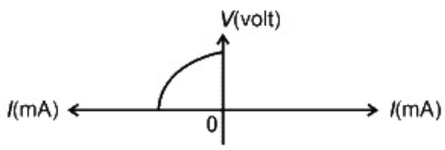
Semiconductor Electronics

Question1



The I-V characteristics shown above are exhibited by a

[NEET 2024 Re]

Options:

A.

Light emitting diode

B.

Zener diode

C.

Photodiode

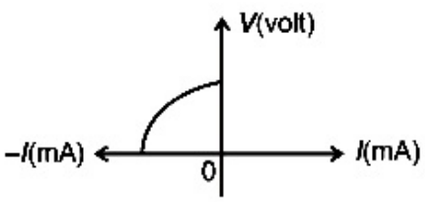
D.

Solar cell

Answer: D

Solution:

The I-V characteristics of solar cell is



Question2

When the output of an OR gate is applied as input to a NOT gate, then the combination acts as a

[NEET 2024 Re]

Options:

A.

NAND gate

B.

NOR gate

C.

AND gate

D.

OR gate

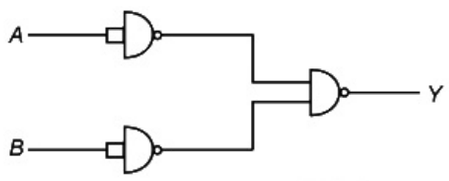
Answer: B

Solution:

When the output of an OR gate is applied as input to a NOT gate, then the combination acts as NOR gate.

Question3

The output Y for the inputs A and B of the given logic circuit is :



[NEET 2024 Re]

Options:

A.

A · B

B.

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

C.

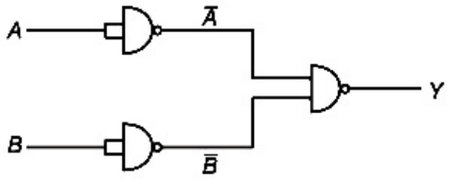
A + B

D.

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

Answer: C

Solution:



$Y = \overline{AB} = A + B$

Question4

A logic circuit provides the output Y as per the following truth table :

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

The expression for the output Y is

[NEET 2024]

Options:

A.

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

B.

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

C.

$\overline{B}$

D.

B

Answer: C

Solution:

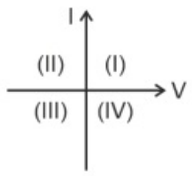
A	B	Y
0	0	1
0	1	0
1	0	1
1	1	0

According to given truth table, output is independent on value of A

$\therefore$ Output $Y = \overline{B}$

Question5

Consider the following statements A and B and identify the correct answer:



A. For a solar-cell, the I-V characteristics lies in the IV quadrant of the given graph.
B. In a reverse biased pn junction diode, the current measured in(μA), is due to majority charge carriers.

[NEET 2024]

Options:

A.

A is correct but B is incorrect

B.

A is incorrect but B is correct

C.

Both A and B are correct

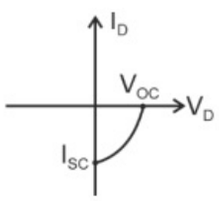
D.

Both A and B are incorrect

Answer: A

Solution:

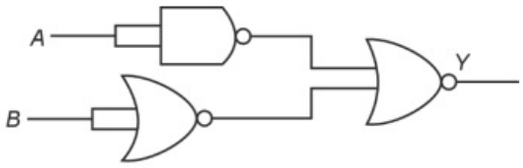
A: Solar cell characteristics



B: In reverse biased pn junction diode, the current measured in (μA), is due to minority charge carrier.

Question6

The output (Y) of the given logic gate is similar to the output of an/a



[NEET 2024]

Options:

A.

NAND gate

B.

NOR gate

C.

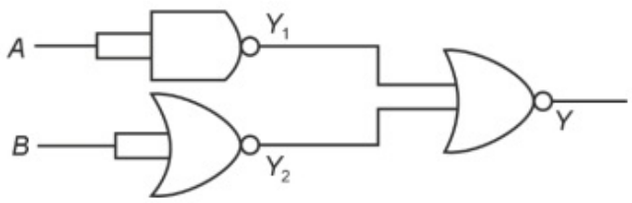
OR gate

D.

AND gate

Answer: D

Solution:



$Y_1 = \overline{A \cdot A}$

$= \overline{A}$

$Y_2 = \overline{B + B}$

$= \overline{B}$

$Y = \overline{Y_1 + Y_2}$

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

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

$= A \cdot B$ is similar to output of AND Gate

Question7

Given below are two statements:
Statement I: Photovoltaic devices can convert optical radiation into electricity.
Statement II: Zener diode is designed to operate under reverse bias in breakdown region.

In the light of the above statements, choose the most appropriate answer from the options given below.

[NEET 2023]

Options:

A.

Both Statement I and Statement II are incorrect

B.

Statement I is correct but Statement II is incorrect

C.

Statement I is incorrect but Statement II is correct

D.

Both Statement I and Statement II are correct

Answer: D

Solution:

Both Statements are correct.
I: Photovoltaic devices convert optical radiation into electricity.
II: Zener diode is designed to operate under reverse bias in breakdown region.
e.g., Zener diode as a voltage regulator.

Question8

A full wave rectifier circuit consists of two p-n junction diodes, a centre-tapped transformer, capacitor and a load resistance. Which of these components remove the ac ripple from the rectified output?

[NEET 2023]

Options:

A.

p-n junction diodes

B.

Capacitor

C.

Load resistance

D.

A centre-tapped transformer

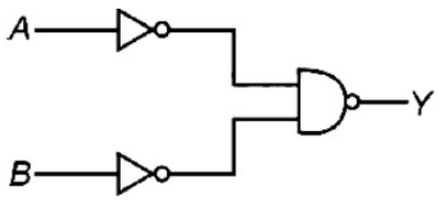
Answer: B

Solution:

Capacitor removes the ac ripple from rectified output.

Question9

For the following logic circuit, the truth table is



[NEET 2023]

Options:

A.

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

B.

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

C.

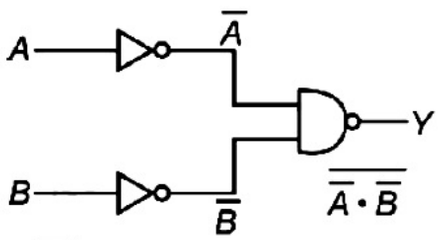
A	B	Y
0	0	0
0	1	0
1	0	0
1	1	1

D.

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

Answer: A

Solution:



$Y = \overline{A \cdot B} = A + B$

It is OR gate.

A B Y

0 0 0

0 1 1

1 0 1

1 1 1

Question10

On the basis of electrical conductivity, which one of the following material has the smallest resistivity?

[NEET 2023 mpr]

Options:

A.

Germanium

B.

Silver

C.

Glass

D.

Silicon

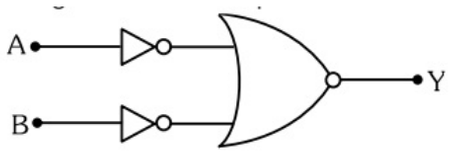
Answer: B

Solution:

Silver is good conductor so its resistivity will be very less.

Question11

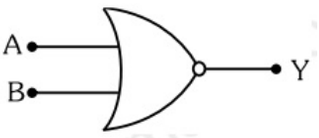
The given circuit is equivalent to :



[NEET 2023 mpr]

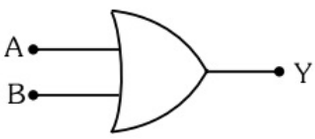
Options:

A.



B.

C.



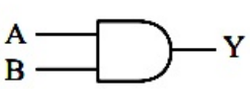
D.

Answer: D

Solution:

$Y = \overline{A} + \overline{B} = \overline{A} \cdot \overline{B} = A \cdot B$

AND gate for AND gate



Question12

A p-type extrinsic semiconductor is obtained when Germanium is doped with:

[NEET 2023 mpr]

Options:

A.

Antimony

B.

Phosphorous

C.

Arsenic

D.

Boron

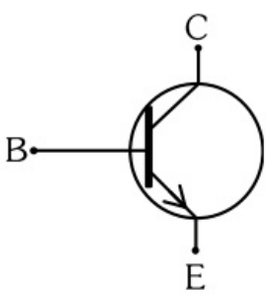
Answer: D

Solution:

Solution:

For p type semiconductor trivalent impurity added

Question13



The above figure shows the circuit symbol of a transistor. Select the correct statements given below:
(A) The transistor has two segments of p-type semiconductor separated by a segment of n-type semiconductor.
(B) The emitter is of moderate size and heavily doped.
(C) The central segment is thin and lightly doped.
(D) The emitter base junction is reverse biased in common emitter amplifier circuit.

[NEET 2023 mpr]

Options:

A.

(C) and (D)

B.

(A) and (D)

C.

(A) and (B)

D.

(B) and (C)

Answer: D

Solution:

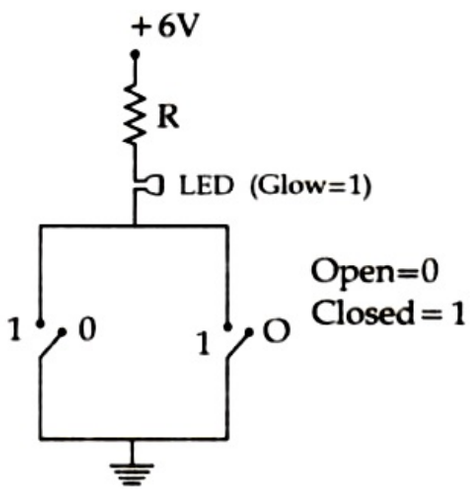
In given symbol, emitter current leave from emitter so transistor is NPN

order of doping E > C > > B

order of size C > E > > B

for active mode emitter base junction is forward bias and base-collector junction is reverse bias.

Question14



Identify the equivalent logic gate represented by the given circuit : [NEET Re-2022]

Options:

A. NAND

B. OR

C. NOR

D. AND

Answer: B

Solution:

When both inputs given as "O" means open circuit, no current flows throw LED means "O".

If the inputs given as 0, 1 & 1, 0 & 1, 1 current flows throw LED, it means "I". Truth table same as "OR" gate.

Question15

The incorrect statement about the property of a Zener diode is: [NEET Re-2022]

Options:

A. p and n regions of zener diode are heavily doped

B. Zener voltage remains constant at breakdown

C. It is designed to operate under reverse bias

D. Depletion region formed is very wide

Answer: D

Solution:

Solution:

Depletion region of Zener diode is not very wide.

Question16

The collector current in a common base amplifier using n-p-n transistor is 24 mA. If 80% of the electrons released by the emitter is accepted by the collector, then the base current is numerically: [NEET Re-2022]

Options:

A. 3 mA and entering the base

B. 6 mA and leaving the base

C. 3 mA and leaving the base

D. 6 mA and entering the base

Answer: D

Solution:

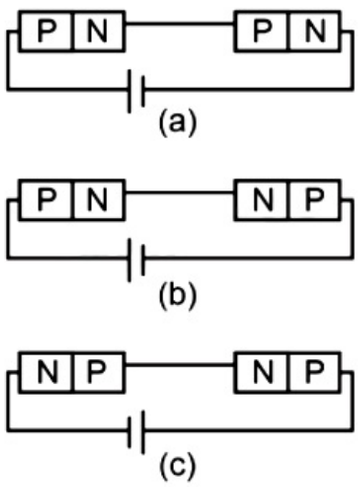
$I_c = 24\,mA$

$I_c = 80\%$ of I_E

$\therefore I_E = 30\,mA$

$\therefore I_B = 6\,mA$ entering the base

Question17



In the given circuits (a), (b) and (c), the potential drop across the two p − n junctions are equal in
[NEET-2022]

Options:

A. Circuit (a) only

B. Circuit (b) only

C. Circuit (c) only

D. Both circuits (a) and (c)

Answer: D

Solution:

Solution:

Potential drops across the p−n junctions will be same if either both junctions are forward biased or both junction are reverse biased.

In figure (a) and (c), both junctions are forward biased therefore both have same potential. In figure (b) first junction is forward biased and second junction is reverse biased, so both junctions have different potential difference.

Question18

In half wave rectification, if the input frequency is 60H z, then the output frequency would be

[NEET-2022]

Options:

A. Zero

B. 30H z

C. 60H z

D. 120H z

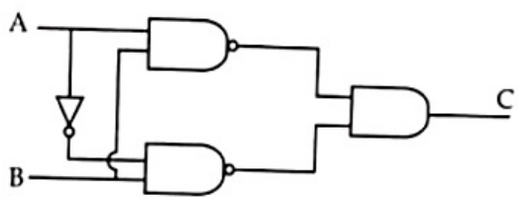
Answer: C

Solution:

Solution:

In half wave rectifier, the output frequency is same as that of input frequency.

Question19



The truth table for the given logic circuit is [NEET-2022]

Options:

A.

A	B	C
0	0	0
0	1	1
1	0	1
1	1	0

B.

A	B	C
0	0	1
0	1	0
1	0	0
1	1	1

C.

A	B	C
0	0	1
0	1	0
1	0	1
1	1	0

D.

