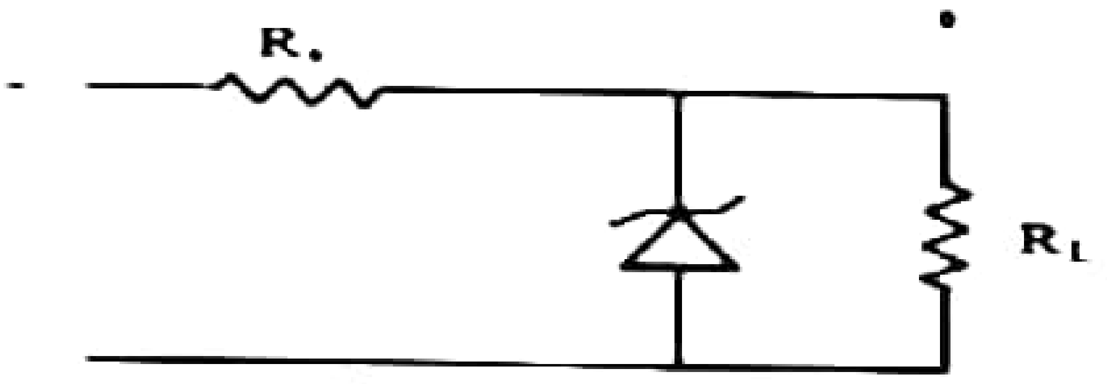
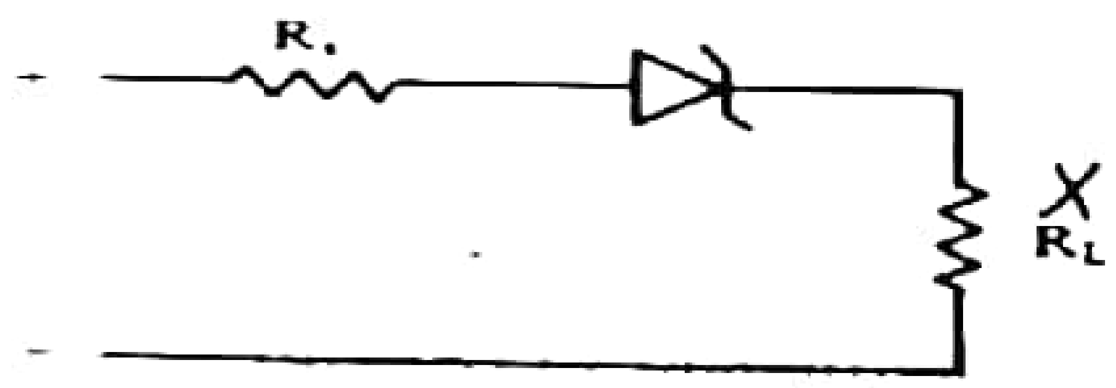
1.

A zener diode is to be used as a voltage regulator. Identify the correct set up

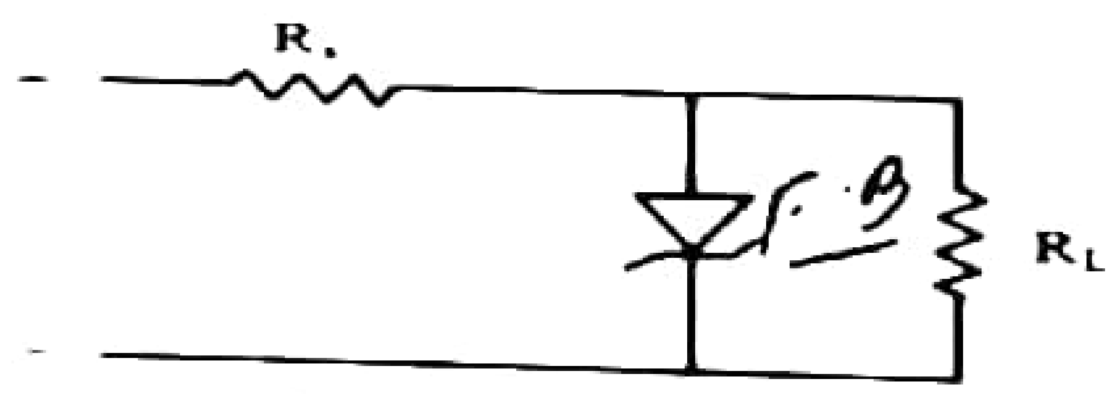
(A)



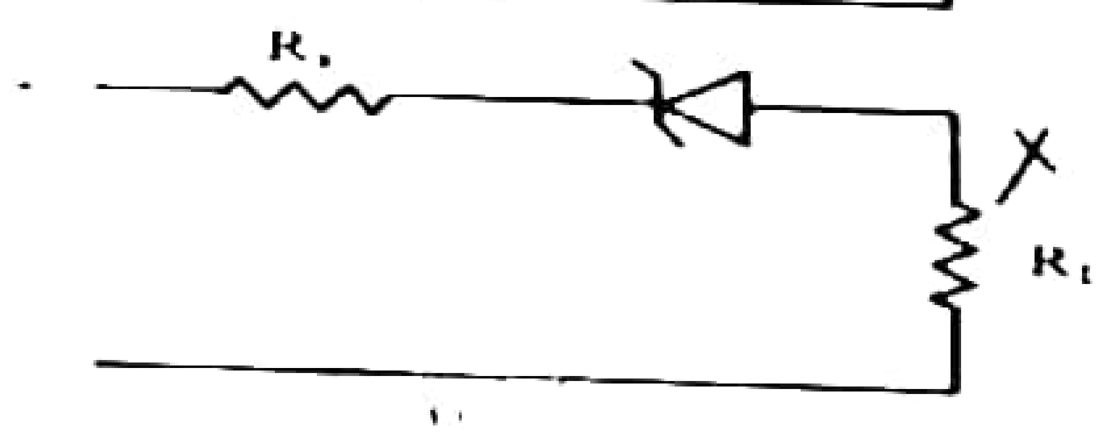
(B)

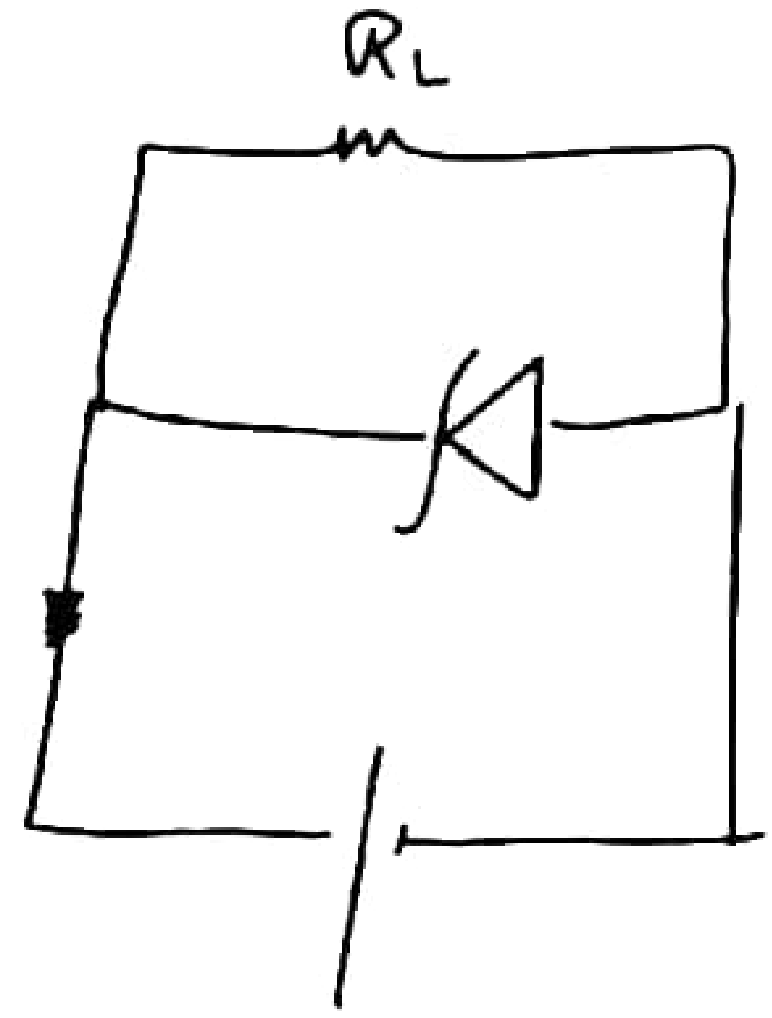


(C)



(D)





2.

Statement 1 : Conductivity of semiconductors decreases with increase in temperature. incorrect

Statement 2 : More electron goes from valance band to conduction band with increase in temperature. Correct

(A) Both Statement-1 and Statement-2 are true, and Statement-2 is the correct explanation of Statement1.

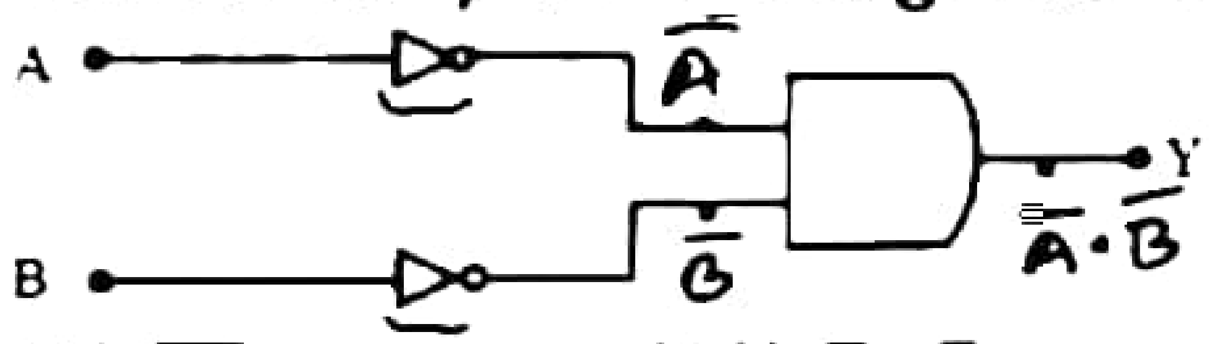
(B) Both Statement-1 and Statement-2 are true but Statement-2 is not the correct explanation of Statement-1.

(C) Statement-1 is true but Statement-2 is false.

(D) Statement-1 is false but Statement-2 is true.

3.

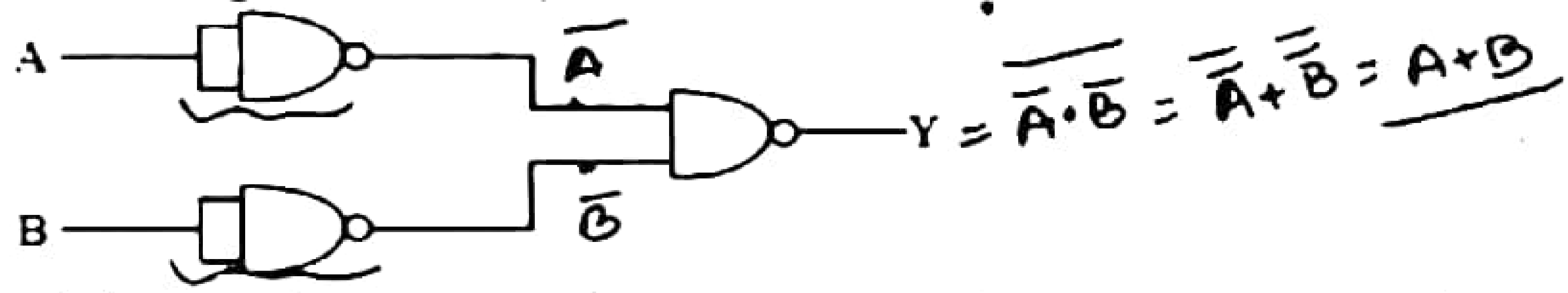
What is out put Y of the gate circuit shown in figure?



(A) $\overline{A B}$ (B) $\bar{A} . \bar{B}$ (C) $\overline{\bar{A}\bar{B}}$ (D) A . B

4.

Following circuit is equivalent to –



(A) AND gate (B) OR gate (C) NOT gat (D) X-OR gate

5.

