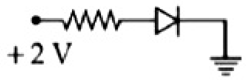
Electronic Devices

Question1

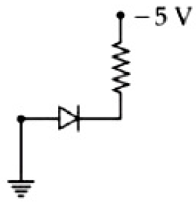
Which of the following circuits is reverse - biased ? [27-Jan-2024 Shift 1]

Options:

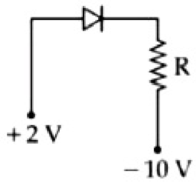
A.



B.



C.



D.

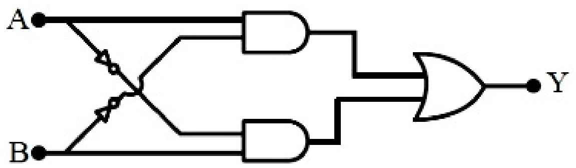
Answer: D

Solution:

Solution:
P end should be at higher potential for forward biasing.

Question2

The truth table of the given circuit diagram is:



[27-Jan-2024 Shift 2]

Options:

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

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

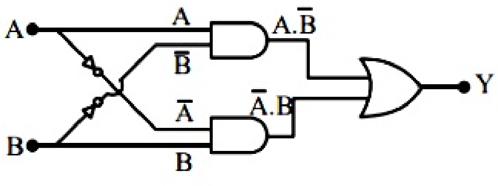
C. A B Y
0 0 0
0 1 0
1 0 0
1 1 1

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

Answer: B

Solution:

Solution:

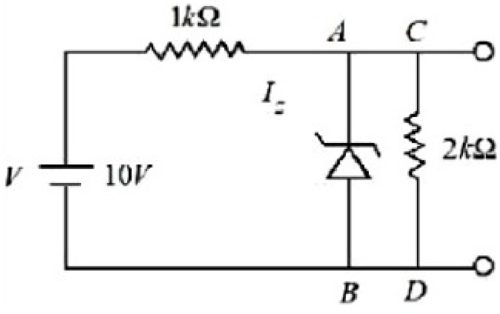


$Y = A \cdot \overline{B} + \overline{A} \cdot B$

This is XOR GATE

Question3

In the given circuit, the breakdown voltage of the Zener diode is 3.0V. What is the value of I_z ?



[29-Jan-2024 Shift 1]

Options:

A. 3.3 mA

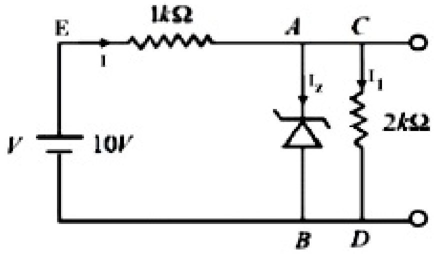
B. 5.5 mA

C. 10 mA

D. 7 mA

Answer: B

Solution:



$V_z = 3V$

Let potential at B = 0V

Potential at $E\,(V_E) = 10V$

$V_C = V_A = 3V$

$I_z + I_1 = I$

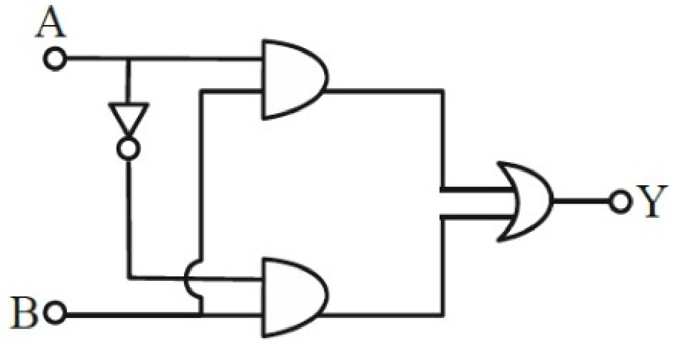
$I = \frac{10-3}{1000} = \frac{7}{1000} A$

$I_1 = \frac{3}{2000} A$

Therefore $I_z = \frac{7-1.5}{1000} = 5.5\,\text{mA}$

Question4

The truth table for this given circuit is :



[29-Jan-2024 Shift 2]

Options:

A.

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

B.

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

C.

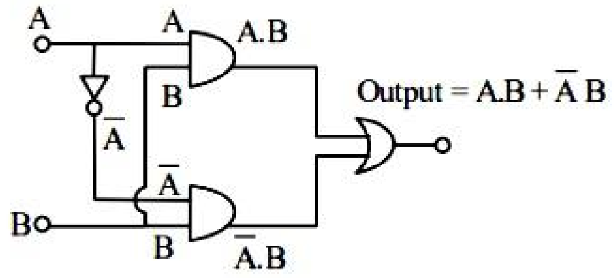
A	B	Y
0	0	0
0	1	0
1	0	0
1	1	1

D.

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

Answer: B

Solution:



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

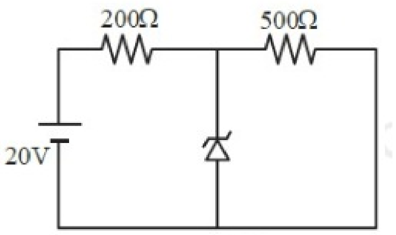
$$= (A + \overline{A}) \cdot B$$

$$Y = 1 \cdot B$$

$$Y = B$$

Question5

A Zener diode of breakdown voltage 10V is used as a voltage regulator as shown in the figure. The current through the Zener diode is



[30-Jan-2024 Shift 1]

Options:

A. 50 mA

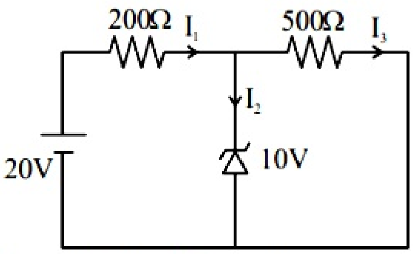
B. 0

C. 30 mA

D. 20 mA

Answer: C

Solution:



Zener is in breakdown region.

Zener is in breakdown region.

$$I_3 = \frac{10}{500} = \frac{1}{50}$$

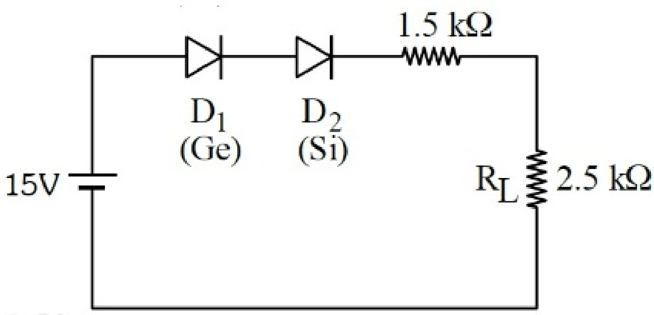
$$I_1 = \frac{10}{200} = \frac{1}{20}$$

$$I_2 = I_1 - I_3$$

$$I_2 = \left(\frac{1}{20} - \frac{1}{50}\right) = \left(\frac{3}{100}\right) = 30\,\text{mA}$$

Question6

In the given circuit, the voltage across load resistance (R_L) is:



[30-Jan-2024 Shift 2]

Options:

A. 8.75V

B. 9.00V

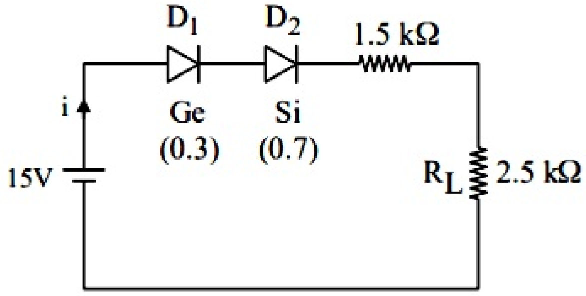
C. 8.50V

D. 14.00V

Answer: A

Solution:

Solution:



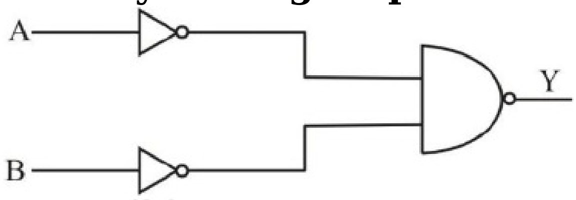
$i = \frac{14}{4} = 3.5\,\text{mA}$

$V_L = iR_L = 3.5 \times 2.5$ volt

$= 8.75$ volt

Question7

Identify the logic operation performed by the given circuit.



[31-Jan-2024 Shift 1]

Options:

A. NAND

B. NOR

C. OR

D. AND

Answer: C

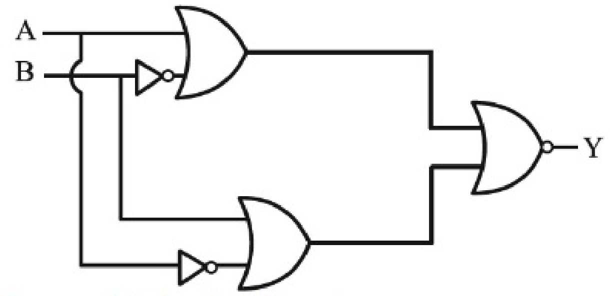
Solution:

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

(De-Morgan's law)

Question8

The output of the given circuit diagram is



[31-Jan-2024 Shift 2]

Options:

A.

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

B.

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

C.

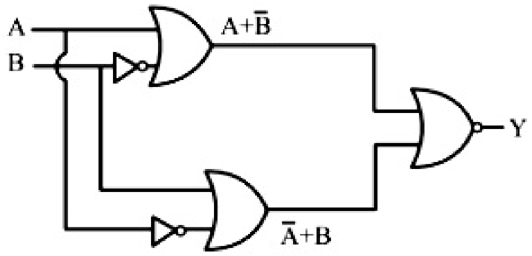
A	B	Y
0	0	0
1	0	0
0	1	0
1	1	0

D.

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

Answer: C

Solution:



If $A = 0; \overline{A} = 1$

$A = 1; \overline{A} = 0$

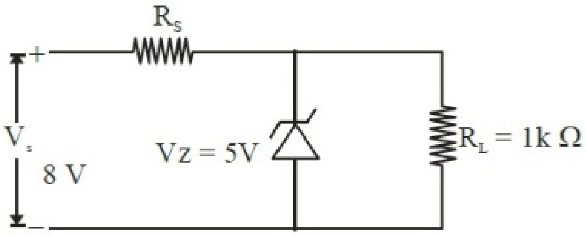
$B = 0; \overline{B} = 1$

$B = 1; \overline{B} = 0$

$Y = \overline{(A+\overline{B})+(\overline{A}+B)} = \overline{(1+1)} = 0$

Question9

In the given circuit if the power rating of Zener diode is 10 mW, the value of series resistance R_s to regulate the input unregulated supply is :



[1-Feb-2024 Shift 1]

Options:

A. 5kΩ

B. 10Ω

C. 1kΩ

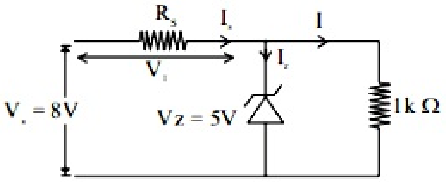
D. 10kΩ

E. None of above

Answer: E

Solution:

Solution:



Pd across R_s

$V_1 = 8 - 5 = 3V$

Current through the load resistor

$I = \frac{5}{1 \times 10^3} = 5\,mA$

Maximum current through Zener diode

$I_{z\,max.} = \frac{10}{5} = 2\,mA$

And minimum current through Zener diode

$I_{z\,min.} = 0$

$\therefore I_{s\,max.} = 5 + 2 = 7\,mA$

And $R_{s\,min} = \frac{V_1}{I_{s\,max}} = \frac{3}{7}k\Omega$

Similarly

$I_{s\,min.} = 5\,mA$

And $R_{s\,max.} = \frac{V_1}{I_{s\,min.}} = \frac{3}{5}k\Omega$

$\therefore \frac{3}{7}k\Omega < R_s < \frac{3}{5}k\Omega$

Question10

Conductivity of a photodiode starts changing only if the wavelength of incident light is less than 660 nm. The band gap of photodiode is found to be $\left(\frac{X}{8}\right)$ eV. The value of X is :
(Given, h = 6.6×10^{-34} Js, e = 1.6×10^{-19}C)
[1-Feb-2024 Shift 2]

Options:

A. 15

B. 11

C. 13

D. 21

Answer: A

Solution:

$$E_g = \frac{hc}{\lambda} = \frac{6.6 \times 10^{-34} \times 3 \times 10^8}{660 \times 10^{-9}} J$$

$$= \frac{6.6 \times 10^{-34} \times 3 \times 10^8}{660 \times 10^{-9} \times 1.6 \times 10^{-19}} eV$$

$$= \frac{15}{8} eV$$

So $x = 15$

Question11

Given below are two statements : one is labelled as Assertion A and the other is labelled as Reason R
Assertion A : Photodiodes are preferably operated in reverse bias condition for light intensity measurement.
Reason R : The current in the forward bias is more than the current in the reverse bias for a p − n junction diode.
In the light of the above statement, choose the correct answer from the options given below :
[24-Jan-2023 Shift 1]

Options:

A. A is false but R is true

B. Both A and R are true but R is NOT the correct explanation of A

C. A is true but R is false

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

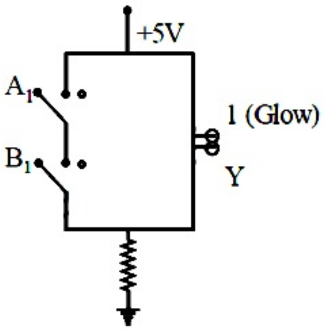
Answer: B

Solution:

Solution:
Photodiodes are operated in reverse bias as fractional change in current due to light is more easy to detect in reverse bias.

Question12

The logic gate equivalent to the given circuit diagram is :



[24-Jan-2023 Shift 2]

Options:

A. OR

B. NAND

C. NOR

D. AND

Answer: B

Solution:

$Y = \overline{A_1 \odot B_1}$ NAND

Question13

Given below are two statements : one is labeled as Assertion A and the other is labeled as Reason R
Assertion A: Photodiodes are used in forward bias usually for measuring the light intensity.
Reason R: For a p-n junction diode, at applied voltage V the current in the forward bias is more than the current in the reverse bias for $\left|V_z\right| > \pm V \geq \left|V_0\right|$ where V_o is the threshold voltage and V_z is the breakdown voltage.
In the light of the above statements, choose the correct answer from the options given below
[25-Jan-2023 Shift 1]

Options:

A. Both A and R are true and R is correct explanation A

B. Both A and R are true but R is NOT the correct explanation A

C. A is false but R is true

D. A is true but R is false

Answer: C

Solution:

Solution:
Theory based
Photodiodes are operated in reverse bias condition.
For P-N junction current in forward bias (for $V \geq V_0$) is always greater than current in reverse bias (. for $V \leq V_Z$) .
Hence Assertion if false but Reason is true

Question14

Statement I : When a Si sample is doped with Boron, it becomes P type and when doped by Arsenic it becomes N-type semi conductor such that P-type has excess holes and N-type has excess electrons.
Statement II : When such P-type and N-type semi-conductors, are fused to make a junction, a current will automatically flow which can be detected with an externally connected ammeter.
In the light of above statements, choose the most appropriate answer from the options given below. Options:
[25-Jan-2023 Shift 2]

Options:

A. Both Statement I and statement II are incorrect

B. Statement I is incorrect but statement II is correct

C. Both Statement I and statement II are correct

D. Statement I is correct but statement II is incorrect

Answer: D

Solution:

Solution:
Statement - I is correct
When P-N junction is formed an electric field is generated form N-side to P-side due to which barrier potential arises & majority charge carrier can not flow through the junction due to barrier potential so current is zero unless we apply forward bias voltage.

Question15

Which of the following statement is not correct in the case of light emitting diodes?
A. It is a heavily doped $p-n$ junction.
B. It emits light only when it is forward biased.
C. It emits light only when it is reverse biased.
D. The energy of the light emitted is equal to or slightly less than the energy gap of the semiconductor used.
Choose the correct answer from the options given below :
[29-Jan-2023 Shift 1]

Options:

A. C and D

B. A

C. C

D. B

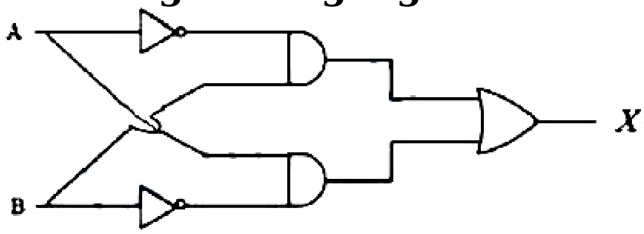
Answer: C

Solution:

LED works in forward biasing and light energy maybe slightly less or equal to band gap.

Question16

For the given logic gates combination, the correct truth table will be



[29-Jan-2023 Shift 2]

Options:

A.

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

B.

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

C.

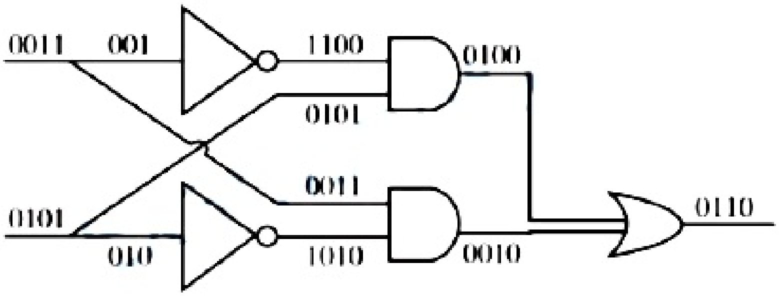
A	B	X
0	0	1
0	1	0
1	0	1
1	1	0

D.

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

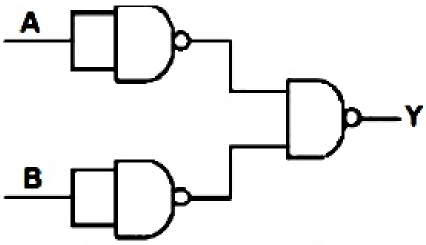
Answer: B

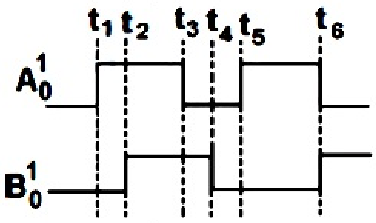
Solution:



Question17

The output waveform of the given logical circuit for the following inputs A and B as shown below, is:



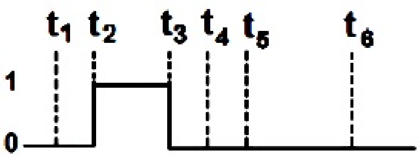


Inputs

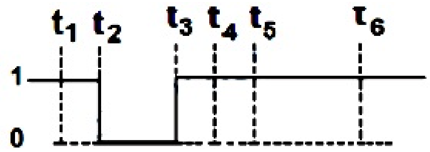
[30-Jan-2023 Shift 1]

Options:

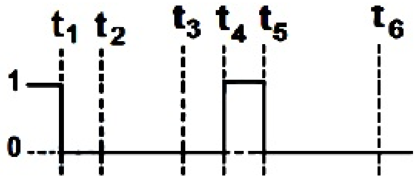
A.



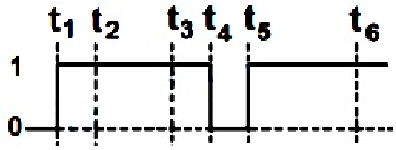
B.



C.



D.



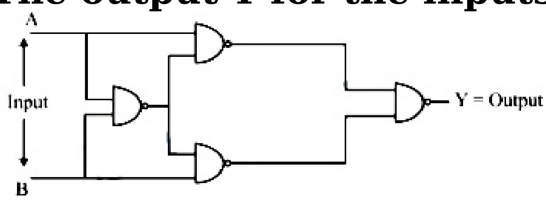
Answer: D

Solution:

$(\overline{A \cdot A}) = \overline{A}$
$\overline{B \cdot B} = \overline{B}$
$(\overline{\overline{A} \cdot \overline{B}}) = A + B$
OR Gate

Question18

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



Truth table of the shown circuit is :
[30-Jan-2023 Shift 2]

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	1

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	1
1	0	1
1	1	0

Answer: D

Solution:

Solution:
Given circuit represent XOR.

Question19

The effect of increase in temperature on the number of electrons in conduction band (n_e) and resistance of a semiconductor will be as: [31-Jan-2023 Shift 1]

Options:

A. Both n_e and resistance decrease

B. Both n_e and resistance increase

C. n_e increases, resistance decreases

D. n_e decreases, resistance increases

Answer: C

Solution:

Solution:
As temperature increases, more electron excite to conduction band and hence conductivity increases, therefore resistance decreases.

Question20

Given below are two statements:
Statement I: In a typical transistor, all three regions emitter, base and collector have same doping level.
Statement II: In a transistor, collector is the thickest and base is the thinnest segment.
In the light of the above statements, choose the most appropriate answer from the options given below.
[31-Jan-2023 Shift 2]

Options:

A. Both Statement I and Statement II are correct

B. Both Statement I and Statement II are incorrect

C. Statement I is incorrect but Statement II is correct

D. Statement I is correct but Statement II is incorrect

Answer: C

Solution:

Solution:

Emitter	Base	Collector
Moderate size	Thin	Thick
Maximum Doping	Minimum Doping	Moderate Doping

Question21

Match the List I with List II

List I	List II
A. IntrinsicSemiconductor	I. Fermi-level near conduction band
B. n-typesemiconductor	II. Fermi-level at middle
C. p-typesemiconductor	III. Fermi-level near valence band
D. Metals	IV. Fermi-level inside conduction band

Choose the correct answer from the options given below:
[1-Feb-2023 Shift 1]

Options:

A. (A) → I, (B) → II, (C) → III, (D) → IV

B. (A) → II, (B) → I, (C) → III, (D) → IV

C. (A) → II, (B) → III, (C) → I, (D) → IV

D. (A) → III, (B) → I, (C) → II, (D) → IV

Answer: C

Solution:

Solution:
Based on theory.

Question22

Choose the correct statement about Zener diode: [1-Feb-2023 Shift 2]

Options:

A. It works as a voltage regulator in reverse bias and behaves like simple pn junction diode in forward bias.

B. It works as a voltage regulator in both forward and reverse bias.

C. It works a voltage regulator only in forward bias.

D. It works as a voltage regulator in forward bias and behaves like simple pn junction diode in reverse bias.

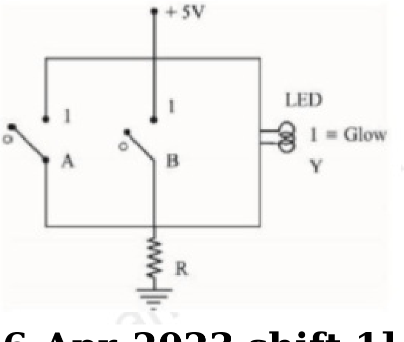
Answer: A

Solution:

Solution:
Woks as voltage regulator in reverse bias and as simple P-n junction in forward bias.

Question23

Name the logic gate equivalent to the diagram attached



[6-Apr-2023 shift 1]

Options:

A. NOR

B. OR

C. NAND

D. AND

Answer: A

Solution:

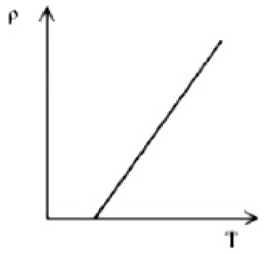
Solution:
NOR gate

Question24

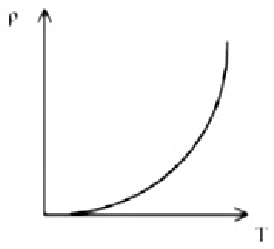
The resistivity (ρ) of semiconductor varies with temperature. Which of the following curve represents the correct behavior
[6-Apr-2023 shift 1]

Options:

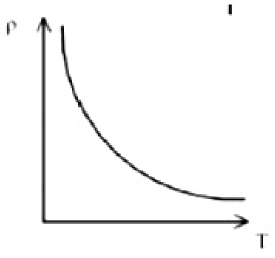
A.



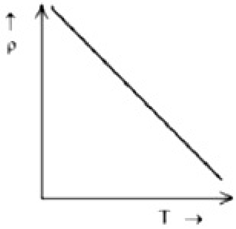
B.



C.



D.



Answer: C

Solution:

Solution:
A semiconductor starts conduction more as the temperature increases. It means resistance decreases with increase in temperature. So, if temperature increases, its resistivity decreases.

Also, $\rho = \frac{m}{ne^2\tau}$

As Temperature increase, τ decreases but n increases and n is dominant over τ.

Question25

Given below are two statements : one is labelled as Assertion A and the other is labelled as Reason R
Assertion A : Diffusion current in a p-n junction is greater than the drift current in magnitude if the junction is forward biased.
Reason R: Diffusion current in a p-n junction is from the n-side to the p-side if the junction is forward biased. In the light of the above statements, choose the most appropriate answer from the options given below
[6-Apr-2023 shift 2]

Options:

A. A is not correct but R is correct

B. Both A and R are correct and R is the correct explanation of A

C. Both A and R are correct but R is NOT the correct explanation of A

D. A is correct but R is not correct

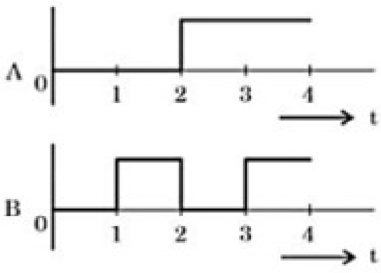
Answer: D

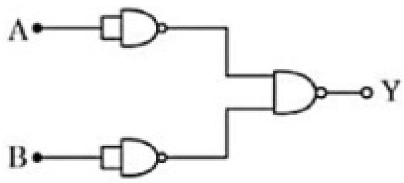
Solution:

Solution:
Statement A is correct and Statement R is wrong as per the theory of $p-n$ junction.

Question26

For the logic circuit shown, the output waveform at Y is:

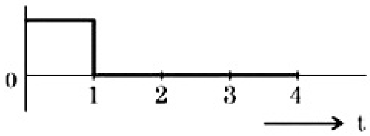




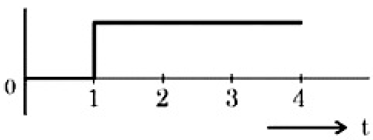
[8-Apr-2023 shift 1]

Options:

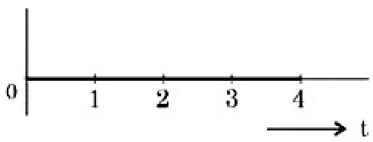
A.