A	B	C
0	0	0
0	1	1
1	0	0
1	1	1

Answer: C

Solution:

$C = (\overline{A \cdot B}) \cdot (\overline{A \cdot B})$

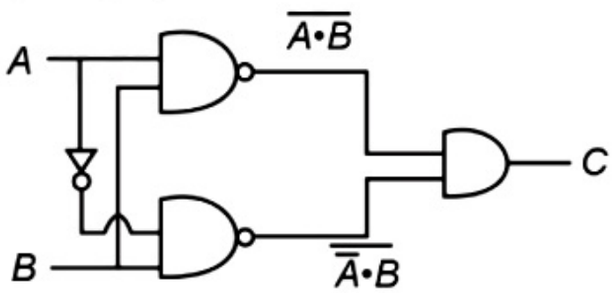
$\Rightarrow C = \overline{A \cdot B + \overline{A} \cdot B}$

$\Rightarrow C = \overline{(A + \overline{A})B}$

$\Rightarrow C = \overline{B}$

The truth table would be

A	B	C
0	0	1
0	1	0
1	0	1
1	1	0



Question20

The electron concentration in an n-type semiconductor is the same as hole concentration in a p-type semiconductor. An external field (electric) is applied across each of them. Compare the currents in them. [NEET 2021]

Options:

A. Current in n-type = current in p-type

B. Current in p-type > current in n-type

C. Current in n-type > current in p-type

D. No current will flow in p-type, current will only flow in n-type

Answer: C

Solution:

The current through a semiconductor is

$I = neAv_d$

$I = neA\mu E$

$\frac{I_n}{I_p} = \frac{n_e eA\mu_e E}{n_h eA\mu_h E}$

$\frac{I_n}{I_p} = \frac{\mu_e}{\mu_h}$

$\because \mu_e > \mu_h$

$\Rightarrow I_n > I_p$

Question21

Consider the following statements (A) and (B) and identify the correct answer.
(A) A zener diode is connected in reverse bias, when used as a voltage regulator.
(B) The potential barrier of p-n junction lies between 0.1 V to 0.3 V.
[NEET 2021]

Options:

A. (A) and (B) both are correct.

B. (A) and (B) both are incorrect

C. (A) is correct and (B) is incorrect.

D. (A) is incorrect but (B) is correct.

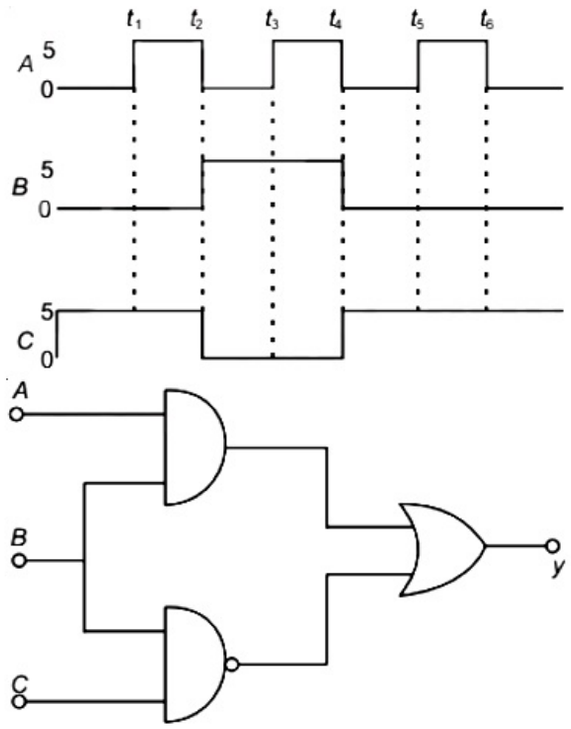
Answer: C

Solution:

• In reverse biased, after breakdown, voltage across the zener diode becomes constant. Therefore zener diode is connected in reverse biased when used as voltage regulator.
• Potential barrier of silicon diode is nearly 0.7 V statement A is correct and statement B is incorrect.

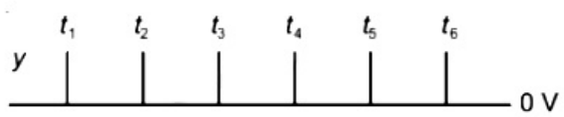
Question22

For the given circuit, the input digital signals are applied at the terminals A, B and C. What would be the output at the terminal y ? [NEET 2021]



Options:

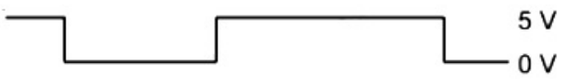
A.



B.

C.

D.



Answer: C

Solution:

Output of combination of logic gates is given as
$y = A \cdot B + \overline{B \cdot C}$

	Input Signals					Output Signa
Time duration	A	B	C	AB	$\overline{B.C}$	$y=A.B+\overline{B.C}$
$0-t_1$	0	0	1	0	1	1
t_1-t_2	1	0	1	0	1	1
t_2-t_3	0	1	0	0	1	1
t_3-t_4	1	1	0	1	1	1
t_4-t_5	0	0	1	0	1	1
t_5-t_6	1	0	1	0	1	1
t_6-t_7	0	0	1	0	1	1

So the output y is high (1) that is v_0 = 5V

Question23

The increase in the width of the depletion region in a p-n junction diode is due to :
[2020]

Options:

A. reverse bias only

B. both forward bias and reverse bias

C. increase in forward current

D. forward bias only

Answer: A

Solution:

Due to reverse biasing, the width of the depletion region increases in a p-n junction diode.

Question24

For transistor action, which of the following statements is correct?
[2020]

Options:

A. Base, emitter and collector regions should have same size.

B. Both emitter junction as well as the collector junction are forward biased.

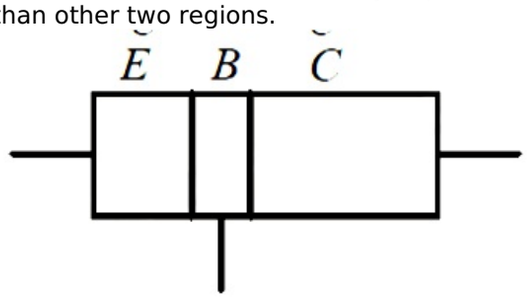
C. The base region must be very thin and lightly doped.

D. Base, emitter and collector regions should have same doping concentrations.

Answer: C

Solution:

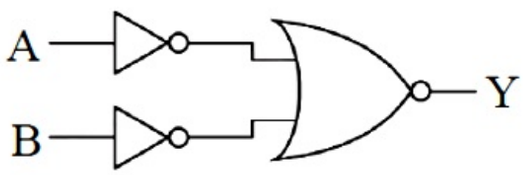
In a transistor, emitter is heavily doped, the base region is lightly doped and thin. The size of collector region is larger than other two regions.



Length profile in transistor is $L_C > L_E > L_B$ and doping profile in transistor is E > C > B. For transistor action Base-emitter junction is forward biased and Base-collector junction is reversed biased.

Question25

For the logic circuit shown, the truth table is: (2020)



Options:

A.

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

B.

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

C.

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

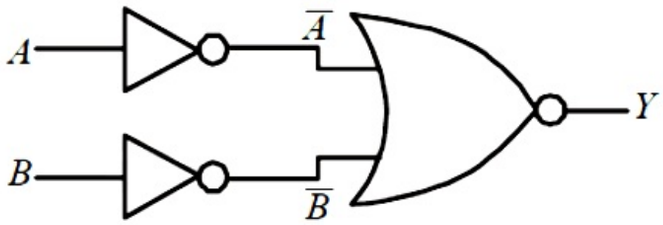
D.

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

Answer: D

Solution:

Solution:



$Y = \overline{\overline{A} + \overline{B}} = \overline{A \cdot B} = A \cdot B \Rightarrow AND$ Gate

Truth Table is :

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

Question26

For a p -type semiconductor, which of the following statements is true? (NEET 2019)

Options:

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

B. Electrons are the majority carriers and trivalent atoms are the dopants.

C. Holes are the majority carriers and trivalent atoms are the dopants.

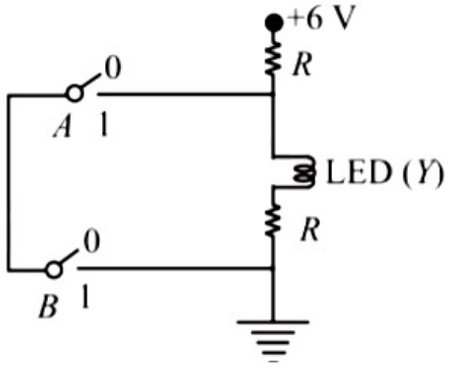
D. Holes are the majority carriers and pentavalent atoms are the dopants.

Answer: C

Solution:

Solution:
In p -type semiconductors, holes are the majority carriers and trivalent atoms are the dopants such as B, Al or Ga.

Question27



The correct Boolean operation represented by the circuit diagram drawn is
(NEET 2019)

Options:

A. NOR

B. AND

C. OR

D. NAND

Answer: D

Solution:

Solution:
LED bulb will light up if switch(s) A or B or both A and B is/are open.
Hence it represents a NAND gate.
For this circuit, we will make a truth table that depicts all the possible values for A and B and the resultant Y value.
The truth table for the above circuit can be depicted as:

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

From the above table it can be predicted that the Boolean operator depicted by the circuit diagram is a NAND gate.

Question28

An LED is constructed from a p − n junction diode using GaAsP. The energy gap is 1.9 eV. The wavelength of the light emitted will be equal to
(NEET 2019)

Options:

A. $10.4 \times 10^{-26}\text{m}$

B. $654\,\text{nm}$

C. 654Å

D. $654 \times 10^{-11}\text{m}$

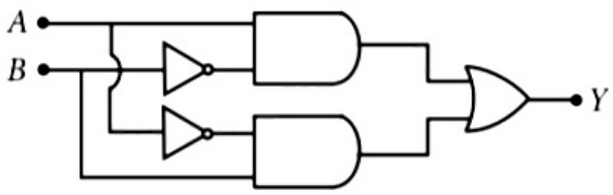
Answer: B

Solution:

Solution:
Given, energy gap $= 1.9\,\text{eV}$
Now, for the LED to operate, electrons need to cross this energy gap.
Wavelength of light emitted, $\lambda = \frac{1242\,\text{eV} - \text{nm}}{1.9\,\text{eV}} = 654\,\text{nm}$

Question29

In the combination of the following gates the output Y can be written in terms of inputs A and B as (NEET 2018)



Options:

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

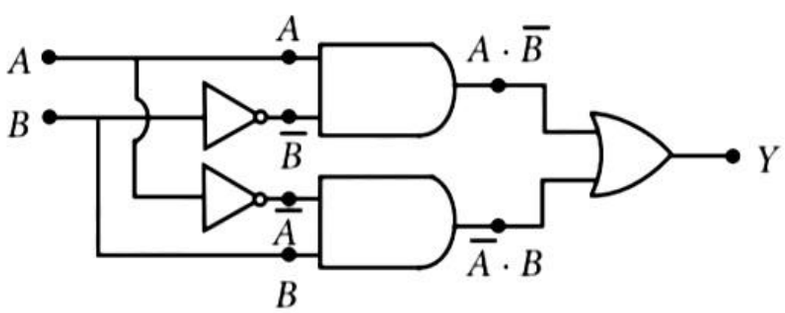
B. $A \cdot \overline{B} + \overline{A} \cdot B$

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

D. $\overline{A + B}$

Answer: B

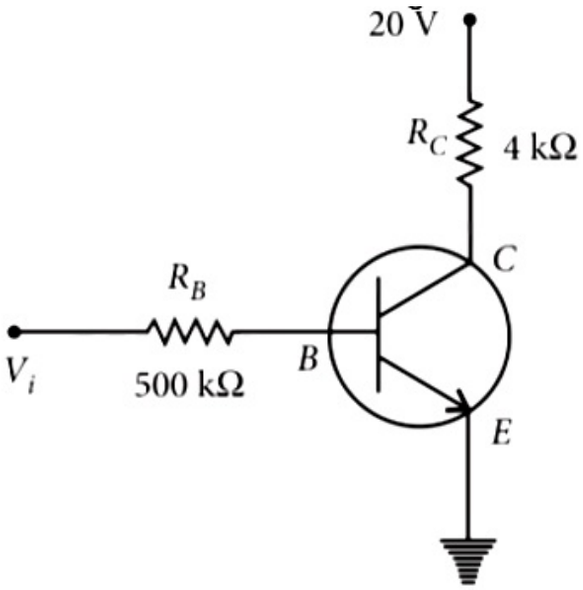
Solution:



$Y = A \cdot \overline{B} + \overline{A} \cdot B$

Question30

In the circuit shown in the figure,



the input voltage V_i is 20V , V_{BE} = 0 and V_{CE} = 0. The values of I_B, I_C and β are given by
(NEET 2018)

Options:

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

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

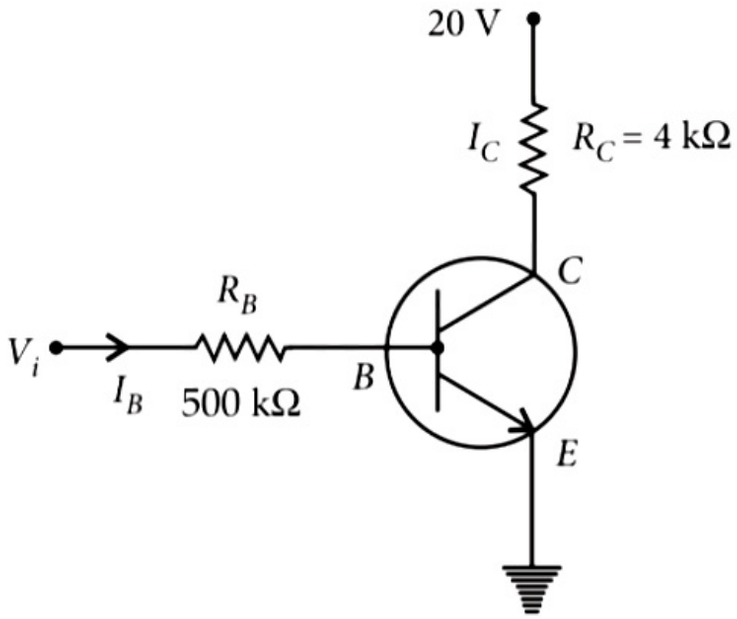
C. $I_B = 20\mu A$, $I_C = 5mA$, $\beta = 250$

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

Answer: D

Solution:

Given $V_{BE} = 0$; $V_{CE} = 0$



∴ Collector current, $I_C = \frac{(20-0)}{4\times10^3}$

or $I_C = 5\times10^{-3}\text{A} = 5\text{mA}$

Input voltage, $V_i = V_{BE} + I_B R_B$

or $V_i = 0 + I_B R_B$ or $20 = I_B \times 500 \times 10^3$

$\therefore I_B = \frac{20}{500\times10^3} = 40\mu\text{A}$

∴ Current gain, $\beta = \frac{I_C}{I_B} = \frac{5\times10^{-3}}{40\times10^{-6}} = 125$

Question31

In a p − n junction diode, change in temperature due to heating (NEET 2018)

Options:

A. affects only reverse resistance

B. affects only forward resistance

C. does not affect resistance of p − n junction

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

Answer: D

Solution:

Solution:
Due to heating, number of electron-hole pairs will increase, so overall resistance of diode will change.
Due to which forward biasing and reversed biasing both are changed.