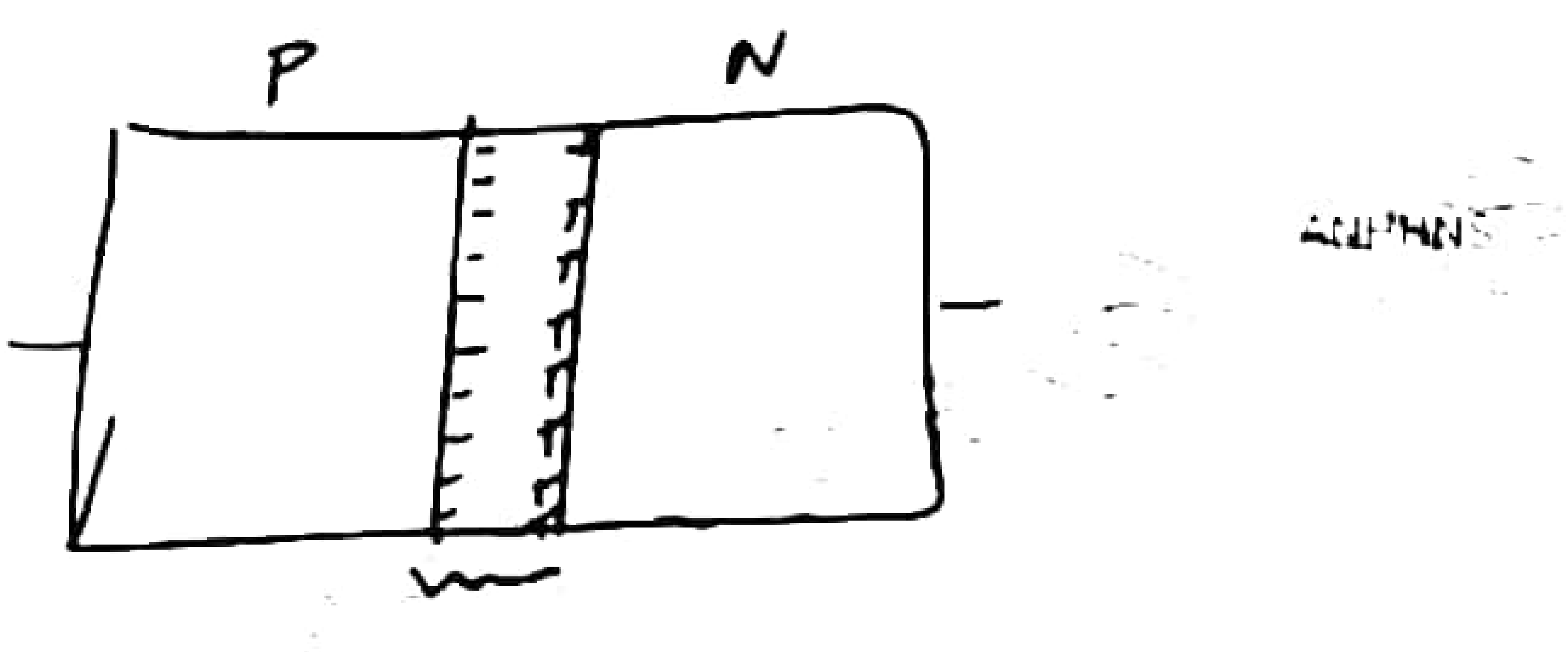
Depletion layer in the p-n junction consists of -

(A) electrons

(B) holes

(C) positive and negative ions fixed in their position

(D) both electron and holes



6.

The depletion layer in silicon diode is 1μm wide and the knee potential is 0.6 V, then the electric field in the depletion layer will be -

(A) Zero (B) $0.6 Vm^{-1}$ (C) 6×10^4 V/m (D*) 6×10^5 V/m

$d = 1 \mu m$

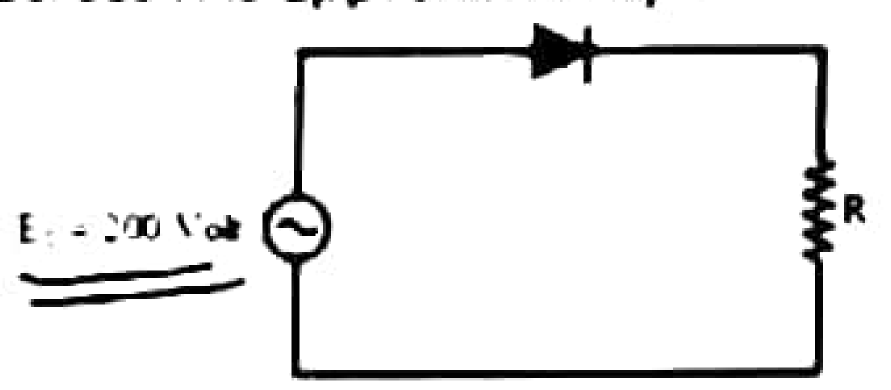
$V_B = 0.6 V$

$E = \frac{V}{d} = \frac{0.6}{10^{-6}} V/m$

$\Rightarrow 6 \times 10^5 V/m$

7.

A sinusoidal voltage of peak value 200 volt is connected to a diode and resistor R in the circuit shown so that half wave rectification occurs. If the forward resistance of the diode is negligible compared to R the rms voltage (in volt) across R is approximately -

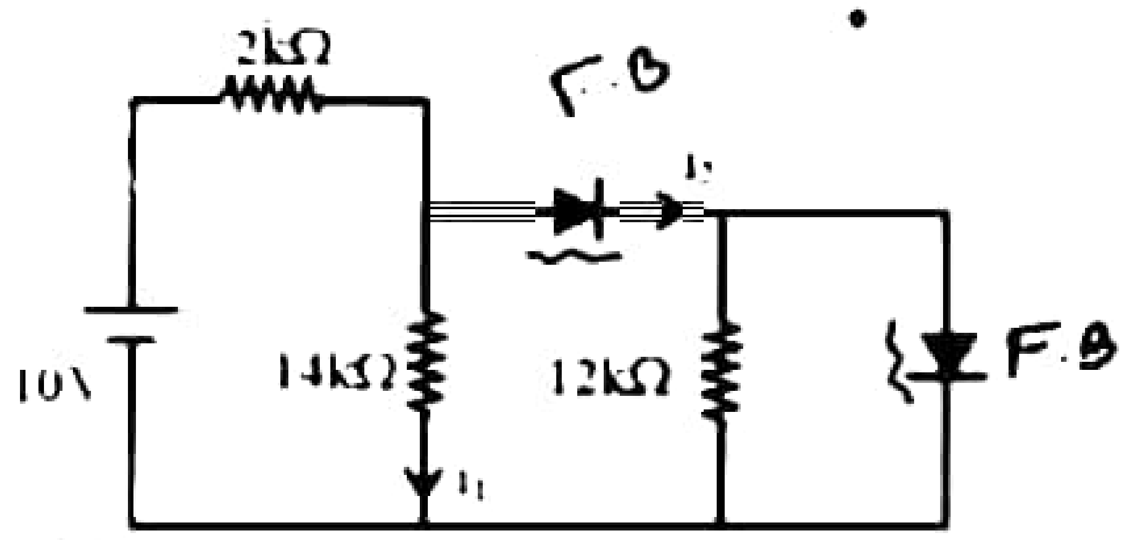


$V_{rms} = \frac{V_0}{2} = \frac{200}{2} = 100V$

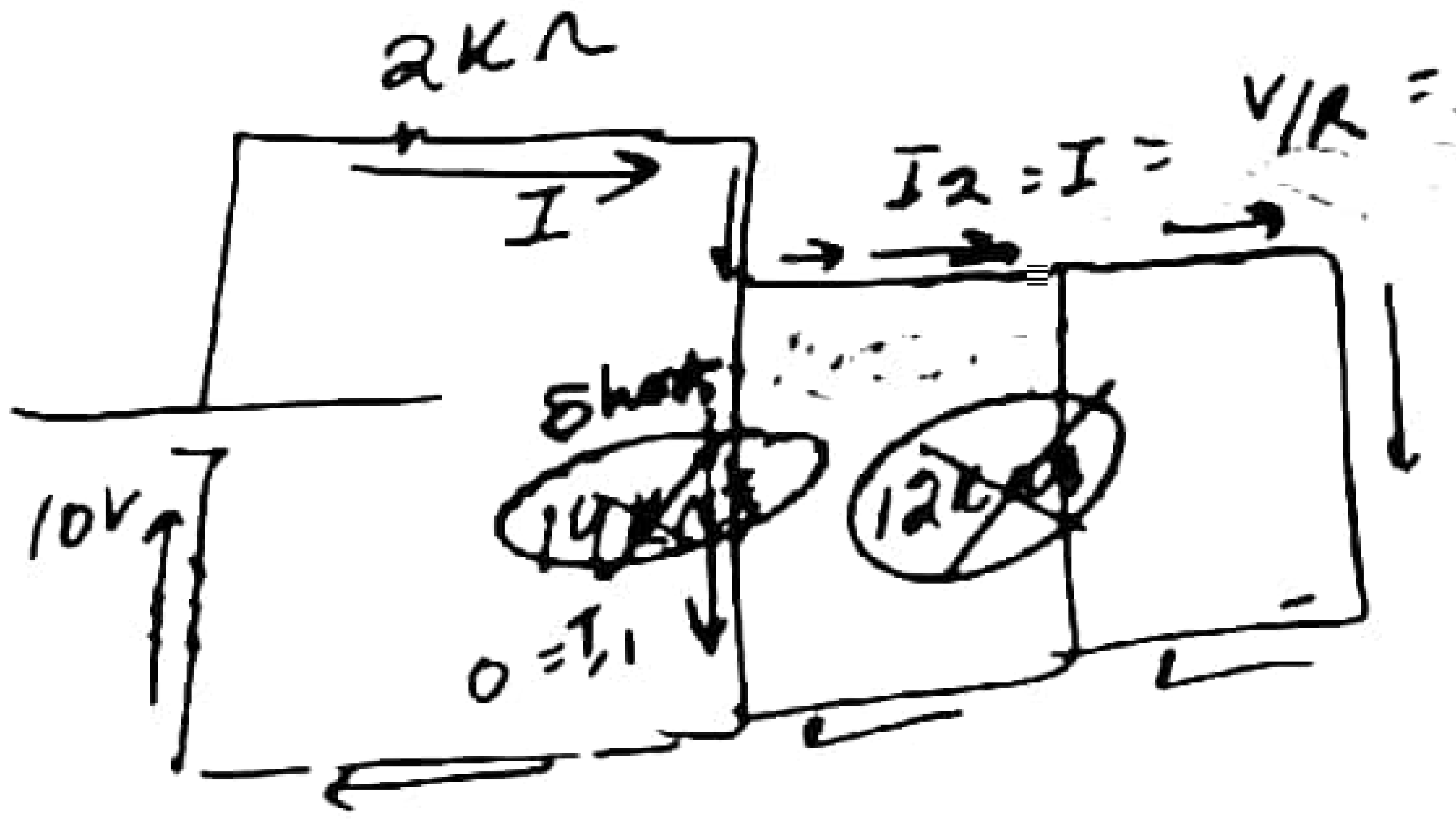
(A) 200 (B*) 100 (C) $\frac{200}{\sqrt{2}}$ (D) 280

8.

In the following circuit find i_1 and i_2 –



(A) 0,0 (B) 5 mA, 5 mA (C) 5 mA, 0 (D) 0, 5 mA



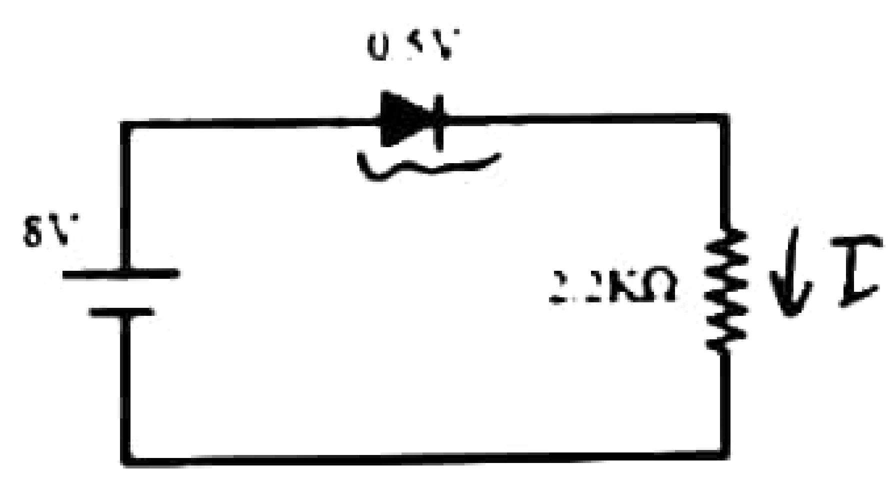
$I_2 = I = V/R = \frac{10V}{2K\Omega} = 5mA$

$I_1 = 0$

$I_2 = I = 5mA$

9.