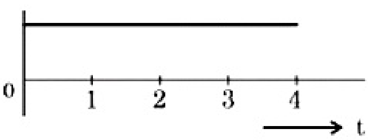
B.



C.

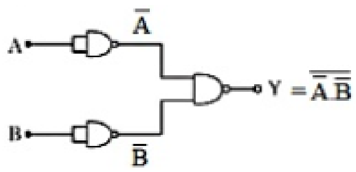


D.



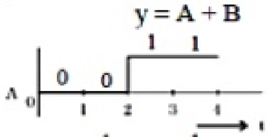
Answer: B

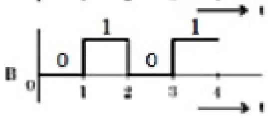
Solution:



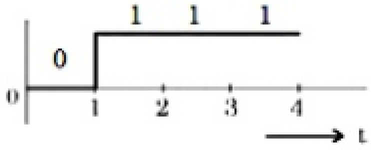
$y = \overline{\overline{A}\,\overline{B}} \Rightarrow y = \overline{\overline{A}} + \overline{\overline{B}}$

$y = A + B$



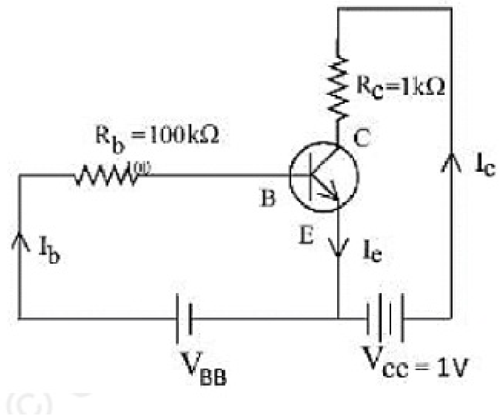


A	B	y = A + B
0	0	0
0	1	1
1	0	1
1	1	1



Question27

For a given transistor amplifier circuit in CE configuration $V_{CC} = 1V$, $R_C = 1k\Omega$, $R_b = 100k\Omega$ and $\beta = 100$. Value of base current I_b is



[8-Apr-2023 shift 2]

Options:

A. $I_b = 100\mu A$

B. $I_b = 10\mu A$

C. $I_b = 0.1\mu A$

D. $I_b = 1.0\mu A$

Answer: B

Solution:

Solution:
$V_{cc} = 1V$

$R_cI_c = 1$

$I_c = \frac{1}{10^3}A = 1\text{ mA}$

$\beta = \frac{I_c}{I_\beta}$

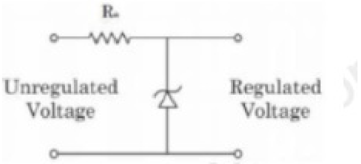
$I_\beta = \frac{I_C}{\beta}$

$= 1 \times 10^{-5}A$

$= 10\mu A$

Question28

A zener diode of power rating 1.6W is be used as voltage regulator. If the zener diode has a breakdown of 8V and it has to regulate voltage fluctuating between 3V and 10V. The value of resistance R_8 for safe operation of diode will be



[10-Apr-2023 shift 1]

Options:

A. 13.3Ω

B. 13Ω

C. 10Ω

D. 12Ω

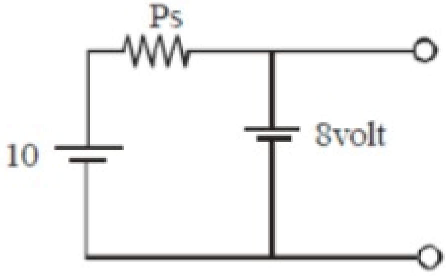
Answer: C

Solution:

$I_t = \frac{P_t}{V_t} = \frac{1.6}{8} = 0.2A$

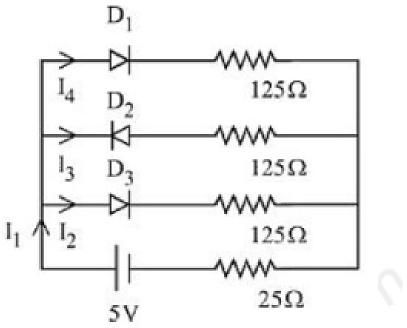
$R_s = \frac{10 - 8}{I}$

$R_s = \frac{2}{0.2} = 10\Omega$



Question29

If each diode has a forward bias resistance of 25Ω in the below circuit,



Which of the following options is correct:
[10-Apr-2023 shift 2]

Options:

A. $\frac{I_1}{I_2} = 2$

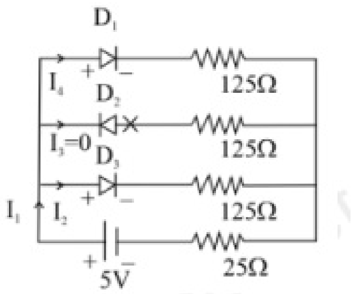
B. $\frac{I_2}{I_3} = 1$

C. $\frac{I_3}{I_4} = 1$

D. $\frac{I_1}{I_2} = 1$

Answer: A

Solution:



Here we can see that D_1 and D_3 conducts but D_2 is reversed biased.
Current I_1 will be equally distributed among I_3 and I_4 and $I_3 = 0$

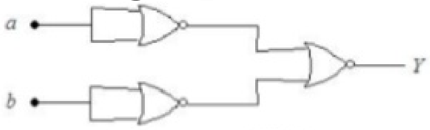
$I_1 = I_2 + I_4 + I_3$

$I_1 = 2I_2$

$\frac{I_1}{I_2} = 2$

Question30

The logic performed by the circuit shown in figure is equivalent to :



[11-Apr-2023 shift 1]

Options:

A. NAND

B. NOR

C. AND

D. OR

Answer: C

Solution:

Solution:

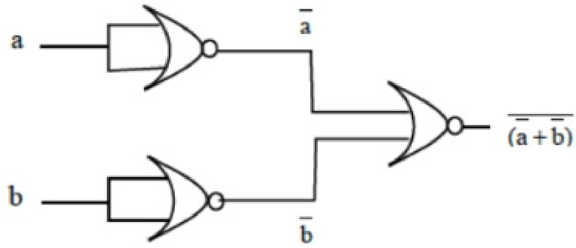
$Y = Y = \overline{(\bar{a} + \bar{b})}$

$Y = Y = \overline{(a \cdot b)}$

$Y = a \cdot b$

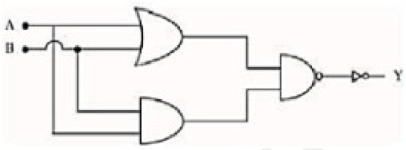
Ans. → AND gate

Option →3



Question31

The logic operations performed by the given digital circuit is equivalent to:



[11-Apr-2023 shift 2]

Options:

A. OR

B. NAND

C. NOR

D. AND

Answer: D

Solution:

Solution:

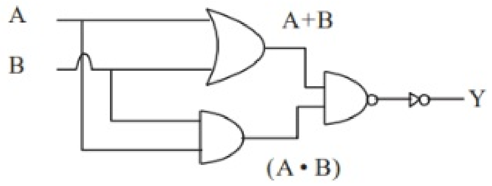
$Y = \overline{(A + B) \cdot (AB)}$

$Y = (A + B) \cdot (AB)$

$Y = AB + AB$

$Y = (A \cdot B)$

$Y = \text{AND Gate}$



Question32

In an n-p-n common emitter (CE) transistor the collector current changes from 5 mA to 16 mA for the change in base current from 100μA and 200μA, respectively. The current gain of transistor is _______. [12-Apr-2023 shift 1]

Options:

A. 110

B. 9

C. 0.9

D. 210

Answer: A

Solution:

Solution:

(1) $\beta = \frac{\Delta I_C}{\Delta I_B}$ $\Delta I_C = 16 - 5 = 11\,\text{mA}, \Delta I_B = 200 - 100 = 100\mu A$

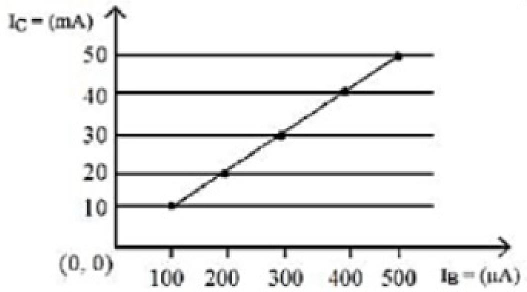
$\beta = \frac{11 \times 10^{-3}}{100 \times 10^{-6}}$

$\beta = \frac{11000}{100}$

$\beta = 110$

Question33

From the given transfer characteristic of a transistor in CE configuration, the value of power gain of this configuration is 10^x, for $R_B = 10k\Omega$, $R_C = 1k\Omega$. The value of x is _______



[13-Apr-2023 shift 1]

Answer: 3

Solution:

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

$\beta = \frac{10\,mA}{100\mu A}$

$\beta = 100$

Power gain $\beta^2 \frac{R_C}{R_B}$

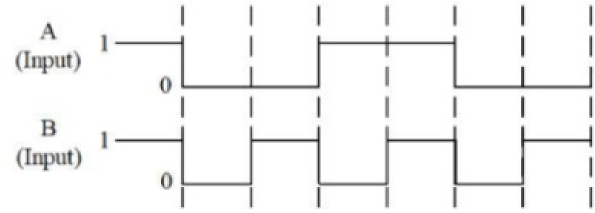
$= 10^4 \times \frac{1}{10}$

$= 10^3$

So, $x = 3$

Question34

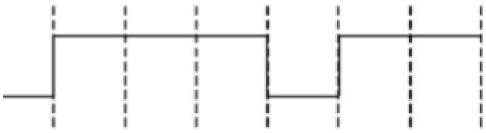
The output from a NAND gate having inputs A and B given below will be,



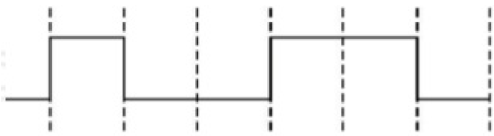
[13-Apr-2023 shift 2]

Options:

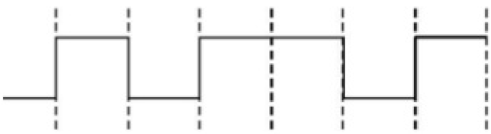
A.



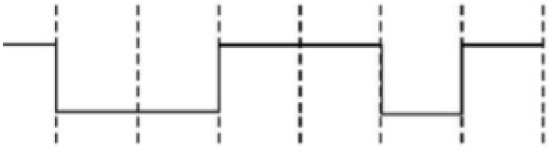
B.



C.



D.



Answer: A

Solution:

Truth table for NAND gate is

A	B	$Y = \overline{A.B}$
0	0	1
0	1	1
1	0	1
1	1	0

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

On the basis of given input A and B the truth table is

Question35

A transistor is used in common-emitter mode in an amplifier circuit. When a signal of 10 mV is added to the base-emitter voltage, the base current changes by 10μA and the collector current changes by 1.5 mA. The load resistance is 5kΩ. The voltage gain of the transistor will be____ [24-Jun-2022-Shift-1]

Answer: 750

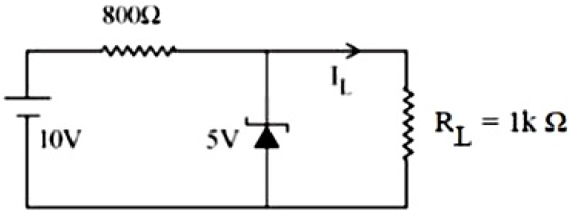
Solution:

$$R_B = \frac{10 \times 10^{-3}}{10 \times 10^{-6}}$$
$$= 10^3 \Omega$$

$$\therefore A_v = \left(\frac{\Delta I_C}{\Delta I_B}\right) \times \left(\frac{R_C}{R_B}\right)$$
$$= \frac{1.5 \times 10^{-3}}{10 \times 10^{-6}} \times \frac{5 \times 10^3}{1 \times 10^3}$$
$$= \frac{1.5 \times 5}{10} \times (1000)$$
$$= 750$$

Question36

In the given circuit, the value of current I_L will be _____mA. (When $R_L = 1k\Omega$)



[24-Jun-2022-Shift-2]

Answer: 5

Solution:

$V_L = 5V$ as $V_Z = 5V$

$$\therefore I_L = \frac{V_L}{R_L} = \frac{5}{10^3} = 5\,mA$$

Question37

The photodiode is used to detect the optical signals. These diodes are preferably operated in reverse biased mode because :
[25-Jun-2022-Shift-1]

Options:

A. fractional change in majority carriers produce higher forward bias current

B. fractional change in majority carriers produce higher reverse bias current

C. fractional change in minority carriers produce higher forward bias current

D. fractional change in minority carriers produce higher reverse bias current

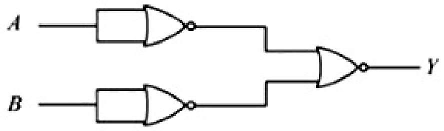
Answer: D

Solution:

A photodiode is reverse biased. When light falling on it produces charge carriers, the fractional change, in minority carriers is high since the original current is very small.

Question38

Identify the logic operation performed by the given circuit:



[25-Jun-2022-Shift-2]

Options:

A. AND gate

B. OR gate

C. NOR gate

D. NAND gate

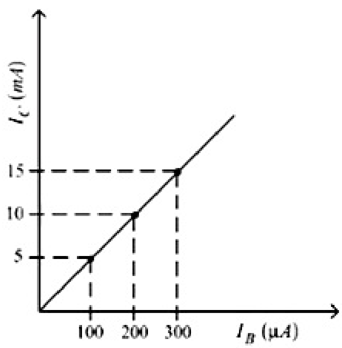
Answer: A

Solution:

Solution:
According to the circuit,
$Y = (A' + B')'$
$\Rightarrow Y = AB$
$\Rightarrow$ AND gate

Question39

In an experiment of CE configuration of $n-p-n$ transistor, the transfer characteristics are observed as given in figure.



If the input resistance is 200Ω and output resistance is 60Ω, the voltage gain in this experiment will be_____
[25-Jun-2022-Shift-2]

Answer: 15

Solution:

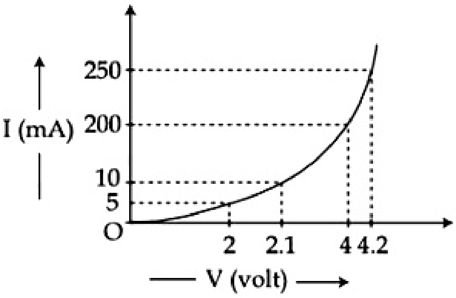
Voltage gain $= \dfrac{I_C R_0}{I_B R_i}$

$= \dfrac{(10\text{mA})(60\Omega)}{(200\mu\text{A})(200\Omega)}$

$\Rightarrow$ Voltage gain $= 15$

Question40

The I-V characteristics of a p-n junction diode in forward bias is shown in the figure. The ratio of dynamic resistance, corresponding to forward bias voltage of 2V and 4V respectively, is :



[26-Jun-2022-Shift-1]

Options:

A. 1 : 2

B. 5 : 1

C. 1 : 40

D. 20 : 1

Answer: B

Solution:

$\therefore R = \dfrac{\Delta v}{\Delta i}$

Now, dynamic resistance at $V = 2V$ is

$R_2 = \dfrac{0.1}{5 \times 10^{-3}}\Omega$

$= 20\Omega$

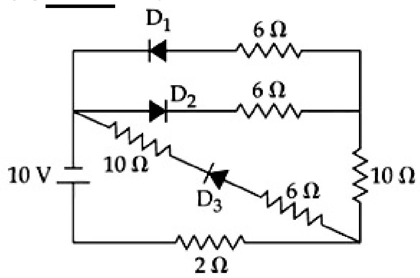
Similarly,

$R_4 = \dfrac{0.2}{50 \times 10^{-3}} = 4\Omega$

$\dfrac{R_2}{R_4} = \dfrac{5}{1}$

Question41

As per the given circuit, the value of current through the battery will be____ A.

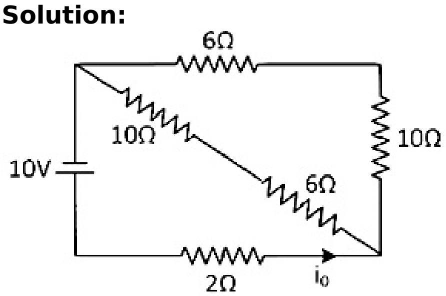


[26-Jun-2022-Shift-1]

Answer: 1

Solution:

Solution:



$R_{eq} = 16 \mid 16 + 2 = (8 + 2)\Omega$
$= 10\Omega$
$I_0 = 10 / 10$
$= 1A$

Question42

The positive feedback is required by an amplifier to act an oscillator. The feedback here means :
[26-Jun-2022-Shift-2]

Options:

A. External input is necessary to sustain ac signal in output.

B. A portion of the output power is returned back to the input.

C. Feedback can be achieved by LR network.

D. The base-collector junction must be forward biased.

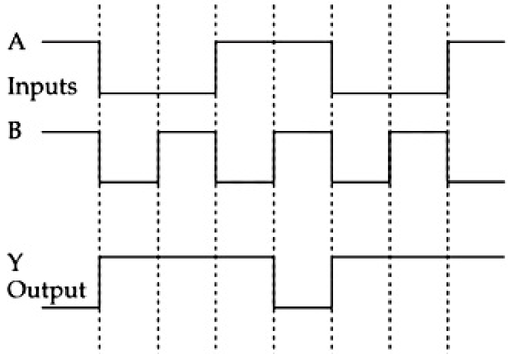
Answer: B

Solution:

When the amplifier connects with positive feedback, it acts as the oscillator the feedback here is positive feedback which means some amount of voltage is given to the input.

Question43

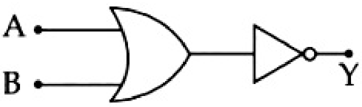
Identify the correct Logic Gate for the following output (Y) of two inputs A and B.



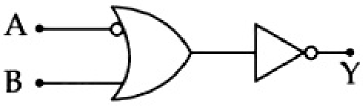
[27-Jun-2022-Shift-1]

Options:

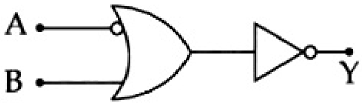
A.



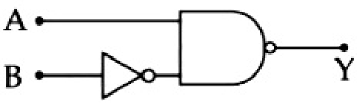
B.



C.



D.



Answer: B

Solution:

Solution:

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

$\Rightarrow Y = (AB)'$

Question44

For a transistor to act as a switch, it must be operated in [27-Jun-2022-Shift-2]

Options:

A. Active region.

B. Saturation state only.

C. Cut-off state only.

D. Saturation and cut-off state.

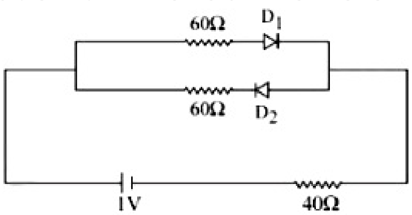
Answer: D

Solution:

Solution:
Transistor act as a switch in saturation and cut ofregion.

Question45

The cut-off voltage of the diodes (shown in figure) in forward bias is 0.6V. The current through the resister of 40Ω is_____ mA.



[27-Jun-2022-Shift-2]

Answer: 4

Solution:

D_1 : conducting
D_2 : open circuit

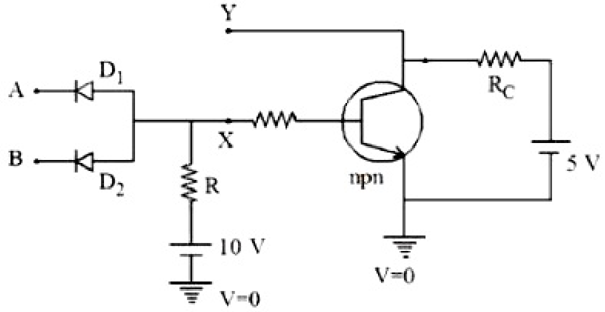
$i = \frac{1 - 0.6}{60 + 40} A$

$= \frac{0.4}{100} A$

$\Rightarrow i = 4 \, mA$

Question46

In the following circuit, the correct relation between output (Y) and inputs A and B will be :



[28-Jun-2022-Shift-1]

Options:

A. $Y = AB$

B. $Y = A + B$

C. $Y = \overline{AB}$

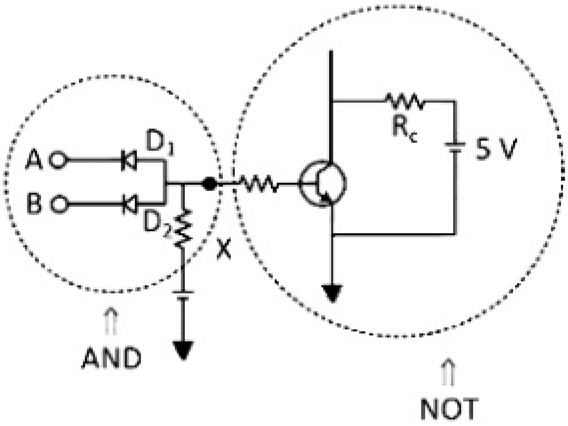
D. $Y = \overline{A + B}$

Answer: C

Solution:

This is NAND gate

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



Question47

For using a multimeter to identify diode from electrical components, choose the correct statement out of the following about the diode : [28-Jun-2022-Shift-1]

Options:

A. It is two terminal device which conducts current in both directions.

B. It is two terminal device which conducts current in one direction only.

C. It does not conduct current gives an initial deflection which decays to zero.
It is three terminal device which conducts current in one direction only between central terminal and either of the remaining

D. two terminals

Answer: B

Solution:

Solution:
In forward bias diode conducts
In revers bias it does not conducts

Question48

Given below are two statements : One is labelled as Assertion A and the other is labelled as Reason R.
Assertion A : n-p-n transistor permits more current than a p-n-p transistor.
Reason R : Electrons have greater mobility as a charge carrier.

Choose the correct answer from the options given below :
[28-Jun-2022-Shift-1]

Options:

A. Both A and R are true, and R is correct explanation of A.

B. Both A and R are true but R is NOT the correct explanation of A.

C. A is true but R is false.

D. A is false but R is true.

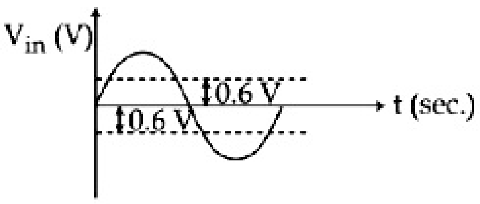
Answer: A

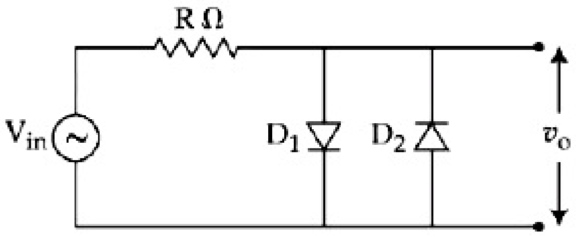
Solution:

(A) is true as $n-p-n$ transistor permits more current than $p-n-p$ transistor as electrons which are majority charge carriers in n-p-n have higher mobility than holes which are majority carriers in p-n-p transistor.
⇒ Statement R is correct explanation of statement A.

Question49

In the given circuit the input voltage V_{in} is shown in figure. The cut-in voltage of p-n junction diode ($D_{1.}$ or . D_2) is 0.6V . Which of the following output voltage (V_0) waveform across the diode is correct?

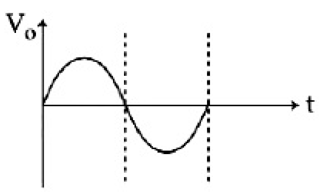




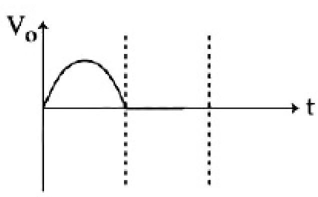
[28-Jun-2022-Shift-2]

Options:

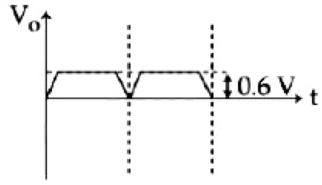
A.



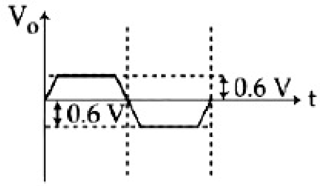
B.



C.



D.



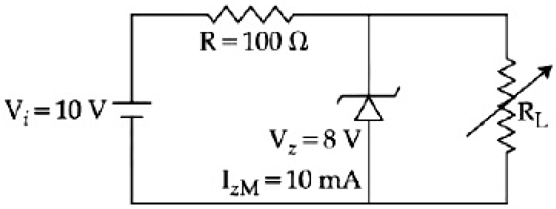
Answer: D

Solution:

Till $| V \ | \leq 0.6V$
$\left| V_{0^{\cdot}} \right| = \left| V \right|$
So correct graph will be D.

