PHYSICS

BOOKS - AAKASH SERIES

SEMICONDUCTOR DEVICES

Example

1. Pure Si at 300 K has equal electron (n_e) and hole (n_h) concentrations of $1.5 \times 10^{18} m^{-3}$.

Doping by indium increases n_h to $4.5 \times 10^{22} m^{-3}$. Calculate n_e in the dipoed Si.

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2. Find the number density of impurity atoms that must be added to a pure silicon crystal inorder to convert it to have resistivity

(i) 10^{-1} Ωm n-type silicon

(ii) 10^{-1}Ωm p-type silicon.

Give for silicon: μ_e=0.135$m^2 V^{-1} s^{-1}$

and μ_h=0.048$m^2 V^{-1} s^{-1}$.

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3. A battery of e.m.f.2 volt is applied across the block of a semiconductor of length 0.1 m and area of cross section $1 \times 10^{-4} m^2$. If the block is of intrinsic silicon at 300 K, find the magnitude of the total current. What will be the order of magnitude of total current if germanium is used instead of silicon? Given that for Si at 300K

$\mu_e = 0.135 m^2 v V^{-1} s^{-1}, \mu_h = 0.048 m^2 V^{-1} s^{-1}$

intrinsic carrier concentration

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

For Ge at 300 K $\mu_e = 0.39 m^2 V^{-1} s^{-1}$

$\mu_h = 0.19 m^2 V^{-1} s^{-1}, n_1 = 2.4 \times 10^{19} m^{-3}$

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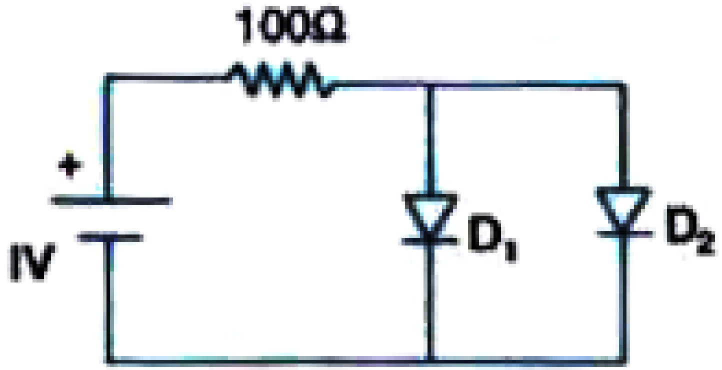
4. Considering the circuit and data given in the diagram calculate the currents flowing in the diodes D_1 and D_2 with linear characteristics.Forward resistance of D_1 and

D_2 is 20 Ω



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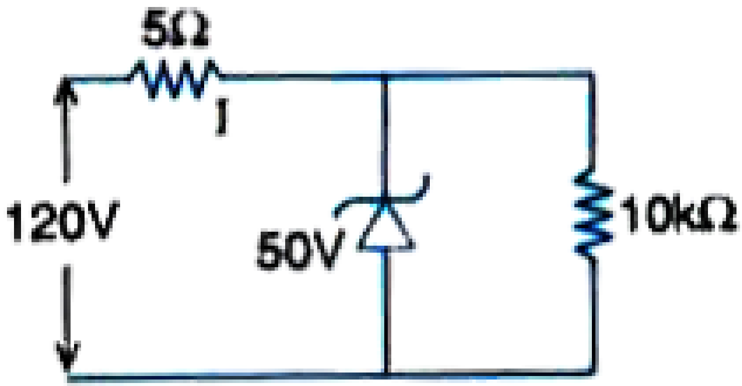
5. Calculate the voltage drop across 5k Ω resistance and current passing through the zener diode for the circuit given below:



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6. Current amplification factor of a common base configuration is 0.88. Find the value of base current when the emitter current is 1 mA.

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7. For a transistor β=40 and $I_B = 25\mu A$ .Find the value of I_E

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8. The constant α of a transistor is 0.9 .What would be the change in the collector current corresponding to a change of 4 mA in the base current in a common emitter arrangement?

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9. A voltage amplifier operated from a 12 volt battery has a collector load 6 kΩ .Calculate the maximum collector current in the circuit.

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10. In a single state transistor amplifier,When the signal changes by 0.02 V,the base current change by 10 μA and collector current by 1mA.If collector load $R_C = 2k\Omega$ and

$R_L = 10k\Omega$,Calculate ,(i)Current Gain (ii)Input impedance ,(iii)Effective a.c load (iv)Voltage gain and (v)Power gain.

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11. In a negative feedback amplifier ,the gain without feedback is 100,feed back ratio is 1/25 and input voltage is 50 m V.Calculate.

i)gain with feedback

ii)feedback factor

iii)output voltage

iv)feedback voltage

v)new input voltage so that output voltage with feedbck the output voltage without feedback

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Exercise Long Answer Questions

1. What are n-type and p-type semiconductor?

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2. What is a junction diode ? Explain the formation of depletion region at the junction. Explain the variation of depletion region in forward and reverse-biased condition.

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3. Zener diode is used-

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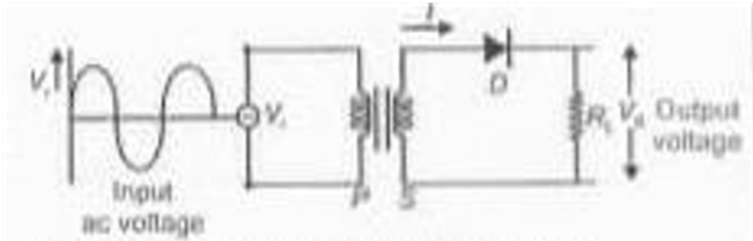
4. In a half wave rectifier, the current flows



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5. In a transistor

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6. What is amplification ? Explain the working of a common emitter amplifier with necessary diagrams.

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Exercise Short Answer Questions

1. Distinguish between a conductor , a semiconductor and an insulator on the basis of energy band diagrams.

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2. What is menat by intrinsic semi-conductors?

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3. How are n-type and p-type semiconductors formed ? Give one example in each case.

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4. The condictivity of a semiconductor increaes with incrase in temperature ,because

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5. Write the dependence of mobility on doping concentration and temperature?

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6. Define Fermi energy level. Represent Fermi level on band diagram for pure semiconductor, N-type and P-type semiconductor

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7. Why is silicon preferred over germanium in the manufacture of semiconductor devices?

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8. What is the effect of temperature on extrinsic semi conductor?

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9. Discuss the behaviour of p-n junction. How does a potential barrier develop at the junction ?

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10. Draw and explain the current -voltage (I-V) characteristic curves of a junction diode in forward and reverse bias.

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11. If the doping concentration in a P-N junction diode is increased, will its zener breakdown voltage increase or decrease.

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12. What is a avalanche breakdown ? How does it vary with temperature ?

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13. Zener breakdown takes place if

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14. Describe how a semiconductor diode is used as a half wave rectifier and write the expression for its efficiency.

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15. Describe the full wave rectifier and write the expression for its efficiency. How is a semiconductor diode used as a full wave rectifier ?

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16. How does the reverse saturation current in a P-N diode vary with temperature.

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17. Explain the reason for getting a constant reverse saturation current with increasing negative bias in a P-N junction diode.

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18. What is a photodiode? Explain its working with a circuit diagram and draw its 1-V characteristics.

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19. Draw a circuit diagram of L.E.D. What are its advantages?

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20. Why is the collector of a transistor made wider than emitter and base ?

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21. The transistor parameters, namely α and β of a transistor are related as

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22. What is an amplifier? None different types of amplifiers.

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23. Draw a circuit diagram of C.E. transistor amplifier. Briefly explain its working and write the expression for (i) current gain (ii) voltage gain of the amplifier.

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24. Explain what is meant by feedback. Write relation between the gain with feedback and the gain without feedback of an amplifier.

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25. Explain, with the help of a circuit diagram, the working of a photo diaode. Write briefly how it is used to detect the optical signals.

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26. What are LED ? Give their uses and merits.

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27. Write about solar cells.

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Exercise Very Short Answer Questions

1. What is the effect of temperature on the resistance of

(i) metal and (ii) semi-conductors?

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2. What are intrinsic and extrinsic proteins? Explain their functions.

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3. The majority charge carriers in P-type semiconductore are

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4. With reference to semi-conductors answer the following

Name the majority charge carriers in n-type semi-conductor

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5. Why does the fermi energy level in an n-type semi conductor shift towards the conduction band?

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6. Why does the Fermi energy level in p-type semiconductor shift towards the valence band?

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

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8. Of the two types charge carries-holes and electrons which has greater mobility?

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9. Lets $n_p$and n_e be the number of holes and conduction electrons in an intrinsic semiconductor.

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10. What is the ratio of number density of free electron and hole in a p-type Semi Conductor?

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11. What is the ratio of n_p to n_e , in an n-type semi conductor?

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12. How does electrical conductivity of semiconductors vary with temperature?

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13. What is p-n junction diode ? Define depletion layer.

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14. What are 1) forward bias and 2) reverse - bias?

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15. What happens to the width of depletionlayer ofa p-n-junction when it is (i) forward biased, (ii) reverse biased?

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16. To forward-bias a diode, its p-type is to be connected to the positive terminal of a cell and n-type to the negative terminal of the cell. Is it necessary?

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17. To reverse -bias a diode, its p-type is to be connected to the negative terminal of a cell and n-type to the positive terminal cell. Is it necessary?

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18. Which type of biasing gives a semi-conductor diode very high resistance?

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

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20. Which type of break down results due to strong electric fields at the junction?

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21. Is it correct to say that a diode behaves like a closed switch in the forward biased condition and behaves like an open switch in the reverse-biased condition?

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22. What is the use of a Zener diode?

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23. In which bias zener diode characteristic is same as that of function diode?

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24. Distinguish half wave and full wave rectifiers

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25. 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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26. Can a zener diode be used in place junction diode in rectifier circuit?

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27. What is a transistor ?

i)What is a transistor ?

ii) In an n-p-n transistor, how does the p-region act?

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28. Draw the circuit symbols for p-np and n-p-n transistors.

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29. Define amplifier and amplification factor.

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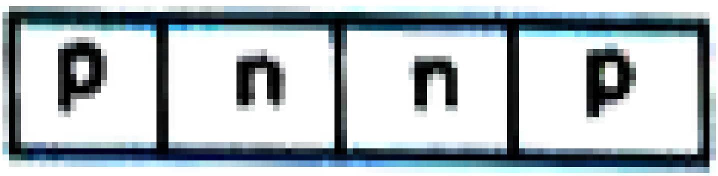
30. Can two diodes combined back to back as shown in figure from a transistor?



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31. In common base configuration, current gain (α) is defined as the ratio of collector current to emitter current i.e., $\alpha = I_C / I_E$, then what will be excepted the value of α?

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32. What will be the relation between α and β ?

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33. Define voltage gain and power gain.

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34. Write the uses of photo diode.

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35. Write the uses of light emitting diode.

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36. Define a solar panel.

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Problems Level I

1. The electrical conductivity of a semiconductor increases when electromagnetic radiation of wavelength shorter than 2480 nm is incident on it. Find the band gap of the semiconductor.

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2. In a pure semiconductor, the number of conduction electron is 6×10^{19} per cubic meter. How many holes are there in a sample of size 1 cm x 2 cm x 2mm ?

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3. Find the static resistance of a P-N junction germanium diode if temperature is $27^{\circ} C$ and

I_s = 1 μ A for an applied forward bias of 0.2 volt.

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4. In a p-n junction diode the thickness of depletion layer is 2×10^{-6}m and barrier potential is 0.3 V. The intensity of the electric field at the junction is :

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5. A potential barrier of 0.3V exists across a P-N junction (a) If the depletion region is 1 μm wide, what is the intensity of electric field in this region ?

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6. A junction diode is connected to an external resistance of 100Ω and a source of e.m.f. 3.0V. If potential barrier developed in the junction diode is 0.7, obtain the current in the circuit.

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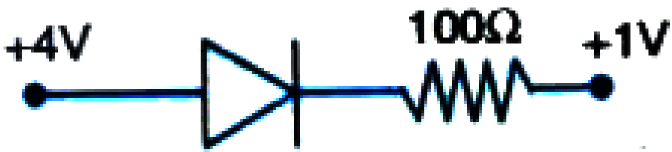
7. The junction diode shown in figure is ideal. Find the current in the circuit



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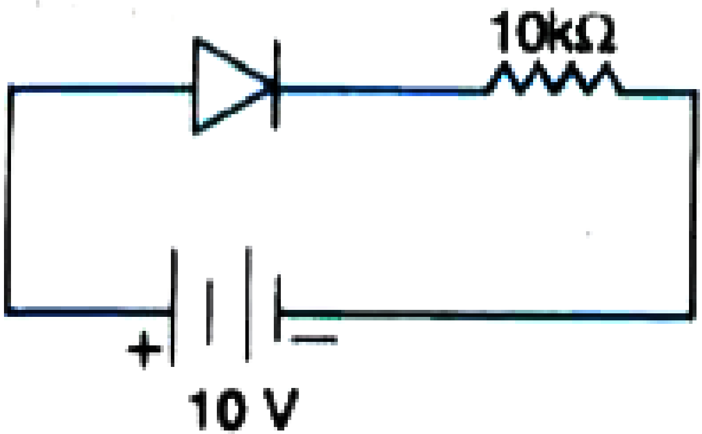
8. Determine the current through a silicon diode of (barrier potential = 0.7V Fig Assume

that the diode resistance is negligible.



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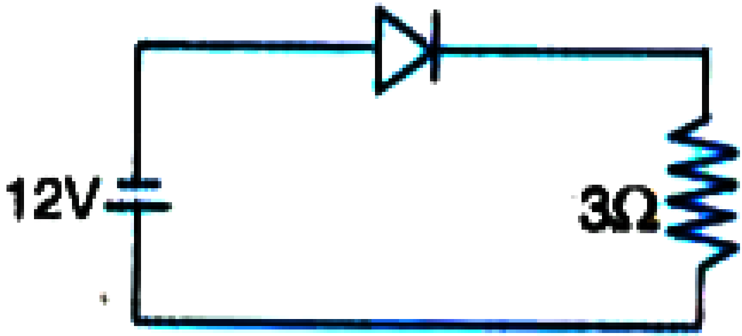
9. Find the current in the circuit shown below



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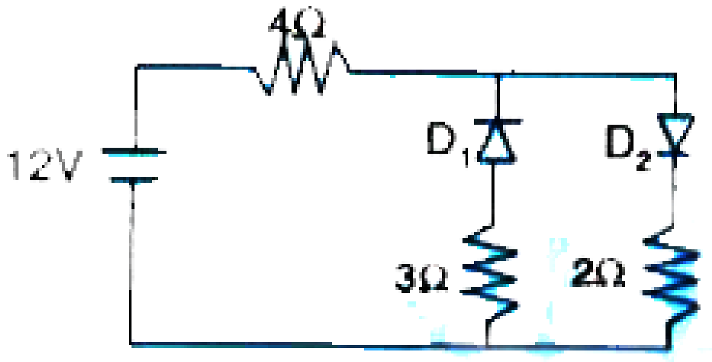
10. Calculate the current flowing in the circuit below which has two opposite connected ideal diodes in parallel.



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11. The circuit shown in figure contains two diodes each with a forward resistance of 50Ω and infinite reverse resistance.If the battery voltage is 6 v ,then the current through the 100Ω resistance is

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12. A p-n junction diode can withstand current up to 10 mA under forward bias, the diode has a potential drop of 0.5 V across it which is assumed to be independent of current what is the maximum voltage of battery used to forwaed bias the diode when a resistance of 200Ω is connected in series with it.

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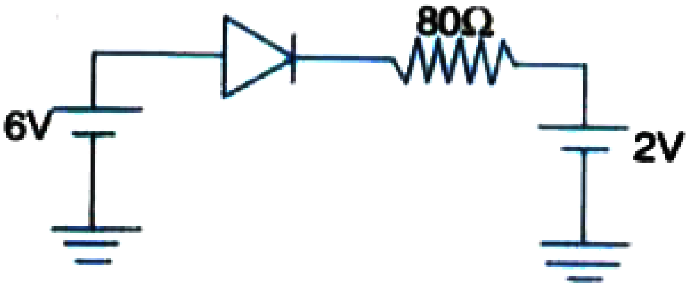
13. The resistance of the diode in the forward biased condition is 20Ω and infinity in the reverse biased condition. Find the current in the given circuit



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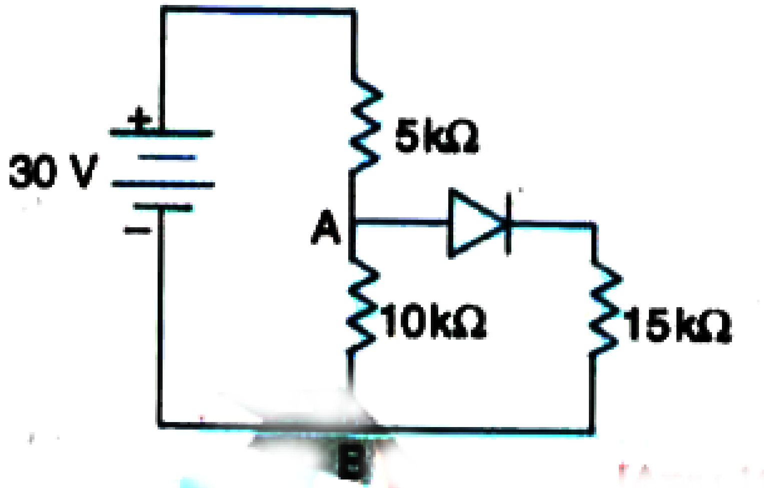
14. Find maximum voltage across AB in the circuit shown in figure. Assume that the diode is ideal.



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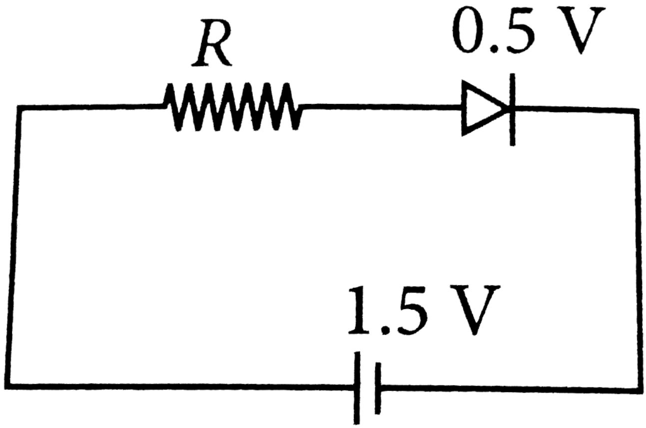
15. The diode used in the circuit shown in the figure has a constant voltage drop at 0.5 V at all currents and a maximum power rating of 100 mW. What should be the value of the resistor R, connected in series with diode, for obtaining maximum current ?



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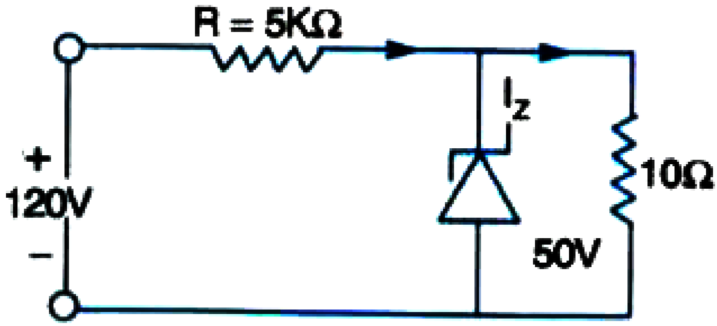
16. For the circuit shown in Fig. find

1) the output voltage

2) the voltage drop across series resistance,

3) the current through Zener diode.



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17. The applied input AC power to a half wave rectifier is 190W. The DC output power obtained is 40 W. Find the rectifier efficiency.

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18. A p-n diode is used in a half wave rectifier with a load resistance of 1000Ω. If the forward resistance (r_f) of diode is 10Ω, calculate the efficiency of this half wave rectifier.

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

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20. A full-wave rectifier is used to convert 50 Hz A.C into D.C, then the number of pulses per second present in the rectified voltage is

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21. In an N-P-N transistor operating in the active region, the collector current equals 7 mA and emitter current equals 7.2 mA. Calculate the value of current gain α

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22. In a common base configuration, with a base current of 0.005 mA, the emitter current is I mA. Calculate the value of collector current.

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23. For a transistor 'alpha' = 0.98 and emitter current I_E = 2.5 mA. Calculate collector current and base current

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24. In common base configuration of a transistor, a change of 200 mV in emitter voltage produces a change of 5 mA in emitter current. If base collector voltage V_{CB} remains constant, find the dynamic input resistance of transistor.

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25. In a transistor the emitter current is 1.01 times as large as the collector current .If the emitter current is `12.12 mA. Find the base current.

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26. In a transistor circuit the base current changes from 30 μA to $90\mu A$.If the current gain of the transistor is 30 ,find the change in the collector current.

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27. The constant a of a transistor is 0.9. What would be the change in collector current corresponding to change of 0.4 mA in the base current in a common emitter arrangement.

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28. For a transistor, the current gain of common-base configuration is 0.8. If the

transistor is in common emitter configuration and the base current changes by 5mA, find the change in collector current.

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29. The current gain of a transistor in common emitter circuit is 49. Calculate its common base current gain. Find the base current when emitter current is 3 mA.

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30. A change of 0.5 mA in the emitter current of a transistor produces a change of 0.49 mA in collector current Calculate

(1) Common base short circuit current gaina α.

(ii) common emitter short circuit current gain β.

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31. A change of 200mV in base-emitter voltage causes a change of 100µA in the base current. Find the input resistance of the transistor

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32. For a single transistor amplifier, the collector load is $R_L = 22k\Omega$ and input resistance $R = 1k\Omega$. If the current gain is 50, find the voltage gain of the amplifier

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33. $AP - N - P$ transistor is used in common-emitter mode in an amplifier circuit.

A change of $40\mu A$ in the base current brings a change of 2 mA in collector current and 0.04 V in base-emitter voltage. Find the , (1) input resistance (R_{input}) and

(2). the base current amplification factor (β).

If a load of $6k\Omega$ is used then also find the voltage gain of the amplifier

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34. The input resistance of a common-emitter amplifier is 600 Ω and load resistance is $6k\Omega$ A change of base current by $50\mu A$ results in the change of collector current by 5 mA. Find voltage gain.

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35. If voltage gain in CE configuration is 24. If $R_e = 10k$, R_(c)` = 10. B = 100 and input resistance R =2.5kohm, find the output voltage for an input voltage of 1 mV.

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Problems Level Ii

1. A n-type silicon sample of width $4 \times 10^{-3} m$, thickness $25 \times 10^{-5} m$ and length $6 \times 10^{-2} m$ carries a current of 4.8 mA when the voltage is applied across the length of the sample. If the free electron density is $10^{22} m^{-3}$, then find how much time does it take for the electrons to travel the full length of the sample? Given that charge on an electron $e = 1.6 \times 10^{-19} C$

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2. Determine the number of density of donor atoms which have to be added to an intrinsic germanium semiconductor to produce an N-type semi-conductor of conductivity 6.4 Ωcm^{-1}. Given that mobility of electron in N-type Ge is 4000 cm^2/Vs. Neglect the contribution of holes. to conductivity.

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3. The concentration of electrons in a semiconductor is $3 \times 10^{13}/cm^3$ and hole

concentration is $5 \times 10^{14} / cm^3$. The semiconductor is

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4. Calculate the conductivity of pure silicon at room temperature where the concentration of carriers is $1.6 \times 10^{16} / m^3$. Assume the mobility of electrons and holes to be 0.15 and 0.05 $m^2 V^{-1} s^{-1}$.

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5. Calculate the values of drift velocities of holes and electrons at 300 K if the electric field is 100 V/cm in germanium. Given, carrier mobility for electron - 3600 cm^2/volt-sec. Carrier mobility for holes 1700 cm^2/ volt-sec.