In the circuit, if the forward voltage drop for the diode is 0.5V, the current will be -



(A) 3.4 mA (B) 2 mA (C) 2.5 mA (D) 3 mA

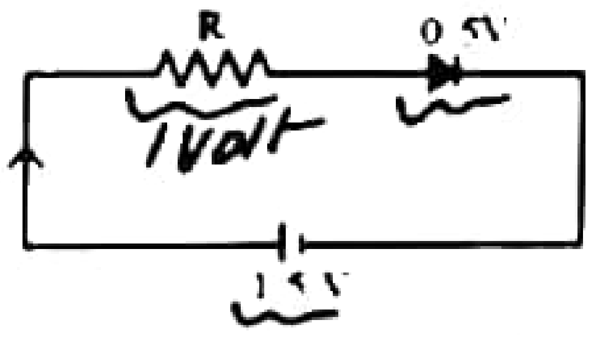
$8 - 0.5 = I \times 2.2K\Omega$

$\frac{7.5V}{2.2K\Omega} = I$

$I = 3.4mA$

10.

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



(A) 1.5 Ω (B) 5 Ω (C) 6.67 Ω (D) 200 Ω

$P_{max} = 100 mW = V I.$

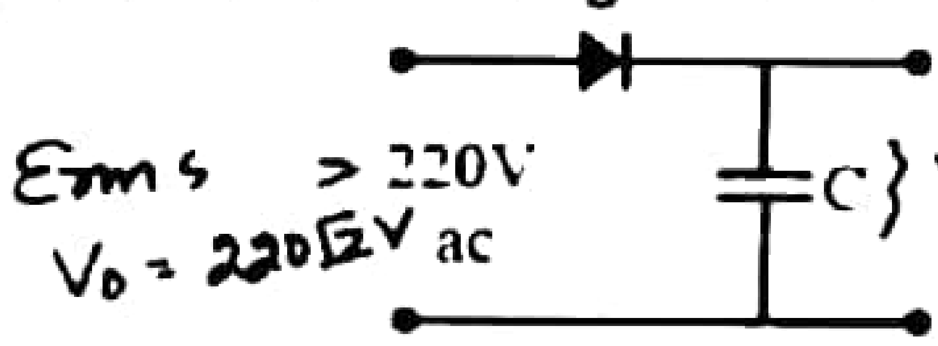
$100 mW = 0.5 I_{max}$

$I_{max} = 200 mA$

$V = IR \quad R = \frac{V}{I} = \frac{1 volt}{200 \times 10^{-3}} = 5 \Omega$

11.

A diode is connected to 220 V (rms) ac in series with a capacitor as shown in figure. The rms voltage across the capacitor is –

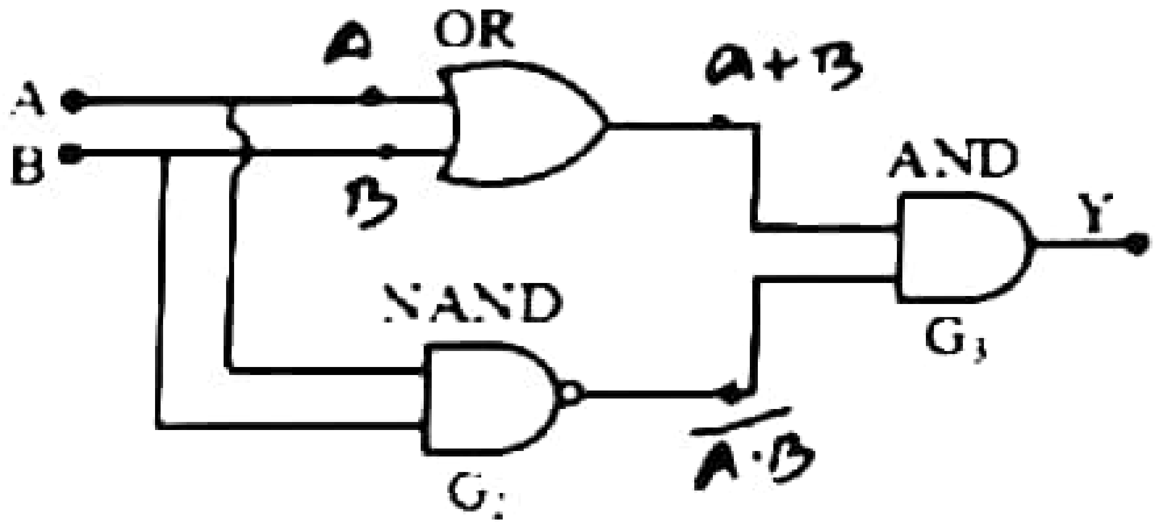


$V_{rms} = \frac{V_0}{2} = \frac{220\sqrt{2}}{2} = \frac{220}{\sqrt{2}}$ volt

(A) 220 V (B) 110 V (C) 311.1 V (D) $\frac{220}{\sqrt{2}}$ V

12.

The following configuration of gate is equivalent to-



(A) NAND (B) XOR (C) OR (D)None of these

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

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

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

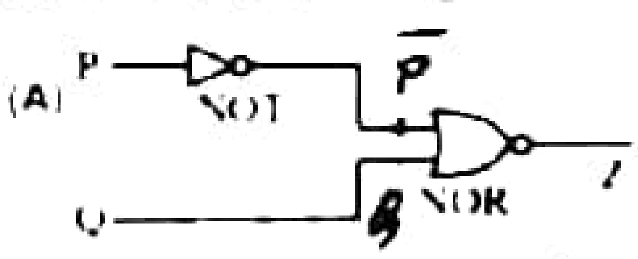
$= B\bar{A} + A\bar{B}$ (XOR)

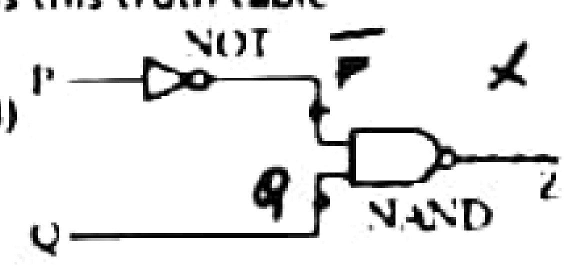
13.

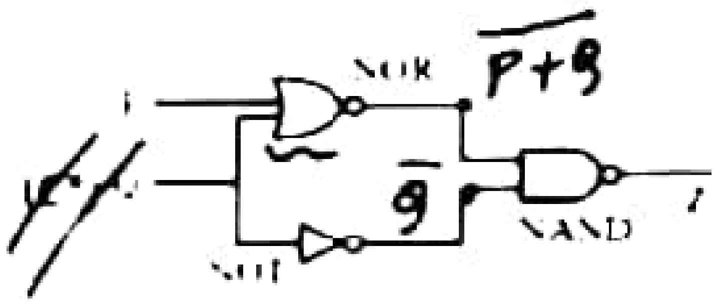
A combination of logic gates has the truth table below

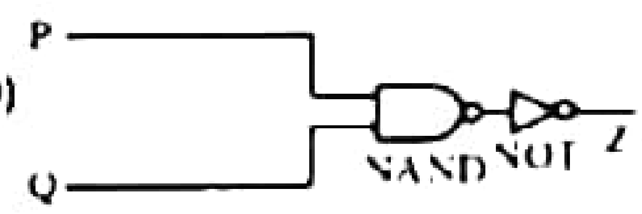
P	Q	Z
0	0	0
0	1	1
1	0	1
1	1	1

Which of the following combinations has this truth table ?

(A)


(B)


(C)


(D)


Sol^n a) $Z = \overline{\bar{P} + Q}$

$= \bar{\bar{P}} \cdot \bar{Q}$

$= P\bar{Q}$ ✗

P	Q	$\bar{Q}$	$P\cdot\bar{Q}$
0	0	1	0
0	1	0	0
1	0	1	1
1	1	0	0

b) $Z = \overline{\bar{P}\cdot Q}$ ✗

$= \bar{\bar{P}} + \bar{Q}$

$= P + \bar{Q}$

$P+\bar{Q}$
1
0
1
1

c) $Z = \overline{(\overline{P+Q})\cdot\bar{Q}}$

$Z = \overline{\overline{P+Q}} + \bar{\bar{Q}}$

$Z = P + Q + Q$

$Z = P + Q$

Z = 0
1
1
1

14.

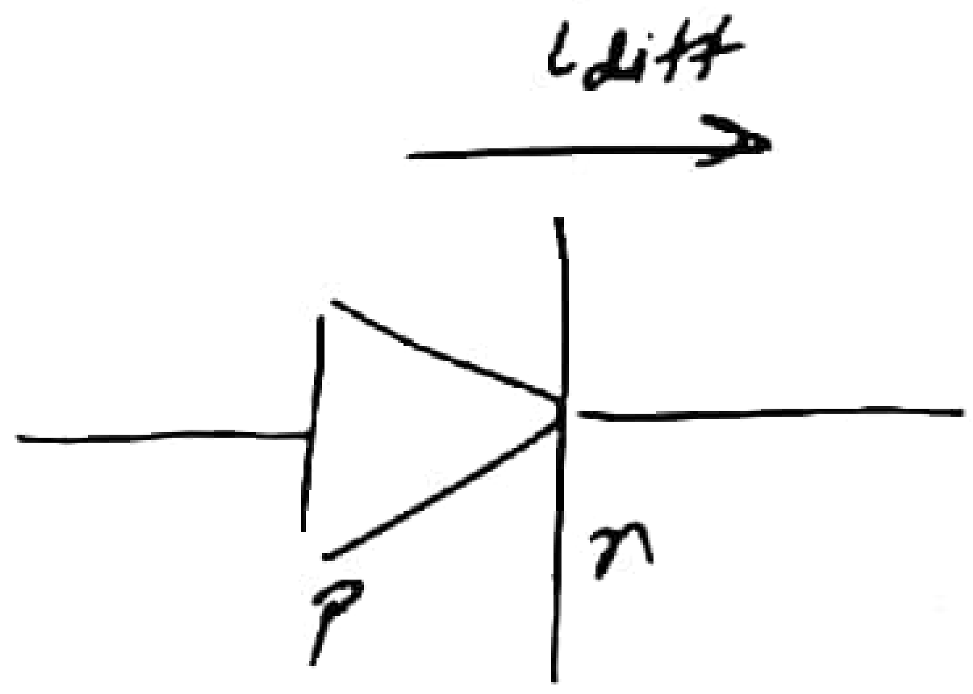
In a p-n junction diode the direction of diffusion current is from -

(A) p-region to n-region

(B) n-region to p-region

(C) n-region to p-region when forward biased and vice-versa when reverse biased

(D) p-region to n-region when forward biased and vice-versa when reverse biased



15.