Question32

In a common emitter transistor amplifier the audio signal voltage across the collector is 3 V. The resistance of collector is 3kΩ.If current gain is 100 and the base resistance is 2kΩ,the voltage and power gain of the amplifier is
(2017 NEET)

Options:

A. 15 and 200

B. 150 and 15000

C. 20 and 2000

D. 200 and 1000

Answer: B

Solution:

Given
$V_i = 3V$, $R_C = 3k\Omega$, $R_B = 2k\Omega$, $\beta = 100$

Voltage gain of the CE amplifier

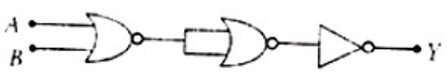
$$A_v = -\beta_{ac}\left(\frac{R_C}{R_B}\right) = -100\left(\frac{3}{2}\right) = -150$$

Power gain,$A_P = \beta \times A_V = 100 \times (-150) = -15000$

Negative sign represents that output voltage is in opposite phase with the input voltage.

Question33

The given electrical network is equivalent to
(2017 NEET)



Options:

A. OR gate

B. NOR gate

C. NOT gate

D. AND gate

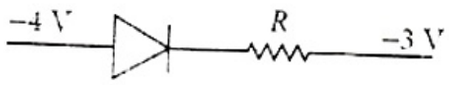
Answer: B

Question34

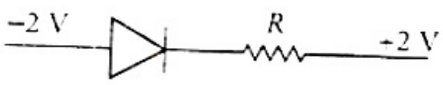
Which one of the following represents forward bias diode? (2017 NEET)

Options:

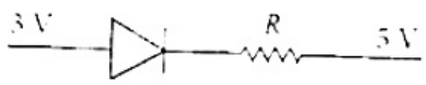
A.



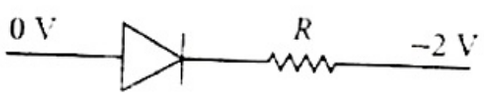
B.



C.



D.



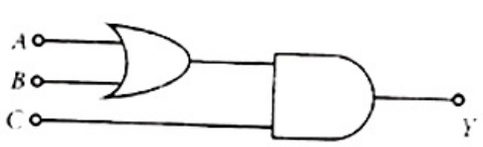
Answer: D

Solution:

Solution:
A diode is said to be forward biased if p-side is at higher potential than n-side of p-n junction.

Question35

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



(2016 NEET Phase-I)

Options:

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

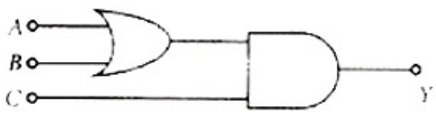
B. A = 1, B = 0, C= 1

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

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

Answer: B

Solution:



Output of the circuit,$Y = (A + B) \cdot C$
$Y = 1$ if $C = 1$ and $A = 0$, $B = 1$ or $A = 1$, $B = 0$ or $A = B = 1$

Question36

A npn transistor is connected in common emitter configuration in a given amplifier. A load resistance of 800Ω is connected in the collector circuit and the voltage drop across it is 0.8 V. If the current amplification factor is 0.96 and the input resistance of the circuit is 192Ω,the voltage gain and the power gain of the amplifier will respectively be
(2016 NEET Phase-I)

Options:

A. 4,4

B. 4,3.69

C. 4,3.84

D. 3,69,3.84

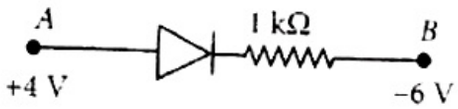
Answer: C

Solution:

Solution:
Here, $R_0 = 800\Omega$, $R_i = 192\Omega$
current gain,$\beta = 0.96$
Voltage gain = Current gain x Resistance gain $= 0.96 \times \frac{800}{192} = 4$
Power gain = [Current gain] x [Voltage gain] = $0.96 \times 4 = 3.84$

Question37

Consider the junction diode as ideal. The value of current flowing through AB is
(2016 NEET Phase-I)



Options:

A. 10^{-1}A

B. 10^{-3}A

C. 0A

D. 10^{-2}A

Answer: D

Solution:

Solution:
Here, the p-n junction diode is forward biased, hence it offers zero resistance.
$\therefore I_{AB} = \frac{V_A - V_B}{R_{AB}} = \frac{4V - (-6V)}{1k\Omega} = \frac{10}{100}A = 10^{-2}A$

Question38

For CE transistor amplifier, the audio signal voltage across the collector resistance of 2kΩ is 4V If the current amplification factor of the transistor is 100 and the base resistance is 1kΩ,then the input signal voltage is
(2016 NEET Phase-II)

Options:

A. 10 mV

B. 20 mV

C. 30 mV

D. 15 mV

Answer: B

Solution:

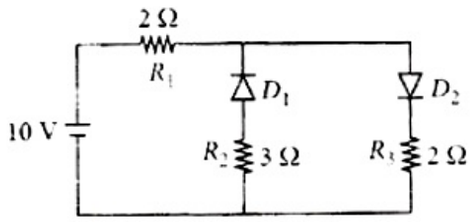
Here, $R_C = 2k\Omega = 2000\Omega$, $V_0 = 4V$
$\beta = 100$, $R_B = 1k\Omega = 1000\Omega$, $V_i = ?$

Voltag gain, $A = \beta\frac{R_C}{R_B} = 100 \times \frac{2000}{1000} = 200$

Also, $A = \frac{V_0}{V_i}$ or $V_i = \frac{V_0}{A} = \frac{4}{200} = \frac{2}{100}V = 20mV$

Question39

The given circuit has two ideal diodes connected as shown in the figure. The current flowing through the resistance R_1 will be



(2016 NEET Phase-II)

Options:

A. 2.5 A

B. 10.0 A

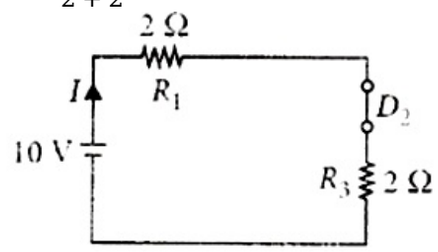
C. 1.43 A

D. 3.13 A

Answer: A

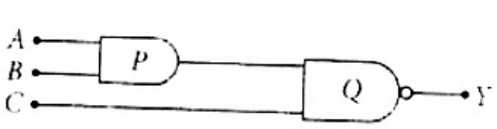
Solution:

Solution:
Diode D_1 is reverse biased so, it will block the current and diode D_2 is forward biased, so it will pass the current.
Hence, equivalent circuit becomes as shown in the figure. Current in the circuit = Current flowing through the resistance $R_1 = \frac{10}{2+2} = 2.5A$



Question40

What is the output Y in the following circuit, when all the three inputs A, B, C are first 0 and then 1 ?



(2016 NEET Phase-II)

Options:

A. 0,1

B. 0,0

C. 1,0

D. 1,1

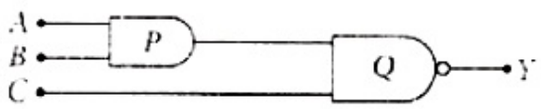
Answer: C

Solution:

$Y = \overline{(ABC)} = \overline{ABC}$

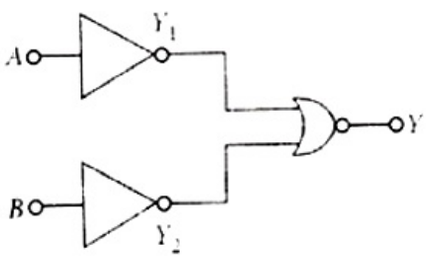
If $A = B = C = 0$ then $Y_0 = \overline{0} = 1$

If $A = B = C = 0$ then $Y_1 = \overline{1} = 0$



Question41

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



(2015)

Options:

A. AND

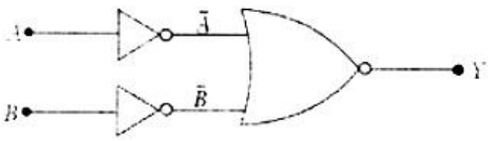
B. NOR

C. OR

D. NAND

Answer: A

Solution:



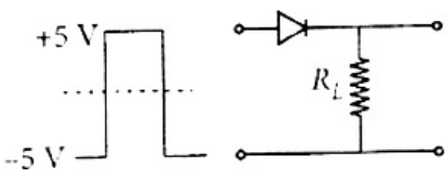
The Boolean expression of this arrangement is

$Y = \overline{\overline{A} + \overline{B}} = \bar{\bar{A}} \cdot \bar{\bar{B}} = A \cdot B$

Thus, the combination represents AND gate.

Question42

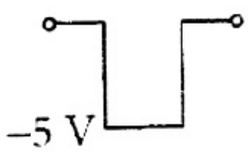
If in a p -n junction, a square input signal of 10 V is applied, as shown, then the output across R_L will be



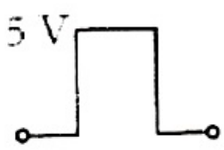
(2015)

Options:

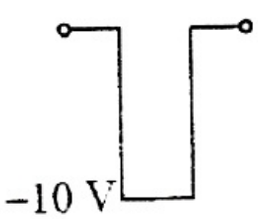
A.



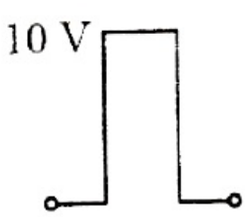
B.



C.



D.



Answer: B

Solution:

Diode is forward bias for positive voltage i.eV > 0,so output across R_L is given by

Question43

The input signal given to a CE amplifier having a voltage gain of 150 is $V_i = 2\cos\left(15t + \frac{\pi}{3}\right)$ The corresponding output signal will be (2015)

Options:

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

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

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

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

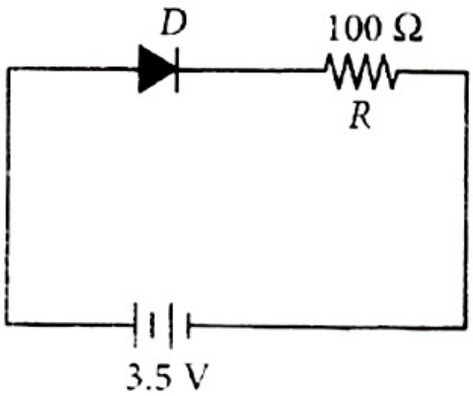
Answer: B

Solution:

Solution:
Here,
Input signal,$V_i = 2\cos\left(15t + \frac{\pi}{3}\right)$ and voltage gain,$A_v = 150$
As $A_V = \frac{V_o}{V_i}$
$\therefore$Output signal,$V_o = A_v V_i$
Since CE amplifier gives a phase difference of $\pi(= 180°)$ between input and output signals,
$\therefore V_o = 150\left[2\cos\left(15t + \frac{\pi}{3} + \pi\right)\right] = 300\cos\left(15t + \frac{4\pi}{3}\right)$

Question44

In the given figure, a diode D is connected to an external resistance R = 100Ω and an e.m.f of 3.5 V.If the barrier potential developed across the diode is 0.5 V, the current in the circuit will be



(2015)

Options:

A. 20 mA

B. 35 mA

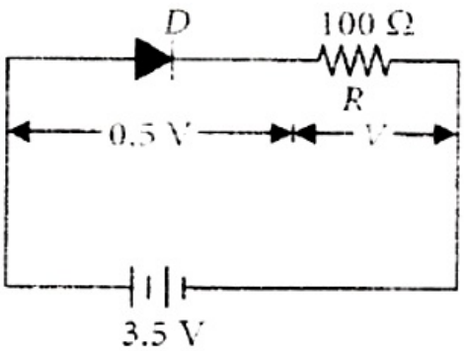
C. 30 mA

D. 40 mA

Answer: C

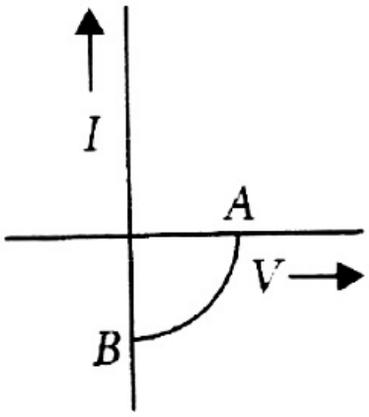
Solution:

The potential difference across the resistance R is
$V = 3.5V - 0.5V = 3V$
By Ohm's law
The current in the circuit is
$I = \frac{V}{R} = \frac{3V}{100\Omega}$
$= 3 \times 10^{-2}A = 30 \times 10^{-3}A$
= 30 mA



Question45

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



(2014)

Options:

A. It is V-I characteristic for solar cell where, point A represents open circuit voltage and point B short circuit current

B. It is for a solar cell and points A and B represent open circuit voltage and current, respectively.

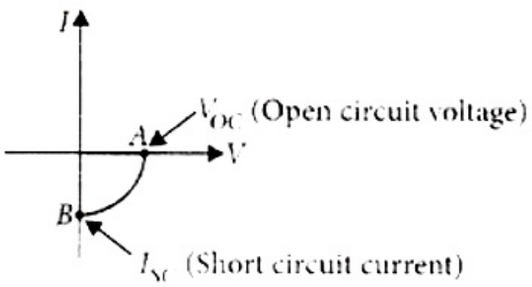
C. It is for a photodiode and points A and B represent open circuit voltage and current, respectively

D. It is for a LED and points A and B represent open circuit voltage and short circuit current, respectively.

Answer: A

Solution:

Solution:
The V-I characteristic for a solar cell is as shown the figure.