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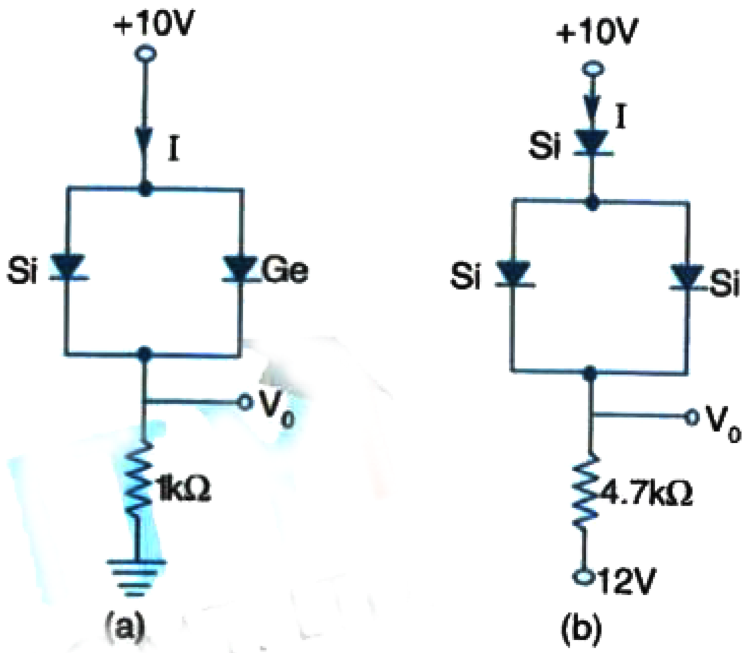
6. Determine V_0 and I for the networks of figure.



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7. In an n-p-n transistor 10^{10} electron enter the emitter in 10^{-6} s. If 2% of the electrons are lost in the base, the current amplification factor is

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8. A transistor connected in common emitter mode configuration is used as an amplifier. If $R_L = 5\Omega$ and input resistance $R_1 = 2k\Omega$ and current gain is 50. Find its power gain

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9. An amplifier has a voltage gain of 100 without feedback. A fraction of its output voltage is applied to input in such a way that the gain reduces to 50. Find feedback factor

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Examples

1. The energy of a photon of sodium light $(\lambda = 589 nm)$ equal to the band gap of a semiconducing material . Find the minimum energy E required to create a hole -electron pair.

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2. The energy of a photon of sodium light $(\lambda = 589 nm)$equal the band gap of a semiconducting material.(a)Find the minimum energy E requried to create a hole-electron pair.(b)Find the value of E/kTat a temperature of 300K.

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3. Pure Si at 300 K has equal electron (n_e) and hole (n_h) concentrations of $1.5 \times 10^{18} m^{-3}$. Doping by indium increases n_h to $4.5 \times 10^{22} m^{-3}$. Calculate n_e in the dipoed Si.

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4. A pure Si crystal has 5×10^{22} atoms m^{-3}. It is doped by 1 ppm concentration of pentavalent As. The number of holes is

$(n_i^2 = n_p n_e)$

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

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5. A semiconductor has an electron concentration of $0.45 \times 10^{12} m^{-3}$ and a hole concentration of $5.0 \times 10^{20} m^{-3}$ Calculate its conductivity. Given electron mobility $= 0.135 m^2 V^{-1} s^{-1}$, hole mobility $= 0.048 m^2 V^{-1} s^{-1}$

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6. A n-type silicon sample of width $4 \times 10^{-3} m$, thickness $25 \times 10^{-5} m$ and length $6 \times 10^{-2} m$ carries a current of 4.8 mA when the voltage is applied across the length of the sample. If the free electron density is $10^{22} m^{-3}$, then find how much time does it take for the electrons to travel the full length of the sample? Given that charge on an electron $e = 1.6 \times 10^{-19} C$

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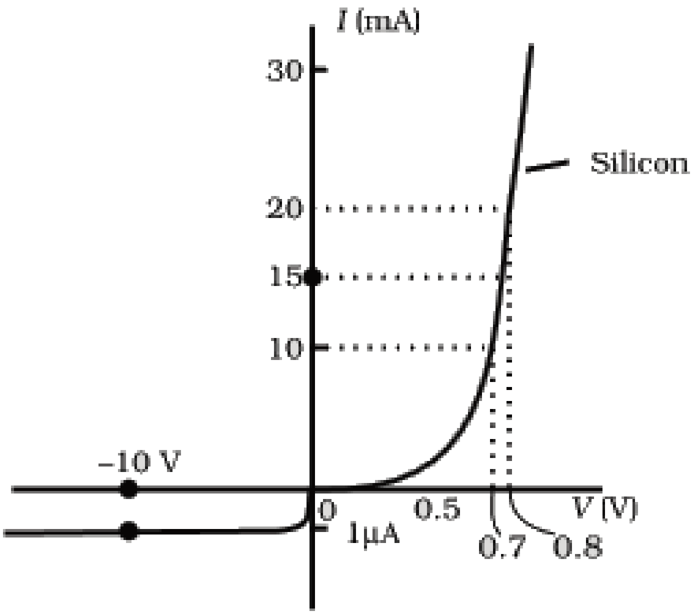
7. The V-I characteristic of a silicon diode is shown in the Fig. 14.17. Calculate the resistance of the diode at (a) $I_D = 15mA$ and (b) $V_D = -10V$.



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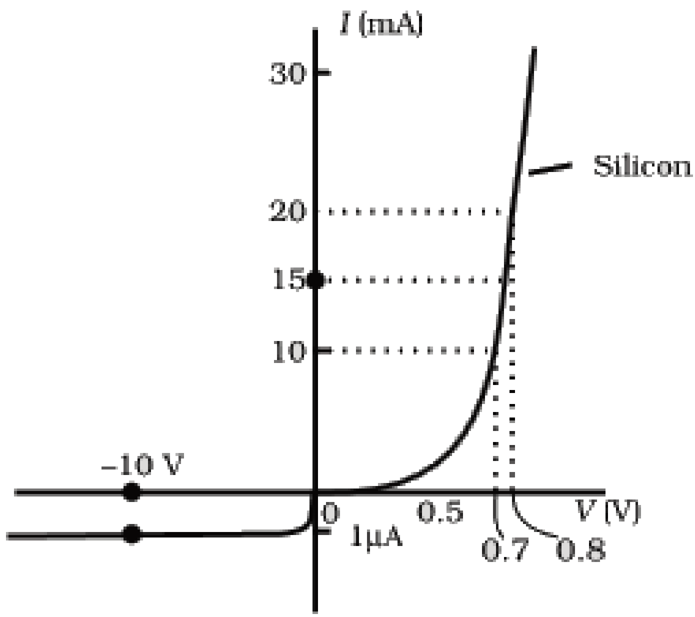
8. The V-I characteristic of a silicon diode is shown in the Fig. 14.17. Calculate the resistance of the diode at (a) $I_D = 15mA$ and $(b) V_D = -10V$.



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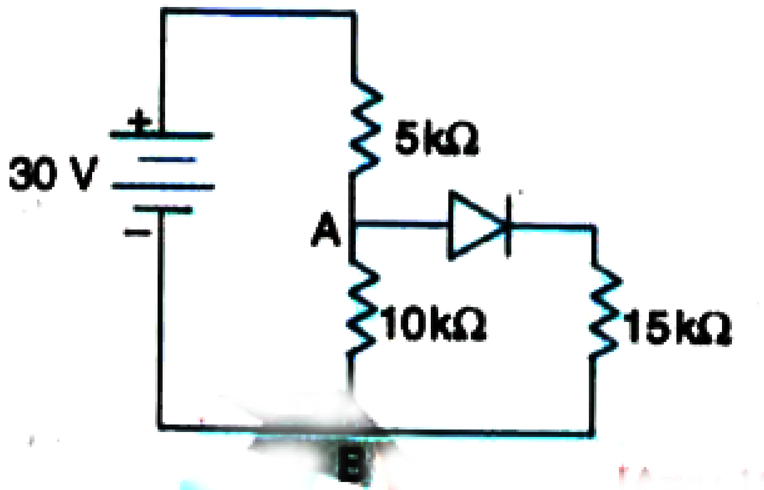
9. Find maximum voltage across AB in the circuit shown in figure. Assume that the diode is ideal.



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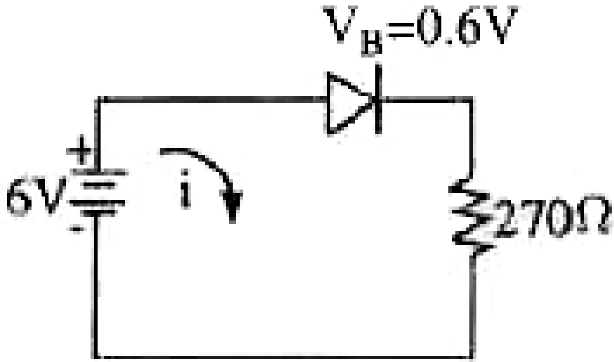
10. In the given circuit diagram. $V_B \approx 0.6V$

Calculate the current i in the circuit.



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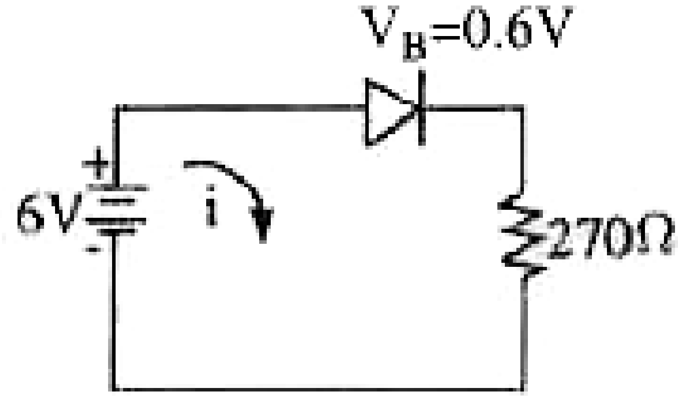
11. In the given circuit diagram. $V_B \approx 0.6V$

Find the current (I) if the diode is reversed.



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12. In a p-n junction, the depletion region is 400nm wide and and electric field of $5 \times 10^5 Vm_{-1}$exists in it (a)Find the height of the potential barrier, (b)What should be the minimum kinetic energy of a conduction electron which can diffuse from the n-side to the p-side?

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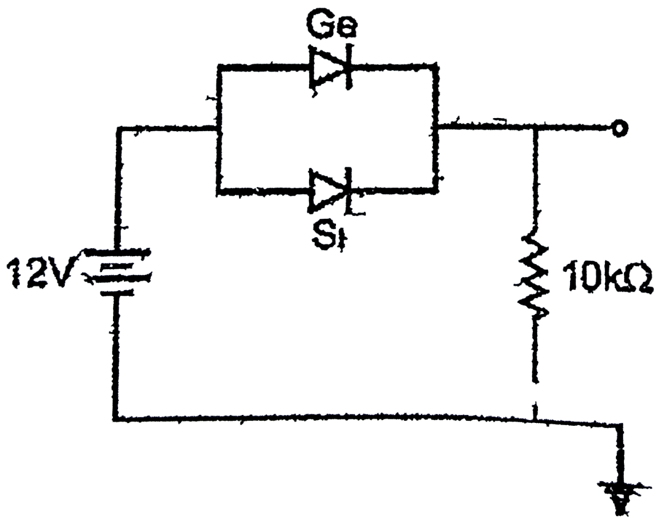

13.

Two junction diodes one of germanium (Ge) and other of sillicon (Si) are connected as shown in figure to a battery of emf 12 V and a load resistance $10k\Omega$ the germanium diode conducts at 0.3 V and silicon diode at 0.7 V. When a current flows in the circuit, The potential of terminal Y will be

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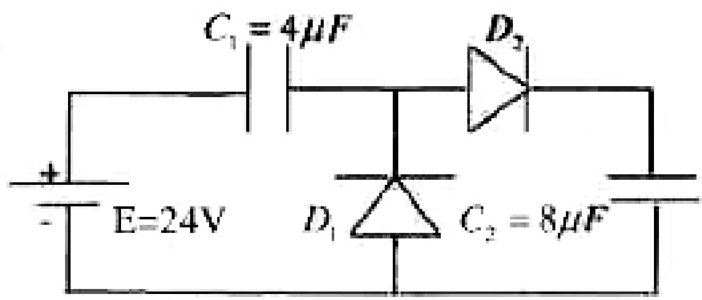
14. In the circuit shown, the potential drop across each capacitor is (assuming the two diodes are ideal)



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15. A potential barrier of 0.50V exists across a p-n junction.(a) If the depletion region is 5.0×10^{-7}m wide,what is the intensity of the electric field in this region?(b) An electron with speed$5.0 \times 10^5 ms^{-1}$approaches the p-n junction form the n-side.With what speed will it enter the p-side?

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16. A potential barrier of 0.50V exists across a p-n junction.(a) If the depletion region is 5.0×10^{-7}m wide,what is the intensity of the electric field in this region?(b) An electron with speed$5.0 \times 10^5 ms^{-1}$approaches the p-n junction form the n-side.With what speed will it enter the p-side?

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17. The circuit shown in figure contains two diodes each with a forward resistance of 50Ω and infinite reverse resistance.If the battery voltage is 6 v ,then the current through the 100Ω resistance is

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18. The applied input ac power to a half wave rectifier is 100 W. The dc output power obtained is 40W. Find the rectifier efficiency.

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19. A p-n diode is used in a half wave rectifier with a load resistance of 1000Ω. If the forward resistance (r_f) of diode is 10Ω, calculate the efficiency of this half wave rectifier.

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

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21. The current through a P-N junction diode is 55mA at a forward bias voltage of 3.0 V. If the temperature is $27^\circ C$, find the static resistance of the diode.

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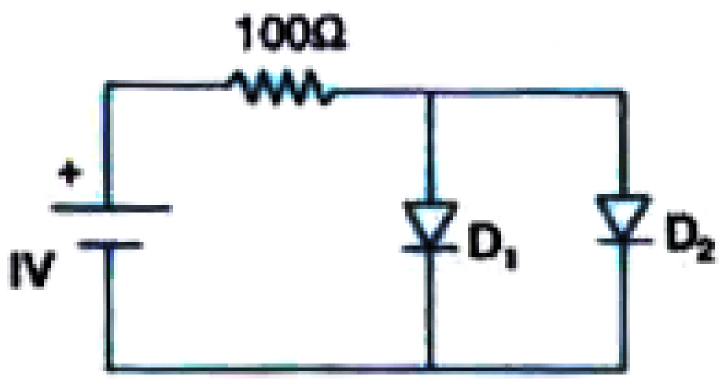
22. Considering the circuit and data given in the diagram calculate the currents flowing in the diodes D_1 and D_2 with linear characteristics.Forward resistance of D_1 and D_2 is 20 Ω



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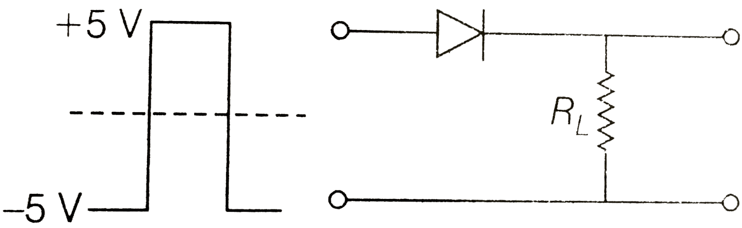
23. If in a p-n junction, a square input signal of $10V$ is applied as shown,



then the output across R_L will be

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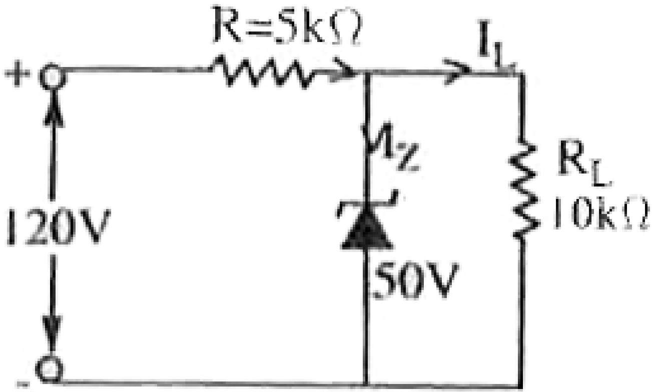
24. For the circuit shown in Fig. find the output voltage,



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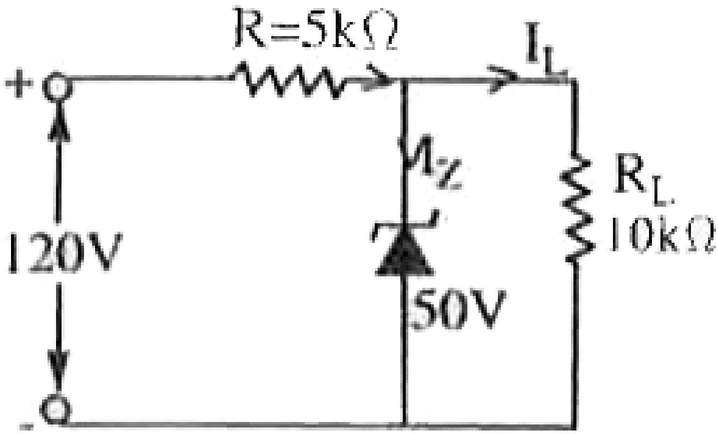
25. For the circuit shown in Fig. find

the voltage drop across series resistance,



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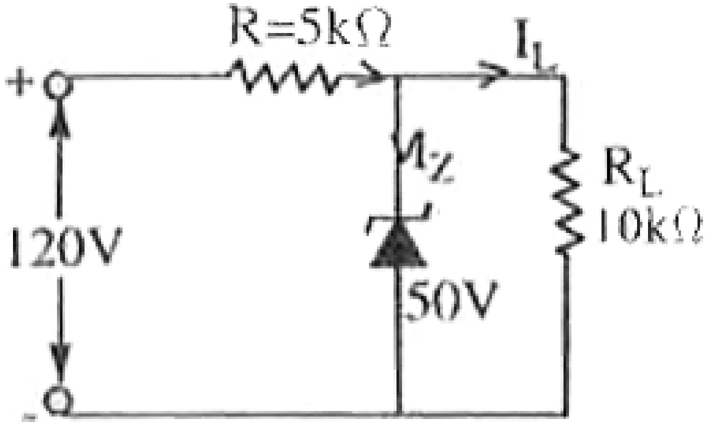
26. For the circuit shown in Fig. find the current through Zener diode.



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27. A Zener diode is specified as having a breakdown voltage of 9.1 V,with a maximum power dissipation of 364 mW. What is the maximum current the diode can handle?

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28. In a single state transistor amplifier, when the signal changes by 0.02 V, the base current change by 10μA and collector current by 1 mA. If collector load $R_c = 2k\Omega$ and $R_L = 10k\Omega$, Calculate Current Gain

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29. In a single state transistor amplifier, when the signal changes by 0.02 V, the base current change by 10uA and collector current by 10μA.

If collector load $R_c = 2k\Omega$ and $R_L = 10k\Omega$,

Calculate :

Input impedance,

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30. In a single state transistor amplifier, when

the signal changes by 0.02 V, the base current

change by 10uA and collector current by 10μA.

If collector load $R_c = 2k\Omega$ and $R_L = 10k\Omega$, Calculate :

Input impedance,

Watch Video Solution

31. In a single state transistor amplifier, when the signal changes by 0.02 V, the base current change by 10μA and collector current by 1 mA. If collector load $R_c = 2k\Omega$ and $R_L = 10k\Omega$, Calculate Current Gain

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32. In a single state transistor amplifier,When the signal changes by 0.02 V,the base current change by 10 μA and collector current by 1mA.If collector load $R_C = 2k\Omega$ and $R_L = 10k\Omega$,Calculate ,(i)Current Gain (ii)Input impedance ,(iii)Effective a.c load (iv)Voltage gain and (v)Power gain.

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33. $AP-N-P$ transistor is used in common-emitter mode in an amplifier circuit.

A change of $40\mu A$ in the base current brings a change of 2 mA in collector current and 0.04 V in base-emitter voltage. Find the , (1) input resistance (R_{input}) and

(2). the base current amplification factor (β).

If a load of $6k\Omega$ is used then also find the voltage gain of the amplifier

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34. For a transistor $\beta = 40$ and $I_B = 25\mu A$.

Find the value of l_E.

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35. In a transitor $(B\eta = 50)$, the voltage across $5k\Omega$ load resistance in collector circuit is $5V$. The base current is

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36. Current amplification factor of a common base configuration is 0.88. Find the value of base current when the emitter current is 1 mA.

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37. In a transistor, the emitter circuit resistance is $100 k\Omega$ and the collector resistance is 100Ω. The power gain, if the emitter and collector currents are assumed to be equal, will be

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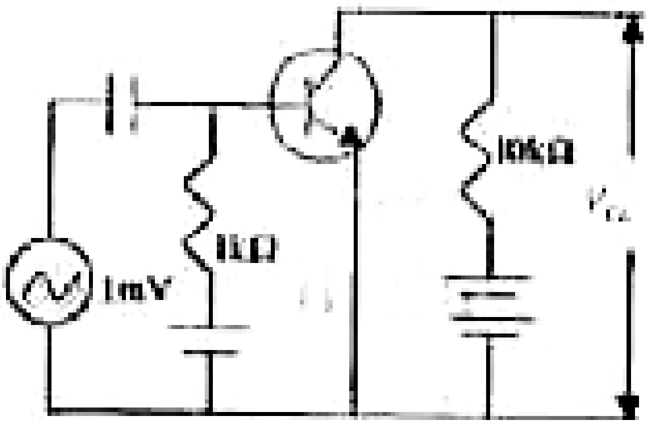
38. In the following common-emitter configuration an n-p-n transistor with $\beta = 100$

is used. The output voltage of the amplifier will be



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39. An n-p-n transistor in a common-emitter mode is used as a simple voltage-amplifier with a collector current of 4 mA. The terminals of a 8 V battery is connected to the collector through a load-resistance R_L and to the base through a resistance R_B. The collector-emitter voltage $V_{CE} = 4V$, the base-emitter voltage $V_{BE} = 0.6V$ and the current amplification factor $\beta_{dc} = 100$. Then

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40. The overall gain of a multistage amplifier is 100. When negative feedback is applied, the gain reduces to 10. Find the fraction of the output that is feedback to the input.

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41. Calculate the gain of

a negative feedback amplifier with an internal gain of A = 100 and feedback factor $\beta = \frac{1}{1000}$

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42. Calculate the gain of a negative feedback amplifier with an internal gain of A = 100 and feedback factor $\beta = \frac{1}{1000}$

Watch Video Solution

43. In a negative feedback amplifier ,the gain without feedback is 100,feed back ratio is 1/25 and input voltage is 50 m V.Calculate.

i)gain with feedback

ii)feedback factor

iii)output voltage

iv)feedback voltage

v)new input voltage so that output voltage with feedbck the output voltage without feedback

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44. In a negative feedback amplifier ,the gain without feedback is 100,feed back ratio is 1/25 and input voltage is 50 m V.Calculate.

i)gain with feedback

ii)feedback factor

iii)output voltage

iv)feedback voltage

v)new input voltage so that output voltage with feedbck the output voltage without feedback

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45. In a negative feedback amplifier ,the gain without feedback is 100,feed back ratio is 1/25 and input voltage is 50 m V.Calculate.

i)gain with feedback

ii)feedback factor

iii)output voltage

iv)feedback voltage

v)new input voltage so that output voltage with feedbck the output voltage without feedback

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46. In a negative feedback amplifier ,the gain without feedback is 100,feed back ratio is 1/25 and input voltage is 50 m V.Calculate.

i)gain with feedback

ii)feedback factor

iii)output voltage

iv)feedback voltage

v)new input voltage so that output voltage with feedbck the output voltage without feedback

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47. In a negative feedback amplifier ,the gain without feedback is 100,feed back ratio is 1/25 and input voltage is 50 m V.Calculate.

i)gain with feedback

ii)feedback factor

iii)output voltage

iv)feedback voltage

v)new input voltage so that output voltage with feedbck the output voltage without feedback

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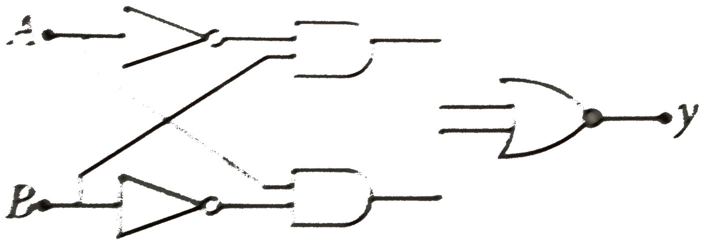
48. The Boolean expression of the output y in terms of the input A and B for the circuit shown in figure.