Choose only false statement from the following -

(A) In conductors the valence and conduction band overlap Correct

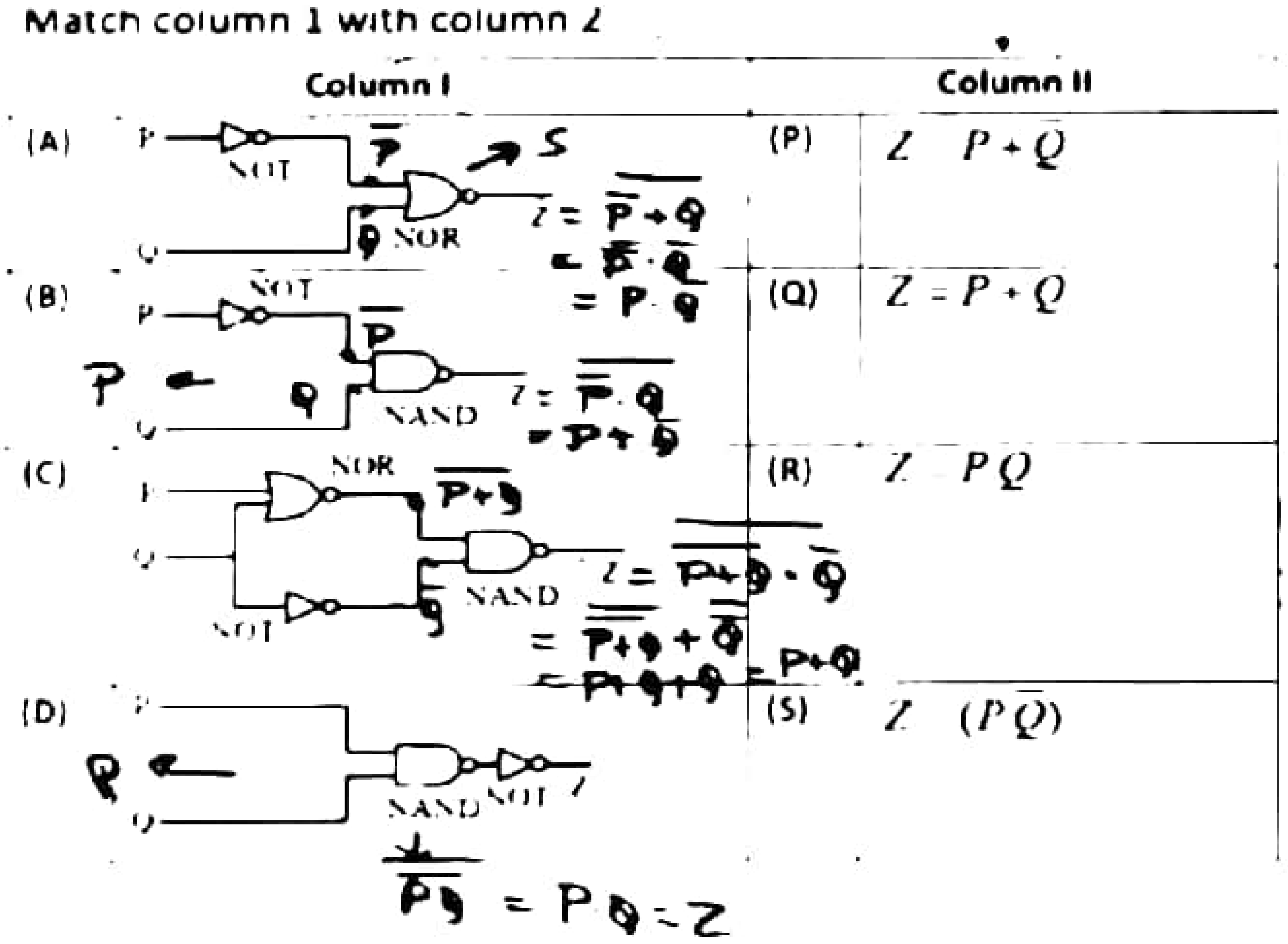
(B) Substance with energy gap of the order of 10 eV are insulators Correct

(C) The resistivity of a semi conductor increase with increase in temperature Incorrect

(D) The conductivity of semiconductor increase with increase in temperature Correct

16.

Match column 1 with column 2



(A) A → R; B → P, C → Q, D → S

(B) A → S, B → P, C → Q, D → R

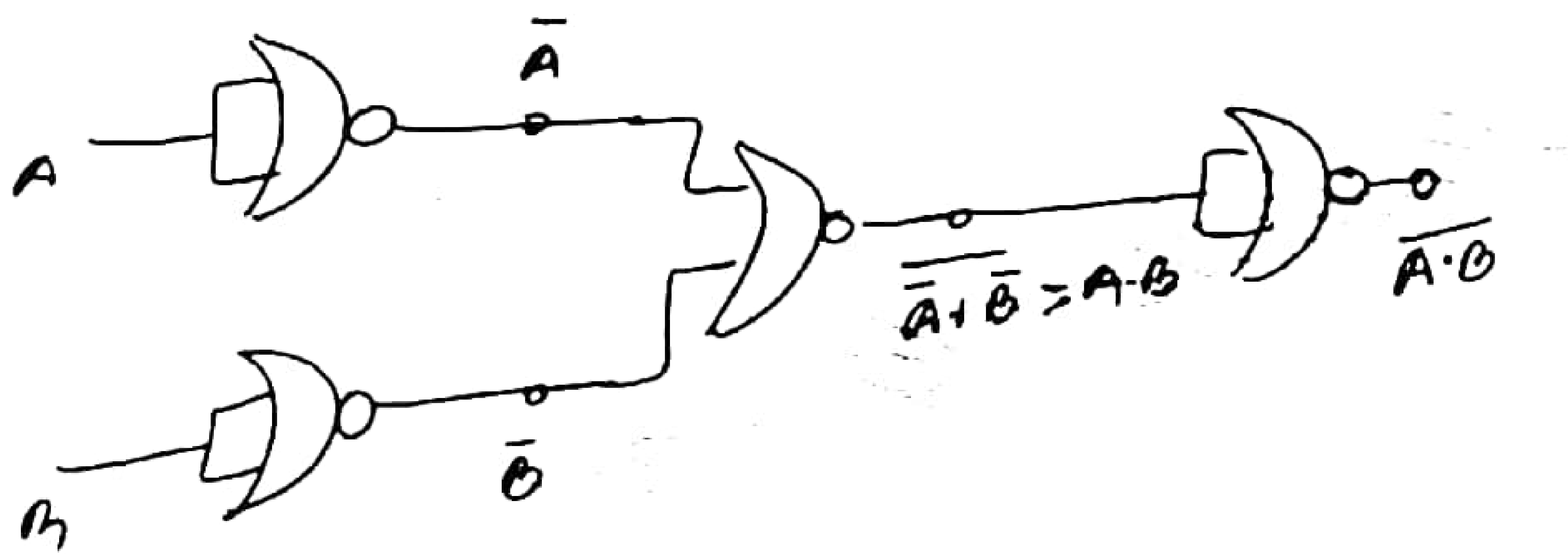
(C) A → S; B → P; C → R, D → Q

(D) A → P, B → S, C → Q, D → R

17.

How many minimum "NOR" gates are required to make one "NAND" gate -

(A) 1 (B) 2 (C) 3 (D) 4



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18.

Which statement is correct for p-type semiconductor -

(A) the number of electrons in conduction band is more than the number of holes in valence band at room temperature

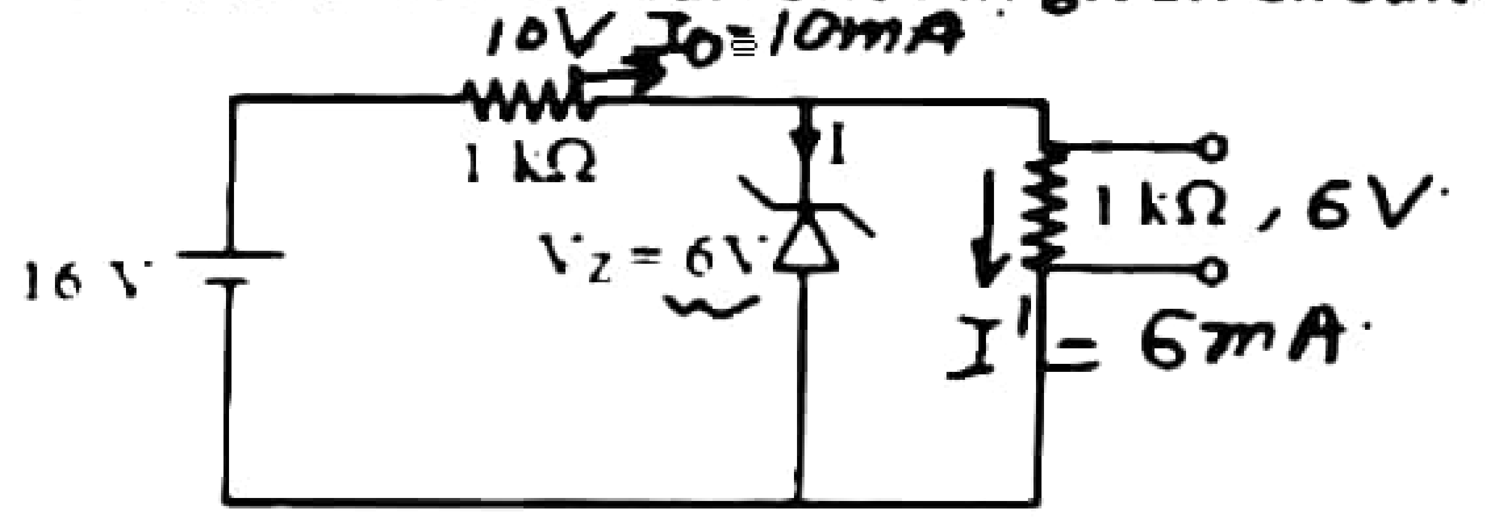
(B) the number of holes in valance band is more than the number of electrons in conduction band at room temperature

(C) there are no holes and electrons at room temperature

(D) number of holes and electrons is equal in valence and conduction band

19.

What is value of current I in given circuit -



(A) 6 mA (B) 4 mA (C) 10 mA (D) zero

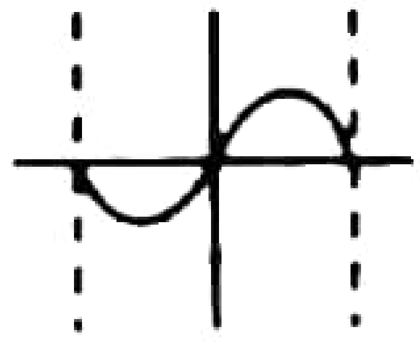
$$I_0 = I + I'$$

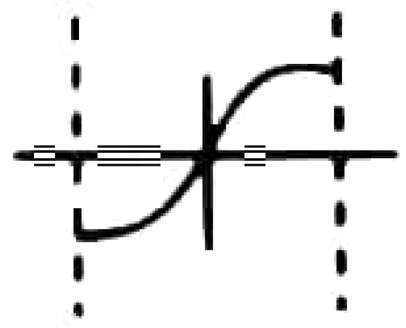
$$10mA = I + 6mA$$

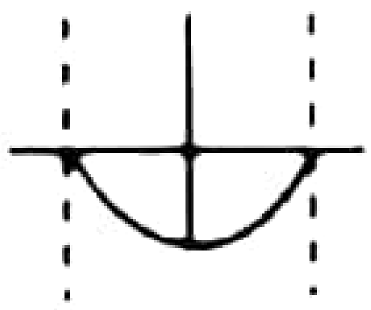
$$I = \underline{4mA}$$

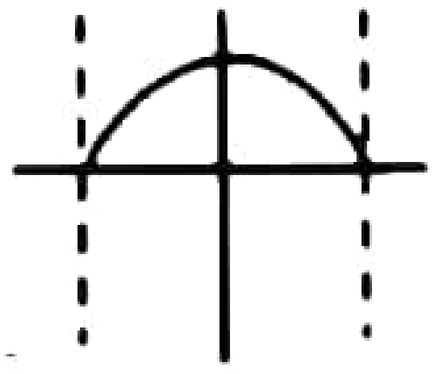
20.

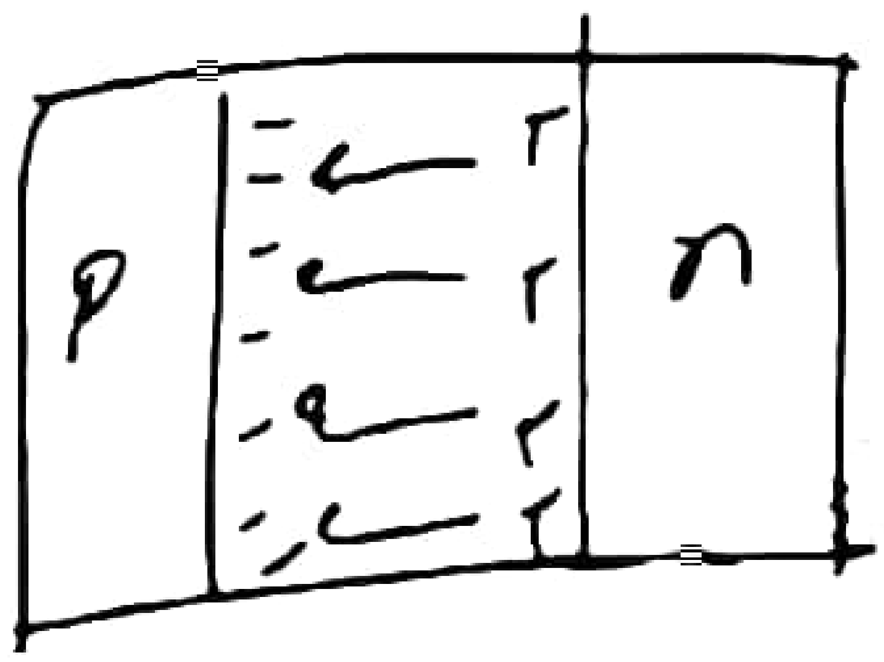
Which graph shows correct variation of electric field across depletion layer of p-n junction -

(A) 

(B) 

(C) 

(D) 



21.