Question50

A zener of breakdown voltage V_Z = 8V and maximum zener current, I_{ZM} = 10 mA is subject to an input voltage V_i = 10V with series resistance R = 100Ω. In the given circuit R_L represents the variable load resistance. The ratio of maximum and minimum value of R_L is_____



[28-Jun-2022-Shift-2]

Answer: 2

Solution:

Minimum value of R_L for which the diode is shorted is $\frac{R_L}{R_L + 100} \times 10 = 8 \Rightarrow R_L = 400\Omega$
For maximum value of R_L, current through diode is $10\,mA$
So $i_R = i_{R_L} + I_{ZM}$

$$\frac{2}{100} = \frac{8}{R_L} + 10 \times 10^{-3}$$
$$10 \times 10^{-3} = \frac{8}{R_L}$$
$R_L = 800\Omega$

So $\frac{R_{L\,max}}{R_{L\,min}} = 2$

Question51

A transistor is used in an amplifier circuit in common emitter mode. If the base current changes by 100μA, it brings a change of 10 mA in collector current. If the load resistance is 2kΩ and input resistance is 1kΩ, the value of power gain is $x \times 10^4$. The value of x is_____ [29-Jun-2022-Shift-1]

Answer: 2

Solution:

$$\text{Power gain } = \left[\frac{\Delta i_C}{\Delta i_B}\right]^2 \times \frac{R_o}{R_i}$$
$$= \left[\frac{10^{-2}}{10^{-4}}\right]^2 \times \frac{2}{1}$$
$$= 2 \times 10^4$$
$\Rightarrow x = 2$

Question52

A potential barrier of 0.4V exists across a p-n junction. An electron enters the junction from the n-side with a speed of $6.0 \times 10^5 ms^{-1}$. The speed with which electron enters the p side will be $\frac{x}{3} \times 10^5 ms^{-1}$ the value of x is____ (Given mass of electron $= 9 \times 10^{-31}$ kg, charge on electron $= 1.6 \times 10^{-19}$C.) [29-Jun-2022-Shift-2]

Answer: 14

Solution:

Conserving energy,

$$\frac{1}{2}mv^2 = \frac{1}{2}m(6\times10^5)^2 - 0.4\,\text{eV}$$

$$\Rightarrow v = \sqrt{(6\times10^5)^2 - \frac{2\times1.6\times10^{-19}\times0.4}{9\times10^{-31}}}$$

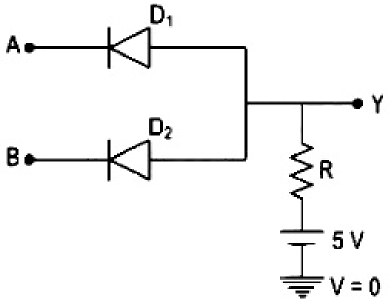
$$= \sqrt{36\times10^{10} - \frac{1.28}{9}\times10^{12}}$$

$$\Rightarrow v = \frac{14}{3}\times10^5\,\text{m / s}$$

$$\Rightarrow x = 14$$

Question53

In the circuit, the logical value of A = 1 or B = 1 when potential at A or B is 5V and the logical value of A = 0 or B = 0 when potential at A or B is 0V.



The truth table of the given circuit will be : [25-Jul-2022-Shift-1]

Options:

A.

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

B.

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

C.

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

D.

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

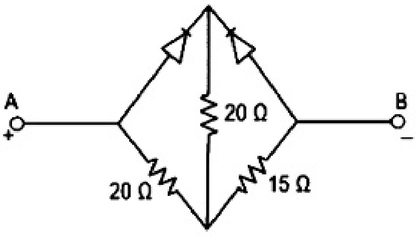
Answer: A

Solution:

Given circuit is equivalent to an AND gate.
A B Y
0 0 0
0 1 0
1 0 0
1 1 1

Question54

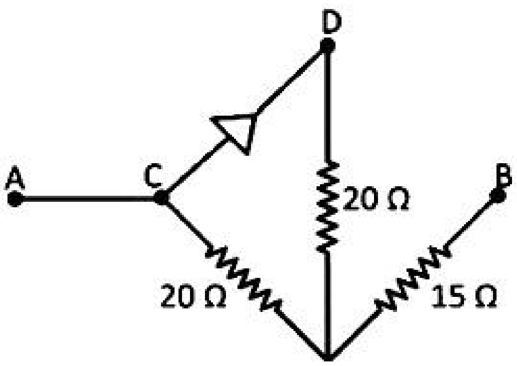
Two ideal diodes are connected in the network as shown in figure. The equivalent resistance between A and B is ____Ω.



[25-Jul-2022-Shift-2]

Answer: 25

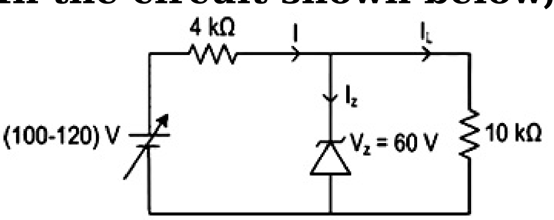
Solution:



$$R = \frac{20 \times 20}{40} + 15 = 25\Omega$$

Question55

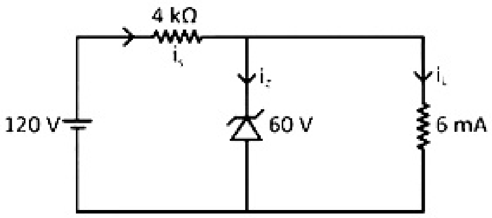
In the circuit shown below, maximum zener diode current will be___ mA.



[26-Jul-2022-Shift-1]

Answer: 9

Solution:



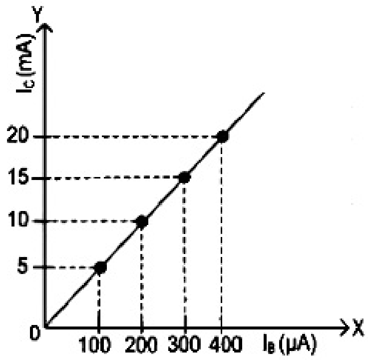
$i_s = \dfrac{60}{4 \times 10^3} = 15 \times 10^{-3} = 15\,mA$

$i_L = \dfrac{60}{10 \times 10^3} = 6\,mA$

$I_z = i_s - i_L = 9\,mA$

Question56

The typical transfer characteristics of a transistor in CE configuration is shown in figure. A load resistor of 2kΩ is connected in the collector branch of the circuit used. The input resistance of the transistor is 0.50kΩ. The voltage gain of the transistor is ________.



[26-Jul-2022-Shift-2]

Answer: 200

Solution:

Solution:
Current gain in C − E configuration

$\Rightarrow \beta = \dfrac{\Delta I_C}{\Delta I_B}$

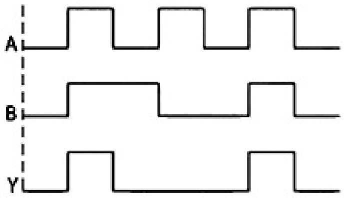
$R_C = 2k\Omega$, $R_B = 0.50k\Omega$

Voltage gain $= \dfrac{\Delta I_C R_C}{\Delta I_B R_B} = \dfrac{5 \times 10^{-3}}{100 \times 10^{-6}} \times \dfrac{2}{0.5}$

$= \dfrac{10^{-2}}{5 \times 10^{-5}} = \dfrac{1000}{5} = 200$

Question57

A logic gate circuit has two inputs A and B and output Y . The voltage waveforms of A, B and Y are shown below.



The logic gate circuit is :
[27-Jul-2022-Shift-1]

Options:

A. AND gate

B. OR gate

C. NOR gate

D. NAND gate

Answer: A

Solution:

Solution:
By making Truth table

A	B	Output
0	0	0
1	1	1
0	1	0
1	0	0

Comparing with output of AND gate

A	B	AND
0	0	0
0	1	0
1	0	0
1	1	1

⇒ logic gate present is AND gate

Question58

For a constant collector-emitter voltage of 8V, the collector current of a

transistor reached to the value of 6 mA from 4 mA, whereas base current changed from 20μA to 25μA value. If transistor is in active state, small signal current gain (current amplification factor) will be :
[27-Jul-2022-Shift-2]

Options:

A. 240

B. 400

C. 0.0025

D. 200

Answer: B

Solution:

Solution:

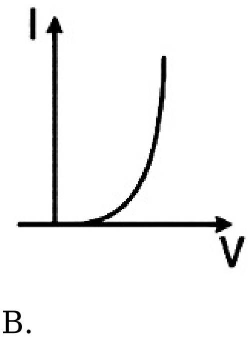
$$\beta = \frac{\Delta I_C}{\Delta I_B}$$
$$= \frac{(6-4)\times 10^{-3}}{(25-20)\times 10^{-6}}$$
$$= \frac{2}{5}\times 10^{3}$$
$$= 400$$

Question59

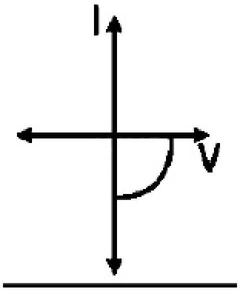
Identify the solar cell characteristics from the following options :
[28-Jul-2022-Shift-1]

Options:

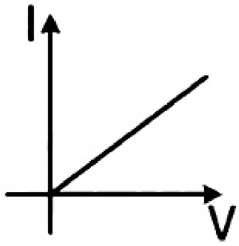
A.



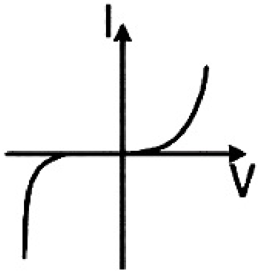
B.



C.



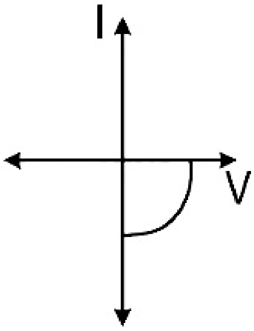
D.



Answer: B

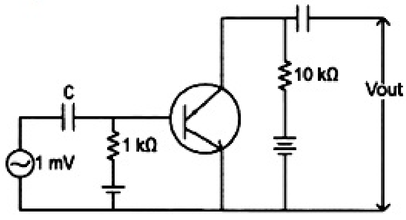
Solution:

Solution:
Solar cell characteristics



Question60

An n.p.n transistor with current gain β = 100 in common emitter configuration is shown in figure. The output voltage of the amplifier will be



[28-Jul-2022-Shift-2]

Options:

A. 0.1V

B. 1.0V

C. 10V

D. 100V

Answer: B

Solution:

Solution:

$$\frac{V_{out}}{V_{in}} = \beta \frac{R_{out}}{R_{in}}$$

$$v_{out} = \frac{100 \times 10 \times 10^3}{10^3} \times 10^{-3}$$

$$= 1V$$

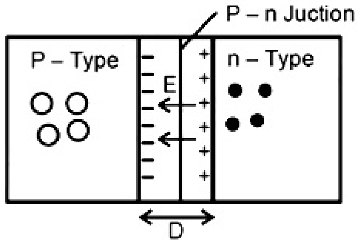
Question61

If the potential barrier across a p-n junction is 0.6V. Then the electric field intensity, in the depletion region having the width of 6×10^{-6}m, will be ________ $\times 10^5$N / C.
[29-Jul-2022-Shift-1]

Answer: 1

Solution:

Solution:



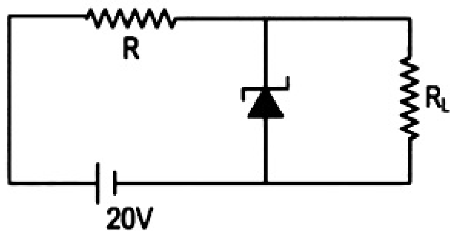
$$E = \frac{V}{d} = \frac{\text{Potential barrier Across Junction}}{\text{width of Depletion layer}}$$

$$= \frac{0.6V}{6 \times 10^{-6}m} = 1 \times 10^5 V / m$$

$$= 1 \times 10^5 N / C$$

Question62

A 8V Zener diode along with a series resistance R is connected across a 20V supply (as shown in the figure). If the maximum Zener current is 25 mA, then the minimum value of R will be _______ Ω



[29-Jul-2022-Shift-2]

Answer: 480

Solution:

Solution:
R will be minimum when R_L is infinitely large, so

$R_{Zener} = \frac{8}{25 \times 10^{-3}} = 320\Omega$

So $\frac{R}{R_{Zener}} = \frac{12}{8}$

$R = \frac{12}{8} \times 320 = 480\Omega$

Question63

If an emitter current is changed by 4mA, the collector current changes by 3.5mA. The value of β will be : [24feb2021shift1]

Options:

A. 7

B. 0.5

C. 0.875

D. 3.5

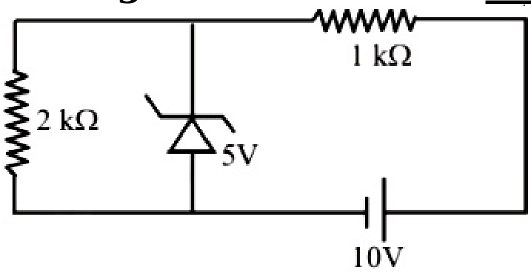
Answer: A

Solution:

Solution:
Given, $\Delta I_e = 4mA$
$\Delta I_c = 3.5mA$
For transistors,
$I_e = I_C + I_B$
$\therefore \Delta I_e = \Delta I_C + \Delta I_B$
$\Rightarrow 4mA = 3.5mA + \Delta I_B \Rightarrow \Delta I_B = 0.5mA$
Current gain for common emitter transistor,
$\beta = \frac{\Delta I_C}{\Delta I_B} \Rightarrow \beta = \frac{3.5}{0.5}$
$\Rightarrow \beta = 7$

Question64

In connection with the circuit drawn below, the value of current flowing through 2kΩ resistor is_____ $\times 10^{-4}$A.



[24feb2021shift1]

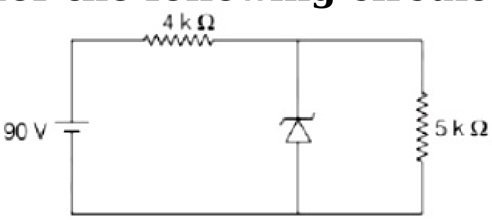
Answer: 25

Solution:

Solution:
Current through 2kΩ resistance is
$I = \dfrac{5}{2 \times 10^3} = 2.5 \times 10^{-3}\text{A}$
$I = 25 \times 10^{-4}\text{A}$

Question65

The Zener diode has a $V_2 = 30V$. The current passing through the diode for the following circuit is .... mA.

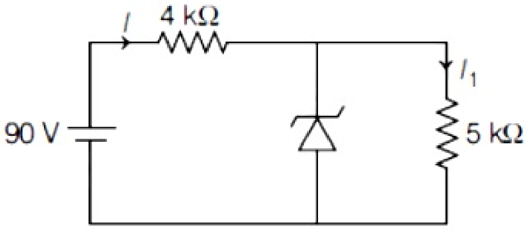


[26 Feb 2021 Shift 2]

Answer: 9

Solution:

Given, Zener diode voltage, $V_z = 30V$
Supply voltage, $V = 90V$
According to figure,



Let I be supply current, then
I_2 be Zener current ($= I - I_1$)
and I_1 be current through $5k\Omega$.
$\therefore V_1 = V_2 = 30V$
By Ohm's law,
$V_1 = V_2 = I_1R$
$\Rightarrow I_1 = V_2 / R = \frac{30}{5000} = 6mA$
If V' be the voltage across $4k\Omega$ resistor.
$\therefore V' = 90 - 30 = 60V$
and $I = \frac{60}{4000} = 15mA$
Therefore, $I_2 = I - I_1$
$= 15 - 6 = 9mA$

Question66

LED is constructed from GaAsP semiconducting material. The energy gap of this LED is 1.9eV . Calculate the wavelength of light emitted and its colour.
[$h = 6.63 \times 10^{-34}$J s and $c = 3 \times 10^8 ms^{-1}$]
[26 Feb 2021 Shift 1]

Options:

A. 1046nm and red colour

B. 654nm and orange colour

C. 1046nm and blue colour

D. 654nm and red colour

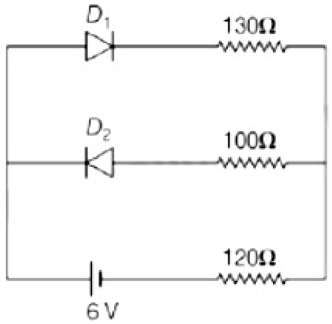
Answer: D

Solution:

Solution:
Given, energy gap of LED, $E = 1.9eV$
Speed of light in free space, $C = 3 \times 10^8 ms^{-1}$
Planck's constant, $h = 6.63 \times 10^{-34} J - s$
As we know that, $E = \frac{hc}{\lambda}$
$\Rightarrow \lambda = \frac{hc}{E}$
$\Rightarrow \lambda = \frac{6.63 \times 10^{-34} \times 3 \times 10^8}{19 \times 1.6 \times 10^{-19}}$
$= 654 \times 10^{-9} m$
$= 654nm$
As, wavelength of red light is 600nm.
∴ Required wavelength will be of red colour.

Question67

The circuit contains two diodes each with a forward resistance of 50Ω and with infinite reverse resistance. If the battery voltage is 6V , the current through the 120Ω resistance is .... mA.

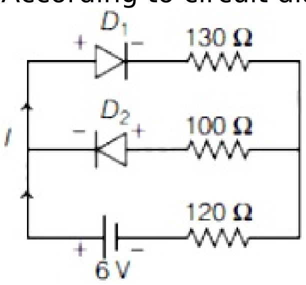


[26 Feb 2021 Shift 1]

Answer: 20

Solution:

Given, forward resistance, $R_1 = 50\Omega$
Reverse resistance, $R_2 =$ infinity
Battery voltage $= 6V$
According to circuit diagram,



In this case, diode D_1 is forward biased, whereas diode D_2 is reverse biased.
So, D_2 will act as open circuit.
By using Kirchhoff's voltage law,
$\Rightarrow\ 6 - 50I - 130I - 120I = 0$
$\Rightarrow\ 6 = 300I$
$\Rightarrow\ I = \frac{6}{300} = \frac{1}{50} = \frac{2}{100} = 0.02A = 20mA$
Hence, current through $120\Omega = 20mA$

Question68

For extrinsic semiconductors when doping level is increased,
[25 Feb 2021 Shift 2]

Options:

A. Fermi level of p-type semiconductor will go upward and Fermi level of n-type semiconductors will go downward

B. Fermi level of p-type semiconductors will go downward and Fermi level of n-type semiconductor will go upward

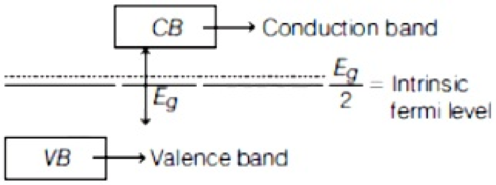
C. Fermi level of p and n-type semiconductors will not be affected

D. Fermi level of both p-type and n-type semiconductors will go upward for $T > T_F K$ and downward for $T < T_F K$, where T_F is Fermi temperature

Answer: B

Solution:

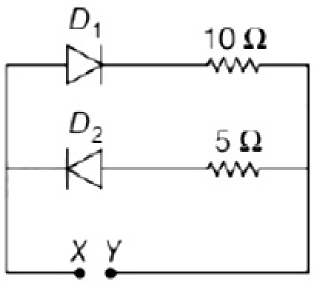
In case of n-type semiconductor, the energy level diagram will be



In case of n-type semiconductor $n > p$, so the fermi level will go upward.
Similarly, in case of p-type semiconductor $p > n$, so the fermi level will go downward.

Question69

A 5V battery is connected across the points X and Y. Assume D_1 and D_2 to be normal silicon diodes. Find the current supplied by the battery, if the positive terminal of the battery is connected to point X.



[25 Feb 2021 Shift 1]

Options:

A. ~0.5A

B. ~1.5A

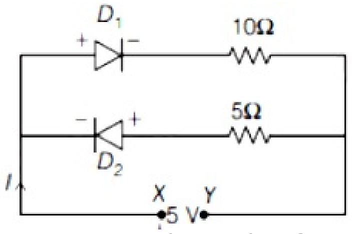
C. ~0.86A

D. ~0.43A

Answer: B

Solution:

Solution:
Given, supply voltage,
$V = 5V$
The circuit diagram, when positive terminal of the battery is connected to X is as shown below



Let I current is coming from battery.
$\therefore D_1$ will act as closed circuit as forward biased and D_2 will act as open circuit as reverse biased.
Now, by using Kirchhoff's voltage law,
$5 - V_{D_1} - 10I = 0$
$\Rightarrow 5 - 0.7 - 10I = 0 \quad (\because V_{D_1} = 0.7V)$
$\Rightarrow 4.3 = 101$
$\Rightarrow I = 0.43A$

Question70

Zener breakdown occurs in a p − n junction having p and n both [24 Feb 2021 Shift 2]

Options:

A. lightly doped and have wide depletion layer

B. heavily doped and have narrow depletion layer

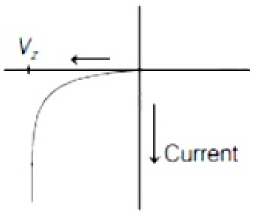
C. lightly doped and have narrow depletion layer

D. heavily doped and have wide depletion layer

Answer: D

Solution:

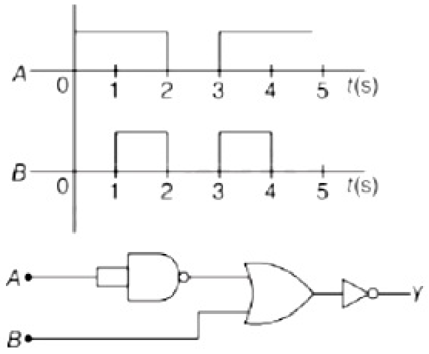
Solution:
As we know that, Zener breakdown takes place, when we supply reverse bias voltage to Zener diode. Due to heavily dopping, the electrons in the valence band of p-type region can jump easily to the conduction band of n-type region, hence due to high electric field, zener breakdown occur. Thus, there is very high sudden increase in Zener current (I_Z) that is caused by reverse breakdown voltage (V_Z).



Hence, Zener breakdown is easily observed in Zener diode which is heavily doped and having narrow depletion region.

Question71

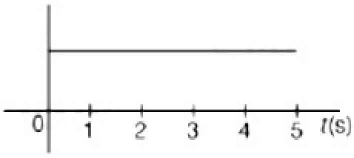
Draw the output signal Y in the given combination of gates



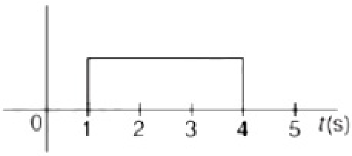
[26 Feb 2021 Shift 2]

Options:

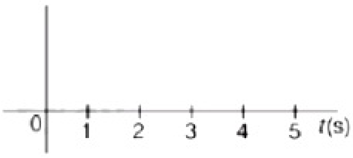
A.



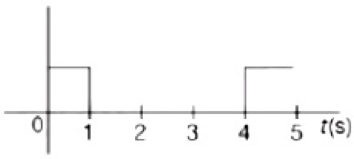
B.



C.



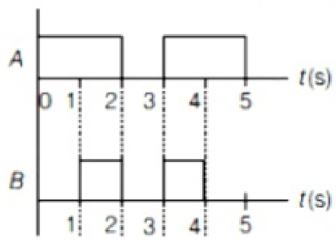
D.



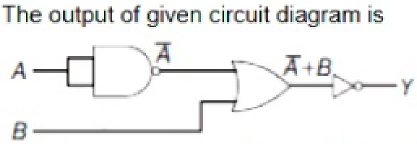
Answer: D

Solution:

According to the given figure signals are



The output of given circuit diagram is

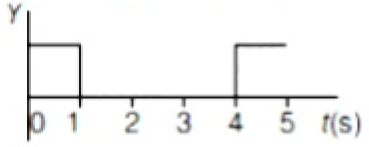


By using concept of de-Morgan's law, $Y = \overline{\overline{A} + B} = A \cdot \overline{B}$

Truth table of given signals is

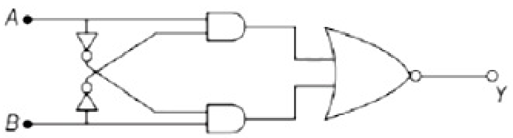
Time interval	A	B	$\overline{B}$	$A\overline{B}$
$(0-1)s$	1	0	1	1
$(1-2)s$	1	1	0	0
$(2-3)s$	0	0	1	0
$(3-4)s$	1	1	0	0
$(4-5)s$	1	0	1	1

Hence, output signal is,



Question72

The truth table for the following logic circuit is



[25 Feb 2021 Shift 2]

Options:

A.

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

B.

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

C.

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

D.

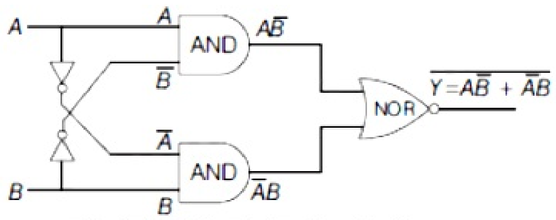
A	B	Y
0	0	0
0	1	1
1	0	0
1	1	1

Answer: B

Solution:

Solution:

Here A and B be the input and Y be the output.



$$\because Y = \overline{A\overline{B}} + \overline{\overline{A}B} = \overline{A\overline{B}} \cdot \overline{\overline{A}B} = (\overline{A}+\overline{\overline{B}}) \cdot (\overline{\overline{A}}+\overline{B})$$

$$= (\overline{A}+B)(A+\overline{B}) = \overline{A}A + \overline{AB} + AB + B\overline{B}$$

$$= 0 + \overline{AB} + AB + 0 = AB + \overline{AB}$$

According to the truth table

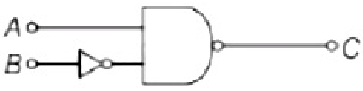
A	B	$\overline{A}$	$\overline{B}$	AB	$\overline{AB}$	$Y = AB + \overline{AB}$
0	0	1	1	0	1	1
0	1	1	0	0	0	0
1	0	0	1	0	0	0
1	1	0	0	1	0	1

Question73

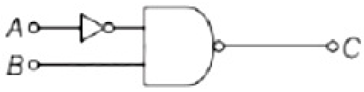
The logic circuit shown above is equivalent to
[24 Feb 2021 Shift 2]

Options:

A.

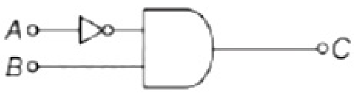


B.



C.

D.

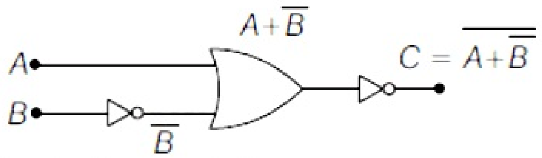


Answer: D

Solution:

Solution:

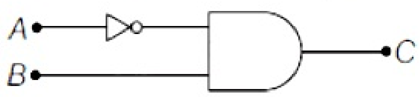
The logic circuit is given as



By using De-morgan's theorem,

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

This relation can be shown by the circuit drawn below



Question74

The correct relation between α (ratio of collector current to emitter current) and β (ratio of collector current to base current) of a transistor is
[18 Mar 2021 Shift 2]

Options:

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

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

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

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

Answer: D

Solution:

Solution:
Current gain in common base,

$\alpha = \frac{\Delta I_C}{\Delta I_E}$

Current gain in common emitter,

$\beta = \frac{\Delta I_C}{\Delta I_B}$

Here, $\Delta I_C =$ change in collector current,

$\Delta I_E =$ change in emitter current

and $\Delta I_B =$ change in base current.