Question46

The barrier potential of a p-n junction depends on
(1) type of semiconductor material
(2) amount of doping
(3) temperature
Which one of the following is correct?
(2014)

Options:

A. (1) and (2) only

B. (2) only

C. (2) and (3) only

D. (1), (2) and (3)

Answer: D

Solution:

Solution:
The barrier potential depends on type of semiconductor
(For Si,$V_b = 0.7V$ and for Ge, $V_b = 0.3V$) amount of doping and also on the temperature.

Question47

In a common emitter (CE) amplifier having a voltage gain G, the transistor used has transconductance 0.03 mho and current gain 25. If the above transistor is replaced with another one with transconductance 0.02 mho and current gain 20, the voltage gain will be (2013 NEET)

Options:

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

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

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

D. 1.5G

Answer: C

Solution:

Voltage gain = Current gain x Resistance gain

$A_v = \beta \times \frac{R_{out}}{R_{in}}$

Transconductance,$gm = \frac{\beta}{R_m}$

or $R_{in}\frac{\beta}{g_m}$

$\therefore A_v = g_m R_{out}$

For first case,$A_v = G$, $g_m = 0.03$mho, $\beta = 25$

$\therefore G = 0.03R_{out}$.....(i)

$\therefore A_v = g_m R_{out}$

For Second case,$A_v = G'$, $g_m = 0.02$mho, $\beta = 20$

$\therefore G' = 0.02R_{out}$.....(ii)

Divide (ii) by (i), we get

$\frac{G'}{G} = \frac{2}{3}$ or $G' = \frac{2}{3}G$

Question48

In a n-type semiconductor, which of the following statement is true (2013 NEET)

Options:

A. Holes are minority carriers and pentavalent atoms are dopants.

B. Holes are majority carriers and trivalent atoms are dopants.

C. Electrons are majority carriers and trivalent atoms are dopants

D. Electrons are minority carriers and pentavalent atoms are dopants

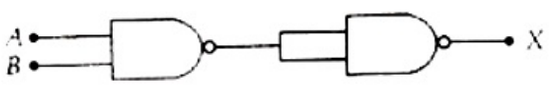
Answer: A

Solution:

Solution:
In n-type semiconductor, electrons are majority charge carriers and holes are minority charge carriers and pentavalent atoms are dopants.

Question49

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



(2013 NEET)

Options:

A. $X = A \cdot B$

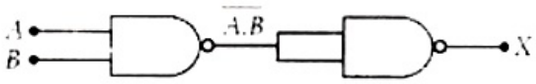
B. $X = \overline{A + B}$

C. $X = \bar{A} \cdot \bar{B}$

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

Answer: A

Solution:

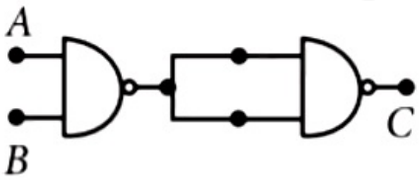


The output of the given logic circuit is

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

Question50

The output from of a NAND gate is divided into two in parallel and fed to another NAND gate.



The resulting gate is a
(KN NEET 2013)

Options:

A. AND gate

B. NOR gate

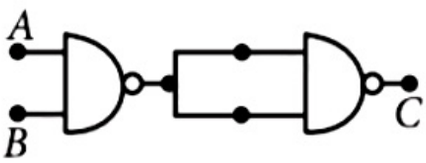
C. OR gate

D. NOT gate

Answer: A

Solution:

Solution:



The output of the given logic gate is

$C = \overline{AB} = A . B$
It is the Boolean expression of AND gate.
Hence, the resulting gate is a AND gate.

Question51

One way in which the operation of a n − p − n transistor differs from that of a p − n − p
(KN NEET 2013)

Options:

A. The emitter junction injects minority carriers into the base region of the $p-n-p$

B. The emitter injects holes into the base of the $p-n-p$ and electrons into the base region of $n-p-n$

C. The emitter injects holes into the base of $n-p-n$

D. The emitter junction is reversed biased in $n-p-n$

Answer: B

Solution:

Solution:
The emitter injects electrons into the base region of the $n-p-n$ transistor and holes into the base region of $p-n-p$ transistor.

Question52

In an unbiased $p-n$ junction, holes diffuse from the p -region to n -region because of (KN NEET 2013)

Options:

A. The attraction of free electrons of n -region.

B. The higher hole concentration in p -region than that in n -region.

C. The higher concentration of electrons in the n -region than that in the p -region.

D. The potential difference across the $p-n$ junction.

Answer: B

Solution:

Solution:
The higher hole concentration in p -region than that in n -region.

Question53

Two ideal diodes are connected to a battery as shown in the circuit. The current supplied by the battery is (2012)

Options:

A. 0.75 A

B. zero

C. 0.25 A

D. 0.5 A

Answer: D

Solution:

Solution:
In the given circuit, the upper diode D_1 is forward biased and the lower diode D_2 is reverse biased. So, the current supplied by the battery is
$I = \frac{5V}{10\Omega} = \frac{1}{2}A = 0.5A$

Question54

In a CE transistor amplifier, the audio signal voltage across the collector resistance of 2kΩ is 2 V. If the base resistance is 1kΩ and the current amplification of the transistor is 100, the input signal voltage is (2012)

Options:

A. 0.1 V

B. 1.0 V

C. 1 mV

D. 10 mV

Answer: D

Solution:

Solution:
Here, $R_C = 2k\Omega = 2 \times 10^3\Omega$
$V_o = 2V$
$R_B = 1k\Omega = 1 \times 10^3\Omega$
$\beta = 100$
Output Voltage, $V_0 = I_C R_C$
or $I_C = \frac{V_0}{R_C} = \frac{2V}{2 \times 10^3\Omega} = 10^{-3}A = 1mA$
As $\beta = \frac{I_C}{I_B}$ or $I_B = \frac{I_C}{\beta}$
$I_B = \frac{10^{-3}A}{100} = 10^{-5}A$
Input Voltage,
$V_i = I_B R_B = (10^{-5}A)(1 \times 10^3\Omega) = 10^{-2}V = 10mV$

Question55

C and Si both have same lattice structure, having 4 bonding electrons in each. However, C is insulator whereas Si is intrinsic semiconductor. This is because
(2012)

Options:

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

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

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

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

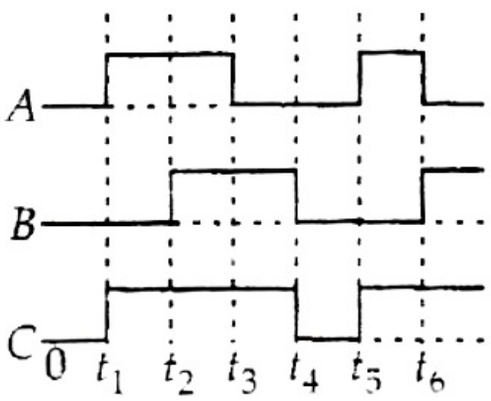
Answer: C

Solution:

Solution:
The electronic configuration of carbon (^{6}C) is $1s^2 2s^2 2p^2$.The electronic configuration of silicon (^{14}Si) is $1s^2 2s^2 2p^6 3s^2 3p^2$
Hence, the four bonding electrons of C and Si respectively lie in second and third orbit.

Question56

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



(2012)

Options:

A. OR gate

B. NOR gate

C. AND gate

D. NAND gate

Answer: A

Solution:

Solution:
The truth table of the given waveform is as shown in the table.

Time interval	Input A	Input B	Output B
0 to t_1	0	0	0
t_1 to t_2	1	0	1
t_2 to t_3	1	1	1
t_3 to t_4	0	1	1
t_4 to t_5	0	0	0
t_5 to t_6	1	0	1
$>t_6$	0	1	1

The logic circuit is OR gate.

Question57

The input resistance of a silicon transistor is 100Ω current is changed by 40μA which results in a change in collector currently by 2 mA. This transistor is used as a common emitter amplifier with a load resistance of 4kΩ.The voltage gain of the amplifier is
(2012 Mains)

Options:

A. 2000

B. 3000

C. 4000

D. 1000

Answer: A

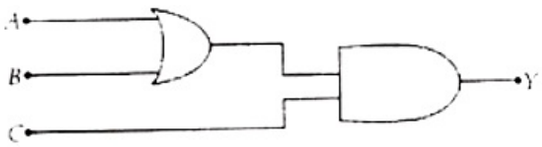
Solution:

Here,
Input resistance,$R_i = 100\Omega$
Change in base current,$\Delta I_B = 40\mu A$
Change in collector current,$\Delta I_C = 2mA$
Load resistance,$R_L = 4k\Omega = 4 \times 10^3\Omega$
Current gain,$\beta = \frac{\Delta I_C}{\Delta I_B} = \frac{2mA}{40\mu A} = \frac{2 \times 10^{-3}A}{40 \times 10^{-6}A} = 50$

Voltage gain of the amplifier is
$A_V = \beta = \frac{R_L}{R_i} = 50 \times \frac{4 \times 10^3}{100} = 2000$

Question58

To get an output Y = 1 in given circuit, which of the following input will be correct?



	A	B	C
(a)	1	0	0
(b)	1	0	1
(c)	1	1	0
(d)	0	1	0

(2012 Mains)

Options:

A. a

B. b

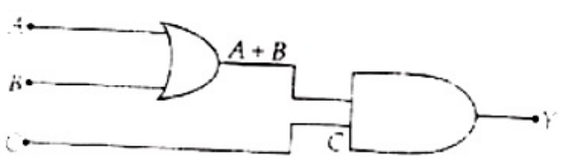
C. c

D. d

Answer: B

Solution:

Solution:



The Boolean expression of the given circuit is

$Y = (A + B) \cdot C$
The truth table of the given inputs is as shown in the table.

Inputs	Output
A B C	$Y = (A+B) \cdot C$
1 0 0	0
1 0 1	1
1 1 0	0
0 1 0	0

From the above truth table it is clear that
$Y = 1$,When A = 1, B = 0 and C = 1

Question59

A transistor is operated in common emitter configuration at $V_C = 2V$ such that a change in the base current from 100μA to 300μA produces a change in the collect or current from 10 mA to 20 mA. The current gain is
(2011)

Options:

A. 50

B. 75

C. 100

D. 25

Answer: A

Solution:

$$\text{Current gain},\beta = \frac{\Delta I_C}{\Delta I_B}$$

$$= \frac{(20-10)\text{mA}}{(300-100)\mu\text{A}} = \frac{10 \times 10^{-3}\text{A}}{200 \times 10^{-6}\text{A}} = 50$$

Question60

In forward biasing of the p-n junction

(2011)

Options:

A. the positive terminal of the battery is connected to p-side and the depletion region becomes thick.

B. the positive terminal of the battery is connected to n-side and the depletion region becomes thin.

C. the positive terminal of the battery is connected to n-side and the depletion region becomes thick.

D. the positive terminal of the battery is connected to p-side and the depletion region becomes thin.

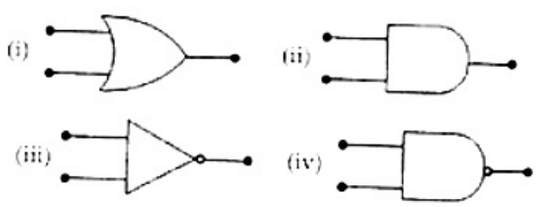
Answer: D

Solution:

Solution:
In forward biasing, the positive terminal of the battery is connected to p-side and the negative terminal to n-side of p-n junction. The forward bias voltage opposes the potential barrier. Due to it, the depletion region becomes thin.

