PHYSICS

BOOKS - MODERN PUBLISHERS PHYSICS (HINGLISH)

SEMICONDUCTOR ELECTRONICS METERIALS DEVICES AND SIMPLE CIRCUITS

Solved Examples

1. The number of conduction electrons in a pure semiconductor is 5×10^{18} per cubic metre calculte the number of holes in a sample of size $2cm \times 1cm \times 2mm$

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2. Energy of an electramagnetic radiation of wavelenght 590 nm equals the band gap of a semiconductor calculate the minimum energy required to create an electron hole pair

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3. A p type semiconductor has acceptor level 30 mev above the valence band what will be the maximum wavelength of light that can create a hole

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4. Pure Si crystal at 300 k has 2.5×10^{28} atoms m^{-3} it is doped by 1 ppm concentration of pentavalent element As calculate the new concentration of electrons and holes take

$n_i = 1.5 \times 10^{16} m^{-3}$

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5. A semiconductor crystal has equal electron and hole concentration of $9 \times 10^{8} m^{-3}$ it is doped by indium so that the hole concentration increases to $4.5 \times 10^{12} m^{-3}$ calculate the new concentration of free electrons in the doped crystal nad also mention its type

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6. Mobilities of electrons and holes in a sample of a semiconductor is 25000 $cm^2V^{-1}s^{-1}$ and 200 cm^2 Vs respectively if the electron and hole concentration are 9×10^{13} per cm^3 and 4×10^{12} per cm^3 respectively calculate the conductivity of the sample

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7. An n type semiconductor of conductivity 6 $\Omega^{-1} cm^{-1}$ is produced when donor atoms are added to an intrinsic germanisum crystal ignoring the contributio of holes to conductivity and taking mobility of electron in n type Ge equal to 3500 cm^2 /Vs determine the number density of donor atoms used for doping

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8. A block of intrinsic silicon at room temperature has length 0.2 m and area of cross section $4 \times 10^{-4} m^2$ a battery of 3 V is connected across the block find the

(i) electron and hole currents

(ii) magnitude of total current

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9. The V-I characteristic of a silicon diode is as show in the following calulate the resistance of the diode at (i) $I_D = 15$ mA and (ii) $V_D = 10$ V

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10. The following table provides the set of values of V and I abtained for a given diode

Assuming the characteristics to be nearly linear and calculate the forwared and reverse bias resistance of the given diode

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11. The V-I characteristics of a germainium dioide is shown in the below calculate the diode resistance in forward bias at V= +1.75 V and (b) reverse at V=-1 V

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12. A p-n junction diode is designed to withstand current without damage up to 5 Ma across the combination. What is the maximum voltage of the battery that can forward bias the diode safely given that the diode has a constant potential drop of 0.5 V when forward biased

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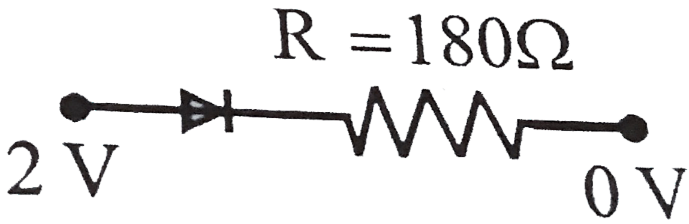
13. Assuming that the silicon diode having resistance of 20Ω, the current through the

diode is (knee voltage 0.7 V)



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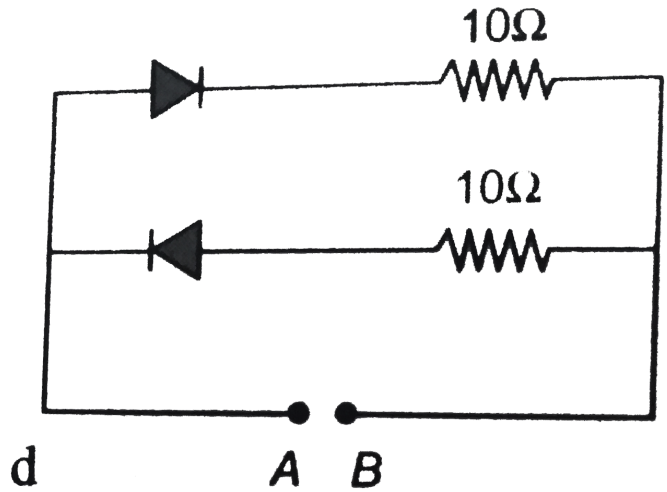
14. A $2V$ battery is connected across the points A and B as shown in the figure given below. Assuming that the resistance of each diode is zero in forward bias and infinity in reverse baise, the current supplied by the battery when its positive terminal is connected to A is



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15. Calculate the currents through the resistance of the circuits shown in the following figure consider the diodes to be

ideal

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16. In the circuite shown below calculate the curretn flowing through the cirucit and potential differnce across the diode take the drift current for the diode equal to 20 μA

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17. Compute the equivalent resistance of the circuit shown below between the points X and Y

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18. The following figure shows the circuit for using zener diode of 10 V as a voltage regulator the zener diode is connected in series with a resistor r acorss a 50 V supply claculate the minimum value of r if the the maximum zener current is 25 mA

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19. A crystal diode of internal resistance 100 ω is used as a half wave rectifier as shown in the figure with AC input of V=50 sin wt and load resistance $R_L = 1k\omega$ calculate

(i) the maximum output current

(ii) DC output current (iii) DC output power

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20. In a p n p transistor circuit 80% of the holes reach the collector if the collector current is 9 mA calculate the emitter and base curernts

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21. The ac current gain of a transistor is 120. What is the change in the collector current in the transistor whose base current changes by $100\mu A$?

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22. In a common emitter transistor circuit the valtage drop across the collector is 1 V and curent gain is 70 if the collector resistor is 3 k ω calculate the base current

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23. A common emitter amplifier has a current gain of 59 if the emitter current is 5.0 mA find its base current and collector current

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24. Current gain of a transistor is 50 if the collector resistance is 5 k ω and input resistance is 1 k ω calculate the voltage gain

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25. In a common emitter amplifier change in base current by 10 μA and collector current by $1 mA$ if the input resistance of the transistor is 1 $k\omega$ and load resistacne of $6k\omega$ is used in the circuit calculate

(i) the current gain

(ii) the voltage gain

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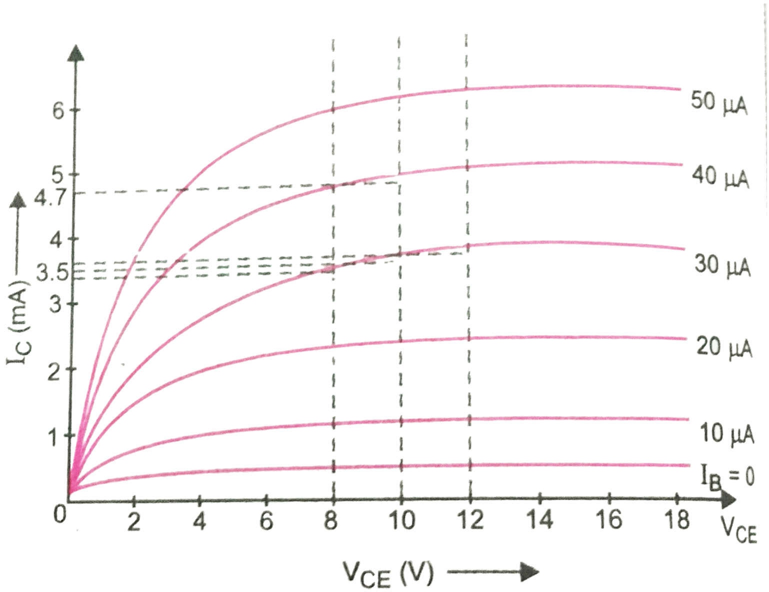
26. Output characteristics of an n-p-n transistor in CE configuration is shown in the

Fig. Determine



(i) dynamic output resistance (ii) dc current gain and (iii) ac current gain at an opererating point $V_{CE} = 10V$, when $I_B = 30\mu A$.

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27. The current gain for a common emtiter amplifier is 50 the collector resistance of the CE amplifier circuit is 2 $k\omega$ and input resistance is 500 ω if the input voltage is 0.02 V calculate the output voltage

Also calculate the power gain of the circuit

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28. When base current in a silicon transistor is changed by 12 μA the input resistance of the transistor is 650 ω when this transistor is uded as a CE amplifier with load resistance of 2 k ω calculate

(i) the current gain

(ii) transconductance

(iiii) voltage gain of the amplifer

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29. An n p-n transistor is uded as a CE amplifier as given below if the current gain is 30 and internal resisitacne of the transistor is 100 ω

calculate

(i) collector emitter voltage

(ii) base current

(iii) voltage gain

(iv) power gain

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30. In the transistor cirucuit the base current $I_B = 5 \mu A$ and the collector current $I_C = 5$ mA the dc voltage of the collector circuit

$V_{\mathbb{C}} = 6V$

(i) can this circuit be used as an amplifier

(ii) If R_C is reduced to 500 ω can the circuit be then used as an amplifier

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31. An amplifier circuit is below having an input resistance $R_i = 25k\omega$ it is connected to an external voltage vs through a eries resistance $R_S = 50\omega$ the no load voltage gain of the transistor is 150 find the apparent gain of the amplifier

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32. Write the truth table for the combinatio of the gates shown name the gates used

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33. Circuit symbol of logic gate and two input wave fronts 'A' and 'B' are in given below

(i) Name the gate used and write its truth table

(ii) Draw the output wave form

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34. Identify the logic gates G_1 and G_2 marked in the write down the output Y when A=1 ,B =1 and A=1 and B=0

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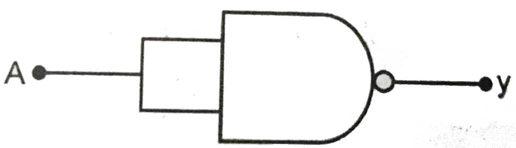
35. Write the truth table for a NAND gate as given in Fig.9. Hence identify the exact logic operation carried out by this circuit.



a

A	B
1	0
0	1

b

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36. For the given combinatin of gates find the values of ouputs Y_1 and Y_2 in the table given below inentify the gates G_1 and G_2

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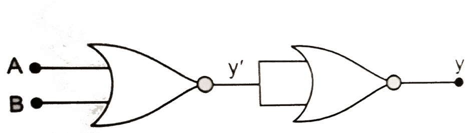
37. Write the truth table for circuit given in Fig.below consisting of NOR gates and identify the logic operation (OR, AND and NOT) which this circuit is performing.



a

b

A	B	y'	y
0	0	1	0
1	0	0	1
0	1	0	1
1	1	0	1

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38. Write the output Y for the final circuit when

(i) A=1 and B=1

(ii) A=0 and B=0

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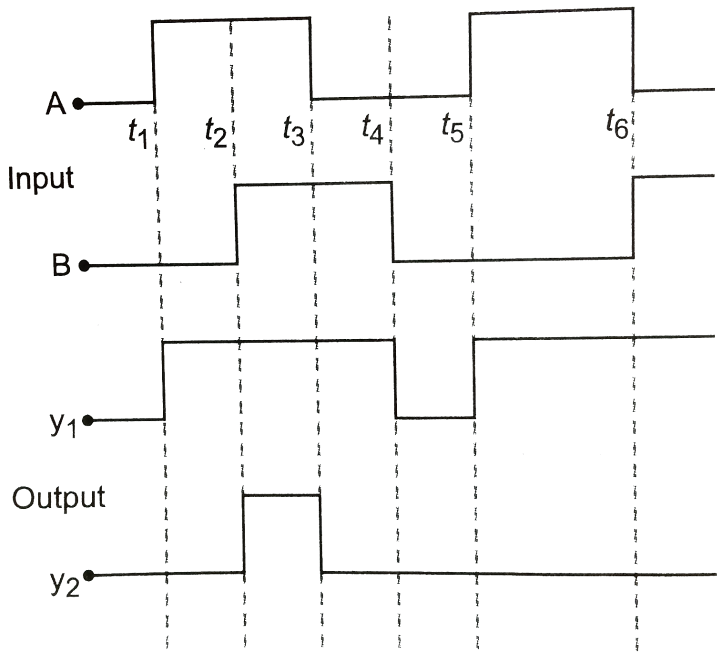
39. A student has to use an appropriate number of (i) NAND gates (only) to get the output y_1 (ii) NOR gates (only) to get the output y_2 from two given input A and B as shown in the Fig.



Identify the 'equivalent gate' needed in each case. Show how one can connect an appropriate number of (i) NAND (ii) NOR gates respectively in the two cases to gat the equivalent gates.

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40. Write the truth table for the following circuit

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Practice Problems

1. A pure semiconductor of volume $3.5 \times 10^{-7} m^3$ contains 5×10^{20} conduction electrons per m^3 determine the number of holes present in it

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2. The mean free path of conduction electron in a metallic block is 5×10^{-6} m the block is placed in an electric field of $5 \times 10^{+7} vm^{-1}$ calculate the energy of the conduction electron in the block

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3. Suppose a pure Si-crystal has $5 \times 10^{28} \text{atoms} m^{-3}$. It is doped by 1 ppm concentration of pentavalent As. Calculate the number of electrons and holes. Give that $n_i = 1.5 \times 10^{16} m^{-3}$.

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4. In pure silicon semiconductor having same electron and hole concentration of 1.5×10^{16} the hole density is increased to 1.5 times on doping calculate the electron density in silicon after doping

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5. A semiconductor has equal electron and hole concentration of $6 \times 10^{8} m^{-3}$ on doping with certain impurity electron concentration

increases to 9×10^{-12} m calculate the new hole concentration

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6. The separation between conduction band of electromagnetic radiation required to generate an electron hole pair in ti

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7. The fobbidden gap in an ntype semiconductor is 4 me v so that the electrons are just able to enter the coduction band

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8. A type semiconductor sample has electron and hole concentration of 1.6×10^{19} the electron and hole mobility in the sample is $1.2 m^2 v^{-1} s^{-1}$ and 0.001 $m^2 v^{-1} s^{-1}$

respectively calculate the value of resistivity of the sample

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9. The value of forward current in ap-n junction at 0.1 V is 1.04×10^{-2} A calculate the reverse saturation current of the diode at 300 k kuse bottzmann's k =$1.4 \times 10^{-23} jK^{-1}$ and exp (3.80)=44.7011

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10. The values of v and I for silicon diode is given as follows

	V	I
Forward bias	1.0 V 0.80 V	10 mA 6 mA
Reverse bias	–2 V –4 V	3 mA 2 mA

Using the data calculate the forward and reverse bias resistance of silicon diode

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11. Voltage drop across a p-n junction in forward bias is 0.5 V a battery of 2V is connected across the p-n junction such that the maximum current does not exceed 10 mA calculate the value of resistance to be connected across the diode

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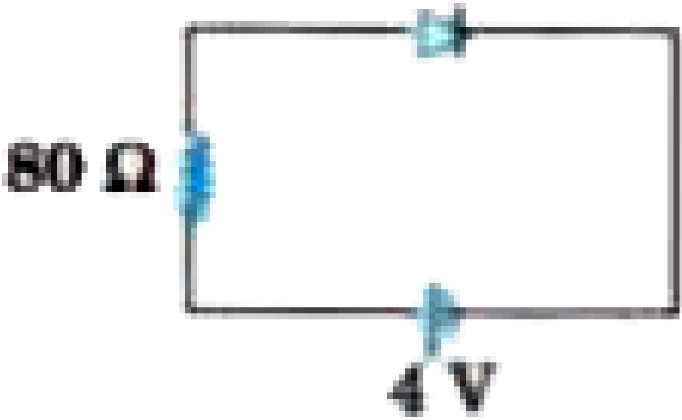
12. A p-n junction diode in forward bias is connected to a battery of 4 V and a resistance of 80 ω as shown in the ajoining determine the maximum current in the circuit barrier potential of p-n diode is 0.2 V



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13. Two diodes with internal resistance of 20 ω each are used in a full wave rectifier determine the mean load current and rms value of load current if load resistance of 800 ω given rms value of secondary voltage is 40 V

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14. The rms value of input voltage in a full wave rectifier is 12 V determine the output voltage if a step up a transformer with ratio 1:2 is used

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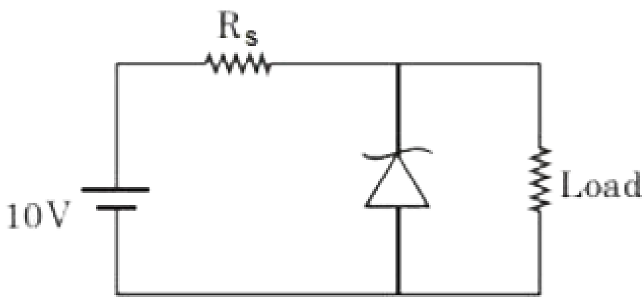
15. In a Zener regulated power supply a Zener diode with $V_Z = 6.0V$ is used for regulation. The load current is to be 4.0 mA and the unregulated input is 10.0 V. What should be the value of series resistor R_S ? Choose zener current to be 20 mA.



