PHYSICS

BOOKS - MTG-WBJEE PHYSICS (HINGLISH)

SOLID STATE ELECTRONS

Wb Jee Workout Category 1 Single Option Correct Type

1. A Si and a Ge diode has identical physical dimensions. The band gap in Si is larger than that

in Ge. An indentical reverse bias is applied across the diodes.

A. The reverse current in Ge is larger than that in Si

B. The reverse current in Si is larger than that in Ge

C. The reverse current is identical in the two diodes

D. The relative magnitude of the reverse currents cannot be determined from the given data only.

Answer: C

2. Carbon , silicon and germanium have four valence electrons each . At room temperature which one of the following statements is most appropriate ?

A. The number of free electrons for conduction is significant only in Si and Ge but small in C.

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

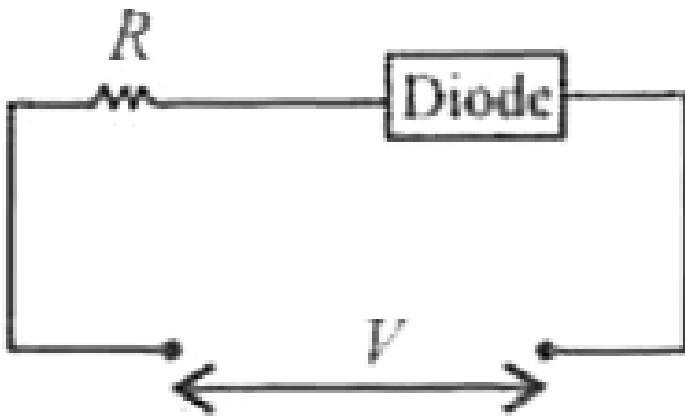C. The number of free conduction electrons is negligibly small in all the three.

D. The number of free electrons for conduction is significant in all the three.

Answer: A

▶ Watch Video Solution

**3.** For the given circuit of p-n junction diode which is correct?

A. in forward bias the voltage across R is V

B. in reverse bias the voltage across R is V

C. in forward bias the voltage across R is 2V

D. in reverse bias the voltage across R is 2V.

Answer: A

Watch Video Solution

4. A junction diode has a resistance of 25 Ω when forward biased and 2500 Ω when reverse biased. What is the current in the diode, for the arrangement shown ?

5 V · · · · 10 Ω · · · 0 V
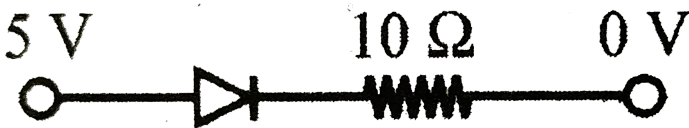
A. $\dfrac{1}{15} A$

B. $\dfrac{1}{7} A$

C. $\dfrac{1}{25} A$

D. $\dfrac{1}{480} A$

Answer: B

5. The peak voltage in the output of a half-wave diode rectifier fed with a sinusiodal signal without filter is $10V$. The dc component of the output voltage is

A. $10/\sqrt{2}V$

B. $10/\pi V$

C. 10V

D. $20/\pi V$

Answer: B

6. A transistor is operated in common emitter configuration at constant collector voltage $V_c = 1.5V$ such that a change in the base current from $100\mu A$ to $150\mu A$ produces a change in the collector current from $5mA$ to $10mA$. The current gain (β) is

A. 50

B. 67

C. 75

D. 100

Answer: D

7. Determine the number density of donor atoms which have to be added to an intrinsic germanium semiconductor to produce an n-type semiconductor of conductivity $5\Omega^{-1}cm^{-1}$, given that the mobility of electron in n-type germanium is $3900cm^2V^{-1}s^{-1}$. Neglect the contribution of holes to conductivity.

A. $12 \times 10^{14} cm^{-3}$

B. $10^{14} cm^{-3}$

C. $8 \times 10^{15} cm^{-3}$

D. $4 \times 10^{15} cm^{-3}$

Answer: C

▶ **Watch Video Solution**

---

8. In a common emitter configuration, a transistor has $\beta = 50$ and input resistance $1k\Omega$. If the peak value of a.c. input is 0.01 V then the peak value of collector current is
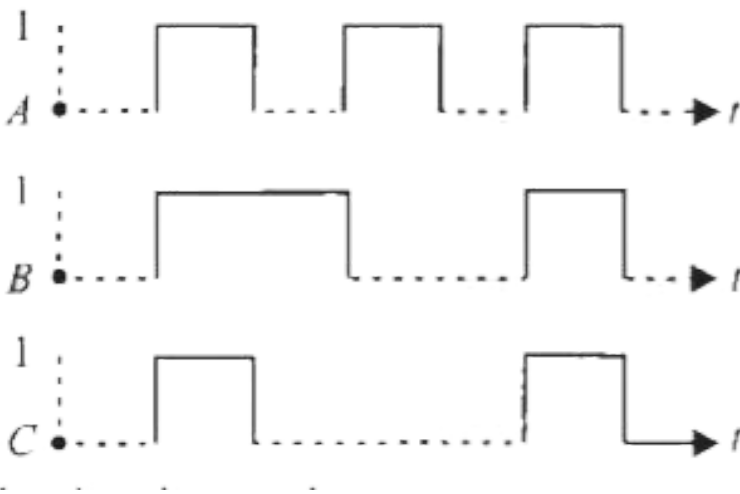
A. $0.01\mu A$