The maxwell's equation :

$$\oint \vec{B}\cdot d\vec{l} = \mu_0\left(I + \varepsilon_0 \frac{d\phi_E}{dt}\right)$$ is a statement of-

(A) Faraday's law of induction

(B) Modified Ampere's law

(C) Gauss's law of electricity

(D) Gauss's law of magnetism

22.

The relation between electric field E and magnetic field H in an electromagnetic wave is-

(A) E = H (B) $E = \frac{\mu_0}{\varepsilon_0} H$ (C) $E = \sqrt{\frac{\mu_0}{\varepsilon_0}} H$ (D) $E = \sqrt{\frac{\varepsilon_0}{\mu_0}} H$

$\frac{E}{B} = C$

$E = B \times \frac{1}{\sqrt{\mu_0 \varepsilon_0}}$

$H = \frac{B}{\mu_0}$

$E = \frac{\mu_0 H}{\sqrt{\mu_0 \varepsilon_0}}$

$E = \sqrt{\frac{\mu_0}{\varepsilon_0}} \times H$

23.

The relation between electric field E and magnetic field induction B in an electromagnetic waves-

(A) $E = \sqrt{\frac{\mu_0}{\varepsilon_0}} B$ (B) E = cB (C) $E = \frac{B}{c}$ (D) $E = \frac{B}{c^2}$

24.

An electromagnetic wave going through vacuum is described by-

$E = E_0 \sin(kx - \omega t)$

$B = B_0 \sin(kx - \omega t)$

(A) $E_0B_0 = \omega k$ (B) $E_0\omega = B_0k$ (C) $E_0k = B_0\omega$ (D) none of these

$\frac{E_0}{B_0} = v = \frac{\omega}{k}$

$E_0 k = \omega B_0$

25.

A plane E M wave of frequency 25 MHz travels in free space in x direction. At a particular point in space and time E = 6.3 $\hat{j}$ v/m then B at that point is -

(A) 2.1×10^{-8} $-\hat{j}$ (B) 2.1×10^{-8} $\hat{k}$

(C) 2.1 $\hat{k}$ (D) 2.1×10^{-8} $\hat{i}$

$$\frac{E}{B} = C$$

$$\frac{6.3}{3\times10^{8}} = B$$

$$\vec{B} = 2.1 \times 10^{-8}\ T\ \hat{k}$$

26.

The average value of electric energy density in an electromagnetic wave is (E_0 is peak value) -

(A) $\frac{1}{2}\varepsilon_0 E_0^2$ (B) $\frac{E_0^2}{2\varepsilon_0}$ (C) $\varepsilon_0 E_0^2$ (D) $\frac{1}{4}\varepsilon_0 E_0^2$

$$\bar{u} = \frac{1}{2}\varepsilon_0 \overline{E^2}$$

$$\bar{u} = \frac{1}{4}\varepsilon_0 E_0^2$$

27.

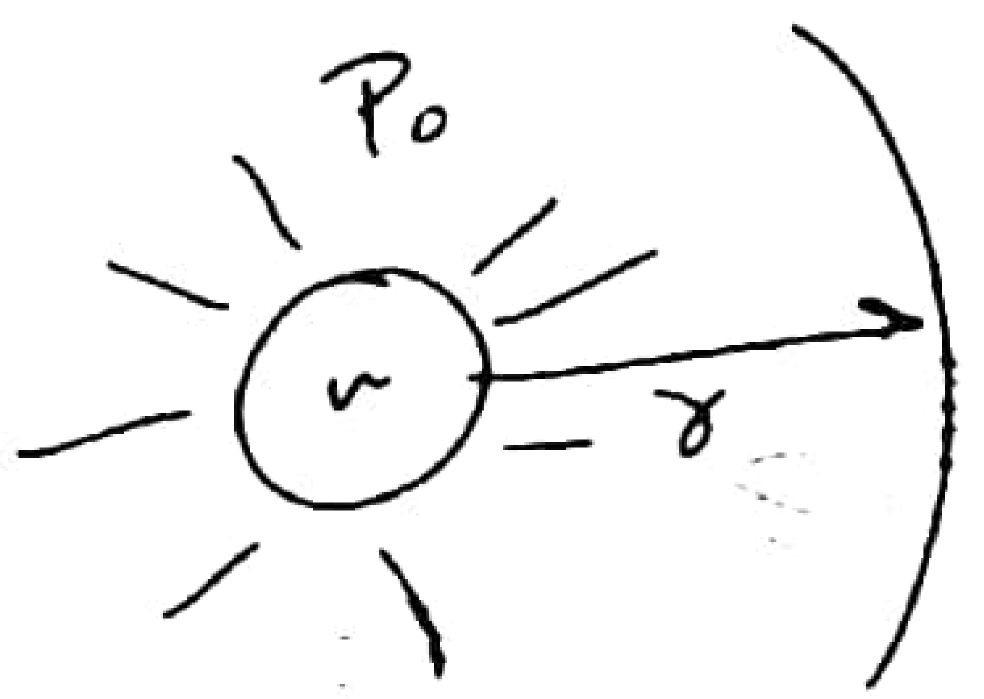
A lamp radiates power P_0 uniformly in all directions, the amplitude of electric field strength E_0 at a distance r from it is-

(A) $E_0 = \frac{P_0}{2\pi\varepsilon_0 c r^2}$

(B) $E_0 = \sqrt{\frac{P_0}{2\pi\varepsilon_0 c r^2}}$

(C) $E_0 = \sqrt{\frac{P_0}{4\pi\varepsilon_0 c r^2}}$

(D) $E_0 = \sqrt{\frac{P_0}{8\pi\varepsilon_0 c r}}$



$$I = \frac{P_0}{4\pi r^2} = \bar{u} c$$

$$\frac{P_0}{4\pi r^2} = \frac{1}{2}\varepsilon_0 E_0^2 \cdot c$$

$$E_0 = \sqrt{\frac{P_0}{2\pi r^2 c \varepsilon_0}}$$

28.

A parallel plate capacitor consists of two circular plates each of radius 2 cm, separated by a distance of 0.1 mm. If voltage across the plates is varying at the rate of 5 × 10^{13} V/s, then the value of displacement current is-

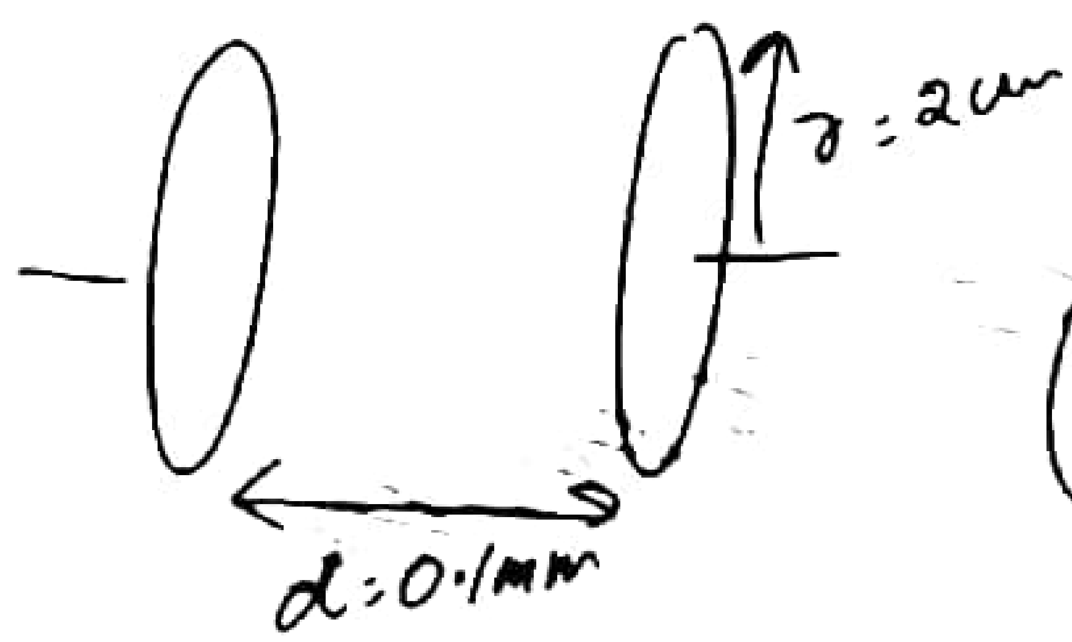
(A) 5.50 A

(B) 5.56 × 10^2 A

(C) 5.56 × 10^3 A

(D) 2.28 × 10^4 A

$$\frac{dV}{dt} = 5\times10^{13}\ V/s$$



$$q = CV$$

$$\frac{dq}{dt} = C\frac{dV}{dt}$$

$$i = \frac{4\varepsilon_0\pi r^2}{4d}\frac{dV}{dt}$$

$$i = \frac{1}{9\times10^9\times4\times10^{-4}}\times4\times10^{-4}\times5\times10^{13}$$

$$i = 5.56\times10^{3}\ A$$

29.

In an electromagnetic wave-

(A) Power is transmitted along the magnetic field

(B) power is transmitted along the electric field

(C) power is equally transferred along the electric and magnetic fields

(D✓) power is transmitted in a direction perpendicular to both the fields

30.

For any E.M. wave if E = 100 V/m and B = 3.33×10^{-7} T. Then the rate of energy flow per unit area is-

(A) 3.33×10^{-5} J/m^2

(B✓) 26.5 VA/m^2

(C) 3×10^{8} J/m^2

(D) None of these

Rate of energy flow/Area = Intensity $= |\vec{S}| = \frac{|\vec{E} \times \vec{B}|}{\mu_0}$

$= \frac{EB}{\mu_0}$

$= \frac{100 \times 3.33 \times 10^{-7}}{4\pi \times 10^{-7}}$

$= \frac{333}{4\pi} = 26.5 \frac{W}{m^2} = 26.5 \frac{V \cdot A}{m^2}$

31.

In an electromagnetic wave, the amplitude of electric field is 10 V/m. The frequency of wave is 5×10^{14} Hz, the wave is propagating along z–axis, then total average energy density of E.M. wave is -

(A) 2.21×10^{-10} J/m³ (B*) 4.42×10^{-10} J/m³

(C) 1.11×10^{-10} J/m³ (D) None

Solⁿ $E_0 = 10 V/m$

$\bar{u} = \frac{1}{2} \epsilon_0 E_0^2$

$= \frac{1}{2} \times 8.85 \times 10^{-12} \times 100$

$= 4.42 \times 10^{-10} J/m^3$

32.

The resonance frequency of the tank circuit of an oscillator when $L = \frac{10}{\pi^2} mH$ and $C = 0.04\mu F$ are connected in parallel is:

(A) 250 kHz (B*) 25 kHz (C) 2.5 kHz (D) 25 MHz

$f = \frac{1}{2\pi\sqrt{LC}}$

$= \frac{1}{2\pi\sqrt{\frac{10 \times 10^{-3} \times 4 \times 10^{-8}}{\pi^2}}}$

$= \frac{1}{2\sqrt{4 \times 10^{-10}}}$ $= \frac{1}{4 \times 10^{-5}}$ Hz

$= \frac{100}{4}$ kHz

$= 25$ kHz

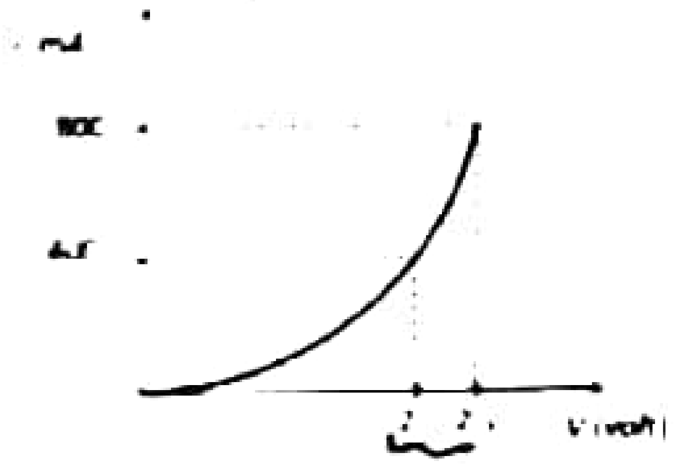
33.