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16. A 10V of zener diode is connected in series to a resistance across a power supply of 50 V calculate the minimum value of resistance required such that the zener current is 25 mA

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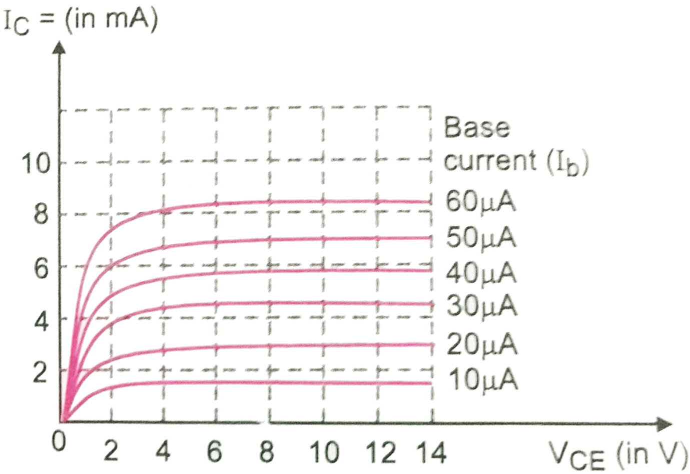
17. From the output characteristics of common emitter circuit shown in Fig., calculate the value of β_{ac} and β_{dc} of the transistor when

V_{cE} is $10V$ and $I_c = 4.0mA$.



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18. In a common emitter transistor the potential drop across the collector is found to be 2 v claculate the emitter current if value of collector resistance is 2 $k\omega$ the dc gain of transistor is 40

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19. In a common base transistor the value of load resistance in output and input circuit is 500 $k\omega$ and 300 ω respectively calculate the voltage gain and power gain if value of current gain is 0.90

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20. In a semiconductor transistor there is change in collector current of 8.2 mA with change of 8.29 mA in emitter current calculate the change in base current that produces same change in collector current

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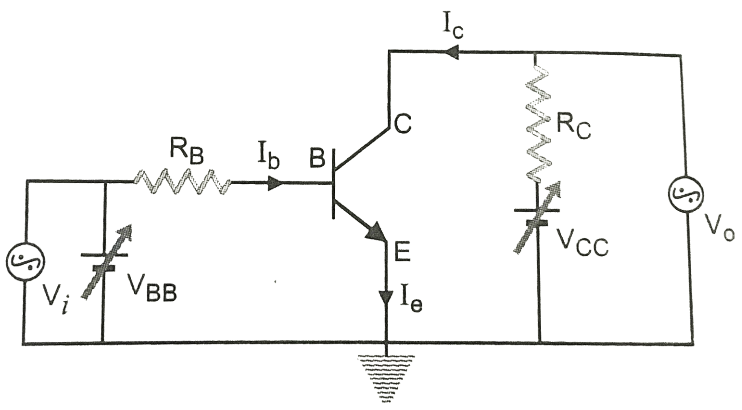
21. In common emitter transistor as shown in Fig., the V_{BB} supply can be varied from 0 V to 5.0V. The Si. Transistor has $\beta_{ac} = 250$ and $R_B = 100k\Omega, R_c = 1k\Omega, V_{CC} = 5.0V.$

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.



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22. For a CE transistor amplifier the audio signal voltage across the collector resistance of 2.0 $k\omega$ is 2.0 V suppose the current amplification factor of the transistor is 100 what should be the value of R_B in series with V_{BB} 10 times the signal current also calculate the DC drop across the collector resistance

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23. Which gate is represented by the given truth table

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

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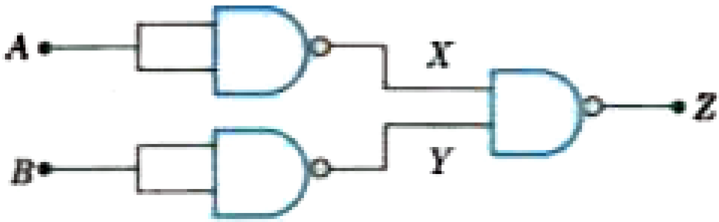
24. You are given a circuit below write its truth table hence identify the logic operation carried out by the circuit draw the logic symbol of the gate it corresponds to



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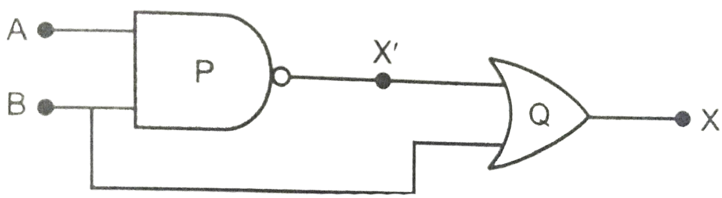
25. Identify the logic gates marked P and Q in the circuit Fig. Write the truth table for this combination.



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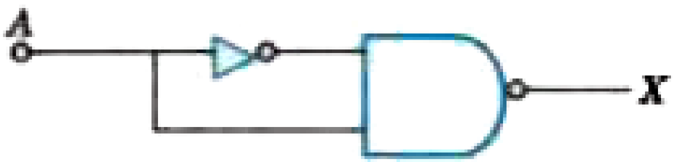
26. Write the truth table for the given combination of gates



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Concepual Questions

1. C, Si and Ge have same lattice structure. Why is C insulator,

while Si and Ge intrinsic semiconductors ?

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2. What type of inter atomic bonding is there in semiconductors

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3. Why doping is done in semiconductor?

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4. Can we take one slab of p - type semiconductor and physically join it to another n - type semiconductor to get p - n junction?

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

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6. Intrinsic and extrinsic semiconductors .

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7. p-type and n-type semiconductors .

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8. A p - type semiconductor crystal is electrically neutral although it has larger number of holes explain

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9. In a semiconductor energy gap between the impurites level and conduction band is 1 me V is it an n type or p type of semiconductor

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10. Out of electron and hole, which one has higher mobility and Why?

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11. How does the forbidden energy gap of an intrinsic semiconductor vary with the increase in temperature

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12. An intrinsic semiconductor is doped with boron how will the energy gap change in semiconductor

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13. An intrinsic semiconductor is doped with arsenic how will the energy gap change in semiconductor

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14. What will happen to the conductivity of a semiconductor on passing large currents through it

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15. Graphically represent the variatin of resistivity of carbon with temperture

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16. Why si and gaas are preferred material for solar cells

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17. The resistance of p-n junction is low when forward biased and is high when reverse biased. Explain.

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18. A p n junction diode is connected to a battery of 2 v and a resistance of 8 ohm as shown in figure calculate the current passing through the resistor

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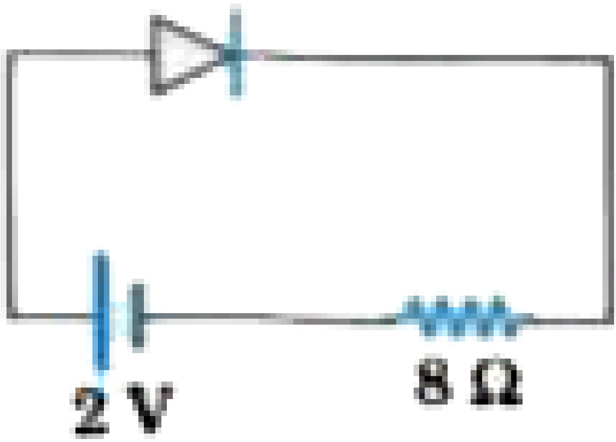
19. A p -n junctin diode is connected to a battery of 2 V and a resistance as shownin the adjoining calculate the curernt passing through the resistor



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20. A half wave rectifier provides DC output power of 30 W when 100 W AC power is supplied to it what will be the rectification efficiency and power efficiency

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21. How can we use a diode as a switch

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22. How can we increase the intensity of an LED

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23. In a transistor base is made thin and doped with little impurity atoms. Why?

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24. How will the current in the transistor change with the increase in temperature

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25. Explain, why the input resistance of a transistor is low and output resistance is high.

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26. Transistor also works bidirectinaly commment

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27. In a transistor both emitter base jucntion and colector base junction are reverse biased how will the concentration of charge carrier across the each junction change

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28. If the base region of a transistor is made large, as compared to a usual transistor, how does it affect (i) the collector current and (ii) current gain of this transistor.

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29. In the given circuit diagram, a voltmeter 'V' is connected across a lamp 'L'. How would (i) the brightness of the lamp and (ii) voltmeter reading 'V' be affected, if the value of resistance 'R' is decreased ? Justify your answer.

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30. How are analogue and digital signals different

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31. Discuss how a NOT gate is realised using NAND gates.

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32. Realise the formation of AND gate using NAND gate

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33. Realise the formation of OR gate from NAND gate

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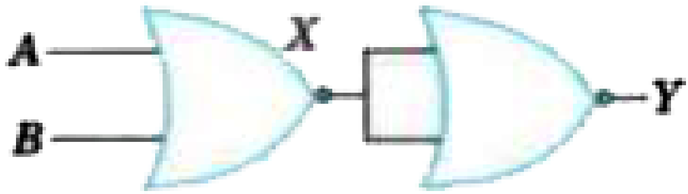
34.



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35. NAND gate is also known as digital building block explain

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36. Arrange two NAND gates and one OR gate such that the combination obtained acts as the NAND gate only

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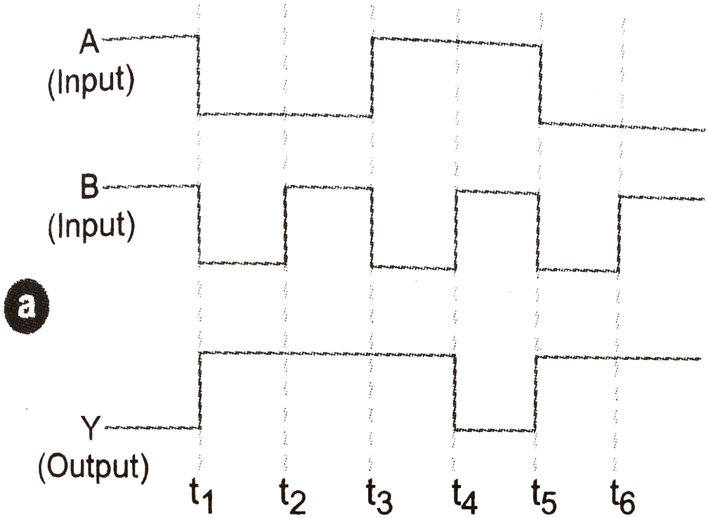
37. The following Fig. shows the input waveforms (A,B) and the output waveform (y) of a gate. Identify the gate and write its truth table.



b

	A	B	$y = \overline{A \cdot B}$
At $t < t_1$	1	1	0
For t_1 to t_2	0	0	1
For t_2 to t_3	0	1	1
For t_3 to t_4	1	0	1
For t_4 to t_5	1	1	0
For t_5 to t_6	0	0	1

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Tough Tricky Problems

1. The number of electron hole pairs in a semiconductor is proportional to where for germainium $\triangle E = 0.65$ eV and the temperature increases form 280 K to 300 K find the percentage increase in the number of charge carriers

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2. An n-p-n transistor is used as a simple voltage amplifier in common emitter mode. when a signal of 30mV is added to base emitter voltage results a change in base current by 40 micro ampere and collector current changes by 2 mA given that the load resistance is 5 $k\omega$ calculate

(i) current gain

(ii) input resistance

(iii) transconductance

(iv) voltage gain

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3. A potential barrier of 0.2 V exists across an unbiased p-n junction

(i) Calculate the width of the depletion region if an electric field of $10^6 Vm^{-1}$ exists in it

(ii) With what minimum kinetic energy a hole should diffuse from the p side to the n side if the junction is

(a) unbiased

(b) forward biased at 0.1 V

(c) reverse biased at 0.1 V

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4. A p-n junction when forward biased at 100 mV has a current of 50 μA and when reverse biased it has a constant current of 20 μA flowing through it

Calculate the magnitude of diffusion current when the diode is

(i) unbiased

(ii) forward biased at 100 mV

(iii) reverse biased at 100 mV

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5. Using AND ,Not and OR gates desigin a local circuit to evalute ABC+ABC+BAC

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6. A sample of pure silicon is doped with a trivalent impurity whose each atom creates a hole the concentration holes in pure silicon is 7×10^{15} holes per cubic metre and density of silicon is 5×10^{23} a pure silicon sample by a factor of 120 calculate approximately the proportion in which the impurity is added

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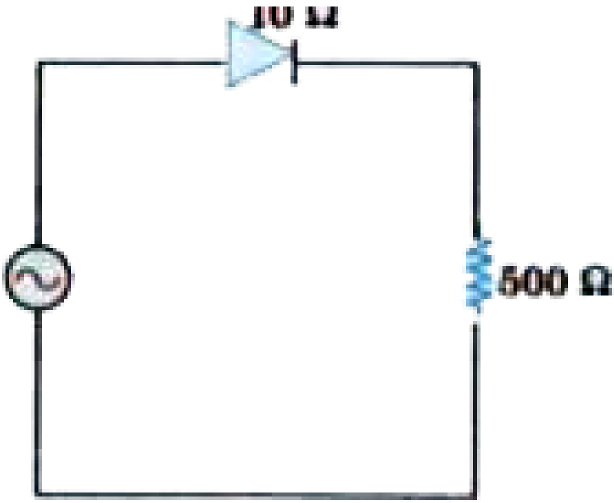
7. An AC voltage with peak value 20 V is connected in series a diode and load resistance of 500 ω exists across the diode calculate the peak current through the diode and peak voltage across the load resistance what will be the answer if the diode is ideal



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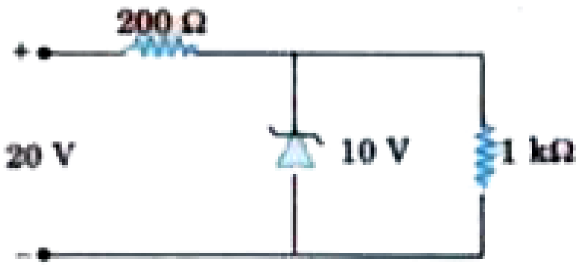
8. A zener diode has a breakdown voltage of 10 V and is used in a voltage regulator circuit as shown in the given figure what will be current through the diode



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9. The relation of voltage with current in a diode is expressed as below

$$V = \frac{1000In(I+1)}{T}$$

where v is the applied voltage in volts

T is the temperature in degree kelvin and I is the current in milli amperes while measuring a current of 10 mA at T=300 k a student makes an error of $\pm$ 0.01 V calculate the error in the value of current in mA

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10. (i) the number of conduction electrons in a sample of pure semiconductor is 7×10^{20} per cubic metre calculate the number of holes in a sample of size $2cm \times 2cm \times 2cm$

(ii) an electron in the conduction band combines with a hole in the valence band of the semiconductor and excess energy is released in the of the semiconductor is 2.1 eV find the maximum wavelength that can be emitte in this process

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Ncert File Solved Text Book Exercises

1. In an n type silicon which of the following statement is true

(a) electrons are majortiy carriers and trivalent atoms are the dopants

(b) electrons are minority carriers and pentavalent atoms are the dopants

(c) hoes are minority carriers and pentavalent atoms are the dopants

(d) holes are majority carriers and trivalen atoms are the dopant

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2. Which of the statements given in above example is true for p - type semiconductors ?

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3. Carbon silicon and germanium have four valence electrons each these are characterised by valence and conduction bands separated by energy band gap respectively equal to which of the following statement is true

(a) $(E_g)_{Si} < (E_g)_{Ge} < (E_g)_c$

(b) $(E_g)_c < (E_g)_{Ge < (E_g)_{Si}}$

(c) $(E_g)_c > (E_g)_{Si} > (E_g)_{Ge}$

(d) $(E_g)_c = (E_g)_{si} = (E_g)_{Ge}$

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4. In an unblased p-n junction, holes diffuse from the p - region to n- region because

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5. When a forward bias is applied to a p -n junction. It

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6. For transistor action which of the following statement are correct

(a) base emitter and collector regions should have smilar size and doping concentrations

(b) the base region must be very thin and lightly doped

(c) the emitter junction is forward biased and collector junctions is reverse biased

(d)both the emitter junction as well as the collector junction are forward biased

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7. For transistor amplifier the voltage gain

(a) remains constant for all frequencies

(b) is high at high and low frequencies

(c) is low at high and low frequencies and constant in the middle frequency range

(d) none of these

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8. 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 ?

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9. For a CE -transistor amplifier the audio signal voltage across the collector resistance of 2 k$\Omega$is 2V. Given the current amplification factor of the transistor is 100 find the input signal voltage and base current if the base resistance is 1 k Ω.

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10. Two amplifiers are connected one after the other in series (cascaded). The first amplifier has a voltage gain of 10 and the second has a voltage gain of 20 . If the input signal is 0.01 V , calcualte the output AC signal .

Watch Video Solution

11. A p-n photodiode is fabricated from a semiconductor with band gap of 2.8 eV can it detect a wavelength of 6000 nm

Watch Video Solution

12. 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?

Watch Video Solution

13. In an intrinsic semiconductor, the energy gap E_g of an intrinsic semiconductor is 1.2 eV. Its hole mobility is very much smaller than electron mobility and is indepndent of temperature. What is the ratio between conductivity at 600K and at 300K? Assume that the temperature dependence of intrinsic concentraction n_i is expressed as,

$n_i = n_o e^{-E_g' / k_B} T$, where n_o is constant and

E_g' is an energy equal to $E_g / 2$,

$k_B = 8.62 \times 10^{-6} eV K^{-1}$.

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14. In a $p-n$ junction diode, the currect I can expressed as $I = I_0 \exp\left(\frac{eV}{2k_BT} - 1\right)$ where I_0 is called the reverse saturation current, V is the voltage across the diode and is positive for forward bias and negative for reverse bias, and I is the current through the diode, K_B is the Boltzmann constant $(8.6 \times 10^{-5} eV/K)$ and T is the absolute temperature. If for a given diode $I_o = 5 \times 10^{-12} A$ and $T = 300K$, then

(a) What will be the forward current at a formward voltage of $0.6V$?