B. $0.25\mu A$

C. $100\mu A$

D. $500\mu A$

Answer: D

▶ **Watch Video Solution**

---

9. The following 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 shown below.

The logic circuit gate is

A. OR gate

B. AND gate

C. NAND gate

D. NOR gate

Answer: B

▶ Watch Video Solution

10. The current through the ideal diode as shown in the is

$$6 \text{ V} \quad 150 \text{ }\Omega \quad\quad\quad 3 \text{ V}$$

A. $0A$

B. $0.02A$

C. $0.04A$

D. $0.06A$

Answer: B

11. The following truth table represents which type of gate?

Input		Output
A	B	Q
0	0	1
0	1	1
1	0	1
1	1	0

A. NOT

B. AND

C. OR

D. NAND

Answer: D

Watch Video Solution

---

12. A forward biased diode is

A. 0 V ——▷|——∿∿——-2 V

B. -4 V ——▷|——∿∿-- 3 V

C. 3 V ——▷|——∿∿—5 V

D. -2 V ——▷|---∿∿— +2 V

Answer: A

13. A common emitter amplifier has a voltage gain of 50, an input impedance of 100Ω and an output impedance of 200 Ω. The power gain of the amplifier is :-
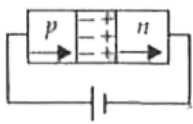
A. 1000

B. 1250

C. 100

D. 500

Answer: B

14. In the case of forward biasing of PN-junction, which one of the following figures correctly depicts the direction of flow of carriers?
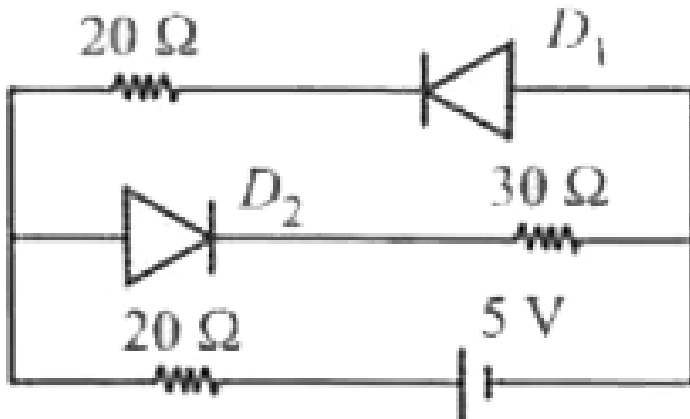
A.

B.

C.

D.
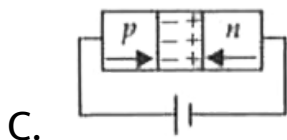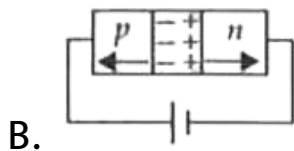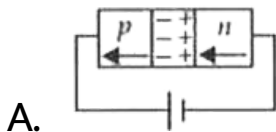
Answer: D

> ▶ **Watch Video Solution**

15. The current in the circuit will be

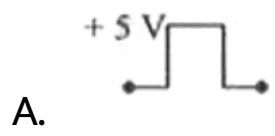A. $5/40A$

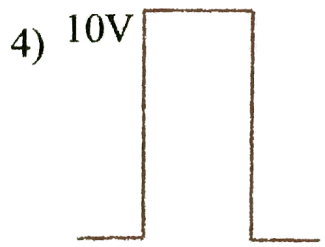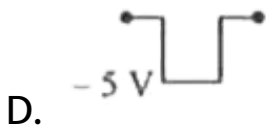B. $5/50A$

C. $5/10A$

D. $5/20.$ A
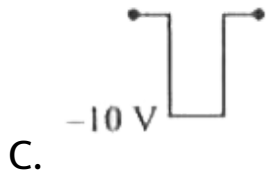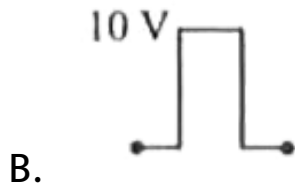
Answer: B

▶ **Watch Video Solution**

---

16. If a $p-n$ junction diode, a square input signal

of $10V$ is applied as shown.

+5v

R_L

−5v
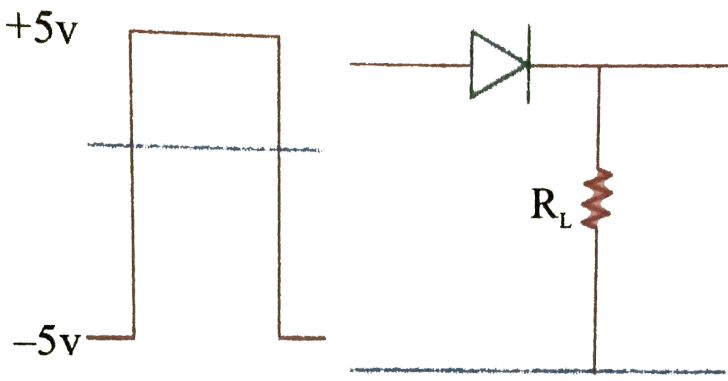
Then the out put signal across R_L will be

1)

−10V

2)

−5V

3) 5V

4) 10V

A.

+ 5 V

B.

C.

D.