Semiconductor is damaged by the strong current due to

(A) Lack of free electron
(B*) Excess of electrons
(C) Excess of proton
(D) None of these

34.

The I characteristic of a P-N junction diode is shown below. The approximate dynamic resistance of the P-N junction when a forward bias of $2\,volt$ is applied\



(A) $1\,\Omega$
(B*) $0.25\,\Omega$
(C) $0.5\,\Omega$
(D) $5\,\Omega$

$$R_{Dynamic} = \frac{\Delta V}{\Delta I} = \frac{0.1\ Volt}{400\ mA} = \frac{1}{4}\,\Omega = 0.25\,\Omega$$

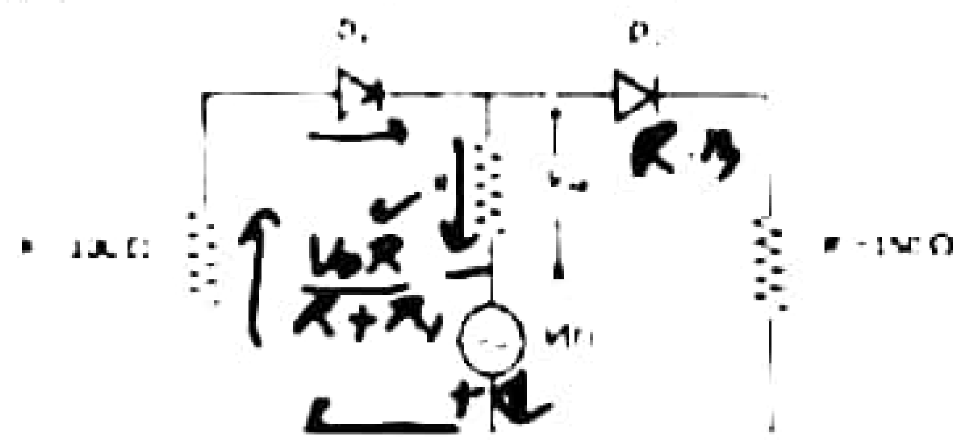
35.

Zener breakdown in a semi-conductor diode occurs when

(A) Forward current exceeds certain value
(B) Reverse bias exceeds certain value
(C) Forward bias exceeds certain value
(D*) Potential barrier is reduced to zero

36.

In the circuit given below, $V(t)$ is the sinusoidal voltage source, voltage drop $V_{AB}(t)$ across the resistance R is

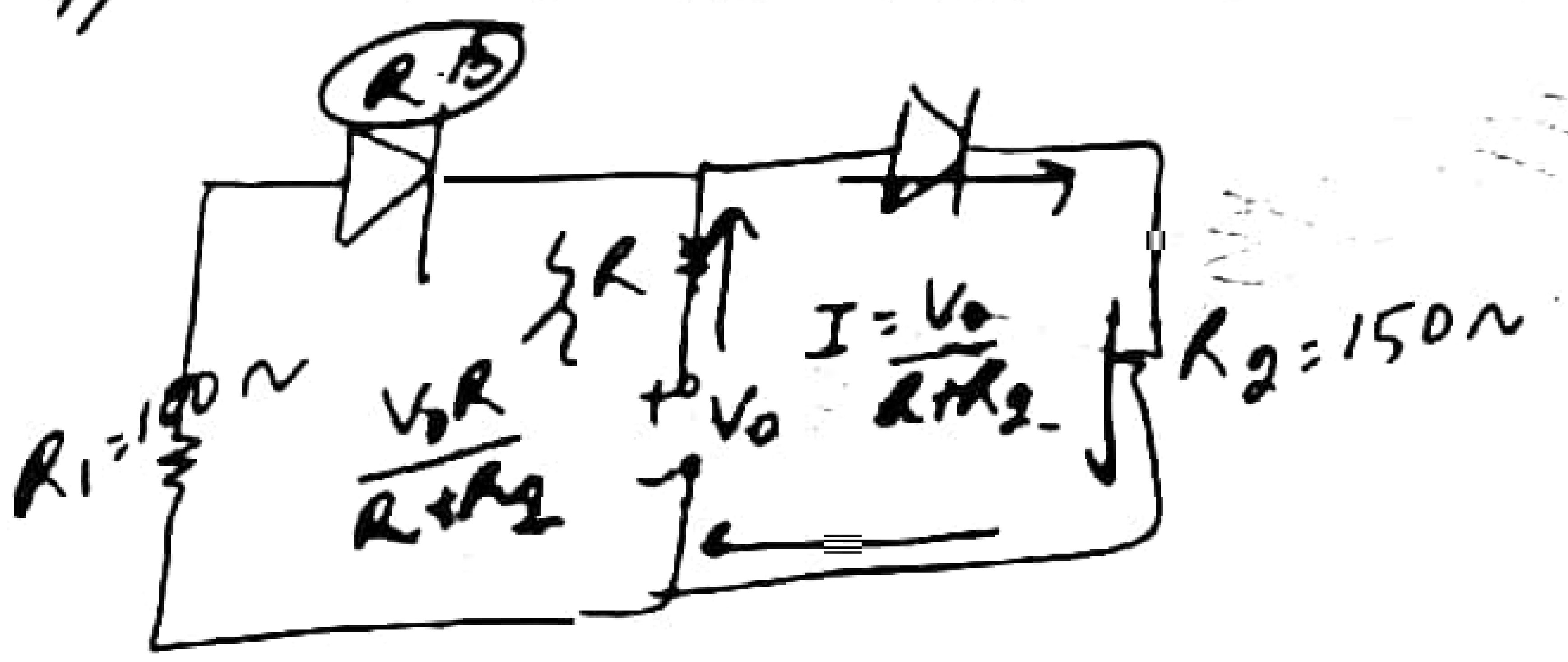


(A) Is half wave rectified ✗

(B) Is full wave rectified ✗

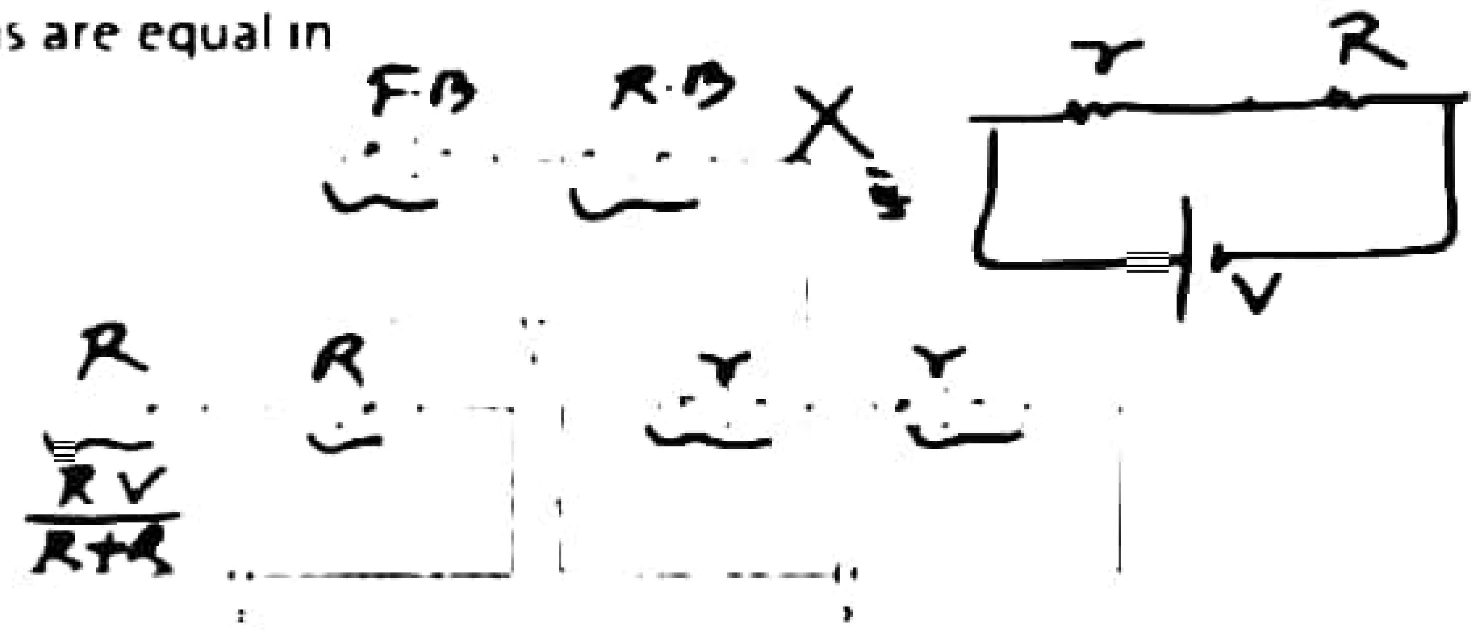
(C) Has the same peak value in the positive and negative half cycles ✗

(D) Has different peak values during positive and negative half cycle ✓



37.

Two identical p-n junctions are connected in series in three different ways as shown below to a battery. The potential drop across the p-n junctions are equal in



(A) Circuits 2 and 3 (B) Circuits 1 and 2

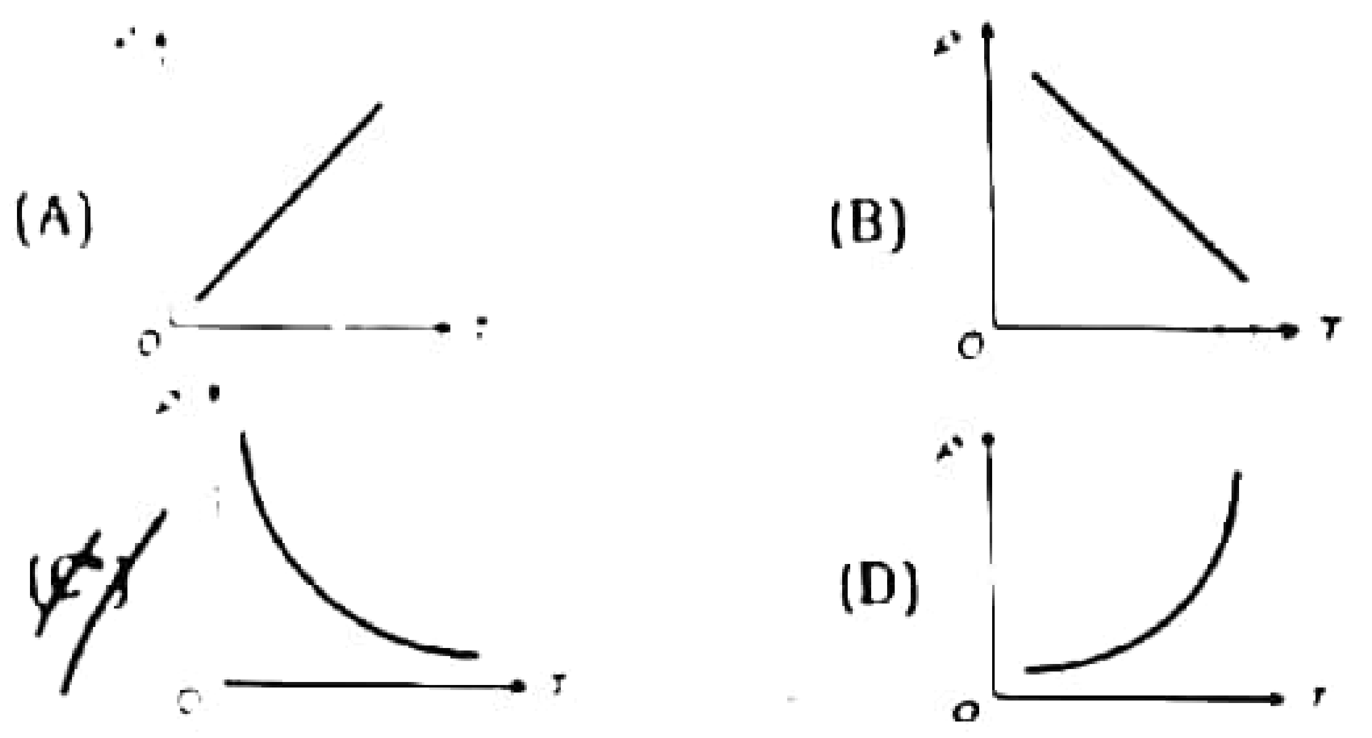
(C) Circuits 1 and 3 (D) None of the circuit

$R_{FB} = r$

$R_{RB} = R$

38.