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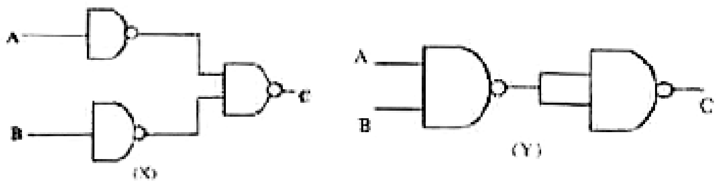
49. The combination of NAND gates shown here under are equivalent to



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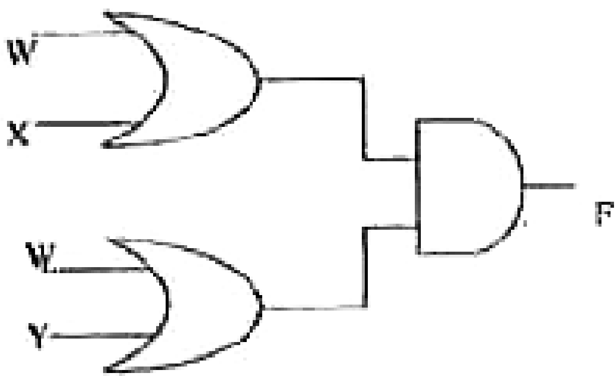
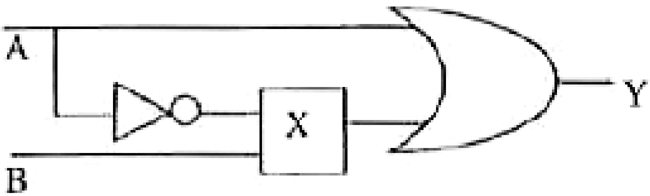
50. The diagram of a logic circuit is given below. The output of the circuit is represented by



51. The logic circuit and its truth table are given, what is the gate X in the diagram

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



52. Draw the logic circuit corresponding to the Boolean expression. $Y = AB + \overline{B}C$.

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53. Simplify $Y = AB + ABC + \overline{A}B + A\overline{B}C$ using Boolean Algebra. Draw the resultant simplified logic circuit.

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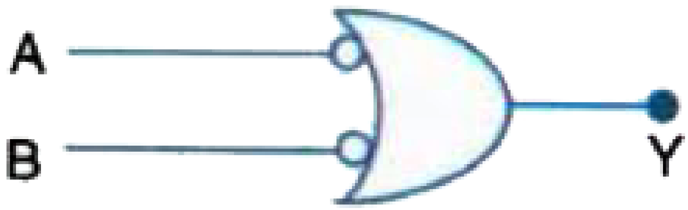
54. Write Boolean equation for the output of fig. and solve this equation for all possible input conditions.



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55. Draw logic diagrams for the Boolean expressions given below.

(i)$A.\overline{B}+\overline{A}.B=Y$, (ii) $(A+\overline{B}).(\overline{A}+B)=Y$

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56. Draw logic diagrams for the Boolean expressions given below.

(i)$A.\overline{B}+\overline{A}.B=Y$, (ii) $(A+\overline{B}).(\overline{A}+B)=Y$

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Exercise I Energy Bands And Classification Of Solids

1. 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 $(E_g)_C$, $(E_g)_{Si}$, and $(E_g)_{Ge}$. Which of the following statements is true?

A. $(E_g)_{si} < (E_g)_{\geq} < (E_g)_C$

B. $(E_g)_C < (E_g)_{Ge} > (E_G)_{si}$

C. $\left(E_g\right)_c > \left(E_G\right)_{si} > E_g - (Ge)$

D. $\left(E_g\right)_C = \left(E_g\right)_{si} = \left(E_g\right)_{Ge}$

Answer: C

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2. C, Si and Ge have same lattice structure. Why is C insulator while Si and Ge intrinsic semiconductors?

A. number of free electrons for conduction in charbon is negligibly small

B. more energy is required for the electron to remove in carbon

C. the bonding electrons exist in first orbit in case of carbon

D. All the above

Answer: D

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3. Which of the following statements is not true

A. The resistance of intrinsic semiconductors decreases with increase of temperature

B. Doping pure Si with trivalent impurities give p - type semiconductors

C. The majority carries in n - type semiconductors are holes

D. Ap-n junction can act as a semiconductor diode

Answer: C

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4. Which of the following is correct

A. Forbidden energy gap is the energy gap between the valence band and conduction band

B. Forbidden energy gap may be empty or may be partially filled with electrons

C. No electron will exist in the forbidden energy gap

D. Both 1 and 3

Answer: D

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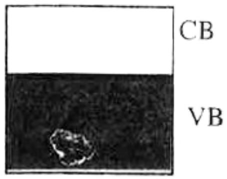
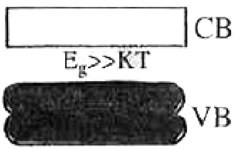
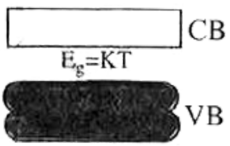
5. Which of the energy band diagram shown in the figure corrensponds to that of a semiconductor

A. 

B. 

C. 

D. 

Answer: D

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6. The bond that exists in a semi conductor is

A. Covalent Bond

B. Ionic Bond

C. Metallic Bond

D. Hydrogen Bond

Answer: A

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7. The conduction band and valence band in a good conductor

A. Are well separated by a forbidden band

B. are overlapped

C. Some times overlap and sometimes separated

D. Have forbidden band

Answer: B

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8. At absolute zero , Si acts as

A. nonmetal

B. metal

C. insulator

D. none

Answer: C

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9. On increasing the temperature, the specific resistance of

A. increases for both

B. decreases for both

C. increases, decreases

D. decreases, increases

Answer: C

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10. A solid which is not transparent to visible light end whose conductivity increases with temperature is formed by-

A. metallic bonding

B. ionic bonding

C. covalent bonding

D. vander walls bonding

Answer: C

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11. A piece of copper and another of germanium are cooled from room temperature to $80K$. The resistance of

A. each of these decreases

B. copper strip increases and that of germanium decreases

C. copper strip decreases and that of germanium increases

D. each of these increases.

Answer: C

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12. In a good conductor, what is the energy gap between the conduction band and the valence band.?

A. 1.1eV

B. zero

C. 0.7eV

D. 6.7eV

Answer: B

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13. In a semiconductor, the separation between conduction band and valence band is of the order of

A. 100 eV

B. 10 eV

C. 1 eV

D. 0 eV

Answer: C

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14. The intrinsic semi conductor behaves as insulator at

A. 0°

B. $-100^{\circ}C$

C. $100K$

D. $0K$

Answer: D

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15. The energy gap for an insulator may be

A. 0.7 eV

B. 0.1 MeV

C. 1.1 eV

D. 5 eV

Answer: D

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16. In case of a semi conductor, which one of the following statements is wrong?

A. Resistivity is in between that of a conductor and insulator

B. Temperature coefficient of resistance is negative

C. Doping increases conductivity

D. At absolute zero it behaves as a conductor

Answer: D

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17. An electric field us applied to a semiconductor.Let the number of charge carriers be n and the average drift speed be v.If the temperature is increased,

A. both n and v will increase

B. n will increase but v will decrease

C. v will increase but n will decrease

D. both n and v will decrease

Answer: B

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18. Lets $n_p$and n_e be the number of holes and conduction electrons in an intrinsic semiconductor.

A. $np > n_c$

B. $n_p = n_e$

C. $n_p < n_e$

D. $n_p \neq n_e$

Answer: B

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19. If the two ends of a p-n junction are joined by a wire .

A. there will not be a steady current in the circuit

B. there will be a steady current from the n-side to the p - side

C. there will a steady current from the p - side to the n - side

D. there may or may not be a current depending upon the resistance of the connecting wire

Answer: A

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20. The drift current in a p-n junction is

A. from the n- side to the p - side

B. from the p - side to the n - side

C. from the n-side to the p-side if the junction is forward - biased and in the opposite direction if it is reverse - biased

D. from the p-side to the n-side if the junction is forward - biased and in the opposite direction if it is reverse - biased

Answer: A

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21. The diffusion current in a p-n junction is

A. from the n - side to the p-side

B. from the p - side to the n-side

C. from the n-side to the p-side if the function is forward-biased and in the opposite direction if it is reverse-biased

D. from the p- side to the n- side of the junction is forward - biased and in the opposite direction if it is reverse - biased

Answer: B

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22. Diffusion current in a p-n junction is greater than the drift current in magnitude

A. if the junction is forward - biased

B. if the junction is reverse - biased

C. if the junction is unbiased

D. in no case

Answer: A

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23. In an intrinsic semiconductor, the fermi energy level lies

A. nearer to valence band

B. nearer to conduction band

C. exactly at the middle of the forbidden energy gap

D. Cant' say

Answer: C

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24. Which of the following statements is not true?

A. the resistance of intrinsic semiconductors decreases with increase of temperature

B. doping pure Si with trivalent impurities give p-type semiconductors

C. the majority charge carries in n-type semiconductors are holes

D. a p-n junction can act as a semiconductor diode

Answer: C

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25. The mobility of free electron is greater than that of free holes because they

A. are lighter

B. have negative charge

C. need less additional energy to move

D. experience collisions less frequently

Answer: C

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26. Pick out the incorrect statement

A. This current doubles for every 100°C rise in temperature

B. This current is due to minority charge carriers

C. Reverse saturation current is also known as leakage current

D. Width of depletion layer increases

Answer: A

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27. The value indicated by fermi-energy level in an intrinsic semiconductor is

A. The average energy of electrons and holes

B. The energy of electrons in conduction band

C. The energy of holes in valence band

D. The energy of forbidden region

Answer: A

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28. Pure semiconductor is known as

A. an infinite resistance at 0° C

B. a finite resistance which doesn't depend upon temperature

C. a finite resistance which increases with increase of temperature

D. a finite resistance which decreases with increase of temperature

Answer: D

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29. A doped semiconductor is

A. Positively charged

B. Negatively charged

C. electrically neutral

D. may be positive or negative

Answer: C

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30. The potential barrier, in the depletion layer

, is due to

A. Electrons

B. Holes

C. Ions

D. Forbidden Band

Answer: C

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31. A hole is

A. A positively charge electron

B. An electron in Valence Band

C. An unfilled covalent bond

D. An excess electron in covalent bond

Answer: C

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32. The donor impurity to be added for doping germanium crystal, will be of valency

A. 2

B. 3

C. 4

D. 5

Answer: D

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33. A P-type semiconductor can be formed by doping Si or Ge with

A. Boron

B. Aluminium

C. Galium

D. All the above

Answer: D

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34. An-type and P-type silicon can be obtained by doping pure silicon with

A. III group element

B. IV group elements

C. V group elements

D. VI group elements

Answer: C

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35. An-type and P-type silicon can be obtained by doping pure silicon with

A. Arsenic and Phosphorous

B. Indium and Aluminium

C. Phosphorous and Indium

D. Aluminium and Boron

Answer: C

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36. At room temperature, a p-type semiconductor has

A. large number of holes and few electrons

B. large number of free electrons and few holes

C. equal number of free electrons and holes

D. large number of holes and electrons

Answer: A

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37. In an n-type semiconductor, the fermi energy level lies

A. in the forbidden energy gap nearer to the conduction band

B. in the forbidden energy gap nearer to the valence band

C. in the middle of forbidden energy gap

D. outside the forbidden energy gap

Answer: A

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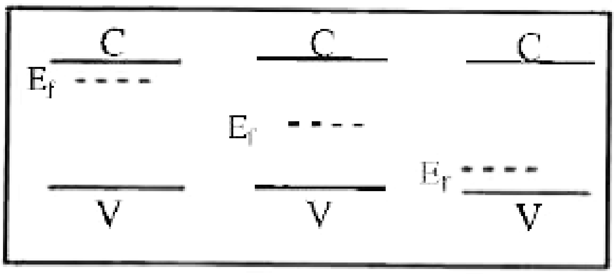
38. The band diagrams of three semiconductors are given in the figure. From left to right they are respectively.



A. n-intrinsic-p

B. p-intrinsic-n

C. intrinsic-p-n

D. intrinsic-n-p

Answer: A

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39. The element that can be used as an acceptor impurity to doped silicon is

A. Antimony

B. Arsenic

C. Boron

D. Phosphorous

Answer: C

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40. In extrinsic semiconductors

A. The conduction Band and Valence Band overlap

B. The gap between Conduction Band and Valence Band is more than 16e V

C. The gap between C.B. and V.B. is nearly about 1 eV

D. The gap between C.B. and V.B. will be 100 V and more

Answer: C

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41. In an intrinsic semiconductor at room temperature, number of electrons and holes are

A. greater than one

B. less than one

C. equal to one

D. decreases and becomes zero

Answer: C

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Exercise I P N Junction Diode

1. The neutral region formed at P-n junction due to recombination of electrons and holes is

A. Fermi layer

B. Depletion layer

C. Acceptor layer

D. All the above

Answer: B

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2. The potential barrier at a P-n junction is due to the charges on either side of the junction. These charges are

A. Fixed ions

B. Majority carriers

C. Both majority and minority carriers

D. Minority carriers

Answer: A

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3. In an unbiased p-n junction, holes diffuse from the p-region ton-region because

(a) free electron in the n-region attract them.

(b) they move across the junction by the potential difference.

(c) hole concentration in p-region is more as compared to n-region.

(d) All the above.

A. free electrons in the n-region attract them.

B. they move across the junction by the potential difference.

C. hole concentration in p-region is more as compared to n-region

D. All the above

Answer: C

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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?

A. Continuous contact at the atomic level is not possible

B. The junction behaves as a discontinuity for the flow

C. The roughness is much larger than interatomic crystal spacing

D. All the above

Answer: D

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5. In a P-N junction diode which is not connected to any circuit-

A. the potential is the same everywhere

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

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

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

Answer: C

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6. The electrical resistance of depletion layer is large because

A. It contains electrons as charge carriers

B. It contains holes as charge carriers

C. It has large number of charge carriers

D. It has no charge carriers

Answer: D

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7. In a PN junction

A. high potential at N side and low potential at P side

B. high potential at P side and low potential at N side

C. P and N both are at same potential

D. undetermined

Answer: A

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8. The barrier potentials for silicon and Germanium diodes are about

A. 0.7V , 0.3V

B. 0.2V, 0.3 volts

C. 1.1V, 0.7V

D. 1.1V , 0.3V

Answer: A

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9. The dominant mechanism for motion of charge carriers in forward and reverse biased silicon p-n junction are

A. drift in forward bias, diffusion in reverse bias

B. diffusion in forward bias, drift in reverse bias

C. diffusion in both forward and reverse bias

D. drift in both forward and reverse bias

Answer: B

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10. Potential barrier developed in a junction diode opposes the flow of

A. free electrons from n-region

B. holes from P-region

C. majority carriers from both the regions

D. minority carriers from both regions

Answer: C

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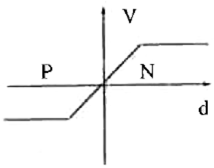
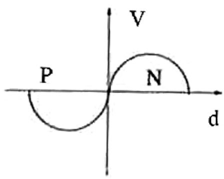
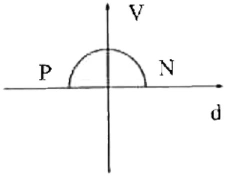
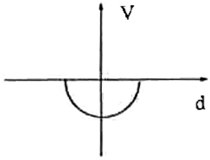
11. The correct curve between potential and distance near P-N junction is

A. 

B. 

C. 

D. 

Answer: A

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12. When $p-n$ junction diode is forward biased, then

A. the depletion region is reduced and barrier height is increased

B. the depletion region is widened and barrier height is reduced.

C. both the depletion region and barrier height are reduced

D. both the depletion region and barrier height are increased

Answer: C

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13. Which of following statement is not correct ?

A. The width of depletion region decreases

B. Free electrons on n-side will move towards the junction

C. Holes on p - side move towards the junction

D. Electrons on n - side and holes on p - side will move away from junction

Answer: D

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14. The resistance of an ideal diode in forward biased condition is

A. zero

B. infinity

C. finite

D. negative

Answer: A

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15. The resistance of an ideal diode in reverse biased condition is

A. Zero

B. Infinity

C. Finite

D. Negative

Answer: B

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16. In forward biased condition, the p-n junction diode behaves as

A. High resistance connection

B. Act as a closed switch

C. A low resistance connection

D. A capacitor

Answer: C

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17. Reverse bias applied to a junction diode

A. lowers the potential barrier

B. raises the potential barrier

C. increases the majority carrier current

D. increases the minority carrier current

Answer: B

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

A. electric field is zero

B. potential is maximum

C. electric field is maximum

D. potential is zero

Answer: D

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19. Avalanche breakdown in a semiconductor diode occurs when-

A. forward current exceeds a certain value

B. reverse bias voltage exceeds a certain value

C. forward bias voltage exceeds a certain value

D. the potential barrier is reduced to zero

Answer: B

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20. When a p-n junction diode is reverse biased the flow of current across the junction is mainly due to

A. Diffusion of charges

B. Drift of charges

C. Both drift and diffusion of charges

D. Neither diffusion nor drift of charges

Answer: B

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21. The small currents in reverse biased condition of p-n diode are due to

A. Electrons

B. Holes

C. Majority charge carriers

D. Thermal agitation of minority charge carriers.

Answer: D

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22. A p-n junction diode can be used as

A. A switch

B. A capacitor

C. Rectifier

D. All the above

Answer: D

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23. In half-wave rectifier, maximum percentage of A.C. power that can be converted into D.C. power is

A. 0.25

B. $40.6\ \%$

C. 81.2%

D. 0.1

Answer: B

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24. The maximum efficiency of full wave rectifier is

A. 40.6%

B. 81.2%

C. 25%

D. 50%

Answer: B

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25. Which of the following does not have a medusa stage?

A. Current

B. Voltage

C. Dynamic impedance

D. Capacitance

Answer: B

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26. The zener diode can be used as

A. As voltage regulator

B. As amplifier

C. As oscillator

D. All the above

Answer: A

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27. In an unbiased p-n junction, holes diffuse from the P-region to n-region because

A. electrons travel across the junction due to potential difference

B. Only electrons move from n to p region and not the vice-versa .

C. holes in p-region attract them

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

Answer: D

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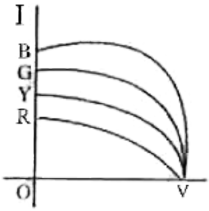
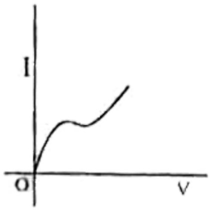
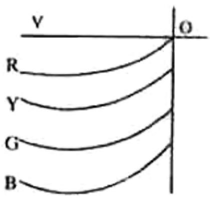
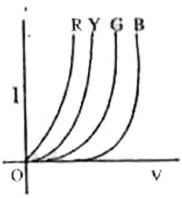
28. The I - V characteristic of an LED is

A. 

B. 

C. 

D. 

Answer: D

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29. In figure, assuming the diodes to be ideal,

A. D_1 and $D_2$are both forward biased and hence current flows from A to B

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

C. $D_1$is forward biased and D, is reverse biased and hence current flows from A to B

D. D_2 is forward biased and D, is reverse biased and hence no current flows from B to A

Answer: D

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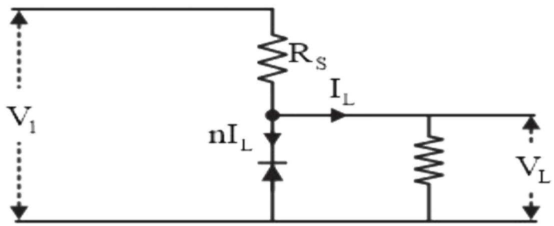
30. The value of the resistor , R_s needed in the DC voltage regulator circuit shown here equals :



A. $(V_i + V_1)nI_L$

B. $(V_i + V_1)(n+1)I_L$

C. $(V_i - V_1)(n+1)I_L$

D. $(V_i - V_1)nI_L$

Answer: C

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Exercise I Transistors

1. Transistor can be used as :-

A. Oscillator

B. Electronic switch

C. Amplifier

D. All the above

Answer: D

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2. In a transistor

A. Emitter is heavily doped

B. Collector is moderately doped

C. Base is lightly doped

D. All the above

Answer: D

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3. A n-p-n transistor is said to be in active region of operation, when

A. both emitter and collector junctions are forward biased.

B. both emitter and collector junctions are reverse biased.

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

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

Answer: C

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4. Statement-I : For faster action, n-p-n transistor is used

Statement-II : In n-p-n transistor, the mobility of majority charge carries is more.

A. Emitter only

B. Collector only

C. Base only

D. Either emitter or Collector

Answer: C

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5. A n-p-n transistor conducts when

A. both collector and emitter are positive with respect to the base

B. collector is positive and emitter is negative with respect to the base

C. collector is positive and emitter is at same potential as the base

D. both collector and emitter are negative with respect to the base

Answer: B

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6. In a N-P-N transistor circuit, the collector current is 10 mA.If 90 % of the electron emitted reach the collector, the emitter current (I_E) and base current (I_B) are given by -

A. slightly more than the collector current

B. slightly less than the collector current

C. equal to the collector current

D. equal to the base current.

Answer: A

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7. In the circuit symbol of transistor the arrow on the emitter indicates

A. The direction of flow of electrons

B. The direction of flow of conventional current

C. The direction of flow of holes in emitter region

D. Both 2 and 3

Answer: D

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8. When a n-p-n transistor is used as an amplifier, then

A. Electrons move from emitter to collector

B. Holes move from emitter to base

C. Electrons move from collector to base

D. Holes move from base to collector.

Answer: A

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9. When a n-p-n transistor is used as an amplifier, then

A. The electrons go from base region to collector region

B. The electrons go from emitter region to base region

C. The electrons go from collector region to base region

D. Conduction in the transistor is due to electrons.

Answer: C

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10. Which of the following statement is true for a p-n-p transistor when used in an amplifier circuit?

A. The semi conductor material used to make the emitter may have been doped with arsenic

B. Most of the current carriers in the collector and emitter are holes from donor impurities

C. The emitter junction is forward biased

D. Both 2 and 3

Answer: D

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11. In CE configuration transistor, the current gain

A. Is always less than 1

B. Is always infinity

C. Is always greater than 200

D. Lies in between 20 and 200

Answer: D

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12. The transistor parameters, namely α and β of a transistor are related as

A. $\beta = \dfrac{\alpha}{(1 - \alpha)}$

B. $\alpha = \dfrac{\beta}{1 + \beta}$

C. $\alpha\beta = \beta - \alpha$

D. All the above

Answer: D

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13. In which of the configuration of a transistor , the power gain is highest ?

