overline{A}} \cdot \overline{\overline{B}}$

B. $X = \overline{A \cdot B}$

C. $X = A \cdot B$

D. $X = \overline{A + B}$

Answer: C

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10. How does the width of the depletion layer of a p-n junction diode change with decrease in reverse bias?

A. decreases

B. increases

C. remain same

D. Can't predicted

Answer: B

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11. To use a transistor as an amplifier

A. the emitter base junction is forward biased and the base collector junction is reverse biased

B. no bias voltage are required

C. Both junctions are forward biased

D. Both junctions are reverse biased

Answer: A

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12. How many NAND gates are required to realise (i) OR gates and (ii) AND gate.

A. 1

B. 2

C. 3

D. 4

Answer: B

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13. LED is a p-n junction diode which is

A. forward biased

B. either forward biased or reverse biased

C. reverse biased

D. neither forward biased nor reverse biased

Answer: A

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14. A $p-n$ photodiode is made of a material with a band gap of $2.0eV$. The minimum frequency of the radiation that can be absorbed by the material is nearly

A. $10 \times 10^{14} Hz$

B. $5 \times 10^{14} Hz$

C. $1 \times 10^{14} Hz$

D. $20 \times 10^{14} Hz$

Answer: B

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15. In diode, when there is saturation current, the plate resistance (r_p) is

A. data insufficient

B. zero

C. some finite quantity

D. infinite quantity

Answer: D

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16. If a full wave rectifier circuit is operating from $50Hz$ mains, the fundamental frequency in the ripple will be

A. 70.7 Hz

B. 100 Hz

C. 25 Hz

D. 59 Hz

Answer: B

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17. The depletion layer in diode is $1\mu m$ wide and the knee potential is $0.6V$, then the electric field in the depletion layer will be

A. $5 \times 10^{6} Vm^{-1}$

B. $5 \times 10^{-7} Vm^{-1}$

C. $5 \times 10^{5} Vm^{-1}$

D. $5 \times 10^{-1} Vm^{-1}$

Answer: C

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18. Which of the following is correct, about doping in a transistor ?

A. Emitter is lightly doped, collector is heavily doped and base is moderately doped

B. Emitter is lightly doped, collector is moderately doped and base is heavily doped

C. Emitter is heavily doped, collector is lightly doped and base is moderately doped

D. Emitter is heavily doped, collector is moderately doped and base is lightly doped

Answer: D

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19. Freuency of given AC signal is 50 Hz. When it connected to a half - wave rectifier, then what is the number of output pulses given by rectifier within one second ?

A. 50

B. 100

C. 25

D. 150

Answer: A

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20. In p-type semiconductor, the major charge carriers are:

A. neutrons

B. protons

C. electrons

D. holes

Answer: D

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21. To obtain a P-type germanium semiconductor, it must be dopped with

A. gallium

B. boron

C. aluminium

D. All of these

Answer: D

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22. The process of adding impurities to the pure semiconductor is called

A. drouping

B. drooping

C. doping

D. None of these

Answer: C

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23. The depletion layer in $P-N$ junction region is caused by

A. drift of electrons

B. migration of impurity ions

C. diffusion of charge carriers

D. drift of holes

Answer: C

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24. In a $p-n$ junction photo cell, the value of the photo electromotive force produced by monochromatic light is proportional to

A. the voltage applied at p-n junction

B. the barrier voltage at p-n junction

C. the intensity of light falling on cell

D. the frequency of light falling on cell

Answer: C

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25. Semiconductor is damaged by the strong current due to

A. lack of free electron

B. excess of electron

C. excess of proton

D. None of the above

Answer: D

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