Question61

Symbolic representation of four logic gates are shown as
Pick out which ones are for AND, NAND and NOT gates, respectively



(2011)

Options:

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

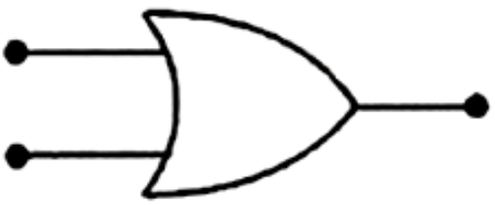
B. (iii), (ii) and (i)

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

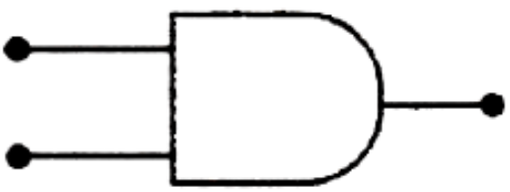
D. (ii), (iv) and (iii)

Answer: D

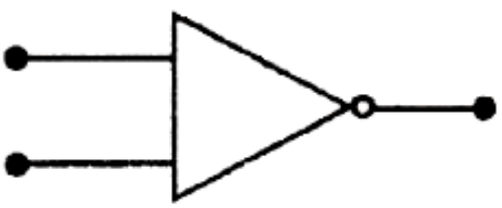
Solution:

(i) 

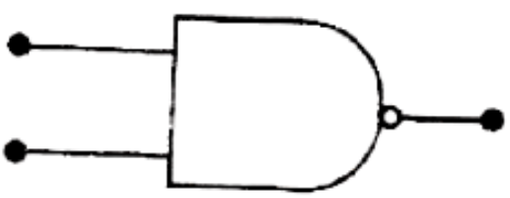
(i) It represents logic symbol of OR gate

(ii) 

(ii) It represents logic symbol of AND gate

(iii) 

(iii) It represents logic symbol of NOT gate

(iv) 

(iv) It represents logic symbol of NAND gate

Question62

If a small amount of antimony is added to germanium crystal (2011)

Options:

A. it becomes p-type semiconductor

B. the antimony becomes an acceptor atom

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

D. its resistance is increased

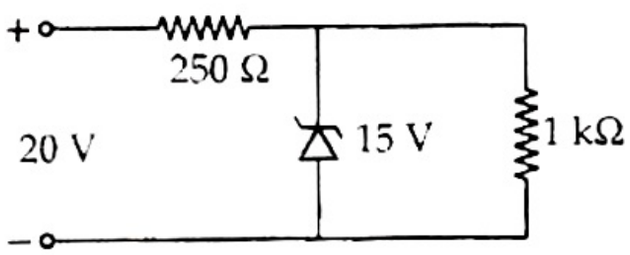
Answer: C

Solution:

Solution:
When a small amount of antimony (pentavalent) is added to germanium (tetravalent) crystal, then crystal becomes n-type semiconductor. In »-type semiconductor electrons are the majority charge carriers and the holes are the minority charge carriers.

Question63

A Zener diode, having breakdown voltage equal to 15 V, is used in a voltage regulator circuit shown in figure. The current through the diode is



(2011 Mains)

Options:

A. 5 mA

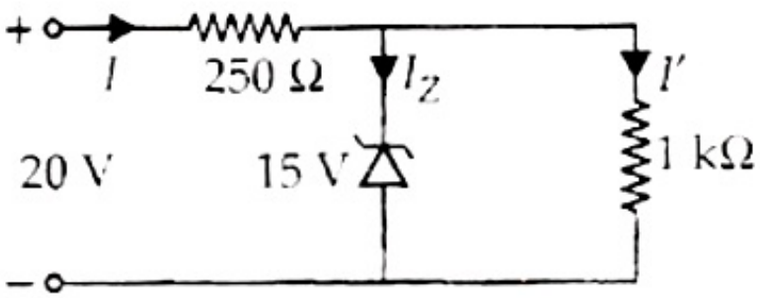
B. 10 mA

C. 15 mA

D. 20 mA

Answer: A

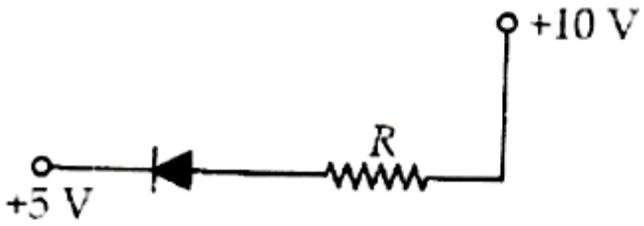
Solution:

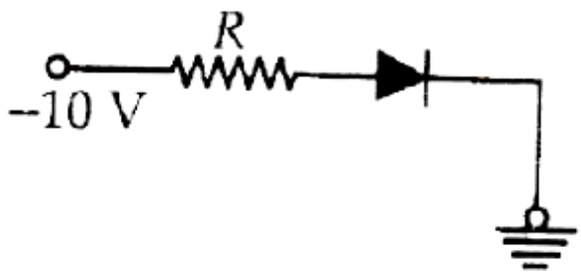


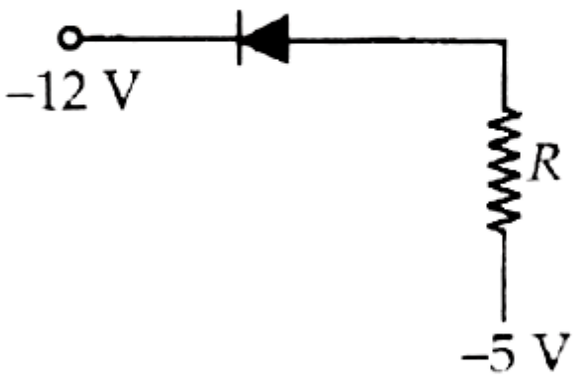
The voltage drop across $1k\Omega = V_Z = 15V$
The current through $1k\Omega$ is
$I' = \frac{15V}{1 \times 10^3 \Omega} = 15 \times 10^{-3} A = 15mA$
The voltage drop across $250\Omega = 20V - 15V = 5V$
The current through 250Ω is
$I = \frac{5V}{250\Omega} = 0.02A = 20mA$
The current through the zener diode is
$I_Z = I - I' = (20 - 15)mA = 5mA$

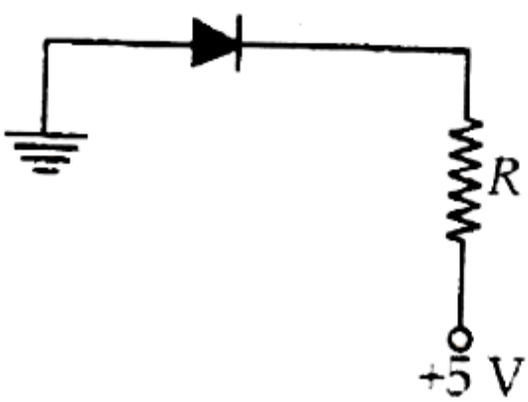
Question64

In the following figure, the diodes which are forward biased are









(2011 Mains)

Options:

A. (A), (B) and (D)

B. (C) only

C. (A) and (C)

D. (B) and (D)

Answer: C

Solution:

Solution:
p-n junction is said to be forward biased when p-side is at high potential than n side. It is for circuit (A) and (C).

Question65

Pure Si at 500 K has equal number of electron (n_e) and hole (n_h) concentrations of $1.5 \times 10^{16} m^{-3}$,Doping by indium increases n_h to $4.5 \times 10^{22} m^{-3}$.The doped semiconductor is of
(2011 Mains)

Options:

A. p-type having electron concentration $n_e = 5 \times 10^{9} m^{-3}$

B. n-type with electron concentration $n_e = 5 \times 10^{22} m^{-3}$

C. p-type with electron concentration $n_e = 2.5 \times 10^{10} m^{-3}$

D. n-type with electron concentration $n_e = 2.5 \times 10^{23} m^{-3}$

Answer: A

Solution:

Solution:
p-type semiconductor is obtained when Si or Ge is doped with a trivalent impurity like aluminium (Al), boron (B), indium (In) etc,
Here, $n_i = 1.5 \times 10^{16} m^{-3} n_h = 4.5 \times 10^{22} m^{-3}$
As

$n_e, n_h = n_i^2$

$$n_e = \frac{n_i^2}{n_h} = \frac{(1.5 \times 10^{16} m^{-3})^2}{4.5 \times 10^{22} m^{-3}} = 5 \times 10^9 m^{-3}$$

Question66

Which one of the following statement is false? (Mains 2010)

Options:

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

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

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

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

Answer: B

Solution:

Solution:
In a n-type semiconductor, electrons are majority carriers and holes are minority carriers.

Question67

The device that can act as a complete electronic circuit is (2010)

Options:

A. junction diode

B. integrated circuit

C. junction transistor

D. zener diode

Answer: B

Solution:

Solution:
The device that can act as a complete circuit is integrated circuit (IC).

Question68

A common emitter amplifier has a voltage gain of 50, an input impedance of 100 Ω and an output impedance of 200 . The power gain of the amplifier is
(2010)

Options:

A. 500

B. 1000

C. 1250

D. 50

Answer: C

Solution:

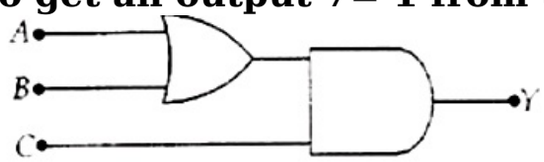
Here, Voltage gain = 50 ;
Input resistance, $R_i = 100\Omega$
Output resistance, $R_0 = 200\Omega$

Resistance $\frac{R_0}{R_i} = \frac{200\Omega}{100\Omega}$

Power gain $= \frac{(\text{Voltage gain})^2}{\text{Resistance gain}} = \frac{50 \times 50}{2} = 1250$

Question69

To get an output 7= 1 from the circuit shown below, the input must be



	A	B	C
(a)	0	1	0
(b)	0	0	1
(c)	1	0	1
(d)	1	0	0

(2010)

Options:

A. a

B. b

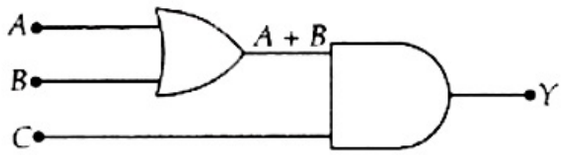
C. c

D. d

Answer: C

Solution:

Solution:



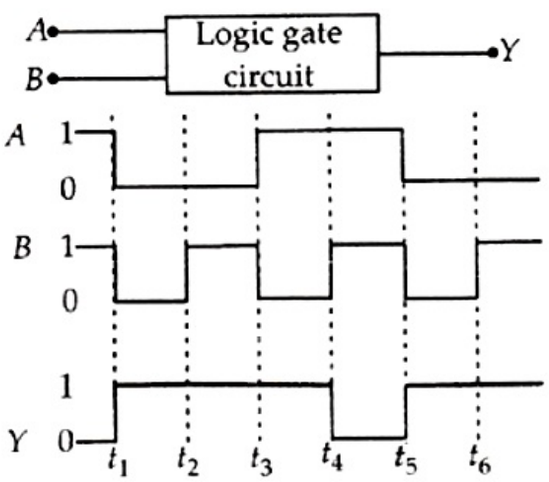
The Boolean expression of the given circuit is
$Y = (A + B) \cdot C$
The truth table of the given input signals as shown in the table.

A	B	C	$A+B$	$Y=(A+B)\cdot C$
0	1	0	1	0
0	0	1	0	0
1	0	1	1	1
1	0	0	1	0

From the truth table we conclude that output Y = 1, for the inputs A = 1,B = 0, C= 1
Hence, option (c) is correct

Question70

The following figure shows a logic gate circuit with two inputs A and B and the output Y. The voltage wave forms of A, B and Y are as given. The logic gate is



(2010 Mains)

Options:

A. NOR gate

B. OR gate

C. AND gate

D. NAND gate

Answer: D

Solution:

Solution:
It is clear from given logic circuit, that output Y is low when both the inputs are high, otherwise it is high. Thus, logic circuit is NAND gate.