Answer: A

▶ **Watch Video Solution**

17. When the forwward bias voltage of a diode is changed from 0.6 V to 0.7 V the current changes

from 5 mA to 15 mA. Then its forward bias resistance is

A. 0.01Ω

B. 0.1Ω

C. 10Ω

D. 100Ω

Answer: C

▶ **Watch Video Solution**

18. Suppose an unregulated D.C. input voltage V_1 is applied to a Zener diode having breakdown voltage (V_z). Then the breakdown condition for the diode to work as voltage regulator is

    A. $V_I < V_Z$

    B. $V_I = V_Z$

    C. $V_I > V_Z$

    D. $V_I = \sqrt{V_Z}$

Answer: C

▶ **Watch Video Solution**

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

A. active region

B. cutoff region

C. saturation region

D. cutoff and saturation

Answer: A

▶ **Watch Video Solution**

20. In a transistor if collector current is 25 mA and base current is 1 mA, then current amplification factor α is

A. $\dfrac{25}{24}$

B. $\dfrac{24}{25}$

C. $\dfrac{25}{26}$

D. $\dfrac{26}{25}$

Answer: C

21. The minimum number of NAND gates required to construct an OR gate is

A. 4

B. 6

C. 5

D. 3

Answer: D

▶ Watch Video Solution

22. In the breakdown region, Zener diode behaves as a

   A. constant current source

   B. constant voltage source

   C. constant resistance source

   D. constant power source

Answer: B

▶ **Watch Video Solution**

23. Digital circuit can be made by repetitive use of

A. NOT gates

B. OR gates

C. AND gates

D. NOR gates

Answer: D

▶ **Watch Video Solution**

---

24. In CE transistor amplifier if the base current is increased by $20\mu A$, the collector current changes from 4 mA to 5 mA. The current gain of the transistor is

A. 200

B. 50

C. 125

D. 250

Answer: B

▶ **Watch Video Solution**

25. An intrinsic semiconductor has a resistivity of 0.50 Ω m at room temperature. Find the intrinsic carrier concentration if the mobilities of electrons

and holes are $0.39 m^2 V^{-1} s^{-1}$ and $0.11 m^2 V^{-1} s^{-1}$

respectively

A. $1.2 \times 10^{18} / m^3$

B. $2.5 \times 10^{19} / m^3$
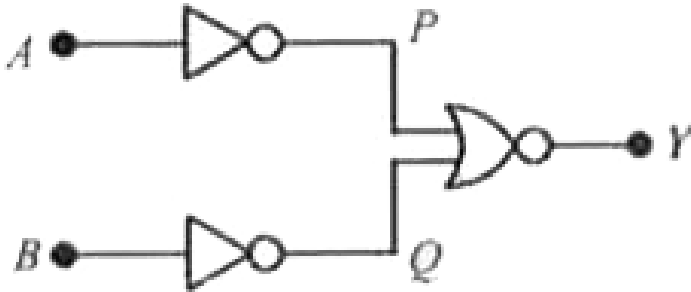
C. $1.9 \times 10^{20} / m^3$

D. $3.1 \times 10^{21} / m^3$

Answer: B

▶ **Watch Video Solution**

26. In the following circuit Y = 1 for A and B respectively equal to
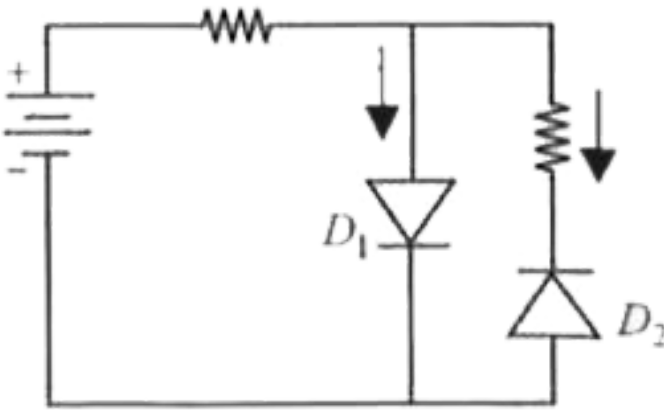

A. 0,0

B. 0,1

C. 1,0

D. 1,1

Answer: D

27. In the given circuit

A. D_1 and D_2 are reverse biased

B. D_1 and D_2 are forward biased

C. D_1 is forward biased and D_2 is reverse biased

D.

D_1 is reverse biased and D_2 is forward biased

Answer: C

▶ **Watch Video Solution**

---

28. Which one of the following semiconductor diodes is reverse biased?

(1) 5 V ———▷|——————⏚

(2) +10 V ———▷|——————⏚

(3) 10 V ———▷|———— −5 V

(4) −5 V ———▷|———— 1.5 V

A. 2

B. 4

C. 1

D. 3

Answer: B

▶ **Watch Video Solution**

29. A light-emitting diode (LED) has a voltage drop of 2V across it and passes a current of $10\mu A$, when it operates with a 6V battery with a limiting resistor R. what is the value of R ?

A. $40k\Omega$

B. $4k\Omega$

C. 200Ω

D. 400Ω

Answer: D

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

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

B. $20 \times 10^{13} Hz$

C. $5 \times 10^{13} Hz$

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

Answer: D

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

    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

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

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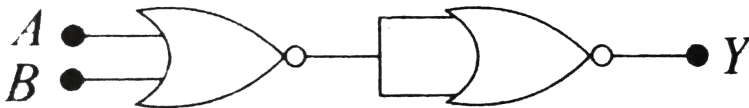
A	B	Y
0	0	1
0	1	1
1	0	1
1	1	0

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

B.