A. CB configuration

B. CE configuration

C. CC configuration

D. 1 and 2 only

Answer: B

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14. Transistor input characteristics curves are the graphs drawn with

A. Collector current I_C on y-axis and the collector emitter voltage V_{CE} on X-axis for a constant base current

B. Base current I_B on y-axis and the base-emitter voltage V_{BE} on X-axis for a constant collector emitter voltage

C. Base current I_B on y-axis and the collector emitter voltage (V_{CB}) on x-axis for a constant collector current

D. Base current I_B on y-axis and collector current I_C on x-axis with constant base emitter voltage

Answer: B

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15. Transistor output characteristic curves are the graphs drawn with

A. Collector current I_C on y-axis and the collector emitter voltage V_{CE} on X-axis for a constant base current

B. Base current I_B on y-axis and the base - emitter voltage V_{BE} on x-axis for a constant collector emitter voltage

C. Base current I_B on y-axis and the collector emitter voltage V_{CE} on X-axis for a constant collector current

D. Base current $I_B$on y-axis and collector current I_C on X-axis with constant base - emitter voltage

Answer: A

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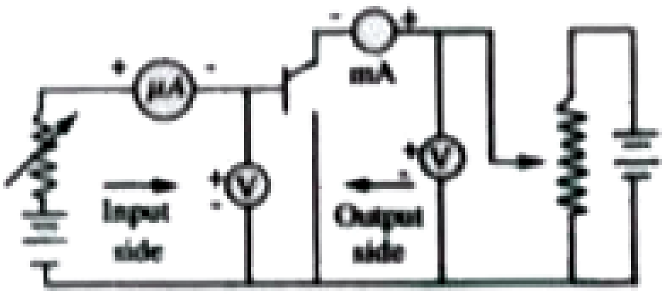
16. The circuit diagram below shows n-p-n transistor in CE configuration. For this configuration, mark the correct statement(s).



A. voltage amplification only

B. current amplification only

C. both current and voltage amplification

D. only power gain of unity

Answer: C

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17. Consider a p-n junction as a capacitor, formed with p and n - materials acting as thin metal electrodes and depletion layer width acting as separation between them. Basing on this, assume that a n-p-n transistor is working as an amplifier in CE configuration. If C_1 and C_2 are the baseemitter and collector-base junction capacities then

A. A) $C_1 > C_2$

B. B) $C_2 < C_2$

C. C) $C_1 = C_2$

D. D) $C_1 = C_2 = 0$

Answer: A

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18. In a common base amplifier the phase difference the input signal voltage and the output voltage is

A. zero

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

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

D. π

Answer: A

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19. For a transistor amplifier, the voltage gain

A. remains constant for all frequencies

B. is high at high and low frequencies and constant in the middle frequency range

C. is low at high and low frequencies and constant at mid frequencies

D. None of the above

Answer: C

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20. An electrical device draws 0.968 kW form AC mains of 220 V.If current lags voltage in phase by $\phi = \tan^{-1}\left(\frac{2}{3}\right)$.The value of resistance is

A. Current Amplifier

B. Oscillator

C. Power Amplifier

D. Rectifier

Answer: D

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21. To use a transistor as an amplifier

A. Its emitter junction is in reverse bias and collector junction is in forward bias

B. The transistor must have breakdown region

C. Its emitter junction is in forward bias and collector junction is in reverse bias

D. Its emitter and collector junctions are in forward bias

Answer: C

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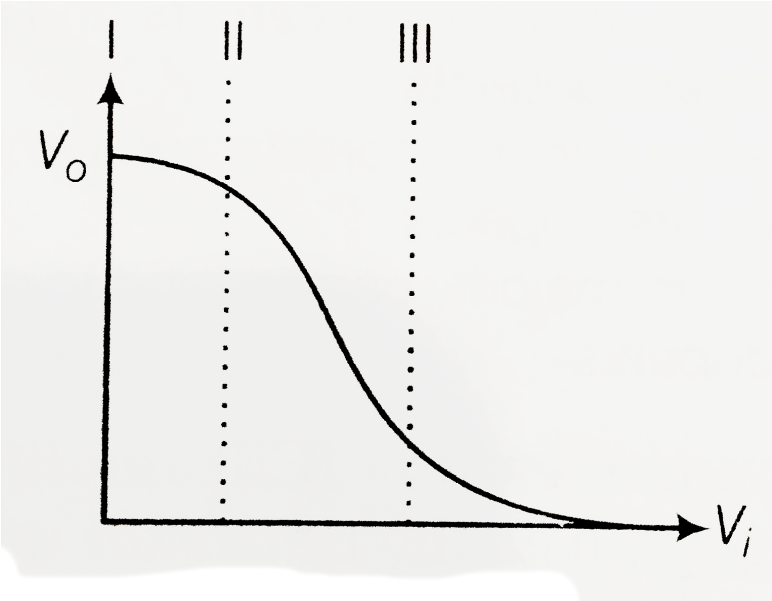
22. Transfer characteristic [output voltage (V_0) vs input voltage (V_i) for a base biased transistor in CE configuration is as shown in the figure. For using transistor as a switch, it is used



A. in region II

B. in region I

C. in region III

D. both in region (I) and (III)

Answer: D

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Exercise I Logic Gates

1. The logic gate is an electric circuit which

A. makes logic decisions

B. allows electrons flow only in one

C. works binary algebra

D. alternates between 0 and 1 values

Answer: A

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2. The output of OR gate is 1 :-

A. if both inputs are zero

B. if either or both the inputs are 1

C. only if both inputs are 1

D. if either input is zero

Answer: B

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3. The output of a two input AND gate is one, only when its

A. either input is one

B. either input is zero

C. both inputs are one

D. both inputs are zero

Answer: C

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4. An OR gate

A. implements logic addition

B. is a universal gate

C. implements logic multiplication

D. implements logic subtraction

Answer: A

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5. An AND gate

A. implements logic addition

B. is a universal gate

C. implements logic multiplication

D. implements logic subtraction

Answer: C

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6. NAND and NOR gates are called universal gates primarily, because they

A. are available universally

B. can be combined to produce OR, AND and NOT gates

C. are widely used in integrated circuits

D. are easiest to manufacture

Answer: B

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7. Digital circuits can be with the repetitive use of

A. OR gates

B. NOT gates

C. AND gates

D. NAND gates

Answer: D

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8. How many NAND gates are required to form and AND gate?

A. 1

B. 2

C. 3

D. 4

Answer: B

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9. The following gate is equivalent to

A. OR

B. AND

C. NOT

D. NOR

Answer: C

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10. An AND gate can be prepared by repetitive use of

A. NOT gate

B. OR gate

C. NAND gate

D. AND gate

Answer: C

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11. The value of $A.\overline{A}$ in Boolean algebra is -

A. 0

B. 1

C. A

D. $\overline{A}$

Answer: B

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12. The value of A.$\overline{A}$ in Boolean algebra is -

A. A) 0

B. B) 1

C. C) A

D. D) $\overline{A}$

Answer: A

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13. If A = 1 and B = 0, then in terms of Boolean algebra , $A + \overline{B} = \ .$

A. A

B. B

C. $\overline{A}$

D. $\overline{A + B}$

Answer: A

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14. In the Boolean algebra $\overline{A} . \overline{B}$ equals

A. A+B

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

C. $\overline{A . B}$

D. $\overline{A + B}$

Answer: D

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15. Two NOT gates are connected at the two inputs of a NAND gate. This combination will behave like

A. NAND gate

B. AND gate

C. OR gate

D. NOR gate

Answer: C

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16. An AND gate can be prepared by repetitive use of

A. A) Only a and b are correct

B. B) Only c and d are correct

C. Only a, b and c are correct

D. All are correct

Answer: B

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17. Let $X = A\overline{BC} + B\overline{CA} + C\overline{AB}$.Evalute X

for

(a)$A = 1, B = 0, C = 1$

(b)$A = B = C = 1$

(c)$A = B = C = 0$

A. 0, 0, 1

B. 1, 0, 0

C. $1, 1, 1$

D. 1, 0, 1

Answer: B

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Exercise I Matching Type Questions

1. Match list - 1 with list -2

List - 1	List - 2
a) Intrinsic semi-conductor	e) Prepared by adding antimony
b) N-type semi-conductor	f) Immobile ion
c) P-type semi-conductor	g) Silicon
d) Depletion layer	h) Prepared by adding indium

A. a-g, b-e, c-h, d-f

B. a-h, b-f, c-e, d-g

C. a-e, b-g, c-f, d-h

D. a-f, b-h, c-g, d-e

Answer: A

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2. Match the following:

Coloumn - I	Coloumn - II
A) Solar cells	p) Computers
B) L.E.Ds	q) Optical communi cation
C) Photo diodes	r) Calculators and watches
D) Zener diode	s) Regulating supply voltage

A. A - r, B - p,q, C - 4,r, D - r,s

B. A - r, B - p,q,r, C - p,q, D-S

C. A - q,5, B - q,r,s, C - p,q, D-P

D. A - 1, B - q.,s, C-s, D - p,r

Answer: D

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3. Match the following:

Column - I	Column - II
A) Zener diode	P) In photograph
B) Photodiode	Q) To illuminate the traffic light
C) Light emitting	R) In switching the diode light on and off
D) Solor cell	S) Voltage regulating power supply

A. A-P, B-Q, C-R, D-S

B. A-P B-R, C-S, D-P

C. A-R, B-Q , C-P, D-S

D. A-S, B-R, C-Q D-P

Answer: D

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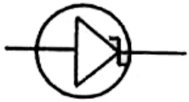
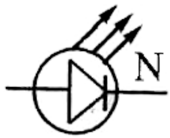
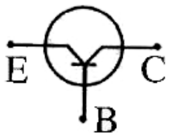
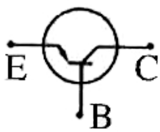
4. match the following

Column - I	Column - II
I) n - p - n transistor	A) 
II) p - n - p transistor	B) 
III) Light emmitting diode	C) 
IV) Zener diode	D) 

A. A) I-A, II-B, III-C, IV-D

B. B) I-D, II-A, III-B, IV-C

C. C) I-C, II-D, III - B, IV - A

D. D) I-B, II - A, III-C, IV-D

Answer: C

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5. Match List -1 with list -2

List - 1	List - 2
a) Emitter	e) Transfer resistor
b) Base	f) Moderately doped
c) Collector	g) Lightly doped
d) Transistor	h) Heavily doped

A. a-f, b-e, c-h, d-g

B. a-g, b-f, c-e, d-h

C. a-h, b-g, c-f, d-e

D. a-e, b-h, c-g, d-f

Answer: C

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6. Match the following.

List -I	List-II
a) p-n junction diode	e) Transmission of electric power
b) Transistor	f) Rectifier
c) Zener diode	g) Amplifier
d) Transformer	h) Voltage stabilizer

A. a-f, b-g.c-e,d-h

B. a-f,b-g,c-h,d-e

C. a-f,b-e,c-h,d-g

D. a-f,b-h,c-e,d-g

Answer: B

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7. For C.E configuration of a transistor, in list - I different regions of operations and in list - II different biasing of junctions are mentioned match list - I with list - II

List - 1	List - 2
a) active region	d) both the junctions are forward biased
b) saturation region	e) both the junctions reverse biased
c) cut off region forward biased	f) emitter junction is and ollector junction reverse biased

A. a -e, b-d, c-f

B. a - f, b - e, c-d

C. a - f, b-d, c-e

D. a - e, b-d, c- f

Answer: C

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8. Match the following:

(i) Diazotization	(a) Bakelite
(ii) Argentite	(b) Nernst equation
(iii) Thermosetting plastics	(c) Aniline
(iv) Electrochemical cell	(d) Ethylenediamine
(v) Bidentate ligand	(e) Froth flotation process

A. a-g, b-e, c-h, d-f

B. a-e, b-g, c-f, d-h

C. a-f, b-e, c-h, d-g

D. a-h, b-g, c-f, d-e

Answer: D

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9. Match the following

	Column A		Column B
(a)	Vibrations cause	(i)	absorb sound
(b)	A shriller sound is	(ii)	second
(c)	Unit of frequency	(iii)	sound
(d)	Unit of time period	(iv)	of high pitch
(e)	Curtains	(v)	hertz

A. a-g, b-e,c-f,d-h

B. a-e,b-g.c-hd-e

C. a-e,b-g,c-f,d-h

D. a-g,b-e,c-hd-f

Answer: D

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Exercise I More Than One Option Type Questions

1. Assertion: If there is some gap between the conduction band and the valence band, electrons in the valence band all remain bound and no free electrons are available in the conduction band. Then the material is an insulator.

Reason: Resistance of insulators is very low

A. A is true, B is false

B. A is false, B is true

C. A and B are true

D. A and B are false

Answer: B

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2. In a semiconductor diode, the reverse biased current is due to orbit of free electrons and holes caused by

A. Only A is true

B. A and C are true

C. Only A and B are true

D. All are true

Answer: C

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3. Choose the correct statement of the following (A): In P-type semiconductor holes are majority carriers (B) : In n-type semi conductor free electrons are majority carriers

A. A and B

B. A, B and C

C. A and C

D. All

Answer: C

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4. Holes are charge carries in A) Intrinsic semiconductors B) Ionic solids C) P-type semiconductors D) Metals

A. Only a and b are correct

B. Only a and c are correct

C. Only a, b and c are correct

D. All are correct

Answer: B

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5. Choose the correct statement of the following (A): In P-type semiconductor holes are majority carriers (B) : In n-type semi conductor free electrons are majority carriers

A. Only a and b are correct

B. Only b and c are correct

C. Only a, c and d are correct

D. All are correct

Answer: C

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6. Which of the following statements is true about semiconductors ?

A. A and B are true

B. Only B is true

C. A, B and D are true

D. All are true

Answer: C

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7. In a p -n junction, a) new holes and conduction electrons are produced continuously throughout the material b) new holes and conduction electrons are produced continuously throughout the material except in the depletion region c) holes and conduction electrons recombine continuously throughout the material d) holes and conduction electrons recombine continuously throughout the material except in the depletion region.

A. Only a and d are correct

B. Only b and c are correct

C. Only a, b and c are correct

D. All are correct

Answer: A

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8. The electrical conductivity of pure germanium can be increased by

A. Only a and b are correct

B. Only b and c are correct

C. Only a, b and c are correct

D. All are correct

Answer: D

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9. Choose the correct statement of the following (A): In P-type semiconductor holes are majority carriers (B) : In n-type semi conductor free electrons are majority carriers

A. A) A is true, B is false

B. B) A is false, B is true

C. C) A and B are true

D. D) A and B are false

Answer: C

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10. Statement(A) : In P-type semi conductor Fermi - energy level lies nearer to the conduction band Statement(B) : In n-type semi conductor Fermienergy level lies above the middle of the Forbidden Band.

A. A is true, B is false

B. A is false, B is true

C. A and B are true

D. A and B are false

Answer: B

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11. Choose the type of semiconductor from the following options for which the electrical conductivity is due to the breaking of its covalent bonds.

A. A is true, B is false

B. A is false, B is true

C. A and B are true

D. A and B are false

Answer: C

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12. When a potential difference is applied across the current passing through a) an insulator at 0 K is zero b) a semiconductor at 0 K is zero c) a metal at 0 K is finite d) a p-n junction at 300 K is finite, if it is reverse biased

A. A) only a and b are correct

B. B) only c is correct

C. C) only a,b and d are correct

D. D) all are correct

Answer: C

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13. Which of the following statements concerning depletion region of an unbiased p-n junction diode are true A) The width of the depletion region is independent of densities of dopants B) The width of the depletion region is dependent on the density of dopants C) The electric field in the depletion region is provided by the electrons in conduction band and holes in valency band D) The electric field in the depletion region is produced by the ionized dopent atoms

A. A and B are true

B. B and C are true

C. B and D are true

D. A and C are true

Answer: C

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14. Consider the following statements A and B and identify the correct choice of the given answers (A): The width of the depletion layer in a P-n junction diode increases in forward bias (B) : In an intrinsic semi conductor the fermienergy level is exactly in the middle of the forbidden gap

A. A) A is true, B is false

B. B) A is false, B is true

C. C) A and B are true

D. D) A and B are false

Answer: B

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15. Consider the following statements and identify the correct answer. a) In forward bias of p-n diode, the effective barrier potential is

$(V_B - V)$. (V_B is barrier potential and V is the applied external voltage) b) In reverse bias of p-n diode, the effective barrier potential is $(V_B + V)$c) In forward bias, an ideal p-n diode offers zero resistance d) In reverse bias, an ideal p-n diode offers infinite resistance

A. a, b only are true

B. a, b, c only are true

C. a, b, c, d are true

D. all are false

Answer: C

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16. Zener diode when used as a voltage regulator is connected a) in forward bias b) in reverse bias c) in parallel to the load d) in series with the load

A. a and b are correct

B. b and c are correct

C. a is only correct

D. d is only correct

Answer: B

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17. Which of the following is a correct statement? A: A zener diode is mainly operated in reverse biased condition B: In forward biased condition, the zener diodem acts like an ordinary P-n junction diode

A. Both A and B

B. Neither A nor B

C. Only A

D. Only B

Answer: A

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18. Consider the following statements A and B and identify the correct answer: A: Germanium is preferred over silicon in construction of Zener diode B: Germanium have high thermal stability

A. A and B are true

B. A and B are false

C. A is true, B is false

D. A is false,B is true

Answer: B

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19. Consider the following statements A and B and identify the correct answer : A: A Zener diode is always connected in reverse bias. B:

The potential barrier of a P-n junction lies in between 0.1 to 0.7 volts, approximately.

A. A is true, B is false

B. A is false, B is true

C. A and B are true

D. A and B are false

Answer: C

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20. Transistor can be used as :-

A. Only B is true

B. A, B and D are true

C. A, B and C are true

D. B and D are true

Answer: B

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21. In n-p-n transistor, in CE configuration a) the emitter is heavily doped than the collector b) emitter and collector can be interchanged c) the base region is very thin but is heavily doped d) the conventional current flows from base to emitter

A. a and b are correct

B. a and c are correct

C. a and d are correct

D. b and c are correct

Answer: C

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22. A transistor is used in the common emitter mode as an amplifier then :-

(A) the base emitter junction is forward biased

(B) the base emitter junction is reverse biased

(C) the input signal is connected in series with the voltage applied to bias the base emitter junction

(D) the input signal is connected in series with the voltage applied to bias the base collector junction.

A. a and c are correct

B. b and c are correct

C. a and d are correct

D. b and d are correct

Answer: A

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

A. A is true, B is false

B. A is false, B is true

C. A and B are true

D. A and B are false

Answer: C

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Exercise I Assertion Reason

1. When a p-n junction diode is reverse biased, then

A. Both 'A' and 'R' are true and 'R' is the correct explanation of 'A'

B. Both 'A' and 'R' are true and 'R' is not the correct explanation of 'A'

C. 'A' is true and 'R' is false

D. 'A' is false and 'R' is true

Answer: A

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2. (A): In forward bias, zener diode acts like an ordinary P-n junction diode.

(R): Zener diode is used as a voltage regulator.

A. Both 'A' and 'R' are true and 'R' is the correct explanation of 'A'

B. Both 'A' and 'R' are true and 'R' is not the correct explanation of 'A'

C. 'A' is true and 'R' is false

D. 'A' is false and 'R' is true

Answer: B

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3. (A): In an N type semiconductor fermi level shifts towards conduction band

(R) : Donor impurities are present in N-type semi conductor.

A. Both 'A' and 'R' are true and 'R' is the correct explanation of 'A'

B. Both 'A' and 'R' are true and 'R' is not the correct explanation of 'A'

C. 'A' is true and 'R' is false

D. 'A' is false and 'R' is true

Answer: A

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4. (A): While temperature of a semi conductor is increased its resistance decreases

(R): The energy gap between conduction band and valency band is very small and on heating the electrons can be shifted from valence band to conduction band.

A. Both 'A' and 'R' are true and 'R' is the correct explanation of 'A'

B. Both 'A' and 'R' are true and 'R' is not the correct explanation of 'A'

C. 'A' is true and 'R' is false

D. 'A' is false and 'R' is true

Answer: A

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5. (A): Common emitter mode of a transistor is widely used

(R): Current gain, voltage gain, and power gain are maximum in C.E mode of a transistors.

A. Both 'A' and 'R' are true and 'R' is the correct explanation of 'A'

B. Both 'A' and 'R' are true and 'R' is not the correct explanation of 'A'

C. 'A' is true and 'R' is false

D. 'A' is false and 'R' is true

Answer: A

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6. Assertion: A transistor can be used as an amplifier.

Reason: A small change in input current can change output on a large scale.

A. Both 'A' and 'R' are true and 'R' is the correct explanation of 'A'

B. Both 'A' and 'R' are true and 'R' is not the correct explanation of 'A'

C. 'A' is true and 'R' is false

D. 'A' is false and 'R' is true

Answer: A

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7. The mobility of free electron is greater than that of free holes because

A. Both 'A' and 'R' are true and 'R' is the correct explanation of 'A'

B. Both 'A' and 'R' are true and 'R' is not the correct explanation of 'A'

C. 'A' is true and 'R' is false

D. 'A' is false and 'R' is true

Answer: D

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8. (A) : Silicon is preferred to germanium while constructing zener diodes

(R): Thermal stability and current compatibility of silicon is high when compared to those of germanium.

A. Both 'A' and 'R' are true and 'R' is the correct explanation of 'A'

B. Both 'A' and 'R' are true and 'R' is not the correct explanation of 'A'

C. 'A' is true and 'R' is false

D. 'A' is false and 'R' is true

Answer: A

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9. (A): All the intrinsic semiconductors are insulators at absolute zero

(R): All electrons are tightly bound at absolute zero.

A. Both 'A' and 'R' are true and 'R' is the correct explanation of 'A'

B. Both 'A' and 'R' are true and 'R' is not the correct explanation of 'A'

C. 'A' is true and 'R' is false

D. 'A' is false and 'R' is true

Answer: A

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10. (A): When a donor electron is excited to the conduction band no hole is created

(R): Donor energy level does not exist in the valence band.

A. Both 'A' and 'R' are true and 'R' is the correct explanation of 'A'

B. Both 'A' and 'R' are true and 'R' is not the correct explanation of 'A'

C. 'A' is true and 'R' is false

D. 'A' is false and 'R' is true

Answer: A

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11. Assertion: When base region has large width, the collector current increases.

Reason: Electron hole combination in base result in increase of base current.

A. Both 'A' and 'R' are true and 'R' is the correct explanation of 'A'

B. Both 'A' and 'R' are true and 'R' is not the correct explanation of 'A'

C. 'A' is true and 'R' is false

D. 'A' is false and 'R' is true

Answer: A

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12. Why are Si and GaAs are preferred materials for solar cells?

A. Both 'A' and 'R' are true and 'R' is the correct explanation of 'A'

B. Both 'A' and 'R' are true and 'R' is not the correct explanation of 'A'

C. 'A' is true and 'R' is false

D. 'A' is false and 'R' is true

Answer: A

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Exercise Ii Energy Bands And Classification Of Solids

1. The forbidden gap in germanium crystal is

A. 0.7eV

B. 1.12×10^{-19}J

C. Both 1 and 2

D. 1.1eV

Answer: C

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2. A semiconductor is known to have an electron concentration of $5x10^{12}cm^{-3}$ and a hole concentration $8x10^{13}cm^{-3}$. (i)Is the semiconductor n-type of p-type ? (ii)What is the resistivity of the sample. If the electron mobility is

$23,000 cm^2 v^{-1} s^{-1}$, and $ho \leq mobility is$

100cm^(2)v^(-1)s^(-1) ' Take charge on electron,

e=.16x10^(-19)c.