The temperature (T) dependence on resistivity (ρ) of a semiconductor is represented by



39.

For a common emitter amplifier, the audio signal voltage across the collector resistance $2k\Omega$ is 2 V. If the current amplification factor of the transistor is 220, and the base resistance is $1.5\ k\Omega$, the input signal voltage and base current are

(A) 0.1 V and 1 μA
(B) 0.15 V and 10 μA
(C) 1.015 V and 1 A
(D) 0.0075 V and 5 μA

$V_0 = 2V$
$R_C = 2K\Omega$
$\beta = 220$
$R_I = 1.5K\Omega$
$V_i = ?$
$I_B = ?$

$V.G = \beta \times R.G$

$\frac{V_0}{V_i} = \beta \times \frac{R_L}{R_I}$

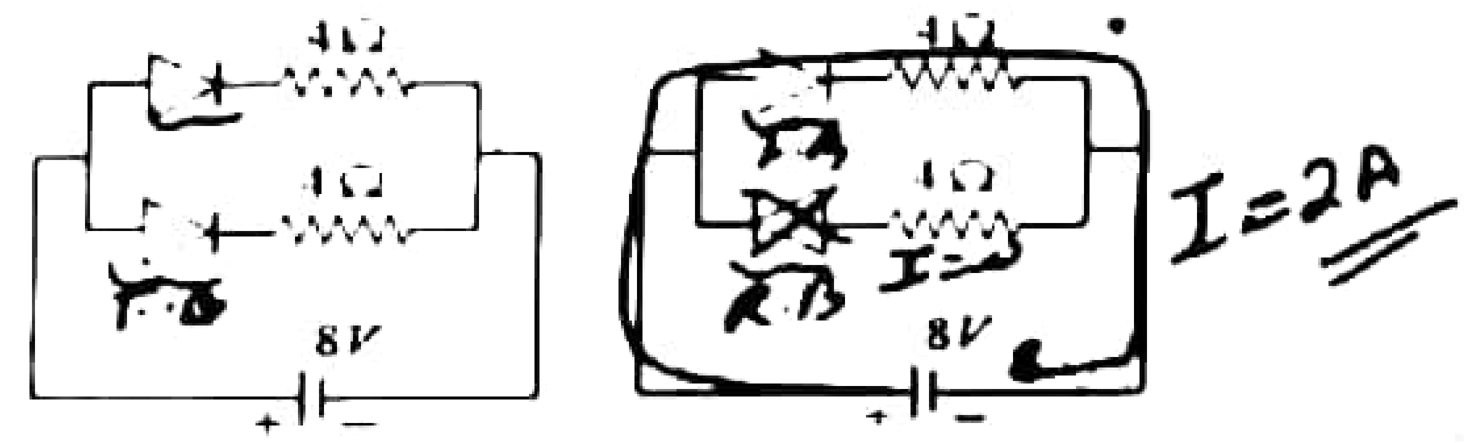
$\frac{2}{V_i} = 220 \times \frac{2}{1.5}$

$V_i = 0.0075$ Volt

$V_0 = I_C R_C$
$2 = I_C \times 2K\Omega$
$I_C = 1mA$
$\beta = \frac{I_C}{I_B}$
$I_B = \frac{1mA}{220}$
$\approx 5\mu A$

40.

Currents flowing in each of the circuits A and B respectively are



(Circuit A) (Circuit B)

(A) 1 A, 2 A (B) 2 A, 1 A (C) 4 A, 2 A (D) 2 A, 4 A

$I_A = \frac{8}{2} = 4A$

41.

For a junction diode the ratio of forward current (I_F) and reverse current (I_r) is?

[I_e =electronic charge, V =voltage applied across junction, k = Boltzmann constant, T =temperature in kelvin]

(A) $e^{-V/kT}$ (B) $e^{V/kT}$

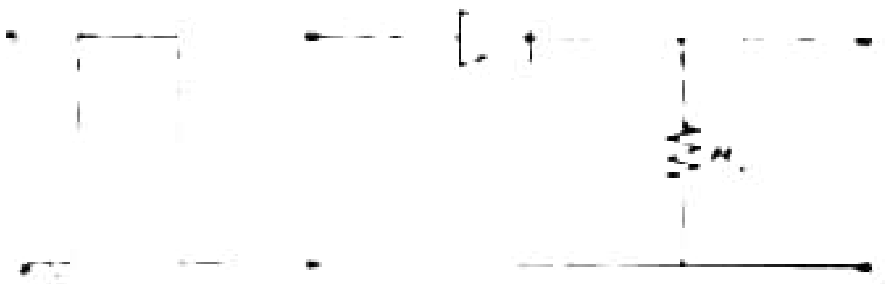
(C) $(e^{-eV/kT} + 1)$ (D) $(e^{eV/kT} - 1)$

$I_F = I_0\left(e^{eV/kT} - 1\right)$

$\frac{I_F}{I_R} = e^{eV/kT} - 1$

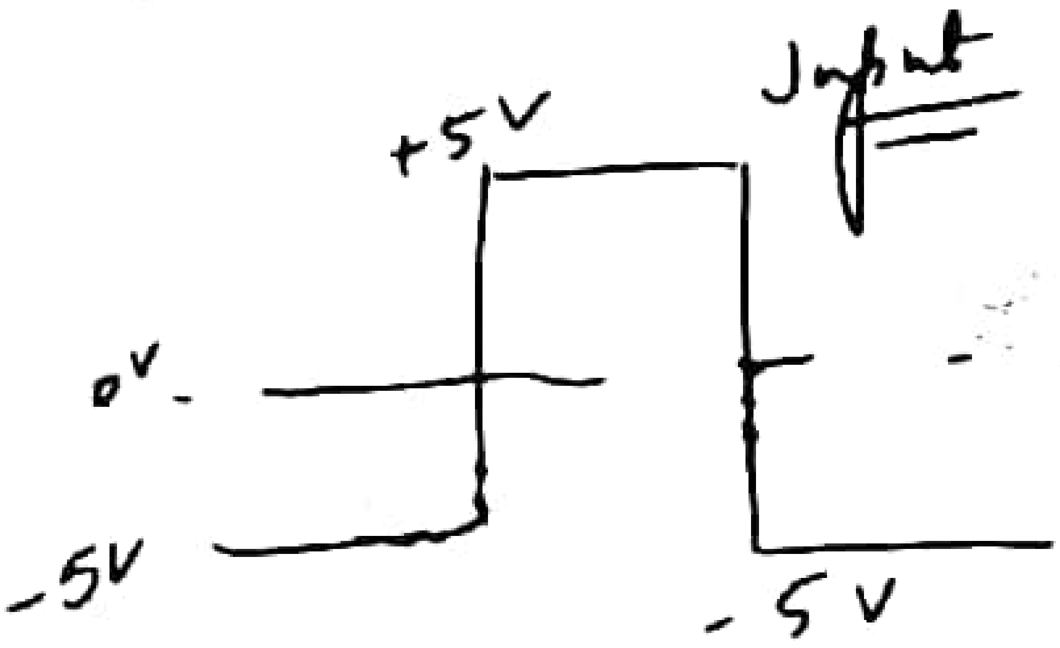
42.

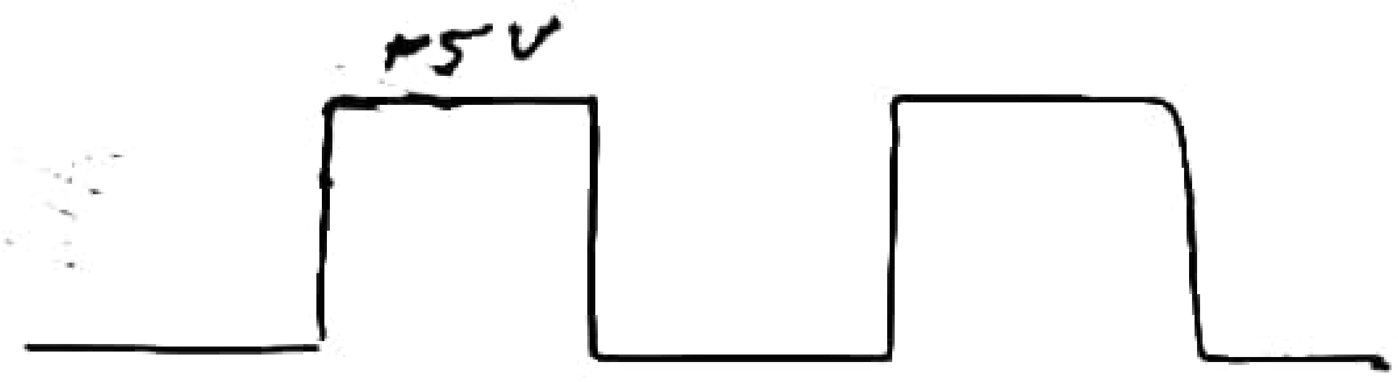
If in a p-n junction diode, a square input signal of 10 V is applied as shown



Then the output signal across R_L will be

(A) (B) (C) (D)





43.

In PN-junction diode the reverse saturation current is $10^{-5} amp$ at $27°C$. The forward current for a voltage of $0.2\ volt$ is
$[\exp(7.62) = 2038.6, k = 1.4 \times 10^{-23} J/K]$

(A) $2037.6 \times 10^{-3} amp$ (B) $203.76 \times 10^{-3} amp$
(C) $20.376 \times 10^{-3} amp$ (D) $2.0376 \times 10^{3} amp$

$$I_F = I_0 \left(e^{eV/kT} - 1\right)$$

$$I_F = 10^{-5} \left[e^{\frac{1.6\times10^{-19} \times 0.2}{1.4\times10^{-23}\times 300}} - 1\right]$$

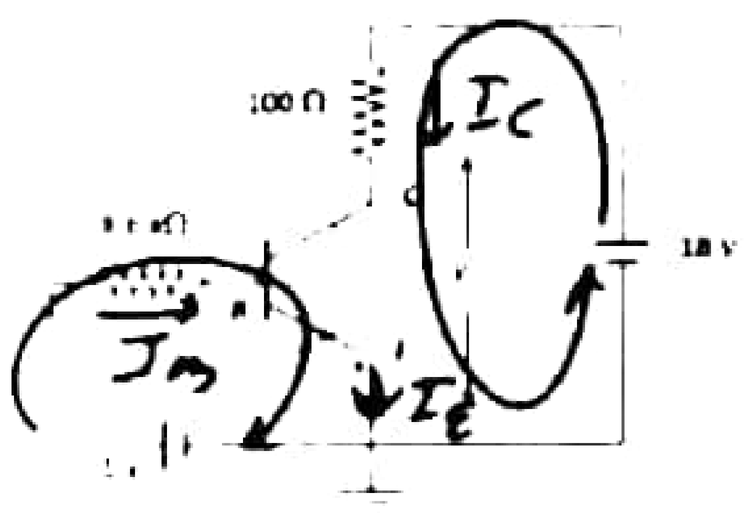
$$= 10^{-5}\left[e^{7.62} - 1\right]$$

$$= 10^{-5}\left[2038.6 - 1\right] = 2037.6\times10^{-5} A$$

$$= 20.376 \times 10^{-3} A$$

44.