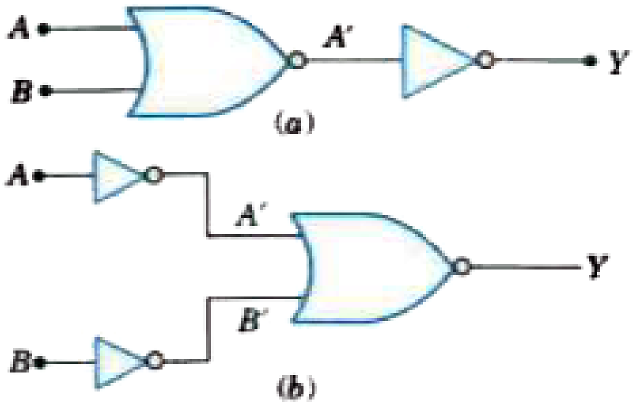
(b) What will be the increase in the current if the voltage across the diode is increased to $0.7V$?

(c) What is the dynamic resistance ?

(d) What will be current if reverse bias voltage changes from $1V$ to $2V$?

Watch Video Solution

15. You are given two circuits as given below show that circuit (a) acts as OR gate while the circuit (b) acts as AND gate



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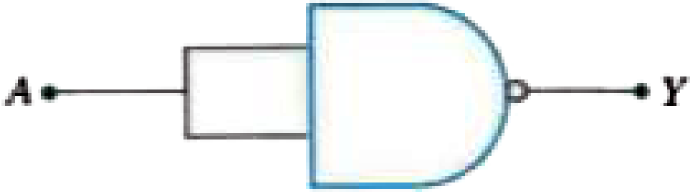
16. Write the truth table for a NAND gae connected as given in the following



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17. Why are elemental dopants for Silicon or Germanium usually chosen from group XIII or group XV?

Watch Video Solution

18. Sn, C, Si and Ge are all group XIV elements . Yet , Sn is a conductor , C is an insulator while Si and Ge are semiconductors . Why?

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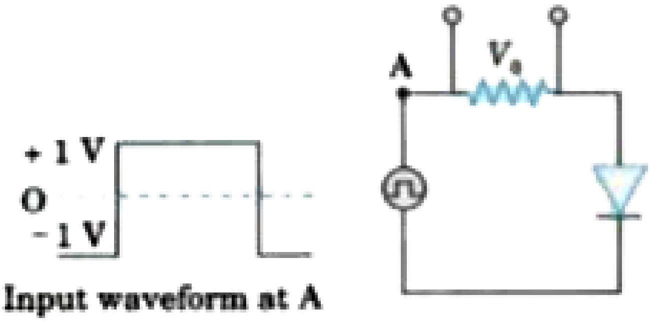
19. Can the potential barrier across a p-n junction be measured by simply connecting a voltmeter across the junction ?

Watch Video Solution

20. Draw the output wave form across the resistor



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21. The amplifiers X, Y and Z are connected in series. If the voltage gains of X, Y and Z are 10, 20 and 30, respectively and the input signal is $1mV$ peak value, then what is the output signal voltage (peak value)

(i) if dc supply voltage is 10V ?

(ii) if dc supply voltage is 5V?

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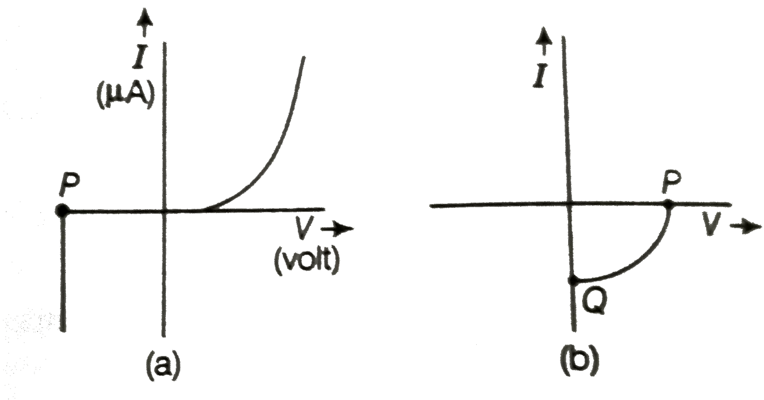
22. In a CE transistor amplifier, there is a current and voltage gain associated with the circuit. In other words there is a power gain. Considering power a measure of energy, does the circuit violate conservation of energy ?

Watch Video Solution

23. (i) Name the type of a diode whose characteristics are shown in figure (a) and (b)

(ii) What does the point P in fig. (a) represent ?

(iii) What does the point P and Q in fig. (b) represent ?



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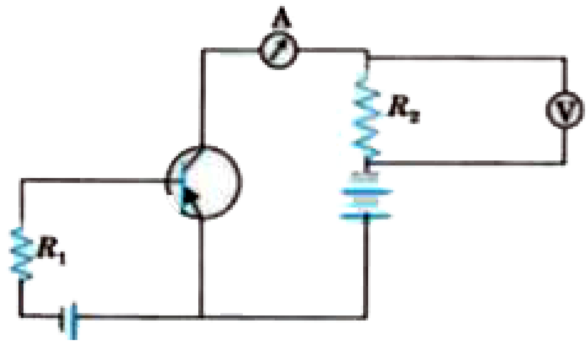
24. Three photodiodes D_1, D_2 and D_3 are made of semiconductors having band gaps of $2.5eV, 2eV$ and 3 eV , respectively . Which one will be able to detect light of wavelength 6000Å ?

Watch Video Solution

25. If the resistance R_1 is increased how will the reading of the ammeter and voltmeter change



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26. Two car garages have a common gate which needs to open automatically when a car enters either of the garages or cars enter both. Devise a circuit that resembles this situation using diodes for the situation .

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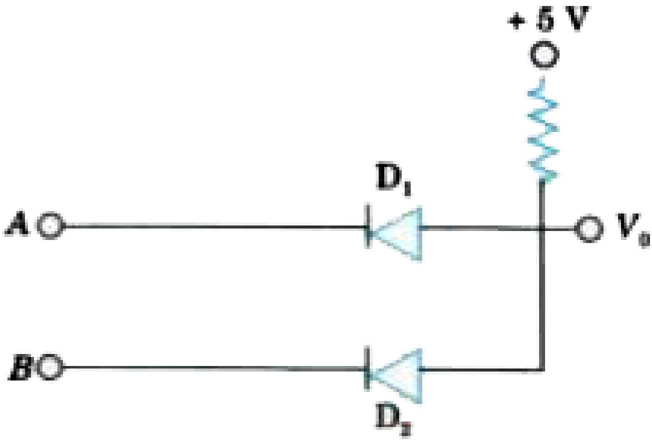
27. How would you set up a circuit to obtain NOT gate using a transistor?

Watch Video Solution

28. Explain why elemental semiconductor cannot be used to make visible LEDs.

Watch Video Solution

29. Write the truth table for the circuit shown in name the gate that the circuit resembles



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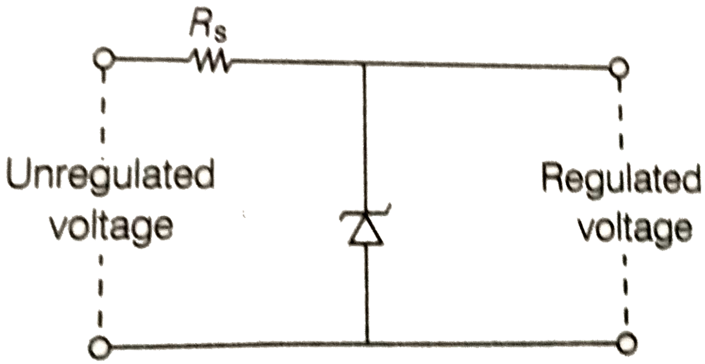
30. A Zener of power rating 1 W is to be used as a voltage regulator. If Zener has a breakdown of 5V and it has to regulate voltage which fluctuated between 3 V and 7 V, what should be the value of R_s for safe operation (see figure) ?



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Higer Order Thinking Skills Advanced Level

1. Impurity levels in a doped semiconductor is found to be 35 millielectron volts below the conduction at temperature T_1 when thermal collisions take place approximate amount of energy and reach the conduction band due to collisions then estimate the temperature of the sample

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2. In semiconductors, thermal collisions are responsible for taking a valence electorn to the conduction band.Why does the number of conduction electrons not go on increasing with time as thermal collisions continuously take place?

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3. When a p-type impurity is doped in a semiconductor,a large number of holes are created. This does not make the semiconductor chared.But when holes diffuse from the p-side to the n-side in a p-n junction,the n-side gets positvely charged.Explain.

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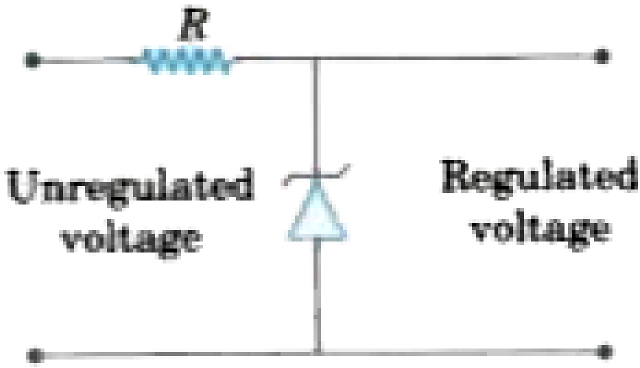
4. A zener diode of power rating 2 W is to used as a voltage regulator if the diode has a breakdown voltage equal to 10 v and has to gregulate voltage fluctuating between 8V and

12 v calculate the value of R for safe operation



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5. If the two ends of a p-n junction are joined by a wire will there be steady current in the circuit if yes then specify its direction

Watch Video Solution

6. Calculate the number of states per cubic metre of sodium in 3s band. The density of sodium is $1013kgm^{-3}$.How naby of them are empty?

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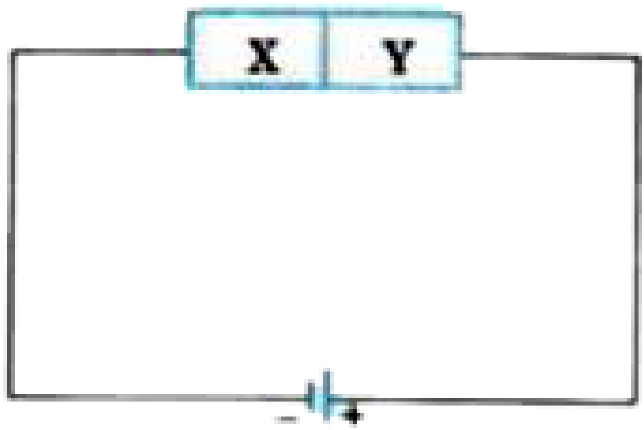
7. A semiconductor material x is made by doping a germanium crystal with indium another semiconductor material y is made by doping a x nad y ar then joined together and connected to a battery



will the jucntion be forward or reverse biased

also draw the V-I characteristics for the circuit

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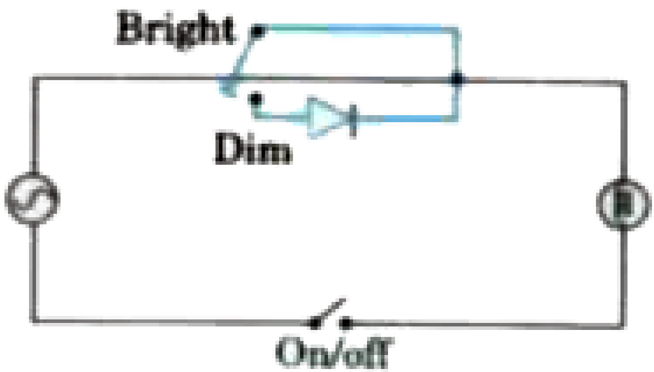
8. A student constructed an inexpensive lamp

using a diode to allow light contro via a switch positin as the reversal of be either dim or brigh another switch is provided for ON/OFF mode



Explain the functioning of this cirucit by how it is able to make the lamp glow brighter or dimmer

if we reverse the orientiatio of the diode how will the lamp behave

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9. A photodiode is operated in reverse mode under different illumination intensities $I_1 I_2 I_3$ and I_4 if $I_1 < I_2 < I_3 < I_4$ show reverse bias current for different intensities on a current voltage graph take reverse bias voltage to be same

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10. The lattice structure for both carbon and silicon is same with each of them having 4 bonding electrons c is an insulator wheres Si is semiconductor why

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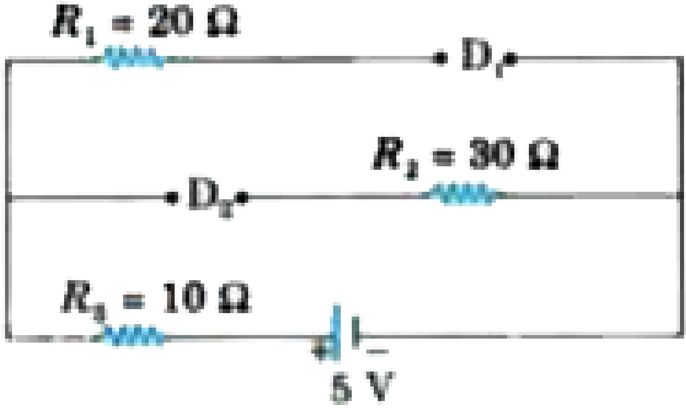
11. The ideal diodes D_1 and D_2 are to be connected in the positions shown in the circuit shown below



calculate the current in the circuit

(i) when p side of D_1 is connected to resistance R_1 and p side of D_2 is connected to resistance R_2

(ii) when n side of D_1 connected to resistance R_1 and n side of D_2 is connected to resistance R_2

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Revision Exercises Very Short Answer Question

1. What are simiconductors

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2. What is fermi level and fermi energy?

Watch Video Solution

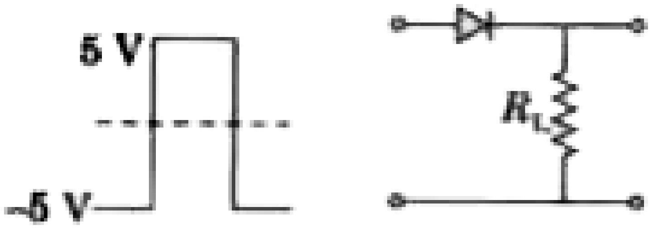
3. what is the behaviour of semiconductors at room temperature

Watch Video Solution

4. Why diamond behaves like an insulator?

Watch Video Solution

5. Draw the output signal in a p-n junction diode when a square input signal of 10 v as is applied across it



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6. Distinguish between intrinsic and extrinsic semiconductors

Watch Video Solution

7. What is doping why it is done

Watch Video Solution

8. Give two example of pentavalent and trivalent impurities

Watch Video Solution

9. What is an extrinsic semiconductor? Discuss the working of the various types of extrinsic semiconductors with help of their energy band diagram.

Watch Video Solution

10. How will you dope a pure silicon crystal to obtain a p type and an n type semiconductor

Watch Video Solution

11. p-type and n-type semiconductors .

Watch Video Solution

12. Give a comparative discussion on majority and minority carriers in n type and type semiconductors

Watch Video Solution

13. When a p-n junction diode is forward biased how will its barrier potential affected

Watch Video Solution

14. What do you mean by reverse biasing of a p-n diode

Watch Video Solution

15. What is the deffect on current when a p-n diode is (i) forward biased (ii) reverse biased

Watch Video Solution

16. What is knee voltage

Watch Video Solution

17. What is the use of a rectifier

Watch Video Solution

18. Give any two difference between a half wave rectifier and a full wave rectifier.

Watch Video Solution

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

Watch Video Solution

20. DYNAMIC RESISTANCE OF THE JUNCTION DIODE

Watch Video Solution

21. What is the value of a ripple factor for a half wave and a full wave rectifier

Watch Video Solution

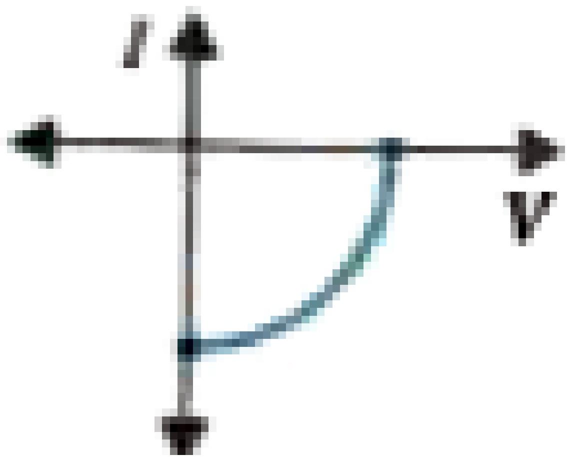
22. What is a zener diode how is it biased in normal operation

Watch Video Solution

23. What is the order of reverse current in a reverse biased p-n junction

Watch Video Solution

24. Name the junction diode whose I-V characteristics are shown adjoining



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25. PHOTODIODE

Watch Video Solution

26. Draw a p-n junction with reverse bias

Watch Video Solution

27. Why are photodiodes used preferably in reverse bias condition?

Watch Video Solution

28. Why germainum is preferred to silicon for making seimiconductor devices

Watch Video Solution

29. Name the semiconductor device that can be used to regulate an irregulation dc power supply. With the help of I-V characteristics of this device, explain its working.

Watch Video Solution

30. Compare the working principal of an LEF and a photodiode

Watch Video Solution

31. What is dark current

Watch Video Solution

32. P-N-P TRANSISTOR

Watch Video Solution

33. In a transistor emitter-base junction is always forward biased while the collector-base junction is reverse biased. Why ?