A. n-type

B. p-type

C. intrinsic

D. insulator

Answer: A

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3. The width of forbidden gap in silicon crystal is 1.1eV. When the crystal is converted into n-type semiconductor, then the distance of fermi energy level from conduction band is

A. equal to 0.55eV

B. equal to 1.leV

C. less than 0.55eV

D. greater than 0.55eV

Answer: C

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Exercise Ii P N Junction Diode

1. In a p-n junction diode the thickness of depletion layer is 2×10^{-6}m and barrier potential is 0.3 V. The intensity of the electric field at the junction is :

A. $0.6 \times 10^{-6} Vm^{-1}$ from n to p side

B. $0.6 \times 10^{-6} Vm^{-1}$ from p to n side

C. $1.5 \times 10^{5} Vm^{-1}$ from n to p side

D. $1.5 \times 10^5 Vm^{-1}$ from p to n side

Answer: C

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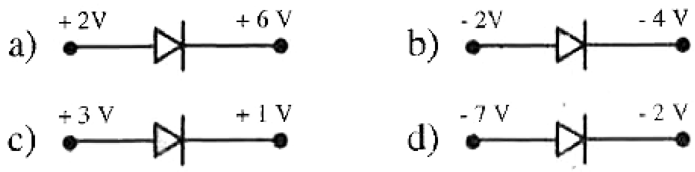
2. Which of the following junction diodes are forward biased ?



A. c only

B. a,b & c only

C. b & c only

D. b & d only

Answer: B

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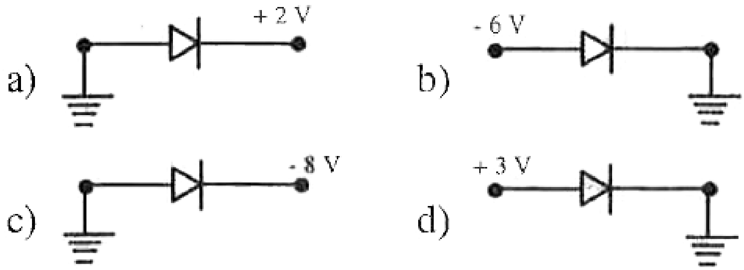
3. Which of the following junction diodes are reverse biased?



A. a and b only

B. c and d only

C. a and c only

D. b and d only

Answer: A

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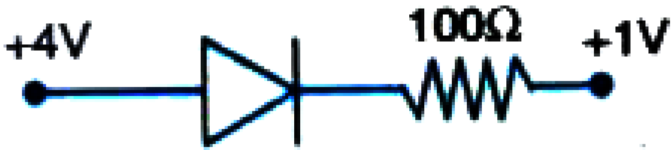
4. The junction diode shown in figure is ideal.

Find the current in the circuit



A. 50A

B. 30A

C. 50mA

D. 30mA

Answer: D

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5. The current from below circuit if forward resistance of the diode in 30Ω is

A. 0.03A

B. 0.01A

C. 0.5A

D. 0.1A

Answer: A

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6. A cell of emf 4.5V is connected to a junction diode whose barrier potential is 0.7V. If the external resistance in the circuit is 190Ω, then the current in the circuit is

A. 20mA

B. 2mA

C. 0.2mA

D. 0.02mA

Answer: A

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7. A p-n junction diode can withstand current up to 10 mA under forward bias, the diode has a potential drop of 0.5 V across it which is assumed to be independent of current what is the maximum voltage of battery used to forwaed bias the diode when a resistance of 200Ω is connected in series with it.

A. 2.5V

B. 4V

C. 5V

D. 1.25V

Answer: A

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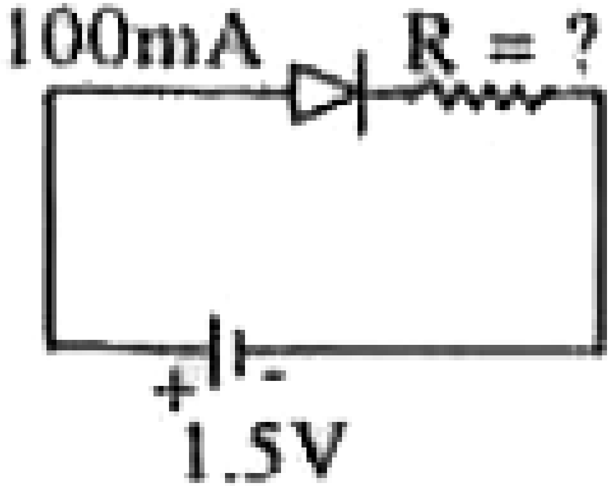
8. Calculate the value of R, if the maximum value of forward current of the diode is 100 mA, when diode is Ge (barrier potential = 0.3V)



A. 12Ω

B. 10Ω

C. 8Ω

D. 9Ω

Answer: A

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9. In a p-n junction, the depletion region is 400nm wide and and electric field of $5 \times 10^5 Vm_{-1}$exists in it (a)Find the height of the potential barrier, (b)What should be the minimum kinetic energy of a conduction electron which can diffuse from the n-side to the p-side?

A. 0.1 eV

B. 0.3 eV

C. 0.2 eV

D. 0.4 eV

Answer: C

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10. In a p-n junction, a potential barrier of 250 MeV exists across the junction. A hole with a kinetic energy of 300 MeV approaches the junction. Find the kinetic energy of the hole when it crosses the junction if the hole approached the junction from the p - side

A. 100 meV

B. 50 meV

C. 150 meV

D. 200 meV

Answer: B

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11. When a p-n junction is reverse-biased,the current becomes almost constant at 25μA. current of when it is forward biased at 200 mV . a current of 75μA is obtained.Find the magnitude of diffusion current when the diode is (a)unbiased ,(b)reverse-biased at 200 mVand (c)forward-biased at 200mV.

A. $50\mu A$, Zero, $100\mu A$

B. $25\mu A$, Zero, 100μA

C. $25\mu A$, $10\mu A$, 100μA

D. $25\mu A$, $10\mu A$, Zero

Answer: B

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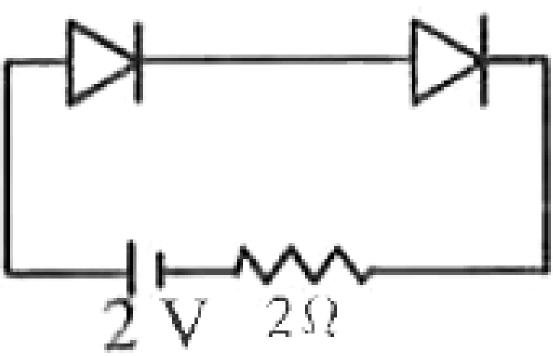
12. Find the current through the resistance in the circuits shown in figure (ideal diode)



A. $1A$

B. Zero

C. 2A

D. 3A

Answer: A

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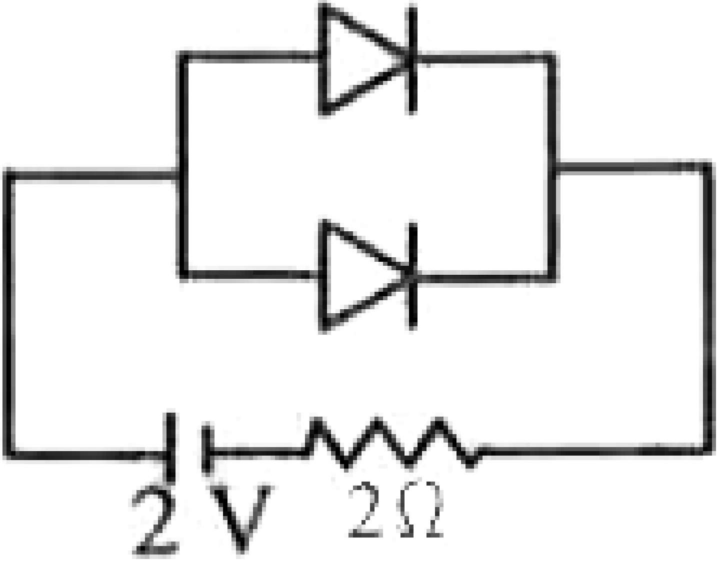
13. Find the current through the resistance in the circuit shown in figure(ideal diode)



A. 1A

B. Zero

C. 2A

D. 3A

Answer: A

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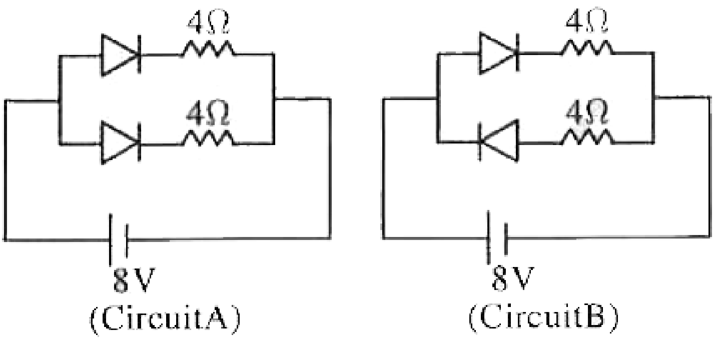
14. Currents in each of the following circuits, A and B respectively are



A. 1A, 2A

B. 4 A, 2 A

C. 2 A, 1A

D. 2 A, 4 A

Answer: C

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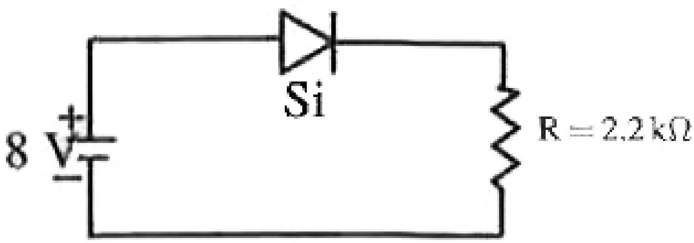
15. The potential difference across the diode is



A. 0.7 V

B. 8.7 V

C. 7.3 V

D. 8 V

Answer: A

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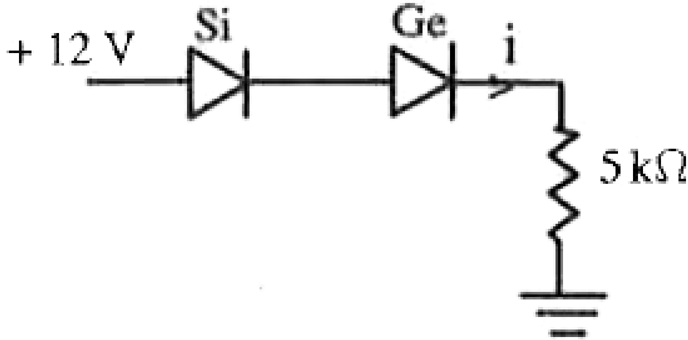
16. The current flow through the resistance in the given circuit is



A. $2.2mA$

B. 3.2 mA

C. 2.4 mA

D. 3 mA

Answer: A

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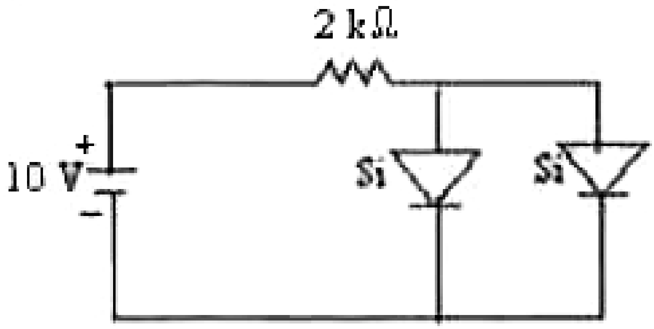
17. The current flow through the resistance in the given circuit is



A. 4.65 mA

B. 5 mA

C. 4.8 mA

D. 5.2 mA

Answer: A

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18. The potential barrier of a P-N junction diode is 50 meV, When an electron having energy 400 meV travels from P to N, after crossing the junction the energy of the electron is

A. 450 meV

B. 350 meV

C. 400 meV

D. 300 meV

Answer: A

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19. A full-wave rectifier is used to convert 'n'Hz a.c into d.c, then the number of pulses per second present in the rectified voltage is

A. n

B. n/2

C. 2n

D. 4n

Answer: C

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20. The applied a.c power to a half-wave rectifier is 200W. The d.c power output obtained is 50W. The rectification efficiency is

A. $12.5\ \%$

B. $25\ \%$

C. $37.5\ \%$

D. $50\ \%$

Answer: B

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21. A full wave p-n junction diode rectifier uses a load resistance of 1300Ω. The internal resistance of each diode is 9Ω. Find the efficiency of this full wave rectifier.

A. 72%

B. 80.64%

C. 75%

D. 79%

Answer: B

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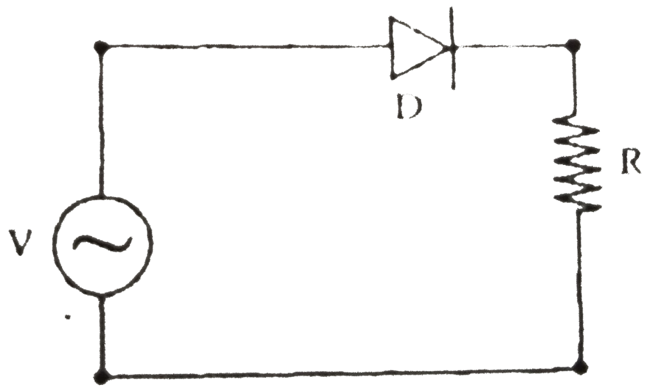
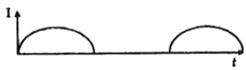
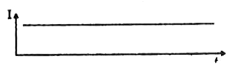
22. A $p-n$ junction (D) shown in the figure can act as a rectifier. An alternating current source (V) is connected in the circuit



A. 

B. 

C. 

D. 

Answer: B

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23. A full-wave p-n diode rectifier uses a load resistor of 1500Ω. No filter is used. The forward bias resistance of the diode is 10Ω. The efficiency of the rectifier is

A. 81.2%

B. 40.6%

C. 80.4%

D. 40.2%

Answer: C

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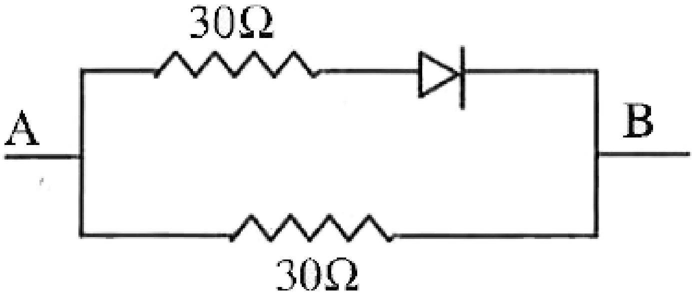
24. If VA and VB, denote potentials of A and B, then the equivalent resistance between A and

B in the adjoining circuit is the diode is ideal)



A. 15Ω if $C_A > V_B$

B. 30Ωif $V_A < V_B$

C. Both 1 and 2

D. neither 1 nor 2

Answer: C

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25. In a silicon diode, the reverse current increases from $10\mu A$to $20\mu A$, when the reverse voltage changes from 2 to 4V.The reverse ac resistance of the diode is

A. $1 \times 10^5\Omega$

B. $3 \times 10^5\Omega$

C. $2 \times 10^5\Omega$

D. $4 \times 10^5\Omega$

Answer: C

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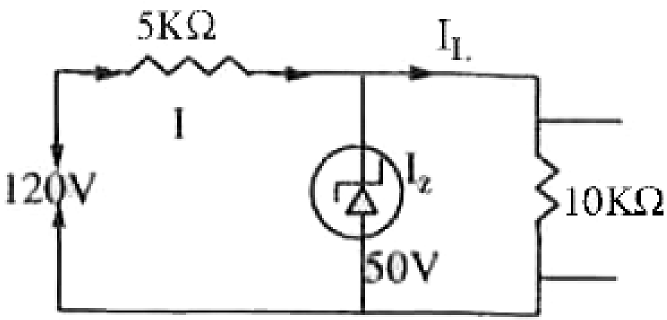
26. In the figure shown, the currents through the series resistance and load resistance are respectively



A. 9mA, 14mA

B. 14mA, 5mA

C. 1mA, 14mA

D. ImA, 6mA

Answer: B

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Exercise Ii Transistors

1. The current gain of a transistor in common base and common-emitter configurations called α and β are related as

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

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

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

D. both 1 & 2

Answer: D

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2. For a transistor,$\alpha = 0.9$, the value of β is

A. 9

B. 0.1

C. 0.09

D. 0.01

Answer: A

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3. The current amplification factor α of a common base transistor and the current amplification factor $\beta$of a common emitter transistor are not related by

A. 0.8

B. 2

C. 40

D. 4

Answer: D

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4. For a transistor, the current gain of common-base configuration is 0.8. If the transistor is in common emitter configuration and the base current changes by 5mA, find the change in collector current.

A. 4mA

B. 20mA

C. 1mA

D. 10mA

Answer: B

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5. Calculate the current amplification factor β when change in collector current is 1mA and change in base current is $20\mu A$.

A. 50

B. 25

C. 75

D. 100

Answer: A

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6. A change of 200mV in base-emitter voltage causes a change of 100μA in the base current. Find the input resistance of the transistor

A. $1k\Omega$

B. $2k\Omega$

C. $6k\Omega$

D. $8k\Omega$

Answer: B

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7. The emitter current in a transistor is 2.2mA and the collector current is 2mA. The base current is

A. $100\mu A$

B. $200\mu A$

C. $300\mu A$

D. $400\mu A$

Answer: B

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8. While a collector-emitter voltage is constant in a transistor, the collector current changes by 8.2mA when the emitter current changes by 8.3mA. The change in base current is

A. $100 \mu A$

B. $200 \mu A$

C. $300 \mu A$

D. $400 \mu A$

Answer: A

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9. In a transistor if $\frac{I_C}{I_E} = \alpha$and $\frac{I_C}{I_B} = \beta$If α varies between $\frac{20}{21}$ and $\frac{100}{101}$ then the value of β lies between

A. $1 - 10$

B. $0.95 - 0.99$

C. $20 - 100$

D. $200 - 300$

Answer: C

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Exercise Ii Logic Gates

1. Which of the following logic gates the given truth table represents

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

A. NOT gate

B. NOR gate

C. OR gate

D. AND gate

Answer: D

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2. Which of the following logic gates the given truth table represents

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

A. XOR gate

B. NOR gate

C. AND gate

D. OR gate

Answer: B

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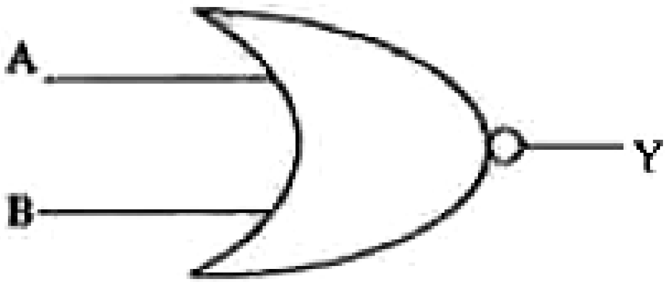
3. The logic symbol shown in figure represents



A. OR gate

B. XOR gate

C. NAND gate

D. NOR gate

Answer: D

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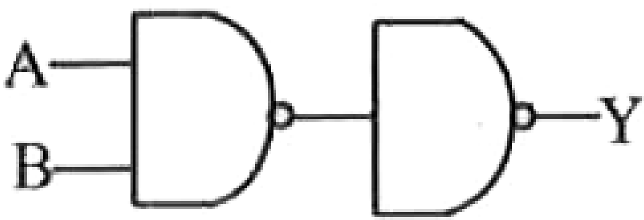
4. The arrangement shown in figure performs the logic function of



A. AND gate

B. NAND gate

C. OR gate

D. XOR gate

Answer: A

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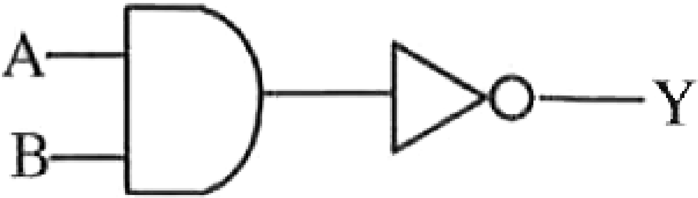
5. The name of the gate obtained by the combination as shown is



A. NAND

B. NOR

C. NOT

D. XOR

Answer: A

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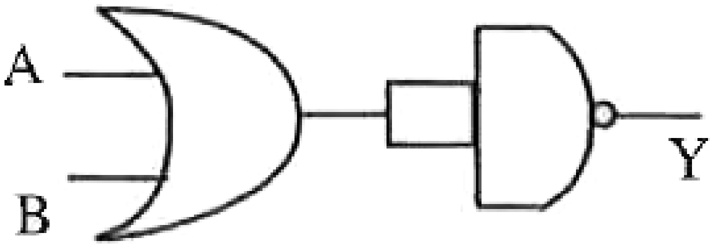
6. Identify the gate represented by the block diagram is



A. AND

B. NOT

C. NAND

D. NOR

Answer: D

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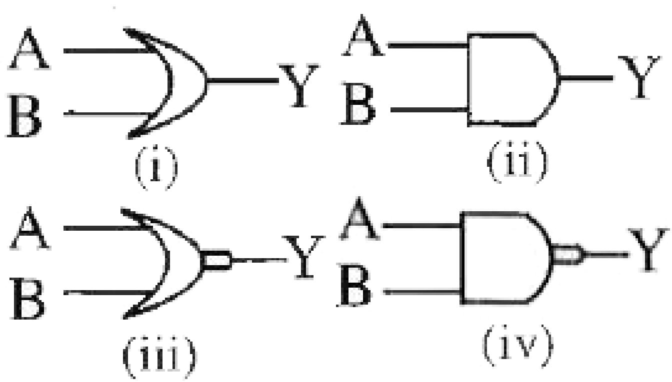
7. Given below are four logic gate symbols. Those for OR, NOR and AND are respectively



A. i, iv, iii

B. iv, i, ii

C. iii, ii, i

D. i, iii, ii

Answer: D

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8. In Boolean expression which gate is expressed as $y = \overline{A + B}$

A. OR

B. NAND

C. AND

D. NOR

Answer: D

Watch Video Solution

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

A. 0,0

B. 0,1

C. 1,0

D. 1,1

Answer: D

Watch Video Solution

10. In the given Boolean expression, $Y = A.\overline{B} + B.\overline{A}$, if A=1, B=1 then Y will be

A. 0

B. 1

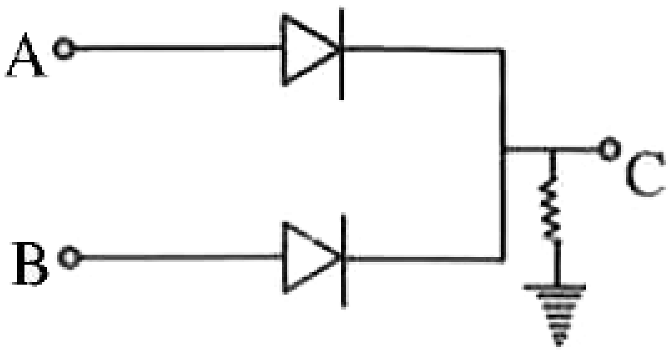
C. 11

D. 10

Answer: A

Watch Video Solution

11. In the circuit below, A and B represent two inputs and C represents the output. The circuit represents



A. NOR gate

B. AND gate

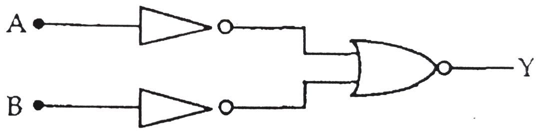
C. NAND gate

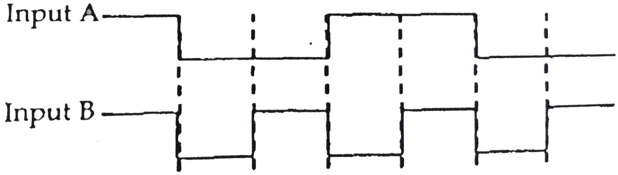
D. OR gate

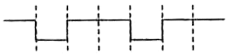
Answer: D

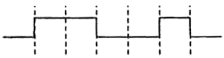
Watch Video Solution

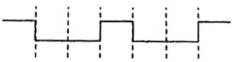
12. The logic circuit shown below has the input waveforems 'A' and 'B' as shown. Pick out the correct output waveform

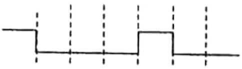




A. 