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

Question71

For transistor action
(1) Base, emitter and collector regions should have similar size and doping concentrations.
(2) The base region must be very thin and lightly doped.
(3) The emitter-base junction is forward biased and base-collector junction is reverse biased.
(4) Both the emitter-base junction as well as the base collector junction are forward biased.
Which one of the following pairs of statements is correct?
(2010 Mains)

Options:

A. (1) and (4)

B. (1) and (2)

C. (2) and (3)

D. (3) and (4)

Answer: C

Question72

A p-n photodiode is fabricated from a semiconductor with a band gap of 2.5 eV. It can detect a signal of wavelength
(2009)

Options:

A. 4000 nm

B. 6000 nm

C. 4000 Å

D. 6000 Å

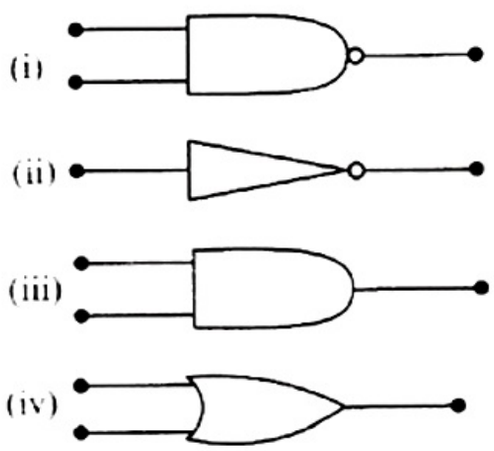
Answer: C

Solution:

Band gap = 2.5 eV
The wavelength corresponding to 2.5 eV
$= \frac{12400\text{eV Å}}{2.5\text{eV}} = 4960\text{Å}$
4000 Å can excite this

Question73

The symbolic representation of four logic gates are given below. The logic symbols for OR, NOT and NAND gates are respectively
(2009)



Options:

A. (i), (iii), (iv)

B. (i), (ii), (iv)

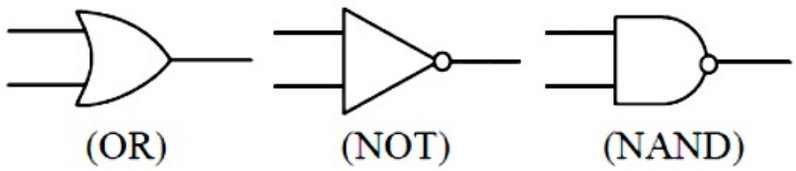
C. (i), (iii), (iv)

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

Answer: B

Solution:

OR gate, NOT gate and NAND gates are (iv), (ii) and (i) respectively



Question74

A transistor is operated in common-emitter configuration at $V_C = 2V$ such that a change in the base current from 100μA to 200μA produces a change in the collector current from5 mA to 10 mA. The current gain is (2009)

Options:

A. 100

B. 150

C. 50

D. 75

Answer: C

Solution:

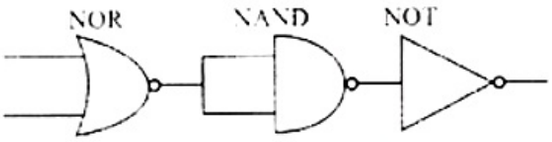
For common emitter, the current gain is

$$\beta = \left(\frac{\Delta I_C}{\Delta I_B}\right)_{V_{CE}}$$

$$\beta = \frac{(10 \times 10^{-3} - 5 \times 10^{-3})A}{(200 \times 10^{-6} - 100 \times 10^{-6})A} = \frac{5 \times 10^{-3}}{100 \times 10^{-6}} = 50$$

Question75

The circuit is equivalent to
(2008)



Options:

A. NOR gate

B. OR gate

C. AND gate

D. NAND gate

Answer: A

Question76

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
(2008)

Options:

A. 1×10^{14} Hz

B. 20×10^{14} Hz

C. 10×10^{14} Hz

D. 5×10^{14} Hz

Answer: D

Solution:

Band gap = 2eV
Wavelength of radiation corresponding to this energy,

$$\lambda = \frac{hc}{E} = \frac{12400 eV\,Å}{2eV} = 6200Å$$

The frequency of this radiation

$$\upsilon = \frac{c}{\lambda} = \frac{3 \times 10^{8} \frac{m}{s}}{6200} \times 10^{-10} m \Rightarrow \upsilon = 5 \times 10^{14} Hz$$

Question77

The voltage gain of an amplifier with 9% negative feedback is 10. The voltage gain without feedback will be
(2008)

Options:

A. 1.25

B. 100

C. 90

D. 10

Answer: B

Solution:

With negative feedback, the voltage gain of the amplifier is given by

$A' = \frac{A}{1 + \beta A}$

where, A = voltage gain without feedback

β = feedback factor

Here $A' = 10$, $\beta = 9\% = 0.09$

$\therefore 10 = \frac{A}{1 + 0.09A}$

$10 + 0.9A = A$

$A(1 - 0.9) = 10$

$A = \frac{10}{0.1} = 100$

Question78

If the lattice parameter for a crystalline structure is 3.6Å, then the atomic radius in fcc crystal is
(2008)

Options:

A. 2.92 Å

B. 1.27 Å

C. 1.81 Å

D. 2.10 Å

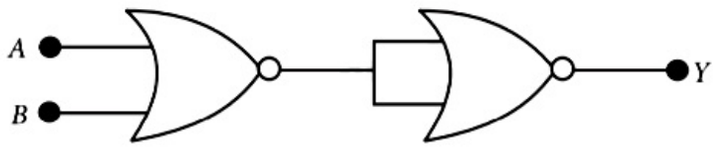
Answer: B

Solution:

The atomic radius in a f.c.c. crystal is $\frac{a}{2\sqrt{2}}$
where a is the length of the edge of the crystal.
$\therefore$ Atomic radius $= \frac{3.6\text{Å}}{2\sqrt{2}} = 1.27\text{Å}$

Question79

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



(2007)

Options:

A.

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

B.

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

C.

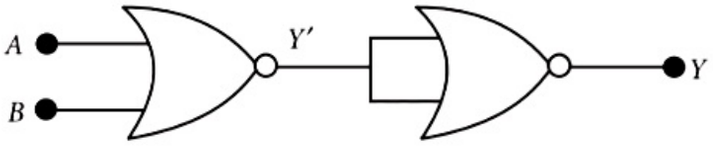
A	B	Y
0	0	0
0	1	1
1	0	1
1	1	1

D.

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

Answer: C

Solution:



$Y' = \overline{A+B}.\quad Y = \overline{\overline{A+B}} = A+B.$

Truth table of the given circuit is given by

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

Question80

For a cubic crystal structure which one of the following relations indicating the cell characteristics is correct? (2007)

Options:

A. a ≠ b ≠ c and α = β = γ = 90°

B. a = b = c and α ≠ β ≠ γ = 90°

C. a = b = c and α = β = γ = 90°

D. a ≠ b ≠ c and α ≠ β and γ ≠ 90°

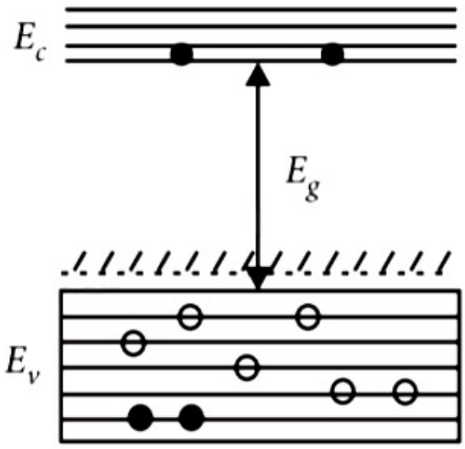
Answer: C

Solution:

Solution:
In a cubic crystal structure
a = b = c and α = β = γ = 90°

Question81

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



(2007)

Options:

A. an insulator

B. a metal

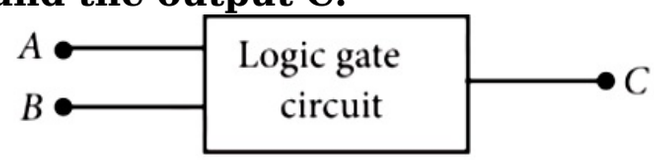
C. an n - type semiconductor

D. a p - type semiconductor.

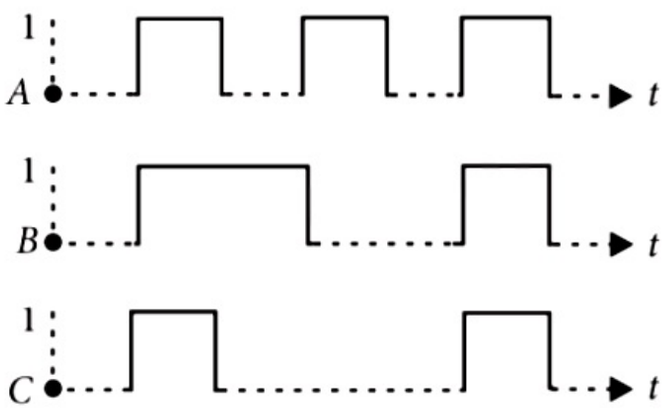
Answer: D

Question82

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 shown below.



The logic circuit gate is

(2006)

Options:

A. OR gate

B. AND gate

C. NAND gate

D. NOR gate

Answer: B

Solution:

The truth table corresponding to waveform is given by

A	B	C
1	1	1
0	1	0
1	0	0
0	0	0

∴ The given logic circuit gate is AND gate.

Question83

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 100μA to 150μA produces a change in the collector current from 5 mA to 10 mA. The current gain β is
(2006)

Options:

A. 50

B. 67

C. 75

D. 100

Answer: D

Solution:

Current gain, $\beta = \Delta I_C / \Delta I_B$

$$= \frac{(10-5)\,\text{mA}}{(150-100)\mu\text{A}} = \frac{5\times10^{-3}}{50\times10^{-6}} = 100$$

Question84

Choose the only false statement from the following. (2005)

Options:

A. In conductors the valence and conduction bands overlap.

B. Substances with energy gap of the order of 10 eV are insulators.

C. The resistivity of a semiconductor increases with increase in temperature.

D. The conductivity of a semiconductor increases with increase in temperature.

Answer: C

Solution:

Solution:
Resistivity of a semiconductor decreases with increase in the temperature.

Question85

Zener diode is used for (2005)

Options:

A. amplification

B. rectification

C. stabilisation

D. producing oscillations in an oscillator.

Answer: C

Solution:

Solution:
Zener diode is used for stabilisation while $p-n$ junction diode is used for rectification.

Question86

Application of a forward bias to a $p-n$ junction (2005)

Options:

A. widens the depletion zone

B. increases the potential difference across the depletion zone

C. increases the number of donors on the n side

D. decreases the electric field in the depletion zone.

Answer: D

Question87

Carbon, silicon and germanium atoms have four valence electrons each. Their valence and conduction bands are separated by energy band gaps represented by $(E_g)_C$, $(E_g)_{Si}$ and $(E_g)_{Ge}$ respectively. Which one of the following relationships is true in their case?
(2005)

Options:

A. $(E_g)_C > (E_g)_{Si}$

B. $(E_g)_C < (E_g)_{Si}$

C. $(E_g)_C = (E_g)_{Si}$

D. $(E_g)_C < (E_g)_{Ge}$

Answer: A

Solution:

Solution:
Band gap of carbon is 5.5 eV while that of silicon is 1.1 eV.
$(E_g)_C > (E_g)_{Si}$

Question88

Copper has face centered cubic (fcc) lattice with interatomic spacing equal to 2.54Å The value of lattice constant for this lattice is

(2005)

Options:

A. 2.54Å

B. 3.59Å

C. 1.27Å

D. 5.08Å

Answer: B

Solution:

Solution:
Lattice constant for (f.c.c.) = a = interatomic spacing $\times\sqrt{2}$ = 3.59Å

Question89

In a p − n junction photo cell, the value of the photo-electromotive force produced by monochromatic light is proportional to
(2005)

Options:

A. The barrier voltage at the p − n junction.

B. The intensity of the light falling on the cell.

C. The frequency of the light falling on the cell.

D. The voltage applied at the p − n junction.

Answer: B

Solution:

Solution:
In photocell, photoelectromotive force, is the force that stimulates the emission of an electric current when photovoltaic action creates a potential difference between two points and the electric current depends on the intensity of incident light.

Question90

In semiconductors at a room temperature
(2004)

Options:

A. the valence band is partially empty and the conduction band is partially filled

B. the valence band is completely filled and the conduction band is partially filled

C. the valence band is completely filled

D. the conduction band is completely empty

Answer: A

Solution:

Solution:
In semiconductor at room temperature the electrons get enough energy so that they are able to over come the forbidden gap. Thus at room temperature the valence band is partially empty and conduction band is partially filled. Conduction band in semiconductor is completely empty only at $0K$.

Question91

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
(2004)

Options:

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

B. $\frac{10}{\pi}V$

C. $10V$

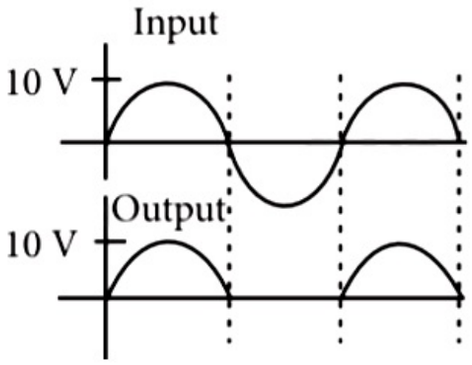
D. $\frac{20}{\pi}V$

Answer: B

Solution:

Solution:

$$V_{dc} = \frac{V_m}{\pi} = \frac{10}{\pi} V$$



Question92

The output of OR gate is 1
(2004)

Options:

A. if both inputs are zero

B. if either or both inputs are 1

C. only if both inputs are 1

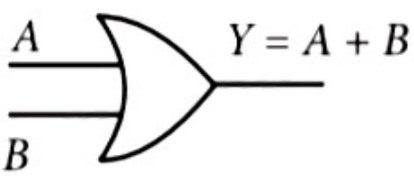
D. if either input is zero

Answer: B

Solution:

The truth table of OR gate is

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



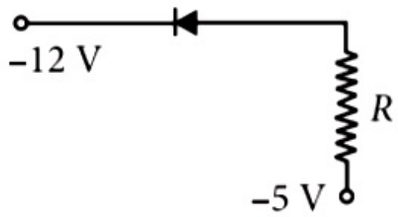
From truth table we can observe that if either of input is one then output is one. Also if both the inputs are one then also output is one.

Question93

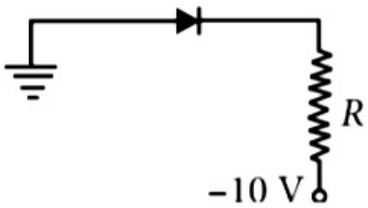
Of the diodes shown in the following diagrams, which one is reverse biased?
(2004)

Options:

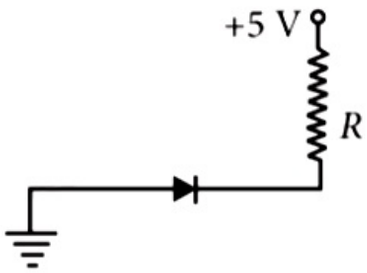
A.



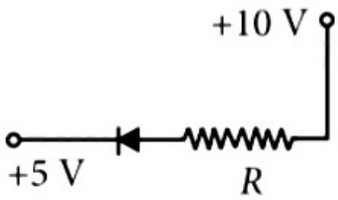
B.



C.



D.



Answer: C

Solution:

Solution:
A diode is said to be reverse biased if p -type semiconductor of p − n junction is at low potential with respect to n -type semiconductor of p − n junction. It is so for circuit (c).

Question94

Reverse bias applied to a junction diode (2003)

Options:

A. lowers the potential barrier

B. raises the potential barrier

C. increases the majority carrier current

D. increases the minority carrier current

Answer: B

Solution:

Solution:
In reverse biasing, the conduction across the $p-n$ junction takes place due to minority carriers, therefore the size of depletion region (potential barrier) rises.

Question95

A $n-p-n$ transistor conducts when (2003)

Options:

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

Solution:

Solution:
A n-p-n transistor conducts when emitter-base junction is forward biased while collector-base junction is reverse biased.

Question96

If a full wave rectifier circuit is operating from 50 Hz mains, the fundamental frequency in the ripple will be (2003)

Options:

A. 25 Hz

B. 50 Hz

C. 70.7 Hz

D. 100 Hz

Answer: D

Solution:

Solution:
In full wave rectifier the fundamental frequency in ripple is twice of input frequency.

Question97

Barrier potential of a p − n junction diode does not depend on (2003)

Options:

A. diode design

B. temperature

C. forward bias

D. doping density

Answer: A

Solution:

Solution:
Barrier potential depends upon temperature, doping density and forward biasing.

Question98

Number of atom per unit cell in B.C.C. (2002)

Options:

A. 9

B. 4

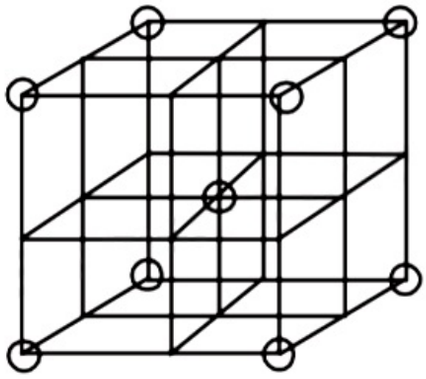
C. 2

D. 1

Answer: C

Solution:

In body-centred cubic (b.c.c.) lattice there are eight atoms at the corners of the cube and one at the centre as shown in the figure.



b.c.c. structure

Therefore number of atom per unit cell $= \frac{1}{8} \times 8 + 1 = 2$

Question99

For a transistor $\frac{I_C}{I_E}$ = 0.96, then current gain for common emitter is (2002)

Options:

A. 12

B. 6

C. 48

D. 24

Answer: D

Solution:

Solution:
The current gain of a common emitter transistor (β) is defined as the ratio of collector current (I_C) to the base current (I_B) .

Also, $I_E = I_B + I_C$; $\frac{I_C}{I_E} = 0.96$ (given)

$\therefore \beta = \frac{I_C}{I_B} = \frac{I_C}{I_E - I_C}$

Now, $\frac{I_E}{I_C} = \frac{1}{0.96}$

$\therefore \frac{I_E - I_C}{I_C} = \frac{1}{0.96} - 1 = \frac{0.04}{0.96}$

$\therefore \beta = \frac{I_C}{I_E - I_C} = \frac{0.96}{0.04} = 24$

Question100

In a p − n junction
(2002)

Options:

A. high potential at n side and low potential at p side

B. high potential at p side and low potential at n side

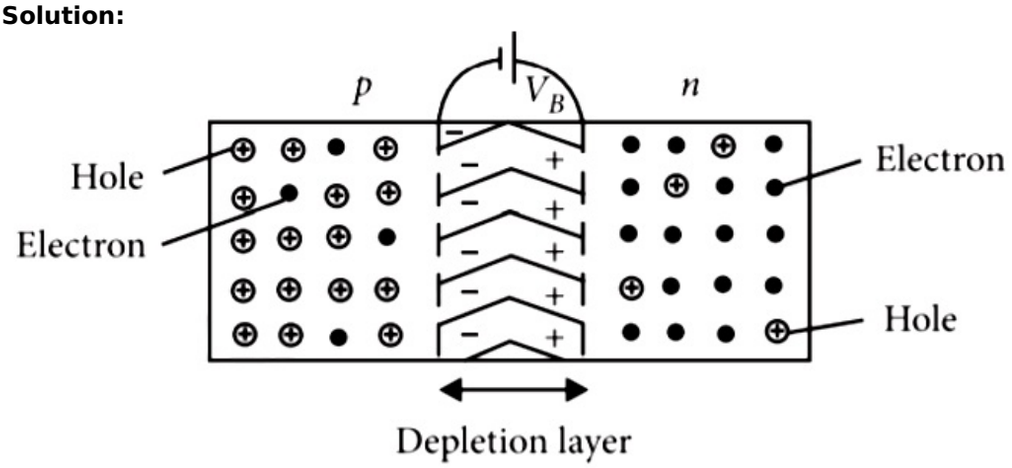
C. p and n both are at same potential

D. undetermined.

Answer: A

Solution:

Solution:



A p − n junction is shown in the figure. On account of difference in concentration of charge carriers in the two sections of p − n junction, the electrons from n -region diffuse through the junction into p - region and the holes from p -region diffuse into n region.

since the hole is a vacancy of an electron, when an electron from n region diffuses into the p -region, the electron falls into the vacancy, i.e., it completes the covalent bond. Due to migration of charge carriers across the junction, the n -region of the junction will have its electrons neutralized by holes from the p -region, leaving only ionised donor atoms (positive charges) which are bound and cannot move. Similarly, the p region of the junction will have ionised acceptor atoms (negative charges) which are immobile.

The accumulation of electric charges of opposite polarities in the two regions of the junction gives rise to an electric field between these regions as if a fictitious battery is connected across the junction with its positive terminal connected to n region and negative terminal connected to p region. Therefore, in a p − n junction high potential is at n side and low potential is at p side.

Question101

The given truth table is for which logic gate?

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

(2002, 2001, 1998, 1994)

Options:

A. NAND

B. XOR

C. NOR

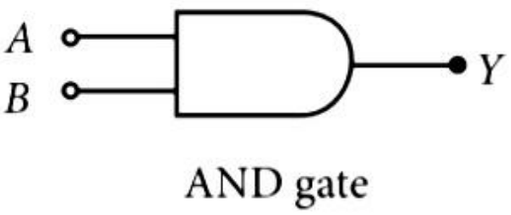
D. OR.

Answer: A

Solution:

Solution:

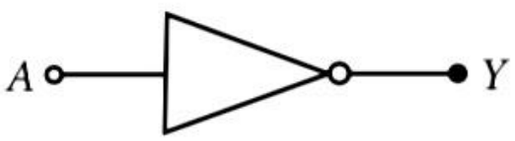
NAND gate is a combination of AND and NOT gate.



AND gate

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

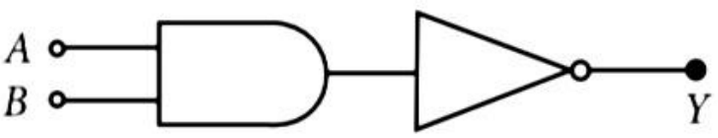
Truth table of AND gate



NOT gate

A	Y
0	1
1	0

Truth table of NOT gate



NAND gate

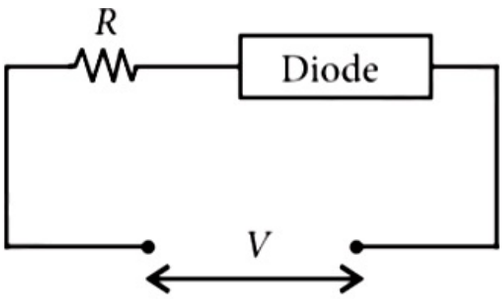
A	B	Y
0	0	1
1	0	1
0	1	1
1	1	0

Truth table of NAND gate

Hence the given truth table is of a NAND gate.

Question102

For the given circuit of p – n junction diode which is correct?



(2002)

Options:

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

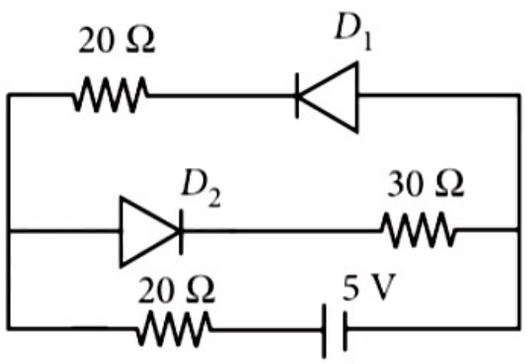
Answer: A

Solution:

Solution:
In forward biasing, the resistance of $p-n$ junction diode is very low to the flow of current. So practically all the voltage will be dropped across the resistance R, i.e., voltage across R will be V.
In reverse biasing, the resistance of $p-n$ junction diode is very high. So the voltage drop across R is zero.

Question103

The current in the circuit will be



(2001)

Options:

A. $\frac{5}{40}$A

B. $\frac{5}{50}$A

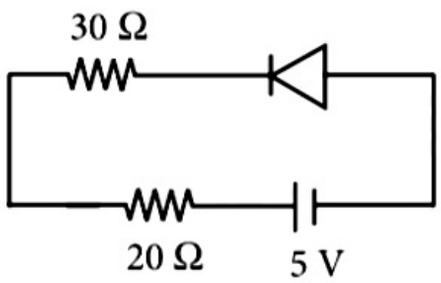
C. $\frac{5}{10}$A

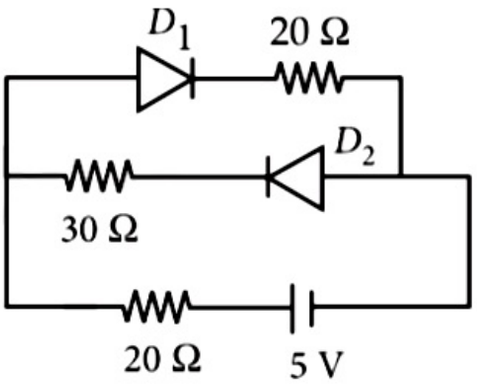
D. $\frac{5}{20}$A

Answer: B

Solution:

D_1→ reverse biased and D_2→ forward biased.
Equivalent circuit is





$I = \frac{5V}{(30+20)\Omega} = \frac{5}{50}A$

Question104

For a common base circuit if $\frac{I_C}{I_E}$ = 0.98 then current gain for common emitter circuit will be
(2001)

Options:

A. 49

B. 98

C. 4.9

D. 25.5

Answer: A

Solution:

$\frac{I_C}{I_E} = \alpha = 0.98, \frac{I_C}{I_B} = \beta = \frac{\alpha}{1-\alpha} = 49$

Question105

The cations and anions are arranged in alternate form in (2000)

Options:

A. metallic crystal

B. ionic crystal

C. covalent crystal

D. semi-conductor crystal.

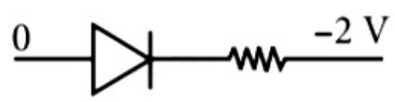
Answer: B

Question106

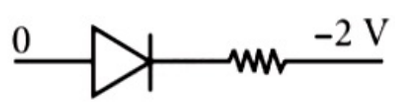
From the following diode circuit, which diode is in forward biased condition (2000)

Options:

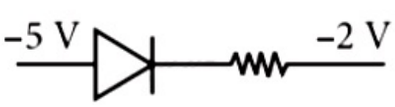
A.



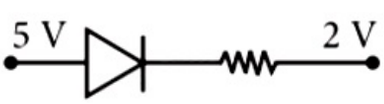
B.



C.



D.



Answer: A

Solution:

A diode is said to be forward biased if p -type semiconductor of p − n junction is at positive potential with respect to n -type semiconductor of p − n junction. It is so for circuit (a).

Question107

The correct relation for α, β for a transistor (2000)

Options:

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

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

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

D. $\alpha\beta = 1$

Answer: B

Solution:

Solution:

$\beta = \frac{I_c}{I_b} = \frac{I_c}{I_e - I_c} = \frac{I_c / I_e}{1 - (I_c / I_e)} = \frac{\alpha}{1-\alpha}$

Question108

A p − n junction diode can be used as (1999)

Options:

A. condenser

B. regulator

C. amplifier

D. rectifier

Answer: D

Solution:

Solution:

As a p − n junction diode conducts in forward bias and does not conduct in reverse bias (current is practically zero), thus

undirectional property leads to application of diode in rectifiers.

Question109

Sodium has body-centred packing. If the distance between two nearest atoms is 3.7Å, then lattice parameter is (1999)

Options:

A. 4.3Å

B. 3.9Å

C. 3.3Å

D. 4.8Å

Answer: A

Solution:

Atomic radius for body centered cubic structure is $r = \frac{a\sqrt{3}}{4}$

or, $a = \frac{4r}{\sqrt{3}} = \frac{4(3.7 / 2)}{1.732} = 4.3Å$

Question110

In a p type semiconductor, the majority carriers of current are (1999)

Options:

A. protons

B. electrons

C. holes

D. neutrons

Answer: C

Question111

In forward bias, the width of potential barrier in a p − n junction diode (1999)

Options:

A. remains constant

B. decreases

C. increases

D. first (a) then (b)

Answer: B

Solution:

Solution:
In forward biasing, the conduction across $p - n$ junction takes place due to migration of majority carriers (i.e., electrons from n -side to p -side and holes from p -side to n -side , hence the size of depletion region decreases.

Question112

Depletion layer consists of (1999)

Options:

A. mobile ions

B. protons

C. electrons

D. immobile ions

Answer: D

Question113

In a junction diode, the holes are due to

(1999)

Options:

A. extra electrons

B. neutrons

C. protons

D. missing of electrons

Answer: D

Question114

Which of the following, when added as an impurity into the silicon produces n type semiconductor?
(1999)

Options:

A. B

B. Al

C. P

D. Mg

Answer: C

Solution:

Because P (phosphorus) is pentavalent.

Question115

The cause of the potential barrier in a p − n junction diode is
(1998)

Options:

A. depletion of negative charges near the junction

B. concentration of positive charges near the junction

C. depletion of positive charges near the junction

D. concentration of positive and negative charges near the junction

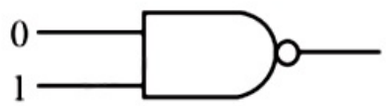
Answer: D

Question116

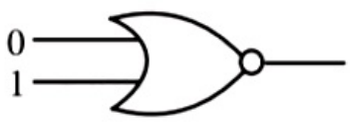
Which of the following gates will have an output of 1? (1998)

Options:

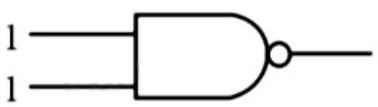
A.



B.



C.



D.

Answer: A

Question117

The transfer ratio beta of a transistor is 50 . The input resistance of the transistor when used in the common-emitter configuration is 1kΩ. The peak value of the collector A.C. current for an A.C. input voltage of 0.01V peak is (1998)

Options:

A. 0.25 mA

B. 0.01 mA

C. 100 mA

D. 500 mA

Answer: D

Solution:

Solution:

$I_b = \frac{V_{in}}{R_{in}} = \frac{0.01}{10^3}$

$I_c = \beta I_b = 50 \times \frac{0.01}{10^3} = 5 \times 10^{-4} A = 500\,mA$

Question118

battery is reversed, the current drops to almost zero. The device may be (1998)

Options:

A. a p -type semiconductor

B. an intrinsic semiconductor

C. a $p-n$ junction

D. an n -type semiconductor

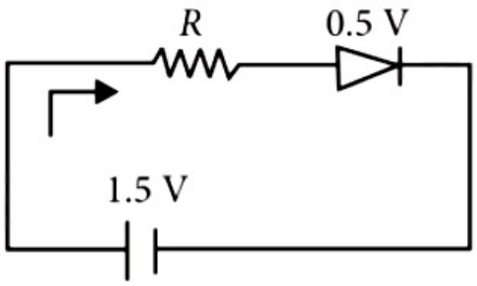
Answer: C

Solution:

Solution:
On reversing the polarity of the battery, the $p-n$ junction is reverse biased. As a result of which its resistance becomes high and current through the junction drops to almost zero.

Question119

The diode used in the circuit shown in the figure has a constant voltage drop at 0.5V at all currents and a maximum power rating of 100 milli watts. What should be the value of the resistor R, connected in series with diode for obtaining maximum current?
(1997)



Options:

A. 6.76Ω

B. 20Ω

C. 5Ω

D. 5.6Ω

Answer: C

Solution:

Solution:
Voltage drop across diode (V_D) = 0.5V
Maximum power rating of diode (P) = 100 mW $= 100 \times 10^{-3}$W
and source voltage (V_s) = 1.5V.
The resistance of diode (R_D) $= \frac{V_D^2}{P} = \frac{(0.5)^2}{100 \times 10^{-3}} = 2.5\Omega$
And current in diode (I_D) $= \frac{V_D}{R_D} = \frac{0.5}{2.5} = 0.2\Omega$
Therefore total resistance in circuit (R)
$= \frac{V_s}{I_D} = \frac{1.5}{0.2} = 7.5\Omega$
And the value of the series resistor = Total resistance of the circuit - Resistance of diode
$= 7.5 - 2.5 = 5\Omega$

Question120

The correct relationship between the two current gains α and β in a transistor is
(1997)

Options:

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

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

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

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

Answer: A

Solution:

Current gain $(\beta) = \frac{\alpha}{1-\alpha}$ or $\beta - \beta\alpha = \alpha$

or, $\beta = \alpha + \beta\alpha = \alpha(1+\beta)$ or $\alpha = \frac{\beta}{1+\beta}$

Question121

The following truth-table belongs to which one of the following four gates?
(1997,1995)

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

Options:

A. XOR

B. NOR

C. OR

D. NAND

Answer: D

Question122

To obtain a p-type germanium semiconductor, it must be doped with
(1997)

Options:

A. indium

B. phosphorus

C. arsenic

D. antimony.

Answer: A

Solution:

Solution:
In p type germanium semiconductor, it must be doped with a trivalent impurity atom. since indium is a third group member, therefore germanium must be doped in indium.

Question123

When npn transistor is used as an amplifier, then (1996)

Options:

A. electrons move from collector to base

B. holes move from base to emitter

C. electrons move from base to collector

D. electrons move from emitter to base.

Answer: C

Solution:

Solution:
In n − p − n transistor, the electrons are majority carriers in emitter, which move from base to collector while using n − p − n transistor as an amplifier.

Question124

When arsenic is added as an impurity to silicon, the resulting material is (1996)

Options:

A. n -type conductor

B. n -type semiconductor

C. p -type semiconductor

D. none of these.

Answer: B

Solution:

Solution:
Arsenic is pentavalent, therefore when added with silicon it leaves one electron as a free electron. In this case the conduction of electricity is due to motion of electrons, so the resulting material is n -type semiconductor.

Question125

When using a triode, as an amplifier, the electrons are emitted by (1996)

Options:

A. grid and collected by cathode only

B. cathode and collected by the anode only

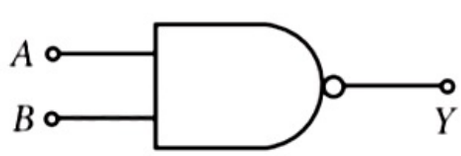
C. anode and collected by cathode only

D. anode and collected by the grid and by cathode.

Answer: B

Question126

This symbol represents



(1996)

Options:

A. AND gate

B. NOR gate

C. NAND gate

D. OR gate.

Answer: C

Solution:

According to figure $Y = \overline{A \cdot B}$
Therefore it is NAND gate.

Question127

Distance between body centered atom and a corner atom in sodium (a = 4.225Å) is (1995)

Options:

A. 2.99Å

B. 2.54Å

C. 3.66Å

D. 3.17Å

Answer: C

Solution:

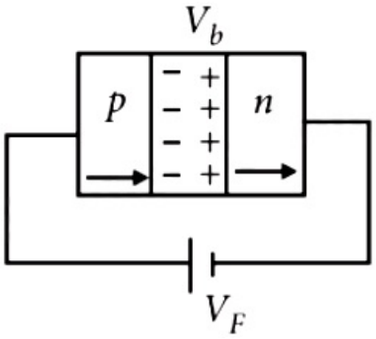
a = 4.225Å
For bcc cubic cell, $4r = \sqrt{3} \times a$
Therefore $2r = \frac{\sqrt{3} \times a}{2} = \frac{1.732 \times 4.225}{2} = 3.66Å$

Question128

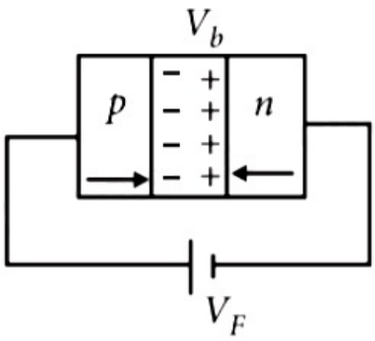
In the case of forward biasing of p − n junction, which one of the following figures correctly depicts the direction of flow of carriers? (1995)

Options:

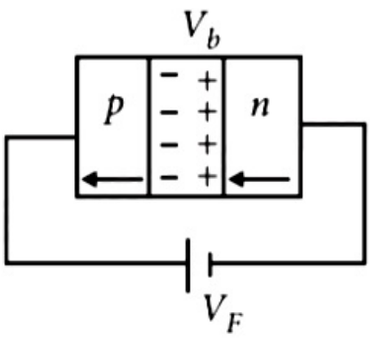
A.



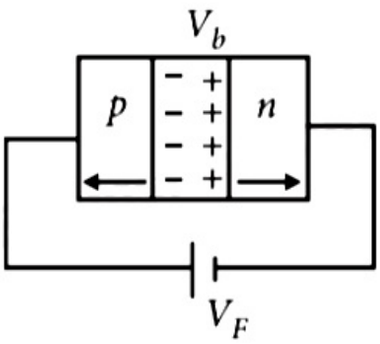
B.



C.



D.



Answer: B

Solution:

Solution:
As soon as the p − n junction is formed, there is an immediate diffusion of the charge carriers across the junction due to thermal agitation. After diffusion, these charge carriers combine with their counterparts and neutralise each other. Therefore correct direction of flow of carriers is depicted in figure (b).

Question129

Diamond is very hard because
(1993)

Options:

A. it is covalent solid

B. it has large cohesive energy

C. high melting point

D. insoluble in all solvents

Answer: B

Solution:

Solution:
Diamond is very hard due to large cohesive energy.

Question130

The part of the transistor which is heavily doped to produce large number of majority carriers is
(1993)

Options:

A. emitter

B. base

C. collector

D. any of the above depending upon the nature of transistor

Answer: A

Solution:

Solution:
The function of emitter is to supply the majority carriers. So, it is heavily doped.

Question131

Which one of the following is the weakest kind of the bonding in solids?

(1992)

Options:

A. ionic

B. metallic

C. van der Waals

D. covalent

Answer: C

Solution:

Solution:
van der Waals bonding is the weakest bonding in solids.

Question132

For amplification by a triode, the signal to be amplified is given to (1992)

Options:

A. the cathode

B. the grid

C. the glass envelope

D. the anode

Answer: B

Solution:

Solution:
The amplifying action of a triode is based on the fact that a small change in grid voltage causes a large change in plate current. The AC input signal which is to be amplified is superimposed on the grid potential.

Question133

For an electronic valve, the plate current I and plate voltage V in the space charge limited region are related as (1992)

Options:

A. I is proportional to $V^{\frac{3}{2}}$

B. I is proportional to $V^{\frac{2}{3}}$

C. I is proportional to V

D. I is proportional to V^{2}

Answer: A

Question134

A piece of copper and other of germanium are cooled from the room temperature to 80K, then
(1992)

Options:

A. resistance of each will increase

B. resistance of copper will decrease

C. the resistance of copper will increase while that of germanium will decrease

D. the resistance of copper will decrease while that of germanium will increase

Answer: D

Solution:

Solution:
Copper is a conductor so its resistance decreases on decreasing temperature as thermal agitation decreases whereas germanium is semiconductor which on decreasing temperature resistance increases.

Question135

The depletion layer in the p − n junction region is caused by
(1991)

Options:

A. drift of holes

B. diffusion of charge carriers

C. migration of impurity ions

D. drift of electrons.

Answer: B

Solution:

Solution:
The depletion layer in the p - n junction region is caused by diffusion of charge carriers.

Question136

The following truth table corresponds to the logical gate

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

(1991)

Options:

A. NAND

B. OR

C. AND

D. XOR.

Answer: B

Solution:

Solution:
This truth table is of identity,
$Y = A + B$, hence OR gate.

Question137

To use a transistor as an amplifier
(1991)

Options:

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

B. no bias voltage is required

C. both junction are forward biased

D. both junction are reverse biased.

Answer: A

Solution:

Solution:
To use transistor as an amplifier the emitter base junction is forward bias while the collector base junction is reverse biased.

Question138

In a common base amplifier the phase difference between the input signal voltage and the output voltage is (1990)

Options:

A. 0

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

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

D. π

Answer: A

Solution:

Solution:
The phase difference between output voltage and input signal voltage in common base transistor or circuit is zero.

Question139

When a triode is used as an amplifier the phase difference between the input signal voltage and the output is (1990)

Options:

A. 0

B. π

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

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

Answer: B

Solution:

Solution:

Voltage gain of an amplifier $= \frac{\text{Output voltage}}{\text{Input voltage}} = -\frac{\mu R_L}{R_L + r_P}$

The negative sign indicates that the output voltage differs in phase from the input voltage by 180°(π). This holds for a pure resistive load.

Question140

When n type semiconductor is heated (1989)

Options:

A. number of electrons increases while that of holes decreases

B. number of holes increases while that of electrons decreases

C. number of electrons and holes remainsame

D. number of electrons and holes increases equally.

Answer: D

Solution:

Solution:
Due to heating, when a free electron is produced then simultaneously a hole is also produced.

Question141

Radiowaves of constant amplitude can be generated with (1989)

Options:

A. FET

B. filter

C. rectifier

D. oscillator

Answer: D

Solution:

Solution:
Radiowaves of constant amplitude can be produced by using oscillator with proper feedback.

Question142

p − n junction is said to be forward biased, when (1988)

Options:

A. the positive pole of the battery is joined to the p -semiconductor and negative pole to the n -semiconductor

B. the positive pole of the battery is joined to the n -semiconductor and p -semiconductor

C. the positive pole of the battery is connected to n -semiconductor andp -semiconductor

D. mechanical force is applied in the forward direction.

Answer: A

Solution:

Solution:
For forward biasing of p − n junction, the positive terminal of external battery is to be connected to p semiconductor and negative terminal of battery to the n semiconductor.

Question143

At absolute zero, Si acts as (1988)

Options:

A. non metal

B. metal

C. insulator

D. none of these.

Answer: C

Solution:

Semiconductors are insulators at room temperature.