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

C.

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

D.

Answer: C

3. In Fig. V_0 is the potential barrier across a $p-n$ junction, when no battery is connected across the junction :
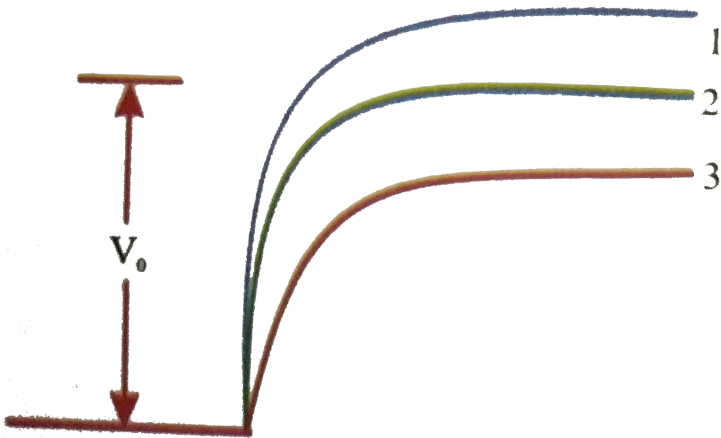
A. 1 and 3 both correspond to forward bias of junction

B. 3 corresponds to forward bias of junction and

1 corresponds to reverse bias of junction

C. 1 corresponds to forward bias and 3

corresponds to reverse bias of junction.

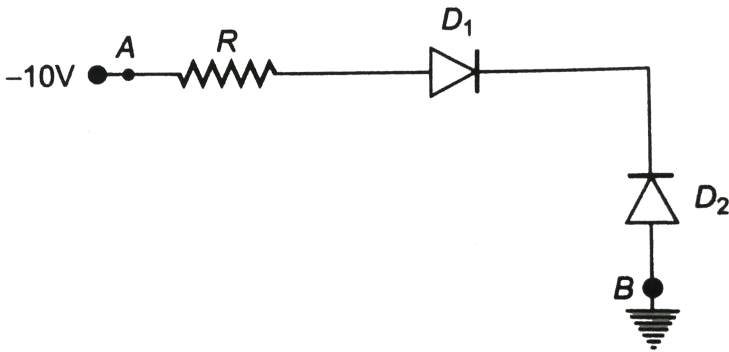D. 3 and 1 both correspond to reverse bias of

junction.

Answer: B

▶ Watch Video Solution

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

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

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

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

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

Answer: B

▶ **Watch Video Solution**

5. Truth table for the given circuit is

A.

A	B	E
0	0	1
0	1	0
1	0	1
1	1	0

B.

A	B	E
0	0	1
0	1	0
1	0	0
1	1	1

A	B	E
0	0	0
0	1	1
1	0	0
1	1	1

C.

A	B	E
0	0	0
0	1	1
1	0	1
1	1	0

D.

Answer: C

▶ **Watch Video Solution**

6. In the circuit shown(Fig.) if the diode forward

voltage drop is $0.3V$, the voltage difference

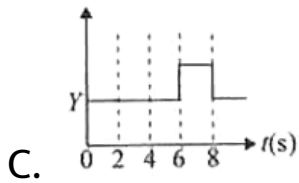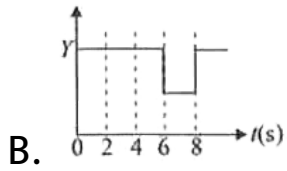between A and B is :
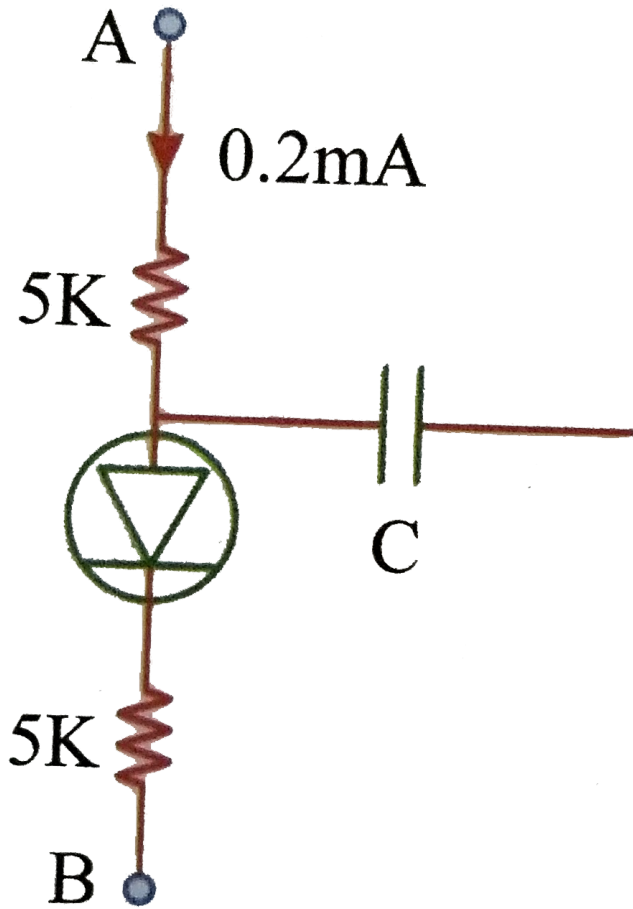
A. $1.3V$