B. 

C. 

D. 

Answer: D

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Practice Exercise Energy Bands And Classification Of Solids

1. The for bidden gap in the energy bands of sillcon is

A. 0.7eV

B. 1.1eV

C. $1.76 \times 10^{-19} J$

D. Both 2 and 3

Answer: D

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2. The concentration of electrons in a semiconductor is $3 \times 10^{13} / cm^3$ and hole concentration is$5 \times 10^{14} / cm^3$. The semiconductor is

A. n-type

B. p-type

C. intrinsic

D. insulator

Answer: B

Watch Video Solution

3. The width of forbidden gap in silicon crystal is 1.1eV. When the crystal is converted into P-type semiconductor, then the distance of fermi energy level from valance band is

A. equal to 0.55eV

B. equal to 1.1eV

C. less than 0.55e V

D. greater than 0.55eV

Answer: C

Watch Video Solution

4. A potential barrier of 0.5V exists across a pn junction diode. If the width of depletion layer is 10^{-6}m, then the strength of the electric field at the junction is

A. $2 \times 10^{5} Vm^{-1}$ from n to p side

B. $2 \times 10^{-7} Vm^{-1}$ from p to n side

C. $5 \times 10^{5} Vm^{-1}$ from n to p side

D. $5 \times 10^{-7} Vm^{-1}$ from p to n side

Answer: C

Watch Video Solution

5. An intrinsic semi conductor has $10^{18} / m^{3}$ free electron and is doped with pentavalent impurity of $10^{24}/m^3$. Then the free electrons density order increase by

A. 4

B. 3

C. 5

D. 6

Answer: D

Watch Video Solution

6. If a semi conductor has an intrinsic carrier concentration of$1.41 \times 10^{16} / m^{3}$. When doped with $10^{21} / m^{3}$ phosphorous atoms, then the concentration of holes / mat room temperature will be

A. 2×10^{21}

B. 2×10^{11}

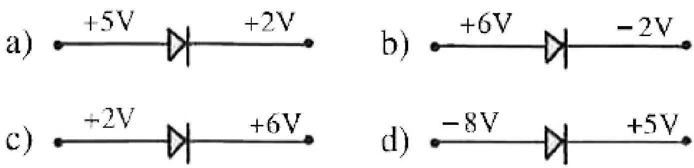
C. 1.41×10^{10}

D. 1.41×10^{16}

Answer: B

Watch Video Solution

7. Which of the following diodes are forward biased ?



A. 'a' only

B. 'b' only

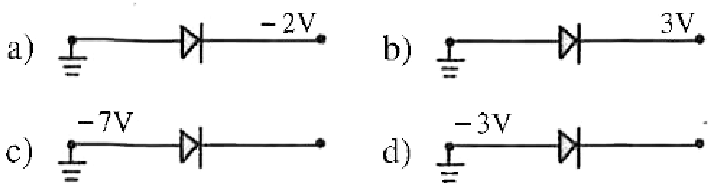
C. a and b only

D. c and d only

Answer: C

Watch Video Solution

8. Which of the following diodes are forward biased ?



A. a' only

B. c only

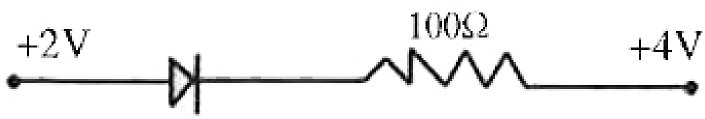
C. a and c only

D. b & d only

Answer: A

Watch Video Solution

9. The junction diode shown in the figure is ideal. The current in the circuit is



A. 60mA

B. 20mA

C. 40mA

D. zero

Answer: D

Watch Video Solution

10. The current from below circuit if forward resistance of the diode is 50Ω

A. 10mA

B. 20mA

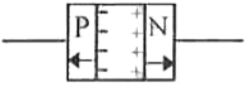
C. 100mA

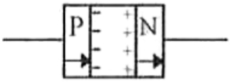
D. 200mA

Answer: A

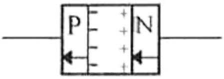
Watch Video Solution

11. The diagram correctly represent the direction of flow of charge carriers in the forward bias of p-n junction is

A. 

B. 

C. 

D. 

Answer: C

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12. The barrier potential in an ideal P-n junction diode is 0.3 volts. The current required is 6 mA. If a resistance of 200Ω is connected in series with the junction diode, then the emf of the cell required for use in the circuit is

A. 0.3 V

B. 1.2 V

C. 0.9 V

D. 1.5 V

Answer: D

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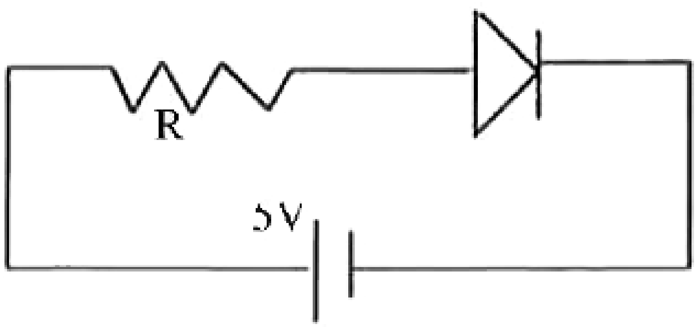
13. The diode used in figure requires minimum current of ImA to be above the knee voltage characteristics. The maximum value of R so that the voltage is above knee point is (Knee voltage of diode is 0.7V)



A. $5k\Omega$

B. $5.7k\Omega$

C. $4.3k\Omega$

D. 3.5Ω

Answer: C

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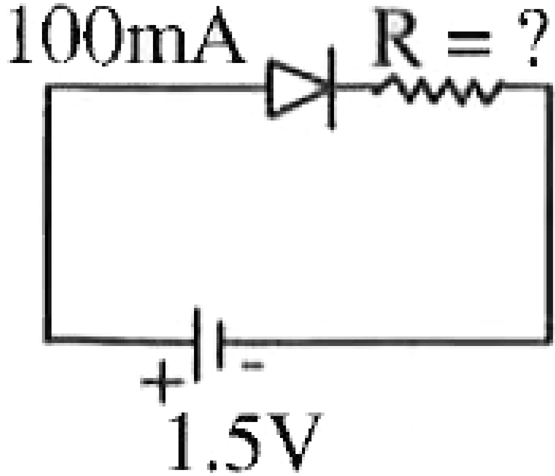
14. Calculate the value of R, if the maximum value of forward current of the diode is 100 mA when diode is (a) Si (Barrier potential = 0.7

V)



A. 8Ω

B. 10Ω

C. 12Ω

D. 11Ω

Answer: A

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15. The potential barrier existing across an unbiased p-n junction is 0.2 volt. What minium kinetic energy a hole should have to diffuse from the p - side to the n - side if (a) the junction is unbiased, (b) the junction is forward-biased at 0.1 volt and (c) the junction is reverse-biased at 0.1 volt ?

A. 0.2 eV, 0.1 eV, 0.3 eV

B. 0.1 eV, 0.2 eV, 0.3 eV

C. 0.1 eV, 0.1 eV, 0.3 eV

D. 0.3 eV, 0.1 eV, 0.2 eV

Answer: A

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16. In a p-n junction, a potential barrier of 250 meV exists across the junction. A hole with a kinetic energy of 300 meV approaches the junction. Find the kinetic energy of the hole when it crosses the junction if the hole approached the junction from the n - side

A. 500 meV

B. 550 meV

C. 5000 meV

D. 55 meV

Answer: B

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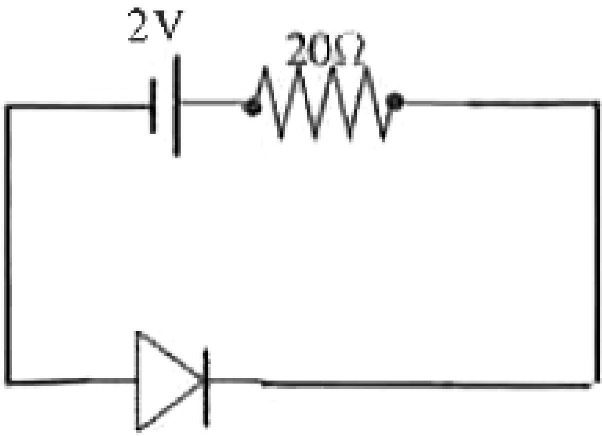
17. Calculate the current through the circuit and the potential difference across the diode shown in figure. The drift current for the diode is 20μ A.



A. $10\mu A, 1.996V$

B. $5\mu A, 1.996V$

C. $20\mu A, 1.996V$

D. $20\mu A, 2V$

Answer: C

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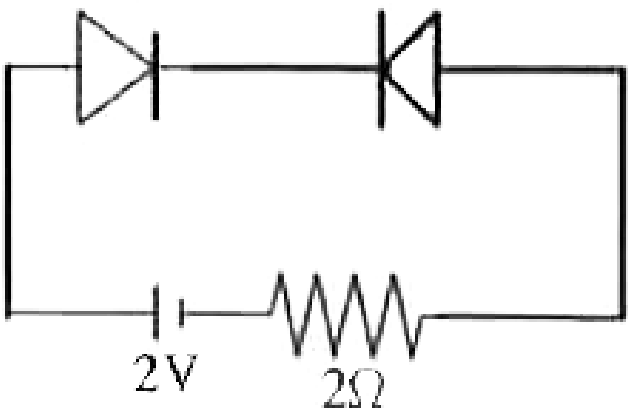
18. Find the currents through the resistances in the circuits shown in figure (Ideal diodes)



A. 1A

B. Zero

C. 2A

D. 3A

Answer: B

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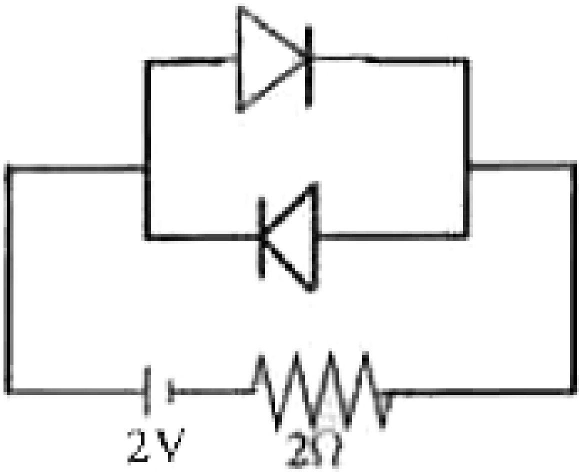
19. Find the currents through the resistances in the circuits shown in figure (Ideal diodes)



A. $1A$

B. Zero

C. 2A

D. 3A

Answer: A

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20. A potential barrier V volts exists across a P-N junction. The thickness of the depletion region is 'd'. An electron with velocity 'v' approaches P-N junction from N-side. The velocity of the electron across the junction is

A. $\sqrt{v^2 + \frac{2Ve}{m}}$

B. $\sqrt{\left(v^2 - \frac{2Ve}{m}\right)}$

C. v

D. $\sqrt{\frac{2Ve}{m}}$

Answer: B

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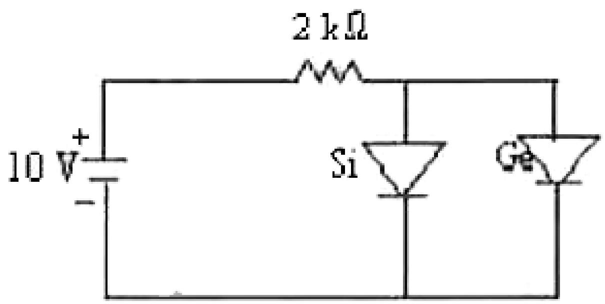
21. The current flow through the resistance in the given circuit is



A. 4.85 mA

B. 5 mA

C. 5.8 mA

D. 4.65 mA

Answer: A

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22. Consider a p-n junction diode which has a potential drop of 0.5 V which is to be taken independent of current (under forward bias). If we want to use 1.5 V cell to forward bias the diode then what should be the value of resistor (in Ω) used in series with the diode so that current may not exceed 10 mA, and hence may work safely.

A. $2 \times 10^2 \Omega$

B. $2 \times 10^5 \Omega$

C. $2 \times 10^3 \Omega$

D. $2 \times 10^4 \Omega$

Answer: A

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23. The potential barrier of a P-N junction diode is 50 meV, When an electron having energy 400 meV travels from N to P, after crossing the junction the energy of the electron is

A. 450 me V

B. 350 meV

C. 400 me V

D. 300 meV

Answer: B

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24. In a half wave rectifier circuit operating from 50 Hz mains frequency, the fundamental frequency in the ripple would be

A. 25Hz

B. 50Hz

C. 70.7Hz

D. 100Hz

Answer: B

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25. A full-wave rectifier is used to convert 50 Hz A.C into D.C, then the number of pulses per second present in the rectified voltage is

A. 50

B. 100

C. 200

D. 400

Answer: B

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26. The applied a.c power to a full-wave rectifier is 400W. The d.c power output obtained is 200W. Rectifier efficiency is nearly

A. 0.25

B. 37.5%

C. 0.5

D. 0.75

Answer: C

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27. In a half wave rectifier, a p-n junction diode with internal resistance 2Ω is used. If the load resistance of $2K\Omega$is used in the circuit, then find the efficiency of this half wave rectifier.

A. 30.2%

B. 38%

C. 40.2%

D. 44%

Answer: C

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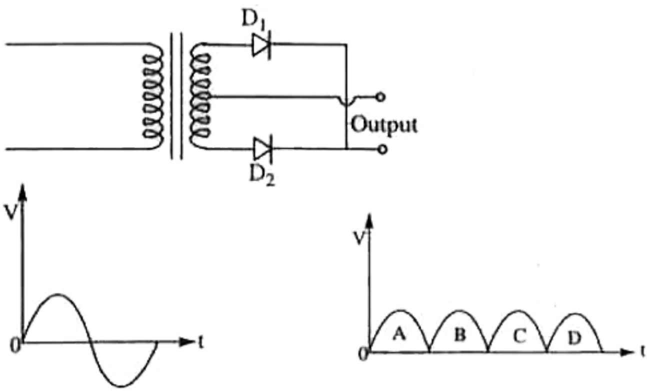
28. A full wave rectifier circuit along with the output is shown in figure. The contribution (s) from the diode 1 is (are):



A. C

B. A, C

C. B, D

D. A, B, C, D

Answer: B

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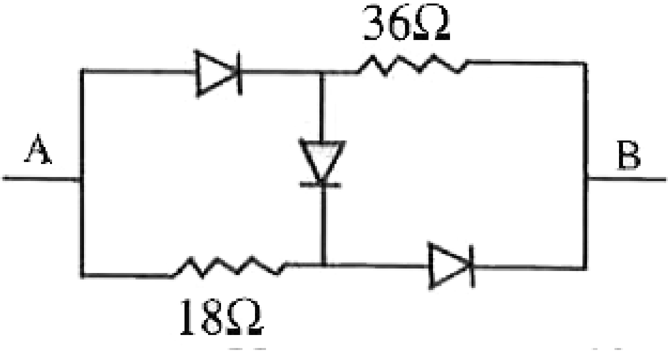
29. The equivalent resistance between A and B is



A. 36Ω If $V_A > V_A$

B. 18Ω if $V_A < V_B$

C. zero if $V_A < V_B$

D. zero if $V_A > V_B$

Answer: D

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30. In a Germanium diode, the forward current increases from 100mA to 200 mA, when forward voltage changes from 5V to 10V. The forward resistance of the diode is

A. 20Ω

B. 50Ω

C. 100Ω

D. 500Ω

Answer: B

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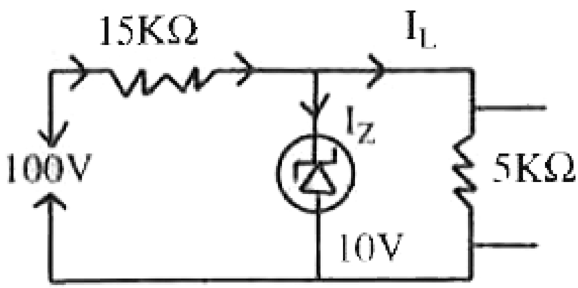
31. In the figure shown, the currents through the zener diode and load resistance are respectively



A. 2mA, 6mA

B. 4mA, 2mA

C. 6mA, 4mA

D. 2mA, 8mA

Answer: B

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Practice Exercise Transistors

1. The current gain of a transistor in common base and common-emitter configurations called α and β are related as

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

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

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

D. both 1 & 3

Answer: D

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2. For a transistor, the value of B = 99, then the value of α is

A. 99

B. 9.9

C. 0.99

D. 100

Answer: C

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3. The current gain of transistor in a common emitter circuit is 40. The ratio of emitter current to base current is.

A. 40

B. 41

C. 42

D. 43

Answer: B

Watch Video Solution

4. A transistor having current amplification β equal to 80 has a change in base current of $250\mu A$, then the change in collector current is

A. $10\mu A$

B. $20\mu A$

C. $20mA$

D. $10mA$

Answer: C

Watch Video Solution

5. In a transistor circuit, when the base current is increased by '100 mu A', keeping the collector voltage fixed at 2V, the collector current increases by 1mA. The current gain of the transistot is

A. 20

B. 40

C. 60

D. 80

Answer: A

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6. If the collector current changes from 2mA to 3mA in a transistor, when collector-emitter voltage is increased from 2 to 10V, then the output resistance of the transistor is

A. $2k\Omega$

B. $4l\Omega$

C. $6k\Omega$

D. $8k\Omega$

Answer: D

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Watch Video Solution

7. The base current in a transistor is $100 \mu A$ and the collector current is 3 mA . The emitter current is

A. $3.9 mA$

B. `3.1 mA

C. 2.4 mA

D. 2.1 mA

Answer: B

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8. For a transistor amplifier the collector load resistance $R_L = 2k\Omega$ and the input resistance $R_i = 1k\Omega$. If the current again is 50 , calculate voltage gain of the amplifier .

A. 100

B. 25

C. 50

D. 75

Answer: A

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Practice Exercise Logic Gates

1. The truth table given below is for

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

A. NAND

B. AND gate

C. XOR gate

D. NOT gate

Answer: A

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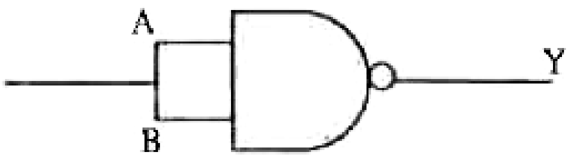
2. The logic symbol shown in figure represents



A. NOT gate

B. OR gate

C. NAND gate

D. NOR gate

Answer: A

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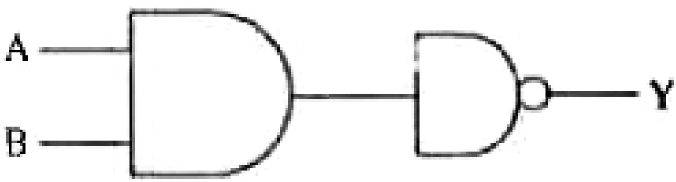
3. Following diagram performs the logic function of



A. OR gate

B. NOR gate

C. AND gate

D. NAND gate

Answer: D

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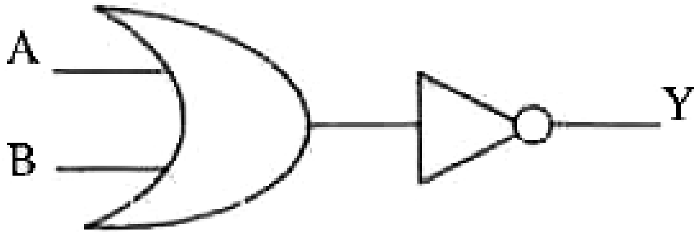
4. The name of the gate obtained by the combination as shown is



A. NAND

B. NOR

C. NOT

D. OR

Answer: B

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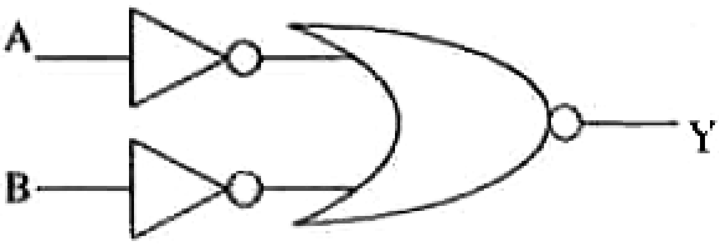
5. Which logic gate is represented by the following combination of logic gates



A. OR

B. NAND

C. AND

D. NOR

Answer: C

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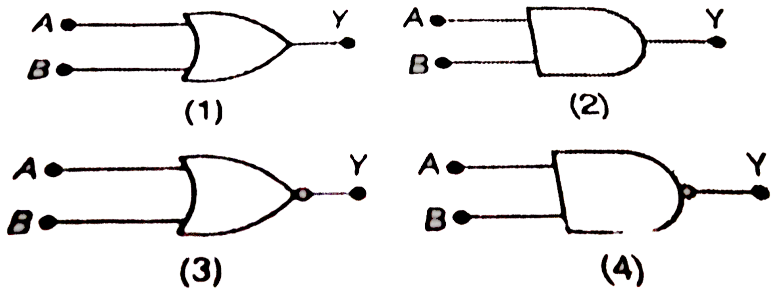
6. Given below are four logic gate symbols. Those for OR, NOR and NAND are respectively



A. IV,I,III

B. II,III,IV

C. I,II,III

D. I,IV,II

Answer: A

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7. In Boolean expression which gate is expressed as $y = \overline{A + B}$

A. OR

B. NAND

C. AND

D. NOR

Answer: B

Watch Video Solution

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

A. 0,0

B. 0,1

C. 1,0

D. 1,1

Answer: A

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9. Show that $AB + \overline{AB}$ is always 1.

A. 0

B. 1

C. 10

D. 11

Answer: B

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10. The following figure shows a logic gate circuit with two inputs A and B and the output C. The voltage waveforms of A, B and C are as given The logic circuit is:

A. OR gate

B. AND gate

C. NAND gate

D. NOR gate

Answer: A

Watch Video Solution

11. The minimum number of gates required to realize this expression $Z = DABC + DA\overline{BC}$ is

A. One

B. Two

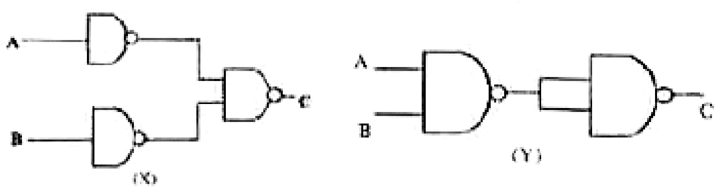
C. eight

D. five

Answer: A

Watch Video Solution

12. The combination of NAND gates shown here under are equivalent to



A. an 'OR ' gate and an 'AND ' gate respectively

B. an 'AND' gate and a 'NOT' gate respectively

C. an 'AND' gate and 'OR' gate respectively

D. an 'OR' gate and an 'NOT' gate respectively

Answer: A

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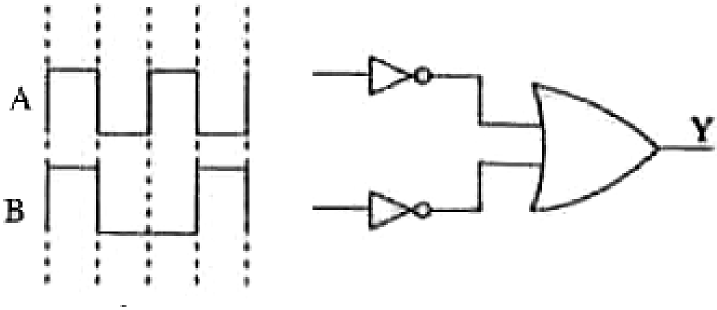
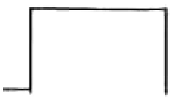
13. In a given circuit as shown the two input wave forms A and B are applied simultaneously

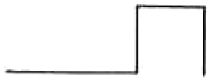


the resultant wave form at Y is

A. 