Watch Video Solution

34. What is the function of base region of a transistor? Why is this region made thin and lightly doped?

Watch Video Solution

35. In a common base transistor what is the phase relationship between input and output voltage

Watch Video Solution

36. In a common emitter amplifier , the phase difference between the input signal voltage and output voltage is

Watch Video Solution

37. Why a common emitter amplifer is preferred toa common base amplifier

Watch Video Solution

38. In n-p-n transistor, what are the current carriers inside and outside the transistor circuit?

Watch Video Solution

39. In n-p-n transistor, what are the current carriers inside and outside the transistor circuit?

Watch Video Solution

40. Derive a relation between current gain of common emitter amplifier.

Watch Video Solution

41. State the relation for the voltage gain in terms of trans-conductance, using transistor as an amplifier.

Watch Video Solution

42. What will be the total voltage amplification factor when three amplifiers having voltage gain of 3 are connected in series

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43. Name a semiconductor device which can be used as a voltage regulator

Watch Video Solution

44. Why transistor can not be used as rectifier?

Watch Video Solution

45. The current amplification factor for CB configuration of a transistor is 0.9 find out the current amplification for CE configuration

Watch Video Solution

46. In a transistor, doping level in base is increased slightly. How will it affect (i) collector current and (ii)base current?

Watch Video Solution

47. Name the operating region of a transistor for the use of transistor as an amlopifier

Watch Video Solution

48. Why a logic gate is so named

Watch Video Solution

49. Name the type in which the electronic circuit have been classified.

Watch Video Solution

50. Why a NOT gate is also known as an inverter

Watch Video Solution

51. For which inputs output is 1 in operation of an AND gate

Watch Video Solution

52. State the rule used in the operation of an OR gate

Watch Video Solution

53. Give the logic symbol of AND gate.

Watch Video Solution

54. Draw the logic symbol of NAND gate and give its Truth table

Watch Video Solution

55. The condluctivity of extrinsic semiconductor depends upon temp[erature and the impurity added (True /Falase)

Watch Video Solution

56. What are the majority and minority charge carriers in a p type semiconductor

Watch Video Solution

57. Using NAND gates make a gate combination diagram to obtain OR gate

Watch Video Solution

58. How a NOR gate is formed

Watch Video Solution

59. Name the optoelectronic device that convert electrical energy in to light

Watch Video Solution

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

Watch Video Solution

61. ICs can be grouped in two categroes what are they

Watch Video Solution

Revision Exercises Additoinal Question

1. Zener diode is used for

A. amplification

B. dectification

C. stabilisation

D. all of above

Answer:

Watch Video Solution

2. A semiconductor is cooled form T_1K to T_2K. Its resistance

A. will increase

B. will decrease

C. will not change

D. will first decrease then increase

Answer:

Watch Video Solution

3. n type semicondlductor is obtained by adding _______impurity to pure semiconductor

A. Trivalent

B. Tetravalent

C. pentavalent

D. all of these

Answer:

Watch Video Solution

4. Which of the following symbols represents a universal gate

A. 

B. 

C.

D.

Answer:

Watch Video Solution

5. What type of semiconductor is obtained by doping indium with silicon

Watch Video Solution

6. A semiconductor is doped with a donor impurity

A. p type

B. n tyhpe

C. n-p-n type

D. p-n-p type

Answer:

Watch Video Solution

7. For a transistor if β =100$then$alpha` will be

A. 0.99

B. 1.01

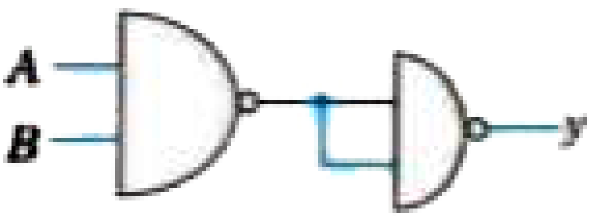
C. 100

D. 0.01

Answer:

Watch Video Solution

8. The combination Of NAND gates shown in the figure



A. AND gate

B. OR gate

C. NOT gate

D. none of these

Answer:

Watch Video Solution

9. Which of the following elements is a semiconductor

A. Na

B. Ba

C. Sr

D. Ge

Answer:

Watch Video Solution

Revision Exercises Fill In The Blanks

1. The donor energy level is close to the ____________band in n type semiconductor

Watch Video Solution

2. The fermi level in p type semiconductoer lies in between .... level and valence abnd

Watch Video Solution

3. On adding trivalenet impurity in a pure semiconductor the fermi level shifts very close to the ....band

Watch Video Solution

4. The highest energy level which can be occupied by an electron in valence band at OK is known as

Watch Video Solution

5. When the ....of the battery is connected to p side and negative terminal to the n side then the diode is said to be in forward bias

Watch Video Solution

6. In forward bias the width of depletion layer is

Watch Video Solution

7. A circuit in which large numbr of resistor capacitors diodes transistor s are connected on a single small chip is known as....................

Watch Video Solution

8. ....in n type semicionductor hoas more mobility than ....in p type semiconductor

Watch Video Solution

9. ....side of a p-n juctin is termed as anode and ....side is termed as cathode

Watch Video Solution

10. The potential harrier for Si is ....V and for Ge is V

Watch Video Solution

Revision Exercises Short Answer Question

1. Distinguish between intrinsic semiconductor and p-type semiconductor. Give reason, why a p-type semiconductor crystal is electrically neutral, although $n_h >\ > n_e$?

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2. Draw the enrgy ban 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 energy level is slightly above the tip of the valence band explai what role do these energy levels play in conduction and valence bands

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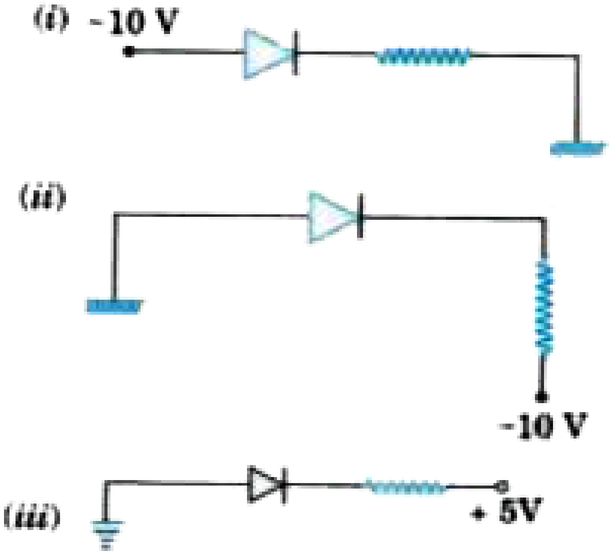
3. which one of the two diodes is forward biased and which is reverse biased



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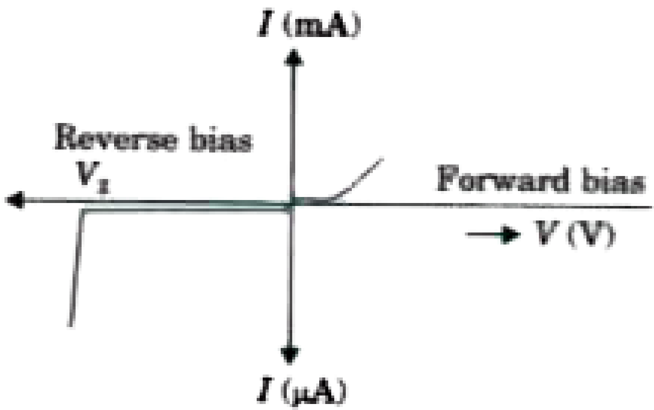
4. The figure shows the V-I characteristic of a semiconductor diode designed to operate under revese bias



(a) identify the semiconductor diode used

(b) draw the cirucuit diagram to obtain the given characteristics of this devics

(c) briefly expain one use of this device

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5. Sketch inputs A,B and output Y from a NAND gate from the table given below

Table

Time	Input A	Input B
$t < t_1$	1	1
t_1 to t_2	0	0
t_2 to t_3	0	1
t_3 to t_4	1	0
t_4 to t_5	1	1
t_5 to t_6	0	0

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6. Explain with the help of a circuit diagram how the thickness of depletion layer in a p-n junction diode changes when it is forward biased

Watch Video Solution

7. What is a rectifier explain the working of P-N diode as half wave rectifier

Watch Video Solution

8. What is rectification Draw relevant circuit diagram and waveforms explain the working of p-n jucntion diode as a full wave rectifier

Watch Video Solution

9. Name the semiconductor device that can be used to regulate an irregulation dc power supply. With the help of I-V characteristics of this device, explain its working.

Watch Video Solution

10. (a) Draw a neat diagram showing forward biasing of a p-n junciton

Briefly explain its working draw it s V-I charcteristics for two different intensities of illumination

Watch Video Solution

11. (a) how is a photodiode fabricated

(b) briefly explain its working draw its V-I characteristics for two different intensities of illumination

Watch Video Solution

12. What is a photodiode why is it kept in reverse bias for operation while the current available in forward bias happens to be more

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13. Describe briefly using the necessary circuit diagram the three process which take place to generate the emf in a solar cell when lights falls on ti write two important criteria required for the selection of a material for solar cell fabrication

Watch Video Solution

14. Describe briefly lhow light emitting diode is fabricated and expalin its working write three important advantages of LED over conventional incandescent lamps

Watch Video Solution

15. p-type and n-type semiconductors .

Watch Video Solution

16. Draw the I-V characteristics of a zener diode also sketch the circuit diagram of zener diode as a voltage regulator

Watch Video Solution

17. Draw a diagram of an illuninated p-n junction solar cell

Watch Video Solution

18. (a). Explains briefly with the help of a circuit diagram how V-I characteristics of a p-n junction diode are obtainedin (i) forward bias, and (ii) reverse bias.

(b). A photo diode is fabricated from a semiconductor with a band gap of 2.8 EV. Can it detect wave length of 6000. nm? Justify.

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19. Draw the cirucit of full wave recitfier with capacitor filter also draw the input and output voltage of this circuit

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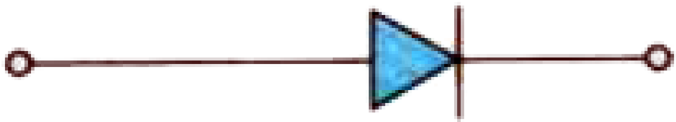
20. The symbol of a diode is show in the figure



(a) the diode is a ________rectifier diode / photo diode / zener diode

(b) draw the VI characteristics of above diode

(c) a zener diode with $V_z = 6.0V$ is sued for voltage regulation if the unregulated input is 10.0 V what is the value of series resistor R

(d) what is the fundamental frequency of the ripple in a full wave rectifier cirucit operating from 50 Hz mains

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21. Draw the graph showing the variation of current with voltage for a p-n junctin diode when the diode is (i) forward biased and (ii) reyerse biased

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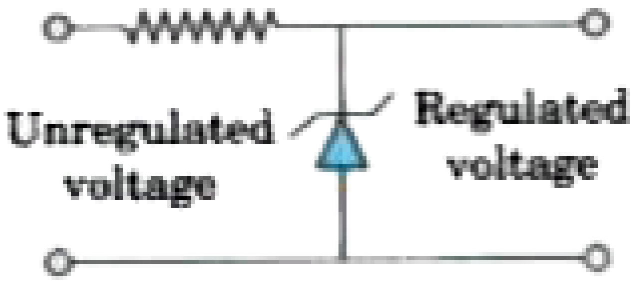
22. A zener diode of rating 100 mW to be used as a voltage regulator if the zener ddiode has the breakdwon voltage of 5 V and it has to regulate should be the value of R_S for safe operation



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23. Draw a circuit diagram of a full-wave rectifier. Explain its working principle. Draw the input/output wave forms indicating clearly the function of the two diode used.

Watch Video Solution

24. (i) three photodiodes D_1, D_2 and D_3 are made of semiconductors ahving band gaps of 2.5 eV 2eV and 3eV respecitvely which of them will not be able to detect light of wavelenghth 600nm

(ii) why phtoodiodes are required to operate in revese bias explain

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25. DIFFERENCE BETWEEN VALANCE BAND, CONDUCTION BAND AND ENERGY BAND

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26. Write logic symbol boolean expression and truth table of AND andNOR gate

Watch Video Solution

27. Write logic symbol boolean expression and truth table of NAND and OR gate

Watch Video Solution

28. Write logic symbol boolean expression and truth table of NOT and OR gate]

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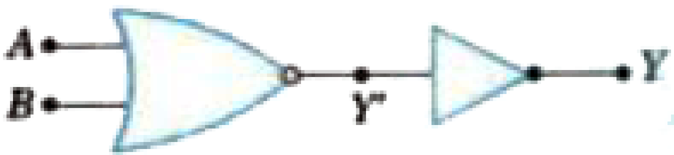
29. What is a logic gate name the logic gate obtained from the figure and write its truth table



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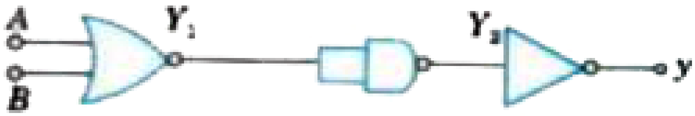
30. What is the equivalent circuti of the combination given below answer with proper truth table



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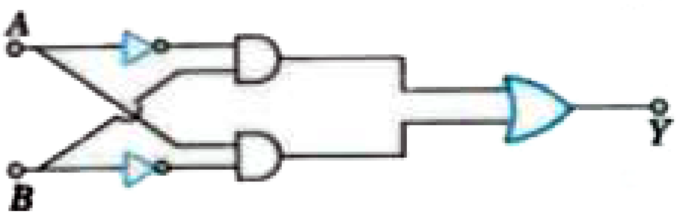
31. Give the truth table for the following logic circuit



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32. What is solar cell why are Si and Ga as preferred materials for solar cell give its V-I characteristics]

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33. (a) Draw a neat diagram for a full wave rectifier circuit

(b) Draw the logic gate symbol and the truth table for a NAND gate with tow inputs

(c) In an n-p-n tranasistor circuit the collector current is 10 mA if 95% of the enemitter current reach the collector what is the base current

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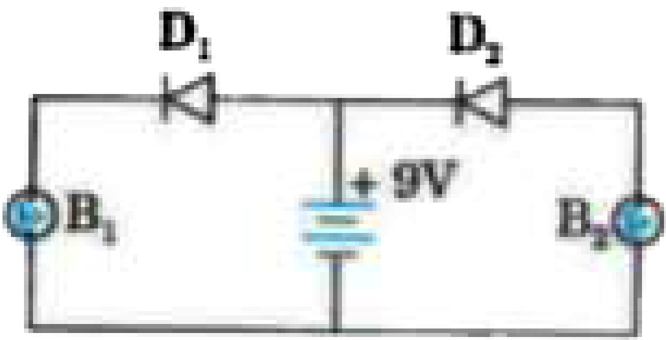
34. In the following diagram which bulb out of B_1 and B_2 will glow and why



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35. What is an integrated cirucit (IC) mention the most widely used technilogy in the fabricaton of IC

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36. (a) Draw the V-I characteristic curve for forward and reverse bias of a p-n juction diode (b) what are th majority and ninority carriers in a p type semiconductor (c) wirte down the symbol and truth table of OR gate

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37. (a) A student wants to use tow p-n junction diodes to convert alternating current in to direct curent draw the labelled circuit diagram she would use and explain how it works

(b) give the truth table and circuit symbol for NAND gate

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Revision Exercises Long Answer Questions

1. (a) distinguish between metals inlsulators and simi conductors on the baisi of their energy bands

(b) why are photodiodes used preferabley in reverse bias condlition can it detect a wavelength of 6000 nm justify

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2. (i) wirte two difference among conductors semiconductor and isulator on the basic of energy band diagram

(ii) in a p-n juction diode what is the change in the width of the depletion layer when the diode is forward bias respectively

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3. (a) explain briefly with the help of necessary diagrams the forward and the reverse charqcteristic cuves in the two cases

(b) A semicionductor has equal electron and holw concentration of 6×10^{8} on doping with increases to $9 \times 10^{12} / m^{3}$

(i) identifty the new semiciondcutor obtained after doping

(ii) calculate the new hole concentrati9no

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4. (a) Describe briefly with the help of a diagram the role of the two important processes involved in the formatiojn of a p-n junction

(b) Name the device which is used as a voltage regulator draw the necessary cirucit diagram and explain its working

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5. The circuit used to change alternating voltage to direct voltage is called rectifier

(a) with a neat diagram explain the working of a full wave rectifier having two diodes

(b) what is the output frequency of a full wave rectifier if the input frequency is 50 Hz

(c) Draw the output waveform across the load resistance connected in the full wave rectifier circuit

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6. (a) Define the terms depletion layer and barrier potential for a p-n junction (i) an increase in the doping concentration and (ii) biasing across the junction affect the width of the depletion layer

(b) Draw the circuit diagram of a p-n diode used a s a half wave rectifier explain its working

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7. (a) state briefly the processes involved in the formation of p-n how the depletion region is formed

(b) using the necessary circuit diagrams show p-n junction are obtained in

(i) forward biasing (ii) reverse biasing how these characteristic are made use of in rectification

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8. How is zener diode fabricated so as to make it a special purpose diode the significance of brekdown votlage explain brielfy with the help of a cirucit diagram how a p-n junction diode works as a half wave rectifier

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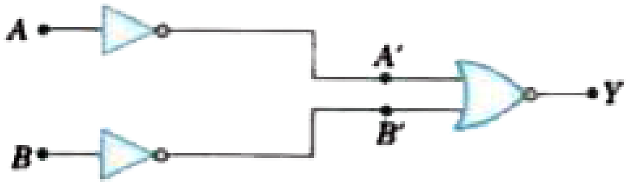
9. identify the equivalent gate for the following cirucit and write its truth table



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10. For CE transistor amplifier, the audio signal voltage across the collector resistance of $2k\Omega$ is 4V. If the current amplification factor of the transistor is 100 and the base resistance is

$1k\Omega$, then the input signal voltage and base current are

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11. State the principle of working of p-n doide as a rectifier with the help of circuit diagram explain rdraw input and output wave forms