B. $2.3V$

C. 0

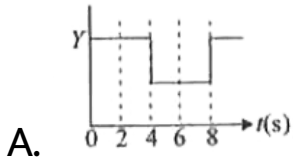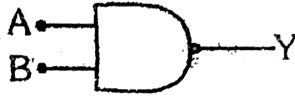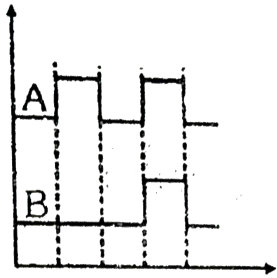D. $0.5V$

Answer: B

▶ **Watch Video Solution**

---

7. The real time variation of input signals A and B are as shown below. If the inputs are fed into NAND gate, then select the output signal from the
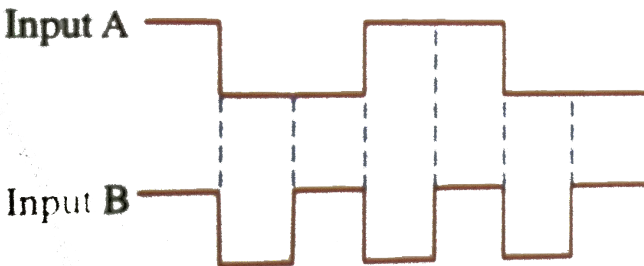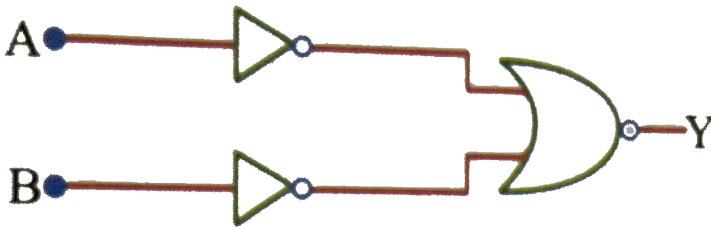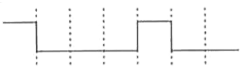
following :-

A.

B.

C.

D.
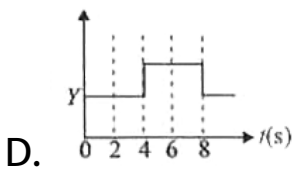
Answer: B

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

A.

B.

C.

D.

Answer: A

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

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

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

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

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

Answer: A

▶ **Watch Video Solution**

10. In a semiconductor material $(1/5)$th of the total current is carried by the holes and the remaining is carried by the electrons. The drift speed of electrons is twice that of holes at this temperature.

Thr ratio between the number densities of electrons and holes is
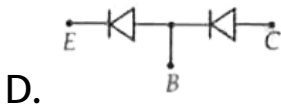
A. $\dfrac{21}{6}$

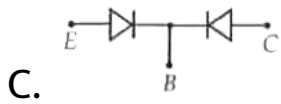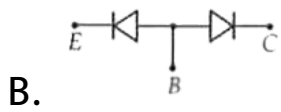B. 5

C. $\dfrac{3}{8}$

D. 2

Answer: D

▶ **Watch Video Solution**

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

A.

B.

C.

D.
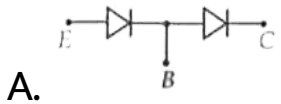
Answer: B

12. In the given circuit the current through the zener diode is
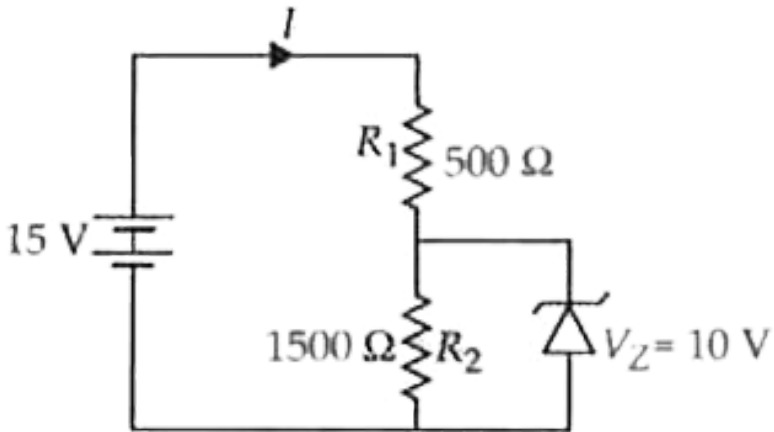
A. 10 mA

B. 6.67 mA

C. 5 mA

D. 3.33 mA

Answer: D

13. The graph shown in Fig. represents the I-V characteristics of a zener diode. Which part of the characteristics curve is most relevent for its