For the transistor circuit shown below, if $\beta = 100$, voltage drop between emitter and base is $0.7\ V$ then value of V_{CE} will be



(A) $10\ V$ (B) $5\ V$ (C) $13\ V$ (D) $0\ V$

$V_{BE} = 0.7V$

$V - V_{BE} = I_B R_B$

$5 - 0.7 = I_B \times 8.6 k\Omega$

$\frac{4.3V}{8.6k\Omega} = I_B$

$I_B = \frac{1}{2} mA$

$\beta = \frac{I_C}{I_B} \Rightarrow I_C = \frac{1}{2} mA \times 100 = 50 mA$

$V - V_{CE} = I_C R_C$

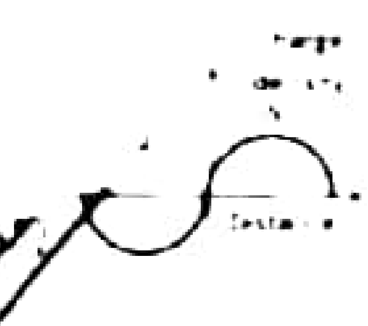
$18 - V_{CE} = 50 \times 10^{-3} \times 100$

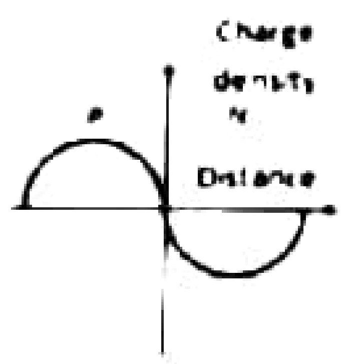
$V_{CE} = (18 - 5)$ volt

$= 13$ volt

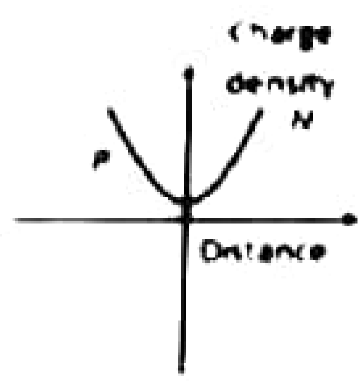
45.

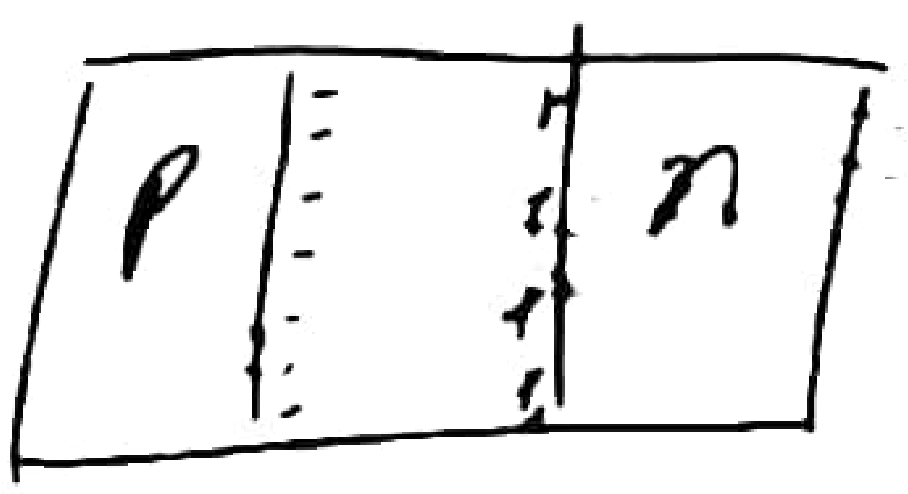
The curve between charge density and distance near P-N junction will be

(A) 

(B) 

(C) 

(D) 



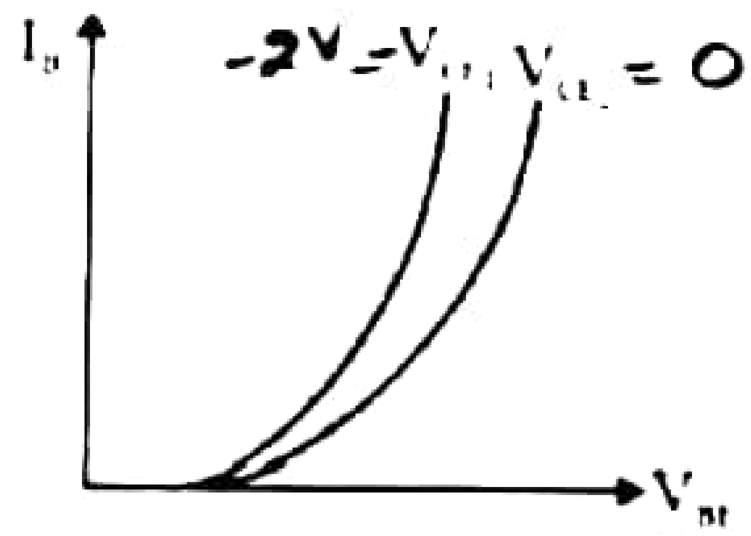
46.

Statement 1 : Doping concentration is maximum in emitter in transistor. correct
Statement 2 : Maximum number of electrons flows from emitter to base in n-p-n correct transistor.

(A) Both Statement-1 and Statement-2 are true, and Statement-2 is the correct explanation of Statement-1.
(B) Both Statement-1 and Statement-2 are true but Statement-2 is not the correct explanation of Statement-1.
(C) Statement-1 is true but Statement-2 is false.
(D) Statement-1 is false but Statement-2 is true.

47.

Input characteristics are shown for CE configuration of n-p-n transistor for different output voltages. Here

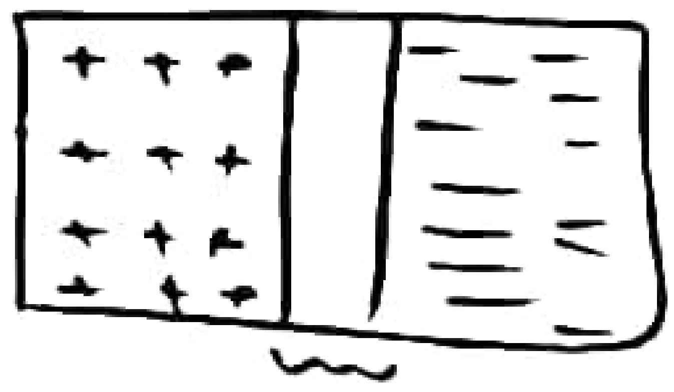


(A) $V_{CE_1} > V_{CE_2}$ (B) $V_{CE_1} = V_{CE_2}$
(C) $V_{CE_1} < V_{CE_2}$ (D) None of these

$V_{CE_1} < V_{CE_2}$

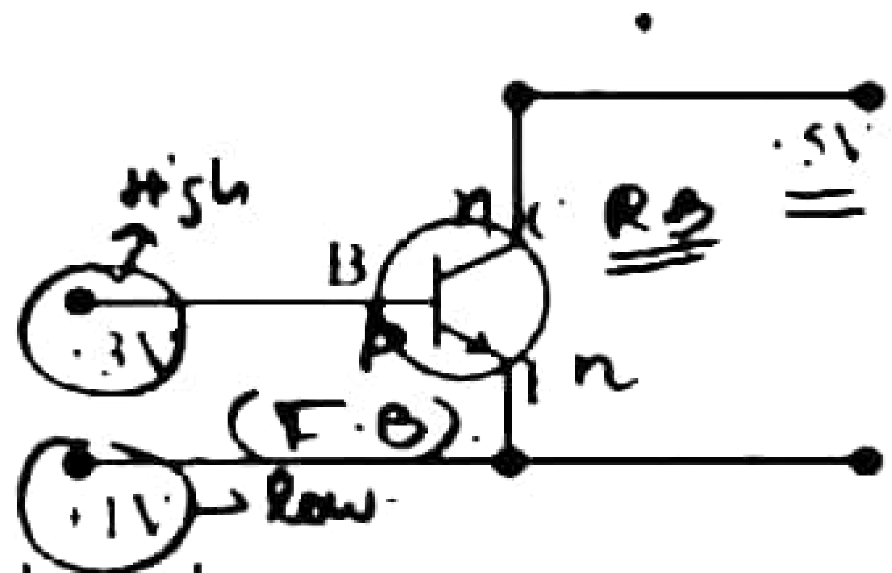
48.

Zener diode has both p and n-ends heavily doped so that –
(A*) it has small thickness of depletion region
(B) it has large thickness of depletion region due to large recombination
(C) it has large reverse bias voltage
(D) it has weak reverse current when reverse biased



49.

In given figure

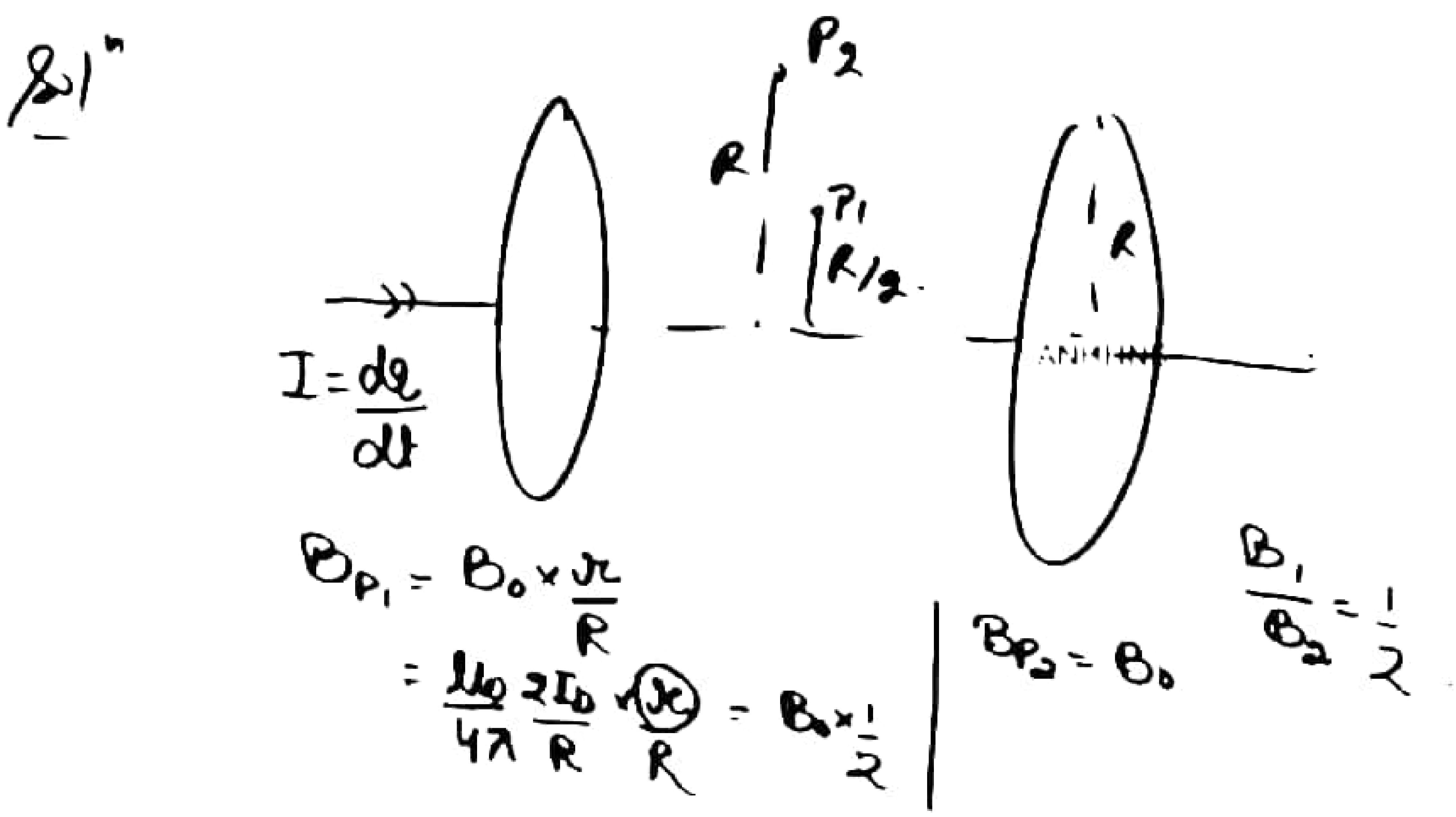


(A) emitter is forward biased
(B) collector is forward biased
(C) emitter is reverse biased
(D) emitter and collector both are reverse biased

50.

A condenser is charged using a constant current. The ratio of the magnetic fields at a distance of R/2 and R from the axis is (R is the radius of plate)

A) 1:1 B) 2:1 C) 1:2 D) 1:4



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