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Revision Exercises Numerical Problems

1. Find the number of acceptro atoms m^3 in the silicon specimen on adding one indium atom per 5×10^8 the number density of atoms in silicon specimen is 5×10^{28} atoms / m^3

Watch Video Solution

2. calculate the maximum wavelength of electromagentic radioation to create pair in germanium Energy band gap of 0.72 eV

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3. Find the hole density in doped silicon if at 27° c the electron density and hole density are equal nd equal to 3.0×10^{16} on doping with arsenic electron density increases to $9 \times 10^{19} m^{-3}$

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4. The electron concentration and hole concentration in a semicoinductor are

6×10^{13} and $7 \times 10^{13} cm^{3}$

(i) what is the nature of semiconductor p type or n type

(ii) find the resistivity of the sample if electron mobility is 24000 and holw mobility is 200 $cm^{2} V^{-1} S^{-1}$

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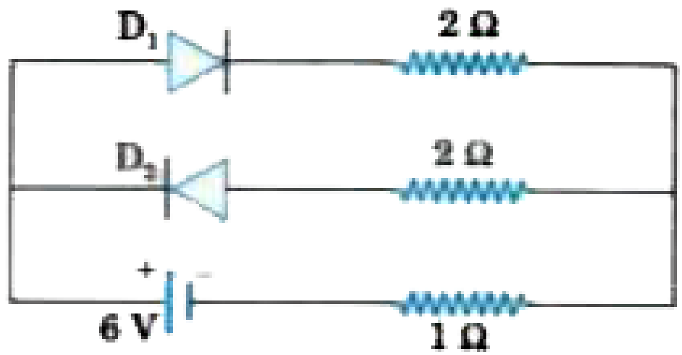
5. Assuming that the two diodes D_1 and D_2 used in the electric cirucit shown are ideal. find out the value of the current flowing through 1 ohm resistor



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6. In an n-p-n transistor the base current is 1 mA if 90% of electons emitteed reach the collector then find the emitter current and collector current

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7. Find the curernt gain in a common base circuit if the base curent is 50 μA emitter current is 1.2 mA

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8. The resistance gain and voltage gain for a commoin base amplifier are 3000 nd 2700 respectively what is the current gain and power gain of amplifier

Watch Video Solution

9. Calculate the base current and emitter current if collector current is 6 mA and current gain is 60 in commoin emitter confitguration

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10. The internal resistance of two diodes usded in fulllwave rectifier is 20 ω (i) the maximum and mena load current (ii) rms value of load current

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11. The output resistance of an n-p-n transistor is 4 $k\omega$ and input resistance is $1k\omega$ if the current gain is 50 and output voltage is 4V then find the input voltage

Watch Video Solution

12. In a common base n-p-n trnsistor the current gain is 0.96 what will be the voltage gain and power gain if output resistance is 500 $k\omega$ and the input resistane is 500 ω

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13. For a germanimu tansistor the change of 9 mA in emitter current produces a change of 8.8 mA in collector produce an equivalent change in base current

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14. In n-p-n transistor 94% of the electrons reach the colectro and 10^{12} electrons enter the emitter in what are the values of current transfer ratio and current amplification factor

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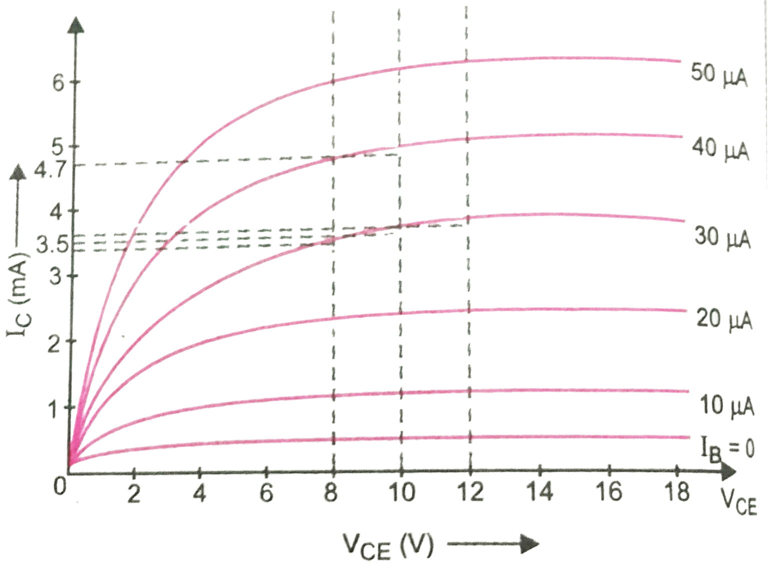
15. Output characteristics of an n-p-n transistor in CE configuration is shown in the Fig. Determine



(i) dynamic output resistance (ii) dc current gain and (iii) ac current gain at an opererating point $V_{CE} = 10V$, when $I_B = 30\mu A$.

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Competion File Multiple Choice Questions With Only One Correct Answer

1. The electrical conductivity of semicondutor increases when electromagnetic radiation of wavelength shorter than 29800 Å is incident on it. The band gap for the semiconductor is

A. 0.83 eV

B. 0.64 eV

C. 0.42 eV

D. 0.36 eV

Answer:

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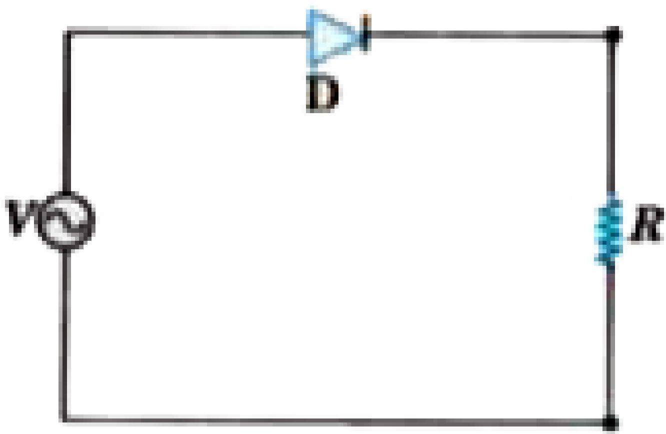
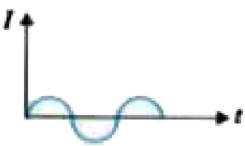
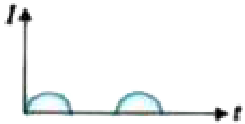
2. A half wave rectifer circuit is constracted using a p-n junction dode D load resistacne R and AC source as shown below

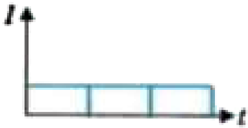


The current thourgh R varies as

A. 

B. 

C. 

D. 

Answer:

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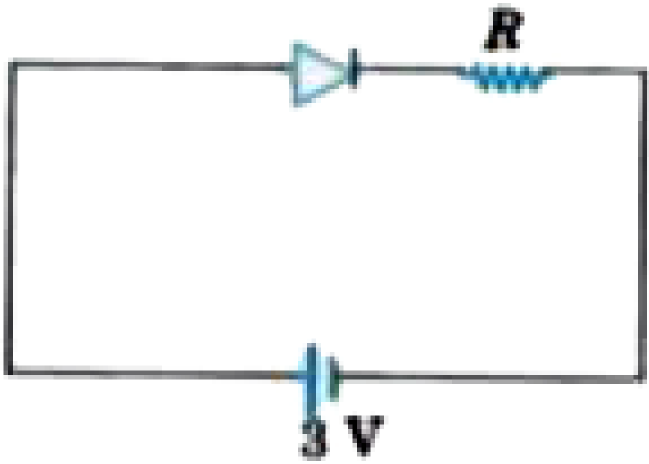
3. In the current versus voltage characteristics of a diode minimum current of 1 mA is required for the knee voltage to be is connected in a cirucit the minimum value of R

so that the voltage is above knee point is



A. 3.7 k ω

B. 2.3 k ω

C. 5.2 k ω

D. 1.7 k ω

Answer:

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4. Atoms of phosphorus aresnic indium and bismuth are used for doping pure semicondluctors to produce p type or n type semiconductors p tyhpe semocnductor

A. phosphourus arsenic indium and bismuth

B. indium and arsenic

C. phosphrous bismuth and indium

D. indium only

Answer:

Watch Video Solution

5. The current gain of a tramnsistor is 0.9 for common base configuration if the change in emitter current is 8 mA the change in base current is

A. 0.1 mA

B. 2 mA

C. 0.8 mA

D. 1.2 mA

Answer:

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6. The dominant mechanisms for motion of charge carriers in forward and reverse biased silicon $P-N$ junction are

A. are drift and diffusion respectively

B. are diffusin and drift respectively

C. is drift in both

D. is diffusion in both

Answer:

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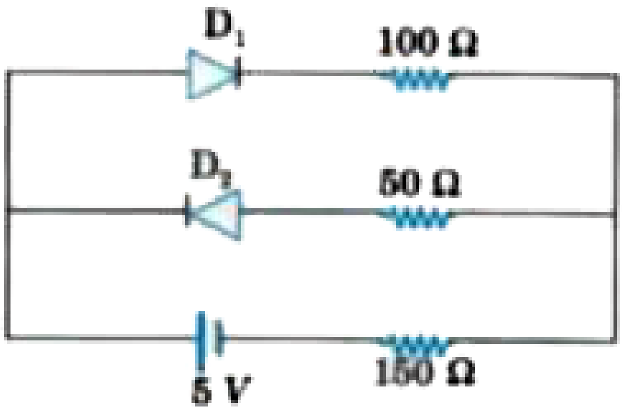
7. Two diodes D_1 and D_2 each with forward resistance of 50 ω and infinite backward resistance are connected as the current througjh thej 150 ω resistance is



A. 1.64 A

B. 0.032 A

C. 0.0167 A

D. zero

Answer:

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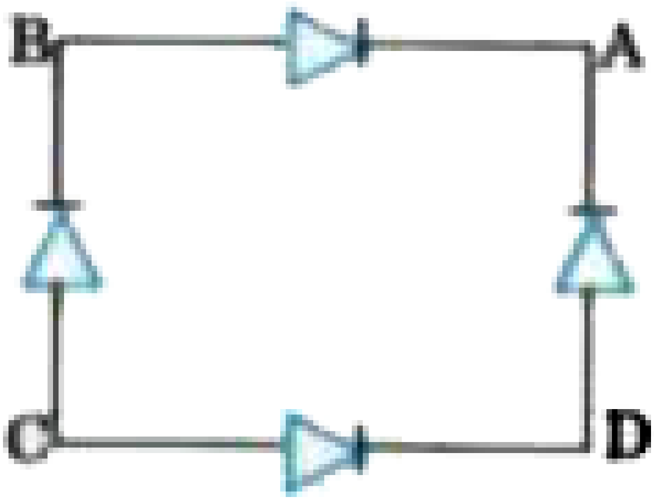
8. Four diodes are connected in the adjoining in order for the circuit toact as a full wave DC output are connected and obtained respectively across



A. BA and CD

B. BD and AC

C. BC and AD

D. AD and BD

Answer:

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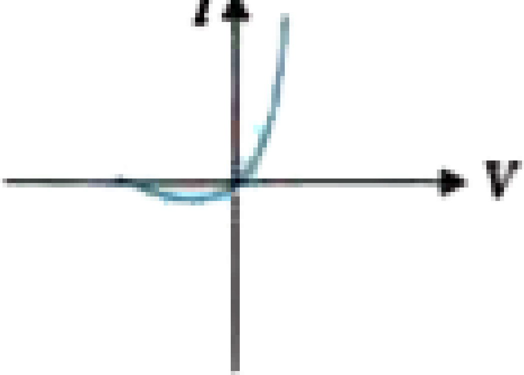
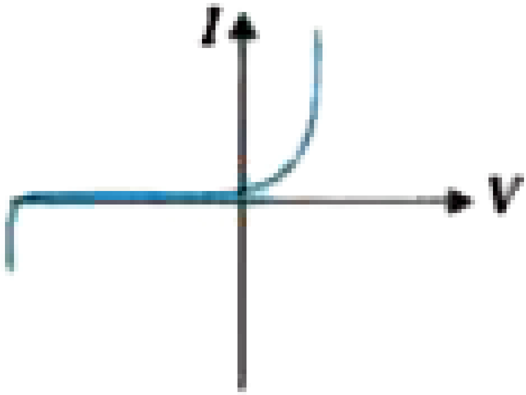
9. I-V characteristics of four semiconductor devices are in graphs (i) ,(ii) (iii) and (iv) the characteristics of zener diode and solar cell are show correctly in :

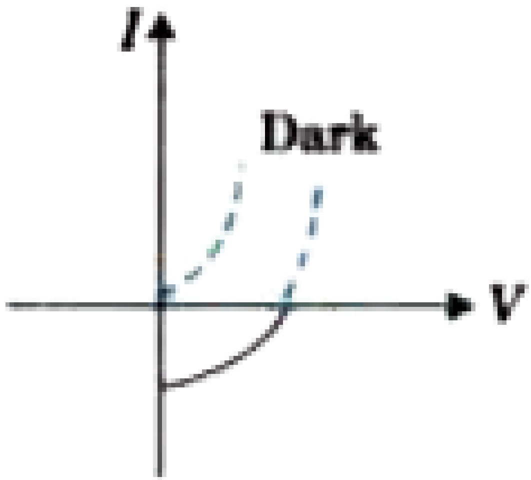
(i)



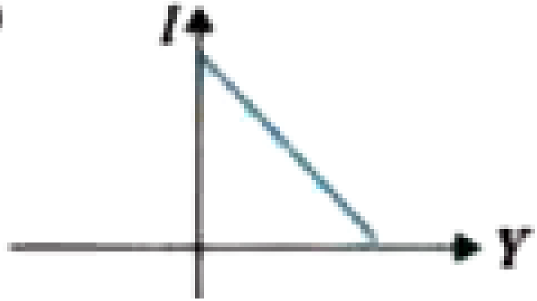
(ii)



(iii)



(iv)



A. (ii) and (iv) respectively

B. (i) and (ii) respectively

C. (ii) and (iii) respectively

D. (i) and (iv) respectively

Answer:

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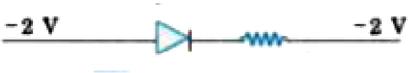
10. In which of the following connections the diode is forward biased

A. 

B. 

C. 

D. 

Answer: C

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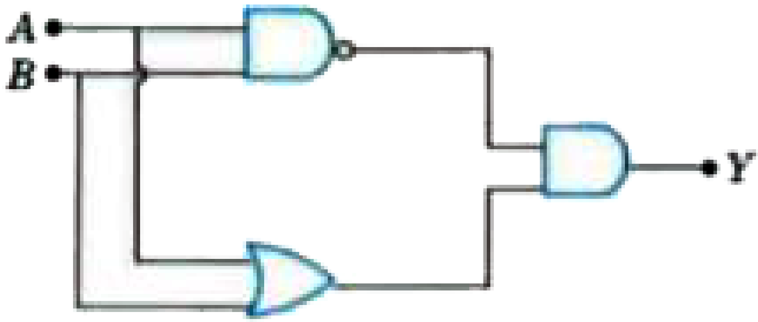
11. 

The above combination of gates produces a

A. AND gate

B. XOR gate

C. NAND gate

D. NOR gate

Answer:

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12. Ge and Si diods in the circuit belwo conduct at 0.3 V and 0.7 V respectiveluy if the connection of Ge diode in now reversed the change in value of V is

A. 0.2 v

B. 0.4 v

C. 0.7 v

D. 0.9 v

Answer:

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13. Input A,B,C,D are given to a gate and y is the oputput obtained from we can see that the gate is

A. NAND gate

B. AND gate

C. NOT gate

D. OR gate

Answer:

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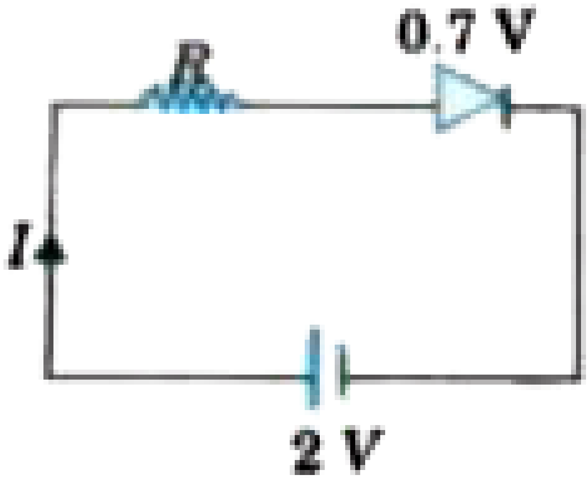
14. Si diode used in the circuit shhas a constant voltage drop of a maximum power rating resistance R to obtain maixmum current is



A. 15 ω

B. 11 ω

C. 17 ω

D. 20 ω

Answer:

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15. A transistor with a current gian of $\beta = 50$ is used as an amplifier if the voltage across the load resistance $R_c = 5k\omega$ in the collectro cirucit is 2.5 V the base current is

A. 1 mA

B. 0.1 mA

C. 0.01 mA

D. 0.001 mA

Answer:

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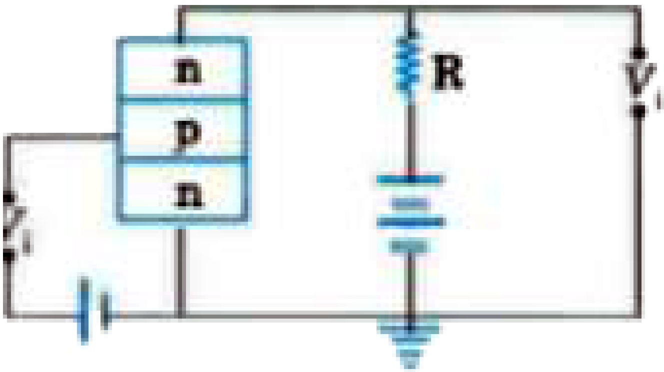
16. An n-p-n tansistor circuit is show below



The arrangement represent a

A. a common - collector amplifier circuit

B. a common - emitter amplifier circuit

C. a common - base amplifier circuit

D. a switch circuit

Answer:

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17. At a plate potential of 150 V the palte current in a diode is 8 mA under space charge limited conditions if the plate potential is changed to 300 V the plate current is

A. 22.63 mA

B. 27.89 mA

C. 36.92 mA

D. 16.17 mA

Answer:

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18. In the circuit given below the p-n junction diode is ideal with negligible forward resistance and infinite backward resistance the current in the circuit is

A. 2 mA

B. 1mA

C. 0.5 mA

D. zero

Answer: D

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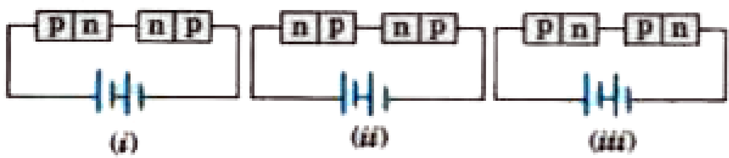
19. In which of the following ciruict the potiential drop across the two p-n juctins are equal take all p-n junctions to be identical



A. (i) and (ii)

B. (i) and (iii)

C. (ii) and (iii)

D. only (iii)

Answer:

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20. A piece of copper and anotehr piece of silicon are cooled down to 80 k from room temperatrue then the resistance of

A. copper decrease and silicon increases

B. copper increases and silicon decreases

C. both of them increases

D. both of them increases

Answer:

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21. A Ge specimen is dopped with Al. The concentration of acceptor atoms is ~$10^{21} atoms/m^3$. Given that the intrinsic concentration of electron hole pairs is $\sim 10^{19}/m^3$, the concentration of electron in the speciman is

A. $10^{17}/m^3$

B. $10^{15}/m^3$

C. $10^{12}/m^3$

D. $10^{16}/m^3$

Answer:

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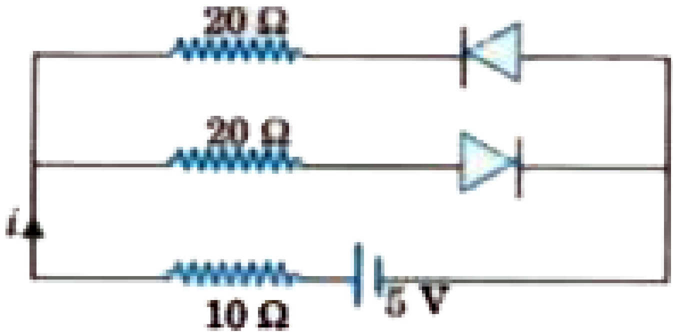
22. In the cirucit given below the knee voltage for both the diodes is 0.5 v the current shupplied by the battery is



A. $\frac{5}{20}$ A

B. $\frac{3}{20}$ A

C. $\frac{5}{10}$ A

D. $\frac{3}{10}$ A

Answer:

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23. The contribution in the total current flowing through a semiconductor due to electrons and holes are $\frac{3}{5}$ and $\frac{2}{5}$ respectively. If the drift velocity of electrons is 2 times that of holes at this temperature, then the ratio of concentration of electrons and holes is

A. $5/2$

B. $6/5$

C. $5/3$

D. $3/4$

Answer:

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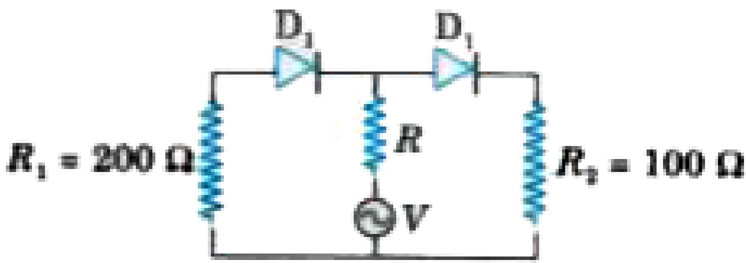
24. In the curcuit given below D_1 and D_2 are two identicall diodes and V is a sinusoidal voltage source the voltage drop across the resistance R_L



A. is half rectified

B. is fully rectified

C. has same value of peak voltage for positive and negative half cycles

D. has different value of peak voltage for positive and negative half cycles

Answer:

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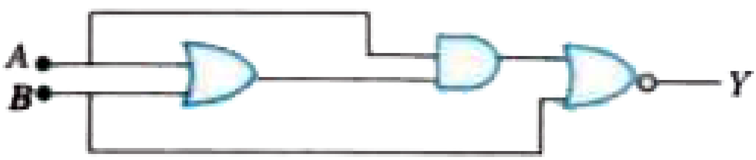
25. For the combination of gates given below the output y is high if



A. a=0,b=1,c=0

B. A=1,B=0

C. A=0,B=0

D. A=1,B=1

Answer:

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26. The base of a transistor is kept very thin and lightly doped as compared to the emitter and collector region so that

A. most of the carriers pass to the collector when injected from the emitter

B. base current is high

C. recombination is increased in the bae region

D. flow across the base region is mainly because of majority carriers

Answer:

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27. A transistor -oscillator using a resonant circuit with an inductor L (of negligible resistance) and a capacitor C in series produce oscillations of frequency f. If L is doubled and C is changed to $4C$, the frequency will be

A. $\frac{f}{2}$

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

C. $\frac{f}{3}$

D. $\frac{f}{2\sqrt{2}}$

Answer:

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28. For a p-type semiconductor, which of the following statements is true?

A. electrons are the majority carriers and pentavalent atoms are the dopants

B. electrons are the majority carriers and trivalen atoms are the dopants

C. holes are the majority carriers and trivalen atoms are the dopants

D. holes are the majority carriers and pendtavlent atoms are the dopants

Answer:

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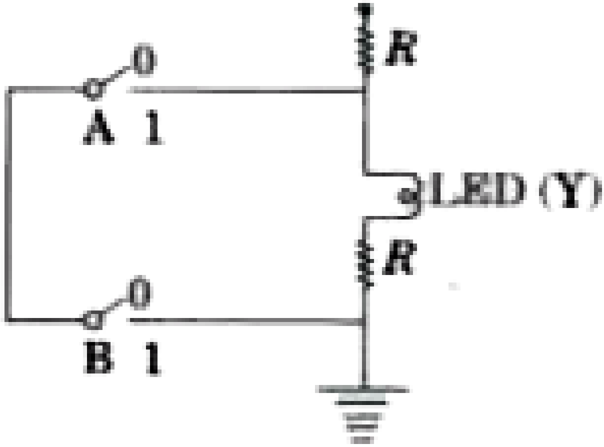
29. The correct booleon operation represented by the circuit diagram drawn is



A. NOR

B. AND

C. OR

D. NAND

Answer:

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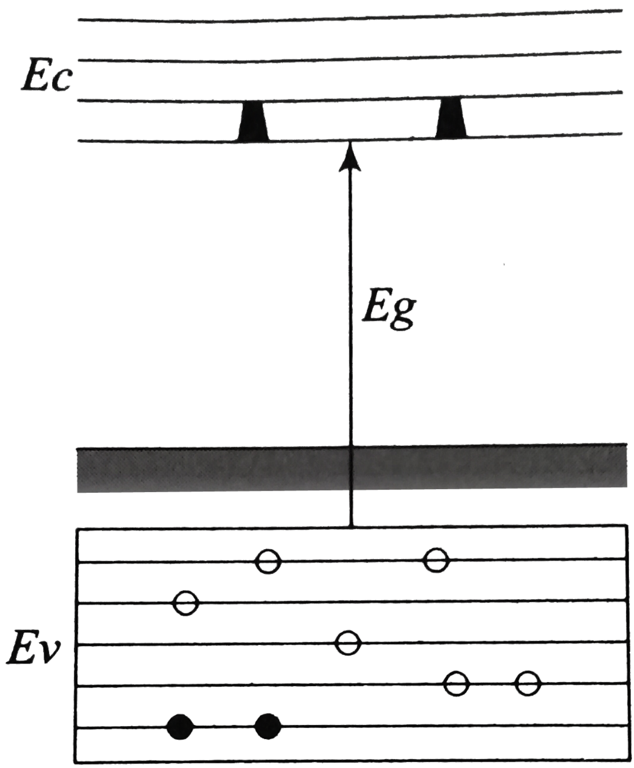
30. In the energy band diagram of a material shown below, the open circles and filled circles denote holes and electrons respectively. The material is a/an



A. an inlsulator

B. a metal

C. an n type semiconductor

D. a p type semiconlductor

Answer: D

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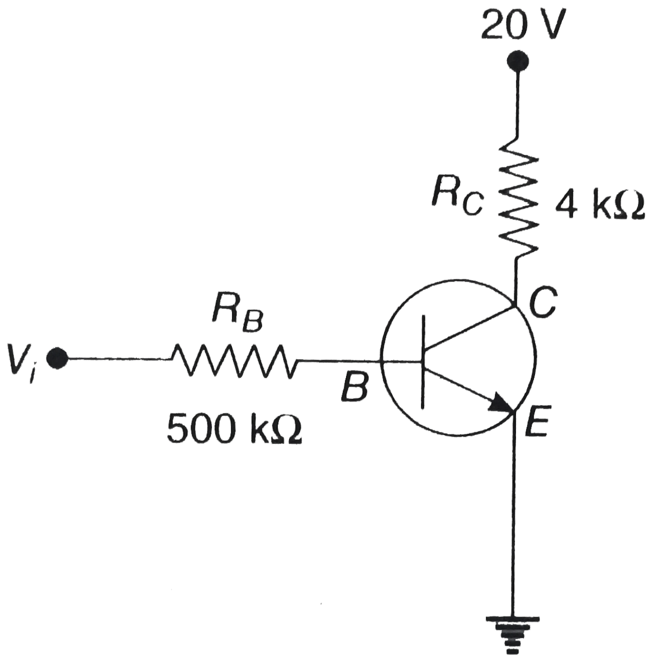
31. In the circuit shown in the figure, the input voltage V_i is $20V$, $V_{BE} = 0$ and $V_{CE} = 0$. The values of I_B, I_C and β are given by:



A. $I_B = 20\mu A,\ I_c = 5mA,\ \beta = 250$

B. $I_B = 25\mu A,\ I_c = 5mA,\ \beta = 200$

C. $I_B = 40\mu A,\ I_c = 10mA,\ \beta = 250$

D. $I_B = 40\mu A,\ I_C = 5mA,\ \beta = 125$

Answer:

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32. In a $p-n$ junction diode, change in temperature due to heating

A. does not affect resistance of p-n jucntion

B. affect only forward resistance

C. affects only reverse resistance

D. affects the overall V-I charactertics of p-n junction

Answer: D

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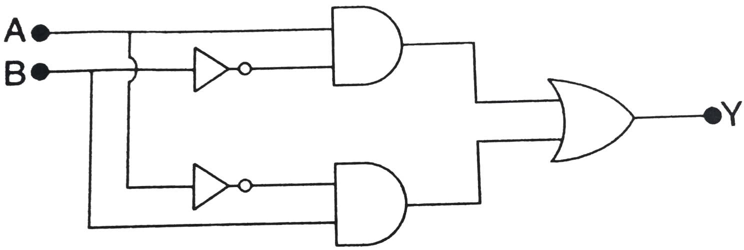
33. In the combination of the following gates the output Y can be written in terms of inputs A and B as:



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

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

C. $\overline{A.B}$

D. $\overline{A+B}$

Answer:

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34. 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. 40 k ω

B. 4 k ω

C. 200 ω

D. 400 ω

Answer:

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35. 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. 5×10^{14} Hz

B. 1×10^{14} Hz

C. 20×10^{14} Hz

D. 10×10^{14} Hz

Answer:

Watch Video Solution

36. A $p-n$ photodiode is fabricated from a semiconductor with a band gap of $2.5eV$. It can detect a signal of wavelength

A. 4000 nm

B. 6000 nm

C. 4000 A

D. 6000 A

Answer:

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37. 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 $200\mu A$ produces a change in the collector current from $5mA$ to $10mA$. The current gain is

A. 100

B. 150

C. 50

D. 75

Answer:

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38. A common emitter amplifier has a voltage gain of 50, an input impedance of 100Ω and an output impedance of 200 Ω. The power gain of the amplifier is :-

A. 1250

B. 50

C. 500

D. 1000

Answer:

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

A. it becomes a p type semiconductor

B. the antimony becomes an acceptor atom

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

D. its resistance is increased

Answer:

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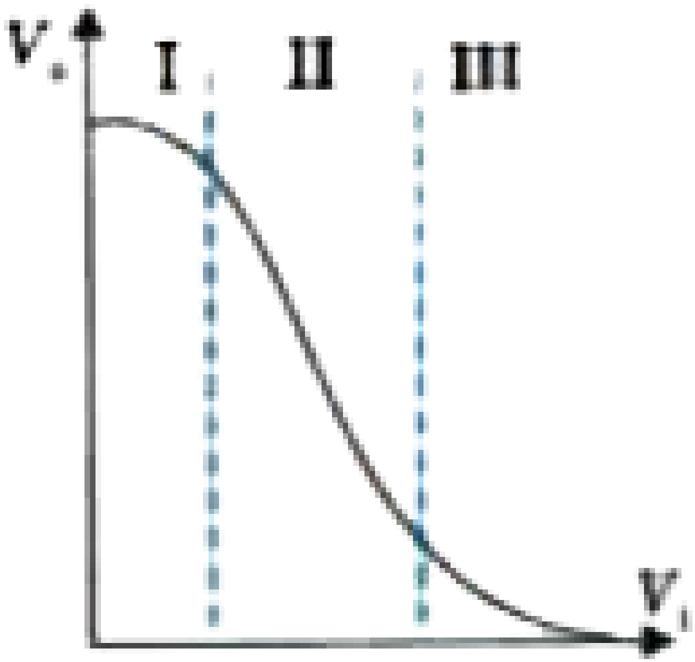
40. Transfer characteristics vs input volage for a base biased transistor in CE configuration for using transistor as a switch it is used



A. in region I

B. in region II

C. both in region I and III

D. in region II

Answer:

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41. C and Si both have same lattice structure, having 4 bonding electrons in each. However, C is insulator whereas Si is intrinsic semiconductor. This is because

A. the four bonding electrons in the case of C lie in the third orbit wheras for Si they lie in the fourth orbit

B. In case of C the valence bond is not completely filled at absolute zero temperature

C. in case of C the condluction band is party filled even at absolute zero temperature

D. the four bonding electrons in the case of C lie in the second orbit wheras in the case of Si they lie in the third

Answer:

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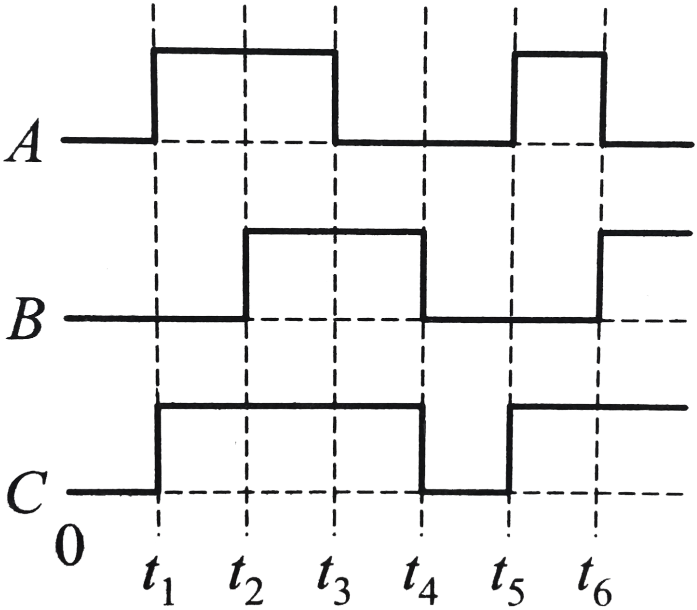
42. The figure shows a logic circuit with two inputs A and B and the output C. The voltage wave forms across A, B and C are as given.

The logic circuit gate is



A. NAND gate

B. OR gate

C. NOR gate

D. AND gate

Answer:

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43. 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. 1.5 g

B. $\frac{1}{3}g$

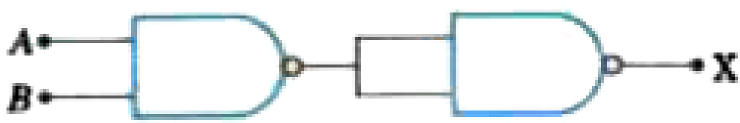
C. $\frac{5}{4}g$

D. $\frac{2}{3}g$

Answer:

Watch Video Solution

44. The ouptu x of the logic circuit will be



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

B. $X = A.\,B$

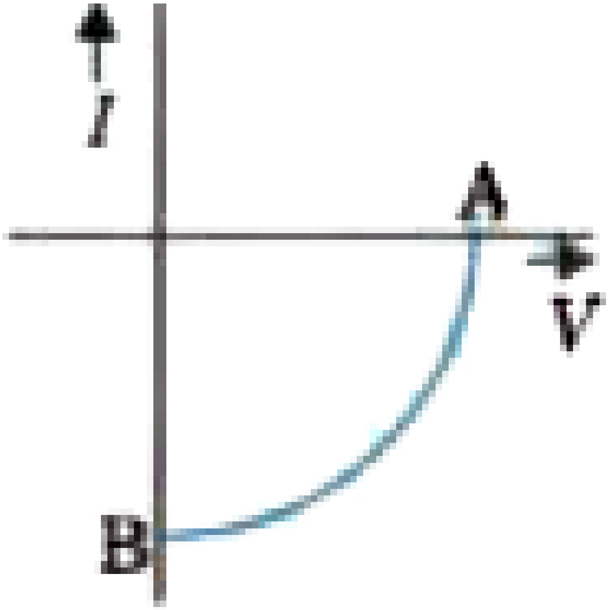
C. $X = \overline{A + B}$

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

Answer:

Watch Video Solution

45. The given graph represents V-I characteristic for a semiconductor device which of the following statement is correct



A. it is V-I characteristics for solar cell wher point a reprsents open circuit voltage and point b short circuti current

B. it is for solar cell and points a and b represent open circuit voltage and current repectively

C. it is for a photodiode and points a and b represent open circuit voltage and current respectively

D. it is for an led and points a and b represent open circuit voltage and short circuit current respectively

Answer:

Watch Video Solution

46. The barrier potential of a p-n junction depends on : (a) type of semiconductor material (b) amount of doping (c) temperature.

Which is one of the following is correct?

A. a and b only

B. b only

C. b and c only

D. a,b and c

Answer:

Watch Video Solution

47. Consider the juction diode as ideal the value of current flowing through AB is

A. $10^2 A$

B. $10^{-1} A$

C. $10^{-3} A$

D. 0A

Answer:

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48. A n-p-n transisitor is connected in common emitter configuration in a given amplifier. A load resistance of 800Ω is connected in the collector circuit and the voltage drop across it is $0.8V$. If the current amplification factor is 0.96 and the input resistance of the circuits is 192Ω, the voltage gain and the power gain of the amplifier will respectively be

A. 3.69,3.84

B. 4,4

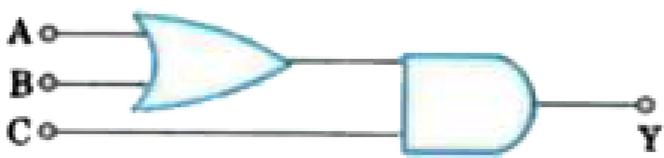
C. 4,3.69

D. 4,3.84

Answer:

Watch Video Solution

49. To get output 1 for the following circuit the correct choice for the input is

f 

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

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

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

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

Answer:

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50. The given electrical network is equivalent to

A. AND gate

B. OR gate

C. NOR gate

D. NOT gate

Answer:

Watch Video Solution

51. In a common emitter transistor amplifier the audio signal voltage across the collector is $3V$. The resistance of collector is $3k\Omega$. If current gain is 100 and the base resistance is $2k\Omega$, the voltage and power gain of the amlifier is :

A. 200 and 1000

B. 15 and 200

C. 150 and 15000

D. 20 and 2000

Answer:

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Competion File Jee Main Other State Boards For Engineering Entrance

1. In a common emitter configuration with suitable bias, it is given that R_L is theload resistance and R_{BE} is small signal dynamic resistance (iiput side). Then, volage gain, current gain and power gain are given , respectively, by :

β is currentgain , I_B, I_C and I_E are respectively base, collector and emitter currents.

A. $\beta \frac{R_L}{R_{RE}}, \frac{\triangle I_C}{\triangle I_B}, \beta^2 \frac{R_L}{R_{BE}}$

B. $\beta \frac{R_L}{R_{RE}}, \frac{tr \in \angle I_E}{\triangle I_B}, \beta^2 \frac{R_L}{R_{RE}}$

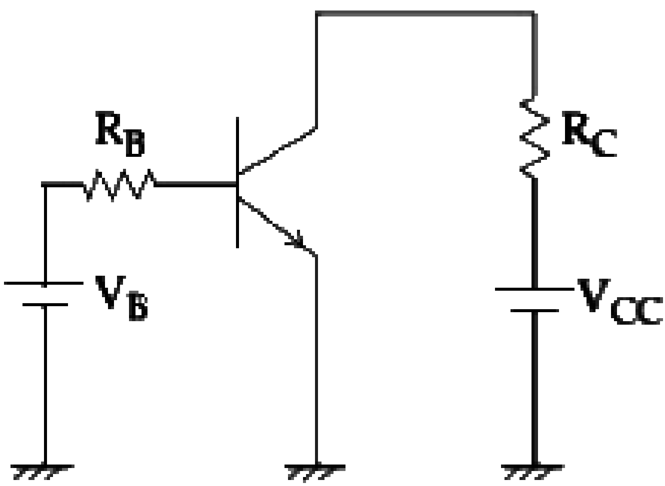
C. $\beta^2 \frac{R_L}{R_{RE}}, \frac{tr \in \angle I_c}{\triangle I_B}, \beta \frac{R_L}{R_{RE}}$

D. $\beta^2 \frac{R_L}{R_{RE}}, \frac{tr \in \angle I_E}{\triangle I_C}, \beta^2 \frac{R_L}{R_{RE}}$

Answer:

Watch Video Solution

2. A common emitted amplifier circuit, built using an npn transistor, is shown in the figure. Its dc current gain is 250, $R_C = 1K\omega$ and $V_{CC} = 10V$. What is the minimum base current for V_{CE} to reach saturation?



A. 7 μA

B. 40 μA

C. 10 μA

D. 100 μA

Answer:

Watch Video Solution

3. An NPN transistor is used in common emitter configuration as an amplifier with $1k\Omega$ load resistance. Signal voltage of 10 mV is applied across the base-emitter. This produces a 3 mA change in the collector current and $15\mu A$ change in the base current of the amplifier. The input resistance and voltage gain are:

A. 0.67 $k\omega$ 300

B. 0.67 $k\omega$ 20

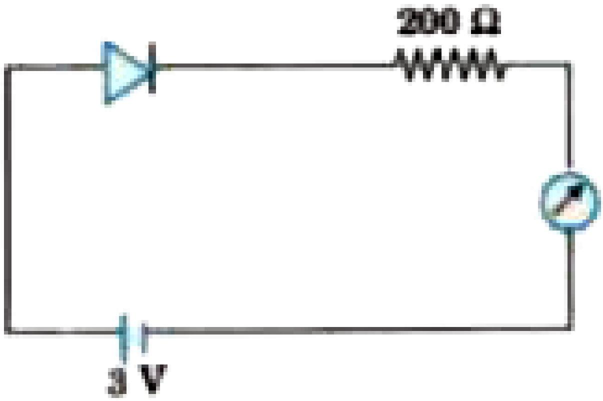
C. 0.33 $k\omega$ 1.5

D. 0.33 $k\omega$ 300

Answer:

Watch Video Solution

4. The reading of an ammeter for a silicon diode in the given circuit is



A. 11.5 mA

B. 13.5 mA

C. 0

D. 15 mA

Answer:

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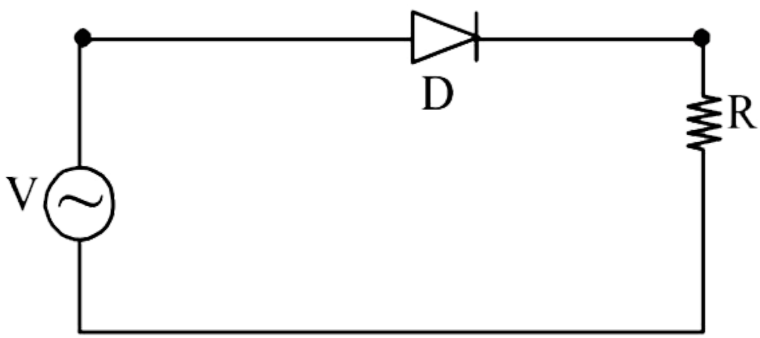
5. a p -n juction (D) shown in the figure can act an a rectifier An alternatting current source (V) is connected in the circuit

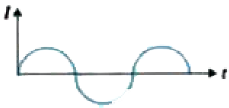


The corrent (I) in the resistor® can be shown

by :

A. 

B. 

C. 

D. 

Answer:

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6. The logic circuit show below has the input waveform A and B as shown pick out the correct output waveform

A.

B.

C.

D.

Answer:

View Text Solution

View Text Solution

7. The combination of gates shown below yields

A. NaND gate

B. OR gate

C. NOT gate

D. OR gate

Answer:

View Text Solution

8. The output of an OR gate is connected to both the inputs of a NAND gate. The combination will serve as a

A. NAND gate

B. NOR gate

C. AND gate

D. Or gate

Answer:

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9. In the givne circuit the current through zener diode is

A. 3.3 mA

B. 2.5 mA

C. 5.5 mA

D. 6.7 mA

Answer:

View Text Solution

10. The $I - V$ characteristic of an LED is.

A.

B.

C.

D.

Answer:

Watch Video Solution

11. The forward biased diode connection is

A.

B.

C.

D.

Answer:

Watch Video Solution

12. The currect voltage relation of diode is given by $1 = \left(e^{1000V/T} - 1\right) mA$, where the applied voltage V is in volt and the temperature T is in degree Kelvin. If a student makes an error measuring $\pm 0.01V$ while measuring the current of $5mA$ at $300K$, what will be error in the value of current in mA?

A. 0.5 mA

B. 0.05 mA

C. 0.2 mA

D. 0.02 mA

Answer:

Watch Video Solution

13. 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. 1.73 V/m

B. 2.45 V/m

C. 5.48 V/m

D. 7.75 V/m

Answer:

Watch Video Solution

14. For LEDs to emit light in visible region of electromagnetic light it should have energy band gap in the range of

A. 0.7 eV to 0.4 eV

B. 0.5 eV to 0.8 eV

C. 0.9 eV to 1.6 eV

D. 1.7 eV and 3.0 eV

Answer:

Watch Video Solution

15. The value of the resistor R_s needed in the DC voltage regulator circuit shown here equals

A. $(V_i - V_L)/nI_L$

B. $(V_i + V_L)/nI_L$

C. $(V_i - V_L)/(n+1)I_L$

D. $(V_i + V_L)/(n+1)I_L$

Answer:

View Text Solution

16. A 2 V battery is connecte across AB the value of the current supplied by the battery when in one case battery positive terminal is connected to A and in other case when positive terminal of battery is connected to B will respectively be

A. 0.2 A and 0.1 A

B. 0.4 A and 0.2 A

C. 0.1 A and 0.2 A

D. 0.2 A and 0.4 A

Answer:

View Text Solution

17. A zener diode is connecte to battery and a load The currents I ,I_z and I_L are respectively

A. 15 mA ,5 mA ,10 mA

B. 15 mA ,7.5 mA ,7.5 mA

C. 12.5 mA ,5 mA ,7.5 mA

D. 12.5 mA ,7.5 mA ,5 mA

Answer:

View Text Solution

18. In an unbiased p-n junction electrons diffuse from n region to p region because

A. holes in p region attract them

B. electrons travel across the junction due to potential difference

C. electron concentration in n region is more as compared to that in p region

D. only electrons move forn pregion and not the vice versa

Answer:

Watch Video Solution

19. if $a, b, c, d$are inputs to a gate and x is its output , then as per the following time graph , the gate is :

d 

d

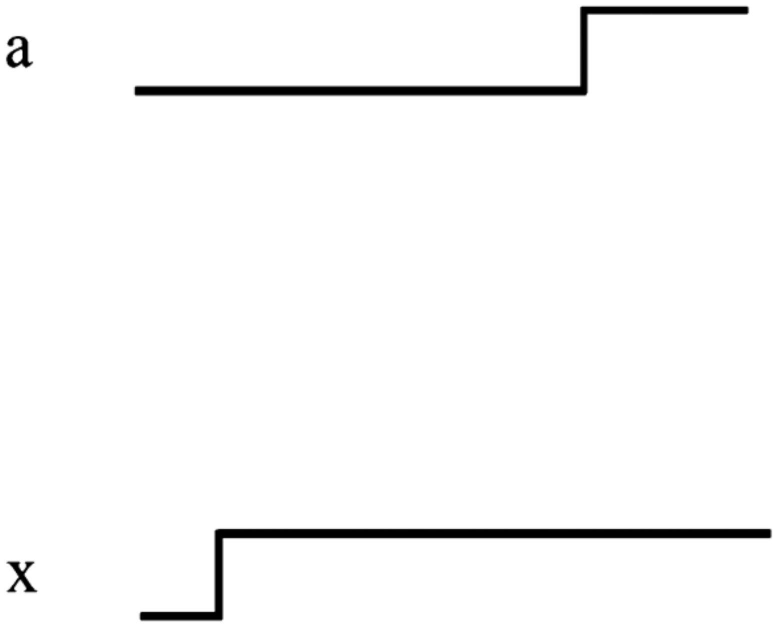
c

c

b

b

a



x

A. NOT

B. AND

C. OR

D. NAND

Answer:

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20. Identify the semiconductor devices whose characteristics are in the order (A),(b) (c),(d)

A. simple diode zener diode solar cell light dependent resistance

B. zener diode simple diode light dependent resistance solar cell

C. solar cell light dependent resistance zener diode simple diode

D. zener diode solar cell simple diode light dependent resistance

Answer:

View Text Solution

21. For a common emiter configuration if a and β have their usualy meaning , the incorrrect relationship between a and β is :

A. $\frac{1}{\alpha} = \frac{1}{\beta} + 1$

B. $\alpha = \frac{1-\beta}{\alpha}$

C. $\alpha = \frac{\beta}{1+\beta}$

D. $\alpha = \frac{\beta^2}{1+\beta^2}$

Answer:

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22. An experiment is preformed to determine the $I - V$ characteristics of a Zener diode, which has a protective resistance of $R = 100\Omega$, and maximum power of dissipation rating of 1 W. The minimum voltage range of the DC source in the circuit is :-

A. 0-5 v

B. 0-8 v

C. 0-12 v

D. 0-24 v

Answer:

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23. An unknown transistor needs to be identified as npn and pnp type. A multimeter, wilth $+ve$ and $-ve$ terminals is used to measure resistance between different terminals transistor. If terminal 2 is the base of the transistor then which of the following is correct for a pnp transistor?

A. positive terminal 1 negative terminal 2 resistance high

B. positive terminal 2 negative terminal 1 resistance high

C. positive terninal 3 negative terminal 2 resistace high

D. positive terminal 2 negative termianl 3 resistance low

Answer:

Watch Video Solution

24. To get an output of 1 from the circuit shown 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=0,b=0,c=1

Answer:

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25. A realistic graph depiciting the variation of thhe reciprocal of input resistance in an input charcteristics measurement in a com- mon emitter transistor configuration is :

A.

B.

C.

D.

Answer:

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26. The ratio (R) of output resistance r_0 and the input resistance r, in measurements of input and output charactersitics of a transistor is typically in the range :

A. $R\text{~}10^2 - 10^3$

B. $R\sim-1-10$

C. $R\sim 0.1-0.01$

D. $R\sim 0.1-1.0$

Answer:

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27. Identify the gate and match A,B,Y in bracket to check

A. AND (A=1,B=1,Y=1)

B. Or (A=1,B=1,Y=0)

C. NOT (A=1,B=1,Y=1)

D. XOR (A=0,B=0,Y=0)

Answer:

View Text Solution

28. An n-p-n transistor has three leads A,B and C connecting B and C by moist fingers A to the positive lead of an ammeter and c to the negative lead of the ammeter one finds large deflection then a,b and c refer respectively to

A. emitter base and collector

B. base emitter and collector

C. base collector and emitter

D. collector emitter and base

Answer:

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29. The V-I characteristic of a diode is the ratio of forward to revese bias resistance is

A. 10

B. 10^{-6}

C. 10^{6}

D. 100

Answer:

View Text Solution

30. The current gain for common emitter amplifier is 69. If the emitter current is $7.0mA$, find (i) base current and (ii) collector current.

A. 9.6 mA

B. 6.9 mA

C. 0.69 mA

D. 69 mA

Answer:

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31. In a common emitter amplifier circuit using an n-p-n transistor, the phase difference between the input and the output voltages will be:-

A. 45°

B. 90°

C. 135°

D. 180°

Answer:

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Competion File Multiple Choice Questions

1. For an n-p-n transistor percentage of electrons emitted reaching the collector is 80% if th e collect current is 1 mA

A. the emitter current is 1.5 mA

B. the base current is 0.5 mA

C. the emitter curretn is 1.25 mA

D. the base current is 0.25 mA

Answer:

View Text Solution

2. To make p type semiconductor pure silicon should be doped with the impurity atoms of

A. antimony

B. boron

C. aluminum

D. inldium

Answer:

Watch Video Solution

3. In a p-n junction diode without any battery

A. there is no net charge transfer from one region to the other

B. there is no systematic flow of charge carriers

C. an electric field exists at the jucntion directed from n region to p region

D. a constant electric exists near the junction

Answer:

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4. Which of the statement is not true for a p-n junction

A. the diffusion current in a p-n junction is from p region to n region

B. the diffusion current in a p-n juction is from n region to p region

C. the drift current in a p-n juction is from n region to p region

D. the drift curretn in ap-n jucntion is from p region to n region

Answer:

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5. A potential difference is applied across (i) an issulator at 0 k (ii) a semiconductor at 0 k (iii) a metal at 0 k (iv) a reverse biased p-n junction diode at 300 k then the current passing through

A. is zero

B. is zero

C. is inlfinite

D. is finite

Answer:

Watch Video Solution

6. Conduction through holes is not possible in

A. metals

B. intrinsic semiconductors

C. ionic solids

D. p type semiconductors

Answer:

Watch Video Solution

7. In a common emitter amplifier circuit shown bleow if the resistance R increase then the reading of

A. ammeter decreases

B. ammeter increases

C. voltmeter increases

D. voltmeter decreases

Answer:

View Text Solution

8. Select the correct set of inputs and output for the given combination of logic shown below

A. A=1 ,B =0 ,Y=0

B. A=0 ,B =1 ,Y=1

C. A=0 ,B =0 ,Y=0

D. A=1 ,B =1,Y=1

Answer:

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9. A common emitter transistor has a current amplification factor of 100 and is used as an amplifier the audio signal voltage across the collector resistance of 5 k ω is 5 V the base resistance is 2 k ω then

A. the input signal voltage is 0.01 v

B. the base curent is 10 μA

C. the input signal voltage is 0.02 v

D. the base current is 5 μA

Answer:

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10. A common base transistor amplifer circuit has 200Ω and $100k\Omega$ input and ouput resistance resepectively if the current gain is 0.85 and $I_c = 1.5$ mA then

A. the voltage gain and power gain are 475 and 451 respectively

B. the base current is 0.1 mA

C. the voltage gain and power gain are 480 and 475 respectively

D. the emitter current is 160 times the base current

Answer:

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11. Two ideal didoes are connected in a circuit as

For the circuit

A. $i_i = 0$

B. $i_2 = 5 mA$

C. $i_1 = 0.3 mA$

D. $i_2 = 0.4 mA$

Answer:

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12.

for the combination of gates above the output y is low where

A. A=0,B=0

B. A=1,B=0

C. A=0,B=1

D. A=1,B=1

Answer:

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13. Passage I

An n-p-n transistor is used as a voltage amplifier in a commoin emitter circuit given

$V_{\mathbb{C}} = 8V I_C = 4mA$

$V_{CE} = 4V,$

$(V_{BE} = 0.6V, V_{BB} = 8V$

$\beta_{Dc} = 200$

The value of load resistqacne is

A. 10 k ω

B. 1 k ω

C. 5 k ω

D. 2.5 k ω

Answer:

Watch Video Solution

14. Passage I

An n-p-n transistor is used as a voltage amplifier in a commoin emitter circuit given

$V_{\mathbb{C}} = 8V I_C = 4mA$

$V_{CE} = 4V,$

$(V_{BE} = 0.6V, V_{BB} = 8V$

$\beta_{Dc} = 200$

The value of base resistance is

A. 185 k ω

B. 275 k ω

C. 370 k ω

D. 410 k ω

Answer:

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15. Passage II

Diode current in a p-n junction diode is given by $I - I_0\left[\frac{\exp(eV)}{2kT} - 1\right]$ where I_0 is the reverse saturation current V is the voltage across the diode k is the boltzmann constant and T is the abosolute temperatuer For a given diode $I_0 = 5$ pA and T =300 k

The forward current at a foward voltage V=0.6 V is

A. 0.05475 A

B. 0.06319 A

C. 0.04482 A

D. 0.03798 A

Answer:

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16. In a $p-n$ junction diode, the currect I can expressed as $I = I_0 \exp\left(\frac{eV}{2k_BT} - 1\right)$ where I_0 is called the reverse saturation current, V is the voltage across the diode and is positive for forward bias and negative for reverse bias, and I is the current through the diode, K_B is the Boltzmann constant $(8.6 \times 10^{-5} eV / K)$ and T is the absolute temperature. If for a given diode $I_o = 5 \times 10^{-12} A$ and $T = 300K$, then

(a) What will be the forward current at a formward voltage of $0.6V$?

(b) What will be the increase in the current if the voltage across the diode is increased to $0.7V$?

(c) What is the dynamic resistance ?

(d) What will be current if reverse bias voltage changes from $1V$ to $2V$?

A. 2.48 A

B. 2.97 A

C. 3.03 A

D. 3.17 A

Answer:

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17. Passage II

Diode current in a p-n junction diode is given by $I - I_0\left[\frac{\exp(eV)}{2kT} - 1\right]$ where I_0 is the reverse saturation current V is the voltage across the diode k is the boltzmann constant and T is the abosolute temperatuer For a given diode $I_0 = 5$ pA and T =300 k

When the reverse bias voltage bias voltage changes from 1 v to 2 V the current will become equal to

A. $2I_0$

B. I_0

C. $-I_0$

D. $-2I_0$

Answer:

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Competion File Assertion Reason Type Questions

1. Assertion with the increase in temperature the conductivity of intrinsic semicionductors increases

Reason The increase in temperature result in increase in thermal energy which cause electrons to jump to the condluction energy band

A. If both asssertion and reason are correct and reason is a correct explanation of the assertion.
B. if both assertion and reason are corect but reason is not the correct explanation of assertion.

C. If assertion is correct but reason is incorrect.

D. If assertion is incorrect but reason is correct

Answer:

Watch Video Solution

2. Assertion for the cicruit show below Y=0 when A=B=1

Reason the given combnation of gates behaves as a NAND gate

A. If both asssertion and reason are correct and reason is a correct explanation of the assertion.

B. if both assertion and reason are corect but reason is not the correct explanation of assertion.

C. If assertion is correct but reason is incorrect.

D. If assertion is incorrect but reason is correct

Answer:

View Text Solution

3. Assertion when base is thick and hightly doped the collector current is high

Reason When base is thick and highly doped the rate of electron hole recokbination is more in the base region which results in larger value of base current

A. If both asssertion and reason are correct and reason is a correct explanation of the assertion.

B. if both assertion and reason are corect but reason is not the correct explanation of assertion.

C. If assertion is correct but reason is incorrect.

D. If assertion is incorrect but reason is correct

Answer:

Watch Video Solution

4. Assertion : ohm's law is not obeyed by semiconductors

Reason the rate of flow of charge in semiconductors depends both on applied voltage and rate of availability of charge carries

A. If both asssertion and reason are correct and reason is a correct explanation of the assertion.

B. if both assertion and reason are corect but reason is not the correct explanation of assertion.

C. If assertion is correct but reason is incorrect.

D. If assertion is incorrect but reason is correct

Answer:

Watch Video Solution

5. Assertion : when a pure semiconductor is doped with a trivalen impurity the number of hols becomes more than the number of electrons

Reason Electrons get recombined with the holes as their concentration increases on addition of trivalent impurity so number of holes become more

A. If both asssertion and reason are correct and reason is a correct explanation of the assertion.

B. if both assertion and reason are corect but reason is not the correct explanation of assertion.

C. If assertion is correct but reason is incorrect.

D. If assertion is incorrect but reason is correct

Answer:

Watch Video Solution

6. Assertion Forward bias reduces the barrier potential

Reason : potential barrier always opposes the applied potential

A. If both asssertion and reason are correct and reason is a correct explanation of the assertion.

B. if both assertion and reason are corect but reason is not the correct explanation of assertion.

C. If assertion is correct but reason is incorrect.

D. If assertion is incorrect but reason is correct

Answer:

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7. Assertion : Silicon is preferred over germanimum in preparing diodes

Reason the number of free conduction electrons is significant in Si and small in go at room temperature

A. If both asssertion and reason are correct and reason is a correct explanation of the assertion.

B. if both assertion and reason are corect but reason is not the correct explanation of assertion.

C. If assertion is correct but reason is incorrect.

D. If assertion is incorrect but reason is correct

Answer:

Watch Video Solution

8. Assertion concentration of free electrons in an n type semiciondluctor is approximately equal to the density of donor atoms

Reason when a p-n junction is forward biased the injected hole curent in the n region is proportional to the total charge of inljected minority carrier holes

A. If both asssertion and reason are correct and reason is a correct explanation of the assertion.

B. if both assertion and reason are corect but reason is not the correct explanation of assertion.

C. If assertion is correct but reason is incorrect.

D. If assertion is incorrect but reason is correct

Answer:

Watch Video Solution

9. Assertion In a common emitter amplifier circuit load resistance of the output circuti is 800 times the load resistance of the input if α =0.95 voltgae gain of the amplifier is 15.2×10^{3}

Reason $\alpha = \dfrac{\beta}{1-\beta}$ where symbols have their usual meaning

A. If both asssertion and reason are correct and reason is a correct explanation of the assertion.

B. if both assertion and reason are corect but reason is not the correct explanation of assertion.

C. If assertion is correct but reason is incorrect.

D. If assertion is incorrect but reason is correct

Answer:

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Competion File Matching Type Questions

1. Each question has a matching list the codes for the lists have choices (a) ,(b) ,(c) and (d) out of which only one is correct

A. $\begin{matrix} P & Q & R & S \\ 1 & 2 & 3 & 4 \end{matrix}$

B. $\begin{array}{cccc} P & Q & R & S \\ 2 & 3 & 1 & 4 \end{array}$

C. $\begin{array}{cccc} P & Q & R & S \\ 2 & 3 & 4 & 1 \end{array}$

D. $\begin{array}{cccc} P & Q & R & S \\ 2 & 1 & 4 & 3 \end{array}$

Answer:

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2. Each question has a matching list the codes for the lists have choices (a) ,(b) ,(c) and (d) out of which only one is correct

A. $\begin{matrix} P & Q & R & S \\ 4 & 3 & 1 & 2 \end{matrix}$

B. $\begin{matrix} P & Q & R & S \\ 4 & 3 & 2 & 1 \end{matrix}$

C. $\begin{matrix} P & Q & R & S \\ 2 & 4 & 1 & 3 \end{matrix}$

D. $\begin{matrix} P & Q & R & S \\ 1 & 3 & 4 & 2 \end{matrix}$

Answer:

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Competion File Matrix Match Type Questions

1. Each question contains statements given in two columns which are to be matched statements in column I are labelled as A,B,C and D whereas statements in column II are labelled as p,q,r and s match the entres of columnn I with appropriate entries of column II each entry in column I may have one or more than one corect option from column II the answers to these questions have to be appropriately bubbled as illustrated in the given example if the correct matches are

$A \rightarrow (q, r), B \rightarrow (p, s)$

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2. Each question contains statements given in two columns which are to be matched statements in column I are labelled as A,B,C and D whereas statements in column II are labelled as p,q,r and s match the entres of columnn I with appropriate entries of column II each entry in column I may have one or more than one corect option from column II the answers to these questions have to be appropriately bubbled as illustrated in the given example if the correct matches are $A \rightarrow (q, r), B \rightarrow (p, s)$

$C \rightarrow (r, s)$ and $D \rightarrow (q)$ then correctly bubbled matrix will look like the following :

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Competion File Integer Type Questions

1. A photon of sodium light has energy equal to the band gap of a semicondluctro at room temperature T= 300 k a minimum energy E is required to generate an electron hole pair find the value of E//kT-80 close to nearest integer tke k = $8.62 \times 10^{-15} eVK^{-1}$

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2. At T=300 k the concentration of hole electron pairs in pure silicon is 6×10^{15} per cubic metre it is then doped with a pentavelent impurity contribnuting only 1 atom in 10^{7} atoms of pure silicon olly half of the impurity atoms contribute electrons in the condluction band the number of charge carier increases by a factor of $9x \times 10^{4}$ due to doping find the value of x take number of silicons atoms cubic meter $= 4.32 \times 10^{28}$

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3. An electron with a speed of 3×10^5 m/s appraches a p-n juction having a potential barrier of 0.20 V from the n side if it enters the p side with speed v then calculate the value of $\frac{5v}{10^5}$ close to the nearest integer

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4. On changing the emitter current by 8.1 mA a change of 7.92 mA is observed in the colector current find the value of 100 $\alpha - 2\beta$

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5. The reverse saturation cureent for a p-n junction diode at 27° C is 70 μA the forward voltage across the diode is decreased form 0.2 v to 0.15 v if the decrease in diode current is expressed as

take boltzmann constant $=8.6 \times 10^{-5}$ eV/K

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6. In an n-p-n transistor 10^{12} electrons cross the emitter in 10 ms when 2% of the elctrons are lost in the base the current amplification factor of the transistor is β if $\beta = (5 + x)^{y}$ calculate y^{x}

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7. When forawsd biased constant voltage drop of 0.7 v and 0.3 v appeears across the Si and Ge diodes respectively calculate the difference in input in the given circuit diagram using the properties of a diode

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8. The output DC voltage equal to 40 V of a half wave rectifier is supplied to a load resistance of 400 ω the value of maximum input AC voltage in half wave rectifier has a resistance of 100 ω is V_0 if $V_0 - 1 = 2^x 3^y 13^z$ find (y+z-x)

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9. In the circuit given below input voltage at the base resistance is 10 V also V_{BE} and V_{CE} are zero for the circuit if

$$\frac{1000I_B - I_c \times \beta}{\frac{15V_0}{R_B}} = 4^x \times 10^y$$

calculate the value of xy

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10. The ratio of intrinsic carrier concentration of ge to that si at room temperature is n if 100 n +1

Take band gap of Ge =0.72 eV and band gap of Si = 1.12 eV

Boltzmann constant =$1.38 \times 10^{-23} JK^{-1}$

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Competion File Ncert Exemplar Problems Multiple Choice Question Type I

1. The conductivity of a semiconductor increases with increase in temperature because

A. number density of free current carriers increases

B. relaxatoin time increses

C. both number density of carriers and relaxiation time increase

D. number density of current carriers increases relaxation time decreased but effect of decrease in relaxation time is much less than increase in number density

Answer:

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2. In the given is the potential barrier across a p-n jucntion when no battery is connecte across the junction

A. 1 and 3 both correspond to forward bias of junction

B. 3 corresponds to forward bias of junction and 1 corresponds to reverse bias of junction

C. 1 corresponds to forward bias and 3 corresponds to reverse bias of junction

D. 3 and 1 both correspond to reverse bias of junction

Answer:

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3. In the given figure assuming the diodes to be ideal

A. D_1 is forward biased and D_2 is reverse biased and hence current flows form A to B

B. D_2 forward biased and D_1 is revese biased and hence no current flows form

B to A and vice versa

C. D_1 and D_2 are both forward biased and hence current flows form A to B

D. D_1 and D_2 are both reverse biased and hence no current flows from A to B and vice versa

Answer:

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4. A 220 V AC supply is connected between points A and B what will be the potential difference V across the capacitor ?

A. 220 v

B. 110 v

C. 0 v

D. $220\sqrt{2}$V

Answer:

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5. Hole is

A. an anti pariticle of electron

B. a vacancy created when an electron leaves a covalent bond

C. absence of free electrons

D. an artificially created particle

Answer:

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6. The output of the given circuit in the given figure

A. would be zero at all times

B. would be like a half wave rectifier with positive cycles in output

C. would be like a half wave rectifier with negative cycles in output

D. would be like that of a full wave recitifer

Answer:

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7. In the circuit shown in the given figure if the diode forward voltage drop is 0.3 V the voltage difference between

A. 1.3 v

B. 2.3 v

C. 0

D. 0.5 v

Answer:

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8. Truth table for the given circuit is

A.

B.

C.

D.

Answer:

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Competion File Ncert Exemplar Problems Multiple Choice Question Type Ii

1. When an electric field is applied across a semiconductor,

A. electrons move from lower energy level to higher energy level in the conduction band

B. electrons move from higher enrgy level to lower energy level in the conduction band

C. holes in the valnece band move from higher energy level to lower energy level

D. holes in the valence band move from lower energy level to higher energy level

Answer:

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2. Consider an n-p-n transistor with its base - emitter junction forward biased and collector base junction reverse biased . Which of the following statements are true?

A. electrons crossover form emitter to collector

B. holes move from base to collector

C. eelctrons move from emitter to base

D. electrons form emitter move out of base without going to the colelctoer

Answer:

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3. The below given figure shows the transfer characteristics of a biased CE transistor which of the following statement are true

A. at $V_i = 0.4$ transistor is in active state

B. at $V_i = 1$ V it can be used as an amplifer

C. at $V_i = 0.5$ V it can be used as a switch turned off

D. at $V_i = 2.5V$ it can be used as a swithc turned on

Answer:

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4. In a $n-p-n$ transistor circuit, the collector current is $10mA$. If 95 per cent of the electrons emitted reach the collector, which of the following statements are true ?

A. the emitter current will be 8 mA

B. the emitter current will be 10.53 mA

C. the base current will be 0.53 mA

D. the base current will be 2 mA

Answer:

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5. In the depletion region of a diode.

A. there are no mobile charges

B. equal number of holes and electrons exist making the region neutal

C. recombination of holes and electrons has taken place

D. immobile charged ions exist

Answer:

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6. What happens during regualtion action of a Zener diode?

A. the current in and voltage across the zener remains fixed

B. the current through the series resistance R_s changes

C. the zener resistance is constant

D. the resistance offered by the zener changes

Answer:

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7. To reduce the ripples in rectifier circuit with capacitor filter

A. R_L should be increased

B. input frequency should be decresed

C. input frequency should be increased

D. capacitors with high capiacitance should be used

Answer:

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8. The breakdown in a reverse biased p-n junction diode is more likely to occur due to

A. large velocity of the minority charge carriers if the doping concetration is small

B. large velocity of the miniority charge carriers if the doping concentration is large

C. strong electric field in a depletion region if the doping concentration is small

D. strong electric field in the depletion region if the doping concentraton is large

Answer:

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Chapter Practice Test For Board Examination

1. What is the behaviour of semiconductors at room temperature

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2. What is the phase relationship in the output and input voltage in the common base transistor amplifier.

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3. Why a common emitter amplifier is preferred to a common base amplifier

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4. Under what condition a transistor works as an open switch?

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

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6. Name the semiconductor device that can be used to regulate an irregulation dc power supply. With the help of I-V characteristics of this device, explain its working.

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7. What is light emitting diode (LED) ? Mention two important advantages of LEDs over conventional lamps.

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8. Name the gates P and Q shown in the figure of logic circuit given below write the truth table for the combination of the gates and identify the equivalent gate

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9. What will happen if emitter as well as collector in a transistor are forward biased?

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10. What is rectifier explain the working of junction diode as a full wave rectifier diagram

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11. Explain that a transistor can be used as a switch.

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12. Using truth tables of AND gate and NOT gate show that NAND gate is an AND gate followed by a Not gate hence write the truth table of NAND gate

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