operation as a voltage regular?
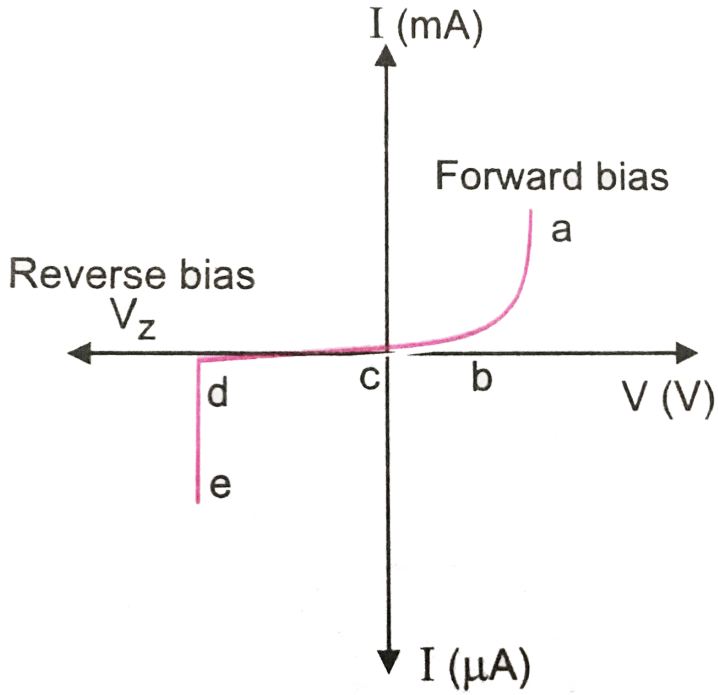
A. ab

B. bc

C. cd

D. de

Answer: D

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

maximum current?

A. 1.5Ω

B. 5Ω

C. 6.67Ω

D. 200Ω
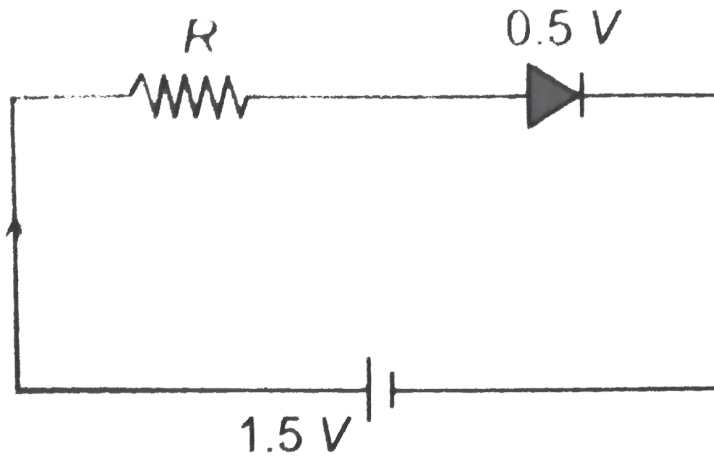
Answer: B

▶ Watch Video Solution

15. Truth table for system of four NAND gates as shown is

A.

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

B.

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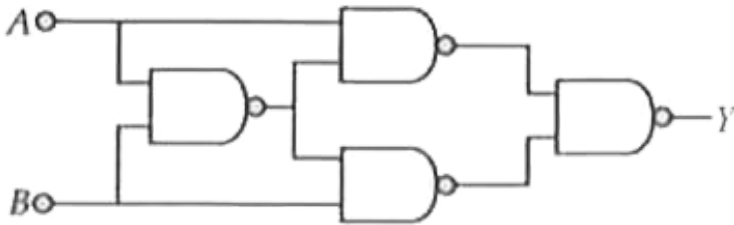
A	B	Y
0	0	1
0	1	0
1	0	0
1	1	1

C.

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

D.

Answer: D

▶ **Watch Video Solution**

1. In a p- n junction diode 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 the 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

2. In an n-p-n transistor circuit, the collector current ia 10 mA. If 90% of the electrons emitted reach the collector.

   A. the emitter current will be 9 mA

   B. the base current will be 1 mA

   C. the emitter current will be 11 mA
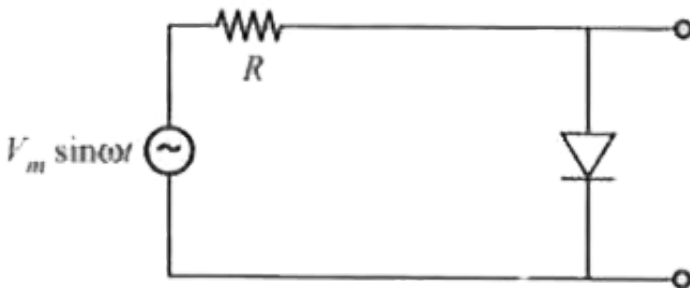
   D. the base current will be -1 mA.

Answer: B::C

3. If the given diode is ideal, the output of the given circuit in

A. would be zero at all times.

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

C. would be like a half wave rectifier with

negative cycles in output.

D. would be like that of a full wave rectifier.

Answer: C

▶ **Watch Video Solution**

4. Consider an n-p-n transistor with its base -

emitter junction forward biased and collector base

junction reverse biased . Which of the following

statements are true?

A. Electrons crossover from emitter to collector.

B. Holes move from base to collector.

C. Electrons move from emitter to base.

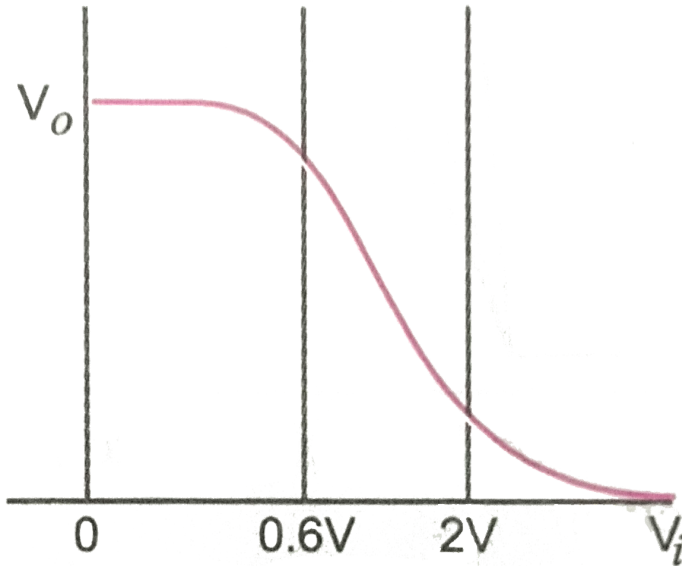D. Electrons from emitter move out of base without going to the collector.