B. 

C. 

D. 

Answer: A

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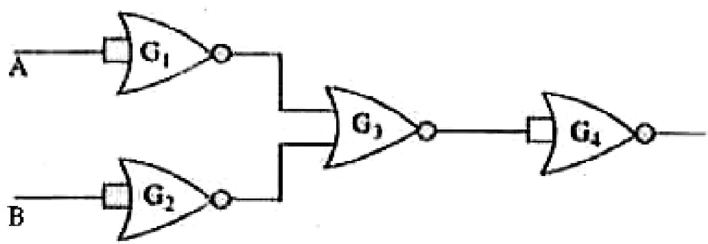
14. The combination of the gates shown below produces



A. AND gate

B. XOR gate

C. NOR gate

D. NAND gate

Answer: D

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15. The output characteristics of an n-p-n transistor represent ,$[I_C =$ Collector current , V_{CE} = potential difference between collector and emitter I_B = Base current , V_{BB} - voltage given to base and emitter]

A. change in I_C as I_B and V_{BB} aare changed

B. changes in I_C with changes in V_{CE} ($I_B =$ constant)

C. changes in I_B with changes in V_{CE}

D. change in I_C as V_{BE} is changed

Answer: B

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Problems

1. The energy of a photon of sodium light $(\lambda = 589nm)$equal the band gap of a semiconducting material.(a)Find the minimum energy E requried to create a hole-electron pair.(b)Find the value of E/kTat a temperature of 300K.

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2. Pure Si at 300 K has equal electron (n_e) and hole (n_h) concentrations of $1.5 \times 10^{18} m^{-3}$. Doping by indium increases n_h to $4.5 \times 10^{22} m^{-3}$. Calculate n_e in the dipoed Si.

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

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4. A semiconductor has an electron concentration of $0.45 \times 10^{12} m^{-3}$ and a hole concentration of $5.0 \times 10^{20} m^{-3}$ Calculate its conductivity. Given electron mobility $= 0.135 m^2 V^{-1} s^{-1}$, hole mobility $= 0.048 m^2 V^{-1} s^{-1}$

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5. A n-type silicon sample of width $4 \times 10^{-3} m$, thickness $25 \times 10^{-5} m$ and length $6 \times 10^{-2} m$ carries a current of 4.8 mA when the voltage is applied across the length of the sample. If the free electron density is $10^{22} m^{-3}$, then find how much time does it take for the electrons to travel the full length of the sample? Given that charge on an electron $e = 1.6 \times 10^{-19} C$

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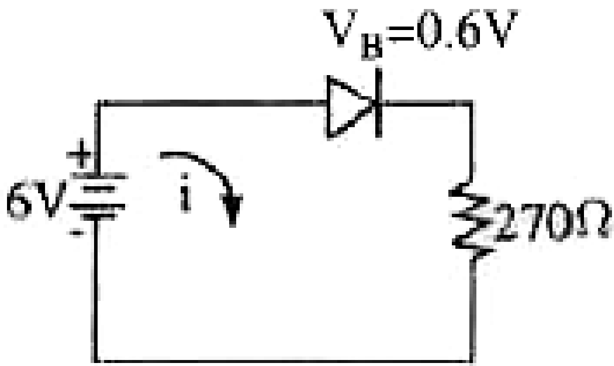
6. In the given circuit diagram. $V_B \approx 0.6V$

Calculate the current i in the circuit.



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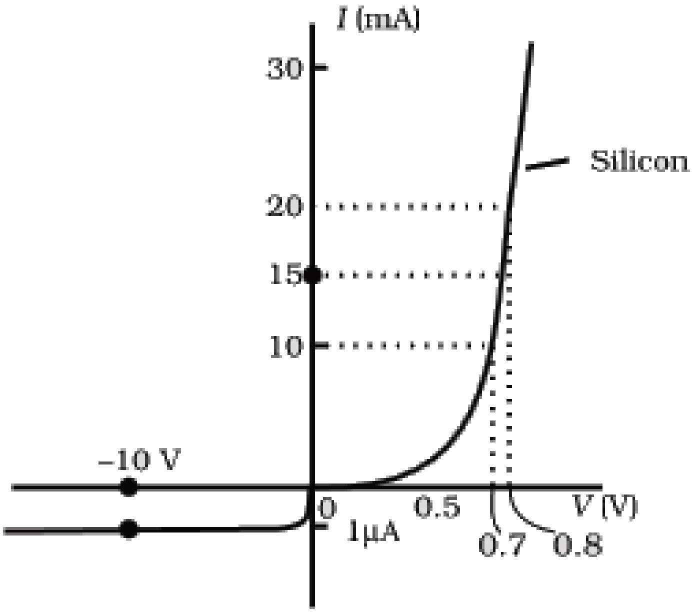
7. The V-I characteristic of a silicon diode is shown in the Fig. 14.17. Calculate the resistance of the diode at (a)

$I_D = 15mA$ and $(b) V_D = -10V$.



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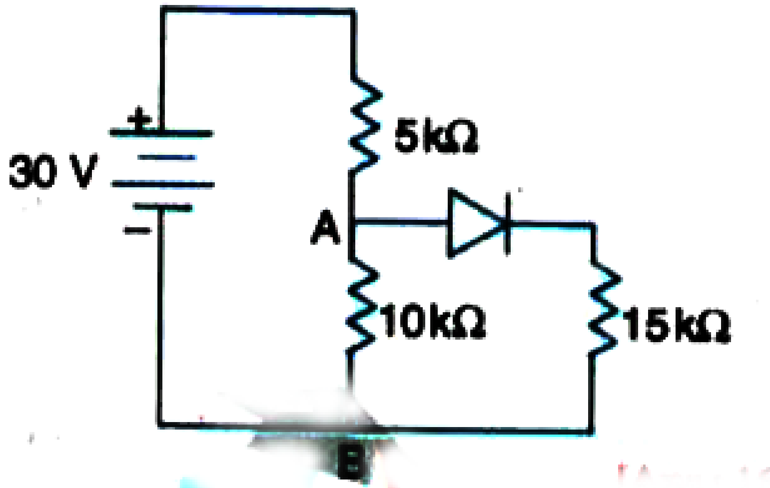
8. Find maximum voltage across AB in the circuit shown in figure. Assume that the diode is ideal.



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9. In a p-n junction, the depletion region is 400nm wide and and electric field of $5 \times 10^5 V m_{-1}$ exists in it (a)Find the height of the potential barrier, (b)What should be the minimum kinetic energy of a conduction electron which can diffuse from the n-side to the p-side?

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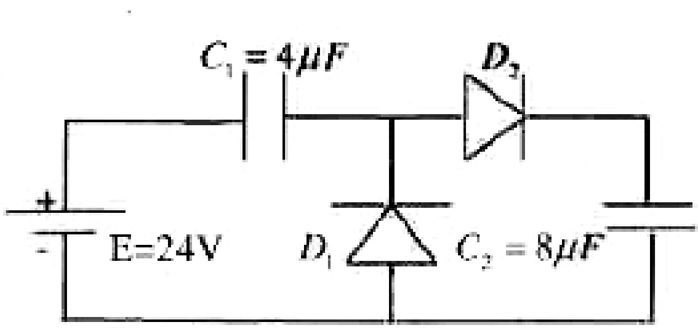
10. In the circuit shown, the potential drop across each capacitor is (assuming the two diodes are ideal)



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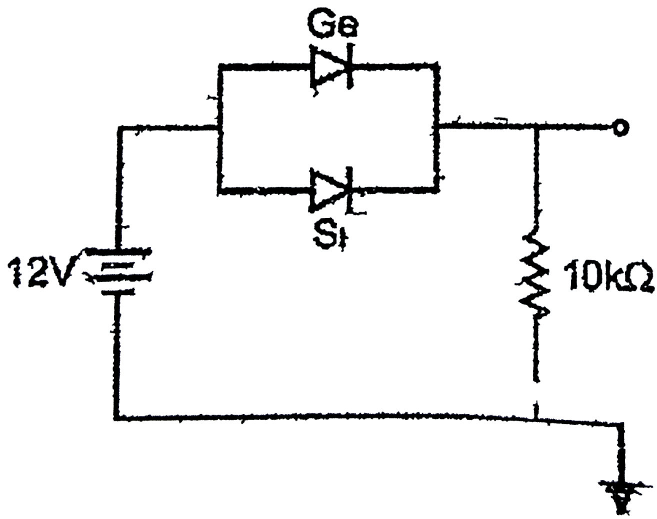

11.

Two junction diodes one of germanium (Ge) and other of sillicon (Si) are connected as shown in figure to a battery of emf 12 V and a load resistance $10k\Omega$ the germanium diode conducts at 0.3 V and silicon diode at 0.7 V.

When a current flows in the circuit, The potential of terminal Y will be

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12. A potential barrier of 0.50V exists across a p-n junction.(a) If the depletion region is 5.0×10^{-7}m wide,what is the intensity of the electric field in this region?(b) An electron with speed$5.0 \times 10^5 ms^{-1}$approaches the p-n junction form the n-side.With what speed will it enter the p-side?

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13. The circuit shown in figure contains two diodes each with a forward resistance of 50Ω and infinite reverse resistance.If the battery voltage is 6 v ,then the current through the 100Ω resistance is

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14. The applied input ac power to a half wave rectifier is 100 W. The dc output power obtained is 40W. Find the rectifier efficiency.

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15. A p-n diode is used in a half wave rectifier with a load resistance of 1000Ω. If the forward resistance (r_f) of diode is 10Ω, calculate the efficiency of this half wave rectifier.

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

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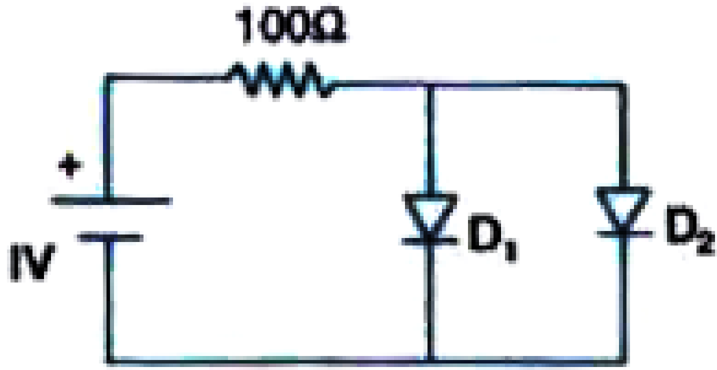
17. Considering the circuit and data given in the diagram calculate the currents flowing in the diodes D_1 and D_2 with linear characteristics.Forward resistance of D_1 and

D_2 is 20 Ω



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18. The current through a P-N junction diode is 55mA at a forward bias voltage of 3.0 V. If the temperature is $27^{\circ} C$, find the static resistance of the diode.

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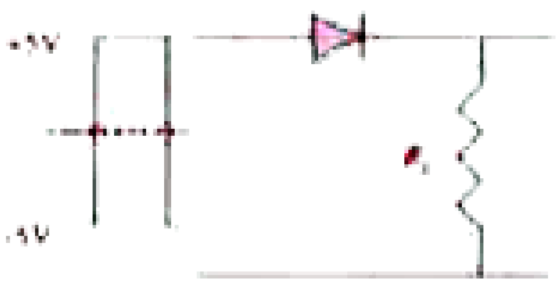
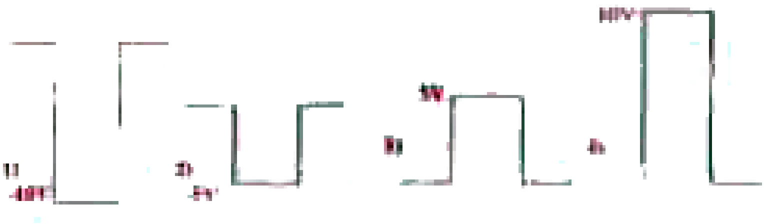
19. If a p-n junction diode, a square input signal of 10V is applied as shown,



then the output signal across R_L will be.



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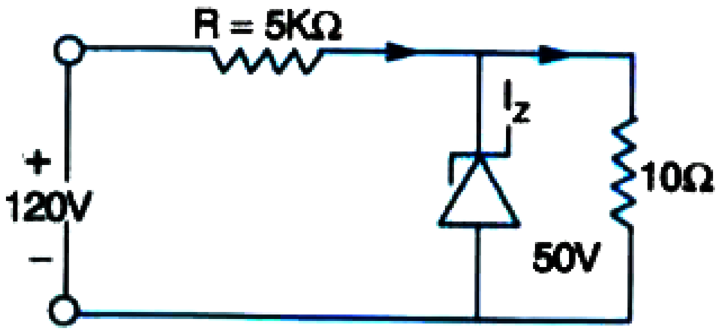
20. For the circuit shown in Fig. find

1) the output voltage

2) the voltage drop across series resistance,

3) the current through Zener diode.



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21. A Zener diode is specified as having a breakdown voltage of 9.1 V,with a maximum power dissipation of 364 mW. What is the maximum current the diode can handle?

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22. In a single state transistor amplifier, when by $10\mu A$ and collector current by 1mA. If collector load $R_C = 2k\Omega$ and $R_L = 10k\Omega$, Calculate : (i) Current Gain (ii) Input impedance, (iii) Effective ac load, (iv) Voltage gain and (v) Power gain.

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23. $AP-N-P$ transistor is used in common-emitter mode in an amplifier circuit. A change of $40\mu A$ in the base current brings a change of 2 mA in collector current and 0.04 V in base-emitter voltage. Find the , (1) input resistance (R_{input}) and

(2). the base current amplification factor (β).

If a load of $6k\Omega$ is used then also find the voltage gain of the amplifier

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24. For a transistor $\beta = 45$, the change in the voltage across $5k\Omega$ resistor which is connected in collector circuit is 5 V. Find the change in base current.

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25. In a transistor $\beta = 45$, the change in the voltage across $5k\Omega$ resistor which is connected in collector circuit is 5V. Find the change in base current.

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26. Current amplification factor of a common base configuration is 0.88. Find the value of base current when the emitter current is 1 mA.

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27. In a transistor, ihe emitter circuit resistance is 100Ω and the collector resistance is 100Ω. The power gain, if the emitter and collector currents are assumed to be equal, will be

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28. An n-p-n transistor in a common-emitter mode is used as a simple voltage-amplifier with a collector current of 4 mA. The terminals of a 8 V battery is connected to the collector through a load-resistance R_L and to the base through a resistance R_B. The collector-emitter voltage $V_{CE} = 4V$, the base-emitter voltage $V_{BE} = 0.6V$ and the current amplification factor $\beta_{dc} = 100$. Then

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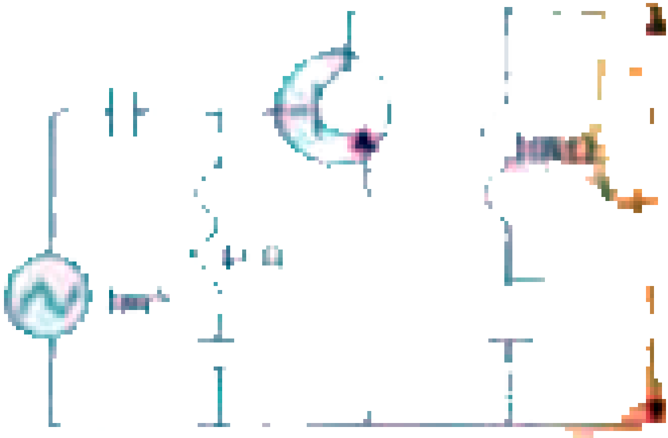
29. In the following common - emitter configuration an $n - p - n$ transistor with $\beta = 100$ is used. The output voltage of the amplifier will be



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30. The overall gain of a multistage amplifier is 100. When negative feedback is applied, the

gain reduces to 10. Find the fraction of the output that is feedback to the input.

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31. Calculate the gain of

a negative feedback amplifier with an internal gain of A = 100 and feedback factor $\beta = \frac{1}{1000}$

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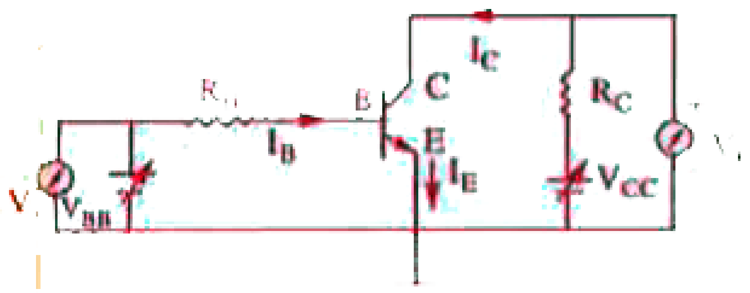
32. For a CE-transistor amplifier fig. The audio signal voltage across the collector resistance of $1.0k\Omega$ is 1.0 V. suppose the current amplification factor of the transistor is 100, what should be the value of R_B in series with V_{BB} supply of 1.0 V if the de base current has be 10 times the signal current, assuming $V_{RE} = 0.6V$. Also calculate the voltage drop across the collector resistance.



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33. In a negative feedback amplifier ,the gain without feedback is 100,feed back ratio is 1/25 and input voltage is 50 m V.Calculate.

i)gain with feedback

ii)feedback factor

iii)output voltage

iv)feedback voltage

v)new input voltage so that output voltage with feedbck the output voltage without feedback

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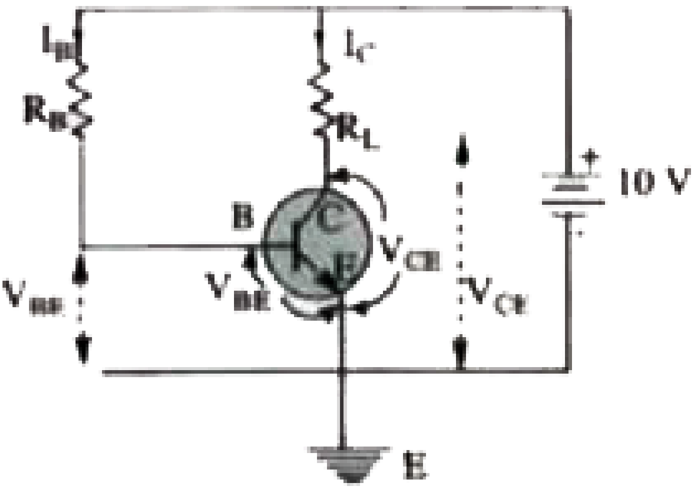
34. A npn transistor in a common emitter mode is used as a simple voltage amplifier with a collector current of 5 m A. The terminal of 10V battery is connected to a collector through a load resistance R_L and to the base through a resistance R_B. The collector emitter voltage $V_{CE} = 5V$, base emitter voltage, $V_{BE} = 0.5V$ and base correct amplification factor $\beta_{d.c} = 100$. Calculate the values of

R_L and R_B



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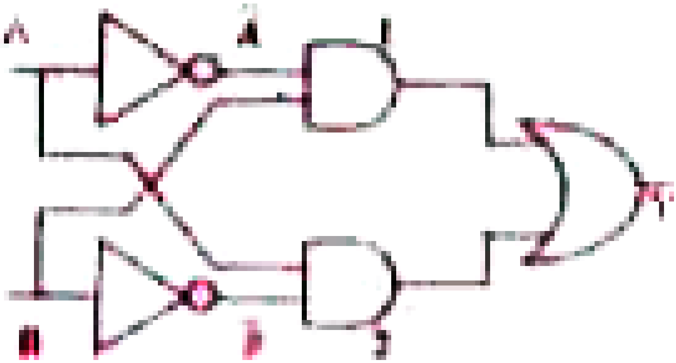
35. The Boolean expression of the output Y of the inputs A and B for the circuit shown in the fig



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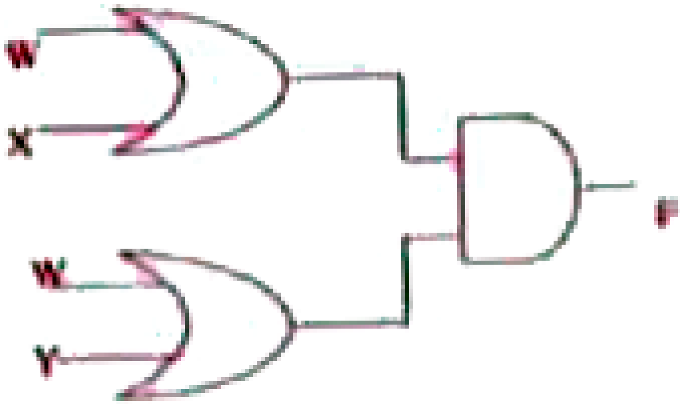
36. The diagram of a logic circuit is given below. The output of the circuit is represented

by



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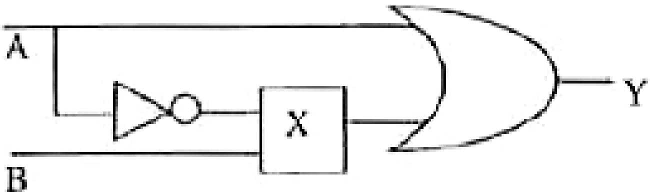
37. The logic circuit and its truth table are given, what is the gate X in the diagram

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



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38. Draw the logic circuit corresponding to the boolean expression. $Y = AB + \overline{B}C.$

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39. Simplify $Y = AB + ABC + \overline{A}B + A\overline{B}C$ using Boolean Algebra. Draw the resultant simplified logic circuit.

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40. Draw logic diagrams for the Boolean expressions given below.

(i) $A.\overline{B} + \overline{A}.B = Y$, (ii) $(A + \overline{B}).(\overline{A} + B) = Y$

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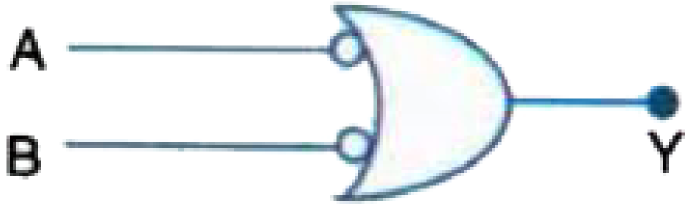
41. Write Boolean equation for the output of fig. and solve this equation for all possible input conditions.



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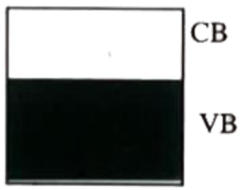
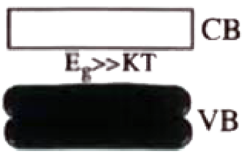
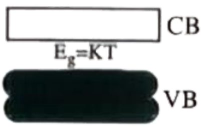
Exercise Ia

1. Which of the energy band diagram shown in the figure corrensponds to that of a semiconductor

A. 

B. 

C. 

D. 

Answer:

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2. The bond that exists in a semi conductor is

A. Covalent Bond

B. Ionic Bond

C. Metallic Bond

D. Hydrogen Bond

Answer:

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3. A solid which is not transparent to visible light end whose conductivity increases with temperature is formed by-

A. metallic bonding

B. ionic bonding

C. covalent bonding

D. vander walls bonding

Answer:

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4. A piece of copper and another of germanium are cooled from room temperature to $80K$. The resistance of

A. each of these decreases

B. copper strip increases and that of germanium decreases

C. copper strip decreases and that of increases germanium

D. each of these increases.

Answer:

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5. In a semiconductor, the separation between conduction band and valence band is of the order of

A. 100 eV

B. 10 eV

C. 1eV

D. 0 eV

Answer:

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6. The intrinsic semi conductor behaves as insulator at

A. 0°

B. -100°

C. 100K

D. 0 K

Answer:

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7. The energy gap for an insulator may be

A. 0.7 eV

B. 0.1 MeV

C. 1.1 eV

D. 5 eV

Answer:

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8. In case of a semi conductor, which one of the following statements is wrong?

A. Resistivity is in between that of a conductor and insulator

B. Temperature coefficient of resistance is negative

C. Doping increases conductivity

D. At absolute zero it behaves as a conductor

Answer:

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9. An electric field us applied to a semiconductor.Let the number of charge carriers be n and the average drift speed be v.If the temperature is increased,

A. both n and v will increase

B. n will increase but v will decrease

C. v will increase but n will decrease

D. both n and v will decrease

Answer:

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10. Lets $n_p$and n_e be the number of holes and conduction electrons in an intrinsic semiconductor.

A. $n_p > n_e$

B. $n_p = n_e$

C. $n_p < n_e$

D. $n_p \neq n_e$

Answer:

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

A. increases

B. decreases

C. remains the same

D. becomes zero

Answer:

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12. Diffusion current in a p-n junction is greater than the drift current in magnitude

A. if the junction is forward - biased

B. if the junction is reverse - biased

C. if the junction is unbiased

D. in no case

Answer:

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13. In an intrinsic semiconductor, the fermi energy level lies

A. nearer to valence band

B. nearer to conduction band

C. exactly at the middle of the forbidden energy gap

D. Cant' say

Answer:

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14. The mobility of free electron is greater than that of free holes because they

A. are lighter

B. have negative charge

C. need less additional energy to move

D. experience collisions less frequently

Answer:

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15. The value indicated by fermi-energy level in an intrinsic semiconductor is

A. The average energy of electrons and holes

B. The energy of electrons in conduction band

C. The energy of holes in valence band

D. The energy of forbidden region

Answer:

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16. A semiconducting device is connected in a series in circuit with a battery and a resistance. A current is allowed to pass through the circuit. If the polarity of the battery is reversed, the current drops to almost zero. The device may be

A. an intrinsic semiconductor

B. a p - type semiconductor

C. an n - type semiconductor

D. a p-n junction

Answer:

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17. Pure semiconductor is known as

A. an infinite resistance at $0^{\circ}C$

B. a finite resistance which doesn't depend upon temperature

C. a finite resistance which increases with increase of temperature

D. a finite resistance which decreases with increase of temperature

Answer:

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18. A doped semiconductor is

A. positively charged

B. negatively charged

C. electrically neutral

D. may be positive or negative

Answer:

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19. The potential barrier, in the depletion layer , is due to

A. Electrons

B. Holes

C. Ions

D. Forbidden Band

Answer:

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20. A P-type semiconductor can be formed by doping Si or Ge with

A. III group element

B. IV group elements

C. V group elements

D. VI group elements

Answer:

Watch Video Solution

21. An-type and P-type silicon can be obtained by doping pure silicon with

A. Arsenic and Phosphorous

B. Indium and Aluminium

C. Phosphorous and Indium

D. Aluminium and Boron

Answer:

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22. In an n-type semiconductor, the fermi energy level lies

A. in the forbidden energy gap nearer to the conduction band

B. in the forbidden energy gap nearer to the valence band

C. in the middle of forbidden energy gap

D. outside the forbidden energy gap

Answer:

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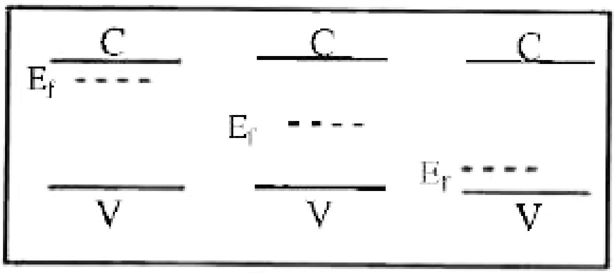
23. The band diagrams of three semiconductors are given in the figure. From left to right they are respectively.



A. n-intrinsic-p

B. p-intrinsic-n

C. intrinsic-p-n

D. intrinsic-n-p

Answer:

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24. The element that can be used as an acceptor impurity to doped silicon is

A. Antimony

B. Arsenic

C. Boron

D. Phosphorous

Answer:

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25. In extrinsic semiconductors

A. The conduction Band and Valence Band overlap

B. The gap between Conduction Band and Valence Band is more than 16eV

C. The gap between C.B. and V.B. is nearly about 1eV

D. The gap between C.B. and V.B. will be 100eV and more

Answer:

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26. The potential barrier at a P-n junction is due to the charges on either side of the junction. These charges are

A. Fixed ions

B. Majority carriers

C. Both majority and minority carriers

D. Minority carriers

Answer:

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27. If the two ends of a p-n junction are joined by a wire .

A. there will not be a steady current in the circuit

B. there will be a steady current from the n-side to the p - side

C. there will a steady current from the p - side to the n - side

D. there may or may not be a current depending upon the resistance of the connecting wire

Answer:

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28. The drift current in a p-n junction is

A. from the n - side to the p - side

B. from the p - side to then – side

C. from the n-side to the p- side if the junction is forward biased and in the opposite direction if it is reverse - biased

D. from the p - side to the n – side if the junction is forward - biased and in the opposite direction if it is reverse - biased

Answer:

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29. The diffusion current in a p-n junction is

A. from the n - side to the p - side

B. from the p - side to then side

C. from the n - side to the p - side if the

function is forward-biased and in the

opposite direction if it is reverse- biased

D. from the p- side to the n- side if the junction is forward - biased and in the opposite direction if it is reverse - biased.

Answer:

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30. The electrical resistance of depletion layer is large because

A. It contains electrons as charge carriers

B. It contains holes as charge carriers

C. It has large number of charge carriers

D. It has no charge carriers

Answer:

Watch Video Solution

31. In a P-N junction diode which is not connected to any circuit-

A. the potential is the same everywhere

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

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

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

Answer:

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32. The dominant mechanism for motion of charge carriers in forward and reverse biased silicon p-n junction are

A. drift in forward bias, diffusion in reverse bias

B. diffusion in forward bias, drift in reverse bias

C. diffusion in both forward and reverse bias

D. drift in both forward and reverse bias

Answer:

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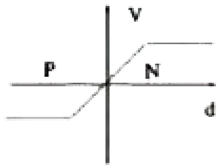
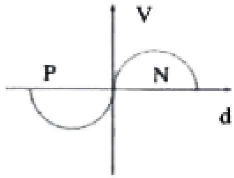
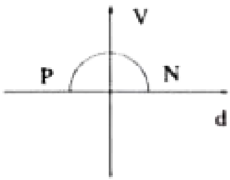
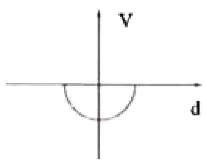
33. The correct curve between potential and distance near P-N junction is

A. 

B. 

C. 

D. 

Answer:

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34. Potential barrier developed in a junction diode opposes the flow of

A. free electrons from n-region

B. holes from P-region

C. majority carriers from both the regions

D. minority carriers from both regions

Answer:

Watch Video Solution

35. When $p-n$ junction diode is forward biased, then

A. the depletion region is reduced and barrier height is increased

B. the depletion region is widened and barrier height is reduced.

C. both the depletion region and barrier height are reduced

D. both the depletion region and barrier height are increased.

Answer:

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

A. electric field is zero

B. potential is maximum

C. electric field is maximum

D. potential is zero

Answer:

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37. Avalanche breakdown in a semiconductor diode occurs when-

A. forward current exceeds a certain value

B. reverse bias voltage exceeds a certain value

C. forward bias voltage exceeds a certain value

D. the potential barrier is reduced to zero

Answer:

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38. When a p-n junction diode is reverse biased the flow of current across the junction is mainly due to

A. Diffusion of charges

B. Drift of charges

C. Both drift and diffusion of charges

D. Neither diffusion nor drift of charges

Answer:

Watch Video Solution

39. The small currents in reverse biased condition of p-n diode are due to

A. Electrons

B. Holes

C. Majority charge carriers

D. Thermal agitation of minority charge carriers.

Answer:

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

A. affects only reverse resistance

B. affects only forward resistance

C. affects the overall V - I characteristics of p - n junction

D. does not affect resistance of p n junction

Answer:

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41. The zener diode can be used as

A. As voltage regulator

B. As amplifier

C. As oscillator

D. All the above

Answer:

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42. In an unbiased p-n junction, holes diffuse from the P-region to n-region because

A. electrons travel across the junction due to potential difference

B. Only electrons move from n to p region and not the vice-versa

C. holes in p-region attract them

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

Semiconductor devices

Answer:

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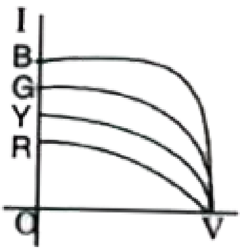
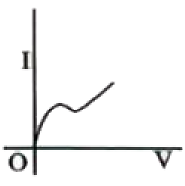
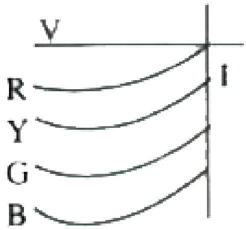
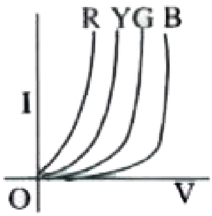
43. The I - V characteristic of an LED is

A. 

B. 

C. 

D. 

Answer:

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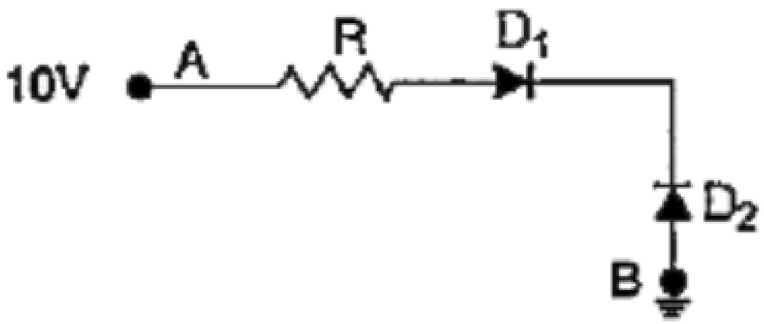
44. In figure, assuming the diodes to be ideal,



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

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

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

D. D_2 is forward biased and D_1 is reverse biased and hence no current flows from B to A

Answer:

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45. Transistor can be used as :-

A. Oscillator

B. Electronic switch

C. Amplifier

D. All the above

Answer:

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46. A n-p-n transistor conducts when

A. both collector and emitter are positive with respect to the base

B. collector is positive and emitter is negative with respect to the base

C. collector is positive and emitter is at same potential as the base

D. both collector and emitter are negative with respect to the base

Answer:

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47. When a n-p-n transistor is used as an amplifier, then

A. Electrons move from emitter to collector

B. Holes move from emitter to base

C. Electrons move from collector to base

D. Holes move from base to collector.

Answer:

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48. In a common base amplifier the phase difference the input signal voltage and the output voltage is

A. zero

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

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

D. π

Answer:

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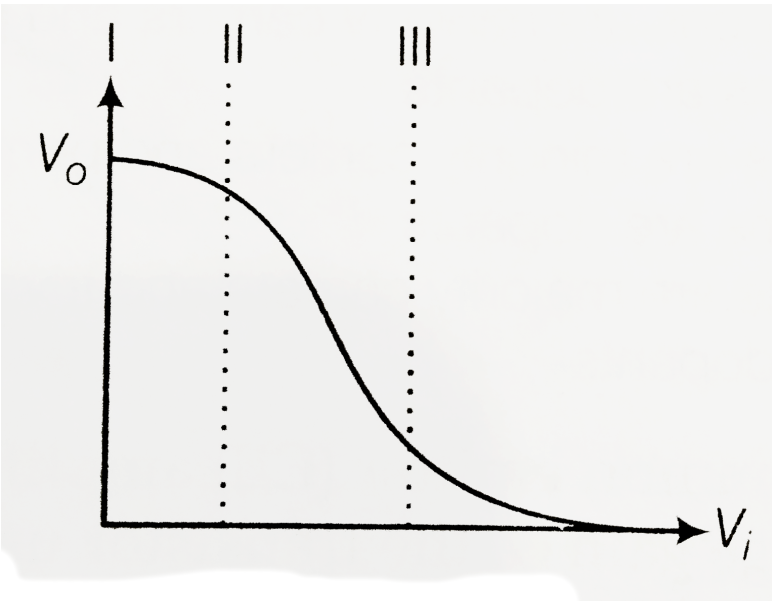
49. Transfer characteristic [output voltage (V_0) vs input voltage (V_i) for a base biased transistor in CE configuration is as shown in the figure. For using transistor as a switch, it is used



A. in region II

B. in region I

C. in region III

D. both in region (I) and (III)

Answer:

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50. An AND gate

A. implements logic addition

B. is a universal gate

C. implements logic multiplication

D. implements logic subtraction

Answer:

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51. Digital circuits can be with the repetitive use of

A. OR gates

B. NOT gates

C. AND gates

D. NAND gates

Answer:

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52. If A = 1 and B = 0, then in terms of Boolean algebra , $A+\overline{B}=$.

A. A

B. B

C. $\overline{A}$

D. $\overline{A+B}$

Answer:

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53. In the Boolean algebra $\overline{A} . \overline{B}$ equals

A. A+B

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

C. $\overline{A. B}$

D. $\overline{A+B}$

Answer:

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54. 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 this situation

A. NOT

B. OR

C. AND

D. NAND

Answer:

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Exercise Ib

1. Assertion : The number of electrons in a p-type silicon semiconductor is less than the number of electrons in a pure silicon semiconductor at room temperature.

Reason : It is due to law of mass action.

A. A is true, B is false

B. A is false, B is true

C. A and B are true

D. A and B are false

Answer:

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2. A: Light emitting diode(LED) emits spontaneous radiation.

R: LED are forward biased p-n junctions.

A. A is true, B is false

B. A is false, B is true

C. A and B are true

D. A and B are false

Answer:

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3. Statement-I : A p-n junction cannot be used at ultra high frequencies

Statement-II : Capacitative reactance of a p-n junction increase with increasing frequency.

A. A is true, B is false

B. A is false, B is true

C. A and B are true

D. A and B are false

Answer:

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4. Assertion: Zener diode works on principle of breakdown voltage.

Reason: Current increases suddenly after breakdown voltage

A. A is true, B is false

B. A is false, B is true

C. A and B are true

D. A and B are false

Answer:

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5. Assertion: When base region has large width, the collector current increases.

Reason: Electron hole combination in base result in increase of base current.

A. A is true, B is false

B. A is false, B is true

C. A and B are true

D. A and B are false

Answer:

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6. A: In transistor common emitter mode as an amplifier is preferred over common base mode

R: In common emitter mode, the input signal is connect in series with the voltage applied to the base emitter junction.

A. A is true, B is false

B. A is false, B is true

C. A and B are true

D. A and B are false

Answer:

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7. Assertion : Two p-n junction diodes placed back to back, will work as a n-p-n transistor.

Reason: The p-region of two p-n junction diodes back to back will form the base of n-p-n transistor.

A. A is true, B is false

B. A is false, B is true

C. A and B are true

D. A and B are false

Answer:

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Exercise Ii

1. The input signal given to a CE amplifier having a voltage gain of 150 is $V_i = 2\cos\left(15t + \frac{\pi}{2}\right)$. The corresponding output signal will be

A. $300\cos\left(15t + \frac{4\pi}{3}\right)$

B. $300\cos\left(15t + \frac{\pi}{3}\right)$

C. $75\cos\left(15t + \frac{2\pi}{3}\right)$

D. $2\cos\left(15t + \frac{5\pi}{6}\right)$

Answer: A

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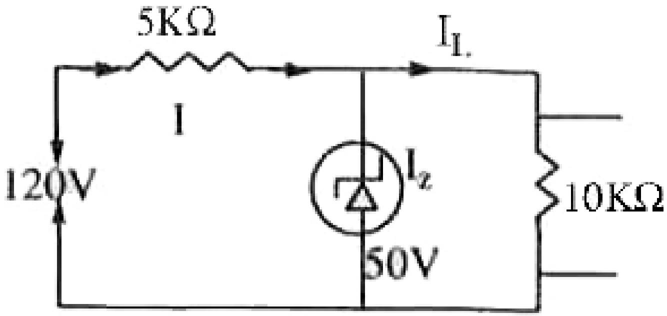
2. In the figure shown, the currents through the series resistance and load resistance are respectively



A. 9mA, 14mA

B. 14mA, 5mA

C. 1mA, 14mA

D. 1mA, 6mA

Answer: B

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3. The current gain of a transistor in common base and common-emitter configurations called α and β are related as

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

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

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

D. both 1 & 2

Answer: D

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4. For a transistor,$\alpha = 0.9$, the value of β is

A. 9

B. 0.1

C. 0.09

D. 0.01

Answer: A

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5. Calculate the current amplification factor β when change in collector current is 1mA and change in base current is $20\mu A$.

A. 50

B. 25

C. 75

D. 100

Answer: A

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6. The emitter current in a transistor is 2.2mA and the collector current is 2mA. The base current is

A. $100\mu A$

B. $200\mu A$

C. $300\mu A$

D. $400\mu A$

Answer: B

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7. While a collector-emitter voltage is constant in a transistor, the collector current changes by 8.2mA when the emitter current changes by 8.3mA. The change in base current is

A. $100\mu A$

B. $200\mu A$

C. $300\mu A$

D. $400\mu A$

Answer: A

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8. Which of the following logic gates the given truth table represents

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

A. NOT gate

B. NOR gate

C. OR gate

D. AND gate

Answer: D

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9. The logic symbol shown in figure represents

A. OR gate

B. XOR gate

C. NAND gate

D. NOR gate

Answer: A

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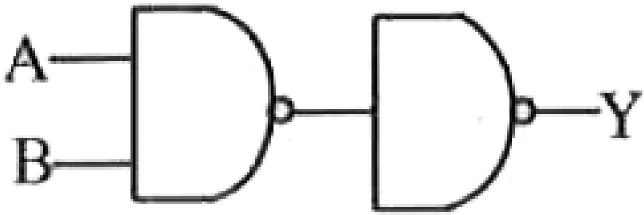
10. The arrangement shown in figure performs the logic function of



A. AND gate

B. NAND gate

C. OR gate

D. XOR gate

Answer: A

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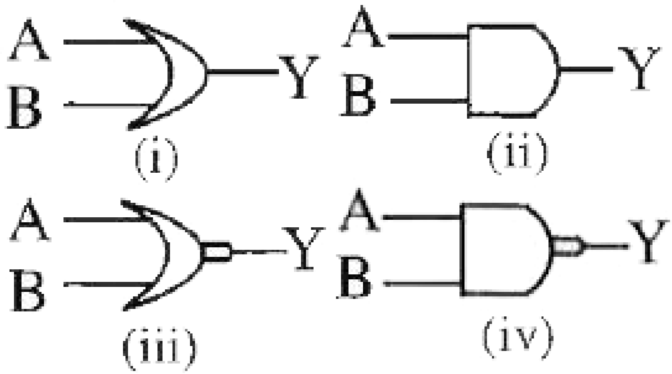
11. Given below are four logic gate symbols.

Those for OR, NOR and AND are respectively



A. i, iv, iii

B. iv, i, ii

C. iii, ii, i

D. i, iii, ii

Answer: D

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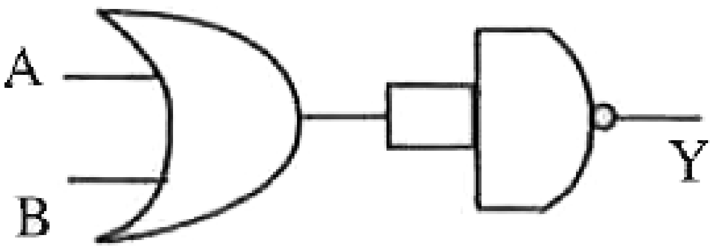
12. Identify the gate represented by the block diagram is



A. AND

B. NOT

C. NAND

D. NOR

Answer: D

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13. In Boolean expression which gate is expressed as $y = \overline{A + B}$

A. OR

B. NAND

C. AND

D. NOR

Answer: D

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14. In the given Boolean expression, $Y = A.\overline{B} + B.\overline{A}$, if A=1, B=1 then Y will be

A. 0

B. 1

C. 11

D. 10

Answer: A

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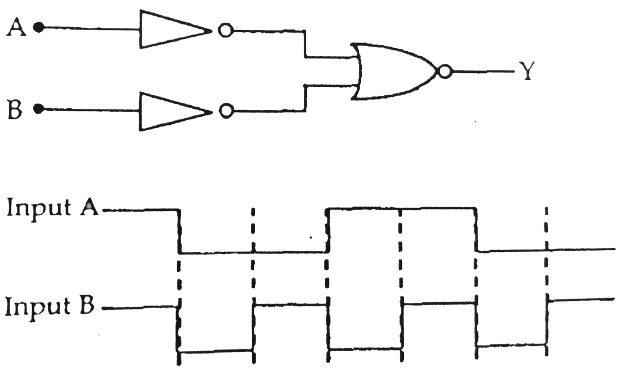
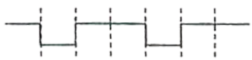
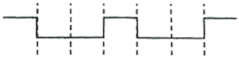
15. The logic circuit shown below has the input waveforems 'A' and 'B' as shown. Pick out the correct output waveform



A. 

B. 

C. 

D. 

Answer: D

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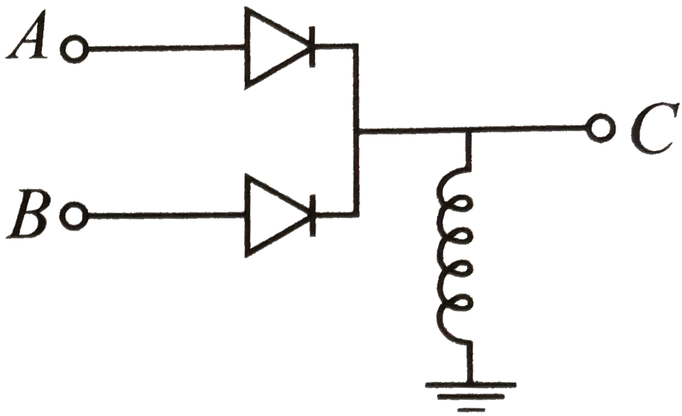
16. In the circuit below, A and B represents two inputs and C represents the output . The circuit represents



A. NOR gate

B. AND gate

C. NAND gate

D. OR gate

Answer: D

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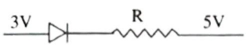
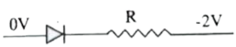
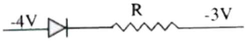
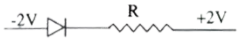
17. Which one of the following represents forward basis diode ?

A. 

B. 

C. 

D. 

Answer: B

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Exercise Iii

1. The intrinsic carrier density in germanium crystal at 300 K is 2.5×10^{13} per cm^3. if the electron density in an N-type germanium crystal at 300 K be 0.5×10^{17} per cm^3 the hole density (per cm^3) in this N-type crystal at 300 K would be expected around-

A. $2.5 \times 10^{13} / cm^3$.

B. $5 \times 10^6 / cm^3$

C. $1.25 \times 10^{10} / cm^3$

D. $0.2 \times 10^4 / cm^3$

Answer:

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2. The peak voltage in the output of a half wave diode rectifier fed with a sinusoidal signal without filter is 10V. The d. c. component of the output voltage is :-

A. $10/\sqrt{2}$

B. $10/\pi V$

C. 10V

D. $20/\pi V$

Answer:

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3. The circuit shown in figure contains two diodes each with a forward resistance of 50Ω and infinite reverse resistance.If the battery voltage is 6 v ,then the current through the 100Ω resistance is

A. zero

B. 0.02

C. 0.03

D. 0.036

Answer:

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