We know that,

$\Delta I_E = \Delta I_B + \Delta I_C$

Divide by the ΔI_c on both sides, we get

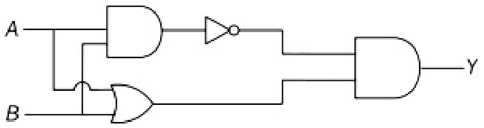
$$\frac{\Delta I_E}{\Delta I_C} = \frac{\Delta I_B}{\Delta I_C} + \frac{\Delta I_C}{\Delta I_C}$$

$$\Rightarrow \frac{1}{\alpha} = \frac{1}{\beta} + 1 \Rightarrow \frac{1}{\alpha} = \frac{\beta+1}{\beta}$$

$$\Rightarrow \alpha = \frac{\beta}{\beta+1}$$

Question75

Which one of the following will be the output of the given circuit?



[17 Mar 2021 Shift 2]

Options:

A. NOR Gate

B. NAND Gate

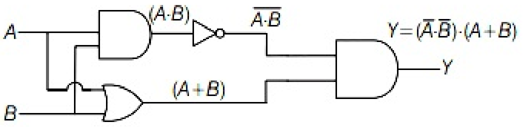
C. AND Gate

D. XOR Gate

Answer: D

Solution:

The given circuit, with the output of the respective gates is as given below.



The Boolean expression of the output is

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

$\Rightarrow \; Y = (\overline{A} + \overline{B}) \cdot (A + B)$

(using de-Morgan's theorem, $\overline{x \cdot y} = \overline{x} + \overline{y}$)

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

This represents the Boolean expression for XOR gate.

Alternate solution

This question can also be verified from the following truth table.

A	B	$P=\overline{A \cdot B}$	$Q=A+B$	$Y=P \cdot Q$
0	0	1	0	0
0	1	1	1	1
1	0	1	1	1
1	1	0	1	0

Hence, the output of this circuit represents the output of a XOR gate.

Question76

An $n-p-n$ transistor operates as a common emitter amplifier with a power gain of 10^6. The input circuit resistance is 100Ω and the output load resistance is $10k\Omega$. The common emitter current gain β will be .... (Round off to the nearest integer) [18 Mar 2021 Shift 1]

Answer: 100

Solution:

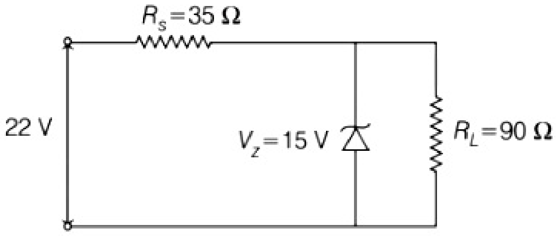
Solution:
Given,
The power gain of an $n-p-n$ transistor,
$P = 10^6$
The input circuit of the resistance,
$r = 100\Omega$
The output load resistance of the circuit,
$R = 10k\Omega = 10000\Omega$
We know that,
Power gain of common emitter amplifier,
$P = \frac{\beta^2 R}{r}$

Here, $10^6 = \dfrac{\beta^2 \times 10000}{100}$

$\Rightarrow \beta = 100$

Question77

The value of power dissipated across the Zener diode ($V_z = 15V$) connected in the circuit as shown in the figure is $x \times 10^{-1} W$.

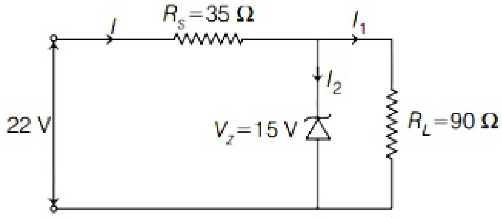


The value of x, to the nearest integer, is ....
[16 Mar 2021 Shift 1]

Answer: 5

Solution:

Solution:
Consider the figure with current in the directions shown below.



Voltage across R_s, $V_s = 22 - 15 = 7V$

Current through R_s, $I = \dfrac{V_s}{R_S}$

$\Rightarrow I = \dfrac{7}{35} = \dfrac{1}{5}A$

Current through 90Ω resistance,

$I_1 = \dfrac{V_z}{R_L} = \dfrac{15}{90} = \dfrac{1}{6}A$

$\therefore$ Current through Zener diode, $I_2 = \dfrac{1}{5} - \dfrac{1}{6} = \dfrac{1}{30}A$

$\therefore$ Power through Zener diode,

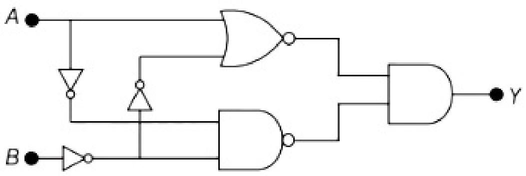
$P = V_2 I_2$

$= 15 \times \dfrac{1}{30} = \dfrac{1}{2} = 0.5W = 5 \times 10^{-1}W$

Comparing with the given value in question i.e., $x \times 10^{-1}$, the value of $x = 5$.

Question78

In the logic circuit shown in the figure, if input A and B are 0 to 1 respectively, the output at Y would be x. The value of x is ....

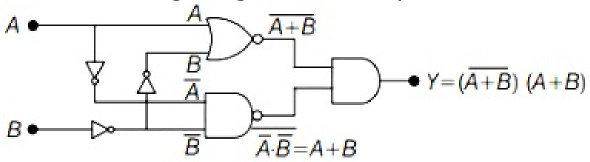


[16 Mar 2021 Shift 1]

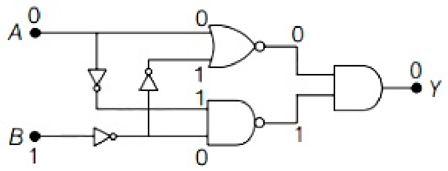
Answer: 0

Solution:

Solution:
Consider the figure given in the question and solve it using Boolean identities.



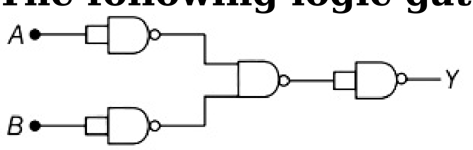
Now, put the value of A and B in the output, we get
$Y = \overline{(0+1)}(0+1)$ $Y = \overline{1} \cdot 1 = 0$
Alternate method
We can directly put the given values in the logic circuit given in the question and can find its output. Let us consider the given logic circuit,



The output is $Y = 0.1 = 0$
∴ The value of x is 0 .

Question79

The following logic gate is equivalent to



[16 Mar 2021 Shift 2]

Options:

A. NOR Gate

B. OR Gate

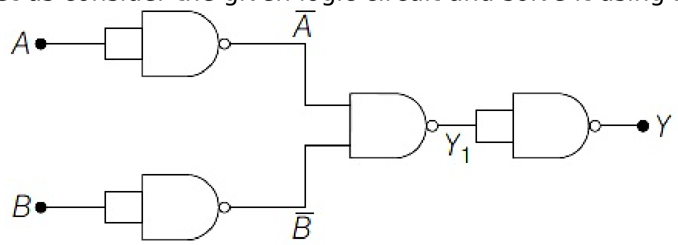
C. AND Gate

D. NAND Gate

Answer: A

Solution:

Let us consider the given logic circuit and solve it using Boolean algebra.



Here, $Y_1 = \overline{\overline{A} \cdot \overline{B}} = \overline{\overline{A}} + \overline{\overline{B}} = A + B$

$\therefore\ Y = \overline{Y}_1 = \overline{A + B}$

which is an expression for NOR Gate.

Question80

In a semiconductor, the number density of intrinsic charge carriers at 27°C is 1.5×10^{16} / m^3. If the semiconductor is doped with impurity atom, the hole density increases to 4.5×10^{22} / m^3. The electron density in the doped semiconductor is_______ $\times 10^9$ / m^3
[25 Jul 2021 Shift 2]

Answer: 5

Solution:

$n_e n_h = n_i^{\ 2}$

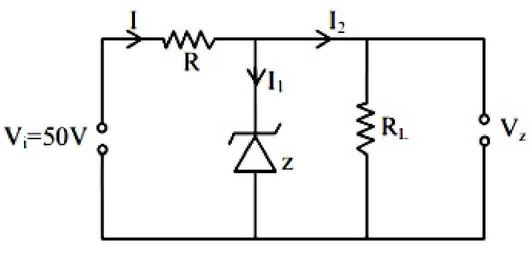
$$n_e = \frac{n_i^{\ 2}}{n_h} = \frac{(1.5 \times 10^{16})^2}{4.5 \times 10^{22}}$$

$$= \frac{1.5 \times 1.5 \times 10^{32}}{4.5 \times 10^{22}}$$

5×10^9 / m^3

Question81

In a given circuit diagram, a 5V zener diode along with a series resistance is connected across a 50V power supply. The minimum value of the resistance required, if the maximum zener current is 90mA will be _____ Ω.

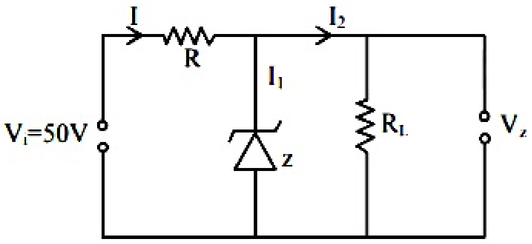


[22 Jul 2021 Shift 2]

Answer: 500

Solution:

Solution:



Voltage across $R_L = 5V$

$\Rightarrow i_2 = \frac{5}{R_L}$

Also voltage across R = 50 − 5 = 45 volt

By $v = iR \Rightarrow R = \frac{v}{i} = \frac{45}{i_i + i_2}$

$R = \frac{45}{90mA + \frac{5}{R_L}}$

Current in zener diode is maximum when $R_L \to \infty (i_2 \to 0$ and $i_i = i)$

So $R = \frac{45}{90mA} = 500\Omega$

Question82

Consider a situation in which reverse biased current of a particular P-N junction increases when it is exposed to a light of wavelength ≤ 621 nm. During this process, enhancement in carrier concentration takes place due to generation of hole-electron pairs. The value of band gap is nearly.
[22 Jul 2021 Shift 2]

Options:

A. 2 eV

B. 4 eV

C. 1 eV

D. 0.5 eV

Answer: A

Solution:

Solution:

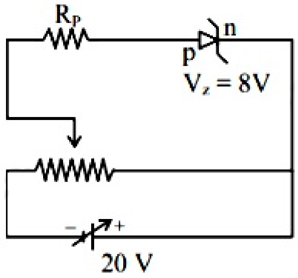
Band gap $= \frac{hc}{\lambda_0}$

λ_0; threshold wavelength

Band gap $= \frac{1242\text{ev} - \text{nm}}{621\text{nm}} = 2\text{eV}$

Question83

A zener diode having zener voltage 8V and power dissipation rating of 0.5W is connected across a potential divider arranged with maximum potential drop across zener diode is as shown in the diagram. The value of protective resistance R_p is .... Ω.



[20 Jul 2021 Shift 2]

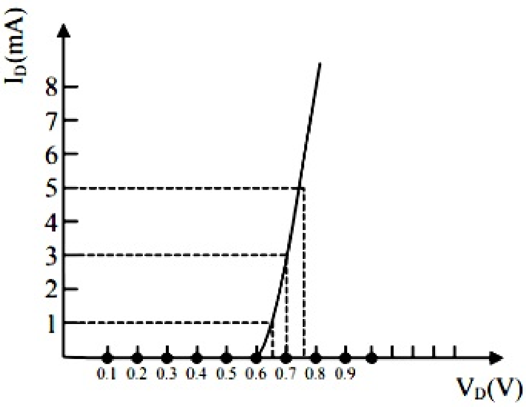
Answer: 192

Solution:

Solution:
$P = V i$
$0.5 = 8i$
$i = \frac{1}{16}A$
$E = 20 = 8 + iR_P$
$R_P = 12 \times 16 = 192\Omega$

Question84

For the forward biased diode characteristics shown in the figure, the dynamic resistance at $I_D = 3\text{mA}$ will be _______Ω.



[20 Jul 2021 Shift 2]

Answer: 25

Solution:

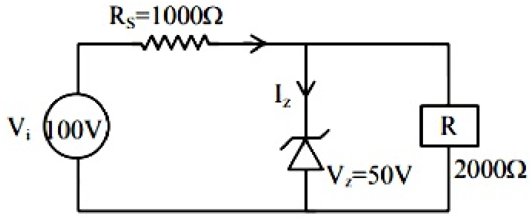
Solution:

$R_d = \frac{dV}{di} = \frac{1}{\frac{di}{dv}} = \frac{1}{\frac{5 - 1 \times 10^{-3}}{0.75 - 0.65}}$

$\frac{100}{4} = 25\Omega$

Question85

For the circuit shown below, calculate the value of I_z:



[20 Jul 2021 Shift 1]

Options:

A. 25 mA

B. 0.15 A

C. 0.1 A

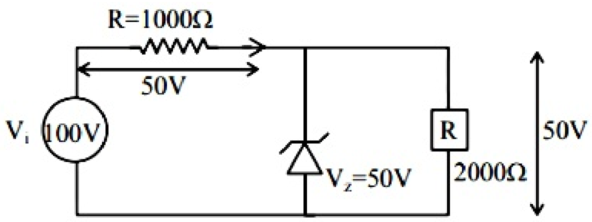
D. 0.05 A

Answer: A

Solution:

Solution:

$I = \frac{50}{1000} = 50mA$



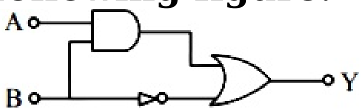
$I = \frac{50}{2000} = 25mA$

$I_Z = I_{1000} - I_{2000}$

$= 50 - 25 = 25mA$

Question86

Find the truth table for the function Y of A and B represented in the following figure.



[27 Jul 2021 Shift 2]

Options:

A.

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

B.

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

C.

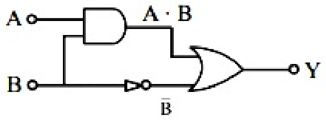
A	B	Y
0	0	0
0	1	0
1	0	0
1	1	1

D.

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

Answer: B

Solution:

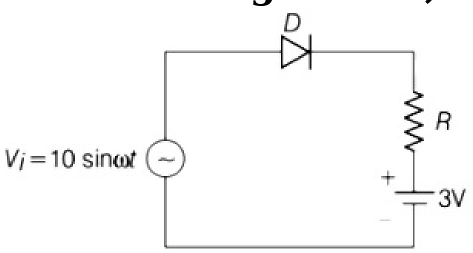


$Y = A.B + \overline{B}$

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

Question87

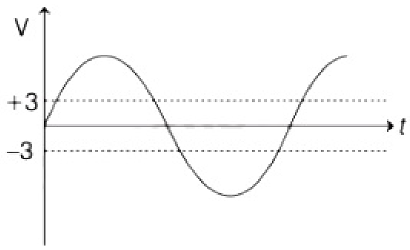
Choose the correct wave form that can represent the voltage across R of the following circuit, assuming the diode is ideal one.



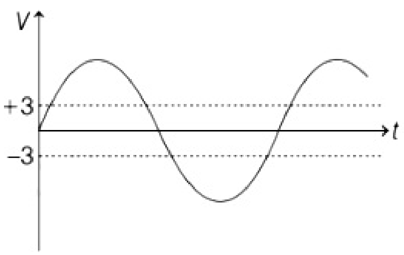
[31 Aug 2021 Shift 1]

Options:

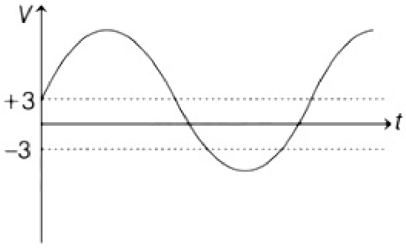
A.



B.



C.

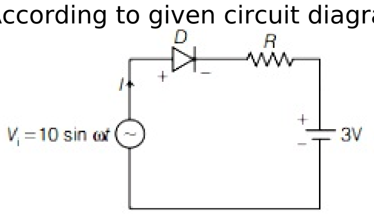


D. None of the above

Answer: E

Solution:

Solution:
According to given circuit diagram,



Let I current is flowing through the circuit.
∴ Kirchhoff's voltage loop equation will be
$10 \sin \omega t - IR - 3 = 0$
$IR = V = 10 \sin \omega t - 3$
∴ At time, $t = 0$, $V = 0 - 3 = -3V$ ...(i)
$t = \frac{T}{4}$, $V = 10 \sin \left(\frac{2\pi}{T}\right) \cdot \frac{T}{4} - 3$
$= 10 - 3 = 7V$ ...(ii)
$t = \frac{T}{2}$ to T, diode is in reverse bias.
∴ $V = 0$ ...(iii)
We see that at $t = 0$, $V = -3$ and $\frac{T}{2} \leq t \leq T$, $V = 0$
Therefore, no waveforms exist in option (a), (b) (c) and (d), which satisfies above condition.
Hence, no option is correct.

Question88

Statement I To get a steady DC output from the pulsating voltage received from a full wave rectifier we can connect a capacitor across the output parallel to the load R_L.
Statement II To get a steady DC output from the pulsating voltage received from a full wave rectifier we can connect an inductor in series with R_L.
In the light of the above statements, choose the most appropriate answer from the options given below.
[31 Aug 2021 Shift 2]

Options:

A. Statement I is true but statement II is false.

B. Statement I is false but statement II is true.

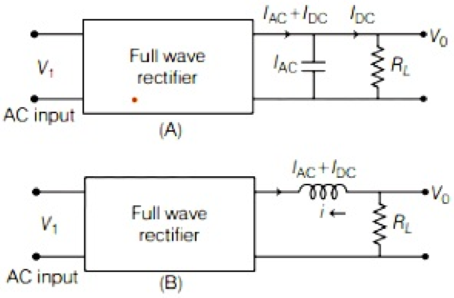
C. Both statement I and statement II are false.

D. Both statement I and statement II are true.

Answer: D

Solution:

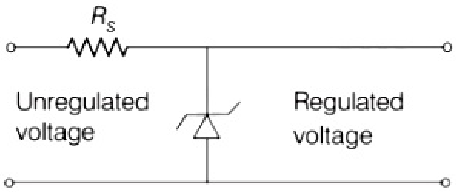
According to statement I and II, full wave rectifier with capacitor and inductor are as shown in figure.



In figure (A), the capacitor is connected in parallel to load resistance (R_L), as it can block DC current.
$\therefore$ DC current can pass only through R_L which gives DC output.
In figure (B), as the AC current is time varying current which can produce an opposition in current due to inductor that cancel the effect of AC in the load resistance (R_L).
Hence, pure DC output is obtained across R_L.
Hence, statement I and statement II are true.

Question89

A Zener diode of power rating 2W is to be used as a voltage regulator. If the Zener diode has a breakdown of 10V and it has to regulate voltage fluctuated between 6V and 14V, the value of R_S for safe operation should be........ Ω



[27 Aug 2021 Shift 2]

Answer: 20

Solution:

Given, power, $P = 2W$
Zener breakdown voltage, $V_z = 10V$
Voltage range, $(V_1 \text{ to } V_2) = 6V$ and $14V$
Let resistance be R.
Since, $P = VI_z$

Zener current, $I_z = \frac{P}{V_z} = \frac{2}{10} = 0.2A$

For safe operation of Zener diode,
$I_z = I_s = 0.2A$
$\therefore V_2 - V_z = I_s R_s$

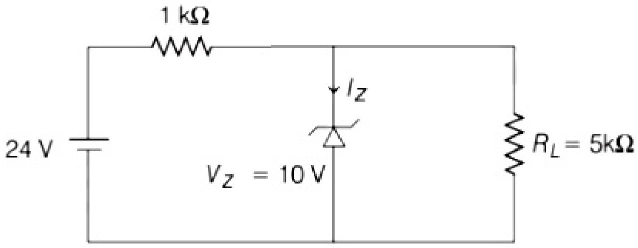
$\Rightarrow\ 14-10\ \ = I_sR_s$

$\Rightarrow\ R_s\ = \dfrac{4}{0.2}$

$= \dfrac{40}{2} = 20\Omega$

Question90

For the given circuit, the power across Zener diode is .... mW.

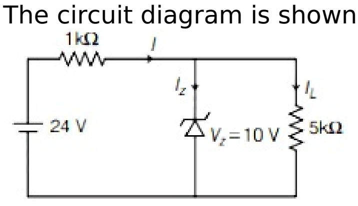


[26 Aug 2021 Shift 2]

Answer: 120

Solution:

Solution:
The circuit diagram is shown below



The supply voltage, $V_s = 24V$
Zener voltage, $V_z = 10V$
The value of supply voltage is greater than the Zener voltage.
Hence, the voltage across the load resistance of 5 kΩ will be equal to Zener voltage as they are connected in parallel combination.
Current I_L flowing through the load resistance can be calculated as

$I_L = \dfrac{10}{5\times10^3} = 2\times10^{-3}A = 2\,mA$

Since, the voltage drop across 5 kΩ is 10 V, then the voltage dropacross 1 kΩ resistance, V′ = 24 − 10 = 14 V
Current flowing through 1 kΩ resistance can be calculated as

$I = \dfrac{V'}{1\times10^3} = \dfrac{14}{1\times10^3} = 14\times10^{-3}A = 14\,mA$

From circuit diagram, $I = I_Z + I_L$
$I_z = I - I_L = 14 - 2 = 12\,mA$
Power across Zener diode is
$P = V_z\times I_z = 10\times12 = 120\,mW$
Thus, the power across the Zener diode is 120 mW.

Question91

Statement I By doping silicon semiconductor with pentavalent material, the electrons density increases.
Statement II The n -type semiconductor has net negative charge.

In the light of the above statements, choose the most appropriate answer from the options given below.
[26 Aug 2021 Shift 1]

Options:

A. Statement I is true but statement II is false.

B. Statement I is false but statement II is true.

C. Both statement I and statement II are true.

D. Both statement I and statement II are false.

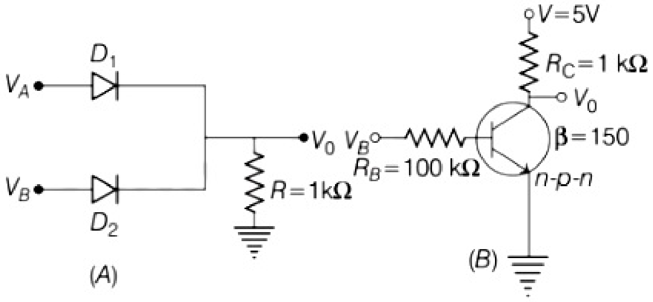
Answer: A

Solution:

Solution:
We know that, the pentavalent impurities have excess free electrons. So, when a silicon semiconductor is doped with pentavalent impurities, the electron density increases. But on the other hand, the whole semiconductor is electrically neutral, therefore net charge on n-type semiconductor is zero.
Hence, statement I true but statement II is false.

Question92

If V_A and V_B are the input voltages (either 5V or OV) and V_0 is the output voltage then the two gates represented in the following circuit (A) and (B) are



[31 Aug 2021 Shift 2]

Options:

A. AND and OR gate

B. OR and NOT gate

C. NAND and NOR gate

D. AND and NOT gate

Answer: B

Solution:

Solution:
In figure A, V_A and V_B are two input voltages (either 5V or 0V)

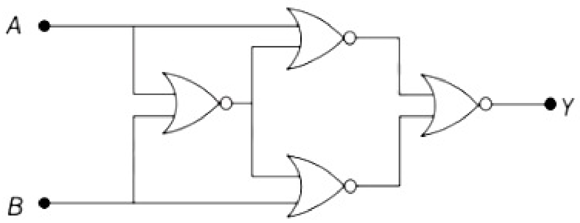
When $V_A = 0$, $V_B = 0$
Both D_1 and D_2 are OFF, so $V_0 = 0$,
When $V_A = 1$ i.e. 5V, $V_B = 0$ i.e. 0V
D_1 is ON but D_2 is OFF
So, $V_0 = 1$ i.e. 5V
When $V_A = 0$ i.e. 0V, $V_B = 1$ i.e. 5V
D_1 is OFF and D_2 is ON
So, $V_0 = 1$ i.e. 5V.
Similarly, when $V_A = V_B = 1$
Both D_1 and D_2 are ON
So, $V_0 = 1$ i.e. 5V.
We get the final truth table on the basis of inputs and their corresponding output.

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

∴ The given circuit (A) is an OR gate.
In figure B, it is a transistor in common emitter configuration which gives high output at low input and low output at high input.
Hence, this circuit behaves as NOT Gate.

Question93

Four NOR gates are connected as shown in figure. The truth table for the given figure is



[26 Aug 2021 Shift 2]

Options:

A.

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

B.

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

C.

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

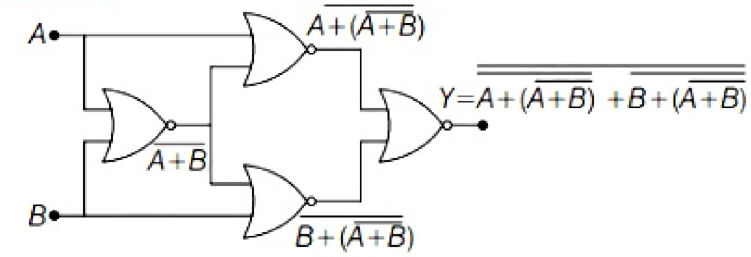
D.

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

Answer: D

Solution:

Given, logic circuit can be drawn as shown below.



The expression for output is

$$Y = \overline{\overline{A + \overline{(A+B)}} + \overline{B + \overline{(A+B)}}}$$

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

(Using de-Morgan’s theorem, $\overline{x+y} = \overline{x} \,.\, \overline{y}$

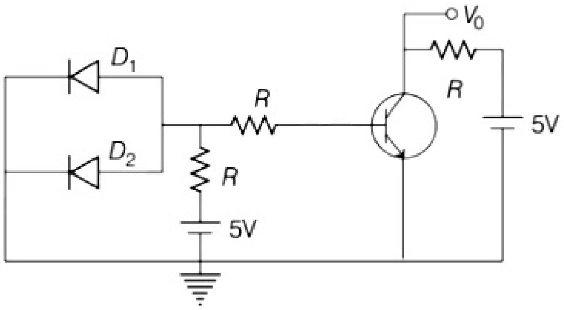
$Y = (A + \overline{A+B}) \,.\, (B + \overline{A+B})$

Draw the truth table for the logic circuit is shown below

A	B	A + B	$\overline{A+B}$	$A+\overline{A+B}$	$B+\overline{A+B}$	Y
0	0	0	1	1	1	1
0	1	1	0	0	1	0
1	0	1	0	1	0	0
1	1	1	0	1	1	1

Question94

A circuit is arranged as shown in figure. The output voltage V_0 is equal to .... V.

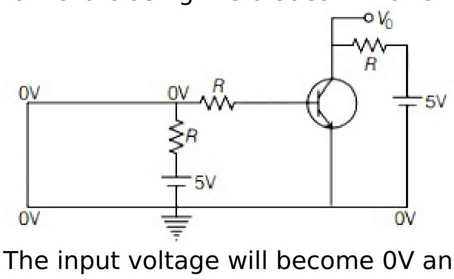


[27 Aug 2021 Shift 1]

Answer: 5

Solution:

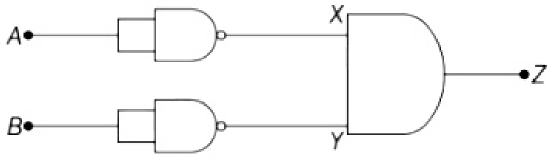
Solution:
In the given circuit diagram shown in question, we can observe that diode D_1 and diode D_2 are in forward biasing. So, in forward biasing the diodes will offer zero resistance. Hence, given circuit diagram is redrawn as



The input voltage will become 0V and thus, the input current will be 0A.
The output current will also be zero.
Thus, the output voltage should be equal to 5 V.

Question95

Identify the logic operation carried out by the given circuit.



[26 Aug 2021 Shift 1]

Options:

A. OR

B. AND

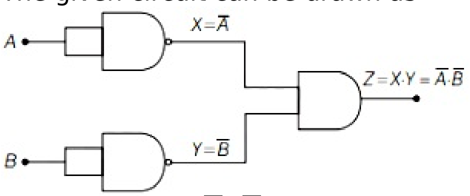
C. NOR

D. NAND

Answer: C

Solution:

Solution:
The given circuit can be drawn as



The output, $Z = \overline{A} \, . \, \overline{B}$
$= \overline{A + B}$
(Using de-Morgan theorem)
This is the expression of a NOR gate. So, the logic operation carried out by the given circuit is NOR.
Alternate Method
The given question can be solved using truth table, which is as given below

A	B	X	Y	Z
0	0	1	1	1
1	1	0	0	0
1	0	0	1	0
0	1	1	0	0

This truth table is similar to that of a NOR gate.

Question96

For a transistor α and β are given as $\alpha = \frac{I_C}{I_E}$ and $\beta = \frac{I_C}{I_B}$. Then, the correct relation between α and β will be
[27 Aug 2021 Shift 2]

Options:

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

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

C. $\alpha\beta = 1$

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

Answer: B

Solution:

Given, $\alpha = \frac{I_C}{I_E}$ and $\beta = \frac{I_C}{I_B}$
where, $\alpha =$ current gain in common-base amplifier
and $\beta =$ current gain in
common-emitter amplifire.
Since, $I_E = I_C + I_B$
where, $I_E =$ emitter current,
$I_C =$ collector current.
and $I_B =$ base current.

$$\therefore \alpha = \frac{I_C}{I_E} = \frac{I_C}{I_C + I_B} = \frac{1}{1 + \frac{I_B}{I_C}} = \frac{1}{1 + \frac{1}{\beta}}$$

$$\Rightarrow 1 + \frac{1}{\beta} = \frac{1}{\alpha}$$

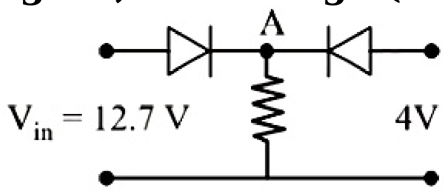
$$\Rightarrow \frac{1}{\beta} = \frac{1}{\alpha} - 1$$

$$\Rightarrow \frac{1}{\beta} = \frac{1-\alpha}{\alpha}$$

$$\therefore \beta = \frac{\alpha}{1-\alpha}$$

Question97

Both the diodes used in the circuit shown are assumed to be ideal and have negligible resistance when these are forward biased. Built in potential in each diode is 0.7 V. For the input voltages shown in the figure, the voltage (in Volts) at point A is ________.



[NA 9 Jan. 2020 I]

Options:

A. 12

B. 10

C. 9

D. 11

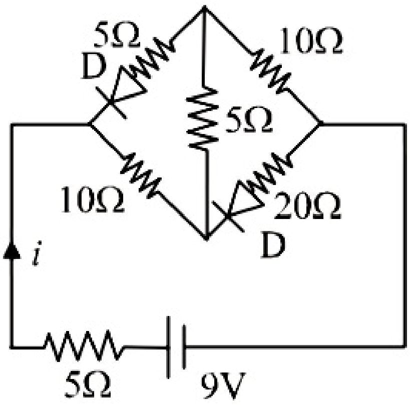
Answer: A

Solution:

Right hand diode is reversed biased and left hand diode is forward biased.
Hence Voltage at ‘A’
$V_A = 12.7 - 0.7 = 12$ volt

Question98

The current i in the network is:



[9 Jan. 2020 II]

Options:

A. 0.2 A

B. 0.6 A

C. 0.3 A

D. 0 A

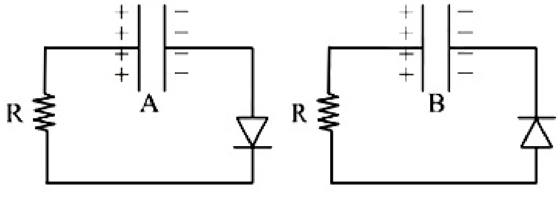
Answer: C

Solution:

Solution:
Both the diodes are reverse biased, so, there is no flow of current through 5Ω and 20Ω resistances.
Now, two resistors of 10Ω and two resistors of 5Ω are in series.
Hence current I through the network = 0.3 A

Question99

Two identical capacitors A and B, charged to the same potential 5V are connected in two different circuits as shown below at time t = 0. If the charge on capacitors A and B at time t = CR is Q_A and Q_B respectively, then (Here e is the base of natural logarithm)



[9 Jan. 2020 II]

Options:

A. $Q_A = \frac{VC}{e}, Q_B = \frac{CV}{2}$

B. $Q_A = VC, Q_B = CV$

C. $Q_A = VC, Q_B = \frac{VC}{e}$

D. $Q_A = \frac{CV}{2}, Q_B = \frac{VC}{e}$

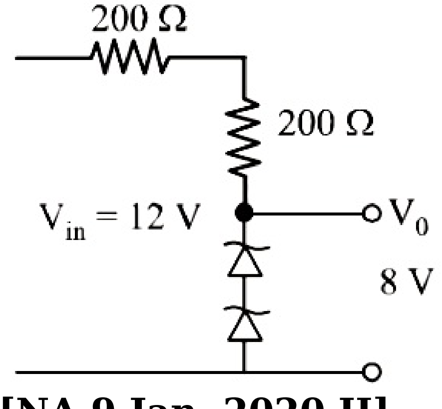
Answer: C

Solution:

Solution:
In case I diode is reverse biased, so no current flows
$\therefore Q_A = CV$
In case II, current will flow as diode is forward biased. So,it offers negligible resistance to the flow of current and thus be replaced by short circuit. Now, the charge of capacitor will leak through the resistance and decay exponentially with time.
During discharging of capacitor
Potential difference across the capacitor at any instant
$V' = Ve^{-\frac{t}{CR}}$
But $t = CR$
$V' = Ve^{-1} = \frac{V}{e}$
$\therefore$ Charge $Q_B = CV' = \frac{CV}{e}$

Question100

The circuit shown below is working as a 8 V dc regulated voltage source. When 12 V is used as input, the power dissipated (in mW) in each diode is; (considering both zener diodes are identical) _____.



[NA 9 Jan. 2020 II]

Options:

A. 40 mW

B. 20 mW

C. 15 mW

D. 25 mW

Answer: A

Solution:

Solution:

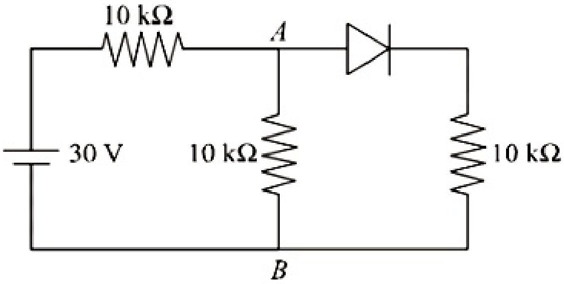
Current in the circuit, $I = \dfrac{12-8}{400} = 10^{-2}A$

Power dissipited in each diode, $P = VI$

$\Rightarrow P = 4 \times 10^{-2} = 40mW$

Question101

In the figure, potential difference between A and B is:



[7 Jan. 2020 II]

Options:

A. 10 V

B. 5 V

C. 15 V

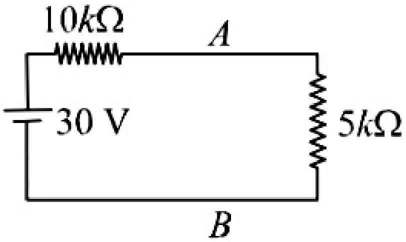
D. zero

Answer: A

Solution:

Solution:

The given circuit has two 10kΩ resistances in parallel, so we can reduce this parallel combination to a single equivalent resistance of 5kΩ.

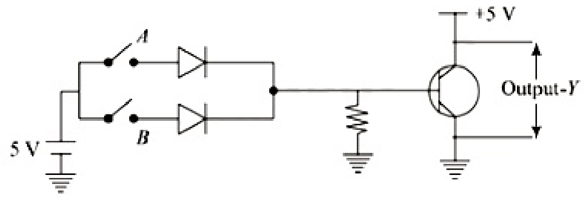


Diode is in forward bias. So it will behave like a conducting wire.

$V_A - V_B = \dfrac{30}{5+10} \times 5 = 10V$

Question102

Boolean relation at the output stage-Y for the following circuit is:



[8 Jan. 2020 I]

Options:

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

B. A + B

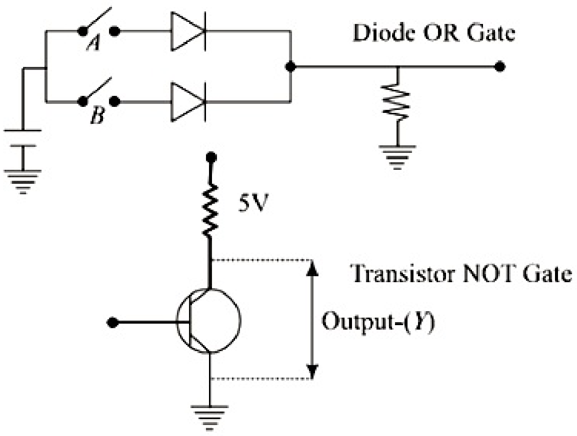
C. A . B

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

Answer: D

Solution:

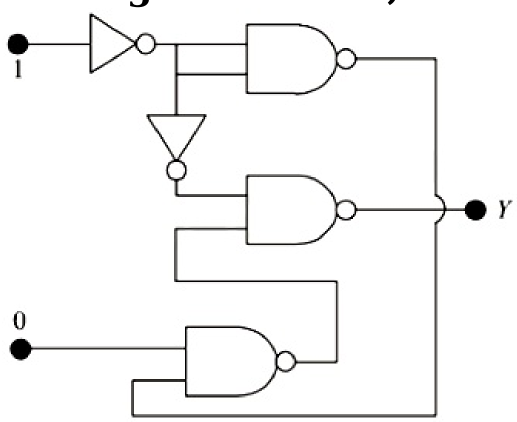
Solution:



OR + NOT → NOR Gate
Hence Boolean relation at the output stage – Y for the circuit,
$Y = \overline{A + B} = \overline{A} . \overline{B}$

Question103

In the given circuit, value of Y is:



[8 Jan. 2020 II]

Options:

A. 0

B. toggles between 0 and 1

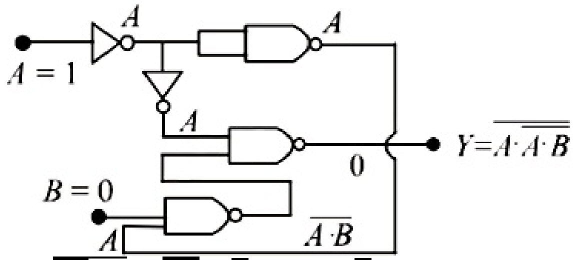
C. will not execute

D. 1

Answer: A

Solution:

Solution:



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

For A = 1, B = 0

$Y = (1) \times 0 + 0$

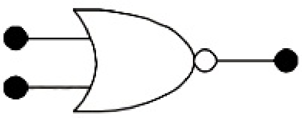
$\Rightarrow Y = 0 + 0 = 0$

Question104

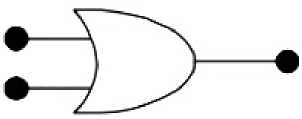
Which of the following gives a reversible operation? [7 Jan. 2020 I]

Options:

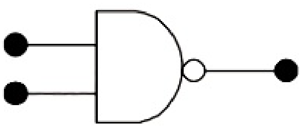
A.



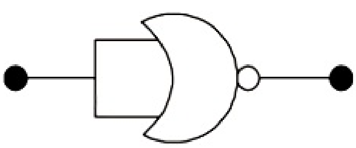
B.



C.



D.



Answer: D

Solution:

Solution:
A logic gate is reversible if we can recover input data from the output. Hence NOT gate.

Question105

With increasing biasing voltage of a photodiode, the photocurrent magnitude :
[Sep. 05, 2020 (I)]

Options:

A. remains constant

B. increases initially and after attaining certain value, it decreases

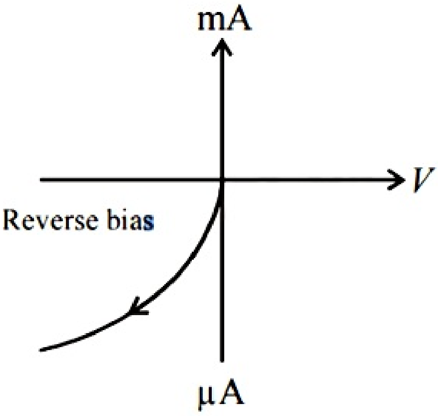
C. Increases linearly

D. increases initially and saturates finally

Answer: D

Solution:

Solution:
I-V characteristic of a photodiode is as follows :

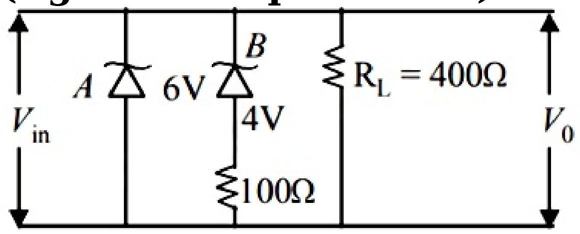


On increasing the biasing voltage of a photodiode, the magnitude of photocurrent first increases and then attains a saturation.

Question106

Two Zener diodes (A and B) having breakdown voltages of $6V$ and $4V$ respectively, are connected as shown in the circuit below. The output voltage V_0 variation with input voltage linearly increasing with time, is given by:
($V_{input} = 0V$ at $t = 0$)

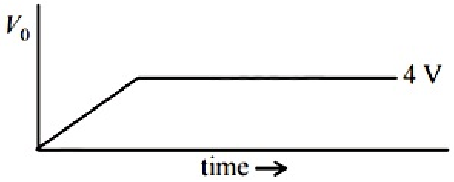
(figures are qualitative)



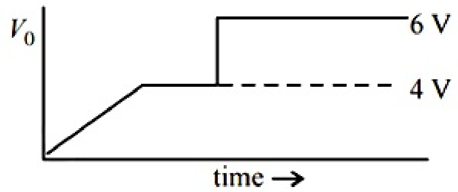
[Sep. 05,2020 (II)]

Options:

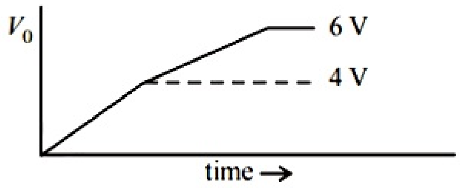
A.



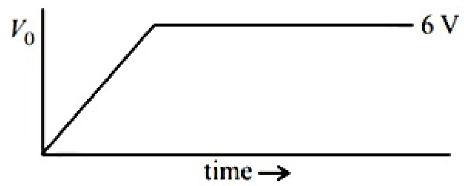
B.



C.



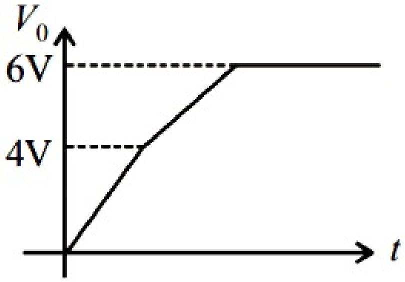
D.



Answer: C

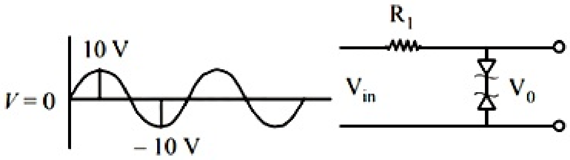
Solution:

Solution:
Till input voltage reaches 4 V. No zener is in breakdown region so $V_0 = V_i$. Then now when V_i changes between $4V$ to $6V$ one zener with $4V$ will breakdown and P.D. across this zener will become constant and remaining potential will dorp across resistance in series with 4 V zener.
Now current in circuit increases abruptly and source must have an internal resistance due to which some potential will get drop across the source also so correct graph between V_0 and t will be



Question107

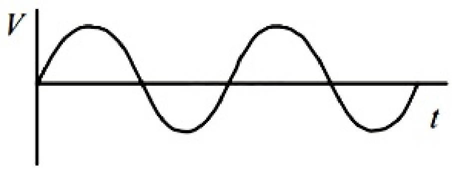
Take the breakdown voltage of the zener diode used in the given circuit as 6V . For the input voltage shown in figure below, the time variation of the output voltage is :
(Graphs drawn are schematic and not to scale)



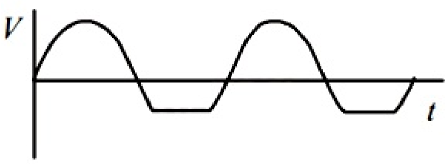
[Sep. 04,2020 (I)]

Options:

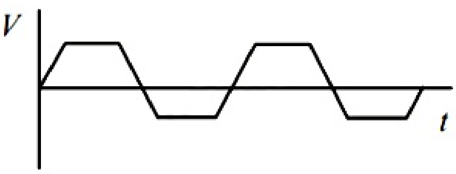
A.



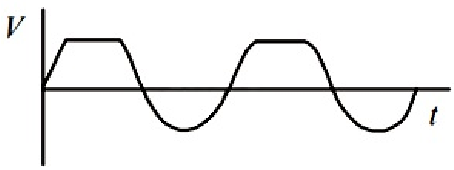
B.



C.



D.



Answer: C

Solution:

Here two zener diodes are in reverse polarity so if one is in forward bias the other will be in reverse bias and above 6V the reverse bias will too be in conduction mode. Hence when $V > 6V$ the output will be constant. And when $V < 6V$ it will follow the inut voltage.

Question108

When a diode is forward biased, it has a voltage drop of 0.5V . The safe limit of current through the diode is 10mA If a battery of emf 1.5V is used in the circuit, the value of minimum resistance to be connected in series with the diode so that the current does not exceed the safe limit is :
[Sep. 03,2020 (I)]

Options:

A. 300Ω

B. 50Ω

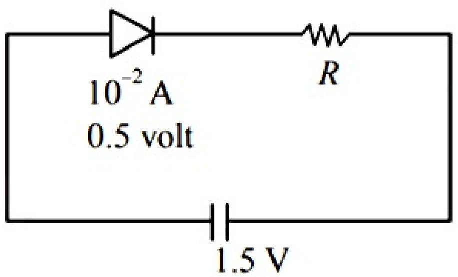
C. 100Ω

D. 200Ω

Answer: C

Solution:

Solution:
According to question, when diode is forward biased,
$V_{diode} = 0.5V$
Safe limit of current, $I = 10mA = 10^{-2}A$
$R_{min} = ?$



Voltage through resistance
$V_R = 1.5 - 0.5 = 1$ volt
$iR = 1 (= V_R)$
$\therefore R_{min} = \frac{1}{i} = \frac{1}{10^{-2}} = 100\Omega$

Question109

If a semiconductor photodiode can detect a photon with a maximum wavelength of 400 nm, then its band gap energy is: Planck's constant,

$h = 6.63 \times 10^{-34} J \cdot s$
Speed of light, $c = 3 \times 10^{8} m / s$
[Sep. 03,2020 (II)]

Options:

A. 1.1 eV

B. 2.0 eV

C. 1.5 eV

D. 3.1 eV

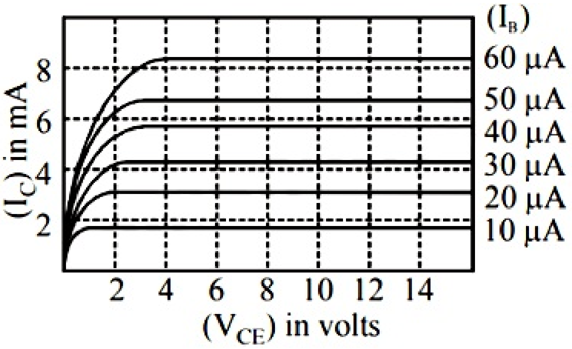
Answer: D

Solution:

Solution:
Given,
Wavelength of photon, $\lambda = 400$ nm
A photodiode can detect a wavelength corresponding to the energy of band gap. If the signal is having wavelength greater than this value, photodiode cannot detect it.
$\therefore$ Band gap $E_g = \frac{hc}{\lambda} = \frac{1237.5}{400} = 3.09 eV$

Question110

The output characteristics of a transistor is shown in the figure. When V_{CE} is 10V and $I_C = 4.0 mA$, then value of β_{ac} is ______.



[NA Sep. 06,2020 (II)]

Answer: 150

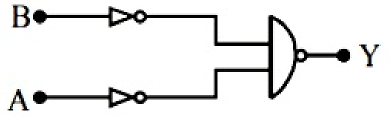
Solution:

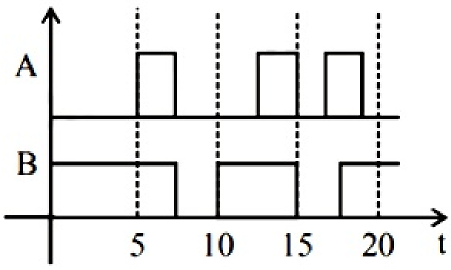
At $V_{CE} = 10V$ and $I_C = 4mA$
Change in base current, $\Delta I_B = (30 - 20) = 10 \mu A$
Change in collector current, $\Delta I_C = (4.5 - 3) = 1.5 mA$

$$\beta = \left(\frac{\Delta I_C}{\Delta I_B}\right) = \frac{1.5 mA}{10 \mu A} = 150$$

Question111

Identify the correct output signal Y in the given combination of gates (as shown) for the given inputs A and B.

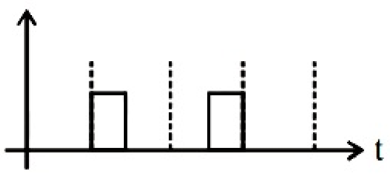




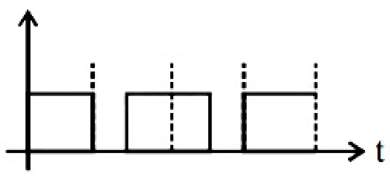
[Sep. 06, 2020 (I)]

Options:

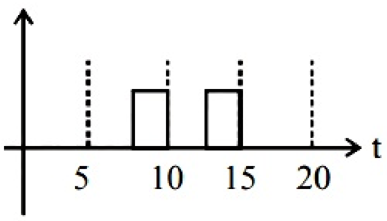
A.



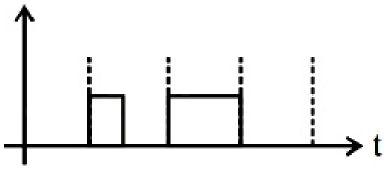
B.



C.



D.



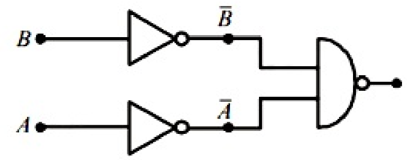
Answer: A

Solution:

Solution:

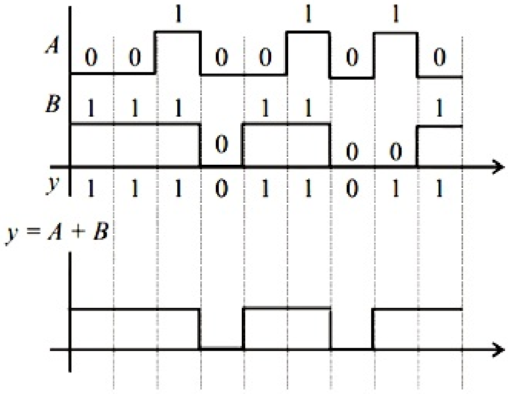
Boolean expression,

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



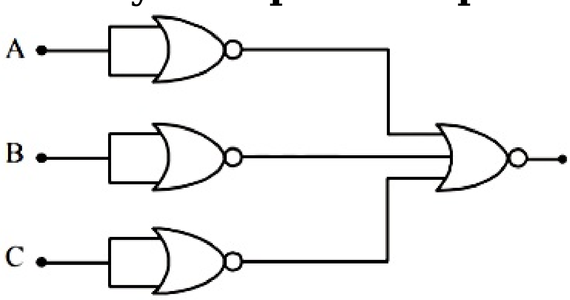
Truth table :

A	B	Y
0	1	2
1	0	1
0	0	0
1	1	1



Question112

Identify the operation performed by the circuit given below:



[Sep. 04, 2020 (II)]

Options:

A. NAND

B. OR

C. AND

D. NOT

Answer: C

Solution:

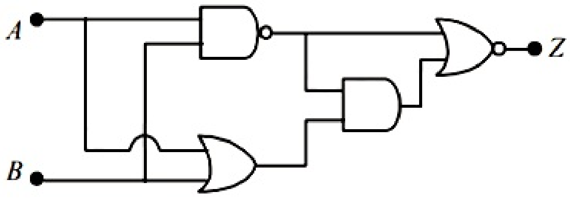
Solution:
When two inputs of NAND gate is shorted, it behaves like a NOT gate so boolen equation will be
$y = \overline{\overline{A} + \overline{B} + \overline{C}}$
$y = A . B . C$

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

Thus, whole arrangement behaves like a AND gate.

Question113

In the following digital circuit, what will be the output at 'Z', when the input (A, B) are (1, 0), (0, 0), (1, 1), (0, 1) :



[Sep. 02, 2020 (II)]

Options:

A. 0, 0, 1, 0

B. 1, 0, 1, 1

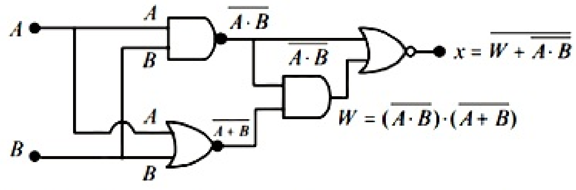
C. 1, 1, 0, 1

D. 0, 1, 0, 0

Answer: A

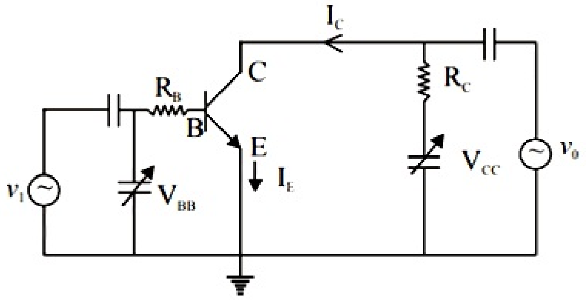
Solution:

Solution:



A	B	$\overline{A.B}$	$\overline{A+B}$	$W = \overline{A.B}.\overline{A+B}$	$Q = W + \overline{A.B}$	$\overline{Q} = x$
1	0	1	0	0	1	0
0	1	1	0	0	1	0
1	1	0	0	0	0	1
0	0	1	1	1	0	0

Question114



In the figure, given that V_{BB} supply can vary from 0 to 5.0 V, V_{CC} = 5V, β_{dc} = 200, R_B = 100kΩ, R_C = 1K Ω and V_{BE} = 1.0V. The minimum base current and the input voltage at which the transistor will go to saturation, will be, respectively:
[12 Jan. 2019 II]

Options:

A. 25 µA and 3.5 V

B. 20 µA and 3.5 V

C. 25 µA and 2.8 V

D. 20 µA and 2.8 V

Answer: A

Solution:

At saturation, $V_{CE} = 0$
$V_{CE} = V_{CC} - I_C R_C$
$\Rightarrow I_C = \frac{V_{CC}}{R_c} = 5 \times 10^{-3} A$
Current gain,
$\beta_{dc} = \frac{I_C}{I_B}$

$I_B = \frac{5 \times 10^{-3}}{200} = 25\mu A$

At input side

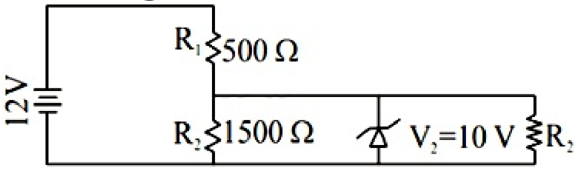
$V_{BB} = I_B R_B + V_{BE}$

$= (25mA)(100k\Omega) + 1V$

$V_{BB} = 3.5V$

Question115

In the given circuit the current through Zener Diode is close to :



[11 Jan. 2019 I]

Options:

A. 0.0 mA

B. 6.7 mA

C. 4.0 mA

D. 6.0 mA

Answer: A

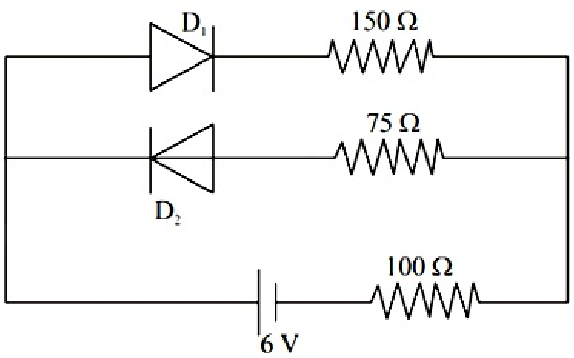
Solution:

Solution:

Since voltage across zener diode does not reach to breakdown voltage therefore its resistance will be infinite & current through it is 0.

Question116

The circuit shown below contains two ideal diodes, each with a forward resistance of 50 Ω. If the battery voltage is 6V, the current through the 100 Ω resistance (in Amperes) is :



[11 Jan. 2019 II]

Options:

A. 0.036

B. 0.020

C. 0.027

D. 0.030

Answer: B

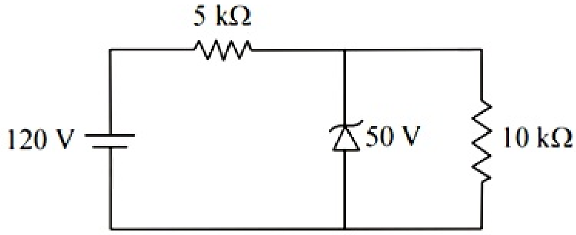
Solution:

Solution:
As D_2 is reversed biased, so no current through 75Ω resistor.

now $R_{eq} = 150 + 50 + 100$
$= 300\Omega$
So, required current $I = \frac{\text{Battery Voltage}}{300}$
$I = \frac{6}{300} = 0.02$

Question117

For the circuit shown below, the current through the Zener diode is:



[10 Jan. 2019 II]

Options:

A. 9 mA

B. 5 mA

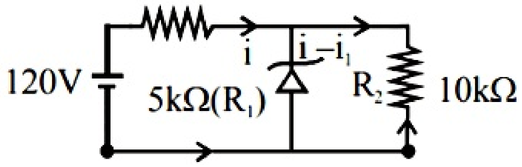
C. Zero

D. 14 mA

Answer: A

Solution:

Solution:
The voltage across zener diode is constant



$i_{(R_2)} = \frac{V}{R} = \frac{50}{10 \times 10^3} = 5 \times 10^{-3}\text{A}$
$i_{(R_1)} = \frac{V}{R} = \frac{120 - 50}{5 \times 10^3} = \frac{70}{5 \times 10^3} 14 \times 10^{-3}\text{A}$
$\therefore i_{\text{zenerdiode}} = 14 \times 10^{-3} - 5 \times 10^{-3} = 9 \times 10^{-3}\text{A} = 9\text{mA}$

Question118

Mobility of electrons in a semiconductor is defined as the ratio of their drift velocity to the applied electric field. If, for an n-type semiconductor, the density of electrons is $10^{19} m^{-3}$ and their mobility is $1.6 m^2/(V.s)$ then the resistivity of the semiconductor (since it is an n-type semiconductor contribution of holes is ignored) is close to:
[9 Jan. 2019 I]

Options:

A. 2 Ωm

B. 4 Ωm

C. 0.4 Ωm

D. 0.2 Ωm

Answer: C

Solution:

Solution:
As we know, current density,
$j = \sigma E = nev_d$

$\sigma = ne\frac{v_d}{E} = ne\mu$

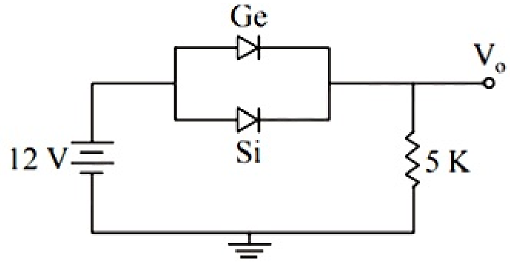
$\frac{1}{\sigma} = \rho = \frac{1}{n_e e \mu_e} =$ Resistivity

$= \frac{1}{10^{19} \times 1.6 \times 10^{19} - 19 \times 1.6}$

or $P = 0.4 \Omega m$

Question119

Ge and Si diodes start conducting at 0.3V and 0.7V respectively. In the following figure if Ge diode connection are reversed, the value of V_0 changes by :
(assume that the Ge diode has large breakdown voltage)



[9 Jan. 2019 II]

Options:

A. 0.8 V

B. 0.6 V

C. 0.2 V

D. 0.4 V

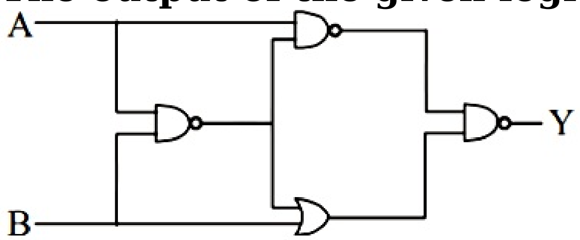
Answer: D

Solution:

Solution:
Initially Ge and Si are both forward biased so current will effectivily pass through Ge diode therefore $V_0 = 12 - 0.3 = 11.7V$
And if "Ge" is revesed then current will flow through "Si" diode
$\therefore V_0 = 12 - 0.7 = 11.3V$
Clearly, V_0 changes by $11.7 - 11.3 = 0.4V$

Question120

The output of the given logic circuit is:



[12 Jan. 2019 I]

Options:

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

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

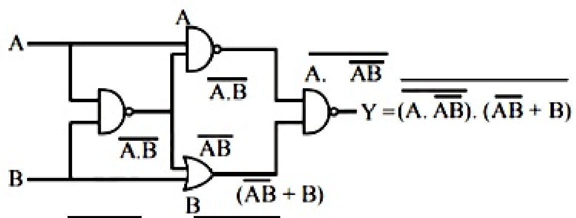
C. $A\overline{B}$

D. $\overline{A}B$

Answer: C

Solution:

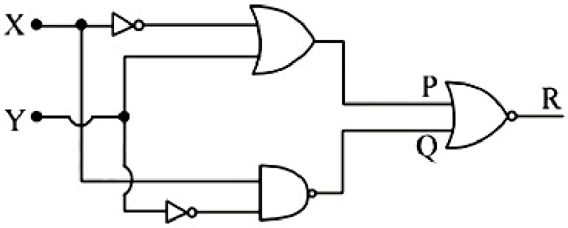
Solution:



$Y = \overline{(A.\overline{AB})} + \overline{(\overline{AB}+B)}$
$= A.\overline{AB} + AB.\overline{B}$
$= A.(\overline{A}+\overline{B}) + AB.\overline{B}$
$= A\overline{B}$

Question121

To get output ‘1’ at R, for the given logic gate circuit the input values must be:



[10 Jan. 2019 I]

Options:

A. X = 0, Y = 1

B. X = 1, Y = 1

C. X = 1, Y = 0

D. X = 0, Y = 0

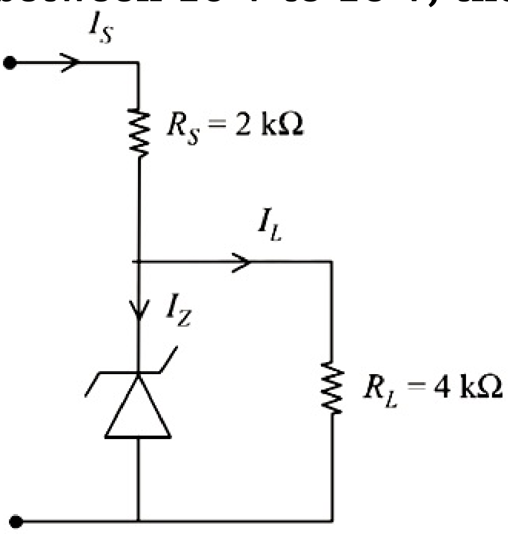
Answer: C

Solution:

Solution:
From the given logic circuit,
p = $\bar{x} + y$
Q = $\overline{\bar{y} . x} = y + \bar{x}$
Output, R = $\overline{P + Q}$
To make output 1
P + Q must be ‘0’
So, x = 1, y = 0

Question122

Figure shows a DC voltage regulator circuit, with a Zener diode of breakdown voltage = 6V. If the unregulated input voltage varies between 10 V to 16 V, then what is the maximum Zener current ?



[12 Apr. 2019 II]

Options:

A. 2.5 mA

B. 1.5 mA

C. 7.5 mA

D. 3.5 mA

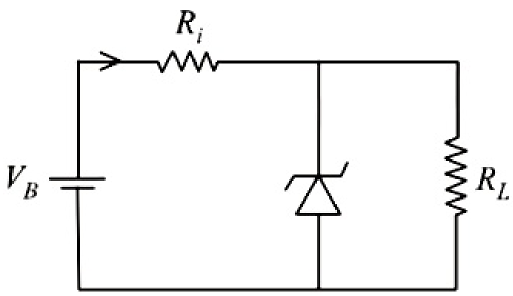
Answer: D

Solution:

Solution:
Current in load resistance,
$i_1 = \frac{6}{4 \times 10^3} = 1.5 \times 10^{-3} A = 1.5mA$
For V = 16 volt,
$i_s = \frac{(16 - 6)}{2 \times 10^3} = 5mA$
$\therefore i_2 = i_s - i_1 = 5 - 1.5 = 3.5$ mA

Question123

The figure represents a voltage regulator circuit using a Zener diode. The breakdown voltage of the Zener diode is 6V and the load resistance is $R_t = 4k$. The series resistance of the circuit is $R_i = 1k$. If the battery voltage V_B varies from 8V to 16V, what are the minimum and maximum values of the current through Zener diode?



[10 Apr. 2019 II]

Options:

A. 0.5 mA; 6 mA

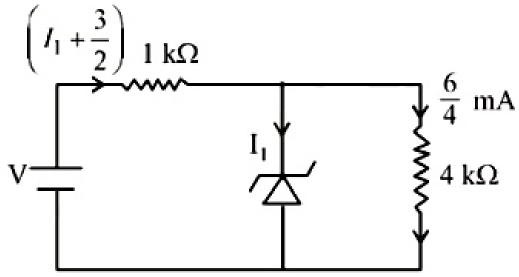
B. 1 mA; 8.5 mA

C. 0.5 mA; 8.5 mA

D. 1.5 mA; 8.5 mA

Answer: C

Solution:



For voltage, V = 8V

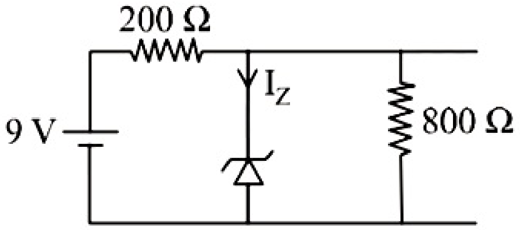
Current, $I_1 = \left(8 - 6 - \frac{3}{2}\right) = 12 = 0.5\text{mA}$

For voltage, V = 16V

Current, $I_2 = \left(16 - 6 - \frac{3}{2}\right) = 8.5\text{mA}$

Question124

The reverse breakdown voltage of a Zener diode is 5.6 V in the given circuit



The current I_z through the Zener is :
[8 April 2019 I]

Options:

A. 10 mA

B. 17 mA

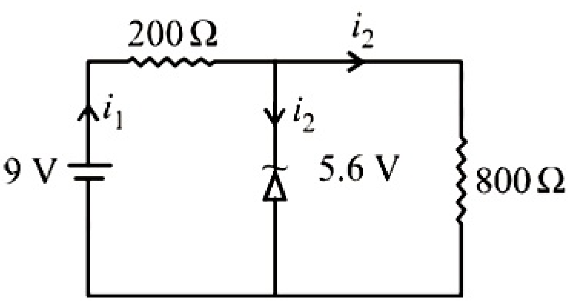
C. 15 mA

D. 7 mA

Answer: A

Solution:

Solution:



P.D. across Ω resistors = 5.6 V

so, $I_{800\Omega} = \frac{5.6}{800}\text{A} = 7\text{mA}$

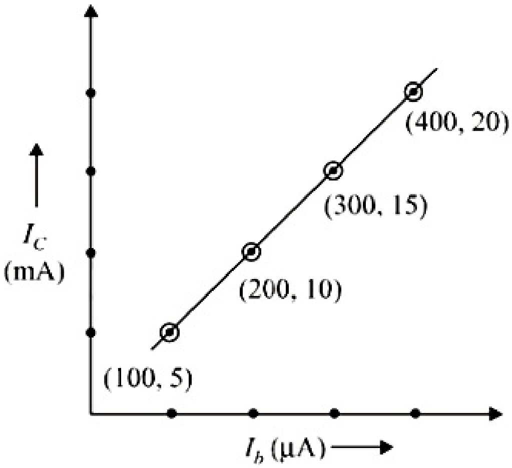
Now, P.D. across 200Ω resistors $= 9 - 5.6\text{V} = 3.4\text{V}$

so, $I_{200\Omega} = \frac{9 - 5.6}{200} = 17\text{mA}$

so, current through zener diode $= I_2 = 17 - 7 = 10\text{mA}$

Question125

The transfer characteristic curve of a transistor, having input and output resistance 100 Ω and 100 k Ω respectively, is shown in the figure. The Voltage and Power gain, are respectively :



[12 Apr. 2019 I]

Options:

A. 2.5×10^4, 2.5×10^6

B. 5×10^4, 5×10^6

C. 5×10^4, 5×10^5

D. 5×10^4, 2.5×10^6

E. None of above

Answer: E

Solution:

Solution:

$\beta = \frac{\Delta i_c}{\Delta i_b} = \frac{200 - 100}{10 - 5} = 20$

Voltage gain $= \beta \frac{R_2}{R_1} = \frac{20 \times 100 \times 10^3}{100} = 20 \times 10^3$

Power gain $= \beta^2 \frac{R_2}{R_1} = 20^2 \left(\frac{100 \times 10^3}{100} \right) = 4 \times 10^5$

Question126

An npn transistor operates as a common emitter amplifier, with a power gain of 60d B. The input circuit resistance is 100Ω and the output load resistance is 10kΩ. The common emitter current gain β is :
[10 Apr. 2019 I]

Options:

A. 10^2

B. 60

C. 6×10^2

D. 10^4

Answer: A

Solution:

Power gain $= 60 = 10 \log\left(\frac{P_0}{p_i}\right)$

$\Rightarrow 6 = \log\left(\frac{P_0}{p_i}\right)$

$\Rightarrow \frac{P_0}{p_i} = 10^6$

$= \beta^2\left(\frac{R_{out}}{R_{in}}\right)$

$\Rightarrow 10^6 = \beta^2\left(\frac{10000}{100}\right)$ [as $R_{out} = 10,000\Omega R_{in} = 100\Omega$]

$\Rightarrow \beta = 100$

Question127

An NPN transistor is used in common emitterconfiguration as an amplifier with 1 k &! load resistance. Signal voltage of 10mV is applied across the base-emitter. This produces a 3mA change in the collector current and $15\frac{1}{4}$A change in the base current of the amplifier. The input resistance and voltage gain are: [9 Apr. 2019 I]

Options:

A. $0.33 k\Omega 1.5$

B. $0.67 k\Omega 300$

C. $0.67 k\Omega 200$

D. $0.33 k\Omega 300$

Answer: B

Solution:

Solution:

$\beta = \frac{\Delta l\, c}{\Delta l\, b} = \frac{3 \times 10^{-3}}{15 \times 10^{-6}} = 200$

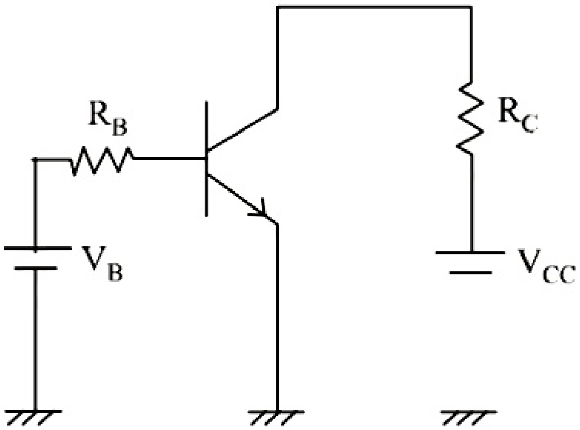
We have $\frac{V_0}{V_i} = \beta\frac{R^2}{R_1}$

or $\frac{V_0}{V_i} = 200\left(\frac{1000}{R_1}\right)$

If $R_1 = 0.67k\Omega \Rightarrow \frac{V_0}{V_i} = 300$

Question128

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



[8 Apr.2019 II]

Options:

A. 40μA

B. 100μA

C. 7μA

D. 10μA

Answer: A

Solution:

Given, $\beta = 250$

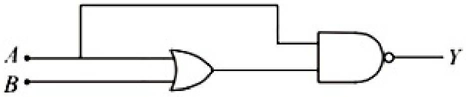
Voltage gain, $\frac{V_{CC}}{V_B} = \beta\frac{R_C}{R_B}$

$\frac{10}{V_B} = 250 \times \frac{10^3}{R_B}$

$\therefore \frac{V_B}{R_B} = \frac{1}{25 \times 10^3} = 40\mu A$

Question129

The truth table for the circuit given in the fig. is :



[9 April 2019 I]

Options:

A. $\begin{bmatrix} \mathrm{A} & \mathrm{B} & \mathrm{Y} \\ 0 & 0 & 1 \\ 0 & 1 & 1 \\ 1 & 0 & 1 \\ 1 & 1 & 1 \end{bmatrix}$

B. $\begin{bmatrix} \mathrm{A} & \mathrm{B} & \mathrm{Y} \\ 0 & 0 & 1 \\ 0 & 1 & 0 \\ 1 & 0 & 0 \\ 1 & 1 & 0 \end{bmatrix}$

C. $\begin{bmatrix} \mathrm{A} & \mathrm{B} & \mathrm{Y} \\ 0 & 0 & 1 \\ 0 & 1 & 1 \\ 1 & 0 & 0 \\ 1 & 1 & 0 \end{bmatrix}$

D. $\begin{bmatrix} \mathrm{A} & \mathrm{B} & \mathrm{Y} \\ 0 & 0 & 0 \\ 0 & 1 & 0 \\ 1 & 0 & 1 \\ 1 & 1 & 1 \end{bmatrix}$

Answer: C

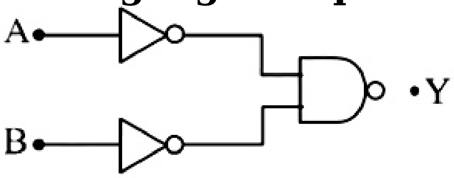
Solution:

Solution:

A	B	$(A+B)$	$(A+B).A$	$\overline{(A+B).A}$
0	0	0	0	1
0	1	1	0	1
1	0	1	1	0
1	1	1	1	0

Question130

The logic gate equivalent to the given logic circuit is:



[9 Apr. 2019 II]

Options:

A. NAND

B. OR

C. NOR

D. AND

Answer: B

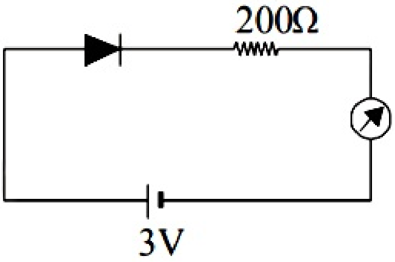
Solution:

Solution:
Truth table →
The output is of OR-gate

A	B	$\bar{A}$	$\bar{B}$	$\overline{\bar{A}.\bar{B}}$
0	0	1	1	0
0	1	1	0	1
1	0	0	1	1
1	1	0	0	1

Question131

The reading of the ammeter for a silicon diode in the given circuit is :



[2018]

Options:

A. 0

B. 15 mA

C. 11.5 mA

D. 13.5 mA

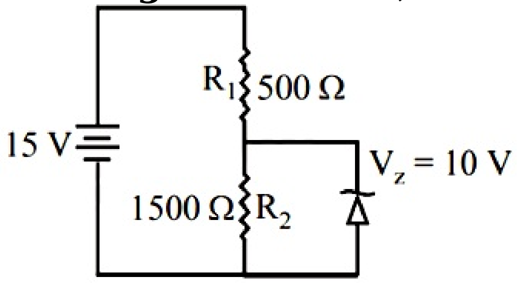
Answer: C

Solution:

Solution:
Clearly from fig. given in question, Silicon diode is in forward bias.
∴ Potential barrier across diode
$\Delta V = 0.7$ volts
Current, $I = \frac{V - \Delta V}{R} = \frac{3 - 0.7}{200} = \frac{2.3}{200} = 11.5 mA$

Question132

In the given circuit, the current through zener diode is:



[Online April 16, 2018]

Options:

A. 2.5mA

B. 3.3mA

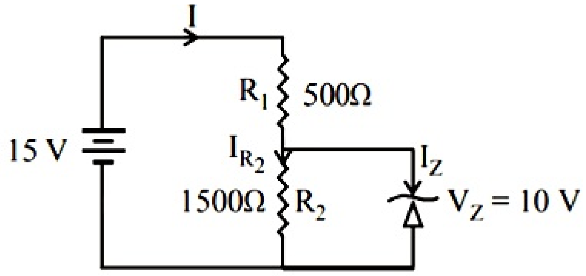
C. 5.5mA

D. 6.7mA

Answer: B

Solution:

Solution:



The voltage drop across R_2 is $V_{R_2} = V_Z = 10V$
The current through R_2 is
$I_{R_2} = \frac{V_{R_2}}{R_2} = \frac{10V}{1500\Omega} = 0.667 \times 10^{-2} A$
$= 6.67 \times 10^{-3} A = 6.67 mA$
The voltage drop across R_1 is
$V_{R_1} = 15V - V_{R_2} = 15V - 10V = 5V$

The current through R_1 is

$I_{R_1} = \frac{V_{R_1}}{R_1} = \frac{5V}{500\Omega} = 10^{-2}A = 10 \times 10^{-3}A = 10mA$

The current through the zener diode is

$I_Z = I_{R_1} - I_{R_2} = (10 - 6.67)mA = 3.3mA$

Question133

In a common emitter configuration with suitable bias, it is given than R_L is the load resistance and R_{BE} is small signal dynamic resistance (input side). Then, voltage gain, current gain and power gain are given, respectively, by:
(β is current gain, I_B, I_C, I_E are respectively base, collector and emitter currents:)
[Online April 15,2018]

Options:

A. $\beta\frac{R_L}{R_{BE}}, \frac{\Delta I_E}{\Delta I_B}, \beta^2\frac{R_L}{R_{BE}}$

B. $\beta^2\frac{R_L}{R_{BE}}, \frac{\Delta I_C}{\Delta I_B}, \beta\frac{R_L}{R_{BE}}$

C. $\beta^2\frac{R_L}{R_{BE}}, \frac{\Delta I_C}{\Delta I_E}, \beta^2\frac{R_L}{R_{BE}}$

D. $\beta\frac{R_L}{R_{BE}}, \frac{\Delta I_C}{\Delta I_B}, \beta^2\frac{R_L}{R_{BE}}$

Answer: D

Solution:

Solution:

Curent gain $\beta = \frac{\Delta I_C}{I_B}$

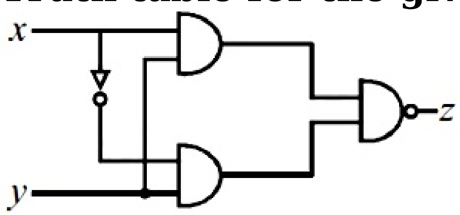
Voltage gain A_v = Current gain × Resistance gain $= \beta\frac{R_L}{R_{BE}}$

Power gain A_p = (Current gain $)^2$ × Resistance gain

$= \beta^2\frac{R_L}{R_{BE}}$

Question134

Truth table for the given circuit will be



[Online April 15, 2018]

Options:

A.

x	y	z
0	0	1
0	1	1
1	0	1
1	1	0

B.

x	y	z
0	0	0
0	1	0
1	0	0
1	1	1

C.

x	y	z
0	0	1
0	1	1
1	0	1
1	1	1

D.

x	y	z
0	0	0
0	1	1
1	0	1
1	1	1

Answer: C

Solution:

Solution:
Truth table of the circuit is as follows

x	y	x	$a = x.y$	$b = \bar{x}.y$	$z = \overline{a.b}$
0	0	1	0	0	1
0	1	1	0	1	1
1	0	0	0	0	1
1	1	0	1	0	1

Question135

What is the conductivity of a semiconductor sample having electron concentration of $5 \times 10^{18} m^{-3}$, hole concentration of $5 \times 10^{19} m^{-3}$, electron mobility of $2.0 m^2 V^{-1} s^{-1}$ and hole mobility of $0.01 m^2 V^{-1} s^{-1}$? (Take charge of electron as $1.6 \times 10^{-19} C$) [Online April 8, 2017]

Options:

A. $1.68 (\Omega - m)^{-1}$

B. $1.83 (\Omega - m)^{-1}$

C. $0.59 (\Omega - m)^{-1}$

D. $1.20 (\Omega - m)^{-1}$

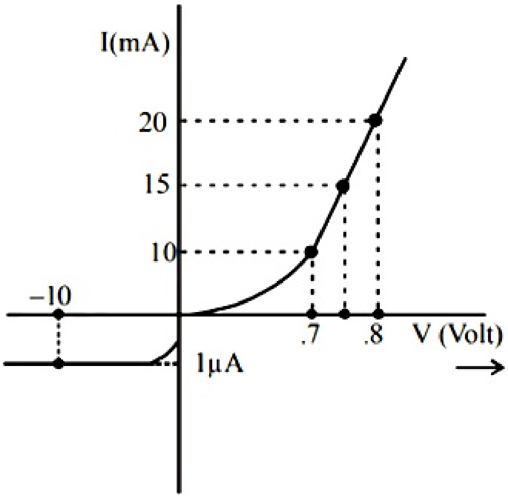
Answer: A

Solution:

Solution:
The conductivity of semiconductor
$\sigma = e(\eta_e \mu_e + \eta_h \mu_h)$
$= 1.6 \times 10^{-19} (5 \times 10^{18} \times 2 + 5 \times 10^{19} \times 0.01)$
$= 1.6 \times 1.05 = 1.68$

Question136

The V–I characteristic of a diode is shown in the figure. The ratio of forward to reverse bias resistance is :



[Online April 8, 2017]

Options:

A. 10

B. 10^{-6}

C. 10^{6}

D. 100

Answer: B

Solution:

Solution:

Forward bias resistance $= \frac{\Delta V}{\Delta I} = \frac{0.1}{10 \times 10^{-3}} = 10\Omega$

Reverse bias resistance $= \frac{10}{10^{-6}} = 10^{7}\Omega$

Ratio of resistances $= \frac{\text{Forward bias resistance}}{\text{Reverse bias resistance}} = 10^{-6}$

Question137

The current gain of a common emitter amplifier is 69. If theemitter current is 7.0 mA, collector current is : [Online April 9, 2017]

Options:

A. 9.6 mA

B. 6.9 mA

C. 0.69 mA

D. 69 mA

Answer: B

Solution:

Given, current gain of CE amplifier $\beta = 69$, $I_E = 7mA$

or $\frac{I_C}{I_B} = 69$

We know that, $\alpha = \beta 1 + \beta = \frac{69}{70} = \frac{I_C}{I_E}$

$I_C = I_E \times \frac{69}{70} = \frac{69}{70} \times 7$

Collector current, $I_C = 6.9mA$

Question138

In a common emitter amplifier circuit using an n-p-n transistor, the phase difference between the input and the output voltages will be : [Online April 2, 2017]

Options:

A. 135°

B. 180°

C. 45°

D. 90°

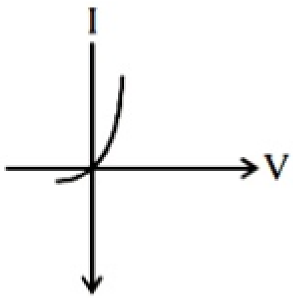
Answer: B

Solution:

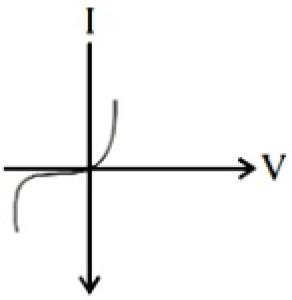
Solution:
In common emitter configuration for n-p-n transistor input and output signals are 180° out of phase i.e., phase difference between output and input voltage is 180°.

Question139

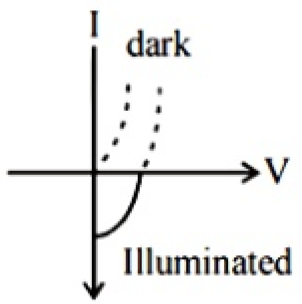
Identify the semiconductor devices whose characteristics are given below, in the order (i), (ii), (iii), (iv) :



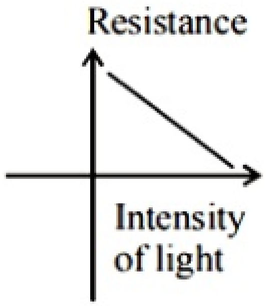
(i)



(ii)



(iii)



(iv)

[2016]

Options:

A. Solar cell, Light dependent resistance, Zener diode,simple diode

B. Zener diode, Solar cell, simple diode, Light dependentresistance

C. Simple diode, Zener diode, Solar cell, Light dependentresistance

D. Zener diode, Simple diode, Light dependentresistance, Solar cell

Answer: C

Solution:

Solution:
Graph (p) is for a simple diode.
Graph (q) is showing the V Break down used for zener diode.
Graph (r) is for solar cell which shows cut-off voltage and open circuit current.
Graph (s) shows the variation of resistance h and hence current with intensity of light.

Question140

The temperature dependence of resistances of Cu and undoped Si in the temperature range 300-400 K, is best described by :
[2016]

Options:

A. Linear increase for Cu, exponential decrease of Si.

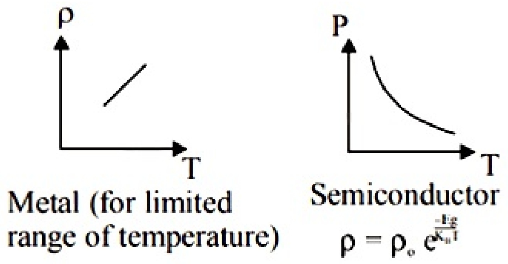
B. Linear decrease for Cu, linear decrease for Si.

C. Linear increase for Cu, linear increase for Si.

D. Linear increase for Cu, exponential increase for Si.

Answer: A

Solution:



Question141

An experiment is performed to determine the 1–V characteristics of a Zener diode, which has a protective resistance of R = 100 Ω, and a maximum power of dissipation rating of 1W. The minimum voltage range of the DC source in the circuit is :
[Online April 9, 2016]

Options:

A. 0 – 5V

B. 0 – 24 V

C. 0 – 12 V

D. 0 – 8V

Answer: C

Solution:

Solution:
The minimum voltage range of DC source is given by
$V^2 = PR \because P = 1$ watt ,$R = 100\Omega$
$= 1 \times 100$
$\therefore V = 10$ volt

Question142

For a common emitter configuration, if α and β have their usual meanings, the incorrect relationship between α and β is:
[2016]

Options:

A. $a = \frac{b}{1 + b}$

B. $a = \frac{b^2}{1 + b^2}$

C. $\frac{1}{a} = \frac{1}{b} + 1$

D. None of these

Answer: 0

Solution:

We know that $\alpha = \frac{I_c}{I_e}$ and $\beta = \frac{I_c}{I_b}$

Also $I_e = I_b + I_c$

$\therefore \alpha = \frac{I c}{I_b + I_c} = \frac{\frac{I_c}{I_b}}{1 + \frac{I_c}{I_b}} = \frac{\beta}{1 + \beta}$

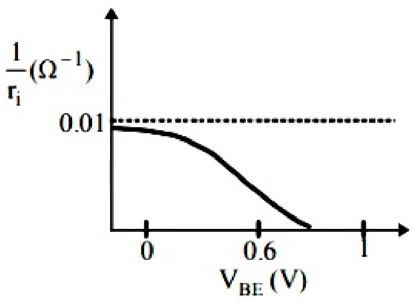
Option (b) and (d) are therefore incorrect.

Question143

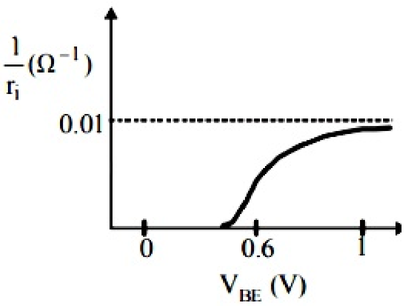
A realistic graph depicting the variation of the reciprocal of input resistance in an input characteristics measurement in a common emitter transistor configuration is : [Online April 10, 2016]

Options:

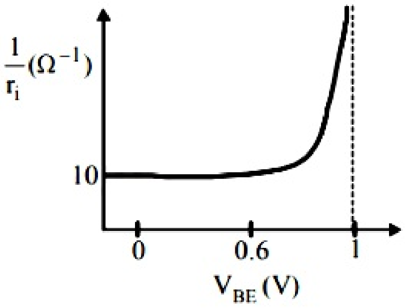
A.



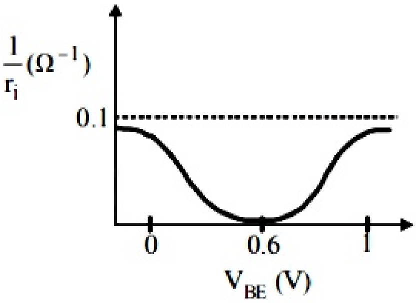
B.



C.



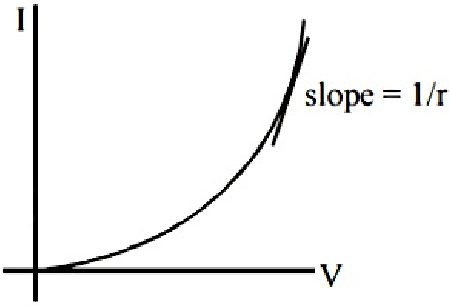
D.



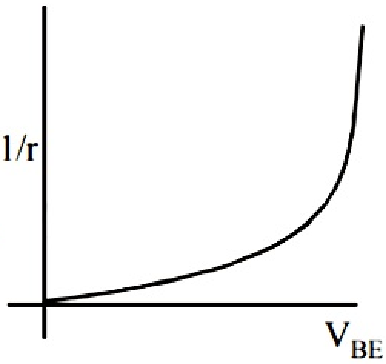
Answer: C

Solution:

Solution:



$\Rightarrow$



Question144

The ratio (R) of output resistance r_0, and the input resistance r_i in measurements of input and output characteristics of a transistor is typically in the range :
[Online April 10,2016]

Options:

A. $R \sim 10^2 - 10^3$

B. $R \sim 1 - 10$

C. $R \sim 0.1 - 1.0$

D. $R \sim 0.1 - 0.01$

Answer: C

Solution:

Solution:
For C.B. configuration $\frac{r_i}{r_o} \cong 0.1\Omega$
For CE and CC -configuration
$\frac{r_i}{r_0} \approx 1\Omega$

Question145

An unknown transistor needs to be identified as a npn or pnp type. A multimeter, with +ve and –ve terminals, is used to measure resistance between different terminals of transistor. If terminal 2 is the base of the transistor then which of the following is correct for a pnp transistor? [Online April 9,2016]

Options:

A. +ve terminal 2, –ve terminal 3,resistance low

B. +ve terminal 2, –ve terminal 1, resistane high

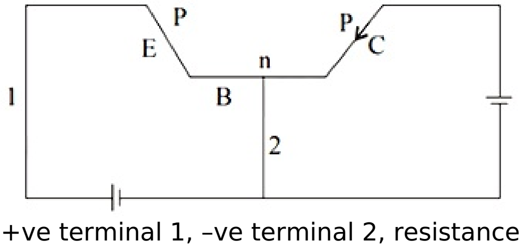
C. +ve terminal 1, –ve terminal 2, resistance high

D. +ve terminal 3, –ve terminal 2, resistance high

Answer: C

Solution:

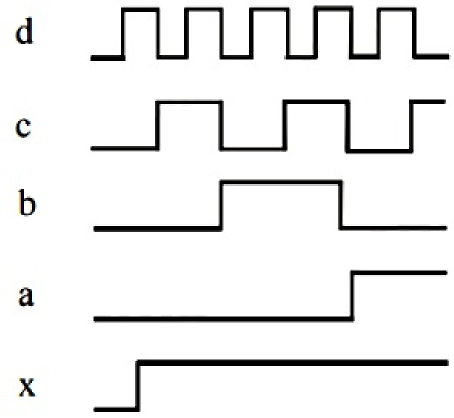
Solution:
Connecting circuit according to question, it is clear



+ve terminal 1, –ve terminal 2, resistance high.

Question146

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



[2016]

Options:

A. OR

B. NAND

C. NOT

D. AND

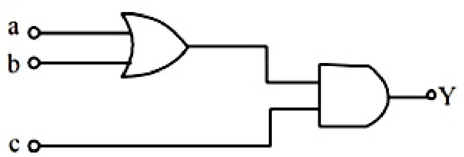
Answer: A

Solution:

Solution:
In case of an 'OR' gate the input is zero when all inputs are zero. If any one input is ' 1', then the output is '1'.

Question147

To get an output of 1 from the circuit shown in figure the input must be :



[Online April 10, 2016]

Options:

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

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

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

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

Answer: C

Solution:

Truth table for given logical circuit

a	b	(a + b)	c	Y = (a + b).c
0	0	0	0	0
0	1	1	1	1
1	0	1	1	1
1	1	1	0	0

Output of OR gate must be 1 and c = 1
So, a = 1, b = 0 or a = 0, b = 1.

Question148

The truth table given in fig. represents :

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

[Online April 9, 2016]

Options:

A. OR – Gate

B. NAND– Gate

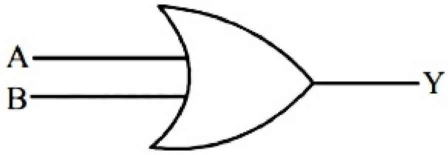
C. AND– Gate

D. NOR– Gate

Answer: A

Solution:

Solution:
It represents OR-Gate.



A	B	A+B=Y
0	0	0
0	1	1
1	0	1
1	1	1

Question149

A red LED emits light at 0.1 watt uniformly around it. The amplitude of the electric field of the light at a distance of 1 m from the diode is : [2015]

Options:

A. 5.48 V/m

B. 7.75 V/m

C. 1.73 V/m

D. 2.45 V/m

Answer: D

Solution:

Solution:

Using $U_{av} = \frac{1}{2}\varepsilon_0 E_0^{\ 2}$

But $U_{av} = \frac{P}{4\pi r^2 \times c}$

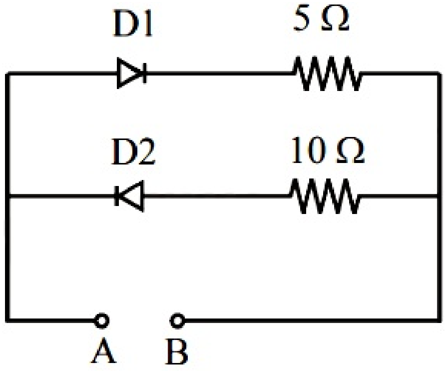
$\therefore \frac{P}{4\pi r^2} = \frac{1}{2}\varepsilon_0 E_0^{\ 2} \times c$

$E_0^{\ 2} = \frac{2P}{4\pi r^2 \varepsilon_0 c} = \frac{2 \times 0.1 \times 9 \times 10^9}{1 \times 3 \times 10^8}$

$\therefore E_0 = \sqrt{6} = 2.45 V / m$

Question150

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



[Online April 11, 2015]

Options:

A. 0.4 A and 0.2 A

B. 0.2 A and 0.4 A

C. 0.1 A and 0.2 A

D. 0.2 A and 0.1 A

Answer: A

Solution:

Solution:
When positive terminal connected to A then diode
D_1 is forward biased, current, $I = \frac{2}{5} = 0.4A$

When positive terminal connected to B then diode D_2 is forward biased, current, $I = \frac{2}{10} = 0.2A$

$E_0^2 = \frac{2P}{4\pi r^2 \varepsilon_0 c} = \frac{2 \times 0.1 \times 9 \times 10^9}{1 \times 3 \times 10^8}$

$\therefore E_0 = \sqrt{6} = 2.45V / m$

Question151

In an unbiased n-p junction electrons diffuse from n-region to p-region because :
[Online April 10, 2015]

Options:

A. holes in p-region attract them

B. electrons travel across the junction due to potential difference

C. only electrons move from n to p region and not the vice-versa

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

Answer: D

Solution:

Solution:
Electrons in an unbiased p-n junction, diffuse from n -region i.e. higher electron concentration to p-region i.e. low electron concentration region.

Question152

The forward biased diode connection is:
[2014]

Options:

A.

B.

C.

D.

Answer: A

Solution:

Solution:

For forward bias, p-side must be at higher potential than n-side. $\Delta V = (+)V$ e

----

Question153

For LED’s to emit light in visible region of electromagnetic light, it should have energy band gap in the range of:
[Online April 12, 2014]

Options:

A. 0.1 eV to 0.4 eV

B. 0.5 eV to 0.8 eV

C. 0.9 eV to 1.6 eV

D. 1.7 eV to 3.0 eV

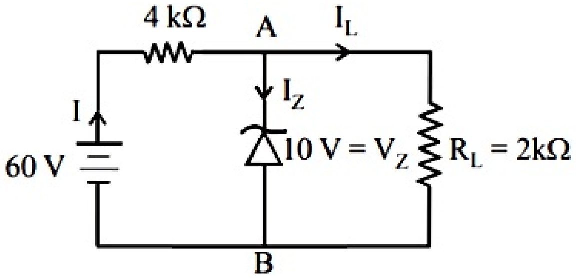
Answer: D

Solution:

Energy band gap range is given by,
$E_g = \frac{hc}{\lambda}$
For visible region $\lambda = (4 \times 10^{-7} \sim 7 \times 10^{-7})\text{m}$
$E_g = \frac{6.6 \times 10^{-34} \times 3 \times 10^{8}}{7 \times 10^{-7}}$
$= \frac{19.8 \times 10^{-26}}{7 \times 10^{-7}}$
$= \frac{2.8 \times 10^{-19}}{1.6 \times 10^{-19}}$
$E_g = 1.75\text{eV}$

Question154

A Zener diode is connected to a battery and a load as show below:



The currents, I, I_Z and I_L are respectively.
[Online April 11, 2014]

Options:

A. 15 mA, 5 mA, 10 mA

B. 15 mA, 7.5 mA, 7.5 mA

C. 12.5 mA, 5 mA, 7.5 mA

D. 12.5 mA, 7.5 mA, 5 mA

Answer: D

Solution:

Solution:
Here, $R = 4\text{k}\Omega = 4 \times 10^3\Omega$
$V_i = 60\text{V}$
Zener voltage $V_z = 10\text{V}$
$R_L = 2\text{k}\Omega = 2 \times 10^3\Omega$
Load current, $I_L = \frac{V_Z}{R_L} = \frac{10}{2 \times 10^3} = 5\text{mA}$
Current through R, $I = \frac{V_i - V_Z}{R}$

$= \frac{60-10}{4 \times 10^3} = \frac{50}{4 \times 10^3} = 12.5 \text{mA}$
Fom circuit diagram,
$I = I_Z + I_L$
$\Rightarrow 12.5 = I_Z + 5$
$\Rightarrow I_Z = 12.5 - 5 = 7.5 \text{mA}$

Question155

An n-p-n transistor has three leads A, B and C. Connecting B and C by moist fingers, A to the positive lead of an ammeter, and C to the negative lead of the ammeter, one finds large deflection. Then, A, B and C refer respectively to:
[Online April 9,2014]

Options:

A. Emitter, base and collector

B. Base, emitter and collector

C. Base, collector and emitter

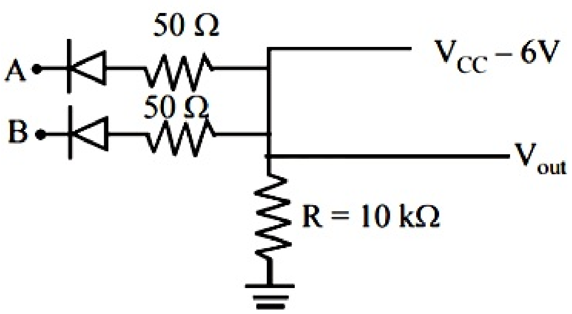
D. Collector, emitter and base

Answer: C

Solution:

Solution:
In the given question, A, B and C refer base, collector and emitter respectively.

Question156



Given: A and B are input terminals.
Logic 1 = > 5 V
Logic 0 = < 1 V
Which logic gate operation, the above circuit does?
[Online April 19, 2014]

Options:

A. AND Gate

B. OR Gate

C. XOR Gate

D. NOR Gate

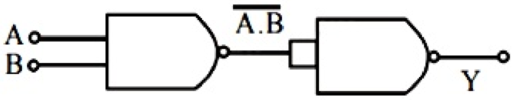
Answer: A

Solution:

Solution:
AND Gate

Question157

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



[Online April 9, 2014]

Options:

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

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

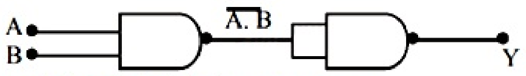
C. NOT (A = 1, B = 1, Y = 1)

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

Answer: A

Solution:

Solution:



$Y = \overline{AB . AB} = \overline{AB} + \overline{AB} = AB + AB = AB$

In this case output Y is equivalent to AND gate.

Question158

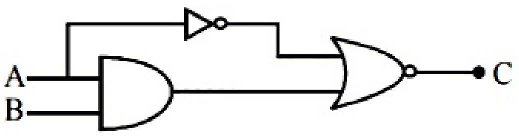
Which of the following circuits correctly represents the following truth table ?

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

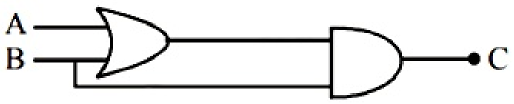
[Online April 25, 2014]

Options:

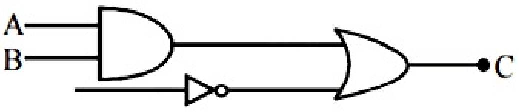
A.



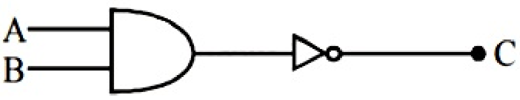
B.



C.



D.



Answer: A

Solution:

Solution:
For circuit 1
A . B = $\overline{Y + \overline{A}}$ = C

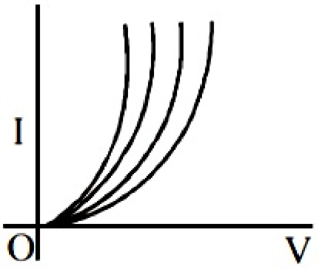
A	B		$\overline{Y + \overline{A}}$	=	C
0	0	0	1		0
0	1	0	1		0
1	0	0	0		1
1	1	1	0		0

Question159

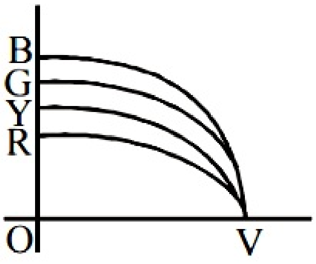
The I-V characteristic of an LED is [2013]

Options:

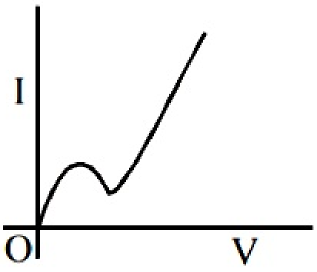
A.



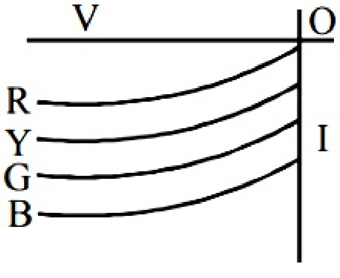
B.



C.



D.



Answer: A

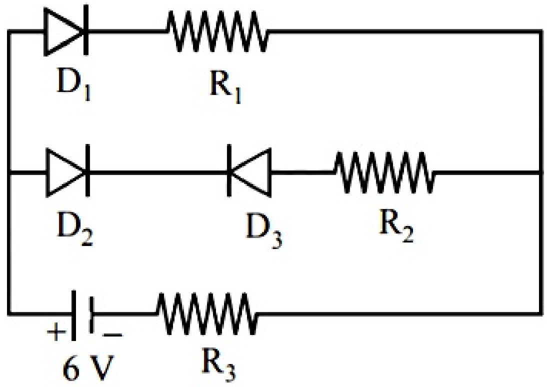
Solution:

Solution:
For same value of current higher value of voltage is required for higher frequency hence (a) is correct answer.

Question160

Figure shows a circuit in which three identical diodes are used. Each diode has forward resistance of 20 Omega and infinite backward

resistance. Resistors $R_1 = R_2 = R_3 = 50\Omega$. Battery voltage is 6V . The current through R_3 is :



[Online April 22, 2013]

Options:

A. 50 mA

B. 100 mA

C. 60 mA

D. 25 mA

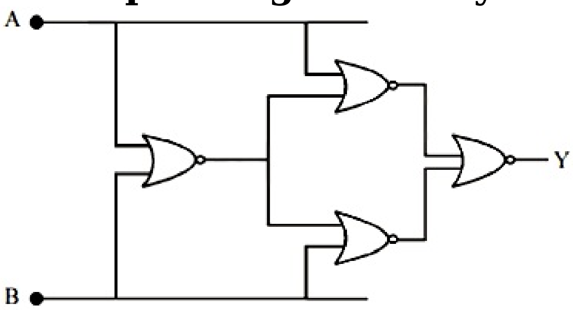
Answer: A

Solution:

Solution:
Here, diodes D_1 and D_2 are forward biased and D_3 is reverse biased.
Therefore current through R_3
$i = \frac{V}{R'} = \frac{6}{120} = \frac{1}{20}A = 50mA$

Question161

A system of four gates is set up as shown. The 'truth table' corresponding to this system is :



[Online April 23, 2013]

Options:

A.

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

B.

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

C.

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

D.

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

Answer: A

Solution:

Solution:
In the given system all four gate is NOR gate
Truth Table

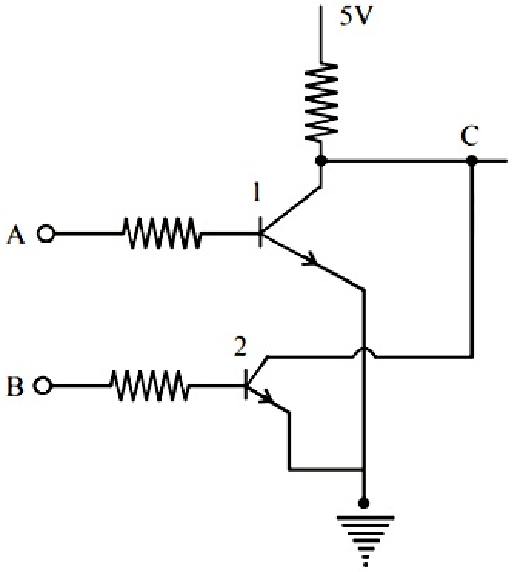
A	B	$(y' = \overline{A+B})$	$(y'' = \overline{A+y'})$	$y''' = (A + y'')$	$y = \overline{y'' + y'''}$
0	0	1	0	0	1
0	1	0	1	0	0
1	0	0	0	1	0
1	1	0	0	0	1

i.e.,

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

Question162

Consider two npn transistors as shown in figure. If 0 Volts corresponds to false and 5 Volts correspond to true then the output at C corresponds to :



[Online April 9, 2013]

Options:

A. A NAND B

B. A OR B

C. A AND B

D. A NOR B

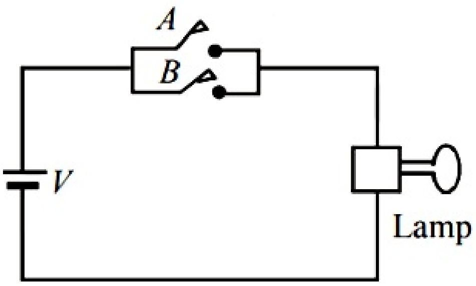
Answer: A

Solution:

The output at C corresponds to A NAND B or
$\overline{A . B} = C$

Question163

Which logic gate with inputs A and B performs the same operation as that performed by the following circuit?



[Online May 7, 2012]

Options:

A. NAND gate

B. OR gate

C. NOR gate

D. AND gate

Answer: B

Solution:

Solution:
When either of A or B is 1 i.e. closed then lamp will glow.
In this case, Truth table

Inputs		Output
A	B	Y
0	0	0
0	1	1
1	0	1
1	1	1

This represents OR gate.

Question164

This question has Statement 1 and Statement 2. Of the four choices given after the Statements, choose the one that best describes the two Statements.

Statement 1: A pure semiconductor has negative temperature coefficient of resistance.
Statement 2: On raising the temperature, more charge carriers are released into the conduction band.
[Online May 12, 2012]

Options:

A. Statement 1 is false, Statement 2 is true.

B. Statement 1 is true, Statement 2 is false.

C. Statement 1 is true, Statement 2 is true, Statement 2 is not a correct explanation of Statement 1.

D. Statement 1 is true, Statement 2 is true, Statement 2 is the correct explanation of Statement 1.

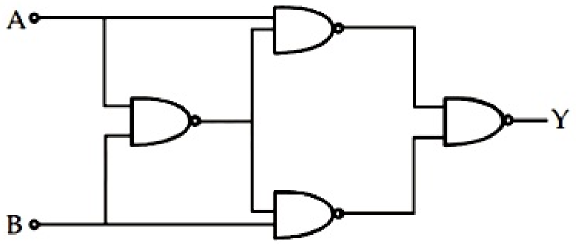
Answer: D

Solution:

Solution:
Temperature coefficient of resistance is negative for pure semiconductor. And no. of charge carriers in conduction band increases with increase in temperature.

Question165

Truth table for system of four NAND gates as shown in figure is :



[2012]

Options:

A.

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

B.

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

C.

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

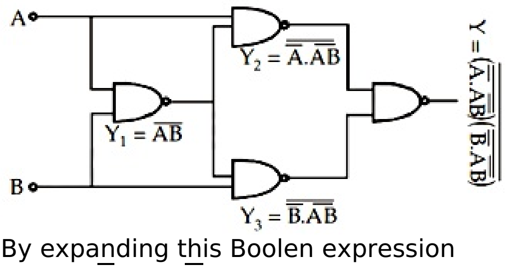
D.

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

Answer: A

Solution:

Solution:



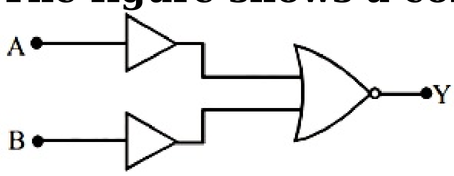
By expanding this Boolen expression

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

Thus the truth table for this expression should be (a).

Question166

The figure shows a combination of two NOT gates and a NOR gate.



The combination is equivalent to a

[Online May 26, 2012]

Options:

A. NAND gate

B. NOR gate

C. AND gate

D. OR gate

Answer: C

Solution:

Solution:
Truth table is as shown :

A	B	$\overline{A}$	$\overline{B}$	$\overline{A}+\overline{B}$	$\overline{\overline{A}+\overline{B}}$
0	0	1	1	1	0
0	1	1	0	1	0
1	0	0	1	1	0
1	1	0	0	0	1

Thus the combination of two NOT gates and one NOR gate is equivalent to a AND gate.

Question167

Which one of the following is the Boolean expression for NOR gate? [Online May 19, 2012]

Options:

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

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

C. $Y = A . B$

D. $Y = \overline{A}$

Answer: A

Solution:

Solution:
NOR gate is the combination of NOT and OR gate.
Boolean expression for NOR gate is
$Y = \overline{A + B}$

Question168

The output of an OR gate is connected to both the inputs of a NAND gate. The combination will serve as a:
[2011 RS]

Options:

A. NOT gate

B. NOR gate

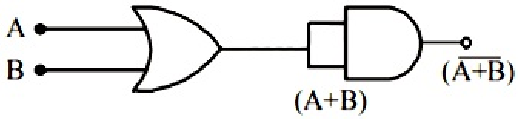
C. AND gate

D. OR gate

Answer: B

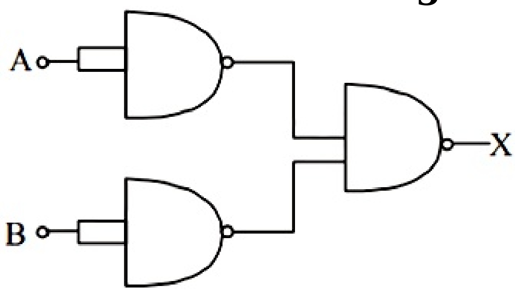
Solution:

Solution:
When both inputs of NAND gate are jointed to form a single input, it behaves as NOT gate
OR + NOT = NOR.
$\overline{(A + B)}$ = N OR gate



Question169

The combination of gates shown below yields



[2010]

Options:

A. OR gate

B. NOT gate

C. XOR gate

D. NAND gate

Answer: A

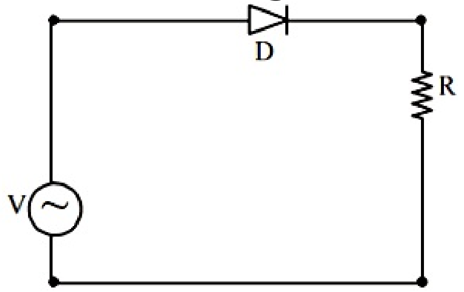
Solution:

The final boolean expression of these gates is,
$X = \overline{(\overline{A} . \overline{B})} = \overline{\overline{A}} + \overline{\overline{B}} = A + B \Rightarrow$ OR gate

It means OR gate is formed.

Question170

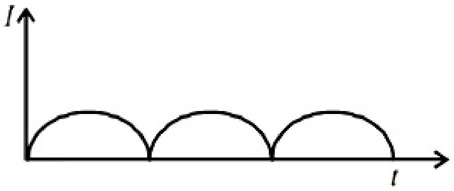
A p-n junction (D) shown in the figure can act as a rectifier. An alternating current source (V) is connected in the circuit.



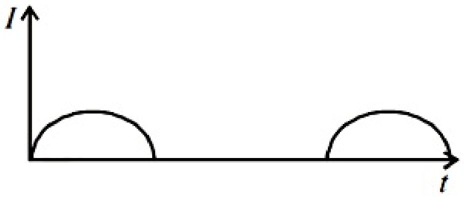
The current (I) in the resistor (R) can be shown by : [2009]

Options:

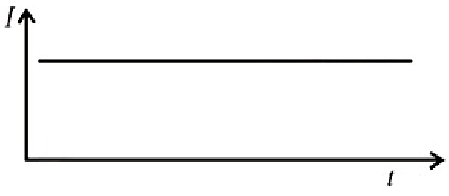
A.



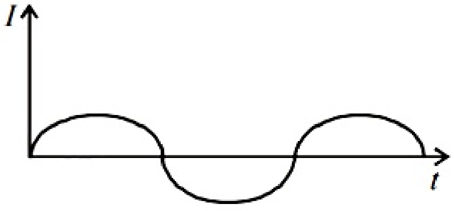
B.



C.



D.



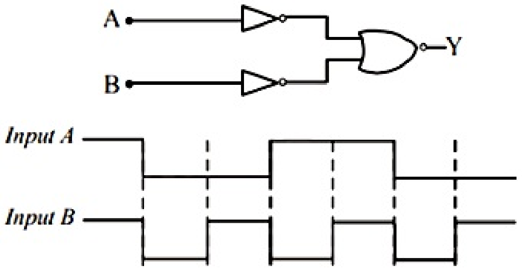
Answer: B

Solution:

The given circuit will work as half wave rectifier as it conducts during the positive half cycle of input AC.
Forward biased in one half cycle and reverse biased in the other half cycle].

Question171

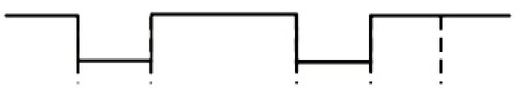
The logic circuit shown below has the input waveforms ‘A’ and ‘B’ as shown. Pick out the correct output waveform.



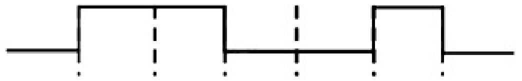
Output is
[2009]

Options:

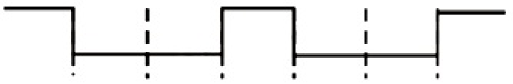
A.



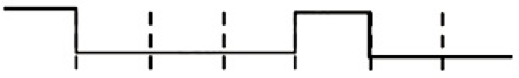
B.



C.



D.



Answer: D

Solution:

Solution:
The final boolean expression

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

$Y = (\overline{A} + \overline{B}) = \overline{A} . \overline{B} = A . B$
Thus, it is an AND gate for which truth table is

Question172

A working transistor with its three legs marked P, Q and R is tested using a multimeter. No conduction is found between P and Q. By connecting the common (negative) terminal of the multimeter to R and the other (positive) terminal to P or Q, some resistance is seen on the multimeter. Which of the following is true for the transistor? [2008]

Options:

A. It is an npn transistor with R as base

B. It is a pnp transistor with R as base

C. It is a pnp transistor with R as emitter

D. It is an npn transistor with R as collector

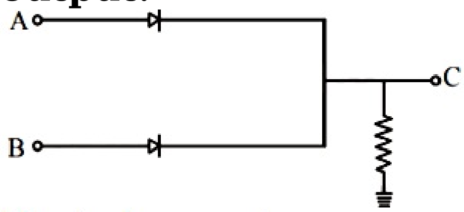
Answer: B

Solution:

Solution:
It is a p-n-p transistor with R as base.

Question173

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



The circuit represents
[2008]

Options:

A. NOR gate

B. AND gate

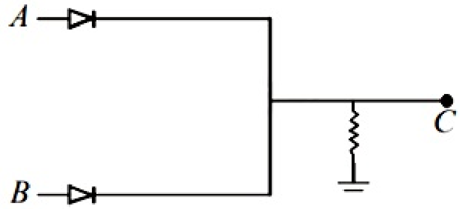
C. NAND gate

D. OR gate

Answer: D

Solution:

Solution:



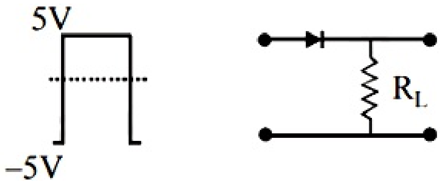
The truth table for the above circuit is :

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

when either A or B conducts, the gate conducts. It means C = A + B which is for OR gate.

Question174

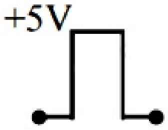
If in a p-n junction diode, a square input signal of 10 V is applied as shown



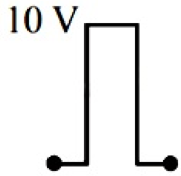
Then the output signal across R_L will be [2007]

Options:

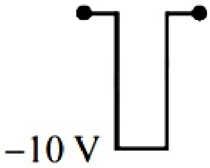
A.



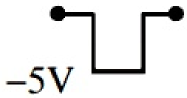
B.



C.



D.



Answer: A

Solution:

Solution:
The current will flow through R_L when the diode is forward biased.

Question175

Carbon, silicon and germanium have four valence electrons each. At room temperature which one of the following statements is most appropriate ?
[2007]

Options:

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

Solution:

Solution:
Si and Ge are semiconductors but C is an insulator. In Si and Ge at room temperature, the energy band gap is low due to which electrons in the covalent bonds gains kinetic energy and break the bond and move to conduction band. As a result, hole is created in valence band. So, the number of free electrons is significant in Si and Ge.

Question176

If the lattice constant of this semiconductor is decreased, then which of the following is correct ?
[2006]

Options:

A. All E_c, E_g, E_v increase

B. E_c and E_v increase, but E_g decreases

C. E_c and E_v decrease, but E_g increases

D. All E_c, E_g, E_v decrease

Answer: C

Solution:

Solution:
(c) A crystal structure is made up of a unit cell arranged in a particular way; which is periodically repeated in three dimensions on a lattice. The spacing between unit cells in various directions is called its lattice constants. As lattice constants increases the band-gap (E_g), also increases which means more energy would be required by electrons to reach the conduction band from the valence band. Automatically E_c and E_v decreases.

Question177

A solid which is not transparent to visible light and whose conductivity increases with temperature is formed by
[2006]

Options:

A. Ionic bonding

B. Covalent bonding

C. Vander Waals bonding

D. Metallic bonding

Answer: B

Solution:

Solution:
Van der Waal's bonding is attributed to the attractive forces between molecules of a liquid. The conductivity of semiconductors (covalent bonding) and insulators (ionic bonding) increases with increase in temperature.
Solid which is formed by covalent bond is not transparent to visible light and its conductivity increase with temperature.

Question178

If the ratio of the concentration of electrons to that of holes in a semiconductor is $\frac{7}{5}$ and the ratio of currents is $\frac{7}{4}$, then what is the ratio of their drift velocities?
[2006]

Options:

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

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

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

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

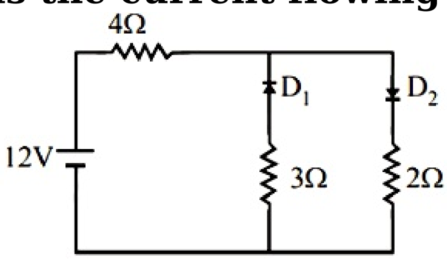
Answer: C

Solution:

Relation between drift velocity and current is
$I = nAeV_d$
$\frac{I_e}{I_h} = \frac{n_e e A v_e}{n_h e A v_h}$
$\Rightarrow 74 = \frac{7}{5} \times \frac{v_e}{v_h}$
$\Rightarrow \frac{v_e}{v_h} = \frac{5}{4}$

Question179

The circuit has two appositively connected ideal diodes in parallel. What is the current flowing in the circuit?



[2006]

Options:

A. 1.71 A

B. 2.00 A

C. 2.31 A

D. 1.33 A

Answer: B

Solution:

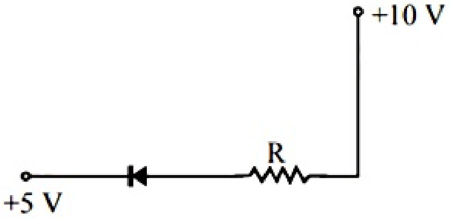
Solution:
D_2 is forward biased.
D_1 is reversed biased. So, it will act like an open circuit.
So effective resistance of the circuit $R = 4 + 2 = 6\Omega$ $\therefore i = \frac{E}{R} = \frac{12}{6} = 2A$

Question180

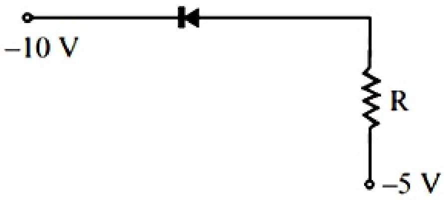
In the following, which one of the diodes reverse biased? [2006]

Options:

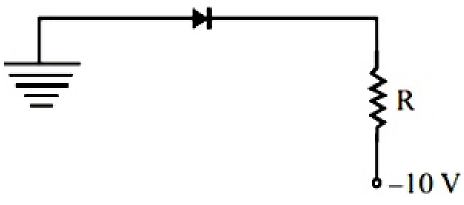
A.



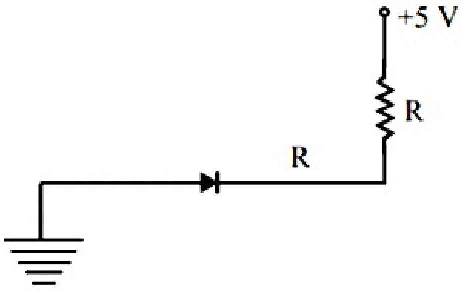
B.



C.



D.



Answer: D

Solution:

p-side connected to low potential and n-side is connected to high potential.

Question181

In a common base mode of a transistor, the collector current is 5.488 mA for an emitter current of 5.60 mA. The value of the base current amplification factor (β) will be [2006]

Options:

A. 49

B. 50

C. 51

D. 48

Answer: A

Solution:

Collector current, $I_C = 5.488\text{mA}$,
Emitter current $I_e = 5.6\text{mA}$
$\alpha = \frac{I_c}{I_e} = \frac{5.488}{5.6}$,
$\beta = \frac{\alpha}{1-\alpha} = 49$

Question182

The electrical conductivity of a semiconductor increases when electromagnetic radiation of wavelength shorter than 2480 nm is incident on it. The band gap in (eV) for the semiconductor is [2005]

Options:

A. 2.5 eV

B. 1.1 eV

C. 0.7 eV

D. 0.5 eV

Answer: D

Solution:

Band gap = energy of photon of wavelength 2480 nm. So,

Band gap, $E_g = \frac{hc}{\lambda}$

$= \left(\frac{6.63 \times 10^{-34} \times 3 \times 10^{8}}{2480 \times 10^{-9}}\right) \times \frac{1}{1.6 \times 10^{-19}} eV$

$= 0.5 eV$

Question183

In a common base amplifier, the phase difference between the input signal voltage and output voltage is [2005]

Options:

A. π

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

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

D. 0

Answer: D

Solution:

Solution:
In common base amplifier circuit, input and output voltage are in the same phase. So, the phase difference between input voltage signal and output voltage signal is zero.

Question184

When p-n junction diode is forward biased then [2004]

Options:

A. both the depletion region and barrier height are reduced

B. the depletion region is widened and barrier height isreduced

C. the depletion region is reduced and barrier height isincreased

D. Both the depletion region and barrier height areincreased

Answer: A

Solution:

Solution:
In forward biasing, the p type is connected to positive terminal and n type is connected with negative terminal.

So holes from p region and electron from n region are pushed towards the Junction which reduces the width of depletion layer. Also, distance between diffused holes and electrons decrease, which decrease electric field hence barrier potential.

Question185

When npn transistor is used as an amplifier [2004]

Options:

A. electrons move from collector to base

B. holes move from emitter to base

C. electrons move from base to collector

D. holes move from base to emitter

Answer: C

Solution:

Solution:
In npn transistor, electrons moves from emitter to base.

Question186

For a transistor amplifier in common emitter configuration for load impedance of 1kΩ(h_{fe} = 50 and h_{oe} = 25) the current gain is [2004]

Options:

A. – 24.8

B. – 15.7

C. – 5.2

D. – 48.78

Answer: D

Solution:

Solution:
In common emitter configuration for transistor amplifier current gain

$$A_i = \frac{-h_{fe}}{1 + b_{oe}R_L}$$

Where h_{fe} and h_{oe} are hybrid parameters.

$$\therefore A_i = \frac{-50}{1 + 25 \times 10^{-6} \times 1 \times 10^3}$$

$$= -48.78$$

Question187

A strip of copper and another of germanium are cooledfrom room temperature to 80K. The resistance of
[2003]

Options:

A. each of these decreases

B. copper strip increases and that of germanium decreases

C. copper strip decreases and that of germanium increases

D. each of these increases

Answer: C

Solution:

Solution:
Copper is a conductor and in conductor resistance decreases with decrease in temperature. Germanium is a semicon ductor. In semi-conductor resistance increases with decrease in temperature.

Question188

The difference in the variation of resistance withtemeperature in a metal and a semiconductor arisesessentially due to the difference in the
[2003]

Options:

A. crystal sturcture

B. variation of the number of charge carriers with temperature

C. type of bonding

D. variation of scattering mechanism with temperature

Answer: B

Solution:

Solution:
When the temperature increases, certain bounded electrons become free which tend to promote conductivity. Simultaneously number of collisions between electrons and positive kernels increases which decrease the relaxation time.

Question189

In the middle of the depletion layer of a reverse- biasedp-n junction, the [2003]

Options:

A. electric field is zero

B. potential is maximum

C. electric field is maximum

D. potential is zero

Answer: A

Solution:

Solution:
In reverse biasing the width of depletion region increases, and current flowing through diode is zero. Thus, electric field is zero at middle of depletion region.

Question190

At absolute zero, Si acts as
[2002]

Options:

A. non-metal

B. metal

C. insulator

D. none of these

Answer: C

Solution:

Solution:
Pure silicon, at OK, will contain all the electrons in bounded state. The conduction band will be empty. So there will be no free electrons (in conduction band) and holes (in valence band).Therefore no electrons from valence band are able to shift to conduction band due to thermal agitation. Pure silicon will act as insulator.

Question191

By increasing the temperature, the specific resistance of aconductor and a semiconductor
[2002]

Options:

A. increases for both

B. decreases for both

C. increases, decreases

D. decreases, increases

Answer: C

Solution:

Solution:
Specific resistance (resistivity) is given by

$\rho = \frac{m}{ne^2 \tau}$

where $n =$ no. of free electrons per unit volume
and $\tau =$ average relaxation time

For a conductor with rise in temperature n increases. Increase in temperature results increase in number of collision between free electrons due to which relaxation time T decreases. But the decrease in τ is more dominant than increase in n resulting an increase in the value of ρ.

For a semiconductor with rise in temperature, n increases and τ decreases. But the increase in n is more dominant than decrease in τ resulting in a decrease in the value of ρ.

Question192

The energy band gap is maximum in [2002]

Options:

A. metals

B. superconductors

C. insulators

D. semiconductors.

Answer: C

Solution:

Solution:
In insulators, valence band is completely filled while conduction band is empty. The energy band gap is maximum in insulators.

Question193

The part of a transistor which is most heavily doped to produce large number of majority carriers is [2002]

Options:

A. emmiter

B. base

C. collector

D. can be any of the above three.

Answer: A

Solution:

Emitter main function is to supply the majority charge carrriers towards the collector. Therefore emitter is most heavily doped.