Answer: A::C

▶ **Watch Video Solution**

5. Fig.shows that transfer characteristics of a base biased CE transistor. Which of the following

statements are true?

A. At $V_i = 0.4V$, transistor is in active state.

B. At $V_i = 1V$, it can be used as an amplifier.

C. At $V_i = 0.5V$, it can be used as a switch

turned off.

D. At $V_i = 2.5V$, it can be used as a switch turned on.

Answer: B::C::D

▶ **Watch Video Solution**

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

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

B. electrons move from higher energy level to

lower energy level in the conduction band.

C. holes in the valence band move from higher

energy level to lower energy level.

D. holes in the valence band move from lower

energy level to higher energy level.

Answer: A::C

▶ **Watch Video Solution**

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

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

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

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

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

Answer: A::D

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

    A. increasing the temperature

    B. doping acceptor impurities

    C. doping donor impurities

    D. irradiating ultraviolet light on it.

Answer: A::B::C::D

9. A charge of 8.0 mA in the emitter current brings a charge of 7.9 mA in the collector current. The values of α and β are

    A. 0.45, 50

    B. 0.25, 50

    C. 0.99, 79

    D. 0.26, 36

Answer: C

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

A. The emitter current will be 8 mA

B. The emitter current will be 10.53 mA.

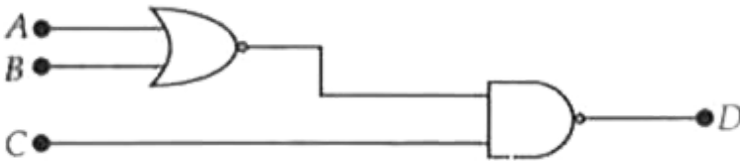C. The base current will be 0.53 mA.

D. The base current will be 2 mA.

Answer: B::C

1. A NOR gate and a NAND gate are connected shown. Two different sets of inputs are given to this set up. In the first case, the inputs to the gates are A = 0, B = 0, C = 0. In the second case, the inputs are A = 1, B = 0, C = 1. The output D in the first case and second case respectively are

A. 0 and 0

B. 0 and 1

C. 1 and 0

D. 1 and 1

Answer: D

▶ **Watch Video Solution**

2. In an n-p-n transistor

A. the emitter has higher degree of doping

compared to that of the collector

B. the collector has higher degree of doping compared to that of the emitter

C. both the emitter and collector have same degree of doping

D. the base region is most heavily doped.

Answer: A

▶ **Watch Video Solution**

3. In a transistor output characteristics commonly used in common emitter configuration, the base current I_B, the collector current I_C and the

collector-emitter voltage V_{CE} have values of the following orders of magnitude in the active region

A. I_b and I_c both are in μA, and V_{ce} in volts

B. I_b is in μA and I_c is in mA and V_{ce} in volts
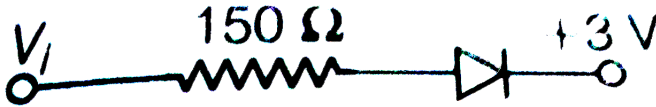
C. I_b is in mA and I_c is in μA and V_{ce} in mV

D. I_b is in mA and I_c is in mA and V_{ce} in mV

Answer: B

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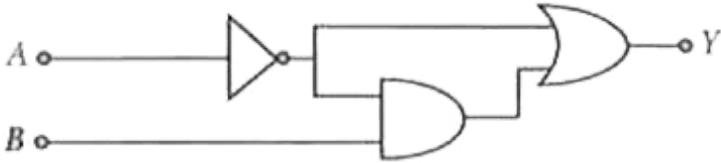

A. zero

B. 20

C. $80/3$

D. 40

Answer:

▶ Watch Video Solution

5. The output Y of the logic circuit given below is

A. $\overline{A} + B$

B. $\overline{A}$

C. $\overline{(\overline{A} + B)} \cdot \overline{A}$

D. $\overline{(\overline{A} + B)} \cdot A$

Answer:

▶ Watch Video Solution

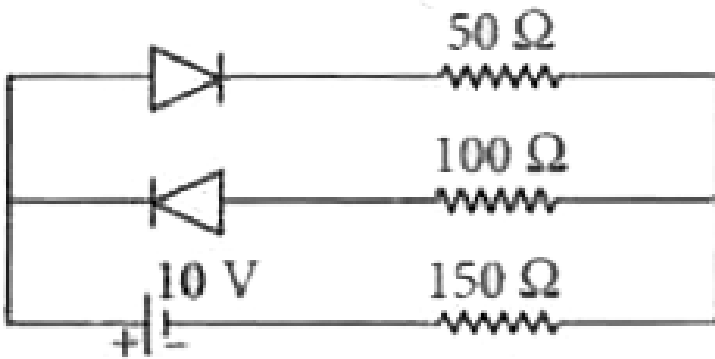**6.** If the bandgap between valence band and conduction band in a material is 5.0 eV, then the material is

    A. semiconductor

    B. good conductor

    C. superconductor

    D. insulator

Answer:

▶ **Watch Video Solution**

7.

Assume that each diode shown has a forward bias resistance of 50Ω and an infinite reverse bias resistance. The current through the resistance 150Ω is
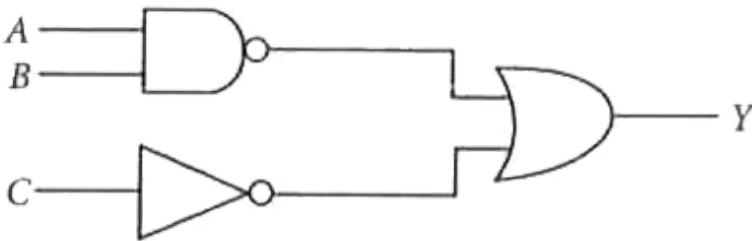

A. 0.66 A

B. 0.05 A

C. zero

D. 0.04 A

Answer:

8. The inputs to the digital circuit are shown below.

The output Y is

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

B. $(A + B)\overline{C}$

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

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

Answer:

9. A zener diode having breakdown voltage 5.6 V is connected in reverse bias with a battery of emf 10 V and a resistance of 100Ω in series . The current flowing through the zener is.

A. 88 mA

B. 0.88 mA

C. 4.4 mA

D. 44 mA

Answer:

▶ **Watch Video Solution**

---

10. In case of a bipolar transistor $\beta = 45$. The potential drop across the collector resistance of $1k\Omega$ is 5 V. The base current is approximately

A. $222\mu A$

B. $55\mu A$

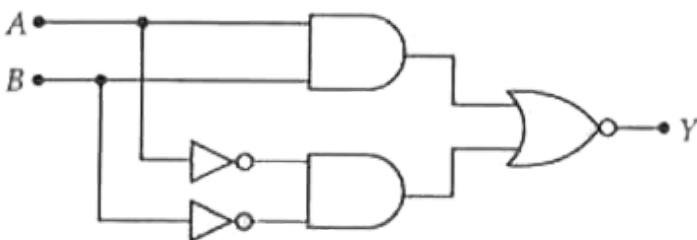C. $111\mu A$

D. $45\mu A$

Answer:

11. In the given circuit, the binary inputs at A and B are both 1 in one case and both 0 in the next case. The respective outputs at Y in these two cases will be:

A. 1,1

B. 0,0

C. 0,1

D. 1,0

Answer:

▶ Watch Video Solution

12. A semiconducting device is connected in a series circuit with a battery and a resistance.A current is found to pass through the circuit .If the polarity of

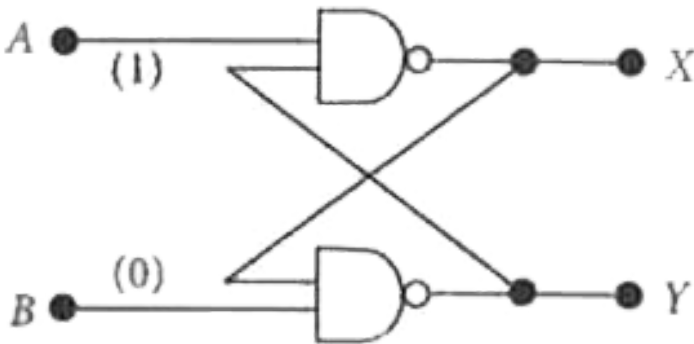the battery is reversed, the current drops to almost

zero.The device may be

A. a p-type semiconductor

B. a n-type semiconductor

C. an intrinsic semiconductor

D. a p-n junction.

Answer:

▶ **Watch Video Solution**

13. In the circuit shown, inputs A and B are in states '1' and '0' respectively. What is the only possible stable state of the outputs 'X' and 'Y'?
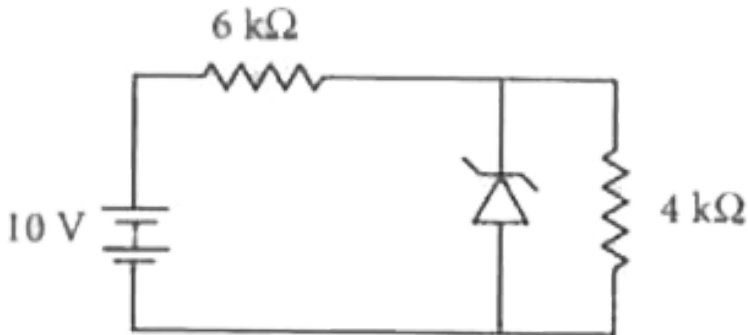

A. X = '1', 'Y' = '1'

B. X = '1', 'Y' = '0'

C. X = '0', 'Y' = '1'

D. X = '0', 'Y' = '0'

Answer:

14. What will be the current flowing through the $6k\Omega$ resistor in the circuit shown, where the breakdown voltage of the zener is 6 V?

A. $\dfrac{2}{3}mA$

B. 1 mA

C. 10 mA

D. $\dfrac{3}{2}mA$

Answer:

15. Each of the two inputs A and B can assume values either 0 or 1. Then which of the following will be equal to $\overline{A}.\overline{B}$?

A. A + B

B. $\overline{A + B}$

C. $\overline{A.\,B}$

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

Answer: